School of

OCEANOGRAPHY

VERTICAL SECTIONS AND MESOSCALE MAPS OF TEMPERATURE, SALINITY AND SIGMA-T OFF THE COAST OF PERU JULY TO OCTOBER 1976 AND MARCH TO MAY 1977

by

Adriana Huyer
and
William E. Gilbert

Data Report 79
Reference 79-16
November 1979

(CUEA TECHNICAL REPORT 60)

National Science Foundation
OCE 78-03381

OREGON STATE UNIVERSITY

School of Oceanography
Oregon State University
Corvallis, Oregon 97331

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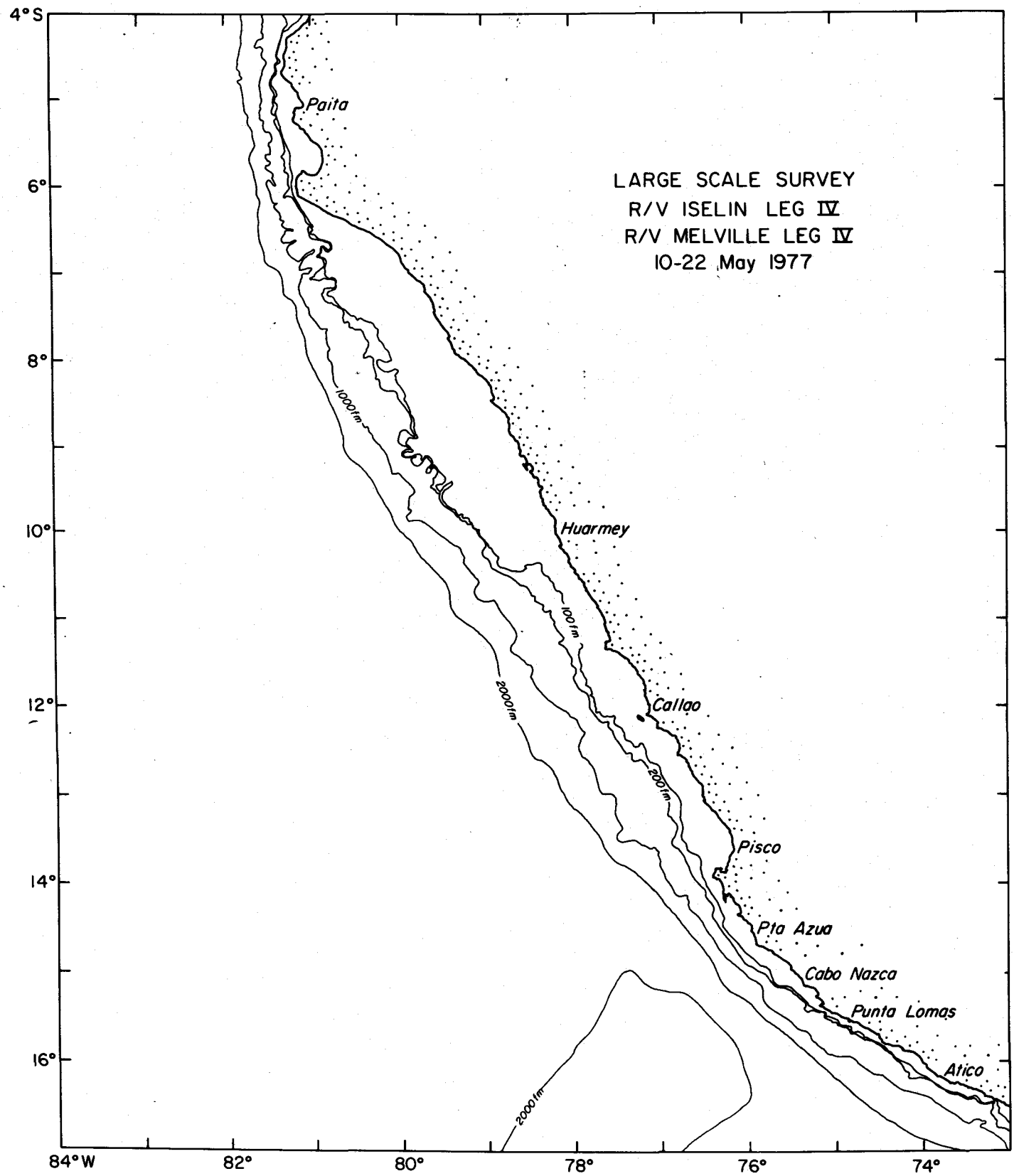
LARGE SCALE SURVEY
R/V ISELIN LEG IV
R/V MELVILLE LEG IV
10-22 May 1977
Paita
Huarmey
Callao
Pisco
Pta Azua
Cabo Nazca
Punta Lomas
Atico
100fm
200fm
1000fm
2000fm
2000fm
4°S
6°
8°
10°
12°
14°
16°
84°W
82°
80°
78°
76°
74°

INTRODUCTION

From March 1976 to May 1977, the Coastal Upwelling Ecosystems Analysis (CUEA) program conducted a continuing field experiment, JOINT-II, with three intensive phases: MAM 76 (March - June 1976), JASON (July - October 1976) and MAM 77 (March - May 1977). The CUEA mesoscale hydrography component made hydrographic observations including both CTD and bottle casts during each intensive phase: from the R/V T. G. Thompson during MAM 76 (Codispoti et al., 1976; Barton, 1977; Friebertshauser, Bishop and Codispoti, 1977); from the R/V Eastward during JASON (Huyer et al., 1978a and Kogelschatz et al., 1979); and on legs 1, 2 and 4 of R/V Melville and legs 2 and 4 of the R/V Columbus Iselin during MAM 77 (Hafferty, Codispoti and Huyer, 1978; Huyer et al., 1978b). Additional hydrographic data were collected during JOINT-II by other CUEA components (Stevenson and Wagner, 1978; MacIsaac et al., 1979; Johnson, Koeb and Mooers, 1979; Paul and MacIsaac, 1979).

In this report we will present vertical sections of temperature, salinity and sigma-t from both CTD and bottle casts made on legs 1-5 of the R/V Eastward during JASON, and from CTD casts made on legs 1, 2 and 4 of the R/V Melville and legs 2 and 4 of the R/V Columbus Iselin during MAM 77. Vertical sections of physical and chemical data from the bottle casts from the Thompson cruise during MAM 76, and from legs 1, 2 and 4 of Melville and legs 2 and 4 of the Iselin during MAM 77 have already been published (Friederich et al., 1977; Hafferty, Lowman and Codispoti, 1979). Vertical sections of the CTD data from the first leg of the R/V Thompson during MAM 76 have also been published

(Robles and Barton, 1977). Detailed vertical sections of the temperature over the continental shelf and upper slope just south of Cabo Nazca during MAM 77 are presented in a report by Brink, Gilbert and Huyer (1979).

METHOD OF PREPARATION AND PRESENTATION

The sections were prepared by hand on a standard scale of 25 m and 10 km per cm; this scale is well suited to distributions of properties along the longer offshore sections, and has the same aspect ratio as the sections in the earlier reports. We used CTD data whenever they were available, and otherwise used data from Niskin bottle casts. For the sections using bottle casts, we have shown dots to indicate sample depths; the data were plotted at the sample depth and the fields were contoured by hand. When CTD data were available we plotted the observed isogram depths, and connected these depths from station to station by hand, smoothing the isograms by hand. The bottom of the CTD cast is shown by an inverted "T" whenever it is shallower than 625 m, the lower limit of the sections.

The bottom profiles were drawn by connecting the bottom depth observed at each station with a smooth curve. Chiefly because of errors in navigation, bottom profiles for repeated sections at the same location do not necessarily agree.

The sections of each variable are shown in consecutive order, regardless of its location. The section just south of Cabo Nazca, the C-line, was repeated frequently, and Table 1 provides an index for the successive occupations.

Mesoscale hydrographic surveys, centered on the C-line and extending approximately 100 km along the coast and 30 km offshore, were made during 20-23 March 1977 and 17-20 April 1977. From these surveys we prepared maps of temperature, salinity and sigma-t at selected depths between the surface and 300 m. Values were plotted at each station position, and the fields were contoured by hand. Dots are shown for each station which had data at that depth.

ACKNOWLEDGMENTS

Mary Batteen prepared most of the JASON sections. Marcia Benad and Anne Ayers each prepared many of the temperature and sigma-t sections for MAM 77; Ayers also assisted in preparing the mesoscale maps. Preparation of the report was supported by the Office for the International Decade of Ocean Exploration under Grant OCE 78-03381. This is a contribution to the Coastal Upwelling Ecosystems Analysis Program.

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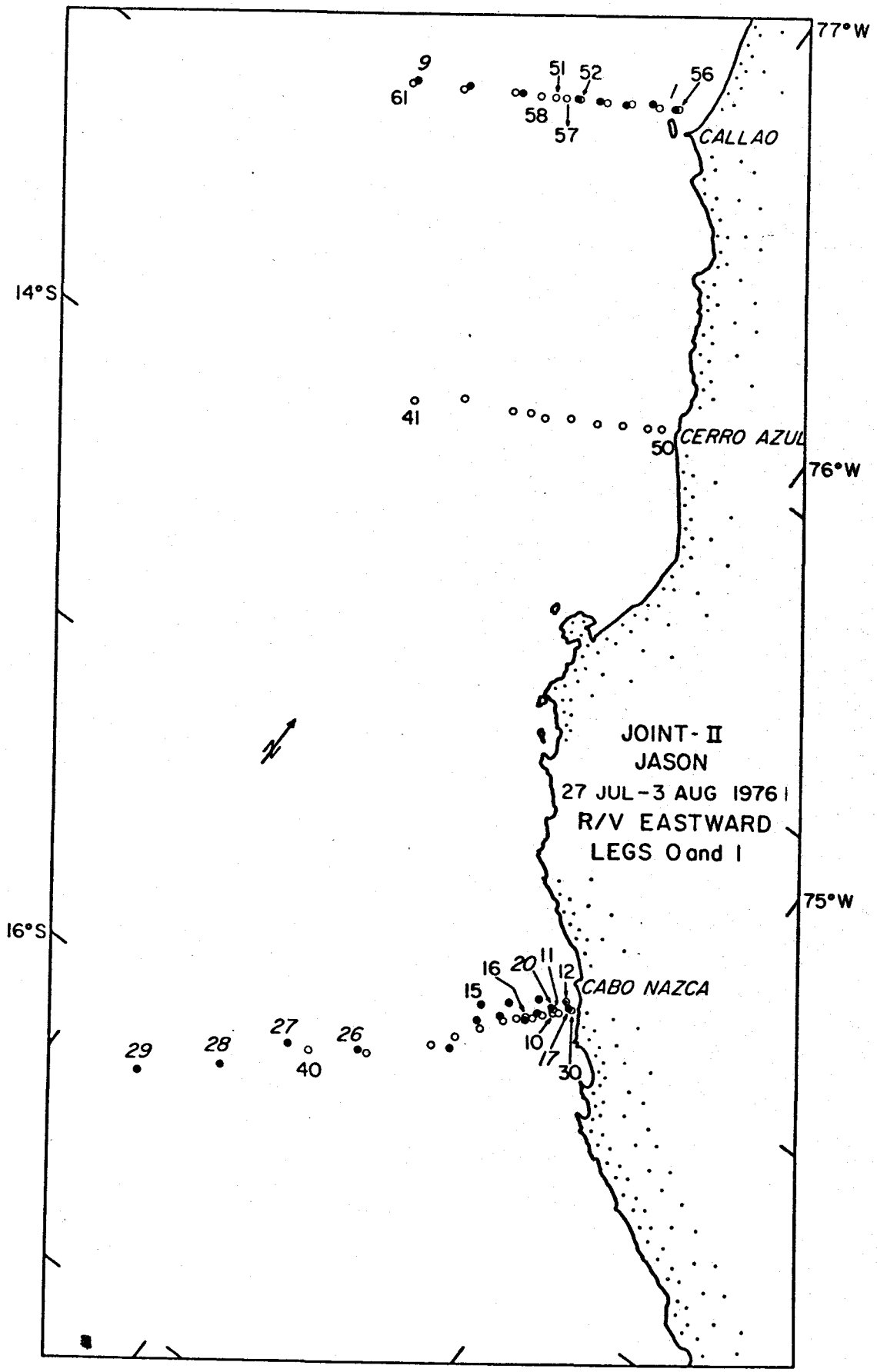
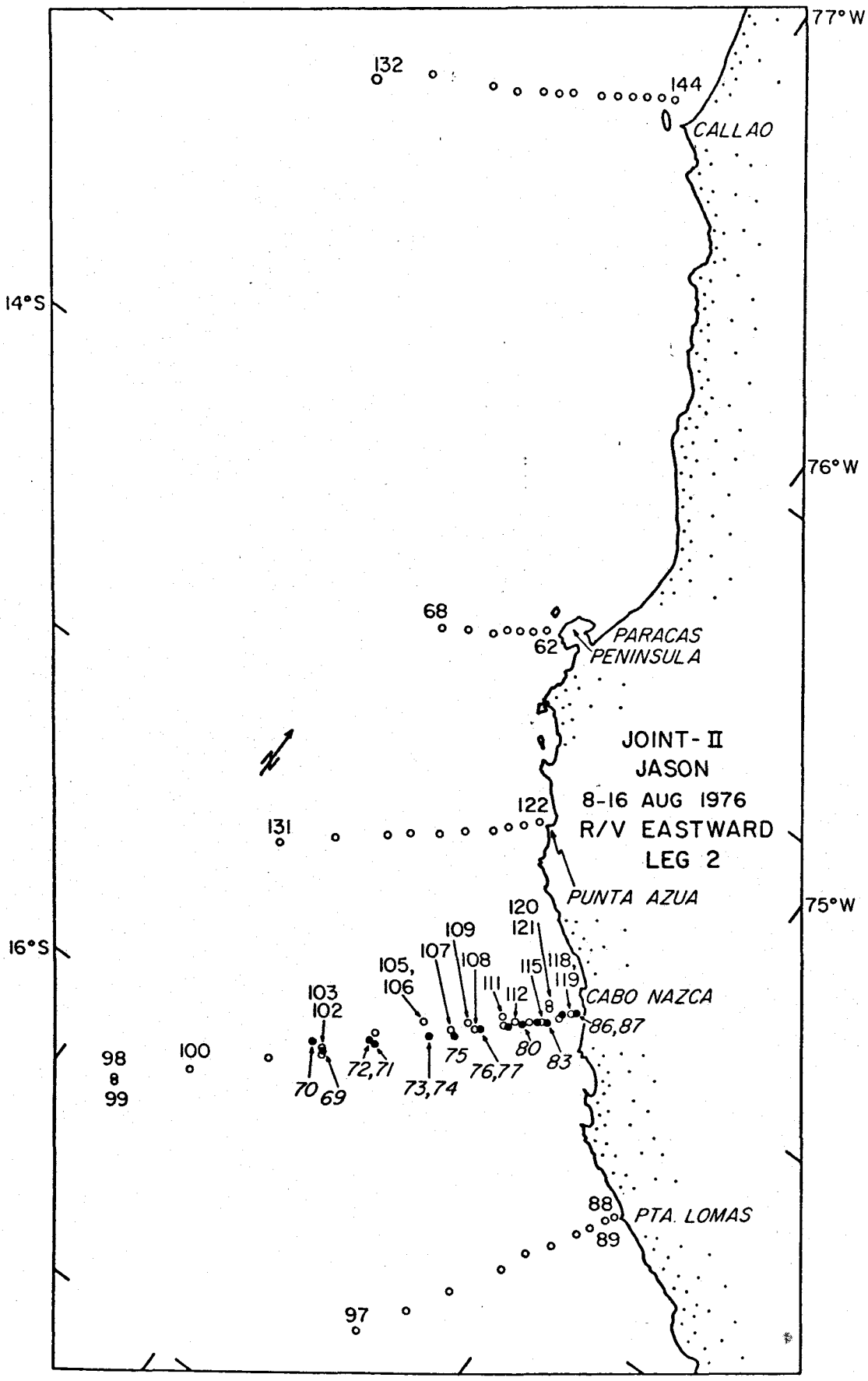
Table 1. Dates of occupation of the C-line, the central hydrographic section during JOINT-II, with the page numbers of the corresponding vertical sections.

Ship/Leg	Date	Stations	Page Number of Vertical Section of: Temperature	Salinity	Sigma-t
Eastward Leg 1	27-28 August 1976	11-16	17	31	45
"	29 July	17-29	18	32	46
"	30 July	30-40	19	33	47
Eastward Leg 2	10-11 August 1976	69-86	21	35	49
"	12-13 August 1976	98-118	22	36	50
Eastward Leg 3	25-27 August 1976	146-153	25	39	53
		155-171	24	38	52
Eastward Leg 4	10-11 Sept. 1976	172-184	25	39	53
"	13-20 Sept. 1976	188-200	26	40	54
"	20-21 Sept. 1976	200-212	27	41	55
Eastward Leg 5	1-3 October 1976	223-235	28	42	56
Melville Leg 1	4-5 March 1977	3-12	73	99	125
"	5-6 March 1977	13-23	73	99	125
"	6-8 March 1977	24-33	73	99	125
Melville Leg 2	15-16 March 1977	48-56	74	100	126
"	16 March 1977	57-61	74	100	126
"	18-19 March 1977	77-93	76	102	128
"	22 March 1977	119-125	78	104	130
"	24-25 March 1977	154-160	79	105	131
"	27-28 March 1977	162-181	80	106	132
Iselin Leg 2	9-10 April 1977	204-215	83	109	135
"	12 April 1977	227-235	84	110	136
"	15-16 April 1977	257-271	86	112	138
"	19 April 1977	321-328	88	114	140
"	20-22 April 1977	344-358	89	115	141
Melville Leg 4	5-6 May 1977	363-380	90,91	116,117	142,143
"	8-9 May 1977	382-391	92	118	144
"	12-13 May 1977	409-417	93	119	145
"	14-15 May 1977	802-810	96	122	148
"	15-16 May 1977	420-432	93	119	145

VERTICAL SECTIONS DURING JASON

Station Positions


77°W
14°S
76°W
75°W
16°S
CALLAO
CERRO AZUL
CABO NAZCA
JOINT-II
JASON
27 JUL-3 AUG 1976
R/V EASTWARD
LEGS 0 and 1
9
61
51
52
56
1
58
57
41
50
16
20
11
12
15
10
17
30
29
28
27
26
40


77°W
76°W
75°W
14°S
16°S
132
144
CALLAO
68
62
PARACAS
PENINSULA
JOINT-II
JASON
8-16 AUG 1976
R/V EASTWARD
LEG 2
122
131
PUNTA AZUA
120
121
109
107
108
105,
106
111
115
118,
119
112
CABO NAZCA
103
102
86,87
98
99
100
70
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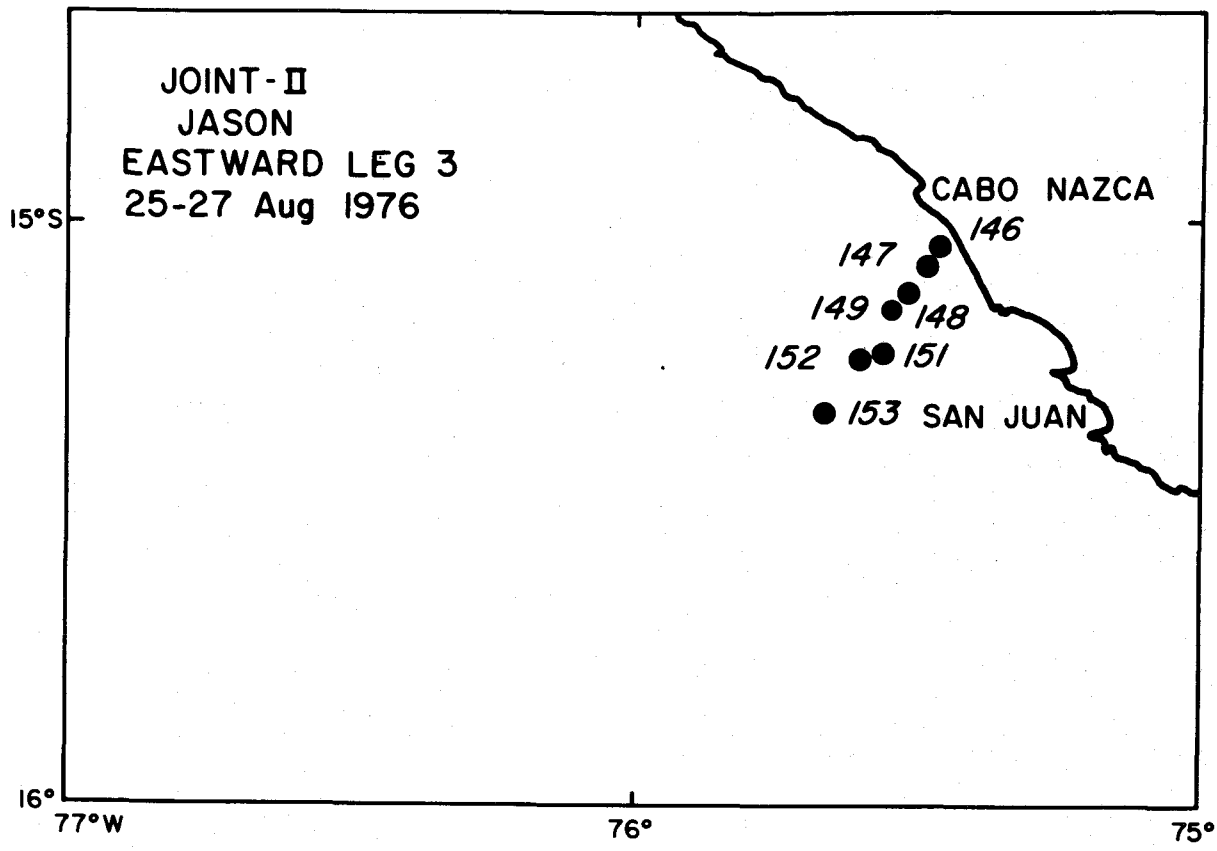
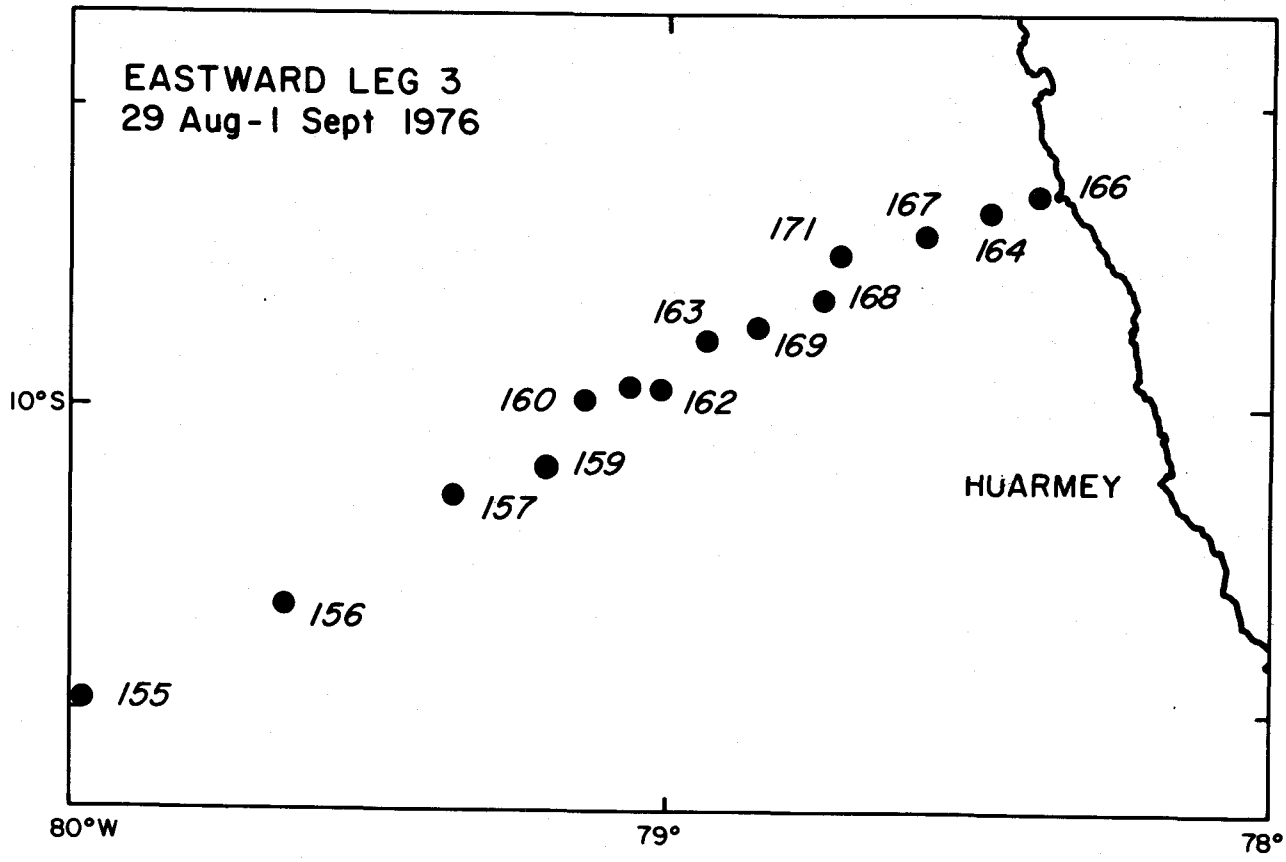
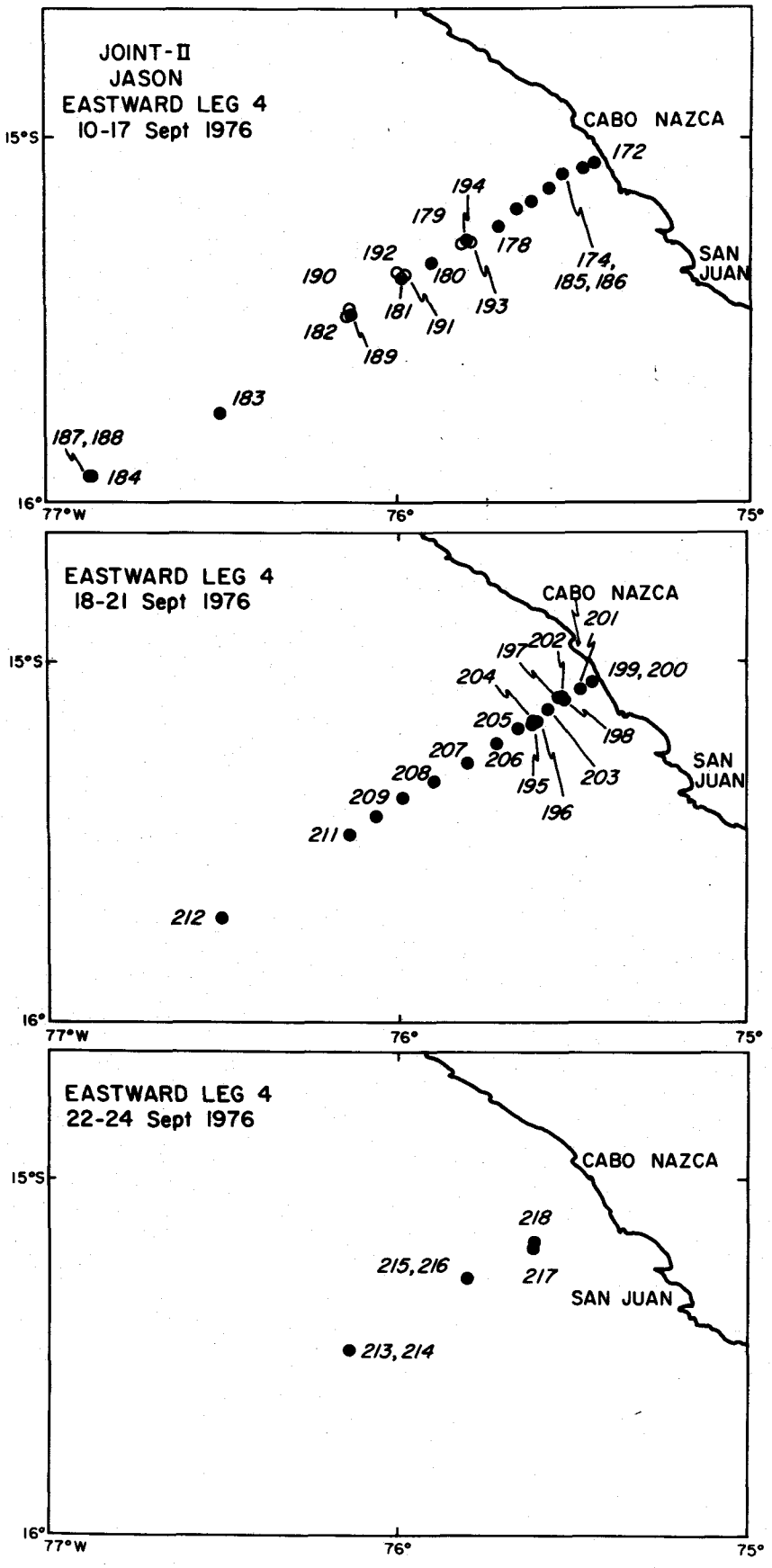
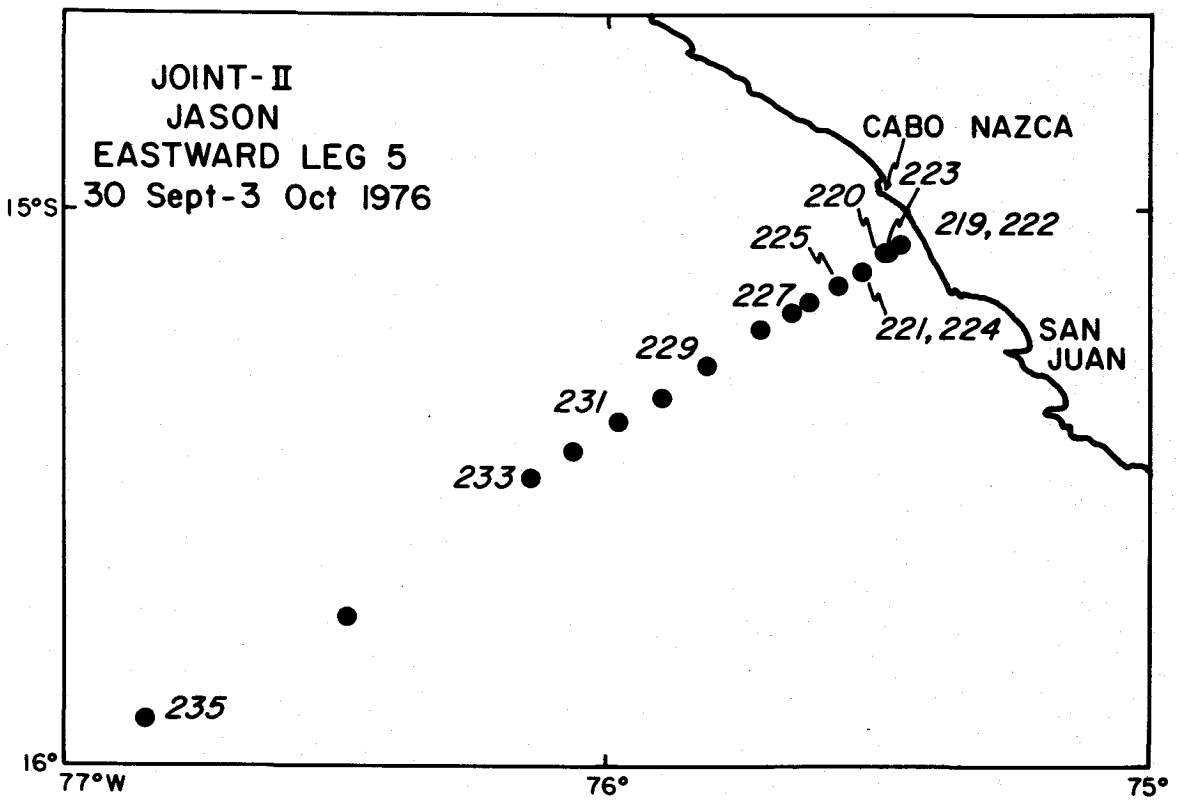
72,71
73,74
75
76,77
80
83
88
PTA. LOMAS
89
97


JOINT-II
JASON
EASTWARD LEG 3
25-27 Aug 1976
CABO NAZCA
146
147
149
148
152
151
153 SAN JUAN
15°S
16°
77°W
76°
75°

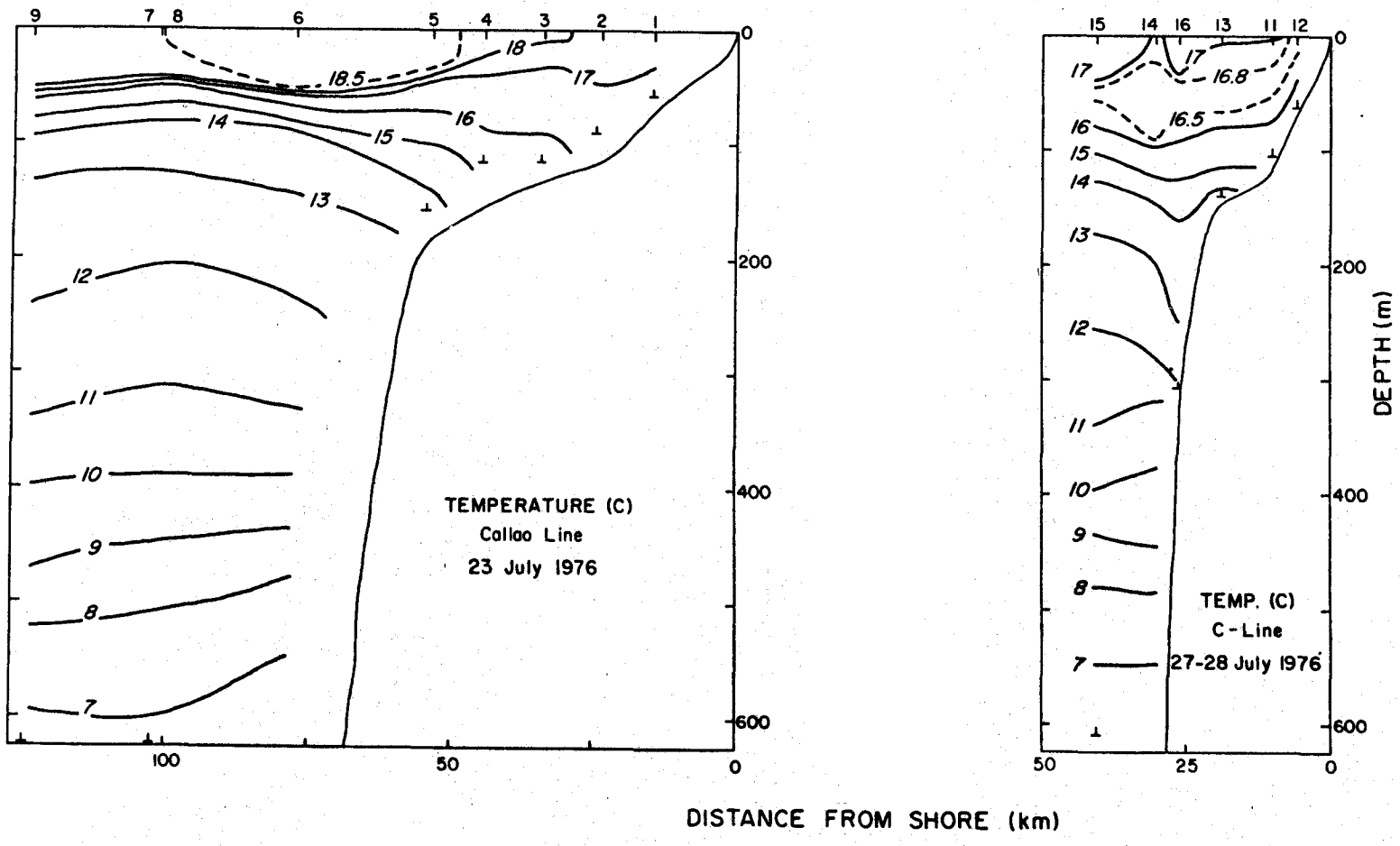

EASTWARD LEG 3
29 Aug-1 Sept 1976
166
167
171
164
168
163
169
160
162
159
157
HUARMEY
156
155
10°S
80°W
79°
78°

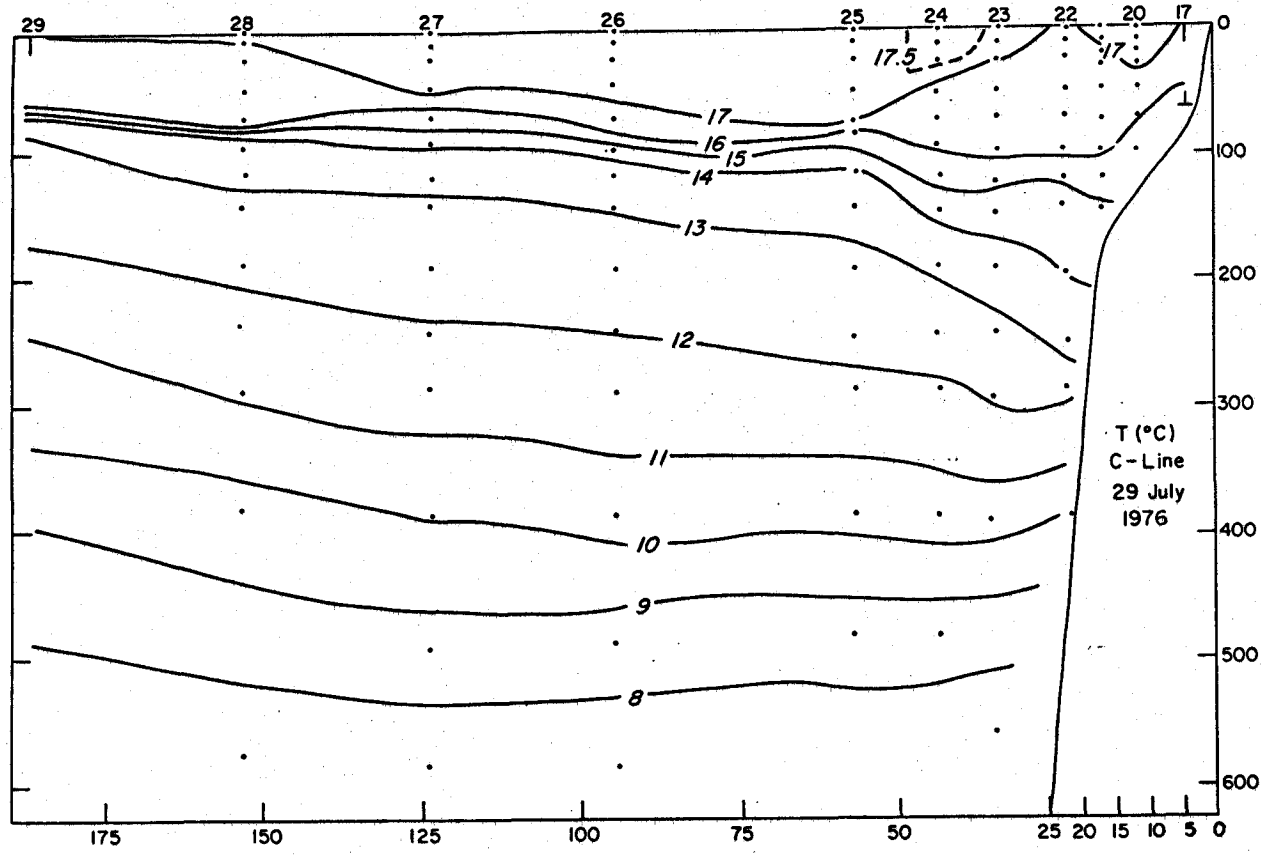

JOINT-II
JASON
EASTWARD LEG 4
10-17 Sept 1976
CABO NAZCA
SAN JUAN
172
194
179
178
174,
185, 186
192
180
190
181
193
191
182
189
183
187, 188
184
15°S
16°
77°W
76°
75°
EASTWARD LEG 4
18-21 Sept 1976
CABO NAZCA
201
202
197
199, 200
204
205
198
207
206
203
208
195
209
196
211
212
SAN JUAN
EASTWARD LEG 4
22-24 Sept 1976
CABO NAZCA
218
215, 216
217
SAN JUAN
213, 214

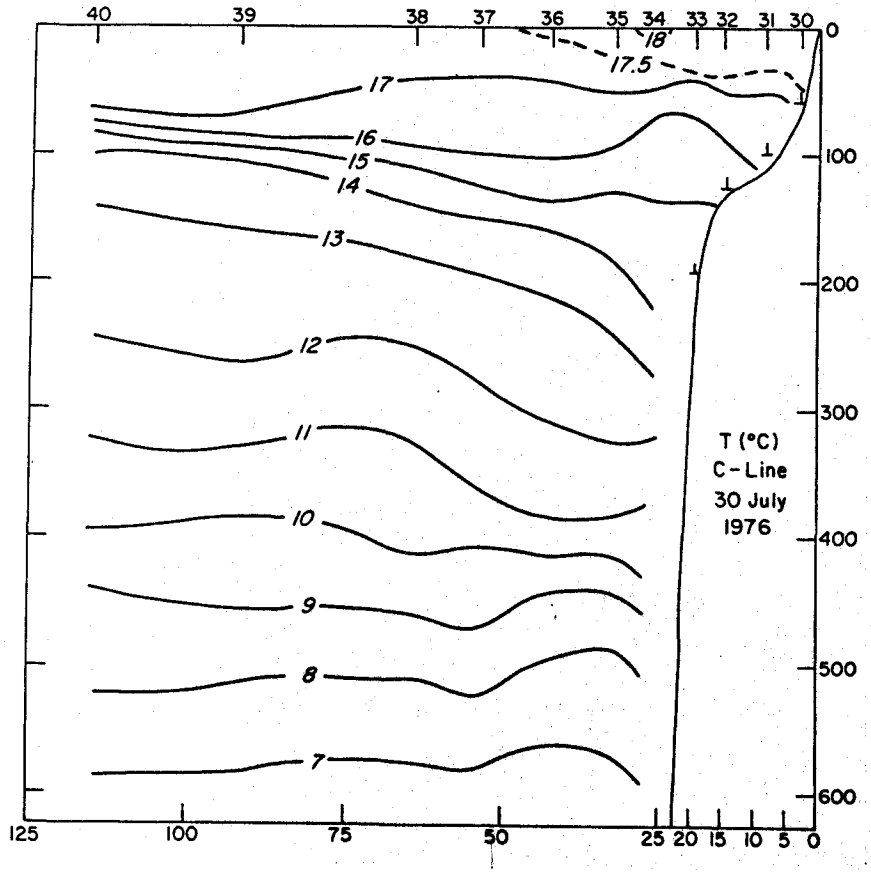

JOINT-II
JASON
EASTWARD LEG 5
30 Sept-3 Oct 1976
CABO NAZCA
223
220
219, 222
225
227
221, 224
SAN
JUAN
229
231
233
235
15°S
16°
77°W
76°
75°

VERTICAL SECTIONS DURING JASON

Temperature


9 7 8 6 5 4 3 2 1
0
18
18.5
17
16
14
15
13
12
11
10
9
8
7
200
400
600
100
50
0
TEMPERATURE (C)
Callao Line
23 July 1976
15 14 16 13 11 12
0
17
17
16.8
16.5
16
15
14
13
12
11
10
9
8
7
200
400
600
50
25
0
TEMP. (C)
C-Line
27-28 July 1976
DEPTH (m)
DISTANCE FROM SHORE (km)


29
28
27
26
25
24
23
22
20
17
0
17.5
17
17
16
15
14
13
12
11
10
9
8
100
200
300
400
500
600
T (°C)
C-Line
29 July
1976
175
150
125
100
75
50
25
20
15
10
5
0


40 39 38 37 36 35 34 33 32 31 30
18
17.5
17
16
15
14
13
12
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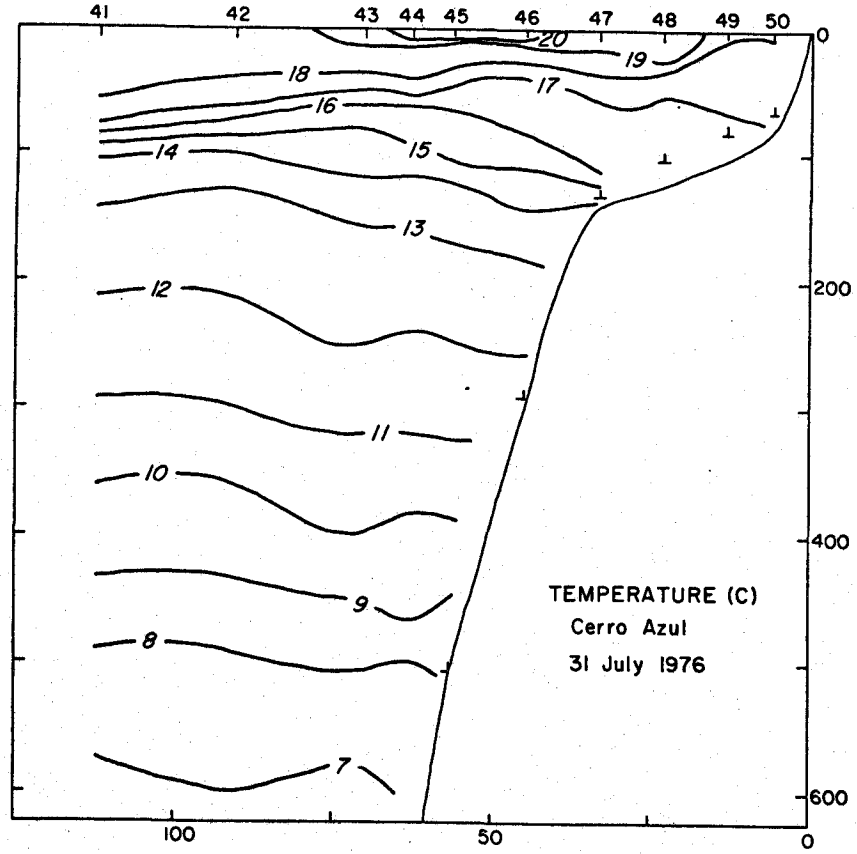
9
8
7
0 100 200 300 400 500 600
125 100 75 50 25 20 15 10 5 0
T (°C)
C-Line
30 July
1976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20
19
18
17
16
15
14
13
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11
10
9
8
7
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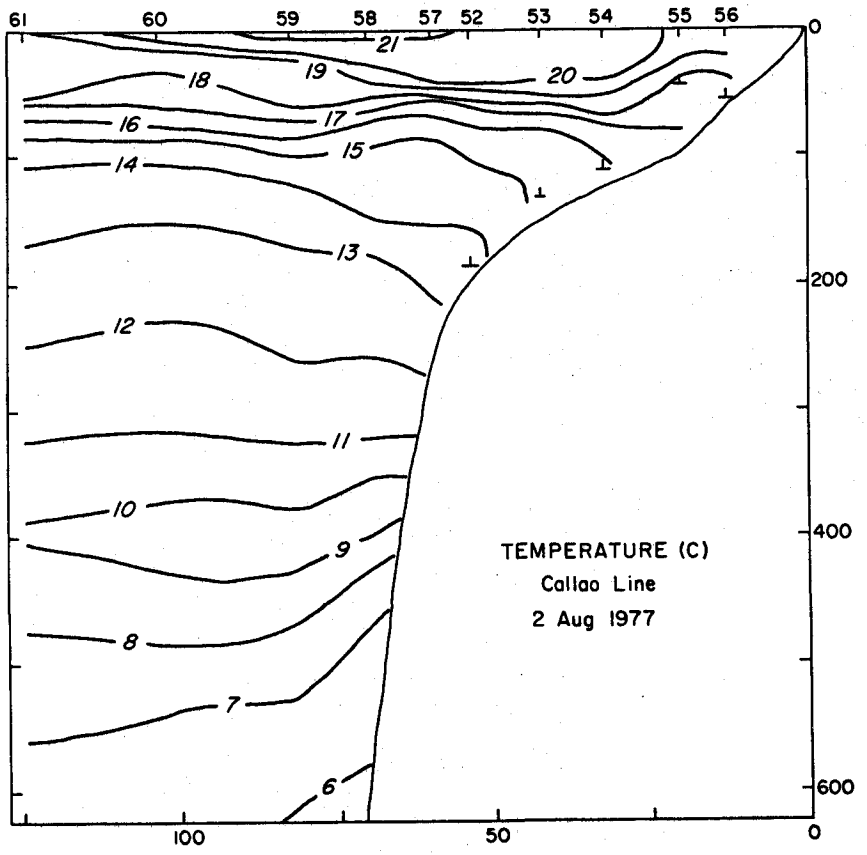
100 50 0
TEMPERATURE (C)
Cerro Azul
31 July 1976


61 60 59 58 57 52 53 54 55 56
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400
600
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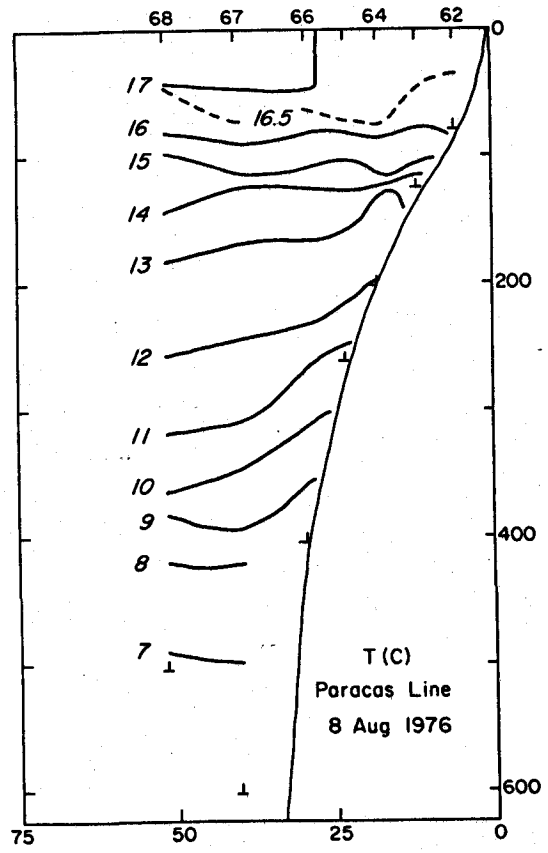
TEMPERATURE (C)
Callao Line
2 Aug 1977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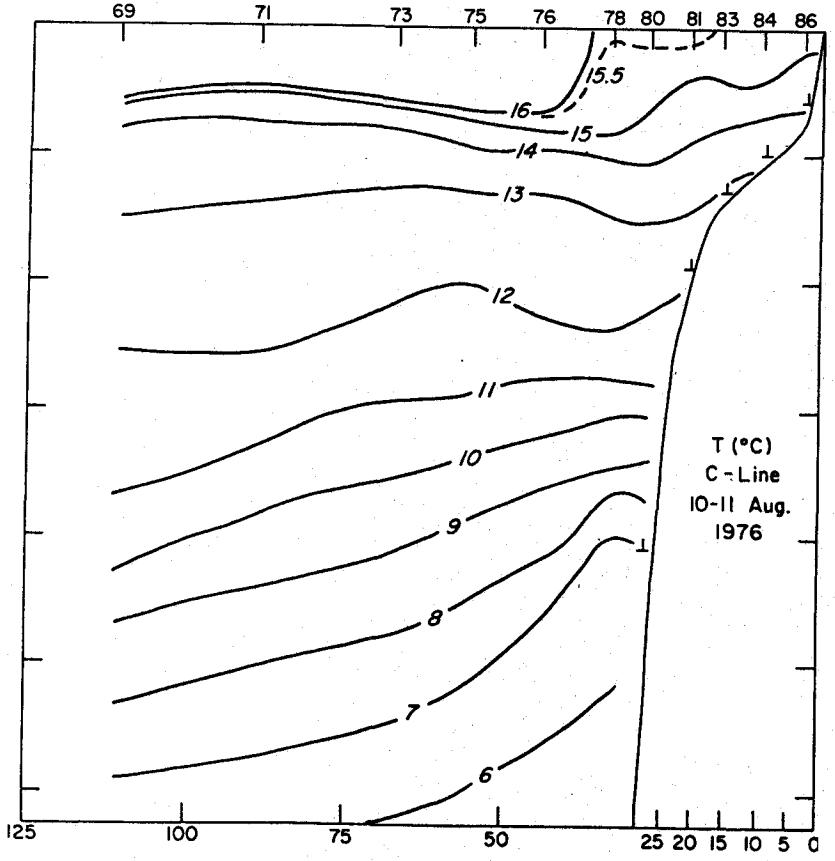
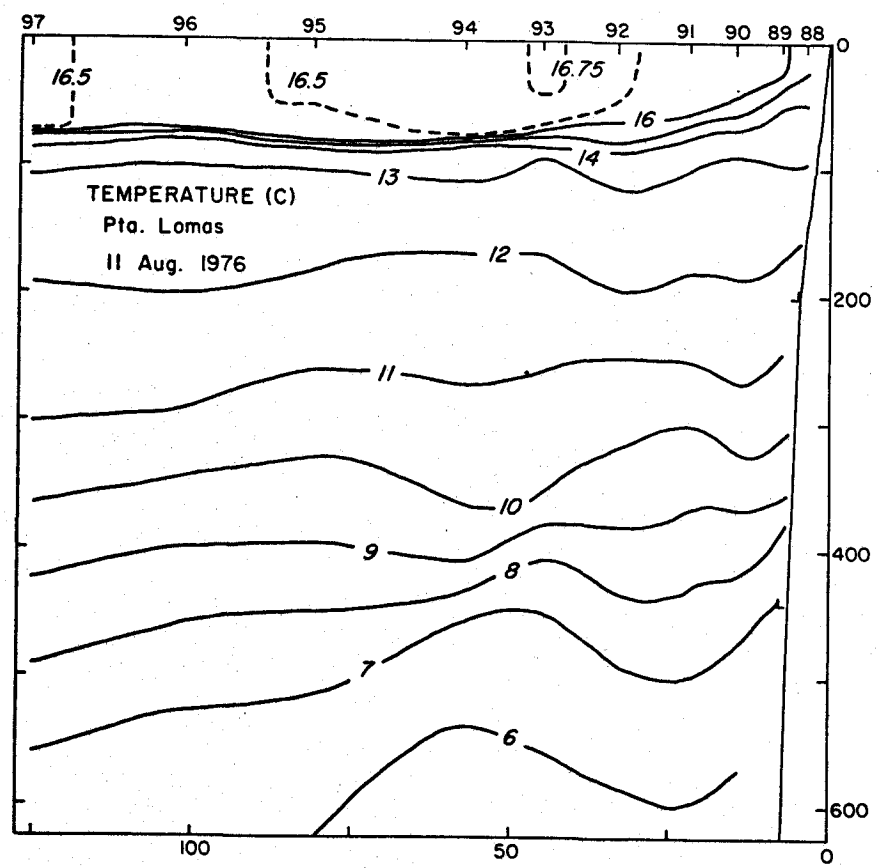
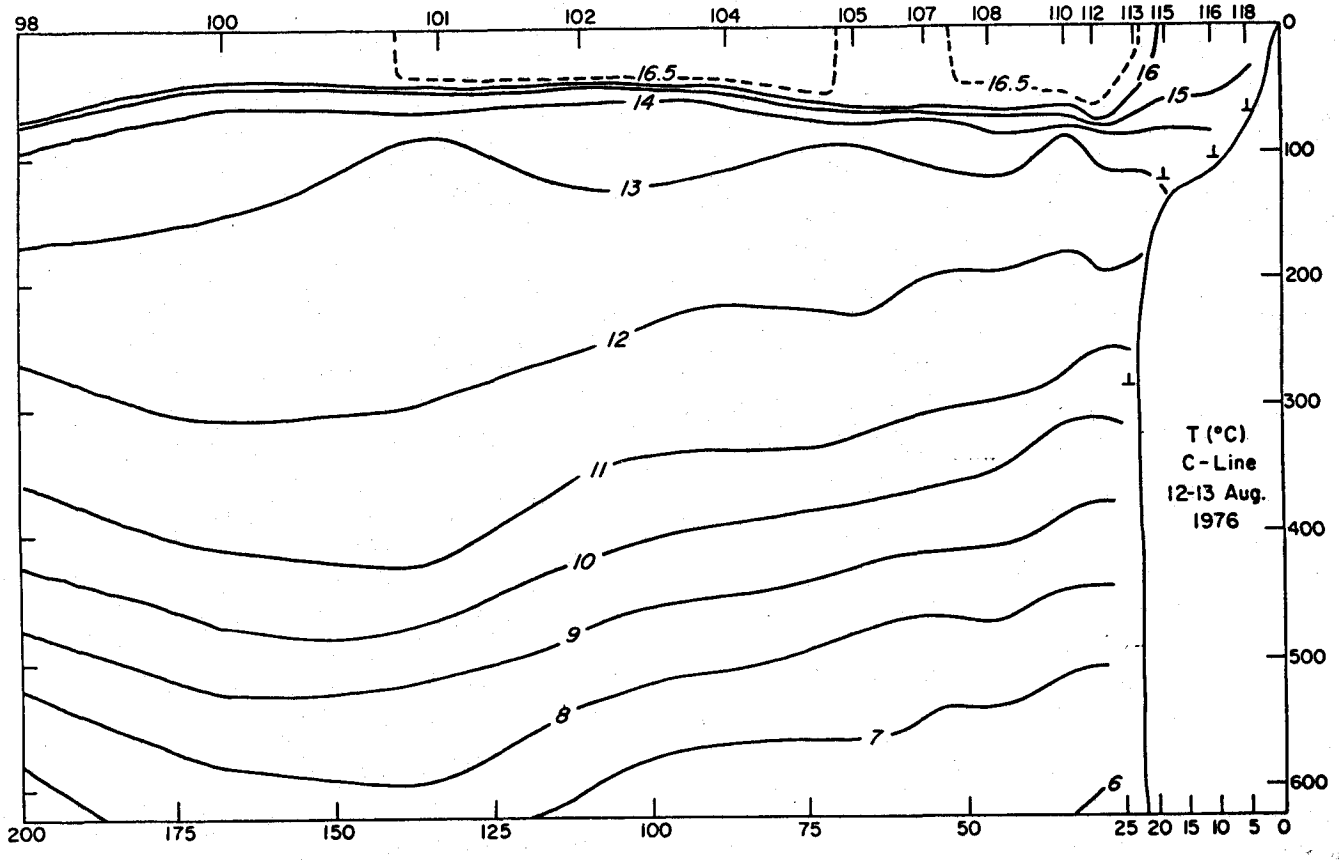
200
400
600
75 50 25 0
17 16.5 16 15 14 13 12 11 10 9 8 7
T (C)
Paracas Line
8 Aug 1976


69 71 73 75 76 78 80 81 83 84 86
15.5
16
15
14
13
12
11
10
9
8
7
6
T (°C)
C - Line
10-11 Aug.
1976
125 100 75 50 25 20 15 10 5 0


97 96 95 94 93 92 91 90 89 88 0
16.5
16.5
16.75
16
14
13
TEMPERATURE (C)
Pta. Lomas
11 Aug. 1976
12
11
10
9
8
7
6
200
400
600
100 50 0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13
12
11
10
9
8
7
6
100
200
300
400
500
600
T (°C)
C-Line
12-13 Aug.
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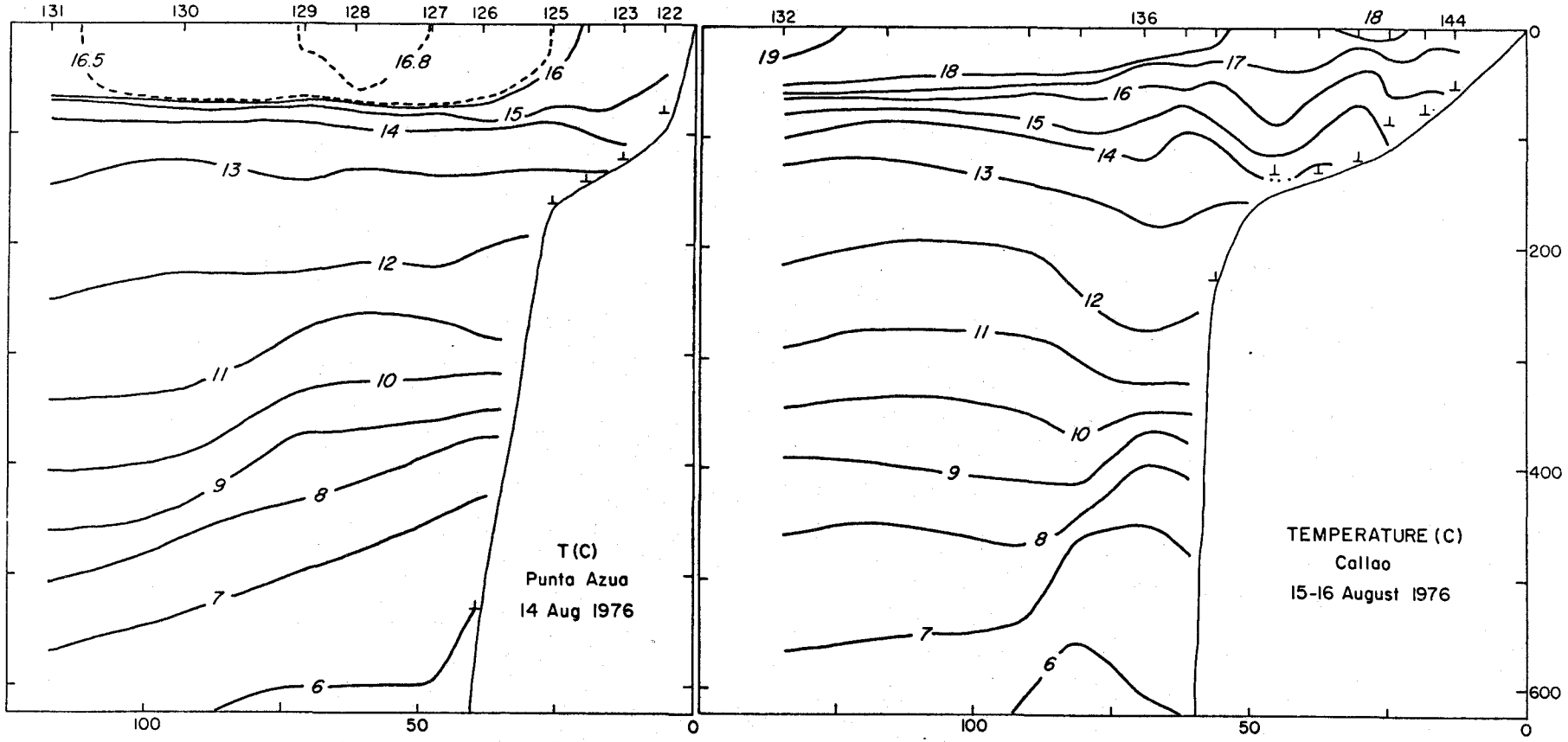
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7
6
100
50
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T(C)
Punta Azua
14 Aug 1976
132
136
18
144
19
18
17
16
15
14
13
12
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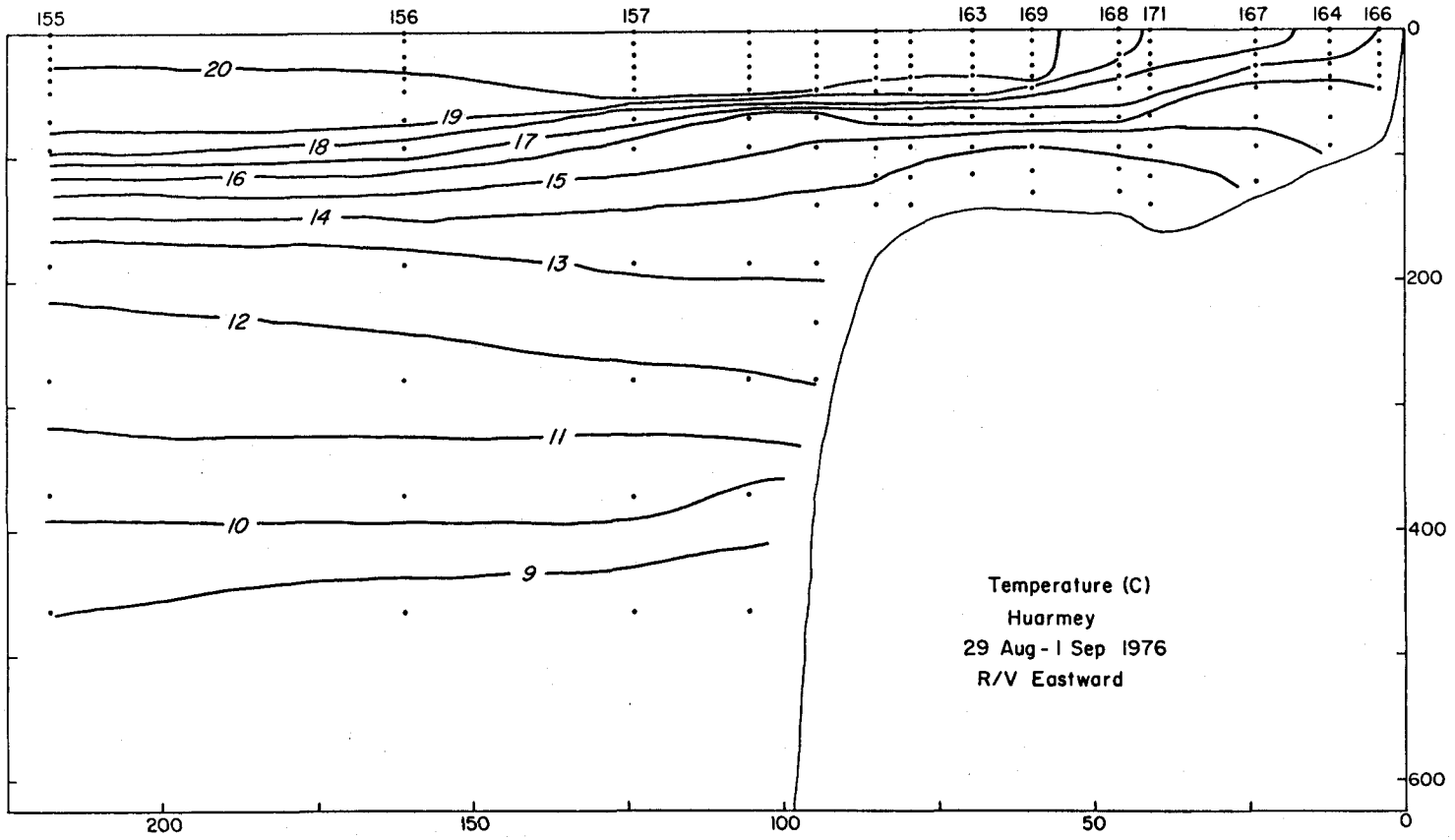
TEMPERATURE (C)
Callao
15-16 August 1976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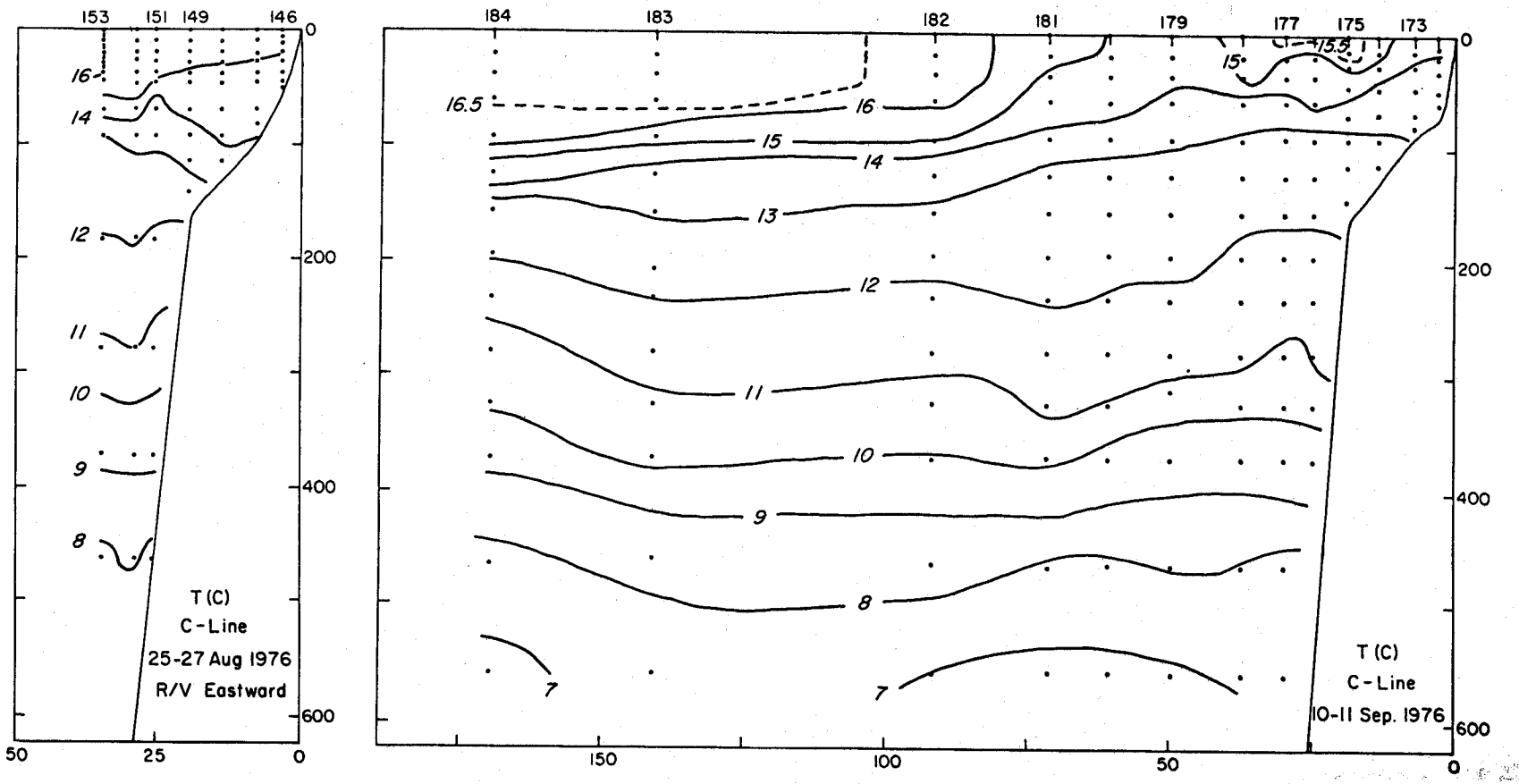
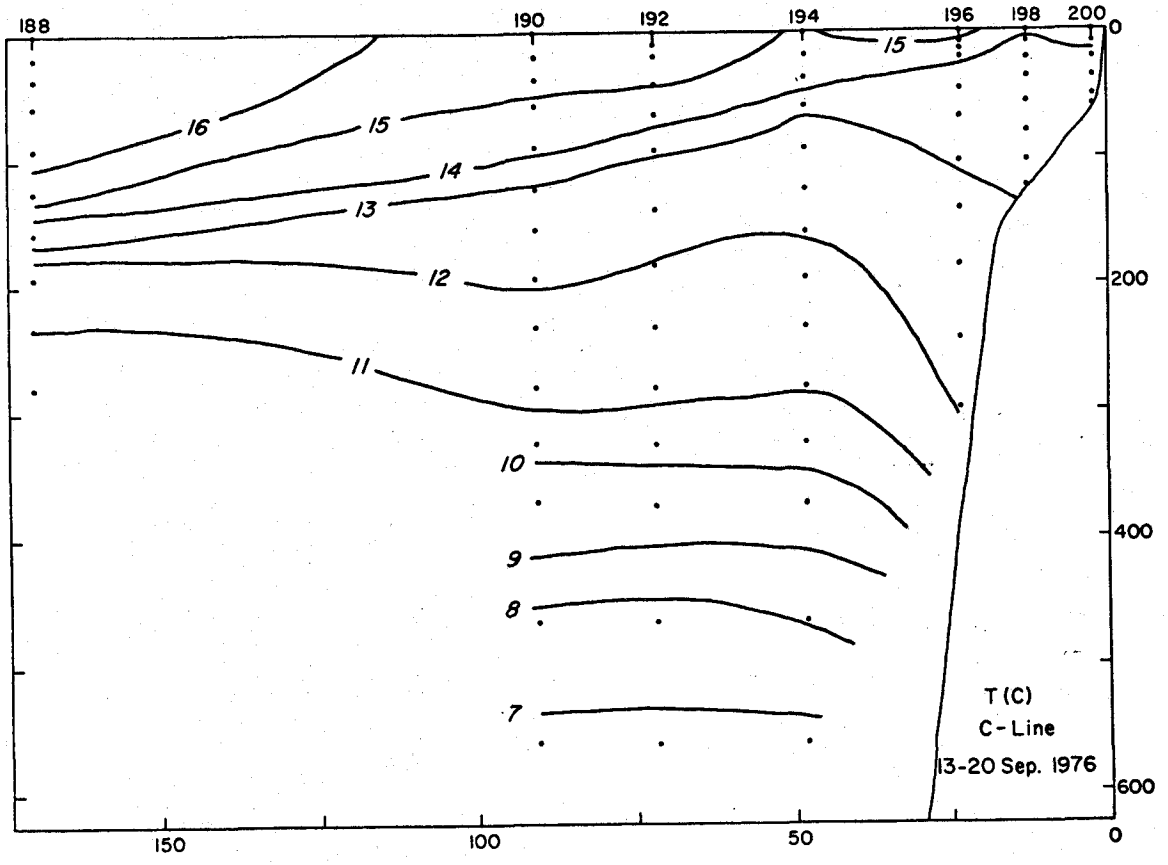
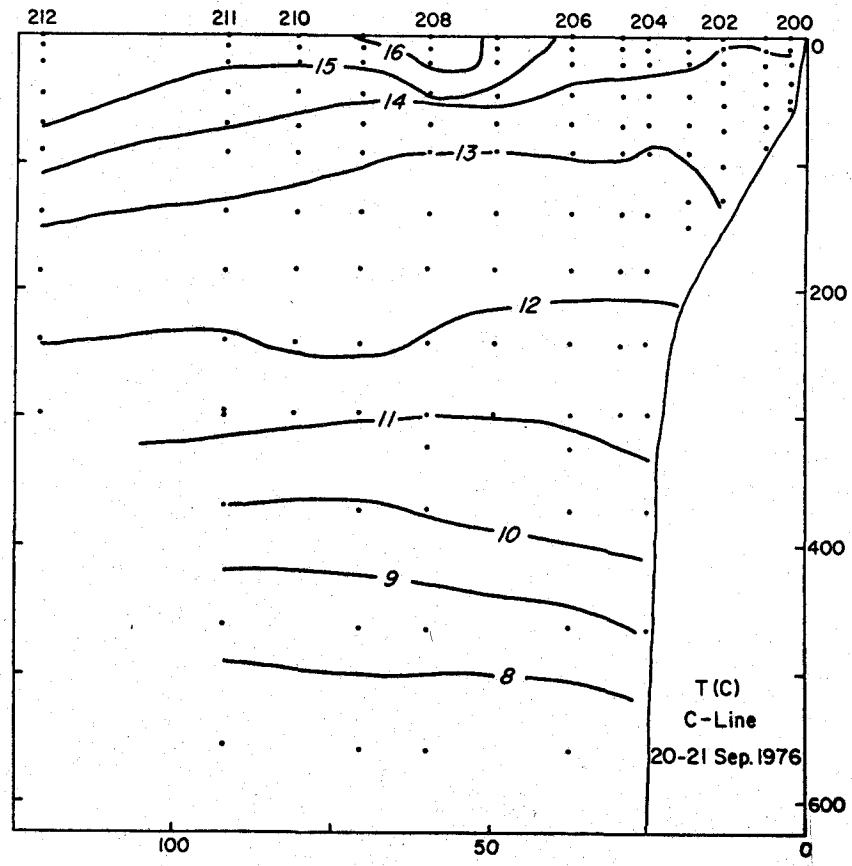
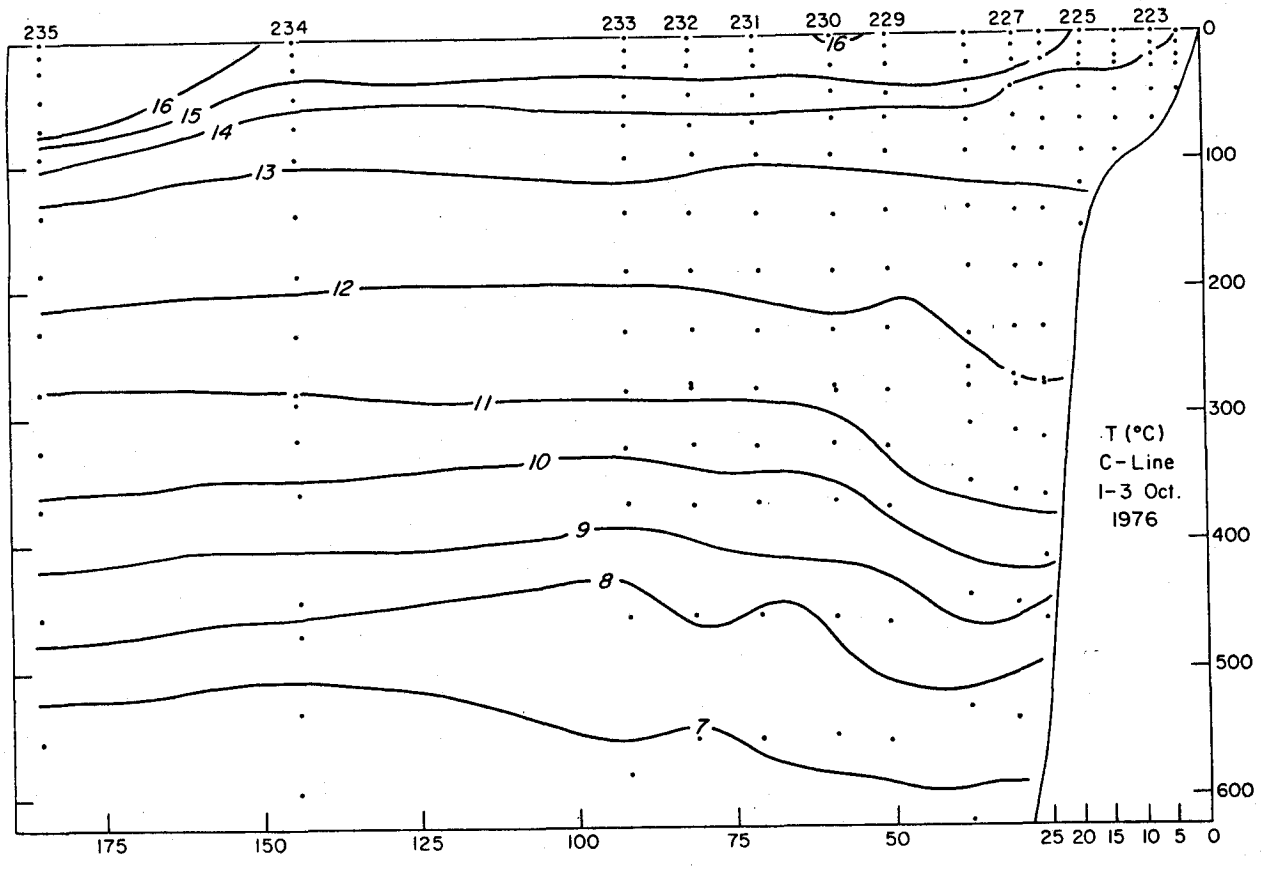
Temperature (C)
Huarmey
29 Aug - 1 Sep 1976
R/V Eastward


153
151
149
146
0
16
14
12
11
10
9
8
200
400
600
50
25
0
T (C)
C - Line
25-27 Aug 1976
R/V Eastward
184
183
182
181
179
177
175
173
0
16.5
16
15
14
13
12
11
10
9
8
7
7
15.5
15
200
400
600
150
100
50
0
T (C)
C - Line
10-11 Sep. 1976

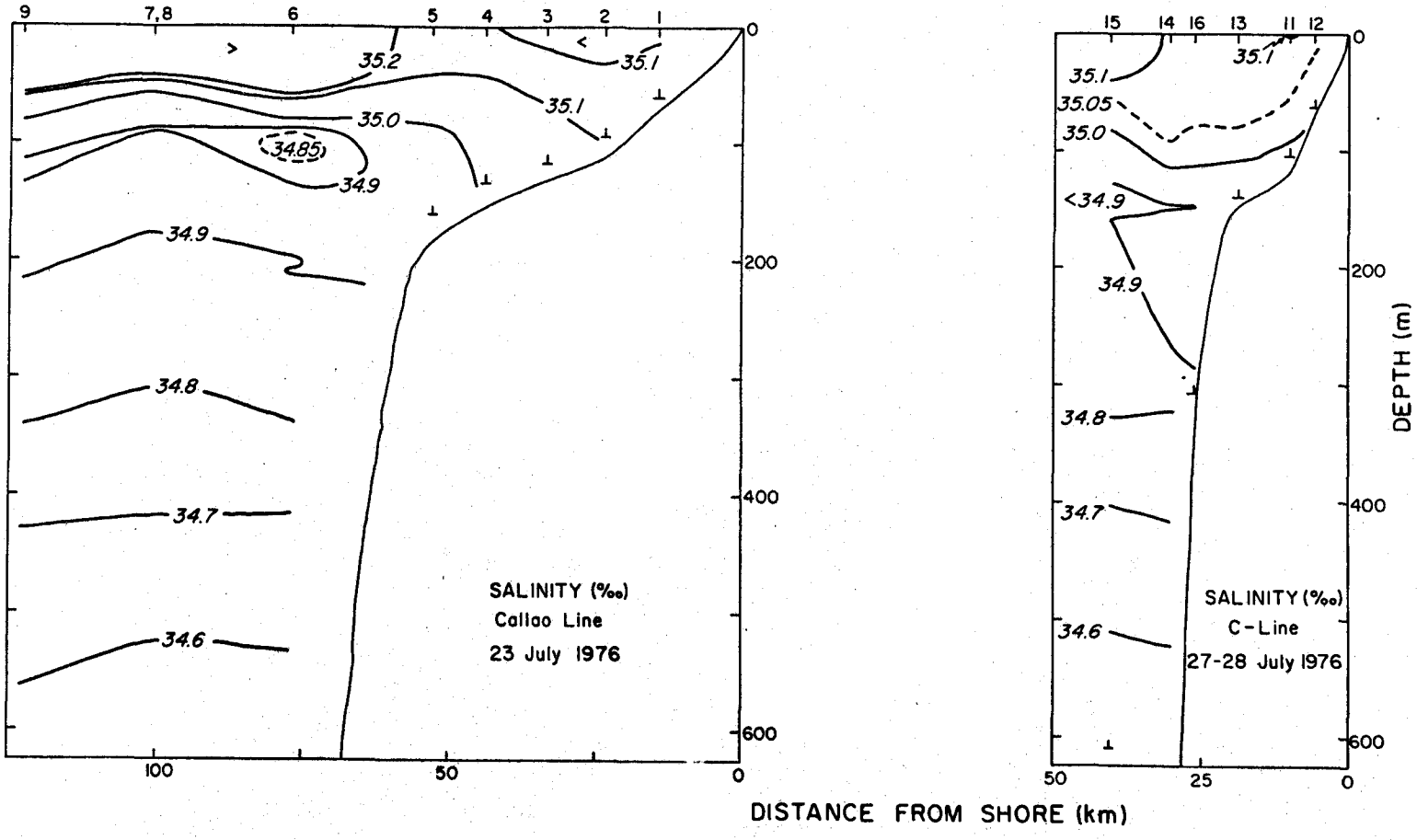

188
190
192
194
196
198
200
0
16
15
14
13
12
11
10
9
8
7
15
200
400
600
T (C)
C-Line
13-20 Sep. 1976
150
100
50
0

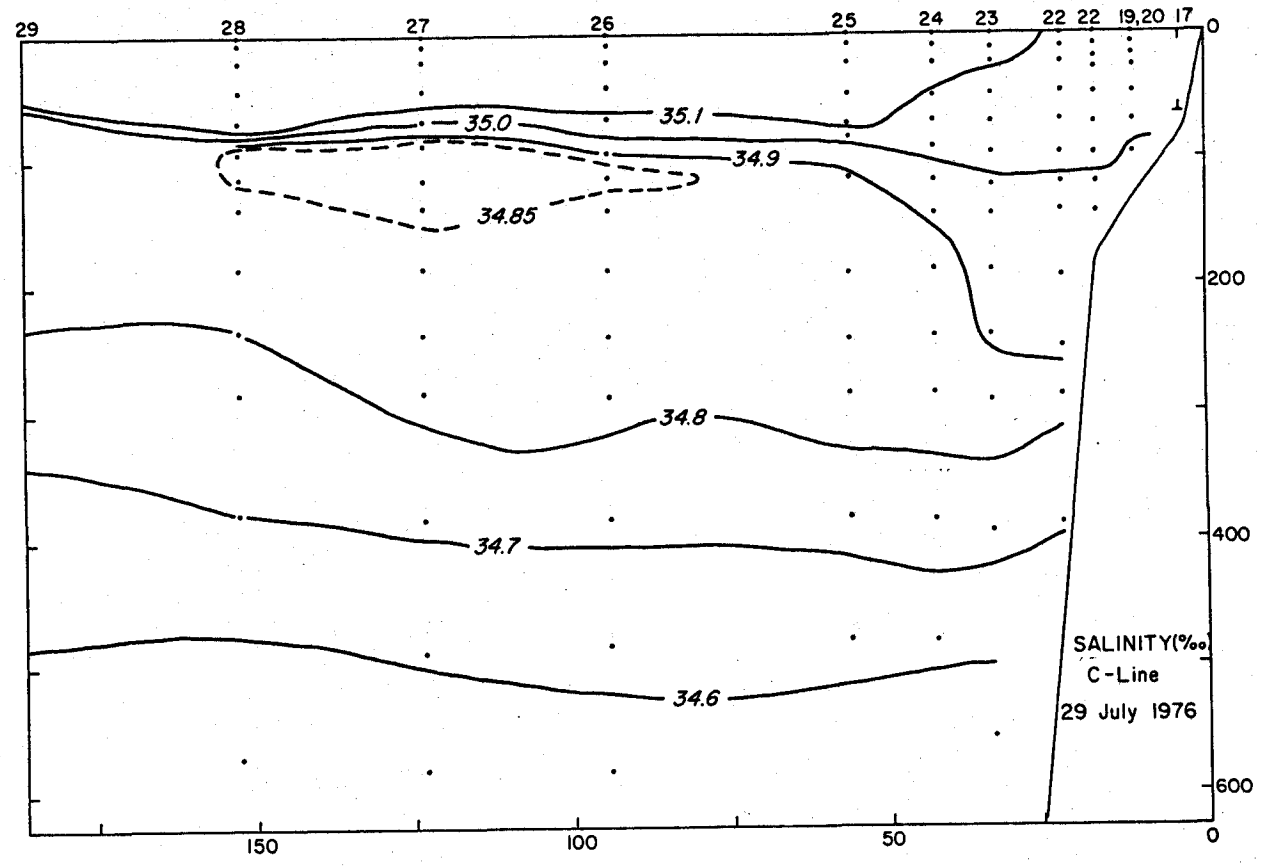

212
211
210
208
206
204
202
200
0
200
400
600
16
15
14
13
12
11
10
9
8
100
50
0
T (C)
C-Line
20-21 Sep. 1976

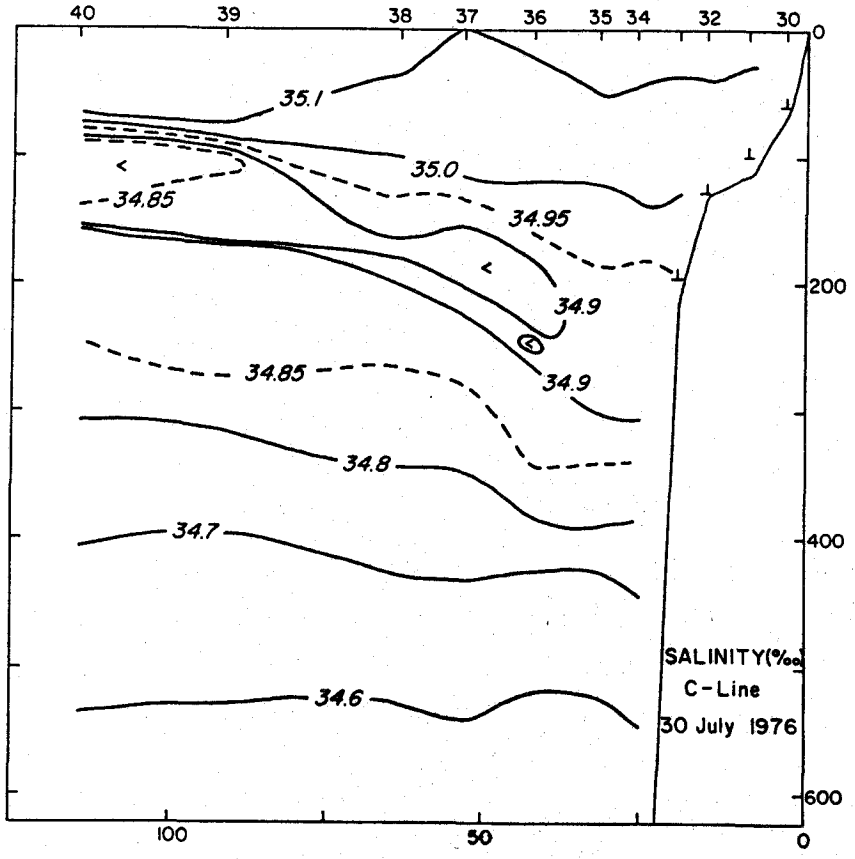

235
234
233
232
231
230
229
227
225
223
16
15
14
13
12
11
10
9
8
7
0
100
200
300
400
500
600
T (°C)
C-Line
1-3 Oct.
1976
175
150
125
100
75
50
25 20 15 10 5 0

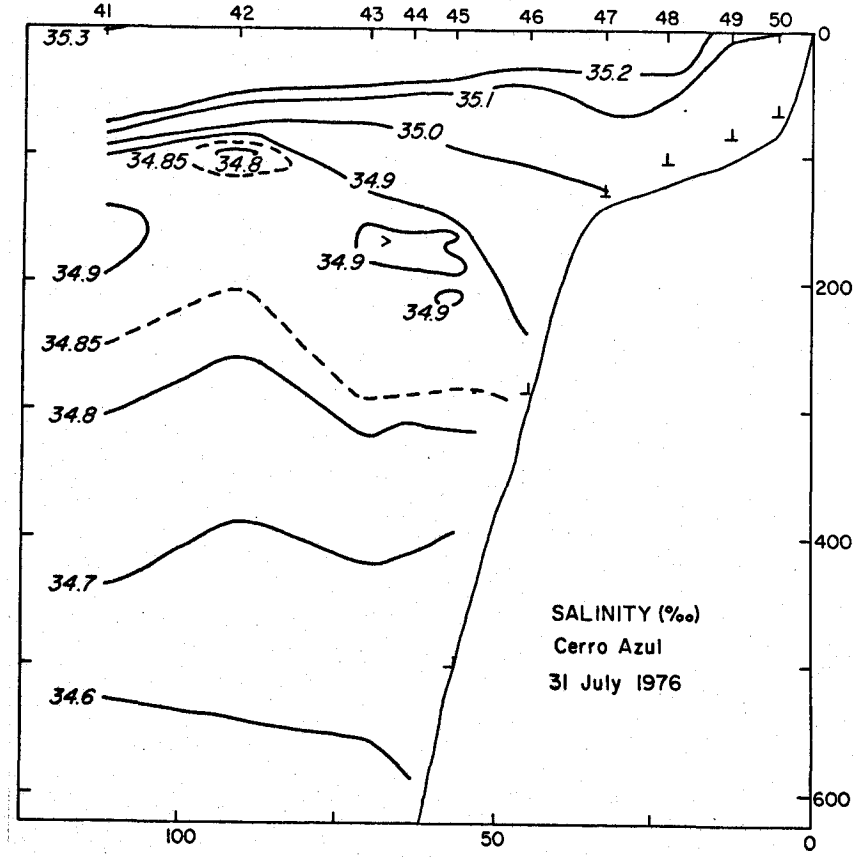
VERTICAL SECTIONS DURING JASON

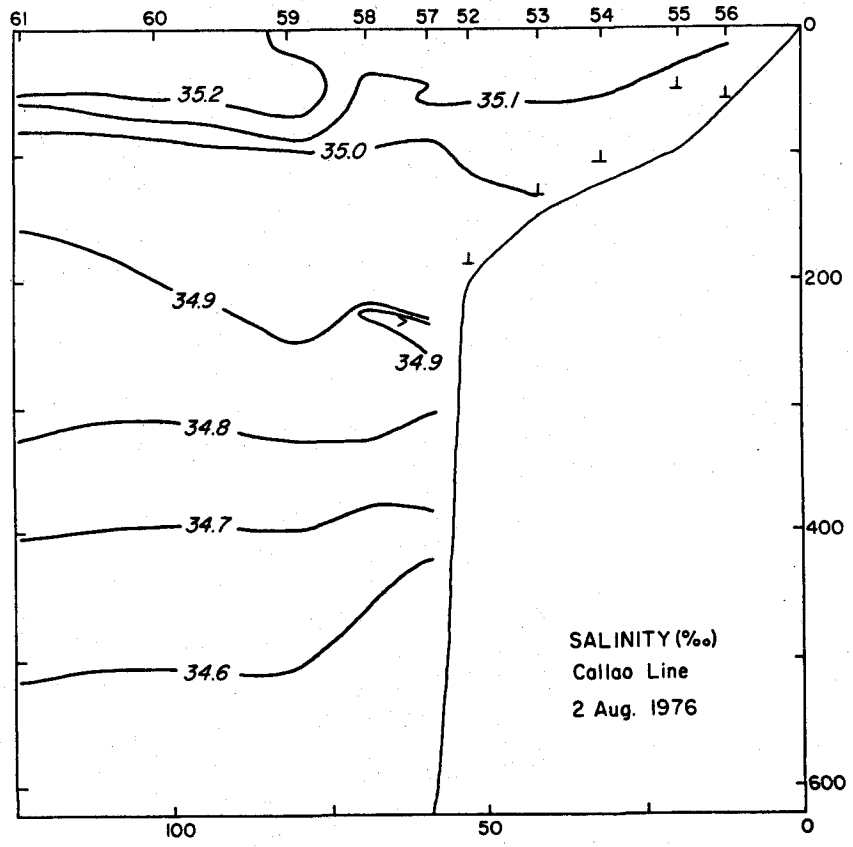
Salinity

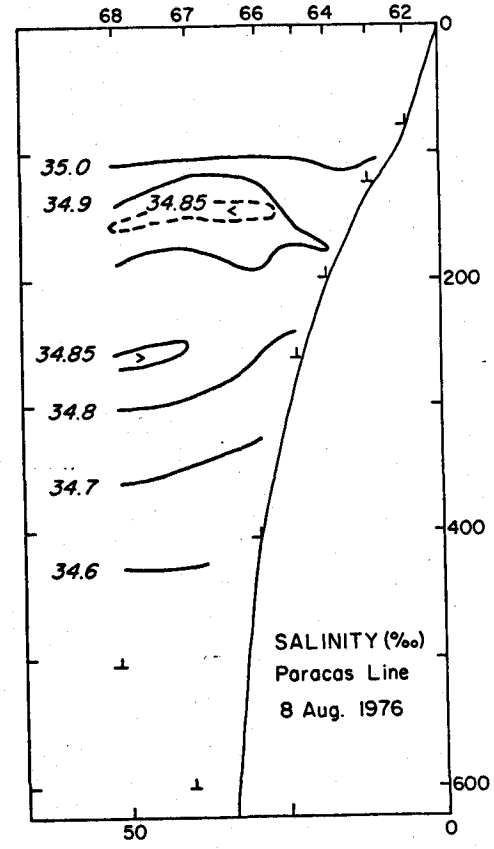

9
7,8
6
5
4
3
2
1
0
35.2
35.1
35.1
35.0
34.85
34.9
34.9
34.8
34.7
34.6
200
400
600
100
50
0
SALINITY (‰)
Callao Line
23 July 1976
15
14
16
13
11
12
0
35.1
35.1
35.05
35.0
<34.9
34.9
34.8
34.7
34.6
200
400
600
50
25
0
SALINITY (‰)
C-Line
27-28 July 1976
DEPTH (m)
DISTANCE FROM SHORE (km)

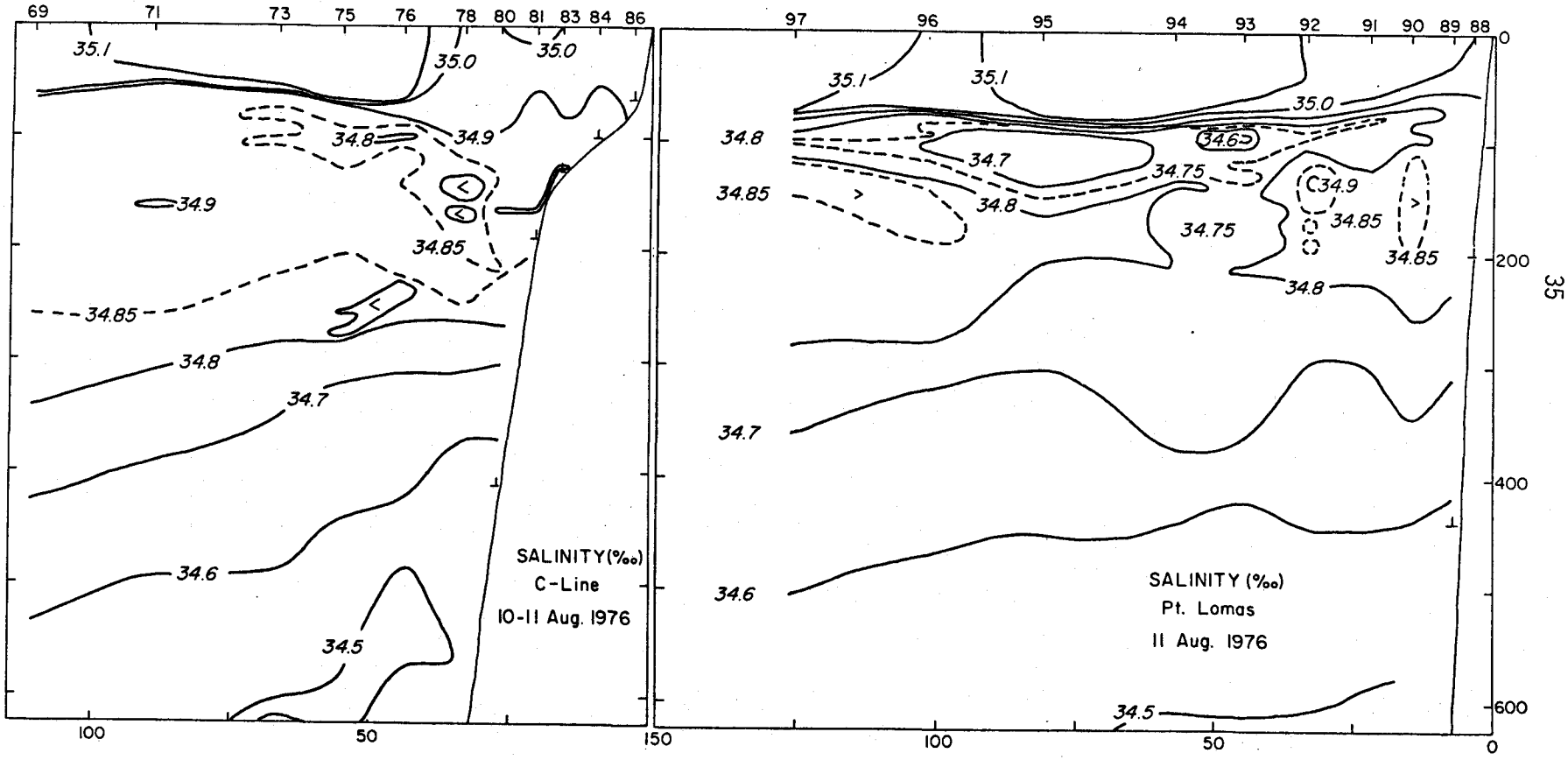

29
28
27
26
25
24
23
22
22
19,20
17
0
35.1
35.0
34.9
34.85
200
34.8
400
34.7
34.6
600
SALINITY(‰)
C-Line
29 July 1976
150
100
50
0

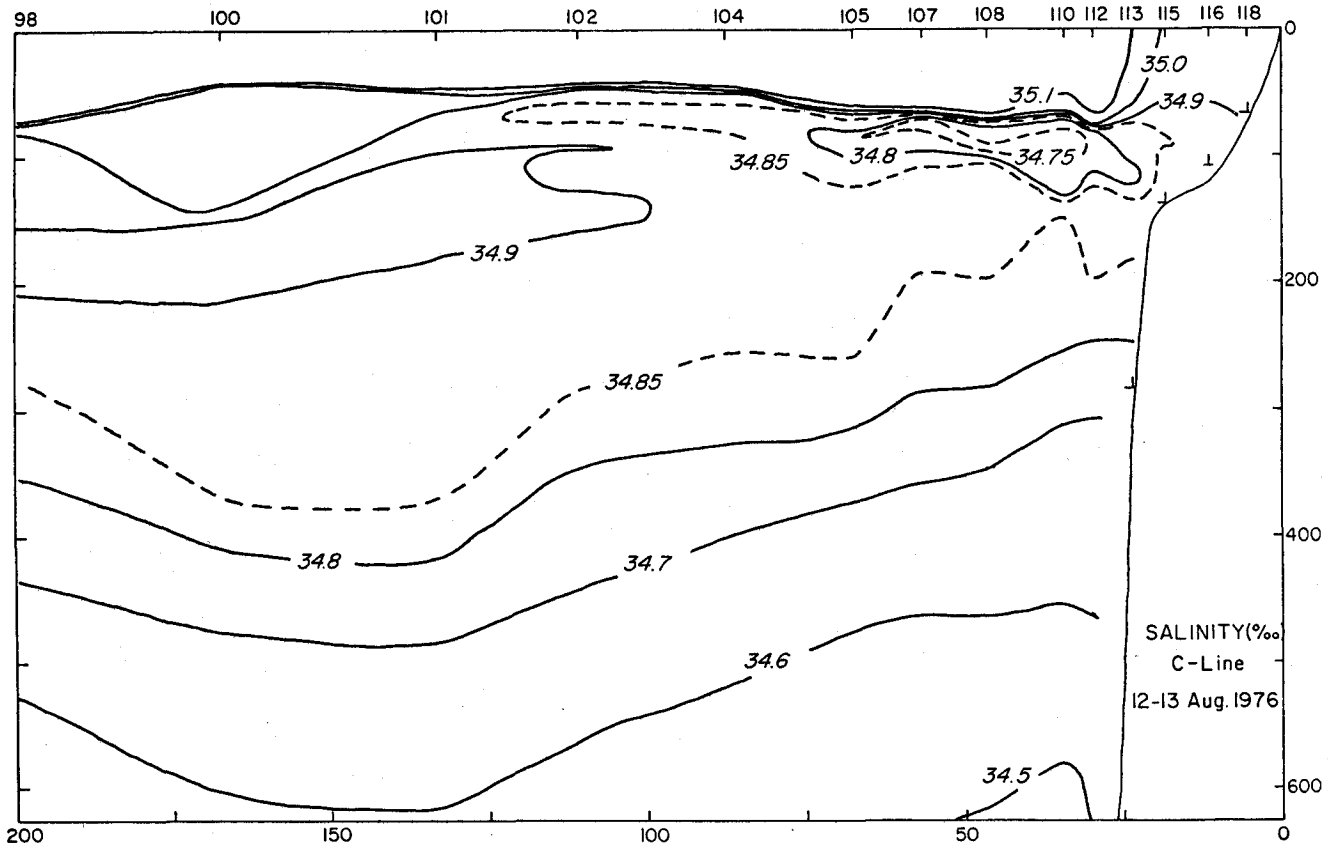

40
39
38
37
36
35
34
32
30
0
35.1
35.0
34.85
34.95
34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
100
50
0
SALINITY(‰)
C-Line
30 July 1976

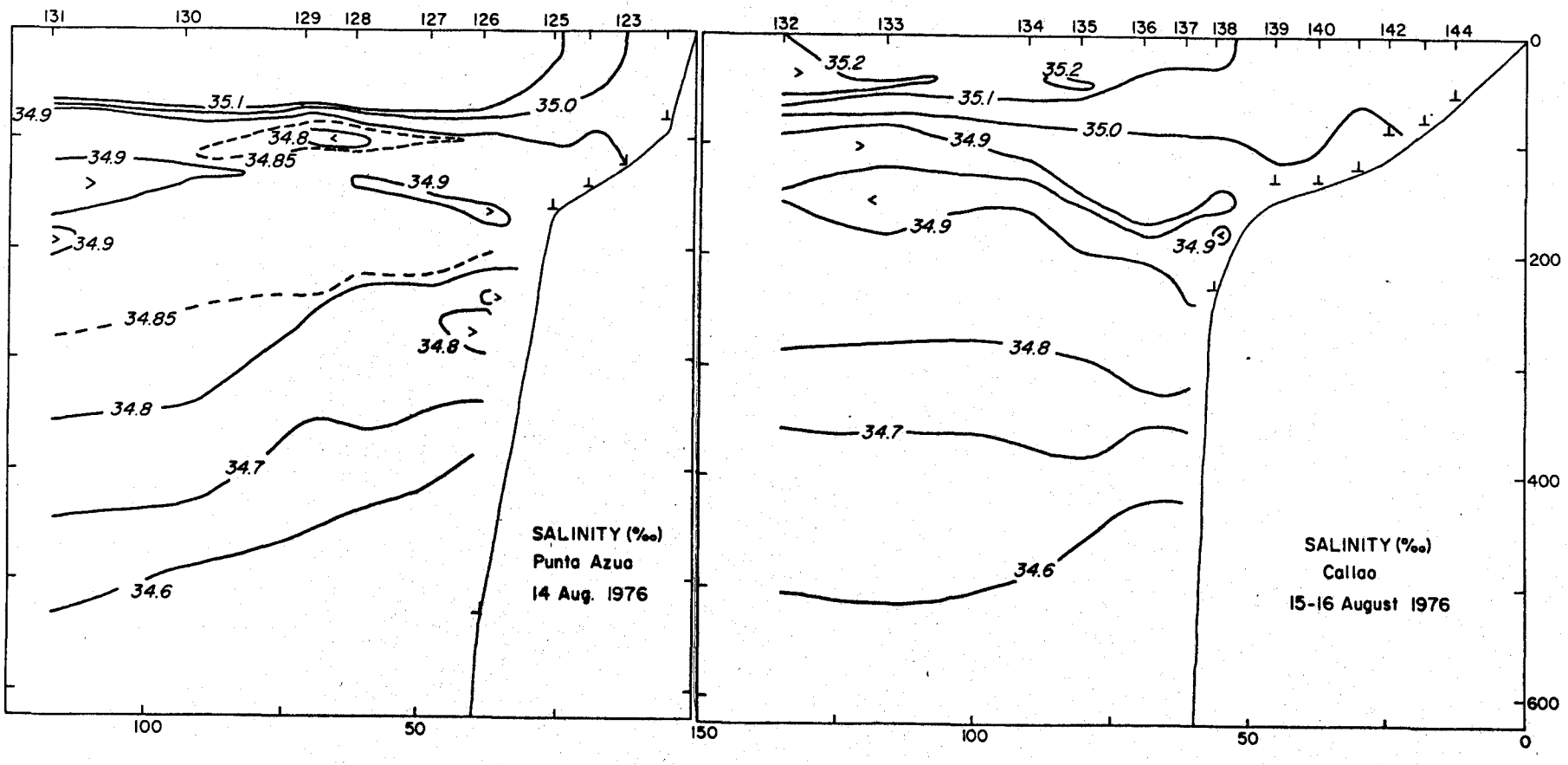

41
42
43
44
45
46
47
48
49
50
0
35.3
35.2
35.1
35.0
34.85
34.8
34.9
34.9
34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
100
50
0
SALINITY (‰)
Cerro Azul
31 July 1976

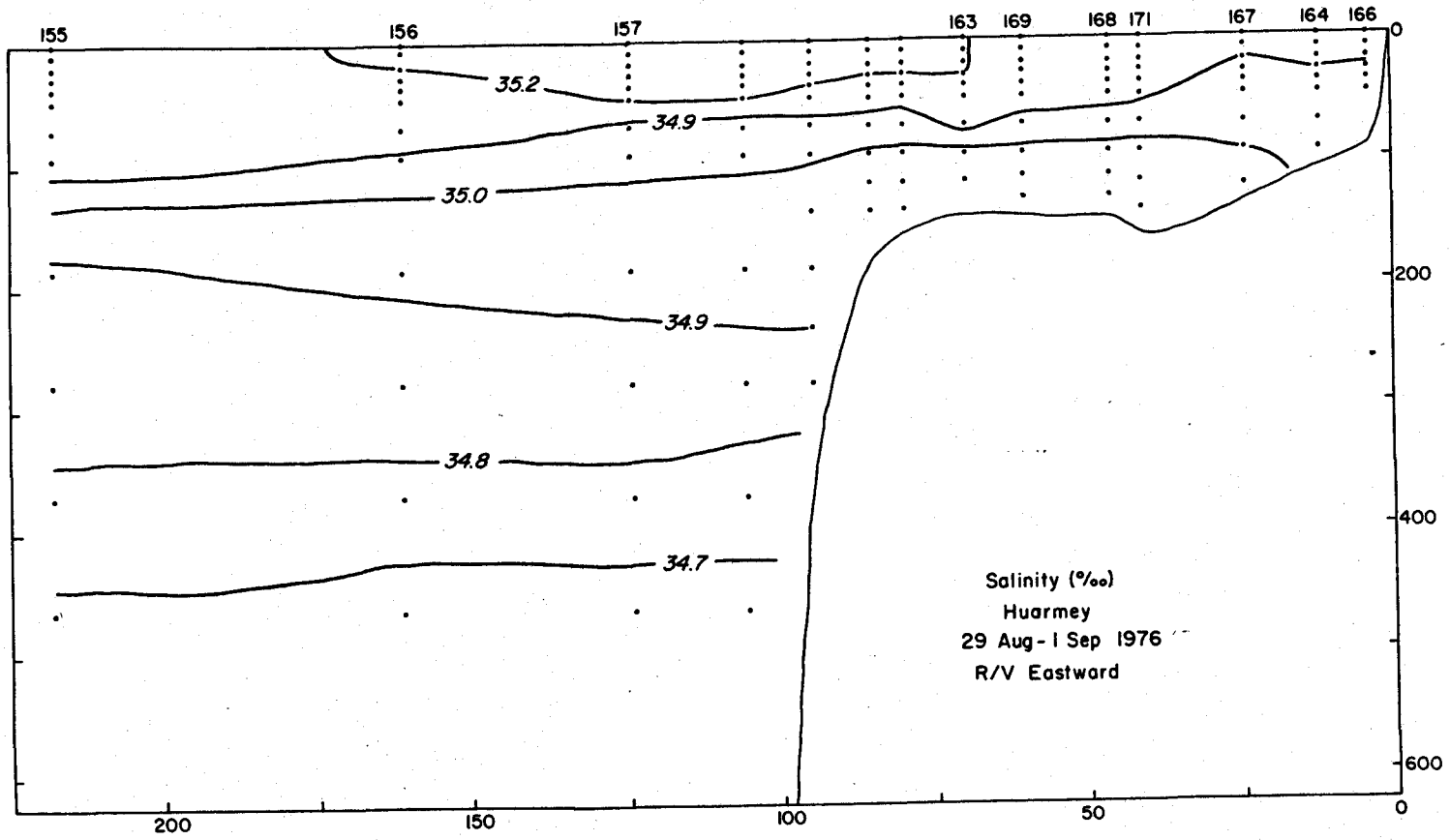

61 60 59 58 57 52 53 54 55 56
0
35.2
35.1
35.0
34.9
34.9
34.8
34.7
34.6
200
400
600
100 50 0
SALINITY (‰)
Callao Line
2 Aug. 1976

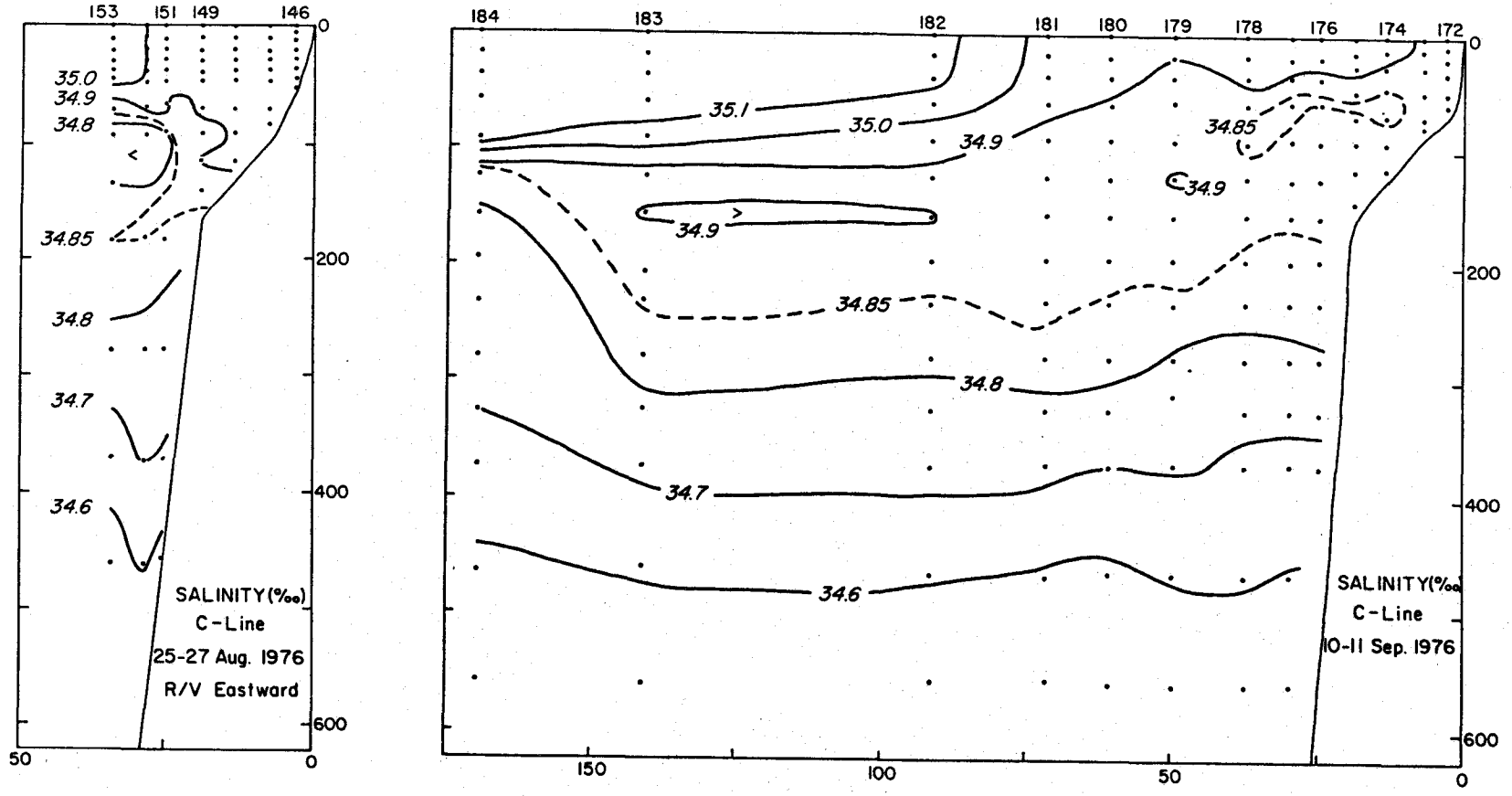

68 67 66 64 62
0
35.0
34.9
34.85
34.85
34.8
34.7
34.6
200
400
600
50 0
SALINITY (‰)
Paracas Line
8 Aug. 1976

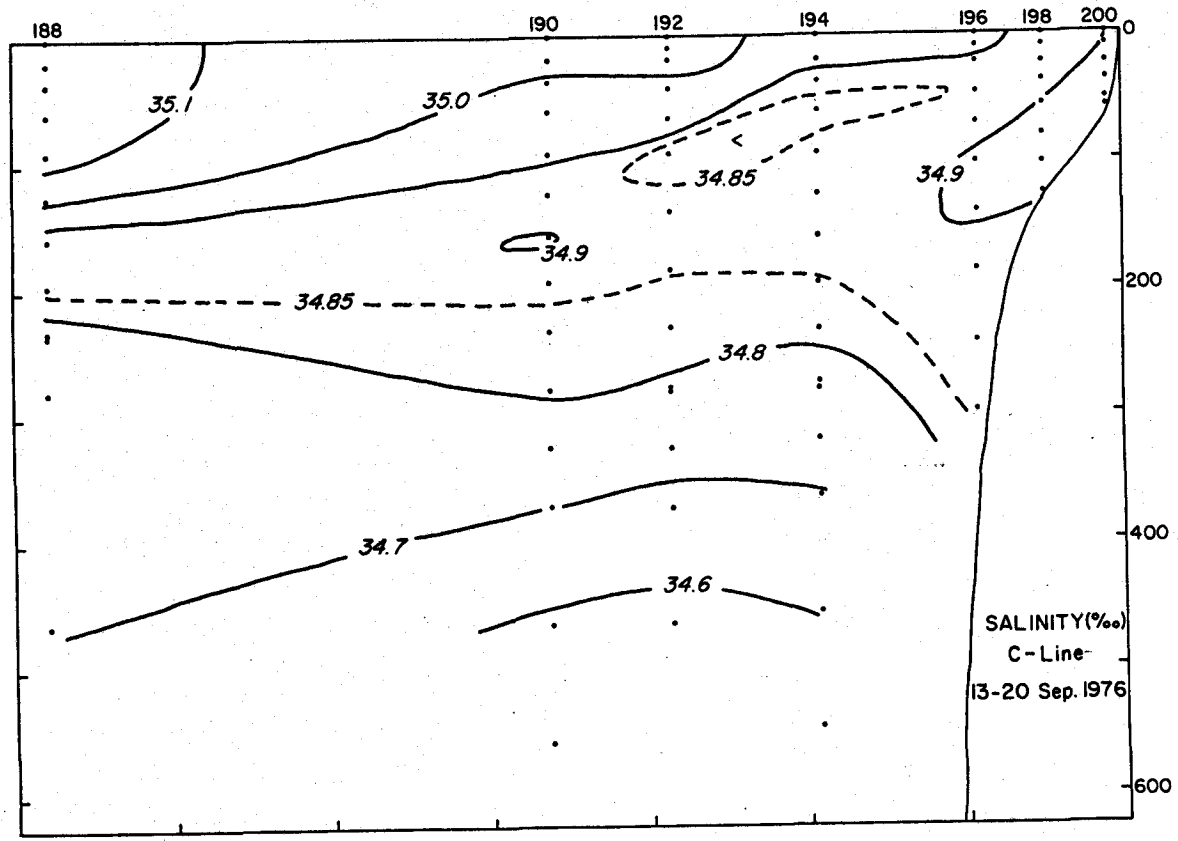

69 71 73 75 76 78 80 81 83 84 86
35.1
35.0
35.0
34.8
34.9
34.9
34.85
34.85
34.8
34.7
34.6
34.5
SALINITY(‰)
C-Line
10-11 Aug. 1976
100 50 150
97 96 95 94 93 92 91 90 89 88
35.1
35.1
35.0
34.8
34.65
34.7
34.75
34.85
34.8
C34.9
34.85
34.85
34.75
34.8
34.7
34.6
34.5
SALINITY (‰)
Pt. Lomas
11 Aug. 1976
100 50 0
0
200
400
600

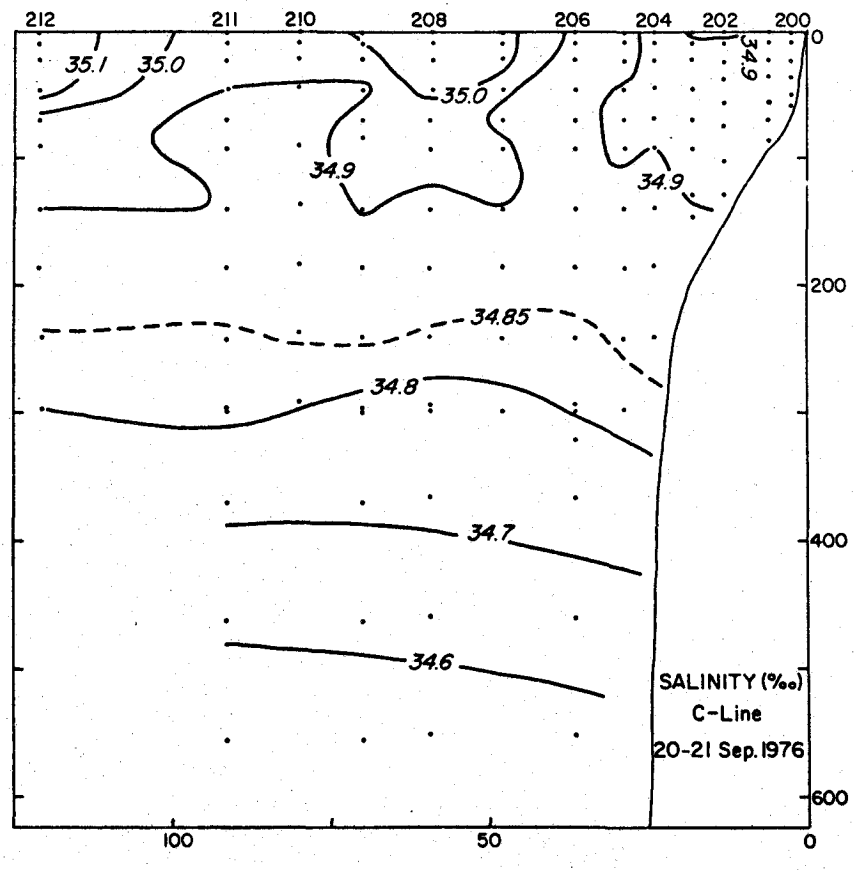

98
100
101
102
104
105
107
108
110
112
113
115
116
118
0
35.0
35.1
34.9
34.85
34.8
34.75
34.9
200
34.85
34.8
34.7
34.6
34.5
400
600
SALINITY(‰)
C-Line
12-13 Aug. 1976
200
150
100
50
0

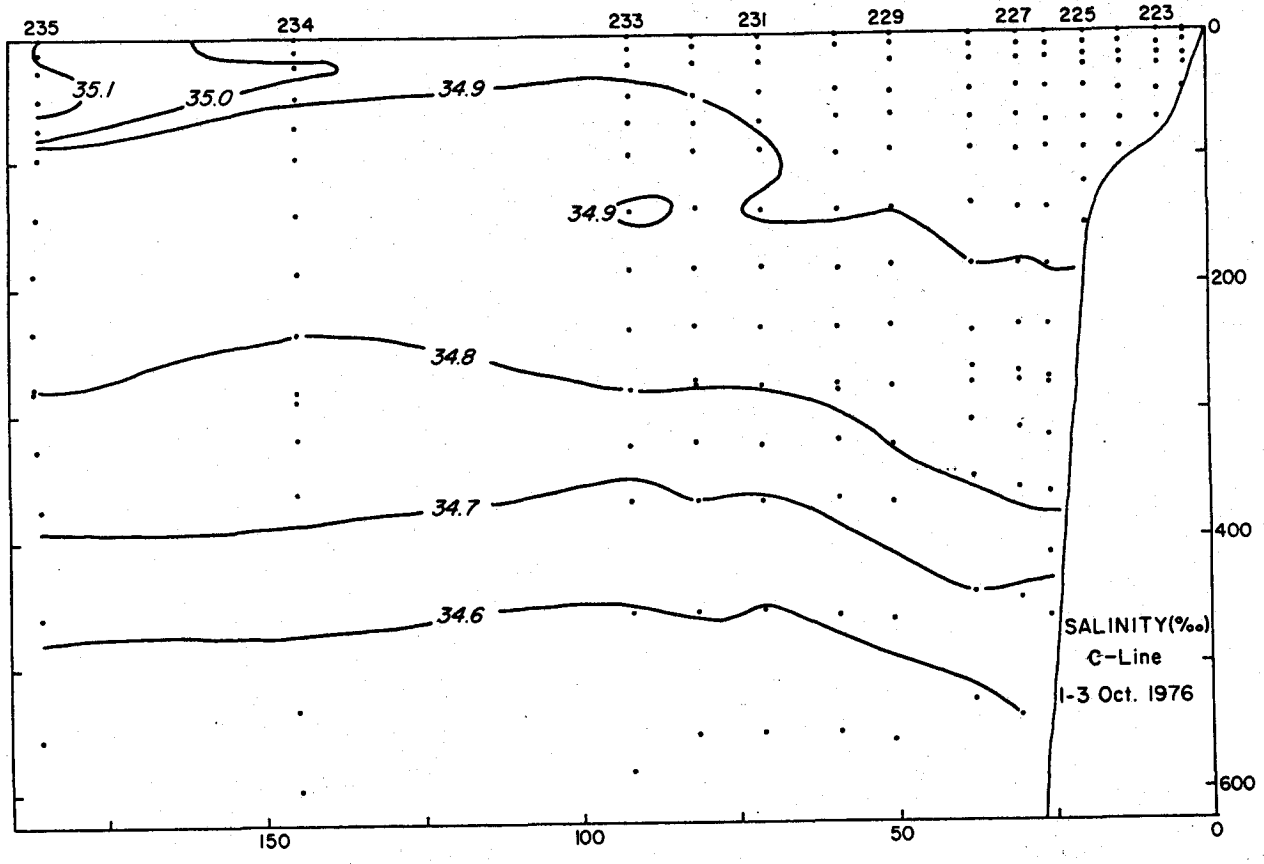

131
130
129
128
127
126
125
123
34.9
35.1
35.0
34.8
34.85
34.9
34.9
34.9
34.85
34.8
34.8
34.7
34.6
SALINITY (‰)
Punta Azua
14 Aug. 1976
100
50
132
133
134
135
136
137
138
139
140
142
144
35.2
35.2
35.1
35.0
34.9
34.9
34.9
34.8
34.7
34.6
SALINITY (‰)
Callao
15-16 August 1976
150
100
50
0
0
200
400
600


155
156
157
163
169
168
171
167
164
166
0
35.2
34.9
35.0
34.9
34.8
34.7
200
400
600
0
200
150
100
50
0
Salinity (‰)
Huarmey
29 Aug - 1 Sep 1976
R/V Eastward


153
151
149
146
0
35.0
34.9
34.8
34.85
34.8
34.7
34.6
200
400
600
50
0
SALINITY(‰)
C-Line
25-27 Aug. 1976
R/V Eastward
184
183
182
181
180
179
178
176
174
172
35.1
35.0
34.9
34.85
34.9
34.9
34.85
34.8
34.7
34.6
150
100
50
SALINITY(‰)
C-Line
10-11 Sep. 1976

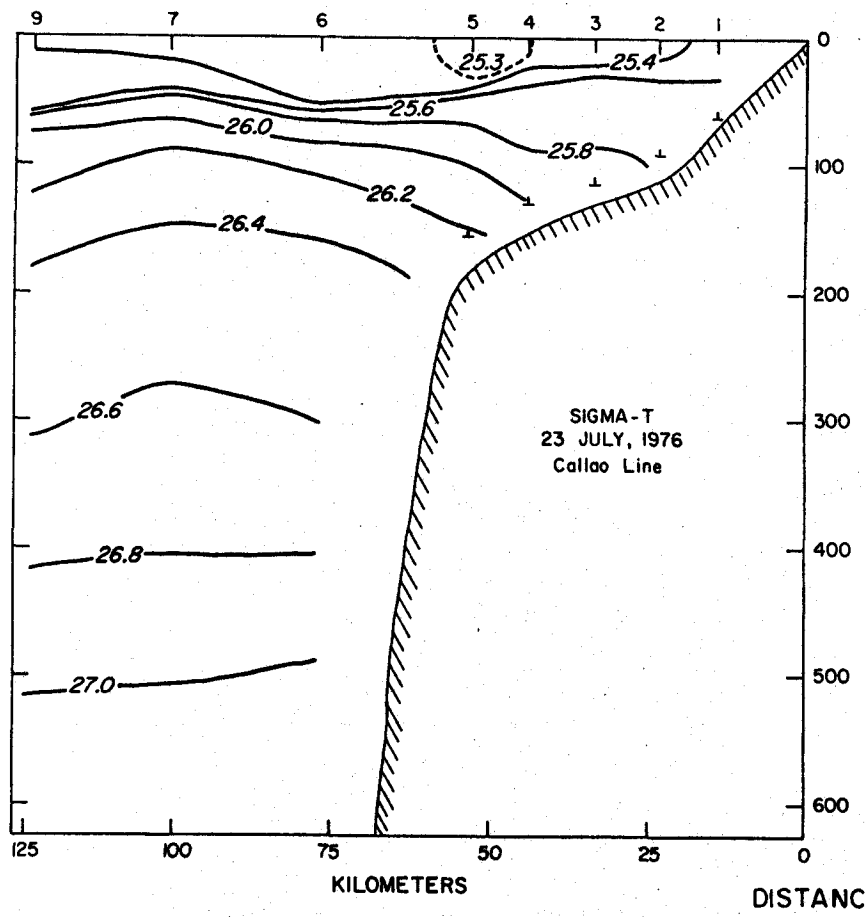

188
190
192
194
196
198
200
0
35.1
35.0
34.85
34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY(‰)
C-Line-
13-20 Sep. 1976

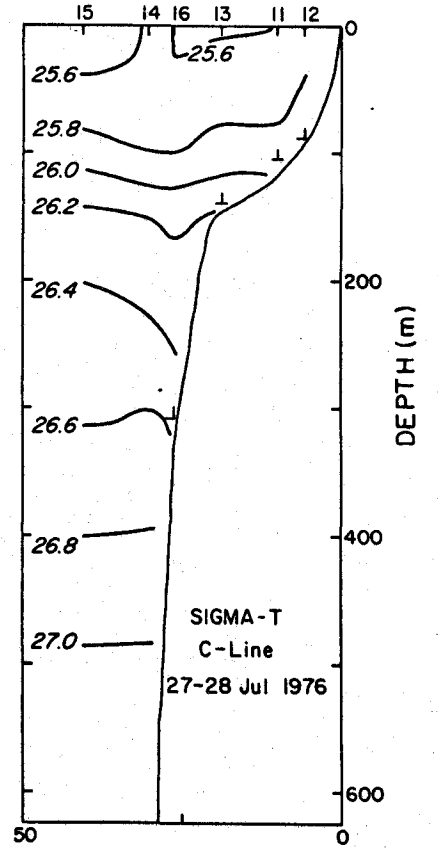

212
211
210
208
206
204
202
200
0
200
400
600
100
50
0
35.1
35.0
35.0
34.9
34.9
34.9
34.85
34.8
34.7
34.6
SALINITY (‰)
C-Line
20-21 Sep. 1976


235
234
233
231
229
227
225
223
0
35.1
35.0
34.9
34.9
200
34.8
34.7
400
34.6
SALINITY(‰)
C-Line
1-3 Oct. 1976
600
150
100
50
0

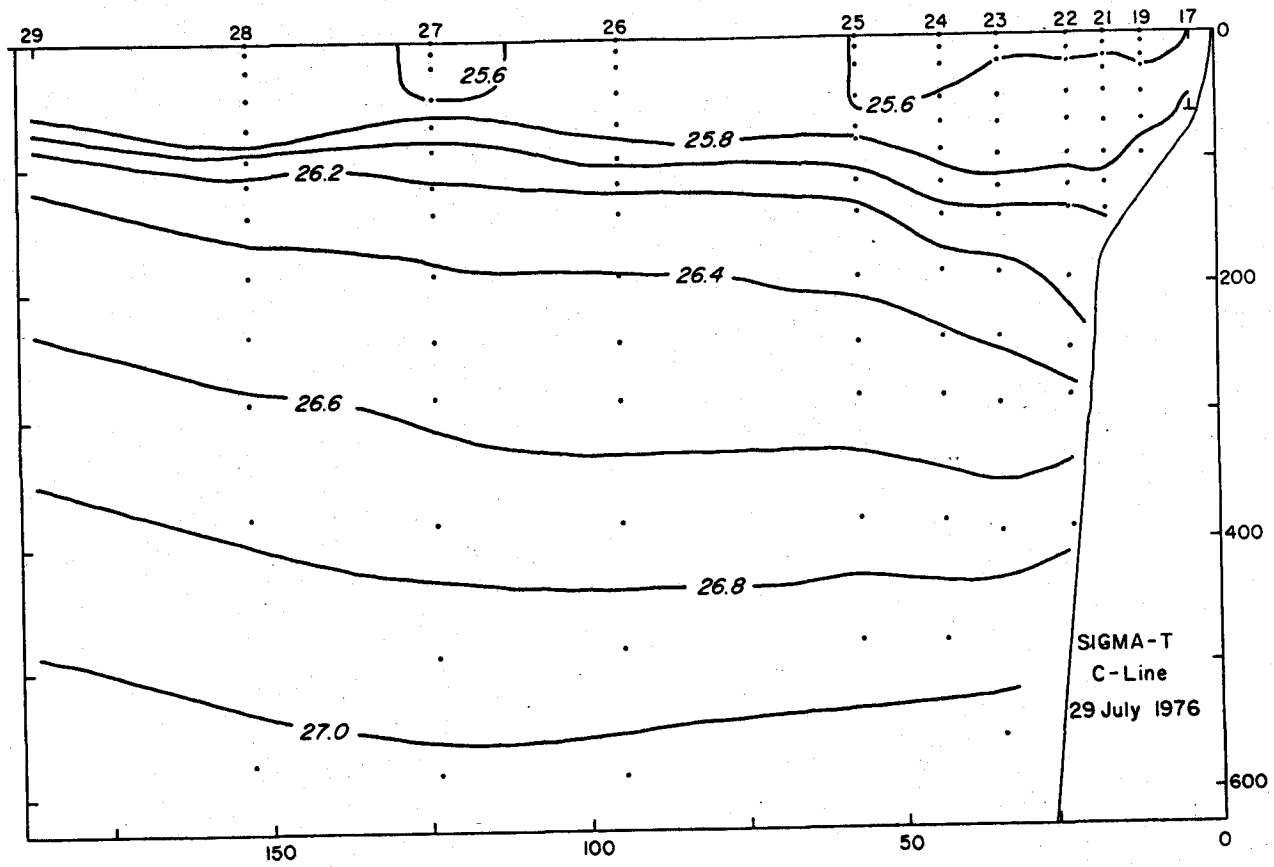
VERTICAL SECTIONS DURING JASON

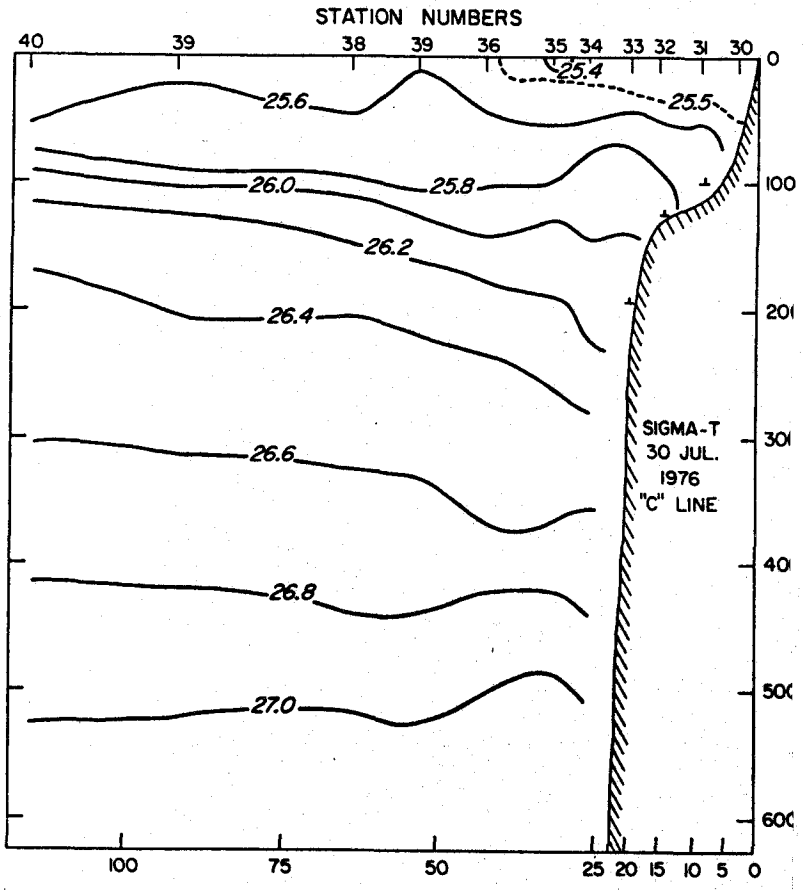
Sigma-T

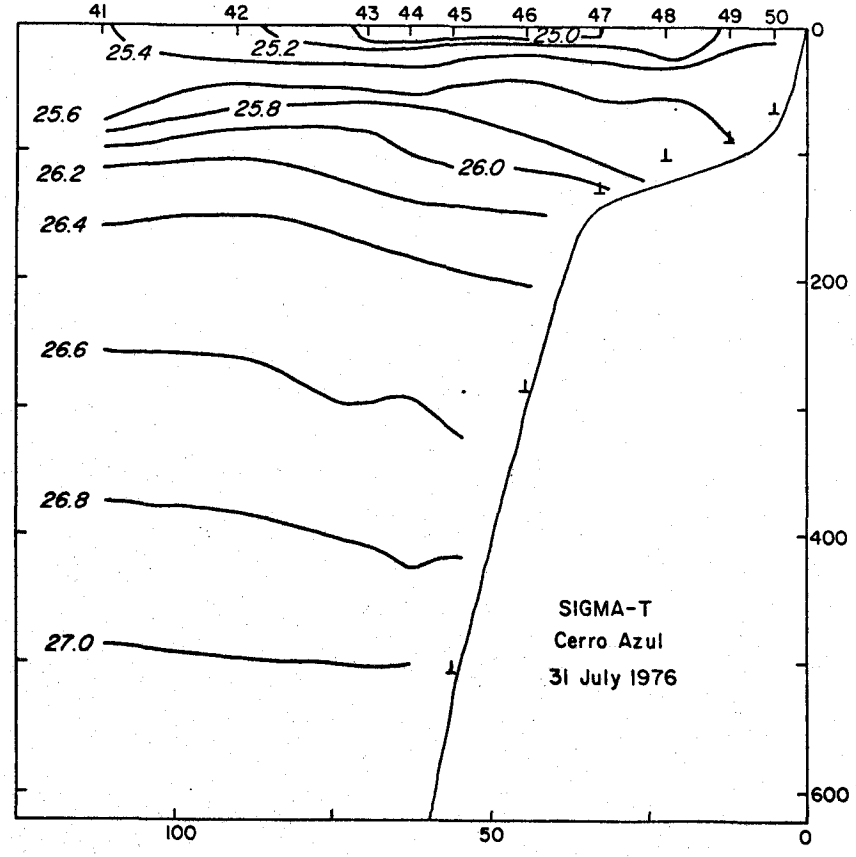


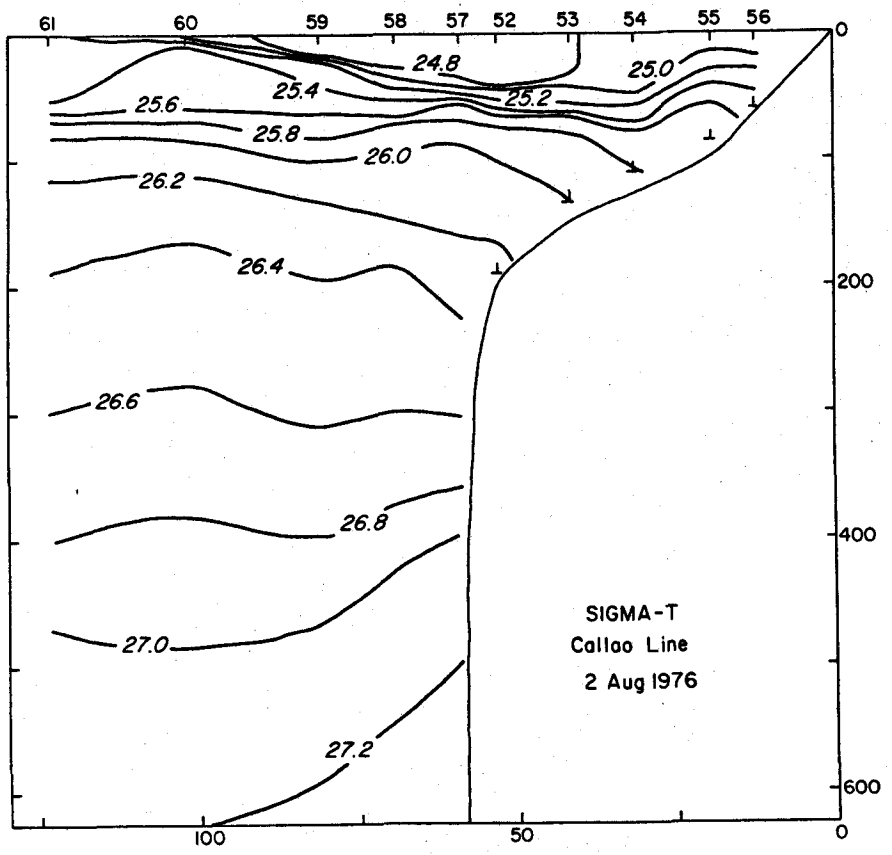


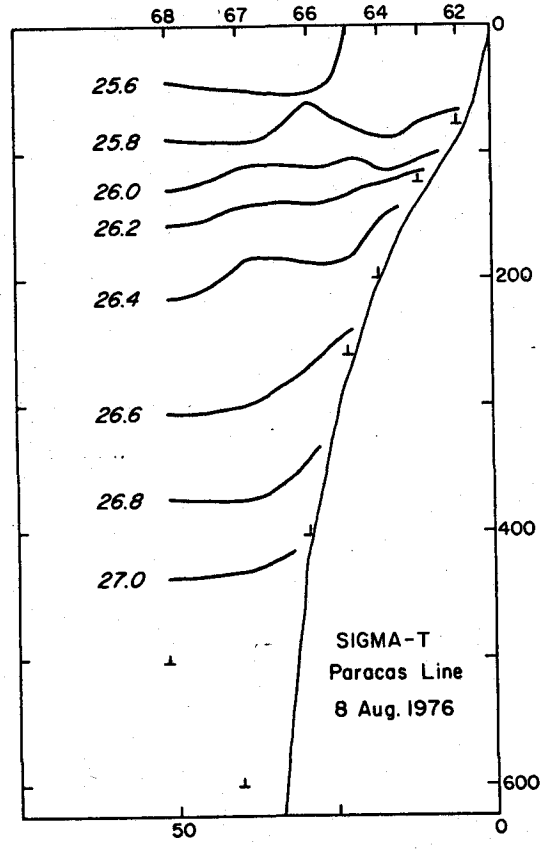
DISTANCE FROM SHORE (km)

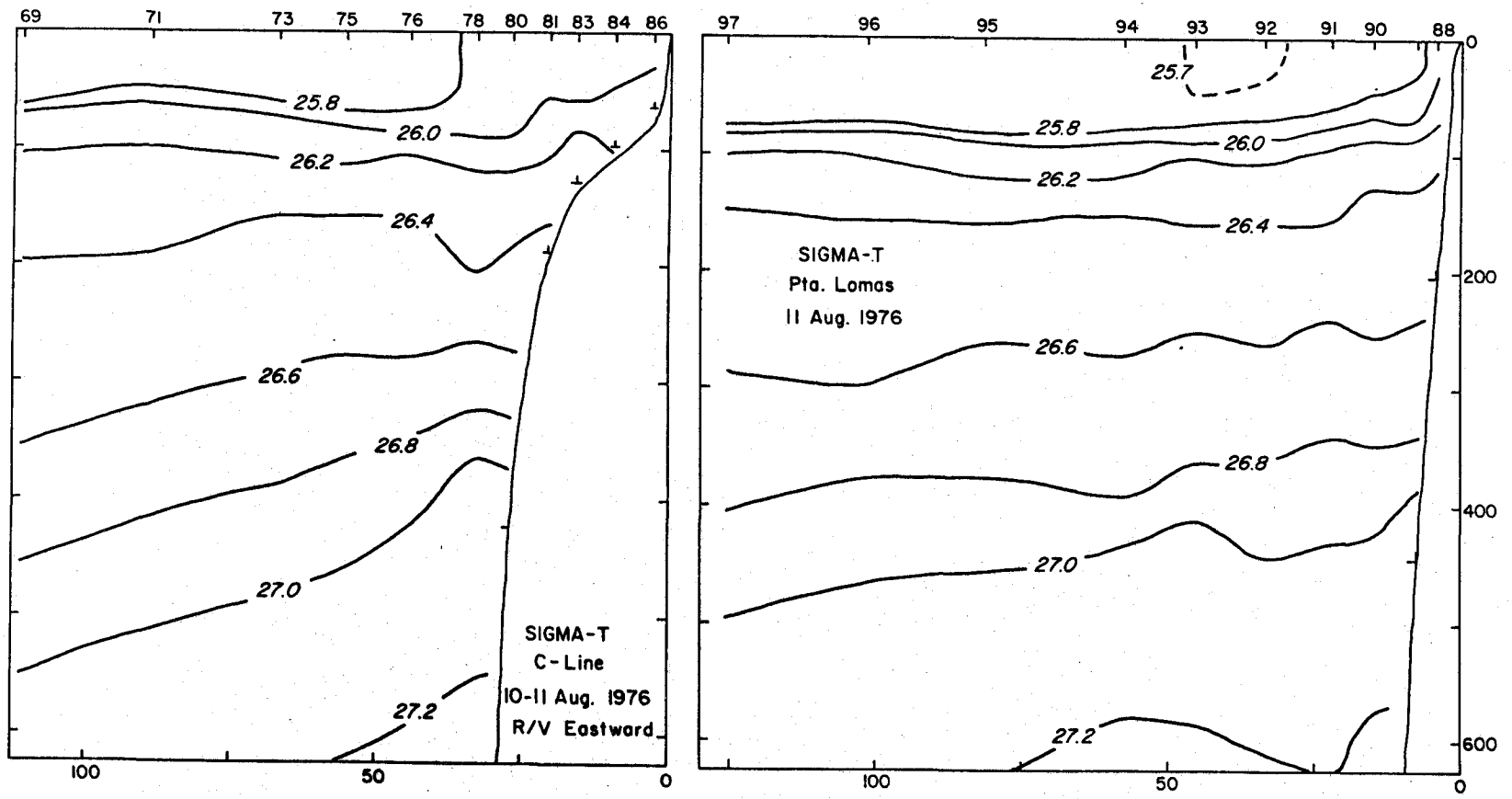

29
28
27
26
25
24
23
22
21
19
17
0
25.6
25.6
25.8
26.2
26.4
26.6
26.8
27.0
200
400
600
SIGMA-T
C-Line
29 July 1976
150
100
50
0

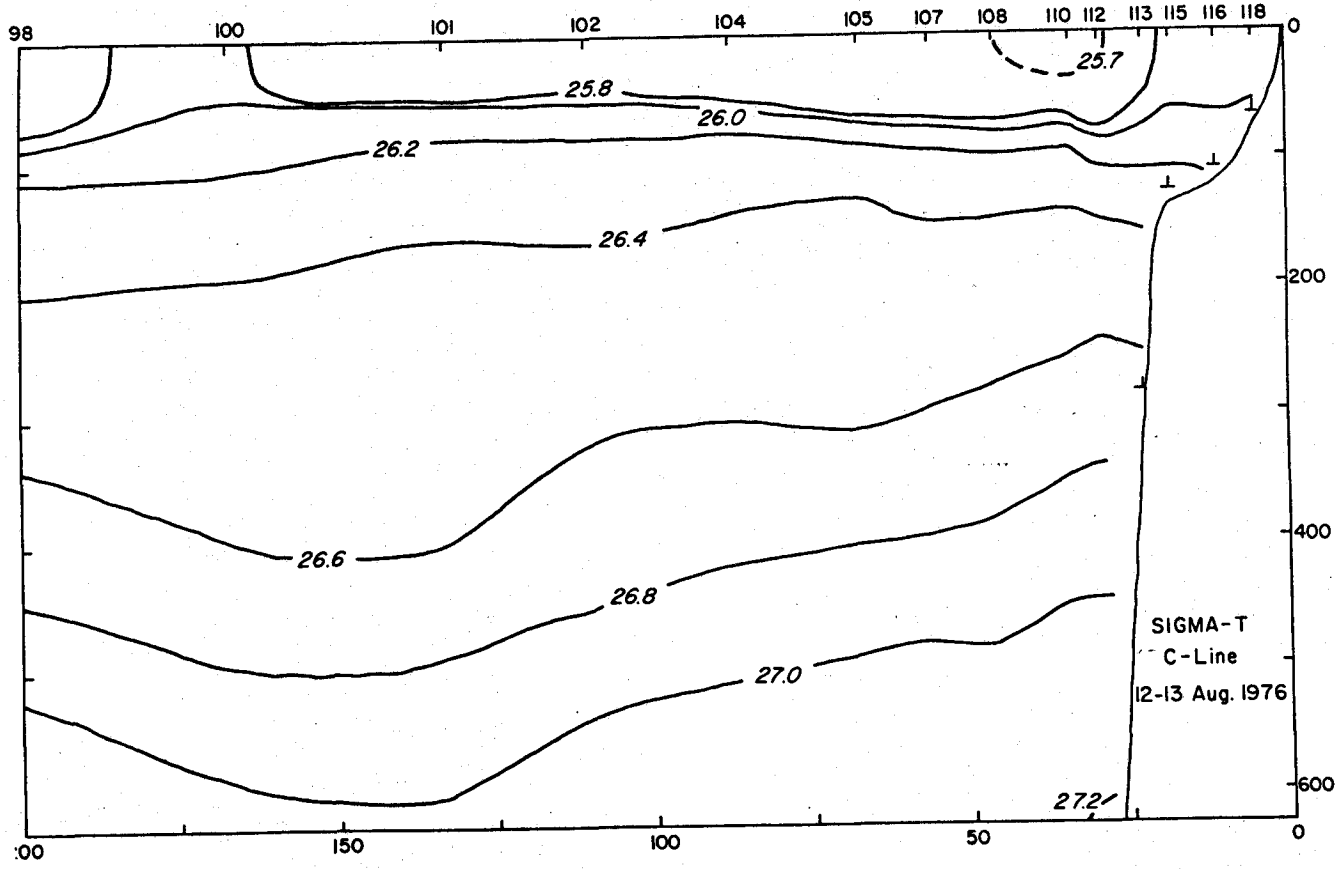

STATION NUMBERS
40 39 38 39 36 35 34 33 32 31 30
25.4
25.6
25.5
26.0
25.8
26.2
26.4
26.6
26.8
27.0
SIGMA-T
30 JUL.
1976
"C" LINE
0
100
200
300
400
500
600
100 75 50 25 20 15 10 5 0

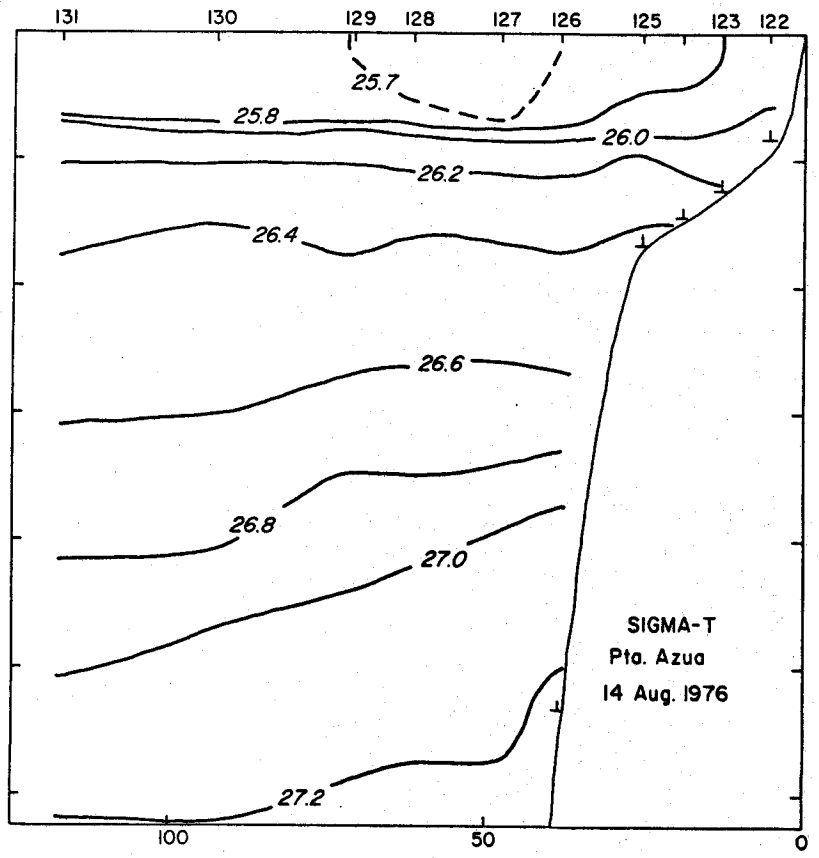

41 42 43 44 45 46 47 48 49 50
25.4
25.2
25.0
25.6
25.8
26.2
26.0
26.4
26.6
26.8
27.0
SIGMA-T
Cerro Azul
31 July 1976
0
200
400
600
100 50 0

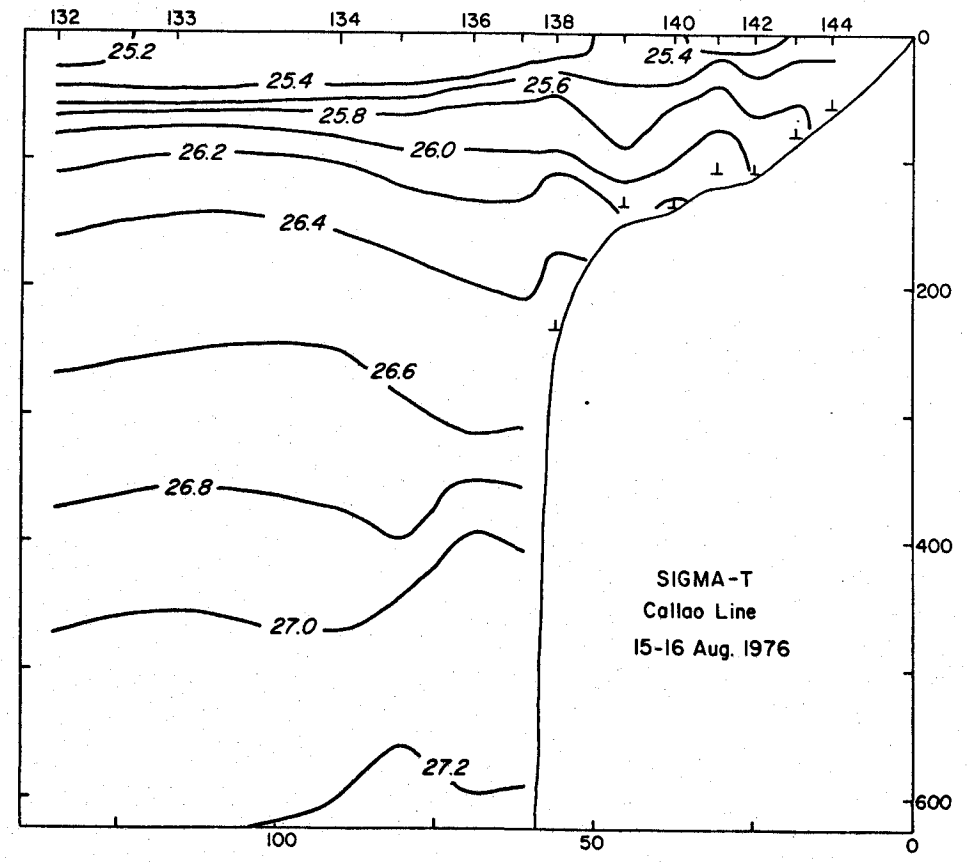

61
60
59
58
57
52
53
54
55
56
0
24.8
25.0
25.4
25.2
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
200
400
600
100
50
0
SIGMA-T
Callao Line
2 Aug 1976

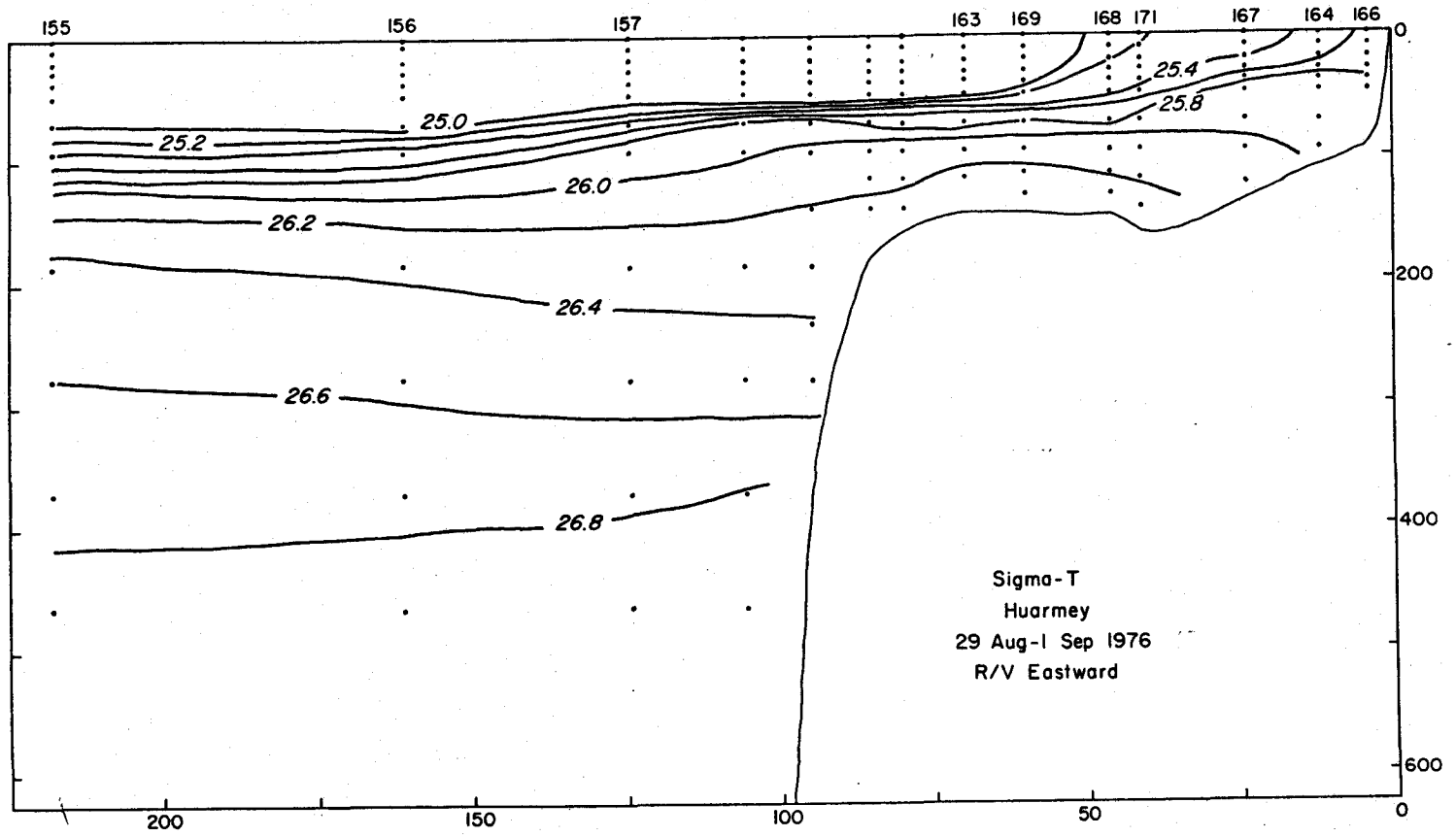

68
67
66
64
62
0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
50
0
SIGMA-T
Paracas Line
8 Aug. 1976

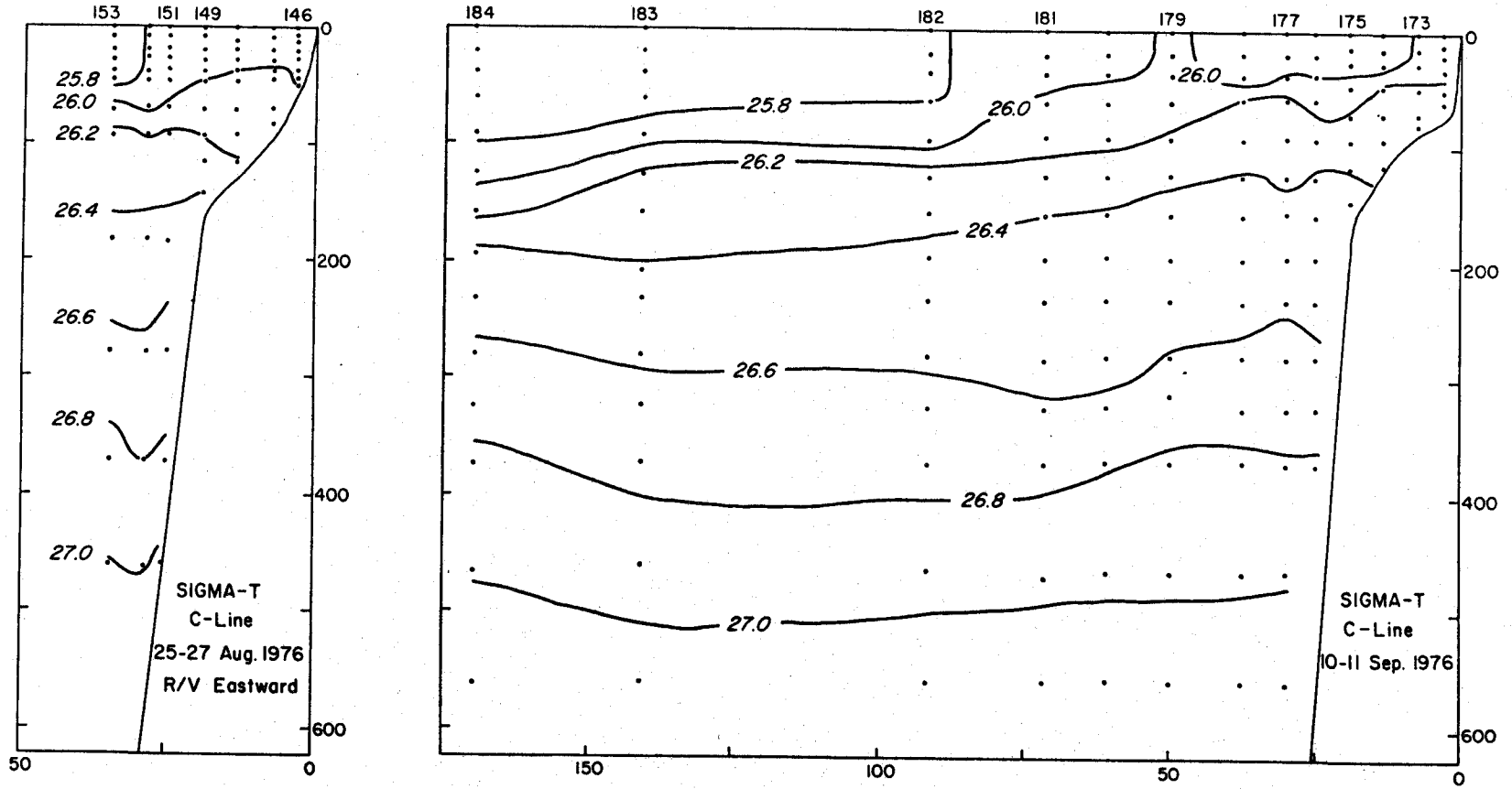

69
71
73
75
76
78
80
81
83
84
86
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
SIGMA-T
C-Line
10-11 Aug. 1976
R/V Eastward
100
50
0
97
96
95
94
93
92
91
90
88
0
25.7
25.8
26.0
26.2
26.4
SIGMA-T
Pta. Lomas
11 Aug. 1976
26.6
26.8
27.0
27.2
200
400
600
100
50
0

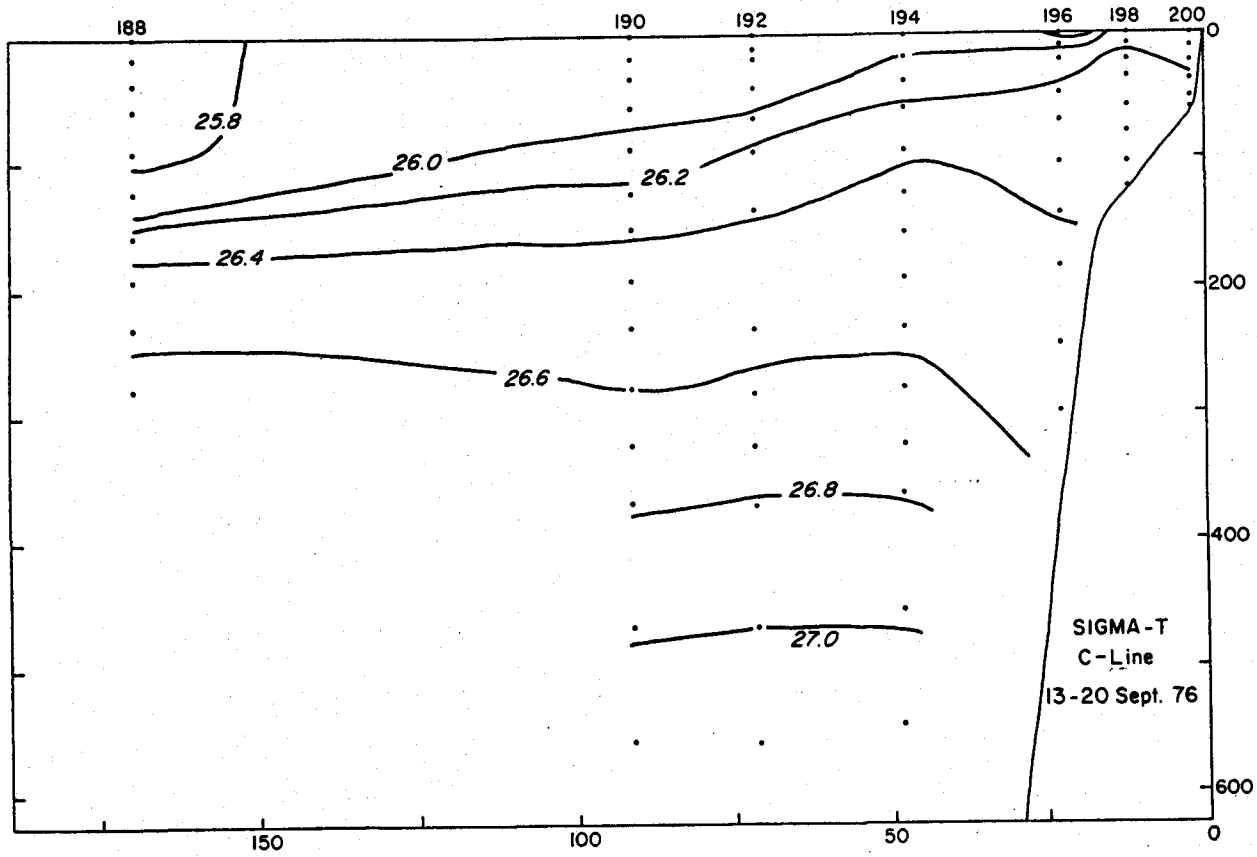

98
100
101
102
104
105
107
108
110
112
113
115
116
118
0
25.7
25.8
26.0
26.2
26.4
200
26.6
400
26.8
27.0
SIGMA-T
C-Line
12-13 Aug. 1976
27.2
600
:00
150
100
50
0

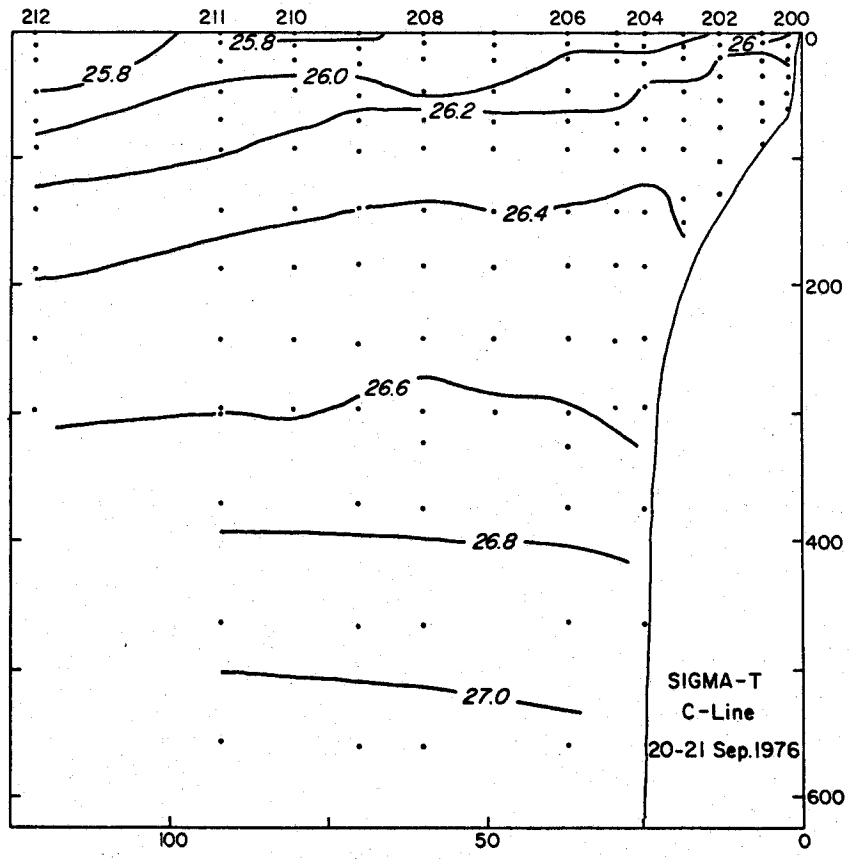

131
130
129
128
127
126
125
123
122
25.7
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
SIGMA-T
Pta. Azua
14 Aug. 1976
100
50
0

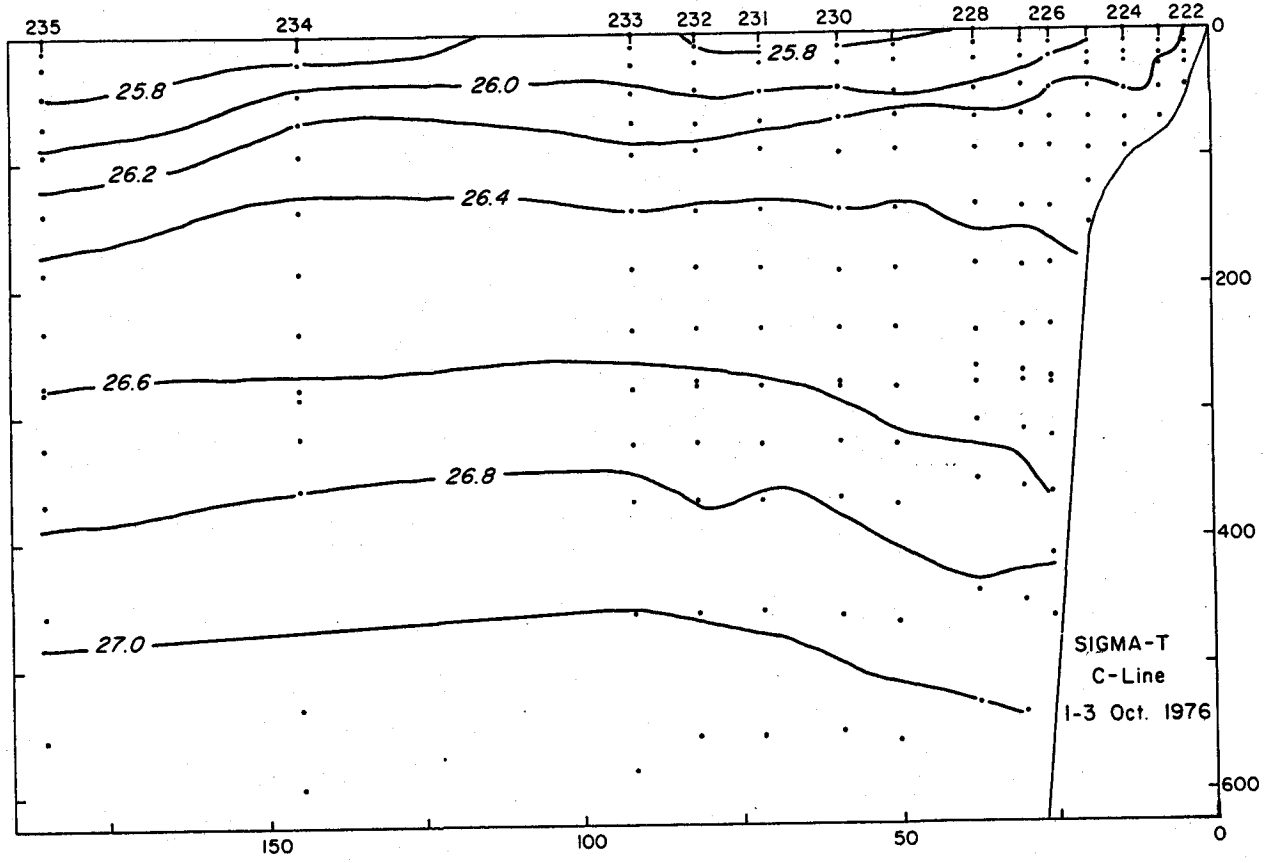

132
133
134
136
138
140
142
144
25.2
25.4
25.4
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
SIGMA-T
Callao Line
15-16 Aug. 1976
0
200
400
600
100
50
0


155
156
157
163
169
168
171
167
164
166
0
25.0
25.2
25.4
25.8
26.0
26.2
26.4
26.6
26.8
200
400
600
Sigma-T
Huarmey
29 Aug-1 Sep 1976
R/V Eastward
200
150
100
50
0


153
151
149
146
0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
50
0
SIGMA-T
C-Line
25-27 Aug. 1976
R/V Eastward
184
183
182
181
179
177
175
173
0
25.8
26.0
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
150
100
50
0
SIGMA-T
C-Line
10-11 Sep. 1976

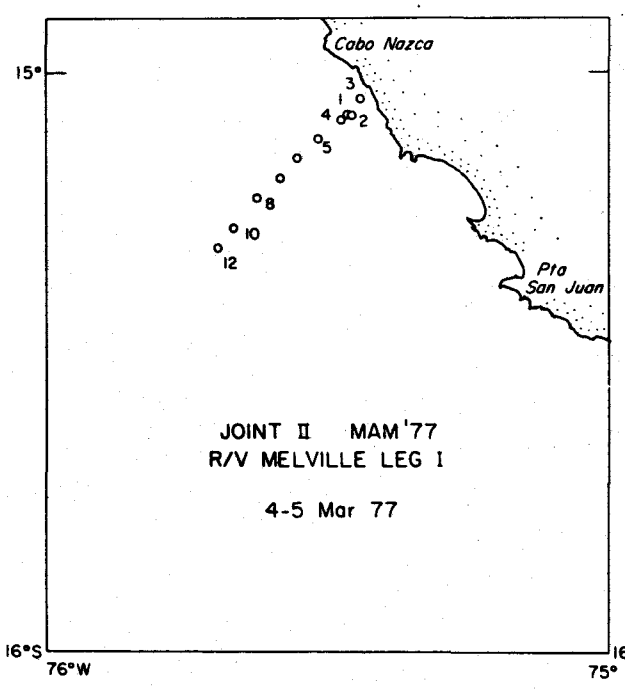

188
190
192
194
196
198
200
0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
SIGMA-T
C-Line
13-20 Sept. 76
150
100
50
0

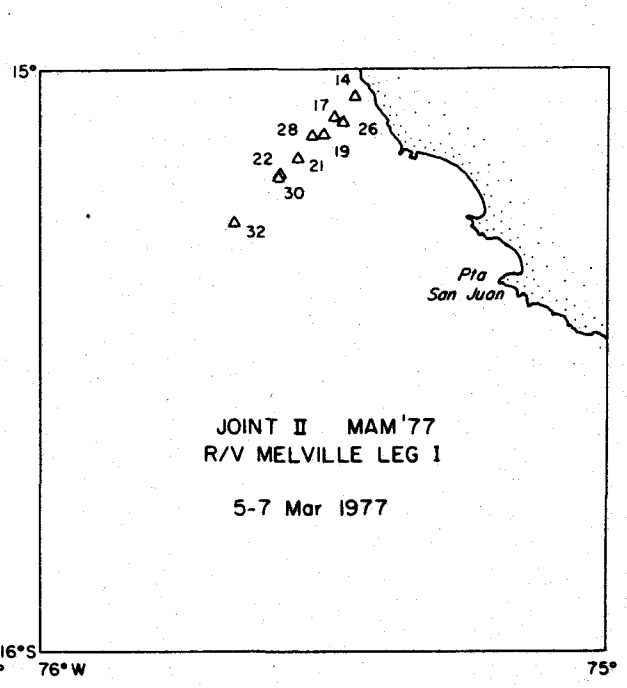

212
211
210
208
206
204
202
200
25.8
25.8
26.0
26.2
26.4
26
26.6
26.8
27.0
0
200
400
600
100
50
0
SIGMA-T
C-Line
20-21 Sep.1976

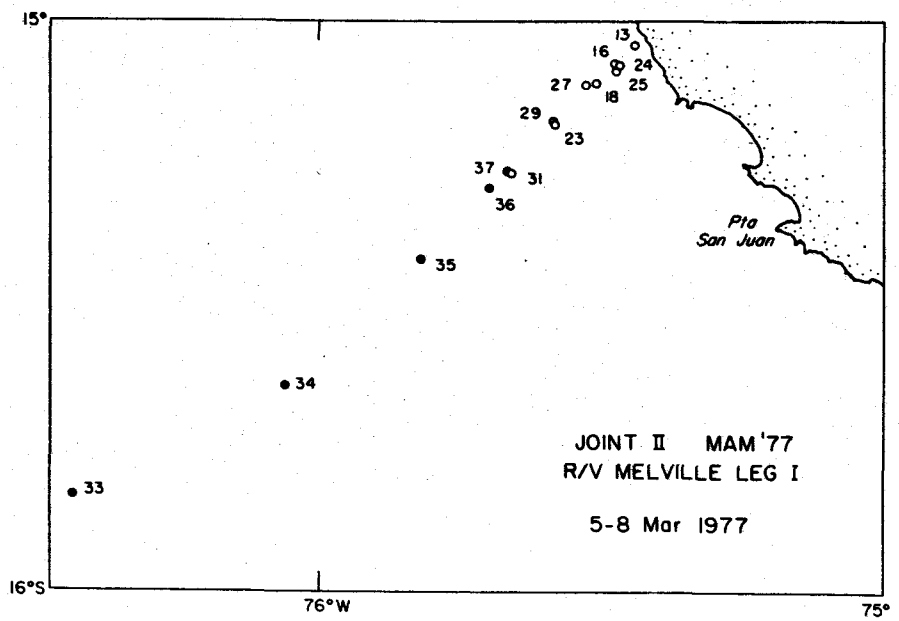

235
234
233
232
231
230
228
226
224
222
0
25.8
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
SIGMA-T
C-Line
1-3 Oct. 1976
150
100
50
0

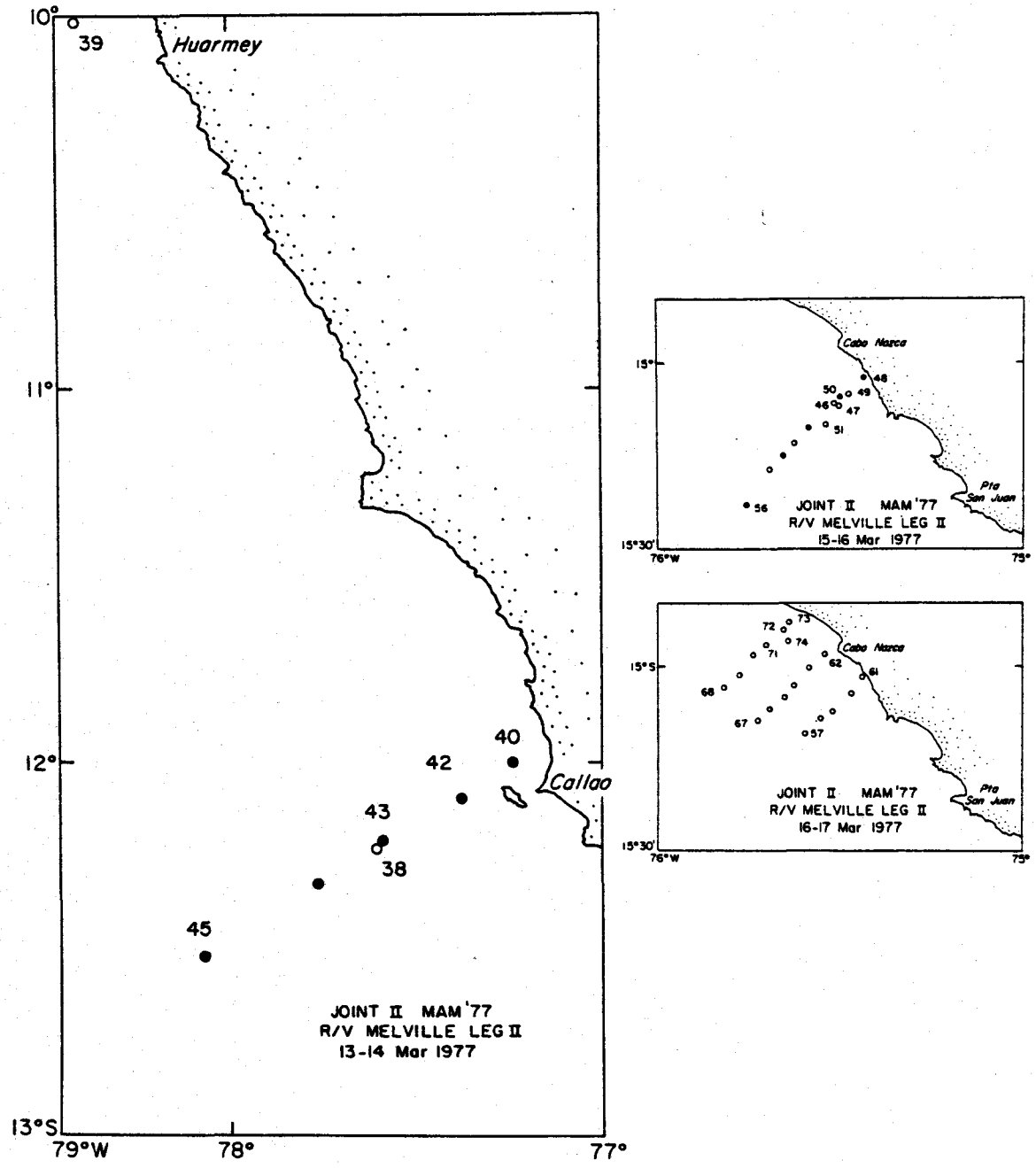
VERTICAL SECTIONS DURING MAM 77

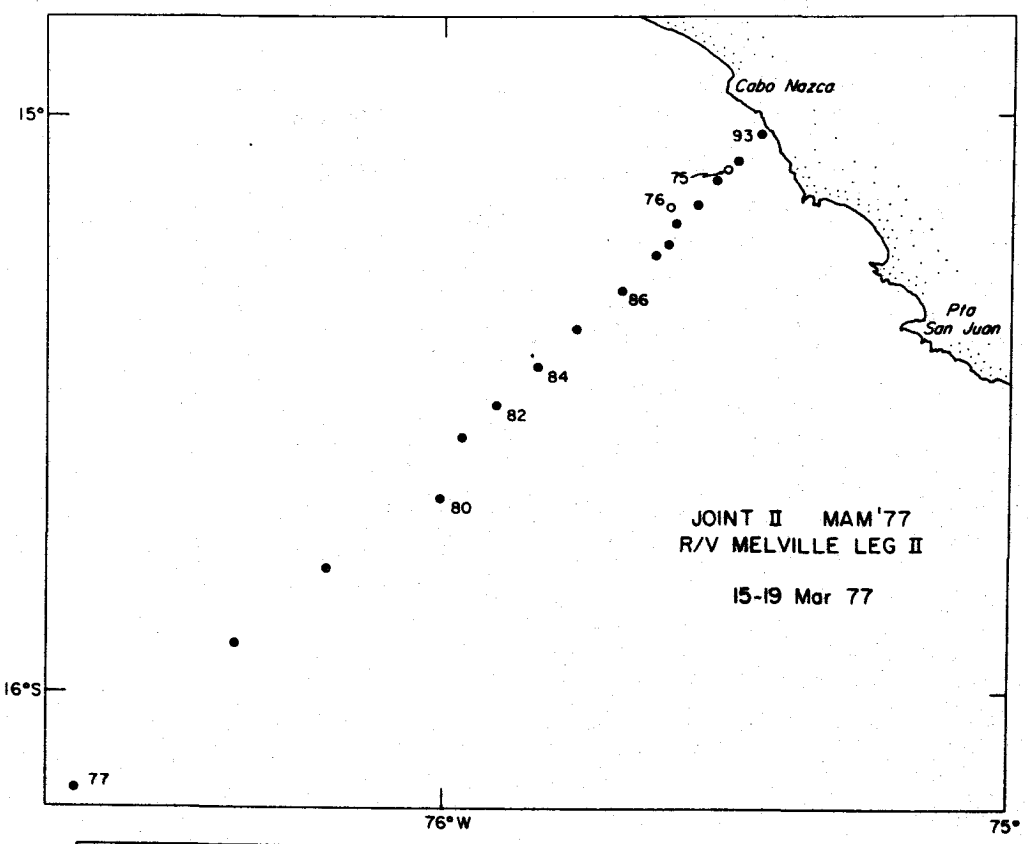
Station Positions

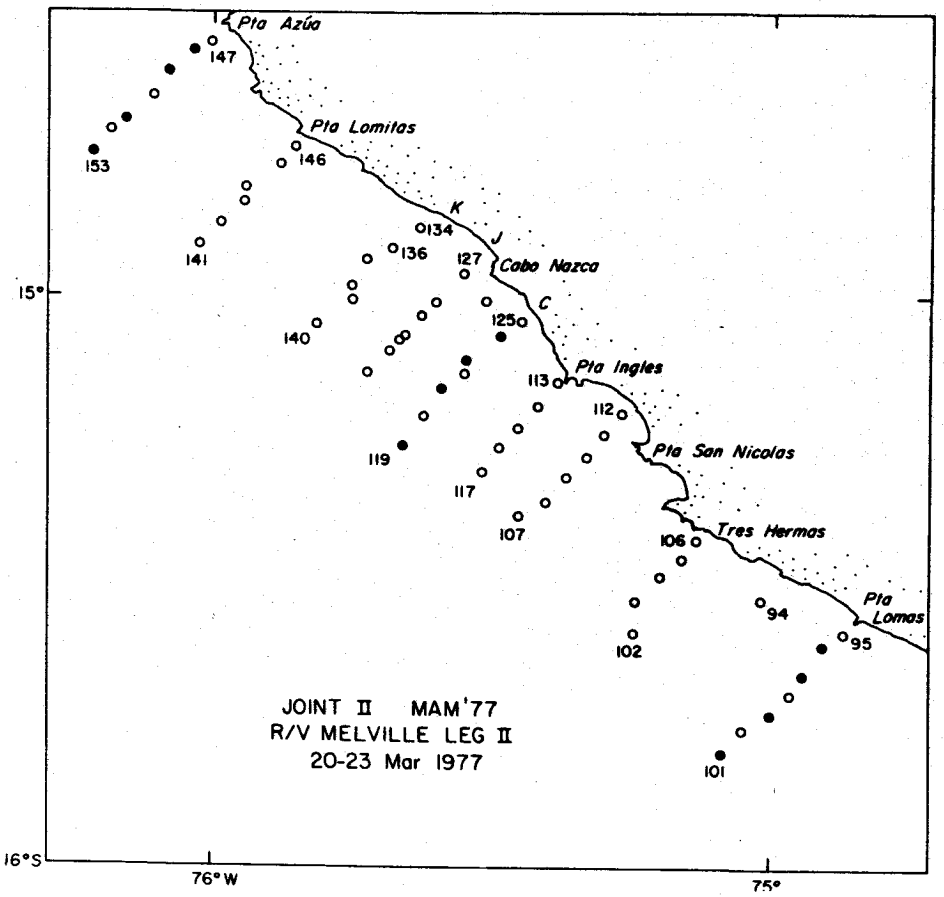

Cabo Nazca
15°
3
1
4
2
5
8
10
12
Pta
San Juan
JOINT II MAM '77
R/V MELVILLE LEG I
4-5 Mar 77
16°S
76°W
75°

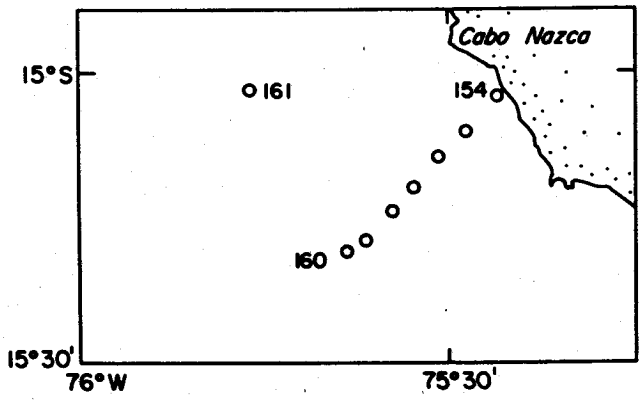

15°
14
17
28
26
22
21
19
30
32
Pta
San Juan
JOINT II MAM '77
R/V MELVILLE LEG I
5-7 Mar 1977
16°S
76°W
75°


15°
13
16
24
27
25
18
29
23
37
31
36
Pta
San Juan
35
34
33
JOINT II MAM '77
R/V MELVILLE LEG I
5-8 Mar 1977
16°S
76°W
75°

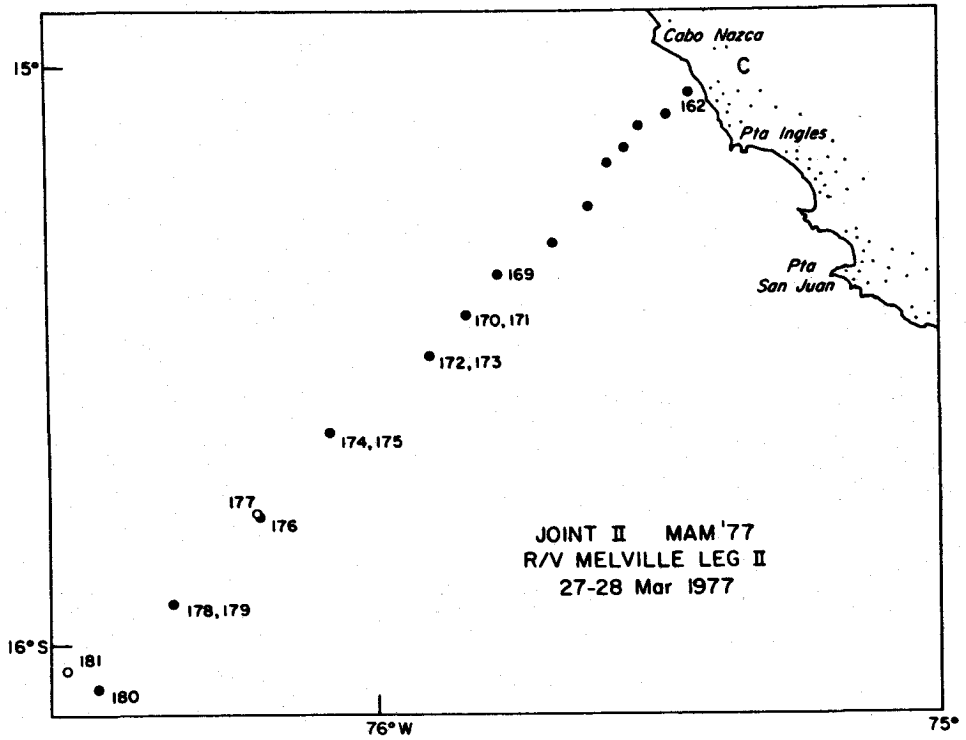

10°
11°
12°
13°S
79°W
78°
77°
39
Huarmey
40
42
43
38
45
Callao
JOINT II MAM '77
R/V MELVILLE LEG II
13-14 Mar 1977
15°
15°30'
76°W
75°
Cabo Nazca
48
50
49
46
47
51
56
Pta San Juan
JOINT II MAM '77
R/V MELVILLE LEG II
15-16 Mar 1977
15°S
72
73
74
71
62
61
68
67
57
JOINT II MAM '77
R/V MELVILLE LEG II
16-17 Mar 1977

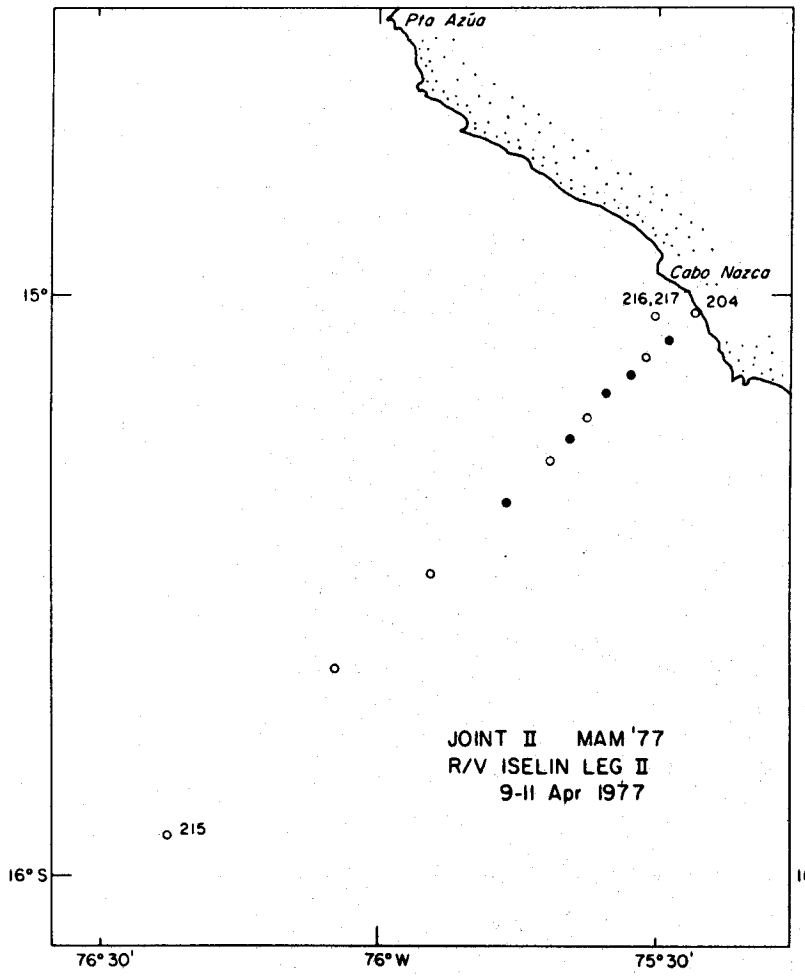

Cabo Nazca
Pta San Juan
93
75
76
86
84
82
80
77
15°
16°S
76°W
75°
JOINT II MAM'77
R/V MELVILLE LEG II
15-19 Mar 77

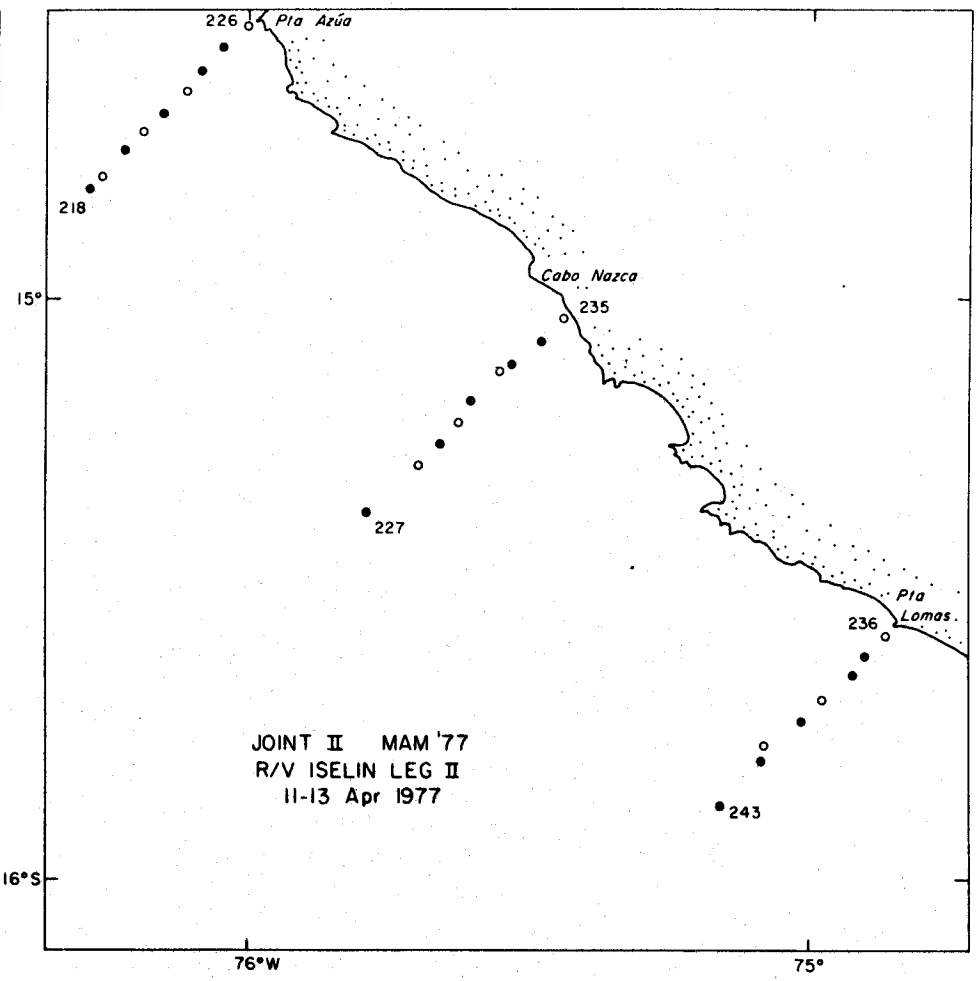

Pta Azúa
Pta Lomitas
Cabo Nazca
Pta Inglés
Pta San Nicolas
Tres Hermas
Pta Lomas
147
153
146
141
134
136
127
125
140
113
112
119
117
107
106
94
95
102
101
K
J
C
15°
16°S
76°W
75°
JOINT II MAM'77
R/V MELVILLE LEG II
20-23 Mar 1977

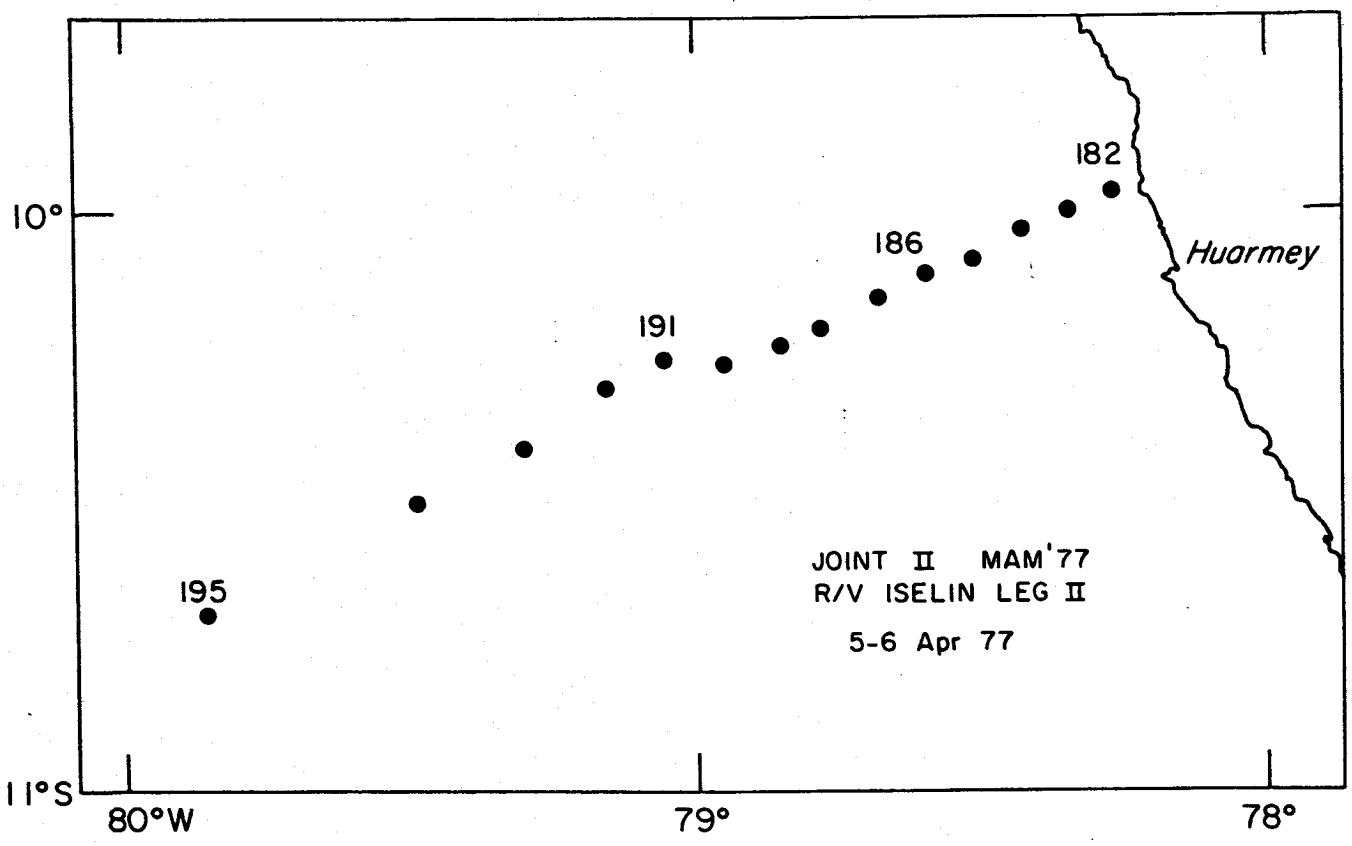


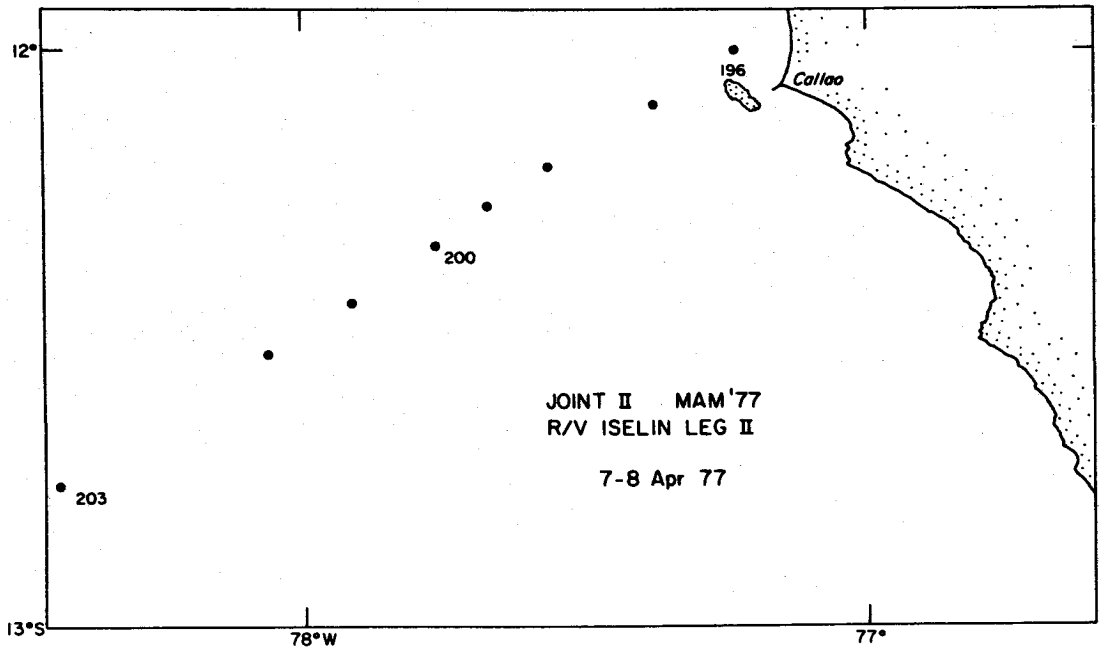
JOINT II MAM '77
R/V MELVILLE LEG II
24-26 Mar 1977

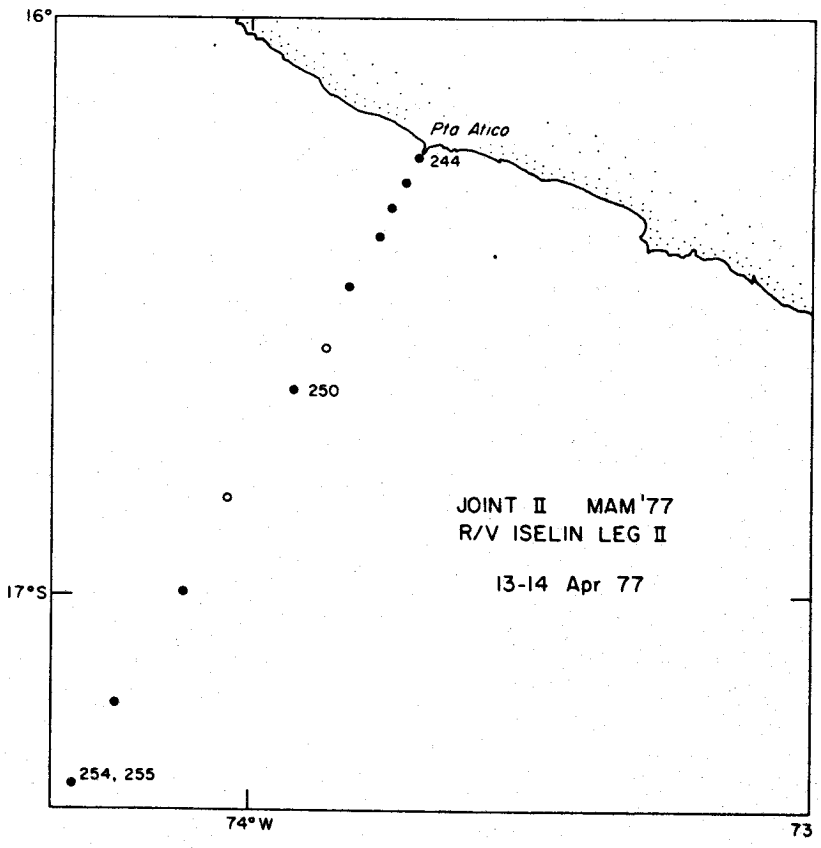


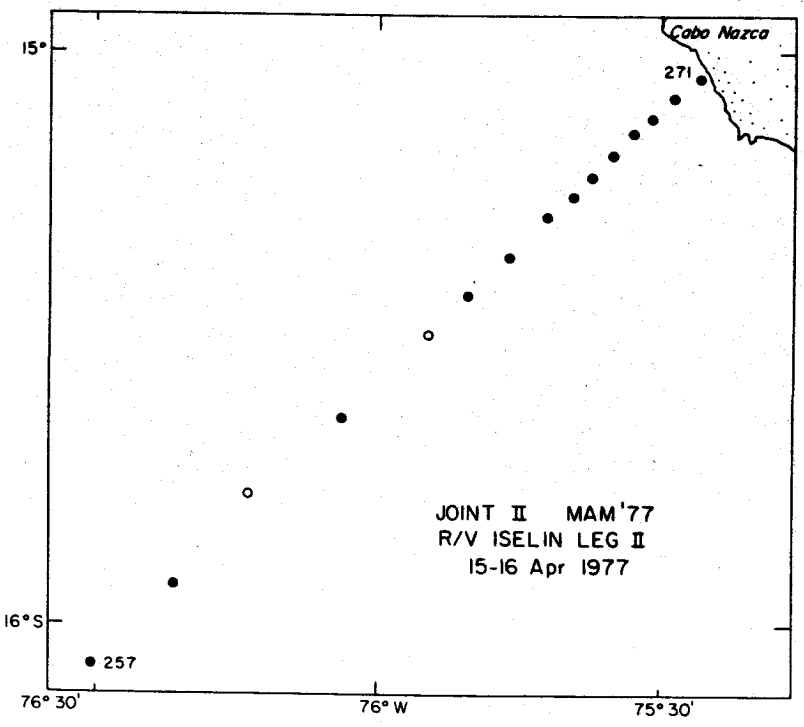

Pta Azúa
Cabo Nazca
216,217
204
15°
JOINT II MAM '77
R/V ISELIN LEG II
9-11 Apr 1977
215
16° S
76° 30'
76° W
75° 30'

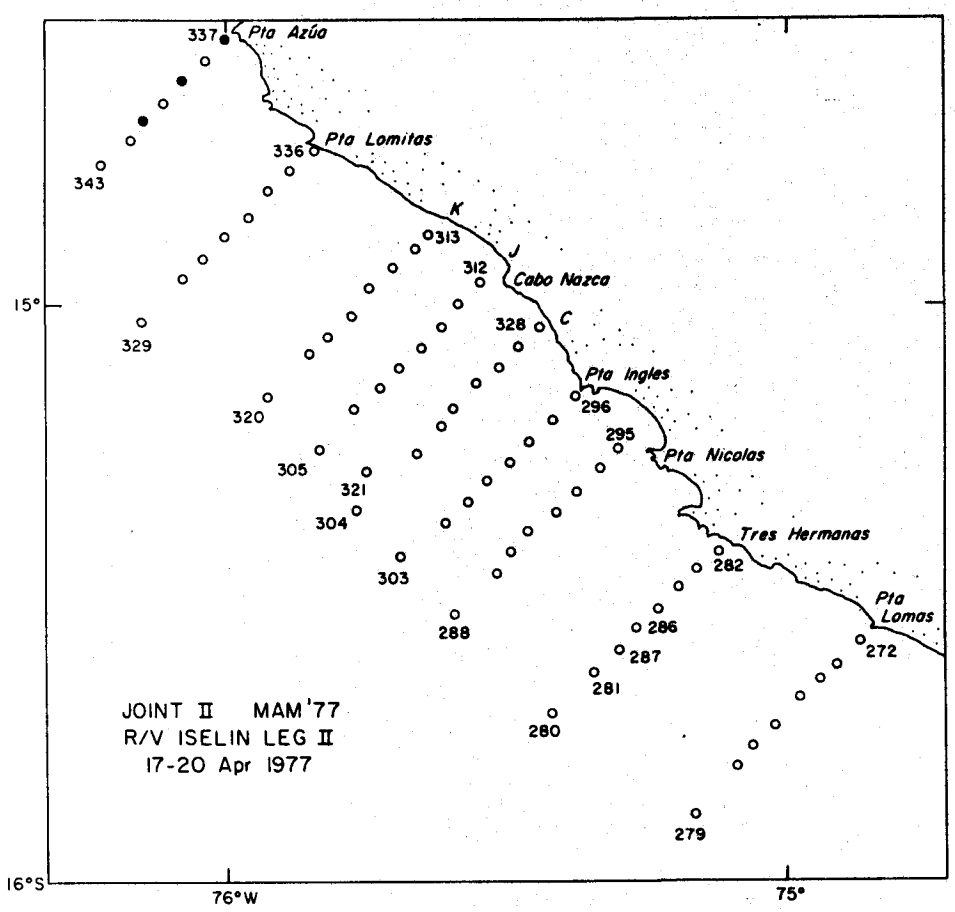

226
Pta Azúa
218
Cabo Nazca
235
15°
227
Pta Lomas
236
JOINT II MAM '77
R/V ISELIN LEG II
11-13 Apr 1977
243
16° S
76° W
75°

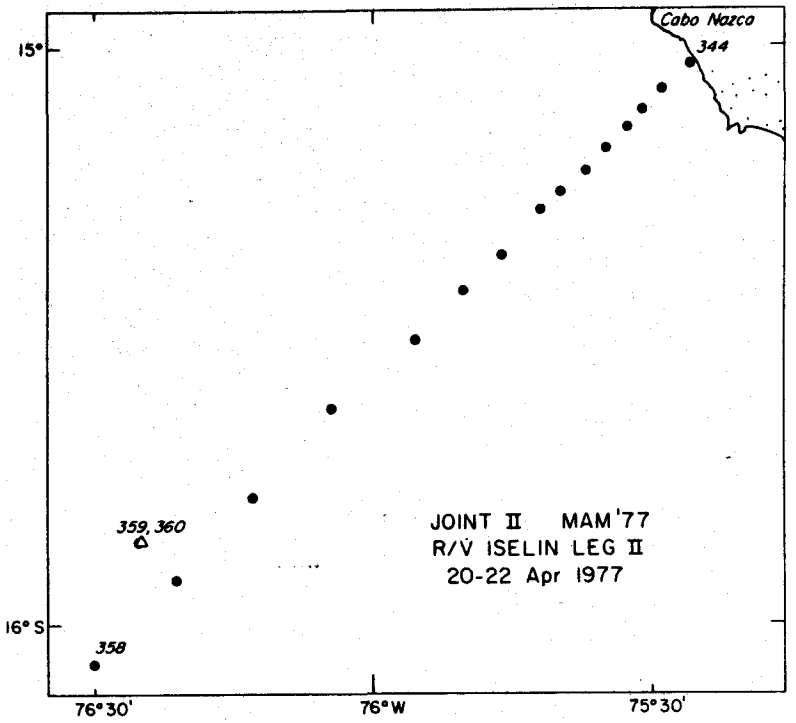

182
186
191
195
Huarmey
JOINT II MAM'77
R/V ISELIN LEG II
5-6 Apr 77
10°
11°S
80°W
79°
78°

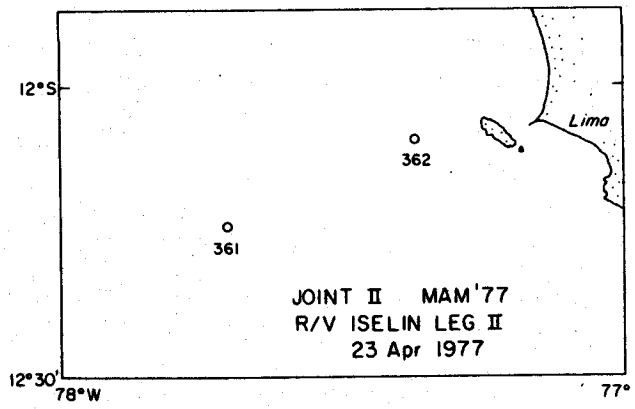

196
Callao
200
203
JOINT II MAM'77
R/V ISELIN LEG II
7-8 Apr 77
12°
13°S
78°W
77°

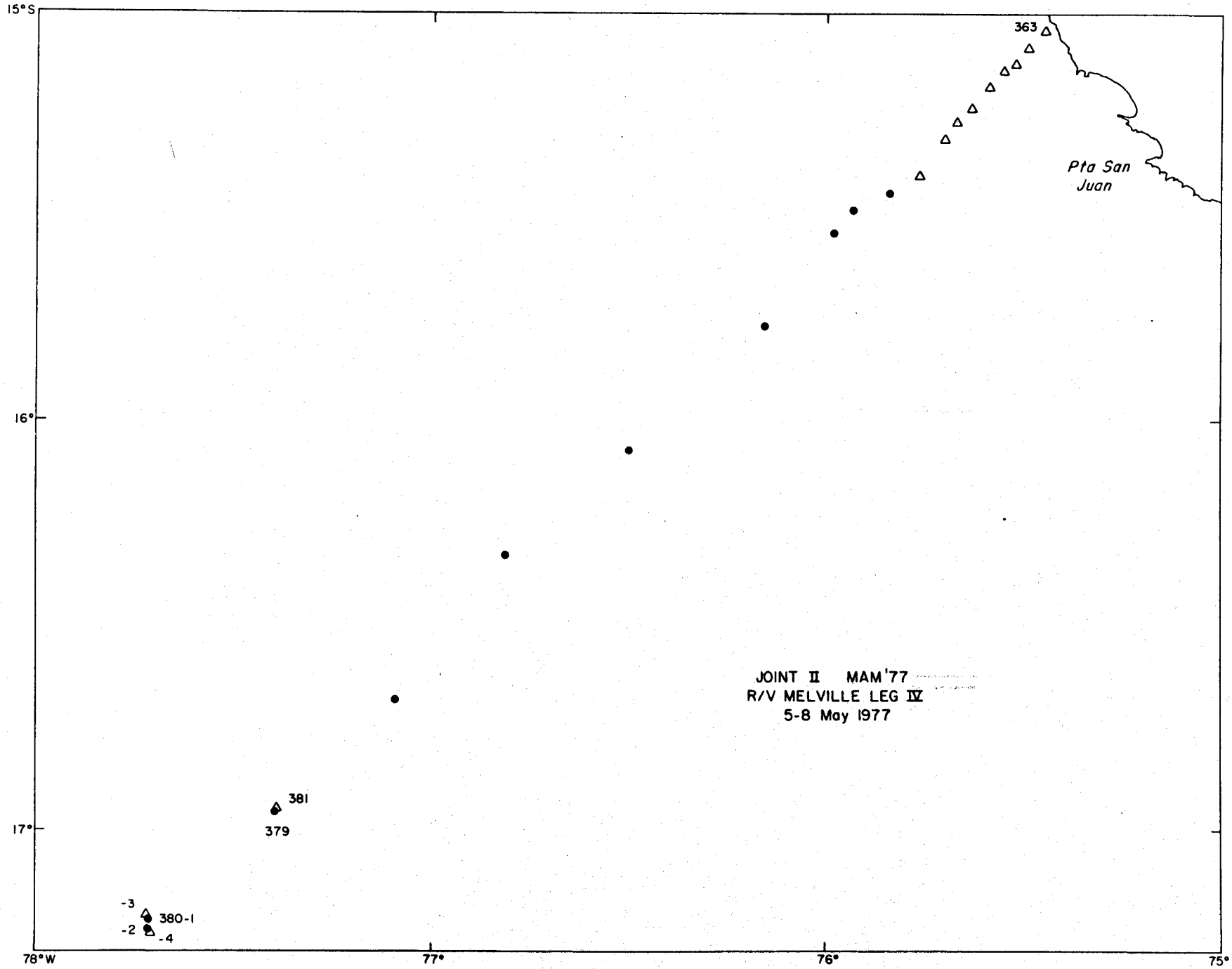

16°
Pto Atico
244
250
JOINT II MAM'77
R/V ISELIN LEG II
13-14 Apr 77
17°S
254, 255
74°W
73

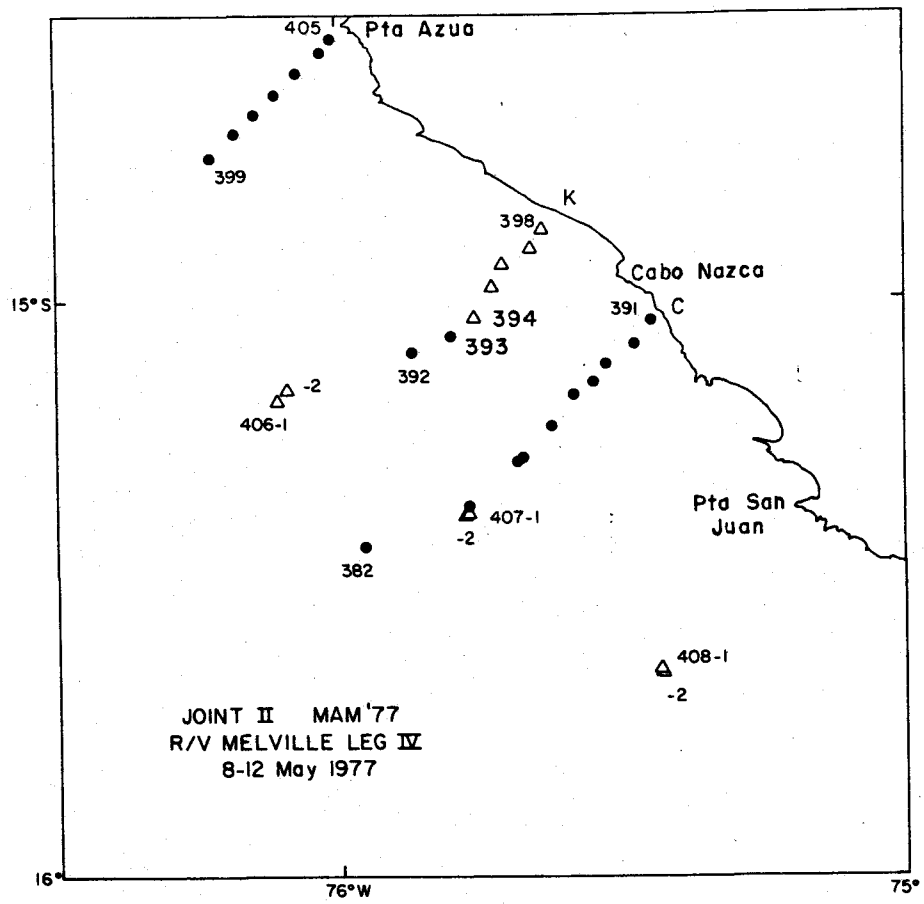

15°
Cabo Nazca
271
JOINT II MAM'77
R/V ISELIN LEG II
15-16 Apr 1977
16°S
257
76° 30'
76° W
75° 30'

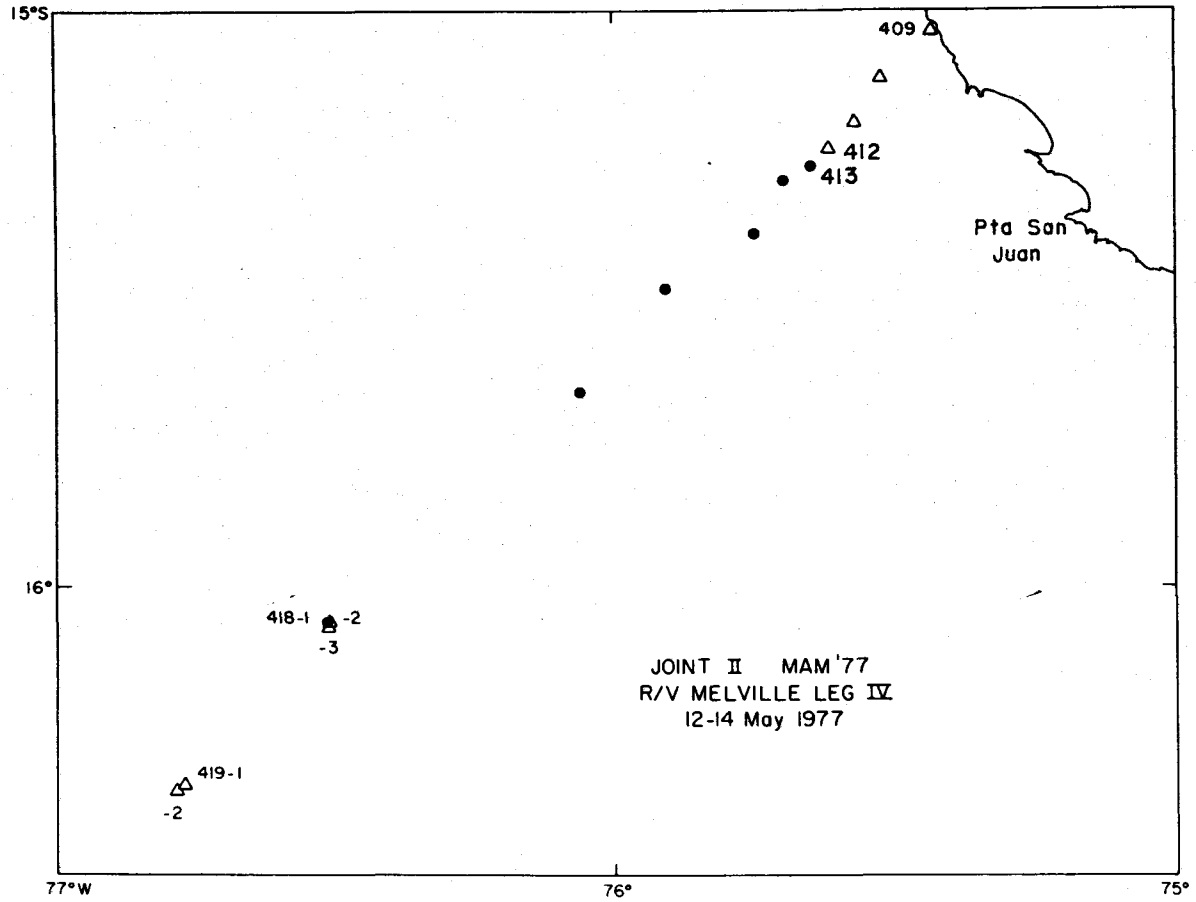

337
Pta Azúa
Pta Lomitas
336
343
K
313
312
J
Cabo Nazca
328
C
329
Pta Ingles
296
320
295
Pta Nicolas
305
321
304
Tres Hermanas
303
282
Pta Lomas
288
286
287
272
281
280
279
15°
16°S
76°W
75°
JOINT II MAM'77
R/V ISELIN LEG II
17-20 Apr 1977

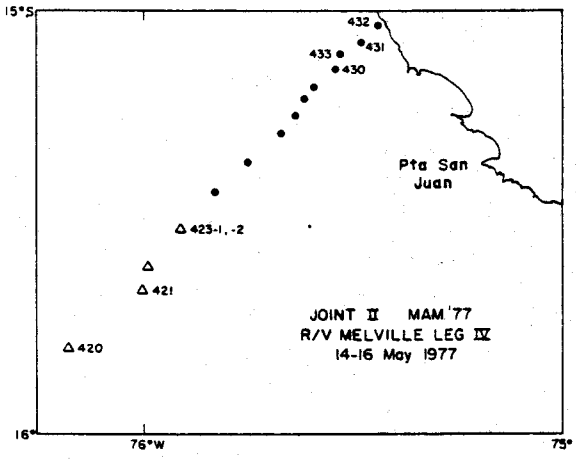

Cabo Nazca
344
15°
359, 360
358
16° S
76°30'
76°W
75°30'
JOINT II MAM'77
R/V ISELIN LEG II
20-22 Apr 1977

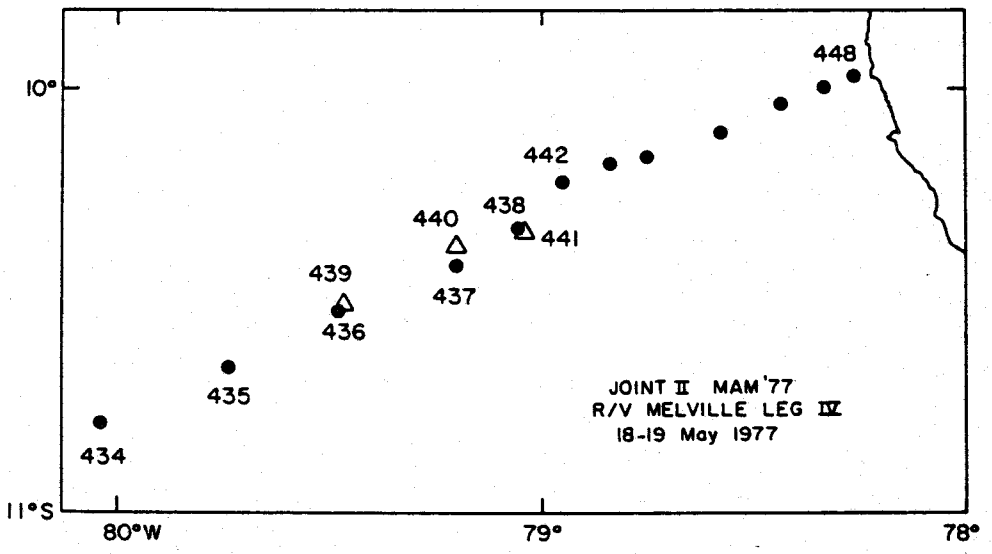

Lima
362
361
12°S
12°30'
78°W
77°
JOINT II MAM'77
R/V ISELIN LEG II
23 Apr 1977

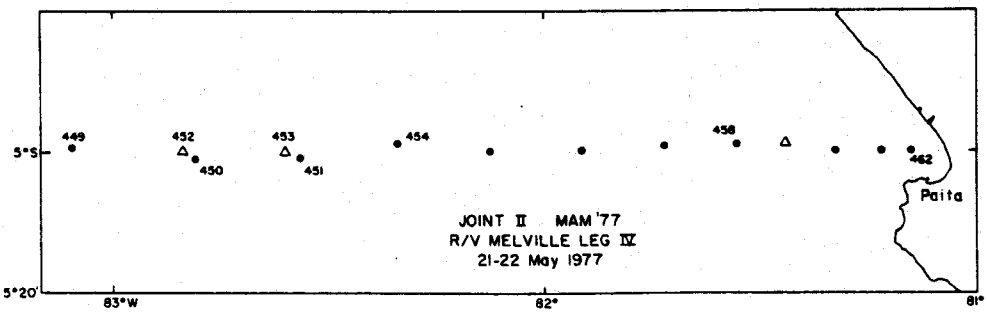

15°S
16°
17°
78°W
77°
76°
75°
363
Pta San
Juan
381
379
-3
380-1
-2
-4
JOINT II MAM'77
R/V MELVILLE LEG IV
5-8 May 1977

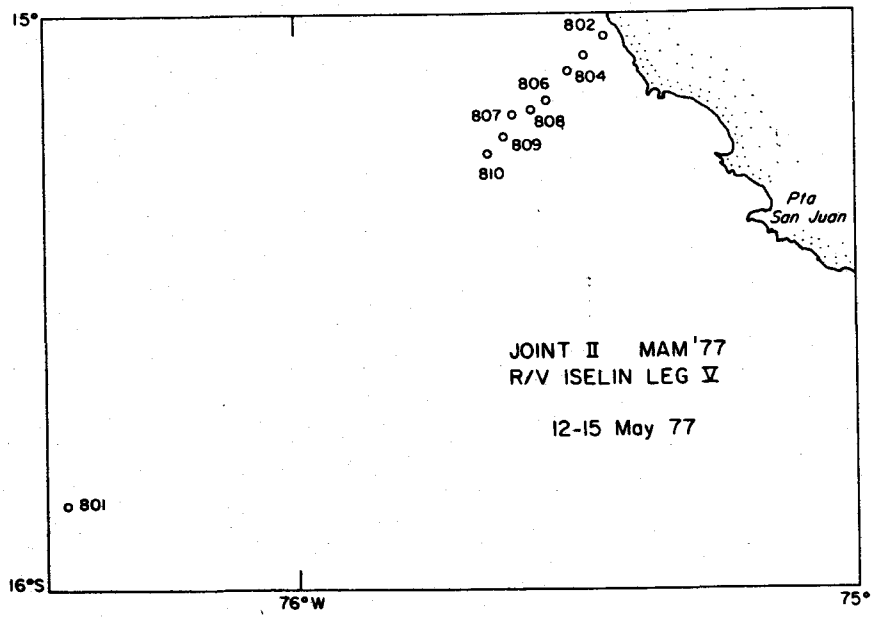

405
Pta Azua
399
K
398
Cabo Nazca
391
C
394
393
392
-2
406-1
15°S
407-1
-2
Pta San
Juan
382
408-1
-2
JOINT II MAM '77
R/V MELVILLE LEG IV
8-12 May 1977
16°
76°W
75°

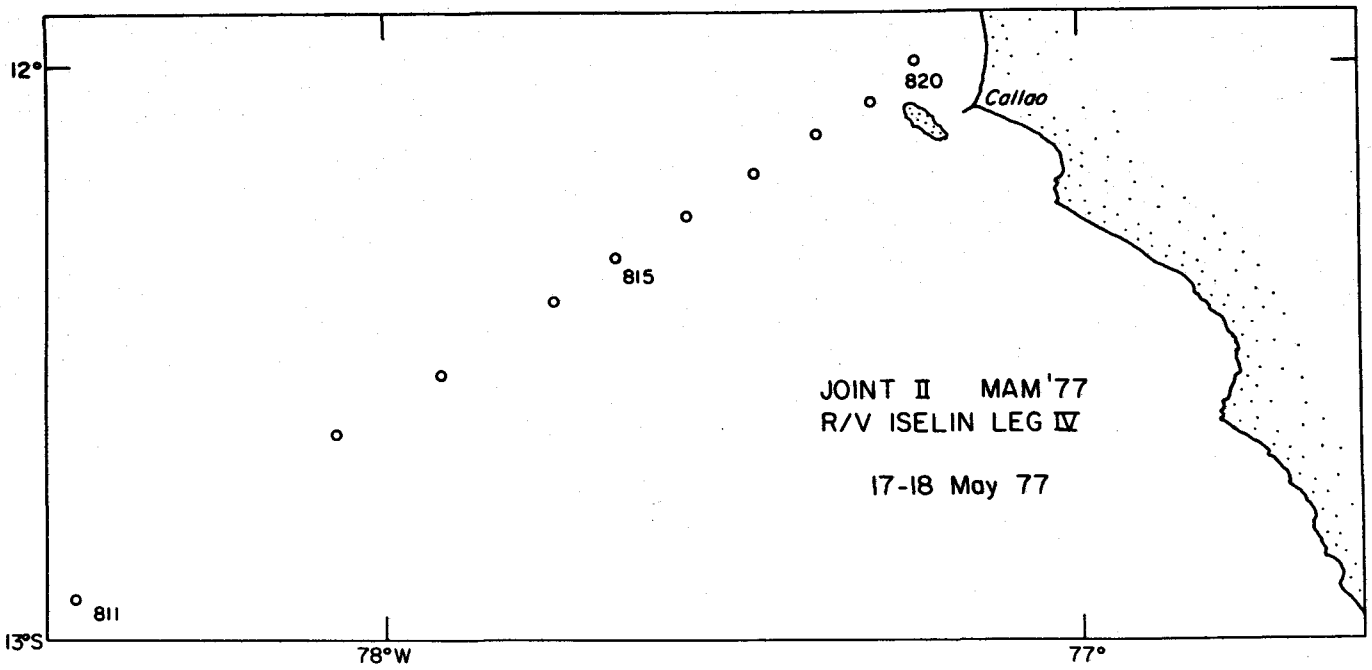

15°S
409
412
413
Pta San
Juan
16°
418-1
-2
-3
JOINT II MAM '77
R/V MELVILLE LEG IV
12-14 May 1977
419-1
-2
77°W
76°
75°


15°S
16°
76°W
75°
432
431
433
430
Pta San Juan
Δ 423-1, -2
Δ 421
Δ 420
JOINT II MAM '77
R/V MELVILLE LEG IV
14-16 May 1977


10°
11°S
80°W
79°
78°
448
442
438
440
441
439
437
436
435
434
JOINT II MAM '77
R/V MELVILLE LEG IV
18-19 May 1977

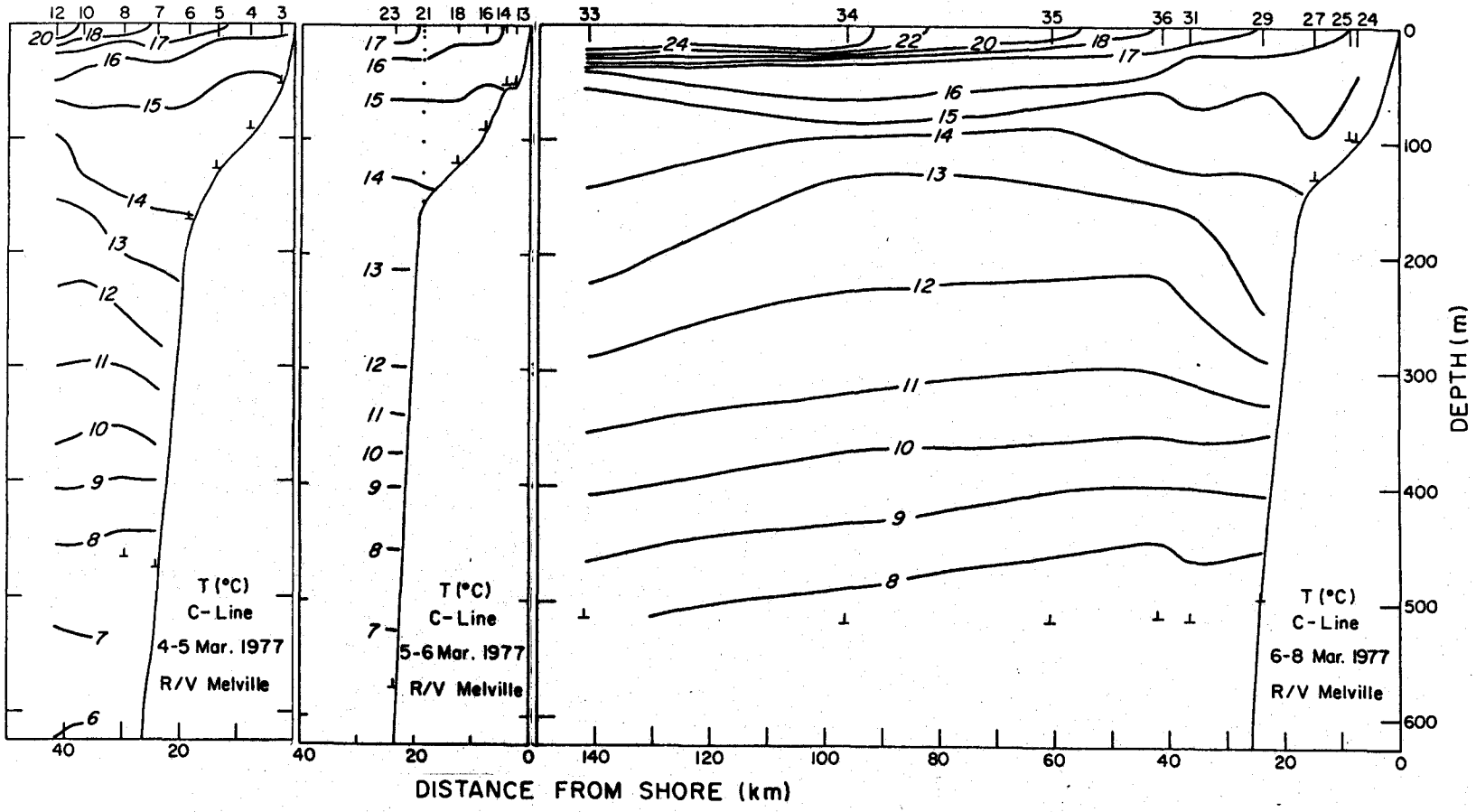

5°S
5°20'
83°W
82°
81°
449
452
450
453
451
454
456
462
Paita
JOINT II MAM '77
R/V MELVILLE LEG IV
21-22 May 1977

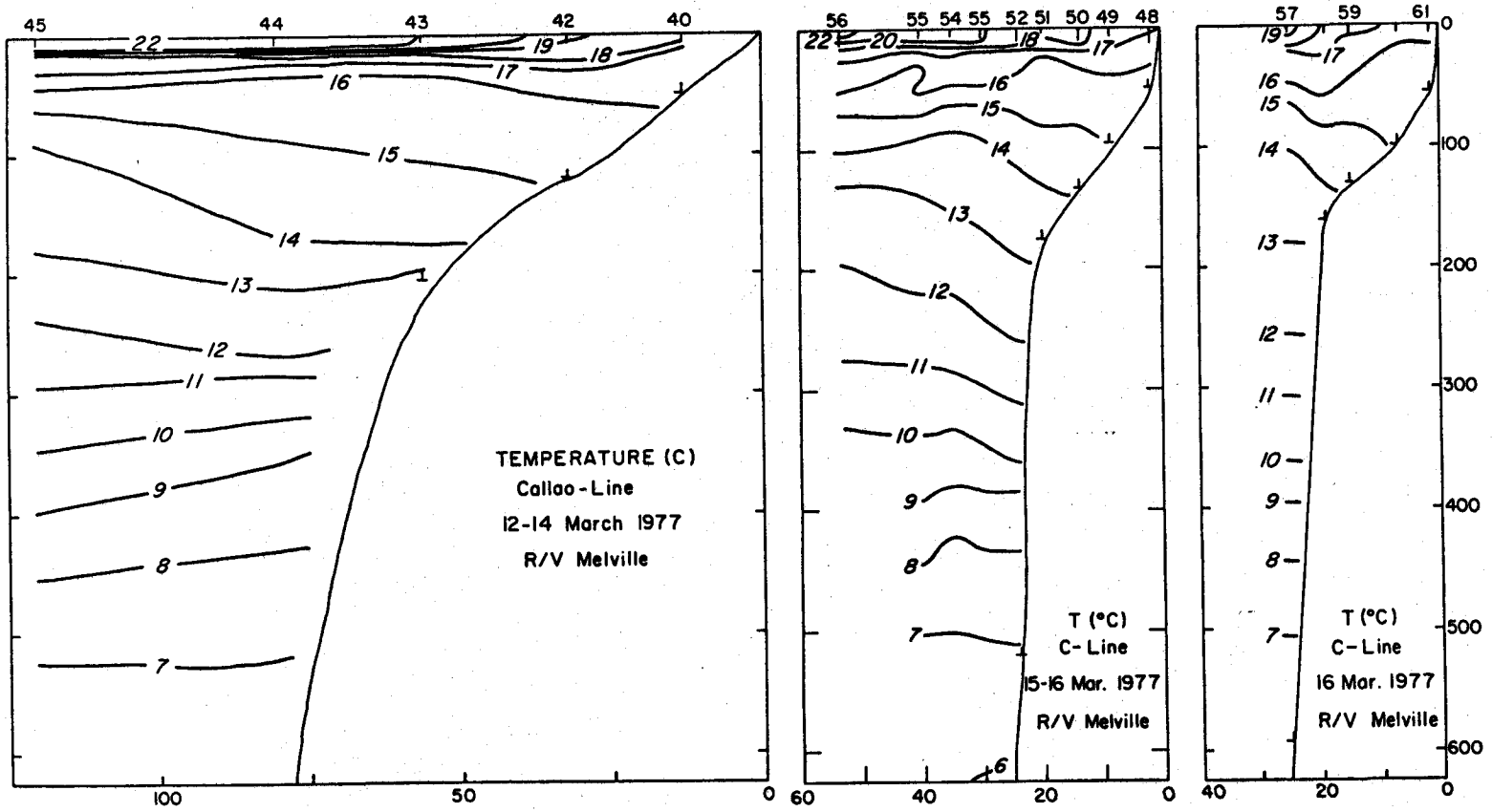

15°
802
804
806
807
808
809
810
Pta
San Juan
JOINT II MAM '77
R/V ISELIN LEG V
12-15 May 77
801
16°S
76°W
75°

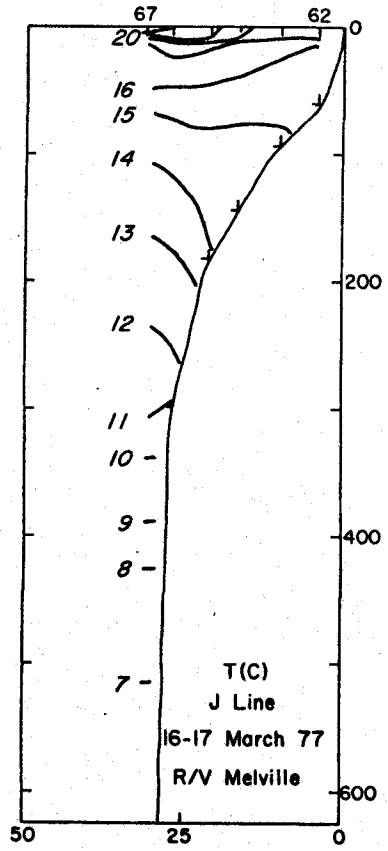

12°
820
Callao
815
JOINT II MAM '77
R/V ISELIN LEG IV
17-18 May 77
811
13°S
78°W
77°

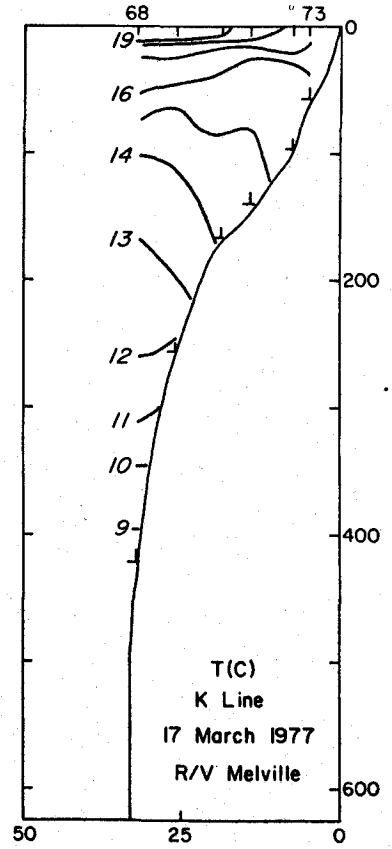
VERTICAL POSITIONS DURING MAM 77

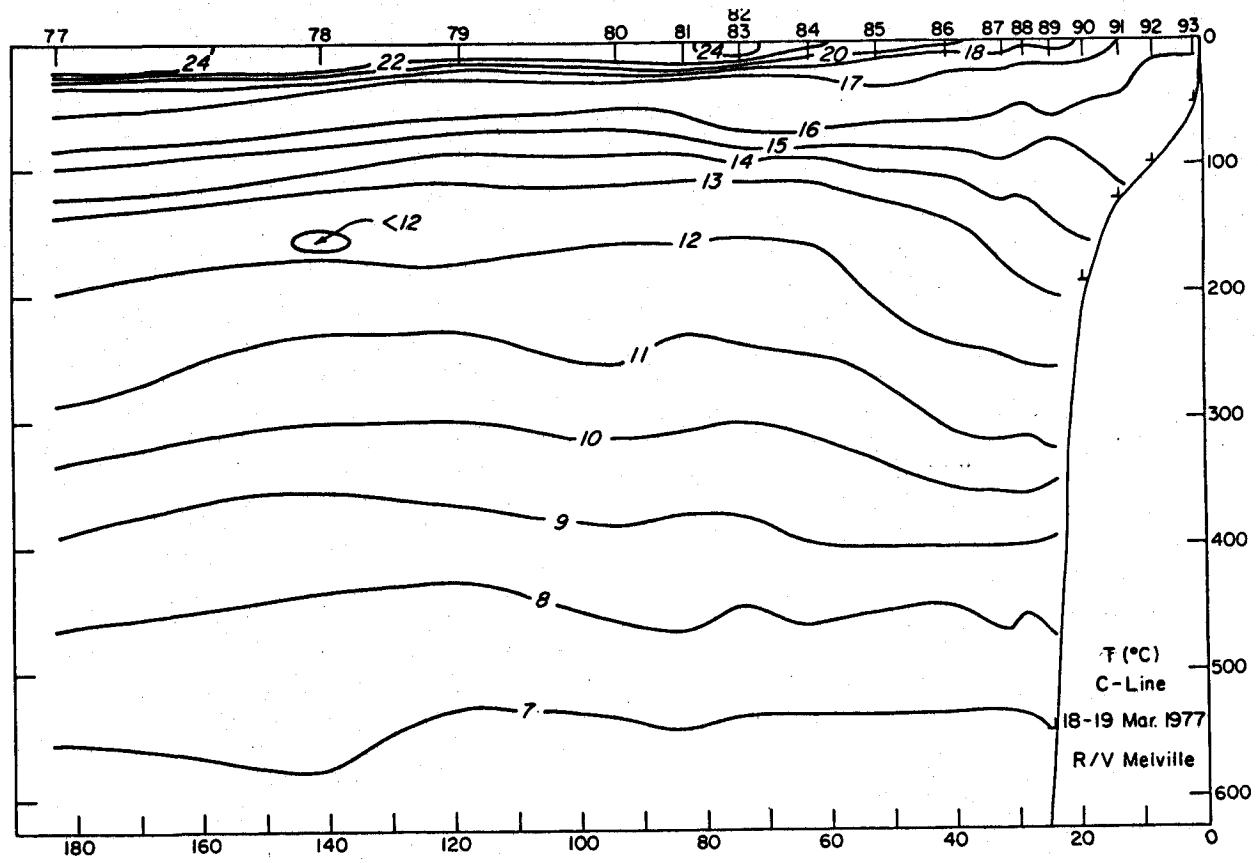
Temperature

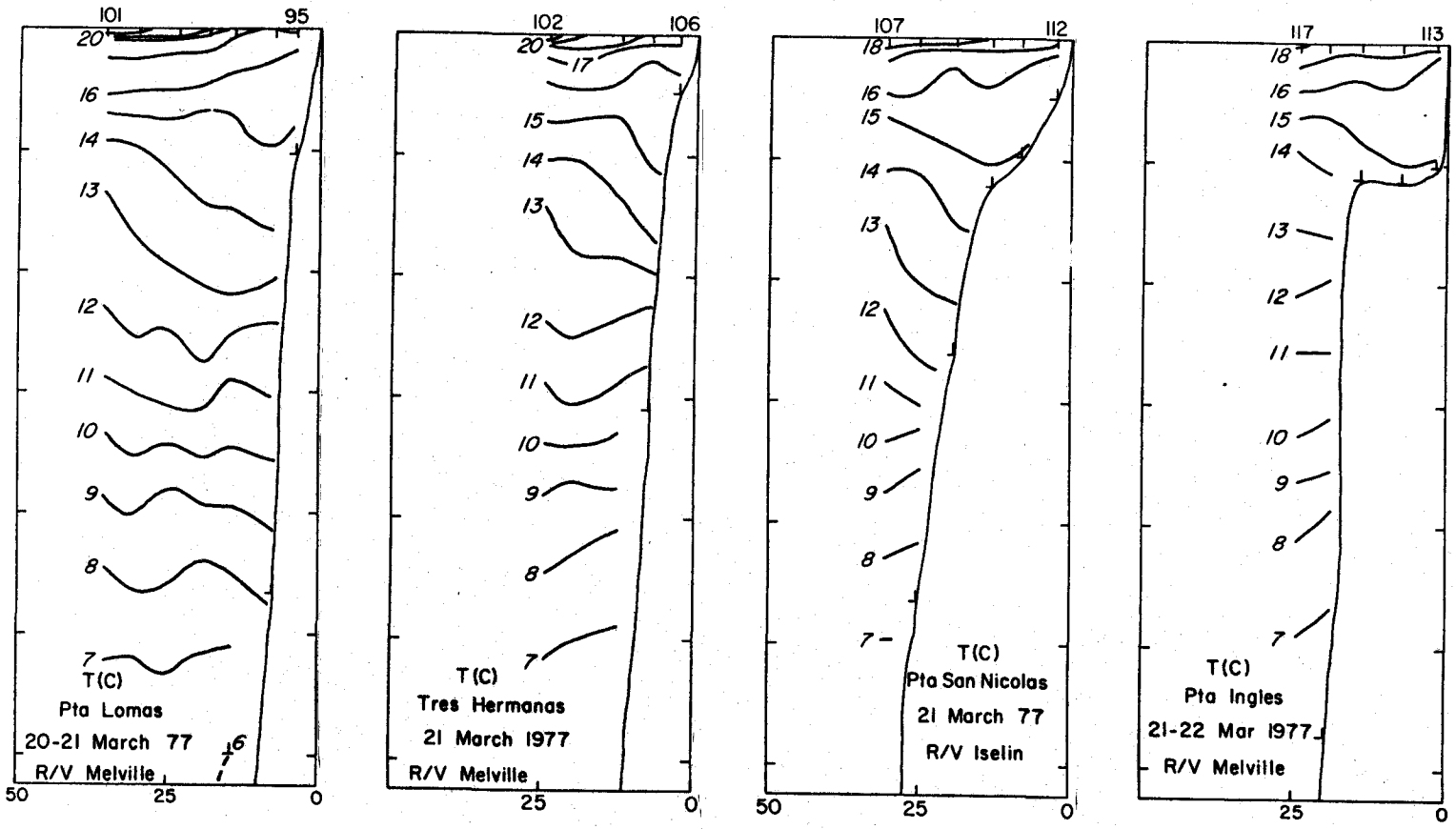

T (°C)
C-Line
4-5 Mar. 1977
R/V Melville
T (°C)
C-Line
5-6 Mar. 1977
R/V Melville
T (°C)
C-Line
6-8 Mar. 1977
R/V Melville
DISTANCE FROM SHORE (km)
DEPTH (m)

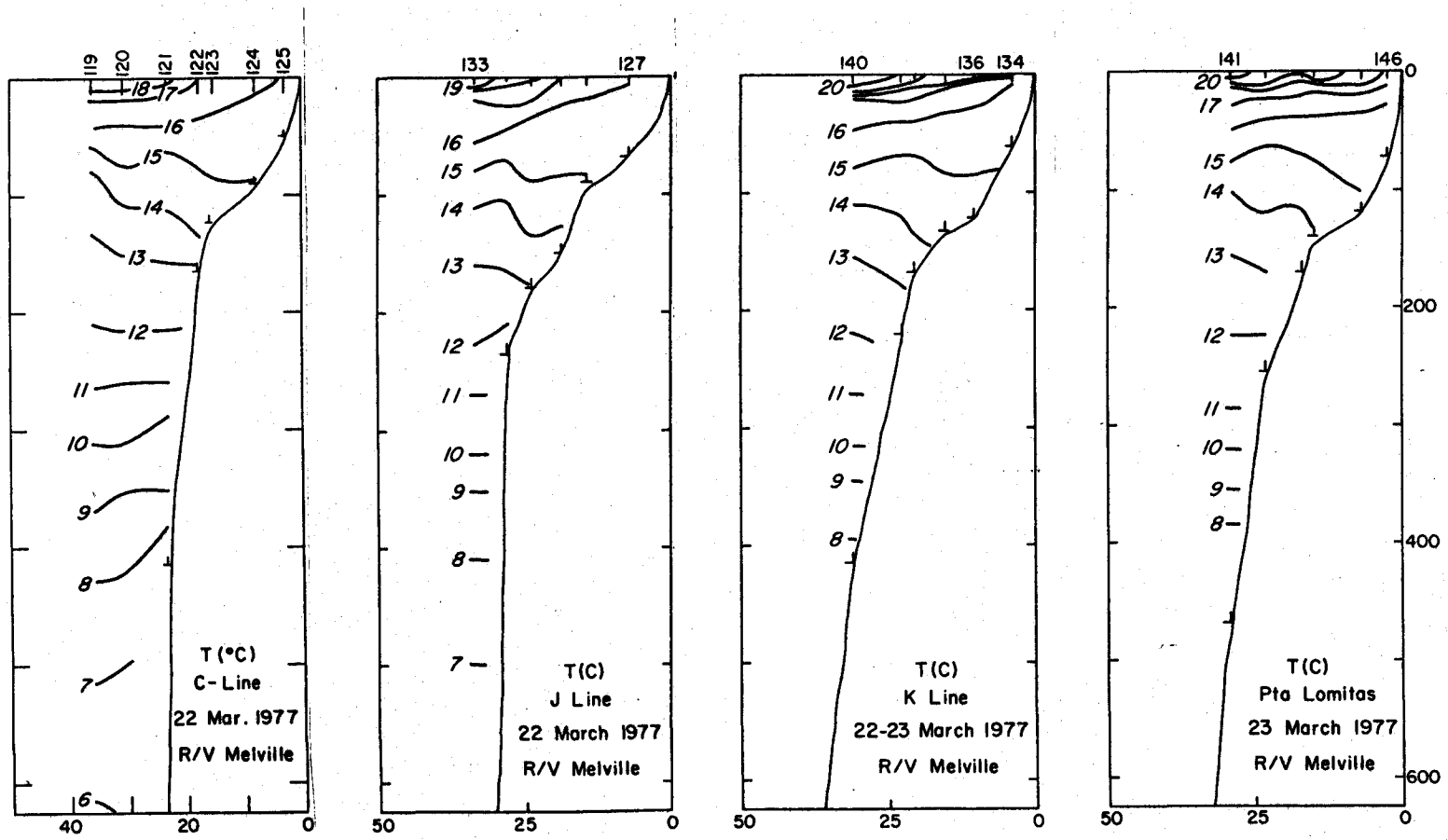

TEMPERATURE (C)
Callao - Line
12-14 March 1977
R/V Melville
T (°C)
C-Line
15-16 Mar. 1977
R/V Melville
T (°C)
C-Line
16 Mar. 1977
R/V Melville

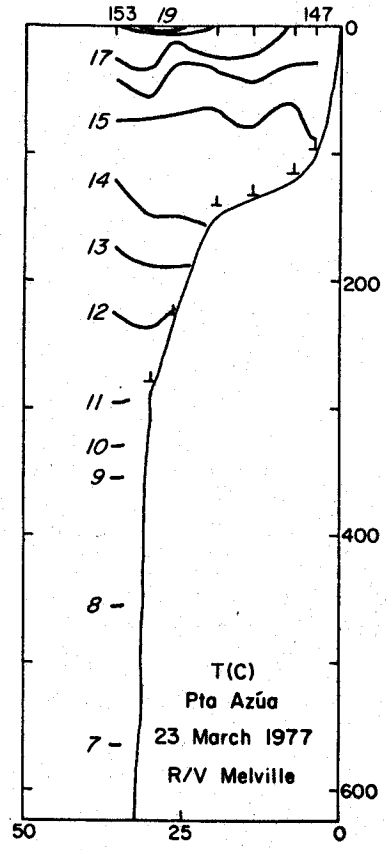

67
62
0
20
16
15
14
13
12
11
10
9
8
7
200
400
600
T(C)
J Line
16-17 March 77
R/V Melville
50
25
0

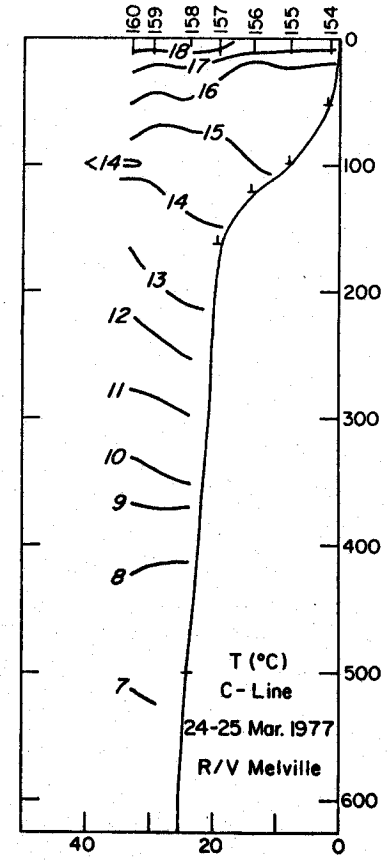

68
73
0
19
16
14
13
12
11
10
9
200
400
600
T(C)
K Line
17 March 1977
R/V Melville
50
25
0

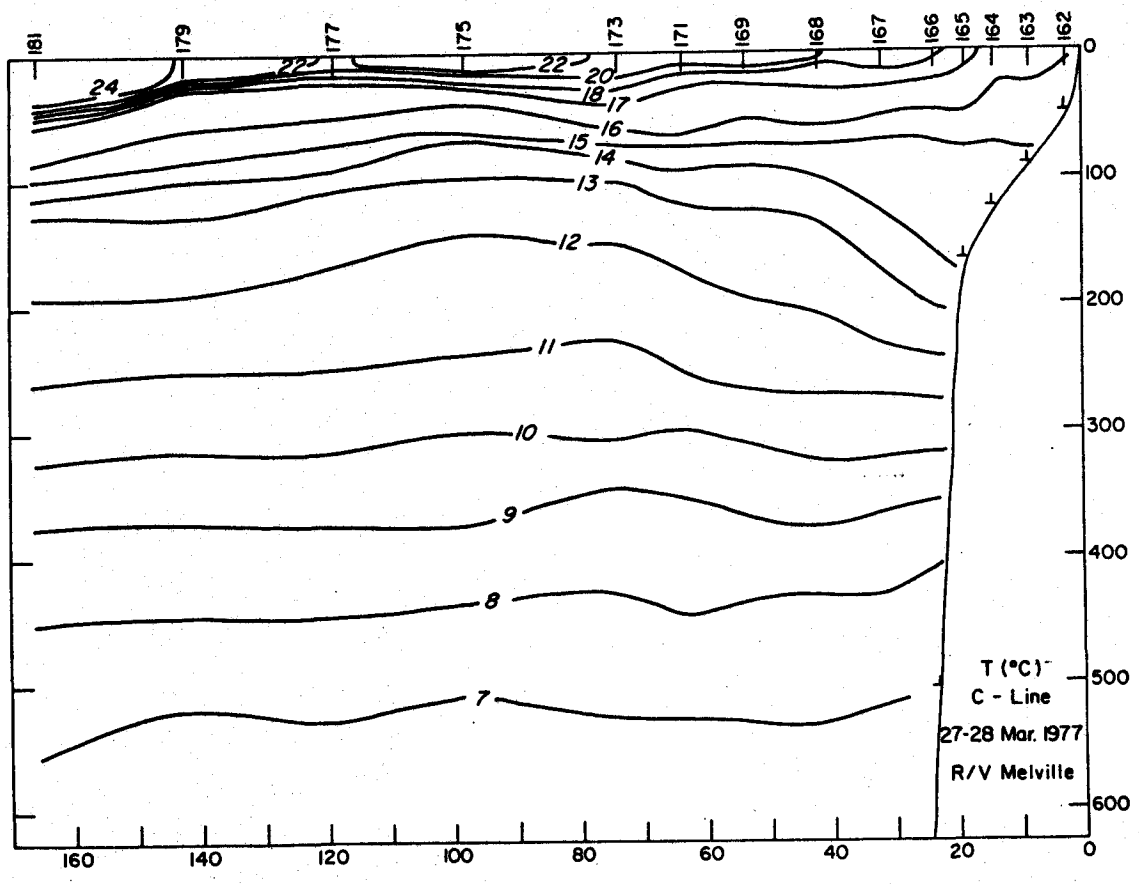

77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
0
100
200
300
400
500
600
24
22
24
20
18
17
16
15
14
13
<12
12
11
10
9
8
7
180
160
140
120
100
80
60
40
20
0
T (°C)
C-Line
18-19 Mar. 1977
R/V Melville

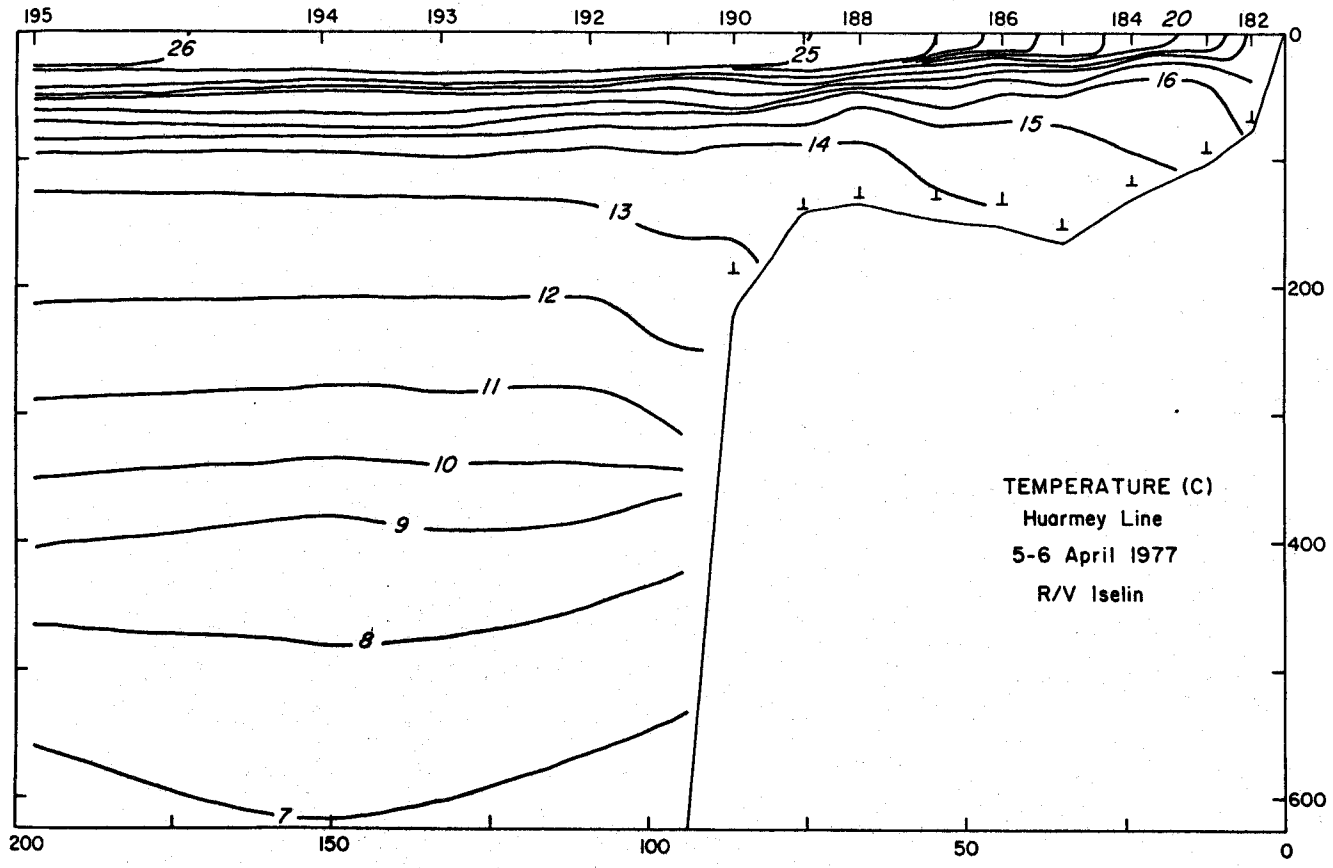

101
95
20
16
14
13
12
11
10
9
8
7
6
T(C)
Pta Lomas
20-21 March 77
R/V Melville
50
25
0
102
106
20
17
15
14
13
12
11
10
9
8
7
T(C)
Tres Hermanas
21 March 1977
R/V Melville
25
0
107
112
18
16
15
14
13
12
11
10
9
8
7
T(C)
Pta San Nicolas
21 March 77
R/V Iselin
50
25
0
117
113
18
16
15
14
13
12
11
10
9
8
7
T(C)
Pta Ingles
21-22 Mar 1977
R/V Melville
25
0


119 120 121 122 123 124 125
18 17 16 15 14 13 12 11 10 9 8 7 6
T (°C)
C-Line
22 Mar. 1977
R/V Melville
40 20 0
133 127
19 16 15 14 13 12 11 10 9 8 7
T(C)
J Line
22 March 1977
R/V Melville
50 25 0
140 136 134
20 16 15 14 13 12 11 10 9 8
T(C)
K Line
22-23 March 1977
R/V Melville
50 25 0
141 146
20 17 16 15 14 13 12 11 10 9 8
T(C)
Pta Lomitas
23 March 1977
R/V Melville
50 25 0
0 200 400 600


153
19
147
0
17
15
14
13
12
11
10
9
8
7
200
400
600
50
25
0
T(C)
Pta Azúa
23 March 1977
R/V Melville


160
159
158
157
156
155
154
0
18
17
16
15
<14=>
14
13
12
11
10
9
8
7
100
200
300
400
500
600
40
20
0
T (°C)
C - Line
24-25 Mar. 1977
R/V Melville


181
179
177
175
173
171
169
168
167
166
165
164
163
162
0
24
22
22
20
18
17
16
15
14
13
12
11
10
9
8
7
100
200
300
400
500
600
160
140
120
100
80
60
40
20
0
T (°C)
C - Line
27-28 Mar. 1977
R/V Melville


195
194
193
192
190
188
186
184
182
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200
150
100
50
0
200
400
600
26
25
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16
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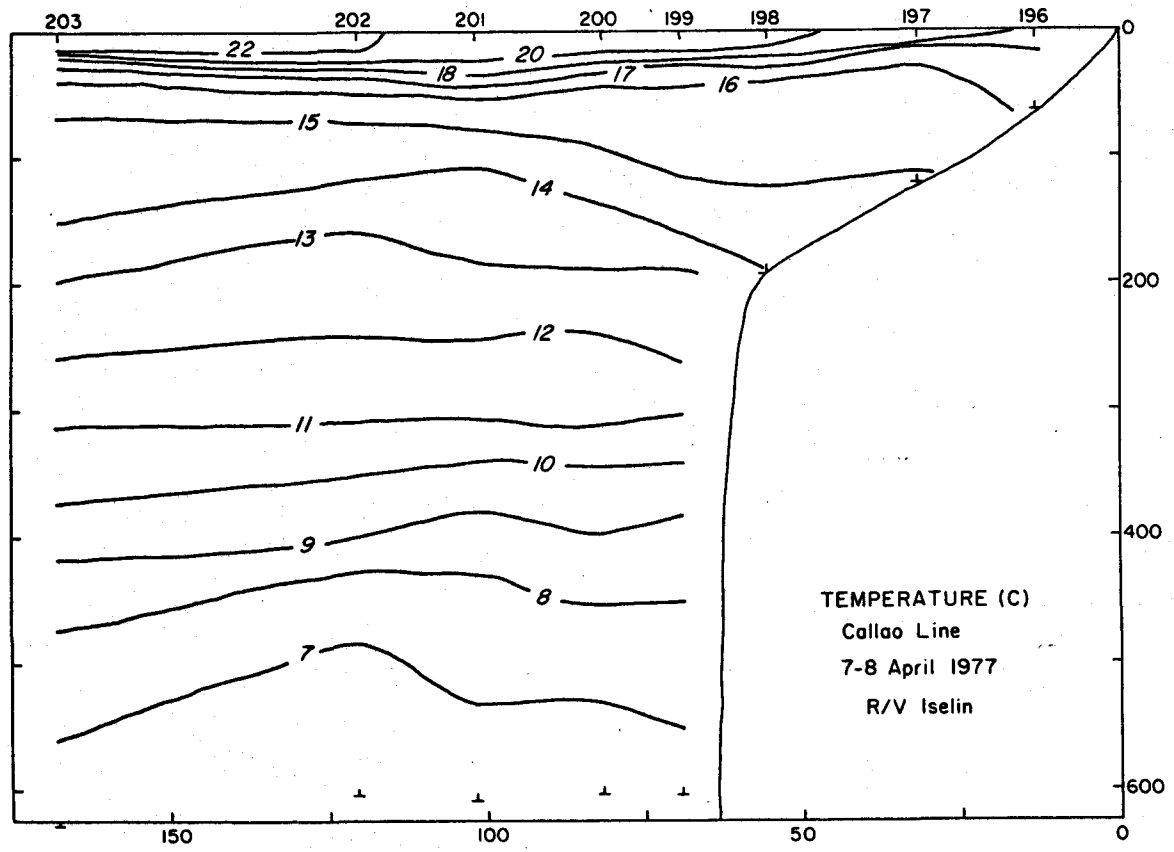
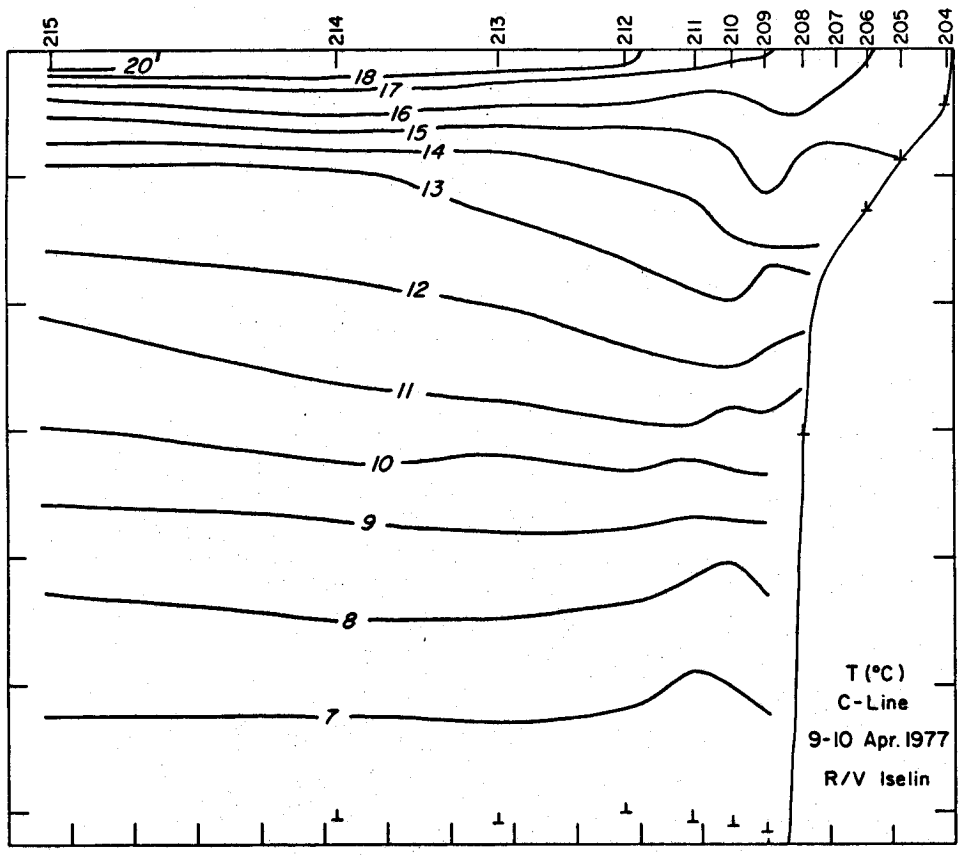
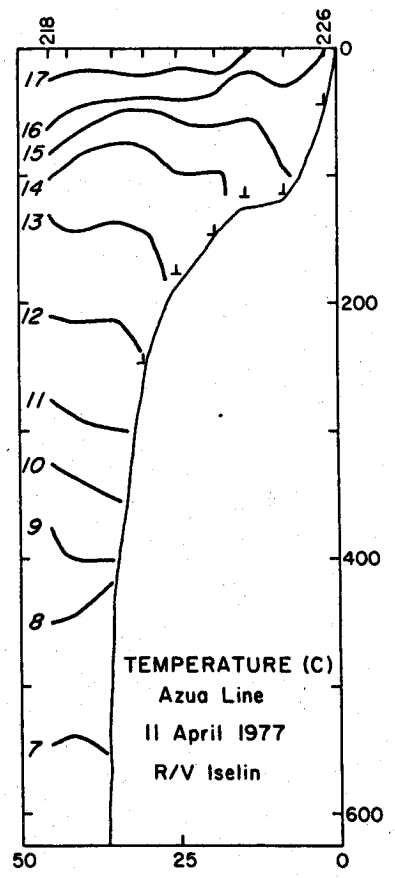
13
12
11
10
9
8
7
TEMPERATURE (C)
Huarmey Line
5-6 April 1977
R/V Iselin


203
202
201
200
199
198
197
196
0
22
20
18
17
16
15
14
13
12
11
10
9
8
7
200
400
600
150
100
50
0
TEMPERATURE (C)
Callao Line
7-8 April 1977
R/V Iselin


215
214
213
212
211
210
209
208
207
206
205
204
20
18
17
16
15
14
13
12
11
10
9
8
7
T (°C)
C-Line
9-10 Apr. 1977
R/V Iselin


218
226
0
17
16
15
14
13
12
11
10
9
8
7
200
400
600
50
25
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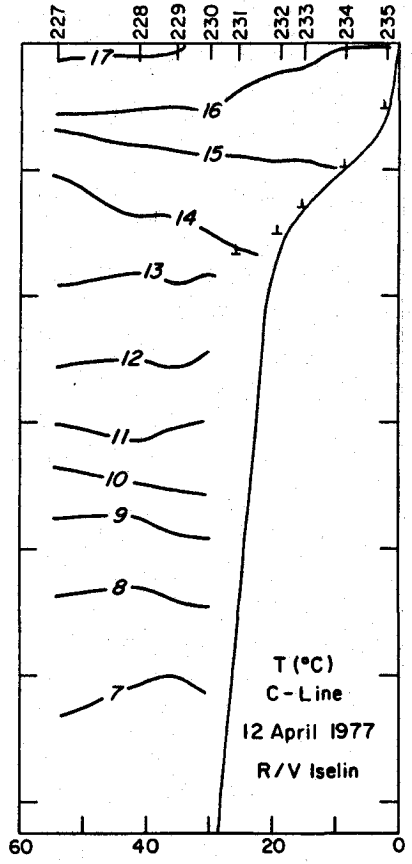
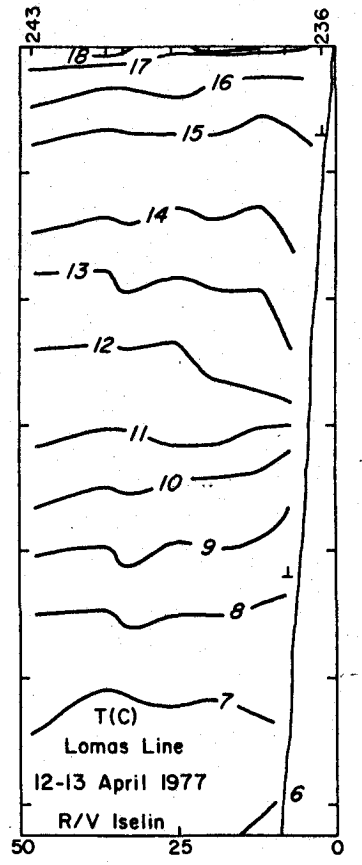
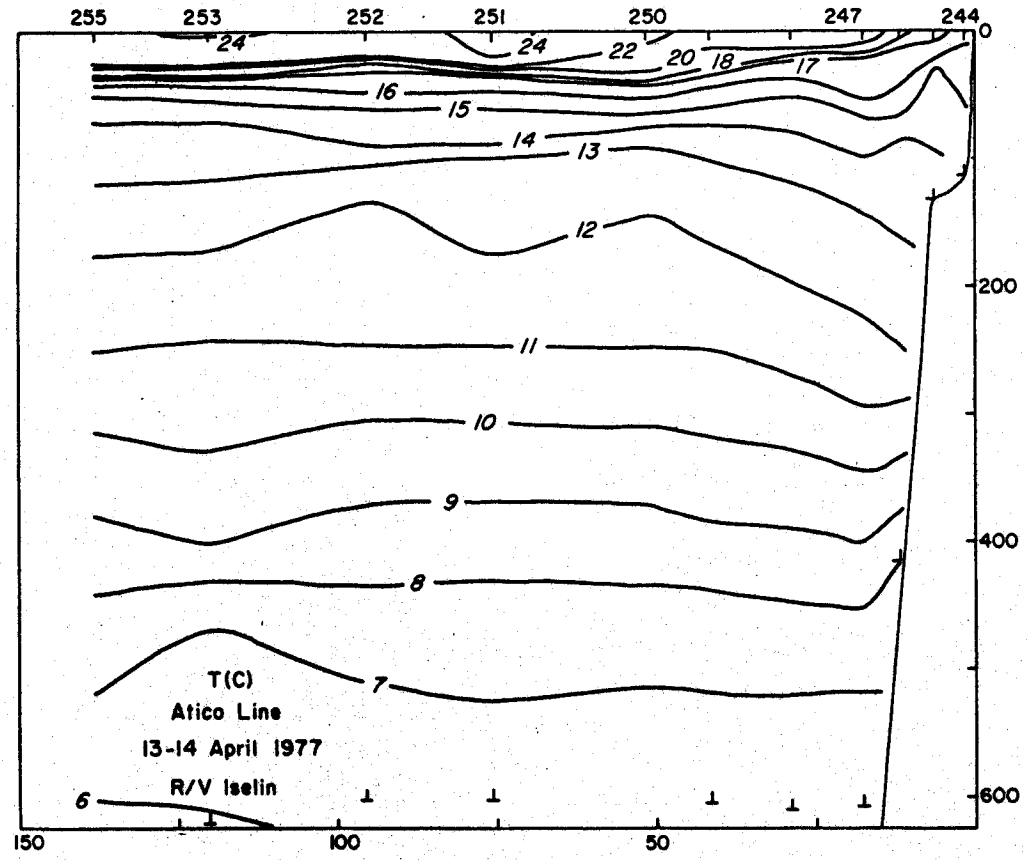
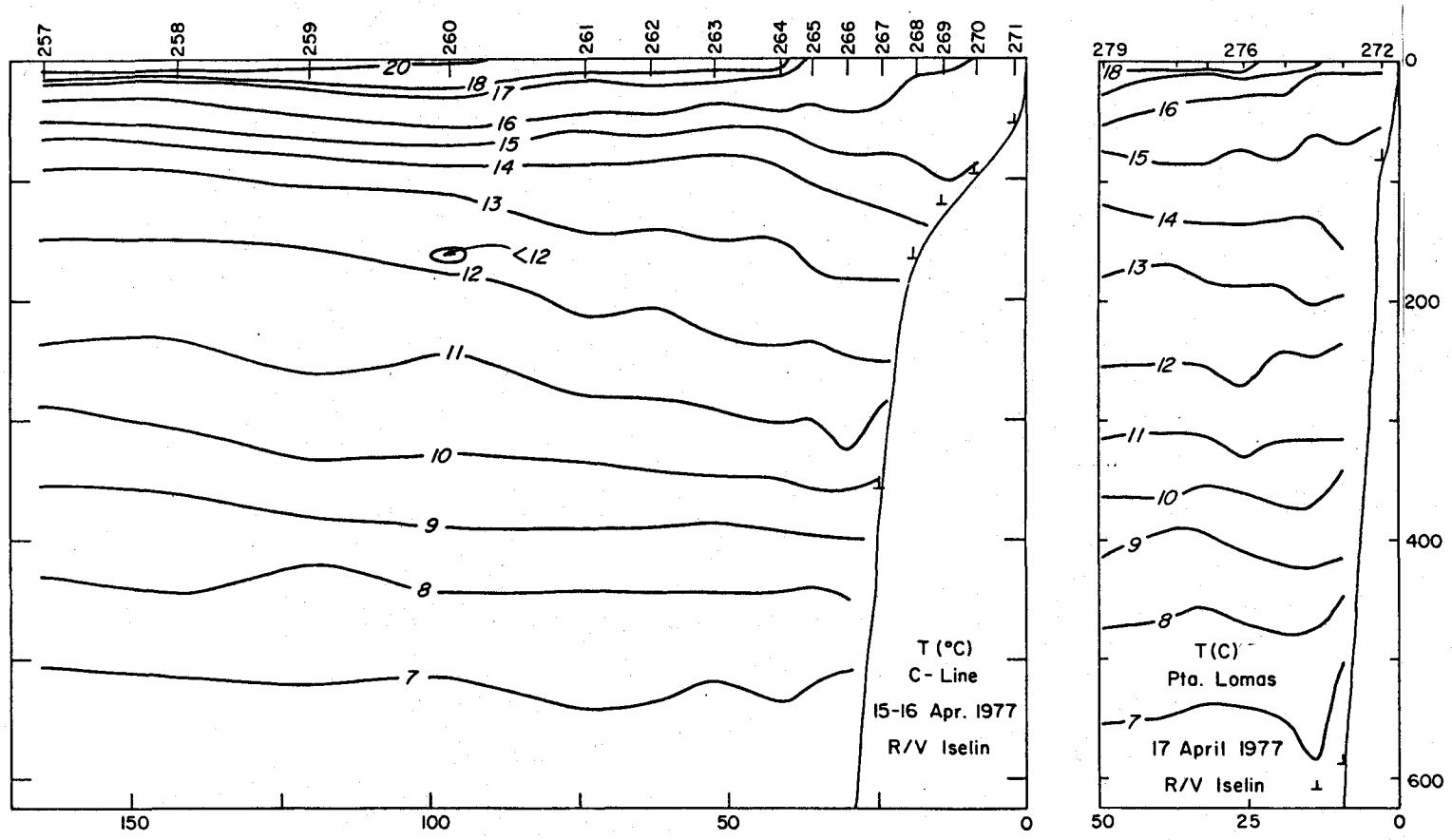
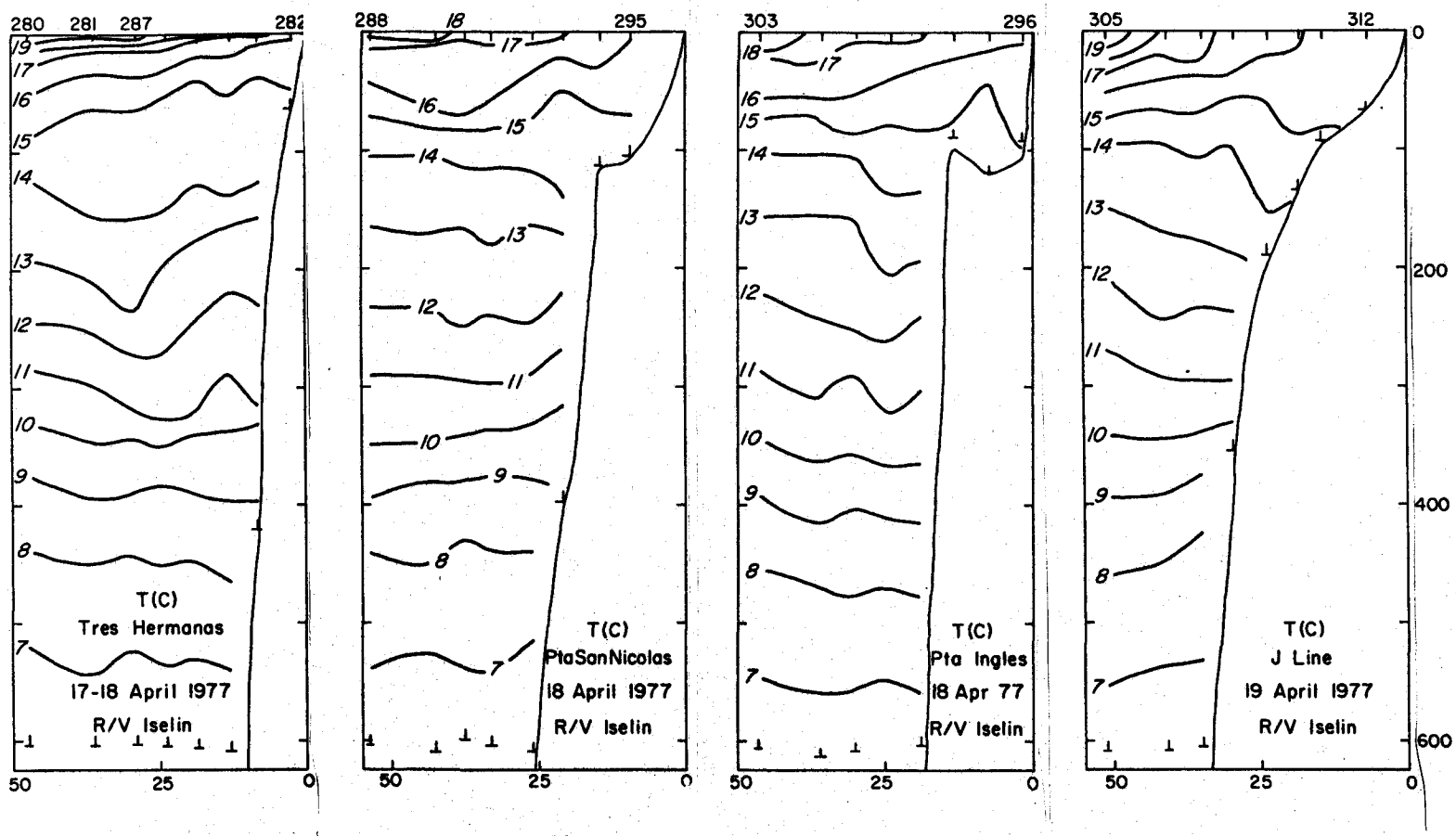
TEMPERATURE (C)
Azua Line
11 April 1977
R/V Iselin

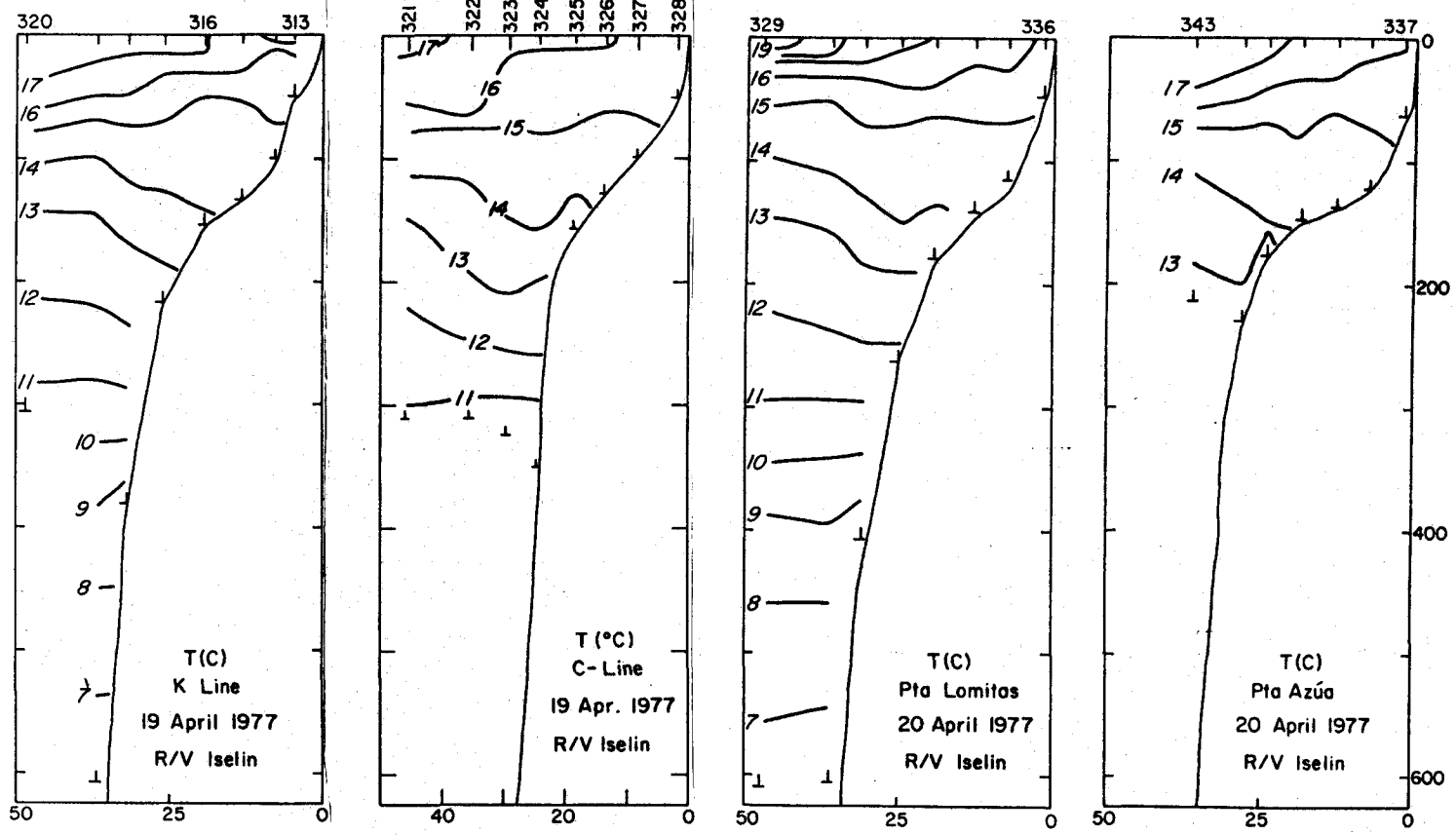

227
228
229
230
231
232
233
234
235
17
16
15
14
13
12
11
10
9
8
7
T (°C)
C-Line
12 April 1977
R/V Iselin
60
40
20
0

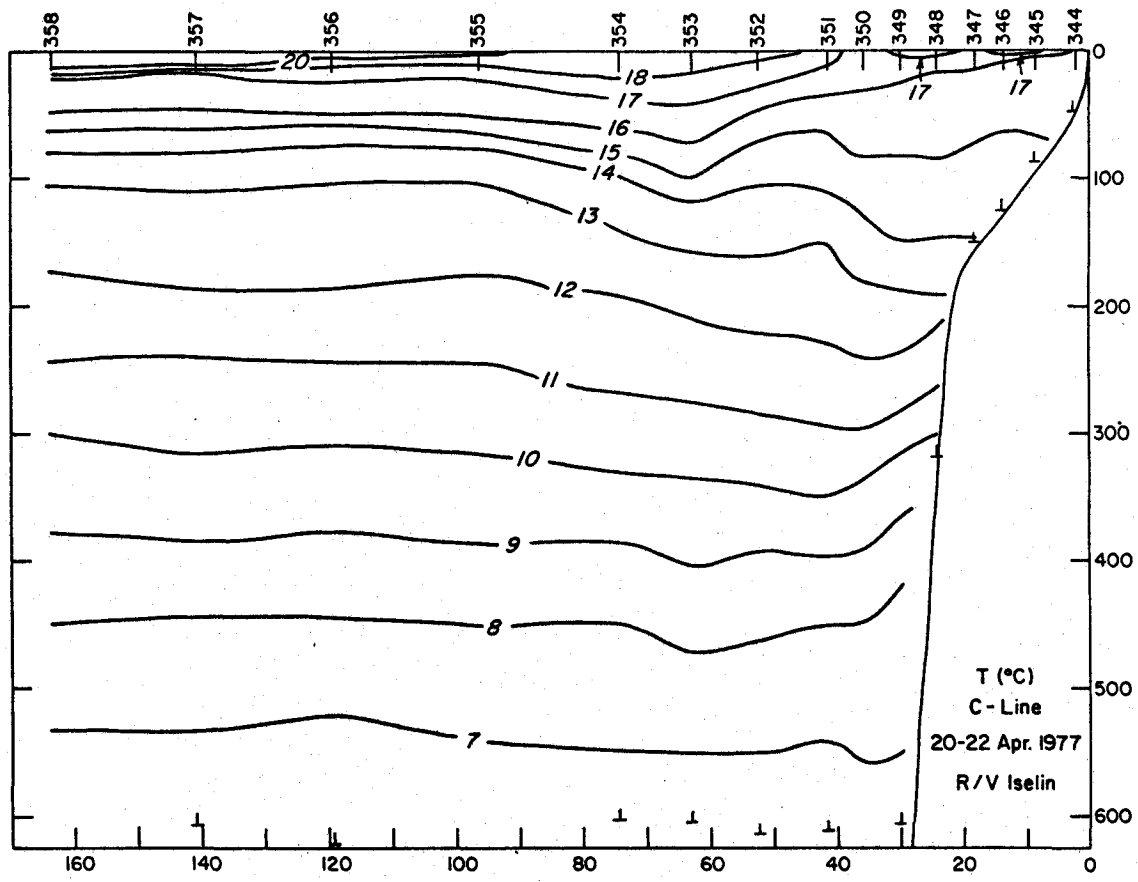

243
236
18
17
16
15
14
13
12
11
10
9
8
7
6
T(C)
Lomas Line
12-13 April 1977
R/V Iselin
50
25
0

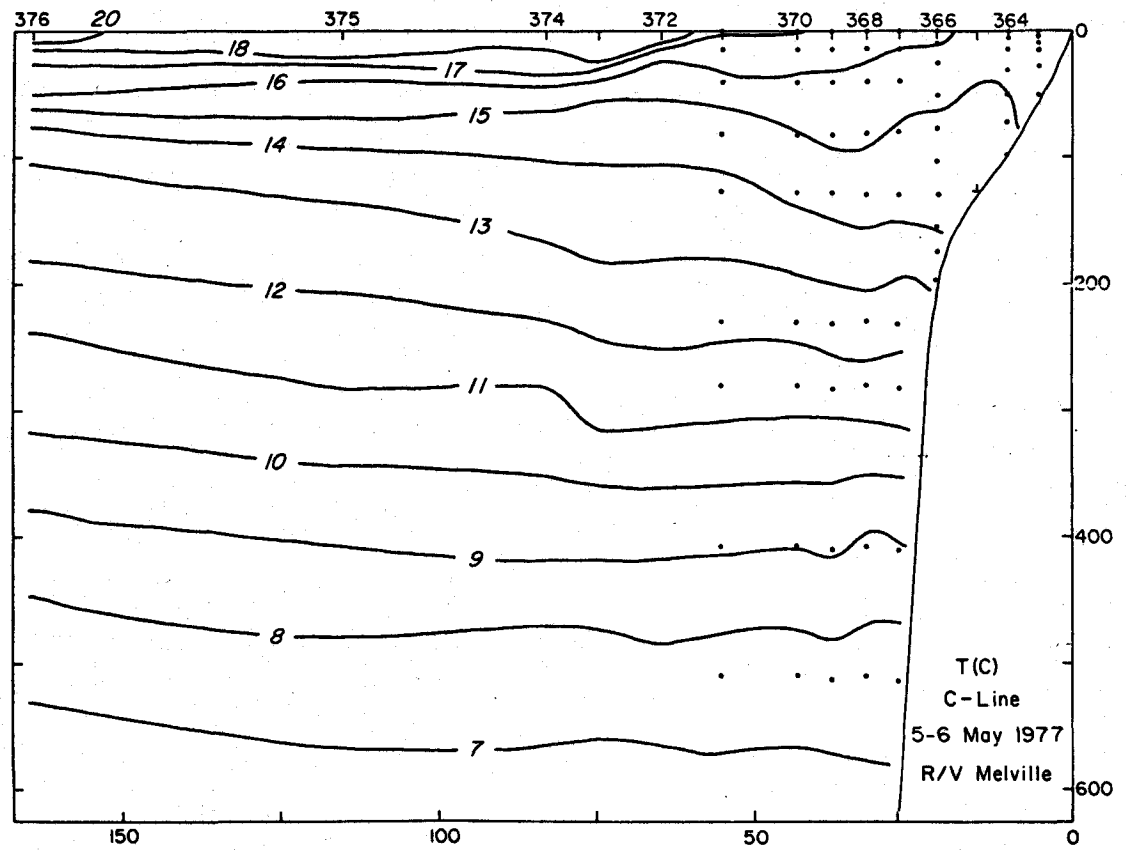

255
253
252
251
250
247
244
0
24
24
22
20
18
17
16
15
14
13
12
200
11
10
9
400
8
7
T(C)
Atico Line
13-14 April 1977
R/V Iselin
6
600
150
100
50

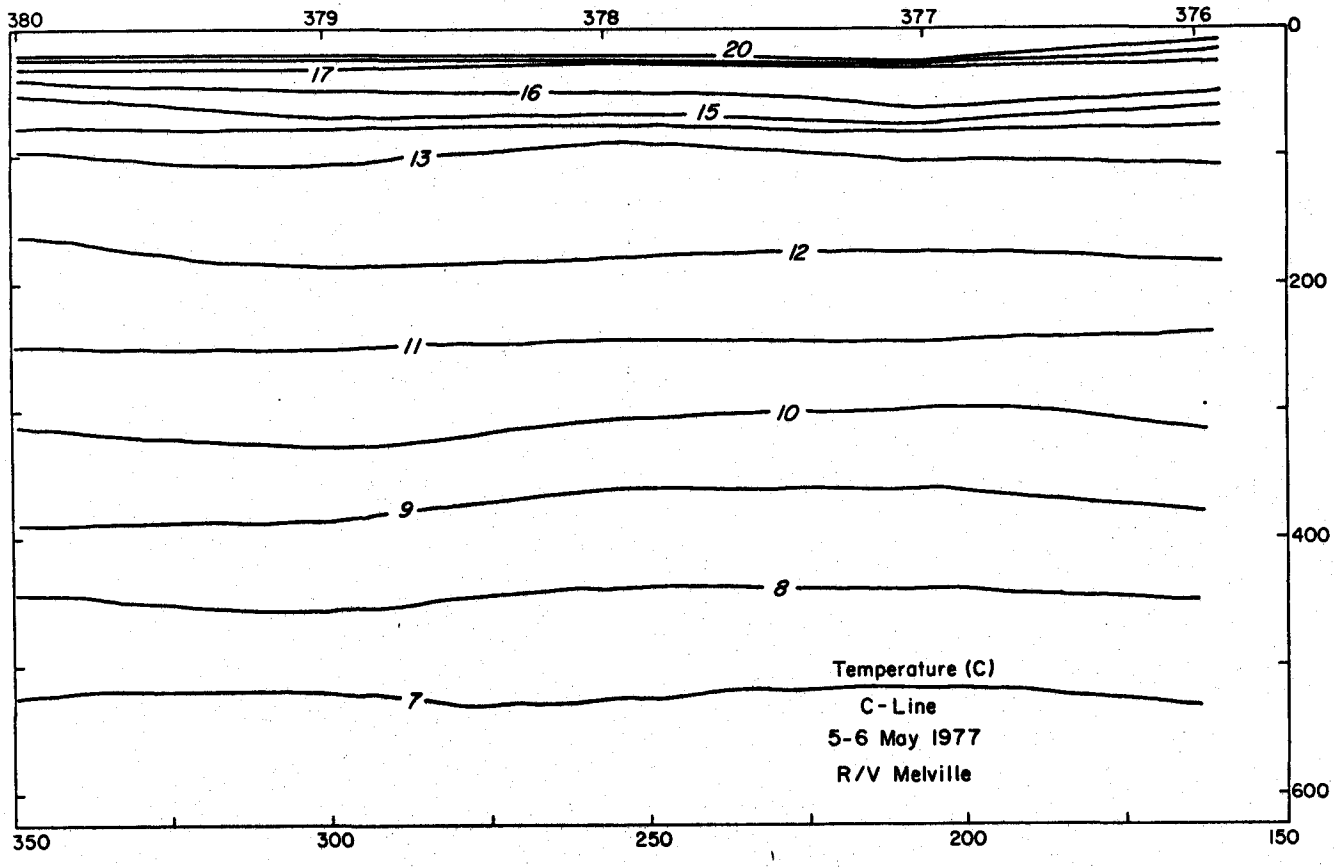

257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
20
18
17
16
15
14
13
<12
12
11
10
9
8
7
150
100
50
0
T (°C)
C - Line
15-16 Apr. 1977
R/V Iselin
279
276
272
0
18
16
15
14
13
12
11
10
9
8
7
200
400
600
T(C)
Pta. Lomas
17 April 1977
R/V Iselin
50
25
0

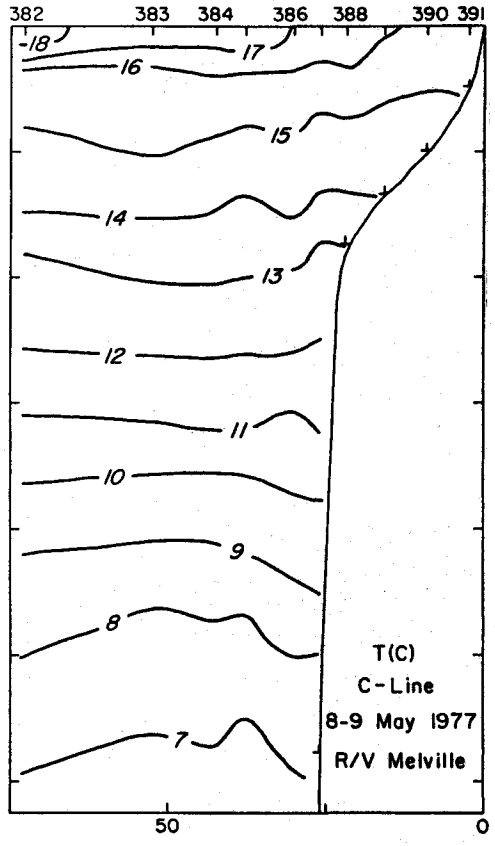

280 281 287 282
19
17
16
15
14
13
12
11
10
9
8
7
T(C)
Tres Hermanas
17-18 April 1977
R/V Iselin
50 25 0
288 18 295
17
16
15
14
13
12
11
10
9
8
7
T(C)
PtaSanNicolas
18 April 1977
R/V Iselin
50 25 0
303 296
18
17
16
15
14
13
12
11
10
9
8
7
T(C)
Pta Ingles
18 Apr 77
R/V Iselin
50 25 0
305 312
19
17
15
14
13
12
11
10
9
8
7
T(C)
J Line
19 April 1977
R/V Iselin
50 25 0
0
200
400
600

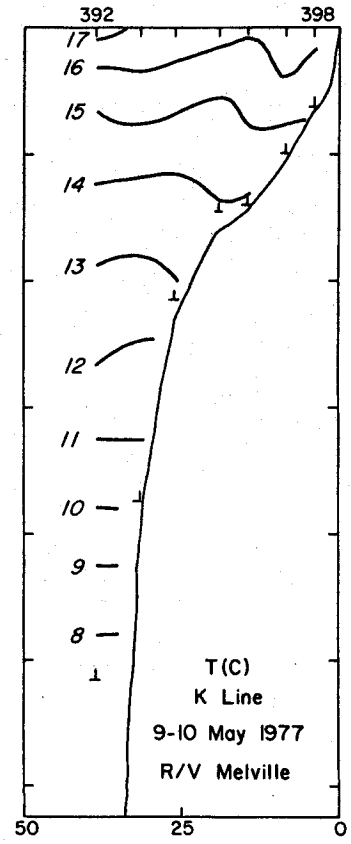

320
316
313
17
16
14
13
12
11
10
9
8
7
50
25
0
T(C)
K Line
19 April 1977
R/V Iselin
321
322
323
324
325
326
327
328
17
16
15
14
13
12
11
40
20
0
T (°C)
C-Line
19 Apr. 1977
R/V Iselin
329
336
19
16
15
14
13
12
11
10
9
8
7
50
25
0
T(C)
Pta Lomitas
20 April 1977
R/V Iselin
343
337
0
17
15
14
13
200
400
600
50
25
0
T(C)
Pta Azúa
20 April 1977
R/V Iselin

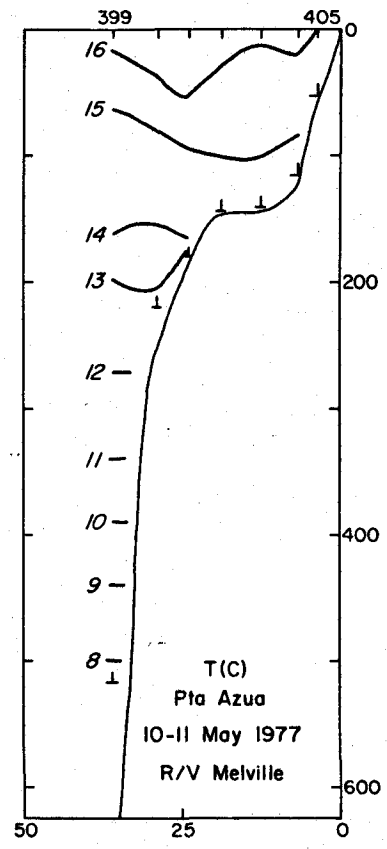

358
357
356
355
354
353
352
351
350
349
348
347
346
345
344
20
18
17
16
15
14
13
12
11
10
9
8
7
17
17
0
100
200
300
400
500
600
160
140
120
100
80
60
40
20
0
T (°C)
C - Line
20-22 Apr. 1977
R/V Iselin

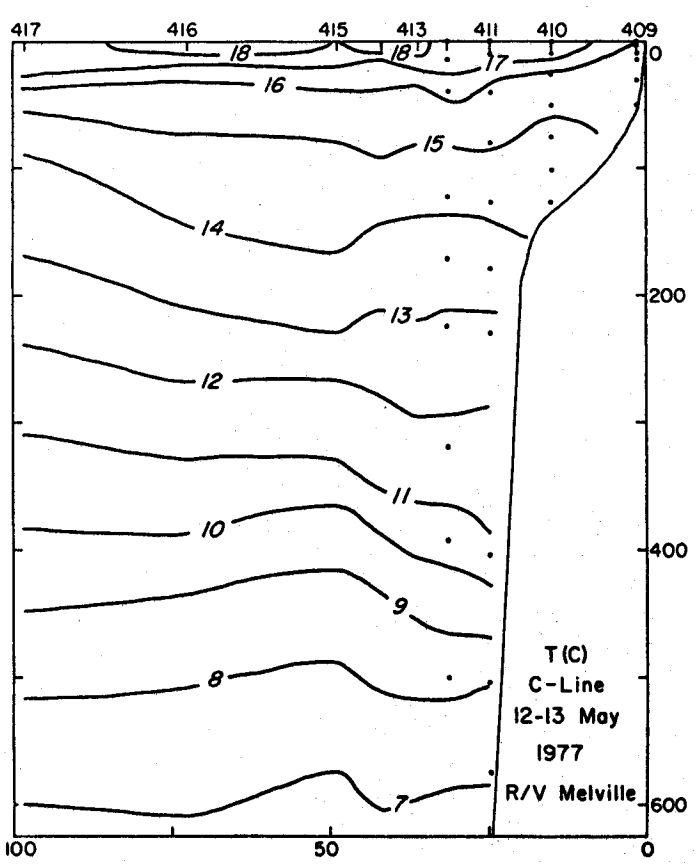

376
20
375
374
372
370
368
366
364
0
18
17
16
15
14
13
12
11
10
9
8
7
200
400
600
T(C)
C-Line
5-6 May 1977
R/V Melville
150
100
50
0

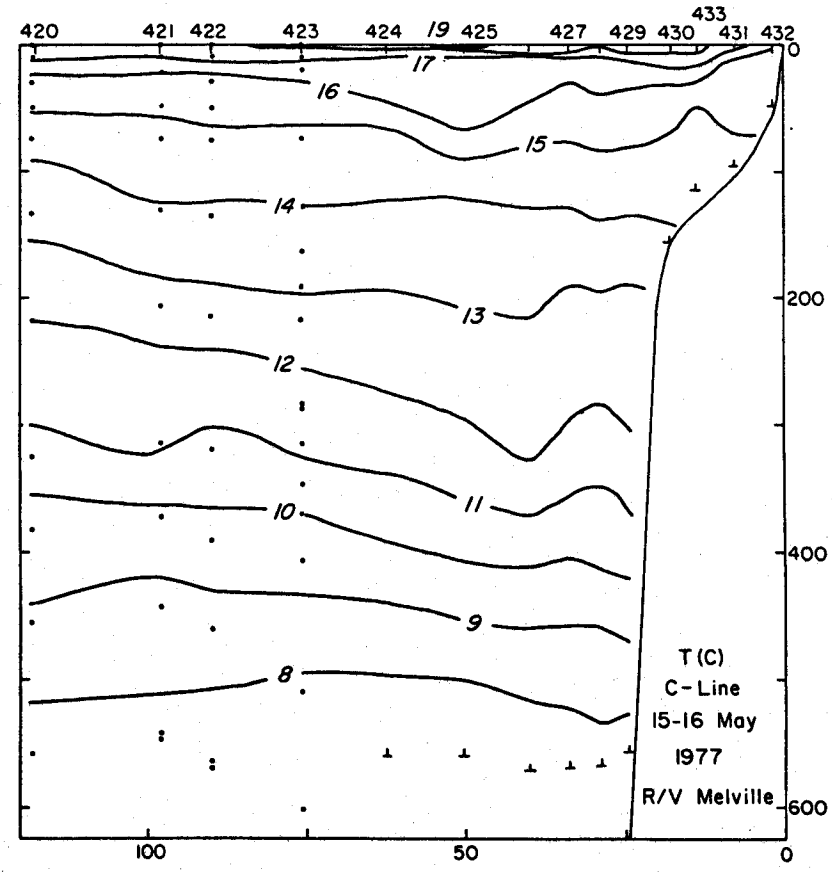

380
379
378
377
376
0
200
400
600
20
17
16
15
13
12
11
10
9
8
7
Temperature (C)
C-Line
5-6 May 1977
R/V Melville
350
300
250
200
150

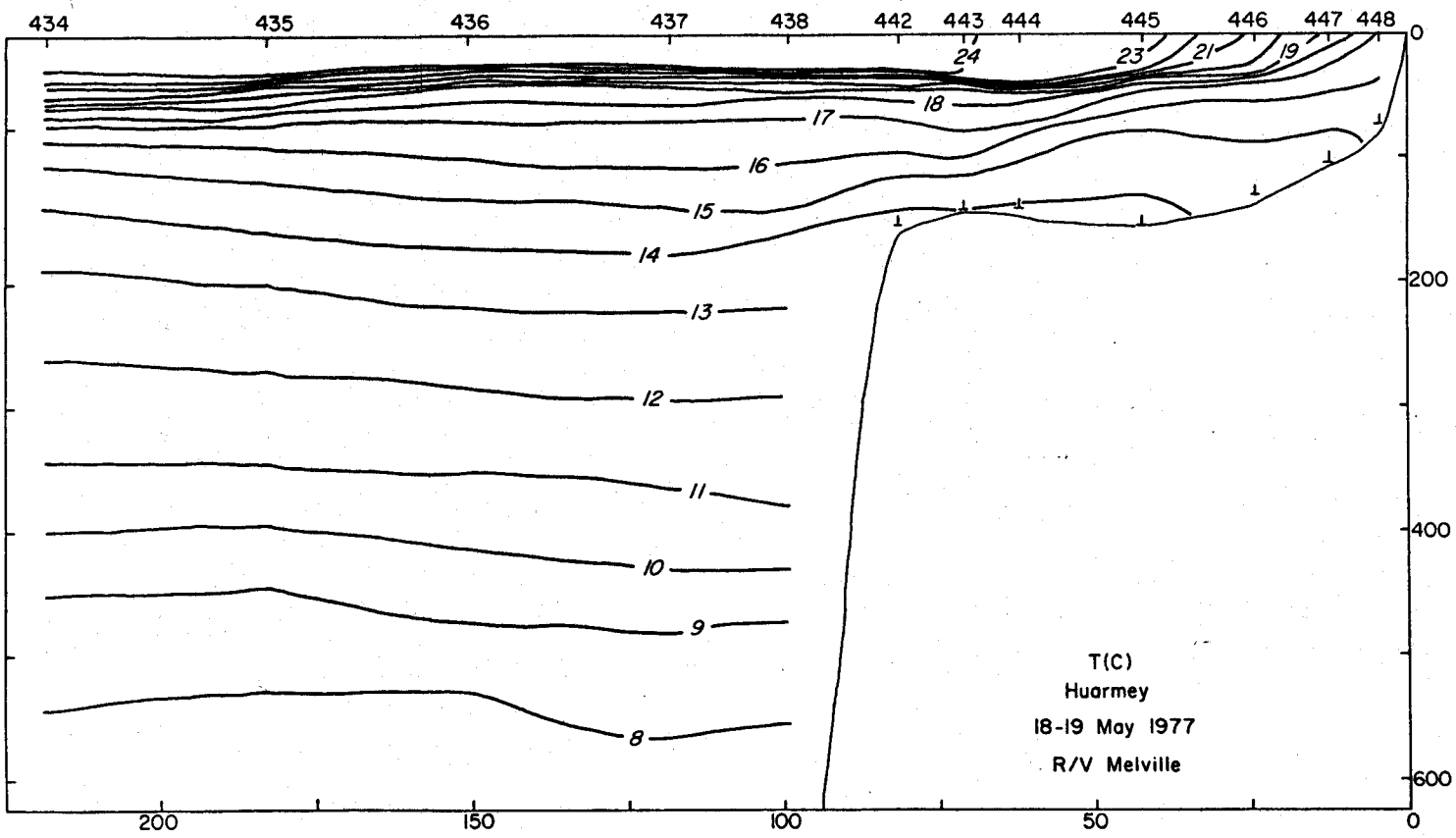

382
383
384
386
388
390
391
18
17
16
15
14
13
12
11
10
9
8
7
50
0
T(C)
C-Line
8-9 May 1977
R/V Melville

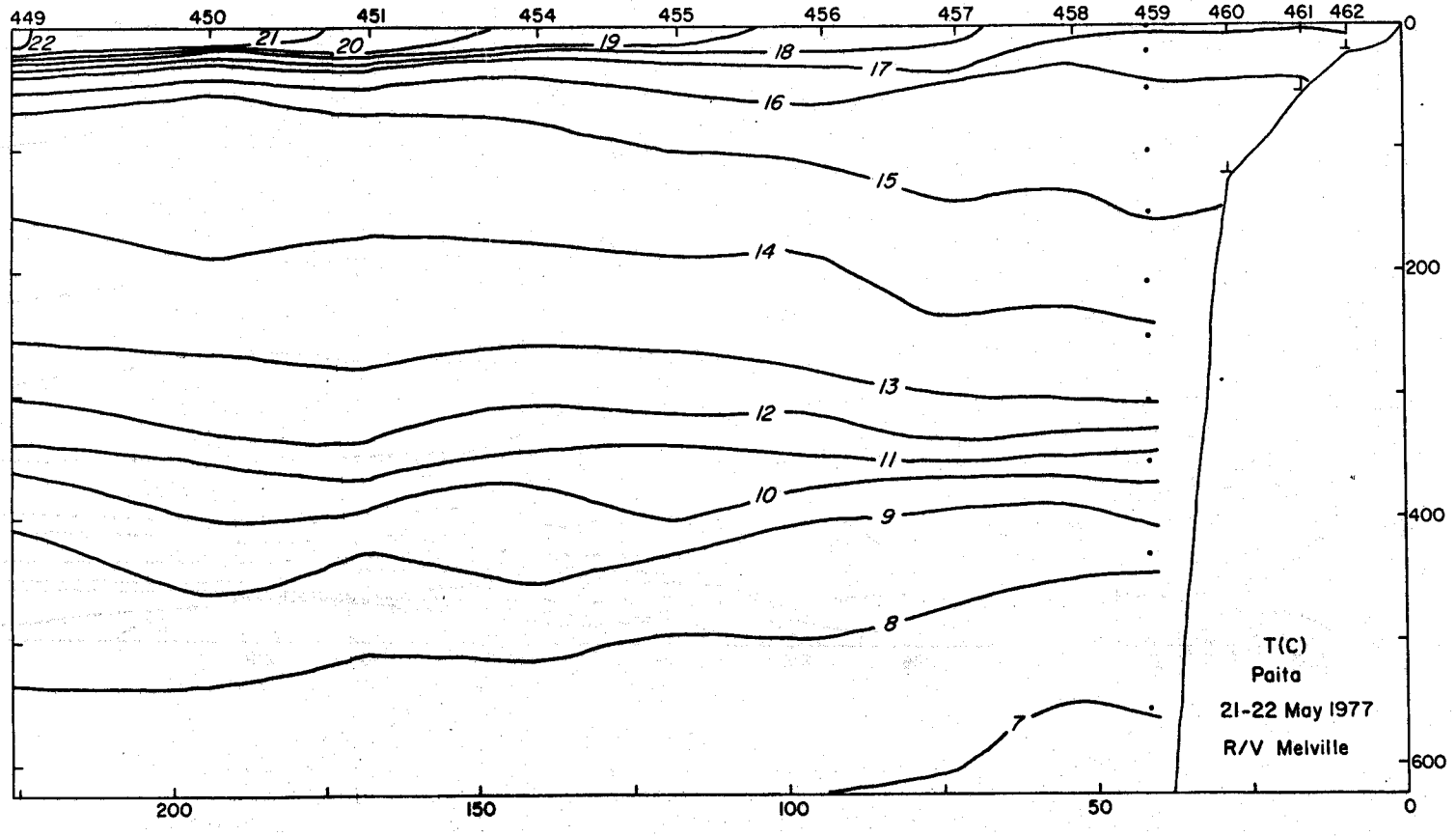

392
398
17
16
15
14
13
12
11
10
9
8
50
25
0
T(C)
K Line
9-10 May 1977
R/V Melville

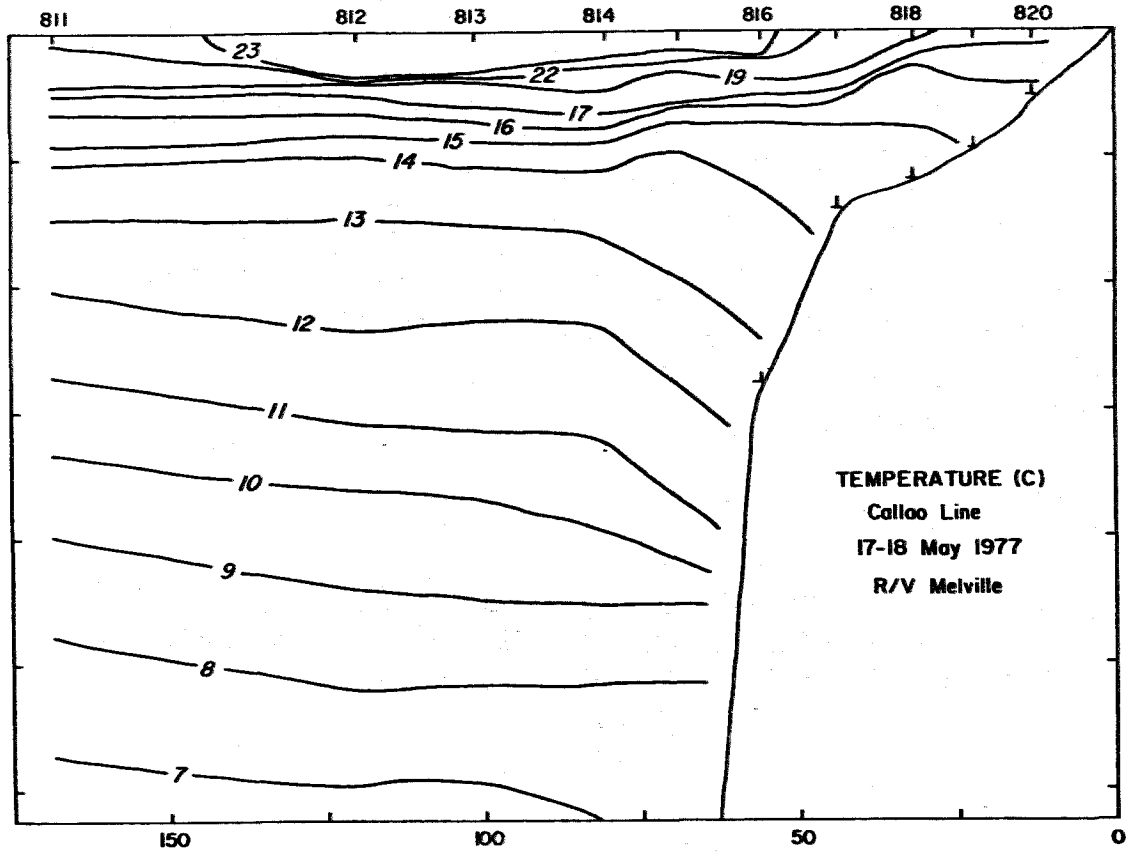

399
405
0
16
15
14
13
12
11
10
9
8
200
400
600
50
25
0
T(C)
Pta Azua
10-11 May 1977
R/V Melville

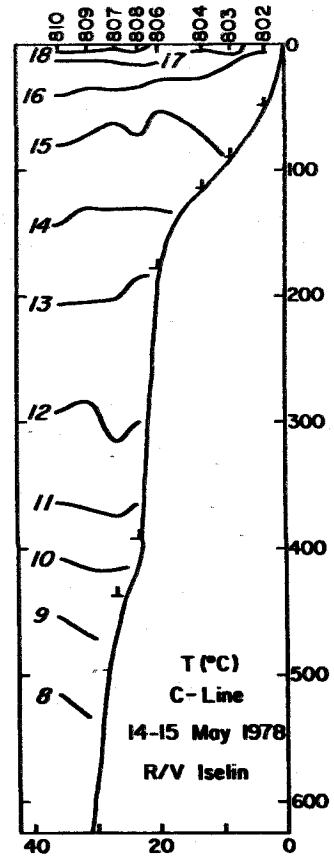

417
416
415
413
411
410
409
18
18
17
16
15
14
13
12
11
10
9
8
7
0
200
400
600
100
50
0
T(C)
C-Line
12-13 May
1977
R/V Melville


420
421
422
423
424
19
425
427
429
430
431
433
432
17
16
15
14
13
12
11
10
9
8
0
200
400
600
100
50
0
T(C)
C-Line
15-16 May
1977
R/V Melville


434
435
436
437
438
442
443
444
445
446
447
448
0
200
400
600
24
23
21
19
18
17
16
15
14
13
12
11
10
9
8
200
150
100
50
0
T(C)
Huarmey
18-19 May 1977
R/V Melville

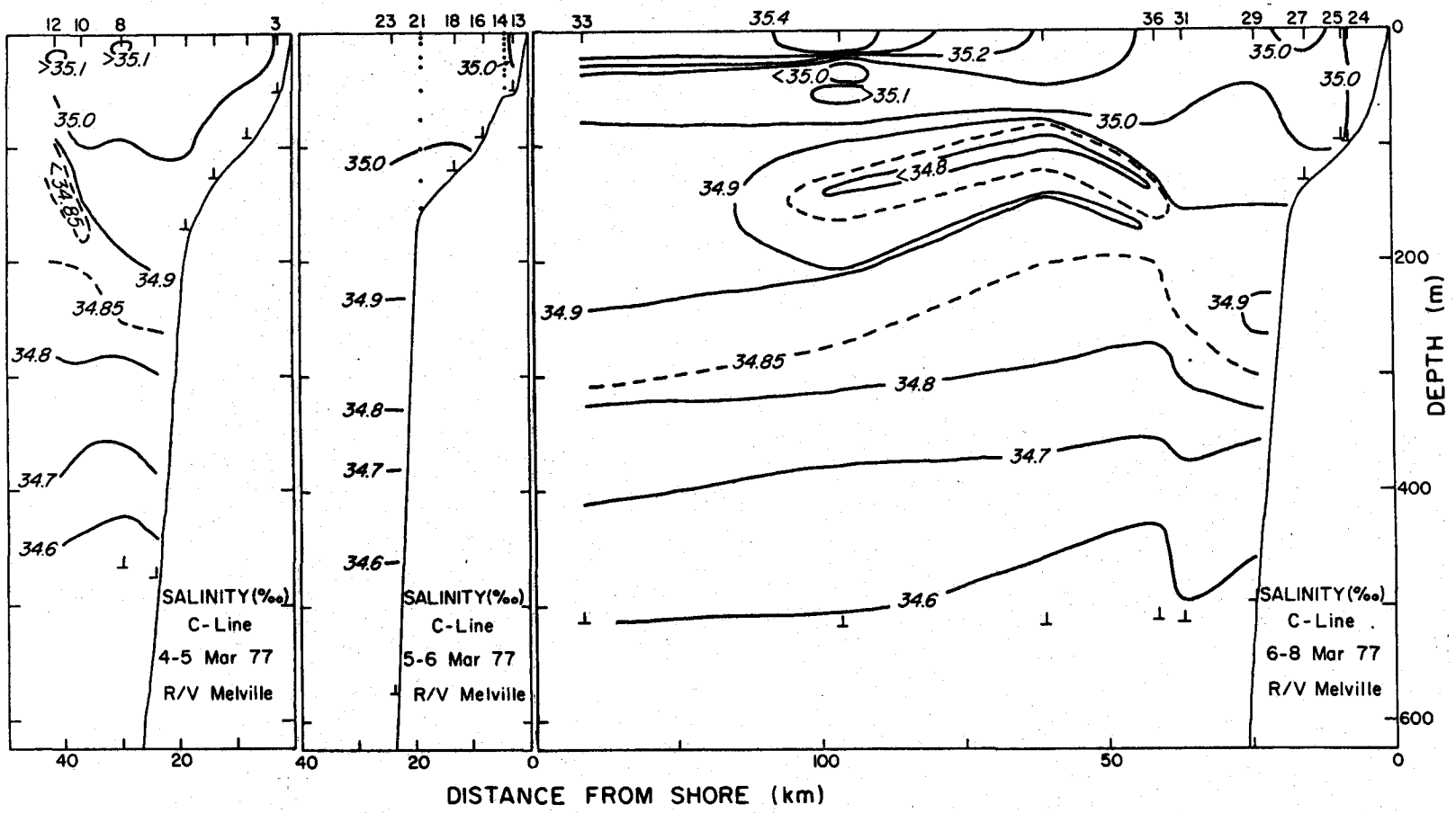

449
450
451
454
455
456
457
458
459
460
461
462
0
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
200
400
600
200
150
100
50
0
T(C)
Paita
21-22 May 1977
R/V Melville

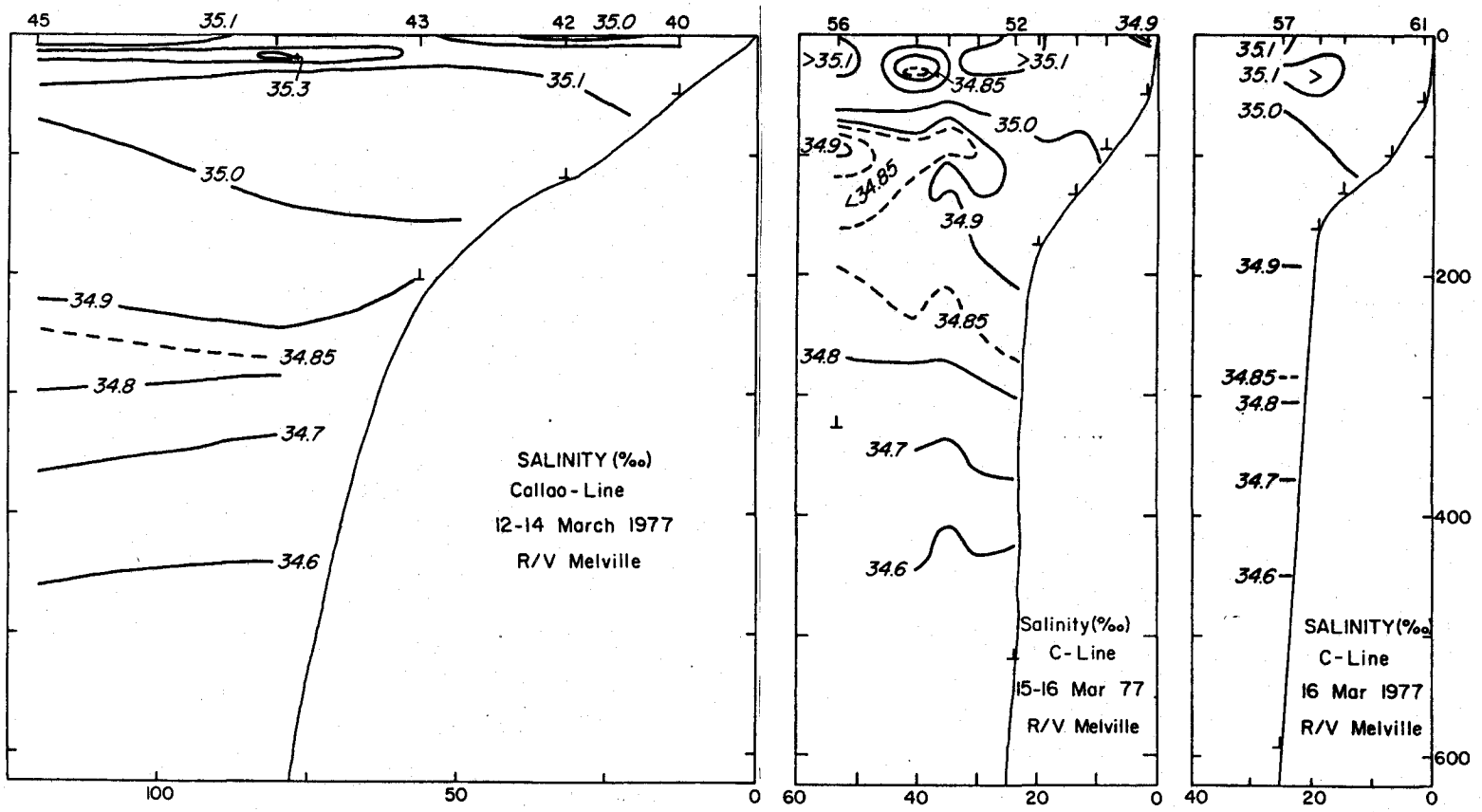

811
812
813
814
816
818
820
23
22
19
17
16
15
14
13
12
11
10
9
8
7
150
100
50
0
TEMPERATURE (C)
Calloo Line
17-18 May 1977
R/V Melville

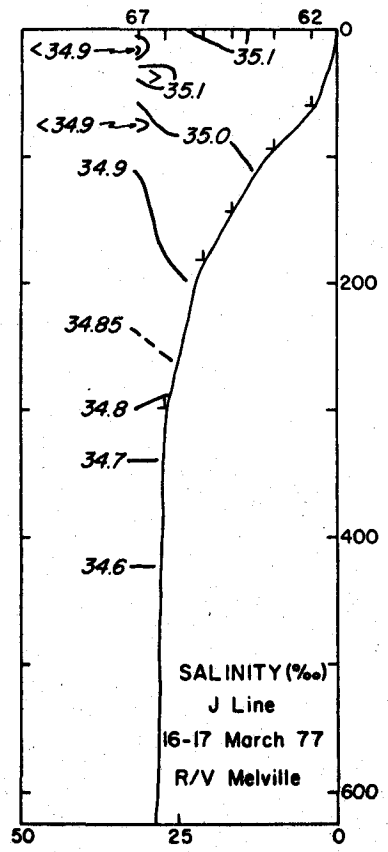

810
809
807
808
806
804
803
802
18
17
16
15
14
13
12
11
10
9
8
0
100
200
300
400
500
600
40
20
0
T (°C)
C-Line
14-15 May 1978
R/V Iselin

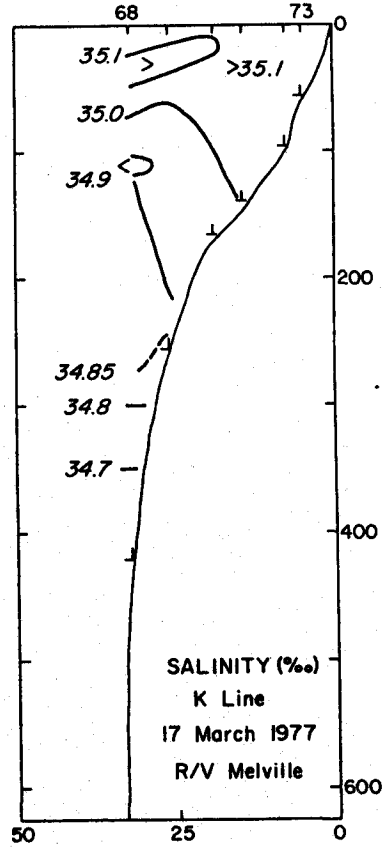
VERTICAL SECTIONS DURING MAM 77

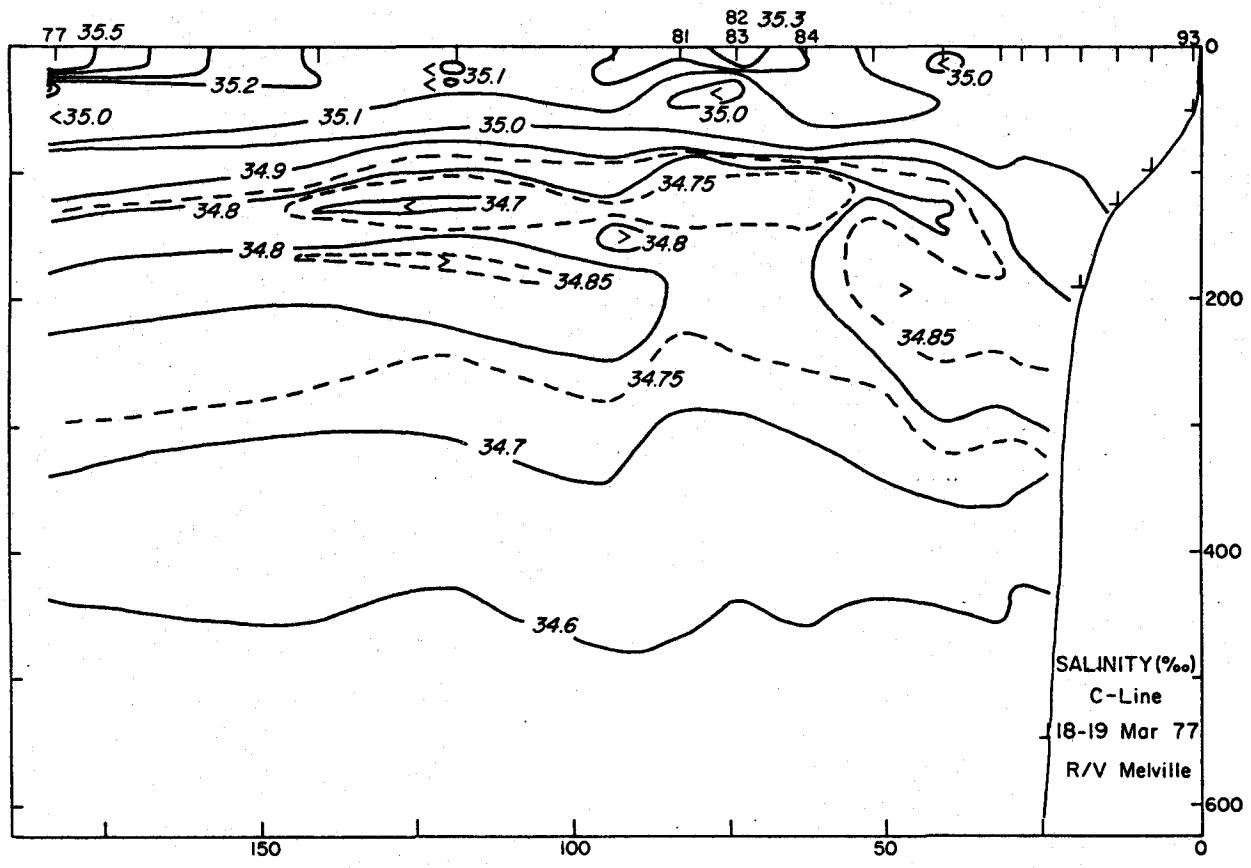
Salinity

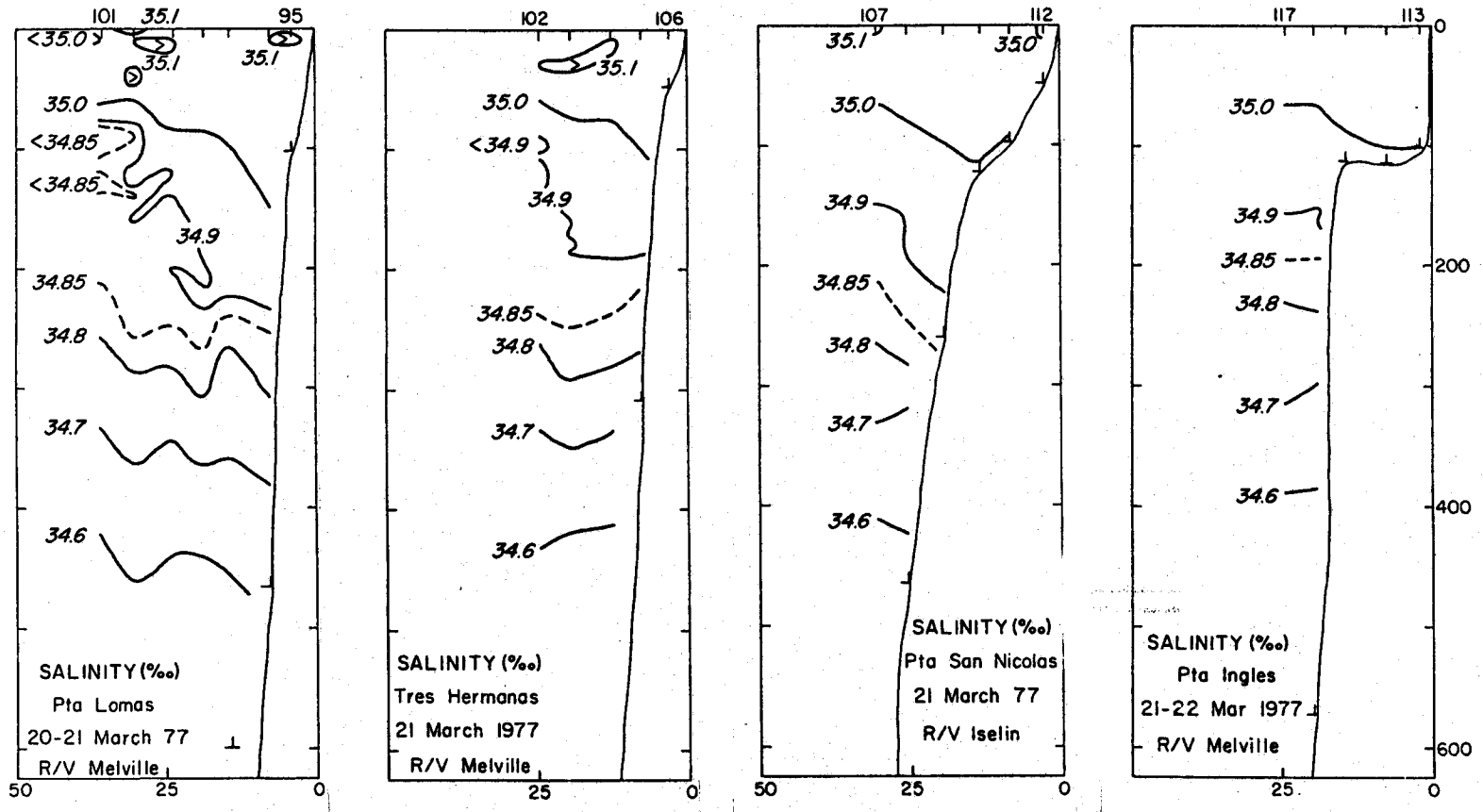

12 10 8 3
23 21 18 16 14 13
33 35.4 36 31 29 27 25 24 0
>35.1
>35.1
35.0
<34.85
34.9
34.85
34.8
34.7
34.6
35.0
34.9
34.8
34.7
34.6
35.0
35.2
<35.0
35.1
35.0
35.0
<34.8
34.9
34.9
34.85
34.8
34.7
34.6
34.9
SALINITY(‰)
C-Line
4-5 Mar 77
R/V Melville
SALINITY(‰)
C-Line
5-6 Mar 77
R/V Melville
SALINITY(‰)
C-Line
6-8 Mar 77
R/V Melville
DEPTH (m)
200
400
600
40 20 40 20 0 100 50 0
DISTANCE FROM SHORE (km)

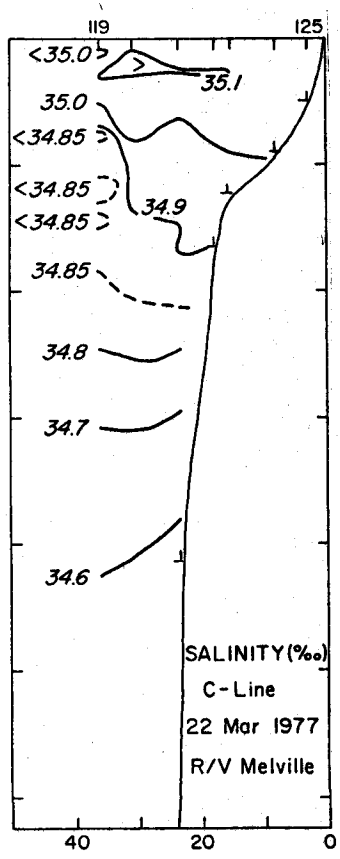

45
35.1
43
42
35.0
40
35.3
35.1
35.0
34.9
34.85
34.8
34.7
34.6
SALINITY (‰)
Callao - Line
12-14 March 1977
R/V Melville
100
50
0
56
52
34.9
>35.1
34.85
>35.1
35.0
34.9
34.85
34.9
34.85
34.8
34.7
34.6
Salinity(‰)
C-Line
15-16 Mar 77
R/V Melville
60
40
20
0
57
61
0
35.1
35.1
35.0
34.9
200
34.85
34.8
34.7
400
34.6
SALINITY(‰)
C-Line
16 Mar 1977
R/V Melville
600
40
20
0

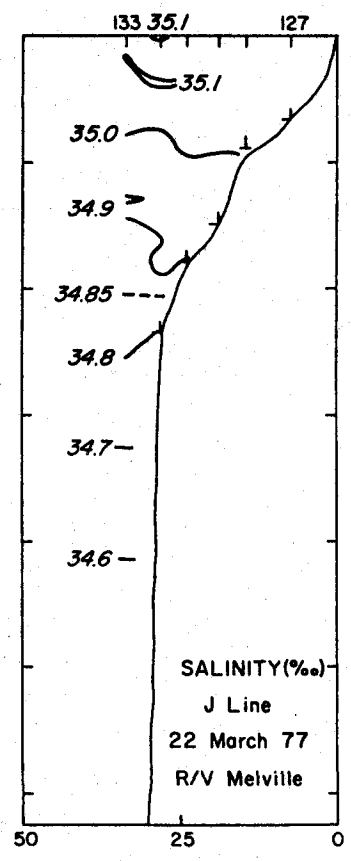

67
62
0
<34.9
35.1
≥35.1
<34.9
35.0
34.9
200
34.85
34.8
34.7
400
34.6
600
SALINITY (‰)
J Line
16-17 March 77
R/V Melville
50
25
0

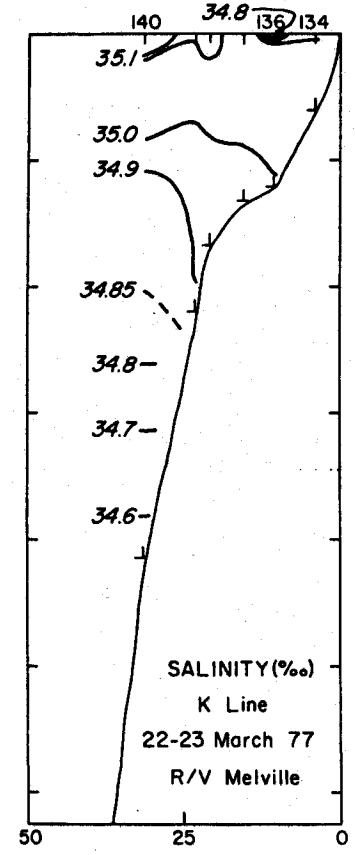

68
73
0
35.1
>35.1
35.0
34.9
200
34.85
34.8
34.7
400
600
SALINITY (‰)
K Line
17 March 1977
R/V Melville
50
25
0

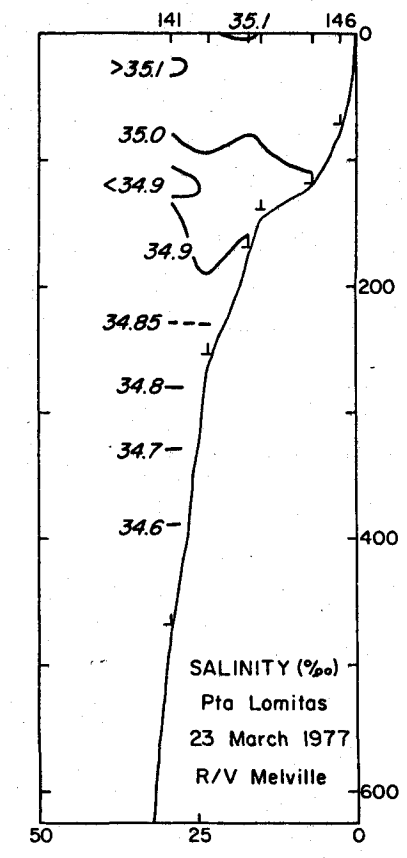

77 35.5
81
82 35.3
83
84
93
0
35.2
35.1
35.0
<35.0
35.1
35.0
35.0
34.9
34.75
34.8
34.7
34.8
34.8
34.85
34.85
34.75
34.7
34.6
200
400
600
150
100
50
0
SALINITY (‰)
C-Line
18-19 Mar 77
R/V Melville

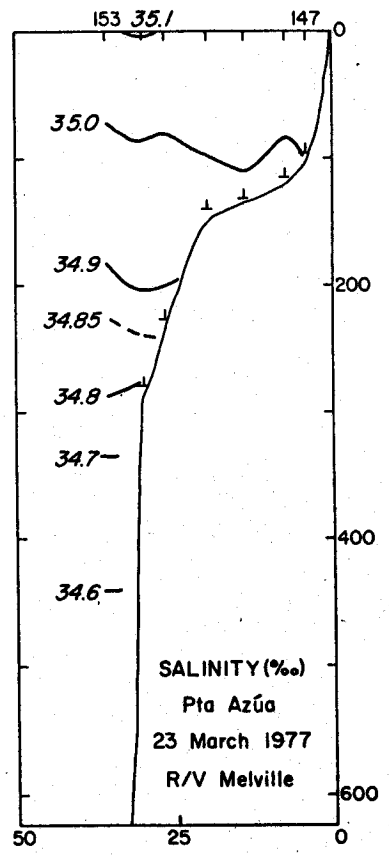

101
95
<35.0
35.1
35.1
35.0
<34.85
<34.85
34.9
34.85
34.8
34.7
34.6
SALINITY (‰)
Pta Lomas
20-21 March 77
R/V Melville
50
25
0
102
106
35.1
35.0
<34.9
34.9
34.85
34.8
34.7
34.6
SALINITY (‰)
Tres Hermanas
21 March 1977
R/V Melville
25
0
107
112
35.1
35.0
35.0
34.9
34.85
34.8
34.7
34.6
SALINITY (‰)
Pta San Nicolas
21 March 77
R/V Iselin
50
25
0
117
113
0
35.0
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY (‰)
Pta Ingles
21-22 Mar 1977
R/V Melville
25
0

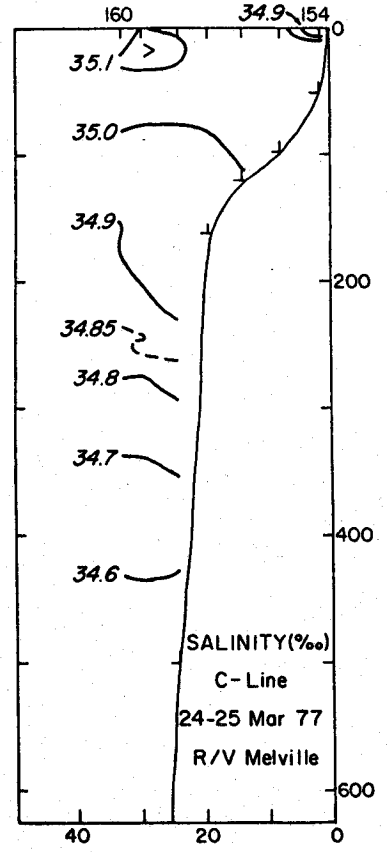

119
125
<35.0
35.1
35.0
<34.85
<34.85
34.9
<34.85
34.85
34.8
34.7
34.6
SALINITY(‰)
C-Line
22 Mar 1977
R/V Melville
40
20
0

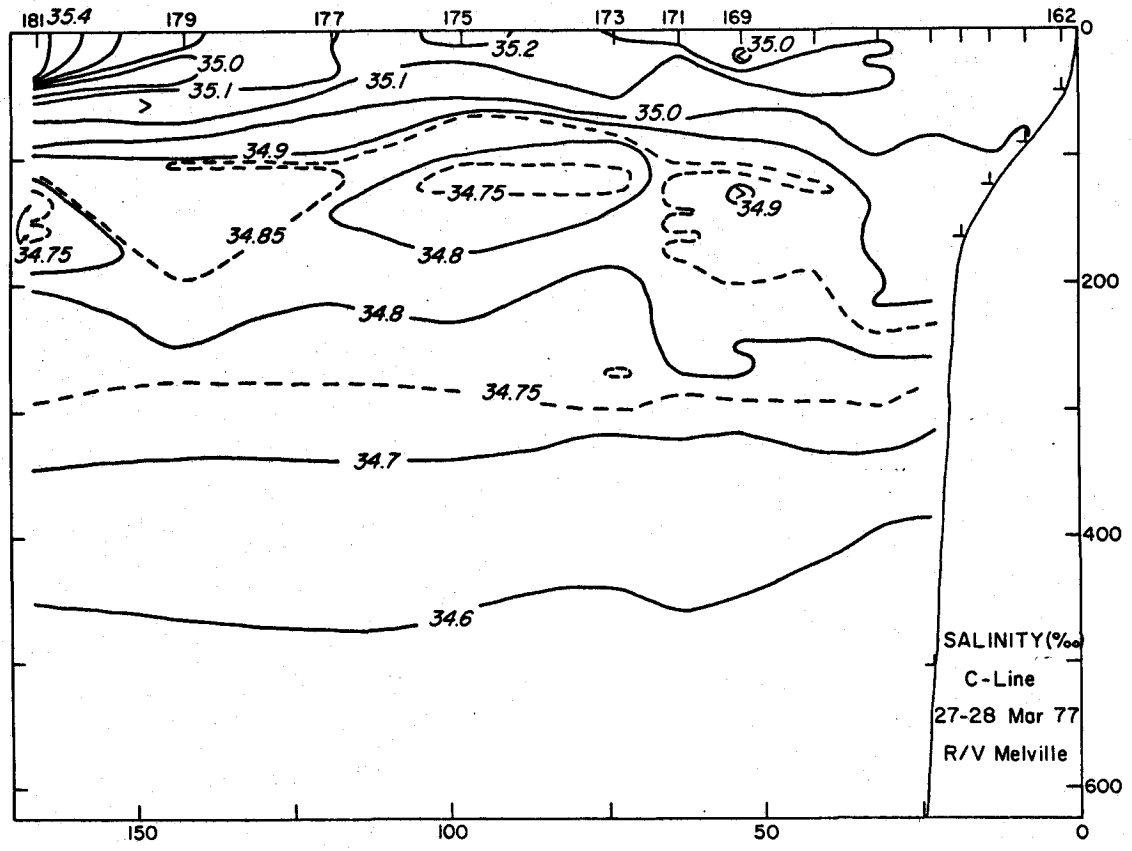

133
35.1
127
35.1
35.0
34.9
34.85
34.8
34.7
34.6
SALINITY(‰)
J Line
22 March 77
R/V Melville
50
25
0

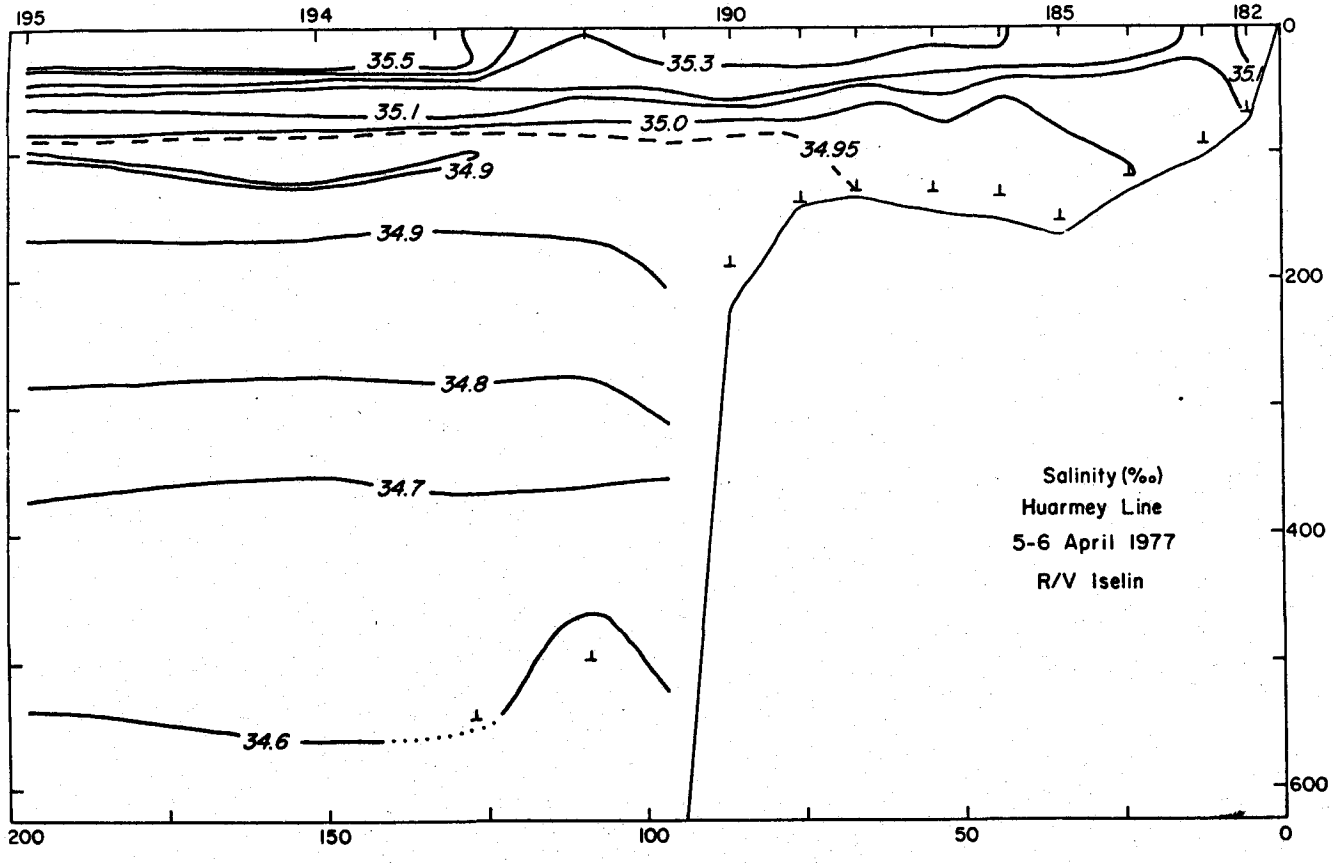

140
34.8
136
134
35.1
35.0
34.9
34.85
34.8
34.7
34.6
SALINITY(‰)
K Line
22-23 March 77
R/V Melville
50
25
0

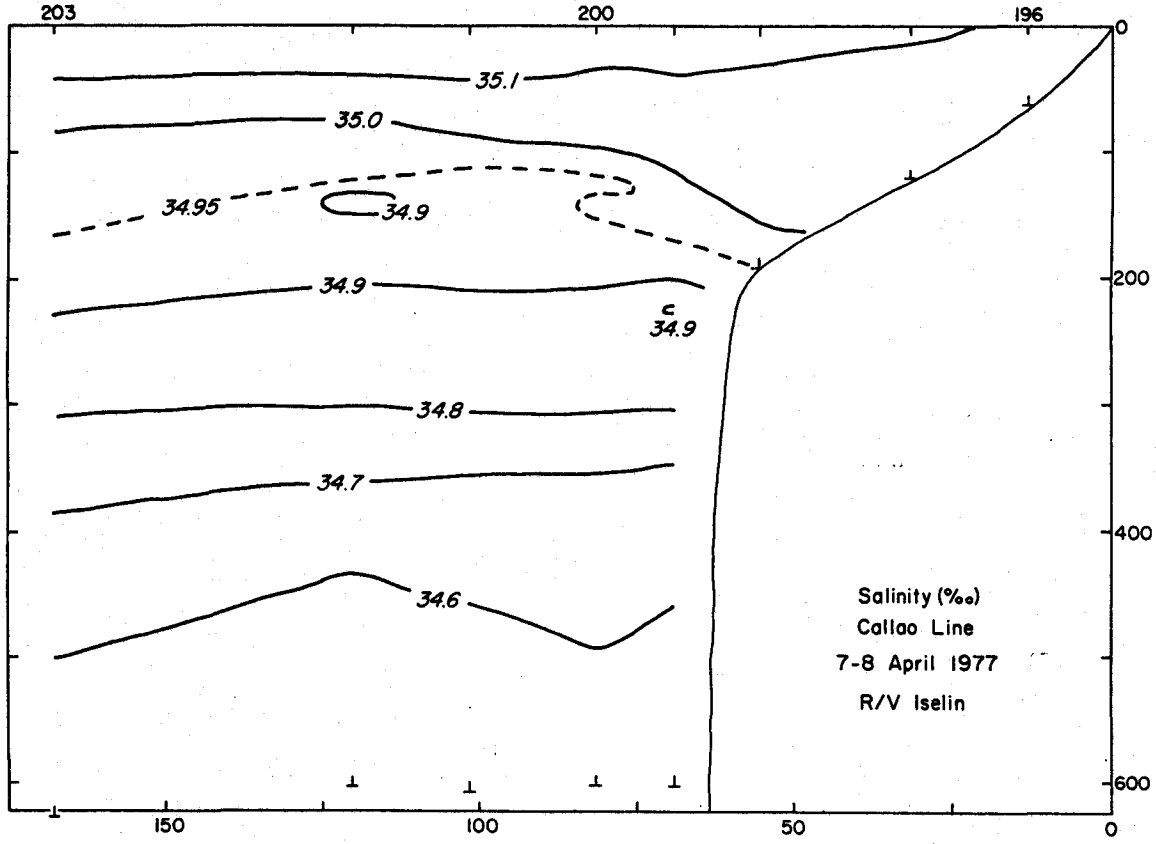

141
35.1
146
0
>35.1
35.0
<34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY (‰)
Pta Lomitas
23 March 1977
R/V Melville
50
25
0

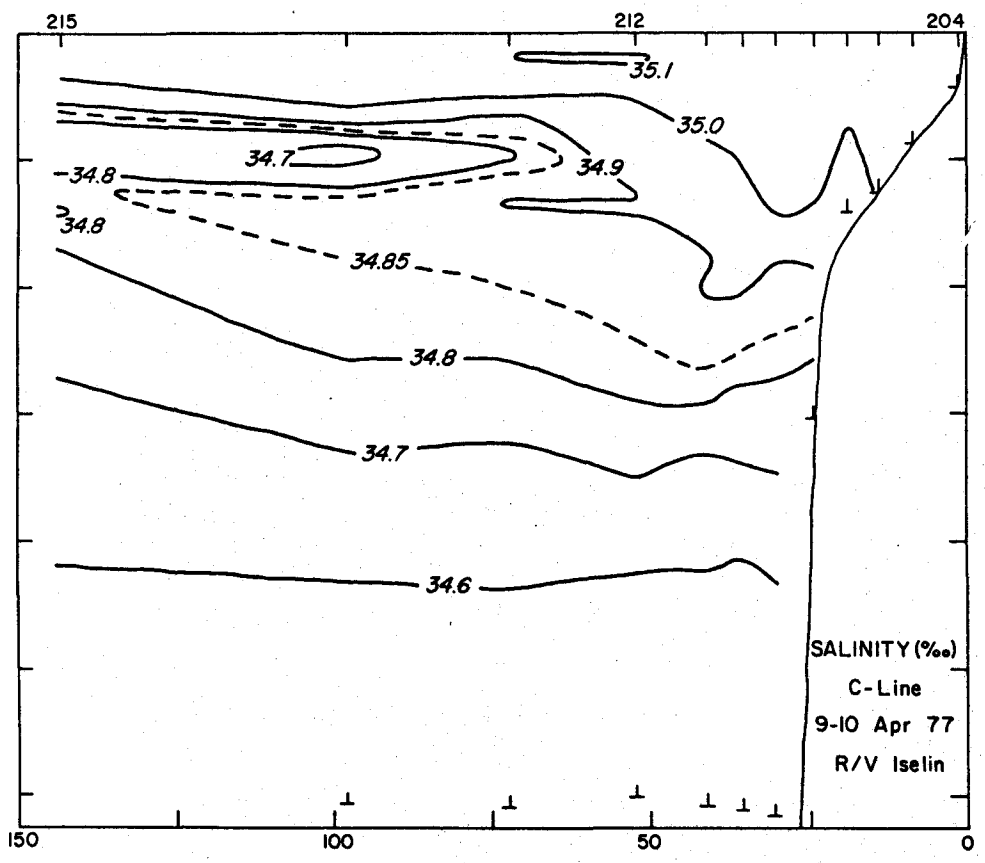

153 35.1
147
0
35.0
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY (‰)
Pta Azúa
23 March 1977
R/V Melville
50
25
0

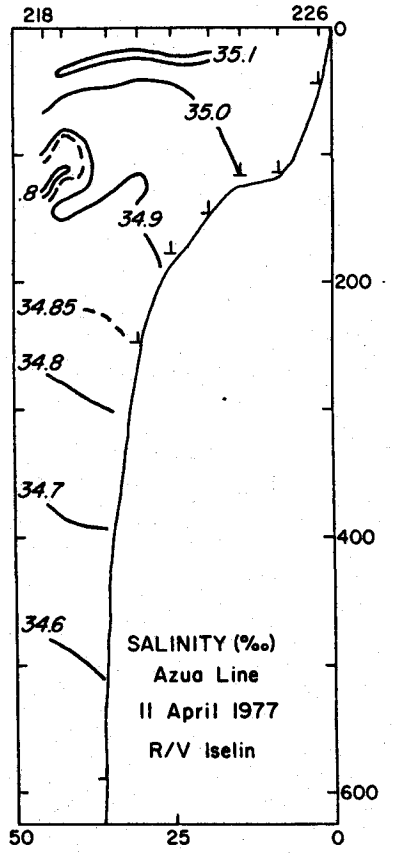

160
34.9
154
0
35.1
35.0
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY(‰)
C-Line
24-25 Mar 77
R/V Melville
40
20
0

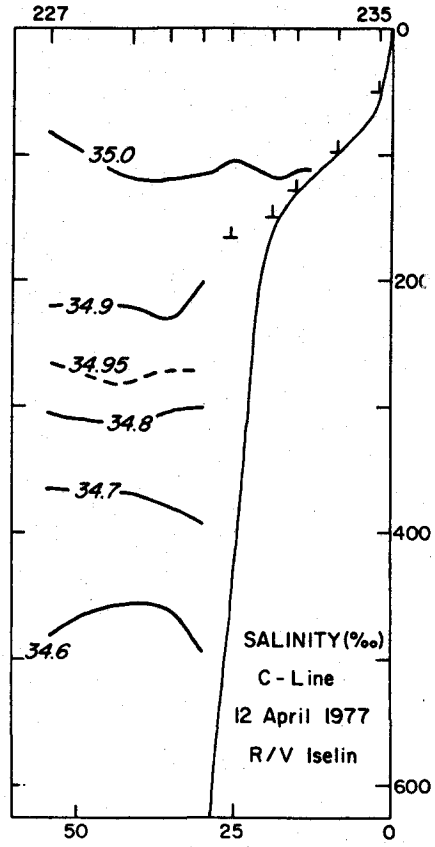

181
179
177
175
173
171
169
162
0
200
400
600
150
100
50
0
35.4
35.0
35.1
35.2
35.0
35.1
35.0
34.9
34.75
34.9
34.85
34.75
34.8
34.8
34.75
34.7
34.6
SALINITY(‰)
C-Line
27-28 Mar 77
R/V Melville

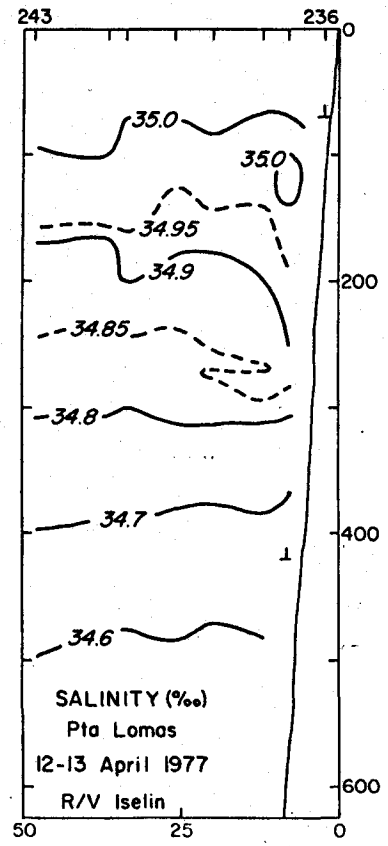

195
194
190
185
182
0
35.5
35.3
35.1
35.1
35.0
34.95
34.9
34.9
34.8
34.7
34.6
200
400
600
200
150
100
50
0
Salinity (‰)
Huarmey Line
5-6 April 1977
R/V Iselin

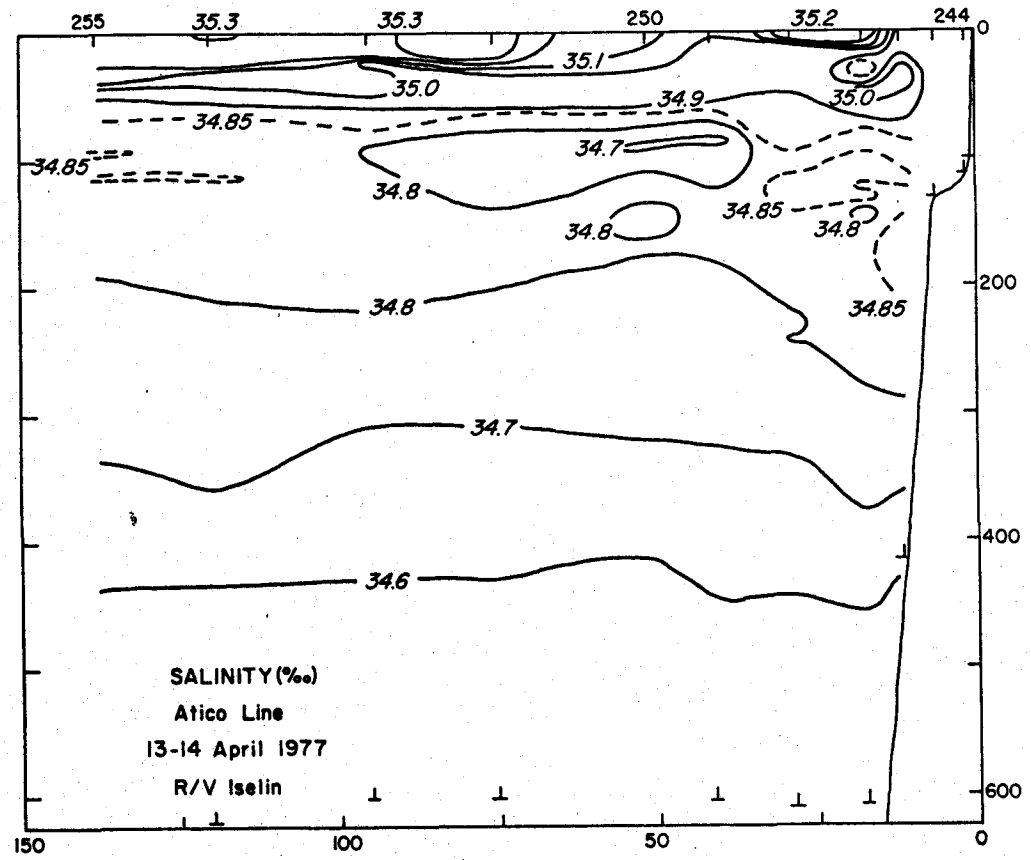

203
200
196
0
35.1
35.0
34.95
34.9
34.9
34.9
34.8
34.7
34.6
200
400
600
Salinity (‰)
Callao Line
7-8 April 1977
R/V Iselin
150
100
50
0

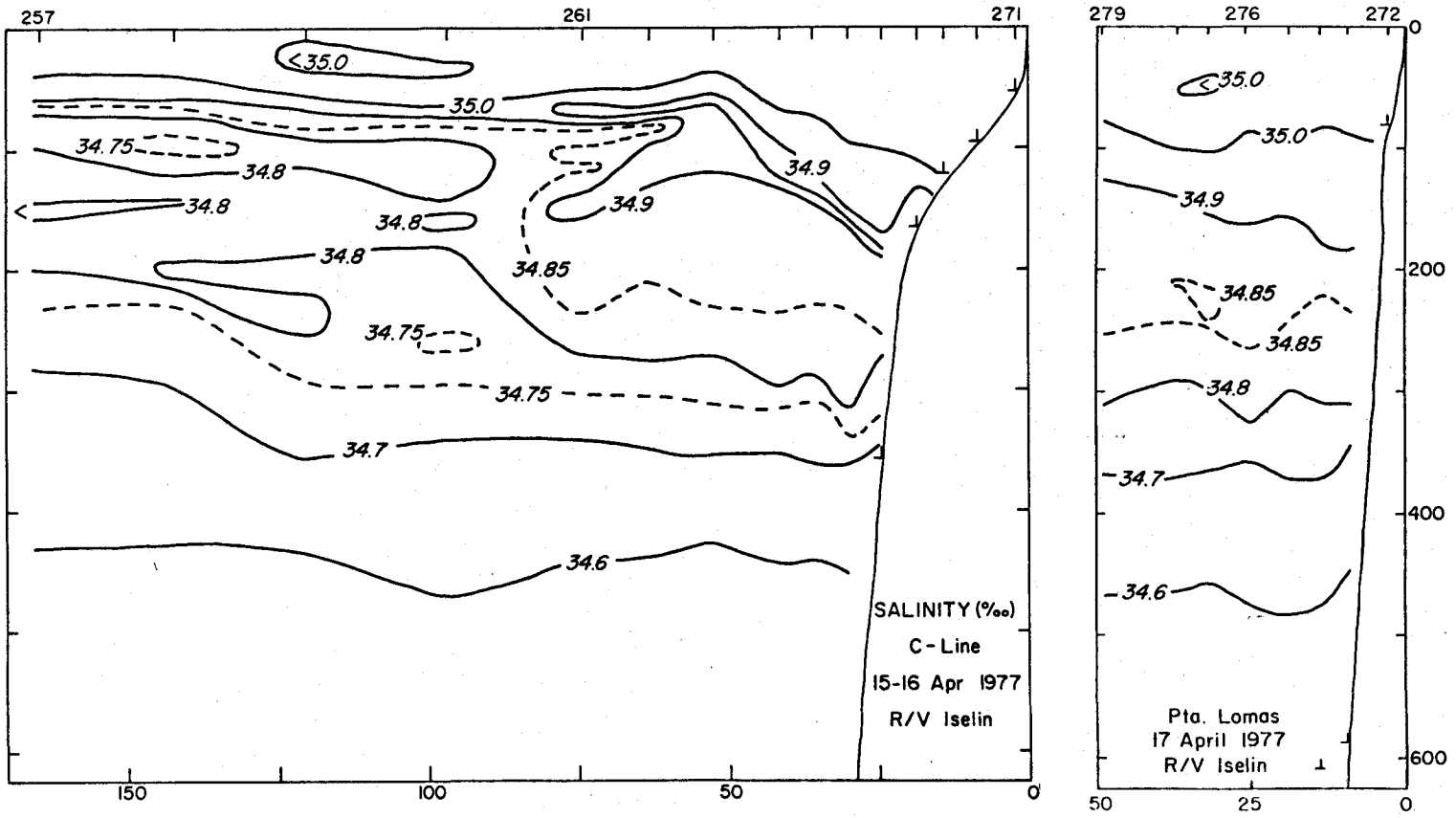

215
212
204
35.1
35.0
34.7
34.9
34.8
34.8
34.85
34.8
34.7
34.6
150
100
50
0
SALINITY (‰)
C-Line
9-10 Apr 77
R/V Iselin

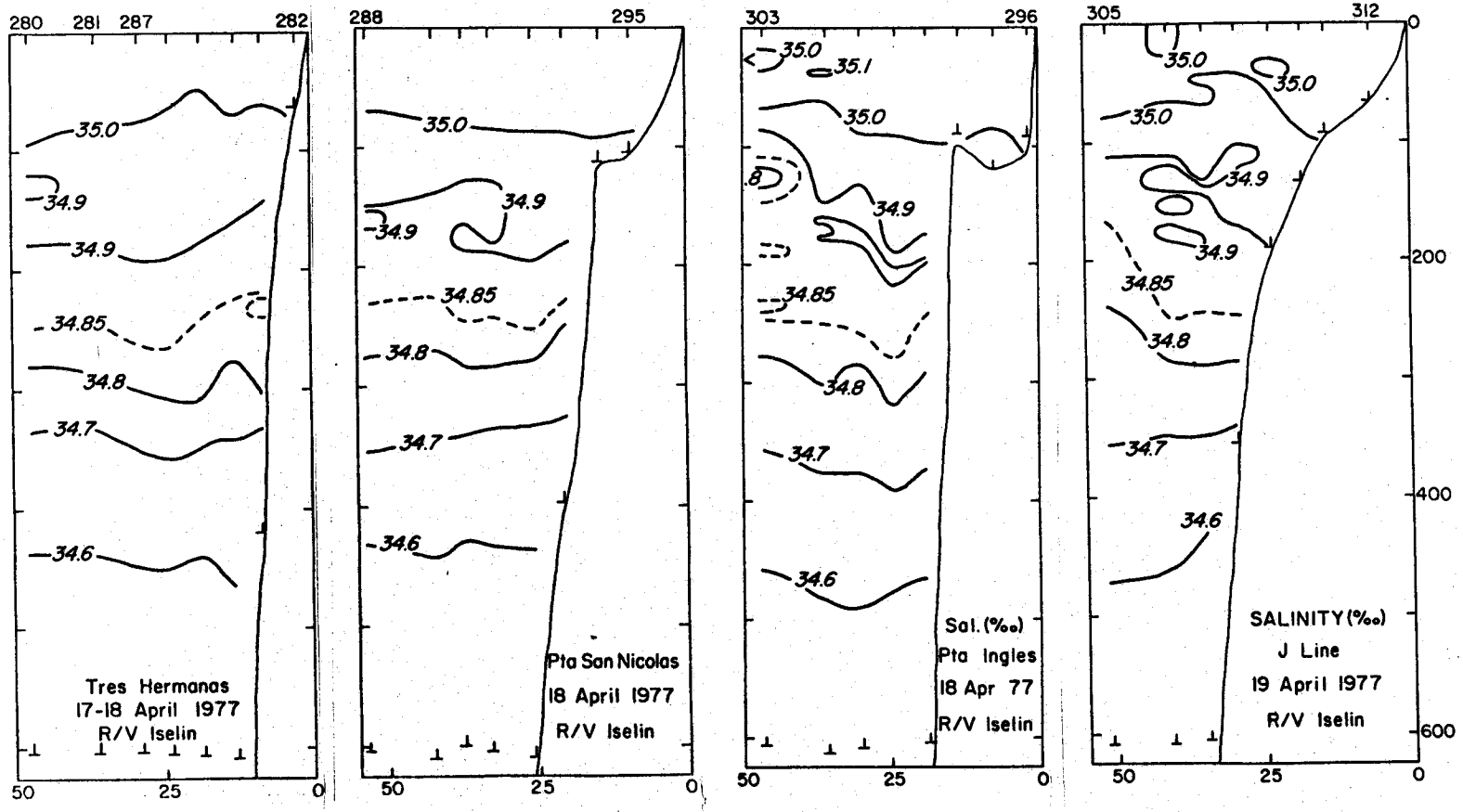

218
226
0
35.1
35.0
.8
34.9
200
34.85
34.8
34.7
400
34.6
600
50
25
0
SALINITY (‰)
Azua Line
11 April 1977
R/V Iselin

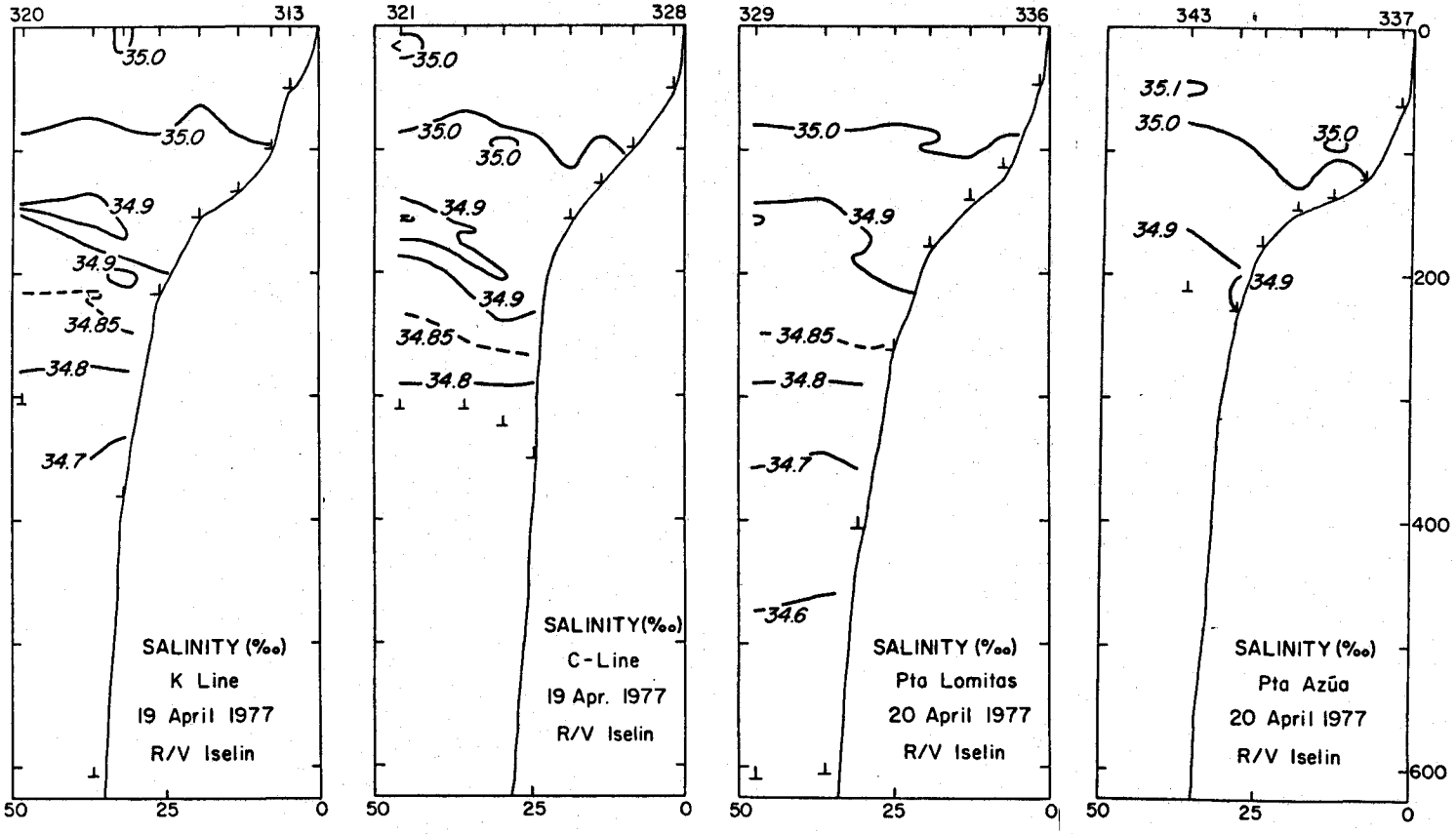

227
235
0
35.0
34.9
34.95
34.8
34.7
34.6
200
400
600
SALINITY (‰)
C - Line
12 April 1977
R/V Iselin
50
25
0

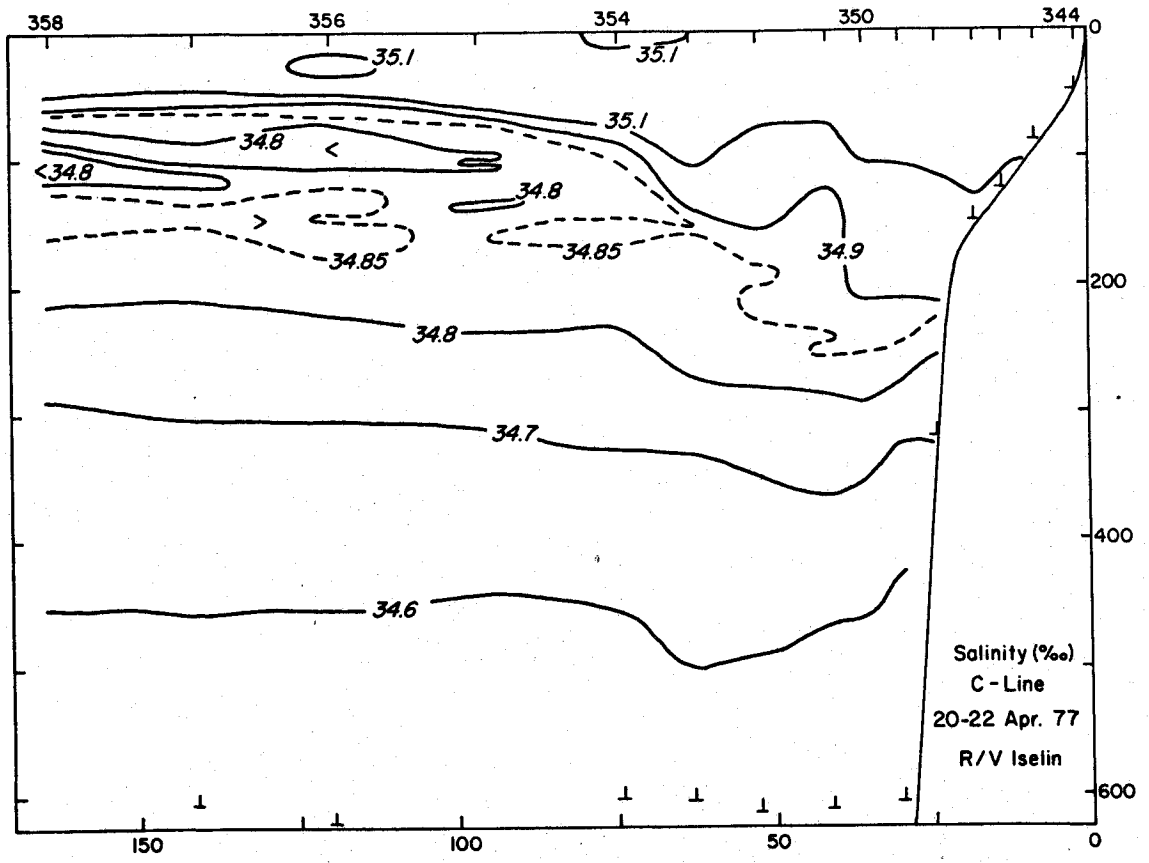

243
236
0
35.0
35.0
34.95
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY (‰)
Pta Lomas
12-13 April 1977
R/V Iselin
50
25
0

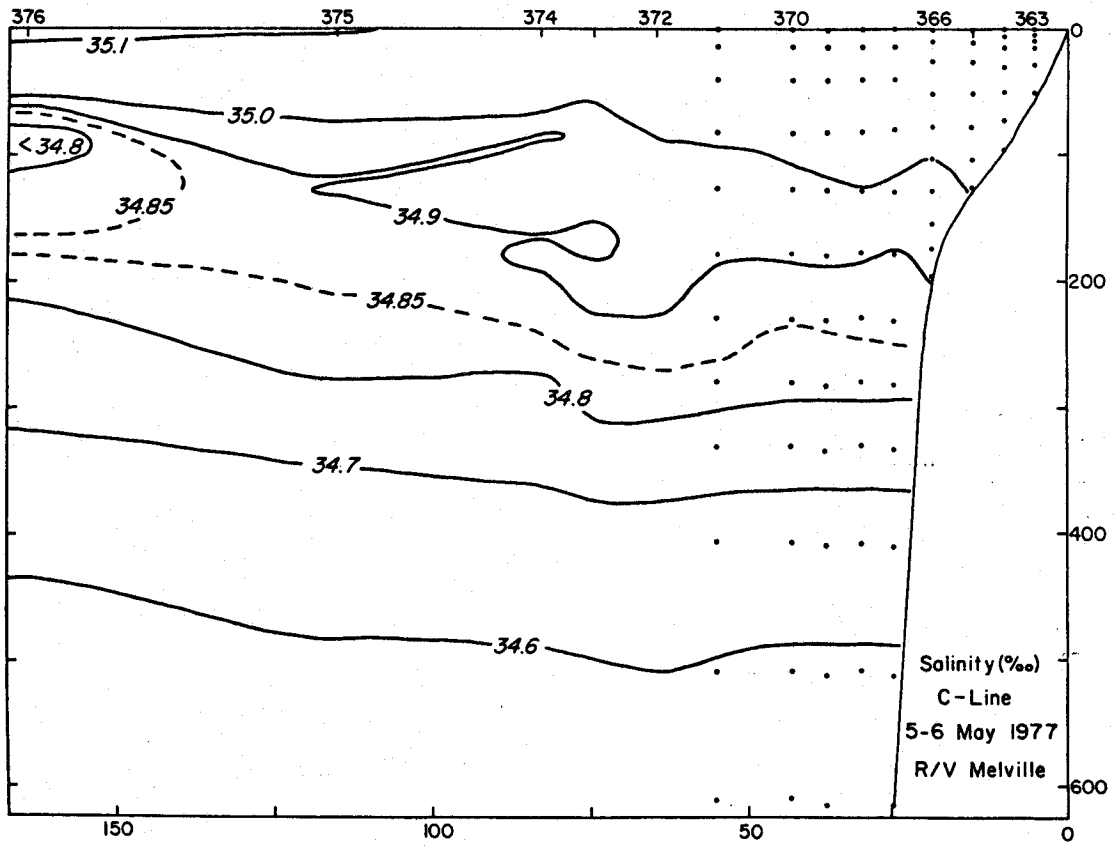

255
35.3
35.3
250
35.2
244
0
35.1
35.0
34.9
35.0
34.85
34.7
34.85
34.8
34.85
34.8
34.8
34.8
34.85
200
34.7
400
34.6
600
SALINITY (‰)
Atico Line
13-14 April 1977
R/V Iselin
150
100
50
0

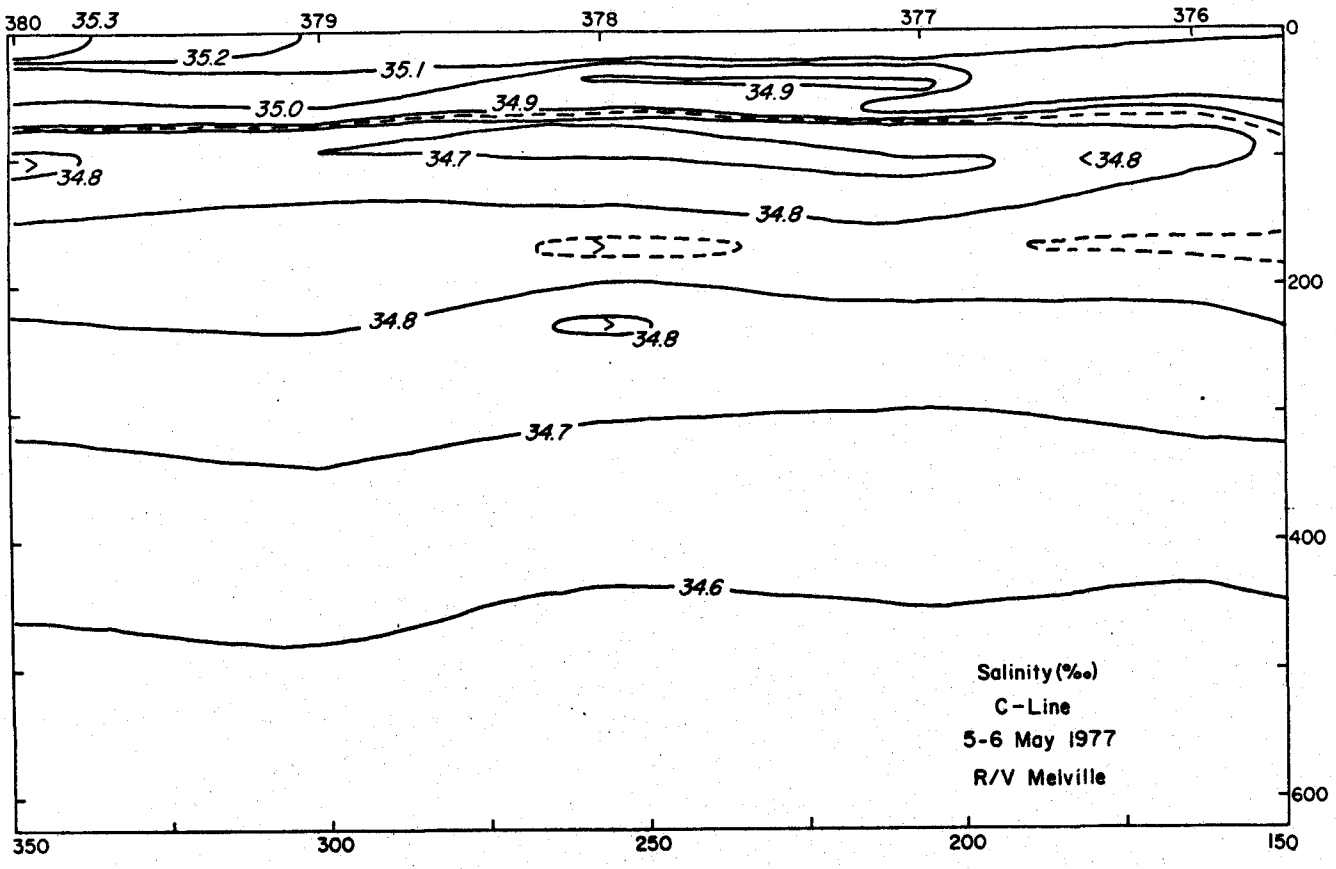

257
261
271
<35.0
35.0
34.75
34.8
<34.8
34.8
34.8
34.9
34.9
34.85
34.75
34.75
34.7
34.6
150
100
50
0
SALINITY (‰)
C-Line
15-16 Apr 1977
R/V Iselin
279
276
272
0
<35.0
35.0
34.9
34.85
34.85
34.8
34.7
34.6
200
400
600
Pta. Lomas
17 April 1977
R/V Iselin
50
25
0

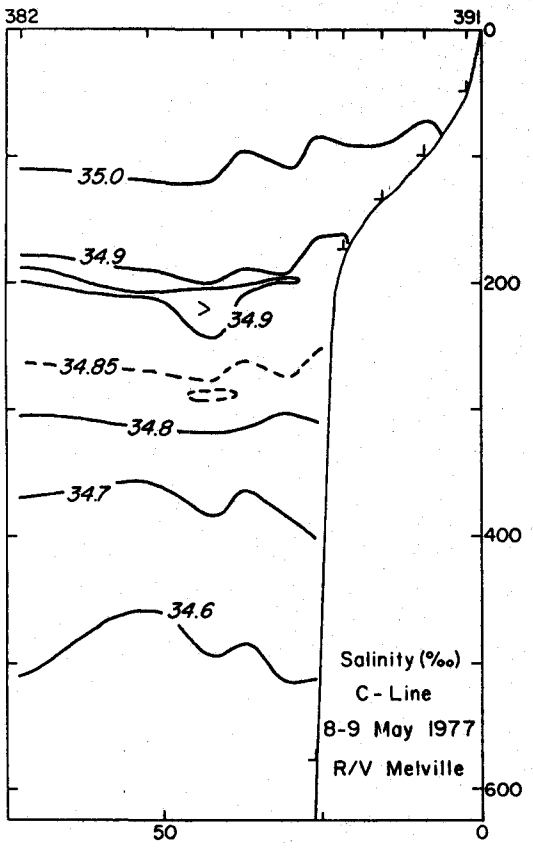

280 281 287 282
35.0
34.9
34.9
34.85
34.8
34.7
34.6
Tres Hermanas
17-18 April 1977
R/V Iselin
50 25 0
288 295
35.0
34.9
34.9
34.85
34.8
34.7
34.6
Pta San Nicolas
18 April 1977
R/V Iselin
50 25 0
303 296
35.0
35.1
35.0
34.9
34.85
34.8
34.7
34.6
Sal. (‰)
Pta Ingles
18 Apr 77
R/V Iselin
50 25 0
305 312 0
35.0
35.0
35.0
34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
SALINITY (‰)
J Line
19 April 1977
R/V Iselin
50 25 0

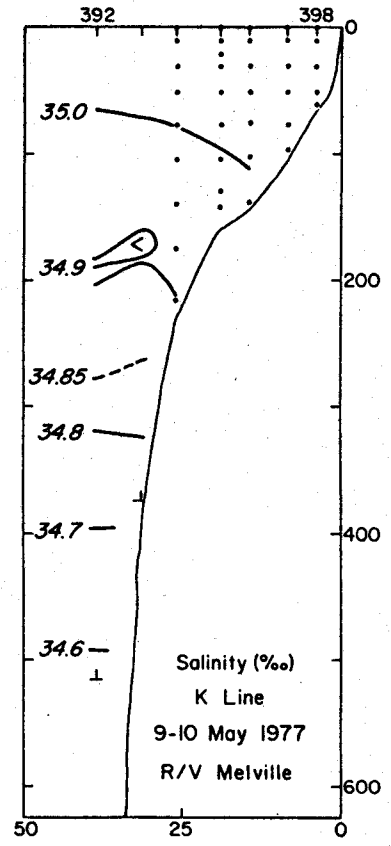

320
313
35.0
35.0
34.9
34.9
34.85
34.8
34.7
50
25
0
SALINITY (‰)
K Line
19 April 1977
R/V Iselin
321
328
35.0
35.0
35.0
34.9
34.9
34.85
34.8
50
25
0
SALINITY(‰)
C-Line
19 Apr. 1977
R/V Iselin
329
336
35.0
34.9
34.85
34.8
34.7
34.6
50
25
0
SALINITY (‰)
Pta Lomitas
20 April 1977
R/V Iselin
343
337
0
35.1
35.0
35.0
34.9
34.9
200
400
600
50
25
0
SALINITY (‰)
Pta Azúa
20 April 1977
R/V Iselin

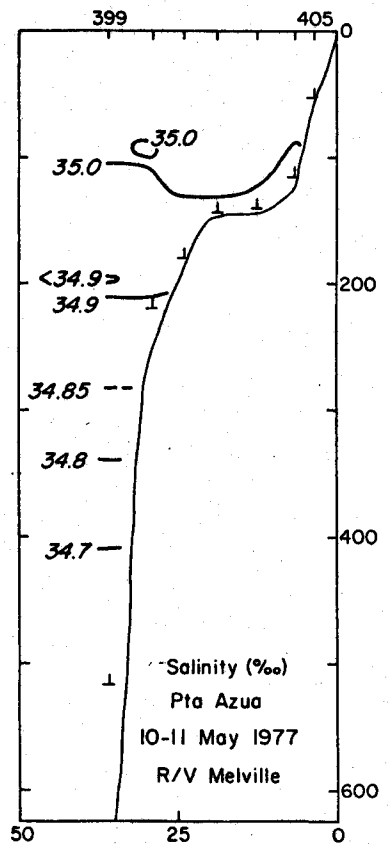

358
356
354
350
344
0
35.1
35.1
35.1
34.8
<34.8
34.8
34.85
34.85
34.9
200
34.8
34.7
400
34.6
Salinity (‰)
C - Line
20-22 Apr. 77
R/V Iselin
600
150
100
50
0

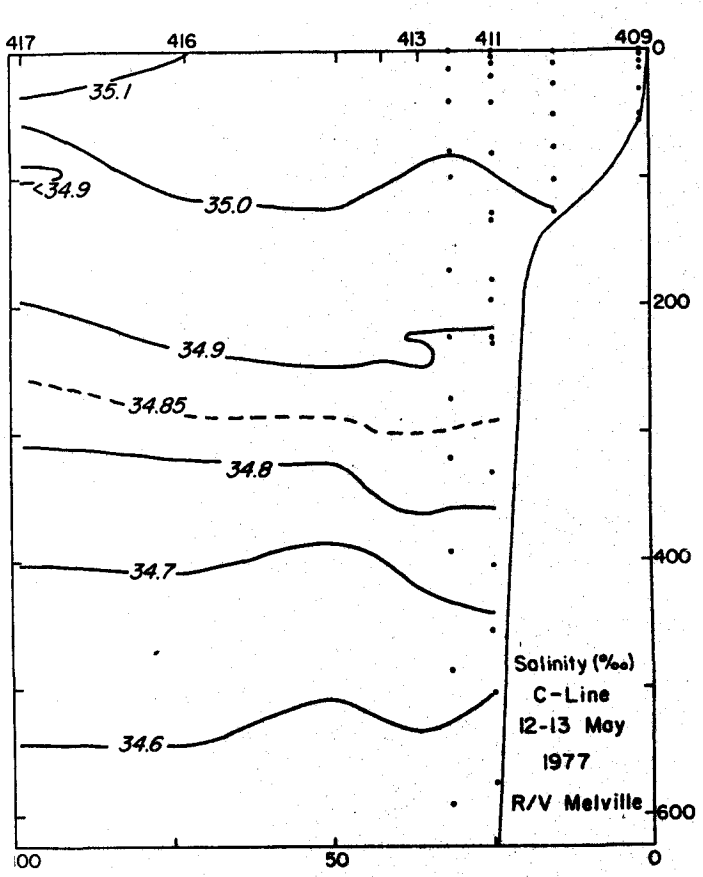

376
375
374
372
370
366
363
0
35.1
35.0
< 34.8
34.85
34.9
34.85
34.8
34.7
34.6
200
400
600
150
100
50
0
Salinity (‰)
C-Line
5-6 May 1977
R/V Melville

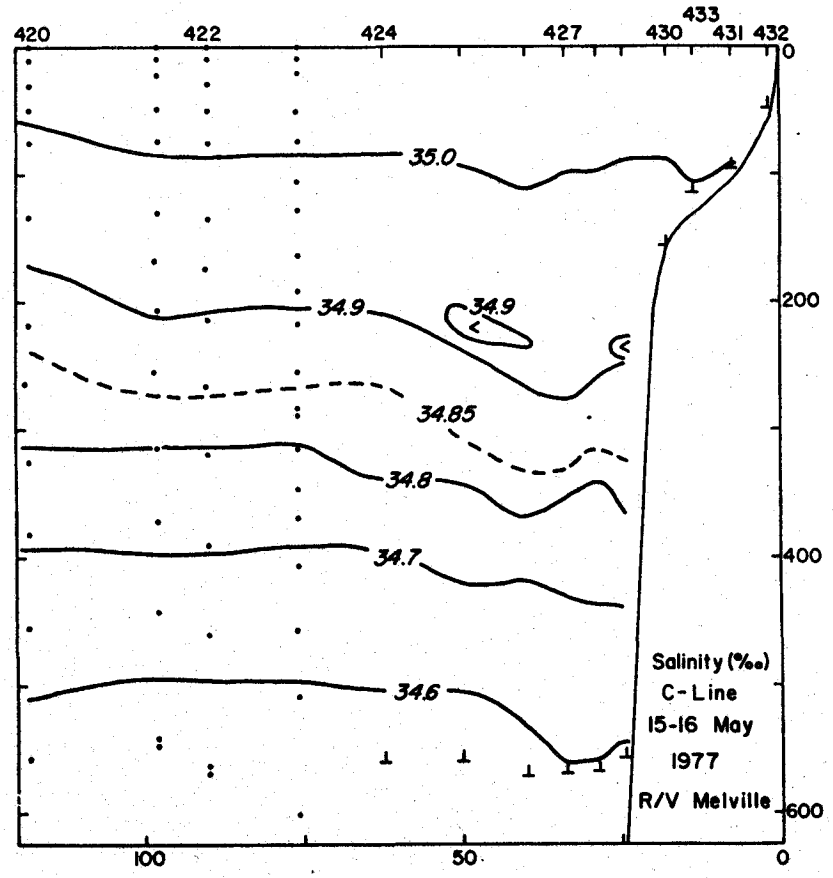

380
379
378
377
376
0
35.3
35.2
35.1
35.0
34.9
34.9
34.8
34.7
<34.8
34.8
34.8
34.8
34.8
34.7
34.6
200
400
600
Salinity (‰)
C-Line
5-6 May 1977
R/V Melville
350
300
250
200
150

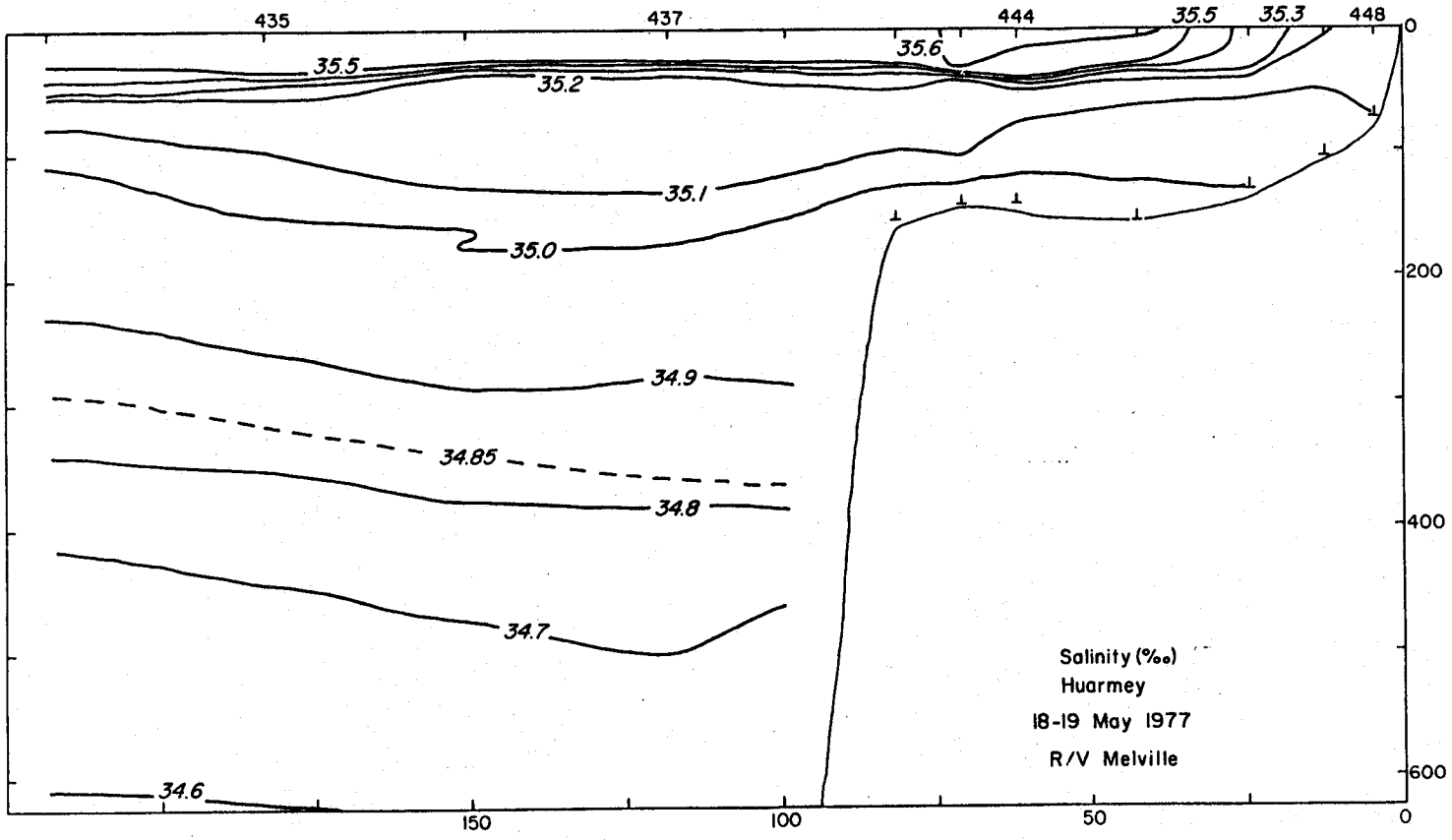

382
391
0
200
400
600
35.0
34.9
34.9
34.85
34.8
34.7
34.6
50
0
Salinity (‰)
C - Line
8-9 May 1977
R/V Melville

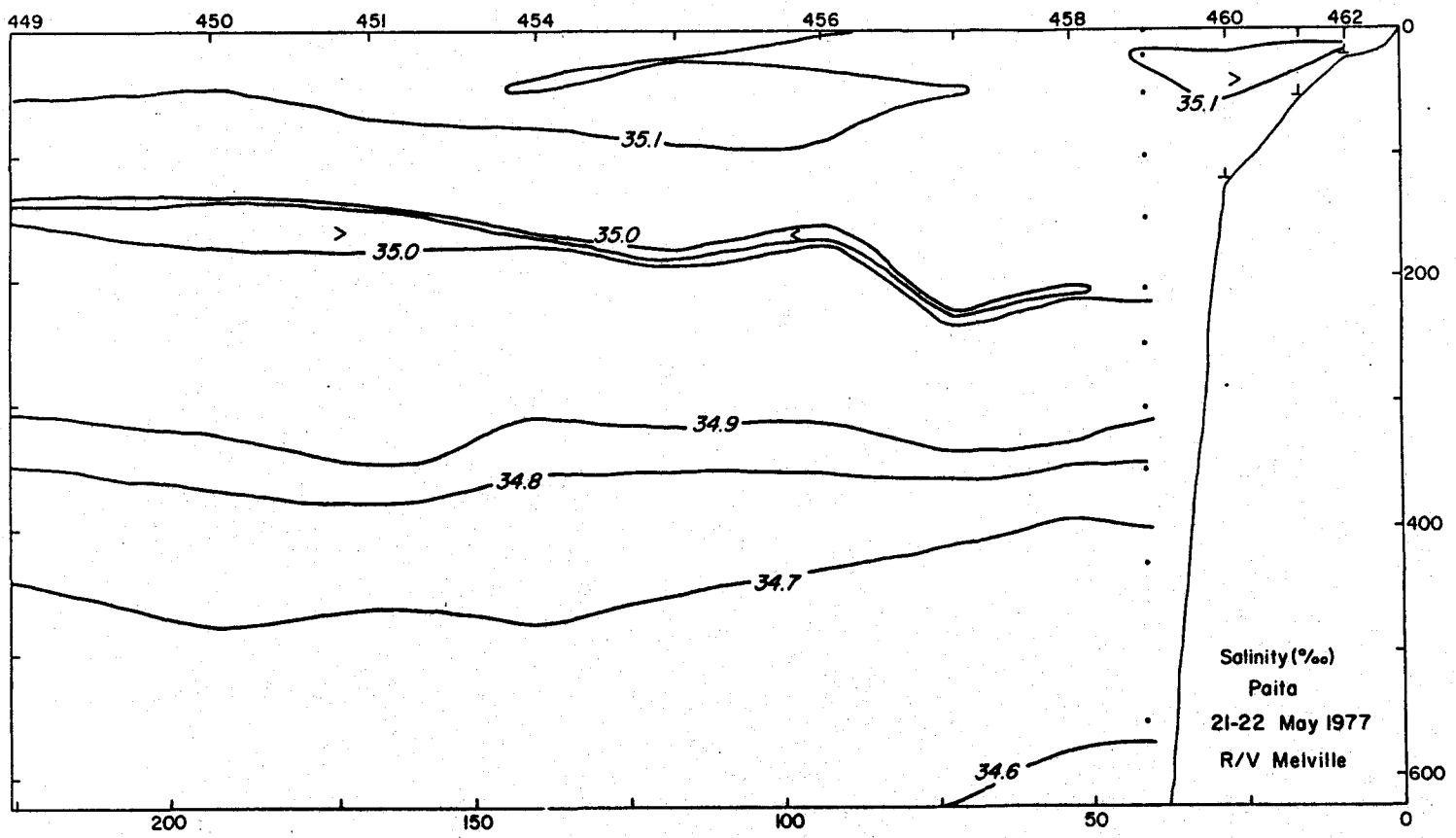

392
398
0
200
400
600
35.0
34.9
34.85
34.8
34.7
34.6
50
25
0
Salinity (‰)
K Line
9-10 May 1977
R/V Melville

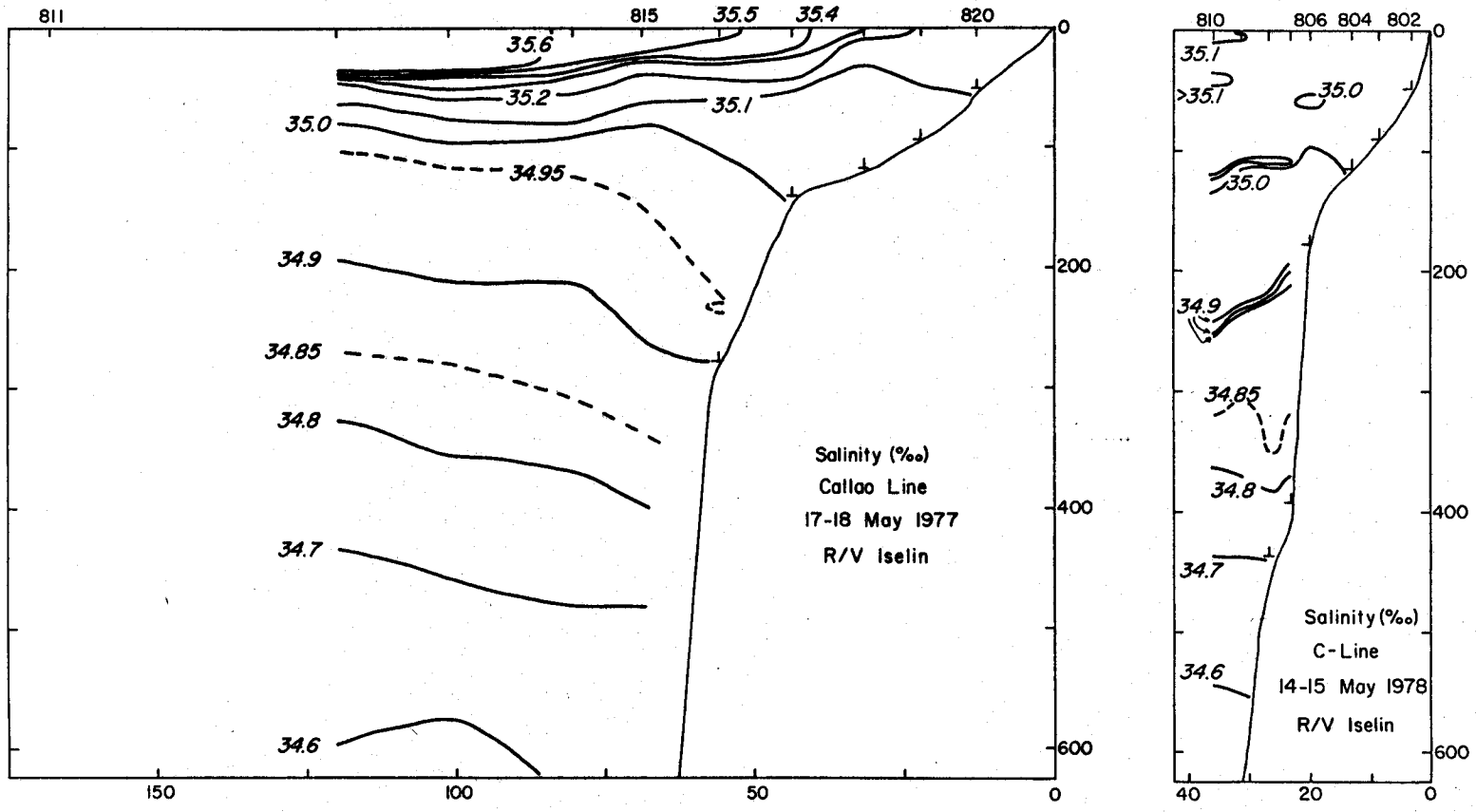

399
405
0
200
400
600
35.0
35.0
34.9
34.9
34.85
34.8
34.7
50
25
0
Salinity (‰)
Pta Azua
10-11 May 1977
R/V Melville


417
416
413
411
409
0
35.1
<34.9
35.0
34.9
34.85
34.8
34.7
34.6
200
400
600
Salinity (‰)
C-Line
12-13 May
1977
R/V Melville
100
50
0


420
422
424
427
433
430
431
432
0
35.0
34.9
34.9
34.85
34.8
34.7
34.6
200
400
600
Salinity (‰)
C-Line
15-16 May
1977
R/V Melville
100
50
0

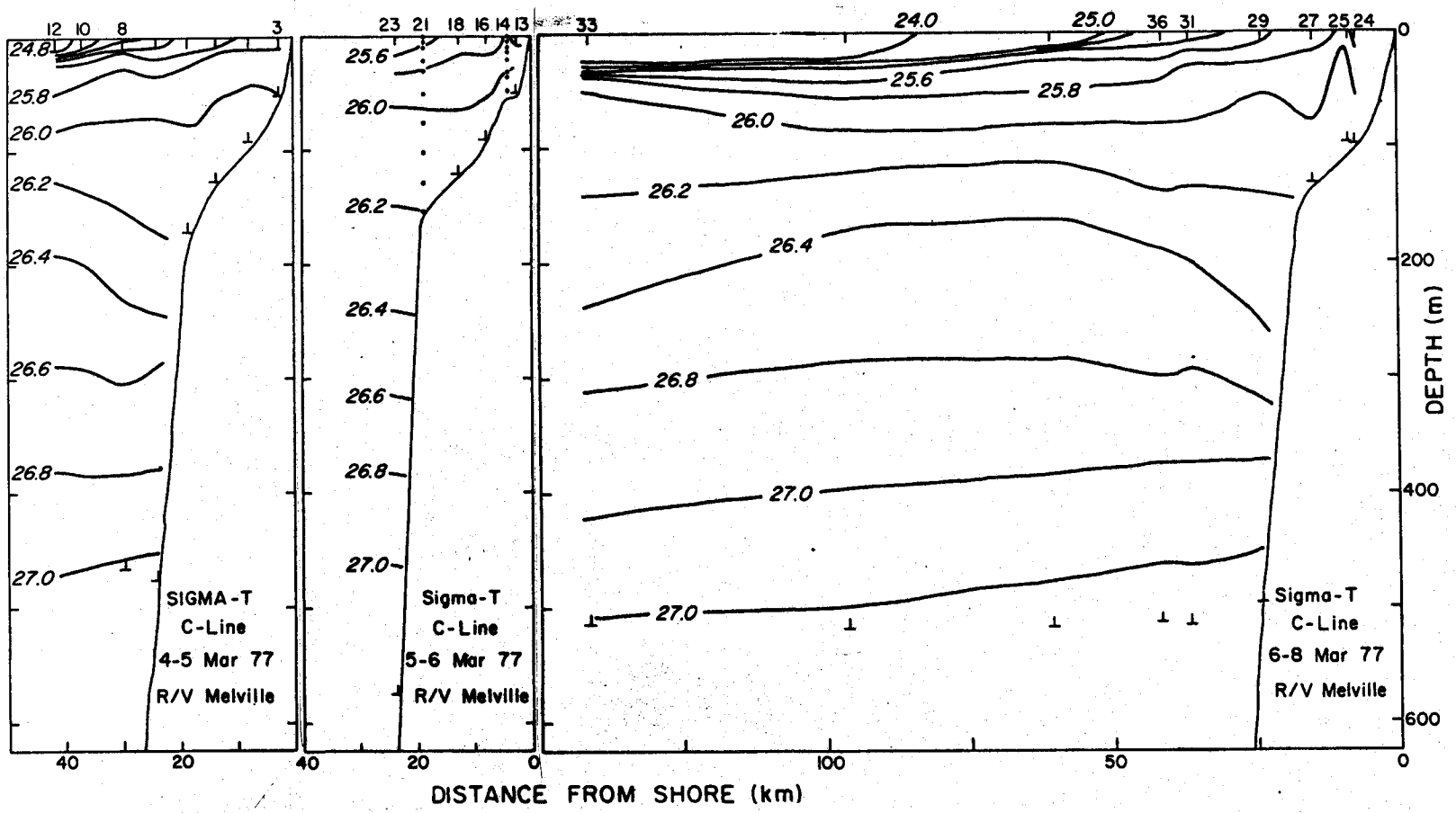

435
437
444
448
35.5
35.3
35.6
35.5
35.2
35.1
35.0
34.9
34.85
34.8
34.7
34.6
0
200
400
600
150
100
50
0
Salinity (‰)
Huarmey
18-19 May 1977
R/V Melville

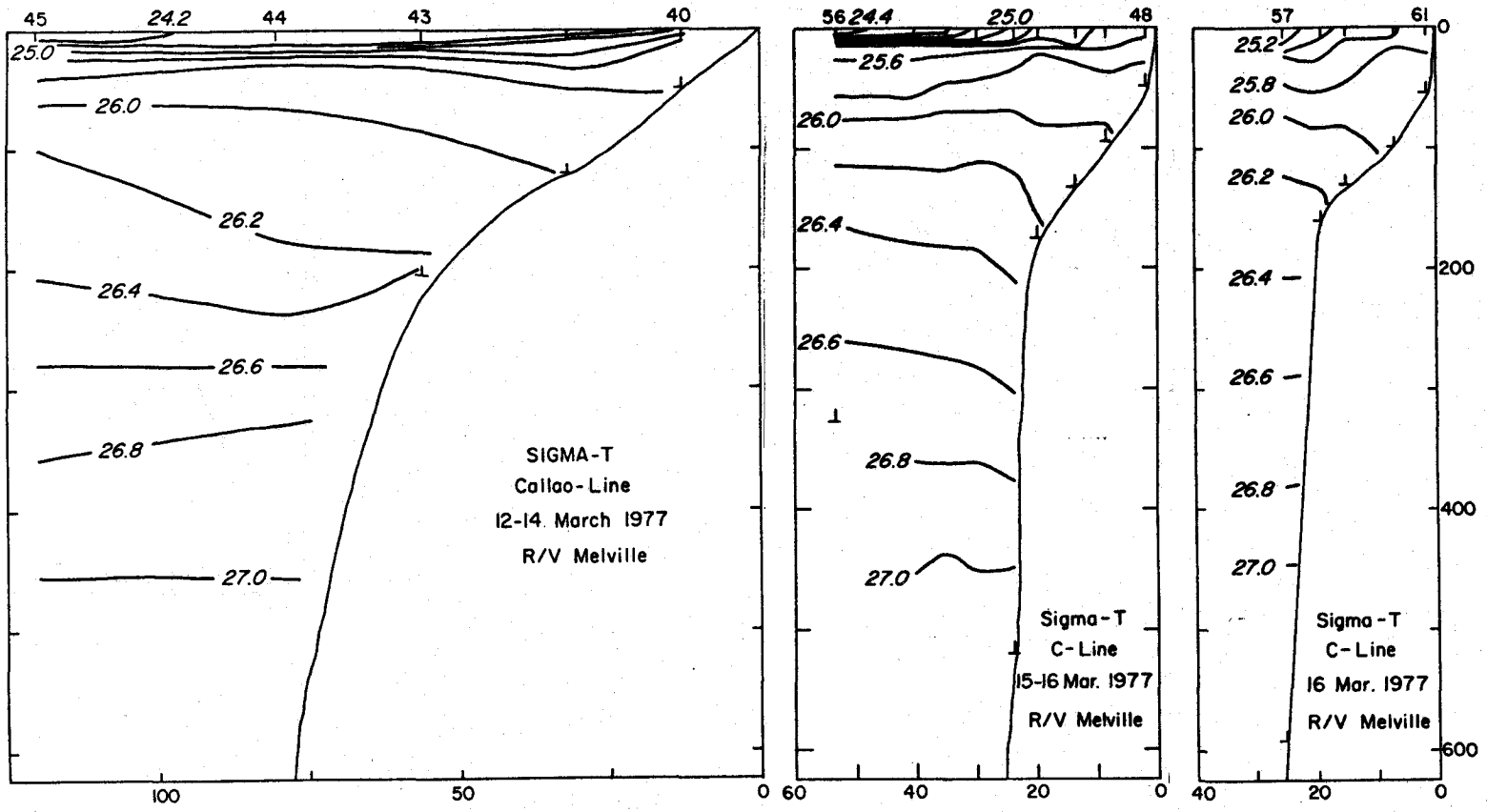

449
450
451
454
456
458
460
462
0
200
400
600
35.1
35.1
35.0
35.0
34.9
34.8
34.7
34.6
Salinity (‰)
Paita
21-22 May 1977
R/V Melville
200
150
100
50
0

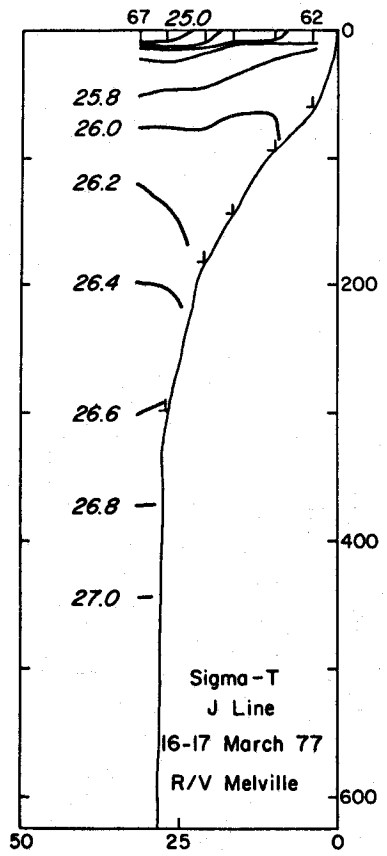

811
815
35.5
35.4
820
35.6
35.2
35.1
35.0
34.95
34.9
34.85
34.8
34.7
34.6
0
200
400
600
150
100
50
0
Salinity (‰)
Callao Line
17-18 May 1977
R/V Iselin
810
806
804
802
35.1
>35.1
35.0
35.0
34.9
34.85
34.8
34.7
34.6
0
200
400
600
40
20
0
Salinity (‰)
C-Line
14-15 May 1978
R/V Iselin

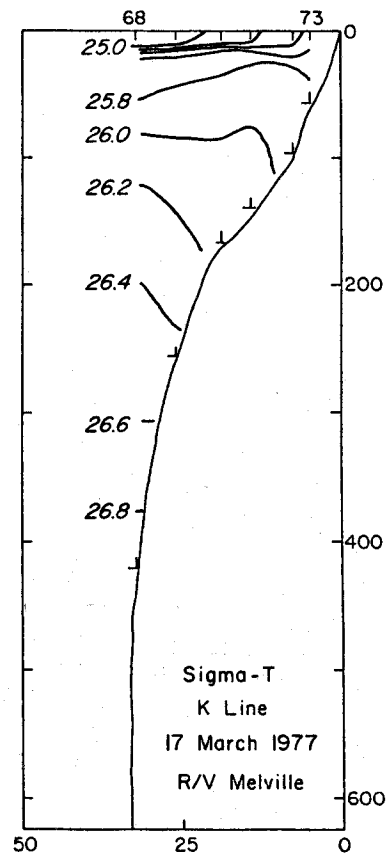
VERTICAL SECTIONS DURING MAM 77

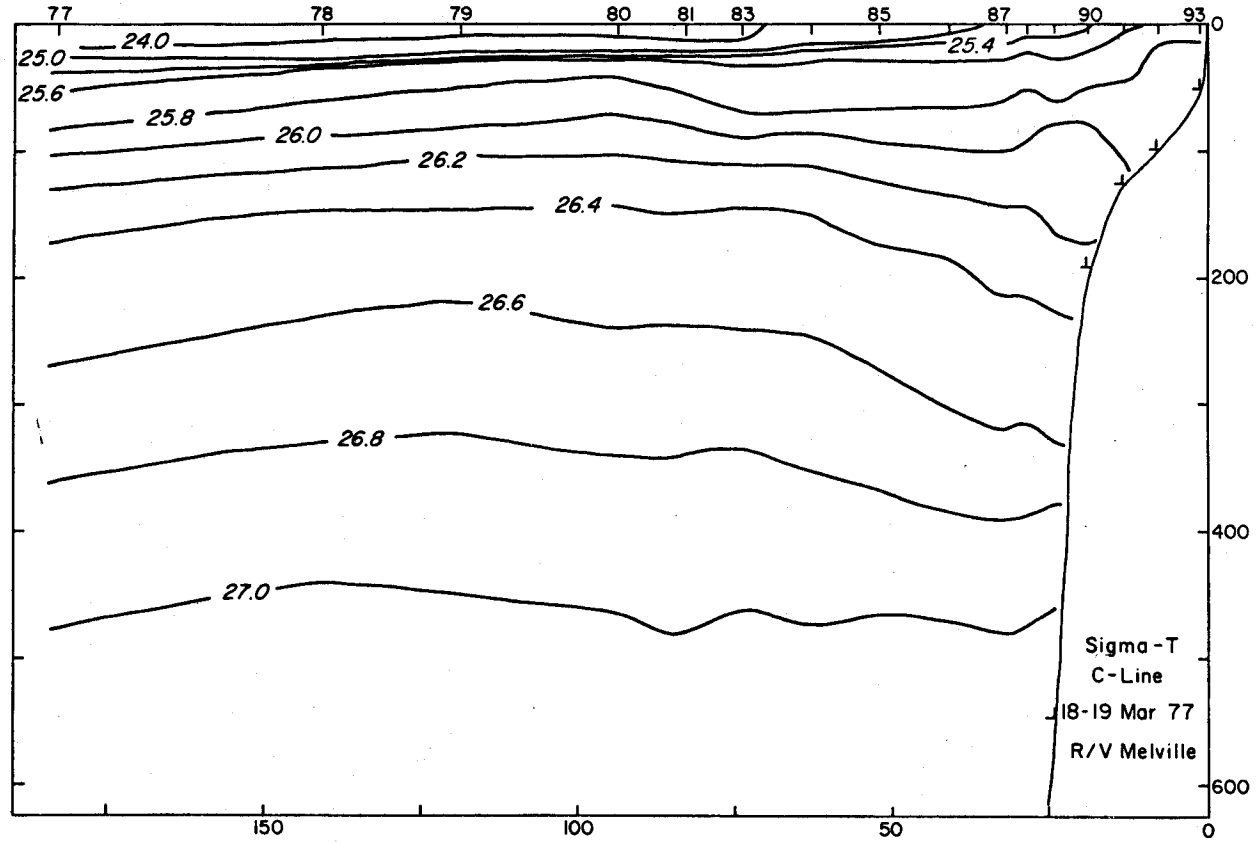
Sigma-T

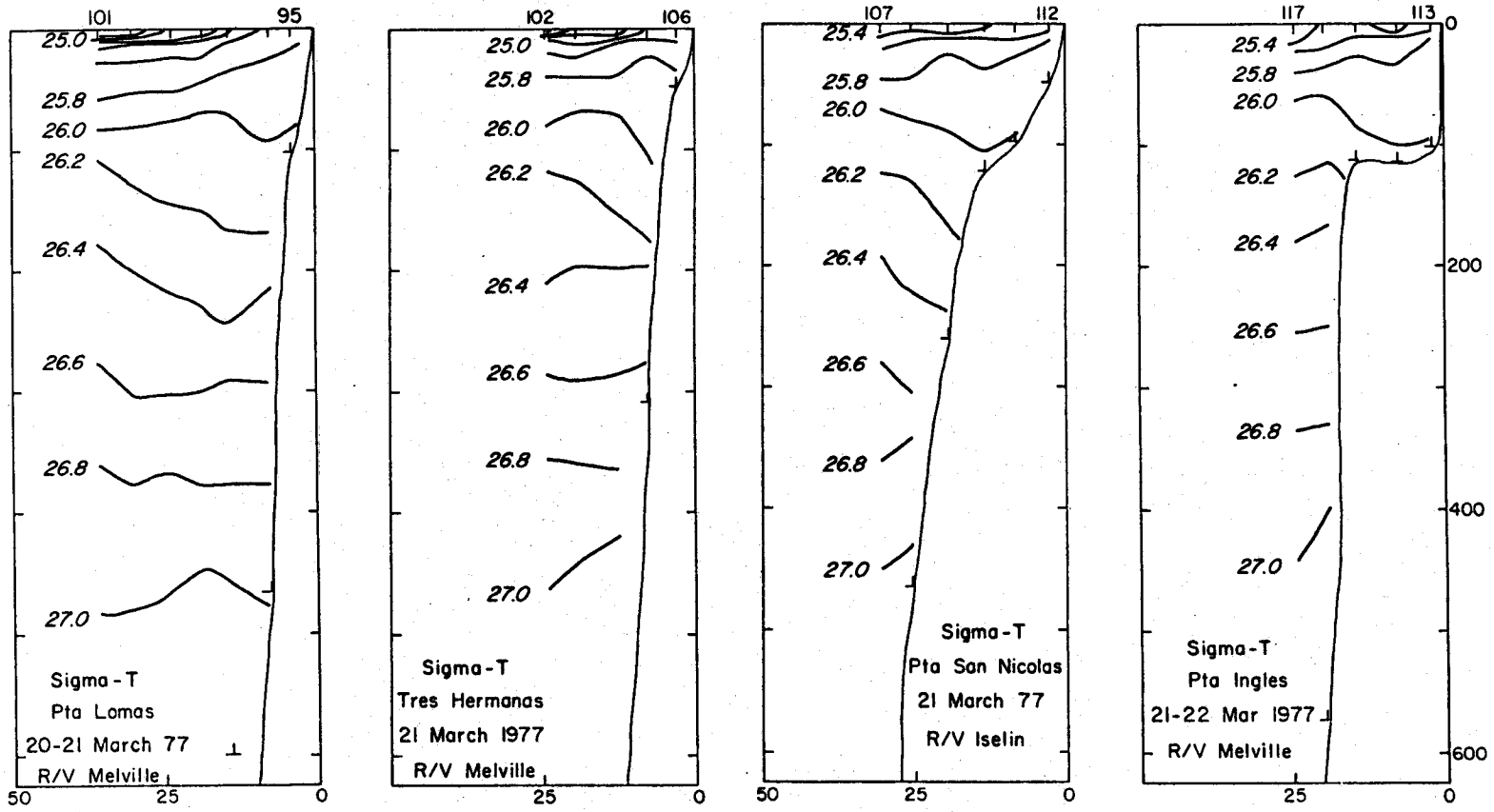

12 10 8 3
24.8
25.8
26.0
26.2
26.4
26.6
26.8
27.0
SIGMA-T
C-Line
4-5 Mar 77
R/V Melville
40 20
23 21 18 16 14 13
25.6
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
C-Line
5-6 Mar 77
R/V Melville
40 20 0
33
24.0
25.0
36 31
29
27 25 24
25.6
25.8
26.0
26.2
26.4
26.8
27.0
Sigma-T
C-Line
6-8 Mar 77
R/V Melville
100 50 0
0
200
400
600
DEPTH (m)
DISTANCE FROM SHORE (km)

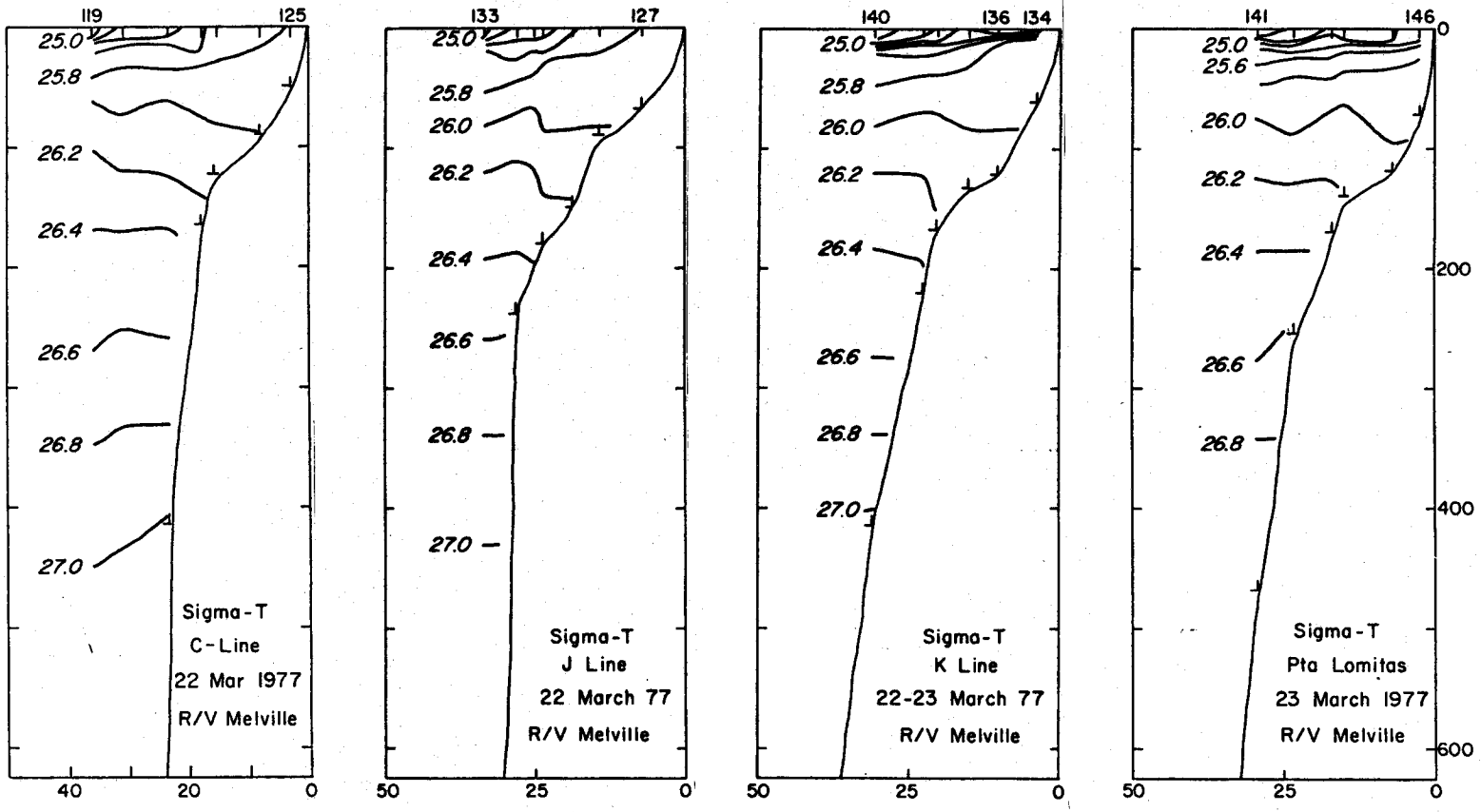

45
24.2
44
43
40
25.0
26.0
26.2
26.4
26.6
26.8
27.0
SIGMA-T
Callao-Line
12-14 March 1977
R/V Melville
100
50
0
56
24.4
25.0
48
25.6
26.0
26.4
26.6
26.8
27.0
Sigma-T
C-Line
15-16 Mar. 1977
R/V Melville
60
40
20
0
57
61
25.2
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
C-Line
16 Mar. 1977
R/V Melville
0
200
400
600
40
20
0

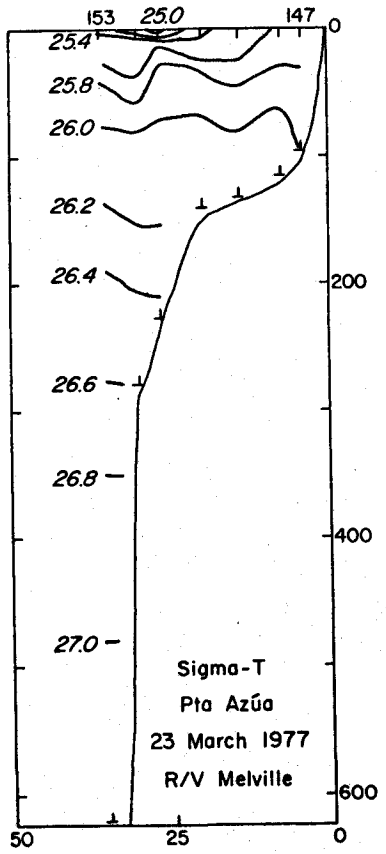

67
25.0
62
0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
J Line
16-17 March 77
R/V Melville
50
25
0

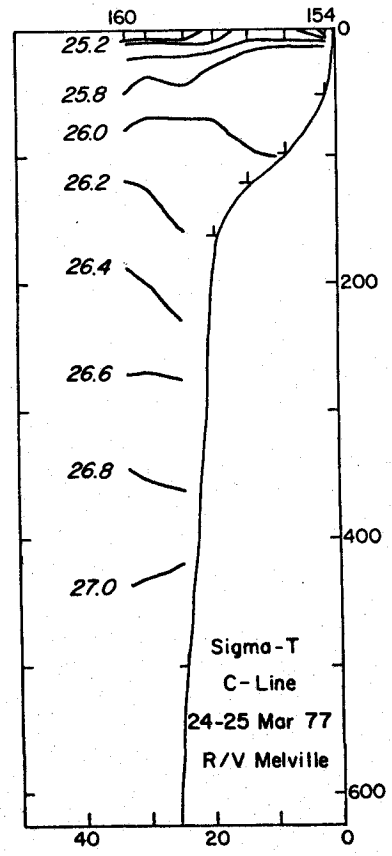

68
73
0
25.0
25.8
26.0
26.2
26.4
26.6
26.8
200
400
600
Sigma-T
K Line
17 March 1977
R/V Melville
50
25
0

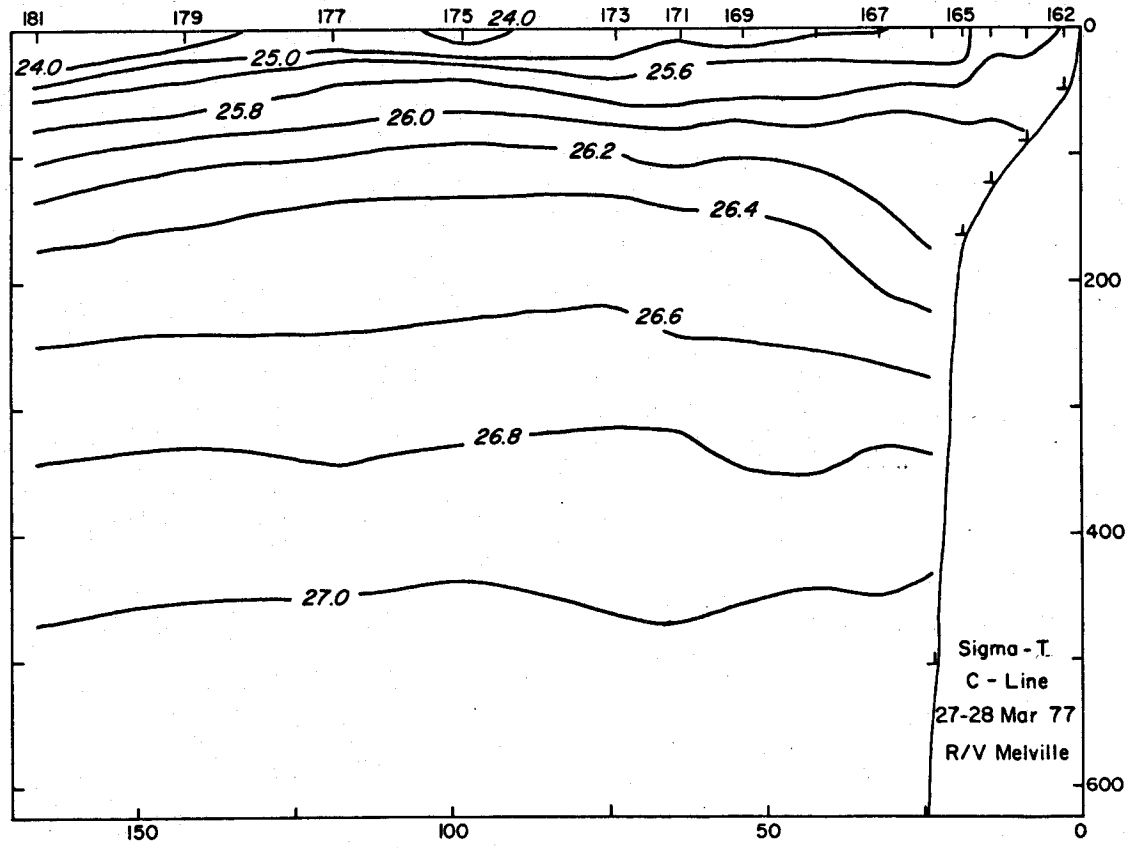

77
78
79
80
81
83
85
87
90
93
0
24.0
25.0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
25.4
200
400
600
150
100
50
0
Sigma-T
C-Line
18-19 Mar 77
R/V Melville

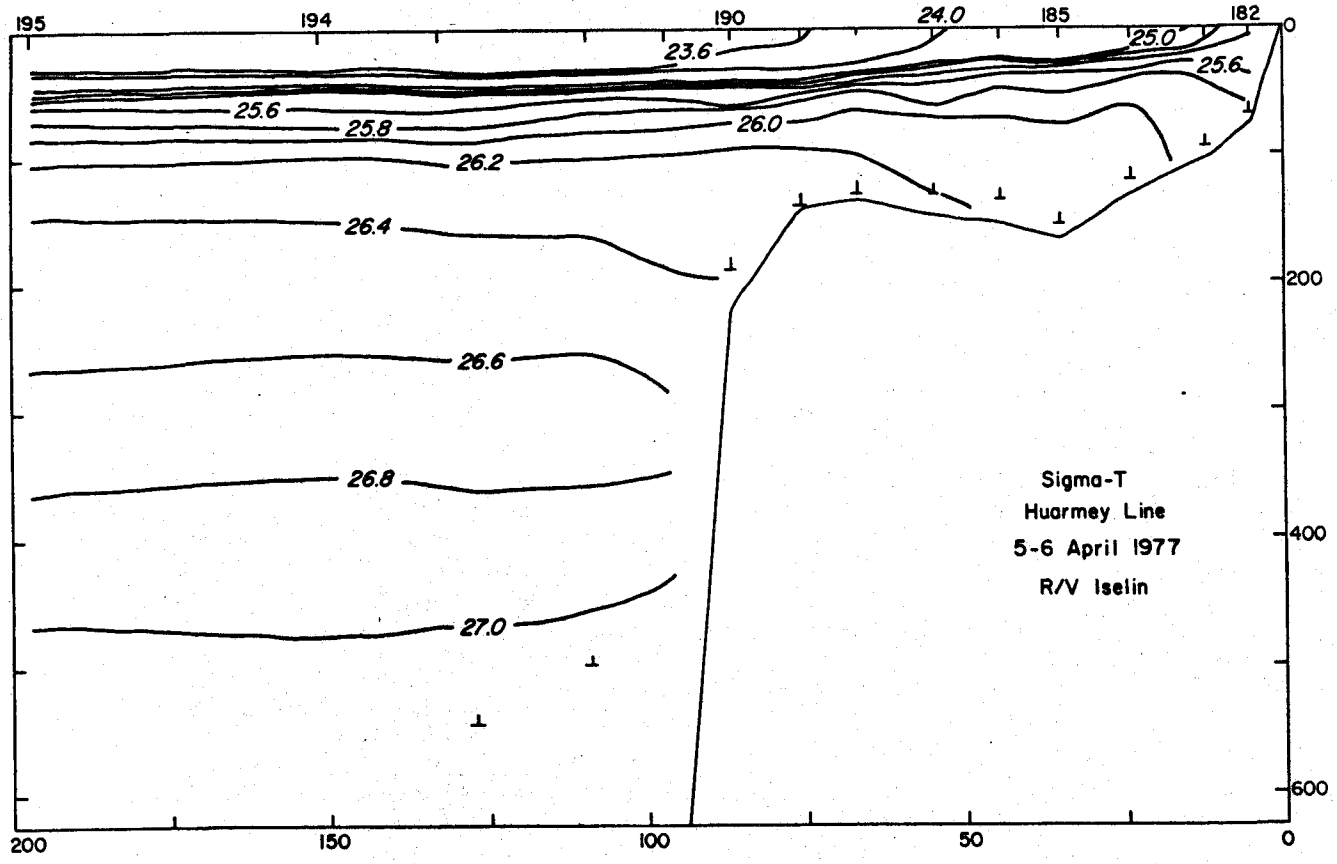

101
95
25.0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Pta Lomas
20-21 March 77
R/V Melville
50
25
0
102
106
25.0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Tres Hermanas
21 March 1977
R/V Melville
25
0
107
112
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Pta San Nicolas
21 March 77
R/V Iselin
50
25
0
117
113
0
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
Pta Ingles
21-22 Mar 1977
R/V Melville
25
0

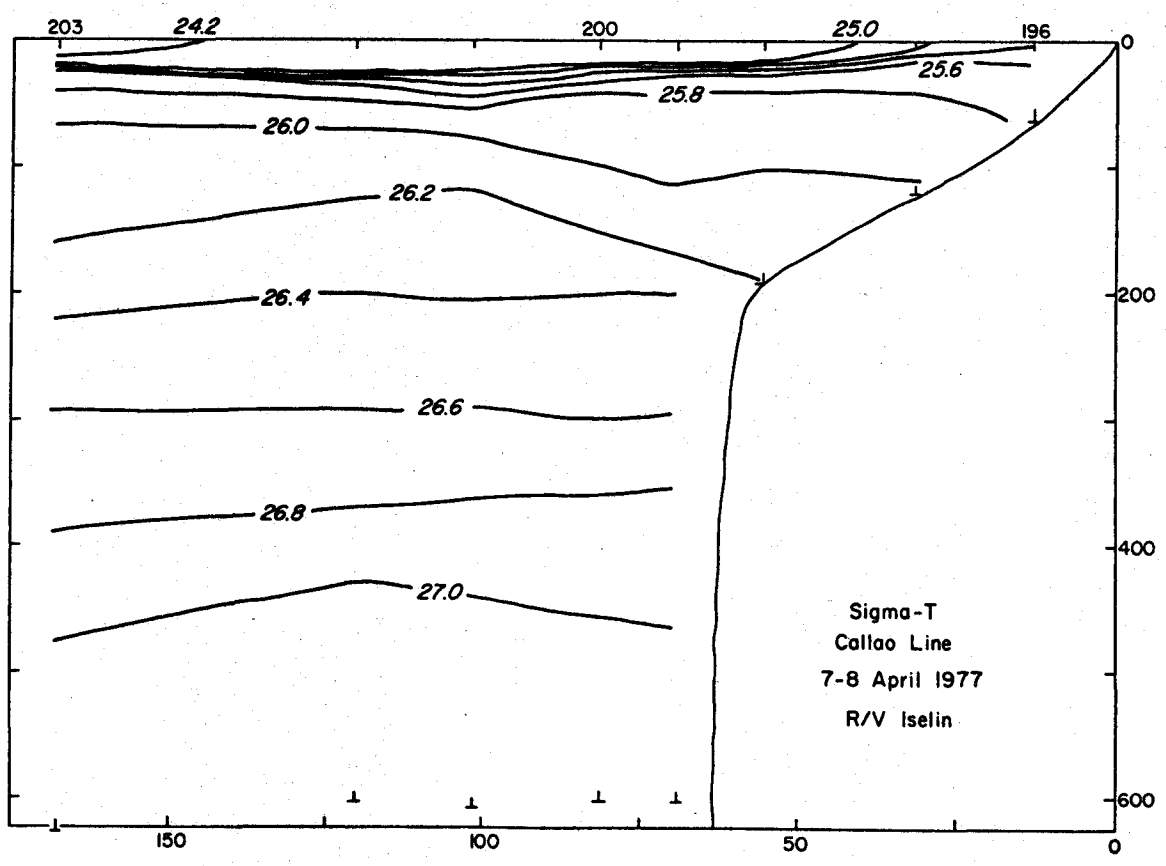

119
125
25.0
25.8
26.2
26.4
26.6
26.8
27.0
40
20
0
Sigma-T
C-Line
22 Mar 1977
R/V Melville
133
127
25.0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
50
25
0
Sigma-T
J Line
22 March 77
R/V Melville
140
136 134
25.0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
50
25
0
Sigma-T
K Line
22-23 March 77
R/V Melville
141
146
0
25.0
25.6
26.0
26.2
26.4
26.6
26.8
200
400
600
50
25
0
Sigma-T
Pta Lomitas
23 March 1977
R/V Melville

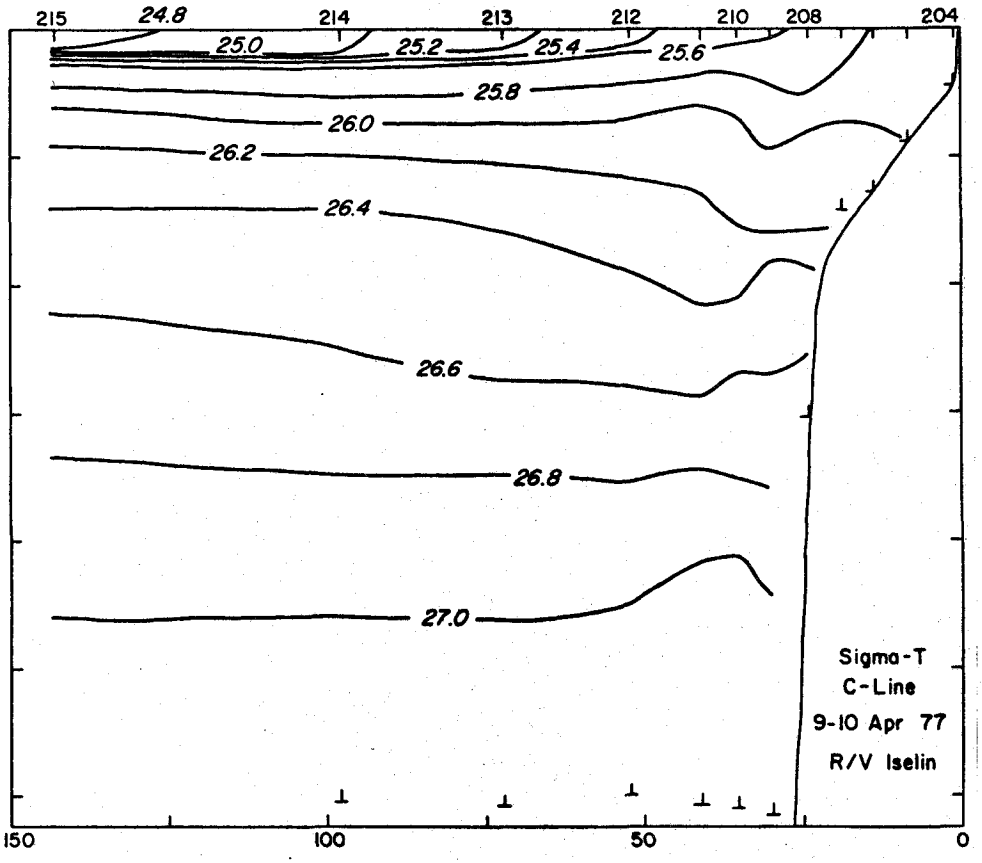

153
25.0
147
0
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
Pta Azúa
23 March 1977
R/V Melville
50
25
0

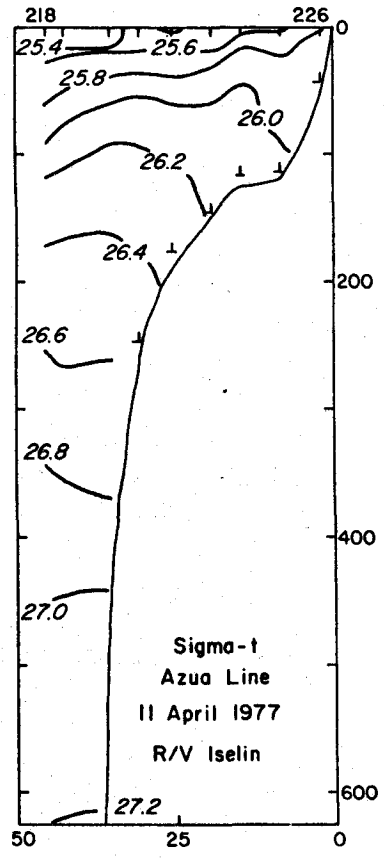

160
154
0
25.2
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
C-Line
24-25 Mar 77
R/V Melville
40
20
0

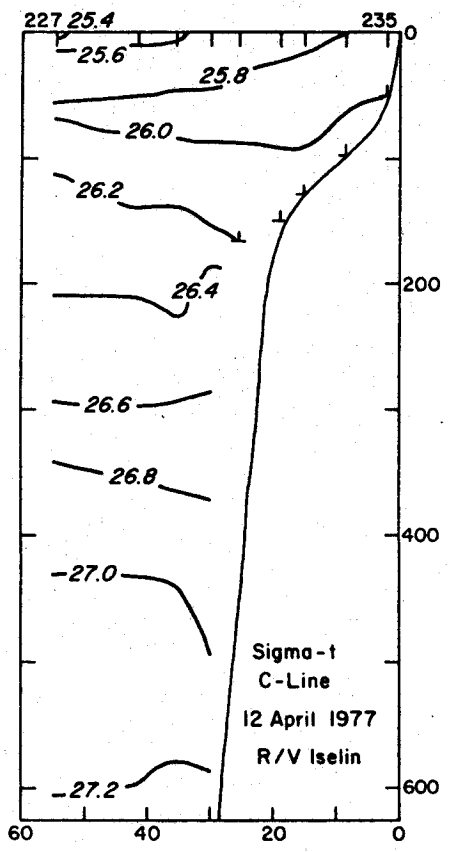

181
179
177
175
24.0
173
171
169
167
165
162
0
24.0
25.0
25.6
25.8
26.0
26.2
26.4
200
26.6
26.8
400
27.0
600
Sigma - T.
C - Line
27-28 Mar 77
R/V Melville
150
100
50
0

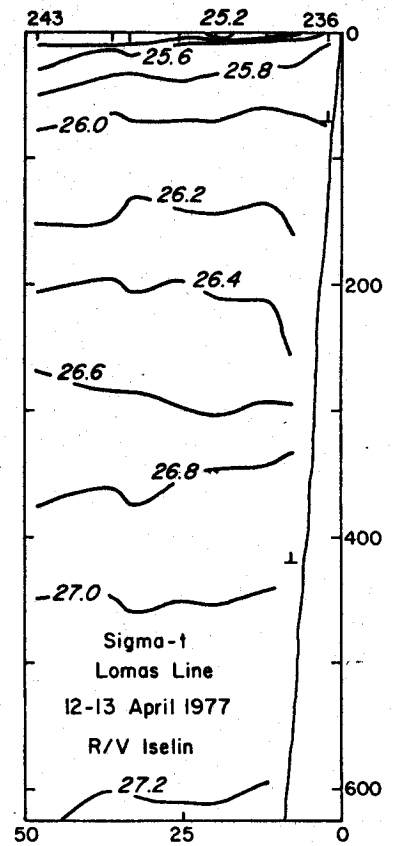

195
194
190
24.0
185
182
0
23.6
25.0
25.6
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
Huarmey Line
5-6 April 1977
R/V Iselin
200
150
100
50
0

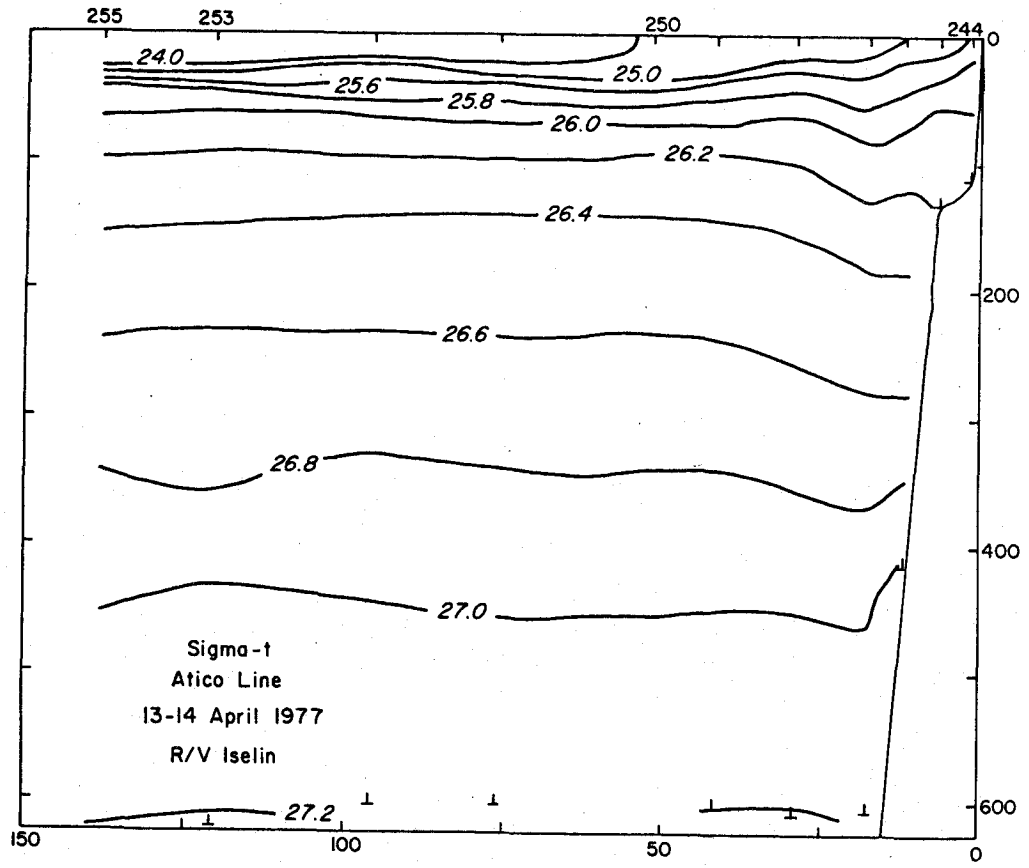

203
24.2
200
25.0
196
0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
Callao Line
7-8 April 1977
R/V Iselin
150
100
50
0

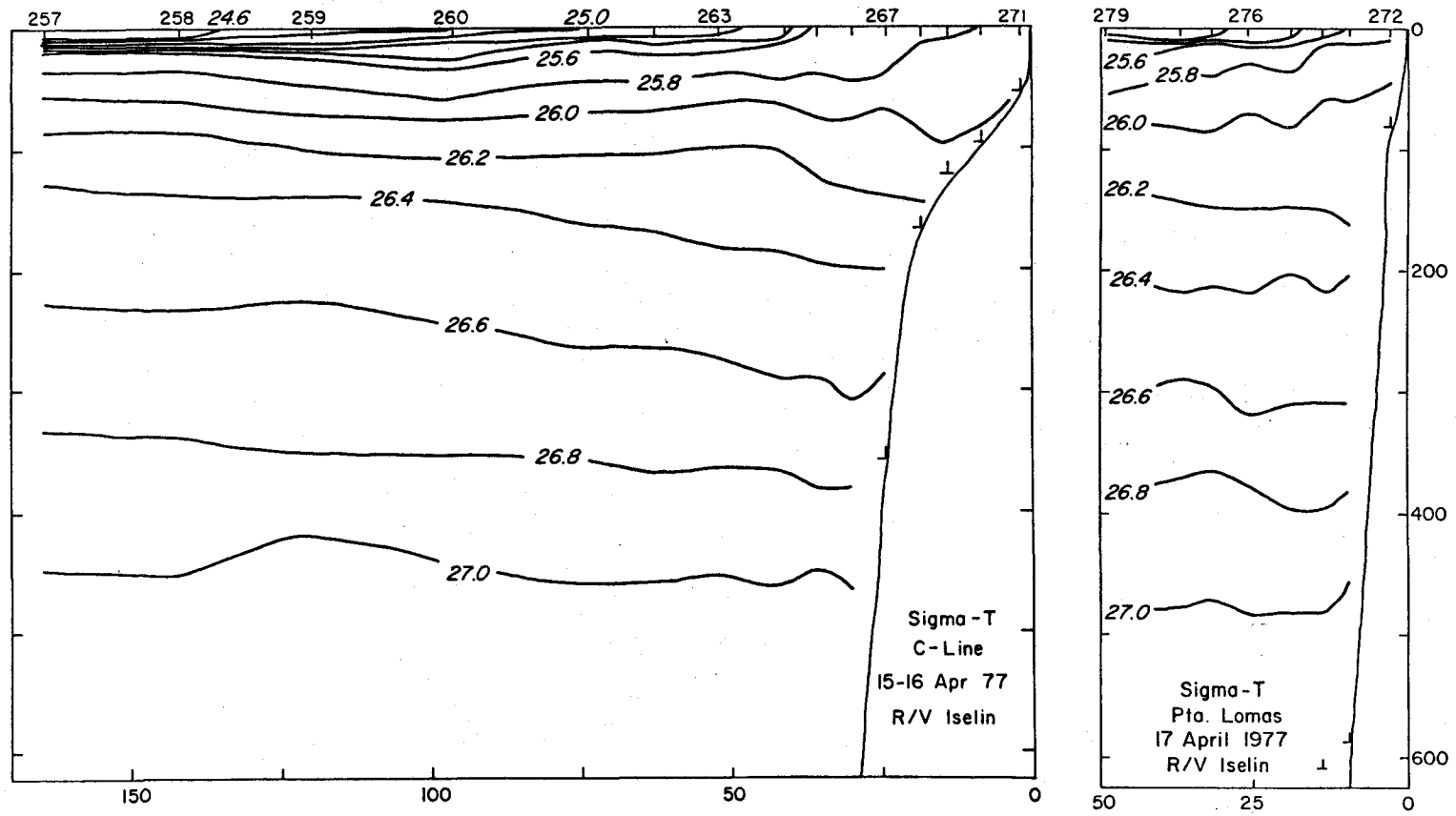

215
24.8
214
213
212
210
208
204
25.0
25.2
25.4
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
C-Line
9-10 Apr 77
R/V Iselin
150
100
50
0

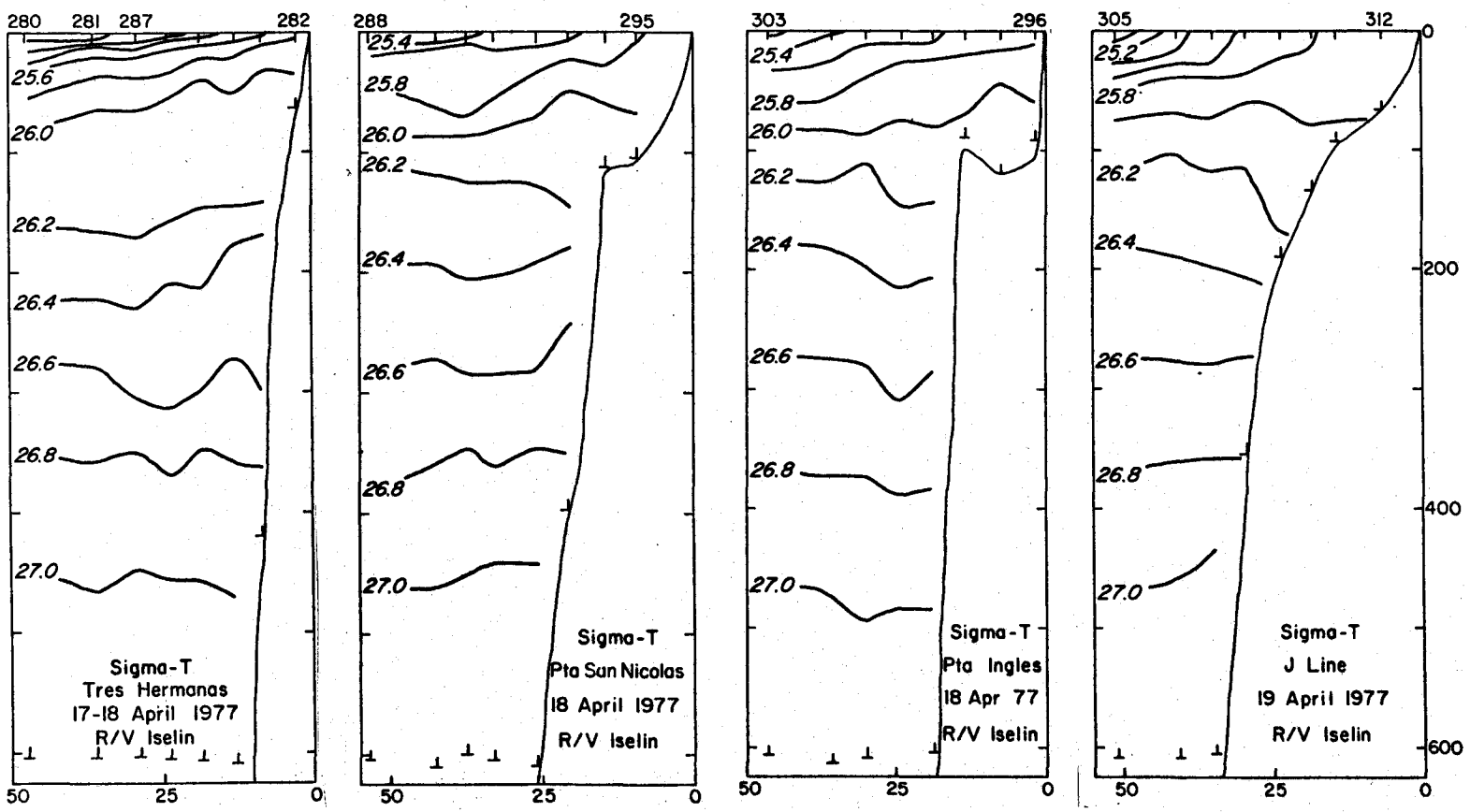

218
226
0
25.4
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
200
400
600
Sigma-t
Azua Line
11 April 1977
R/V Iselin
50
25
0

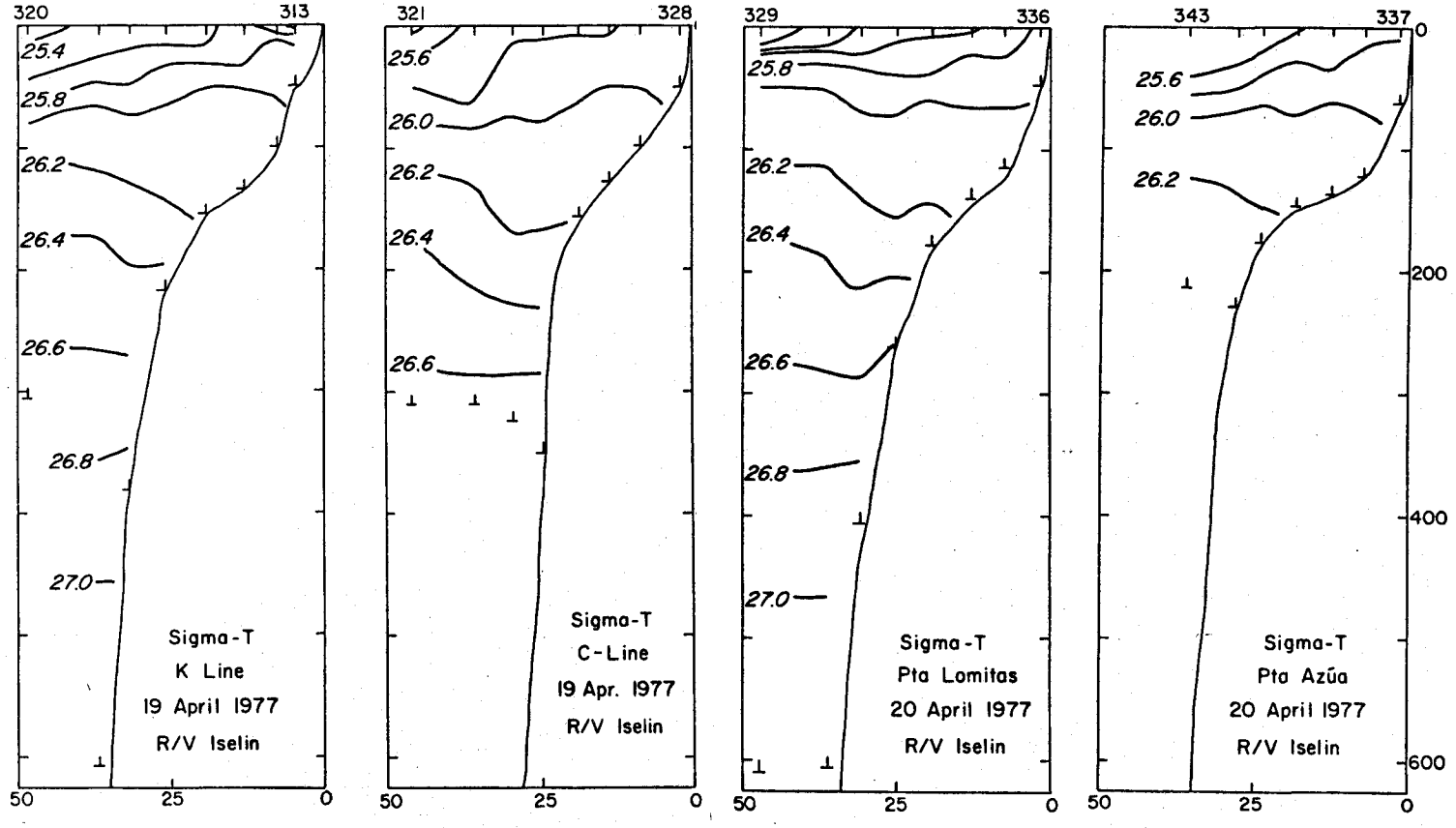

227 25.4
235
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
0
200
400
600
60
40
20
0
Sigma-t
C-Line
12 April 1977
R/V Iselin

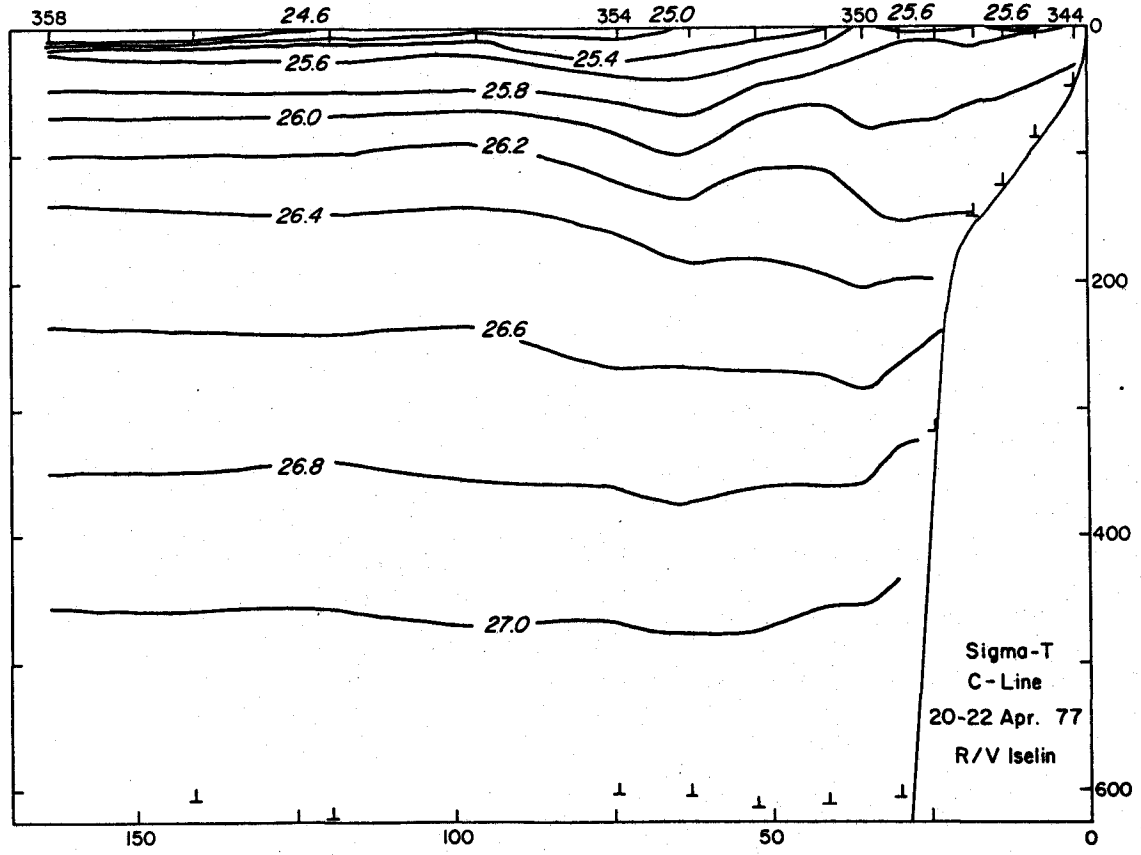

243
25.2
236
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
0
200
400
600
50
25
0
Sigma-t
Lomas Line
12-13 April 1977
R/V Iselin

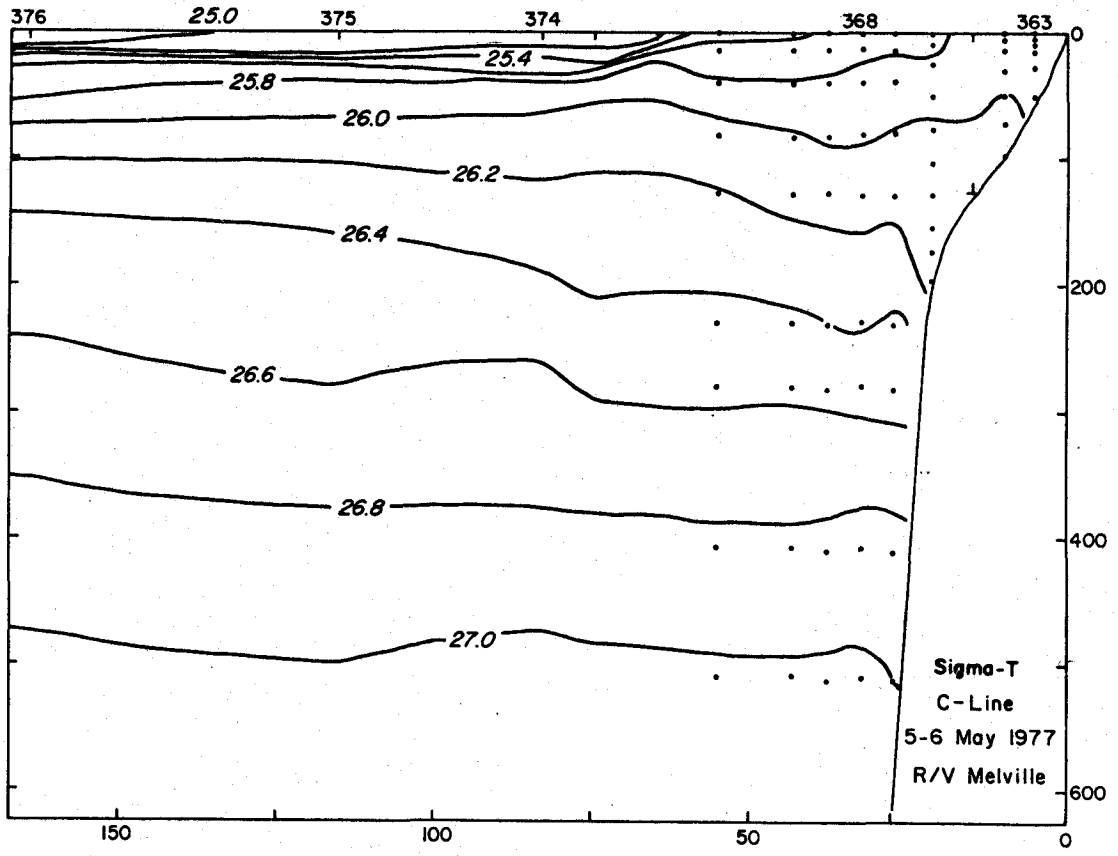

255
253
250
244
0
24.0
25.0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
27.2
200
400
600
Sigma-t
Atico Line
13-14 April 1977
R/V Iselin
150
100
50
0

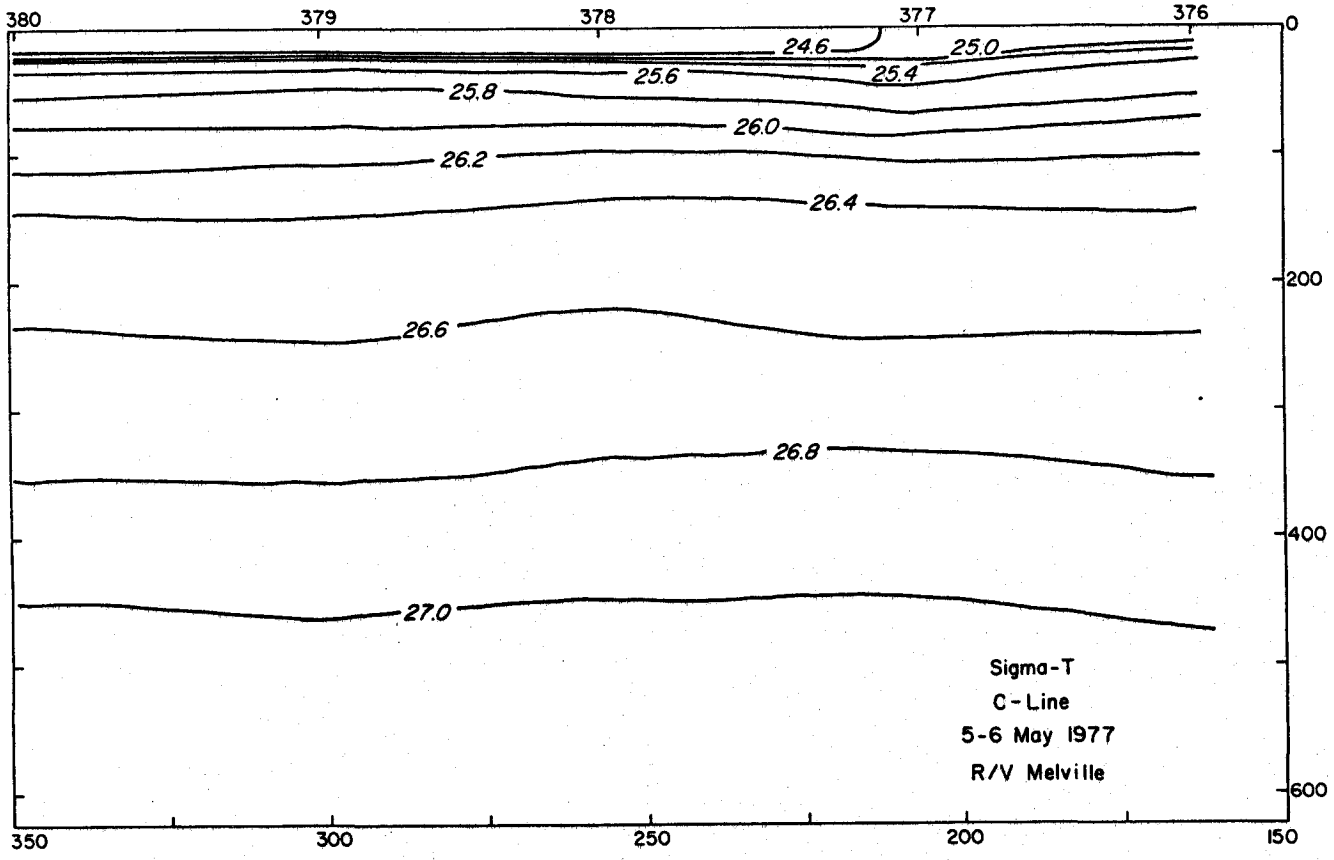

257
258
24.6
259
260
25.0
263
267
271
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
C-Line
15-16 Apr 77
R/V Iselin
150
100
50
0
279
276
272
0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
Pta. Lomas
17 April 1977
R/V Iselin
50
25
0

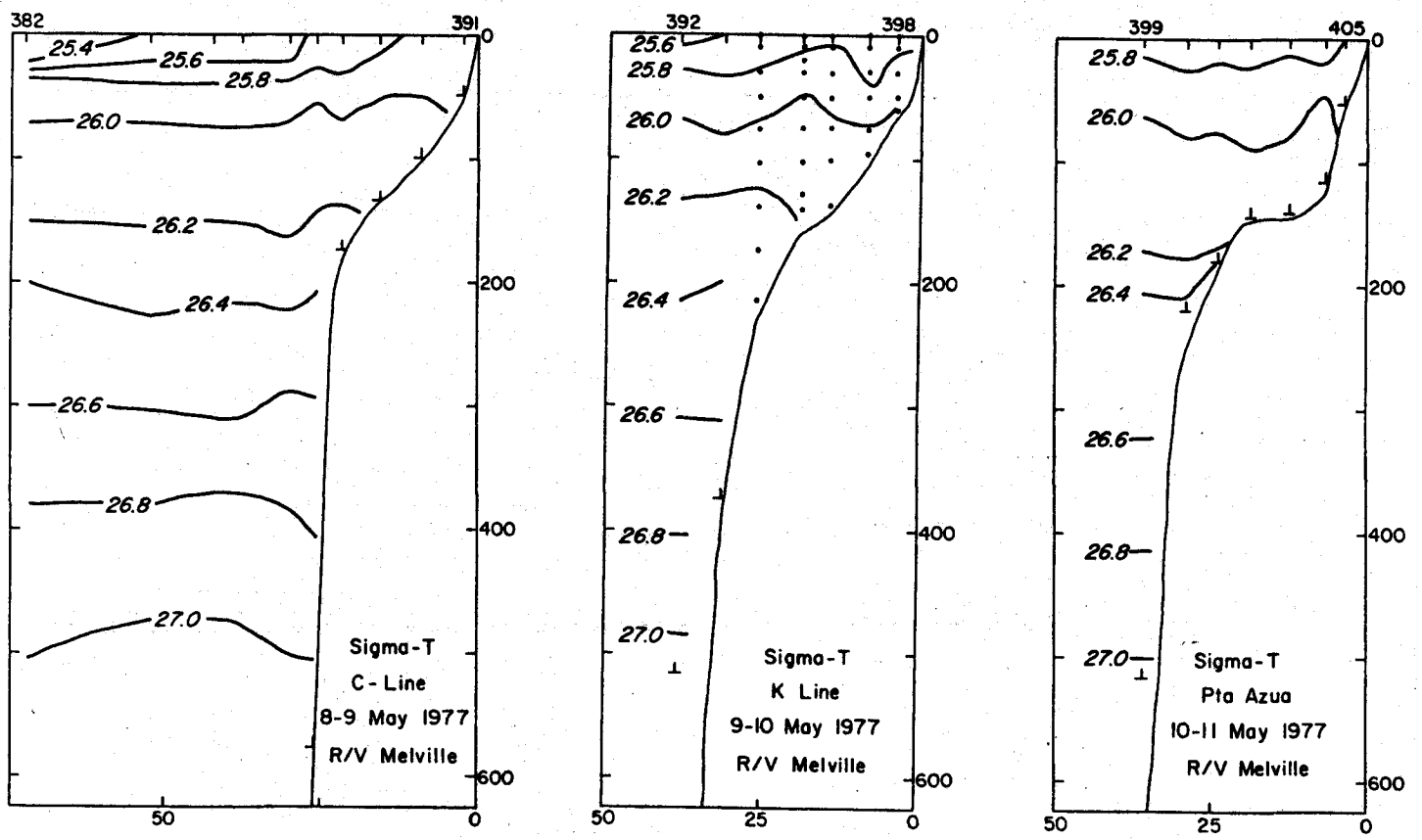

280 281 287 282
25.6
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Tres Hermanas
17-18 April 1977
R/V Iselin
50 25 0
288 295
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Pta San Nicolas
18 April 1977
R/V Iselin
50 25 0
303 296
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
Sigma-T
Pta Ingles
18 Apr 77
R/V Iselin
50 25 0
305 312
25.2
25.8
26.2
26.4
26.6
26.8
27.0
0
200
400
600
Sigma-T
J Line
19 April 1977
R/V Iselin
50 25 0

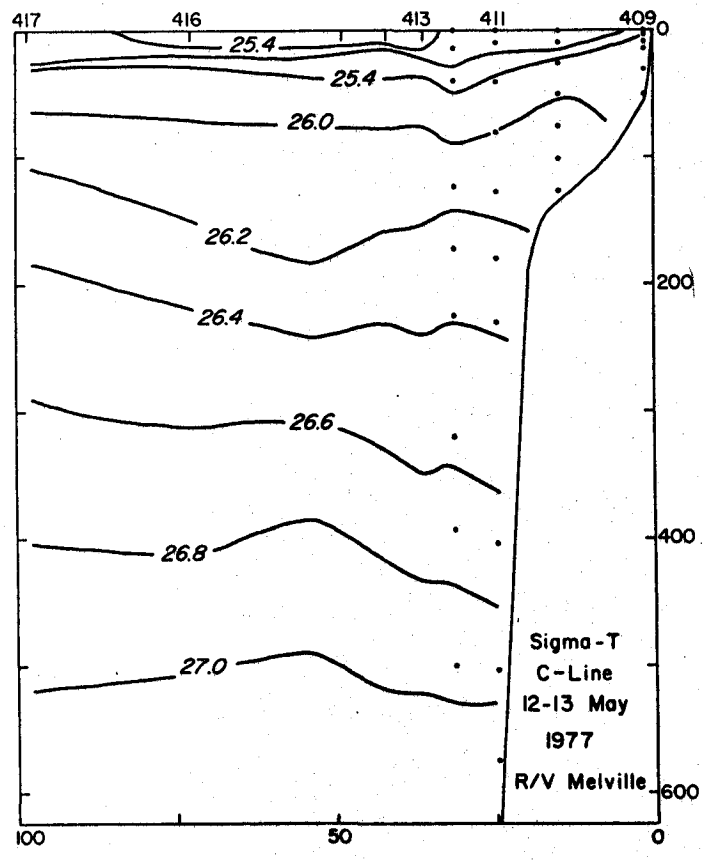

320
313
25.4
25.8
26.2
26.4
26.6
26.8
27.0
Sigma-T
K Line
19 April 1977
R/V Iselin
50
25
0
321
328
25.6
26.0
26.2
26.4
26.6
Sigma-T
C-Line
19 Apr. 1977
R/V Iselin
50
25
0
329
336
25.8
26.2
26.4
26.6
26.8
27.0
Sigma-T
Pta Lomitas
20 April 1977
R/V Iselin
50
25
0
343
337
25.6
26.0
26.2
Sigma-T
Pta Azúa
20 April 1977
R/V Iselin
50
25
0
0
200
400
600

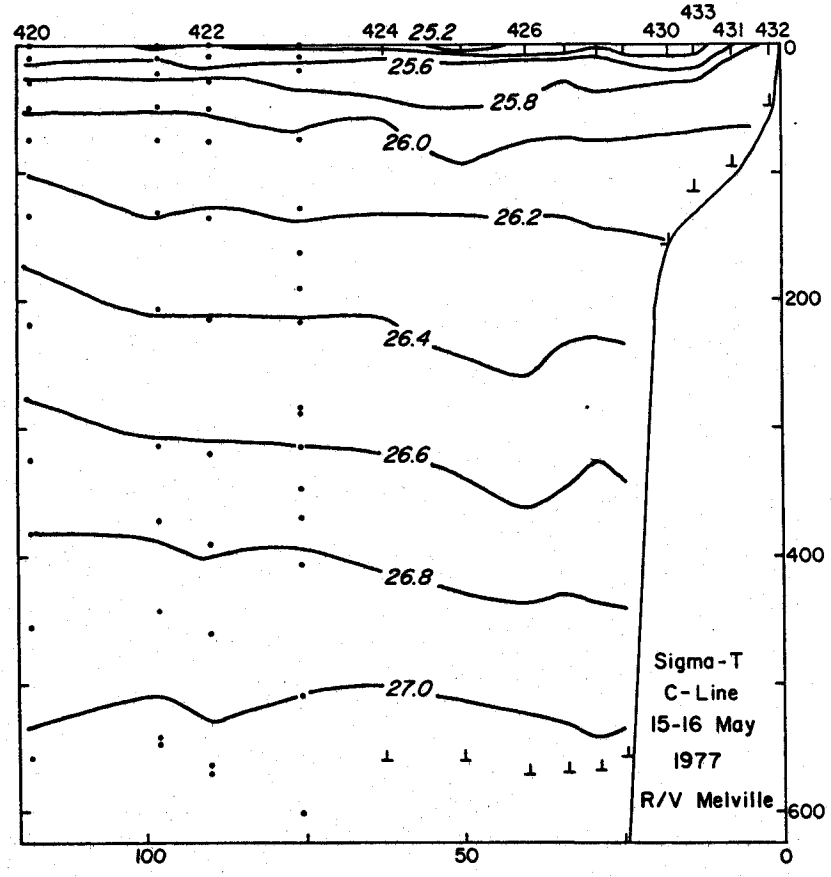

358
24.6
354
25.0
350
25.6
25.6
344
0
25.6
25.4
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
Sigma-T
C-Line
20-22 Apr. 77
R/V Iselin
150
100
50
0

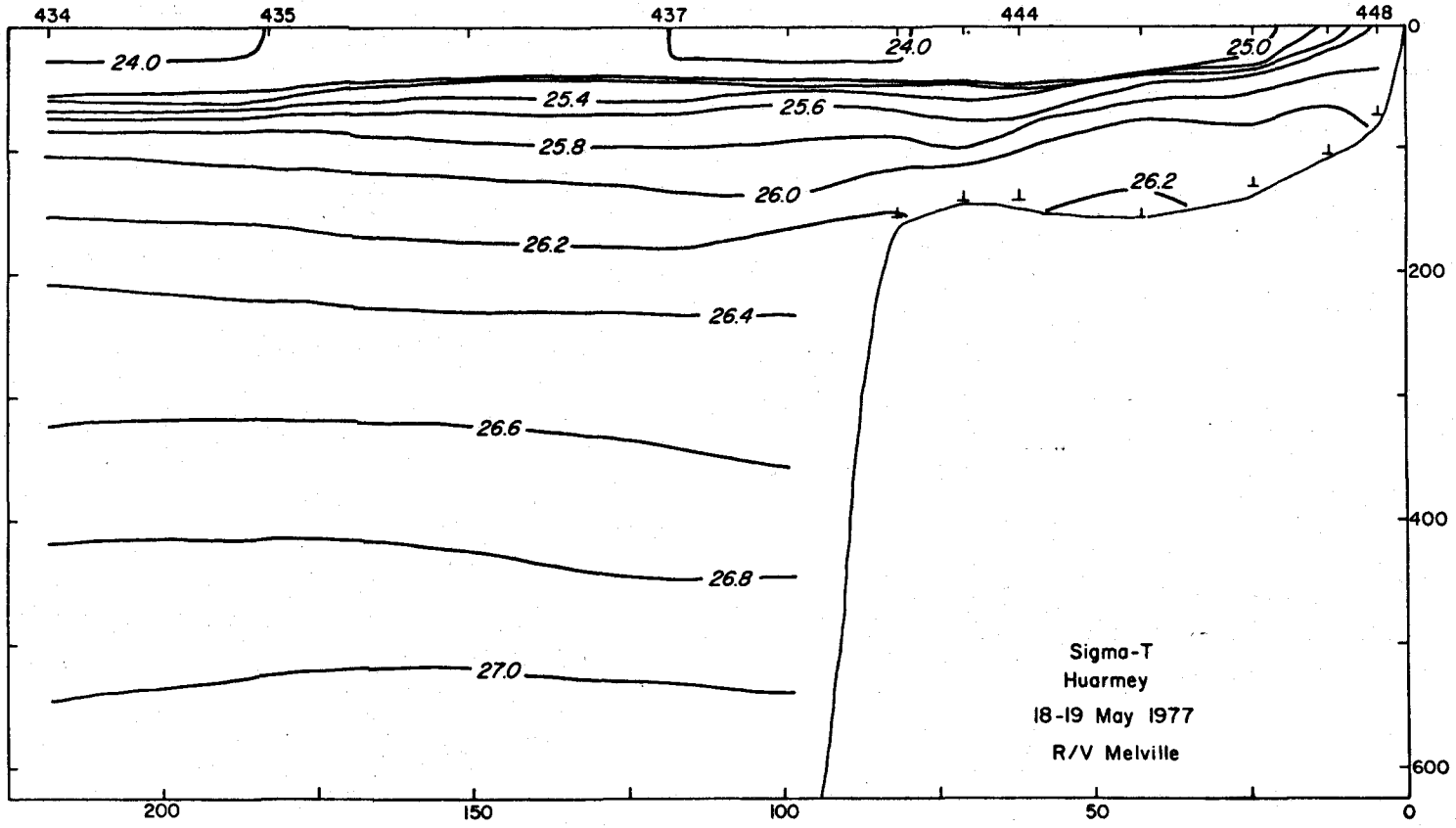

376
25.0
375
374
368
363
0
25.4
25.8
26.0
26.2
26.4
200
26.6
26.8
400
27.0
Sigma-T
C-Line
5-6 May 1977
R/V Melville
600
150
100
50
0

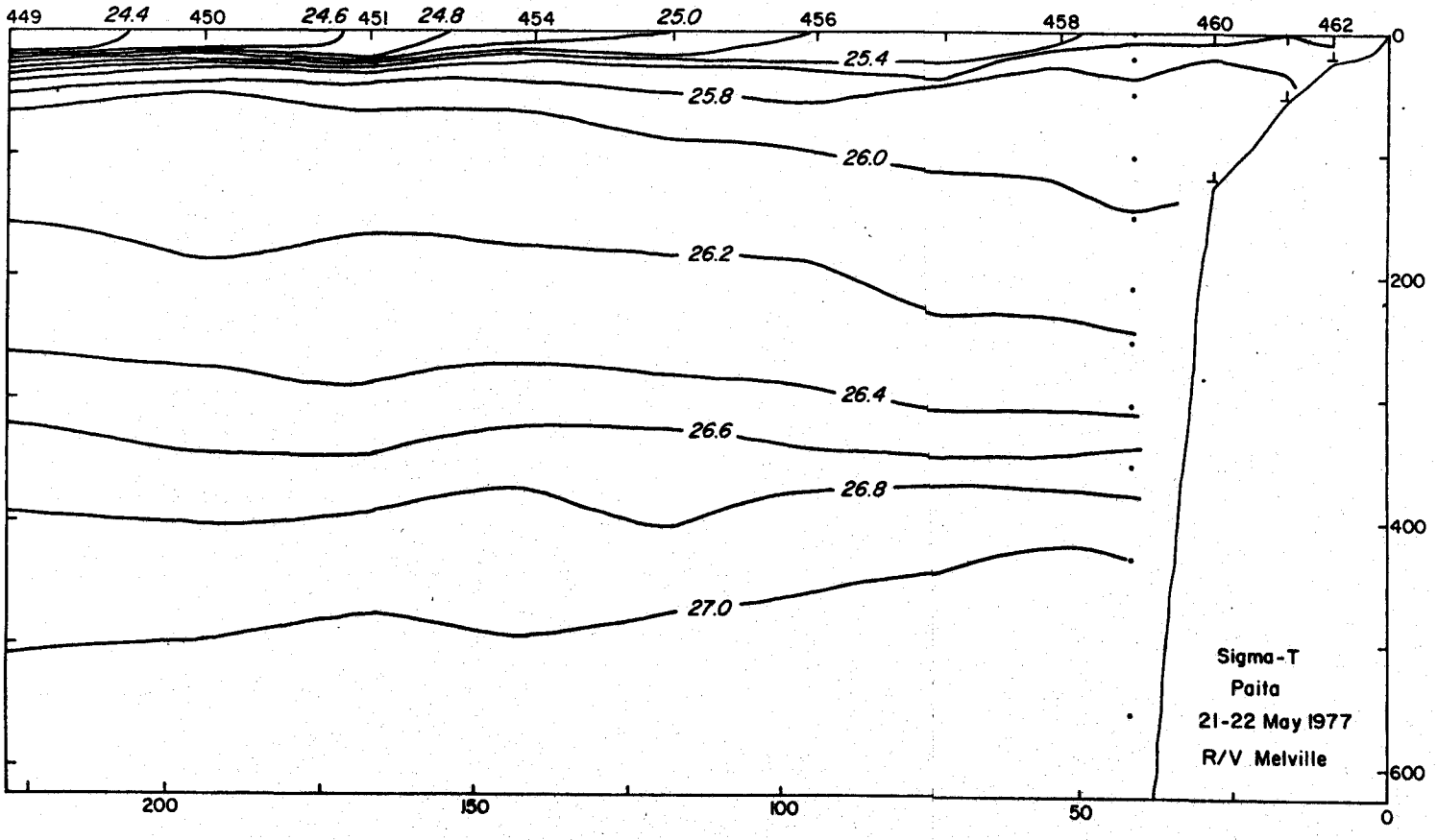

380
379
378
377
376
0
24.6
25.0
25.6
25.4
25.8
26.0
26.2
26.4
200
26.6
26.8
400
27.0
Sigma-T
C-Line
5-6 May 1977
R/V Melville
600
350
300
250
200
150

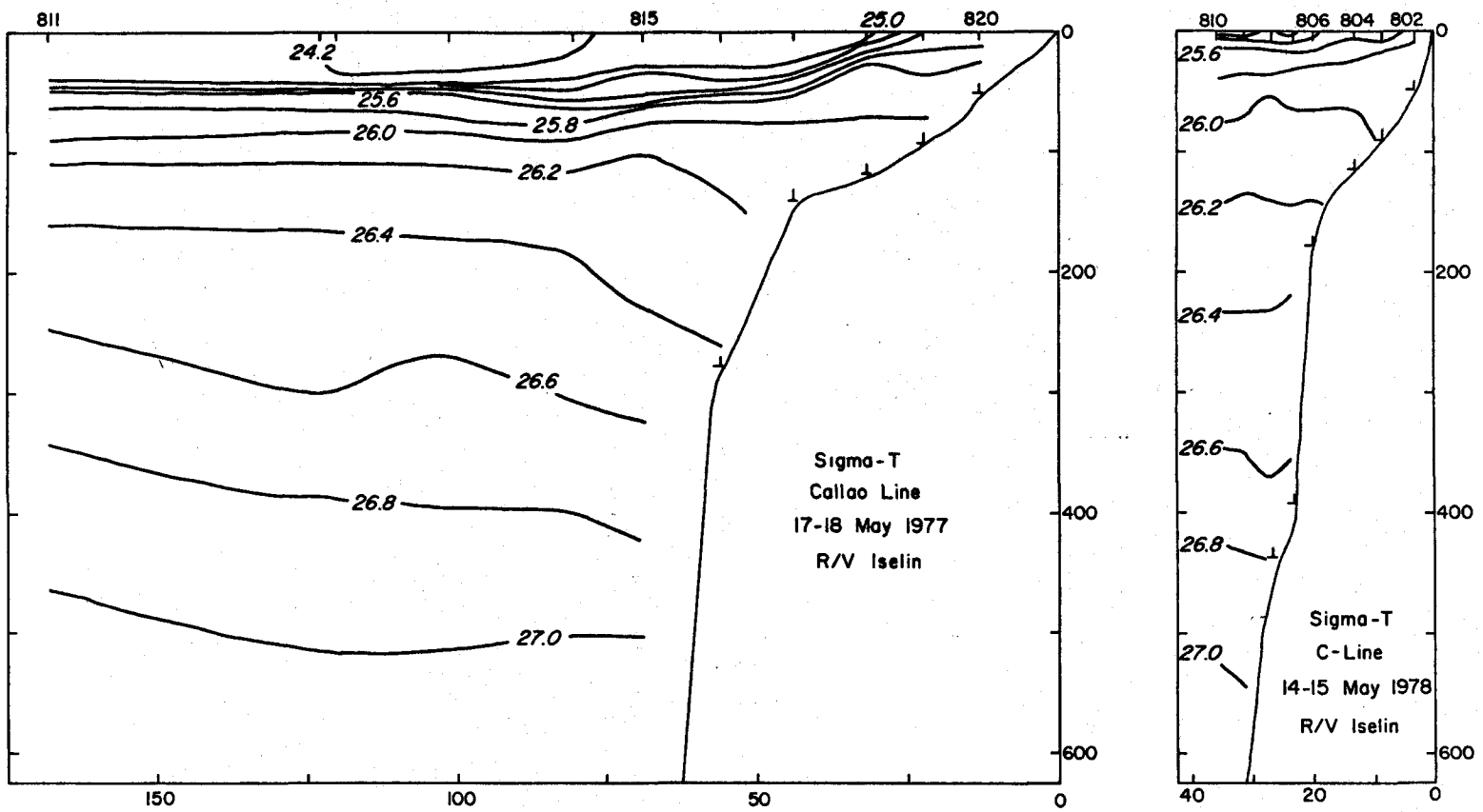

382
391
0
25.4
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
50
0
Sigma-T
C-Line
8-9 May 1977
R/V Melville
392
398
0
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
50
25
0
Sigma-T
K Line
9-10 May 1977
R/V Melville
399
405
0
25.8
26.0
26.2
26.4
26.6
26.8
27.0
200
400
600
50
25
0
Sigma-T
Pta Azua
10-11 May 1977
R/V Melville


417
416
413
411
409
25.4
25.4
26.0
26.2
26.4
26.6
26.8
27.0
0
200
400
600
100
50
0
Sigma-T
C-Line
12-13 May
1977
R/V Melville

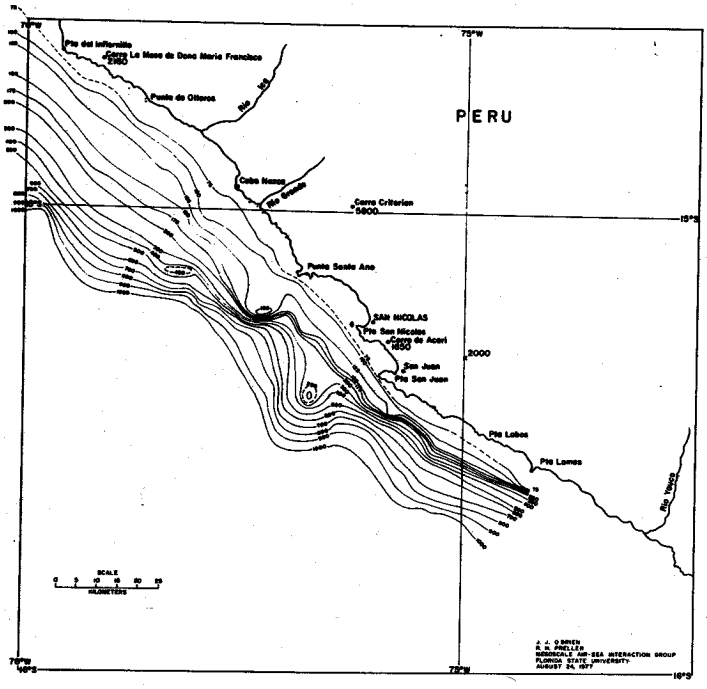

420
422
424
25.2
426
430
433
431
432
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
0
200
400
600
100
50
0
Sigma-T
C-Line
15-16 May
1977
R/V Melville


434
435
437
444
448
0
24.0
24.0
25.0
25.4
25.6
25.8
26.0
26.2
26.2
26.4
26.6
26.8
27.0
200
400
600
200
150
100
50
0
Sigma-T
Huarmey
18-19 May 1977
R/V Melville


449
24.4
450
24.6
451
24.8
454
25.0
456
458
460
462
0
25.4
25.8
26.0
26.2
200
26.4
26.6
26.8
400
27.0
600
Sigma-T
Paita
21-22 May 1977
R/V Melville
200
150
100
50
0

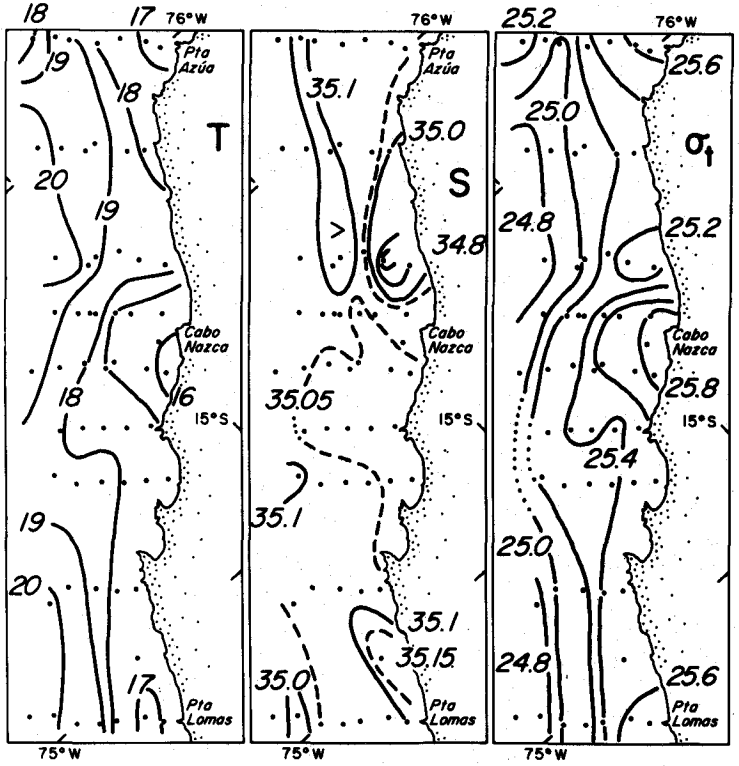

811
815
820
25.0
24.2
25.6
25.8
26.0
26.2
26.4
26.6
26.8
27.0
0
200
400
600
150
100
50
0
Sigma-T
Callao Line
17-18 May 1977
R/V Iselin
810
806
804
802
25.6
26.0
26.2
26.4
26.6
26.8
27.0
40
20
Sigma-T
C-Line
14-15 May 1978
R/V Iselin

MESOSCALE MAPS DURING MAM 77

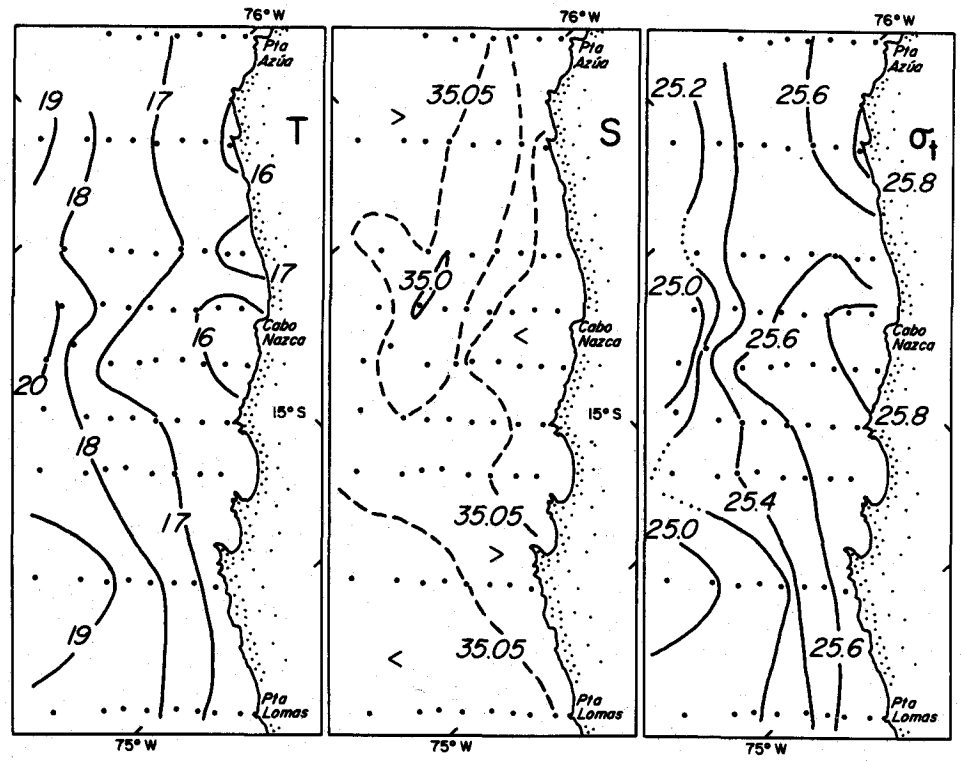


Depth contours in meters from R/V MELVILLE survey in March 1977. (Courtesy of J. J. O'Brien and R. H. Preller, Florida State University)

0m

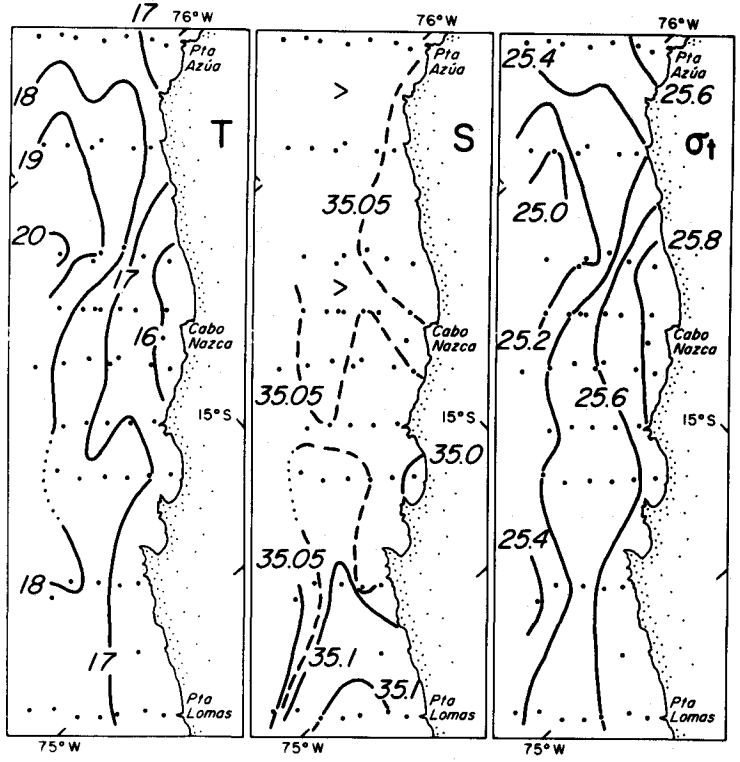


20-23 March 1977

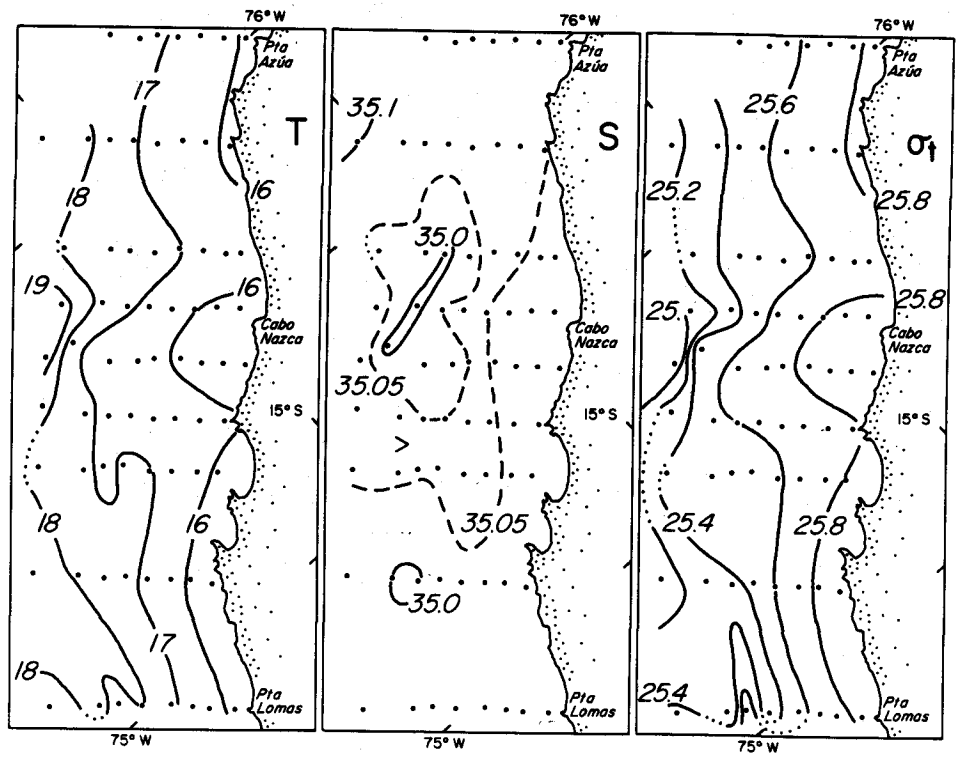


17-20 April 1977

10m

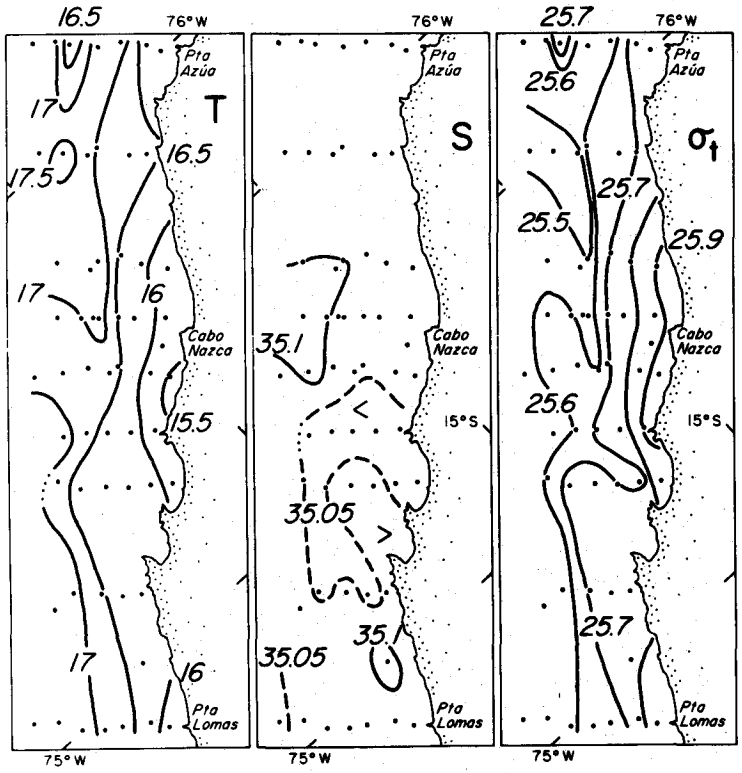


20-23 March 1977

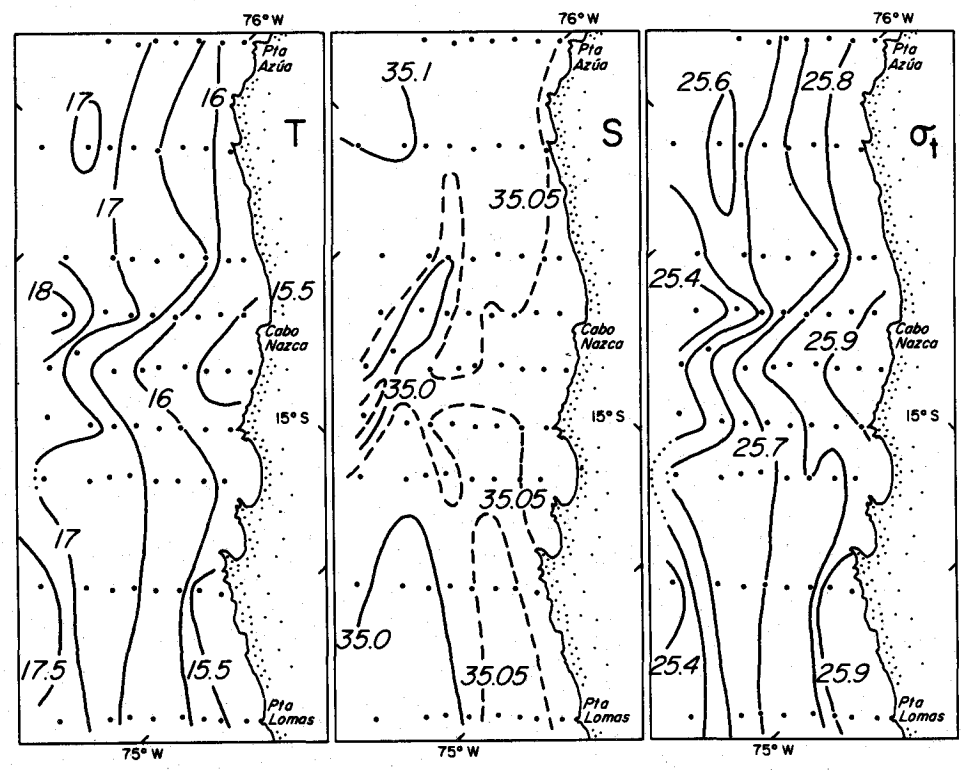


17-20 April 1977

20m

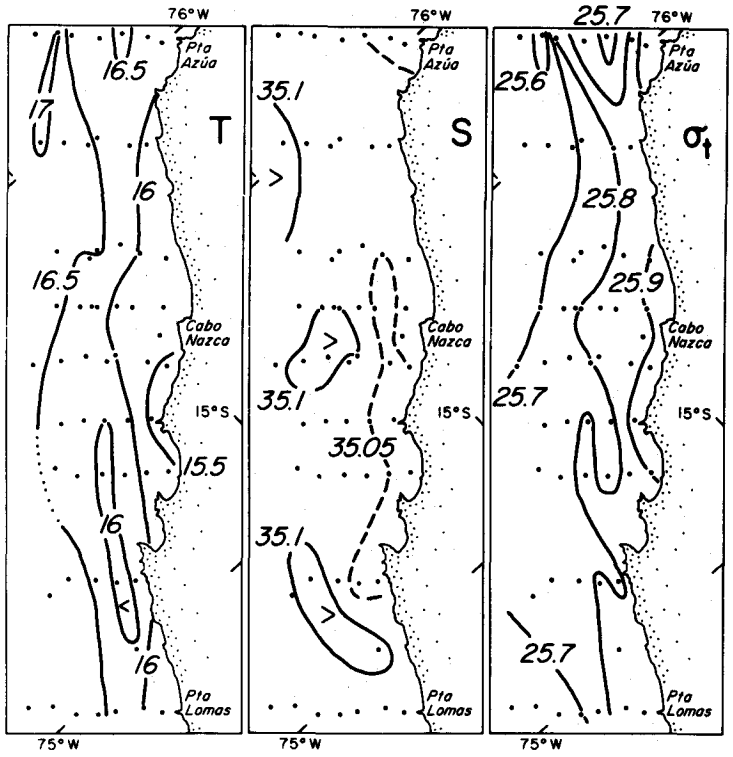


20-23 March 1977



17-20 April 1977

30m



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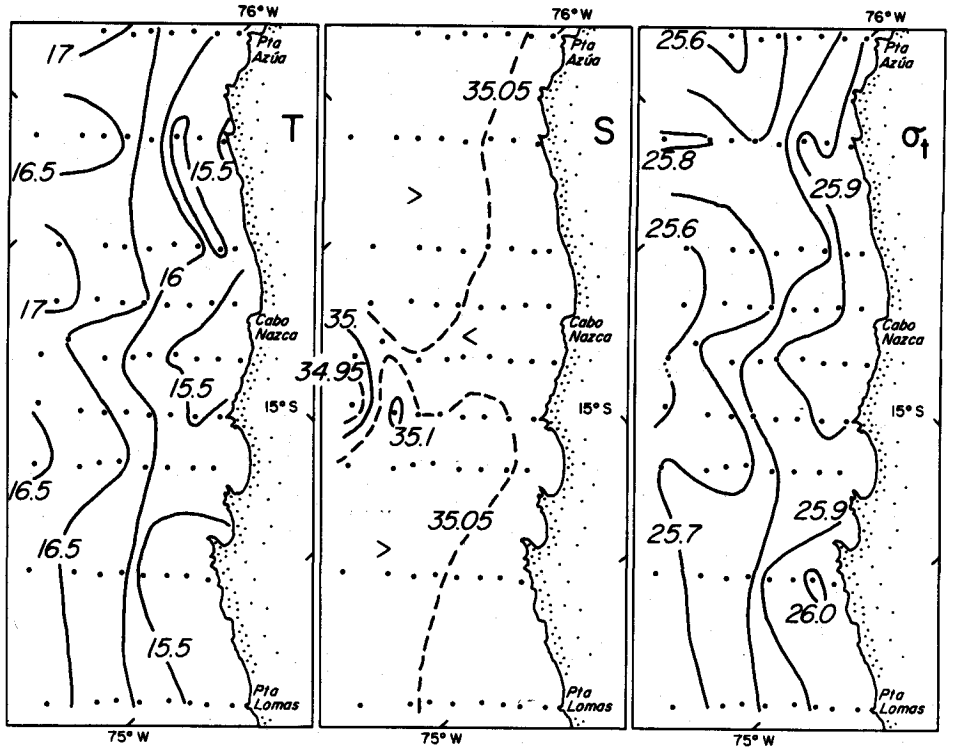
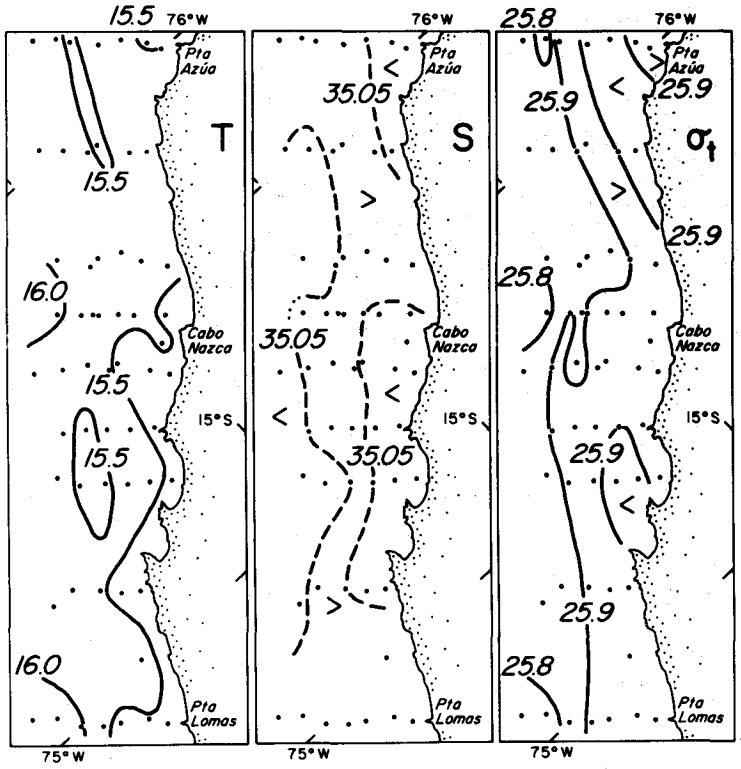


17-20 April 1977

50m



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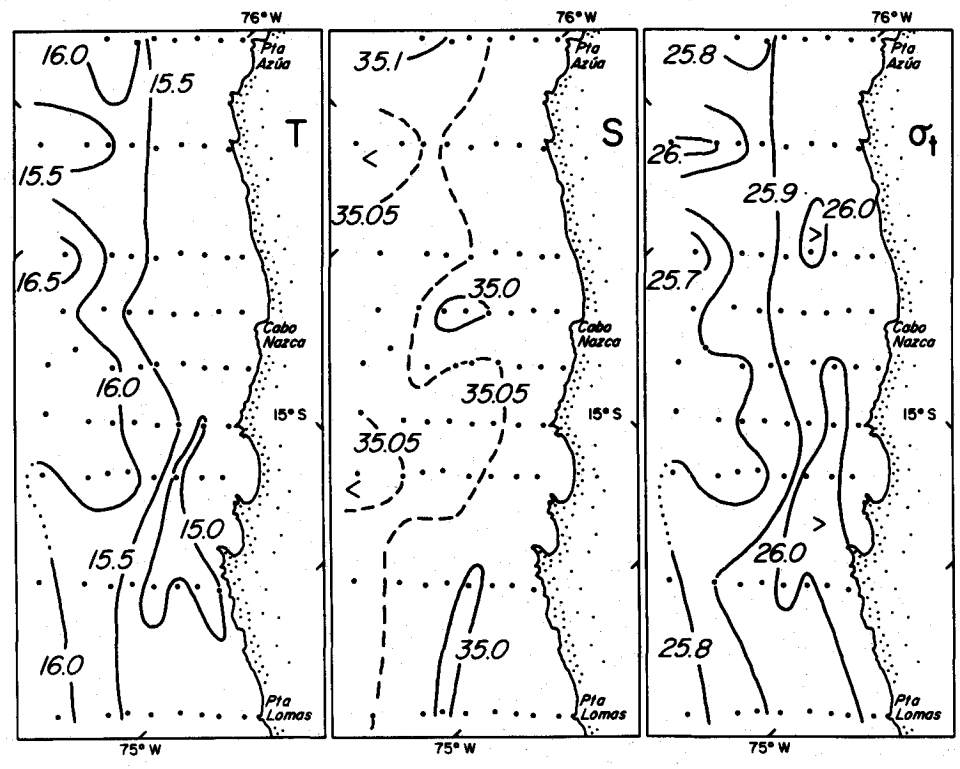
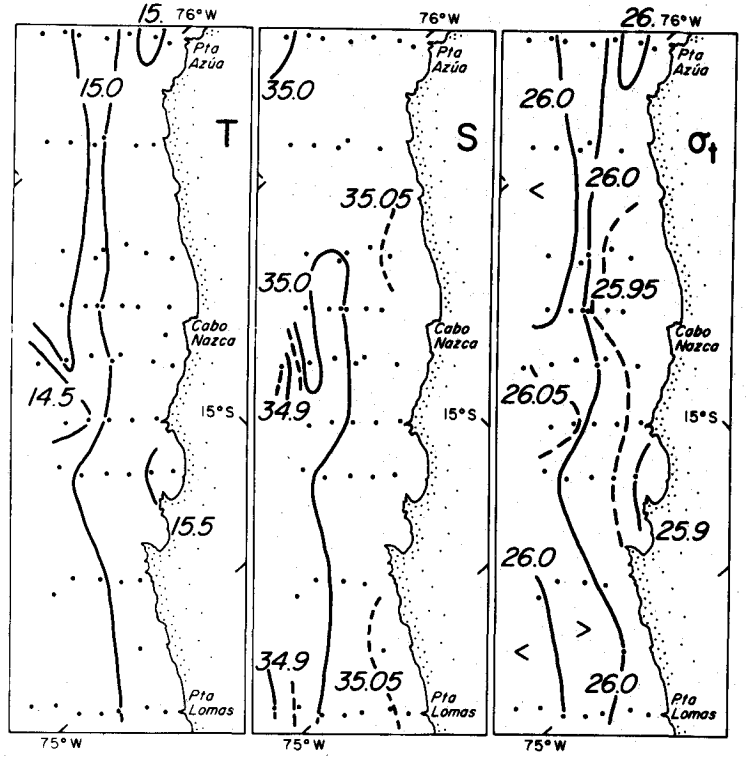


17-20 April 1977

75m



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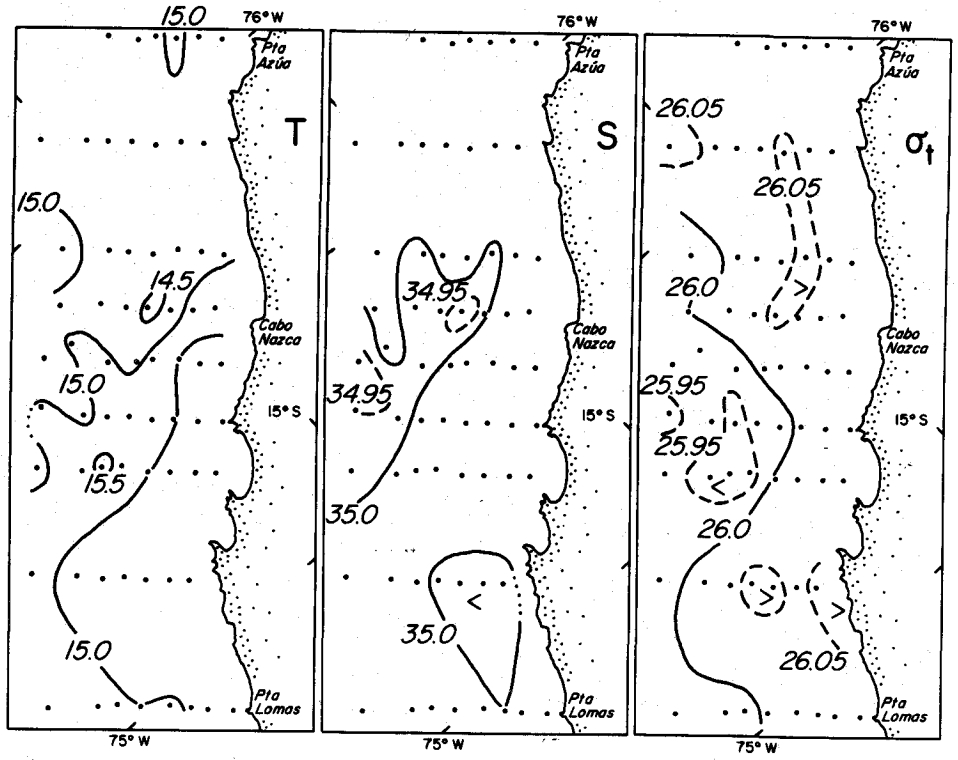
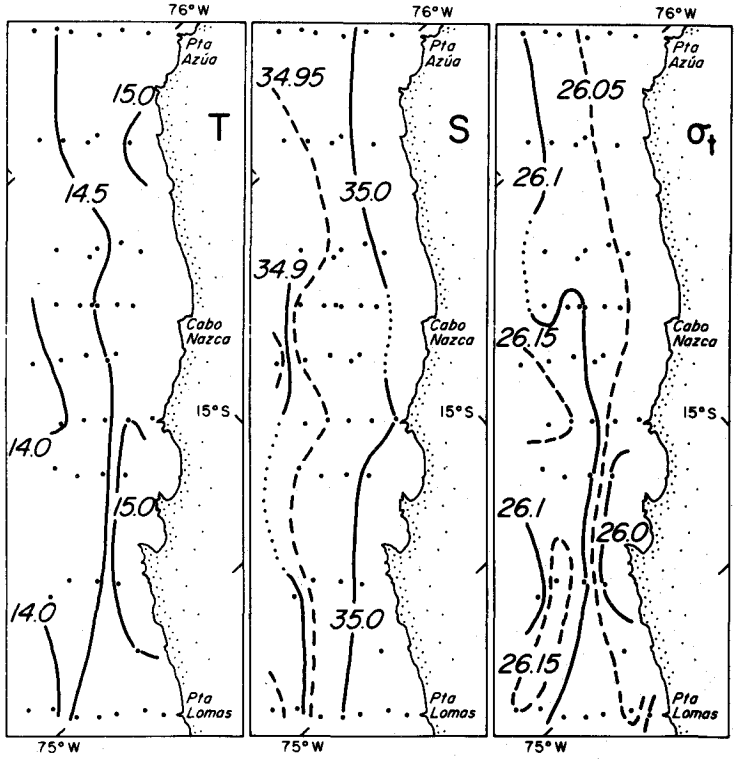
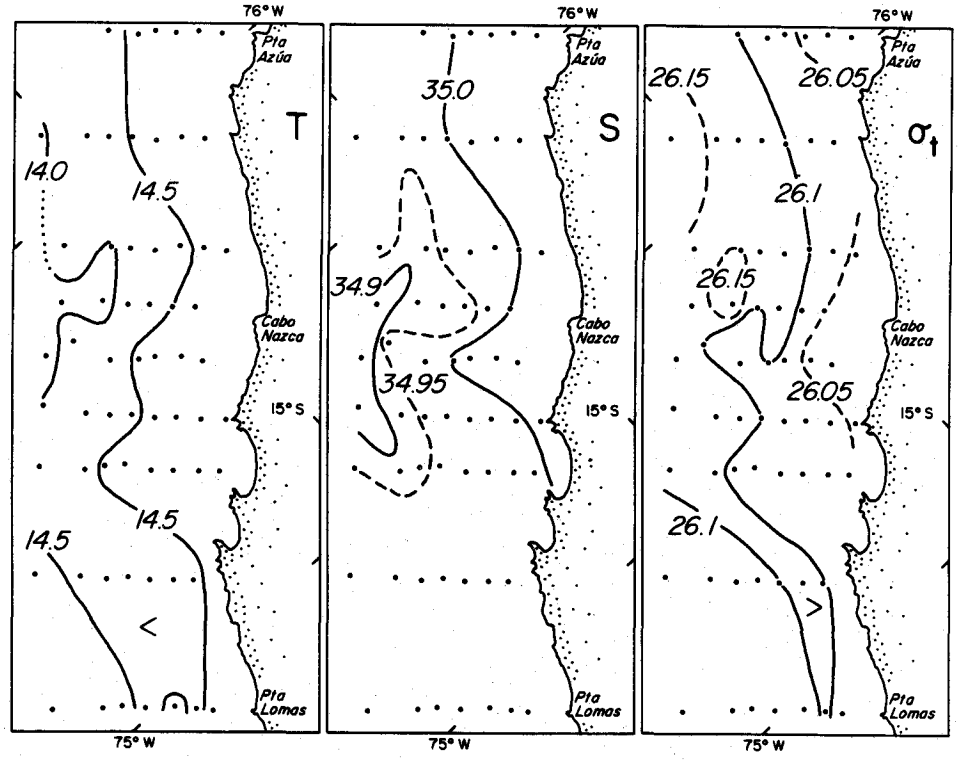


17-20 April 1977

100 m

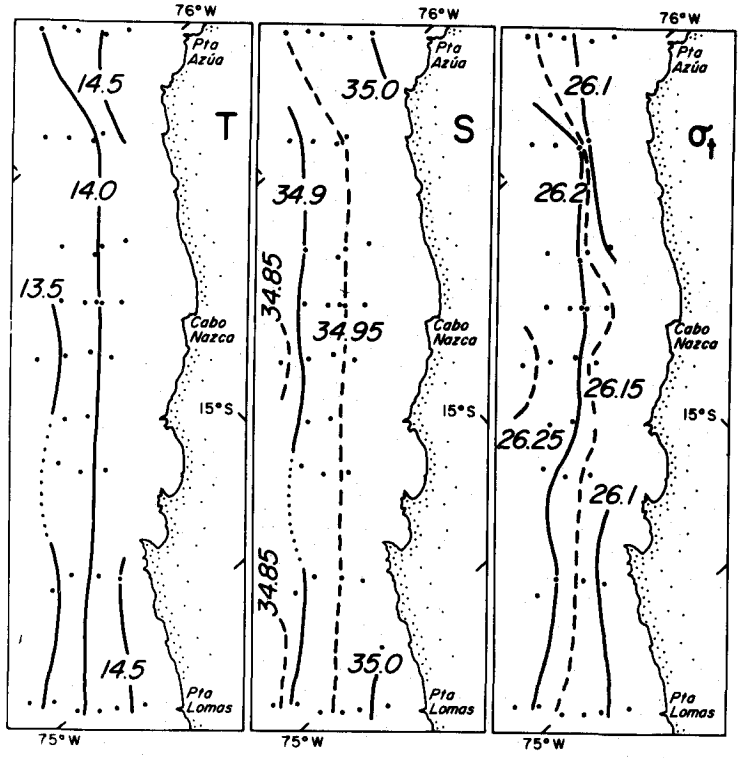


20-23 March 1977

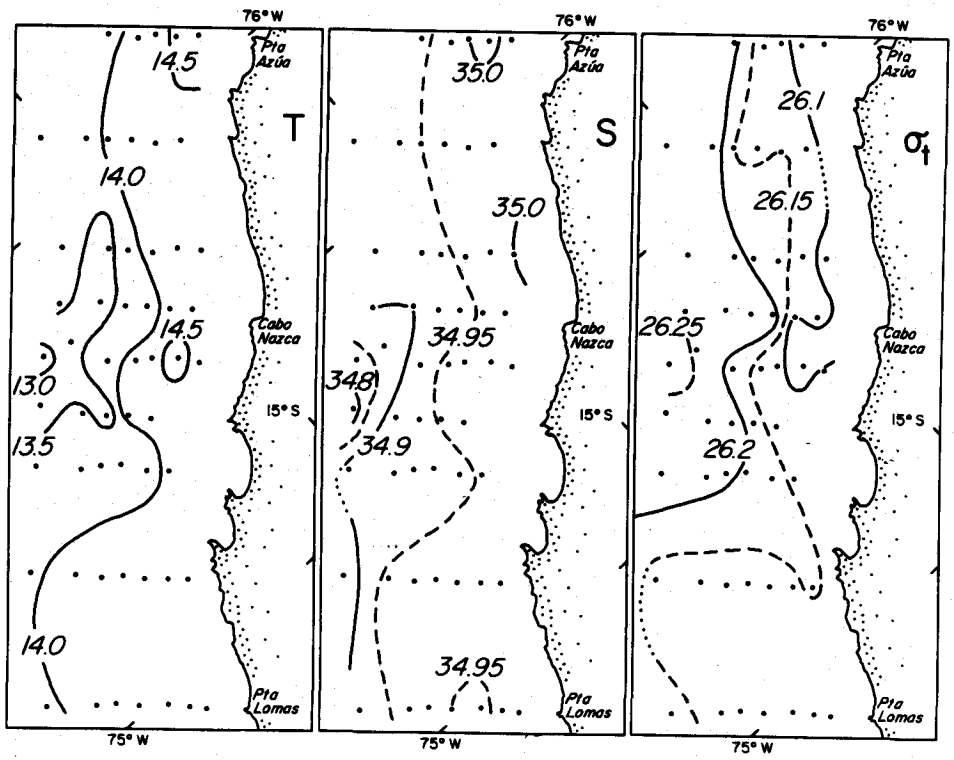


17-20 April 1977

125 m

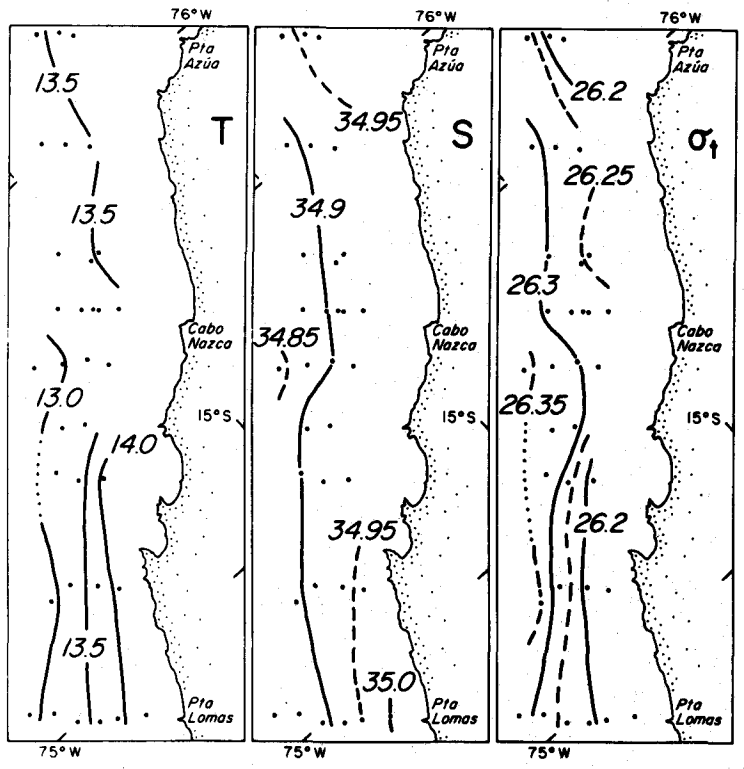


20-23 March 1977



17-20 April 1977

150 m



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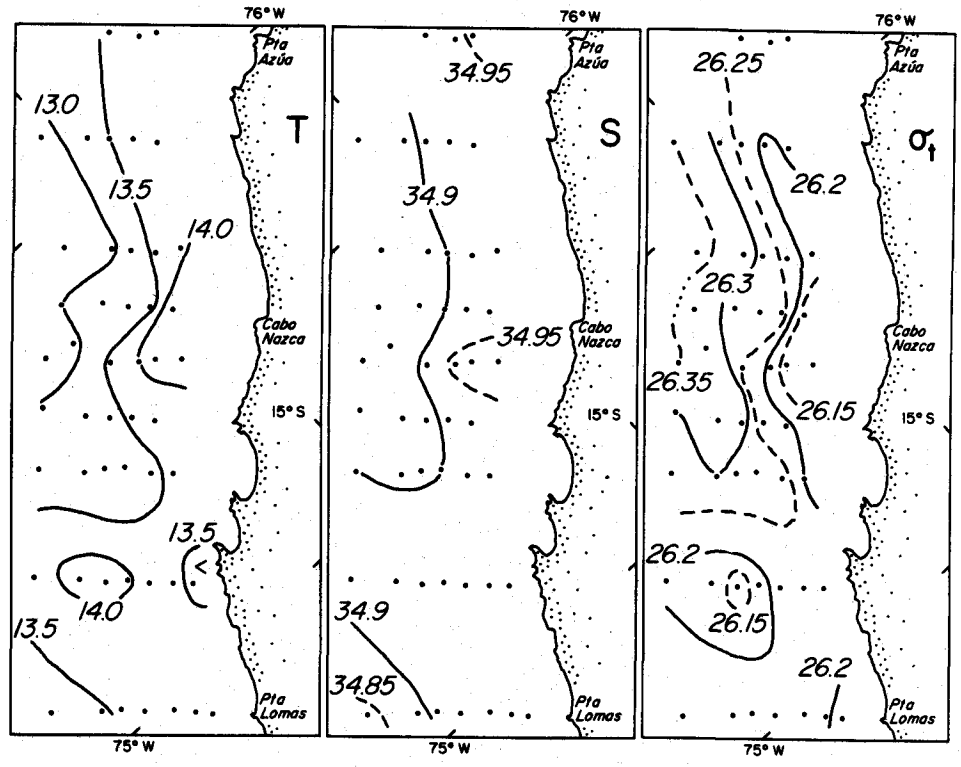
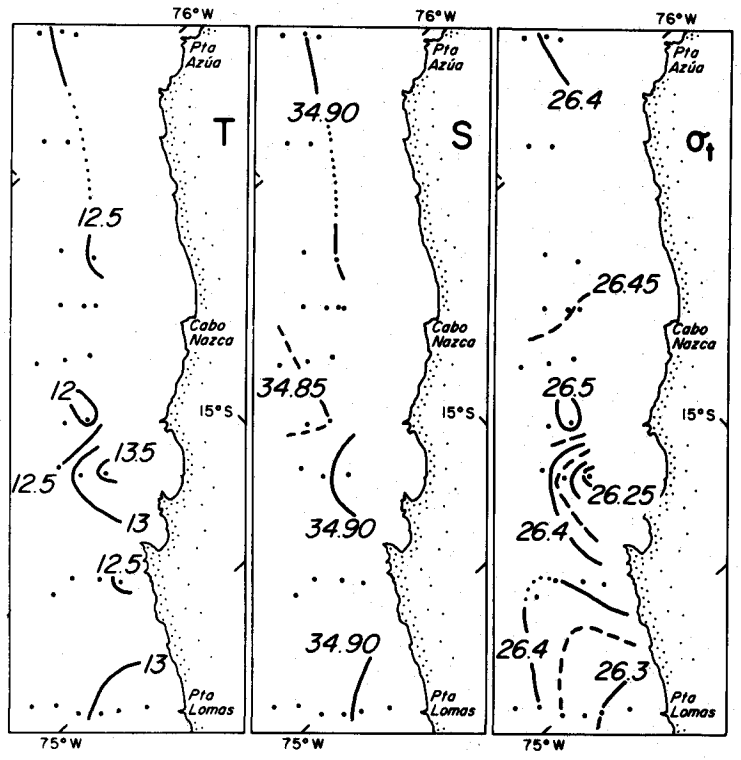
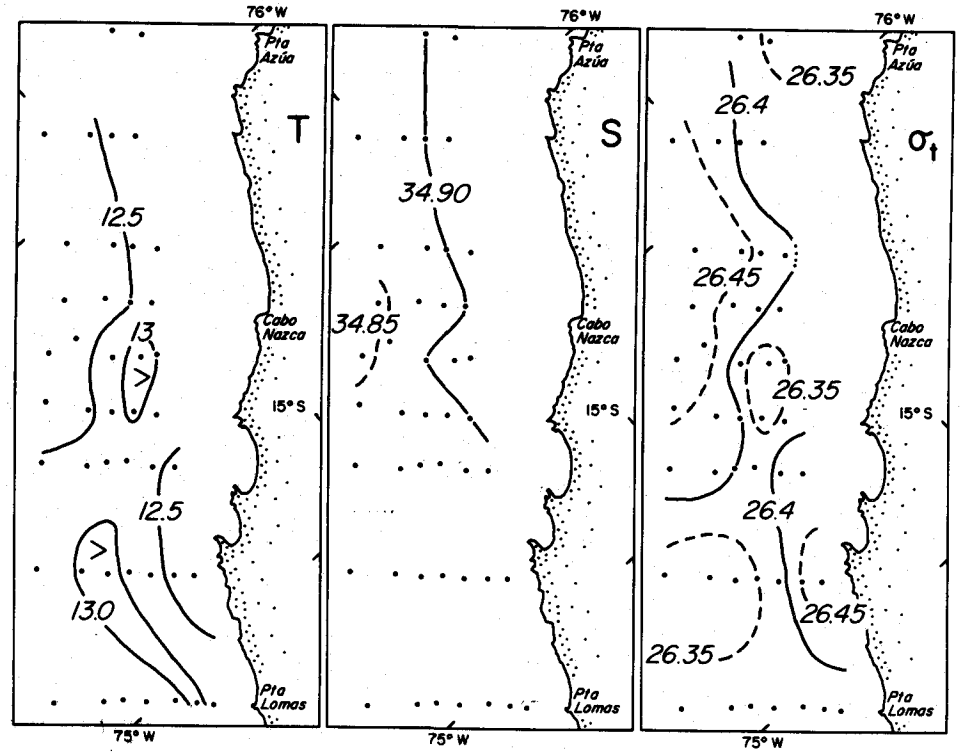


17-20 April 1977

200 m

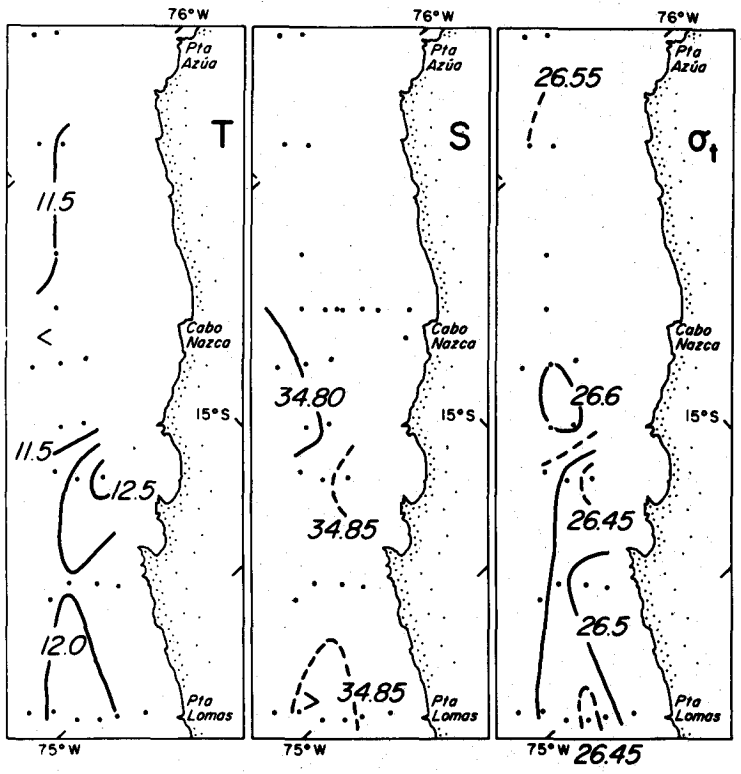


20-23 March 1977



17-20 April 1977

250 m



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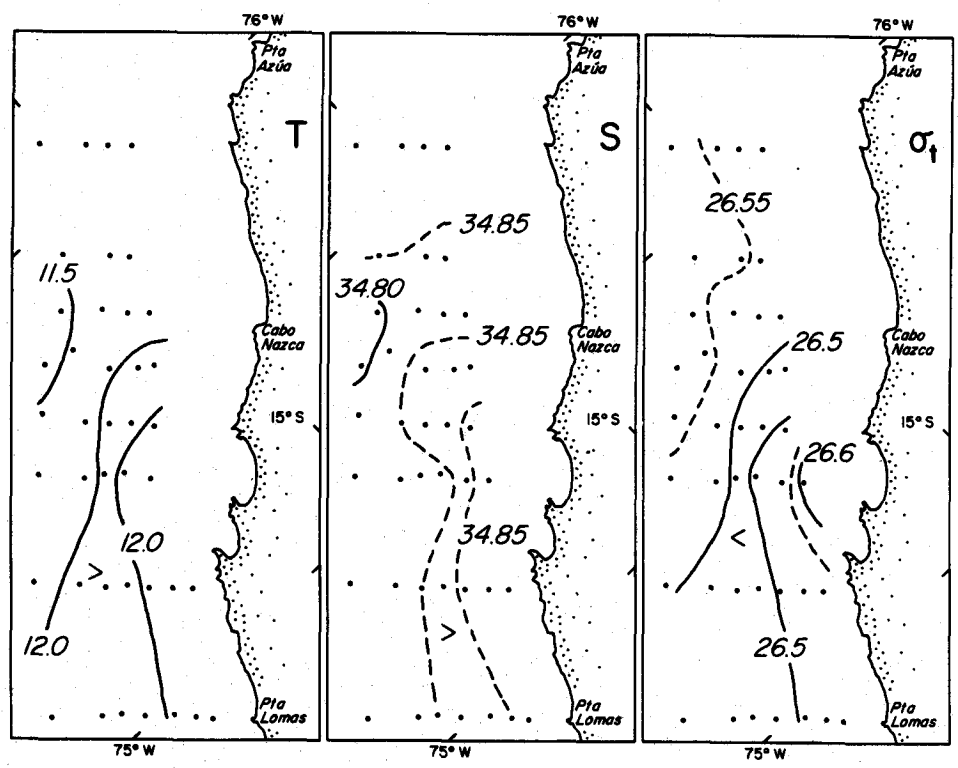
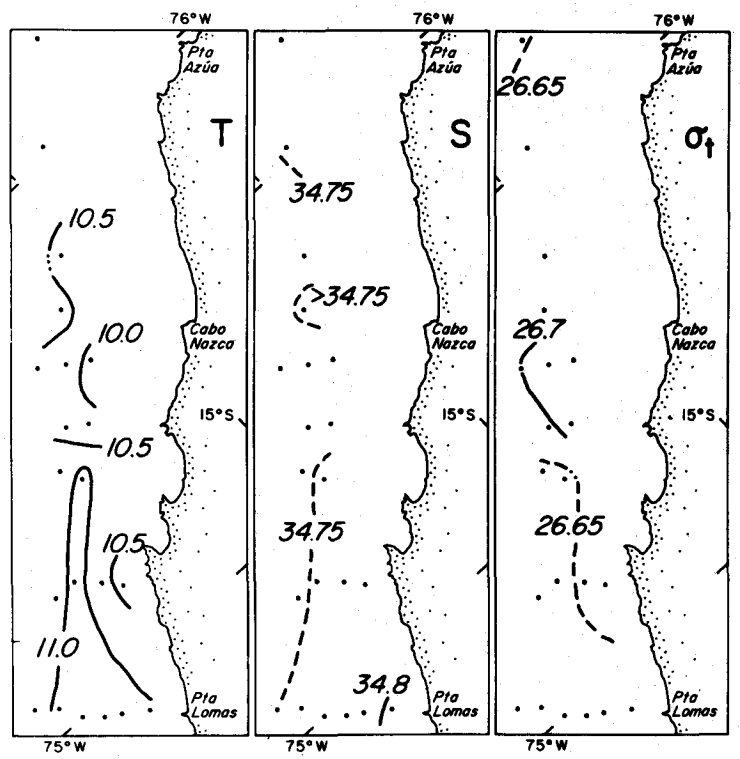


17-20 April 1977

300 m



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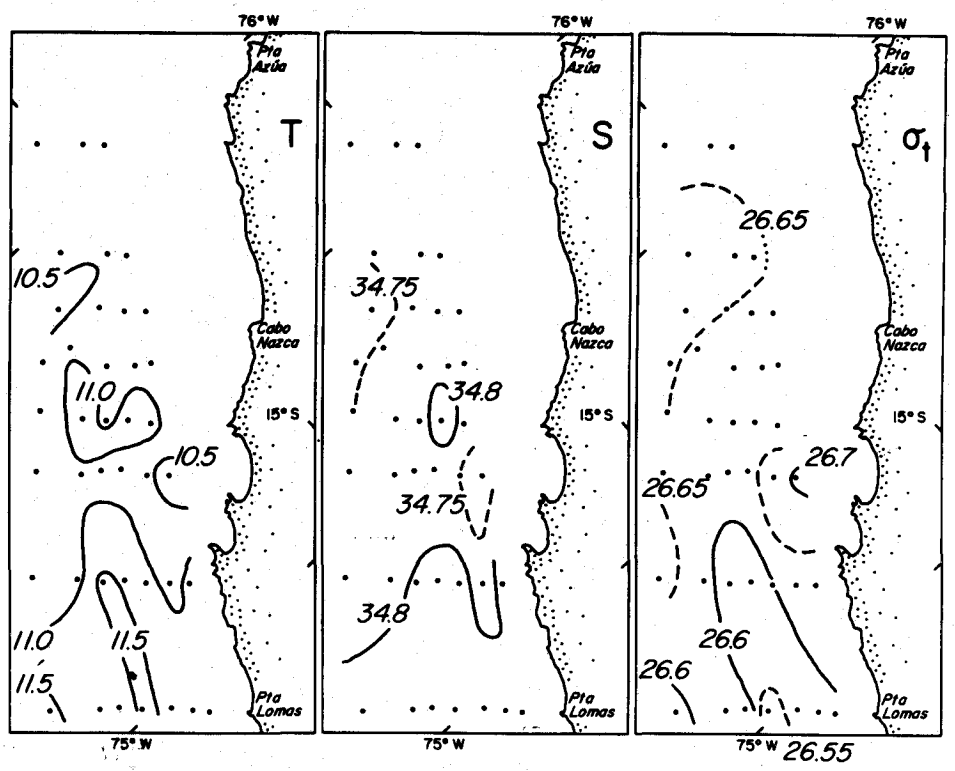

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