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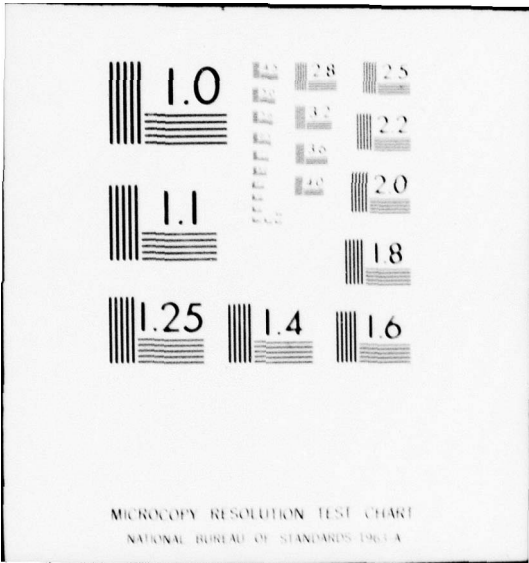
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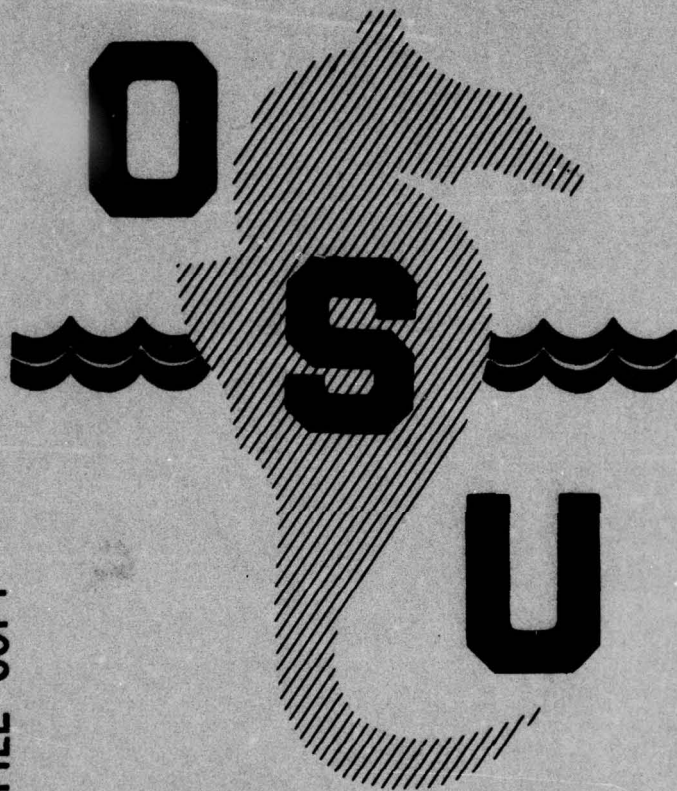
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Hydrographic and Chemical Data  
from the Eastern Tropical North  
Pacific Ocean—January 1977

by

Yuval Cohen  
Marvin D. Lilley  
Louie I. Gordon

Office of Naval Research  
Contract N00014-78-C-0067  
NR 063-102

Reference 78-5                      March 1978

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 78-5	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ⑥ HYDROGRAPHIC AND CHEMICAL DATA FROM THE EASTERN TROPICAL NORTH PACIFIC OCEAN - January 1977.		5. TYPE OF REPORT & PERIOD COVERED ⑥ Technical Repts January 1977
7. AUTHOR(s) ⑩ Yuval Cohen, Marvin D. Lilley, Louis I. Gordon		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS School of Oceanography Oregon State University Corvallis, OR 97331		8. CONTRACT OR GRANT NUMBER(s) ⑮ N00014-76-C-0067 ✓
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Ocean Science & Technology Division Arlington, VA 22217		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 083-102
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) ⑫ 28 PI		12. REPORT DATE ⑪ March 1978
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		13. NUMBER OF PAGES 25
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ⑭ REF-78-5		15. SECURITY CLASS. (of this report) Unclassified
18. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 1. Hydrographic data      6. Eastern Tropical North Pacific Ocean 2. Chemical data 3. Nitrous oxide 4. Nutrients 5. Denitrification		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents hydrographic and chemical data from the eastern tropical North Pacific Ocean collected in January 1977 aboard Oregon State University's (OSU) R/V WECOMA during Leg I of Cruise WELOC 77. The purpose of the cruise, WELOC-77-I, was to investigate the distributions of dissolved nitrous oxide and molecular hydrogen in an oceanic environment characterized by an extensive oxygen minimum layer which is thought to be the major denitrification site in the world ocean. Accordingly, the research effort		

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*CONF* → was concentrated on studying the distributions of variables at stations located around the core of the oxygen minimum.

Some of the data presented in this report have been discussed in the following publications: *ABSTRACT*

- Y. Cohen (1977) Shipboard measurement of dissolved nitrous oxide in sea-water by electron capture gas chromatography. Anal. Chem. 49(8): 1238-1420.
- Y. Cohen and L.I. Gordon (1978) Nitrous oxide in the oxygen minimum of the eastern tropical North Pacific: evidence for its consumption during denitrification and possible mechanisms for its production. Deep-Sea Res., In Press.

<sup>1</sup> The hydrogen data will be submitted in a later data report.

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OREGON STATE UNIVERSITY  
Corvallis, Oregon 97331

HYDROGRAPHIC AND CHEMICAL DATA FROM THE  
EASTERN TROPICAL NORTH PACIFIC OCEAN - JANUARY 1977

Yuval Cohen  
Marvin D. Lilley  
Louis I. Gordon

Office of Naval Research  
Contract N00014-76-C-0067  
Project NR 083-102

Reference 78-5  
March 1978

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Acting Dean

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CONTENTS

	<u>Page</u>
INTRODUCTION	1
METHODS	3
CRUISE PARTICIPANTS	4
ACKNOWLEDGMENTS	4
REFERENCES	5
DATA LISTING	7

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## INTRODUCTION

This report presents hydrographic and chemical data from the eastern tropical North Pacific Ocean collected in January 1977 aboard Oregon State University's (OSU) R/V WECOMA during Leg I of Cruise WELOC 77. The purpose of the cruise, WELOC-77-I, was to investigate the distributions of dissolved nitrous oxide and molecular hydrogen<sup>1</sup> in an oceanic environment characterized by an extensive oxygen minimum layer which is thought to be the major denitrification site in the world ocean (e.g. Codispoti and Richards, 1976; Cline and Kaplan, 1975). Accordingly, the research effort was concentrated on studying the distributions of variables at stations located around the core of the oxygen minimum.

Some of the data presented in this report have been discussed in the following publications:

- Y. Cohen (1977) Shipboard measurement of dissolved nitrous oxide in seawater by electron capture gas chromatography. *Anal. Chem.* 49(8): 1238-1240.
- Y. Cohen and L.I. Gordon (1978) Nitrous oxide in the oxygen minimum of the eastern tropical North Pacific: evidence for its consumption during denitrification and possible mechanisms for its production. *Deep-Sea Res.*, In Press.

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<sup>1</sup> The hydrogen data will be submitted in a later data report.



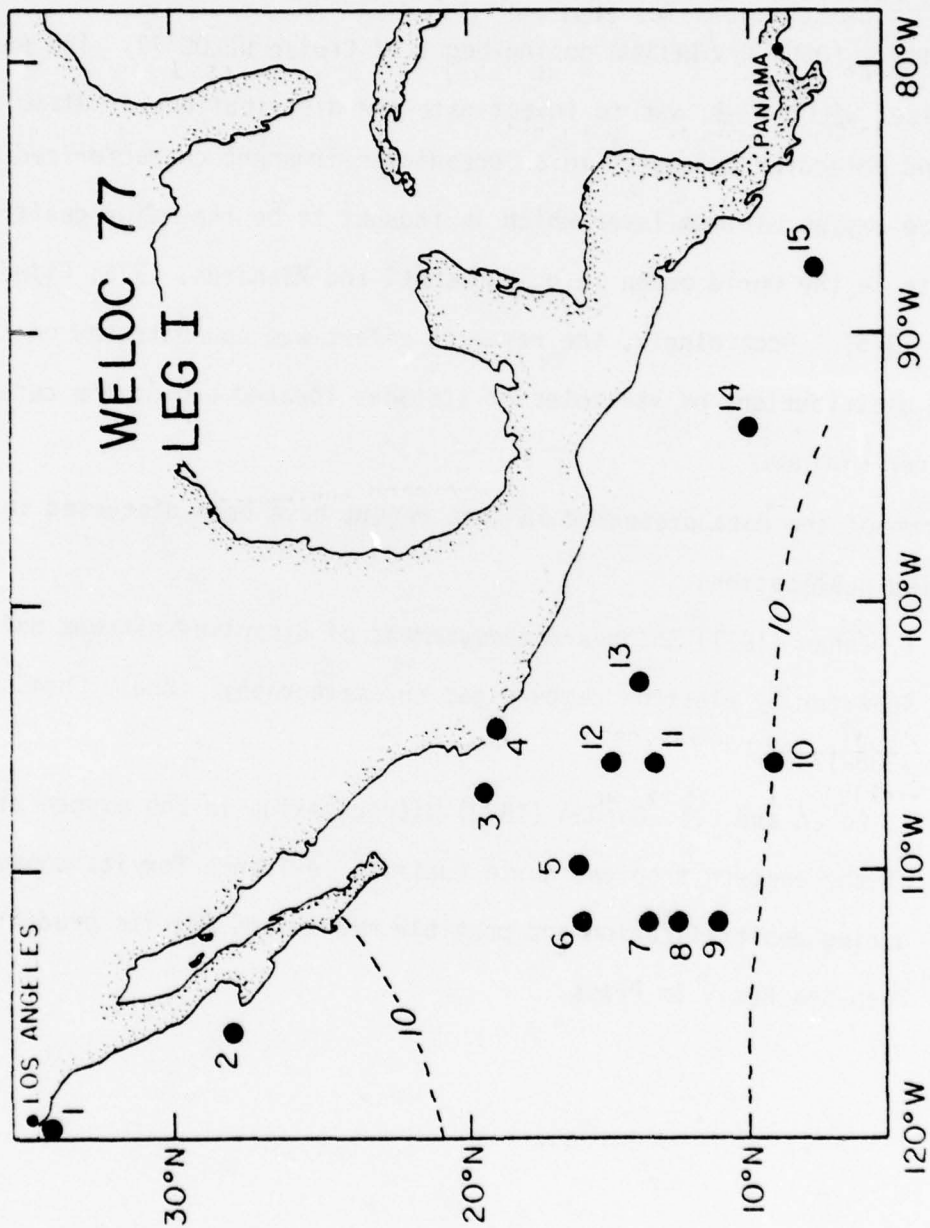


Figure 1. Station locations for Cruise WELOC-77-I. The dashed line delineates the region where intermediate waters contain less than 10  $\mu\text{mol O}_2 \text{l}^{-1}$  as determined by the Winkler procedure.

## METHODS

Sampling

Station locations for Cruise WELOC-77-I are shown in Figure 1. Samples were collected primarily in 5- and 30-liter PVC bottles designed and constructed at OSU (Mesecar, 1976) but at some stations one liter N10 bottles were used. All samples were processed onboard. Therefore, the sampling intervals at a given station were selected on the basis of the data collected at the near-by previously occupied stations.

Analytical Procedures

Temperature was measured with reversing thermometers calibrated at OSU.

Salinity was determined using a Guildline Autosol Model No. 8400 salinometer with an average precision of 0.01%. (All the reported precisions are one relative standard deviation of replicate sample measurements.)

Dissolved oxygen was determined using Carpenter's (1965) modification of the Winkler procedure with 0.3% precision at the deep water levels. The method is accurate to about 0.5% at normal oceanic oxygen levels but its accuracy might be quite poor at the low oxygen levels around the core of the eastern Pacific oxygen minimum (Broenkow and Cline, 1969).

Nutrients were measured with the OSU AutoAnalyzer II system (Gordon et al., 1975). Precisions and estimated accuracies at the deep water levels were 0.2% and 2%, respectively, for silicate, 0.4% and 2%, respectively, for phosphate, 0.5% and 2%, respectively, for nitrate and 0.5% and 5%, respectively, for nitrite.

Dissolved nitrous oxide was measured using electron capture gas chromatography (Cohen, 1977) with 2% precision and an estimated accuracy of 3%. The same method was used for measurements of nitrous oxide in air sam-

ples. The average atmospheric nitrous oxide content determined from 16 samples of marine air taken during the cruise was  $287 \pm 9$  ppbv (3.1%, one relative standard deviation). The atmospheric  $N_2O$  content showed no systematic variations with respect to geographic location along the cruise track.

#### CRUISE PARTICIPANTS

Marvin Lilley	OSU
Yuval Cohen	OSU
Wayne Dickinson	OSU
David Standley	OSU
James Mitchell	OSU
Gary Johnson	OSU
George O'Masta, Jr.	OSU
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Becky McClurken	Corvallis, Oregon
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Ernesto Reynoso	School of Marine Science, Ensenada, Baja California, Mexico
William VanRy	Seattle, Washington

#### ACKNOWLEDGMENTS

Cruise WELOC-77-I was funded by the Office of Naval Research through Contract N00014-76-C-0067 under Project NR 083-102. We greatly appreciate the assistance of the officers, crew and scientific party aboard R/V WECOMA.

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- Broenkow, W.W. and J.D. Cline (1969) Colorimetric determination of dissolved oxygen in low concentrations. Limnol. Oceanog., 14, 450-454.
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- Gordon, L.I., C.N. Dahm, W.H. Dickinson, P.K. Park, and D.R. Standley (1975) A precision oceanographic nutrient data system. In: Proc. UNOLS Working Conf. on Oceanographic Data Systems. Woods Hole Oceanographic Institution, Nov. 12-14, 38-56.
- Mesecar, R. (1976) A positive seal water bottle. Exposure, 4, 1-5.



## DATA LISTING

The following notations are used in the data listing:

Z	Depths in meters
T	Temperature in degrees Celcius
POT T	Potential temperature in degrees Celcius
S	Salinity in per mil
O2	Dissolved oxygen concentration in micro-moles per liter
SIL	Silicate concentration in micro-moles per liter
P04	Phosphate concentration in micr-moles per liter
NO3	Nitrate concentration in micro-moles per liter
NO2	Nitrite concentration in micro-moles per liter
N20	Dissolved nitrous oxide concentration in nanno-moles per liter

A summary of weather conditions during the cruise (Table 1) follows the Data Listing, page 25.

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STATION NUMBER	1	34	10.2N	120	13.5W										
Z	T	POT	S	SIGMA	O2	SIL	PO4	NO3	NO2	N2O					
(M)	(C)	(C)	(0/00)	THETA			(UM/L)			(NM/L)					
1	14.580	14.530	33.656	25.047	267	0	.43	.5	.04	2.52					
10	14.560	14.555	33.679	25.070	267	0	.43	.6	.05	3.36					
25	14.380				264										
49	12.690	12.693	33.666	25.443	205	8.1	1.05	9.5	.05						
74	11.820				190	11.8	1.29	14.2	.04						
98					176	14.7	1.49	17.2	.03						

Date: 1/12/77      Messenger Time: 1345      Bottom Depth: 256 m

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STATION NUMBER	Z	T	POT	S	SIGMA	OW	N20			
(M)	(C)	(C)	(0/00)	THETA	Q2	SIL	P04	N03	N02	(NM/L)
1	17.740	17.740	33.949	24.552	246	.4	.36	0	.02	7.29
10	17.730	17.728	33.947	24.553	246	.4	.36	.1	.02	7.27
20	17.640	17.637	33.954	24.590	247	.3	.36	.1	.01	
30	17.610	17.605	33.949	24.594	246	.6	.37	.1	.02	
50	17.430	17.421	33.939	24.621	246	.5	.37	.1	.02	7.54
75	14.380	14.369	33.525	24.994		1.5	.50	.7	.16	
100	12.550	12.636	33.634	25.427	206	7.6	1.04	9.8	.03	12.15
150	11.700	11.681	34.133	25.996	107	22.0	2.02	22.5	.02	
200	10.720	10.695	34.325	26.325	57	32.2	2.49	27.3	.03	
249	9.580				44					
289	9.230	9.197	34.377	26.619	40					
407	7.500	7.559	34.338	26.940		57.3	2.94	35.7	.02	
499			34.360			67.5	3.18	39.5	.02	
507	5.870				15					
708	5.290	5.230	34.409	27.202	11	91.7	3.40	43.5	.02	
776	4.810	4.746	34.442	27.294	13	100.7	3.36	44.5	.02	
984	4.130	4.053	34.484	27.393		114.1	3.37	45.8	.02	
1443	3.000	2.895	34.576	27.579	49					
1845	2.270	2.140	34.624	27.632	76	157.3	3.12	43.0	.02	

Date: 1/14/77 Messenger Time: 1653 Bottom Depth: 4718 m

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STATION NUMBER 3		19 46.04		107 F.84						
Z	Y	POT T	S	SIGMA	O2	SIL	PO4	NO3	NO2	N2O
(M)	(C)	(C)	(O/00)	THETA		----- (UM/L) -----				
1	25.160	25.160	34.360	22.631	209	.2	.74	0	.01	6.62
50	23.610	23.395	34.510	23.458	10	2.8	.79	5.8	.23	15.49
99	14.400	14.305	34.653	25.890	16	24.0	2.58	27.9	.04	21.49
149	12.840	12.819	34.806	26.238	5	23.9	2.72	27.4	.72	12.66
198	12.040	12.014	34.817	26.464	2	33.0	2.73	28.5	.02	14.96
265	11.300	11.266	34.761	26.561	3	37.1	2.83	27.9	.03	13.67
298	10.740	10.703	34.725	26.635	4	39.3	2.89	26.4	1.03	10.15
357	10.110	10.067	34.674	26.706	5	45.5	3.00	27.2	.36	
394	9.390	9.345	34.655	26.820	2	51.3	3.06	29.0	.21	10.52
448	8.760	8.710	34.602	26.873		57.1	3.17	30.8	.14	
504	8.160	8.106	34.571	26.942	7	61.7	3.20	33.0	.04	19.58
566	7.500	7.442	34.532	27.025	5	68.9	3.24	35.5	.02	18.43
609	7.020	6.960	34.540	27.084	3	74.0	3.33	37.5	.03	20.66
794	5.440	5.371	34.528	27.240	6	93.2	3.48	44.2	.02	25.03
1001	4.490	4.408	34.551	27.408		110.8	3.55	46.2	.02	
1418	3.810	3.698	34.576	27.502	26	125.7	3.47	46.2	.03	

Date: 1/16/77 Messenger Time: 2016 Bottom Depth: 3438 m



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STATION NUMBER		4	19	1.2N	104	22.2W				
Z	T	POT	T	S	SIGMA	02	SIL	POL	N03	N02
(M)	(C)	(C)	(C)	(0/00)	THETA	----- (UM/L) -----				
1	26.830	26.830	34.129	34.129	22.139		.1	.30	0	.03
10	26.830	26.924	34.180	34.180	22.174	210	.1	.30	0	.03
30	25.970	25.963	34.175	34.175	22.445	182	1.7	.55	3.1	.13
60	19.830	19.819	34.560	34.560	24.494	54	12.9	1.93	22.9	.08
80	16.930	16.917	34.694	34.694	25.314	22	19.0	2.33	27.7	.09

Date: 1/17/77

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Bottom Depth: 106 m

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STATION NUMBER	5	16	1.0M	110	1.0M	----- (UM/L) -----				N20	
(M)	(C)	(C)	(C/00)	SIGMA	THETA	C2	SIL	P04	N03	N02	(NM/L)
1	25.950	25.950	33.047	21.601	207	0	0	.26	.1	.04	6.01
10	26.200				210	0	0	.26	.1	.01	
25	26.290	26.264	33.944	22.171	204						6.25
50	26.120	26.108	34.374	22.550	206						7.39
60	25.640					0	0	.41	.5	.16	
75	23.250	23.234	34.414	23.444	170	1.3	1.3	.78	5.1	.66	16.20
100	16.430	16.414	34.462	25.258	63	13.9	13.9	1.97	22.4	.05	32.21
149	13.160	13.139	34.716	26.164	6	27.1	27.1	2.65	29.0	.03	29.07
199	11.890	11.864	34.743	26.435	4	31.7	31.7	2.71	27.6	1.93	13.39
258	11.040	11.007	34.709	26.567	3	35.3	35.3	2.76	29.6	.91	15.20
301	10.310	10.273	34.672	26.669	3	40.0	40.0	2.84	26.9	2.04	5.42
347	9.100	9.056	34.592	26.810	2	47.2	47.2	2.97	34.7	.02	21.64
506	7.730	7.678	34.545	26.945	4	60.0	60.0	3.15	33.5	.02	27.54
569	7.260	7.203	34.543	27.052	9	66.8	66.8	3.22	39.5	.02	25.17
598	7.040	6.981	34.540	27.081	3	72.2	72.2	3.30	40.3	.02	23.91
913	5.450	5.379	34.543	27.291	5	91.9	91.9	3.44	46.1	.03	30.08
1002	4.570	4.488	34.552	27.400	13	107.4	107.4	3.48	47.7	.03	29.87
1340	3.850	3.744	34.569	27.492	29	122.9	122.9	3.41	47.3	.03	26.39

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STATION NUMBER		6		15		29.5N		112		0M			
Z	T	POT	T	S	SIGMA	O2	SIL	PC4	N03	N02	N20	(NM/L)	
(M)	(C)	(C)	(C)	(C/00)	THETA			(UM/L)					
1	26.420	26.420	33.315	21.658	211	0	.25	0	.01	5.97			
25	26.530	26.524	33.705	21.916	211	0	.25	0	.01	5.68			
50	26.610	26.592	33.738	21.963	209	0	.25	0	.02	5.86			
75	26.110	26.092	34.298	22.498	206	.2	.33	.5	.17	3.10			
100	19.830	19.811	34.506	24.455	36	9.6	1.67	18.6	.10	28.57			
125	15.940	15.920	34.634	25.504	26	19.0	2.35	26.3	.06	37.52			
150	13.610	13.588	34.779	26.121	15	25.8	2.62	26.0	1.60	7.60			
175	12.510	12.486	34.810	26.367	6	28.4	2.62	26.3	3.61	5.74			
198	12.120	12.093	34.795	26.431	3	29.6	2.64	27.3	3.24	5.25			
227	11.730	11.700	34.762	26.496	5	30.9	2.65	28.0	2.73	5.86			
248	11.520	11.498	34.769	26.526	4	31.6	2.66	28.5	2.60	6.24			
342	10.400	10.356	34.719	26.691	2	34.5	2.75	29.5	1.79	11.19			
405	9.520	9.473	34.650	26.738	3	44.3	2.96	29.5	.79	5.31			
514	8.160	8.105	34.598	26.963	4	56.5	3.19	32.1	.60	3.21			
605	7.180	7.120	34.561	27.078	1	66.1	3.28	38.1	.02	18.45			
796	5.650	5.579	34.532	27.257	6	84.6	3.41	44.8	.02	30.35			
999	4.700	4.617	34.553	27.387	1	99.8	3.42	47.3	.02	28.66			
1808	2.100	1.976	34.644	27.711	90	150.9	2.99	42.5	.02	18.66			
2744	1.760	1.559	34.674	27.766	113	150.9	2.98	42.3	.02				

Bottom Depth: 3100 m

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Date: 1/19/77

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STATION NUMBER	7	14	ON	C2	SIL	P04	N03	N02	N20
(M)	(C)	(0/00)	SIGMA	(UM/L)	(UM/L)	(UM/L)	(UM/L)	(UM/L)	(NM/L)
0	26.820	33.091	21.362	209	0	.24	0	.02	6.91
25		33.094		209	0	.22	0	.02	
50	26.280	33.428	21.732	190	.1	.42	2.4	.23	10.79
75	17.970	34.596	24.993	37	15.3	2.22	27.2	.10	36.67
100	14.340	34.761	25.953	3	23.6	2.58	29.5	.06	42.37
123	13.120	34.824	26.255	7	25.8	2.56	32.0	.06	33.33
150		34.916		2	28.0	2.53	32.6	.20	30.12
175	11.280	34.797	26.473	6	30.1	2.57	32.2	.30	
221	11.450	34.731	26.547	2	32.3	2.63	31.1	.85	21.33
254	10.860	34.733	26.618	3	36.1	2.79	27.6	2.34	9.20
300	10.210	34.676	26.639	12	39.7	2.84	29.8	1.44	12.53
393	9.760	34.600	26.957	3	52.8	3.07	33.8	.03	21.82
504	7.830	34.546	26.971	9	59.5	3.19	37.0	.02	25.42
511	6.780	34.539	27.115	3	71.4	3.33	40.6	.07	
900		34.552		6	89.0	3.48	45.8	.03	
1002	4.470	34.563	27.420	17	107.3	3.49	47.2	.02	
1501	3.070	34.511	27.601	57	139.4	3.26	45.3	.02	
1997	2.220	34.550	27.707	96	158.9	3.01	42.2	.02	
2514	1.860	34.681	27.763	111	166.4	2.90	40.7	.02	

Messenger Time: 1446

Date: 1/20/77



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STATION NUMBER		8	12	31.7N	111 51.3W						
Z	T	POT	S	SIGMA	02	SIL	P04	N03	N02	N20	
(M)	(C)	(C)	(0/00)	THETA	----- (UM/L) -----						(NM/L)
0	27.220	27.220	34.525	22.312	214	0	.25	.1	.02	6.13	
24			34.529		203	0	.24	.1	.03	6.10	
49	24.540	24.525	34.801	23.355	154					17.32	
73	17.200	17.188	34.911	25.420	32	15.8	2.28	26.5	.29	34.83	
97	14.260	14.246	34.938	26.106	3	24.6	2.63	29.4	.05	39.21	
122	12.990	12.973	34.952	26.390	6	27.1	2.63	31.6	.03	34.51	
146			34.953		5	26.7	2.57	34.2	.04	37.35	
171	11.810	11.787	34.949	26.609	10	28.6	2.39	33.5	.04		
195	11.390	11.365	34.944	26.684	9	29.7	2.58	34.7	.03	32.85	
219			34.940		9	31.1	2.62	34.3	.03	27.74	
249	10.920	10.889	34.939	26.768	11	31.3	2.57	35.7	.03	30.09	
292	10.510	10.474	34.937	26.837	15	33.7	2.66	35.6	.03	27.29	
379	9.450	9.406	34.916	27.006	2	43.4	2.92	35.0	.12	26.73	
506	8.260	8.206	34.903	27.187	3	57.2	3.09	37.2	.02	28.19	
596	7.260	7.200	34.893	27.327	3	64.7	3.25	39.6	.03	25.12	
780			34.892		6	82.2	3.39	46.2	.03	28.47	
987	4.770	4.637	34.892	27.643	20	98.4	3.39	47.2	.03	24.22	
1490	3.220	3.107	34.903	27.820	60	131.5	3.21	45.0	.02	21.29	
199A	2.310										
2494	1.850	1.670	34.920	27.955	112	162.2	2.88	41.0	.03	16.45	

Bottom Depth: 3290 m

Messenger Time: 1320

Date: 1/21/77

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDQ

STATION NUMBER		9	10	45.1N	111	52.3W				
7	Y	POT T	5	SIGMA	02	SIL	P04	N03	N02	N20
(M)	(C)	(C)	(G/00)	THETA			(UM/L)			(NM/L)
0	27.210	27.210	33.142	21.276	204	0	.19	.1	0	6.34
25			33.141		205	0	.19	.1	0	
50	24.910	24.999	33.971	22.617	155	2.7	.93	9.1	1.05	15.84
75	17.020	17.007	33.688	24.527	21	17.6	2.41	29.8	.19	
100	14.300	14.285	34.795	25.987	4	23.2	2.57	32.4	.03	+1.52
125			34.823		6	26.8	2.53	34.0	.02	
149	12.290	12.260	34.519	26.413	7	27.5	2.57	34.8	.03	35.98
174	12.060	12.017	34.811	26.458	10	27.9	2.52	34.8	.03	
198			34.791		9	29.9	2.55	35.0	.02	33.91
233	11.600	11.370	34.774	26.551		31.3	2.38	33.8	.05	
248	10.940	10.809	34.705	26.649	14	31.8	2.56	35.0	.02	30.77
310	10.580	10.542	34.738	26.673	17	34.1	2.63	35.6	.02	32.48
393	9.550	9.504	34.675	26.802	6	43.6	2.90	35.6	.02	29.59
497	8.380	8.328	34.619	26.943	4	52.8	3.11	36.2	.16	28.32
616	6.270	6.870	34.574	27.123		67.7	3.32	41.5	.02	29.15
794			34.563		11	85.4	3.43	47.3	.02	29.54
1008	4.600	4.517	34.568	27.410	33	101.8	3.41	47.1	.02	25.95
1496	3.170	3.054	34.604	27.559	61	132.8	3.21	44.9	.01	21.54
2014	2.230	2.066	34.658	27.713	95	155.4	3.01	42.9	.02	19.50
2505	1.850	1.669	34.677	27.761	114	163.9	2.89	41.0	.01	16.10

Bottom Depth: 3750 m

Messenger Time: 1316

Date: 1/22/77

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

STATION NUMBER	10	8	42.5M	105	56.2M	----- (UM/L) -----				
(M)	(C)	(C)	(C)	(C)	(C)	SIL	PO4	NO3	NO2	NO2
			SIGMA	Q2						(UM/L)
0	27.000	27.000	33.170	21.370	209	.4	.25	0	.00	6.87
50	20.570	20.560	34.465	24.226	87	8.8	1.71	20.2	.02	25.71
100	13.160	13.146	34.830	26.251	6	24.5	2.54	33.0	.03	36.92
150	11.960	11.960	34.907	26.466	22	20.2	2.53	34.4	.02	
198	11.330	11.305	34.775	26.564	14	28.2	2.49	34.0	.03	32.98
266	10.770	10.737	34.766	26.660	30	30.5	2.41	34.0	.28	
296	10.180	10.144	34.717	26.726	11	35.0	2.71	35.6	.04	29.05
348	9.500	9.560	34.679	26.796	13	41.7	2.93	33.8	.03	27.15
397	8.790	8.746	34.639	26.896	3	48.9	3.17	34.6	.08	27.05
445			34.623		2	54.0	3.16	36.3	.02	27.21
490	7.730	7.670	34.602	27.030		55.4	3.24	35.0	.02	29.12
545			34.591		3	65.6	3.32	40.5	.03	26.14
605	6.730	6.672	34.574	27.150	3	69.1	3.35	42.2	.03	30.44
666	6.240	6.213	34.575	27.211	14	73.7	3.38	43.8	.03	
695	5.930	5.967	34.566	27.249	7	78.2	3.41	45.8	.02	30.59
704	5.420	5.351	34.576	27.322	14	84.9	3.42	46.5	.02	27.90
1001	4.390	4.309	34.579	27.441	33	103.8	3.40	46.3	.03	27.02

Date: 1/24/77

Messenger Time: 0903

Bottom Depth: 3199 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDC

STATION NUMBER 11		13 56.0M		105 59.5M						
Z	T	FOY	S	SIGMA	O2	SIL	PO4	NO3	NO2	N2O
(M)	(C)	(C)	(C/00)	THETA						(NM/L)
0	27.270	27.270	33.245	21.364		.2	.23	0	0	6.19
50	27.030	27.019	33.299	21.455	209	0	.24	0	0	6.44
75	22.730	22.714	34.364	23.555	125	17.2	1.20	12.1	.55	
100	16.770	16.753	34.694	25.357	16	17.2	2.44	30.0	.08	38.72
125	13.970	13.952	34.770	26.030	13	23.3	2.59	30.6	.12	
150			34.817		4	25.5	2.61	32.8	.03	35.77
200	12.000	11.973	34.801	26.459	2	28.8	2.65	32.6	.21	27.41
260	11.370	11.336	34.771	26.555	3	30.9	2.67	33.4	.03	26.67
307	10.590	10.652	34.753	26.665	4	34.6	2.78	30.6	2.21	
400			34.650		3	43.1	2.97	32.6	.71	13.01
515	8.170	8.115	34.622	26.991	11					16.91
600	6.990	6.931	34.566	27.108	4	69.0	3.34	38.8	.02	19.41
801	5.560	5.588	34.564	27.292	5	86.2	3.48	44.8	.02	30.42
1018	4.570	4.486	34.568	27.413	13	104.5	3.54	44.7	.02	
1504	2.960	2.879	34.624	27.618	56	134.4	3.28	45.2	.04	
2007	2.170	2.028	34.650	27.711	93	154.7	3.00	42.4	.03	
2518	1.320	1.639	34.671	27.758	114	161.2	2.90	40.9	.03	

Date: 1/25/77  
 Messenger Time: 1930  
 Bottom Depth: 4060 m



THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

STATION NUMBER		12	15	7.0M	100 50.0M							
Z	T	POT T	S	SIGMA	O2	SIL	PO4	NO3	PO2	N2O		
(M)	(C)	(C)	(C/100)	THETA		(UM/L)	(UM/L)	(UM/L)	(UM/L)	(NM/L)		
0	27.220	27.280	33.458	21.490	203	.3	.27	.3	0	5.30		
25	27.060	27.054	33.441	21.550	211	.1	.24	.3	.02			
50	27.070	27.019	33.948	21.479	209	.1	.24	.3	.02	5.49		
75	26.440	26.422	34.224	22.339	204	.3	.30	.3	.02	7.31		
100	17.660	17.843	34.507	25.022	40	14.3	2.14	25.9	.03	35.73		
125	15.060	15.041	34.710	25.759	17	22.0	2.35	26.4	.07	47.69		
150	13.360	13.339	34.743	26.145	10	26.7	2.62			13.44		
175	12.390	12.366	34.793	26.377	5	24.9	2.62	28.5	2.41	15.43		
200	11.750	11.724	34.781	26.491	3	30.9	2.65	30.5	1.83	14.75		
224	11.260	11.231	34.746	26.555		33.1	2.67	29.9	1.54	14.94		
261	10.350	10.917	34.740	26.608	3	35.1	2.75	28.4	2.33	8.24		
299	10.330	10.294	34.699	26.686	3	37.7	2.81	30.2	1.74	7.94		
401	9.450	9.404	34.643	26.794	2	46.3	2.97	30.6	.61	9.67		
498	7.940	7.869	34.599	26.997		60.6	3.19	33.4	.6	6.68		
567	6.390	6.297	34.566	27.193	2	71.2	3.32	38.2	.35	9.41		
911	5.540	5.468	34.560	27.293	16	89.2	3.45	45.9	.02	29.74		
1004	4.550	4.468	34.567	27.414	12	106.6	3.51	48.0	.01			
1492	2.990	2.881	34.612	27.609	58	139.0	3.26	45.3	.01	21.41		
2014	2.180	2.037	34.563	27.721	98	156.8	3.02	43.7	.01	18.18		
2750	1.750	1.549	34.678	27.770	126	163.4	2.92	40.9	.02	16.40		

Date: 1/26/77

Messenger Time: 1704

Bottom Depth: 3330 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

21

STATION NUMBER		13	13	55.54	103	15.9M	----- (UM/L) -----		
Z	T	POT T	S	SIGMA	02	SIL	P04	N03	N02
(M)	(C)	(C)	(0/00)	THETA					
0	27.520	27.520	33.450	21.403	210	.1	.28	.1	.01
24	27.220	27.214	33.456	21.511	203	0	.26	0	.01
49	27.150	27.155	33.624	21.652	209	0	.28	0	.01
98	20.460	20.421	34.413	24.223	89	10.3	1.69	20.8	.07
148	13.220	13.398	34.817	26.096	2	23.4	2.53	32.1	.03
212	12.640	12.611	34.830	26.358	7	25.8	2.49	33.2	.03
241			34.801		6	23.9	2.54	33.5	.03
291	11.180	11.143	34.753	26.577	3	32.6	2.68	31.6	.70
345	10.590	10.547	34.710	26.650		36.3	2.77	29.6	2.06
389			34.558		3	43.0	2.94	29.7	.99
514	8.430	8.374	34.604	26.927	3	55.4	3.14	32.0	.60
601	7.175	7.110	34.565	27.082	4	67.9	3.28	38.1	.07

Date: 1/27/77

Messenger Time: 1402

Bottom Depth 3180 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
 FROM COPY FURNISHED TO DDC

STATION NUMBER	14	9	56.0H	03	25.0W					
Z	T	POT	T	S	SIGMA	02	SIL	P04	N03	N02
(M)	(C)	(C)	(C)	(C/00)	THETA					
0	26.760	26.760	33.830	21.516	217					
50	17.840	17.831	34.713	25.113	84					
100	13.890	13.875	34.839	26.108	14					

----- (U/L) -----

Date: 1/29/77

Messenger Time: 1426

Bottom Depth: 3012 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

STATION NUMBER 15 (1)		7 46.4N		87 49.5W					
Z	T	POT T	S	SIGMA	O2	SIL	PO4	NO3	NO2
(M)	(C)	(C)	(U/00)	THETA		----- (UM/L) -----			
0	25.420	25.420	34.117	22.569	217	4.7	.81	7.5	.22
50	13.420	13.413	34.759	26.142	31	23.4	2.29	30.9	.17
100	12.250	12.237	34.789	26.399	45	26.5	2.38	32.5	.06
150	11.950	11.930	34.312	26.435	49	26.0	2.21	31.1	.03
200	11.630	11.604	34.818	26.542	41	26.9	2.26	32.4	.21
311	10.650	10.611	34.762	26.690	25	32.6	2.51	35.0	.03
349	10.110	10.069	34.728	26.748	21	35.3	2.60	35.2	.03
399	9.620	9.573	34.709	26.917	7	40.9	2.80	35.7	.03
458	8.770	8.719	34.662	26.914	3	49.5	3.03	34.9	.06
498	7.980	7.928	34.627	27.013	3	58.7	3.18	34.4	1.13
555	7.210	7.155	34.613	27.114	6	63.1	3.21	41.1	.02
612	6.820	6.761	34.603	27.160	10	65.6	3.22	43.6	.02
818	5.440	5.368	34.576	27.318	30	84.4	3.28	45.5	.03
1004	4.540	4.458	34.586	27.430	36	101.6	3.28	45.3	.02

Date: 1/30/77      Messenger Time: 1837      Bottom Depth: 3329 m



THIS PAGE IS BEST QUALITY PRACTICABLE  
 FROM COPY FURNISHED TO DDG

STATION NUMBER 15 (2)		7 46.3N		87 47.8W						
(M)	(C)	POT T	S	SIGMA	THETA	02	SIL	P04	N03	N02
		(C)	(0/00)			----- (M/L) -----				
0	25.070									
50	14.100	14.093	34.749	26.024						
100	12.670									
200	11.760									
398	9.680									
450	8.770									
516	7.960									
550	7.120									
604	6.860									
900	5.560	5.495	34.574	27.302		21	32.8	3.29	45.3	.02
1011	4.510	4.427	34.578	27.427		36	99.1	3.33	45.1	.01
1504	3.270	3.156	34.617	27.597		66	130.8	3.15	42.4	.02
2000	2.260	2.117	34.652	27.706		95	152.4	2.94	41.1	.20
2498	1.850	1.670	34.657	27.745		109	149.1	2.90	40.2	.03
3000	1.830	1.603	34.665	27.756		110	148.2	2.87	39.2	.06
3323			34.681			119	165.6	2.83	39.4	.02
3325			34.674			117	165.2	2.83	39.2	.02

Date: 1/31/77      Messenger Time: 1057      Bottom Depth: 330 m

Table 1. A Summary of Weather Conditions, Cruise WELOC-77-I

	Station															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15(1)	15(2)
Date (Day in Jan. 77)	12	14	16	17	18	19	20	21	22	24	25	26	27	29	30	31
Hour (Messenger Time)	1345	1653	2016	0917	1634	1440	1320	1320	1316	0903	1930	1704	1402	1426	1637	1057
Barometer (mb)	1014.8	1015.6	1012.9	1014.8	1014.1	1012.4	1013.2	1012.5	1013.4	1012.0	1012.6	1009.1	1011.2	1010.2	1008.6	1011.0
Air Dry Temp. (°C)	13.4	16.8	25.2	25.1	20.6	24.5	26.0	28.5	28.5	26.8	27.3	28.1	27.2	28.3	26.0	26.6
Air Wet Temp. (°C)	12.2	13.5	22.1	22.4	20.3	22.9	23.1	25.2	25.0	24.1	24.2	26.1	23.1	24.0	24.4	25.3
Cloud Amount	4/10	0/10	10/10	10/10	10/10	10/10	10/10	8/10	10/10	5/10	4/10	2/10	4/10	5/10	7/10	
Visibility (Miles)	20	40	14	12	2	10	10	12	12	12	12	15	12	12	12	12
Wind Direction	280	330	345	030	000	080	105	070	060	065	010	115	060	025	020	
Wind Velocity (k)	24	10	22	10	5	2	18	24	12	14	10	12	4	12	13	
Wave Angle	10	4	8	0	5	2	0	13	5	2	0	2	12	0	4	2
Wave Direction	280	290	300	160	340		320	110	090	320	350	355	130	130	020	020
Wave Height (Ft)	3	4	3	3	4	3	4	4	4	4	4	3	3	2	4	4
Wave Period (Sec)	5	7	10	8	7		7	7	8	7	7	7	8	8	4	9