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PRIMARY PRODUCTIVITY ON THE LABRADOR SHELF DURING JUNE AND JULY 1984

by

B. Irwin, C. Caverhill, P. Dickie, E. Horne and T. Platt

Marine Ecology Laboratory
Department of Fisheries and Oceans

Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
Canada B2Y 4A2

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Abstract

Irwin, B., Caverhill, C., Dickie, P., Horne, E., and Platt, T. 1986. Primary productivity on the Labrador Shelf during June and July 1984. Can. Data Rep. Fish. Aquat. Sci. No. 577: iv + 162p.

During the period 25 June to 4 July 1984 a series of primary productivity experiments were conducted on board CSS Hudson on the Labrador Shelf. In this report we make available the raw data and also the fitted light saturation parameters.

Résumé

Irwin, B., Caverhill, C., Dickie, P., Horne, E., and Platt, T. 1986. Primary productivity on the Labrador Shelf during June and July 1984. Can. Data Rep. Fish. Aquat. Sci. No. 577: iv + 162p.

Pendant la période du 25 juin au 4 juillet 1984 une série d'expériences de productivité primaire ont été effectuée à bord du CSS Hudson sur le plateau du Labrador. Dans ce rapport nous présentons les données brutes sur ces expériences ainsi que les paramètres qui furent calculées pour representer les courbes de production en fonction de la lumière.

CONTENTS

Introduction

This is the eleventh in a series of data reports giving results of experiments on photosynthetic production versus light intensity for natural phytoplankton populations in the North Atlantic and adjacent waters north of 50°N. Samples were collected from C.S.S. Hudson between 25 June and 4 July 1984 on the Labrador Shelf NE of Newfoundland. This was a joint cruise with the Ocean Circulation division of the Atlantic Oceanographic Laboratory.

Sampling

Water samples were collected using a modified continuous pump sampler (Irwin et al. 1985). Sampling depths were determined from physical (e.g. mixed layer depth) or biological (e.g. chlorophyll maximum) parameters at most stations. At stations where no productivity measurements were made, samples were collected at standard oceanographic depths.

A single sample of ice algae was collected in an area where there was >9:10 ice cover. The algae was collected with a plastic bucket by pushing it below the surface between freshly opened cracks in the ice cover. In this way a brown slurry of ice granules containing algae was retrieved.

Methods

Productivity

Primary productivity was measured using the ^{14}C method and the oxygen evolution method. The ^{14}C method was essentially as described by Strickland and Parsons (1972). 20 µCi of sodium bicarbonate ^{14}C was added to each of 42 light and 2 dark bottles containing approximately 100 mls of sample. Bottles were placed in temperature controlled incubators and incubated for periods ranging from 2 to 4 hours. Incubators were of 2 different types. Replicate samples were incubated in standard temperature

controlled incubators (Irwin et al. 1983) and in a new design which used square bottles (Larsen, in prep.). In this incubator illumination was supplied by a 250 watt tungsten halogen lamp (Gilway technical lamp # L7391). The output from the lamp was passed through a beam collimator and then through a series of mirrors to give the desired light levels.

For the oxygen evolution method the high precision Winkler technique of Williams and Jenkinsen (1982) was used. 42 light bottles, 3 dark and 3 time zero bottles were filled for each experiment. The time zero bottles were fixed immediately after filling. Bottles were incubated in the standard incubators for 4 hours.

Photosynthetic Action Spectra

The spectral distribution of the initial slope α of the PI curve was investigated using measurements of photosynthesis on a modified photosynthetron (Lewis and Smith, 1983). 1 mCi of sodium bicarbonate ^{14}C was added to 125 ml of sample and mixed thoroughly. 1 ml aliquots were then dispensed into 7 ml glass scintillation vials. The vials were placed into a temperature controlled bored aluminum block which admitted light from below. This block was mounted on a 5 cm thick glass cuvette through which sea water was pumped to remove heat from the light source. The light source was a 2000 watt tungsten halogen lamp (New Haline OHD 2000). Custom built narrow band pass filters (P.T.R. Optics, Waltham, Mass.) provided 12 wavebands from 400 to 675 nm every 25 nm with the half maximum band pass equal to 25 nm. Variations within a band pass was achieved by placing nickel neutral density screens (Perforated Products) over the narrow band pass filter.

Incubations were for 1 hour at which time 0.5 ml of 6N hydrochloric acid was added to each vial. Vials were shaken for 1 hour in a fume hood

to remove inorganic $H^{14}CO_3$. The acid was neutralised with 0.5 ml of 6N sodium hydroxide and then 5 mls of scintillation cocktail (BDH #R046967) was added and vials counted in usual way.

Chlorophyll

Replicate 100 mls of sample were filtered onto 25 mm Whatman GF/F filters. Chlorophyll was extracted for 24 hours with 85% acetone at 0°C in the dark. The fluorometric technique of Yentsch and Menzel (1963) as modified by Holm Hansen et al. (1965) was used to estimate chlorophyll concentrations.

Organic Particulates

Samples for particulate organic carbon and organic nitrogen were filtered onto precombusted 25 mm Whatman GF/F filters. Filters were analysed by combustion in a Perkin Elmer Model 210 CHN analyser.

Nutrients

Samples for nitrate silicate and inorganic phosphate were collected from most sampled depths. Vials were stored frozen at -20°C and later analysed in the laboratory using a Technicon II Autoanalyser. Nitrate was measured using industrial method 158-71W, silicate with method 186-72W and phosphate with method 155-71W.

Incubation and incident light

Photosynthetically Active Radiation (P.A.R.) was measured at each bottle position in the incubators with a Biospherical Instruments 4π quantum meter (Model Q.S.L. 100).

Total incident light was measured with an Eppley 40 junction black and white pyranometer (Model 8-48) and P.A.R. with a 2π quantum sensor (Licor Li 190S). Output from both instruments was integrated hourly and logged on a Licor Li 550 printing integrator.

Estimation of Photosynthetic Parameters

Measurement of specific production P^B and irradiance I were used to estimate parameters in the equation of Platt et al. (1981),

$$P^B = P_S \left(1 - e^{-\alpha I/P_s}\right) e^{-\beta I/P_s}$$

P_s (mg C Chl^{-1} h^{-1}) is the light saturated rate of photosynthesis in the absence of photoinhibition, α (mg C (mg Chl)$^{-1}$ h^{-1} w^{-1} m^{-2}) is the initial slope of the PI curve and β (same units as α) is a parameter that characterises photoinhibition. Complete details of the fitting routine are given in Irwin et al. (1982) and a discussion of the mathematical basis for this technique is given in Irwin et al. (1980).

Acknowledgements

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Light saturation data and related biomass and inorganic nutrient measurements

Units

$P = mg\ C\ m^{-3}\ h^{-1}\ (mg\ Chl)^{-1}$

$I = W\ m^{-2}$

$P_s = mg\ C\ mg\ Chl^{-1}\ h^{-1}$

$\alpha = mg\ C\ (mg\ Chl)^{-1}\ h^{-1}\ w^{-1}\ m^{-2}$

$\beta = mg\ c\ (mg\ Chl)^{-1}\ h^{-1}\ w^{-1}\ m^{-2}$

Organic particulates are in mg m^{-3} and inorganic nutrients in mg at m^{-3}. The 90% confidence interval for P_s, α and β are shown in the closed brackets below the estimates for each parameter.

LABRADOR SEA 1984

LAT 54 25.60'N LONG 51 49.40'W DATE 25/06/84 DEPTH 35 M

I	P	I	P	I	P	I	P
315	.56	263	.59	215	.70	187	.77
151	.78	140	.87	128	.99	108	1.07
95	1.14	70	1.20	62	1.11	53	1.13
46	1.12	42	1.06	40	1.29	34	1.23
31	1.22	24	1.03	21	1.04	19	.85
14	.87	13	.84	8	.65	5	.38
4	.31	3	.23	2	.19	2	.11
1	.12	1	.09	.9	.07	.7	.02
.5	.01	.3	.01	.3	.02	.2	.02

PARAMETER VALUES

PS : 1.45 (1.40, 1.50)

ALPHA : .097 (.092, .102)

BETA : .0048 (.0043, .0053)

SAMPLE TEMP .9 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : .36

CARBON : 178

NITROGEN : -

NITRATE : 6.33

SILICATE : 6.60

PHOSPHATE : .66

LABRADOR SEA 1984

LAT 54 25.60'N LONG 51 49.40'W DATE 25/06/84 DEPTH 35 M

I	P	I	P	I	P	I	P
253	.80	215	1.22	191	1.05	159	1.13
155	.92	148	1.18	110	1.23	110	1.32
100	1.21	87	1.09	73	1.06	63	1.21
57	1.13	57	1.32	42	1.13	41	1.07
34	1.01	33	1.12	24	1.24	23	1.05
17	.94	17	.82	12	.70	11	.55
8	.50	7	.53	6	.35	6	.44
4	.25	4	.23	3	.17	3	.16
2	.12	2	.11	2	.08	1	.08
1	.04	1	.06	.8	.05	.7	.03
.5	.02						

PARAMETER VALUES

PS : 1.33 (1.26, 1.40)

ALPHA : .082 (.076, .088)

BETA : .0016 (.0011, .0022)

SAMPLE TEMP .9 C

INCUBATION TEMP .5 C

CHLOROPHYLL : .38

CARBON : 182

NITROGEN : 14

NITRATE : 6.10

SILICATE : 6.87

PHOSPHATE : .67

LABRADOR SEA 1984

LAT 52 58.10'N LONG 55 35.30'W DATE 26/06/84 DEPTH 30 M

T	P	T	P	I	P	I	P
407	.29	271	.24	231	.25	183	.38
163	.42	148	.47	120	.42	112	.52
103	.66	85	.69	68	.69	57	.71
50	.68	43	.75	36	.79	35	.71
34	.68	28	.68	23	.69	20	.68
17	.59	14	.55	12	.55	8	.40
5	.27	4	.16	4	.25	2	.12
2	.10	2	.06	1	.07	.9	.04
.7	.03	.6	.02	.5	.02	.4	.01
.3	.01	.3	.01	.2	.01	.2	.01
.2	.01	.1	.00				

PARAMETER VALUES

PS : .94 (.90, .98) ALPHA : .066 (.062, .070) BETA : .0044 (.0039, .0050)

SAMPLE TEMP -1.2 C INCUBATION TEMP 3.0 C

CHLOROPHYLL :	6.82	NITRATE :	.12
CARBON :	306	SILICATE :	.56
NITROGEN :	43	PHOSPHATE :	.67

LABRADOR SEA 1984

LAT 52 58.10'N LONG 55 35.30'W DATE 26/05/84 DEPTH 30 M

T	P	I	P	I	P	I	P
299	.40	227	.69	223	.42	215	.67
171	.65	140	.80	132	.83	128	.59
92	.86	90	.76	87	.86	67	.76
62	.81	62	.86	51	.73	47	.74
28	.68	27	.79	20	.68	20	.61
16	.55	16	.49	9	.42	9	.40
7	.25	7	.27	5	.17	5	.20
4	.13	4	.15	3	.08	2	.10
2	.07	2	.07	2	.03	1	.05
1	.03	1	.02	.8	.02	.7	.02
.5	.01						

PARAMETER VALUES

PS : 1.02 (.96, 1.08)

ALPHA : .049 (.046, .052)

BETA : .0026 (.0020, .0032)

SAMPLE TEMP -1.2 C

INCUBATION TEMP 1.5 C

CHLOROPHYLL : 6.52

CARBON : 349

NITROGEN : 47

NITRATE : .31

SILICATE : .91

PHOSPHATE : .81

LABRADOR SEA 1984

LAT 54 30.00'N LONG 56 20.00'W DATE 27/06/84 ICE ALGAE

I	P	I	P	I	P	I	P
359	1.08	331	1.01	243	.98	239	.82
219	1.29	187	1.13	163	.87	148	1.32
132	1.02	104	1.15	89	1.18	77	1.27
61	1.32	50	1.28	48	1.27	45	1.31
38	1.29	35	1.17	32	1.38	24	1.17
18	1.13	17	1.18	15	1.16	13	1.17
11	1.02	10	.97	10	1.28	7	.57
7	.80	5	.43	5	.35	4	.25
3	.26	2	.09	2	.18	2	.04
2	.09	1	.03	.9	.01	.9	.01

PARAMETER VALUES

PS : 1.38 (1.31, 1.44)

ALPHA : .139 (.126, .153)

BETA : .0016 (.0010, .0021)

SAMPLE TEMP -1.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 20.36

CARBON : 4327

NITROGEN : 524

NITRATE : .00

SILICATE : 2.40

PHOSPHATE : .46

LABRADOR SEA 1984

LAT 54 20.90'N LONG 56 20.80'W DATE 27/05/84 DEPTH 13 M

I	P	I	P	I	P	I	P
239	1.82	179	1.68	159	1.69	140	1.63
132	1.70	124	1.70	96	1.76	89	1.77
64	1.55	56	1.81	48	1.73	43	1.68
39	1.70	36	1.63	33	1.58	31	1.63
23	1.57	19	1.56	16	1.39	14	1.24
13	1.25	12	.85	8	.64	5	.51
4	.37	2	.21	2	.20	1	.13
1	.03	.9	.05	.8	.09	.6	.04
.5	.00	.4	.01	.3	.02	.2	.03
.1	.04	.1	.02				

PARAMETER VALUES

PS : 1.77 (1.71, 1.83)

ALPHA : .137 (.129, .145)

BETA : .0003 (-.0002, .0008)

SAMPLE TEMP -1.2 C

INCUBATION TEMP 2.5 C

CHLOROPHYLL :	12.05	NITRATE :	.45
CARBON :	826	SILICATE :	2.15
NITROGEN :	95	PHOSPHATE :	.65

LABRADOR SEA 1984

LAT 54 30.00'N LONG 56 20.00'W DATE 27/06/84 ICE ALGAE

T	P	T	P	I	P	I	P
215	1.50	171	1.51	144	1.34	124	1.54
95	1.40	81	1.57	70	1.51	69	1.73
50	1.57	54	1.61	43	1.69	38	1.55
33	1.62	26	1.59	24	1.46	22	1.54
22	1.78	18	1.47	15	1.43	12	1.09
11	1.21	8	1.05	8	1.23	5	.69
4	.68	4	.38	2	.34	2	.19
1	.18	1	.09	.9	.15	.7	.11
.6	.04	.5	.02	.4	.05	.3	.01
.2	.04	.2	.02	.2	.02	.2	.01
.2	.03	.1	.01				

PARAMETER VALUES

PS : 1.71 (1.65, 1.76)

ALPHA : .191 (.179, .202)

BETA : .0016 (.0010, .0022)

SAMPLE TEMP -1.5 C

INCUBATION TEMP 3.0 C

CHLOROPHYLL : 15.85

CARBON : 3114

NITROGEN : 387

NITRATE : .00

SILICATE : 2.73

PHOSPHATE : .65

LABRADOR SEA 1984

LAT 54 22.90'N LONG 55 59.50'W DATE 27/06/84 DEPTH 13 M

I	P	I	P	I	P	I	P
179	1.35	159	1.21	140	1.26	132	1.52
124	1.27	96	1.37	89	1.40	64	1.85
56	1.85	48	1.27	43	1.43	39	1.48
36	1.57	33	1.44	31	1.24	19	1.39
16	1.14	14	1.03	13	.96	12	.94
8	1.01	6	.67	5	.55	4	.40
2	.21	2	.14	1	.10	1	.14
.9	.13	.8	.08	.6	.04	.5	.02
.4	.01	.3	.01	.2	.03	.2	.04
.2	.02	.2	.01	.1	.01	.1	.04

PARAMETER VALUES

PS : 1.71 (1.60, 1.81)

ALPHA : .128 (.117, .138)

BETA : .0029 (.0017, .0041)

SAMPLE TEMP -1.2 C

INCUBATION TEMP 2.5 C

CHLOROPHYLL : 11.67

CARBON : 484

NITROGEN : 78

NITRATE : .24

SILICATE : 3.81

PHOSPHATE : .44

LABRADOR SEA 1984

LAT 54 30.00'N LONG 56 20.00'W DATE 27/06/84 ICE ALGAE

T	P	T	P	I	P	I	P
359	.91	331	.88	243	1.13	239	1.05
187	1.50	148	1.61	132	1.41	104	1.40
77	1.60	61	1.63	50	1.64	48	1.59
45	1.69	35	1.63	32	1.66	24	1.55
18	1.34	17	1.52	15	1.30	13	1.58
11	1.22	10	1.13	7	.88	7	.75
5	.68	5	.56	4	.40	3	.40
2	.38	2	.46	2	.17	2	.17
1	.28	1	.08	.9	.21	.9	.06
.6	.02						

PARAMETER VALUES

PS : 1.87 (1.81, 1.93)

ALPHA : .167 (.158, .177)

BETA : .0037 (.0032, .0043)

SAMPLE TEMP -1.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 15.85

CARBON : 3114

NITROGEN : 387

NITRATE : .00

SILICATE : 2.73

PHOSPHATE : .65

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/06/84 DEPTH 40 M

I	P	I	P	I	P	I	P
227	.63	223	.41	215	.81	171	.72
140	.98	128	.92	92	.95	90	.99
87	1.01	67	.93	62	.92	62	.92
51	.97	47	.83	28	1.05	27	.83
20	.84	20	.85	16	.88	16	.93
9	.79	9	.86	7	.69	7	.74
5	.57	5	.68	4	.47	4	.40
2	.37	2	.42	2	.26	2	.22
2	.17	1	.23	1	.24	1	.14
.8	.05	.7	.15	.5	.15		

PARAMETER VALUES

PS : 1.02 (.98, 1.06)

ALPHA : .171 (.158, .185)

BETA : .0017 (.0013, .0022)

SAMPLE TEMP -.2 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 2.73

CARBON : 435

NITROGEN : 54

NITRATE : 1.39

SILICATE : 6.54

PHOSPHATE : .25

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/06/84 DEPTH 30 M

I	P	I	P	I	P	I	P
371	1.77	136	2.72	116	2.60	47	3.10
45	3.25	16	3.20	15	2.91	7	2.83
5	2.42	2	.78	1	.32	.9	.42
.7	.79	.6	.25	.5	.51	.4	.37
.3	.11	.3	.40	.2	.17	.2	.51
.2	.14	.1	.19				

PARAMETER VALUES

PS : 3.38 (3.24, 3.52)

ALPHA : .728 (.654, .802)

BETA : .0060 (.0046, .0074)

SAMPLE TEMP .2 C

INCUBATION TEMP 2.0 C

CHLOROPHYLL :	.59	NITRATE :	.00
CARBON :	305	SILICATE :	6.01
NITROGEN :	38	PHOSPHATE :	.16

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/06/84 DEPTH 50 M

I	P	I	P	I	P	I	P
287	1.43	215	1.42	195	1.31	167	1.50
159	1.49	144	1.18	136	1.24	116	1.26
90	1.16	71	1.40	63	1.38	52	1.29
47	1.19	45	1.28	43	1.34	32	1.17
28	1.24	23	1.23	20	1.29	16	1.02
15	.92	9	.66	7	.64	5	.46
4	.22	2	.20	2	.09	2	.15
1	.10	.9	.04	.7	.03	.6	.11
.5	.07	.4	.03	.3	.13	.3	.03
.2	.08	.2	.02	.2	.05	.1	.04

PARAMETER VALUES

PS : 1.34 ALPHA : .112 BETA : .0000
(1.29, 1.39) (.104, .121) (-.0003, .0003)

SAMPLE TEMP -.2 C INCUBATION TEMP 2.0 C

CHLOROPHYLL : 1.60 NITRATE : 5.53

CARBON : 290 SILICATE : 7.27

NITROGEN : 41 PHOSPHATE : .75

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/05/84 DEPTH 60 M

I	P	I	P	I	P	I	P
371	1.10	287	1.03	239	.96	215	.91
195	1.12	144	.97	116	1.17	80	1.04
71	1.13	63	1.00	52	1.04	47	.93
45	.91	43	1.09	32	.90	28	.95
23	1.01	20	.96	16	.70	15	.86
0	.72	7	.56	5	.39	4	.35
2	.23	2	.23	2	.25	1	.24
.9	.17	.7	.25	.6	.06	.5	.09
.4	.03	.3	.01	.3	.02	.2	.01
.2	.01	.2	.03	.1	.02		

PARAMETER VALUES

PS : 1.02 (.99, 1.05)

ALPHA : .117 (.107, .128)

BETA : .0000 (-.0002, .0002)

SAMPLE TEMP .0 C

INCUBATION TEMP 2.0 C

CHLOROPHYLL : .66

CARBON : 146

NITROGEN : 20

NITRATE : 11.32

SILICATE : 10.68

PHOSPHATE : .92

LABRADOR SEA 1984

LAT 55 46.50'N LONG 54 54.60'W DATE 30/06/84 DEPTH 35 M

I	P	I	P	I	P	I	P
658	.51	630	.59	498	.40	447	.66
407	.76	347	.77	291	.71	215	.87
171	.77	159	.94	151	.76	116	.86
104	.87	96	.99	84	.81	72	.85
58	.86	55	.92	48	.83	39	1.05
32	.78	28	.83	23	1.04	22	.98
15	.98	14	.84	10	.89	9	.90
7	.72	7	.72	6	.58	5	.58
4	.45	3	.50	3	.37	2	.32
2	.30	2	.26	1	.20	1	.17

PARAMETER VALUES

PS : .96 (.94, .99)

ALPHA : .185 (.172, .199)

BETA : .0009 (.0008, .0010)

SAMPLE TEMP -.3 C

INCUBATION TEMP -1.0 C

CHLOROPHYLL : 5.98

CARBON : 435

NITROGEN : 49

NITRATE : 5.33

SILICATE : 7.21

PHOSPHATE : .44

LABRADOR SEA 1984

LAT 55 35.80'N LONG 55 14.70'W DATE 30/06/84 DEPTH 35 M

T	P	I	P	I	P	I	P
159	1.02	132	1.10	124	1.17	102	1.45
78	1.44	59	1.45	38	1.44	29	1.44
28	1.41	24	1.29	23	1.43	21	1.07
10	1.16	16	.88	12	1.03	10	1.14
7	.87	4	.33	4	.47	3	.62
2	.37	1	.25	1	.14	.9	.12
.6	.10	.5	.10	.3	.05	.3	.09
.2	.04	.2	.05	.1	.08	.1	.04
.1	.06	.1	.00				

PARAMETER VALUES

PS : 1.64 (1.51, 1.76) ALPHA : .140 (.127, .153) BETA : .0041 (.0025, .0057)

SAMPLE TEMP -.2 C INCUBATION TEMP 1.0 C

CHLOROPHYLL :	2.97	NITRATE :	.73
CARBON :	435	SILICATE :	5.38
NITROGEN :	69	PHOSPHATE :	.00

LABRADOR SEA 1984

LAT 55 39.60'N LONG 55 8.70'W DATE 30/06/84 DEPTH 50 M

I	P	I	P	I	P	I	P
275	.70	215	.68	179	.70	159	.71
144	.77	132	.65	124	.72	78	.71
59	.94	51	.84	45	.83	38	.95
29	.78	24	.81	23	.71	21	.62
19	.85	16	.69	12	.75	10	.59
7	.53	4	.45	4	.30	3	.41
2	.19	2	.09	1	.12	1	.08
.9	.07	.6	.04	.5	.03	.3	.03
.3	.02	.2	.01	.2	.02	.1	.02
.1	.01	.1	.02				

PARAMETER VALUES

PS : .85 (.82, .88)

ALPHA : .118 (.107, .129)

BETA : .0009 (.0006, .0012)

SAMPLE TEMP -.8 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 1.84

CARBON : 555

NITROGEN : 73

NITRATE : 4.79

SILICATE : 4.89

PHOSPHATE : .17

LABRADOR SEA 1984

LAT 55 42.50'N LONG 55 1.70'W DATE 30/06/84 DEPTH 55 M

I	P	I	P	I	P	I	P
275	.59	215	.49	179	.61	144	.71
132	.74	124	.80	78	.92	51	.75
45	.89	38	.87	29	.74	28	.92
24	.82	23	.76	21	.85	19	.67
16	.80	12	.73	10	.73	7	.64
4	.49	4	.25	3	.41	2	.19
2	.08	1	.15	1	.13	.9	.05
.6	.03	.5	.02	.3	.02	.3	.01
.2	.01	.2	.01	.1	.00	.1	.00
.1	.01	.1	.03				

PARAMETER VALUES

PS : .91 (.87, .95)

ALPHA : .123 (.112, .134)

BETA : .0017 (.0013, .0021)

SAMPLE TEMP -.8 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 2.55

CARBON : 390

NITROGEN : 58

NITRATE : 7.51

SILICATE : 6.01

PHOSPHATE : .29

LABRADOR SEA 1984

LAT 55 53.20'N LONG 54 42.90'W DATE 30/06/84 DEPTH 30 M

T	P	I	P	I	P	I	P
658	.60	630	.85	498	.90	447	.79
347	1.09	291	1.18	235	1.20	215	1.59
171	1.58	159	1.49	151	1.55	116	1.38
104	1.38	96	1.42	84	1.52	72	1.31
58	1.62	55	1.59	48	1.32	39	1.52
32	1.53	28	1.42	23	1.34	22	1.35
15	1.20	14	1.27	10	.88	9	.89
7	.65	7	.71	6	.56	5	.44
4	.35	3	.35	3	.24	2	.26
2	.07	2	.13	2	.12	1	.06
1	.08						

PARAMETER VALUES

PS : 1.70 (1.65, 1.75)

ALPHA : .124 (.117, .133)

BETA : .0022 (.0019, .0025)

SAMPLE TEMP -.6 C

INCUBATION TEMP -1.0 C

CHLOROPHYLL : .72

CARBON : 306

NITROGEN : 19

NITRATE : .00

SILICATE : 6.59

PHOSPHATE : .24

LABRADOR SEA 1984

LAT 55 40.50'N LONG 54 54.60'W DATE 30/06/84 DEPTH 40 M

T	P	T	P	I	P	I	P
399	1.44	132	1.31	124	1.24	102	1.29
78	1.15	59	1.19	51	1.37	40	1.11
38	1.31	29	1.13	28	1.20	24	1.19
23	1.19	21	1.19	19	1.00	16	1.09
12	1.10	10	1.09	7	.89	4	.70
4	.44	3	.56	2	.25	2	.15
1	.29	1	.12	.9	.10	.6	.08
.5	.02	.3	.08	.3	.02	.2	.05
.2	.01	.1	.02	.1	.00	.1	.02

PARAMETER VALUES

PS : 1.24 (1.21, 1.28)

ALPHA : .186 (.171, .201)

BETA : .0000 (-.0003, .0003)

SAMPLE TEMP -.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 5.81

CARBON : 675

NITROGEN : 89

NITRATE : 5.37

SILICATE : 6.01

PHOSPHATE : .28

LABRADOR SEA 1984

LAT 55 50.20'N LONG 54 49.40'W DATE 30/06/84 DEPTH 15 M

T	P	I	P	I	P	I	P
144	1.59	132	3.09	124	2.88	102	1.83
78	2.61	45	3.32	38	3.60	29	3.43
28	3.82	24	4.00	23	4.10	21	3.67
19	3.61	16	3.31	12	2.08	10	2.01
4	1.71	4	1.23	3	1.15	2	1.02
2	.46	1	.58	1	.60	.9	.13
.6	.27	.5	.23	.3	.18	.3	.12
.2	.08	.2	.08	.1	.23	.1	.09
.1	.06	.1	.06				

PARAMETER VALUES

PS : 4.72 (4.23, 5.21)

ALPHA : .402 (.355, .449)

BETA : .0272 (.0189, .0356)

SAMPLE TEMP -.4 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 1.04

CARBON : 525

NITROGEN : 62

NITRATE : .00

SILICATE : 5.93

PHOSPHATE : .07

LABRADOR SEA 1984

LAT 55 46.50'N LONG 54 54.60'W DATE 30/05/84 DEPTH 35 M

I	P	I	P	I	P	I	P
399	1.11	275	1.85	215	2.59	179	3.54
159	3.36	132	3.56	124	3.64	78	3.12
59	2.96	51	2.84	45	3.19	38	3.76
29	2.89	28	3.40	24	3.70	23	3.36
21	3.38	19	3.39	16	2.65	12	2.63
10	2.55	7	2.89	4	2.33	3	2.51
2	1.82	2	.92	1	1.21	1	.13
.9	.73	.6	.44	.5	.27	.3	.50
.3	.23	.2	.20	.2	.31	.1	.28
.1	.23	.1	.17	.1	.08		

PARAMETER VALUES

PS : 3.46	ALPHA : .878	BETA : .0047
(3.31, 3.61)	(.753, 1.004)	(.0033, .0062)

SAMPLE TEMP -.3 C INCUBATION TEMP 1.0 C

CHLOROPHYLL :	6.47	NITRATE :	5.37
CARBON :	675	SILICATE :	6.01
NITROGEN :	89	PHOSPHATE :	.28

LABRADOR SEA 1984

LAT 53 .90'N LONG 50 52.40'W DATE 02/07/84 DEPTH 36 M

I	P	I	P	I	P	I	P
159	1.58	114	2.34	108	2.74	103	2.72
80	2.45	70	2.48	62	2.40	56	2.44
47	2.79	46	2.65	36	2.21	30	2.63
25	2.37	20	2.54	17	1.37	14	1.36
9	1.58	7	1.05	5	.96	4	.49
3	.59	2	.79	2	.57	1	.40
.7	.46	.5	.30	.5	.08	.3	.11
.3	.15	.2	.07	.2	.09	.1	.10
.1	.03	.1	.08				

PARAMETER VALUES

PS : 3.16 (2.80, 3.52)

ALPHA : .194 (.173, .215)

BETA : .0090 (.0042, .0137)

SAMPLE TEMP 1.0 C

INCUBATION TEMP 2.0 C

CHLOROPHYLL :	1.11	NITRATE :	.83
CARBON :	250	SILICATE :	3.53
NITROGEN :	48	PHOSPHATE :	.34

LABRADOR SEA 1984

LAT 52 53.10'N LONG 51 15.10'W DATE 02/07/84 DEPTH 35 M

I	P	I	P	I	P	I	P
159	.66	128	.45	108	.60	103	.43
98	.79	95	.77	80	.76	70	.62
92	.69	56	.79	47	.62	30	.73
25	.59	17	.66	12	.52	9	.34
7	.28	5	.18	4	.20	3	.11
2	.09	2	.06	1	.08	.5	.02
.5	.04	.3	.05	.3	.03	.2	.00
.1	.01	.1	.01	.1	.01		

PARAMETER VALUES

PS : .85	ALPHA : .058	BETA : .0023
(.74, .95)	(.050, .065)	(.0009, .0037)

SAMPLE TEMP	1.2 C	INCUBATION TEMP	2.0 C
CHLOROPHYLL :	3.22	NITRATE :	.27
CARBON :	3	SILICATE :	.57
NITROGEN :	46	PHOSPHATE :	.00

LABRADOR SEA 1984

LAT 52 46.00'N LONG 51 36.30'W DATE 02/07/84 DEPTH 5 M

T	P	T	P	I	P	I	P
379	2.14	271	1.95	159	1.78	128	1.85
114	2.10	108	1.52	103	1.73	95	1.81
94	1.72	80	1.61	70	1.45	62	1.76
56	1.56	47	1.69	46	1.50	30	1.19
25	1.24	20	1.14	17	1.06	14	.70
12	.66	9	.52	7	.33	5	.31
4	.16	3	.11	2	.12	2	.04
1	.02	.7	.03	.5	.07	.5	.03
.3	.01	.3	.05	.2	.02	.2	.03
.1	.02	.1	.01	.1	.01		

PARAMETER VALUES

PS : 1.86 (1.78, 1.94)

ALPHA : .071 (.066, .076)

BETA : .0000 (-.0004, .0004)

SAMPLE TEMP 1.1 C

INCUBATION TEMP 2.0 C

CHLOROPHYLL : 1.69

CARBON : 344

NITROGEN : 64

NITRATE : .39

SILICATE : 4.96

PHOSPHATE : .28

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 15 M

I	P	I	P	I	P	I	P
550	.70	559	1.00	478	.92	439	1.04
359	1.54	323	1.27	295	1.05	239	1.59
231	1.25	211	1.52	163	1.43	132	1.46
120	1.31	112	1.53	90	1.44	82	1.31
78	1.33	62	1.19	53	1.43	52	1.27
43	1.43	37	.91	31	1.12	26	1.29
20	1.06	18	1.05	13	.67	11	.75
9	.66	8	.61	6	.47	6	.38
4	.34	4	.30	3	.18	3	.19
2	.16	2	.14	1	.10	1	.09
1	.07						

PARAMETER VALUES

PS : 1.54 (1.47, 1.61) ALPHA : .082 (.074, .089) BETA : .0012 (.0009, .0015)

SAMPLE TEMP -.5 C INCUBATION TEMP 2.0 C

CHLOROPHYLL :	18.90	NITRATE :	1.62
CARBON :	857	SILICATE :	3.47
NITROGEN :	124	PHOSPHATE :	.45

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 15 M

I	P	I	P	I	P	I	P
303	1.33	247	1.15	215	1.22	195	1.12
167	1.15	151	1.17	128	1.14	90	1.28
75	1.19	68	1.23	61	1.18	56	1.07
51	1.10	45	1.24	37	1.32	31	1.15
27	1.10	24	.97	22	.96	16	.95
14	.79	10	.48	8	.45	6	.35
4	.26	3	.12	3	.09	2	.08
1	.07	1	.04	.7	.04	.5	.02
.5	.02	.3	.02	.2	.01	.2	.02
.2	.01	.2	.01	.1	.01	.1	.01

PARAMETER VALUES

PS : 1.23 (1.19, 1.27)

ALPHA : .084 (.078, .089)

BETA : .0001 (-.0001, .0004)

SAMPLE TEMP -.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 18.90

CARBON : 857

NITROGEN : 124

NITRATE : 1.62

SILICATE : 3.47

PHOSPHATE : .45

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 23 M

I	P	I	P	I	P	I	P
650	.59	558	.82	478	.76	439	.97
359	1.39	323	1.31	239	1.60	231	1.39
211	1.60	163	1.37	151	1.76	132	1.45
120	1.38	112	1.71	90	1.52	82	1.48
78	1.62	62	1.47	53	1.37	52	1.59
43	1.42	37	1.38	31	1.37	26	1.18
20	1.27	18	1.16	13	.85	11	.80
8	.63	8	.59	6	.42	6	.40
4	.34	4	.25	3	.19	3	.19
2	.18	2	.11	1	.08	1	.08
1	.06						

PARAMETER VALUES

PS : 1.83 (1.76, 1.90)

ALPHA : .086 (.080, .092)

BETA : .0024 (.0020, .0028)

SAMPLE TEMP -.5 C

INCUBATION TEMP .5 C

CHLOROPHYLL : 5.20

CARBON : 602

NITROGEN : 85

NITRATE : 3.41

SILICATE : 6.39

PHOSPHATE : .71

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 23 M

T	P	I	P	I	P	I	P
379	1.73	303	1.87	195	1.65	167	1.33
151	1.59	128	1.43	110	1.88	90	1.57
75	1.55	68	1.57	61	1.70	56	1.43
51	1.56	45	1.64	37	1.76	31	1.49
27	1.67	24	1.29	22	1.43	16	1.34
14	1.05	10	.79	8	.95	6	.70
4	.48	3	.38	3	.21	2	.27
1	.11	1	.05	.7	.04	.5	.07
.5	.10	.3	.04	.2	.02	.2	.03
.2	.02	.2	.05	.1	.04	.1	.01

PARAMETER VALUES

PS : 1.63 (1.57, 1.68)

ALPHA : .145 (.133, .156)

BETA : .0000 (-.0003, .0003)

SAMPLE TEMP -.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 5.20

CARBON : 602

NITROGEN : 85

NITRATE : 3.41

SILICATE : 6.39

PHOSPHATE : .71

LABRADOR SEA 1984

LAT 54 29.60'N LONG 56 21.20'W DATE 04/07/84 DEPTH 9 M

I	P	I	P	I	P	I	P
606	1.61	550	2.12	379	1.87	287	2.39
279	1.80	259	2.14	211	1.90	175	2.00
155	2.30	148	2.27	114	2.13	112	2.04
81	2.21	72	2.05	69	2.27	57	2.30
48	2.33	44	1.98	39	2.41	32	1.94
29	2.05	20	1.75	14	1.20	13	1.21
10	.74	9	.84	6	.54	6	.50
4	.38	4	.40	3	.25	3	.25
2	.13	2	.11	2	.14	1	.09
1	.09	1	.10	.9	.12		

PARAMETER VALUES

PS : 2.36 (2.28, 2.45) ALPHA : .127 (.118, .136) BETA : .0011 (.0008, .0015)

SAMPLE TEMP -1.2 C INCUBATION TEMP .5 C

CHLOROPHYLL :	5.84	NITRATE :	.53
CARBON :	773	SILICATE :	7.10
NITROGEN :	140	PHOSPHATE :	.42

LABRADOR SEA 1984

LAT 54 29.60'N LONG 56 21.20'W DATE 04/07/84 DEPTH 9 M

T	P	T	P	I	P	I	P
431	1.82	331	1.90	259	1.90	223	2.04
203	2.23	191	1.92	171	1.95	151	2.26
120	2.15	99	2.07	79	1.90	67	2.10
59	1.92	49	1.35	43	1.66	40	1.76
37	1.89	31	1.72	26	1.81	21	1.25
17	1.09	14	.83	12	1.04	8	.43
5	.41	4	.22	4	.28	3	.16
3	.12	1	.05	1	.09	.9	.04
.6	.03	.5	.01	.4	.03		

PARAMETER VALUES

PS : 2.25 (2.15, 2.34)

ALPHA : .093 (.087, .098)

BETA : .0011 (.0006, .0016)

SAMPLE TEMP -1.2 C

INCUBATION TEMP 1.5 C

CHLOROPHYLL : 5.84

CARBON : 773

NITROGEN : 140

NITRATE : .53

SILICATE : 7.10

PHOSPHATE : .42

Light saturation data for oxygen experiments and related biomass and inorganic nutrient measurements

Units

$P = mg\ O_2\ m^{-3}\ h^{-1}\ (mg\ Chl)^{-1}$

$I = W\ m^{-2}$

$P_s = mg\ O_2\ mg\ Chl^{-1}\ h^{-1}$

$\alpha = mg\ O_2\ (mg\ Chl)^{-1}\ h^{-1}\ w^{-1}\ m^{-2}$

$\beta = mg\ O_2\ (mg\ Chl)^{-1}\ h^{-1}\ w^{-1}\ m^{-2}$

Organic particulates are in mg m^{-3} and inorganic nutrients in mg at m^{-3}. the 90% confidence interval for P_s, α and β are shown in the closed brackets below the estimates for each parameter.

LABRADOR SEA 1984

LAT 54 30.00'N LONG 56 20.00'W DATE 27/06/84 ICE ALGAE

T	P	T	P	I	P	I	P
419	11.49	407	10.83	299	9.95	255	10.94
207	12.58	179	10.98	155	10.37	120	12.73
100	11.24	99	11.30	88	12.20	74	10.51
71	12.59	58	12.36	44	10.52	35	11.31
30	12.18	30	11.19	23	11.49	20	12.19
17	10.92	15	10.73	13	10.21	10	8.65
8	9.36	6	7.12	6	5.77	5	4.10
4	3.99	3	3.11	3	3.04	2	1.82
1	2.07	.6	1.17				

PARAMETER VALUES

PS : 12.04 (11.73, 12.35)

ALPHA : 1.548 (1.446,1.651)

BETA : .0034 (.0015, .0052)

SAMPLE TEMP -1.5 C

INCUBATION TEMP 1.0 C

CHLOROPHYLL : 18.95

CARBON : 4327

NITROGEN : 524

NITRATE : .00

SILICATE : 2.65

PHOSPHATE : 1.21

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/06/84 DEPTH 40 M

I	P	I	P	I	P	I	P
407	5.44	299	3.78	215	7.98	207	8.49
179	9.22	155	9.80	120	11.10	100	11.04
99	9.67	88	9.70	74	12.04	71	10.64
58	11.37	35	11.07	30	10.71	23	10.07
20	9.84	17	10.45	15	7.19	13	4.47
10	4.06	8	3.75	5	3.59	4	2.76
3	1.58	3	3.33	2	1.75	2	1.69
1	2.47	1	1.61	1	1.12	.8	1.85
.6	1.87	.5	1.34				

PARAMETER VALUES

PS : 14.17 (13.13, 15.22) ALPHA : .782 (.711, .853) BETA : .0398 (.0300, .0496)

SAMPLE TEMP -.2 C INCUBATION TEMP 1.0 C

CHLOROPHYLL :	2.73	NITRATE :	1.39
CARBON :	435	SILICATE :	6.54
NITROGEN :	54	PHOSPHATE :	.25

LABRADOR SEA 1984

LAT 55 46.50'N LONG 54 54.60'W DATE 30/06/84 DEPTH 35 M

T	P	I	P	I	P	I	P
500	3.80	478	4.29	411	4.66	327	5.71
287	5.13	279	6.97	235	7.99	183	8.47
179	8.71	179	6.75	132	9.11	128	9.06
120	6.80	88	8.01	81	8.31	54	7.59
50	9.07	45	9.77	42	8.94	38	9.15
28	8.85	23	7.67	16	7.71	11	6.93
10	5.86	8	5.28	7	6.39	6	4.23
4	1.72	3	2.79	3	3.01	2	2.54
2	2.72	2	2.58	2	2.32	1	1.83

PARAMETER VALUES

PS : 9.69 (9.32, 10.07)

ALPHA : 1.054 (.960,1.148)

BETA : .0145 (.0120, .0171)

SAMPLE TEMP -.3 C

INCUBATION TEMP -1.0 C

CHLOROPHYLL : 5.98

CARBON : 435

NITROGEN : 49

NITRATE : 5.33

SILICATE : 7.21

PHOSPHATE : .44

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 15 M

I	P	I	P	I	P	I	P
618	.99	582	.72	454	2.44	371	3.09
303	4.59	247	3.36	243	4.15	187	4.57
167	4.13	140	5.26	116	4.84	111	4.68
102	5.08	90	4.95	81	4.86	59	4.82
49	5.40	46	5.21	36	4.52	22	4.10
19	3.87	16	4.00	14	3.43	10	3.34
10	1.88	8	1.21	5	1.51	5	1.36
4	1.13	4	.64	3	1.06	3	1.04
2	.93	1	.50	1	.09		

PARAMETER VALUES

PS : 6.34 (6.00, 6.67)

ALPHA : .325 (.298, .351)

BETA : .0139 (.0115, .0163)

SAMPLE TEMP -.5 C

INCUBATION TEMP 2.0 C

CHLOROPHYLL : 18.90

CARBON : 857

NITROGEN : 124

NITRATE : 1.62

SILICATE : 3.47

PHOSPHATE : .45

LABRADOR SEA 1984

LAT 54 29.60'N LONG 56 21.20'W DATE 04/07/84 DEPTH 9 M

I	P	I	P	I	P	I	P
538	.53	323	5.22	319	6.47	283	6.11
259	6.13	203	7.67	175	6.60	155	7.90
140	7.48	136	8.74	116	7.65	96	8.18
80	6.77	73	7.31	52	7.52	45	6.44
39	6.93	34	4.07	27	5.08	23	3.76
19	4.10	16	3.23	13	2.90	10	2.77
10	2.60	4	.90	3	.19	2	.04
1	.15						

PARAMETER VALUES

PS : 13.96 (11.52, 16.21)

ALPHA : .232 (.213, .251)

BETA : .0441 (.0277, .0604)

SAMPLE TEMP -1.2 C

INCUBATION TEMP .5 C

CHLOROPHYLL : 5.84

CARBON : 773

NITROGEN : 140

NITRATE : .53

SILICATE : 7.10

PHOSPHATE : .42

Profiles of inorganic nutrients and particulates

LAT. 54°09.4'N LONG. 52°32'W
DATE 25/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
15	0.60	-	-	-	-	-
28	1.03	-	-	-	-	-
35	5.43	-	-	-	-	-
45	2.54	-	-	-	-	-
55	1.80	-	-	-	-	-
103	0.48	-	-	-	-	-

LAT. 53°51.4'N LONG. 53°14.9'W
DATE 25/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	5.25	-	-	-	-	-
10	3.95	-	-	-	-	-
15	3.44	-	-	-	-	-
20	7.81	-	-	-	-	-

LAT. 53°04.7'N LONG. 55°17.2'W
DATE 26/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
15	0.21	-	-	-	-	-
20	0.62	-	-	-	-	-
35	0.59	-	-	-	-	-
110	0.11	-	-	-	-	-

LAT. 54°22.9'N LONG. 55°59.5'W
DATE 27/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	4.58	-	-	-	-	-
10	11.67	0.24	3.81	0.44	484	78
15	2.22	-	-	-	-	-
109	0.46	-	-	-	-	-

LAT. 54°28'N LONG. 55°48.1'W
DATE 27/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	3.63	-	-	-	-	-
20	0.66	-	-	-	-	-
35	0.89	-	-	-	-	-
110	0.18	-	-	-	-	-

LAT. 54°38.9'N LONG. 55°34.6'W
DATE 27/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	1.84	-	-	-	-	-
25	0.72	-	-	-	-	-
40	0.82	-	-	-	-	-
81	0.37	-	-	-	-	-

LAT. 54°50.3'N LONG. 55°27'W
DATE 27/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	2.31	-	-	-	-	-
10	2.23	-	-	-	-	-
25	0.76	-	-	-	-	-
40	0.55	-	-	-	-	-

LAT. 55°33.3'N LONG. 54°48.3'W
DATE 28/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.16	-	-	-	-	-
25	0.22	-	-	-	-	-
40	0.31	-	-	-	-	-
50	0.70	-	-	-	-	-

LAT. 55°47.2'N LONG. 54°37.4'W
DATE 28/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.31	-	-	-	-	-
30	0.59	0.00	6.01	0.16	305	38
40	2.73	1.39	6.54	0.25	435	54
50	1.60	5.53	7.27	0.75	290	41
60	0.66	11.32	10.68	0.66	146	20
70	0.41	-	-	-	-	-
90	0.36	-	-	-	-	-

LAT. 56°05.2'N LONG. 54°23.2'W
DATE 28/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.15	-	-	-	-	-
30	0.35	-	-	-	-	-
40	0.21	-	-	-	-	-
55	0.16	-	-	-	-	-

LAT. 55°35.8'N LONG. 55°14.7'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.51	0.00	5.71	0.18	-	-
25	0.77	0.00	5.98	0.08	-	-
35	2.97	0.65	6.45	0.61	435	69
50	2.56	6.94	8.75	0.63	-	-
75	0.75	11.34	7.54	0.95	-	-
100	0.44	11.62	7.68	0.96	-	-

LAT. 55°39.6'N LONG. 55°08.7'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.15	0.00	5.76	0.12	-	-
20	0.45	0.00	5.51	0.21	-	-
35	2.05	0.00	6.30	0.19	-	-
50	1.84	6.11	6.94	0.62	555	73
75	1.03	10.13	7.60	0.74	-	-
100	0.31	12.19	8.28	0.79	-	-

LAT. 55°42.5'N LONG. 55°01.7'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.19	0.00	5.84	0.22	-	-
25	0.20	0.00	5.90	0.11	-	-
45	3.07	3.61	6.63	0.42	-	-
55	2.55	9.17	7.20	0.67	390	58
75	0.75	12.31	8.01	0.86	-	-
106	0.21	13.60	8.72	0.93	-	-

LAT. 55°46.5'N LONG. 54°54.6'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	8.27	0.00	5.76	0.08	-	-
30	4.76	0.00	6.56	0.26	-	-
35	5.98	6.36	7.73	0.56	435	49
40	5.81	6.68	7.82	0.65	675	89
75	0.11	11.60	8.39	0.82	-	-
112	0.10	14.65	9.22	1.01	-	-

LAT. 55°50.2'N LONG. 54°49.4'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.24	0.00	6.21	0.29	-	-
15	1.04	0.00	6.43	0.18	525	62
25	4.99	7.10	9.61	0.63	-	-
35	3.18	10.11	8.17	0.78	-	-
75	0.23	11.39	8.18	0.97	-	-
112	0.08	14.08	12.39	0.91	-	-

LAT. 55°53.2'N LONG. 54°42.9'W
DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.23	0.00	5.65	0.06	-	-
25	0.50	0.00	6.64	0.29	-	-
31	0.72	0.00	6.88	0.30	306	19
40	0.81	4.70	7.31	0.49	-	-
75	0.20	9.95	8.51	0.74	-	-
111	0.24	12.10	7.82	0.95	-	-

LAT. 55°57'N LONG. 54°35'W

DATE 29/06/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.23	0.00	5.54	0.01	-	-
20	0.42	0.00	5.87	0.07	-	-
30	1.05	0.00	5.57	0.09	-	-
50	0.51	4.49	6.43	0.25	-	-
75	0.05	8.30	7.97	0.70	-	-
114	0.04	14.96	9.37	0.95	-	-

LAT. 53°15.8'N LONG. 50°10.6'W

DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.23	0.00	5.54	0.02	-	-
25	0.86	0.00	0.00	0.14	-	-
35	0.26	9.34	5.78	0.70	-	-
50	0.07	11.14	6.43	0.70	-	-
75	0.06	12.51	8.57	0.83	-	-
112	0.02	13.31	11.39	0.92	-	-

LAT. 53°08'N LONG. 50°32.2'W
DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.37	0.00	2.69	0.00	-	-
25	0.21	0.00	6.54	0.00	-	-
35	0.69	0.19	5.49	0.17	-	-
50	0.28	8.94	9.43	0.82	-	-
75	0.07	11.21	11.28	1.02	-	-
112	0.04	12.48	11.85	-	-	-

LAT. 53°00.9'N LONG. 50°52.4'W
DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.31	0.00	3.90	0.00	-	-
25	0.30	0.00	5.51	0.01	-	-
35	1.11	1.53	4.43	0.30	250	48
50	0.31	9.27	9.90	0.76	-	-
75	0.12	11.88	8.57	0.67	-	-
100	0.07	13.96	9.40	0.74	-	-

LAT. 52°53.1'N LONG. 51°15.1'W
DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.24	0.00	4.48	0.05	-	-
25	1.73	0.00	0.75	0.14	-	-
35	3.22	2.34	1.86	0.31	301	46
50	0.22	7.49	8.46	0.68	-	-
75	0.09	11.26	10.42	0.81	-	-
113	0.09	13.92	9.37	0.91	-	-

LAT. 52°46'N LONG. 51°36.3'W
DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	1.69	0.25	5.65	0.34	344	64
20	0.61	6.78	7.50	0.50	-	-
30	0.34	7.52	9.72	0.71	-	-
50	0.07	9.11	13.83	0.87	-	-
75	0.06	11.21	14.46	0.84	-	-
110	0.09	11.18	11.16	0.67	-	-

LAT. 52°39.5'N LONG. 51°57.3'W
DATE 02/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
5	0.78	0.00	2.85	0.27	-	-
15	18.90	2.67	7.00	0.69	857	124
23	5.20	3.46	9.61	0.74	602	85
50	0.80	7.70	12.35	0.77	-	-
75	2.71	7.95	8.60	0.73	-	-
112	0.15	10.29	15.27	1.01	-	-

LAT. 54°29.6'N LONG. 56°21.2'W
DATE 03/07/84

DEPTH M	CHL mg m^{-3}	NO_3 mg at m^{-3}	SiO_3 mg at m^{-3}	PO_4 mg at m^{-3}	CARBON mg m^{-3}	NITROGEN mg m^{-3}
9	5.84	0.47	7.88	0.43	773	140
25	0.50	5.88	11.15	0.80	-	-
50	0.23	6.54	11.90	0.89	-	-
75	0.13	6.81	11.27	0.78	-	-
112	0.21	7.50	12.44	0.80	-	-

Photosynthetic action spectra

Units

$P = mg\ C\ m^{-3}\ h^{-1}\ (mg\ Chl)^{-1}$

$I = W\ m^{-2}$

$Alpha = mg\ C\ (mg\ Chl)^{-1}\ h^{-}\ w^{-1}\ m^{-2}$

Organic particulates are in mg m^{-3} and inorganic nutrients are in mg at m^{-3}

LABRADOR SEA 1984

LAT 52 58.10'N LONG 55 35.30'W DATE 26/06/84 DEPTH 30 M

T	P	T	P	T	P	T	P
WAVELENGTH 400 NM							
1	.04	.9	.05	.7	.03	.7	.03
.5	.03	.5	.01				
			ALPHA =	.044			
WAVELENGTH 425 NM							
3	.21	3	.21	3	.15	2	.10
1	.06	1	.01	1	.05	1	.00
			ALPHA =	.085			
WAVELENGTH 450 NM							
6	.27	5	.27	4	.17	3	.16
2	.10	2	.07	2	.08	1	.00
			ALPHA =	.055			
WAVELENGTH 475 NM							
8	.44	5	.34	5	.34	3	.16
2	.18	2	.11	.9	.01		
			ALPHA =	.044			
WAVELENGTH 500 NM							
11	.51	8	.40	6	.31	4	.24
3	.16	2	.18	1	.17		
			ALPHA =	.054			
WAVELENGTH 525 NM							
6	.56	4	.31	3	.20	2	.10
2	.09	.9	.04	.7	.04		
			ALPHA =	.097			

WAVELENGTH 550 NM

16	.52	15	.48	8	.36	5	.29
4	.24	1	.05				

ALPHA = .025

WAVELENGTH 575 NM

18	.42	13	.36	9	.34	5	.15
1	.09	1	.13				

ALPHA = .023

WAVELENGTH 600 NM

22	.61	15	.43	13	.36	10	.20
6	.15	4	.19	2	.04	.8	.05

ALPHA = .026

WAVELENGTH 625 NM

29	.61	15	.26	15	.46	12	.41
7	.19	5	.16	1	.04	.9	.07

ALPHA = .020

WAVELENGTH 650 NM

26	.48	25	.43	19	.37	10	.27
2	.10	2	.07				

ALPHA = .014

WAVELENGTH 675 NM

21	.47	17	.35	17	.63	6	.45
2	.15	1	.08				

ALPHA = .014

SAMPLE TEMP -1.2 C

INCUBATION TEMP .5 C

CHLOROPHYLL	:	6.39	NITRATE	:	.31
CARBON	:	349	SILICATE	:	.91
NITROGEN	:	47	PHOSPHATE	:	.81

LABRADOR SEA 1984

LAT 54 30.00'N LONG 56 20.00'W DATE 27/06/84 ICE ALGAE

T	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
1	.34	.8	.09	.8	.08	.7	.11
.5	.06	.5	.01	.5	.00		
			ALPHA =	.712			
WAVELENGTH 425 NM							
3	1.43	3	.89	3	.81	2	.48
1	.17	1	.29	1	.18	1	.08
			ALPHA =	.554			
WAVELENGTH 450 NM							
5	1.61	4	1.29	3	.79	2	.46
2	.44	2	.31	1	.09		
			ALPHA =	.384			
WAVELENGTH 475 NM							
7	1.97	7	1.99	5	1.57	5	1.33
3	.74	2	.78	2	.53	1	.17
			ALPHA =	.290			
WAVELENGTH 500 NM							
10	2.13	10	1.92	7	1.91	6	1.47
3	.80	3	.79	2	.83	1	.40
			ALPHA =	.192			
WAVELENGTH 525 NM							
4	1.42	3	1.04	3	1.29	2	.43
1	.47	.9	.14	.7	.12		
			ALPHA =	.279			

WAVELENGTH 550 NM

12	2.27	7	1.73	6	2.13	4	.97
2	.84	2	.23				

ALPHA = .044

WAVELENGTH 575 NM

11	2.67	7	1.74	7	2.35	6	1.87
4	.92	3	.95	1	.26	.9	.79

ALPHA = .236

WAVELENGTH 600 NM

11	2.26	8	1.61	4	1.74	3	.72
2	.96	.9	.27	.8	.09		

ALPHA = .207

WAVELENGTH 625 NM

11	3.38	9	2.28	7	2.87	5	2.03
4	1.35	2	1.02	.9	.36	.9	.61

ALPHA = .284

WAVELENGTH 650 NM

20	3.15	14	3.00	11	2.86	7	2.17
5	1.38	2	.48	1	.65		

ALPHA = .130

WAVELENGTH 675 NM

12	5.07	9	3.20	5	2.06	3	1.92
1	.66	1	.44				

ALPHA = .299

SAMPLE TEMP -1.5 C

INCUBATION TEMP .0 C

CHLOROPHYLL	:	19.34	NITRATE	:	.13
CARBON	:	5220	SILICATE	:	2.77
NITROGEN	:	482	PHOSPHATE	:	.75

LABRADOR SEA 1984

LAT 54 20.90'N LONG 56 20.80'W DATE 27/06/84 DEPTH 13 M

I	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
1	.14	.9	.18	.8	.12	.7	.08
.5	.06	.5	.05	.5	.05		
			ALPHA =	.220			
WAVELENGTH 425 NM							
3	.48	3	.35	2	.15	1	.08
1	.11	1	.11	1	.05		
			ALPHA =	.182			
WAVELENGTH 450 NM							
5	.84	4	.63	4	.51	3	.35
2	.19	2	.25	2	.19	1	.06
			ALPHA =	.175			
WAVELENGTH 475 NM							
7	.95	7	.90	5	.60	5	.55
3	.40	2	.33	2	.21	1	.11
			ALPHA =	.129			
WAVELENGTH 500 NM							
10	.92	10	.96	6	.68	3	.36
3	.30	1	.18				
			ALPHA =	.088			
WAVELENGTH 525 NM							
6	.58	4	.48	3	.40	3	.45
2	.19	1	.24	.9	.09	.7	.14
			ALPHA =	.091			

WAVELENGTH 550 NM

12	.93	7	.73	6	.76	4	.35
2	.31	2	.12				

ALPHA = .015

WAVELENGTH 575 NM

11	1.06	7	.70	7	.84	6	.68
4	.31	3	.34	1	.11	.9	.24

ALPHA = .096

WAVELENGTH 600 NM

11	.89	8	.54	6	.64	4	.41
3	.19	2	.30	.9	.10	.8	.09

ALPHA = .077

WAVELENGTH 625 NM

11	1.17	8	.72	7	.95	4	.35
2	.30	.9	.09	.9	.17		

ALPHA = .100

WAVELENGTH 650 NM

20	1.38	14	1.08	11	1.00	7	.82
5	.56	4	.66	2	.15	1	.26

ALPHA = .059

WAVELENGTH 675 NM

12	1.46	12	1.55	9	1.57	5	.82
3	.75	1	.21	1	.14		

ALPHA = .117

SAMPLE TEMP -1.2 C

INCUBATION TEMP .0 C

CHLOROPHYLL	:	12.05	NITRATE	:	.45
CARBON	:	826	SILICATE	:	2.15
NITROGEN	:	95	PHOSPHATE	:	.65

LABRADOR SEA 1984

LAT 54 22.90'N LONG 55 59.50'W DATE 27/06/84 DEPTH 13 M

I	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
1	.15	.9	.17	.8	.07	.8	.07
.7	.07	.5	.05	.5	.05	.5	.02
			ALPHA =	.254			
WAVELENGTH 425 NM							
3	.37	3	.27	2	.10	1	.06
1	.11	1	.06	1	.06		
			ALPHA =	.140			
WAVELENGTH 450 NM							
5	.63	4	.53	4	.55	3	.33
2	.20	2	.19	2	.16	1	.07
			ALPHA =	.139			
WAVELENGTH 475 NM							
7	.67	7	.75	5	.50	5	.50
3	.27	2	.28	2	.26	1	.12
			ALPHA =	.094			
WAVELENGTH 500 NM							
10	.90	10	.91	7	.62	6	.57
3	.40	3	.32	2	.35	1	.15
			ALPHA =	.083			
WAVELENGTH 525 NM							
6	.58	4	.44	3	.41	3	.38
2	.20	1	.13	.9	.08	.7	.06
			ALPHA =	.099			

WAVELENGTH 550 NM

12	.69	7	.49	6	.51	4	.20
2	.20	2	.11				

ALPHA = .013

WAVELENGTH 575 NM

11	.62	7	.48	7	.59	6	.44
4	.23	3	.16	1	.11	.9	.15

ALPHA = .059

WAVELENGTH 600 NM

11	.52	8	.46	6	.47	4	.27
3	.18	2	.16	.9	.05	.8	.03

ALPHA = .052

WAVELENGTH 625 NM

11	.80	8	.59	7	.59	5	.43
4	.33	2	.21	.9	.09	.9	.15

ALPHA = .067

WAVELENGTH 650 NM

20	.89	14	.67	11	.80	7	.52
5	.37	4	.39	2	.11	1	.06

ALPHA = .041

WAVELENGTH 675 NM

12	1.38	9	1.05	6	.87	5	.52
3	.37	1	.15	1	.08		

ALPHA = .092

SAMPLE TEMP -1.2 C

INCUBATION TEMP .0 C

CHLOROPHYLL	:	11.67	NITRATE	:	.24
CARBON	:	484	SILICATE	:	3.81
NITROGEN	:	78	PHOSPHATE	:	.44

LABRADOR SEA 1984

LAT 55 47.20'N LONG 54 37.40'W DATE 28/06/84 DEPTH 40 M

I	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
1	.12	.8	.04	.8	.14	.7	.12
.5	.07	.5	.01	.5	.06		
			ALPHA =	.329			
WAVELENGTH 425 NM							
3	.63	3	.47	3	.44	2	.24
1	.09	1	.16	1	.13	1	.02
			ALPHA =	.260			
WAVELENGTH 450 NM							
5	.93	4	.86	4	.89	3	.47
2	.32	2	.22	2	.21	1	.06
			ALPHA =	.227			
WAVELENGTH 475 NM							
7	1.25	7	1.29	5	.91	5	.88
3	.44	2	.30	2	.37	1	.09
			ALPHA =	.194			
WAVELENGTH 500 NM							
10	1.17	10	1.24	7	.93	6	1.01
3	.55	2	.49	1	.32		
			ALPHA =	.079			
WAVELENGTH 525 NM							
6	.83	4	.62	3	.52	2	.27
1	.29	.9	.15	.7	.09		
			ALPHA =	.138			

WAVELENGTH 550 NM

12	1.45	7	1.13	6	1.09	4	.53
2	.44	2	.13				

ALPHA = .029

WAVELENGTH 575 NM

11	1.55	7	.81	7	1.15	6	.86
4	.40	3	.40	1	.11	.9	.22

ALPHA = .143

WAVELENGTH 600 NM

11	1.12	8	.87	6	.83	4	.75
3	.46	2	.35	.9	.12	.8	.04

ALPHA = .104

WAVELENGTH 625 NM

11	1.41	8	1.00	7	1.07	5	.99
4	.61	2	.46	.9	.15	.9	.25

ALPHA = .116

WAVELENGTH 650 NM

20	1.25	14	1.17	11	1.03	7	.70
5	.43	4	.52	2	.17	1	.21

ALPHA = .060

WAVELENGTH 675 NM

12	1.59	9	1.25	6	1.18	5	.61
3	.77	1	.17	1	.11		

ALPHA = .109

SAMPLE TEMP -.2 C

INCUBATION TEMP .0 C

CHLOROPHYLL	:	4.69	NITRATE	:	1.39
CARBON	:	440	SILICATE	:	6.54
NITROGEN	:	65	PHOSPHATE	:	.25

LABRADOR SEA 1984

LAT 55 46.50'N LONG 54 54.60'W DATE 30/06/84 DEPTH 35 M

I	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
.6	.16	.5	.20	.4	.17	.4	.11
.3	.09	.2	.08	.2	.04		
			ALPHA =	.280			
WAVELENGTH 425 NM							
3	.65	2	.47	2	.43	1	.29
.8	.15	.8	.18	.7	.13	.6	.07
			ALPHA =	.264			
WAVELENGTH 450 NM							
5	.95	4	.79	3	.74	2	.50
1	.26	1	.19	1	.29	.5	.10
			ALPHA =	.214			
WAVELENGTH 475 NM							
6	1.33	6	1.29	4	.94	3	.92
2	.50	1	.34	1	.36	.5	.14
			ALPHA =	.213			
WAVELENGTH 500 NM							
8	1.33	7	1.33	6	1.05	5	.88
2	.50	2	.58	2	.50	.9	.36
			ALPHA =	.138			
WAVELENGTH 525 NM							
5	.68	4	.66	3	.57	3	.63
1	.29	1	.24	.6	.18	.3	.10
			ALPHA =	.161			

WAVELENGTH 550 NM

15	1.42	15	1.39	8	1.05	5	1.10
5	.56	2	.50	.8	.18		

ALPHA = .071

WAVELENGTH 575 NM

19	1.27	12	1.06	10	.88	9	.83
4	.38	4	.41	.9	.24	.8	.14

ALPHA = .066

WAVELENGTH 600 NM

19	1.23	12	.90	9	.78	8	.67
5	.49	3	.29	1	.11	.5	.06

ALPHA = .062

WAVELENGTH 625 NM

22	1.39	12	1.14	10	.96	10	.92
6	.62	3	.42	.8	.14	.6	.18

ALPHA = .062

WAVELENGTH 650 NM

11	1.19	9	.88	6	.61	3	.50
3	.35	1	.14	.8	.15		

ALPHA = .065

WAVELENGTH 675 NM

10	1.56	10	1.27	8	1.19	6	1.17
3	.55	3	.52	.7	.17	.5	.09

ALPHA = .134

SAMPLE TEMP	-.3 C		INCUBATION TEMP	-.5 C	
CHLOROPHYLL	:	5.98	NITRATE	:	5.33
CARBON	:	435	SILICATE	:	7.21
NITROGEN	:	49	PHOSPHATE	:	.44

LABRADOR SEA 1984

LAT 55 53.20'N LONG 54 42.90'W DATE 30/06/84 DEPTH 30 M

I	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
.6	.57	.4	.30	.4	.48	.4	.10
.3	.28	.2	.00				
			ALPHA =	.576			
WAVELENGTH 425 NM							
2	.36	2	.34	1	.15	.8	.22
.8	.18	.7	.17	.6	.05		
			ALPHA =	.278			
WAVELENGTH 450 NM							
5	.98	4	.75	3	.78	2	.64
1	.46	1	.41	1	.50	.5	.34
			ALPHA =	.146			
WAVELENGTH 475 NM							
6	1.15	6	1.20	4	.71	3	.79
2	.40	1	.33	1	.39		
			ALPHA =	.131			
WAVELENGTH 500 NM							
8	.90	7	1.29	6	.99	5	.61
2	.48	2	.36	.9	.33		
			ALPHA =	.092			
WAVELENGTH 525 NM							
5	.87	4	.47	3	.60	3	.49
1	.58	1	.34	.3	.16		
			ALPHA =	.055			

WAVELENGTH 550 NM

15	.91	15	.90	8	.65	5	.61
5	.41	2	.22	.8	.18		

ALPHA = .048

WAVELENGTH 575 NM

12	.70	10	.63	9	.63	4	.30
4	.24	.9	.22	.8	.07		

ALPHA = .040

WAVELENGTH 600 NM

19	.90	12	.50	9	.58	8	.48
5	.24	3	.18	1	.15	.5	.09

ALPHA = .042

WAVELENGTH 625 NM

22	1.04	12	.83	10	.61	10	.52
6	.35	3	.30	.8	.06	.6	.16

ALPHA = .045

WAVELENGTH 650 NM

17	.90	11	.73	9	.48	6	.46
3	.41	1	.07	.8	.19		

ALPHA = .044

WAVELENGTH 675 NM

10	1.14	10	.99	8	.84	3	.46
3	.40	.7	.34	.5	.07		

ALPHA = .091

SAMPLE TEMP -.6 C

CHLOROPHYLL : .98

CARBON : 306

NITROGEN : 19

INCUBATION TEMP -.5 C

NITRATE : .00

SILICATE : 6.59

PHOSPHATE : .24

LABRADOR SEA 1984

LAT 52 39.50'N LONG 51 57.30'W DATE 03/07/84 DEPTH 15 M

T	P	I	P	I	P	I	P
WAVELENGTH 400 NM							
.6	.57	.5	.47	.4	.40	.4	.37
.3	.29	.2	.18				
			ALPHA =	.659			
WAVELENGTH 425 NM							
2	1.08	2	.93	1	.75	.8	.40
.8	.34	.7	.43	.6	.29		
			ALPHA =	.651			
WAVELENGTH 450 NM							
5	2.21	4	1.82	3	1.61	2	1.05
1	.78	1	.49	1	.58	.5	.28
			ALPHA =	.480			
WAVELENGTH 475 NM							
6	3.11	6	2.49	4	1.68	3	1.93
2	1.05	1	.65	1	.73	.5	.30
			ALPHA =	.453			
WAVELENGTH 500 NM							
8	2.74	7	2.15	6	1.89	5	1.82
2	1.08	2	1.40	2	.85	.9	.54
			ALPHA =	.256			
WAVELENGTH 525 NM							
5	2.12	4	1.46	3	1.48	3	1.48
1	.79	1	.57	.6	.64	.3	.27
			ALPHA =	.356			

WAVELENGTH 550 NM

15	3.38	15	3.27	8	2.47	5	1.25
2	.76	.8	.34				

ALPHA = .185

WAVELENGTH 575 NM

10	3.53	12	3.26	10	1.70	9	2.33
4	.75	4	.89	.9	.58	.8	.26

ALPHA = .196

WAVELENGTH 600 NM

10	2.30	12	1.33	9	1.89	8	1.18
5	.63	3	.76	1	.22	.5	.16

ALPHA = .110

WAVELENGTH 625 NM

22	2.87	12	2.59	10	1.81	10	1.77
6	.98	3	.83	.8	.26	.6	.55

ALPHA = .127

WAVELENGTH 650 NM

11	3.05	9	1.92	6	1.70	3	1.32
3	.87	1	.25	.8	.46		

ALPHA = .172

WAVELENGTH 675 NM

10	5.30	8	3.67	6	4.13	3	1.58
3	1.59	.7	.43	.5	.37		

ALPHA = .437

SAMPLE TEMP -.5 C

CHLOROPHYLL : 18.90
CARBON : 857
NITROGEN : 124

INCUBATION TEMP -.5 C

NITRATE : 1.62
SILICATE : 3.47
PHOSPHATE : .45

Total Radiation

Units are in W m^{-2} for hour ending at hour indicated. All times are Atlantic Daylight Time.

TOTAL RADIATION
LABRADOR SHELF
June-July 1984

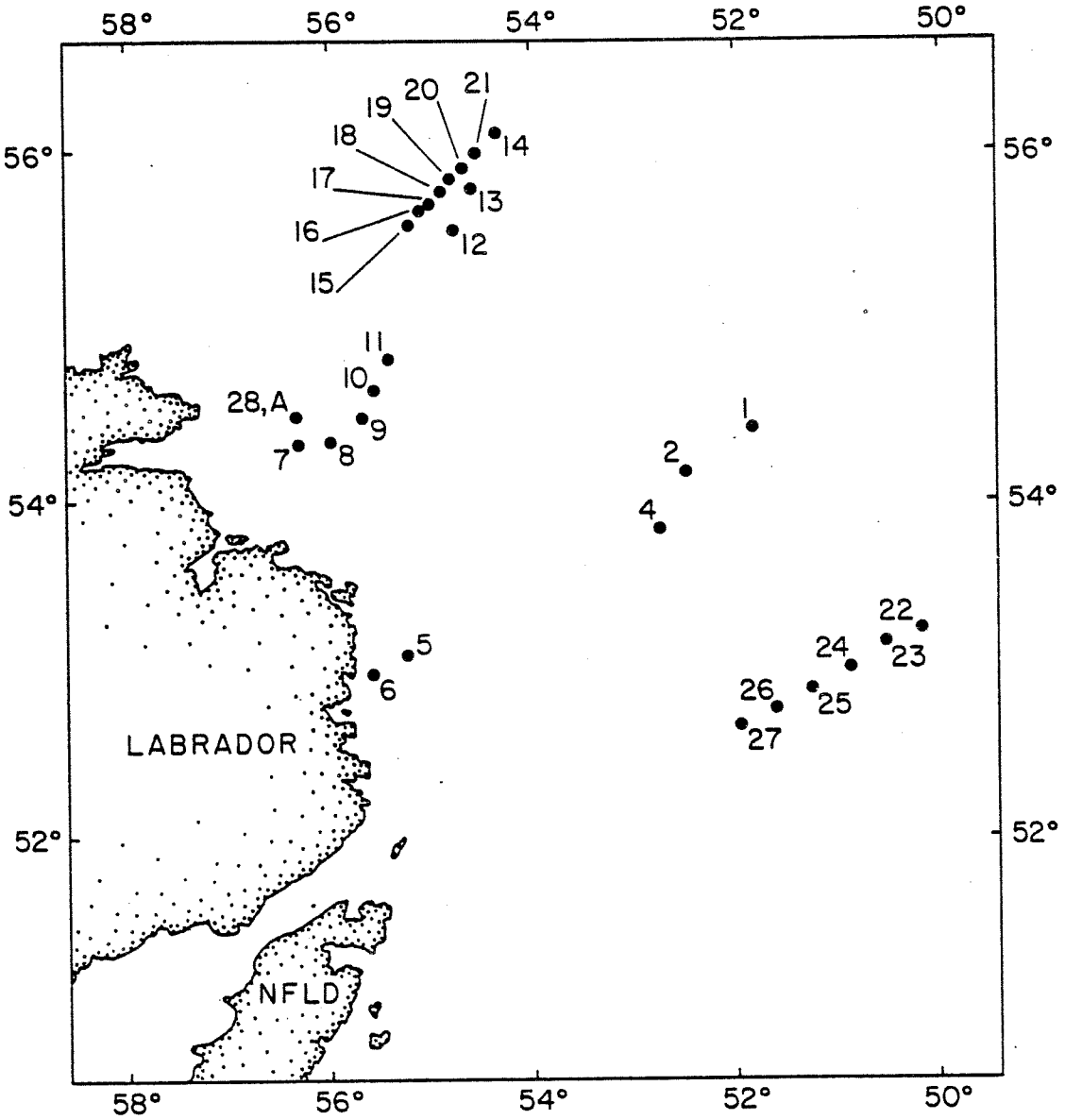
TOTAL	23/6	24/6	25/6	26/6	27/6	28/6	29/6	30/6	1/7	2/7	3/7	4/7	5/7
0500	-	9	51	31	29	9	14	4	5	4	5	9	
0600	-	55	125	89	100	40	86	25	38	14	31	65	21
0700	-	114	270	173	139	78	168	21	73	27	64	115	87
0800	-	195	322	273	196	117	236	33	98	52	113	130	76
0900	-	406	407	437	406	196	344	65	153	77	127	163	-
1000	-	359	619	573	511	288	426	101	129	90	287	242	-
1100	-	463	625	618	493	366	400	55	204	119	405	175	-
1200	522	715	693	567	596	391	497	36	156	140	458	164	-
1300	533	742	742	703	649	426	576	41	143	158	380	494	-
1400	326	725	632	703	516	583	580	85	169	145	395	376	-
1500	298	686	453	660	518	270	534	114	123	237	497	441	-
1600	299	618	610	520	505	365	498	103	91	267	394	388	-
1700	201	517	420	394	344	252	446	53	85	152	377	236	-
1800	149	400	354	336	241	149	311	26	59	108	274	100	-
1900	61	263	157	205	143	87	112	14	46	64	183	33	-
2000	22	98	115	136	53	64	55	5	24	34	72	13	-
2100	1	23	22	37	17	15	16	1	1	6	18	4	-

Photosynthetically Active Radiation

Units are in W m^{-2} for hour ending at hour indicated. All times are Atlantic Daylight Time.

PAR
LABRADOR SHELF
June-July 1984

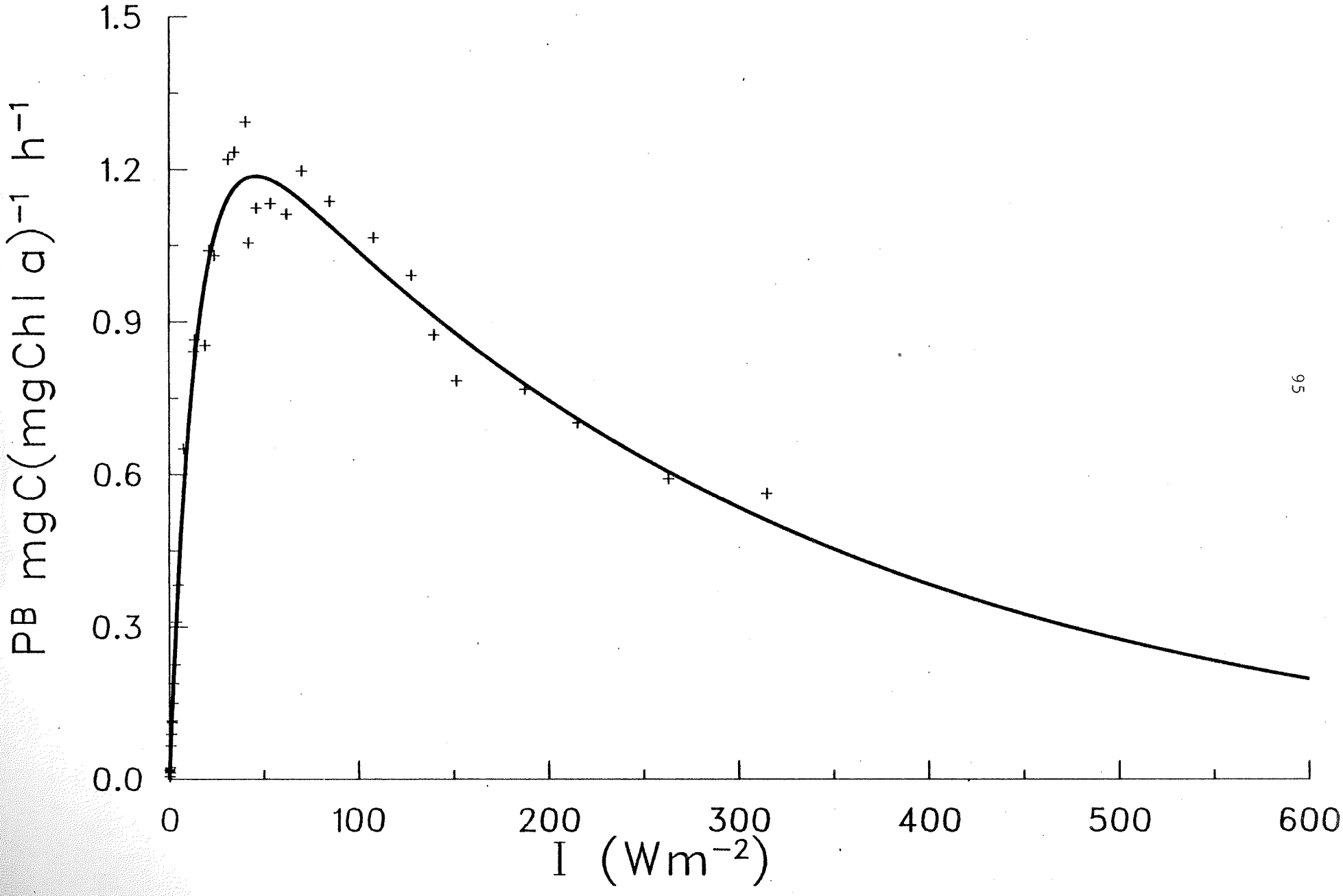
PAR	23/6	24/6	25/6	26/6	27/6	28/6	29/6	30/6	1/7	2/7	3/7	4/7	5/7
0500	-	7	23	20	18	8	-	4	5	4	5	7	
0600	-	42	57	66	72	34	-	22	31	12	25	48	16
0700	-	88	193	128	110	66	-	20	60	24	52	85	66
0800	-	150	242	208	161	99	-	32	82	46	90	102	64
0900	-	302	324	337	305	161	-	61	129	67	104	129	-
1000	-	273	462	431	396	231	330	92	113	79	223	188	-
1100	-	342	483	465	382	296	312	54	173	103	315	144	-
1200	403	553	472	443	474	316	377	37	134	121	367	136	-
1300	410	573	532	550	521	345	427	41	124	137	295	365	-
1400	256	557	482	543	417	470	466	79	145	122	307	266	-
1500	239	512	388	508	416	221	426	102	105	192	393	337	-
1600	233	450	449	385	417	271	381	94	79	211	298	290	-
1700	157	365	295	285	274	202	323	50	74	125	278	186	-
1800	114	272	243	239	187	124	228	25	51	88	203	81	-
1900	48	160	108	126	114	72	87	14	38	52	141	28	-
2000	18	62	73	60	43	50	42	5	20	27	56	12	-
2100		15	16	19	13	13	13			4	15	3	-



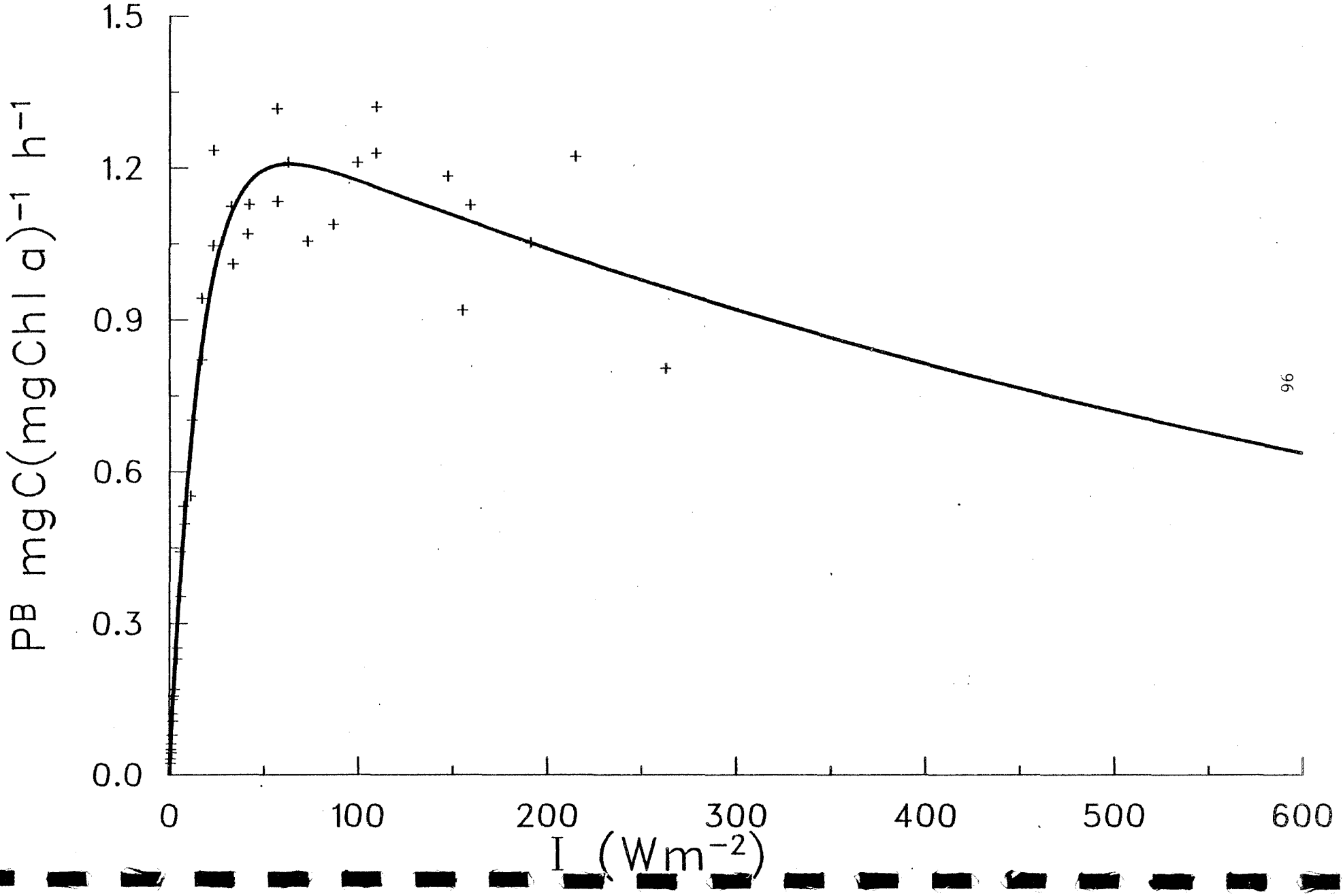
Location of sampling stations on the Labrador Shelf.

Solid line fits to carbon PI data

ID 8403343. STA. 1 25/06/84 35 M

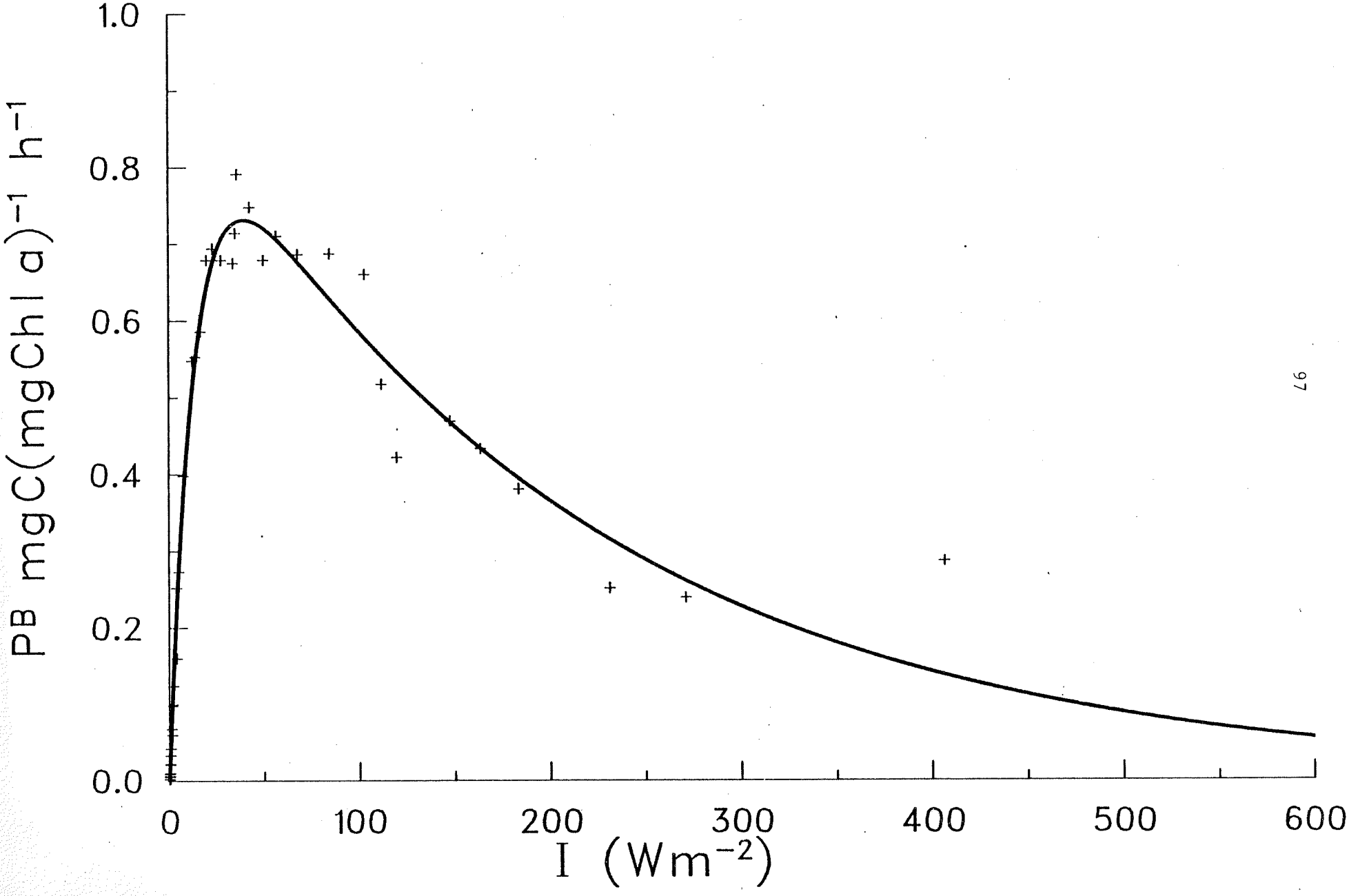


ID 8403345 STA. 1 25/06/84 35 M

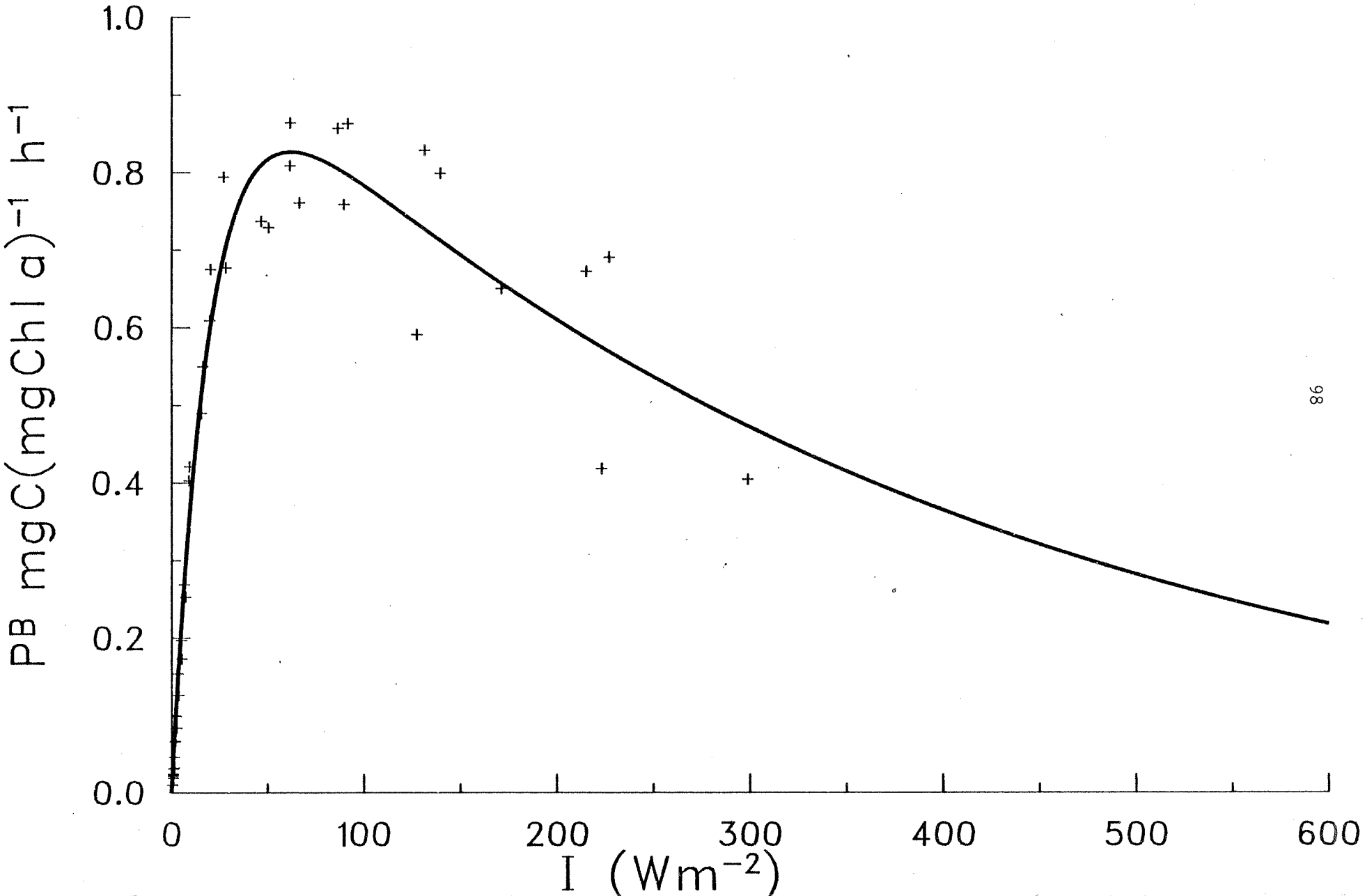


96

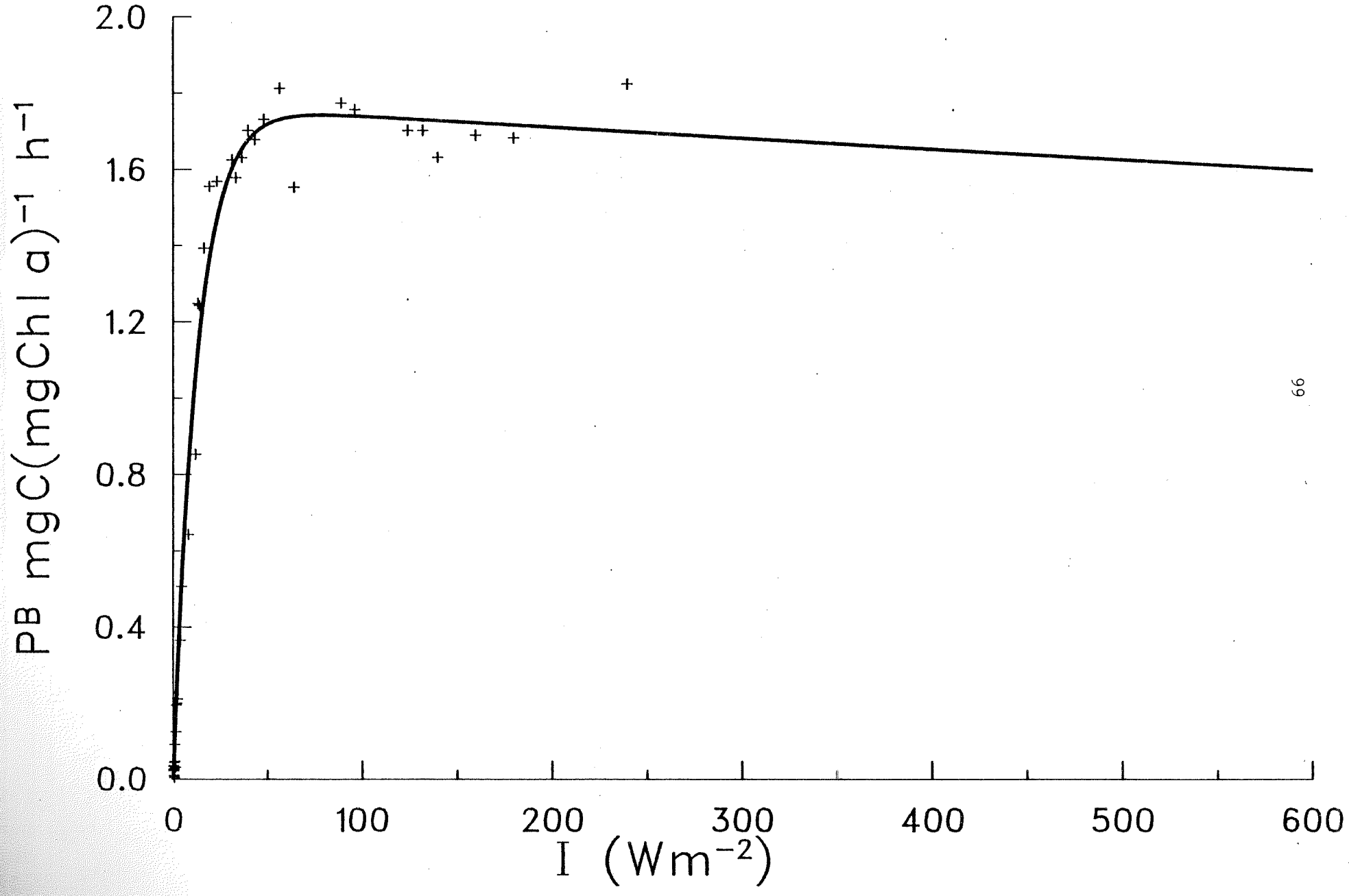
ID 8403361 STA. 6 26/06/84 30 M



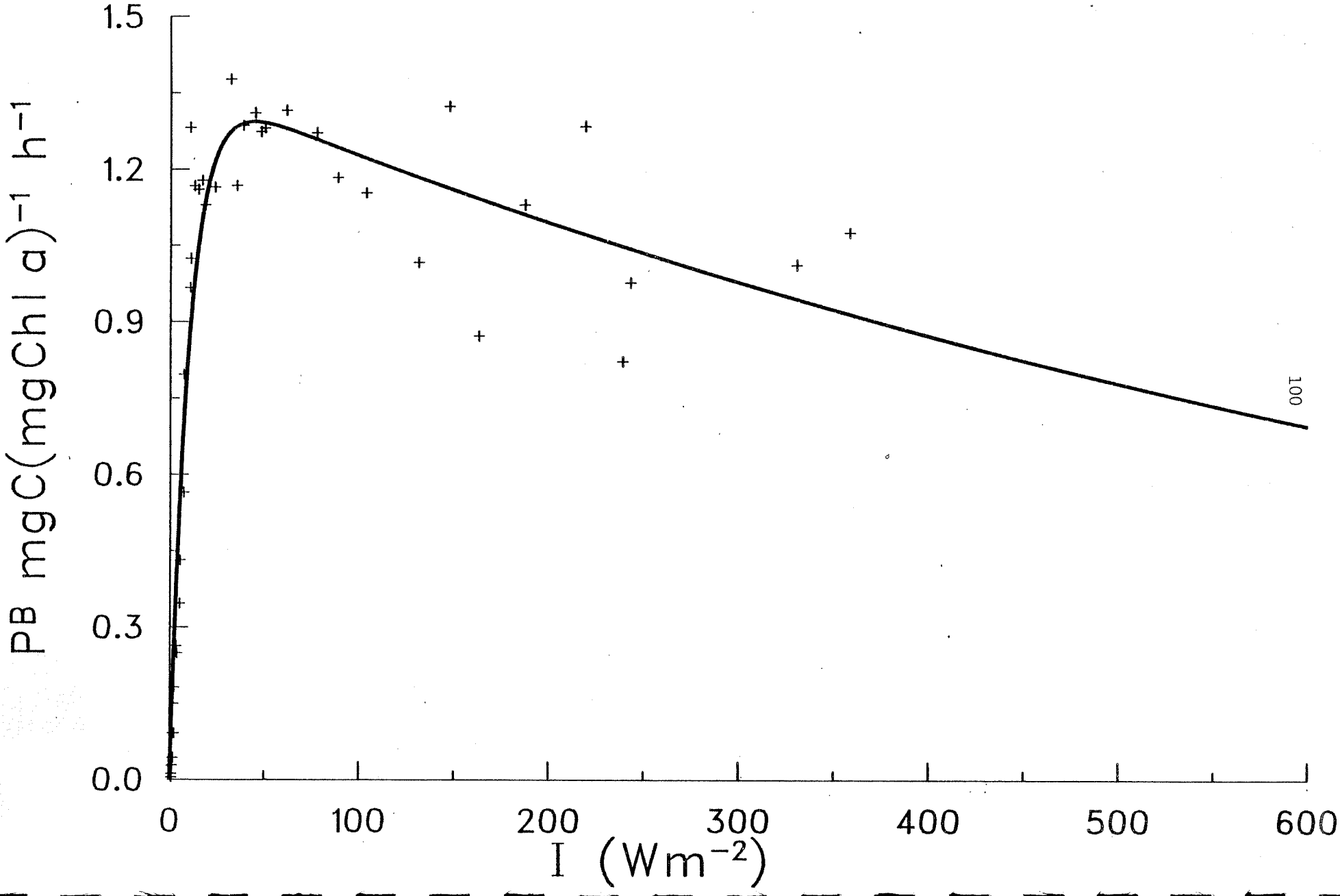
ID 8403362 STA. 6 26/06/84 30 M



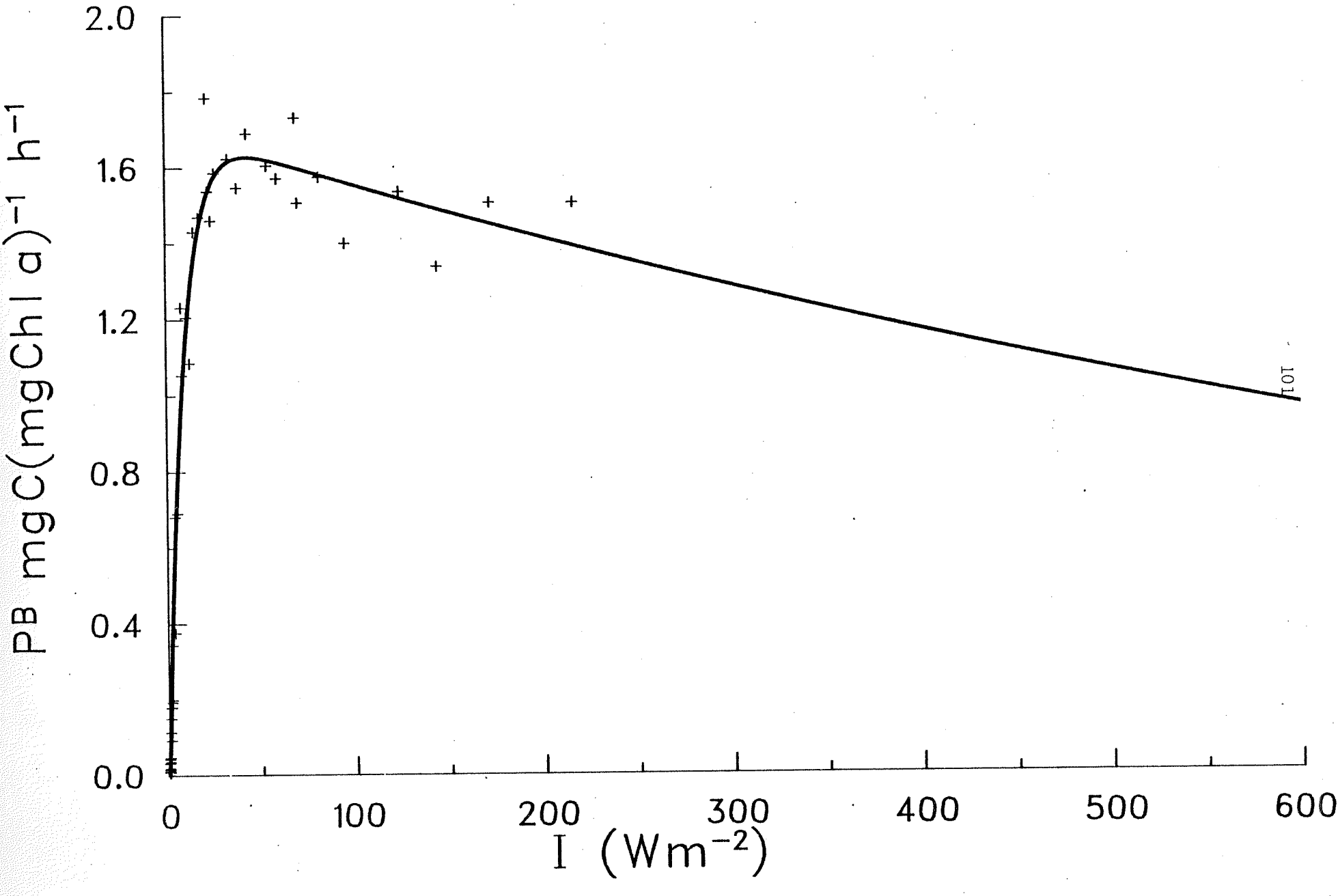
ID 8403371 STA. 7 27/06/84 13 M



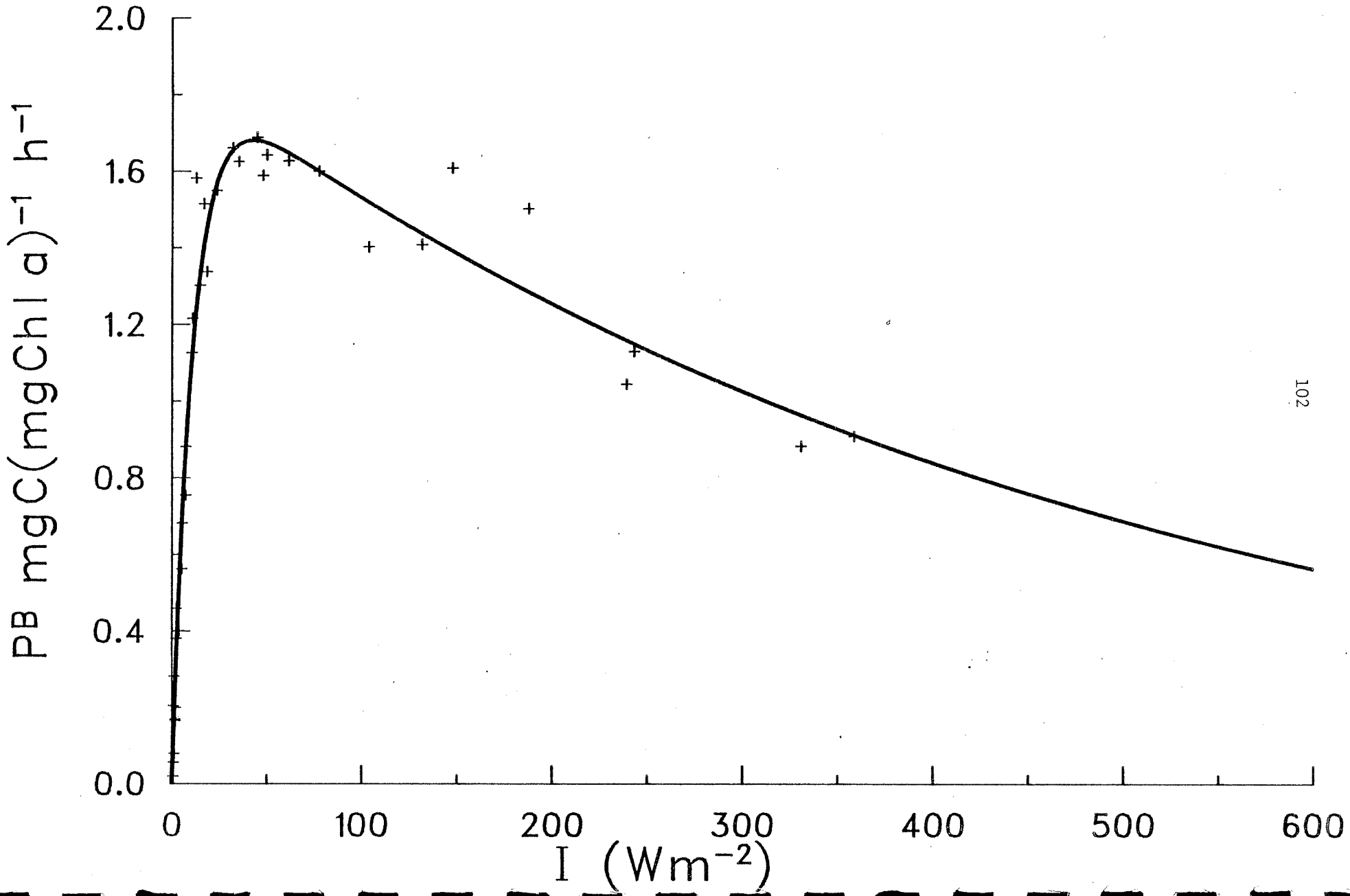
ID 8403366 STA. 7 27/06/84 ICE ALGAE



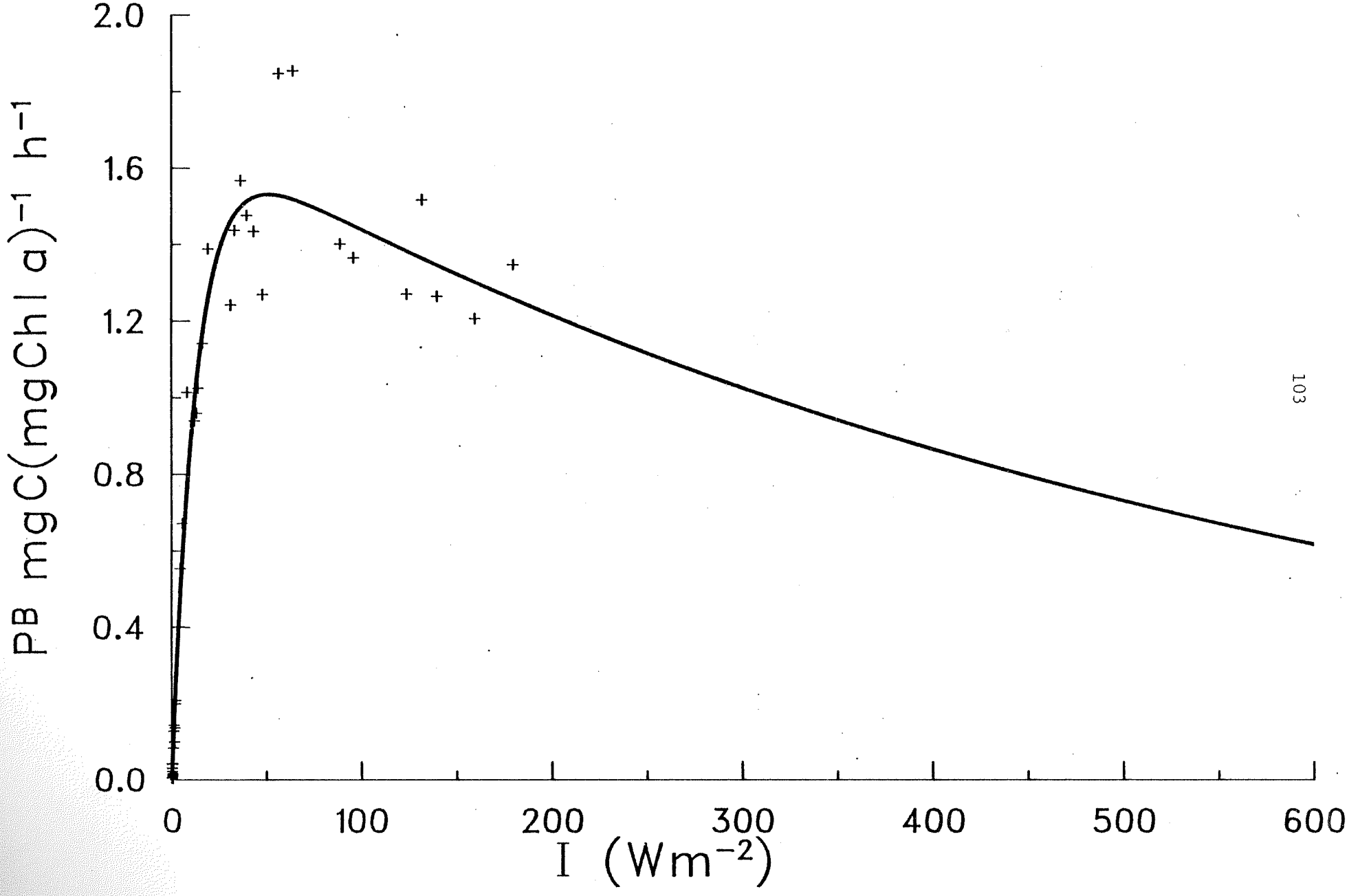
ID 8403374 STA. 7 27/06/84 ICE ALGAE

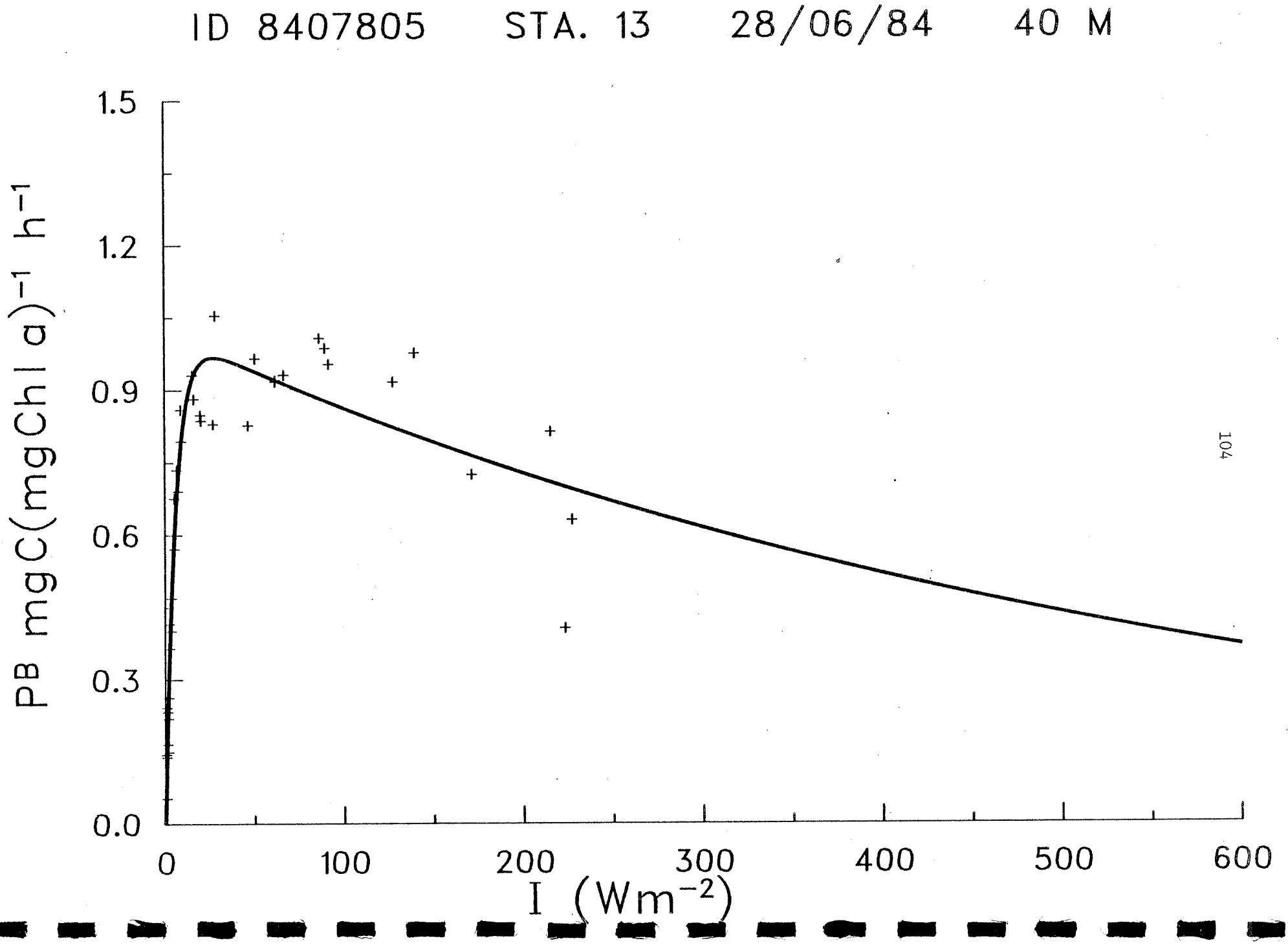


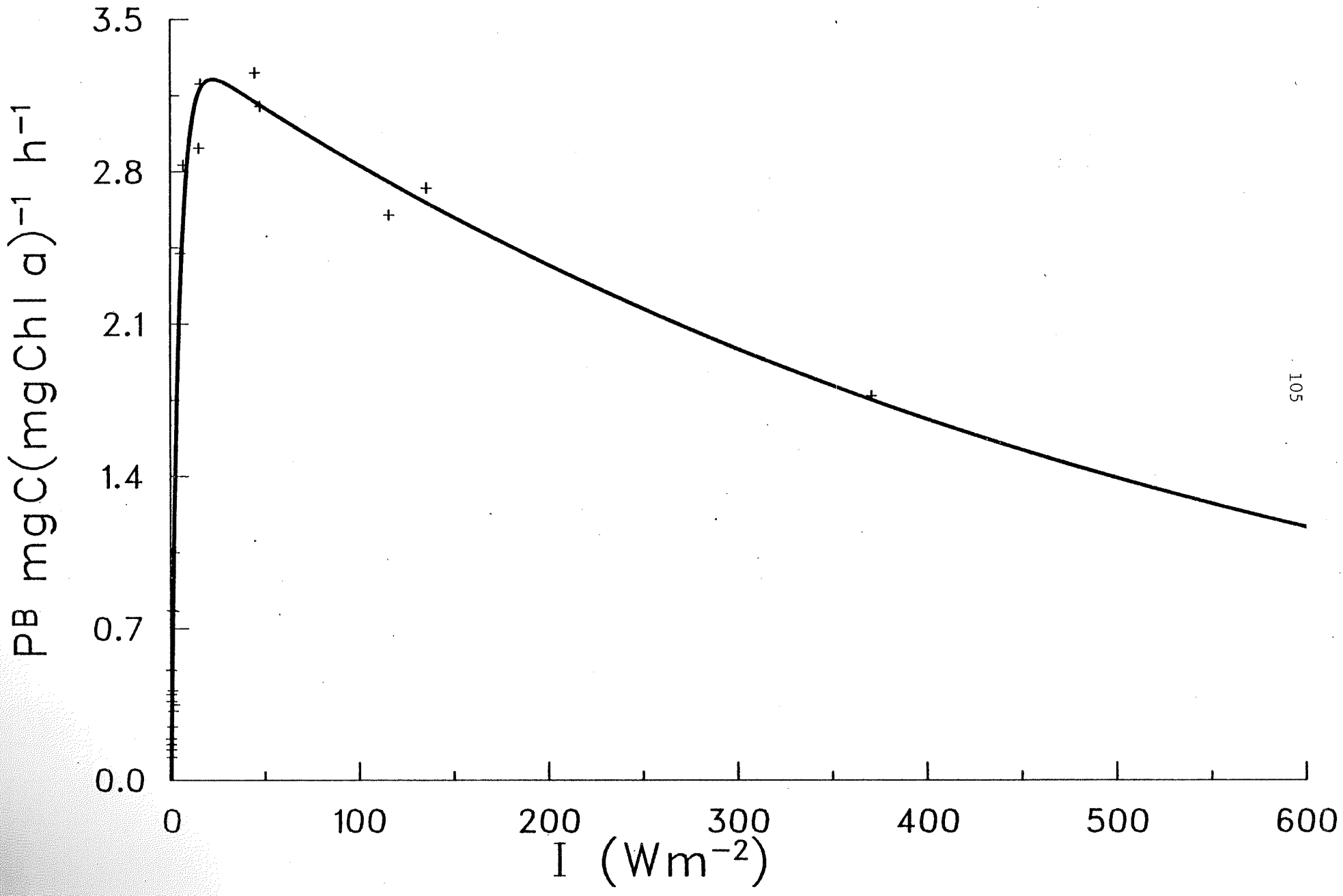
ID 8403383 STA. 7 27/06/84 ICE ALGAE



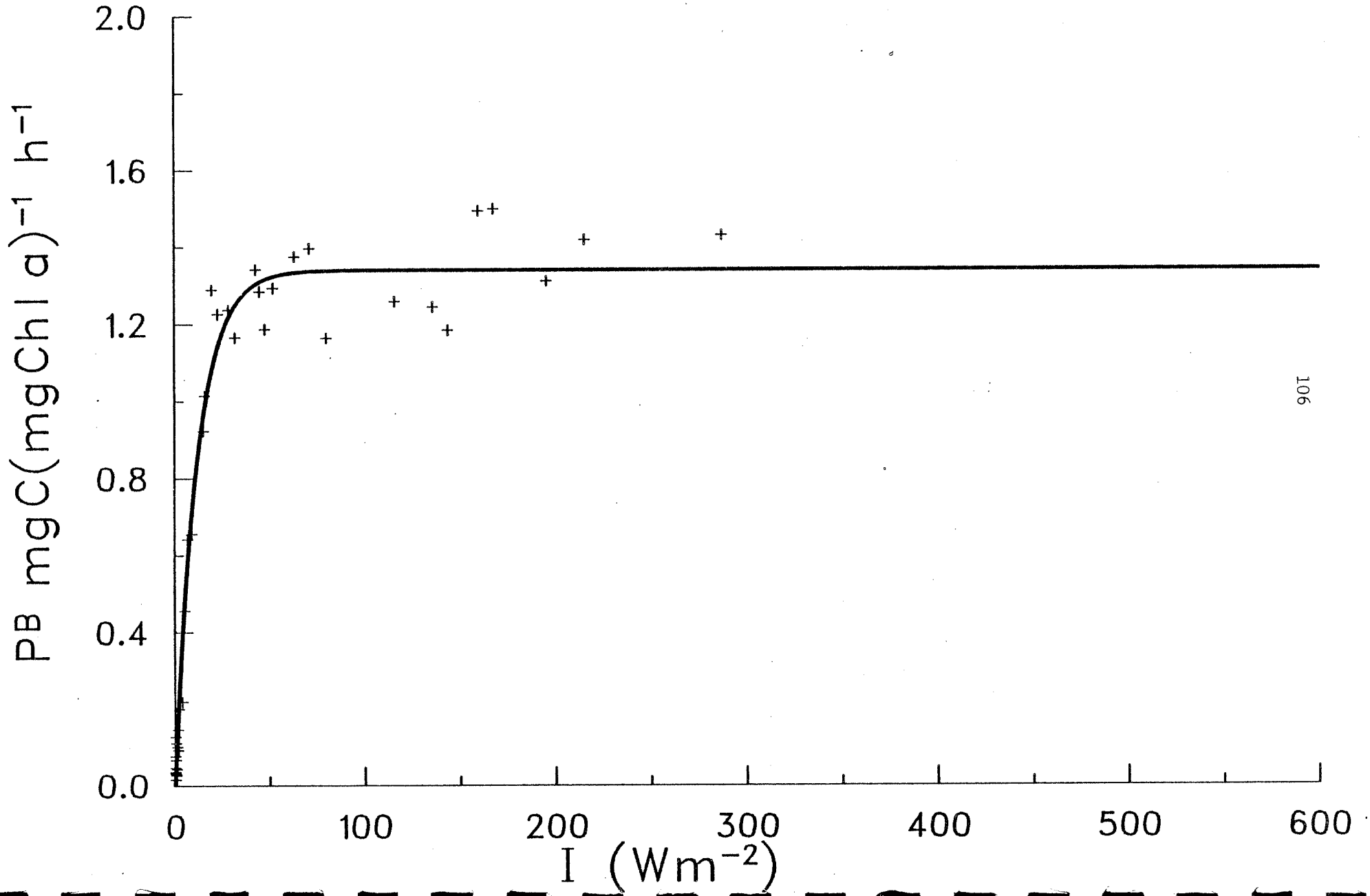
ID 8403377 STA. 8 27/06/84 13 M



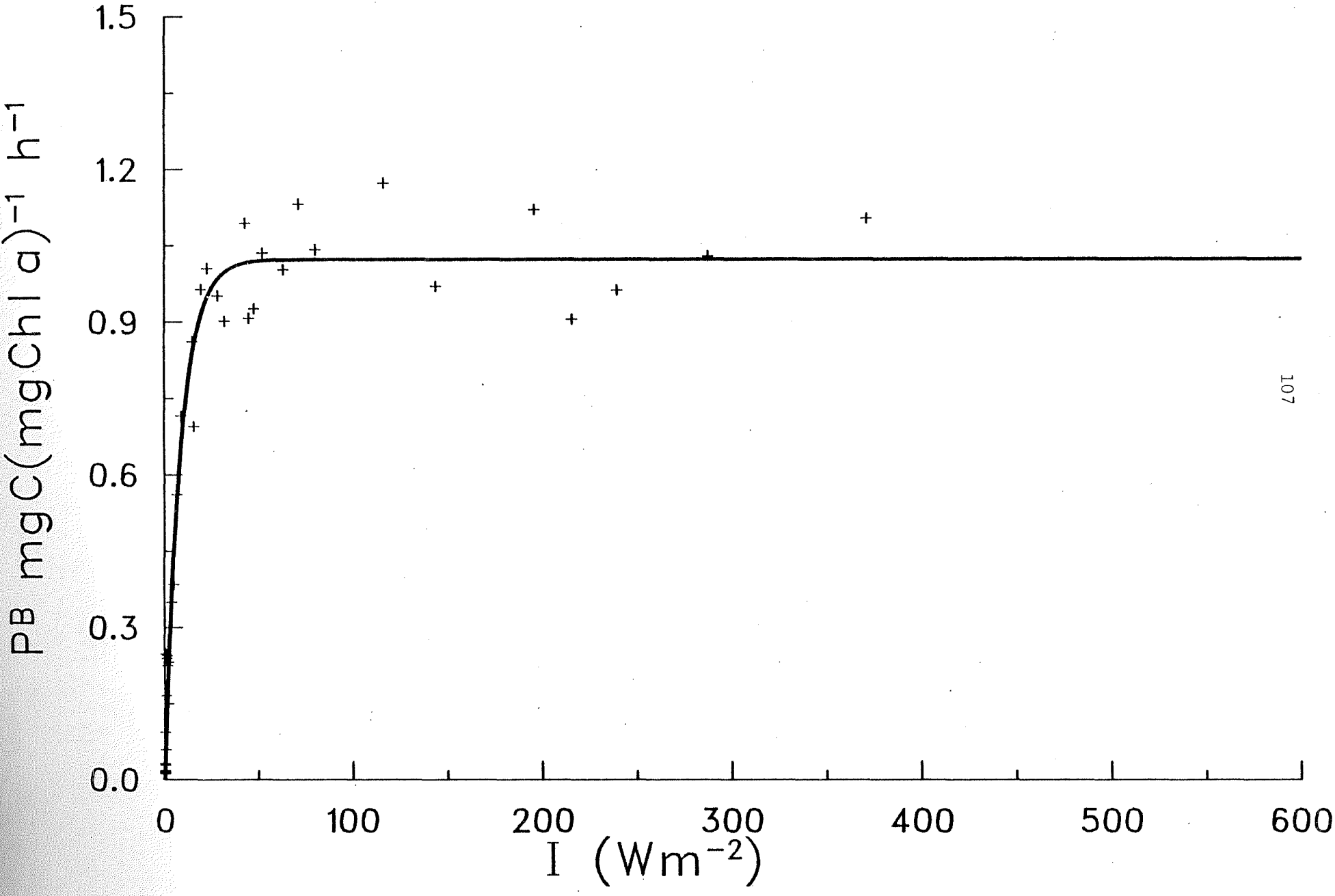

ID 8407805 STA. 13 28/06/84 40 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
1.5
1.2
0.9
0.6
0.3
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

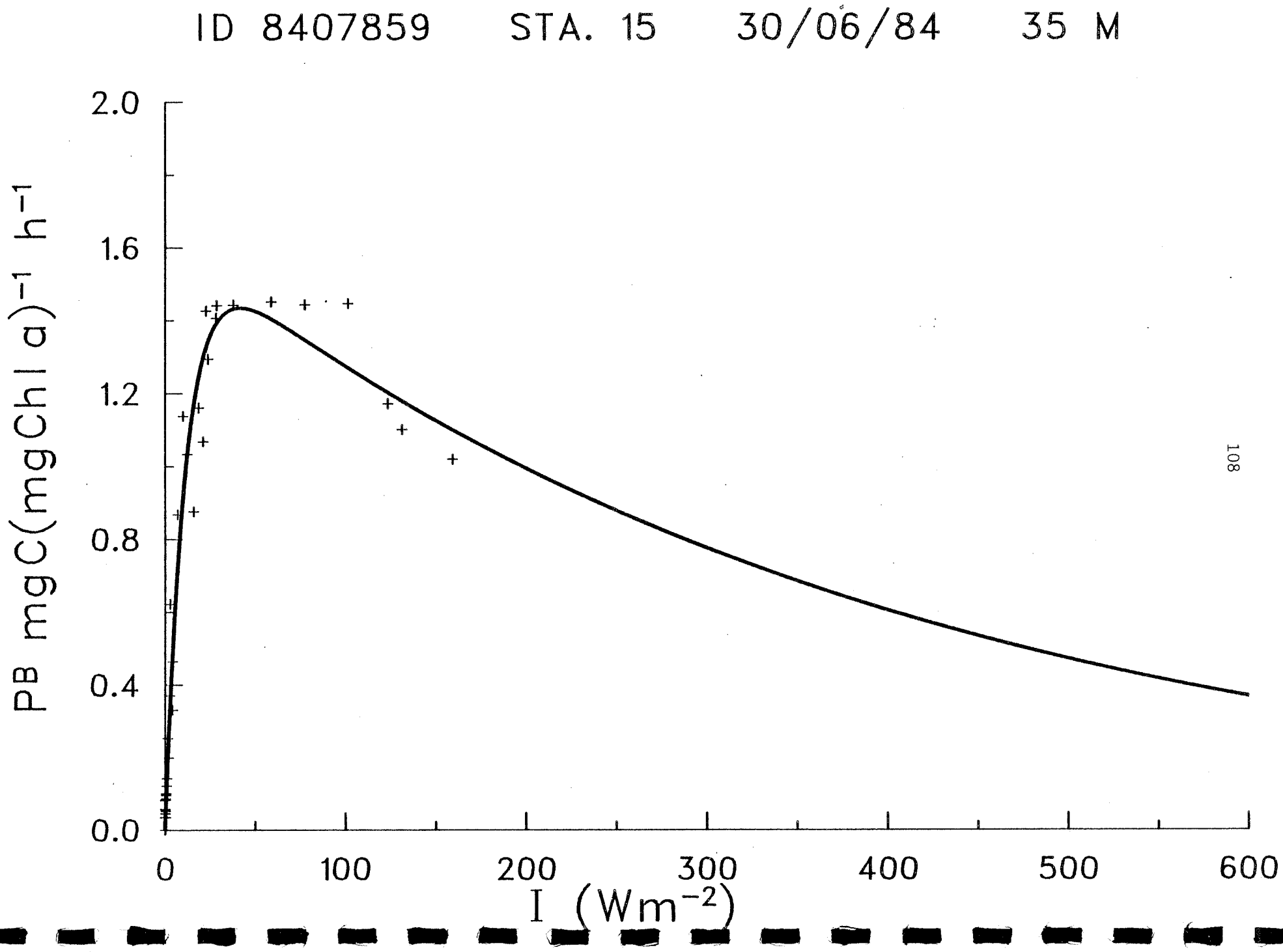

ID 8407807 STA. 13 28/06/84 30 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
3.5
2.8
2.1
1.4
0.7
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

ID 8407812 STA. 13 28/06/84 50 M

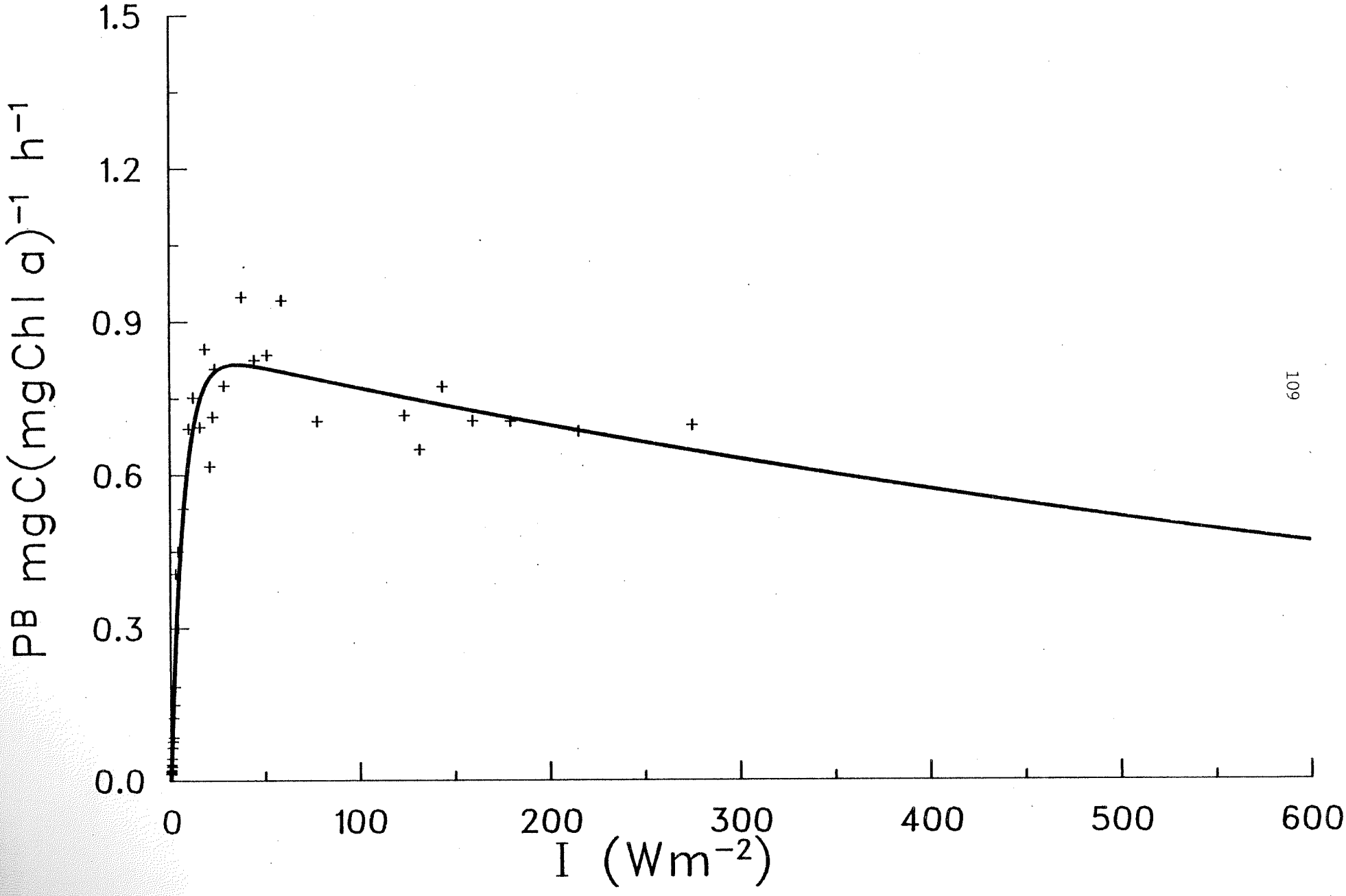


ID 8407813 STA. 13 28/06/84 60 M

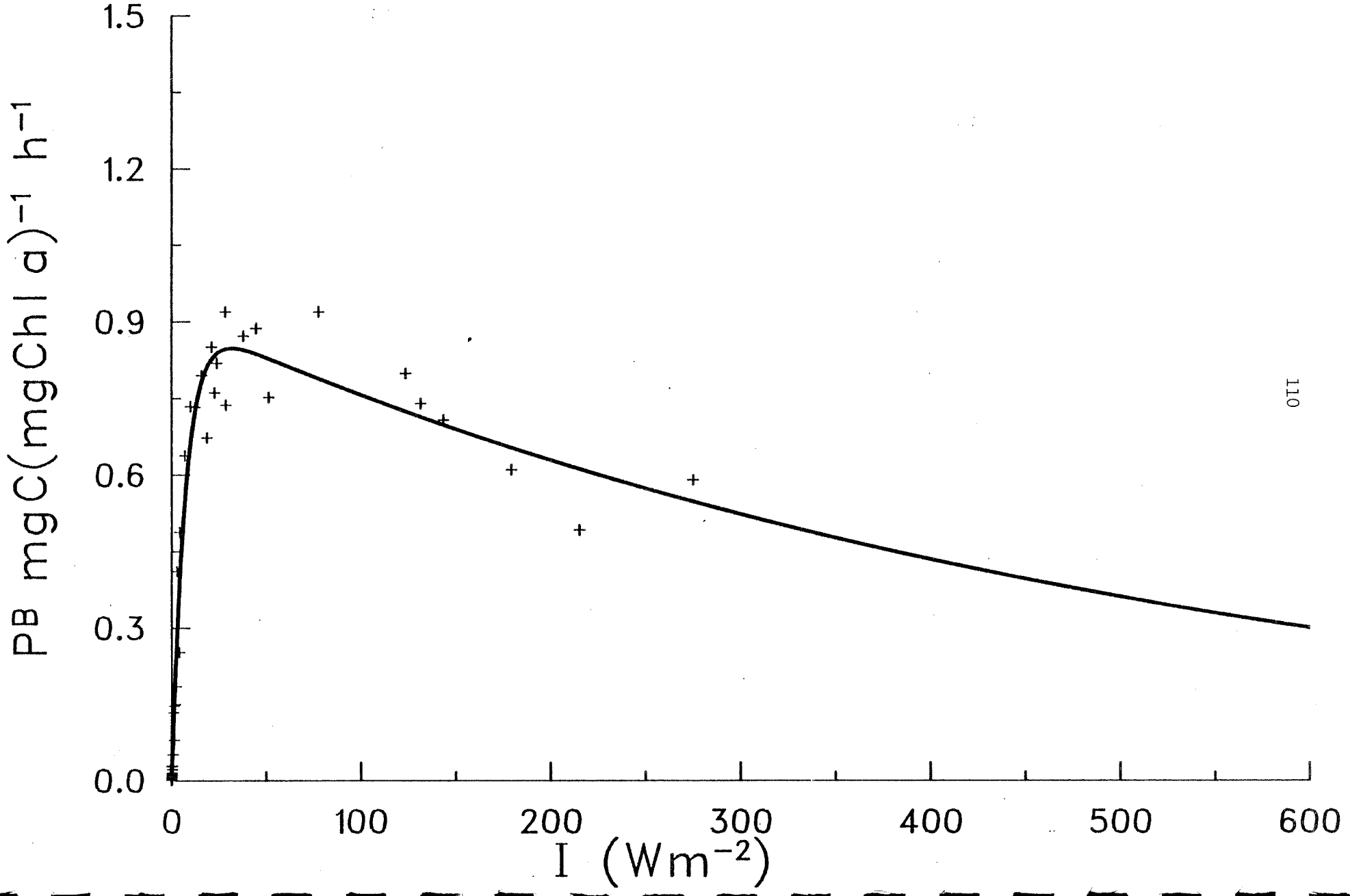



ID 8407859 STA. 15 30/06/84 35 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
2.0
1.6
1.2
0.8
0.4
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

ID 8407860 STA. 16 30/06/84 50 M

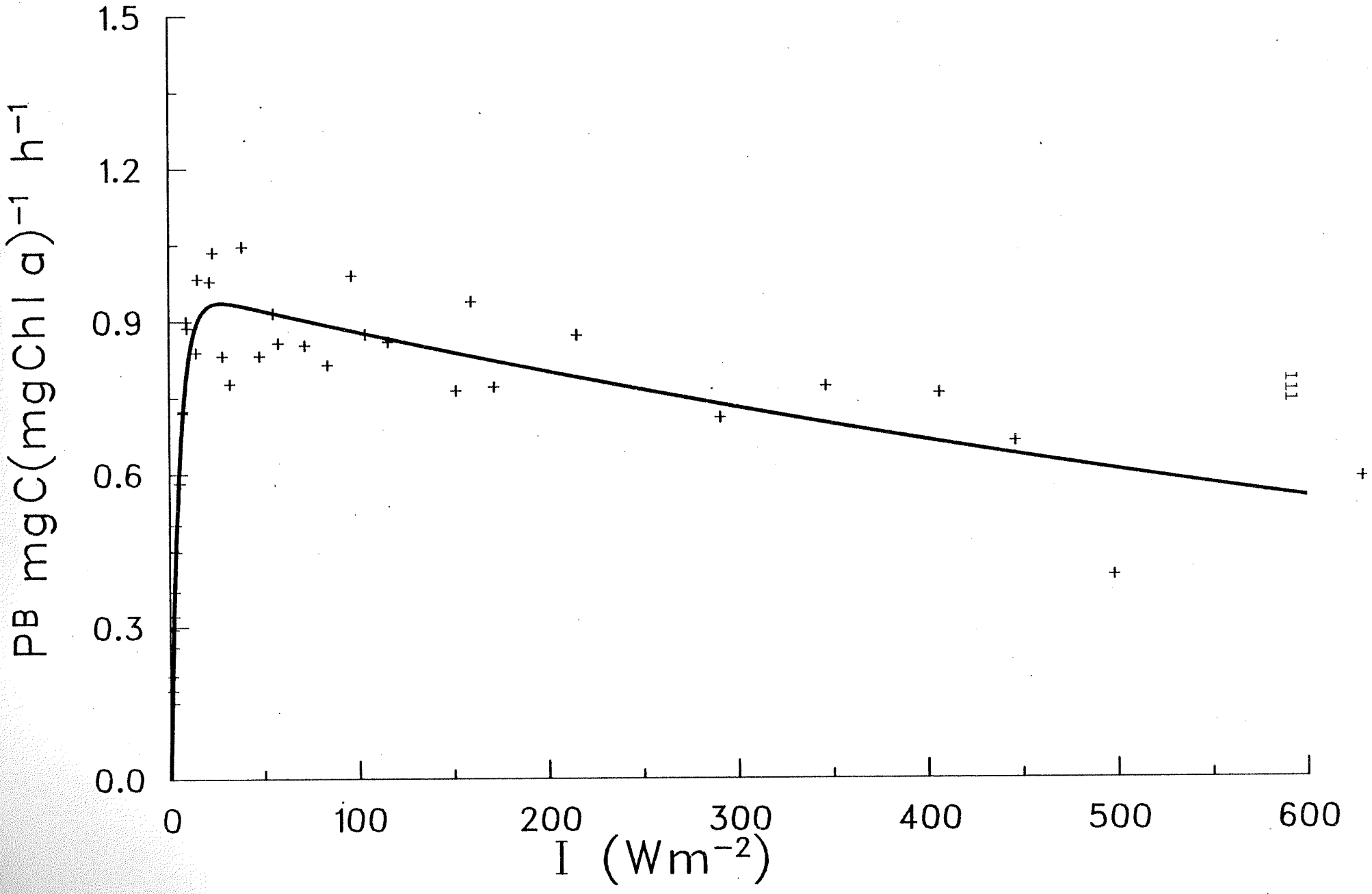


ID 8407861 STA. 17 30/06/84 55 M

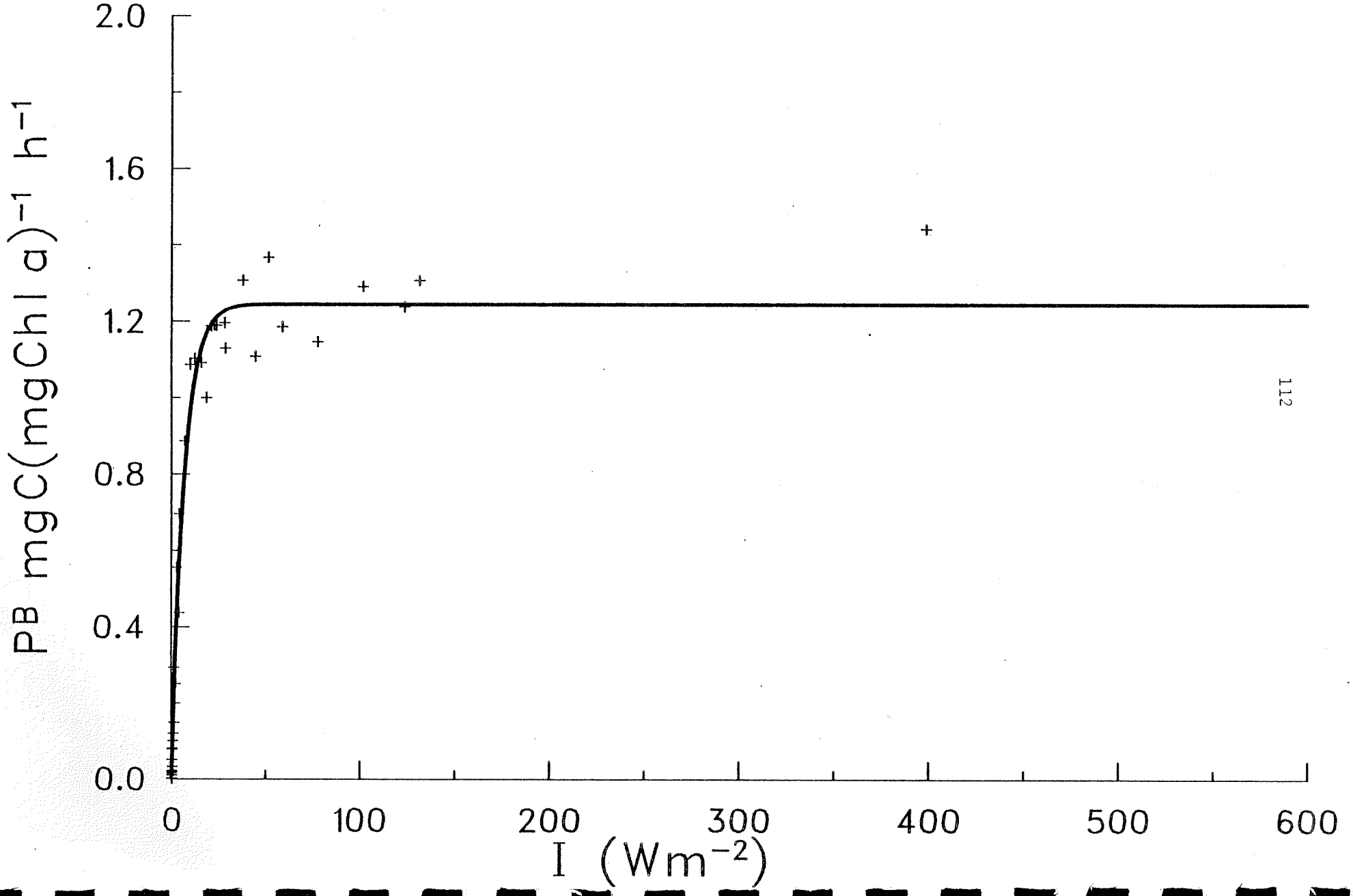


110

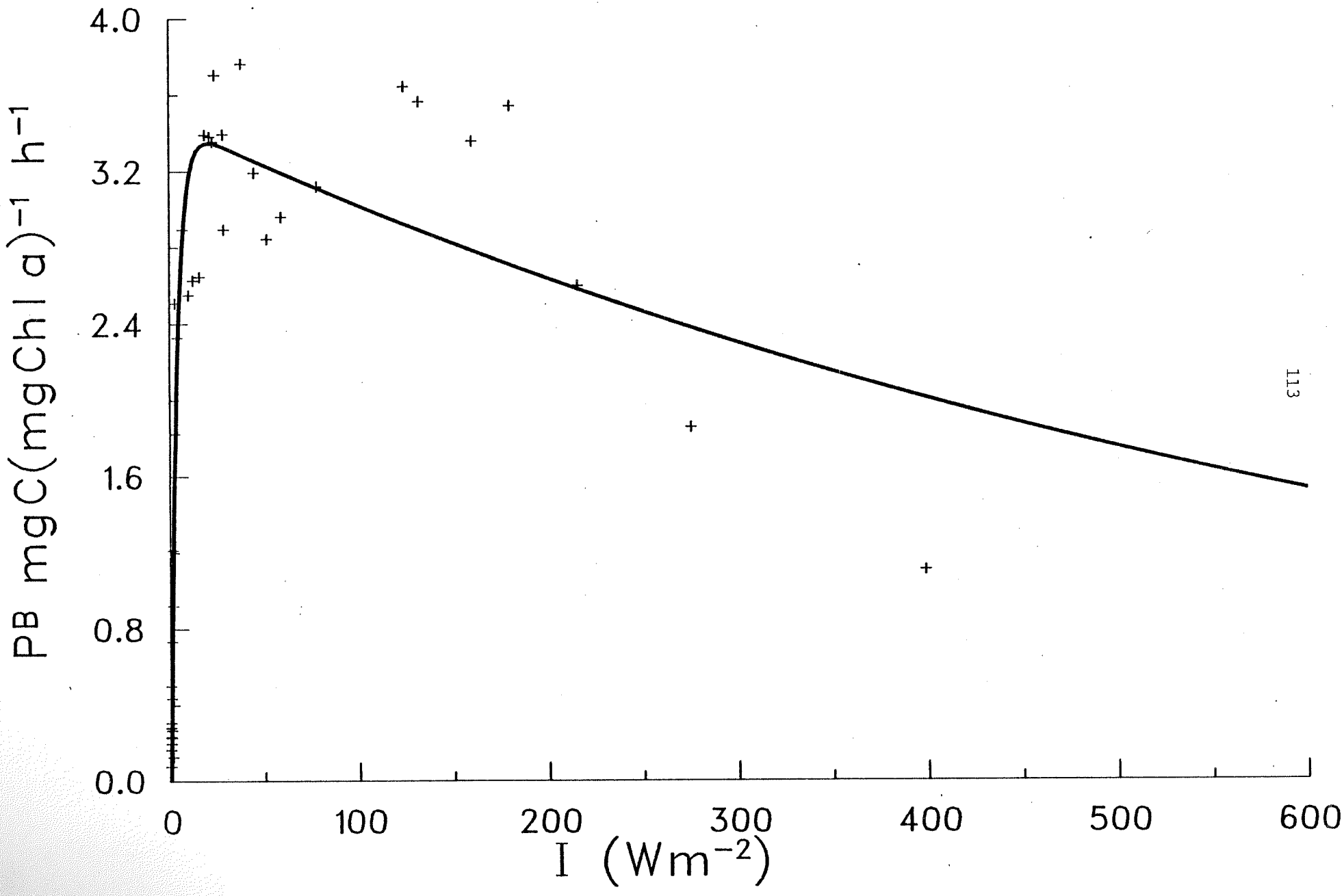
ID 8407857 STA. 18 30/06/84 35 M

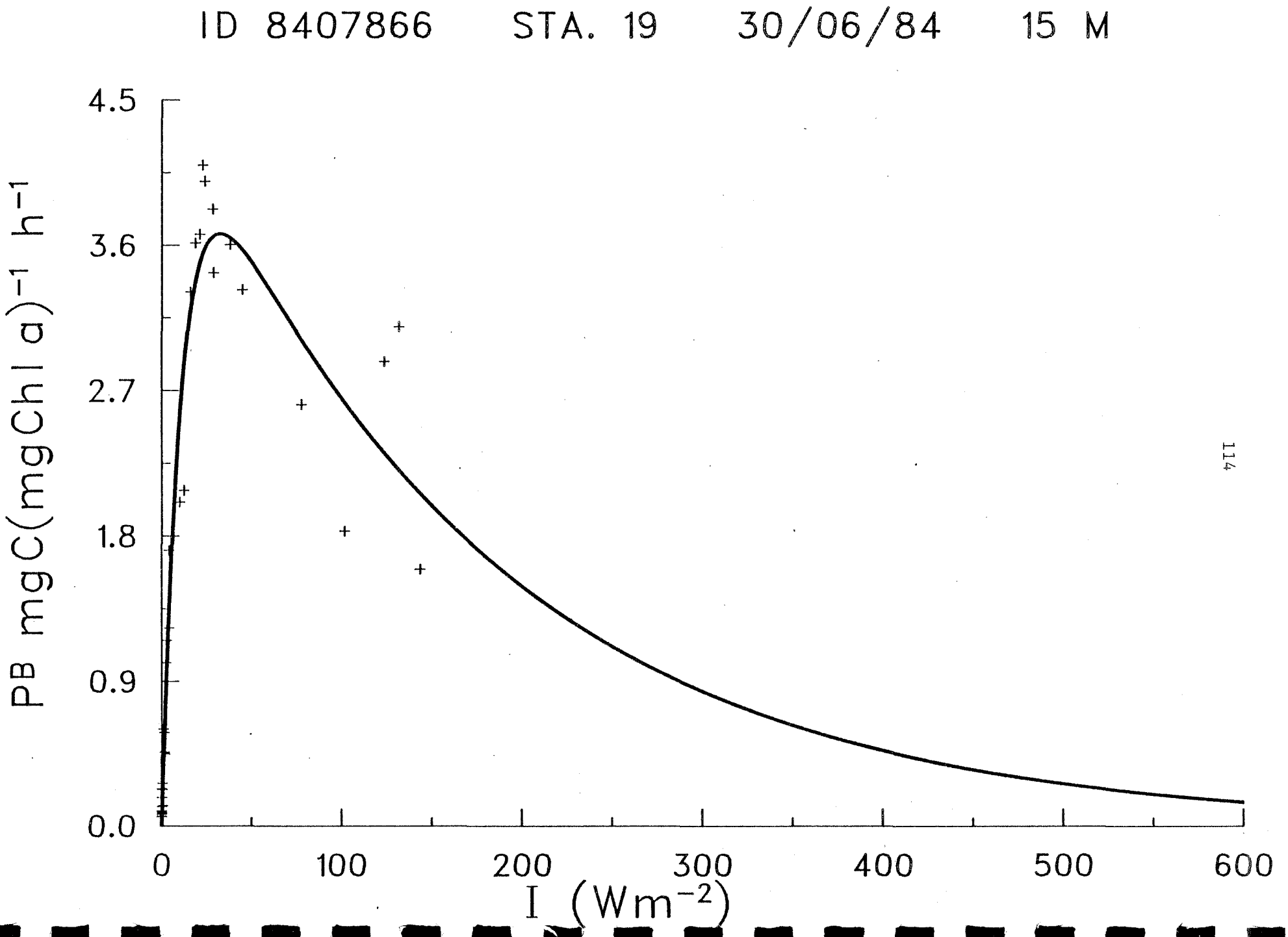


ID 8407864 STA. 18 30/06/84 40 M

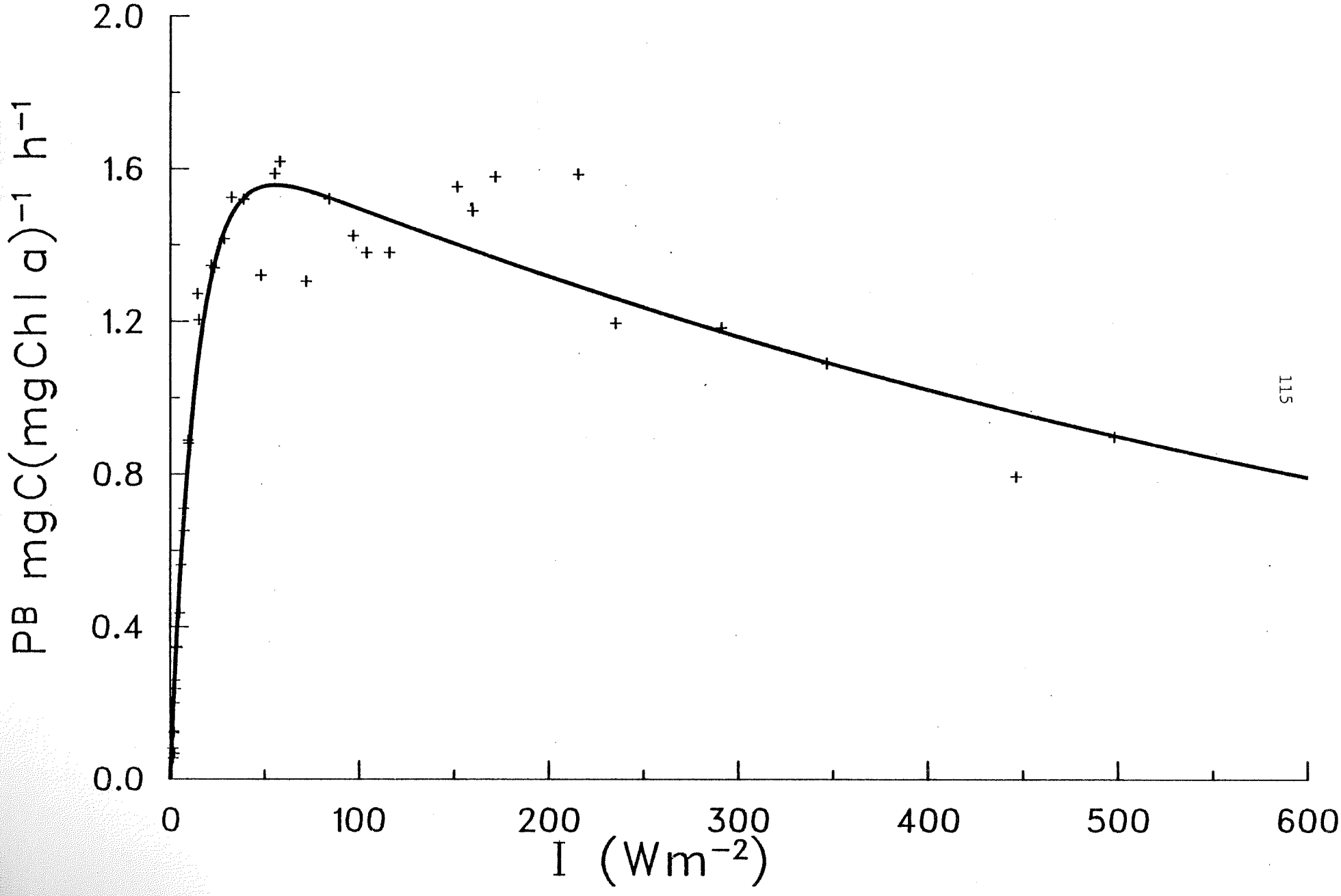


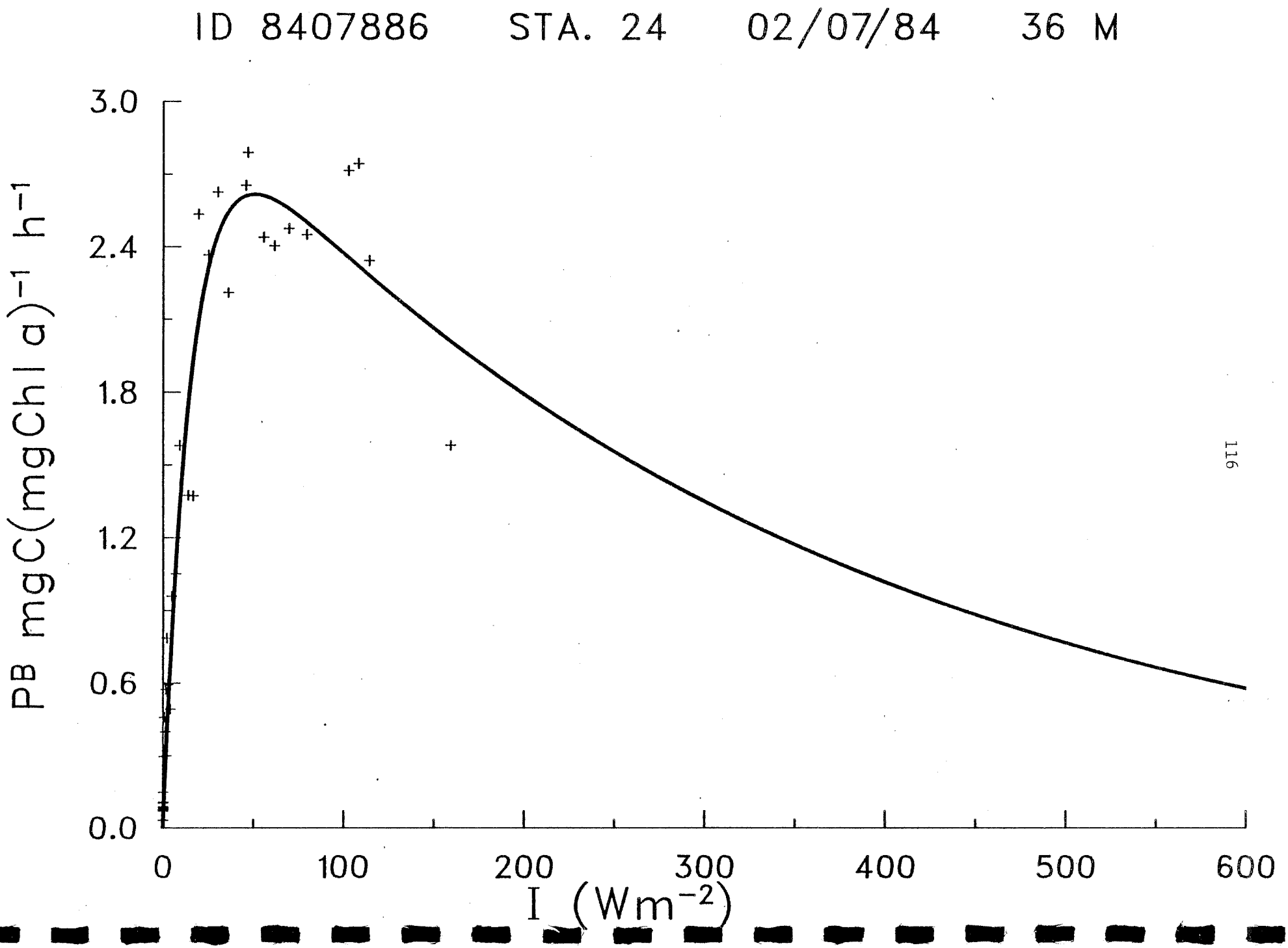
ID 8407867 STA. 18 30/06/84 35 M



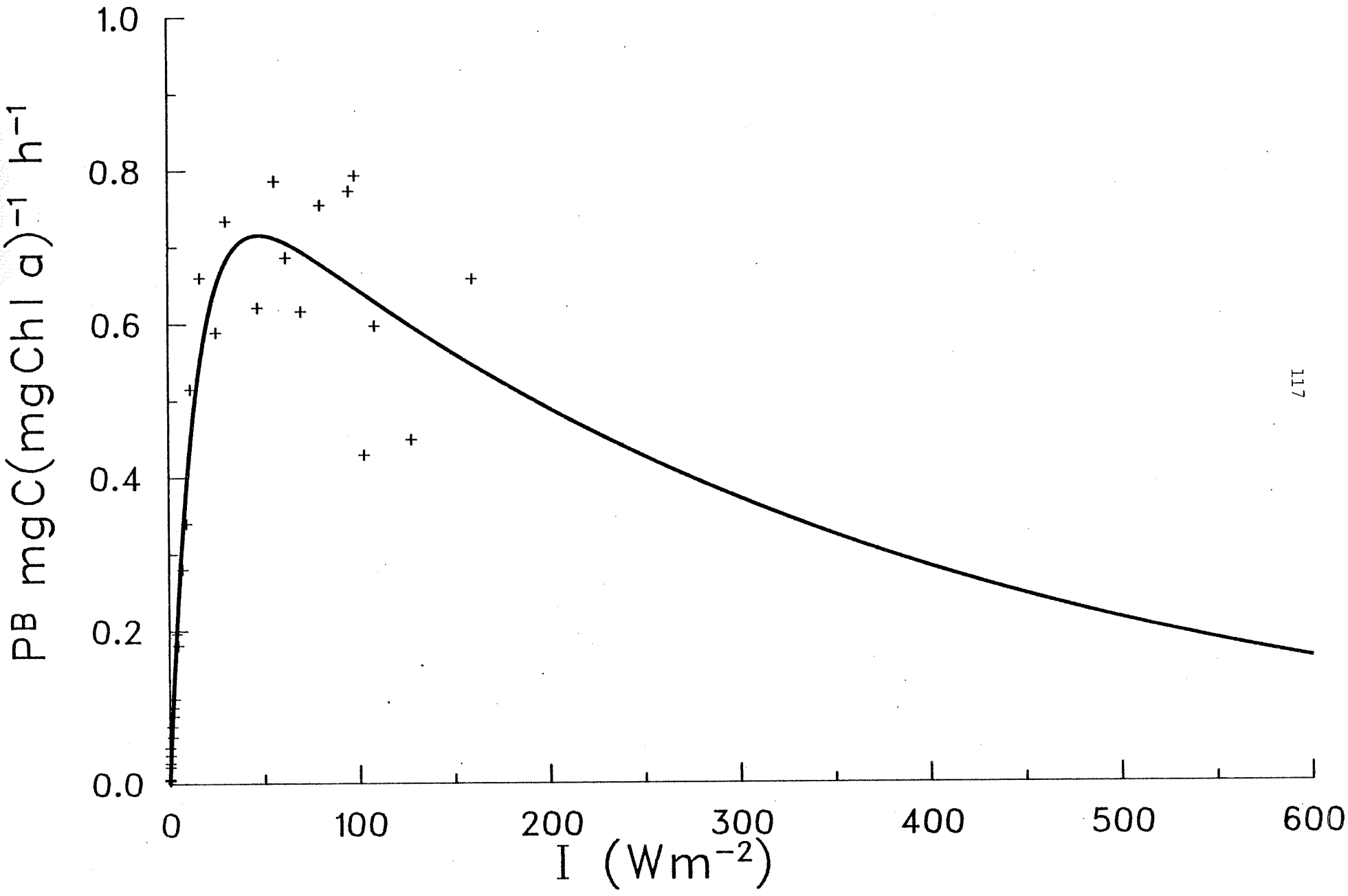

ID 8407866 STA. 19 30/06/84 15 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
4.5
3.6
2.7
1.8
0.9
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

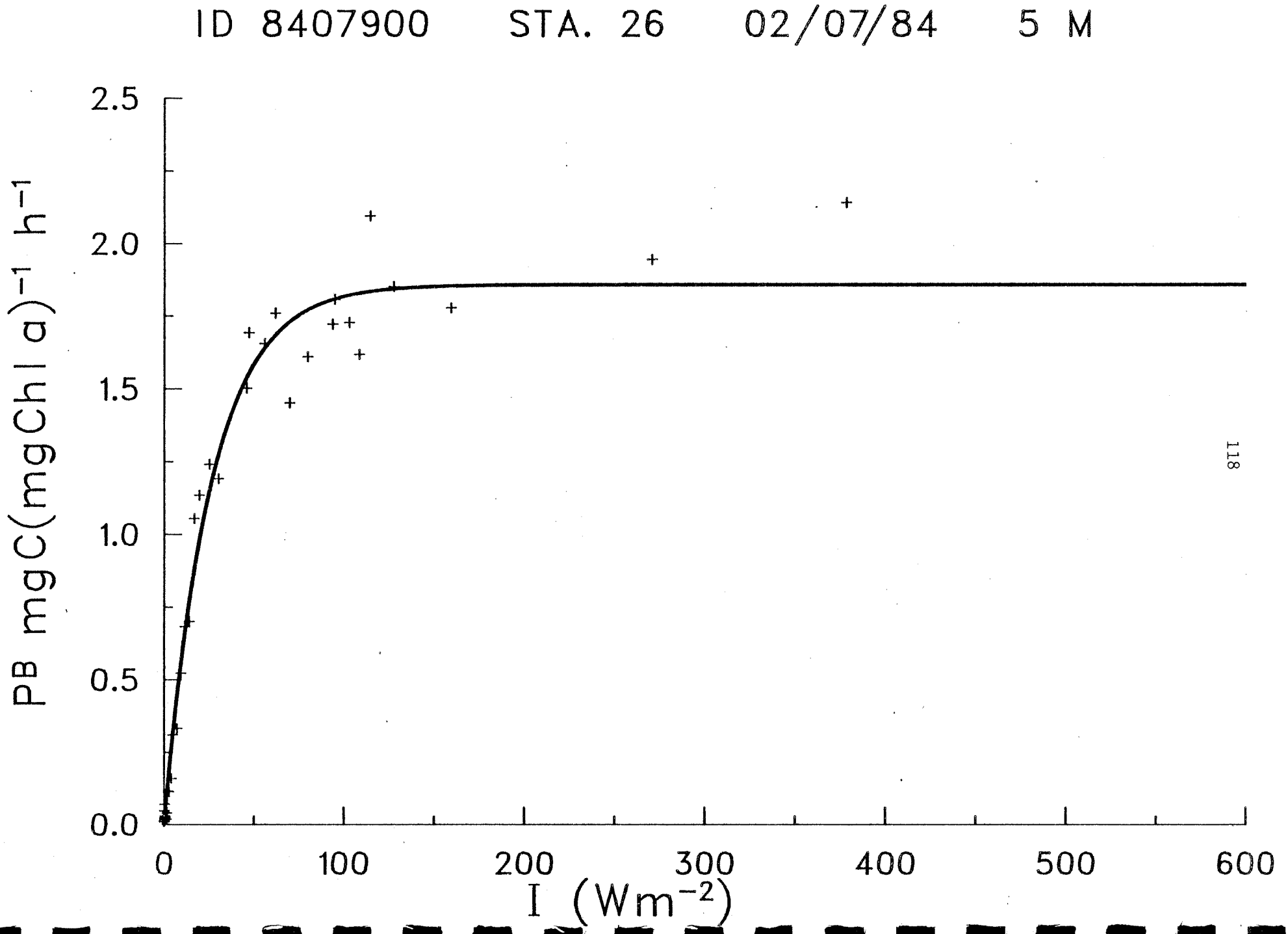
ID 8407863 STA. 20 30/06/84 30 M



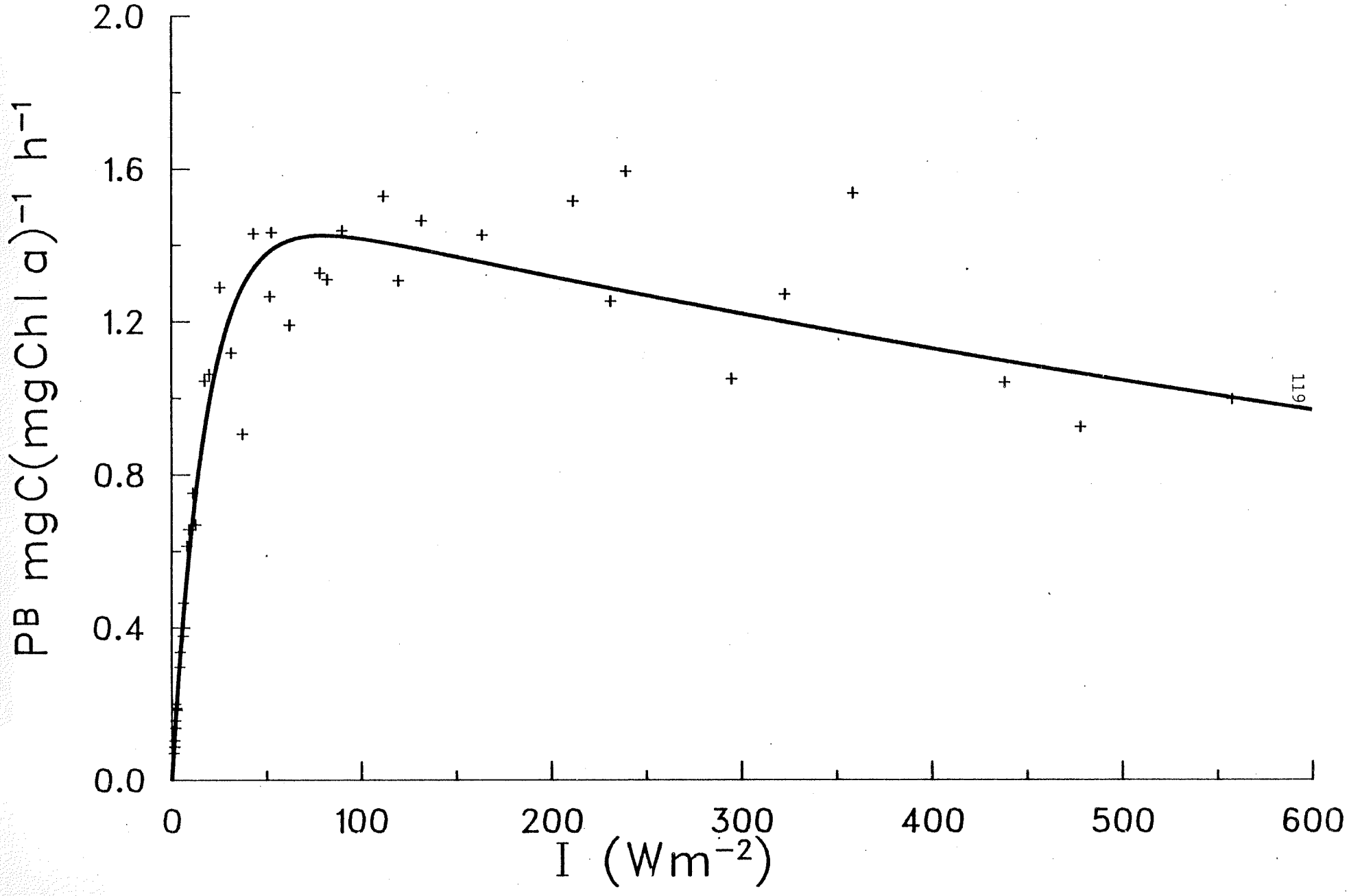

ID 8407886 STA. 24 02/07/84 36 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
3.0
2.4
1.8
1.2
0.6
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

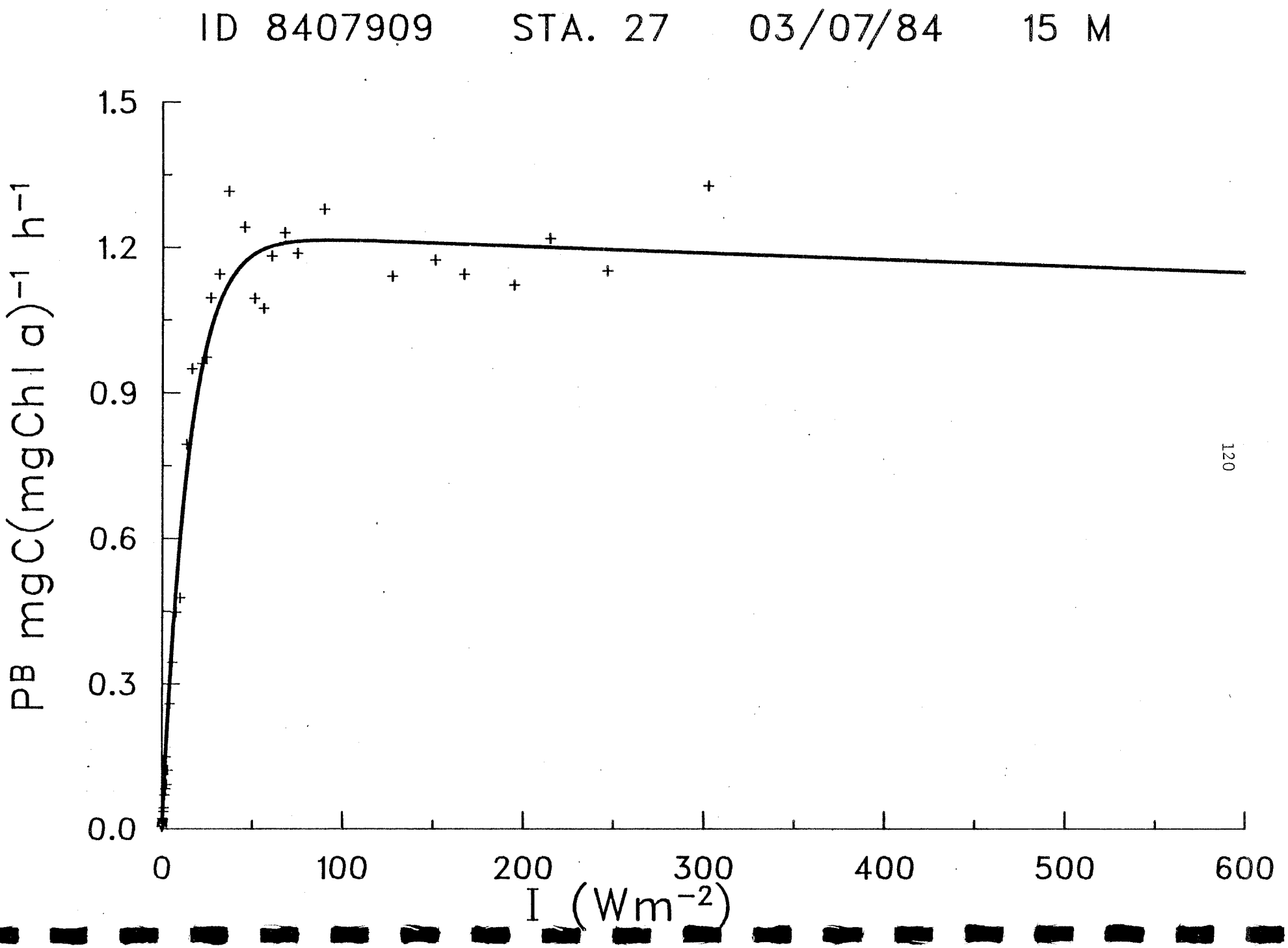
ID 8407893 STA. 25 02/07/84 35 M



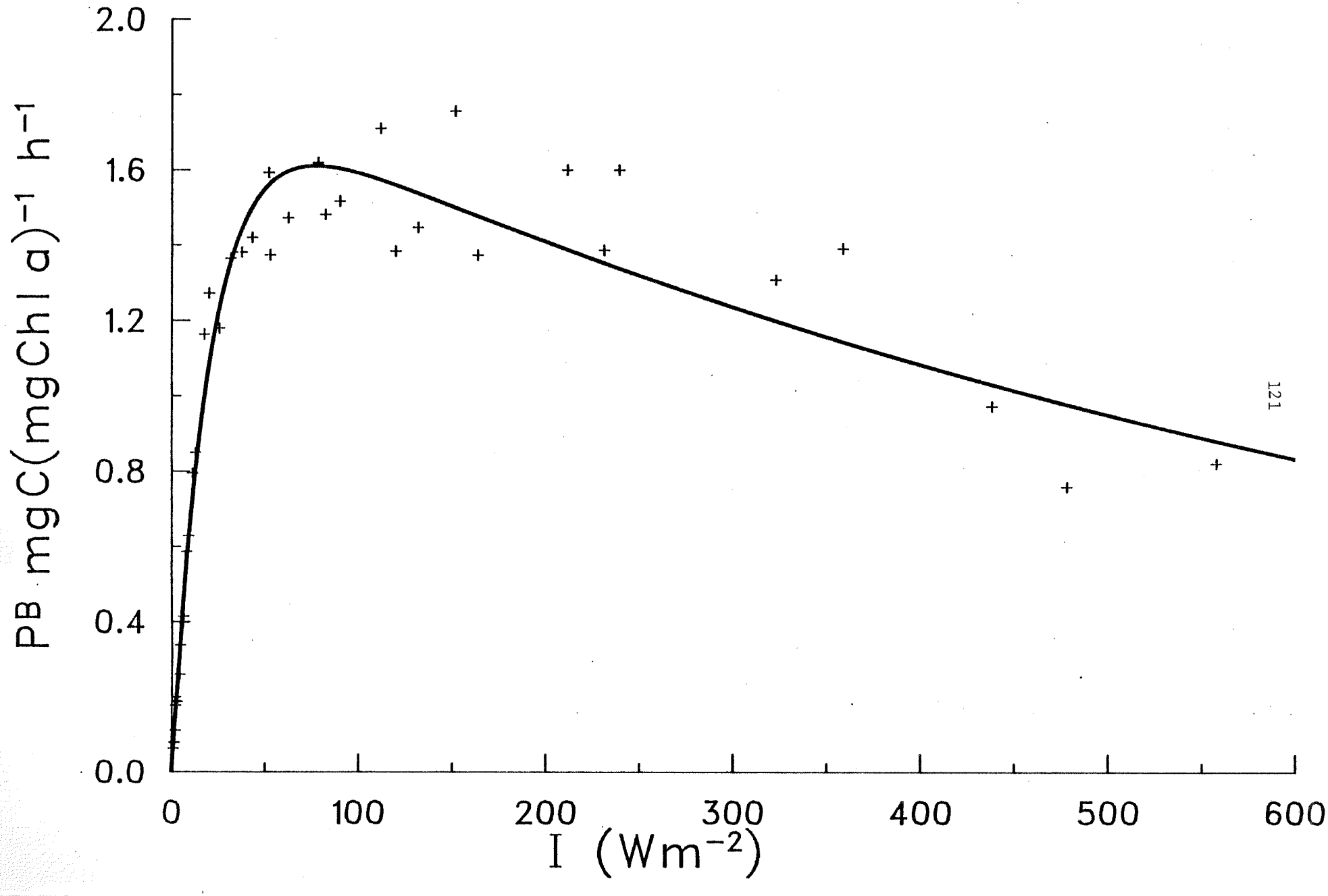

ID 8407900 STA. 26 02/07/84 5 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
2.5
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

ID 8407908 STA. 27 03/07/84 15 M

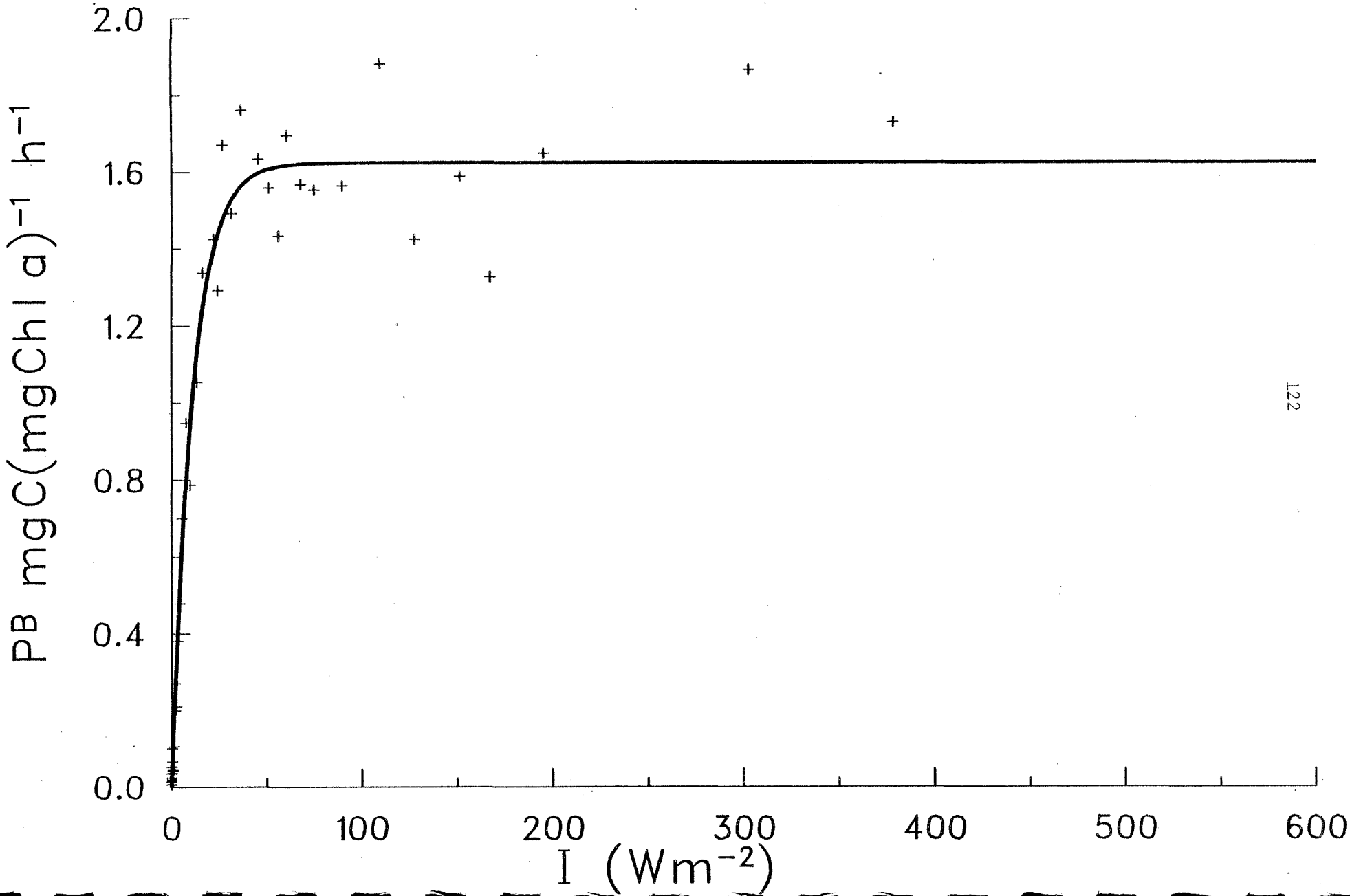



ID 8407909 STA. 27 03/07/84 15 M
PB mgC(mgChl a)$^{-1}$ h^{-1}
1.5
1.2
0.9
0.6
0.3
0.0
0
100
200
300
400
500
600
I (Wm^{-2})

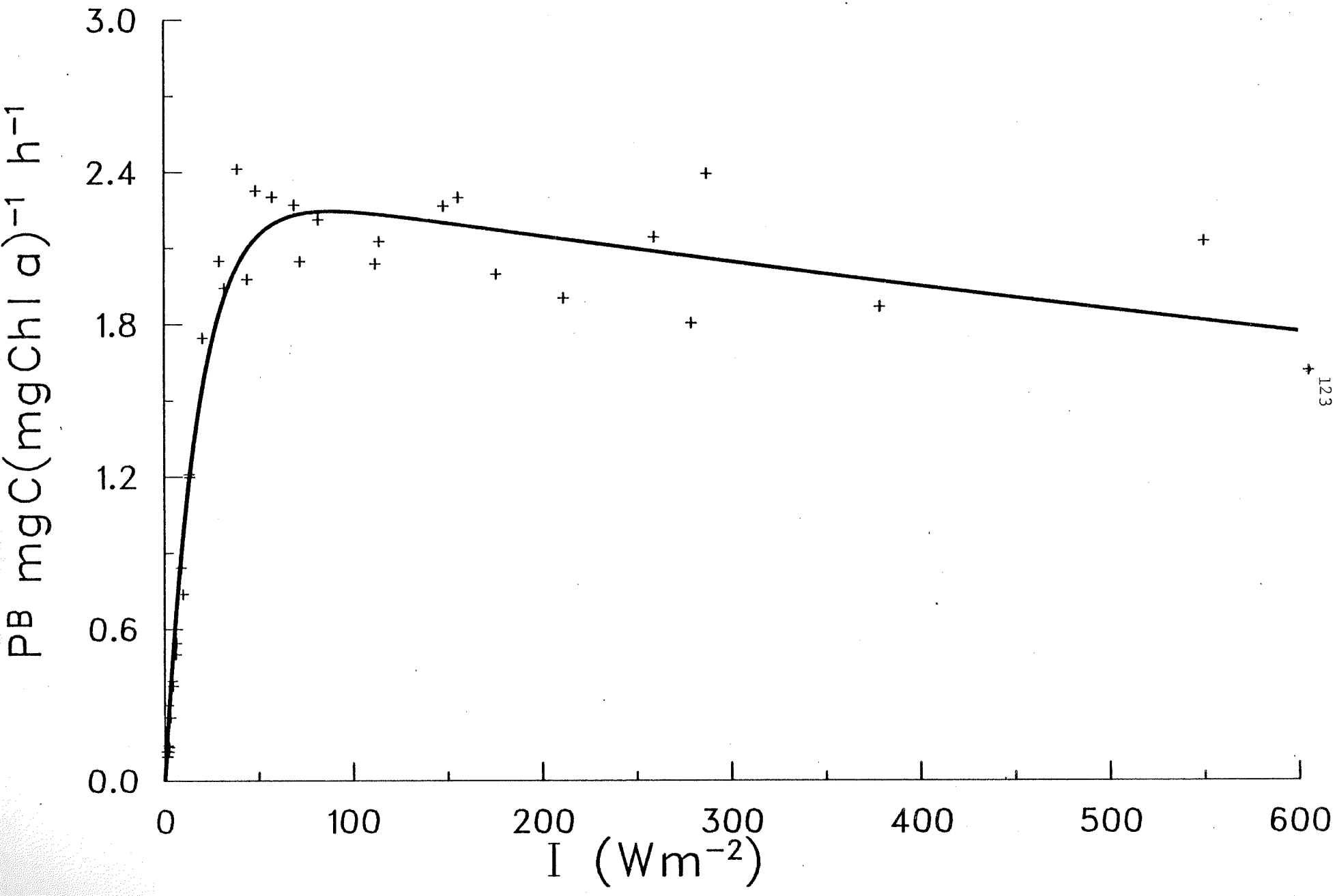
ID 8407912 STA. 27 03/07/84 23 M



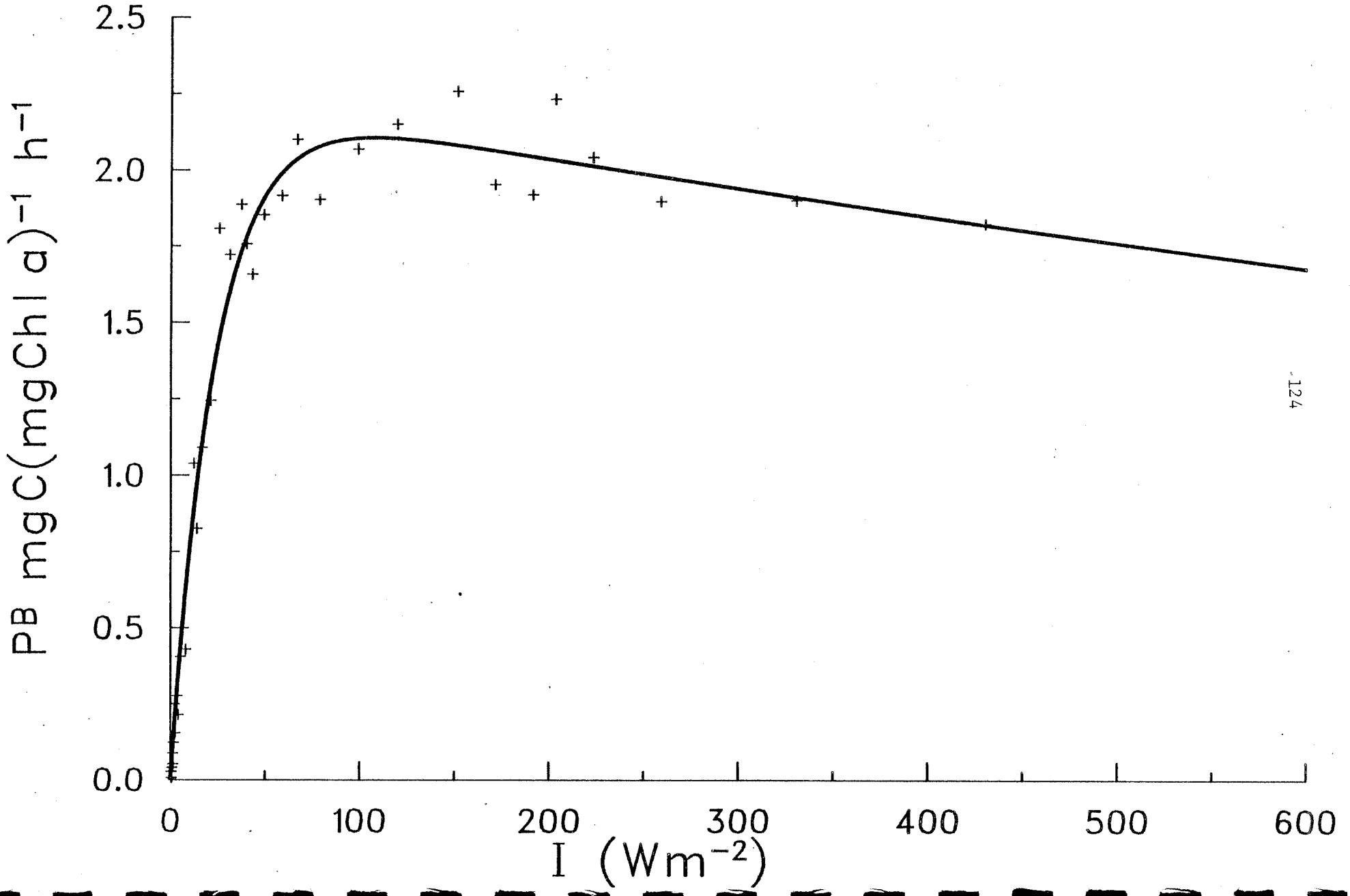
ID 8407913 STA. 27 03/07/84 23 M



ID 8407920 STA. 28 04/07/84 9 M

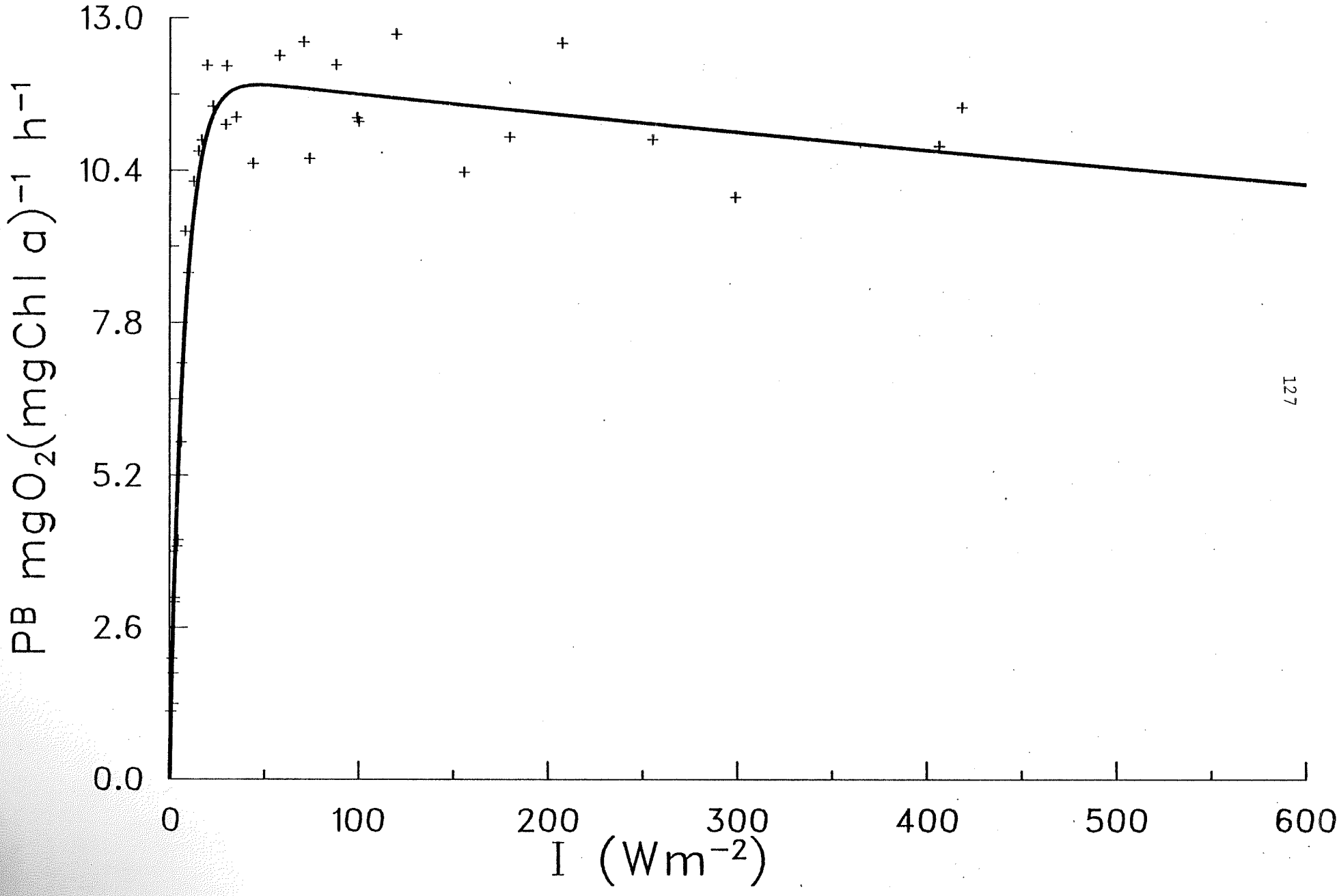


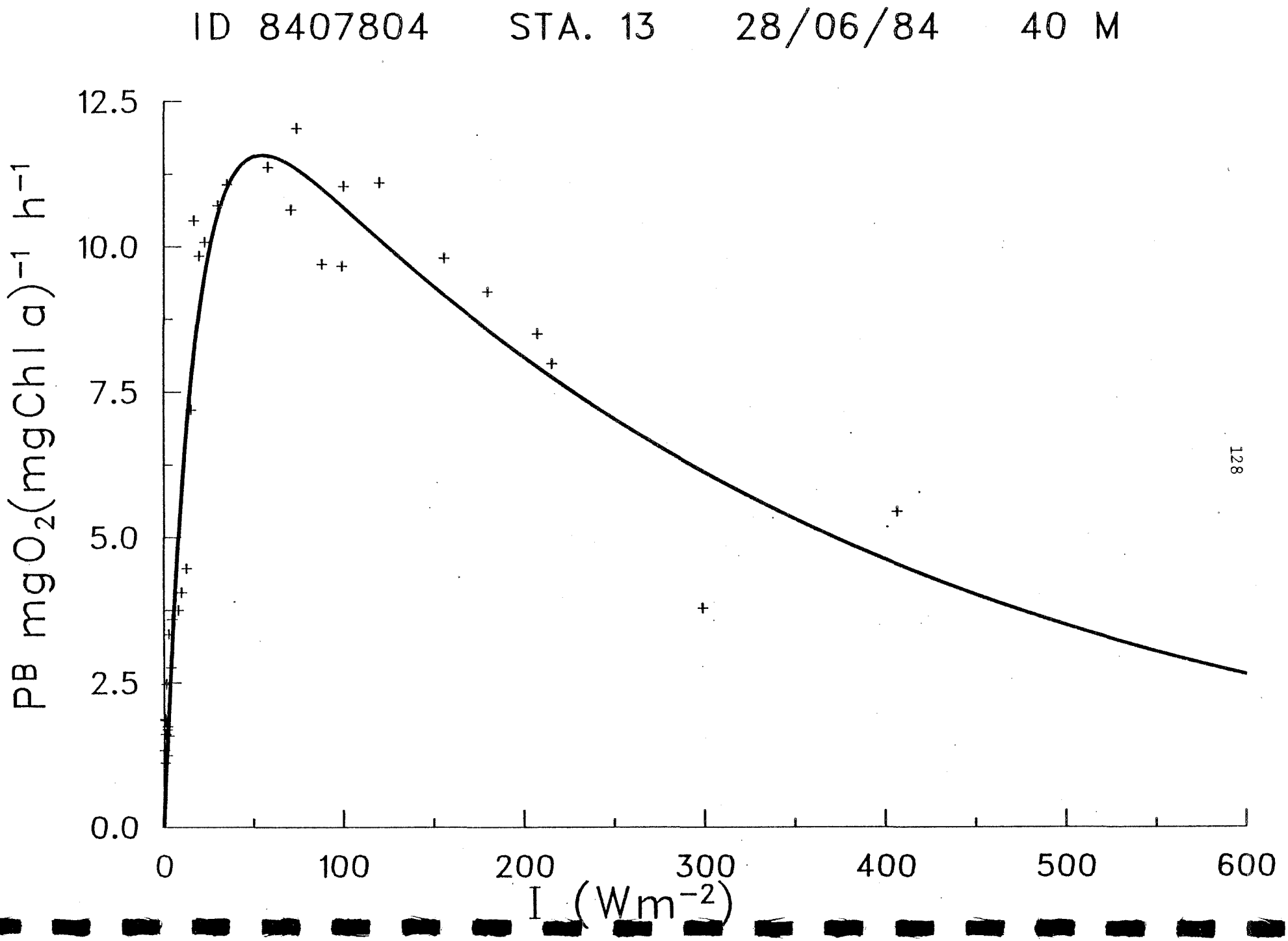
ID 8407921 STA. 28 04/07/84 9 M



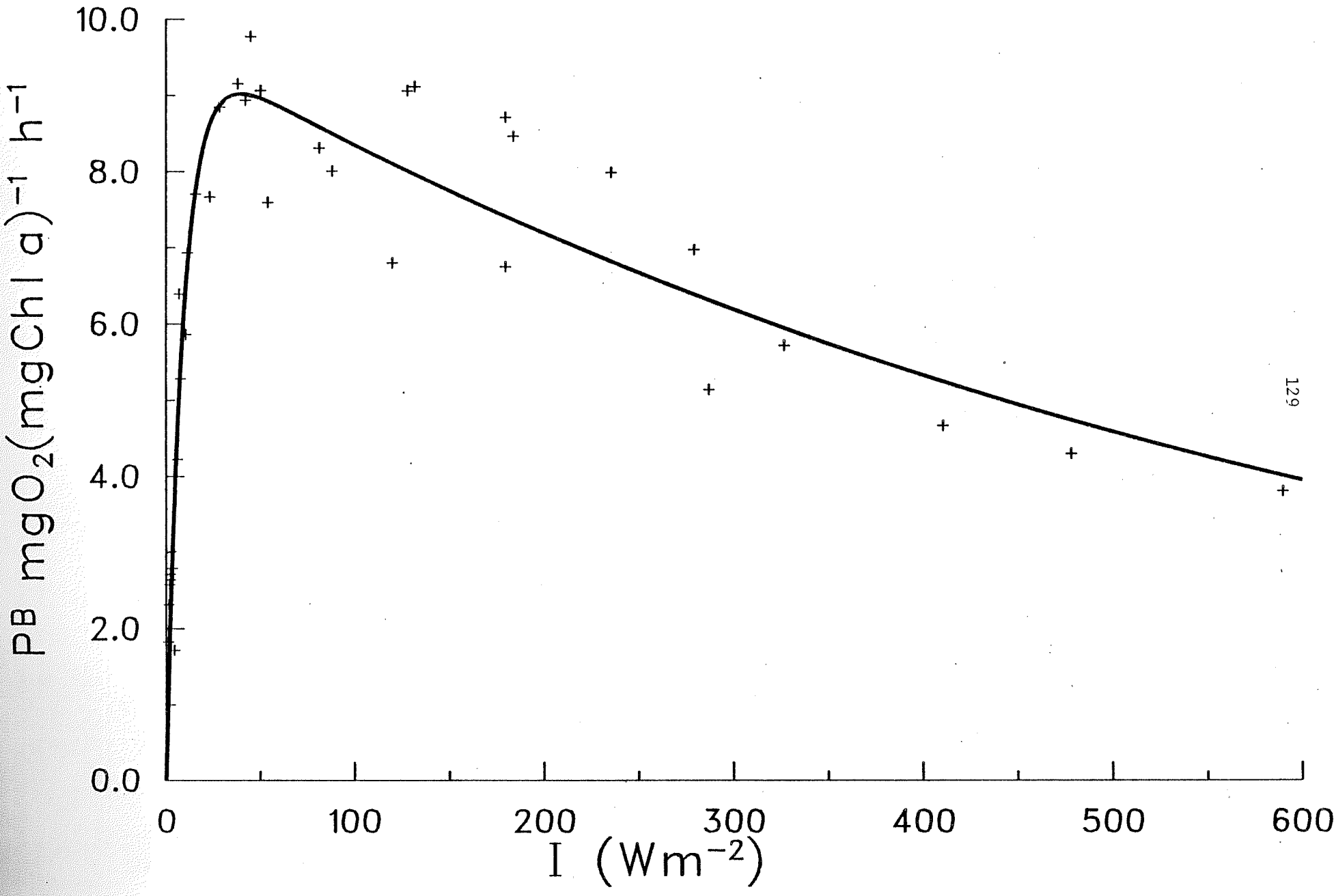
Solid line fits to oxygen PI data

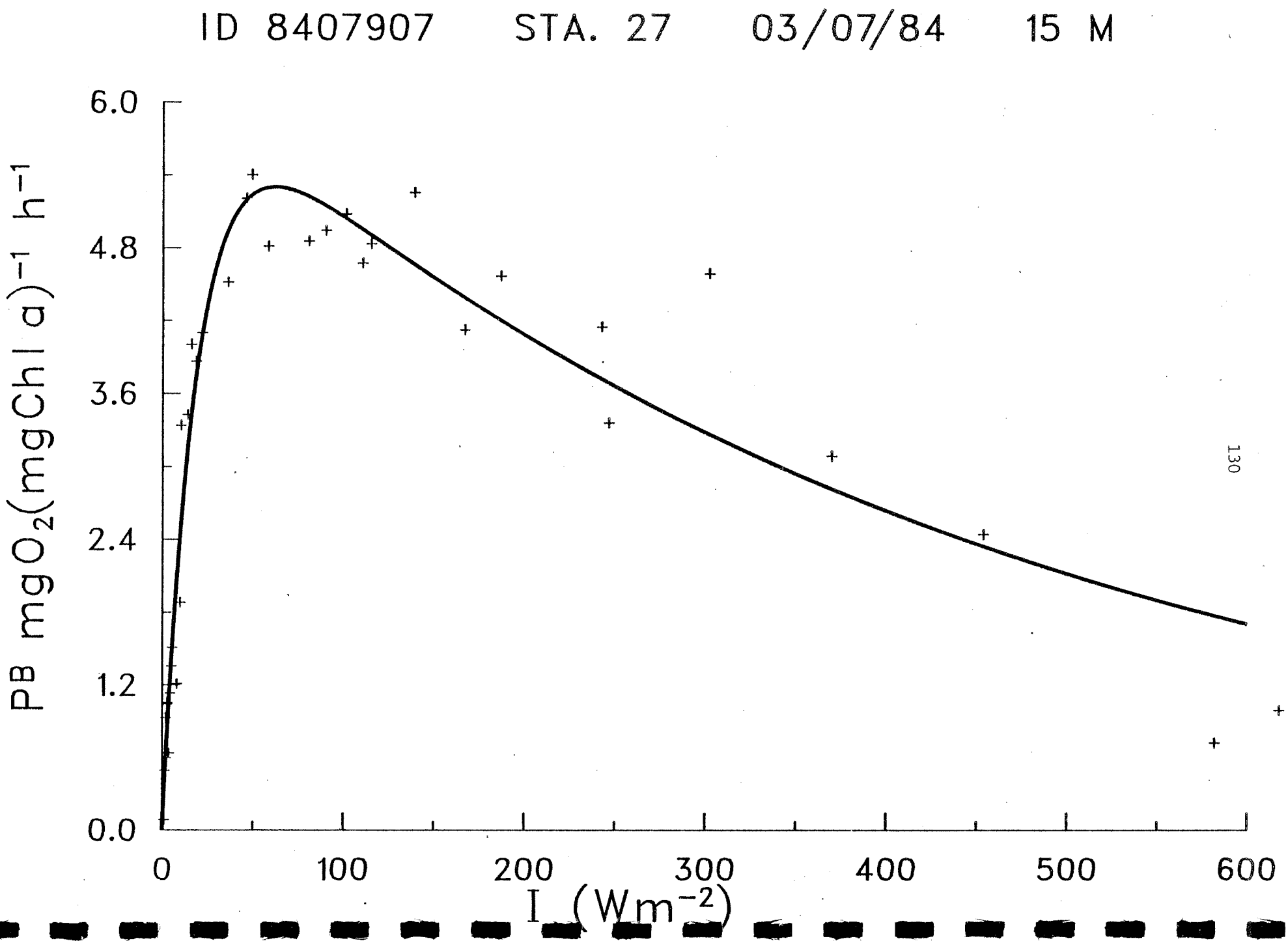
ID 8403365 STA. 7A 27/06/84 ICE ALGAE



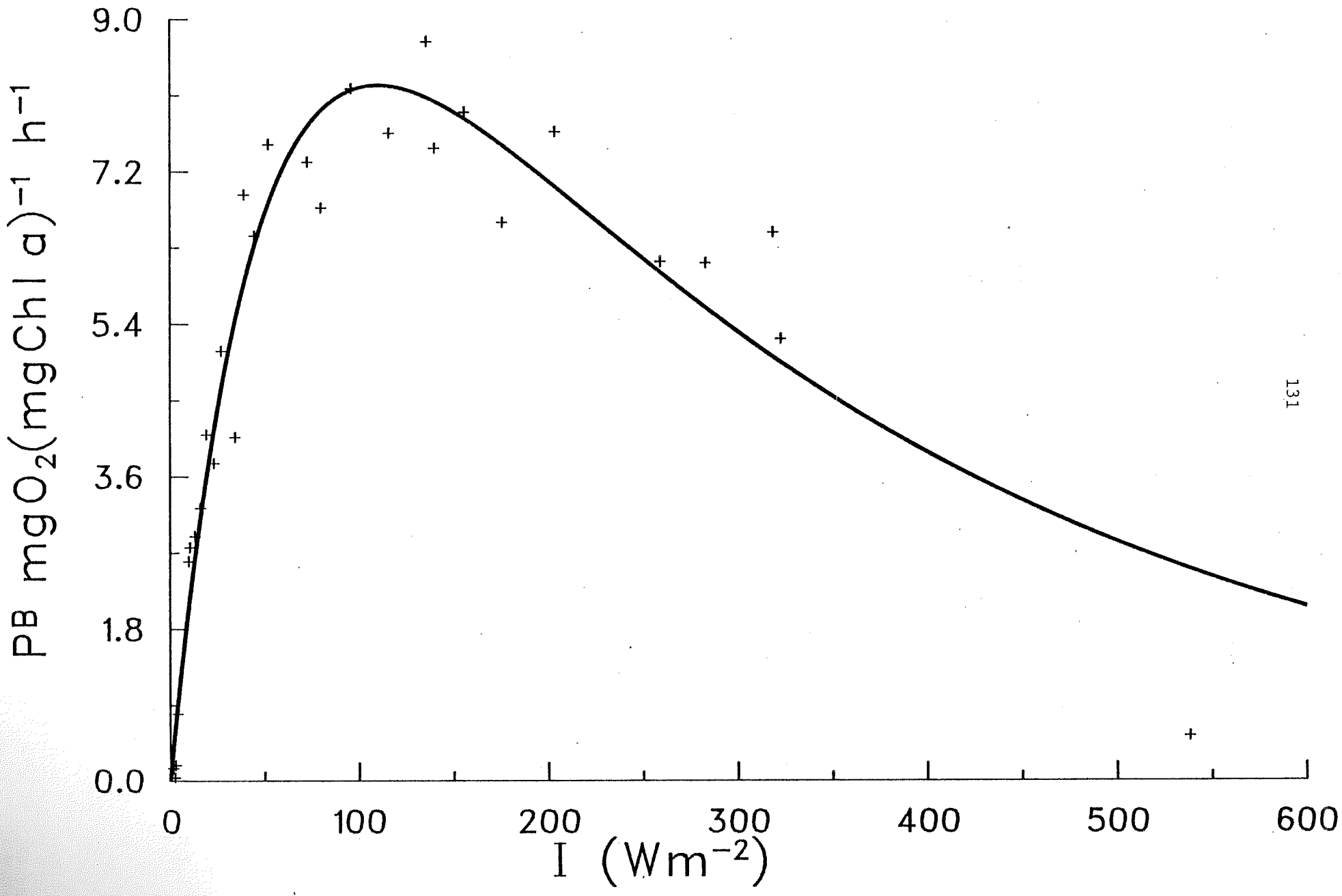

ID 8407804 STA. 13 28/06/84 40 M
PB mgO2(mgChl a)-1 h-1
12.5
10.0
7.5
5.0
2.5
0.0
0
100
200
300
400
500
600
I (Wm-2)

ID 8407856 STA. 18 30/06/84 35 M

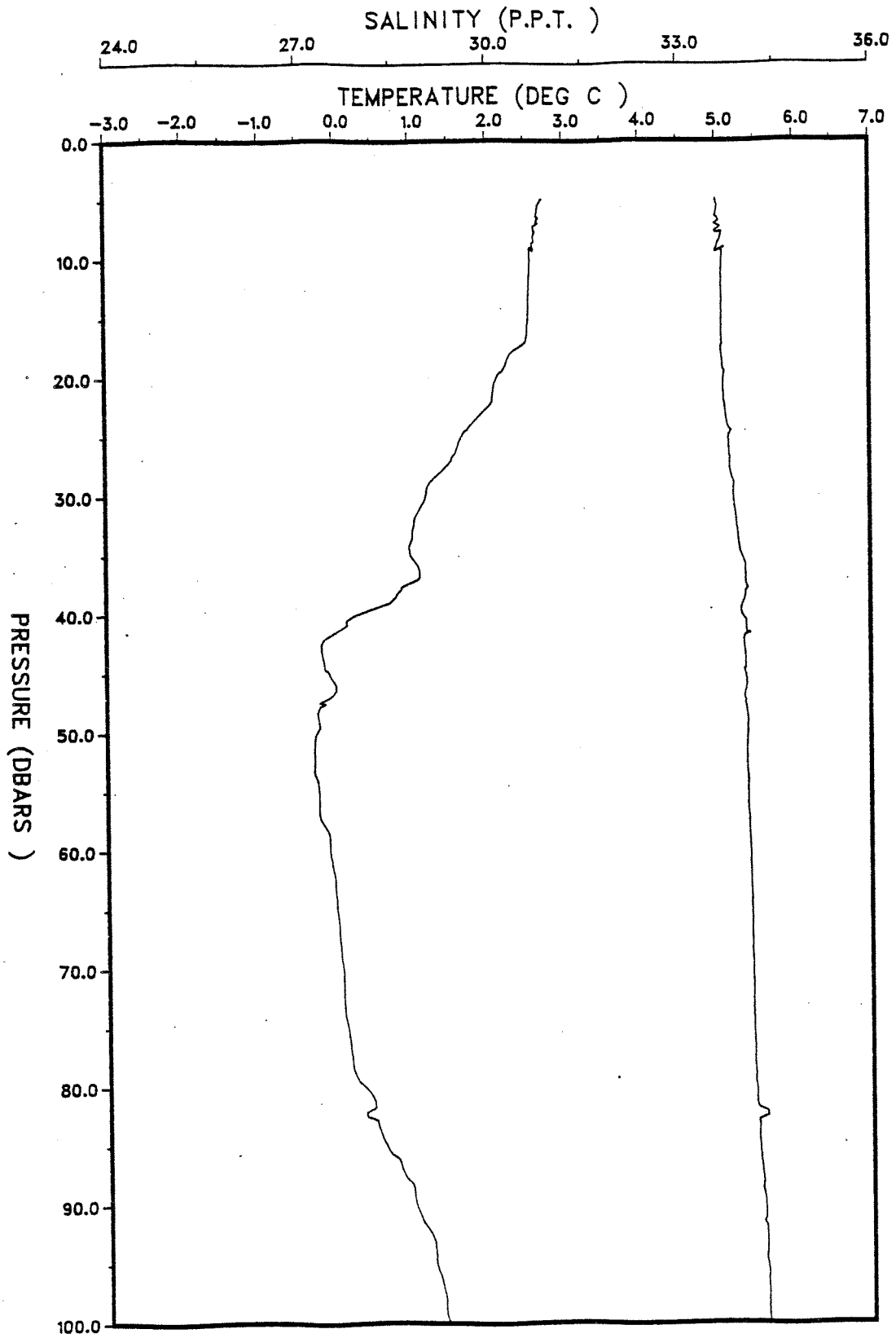



ID 8407907 STA. 27 03/07/84 15 M
PB mgO2(mgChl a)-1 h-1
6.0
4.8
3.6
2.4
1.2
0.0
0
100
200
300
400
500
600
I (Wm-2)

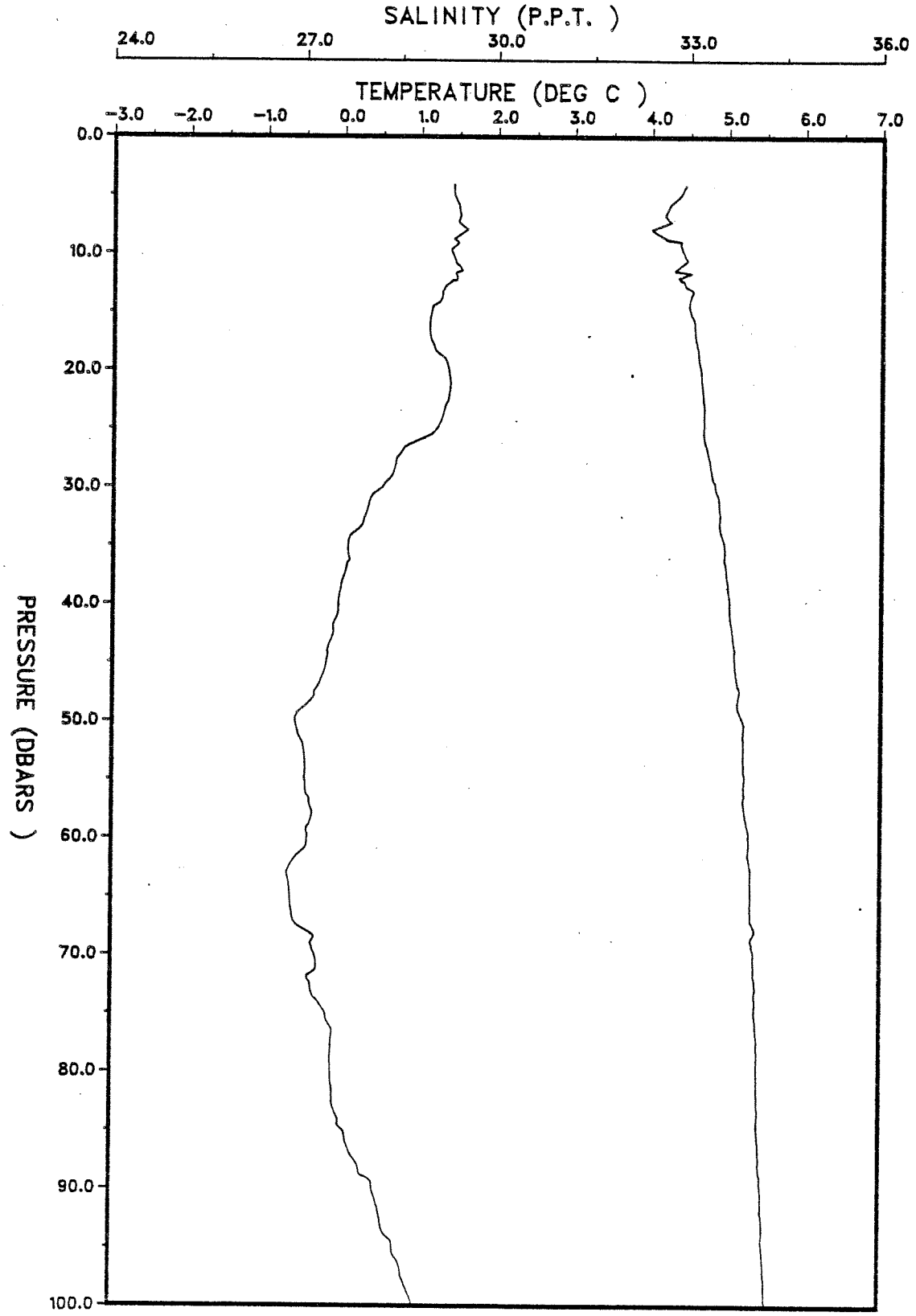
ID 8407919 STA. 28 04/07/84 9 M



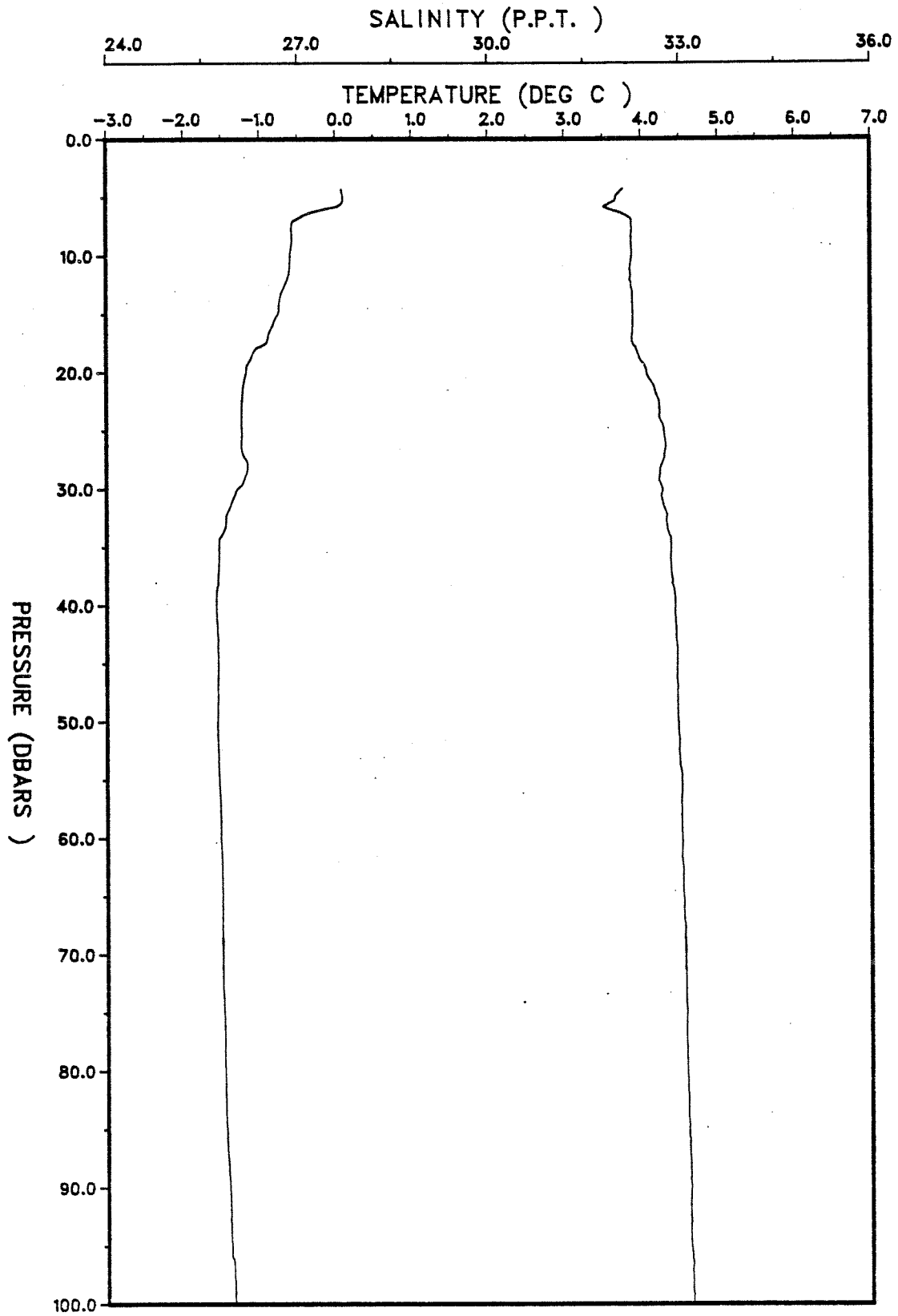
Temperature and salinity profiles



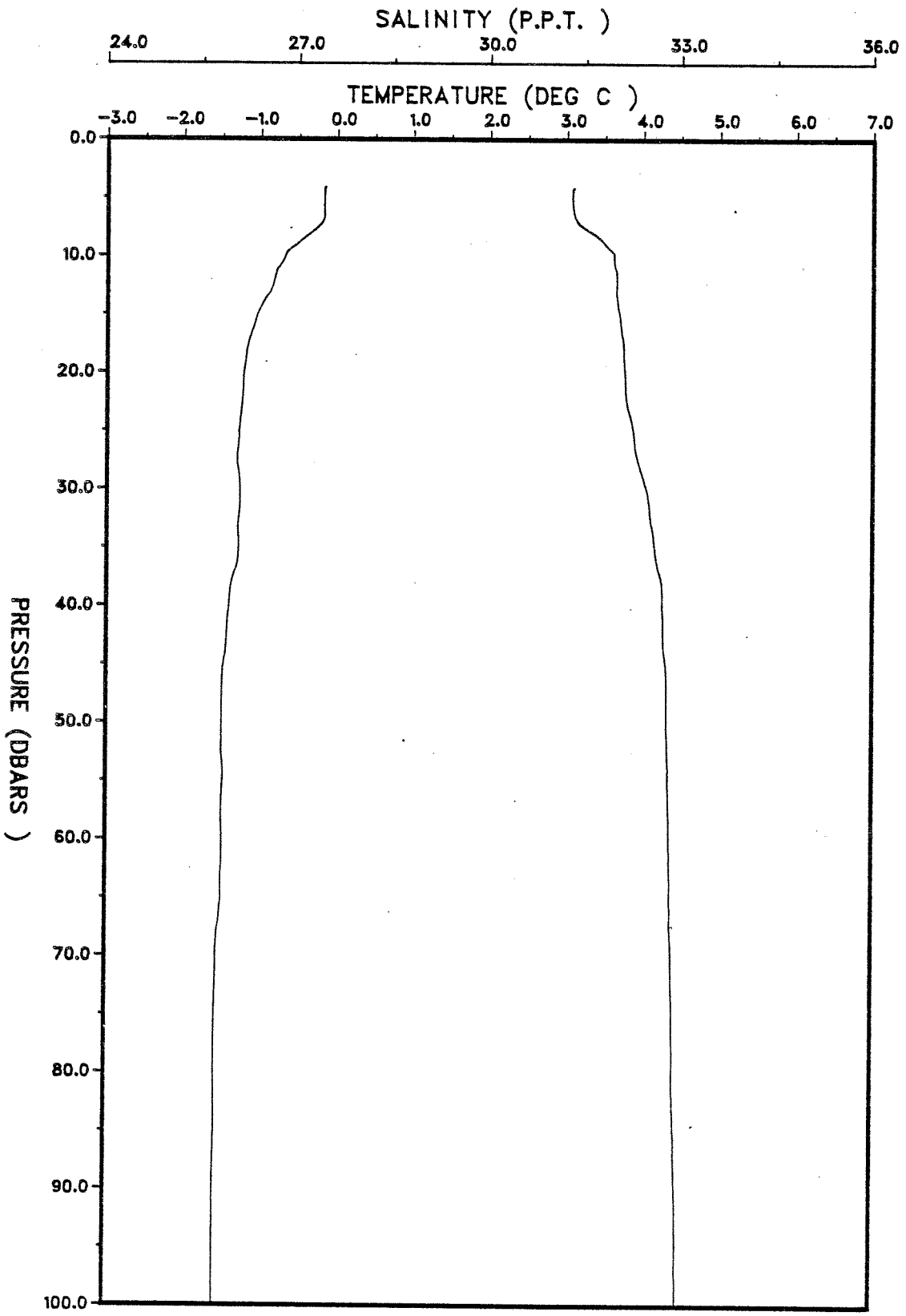
LAT. 54 25.8N, STN 1, CRUISE 84026
LONG. 51 49.2W, STARTING 12: 0GMT, DAY 176, 1984



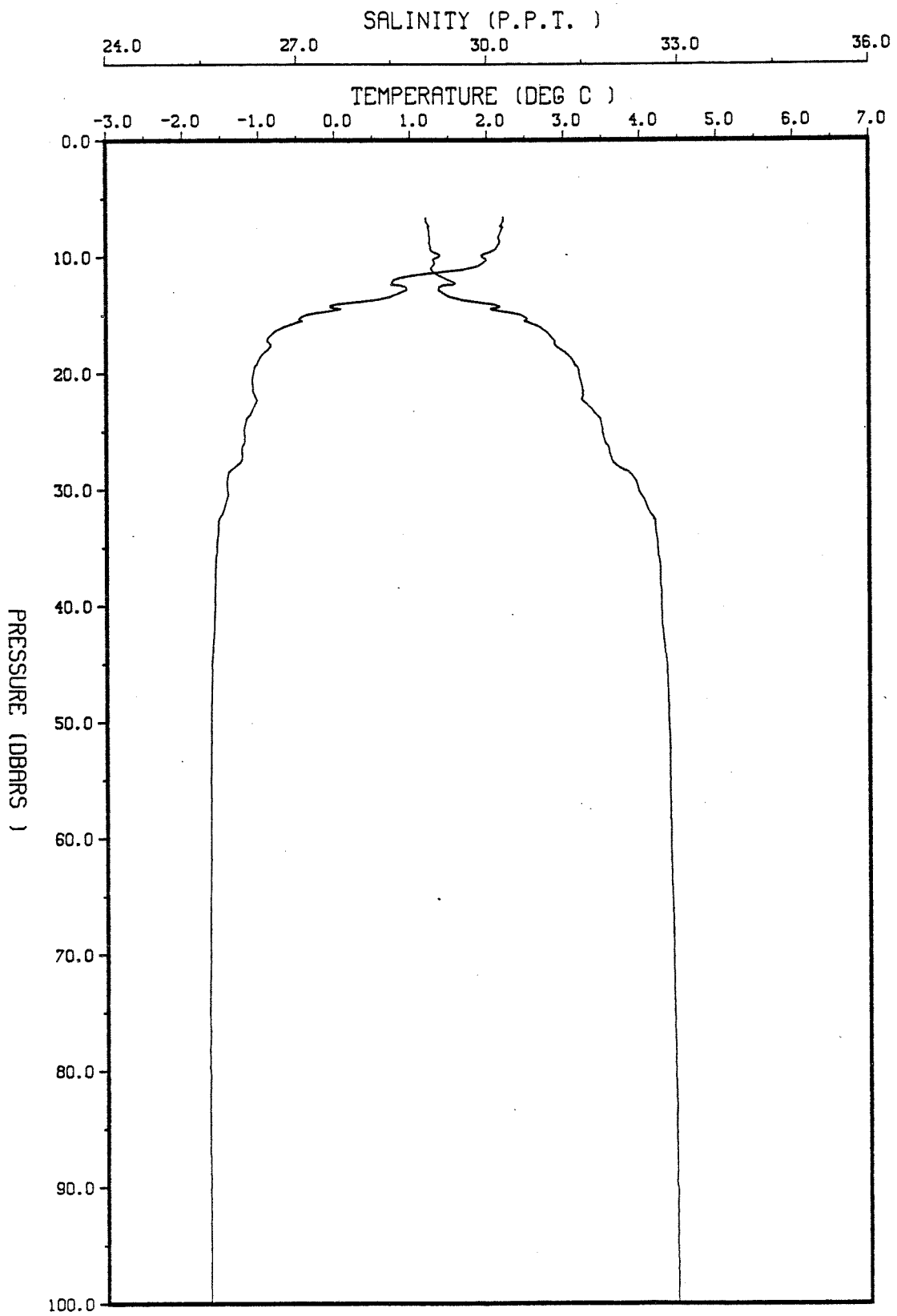
LAT. 54 9.6N, STN 2, CRUISE 84026
LONG. 51 49.2W, STARTING 16: 9GMT, DAY 176, 1984



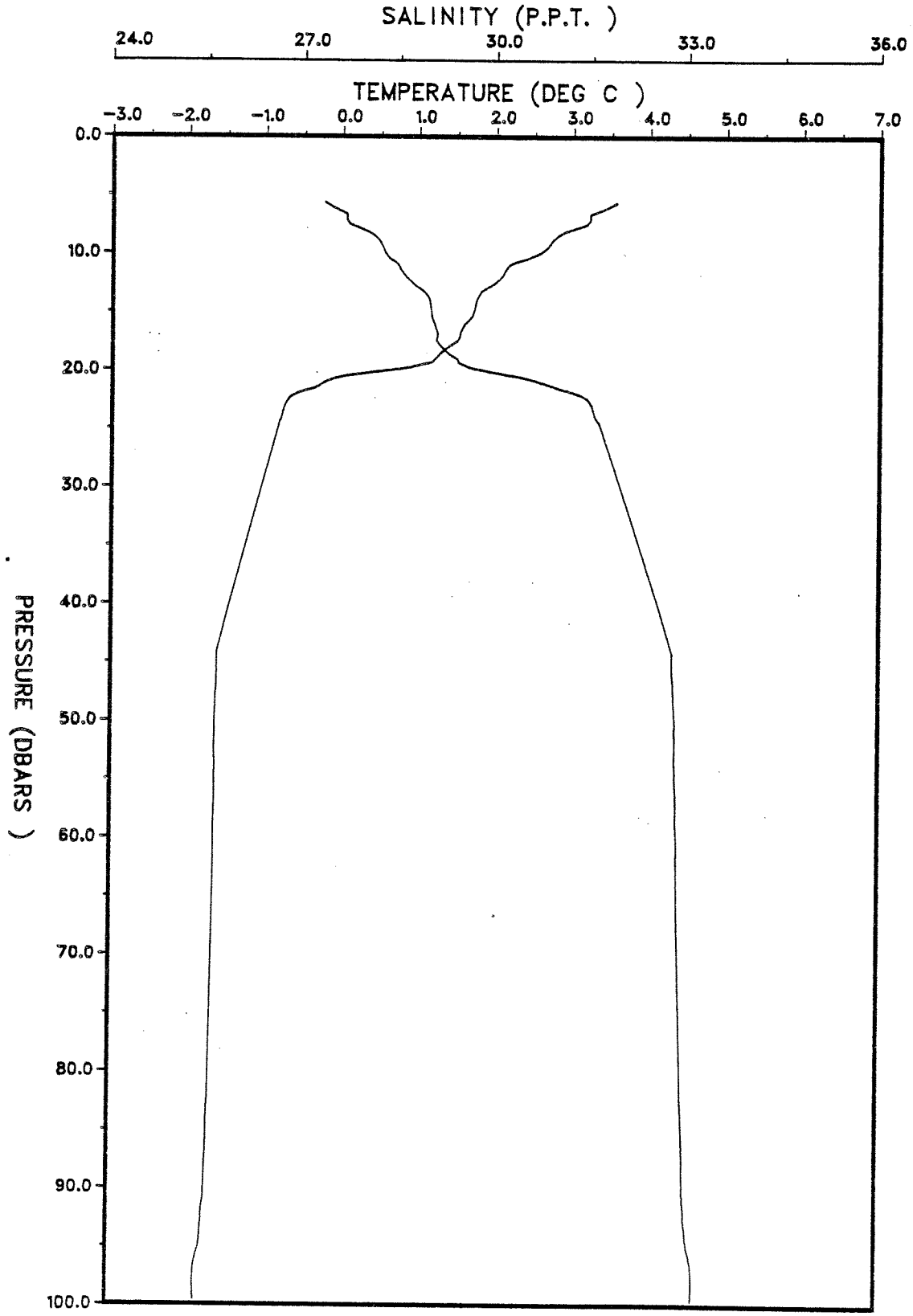
LAT. 53 58.8N, STN 3, CRUISE 84026
LONG. 52 55.2W, STARTING 20:27GMT, DAY 176, 1984



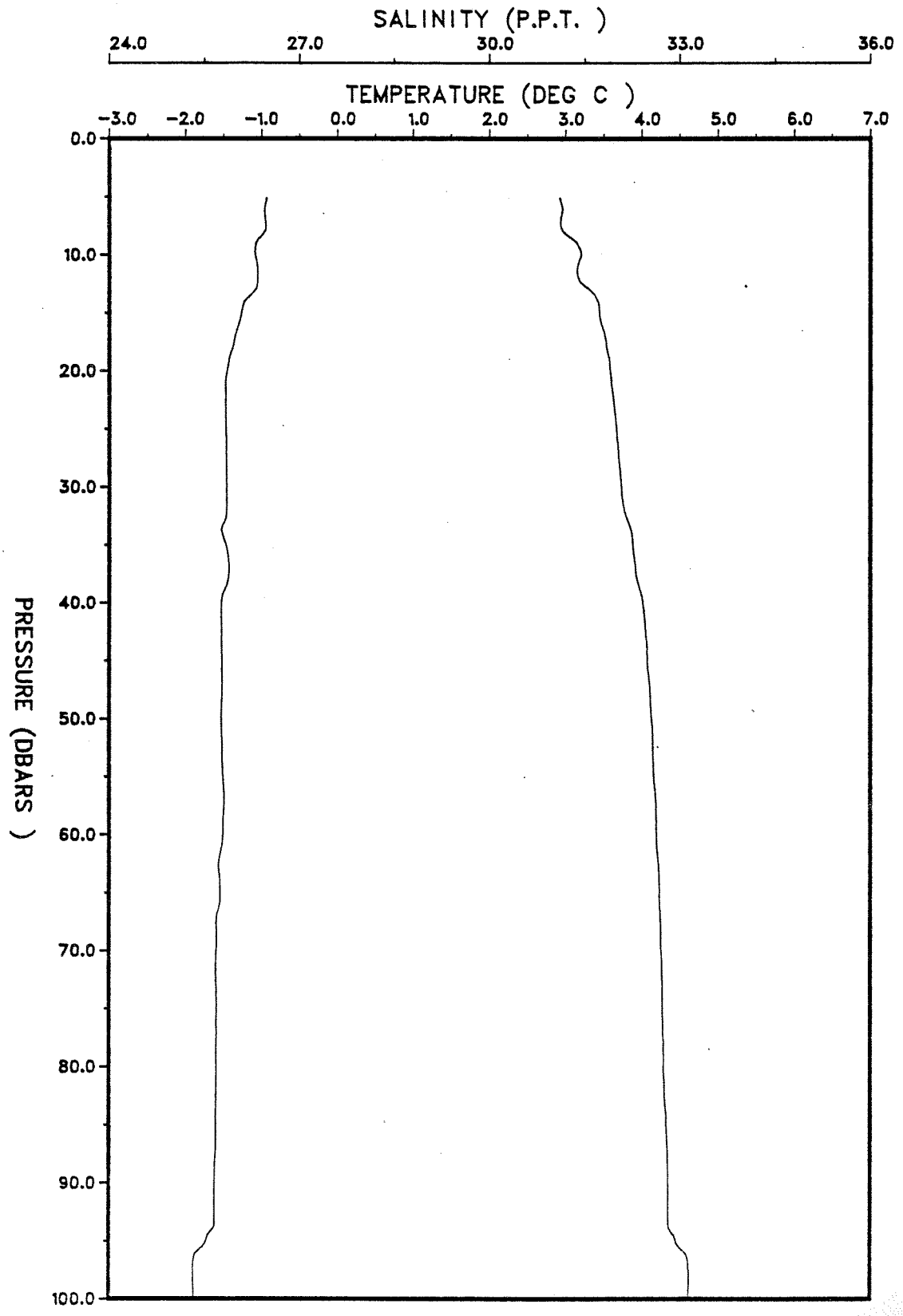
LAT. 53 51.6N, STN 4, CRUISE 84026
LONG. 53 15.6W, STARTING 22:47GMT, DAY 176, 1984



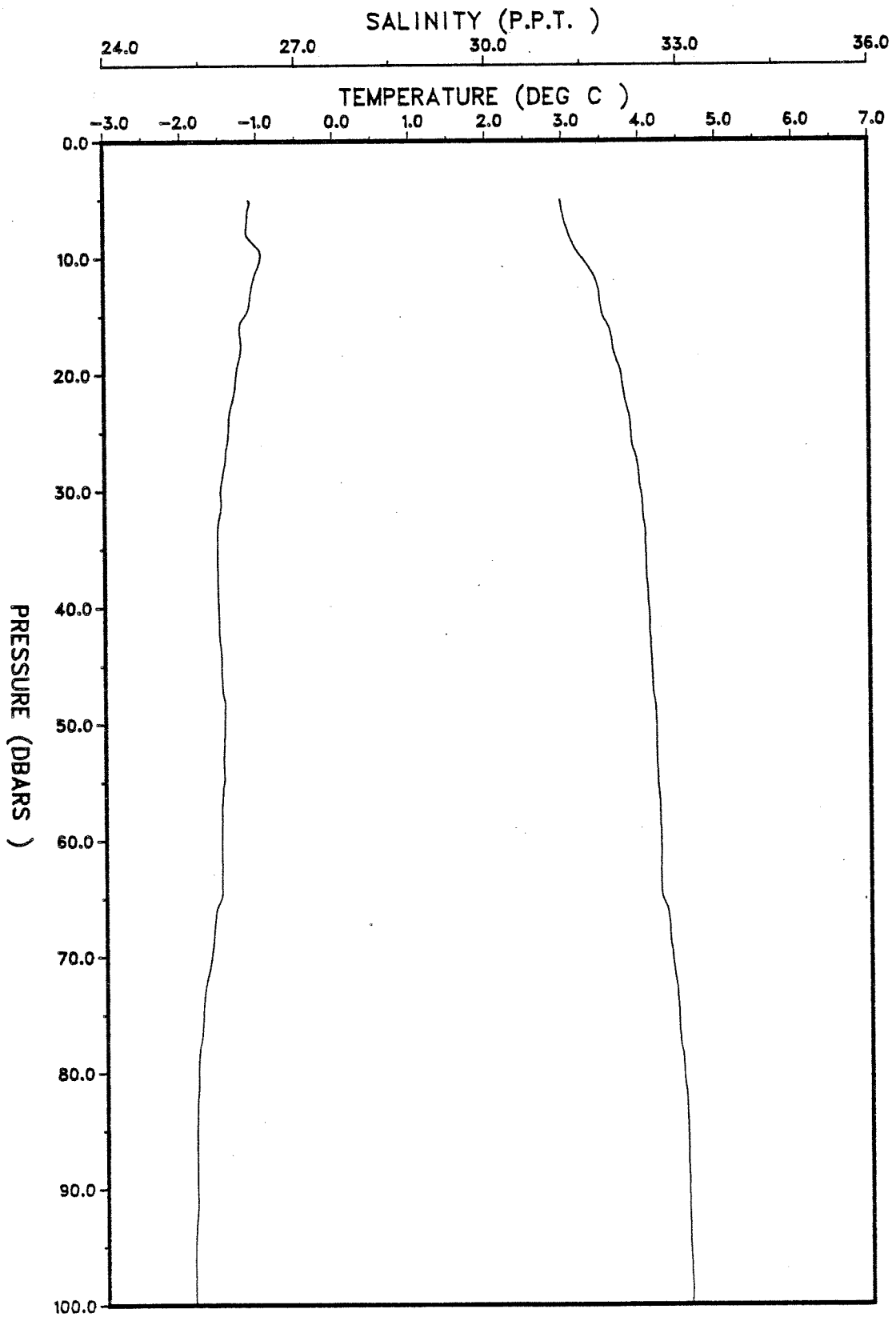
LAT. 53 4.8N, STN 5, CRUISE 84026
LONG. 55 17.4W, STARTING 11:43GMT, DAY 177, 1984



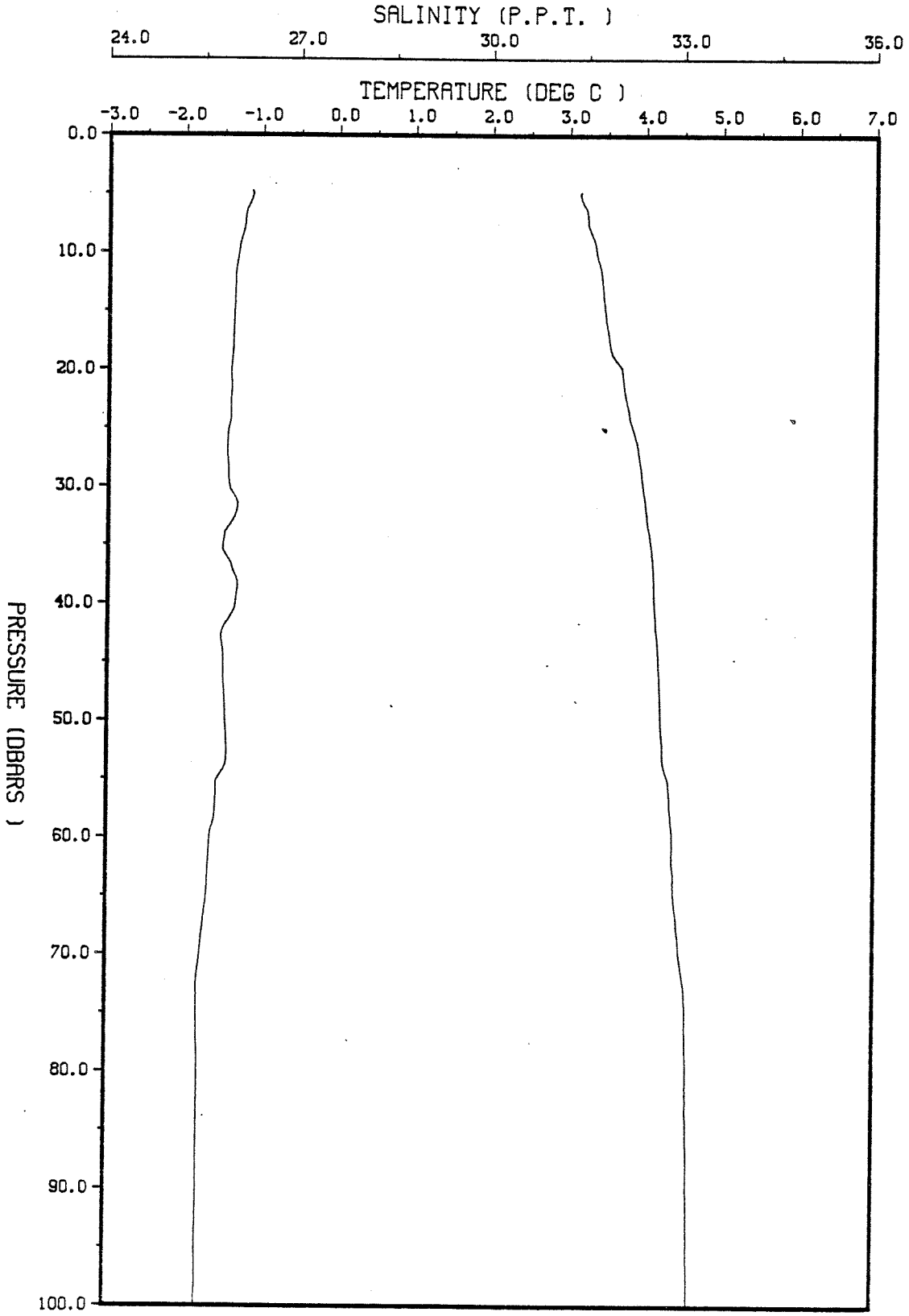
LAT. 52 58.2N, STN 6, CRUISE 84026
LONG. 55 35.4W, STARTING 13:49GMT, DAY 177, 1984



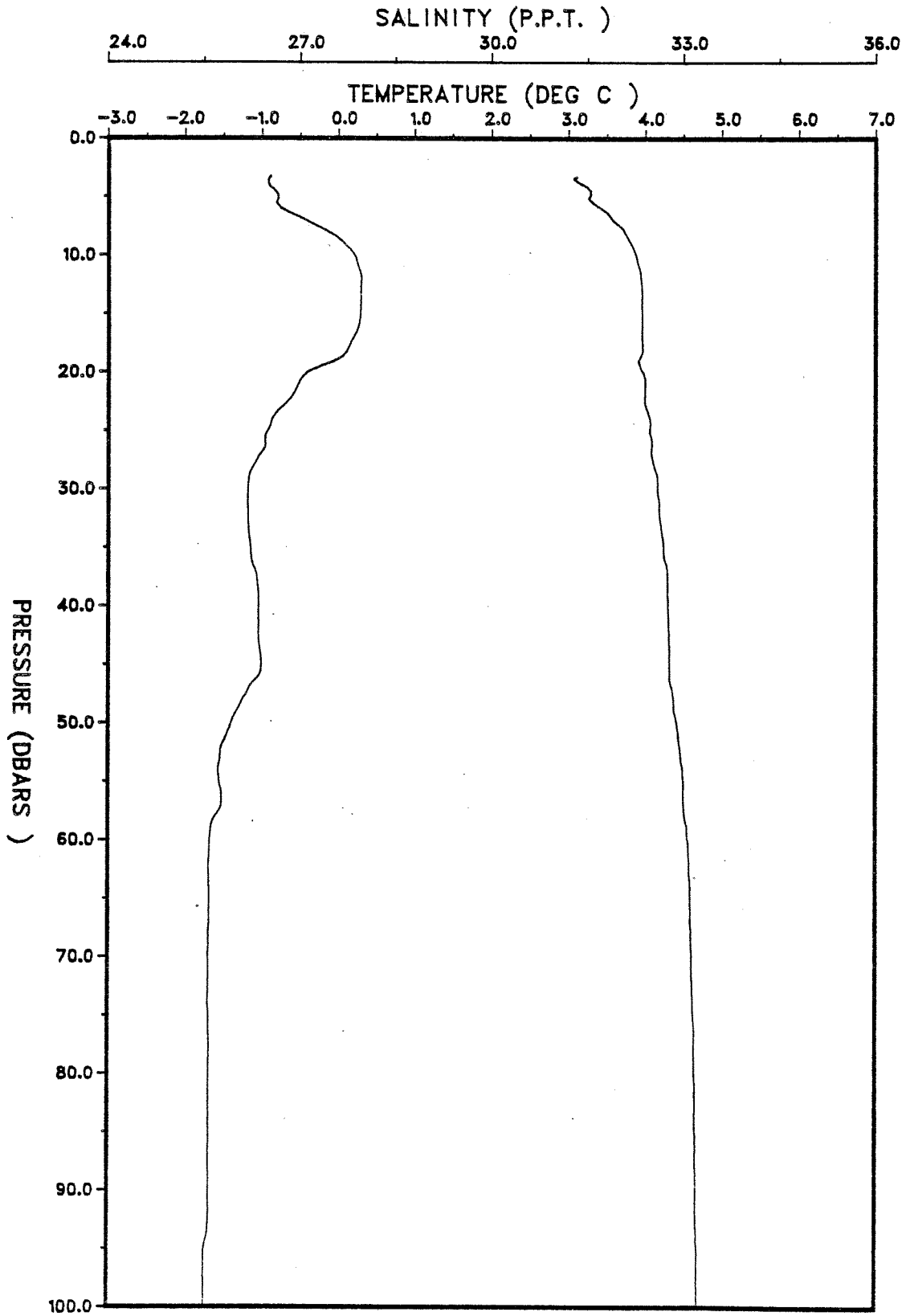
LAT. 54 21.0N, STN 7, CRUISE 84026
LONG. 56 21.0W, STARTING 13:43GMT, DAY 178, 1984



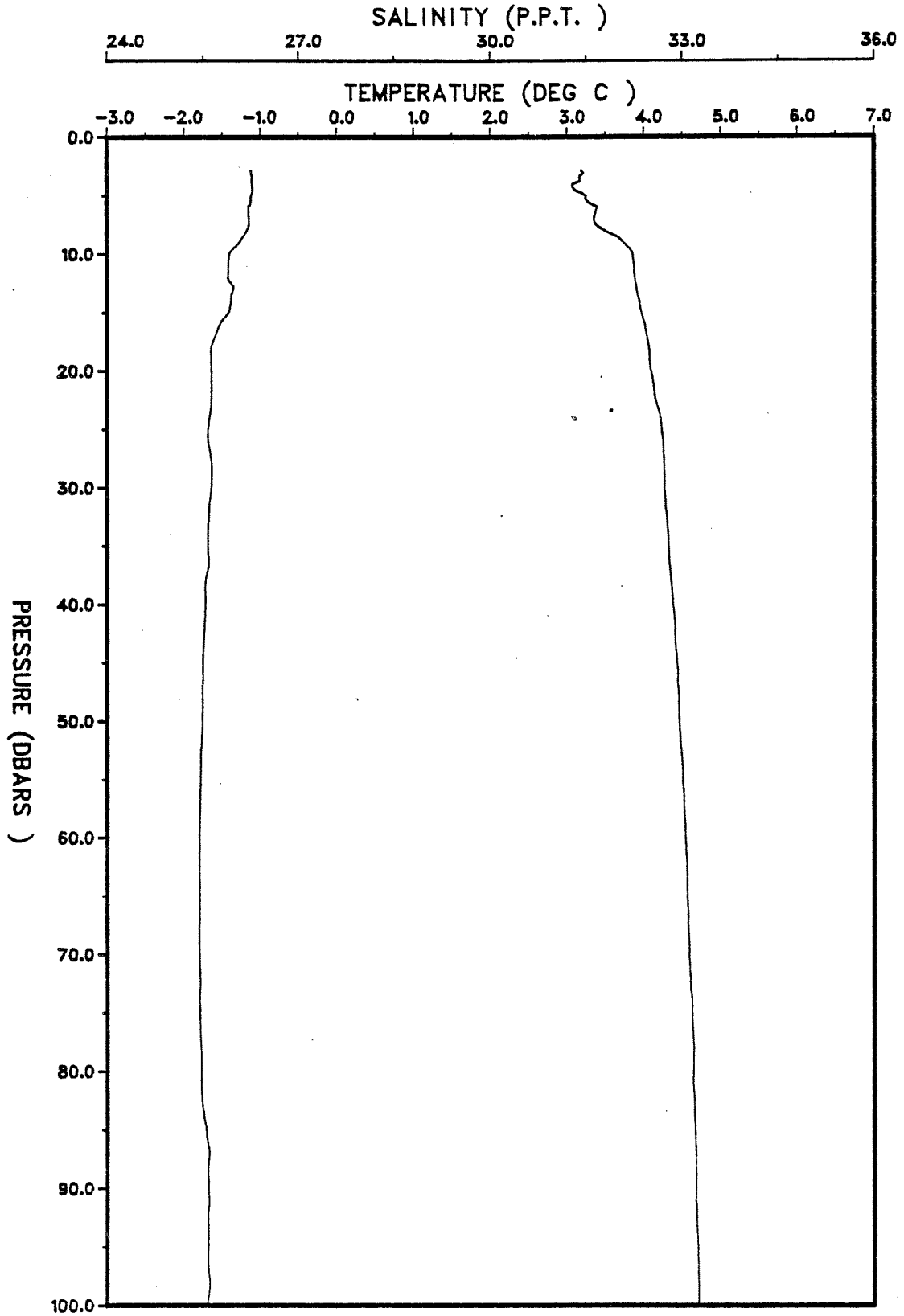
LAT. 54 22.8N, STN 8, CRUISE 84026
LONG. 55 59.4W, STARTING 17:21GMT, DAY 178, 1984



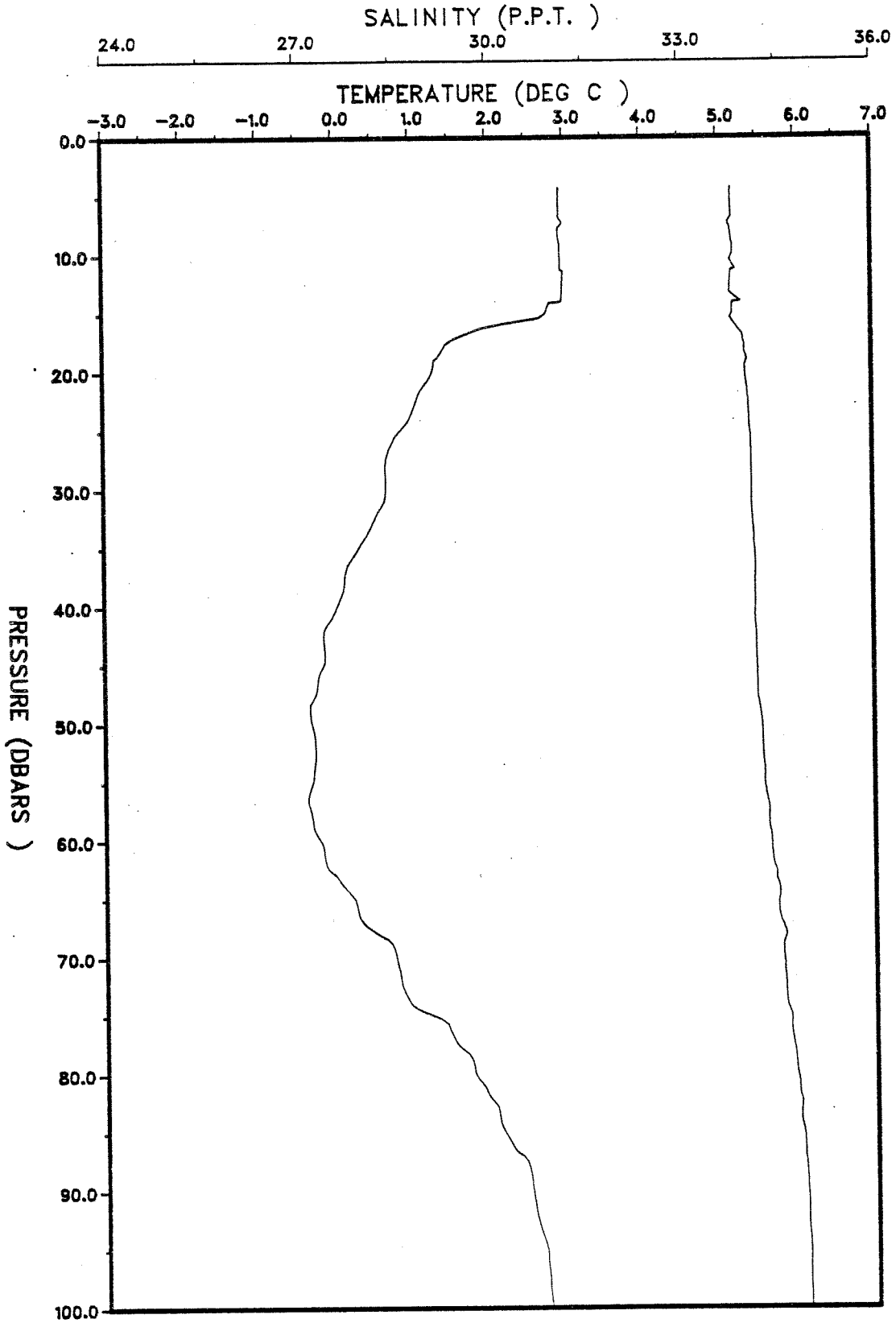
LAT. 54 28.2N, STN 9, CRUISE 84026
LONG. 55 42.0W, STARTING 20: 1GMT, DAY 178, 1984



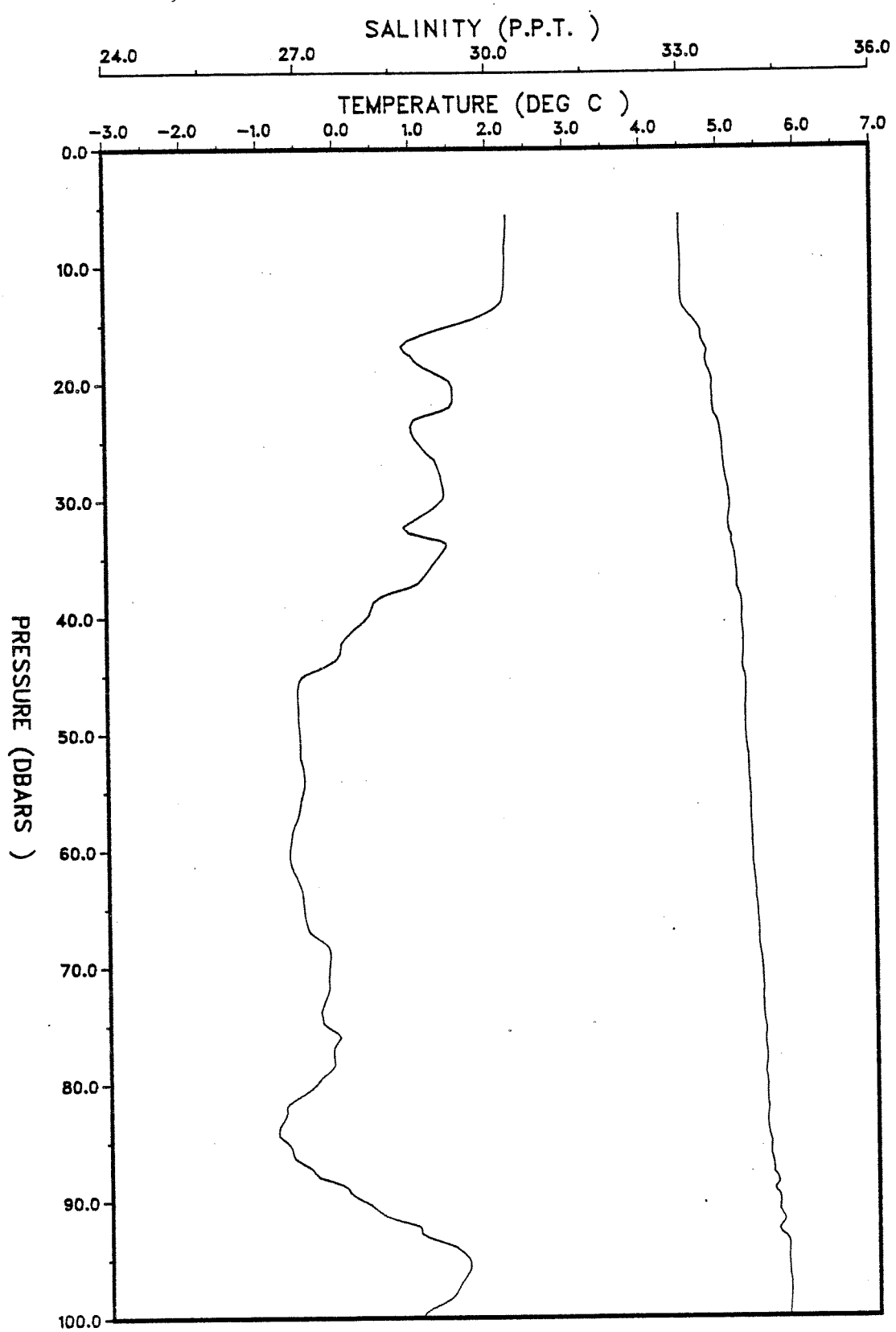
LAT. 54 40.2N, STN 10, CRUISE 84026
LONG. 55 34.8W, STARTING 22: 4GMT, DAY 178, 1984



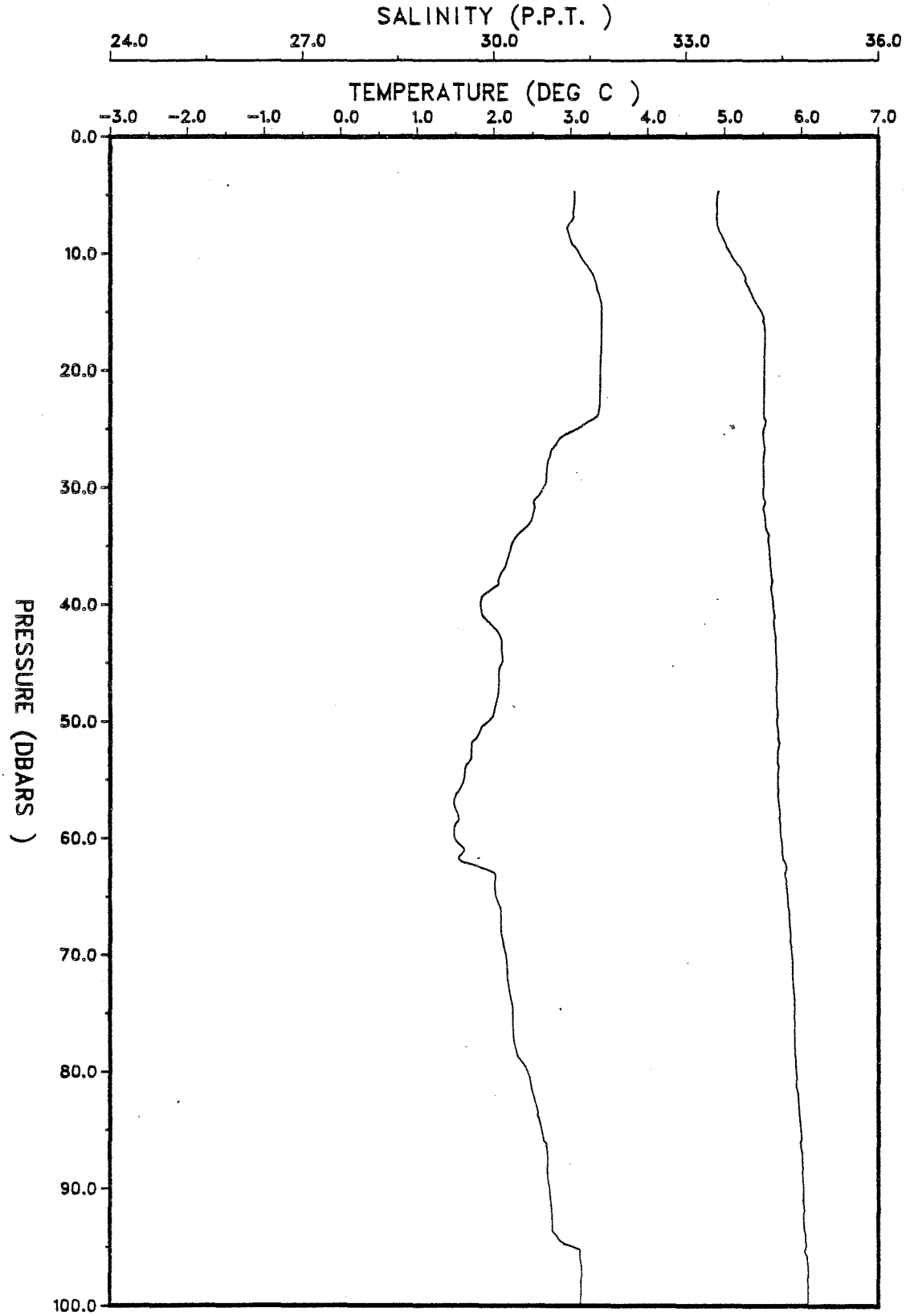
LAT. 54 50.4N, STN 11, CRUISE 84026
LONG. 55 27.0W, STARTING 0:16GMT, DAY 179, 1984



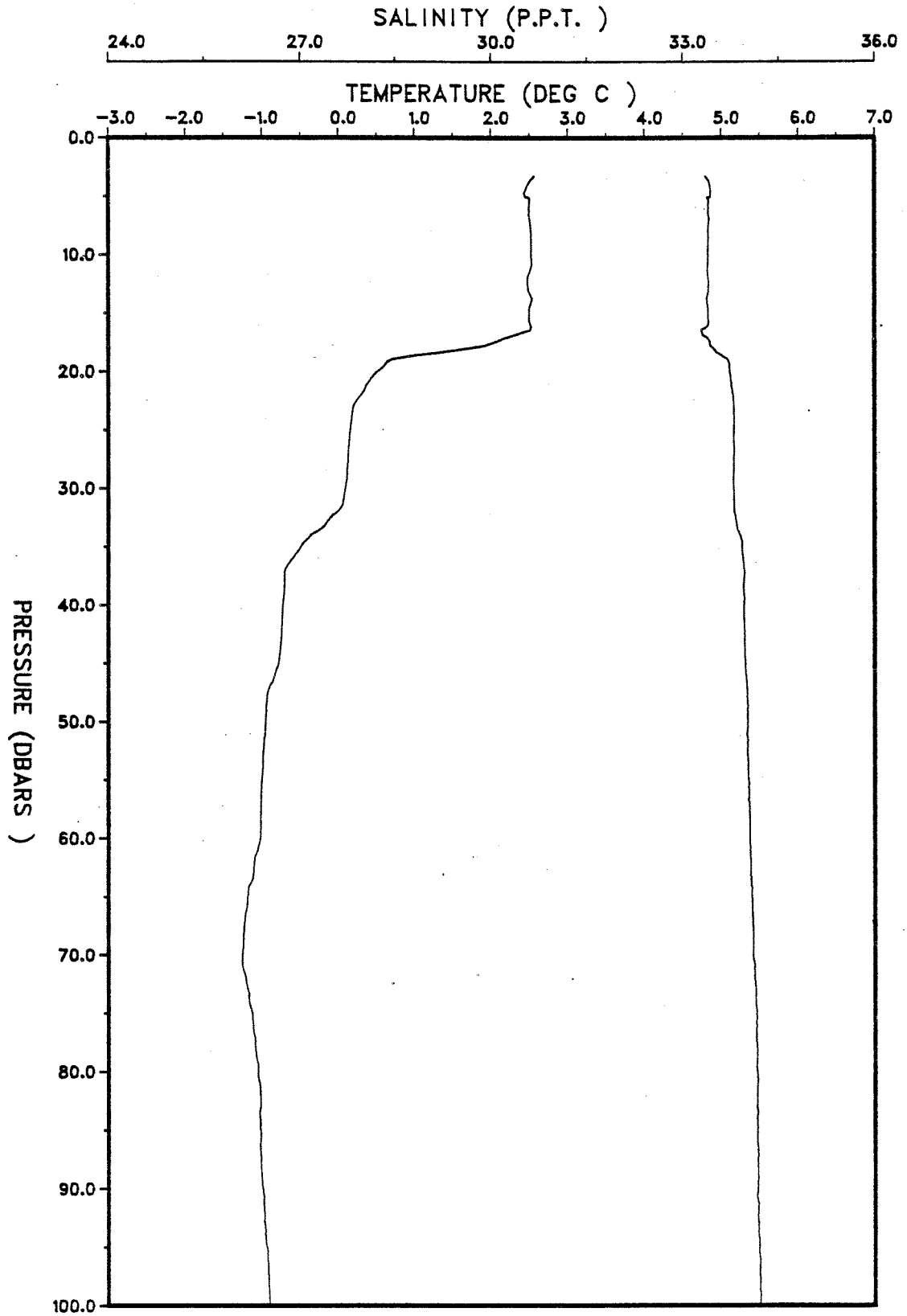
LAT. 55 33.6N, STN 12, CRUISE 84026
LONG. 54 48.6W, STARTING 10:50GMT, DAY 179, 1984



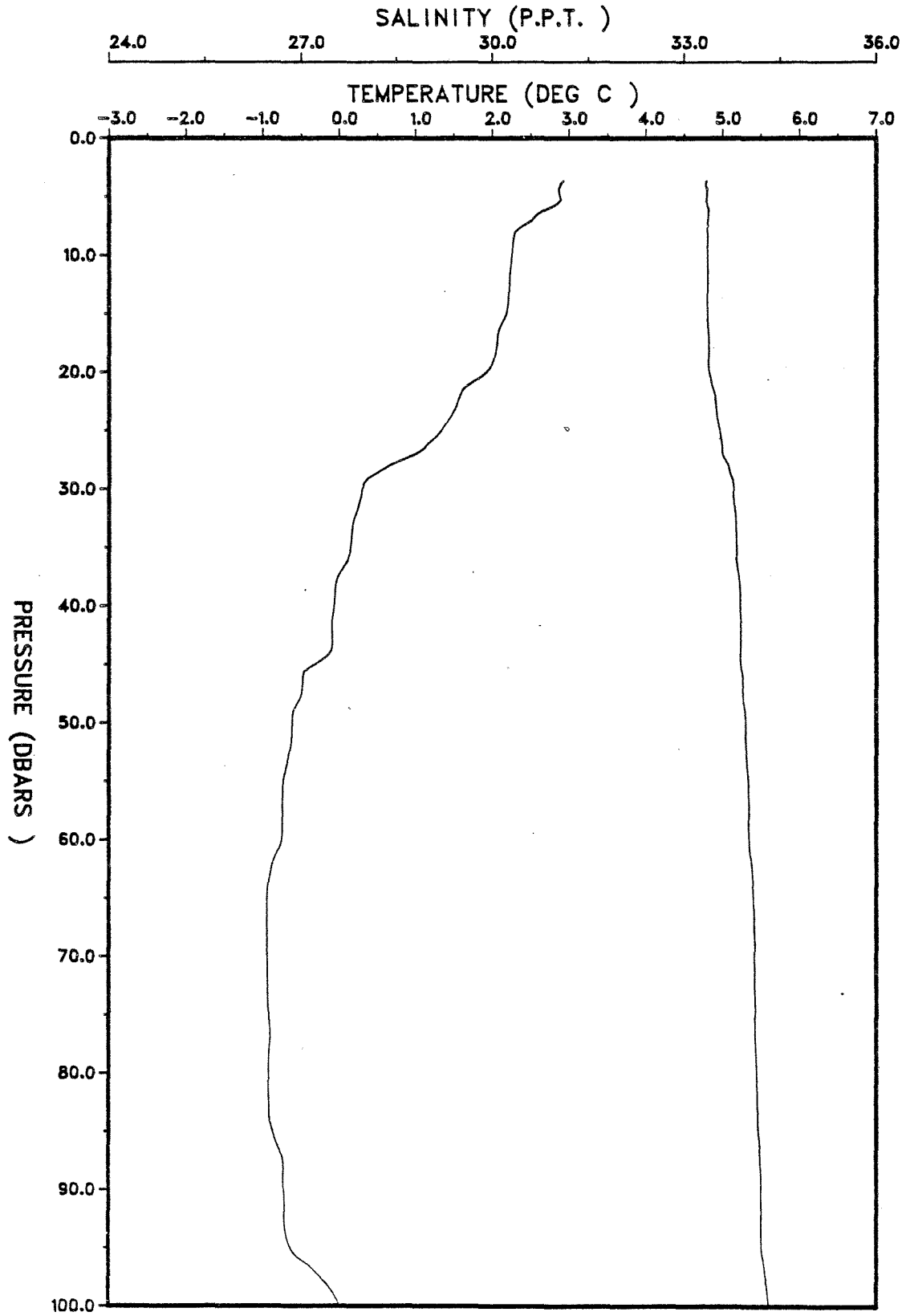
LAT. 55 47.4N, STN 13, CRUISE 84026
LONG. 54 37.2W, STARTING 13:23GMT, DAY 179, 1984



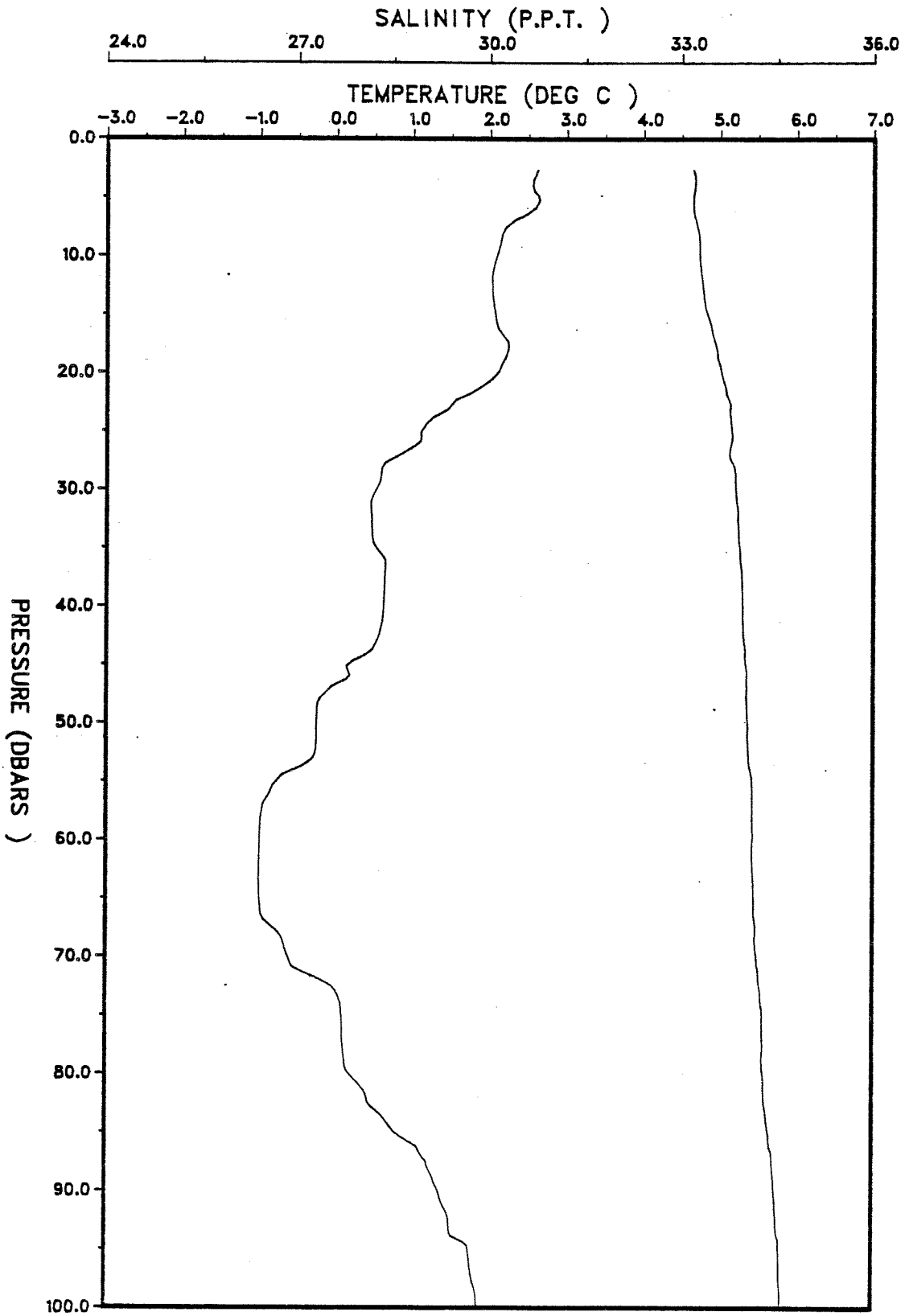
LAT. 56 5.4N, STN 14, CRUISE 84026
LONG. 54 23.4W, STARTING 17:28GMT, DAY 179, 1984



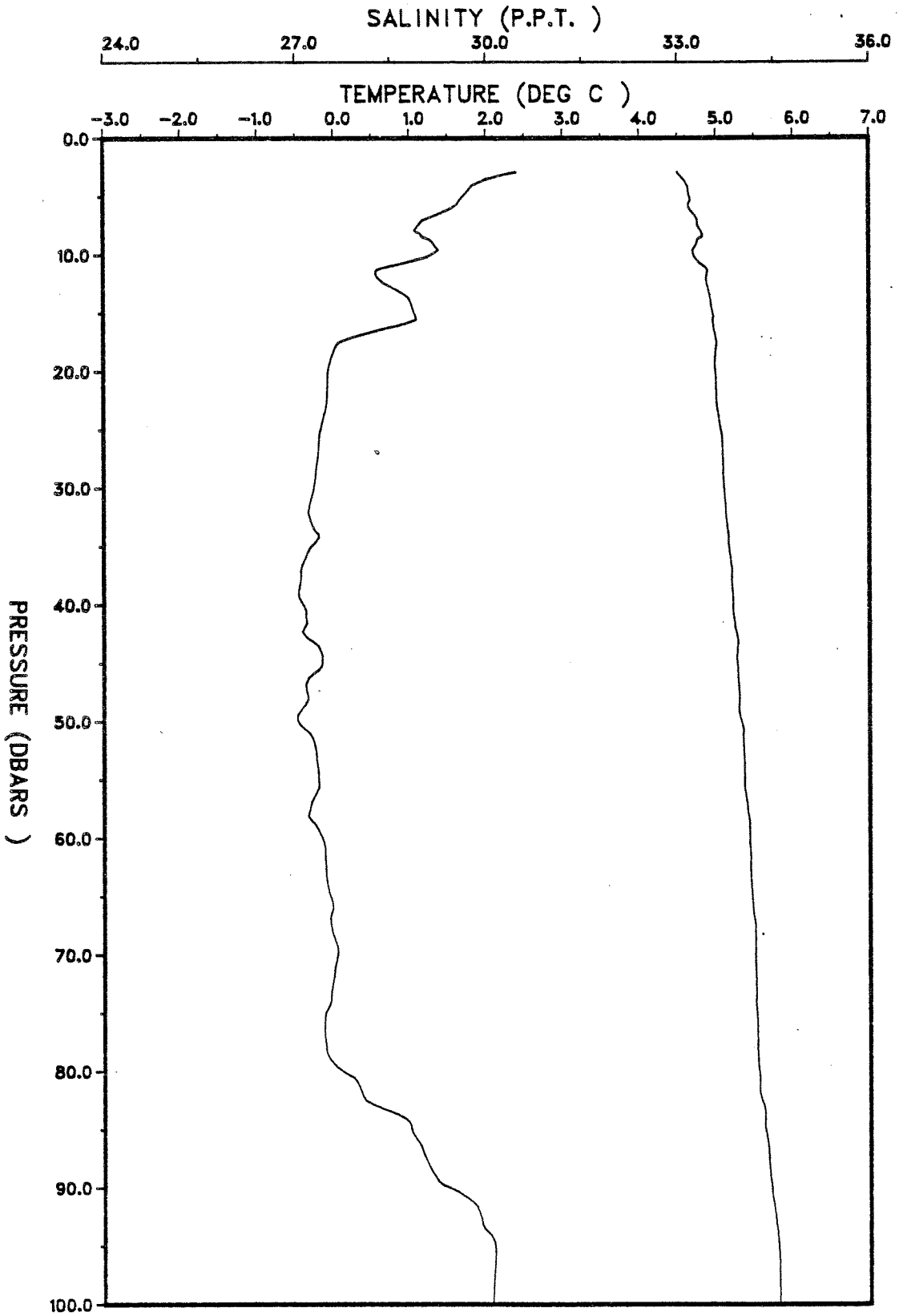
LAT. 55 36.0N, STN 15, CRUISE 84026
LONG. 55 14.4W, STARTING 18:18GMT, DAY 180, 1984



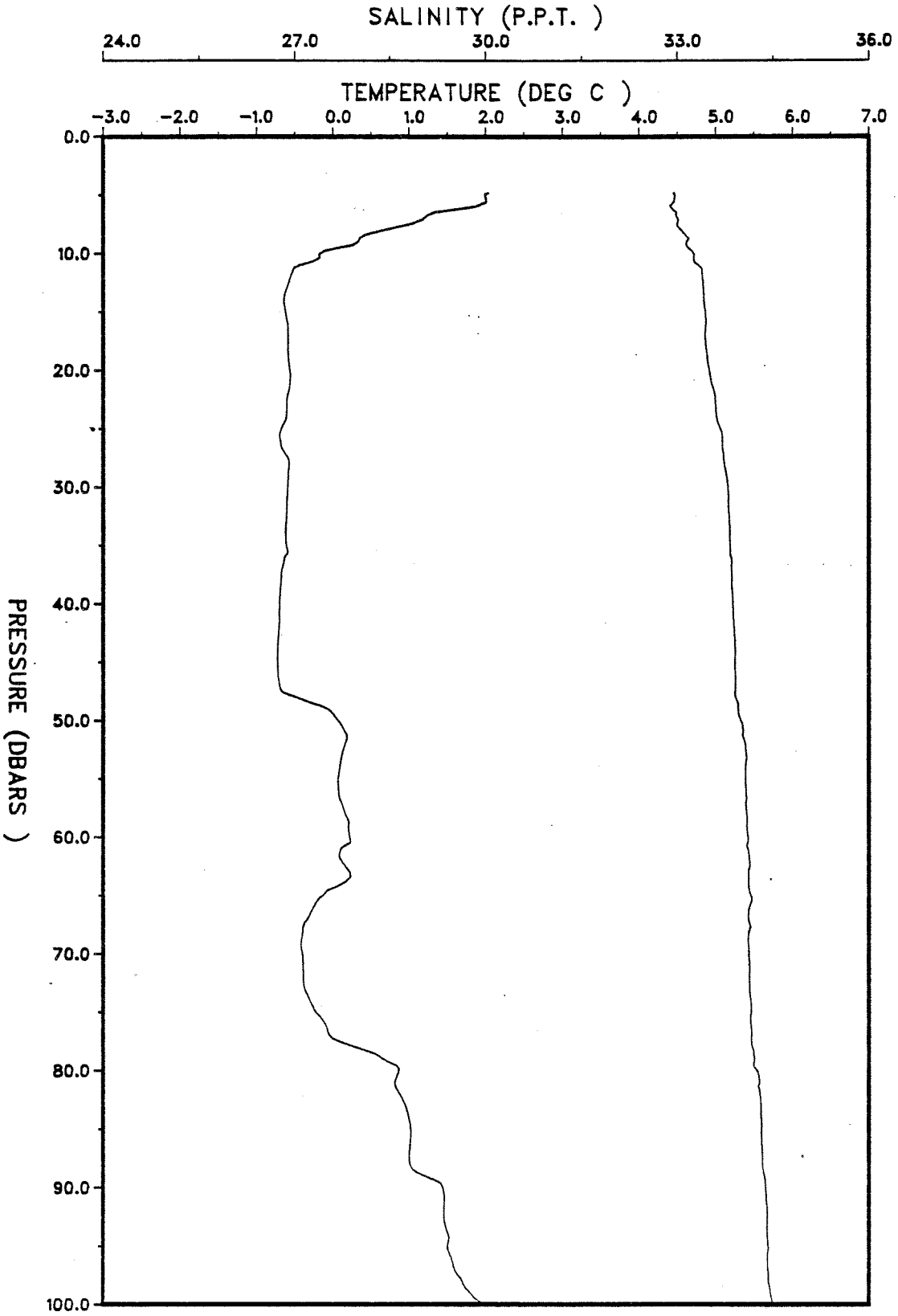
LAT. 55 39.6N, STN 16, CRUISE 84026
LONG. 55 8.4W, STARTING 19:26GMT, DAY 180, 1984



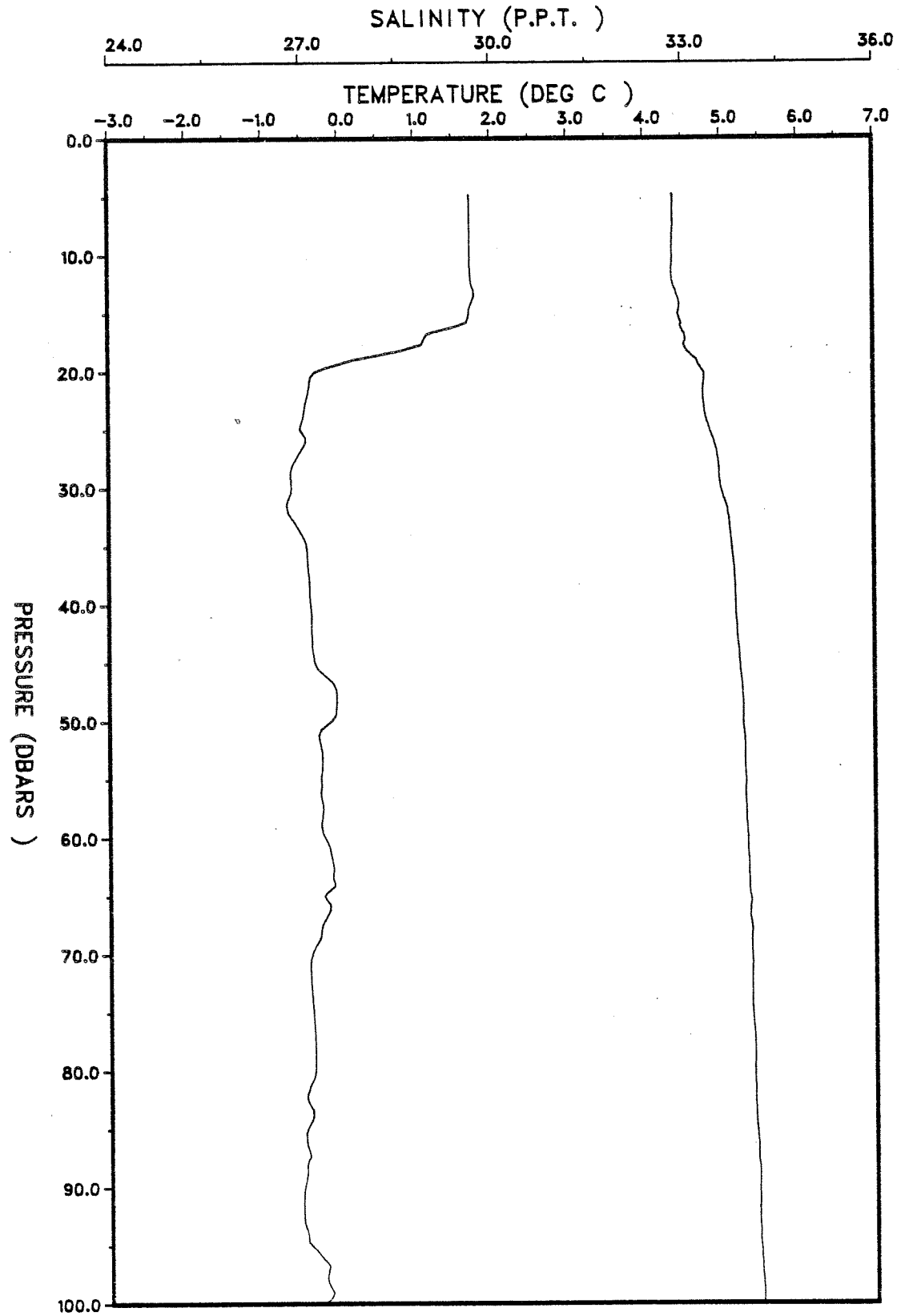
LAT. 55 42.6N, STN 17, CRUISE 84026
LONG. 55 1.8W, STARTING 20:34GMT, DAY 180, 1984



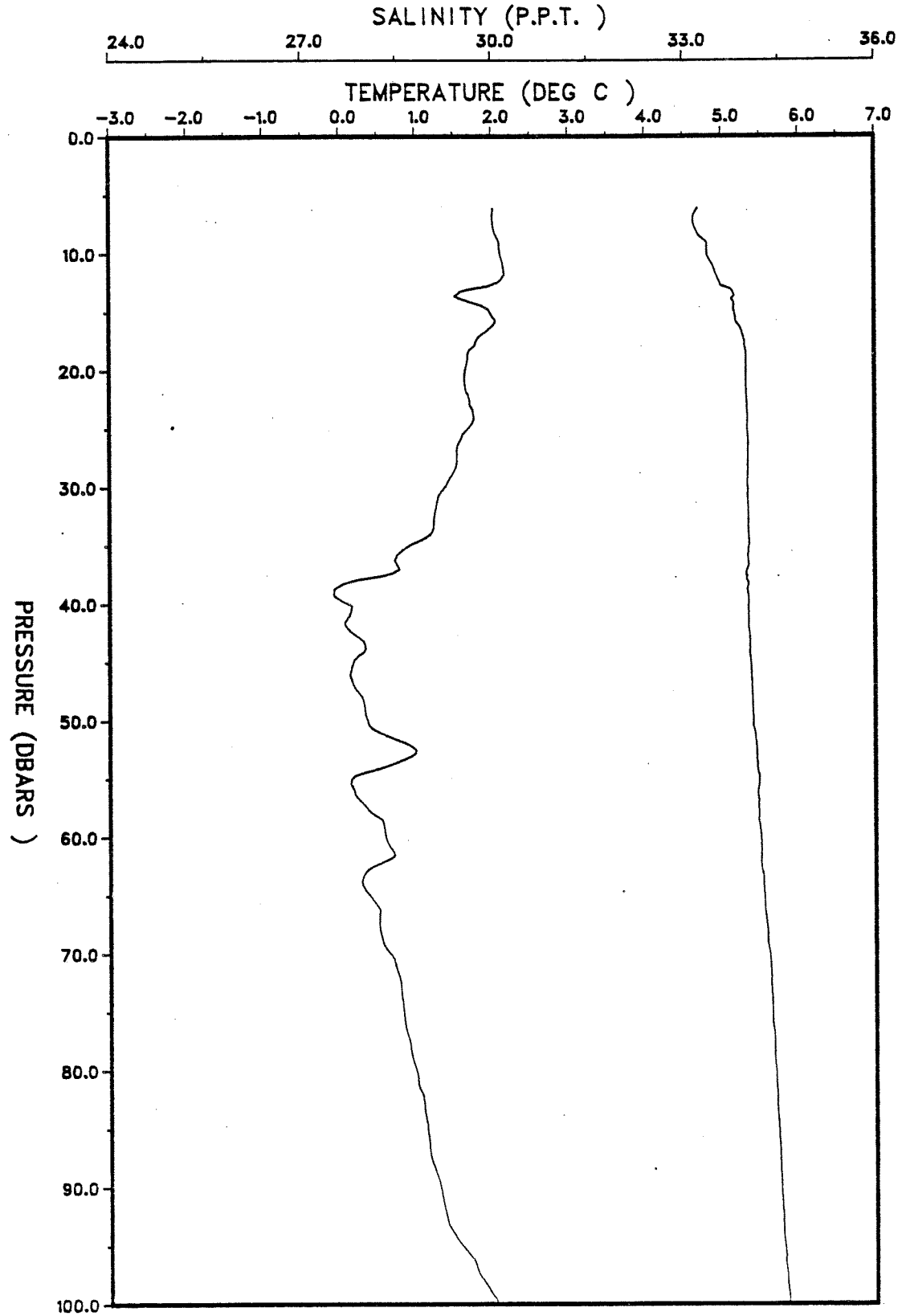
LAT. 55 46.8N, STN 18, CRUISE 84026
LONG. 54 54.6W, STARTING 21:44GMT, DAY 180, 1984



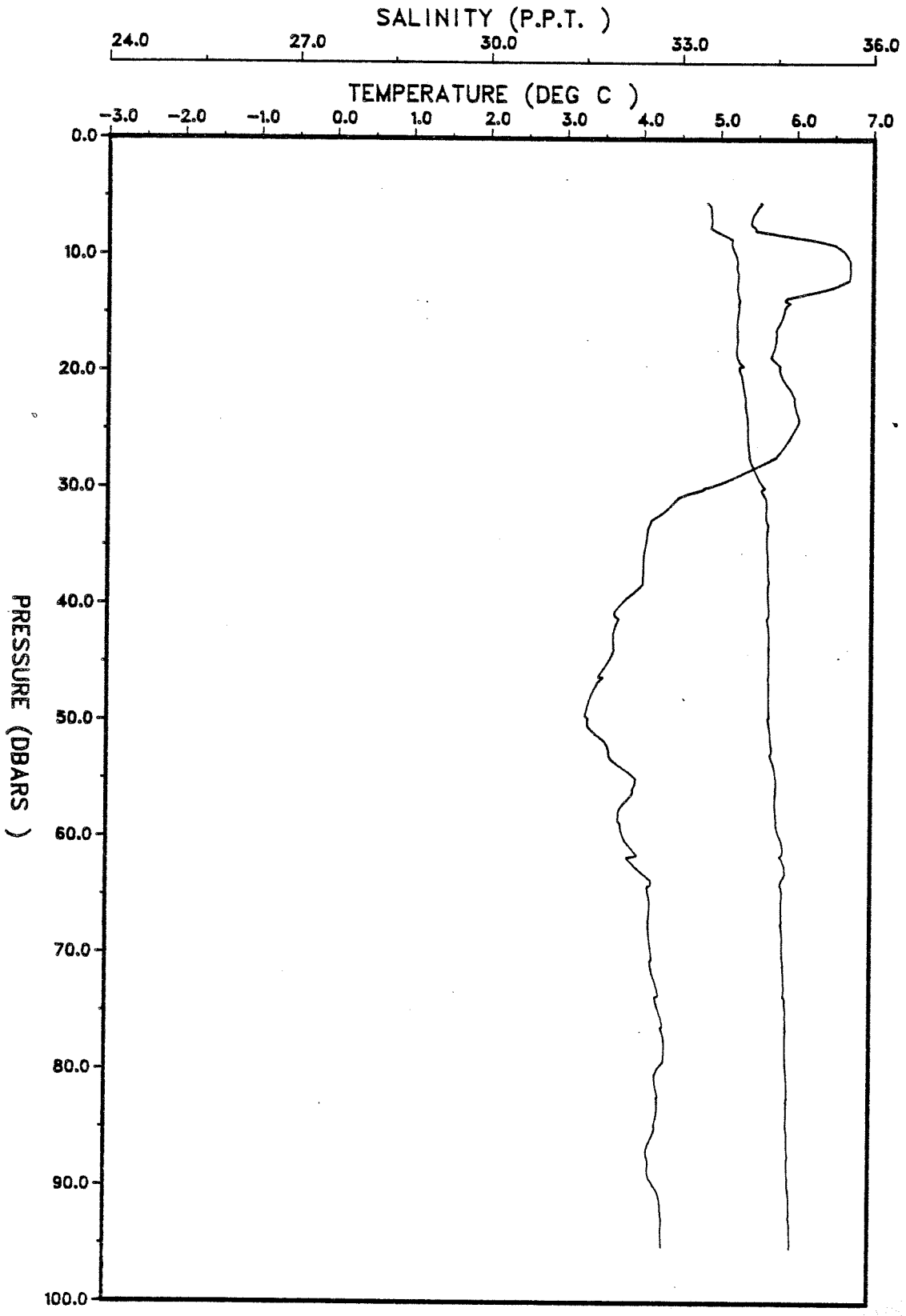
LAT. 55 50.4N, STN 19, CRUISE 84026
LONG. 54 49.2W, STARTING 22:43GMT, DAY 180, 1984



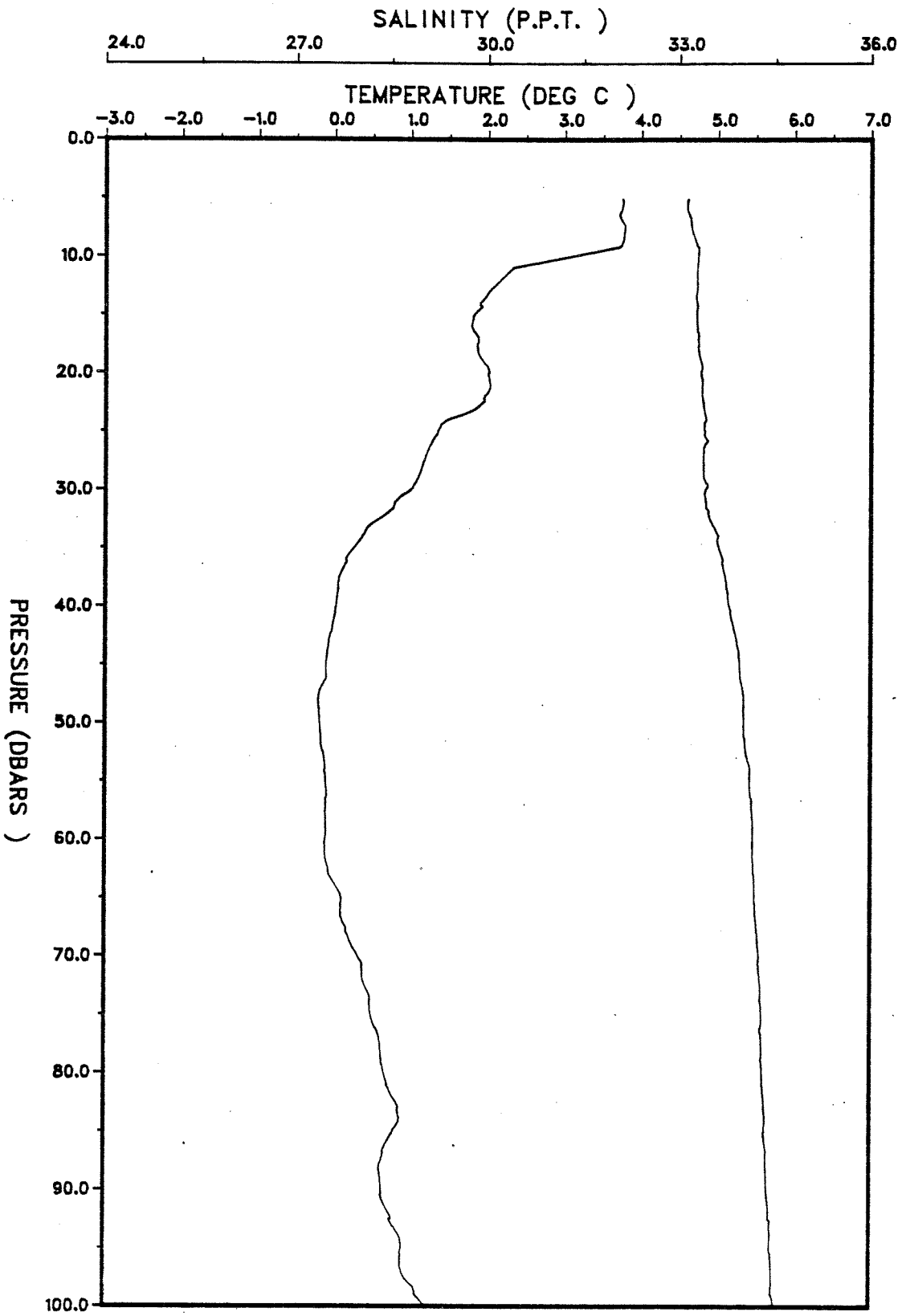
LAT. 55 52.2N, STN 20, CRUISE 84026
LONG. 54 42.6W, STARTING 23:42GMT, DAY 180, 1984



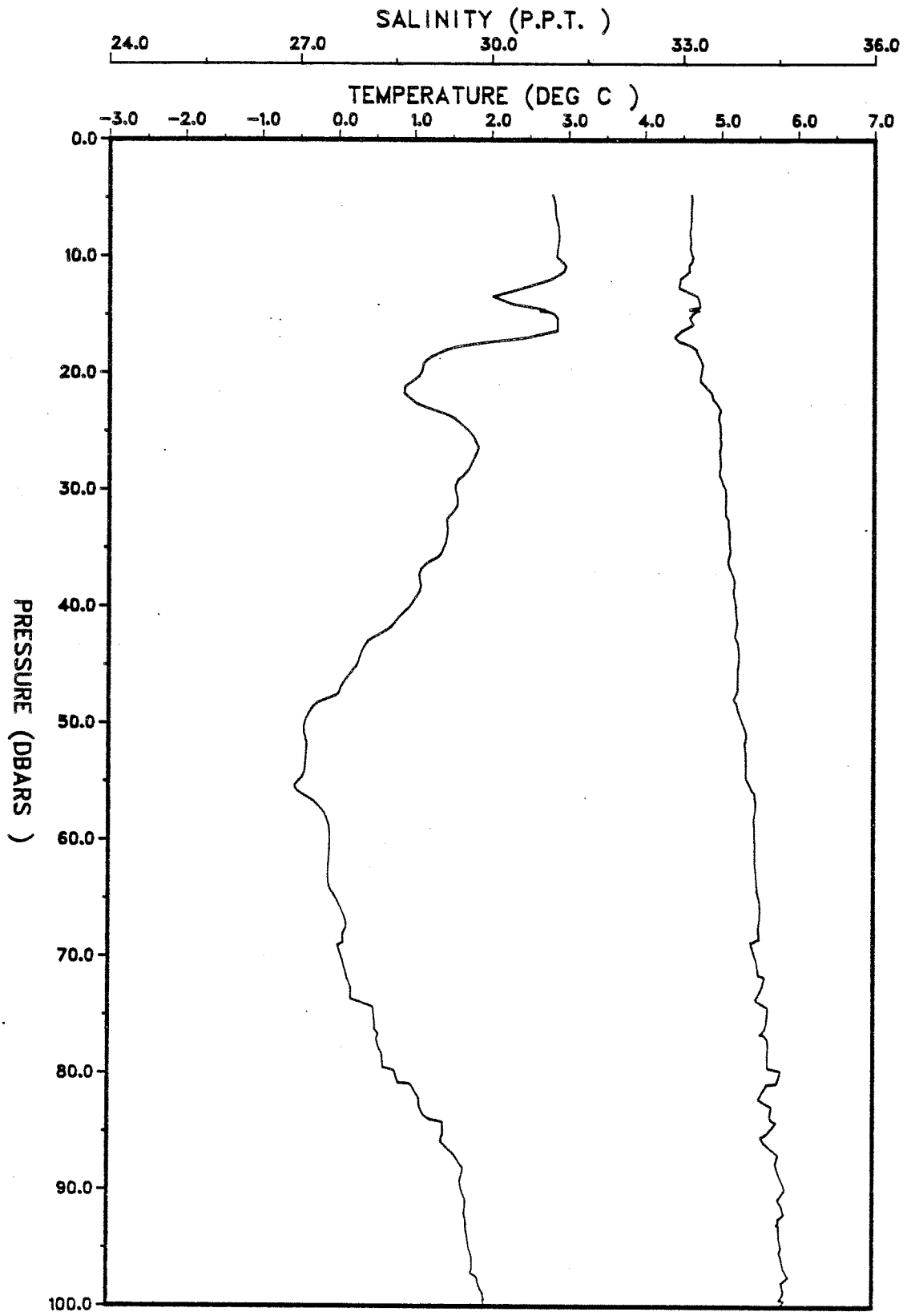
LAT. 55 57.0N, STN 21, CRUISE 84026
LONG. 54 35.4W, STARTING 0:44GMT, DAY 181, 1984



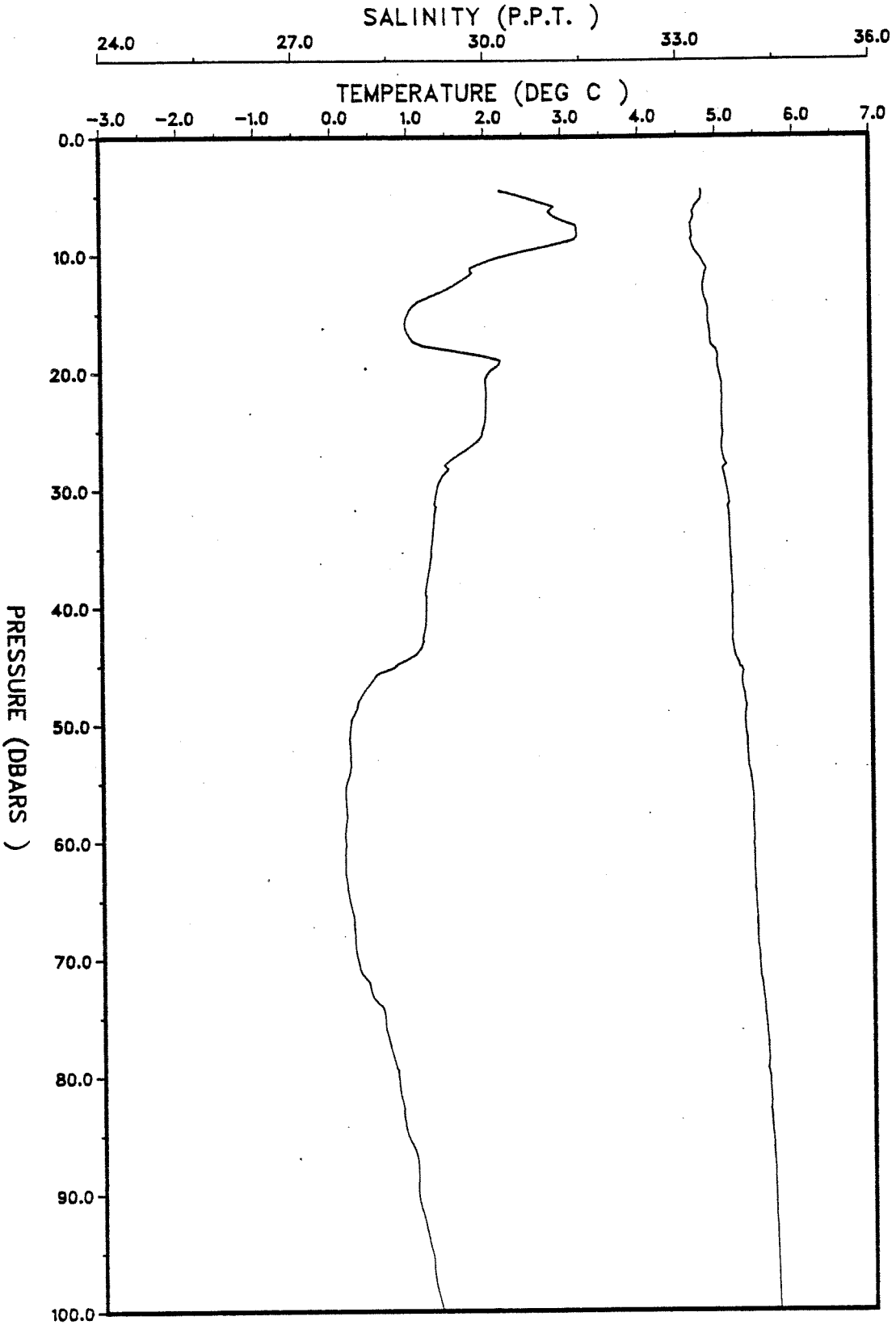
LAT. 53 15.0N, STN 22, CRUISE 84026
LONG. 50 10.8W, STARTING 9:20GMT, DAY 183, 1984



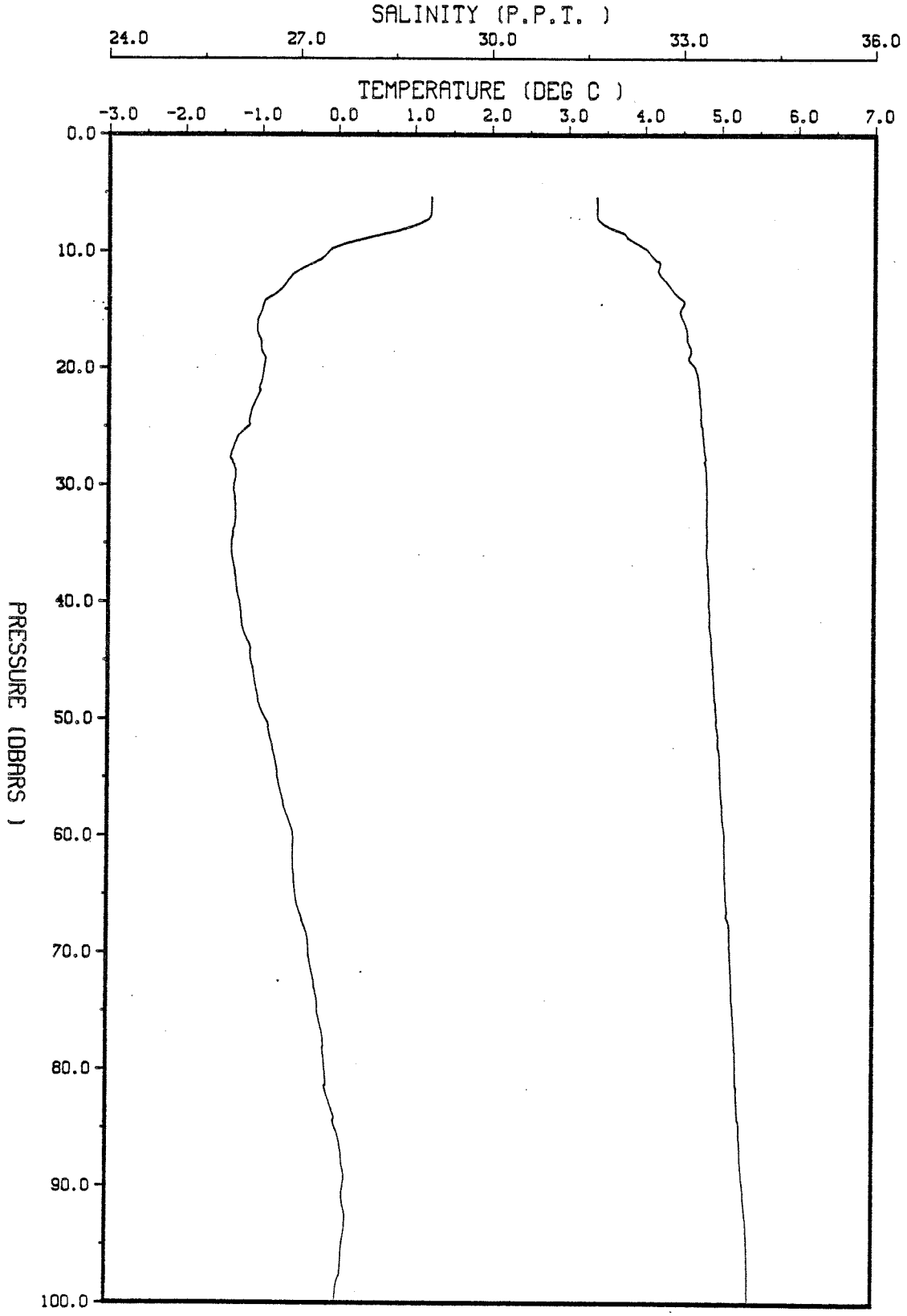
LAT. 53 8.4N, STN 23, CRUISE 84026
LONG. 50 32.4W, STARTING 12:32GMT, DAY 183, 1984



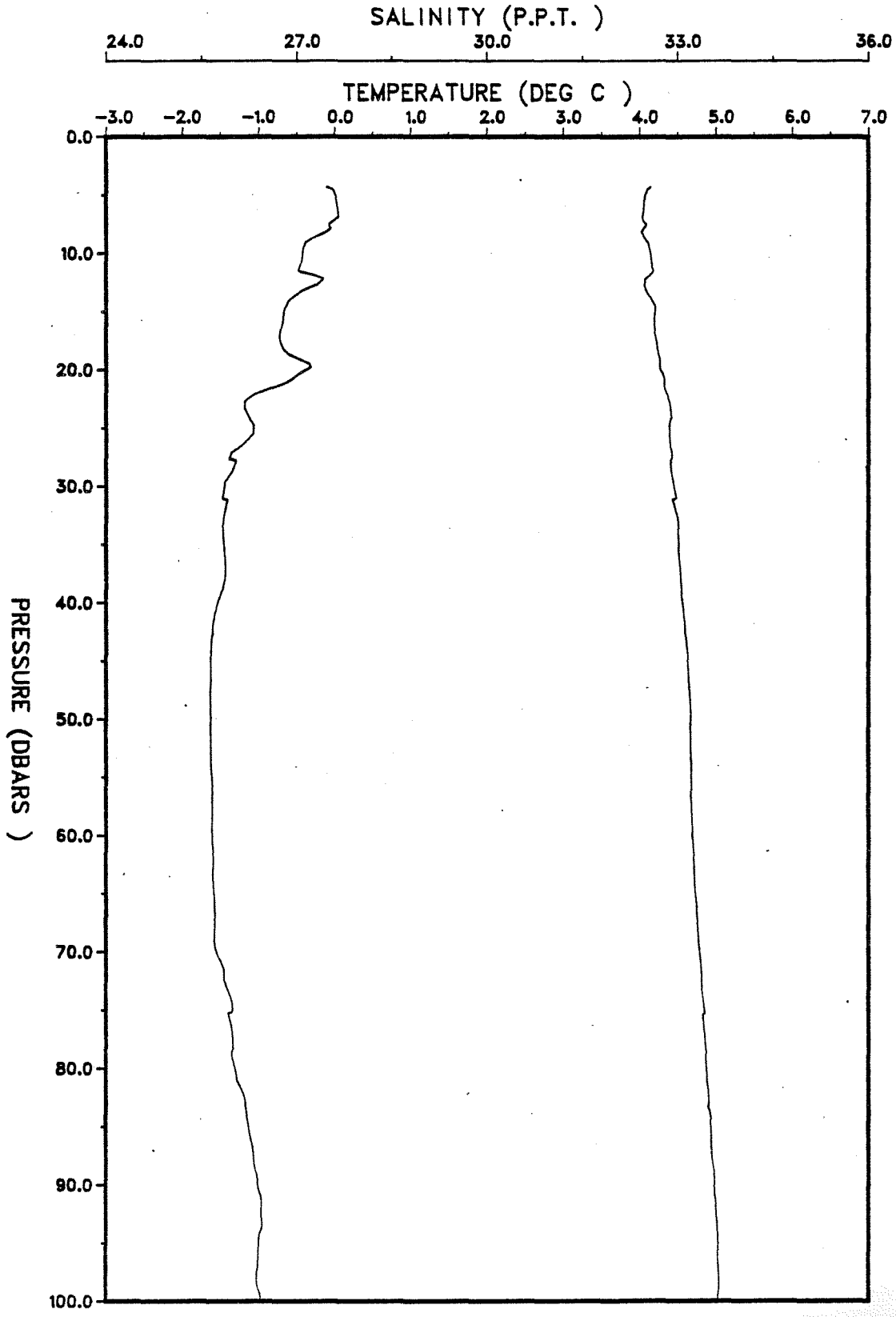
LAT. 53 1.2N, STN 24, CRUISE 84026
LONG. 50 53.4W, STARTING 16:16GMT, DAY 183, 1984



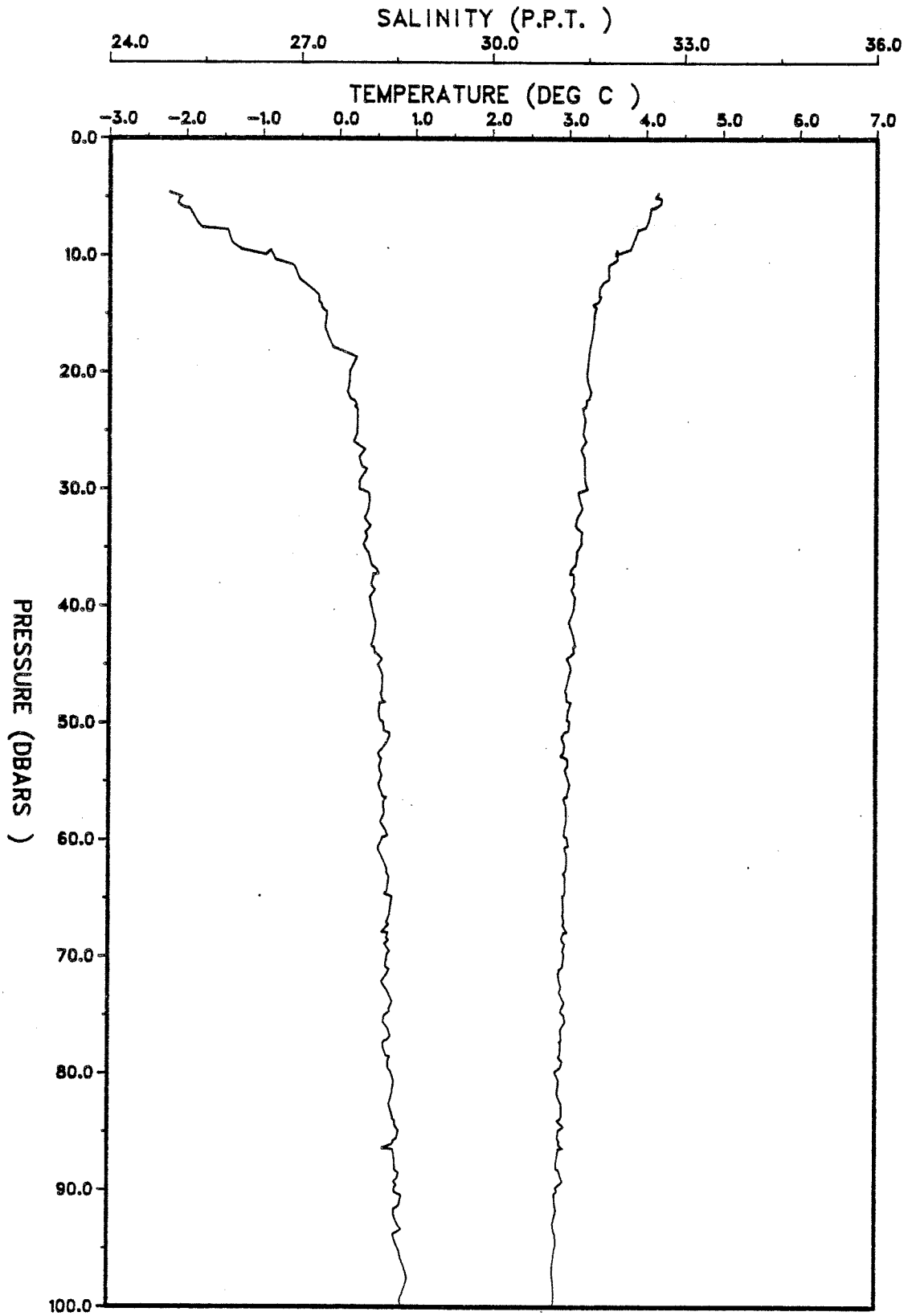
LAT. 52 52.8N, STN 25, CRUISE 84026
LONG. 51 15.0W, STARTING 20: 8GMT, DAY 183, 1984



LAT. 52 46.2N, STN 26, CRUISE 84026
LONG. 51 36.6W, STARTING 22:47GMT, DAY 183, 1984



LAT. 52 39.6N, STN 27, CRUISE 84026
LONG. 51 57.6W, STARTING 0:45GMT, DAY 184, 1984



LAT. 54 29.4N, STN 28, CRUISE 84026
LONG. 56 21.0W, STARTING 22: 6GMT, DAY 184, 1984