Belgian GLOBAL CHANGE Impulse Programme

OMEX - BIOGEOCHEMISTRY Programme

BENTHIC STUDIES Programme

RV BELGICA CRUISE 95/21-22

PARTICIPATING LABORATORIES FROM :

ULg - ULB - MUMM - VUB - UG

MUMM contribution

Sampling stations, trackplot, SCTD profiles and horizontal profiles of salinity, temperature and fluorescence.

REPORT

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R/V BELGICA CRUISES 95/21 and 95/22.

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1. INTRODUCTION.

The RV Belgica cruise 95/21 has been conducted in the frame of the Belgian Global Change Impulse Programme as well as the Ocean Margin Exchange project "OMEX" supported by EEC, that has been focussed the research efforts on the Banc de la Chapelle area and the upwelling zone along the Spanish coast. The cruise started on 11 September 1995 at Zeebrugge. After a rendez-vous with the RRS Discovery at the Isle of Wight in order to embark Mrs. L. Chou (ULB), the RV Belgica sailed to the position 49°41'N, 10°07'W (station 1). The RV Belgica arrived at station 1 on 13 September at 16h00. The objective of the cruise was to sample 11 stations on the leg from station 1 to the OMEX2 station (49°11.20'N, 12°49.18'W).

However, due to bad weather conditions (8 to 9 Bft) SCTD casting was interrupted after the sampling of station 3. The planned stations 4 to 11 were not sampled. Initially the Belgica sailed slowly in a south-east direction. Later it was decided to leave the area and to sail to the Meriadzek Terrace area. The numbering of the stations was continued chronological and not as planned in the cruise program. Two casts were taken at station 04 (Meriadzek Terrace). The following stations 05 to 11 were sampled at the slope of the "Banc de la Chapelle".

The cruise 95/21 ended at Lorient (FR) on 19 September.

The Belgica left the harbour of Lorient on 22 September for the 95/22 cruise. Unlike the 95/21 cruise, an air-sea interaction and biochemistry cruise, the 95/22 cruise combined the OMEX biochemistry programme and benthic studies programme. The latter studies the spatial structure in the hyperbenthic communities of the North Sea, with special reference to the Southern frontal system with Atlantic water, and the slope of the continental shelf.

Following the sampling of station 12 on the Meriadzek Terrace, the RV Belgica sailed 40 miles to the north-east and the stations 13 to 19 were sampled. Due to an accident on the afterdeck, it was necessary to enter the harbour of Brest for the disembarkation of Mr. G. Desmet (UG). The stations 20 to 25 were sampled in the Channel on the way to Zeebrugge.

The RV BELGICA arrived at Zeebrugge on 29 September 1995.

Dr. M. Frankignoulle (ULg) was the principal scientist aboard the BELGICA for the cruise 95/21 while Dr. A. Dewicke (UG) was the principal scientist for the cruise 95/22. The following laboratories have participated :

* Université de Liège (ULg) - Laboratoire d'Océanologie.
* Université Libre de Bruxelles (ULB) - Laboratoire d'Océanographie.
* Vrije Universiteit Brussel (VUB) - Laboratorium voor Analytische Scheikunde.
* Universiteit Gent (UG) - Instituut voor Dierkunde, Sectie Mariene Biologie.
* Ministry of Public Health and Environment - Management Unit of the North Sea and Scheldt Estuary Mathematical Model (MUMM).

The laboratory for Marine Biology (UG) only participated to the 95/22 cruise.

MUMM was mainly entrusted with the automatic data acquisition and logging of oceanographic, meteorological and navigational data (ODAS computer logging and Sea-Bird SCTD casts).

In addition to the data acquisition task, general assistance was offered in using the on board scientific instrumentation and related infrastructure, the Niskin bottle sampling, etc ...

Also samples for laboratory salinity measurements were taken, and these samples have been analyzed in MUMM's laboratory at Oostende.

The present report describes the computer logged oceanographic, meteorological and navigational data gathered during this cruise. Also the results of the laboratory salinity measurements are included.

2. COMPUTER LOGGED OCEANOGRAPHIC, NAVIGATIONAL AND METEOROLOGICAL DATA.

2.1. Navigational instrumentation

During this cruise, the data from the following navigational instruments connected to the shipborn computer system were logged by the so called Oceanographic Data Acquisition Software system "ODAS" :

* SERCEL NR103 DGPS positioning system with an accuracy of 3 to 5 m.
* MAGNAVOX 200MX GPS navigation system with an accuracy of typically 50m.
* Anshutz STD12 Gyro Compass.
* Raytheon DSN450 Doppler speed log and bathymetric depth.
* Atlas Deso 20 Scientific Echosounder.
  The Atlas Deso 20 is equipped with 2 transducers (33 kHz and 210 kHz). The 33 kHz transducer has a depth range of ca. 1500 m in good weather conditions.

2.2. Oceanographic instrumentation

The seasurface temperature was measured continuously with a Rosemount temperature sensor as well as with the remote temperature sensor of the Sea-Bird SBE21 thermosalinograph, both installed at the inlet of the special seawater circuit situated at the bow of the vessel.

The Sea-Bird SBE21 thermosalinograph, installed in the wet lab, is connected to the special seawater circuit. The salinity was measured continuously using a personal computer with a dedicated software package from Sea-Bird. The processed data was continuously (every 6 sec.) transmitted to the HP1000 data acquisition computer. The specifications of this thermosalinograph are found in table 1.

Parameter	Units	Range	Accuracy
TEMPERATURE	°C	-5 - +35	0.01 °C / 6 months
CONDUCTIVITY	S/m	0 - 7	0.001 S / m / month

Table 1. Sea-Bird SBE21 thermosalinograph specifications.

Salinity and density are calculated from conductivity, temperature and depth, in accordance to the 1978 Practical Salinity Scale from the IEEE Journal of Oceanic Engineering, January 1980.

A Turner Designs 10-AU-005 fluorimeter, also connected to the special seawater circuit, was used to measure chlorophyll concentrations during the full campaign. The data were also transmitted to the HP1000 data acquisition system.

The vertical light profiles have been taken with a LiCor LI-192-SA PAR sensor mounted on a Sea-Bird SBE19 SCTD profiler. The PAR sensor has a measuring range of 0 to 10.000 μmol s^{-1} m^{-2} with an accuracy of 5 %.

SCTD vertical profiles have been taken with the Sea-Bird SBE09*plus* CTD profiler integrated with the Sea-Bird carousel water sampling system SBE32. The specifications of this CTD profiling system are given in table 2.

Parameter	Units	Range	Accuracy (guaranteed)
DEPTH	m	0 - 3000	0.1 % of full scale range
TEMPERATURE	°C	-5 - +35	0.01 °C / 6 months
CONDUCTIVITY	S/m	0 - 6	0.001 S / m / month
DIS. OXYGEN	µmol/kg	0 - 600	5 µmol / kg / day

Table 2. Sea-Bird SBE09*plus* specifications.

2.3. Meteorological instrumentation

Following parameters were measured by the Friedrichs meteorological station :

- windspeed
- winddirection
- airtemperature
- atmospheric pressure

In addition a solar radiation measuring device from Kipp & Zonen was installed.

The outputs of these sensors are analogous signals that are measured with the 4 ½ digit digital voltmeter incorporated in the ODAS system. Table 3 gives a review of the specifications of the meteo sensors.

Parameter	Units	Range	Precision
WIND SPEED	m/s	0 - 41	0.2
WIND DIRECTION	degrees	0 - 360	2
ATMOSPHERIC PRESSURE	mbar	950 - 1050	1.5
AIR TEMPERATURE	°C	-35 - +45	0.2
SOLAR RADIATION	Watt/m²	0 - 1000	10

Table 3. Meteo sensor specifications.

3. DATA ACQUISITION SYSTEM.

3.1. HP1000 - ODAS system.

A Hewlett Packard HP1000 minicomputer system with a HP6942 multiprogrammer and an HP3497A digital voltmeter subsystem were used to provide continuously logged data at the following intervals :

01 min. : navigational, meteorological and oceanographic data during the whole cruise.

The Oceanographic Data Acquisition System "ODAS" software package has been used for this purpose.

This ODAS software package was designed to interrogate the different subsystems, instruments and sensors installed, and to gather in real time several groups of parameters at different time intervals. The data are stored on Winchester disc while at the same time the data can be listed or plotted in real time or off line. Selected parameters can also be distributed in real time to the video monitors installed in the laboratories and on the bridge.

The data are transferred to the shore based data processing centre of MUMM situated at Oostende using the integral cartridge backup system of the Winchester drive.

At the shore station the data is stored on a identical HP1000 system, hence the same ODAS software package can be used for further processing.

Additionally the data stored in the internal ODAS format (binary) have been converted to ASCII for transportation to a PC MS-DOS or a UNIX system, using the KERMIT data transfer package.

3.2. SCTD - Horizontal profiling system.

The Sea-Bird SBE21 thermosalinograph data were recorded continuously to obtain horizontal salinity and water temperature profiles during the trajectories or time profiles at the fixed stations. The sensors are interrogated every 6 seconds by a personal computer supplied with dedicated Sea-Bird data acquisition and presentation software. The converted values were transmitted in real-time to the ODAS system.

3.3. SCTD - Vertical profiling system.

The Sea-Bird SBE09*plus* STD system measures the depth of the sensor package, water temperature, conductivity and dissolved oxygen at a rate of 24 samples per second. These data were averaged in the Sea-Bird deck unit over a 0.5 sec. time interval.

The averaged data are plotted in real-time on the PC display, allowing for an immediate decision of the water sampling depths. The Sea-Bird CTD software also allows to mark the SCTD data when water bottle samples are taken so that the SCTD and related parameters are known at the exact depth.

3.4. Data file inventory.

All datafiles created during the BELGICA campaign 95/21 and 95/22 have been concatenated into the following data files :

Filename	Acquisition rate	Type of data	Duration
O22100	1'	navig. + meteo + oceano.	Full campaign.
O22200	1'		
OM9501A.DAT	0.5"		
OM9502A.DAT	0.5"		Stations 01 to 25
OM9503A.DAT	0.5"		
OM9504A-B.DAT	0.5"		
OM9505A-E.DAT	0.5"		
OM9506A.DAT	0.5"		
OM9507A-B.DAT	0.5"		
OM9508A.DAT	0.5"		
OM9509A-B.DAT	0.5"	CTD	
OM9510A-B.DAT	0.5"		
OM9511A.DAT	0.5"	vertical	
OM9512A-C.DAT	0.5"		
OM9513A.DAT	0.5"	profile	
OM9514A.DAT	0.5"		
OM9515B.DAT	0.5"		
OM9516A.DAT	0.5"		
OM9518A-B.DAT	0.5"		
OM9519A.DAT	0.5"		
OM9520A.DAT	0.5"		
OM9521A.DAT	0.5"		
OM9522A.DAT	0.5"		
OM9523A.DAT	0.5"		
OM9524A.DAT	0.5"		
OM9525A.DAT	0.5"		
OMX01B00.DAT	0.5"		
OMX04A00.DAT	0.5"		Stations 01, 04, 05,
OMX05B-D00.DAT	0.5"	Light	07, 08, 10, 11, 12,
OMX07A00.DAT	0.5"	profile	16 and 18
OMX08A00.DAT	0.5"		
OMX10A00.DAT	0.5"		
OMX11A00.DAT	0.5"		
OMX12A00.DAT	0.5"		
OMX16A00.DAT	0.5"		
OMX18A00.DAT	0.5"		

Table 4. Data file inventory.

These file names or derivatives occur on the different listings and plots.

4. REMARKS CONCERNING DATA ACQUISITION AND DATA VALIDITY.

4.1. Position registration.

During the whole OMEX cruise, the DGPS based navigation system (Sercel NR103) was used as the primary positioning instrument. The GPS system (Magnavox MX200) was used as a backup system.

4.2. Salinity measurements.

4.2.1. Validation of the SCTD salinity measurements.

During the campaign vertical SCTD profiles have been taken with the SBE model 09*plus* SCTD system. The SBE09*plus* SCTD system was equipped with a SBE-3 temperature sensor and a SBE-4 conductivity sensor.

At different locations and multiple depths water samples have taken to validate the salinity data of the SBE09*plus* system. The water samples have been analysed in MUMM's laboratory at Oostende with a Beckman RB7 laboratory salinometer.

The Beckman salinometer is calibrated using IAPSO standard seawater capsules obtained from the Institute of Oceanographic Sciences (UK).

The results of the Beckman salinometer have been compared with the Sea-Bird SBE09*plus* salinity measurements (see Table 5 and Figure 1).

	Standard deviation ppt	Mean error ppt	Corrolation coëff.
SBE09*plus* - Beckman	0.0037	0.0160	0.9996

The salinity and the density data in the tables 2 to 36 have been corrected for this mean error of 0.016 ppt :

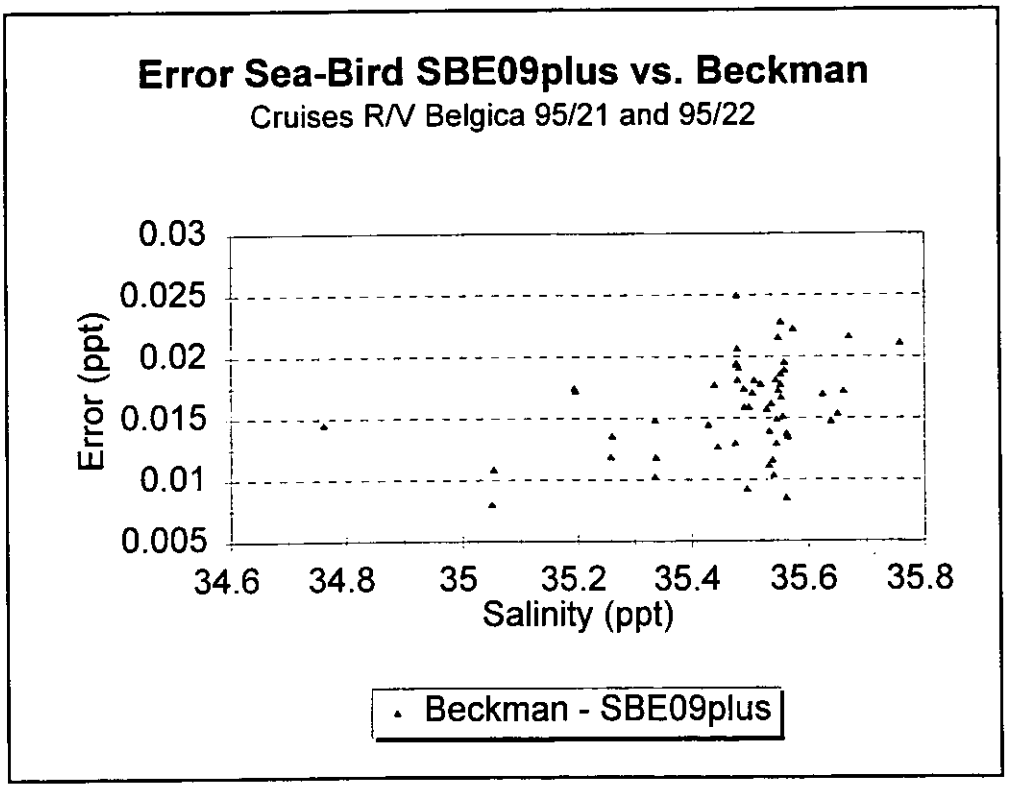
corrected salinity = measured salinity + 0.016
corrected density = measured density + 0.01

Table 5. Data Sea-Bird SBE09*plus* versus Beckman RB7 salinometer.

Station	Sampling depth m	Salinity Beckman ppt	Salinity SBE09*plus* ppt	Difference ppt
1A	5	35.4387	35.4210	0.0177
1A	100	35.4901	35.4727	0.0174
2A	5	35.4281	35.4136	0.0145
2A	120	35.5067	35.4886	0.0181
3A	5	35.3349	35.3200	0.0149
3A	130	35.5185	35.5007	0.0178
4A	5	35.6387	35.6239	0.0148
4A	200	35.5526	35.5297	0.0228
4B	250	35.5486	35.5270	0.0216
4B	1000	35.5735	35.5512	0.0223
5A	40	35.4751	35.4557	0.0194
5B	300	35.5360	35.5197	0.0163
5B	1000	35.7574	35.7362	0.0212
5D	3	35.4775	35.4580	0.0195
5D	250	35.5593	35.5397	0.0196
5E	30	35.4779	35.4572	0.0207
6A	3	35.4814	35.4623	0.0191
6A	1000	35.6700	35.6483	0.0217
7A	40	35.4769	35.4519	0.0250
7A	100	35.5624	35.5539	0.0085
7B	150	35.5565	35.5413	0.0152
7B	900	35.6506	35.6352	0.0154
8A	20	35.4787	35.4605	0.0182
8A	180	35.5324	35.5212	0.0112
9B	150	35.5632	35.5494	0.0138
9B	550	35.5328	35.5188	0.0140
10B	150	35.5589	35.5399	0.0190
10B	400	35.5462	35.5313	0.0149
11A	3	35.4906	35.4746	0.0159
11A	140	35.5486	35.5313	0.0173
12B	200	35.5526	35.5348	0.0178
12B	1000	35.6245	35.6075	0.0170
12C	3	35.6605	35.6432	0.0172
12C	150	35.5644	35.5509	0.0135
13A	3	35.5387	35.5271	0.0116
13A	200	35.5407	35.5303	0.0104

14A	3	35.4949	35.4856	0.0093
14A	220	35.5451	35.5321	0.0130
16A	3	35.5036	35.4865	0.0171
16A	350	35.5447	35.5265	0.0182
18A	574	35.5522	35.5335	0.0187
18B	3	35.4984	35.4825	0.0159
19A	3	35.5293	35.5135	0.0158
19A	690	35.5534	35.5366	0.0168
20A	3	35.4447	35.4320	0.0127
20A	118	35.4743	35.4613	0.0130
21A	3	35.3357	35.3254	0.0103
21A	115	35.3373	35.3254	0.0119
22A	3	35.2575	35.2456	0.0119
22A	89	35.2603	35.2467	0.0136
23A	3	35.1944	35.1769	0.0175
23A	79	35.1956	35.1783	0.0173
24A	3	35.0501	35.0420	0.0081
24A	75	35.0536	35.0427	0.0109
25A	3	34.7617	34.7471	0.0146

Figure 1. Error Sea-Bird SBE09*plus* versus Beckman RB7 salinometer.



Mean 0.016
SD 0.004

4.2.2. Salinity spiking of the SCTD measurements.

In order to improve the performance of the salinity measurements, the Sea-Bird SBE09*plus* has a Temperature and Conductivity (TC) duct with an inertia-balanced pump flow.

The salinity spiking alignment computer program has been applied on the SCTD data (sampling speed 12 samples per second) to minimize the salinity spiking.
See also "JGOFS 90, RV BELGICA cruise 90/18, MUMM contribution Volume I : Report, J. Backers, A. Pollentier.".

4.3. Dissolved oxygen.

The Sea-Bird SBE09*plus* is equipped with a Dissolved Oxygen sensor model SBE-13-Y. This dissolved oxygen sensor is an "YSI" polarographic type which produces an oxygen-dependent electrical current and incorporates a thermistor for determination of the membrane temperature. The computation of dissolved oxygen is made arithmetically according to the methods outlined by Owens and Millard.

The DO sensor has not been recalibrated at sea. However the data of the SBE09*plus* DO sensor at the sampling depths have been corrected using the oxygen measurements from the Laboratoire d'Océanographie - Ulg (Winkler method). The following corrections have been applied on the SBE09*plus* DO data in the tables 2 to 36 (Appendix 4) (see also fig. 2 and 3):

For station 1 :

DO MUMM corrected = DO MUMM measured + 15.0

For stations 5 to 25 :

DO MUMM corrected = DO MUMM measured - 9.3

This deviation was only found in the upcast data. The downcast data (see figures 23.b to 58.b in Appendix 5) have not been corrected.

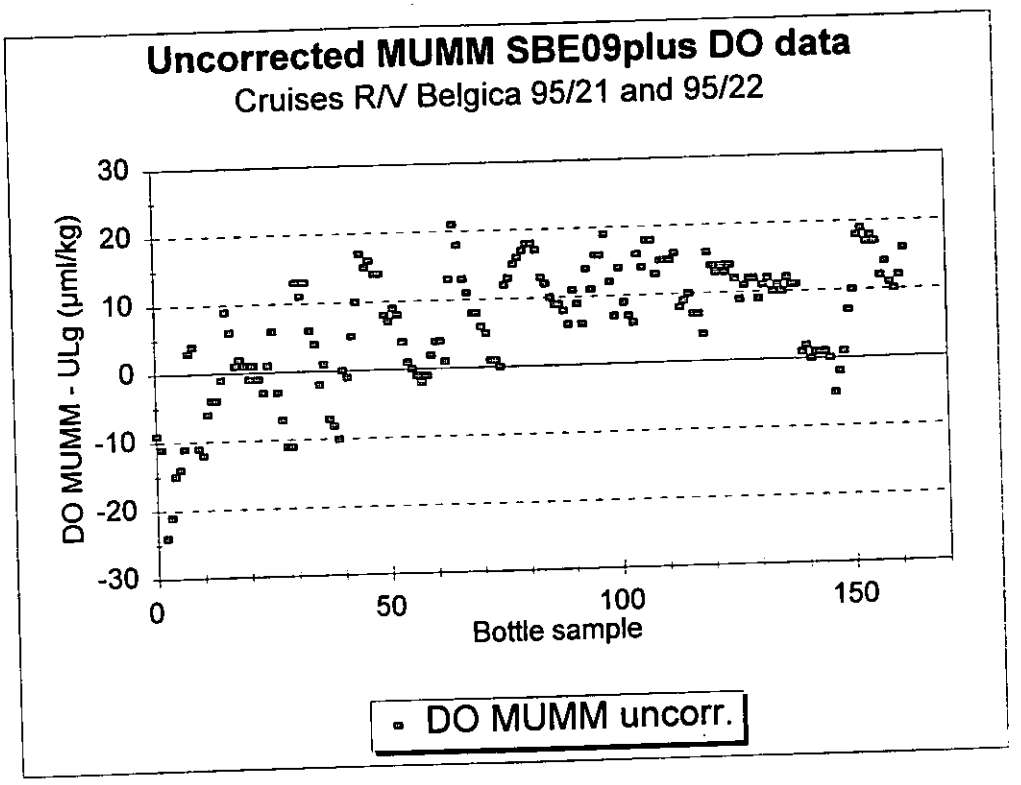


Figure 2. % Deviation between DO data ULg and MUMM, before correction.

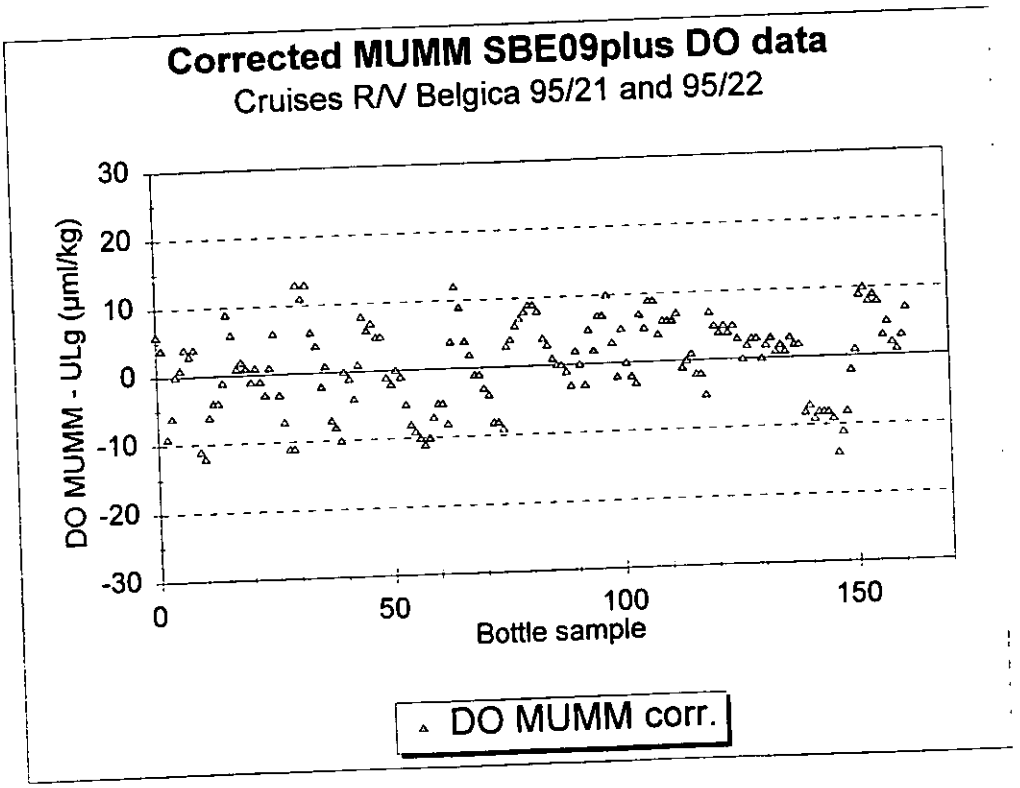


Figure 3. % Deviation between DO data ULg and MUMM, after correction.

4.4. Chlorophyll measurements.

The range of the Turner Designs 10-AU-005 fluorometer is set at MUMM's laboratory using a dilution of standard chlorophyll a in aceton. The blank is set with Milli-Q water. This setting is done to get a fixed reference only.

The measurements have to be correlated to the chlorophyll data (Lorenzen method) of samples taken at regular intervals during the cruise. These data are to be obtained from ULB - Laboratoire d'Océanographie Chimique and/or ULg - Laboratoire d'Océanologie. The fluorescence data available at MUMM - Oostende has not (yet) been correlated to the chlorophyll sample data.

4.5. Data validity.

One of the features of the ODAS package is that it verifies all subsystems, instruments and parameters interrogated.

To each parameter value, subsequently logged in the ODAS files, one byte is added to take into account these data validity checks.

The validity is also shown on the data listings and transferred to the ASCII files. The following code is used :

Code	Meaning
M	Malfunction of a subsystem.
U	No update of the data since the previous logged value.
V	Data not valid (e.g. test on data string format failed).
D	Range error of the DVM subsystem.
R	Lower/upper range test.
G	Gradient test.
=	Not used.
S	Suspected data indication given by e.g. a positioning system.

5. REVIEW OF LISTINGS AND PLOTS.

Table 1 gives the position, the waterdepth, the date and the time of the SCTD vertical profiles. All these profiles have been taken with the Sea-Bird SBE09*plus* SCTD system.

Figure 1 gives a map with the position of the sampling stations while figure 2 shows a trackplot of the cruise 95/21. Figures 3 and 4 are giving this for cruise 95/22.

In figures 5 to 16 the air temperature, solar radiation, atmospheric pressure, absolute windspeed and direction are plotted in function of time. These data are acquired with the Friedrichs meteo system.

In figures 17 to 22 the surface watertemperature, salinity, density and fluorescence are plotted in function of time. These data are acquired with the Sea-Bird SBE21 thermosalinograph and the Turner Designs fluorometer.

The tables 2 to 36 are giving the values of the oceanographic parameters at the SCTD water sampling points.

The verical profiles of temperature, salinity and density are shown in the figures 23a to 58a while the figures 23b to 58b are giving the dissolved oxygen and the backscatterance.

Finally, the graphplots 59 to 70 are giving the incident light vs. depth for the stations 1, 2, 5, 7, 8, 10, 11, 12, 16 and 18.

Appendix 1.

Plot with station annotations and list of positions.

SERCEL NR103 : DGPS position

ATLAS DESO-20 : waterdepth

Table 1. Position SCTD stations OMEX 95/21 and 95/22.

Station number	Date 1995	Time of V.P.(1)	Latitude	Longitude	Water Depth [m]	Data file
01A	13.09	16h34	N 49 41'38"	W 10 06'34"	131	OM9501A
02A	13.09	19h29	N 49 35'45"	W 10 23'49"	144	OM9502A
03A	13.09	22h24	N 49 32'47"	W 10 40'49"	149	OM9503A
04A	15.09	16h47	N 47 26'37"	W 08 32'35"	1870	OM9504A
04B	15.09	18h34	N 47 27'21"	W 08 32'20"	> 2000	OM9504B
05A	16.09	06h10	N 47 24'56"	W 07 15'37"	± 2000	OM9505A
05B	16.09	07h51	N 47 25'06"	W 07 16'20"	± 2000	OM9505B
05C	16.09	12h28	N 47 24'58"	W 07 15'58"	± 2000	OM9505C
05D	16.09	14h11	N 47 24'45"	W 07 15'57"	± 2000	OM9505D
05E	17.09	05h05	N 47 25'01"	W 07 16'18"	1785	OM9505E
06A	17.09	07h07	N 47 28'05"	W 07 13'53"	1512	OM9506A
07A	17.09	11h28	N 47 29'26"	W 07 12'42"	1196	OM9507A
07B	17.09	12h30	N 47 29'07"	W 07 12'28"	968	OM9507B
08A	17.09	15h53	N 47 34'20"	W 07 10'52"	197	OM9508A
09A	17.09	20h18	N 47 31'25"	W 07 12'20"	750	OM9509A
09B	17.09	21h12	N 47 31'38"	W 07 13'17"	686	OM9509B
10A	18.09	06h14	N 47 32'23"	W 07 11'00"	475	OM9510A
10B	18.09	07h38	N 47 32'00"	W 07 11'25"	502	OM9510B
11A	18.09	12h00	N 47 44'54"	W 06 56'08"	162	OM9511A
12A	23.09	01h09	N 47 27'01"	W 08 32'19"	> 2200	OM9512A
12B	23.09	02h57	N 47 27'14"	W 08 32'27"	> 2200	OM9512B
12C	23.09	05h06	N 47 27'11"	W 08 32'31"	> 2200	OM9512C
13A	23.09	11h56	N 47 59'16"	W 07 49'21"	201	OM9513A
14A	24.09	06h02	N 47 52'51"	W 07 51'07"	253	OM9514A
15B	24.09	08h55	N 47 51'15"	W 07 53'14"	312	OM9515B
16A	24.09	12h03	N 47 49'53"	W 07 53'24"	360	OM9516A
18A	25.09	06h53	N 47 47'25"	W 08 00'45"	592	OM9518A
18B	25.09	08h16	N 47 47'34"	W 08 00'51"	583	OM9518B
19A	25.09	11h44	N 47 45'13"	W 07 59'56"	695	OM9519A
20A	26.09	12h00	N 48 02'59"	W 05 45'19"	127	OM9520A
21A	27.09	07h26	N 48 45'10"	W 04 49'49"	107	OM9521A
22A	27.09	10h36	N 48 57'46"	W 04 29'32"	98	OM9522A
23A	27.09	13h58	N 49 11'46"	W 04 03'22"	87	OM9523A
24A	27.09	17h47	N 49 24'40"	W 03 19'52"	79	OM9524A
25A	28.09	18h30	N 50 26'13"	E 00 52'01"	39	OM9525A

Remarks:

(1) The time noted is the starttime (GMT) of the vertical profile.

figure 1

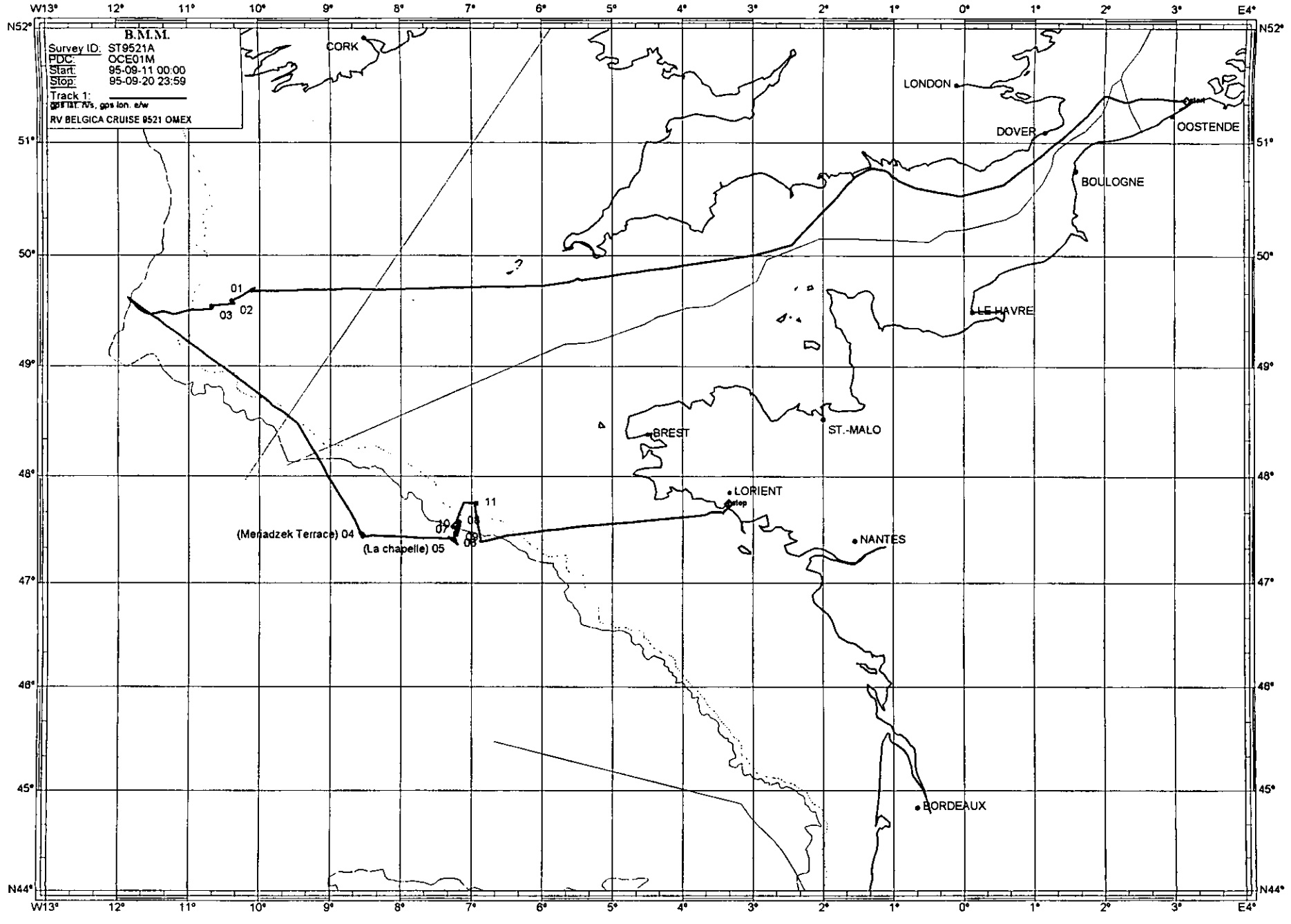

B.M.M.
Survey ID: ST9521A
PDC: OCE01M
Start: 95-09-11 00:00
Stop: 95-09-20 23:59
Track 1:
gps lat. n/s, gps lon. e/w
RV BELGICA CRUISE 9521 OMEX
CORK
LONDON
DOVER
OOSTENDE
BOULOGNE
LE HAVRE
BREST
ST.-MALO
LORIENT
NANTES
BORDEAUX
(Meriadzek Terrace) 04
(La chapelle) 05
01
02
03
11
W13°
12°
11°
10°
9°
8°
7°
6°
5°
4°
3°
2°
1°
0°
E4°
N52°
51°
50°
49°
48°
47°
46°
45°
N44°

figure 2

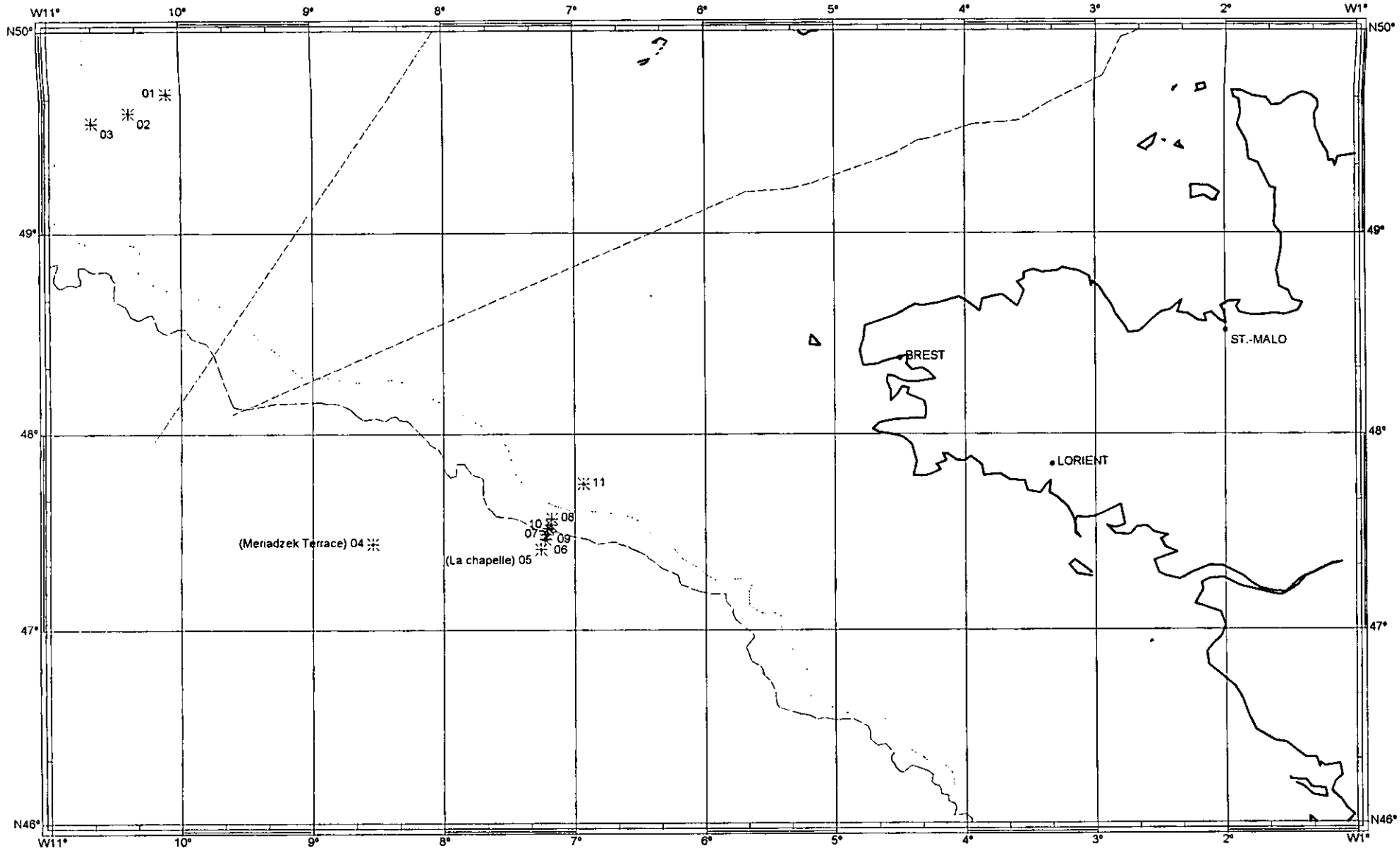

W11°
10°
9°
8°
7°
6°
5°
4°
3°
2°
W1°
N50°
49°
48°
47°
N46°
01
02
03
11
08
10
07
09
06
(Meriadzek Terrace) 04
(La chapelle) 05
BREST
ST.-MALO
LORIENT

figure 3

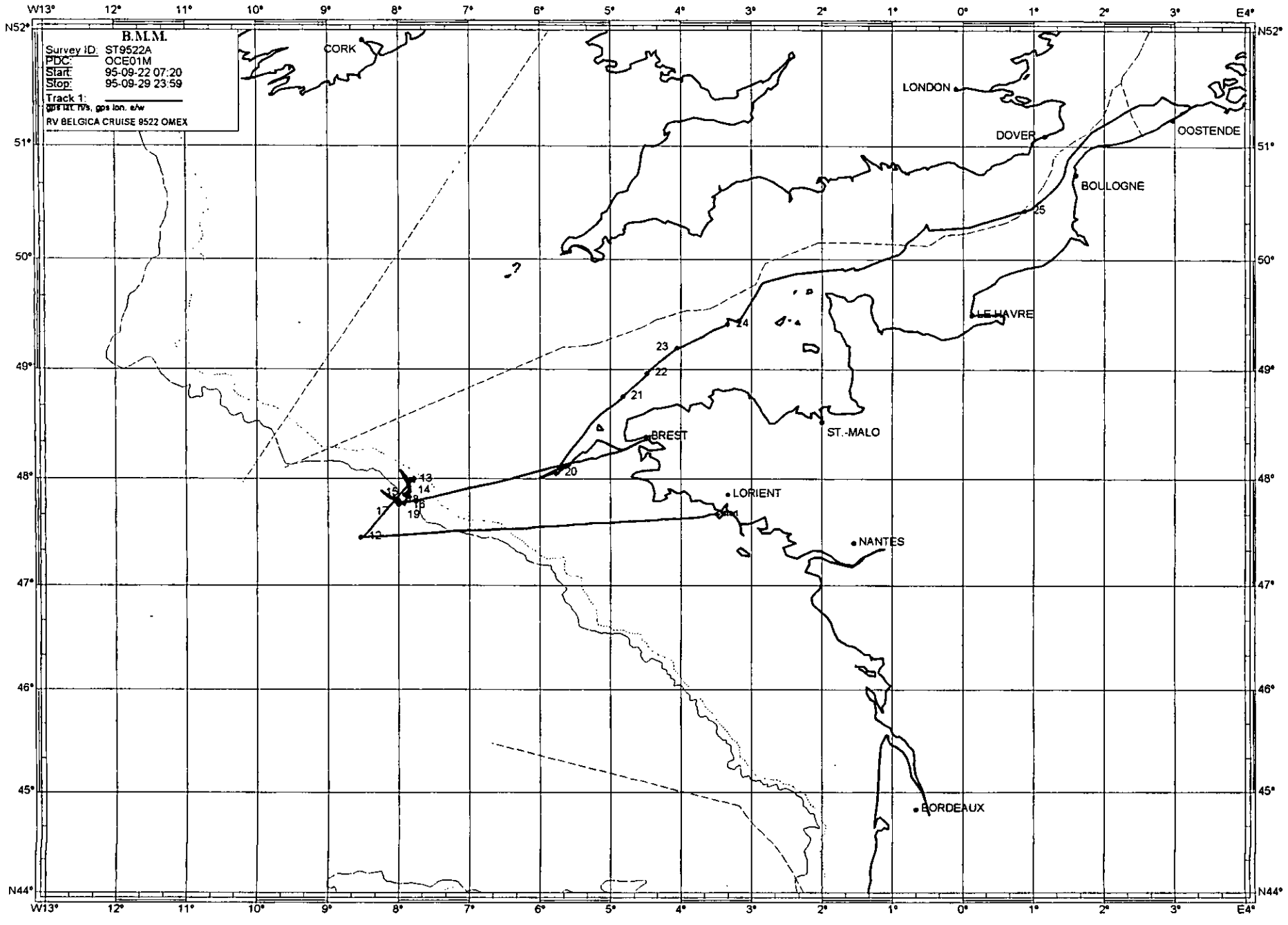
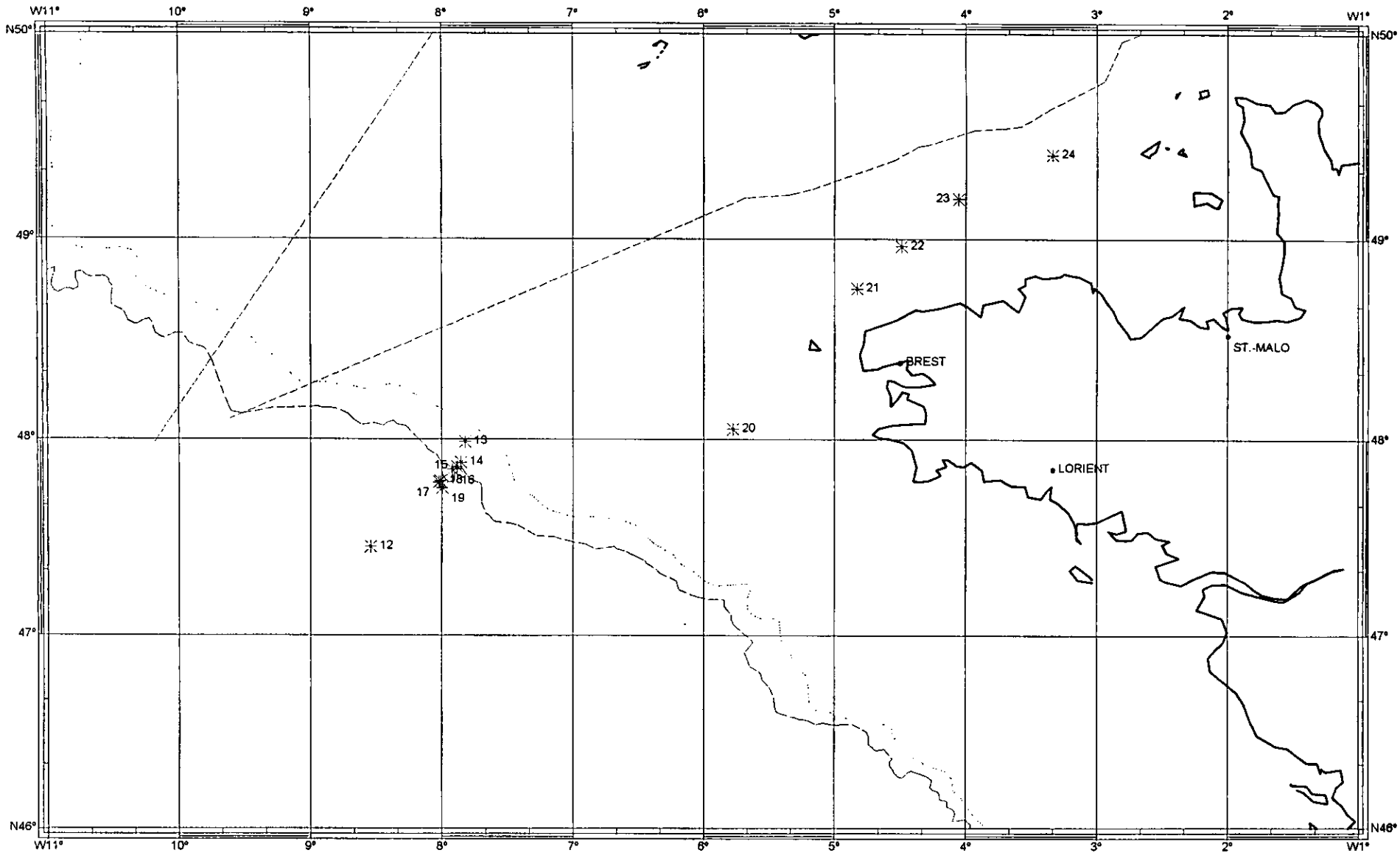

B.M.M.
Survey ID: ST9522A
PDC: OCE01M
Start: 95-09-22 07:20
Stop: 95-09-29 23:59
Track 1:
gps lat. n/s, gps lon. e/w
RV BELGICA CRUISE 9522 OMEX
CORK
LONDON
DOVER
OOSTENDE
BOULOGNE
LE HAVRE
BREST
ST.-MALO
LORIENT
NANTES
BORDEAUX
W13°
12°
11°
10°
9°
8°
7°
6°
5°
4°
3°
2°
1°
0°
1°
2°
3°
E4°
N52°
51°
50°
49°
48°
47°
46°
45°
N44°

figure 4


W11°
10°
9°
8°
7°
6°
5°
4°
3°
2°
W1°
N50°
49°
48°
47°
N46°
12
13
14
15
16
17
18
19
20
21
22
23
24
BREST
ST.-MALO
LORIENT

Appendix 2.

Meteorological data during the complete campaign.

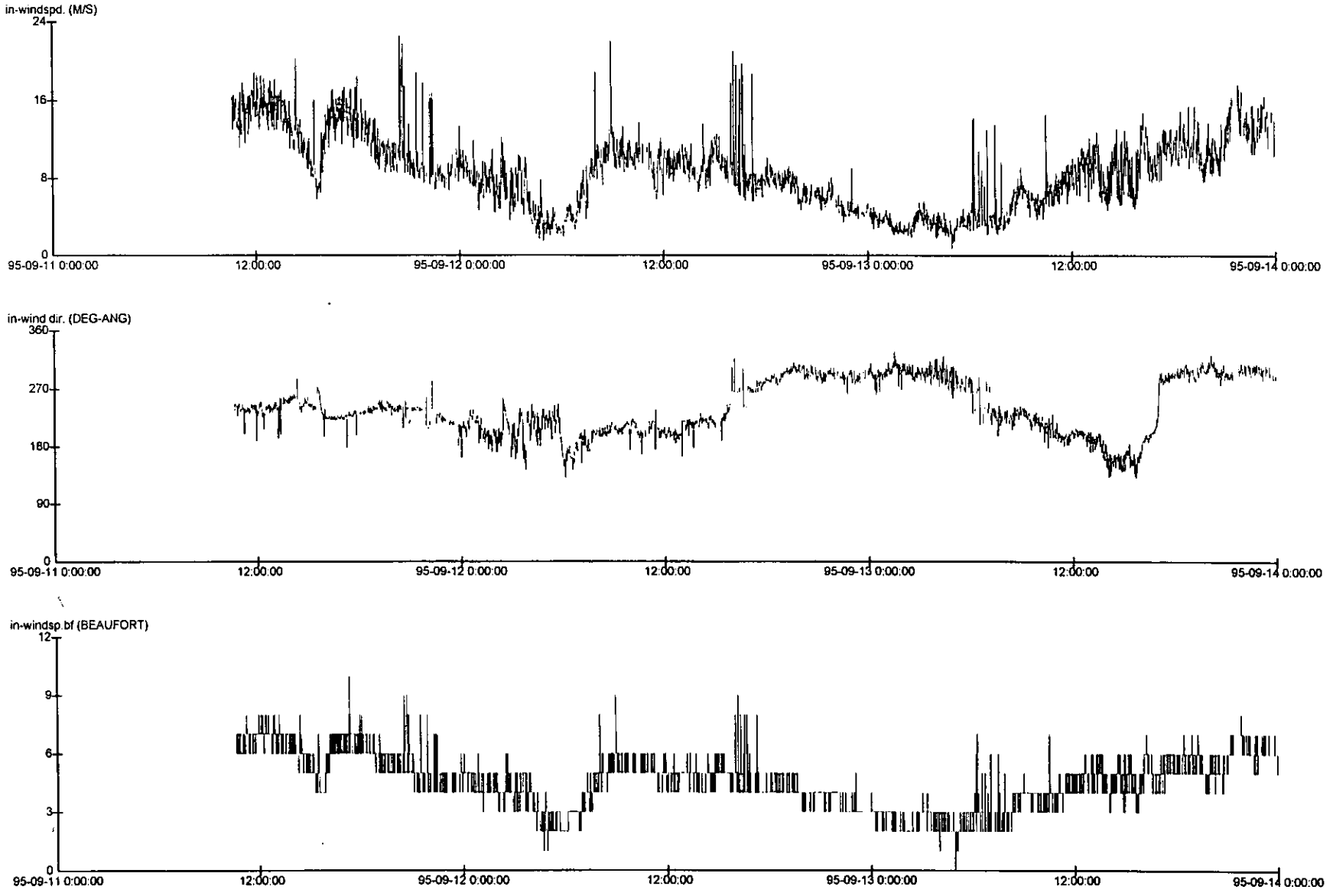
FRIEDRICHS : windspeed and -direction, airtemperature, atm. pressure

KIPP & ZONEN : solar radiation

Figure 5

RV BELGICA-CRUISE 95/21

11.09.95 0:00 - 13.09.95 23:59



in-windspd. M/S

in-wind dir. DEG-ANG

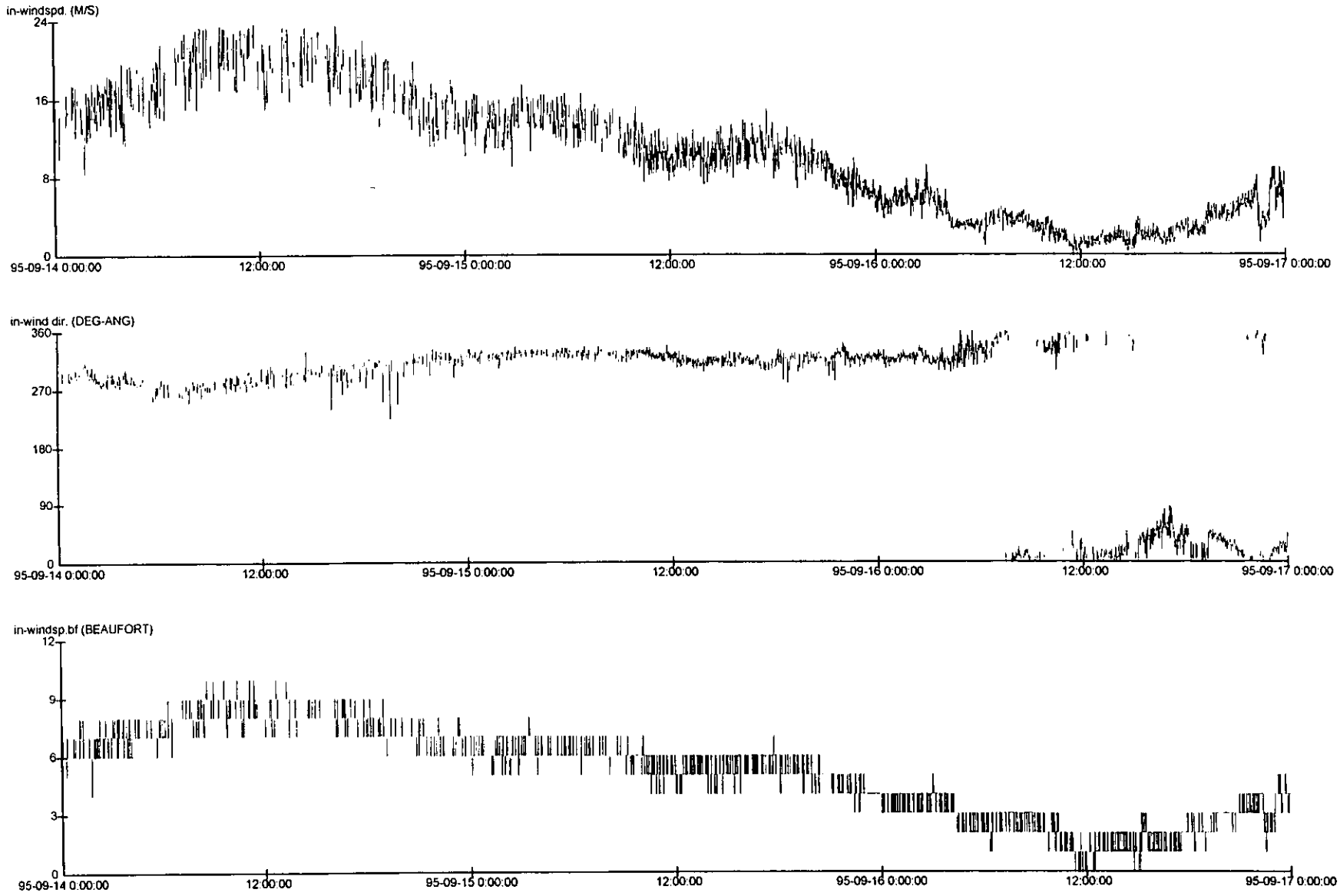
in-windsp.bf BEAUFORT

MUMM Meetdienst Oostende

Figure 6

RV BELGICA-CRUISE 95/21

14.09.95 0:00 - 16.09.95 23:59



in-windspd. M/S

in-wind dir. DEG-ANG

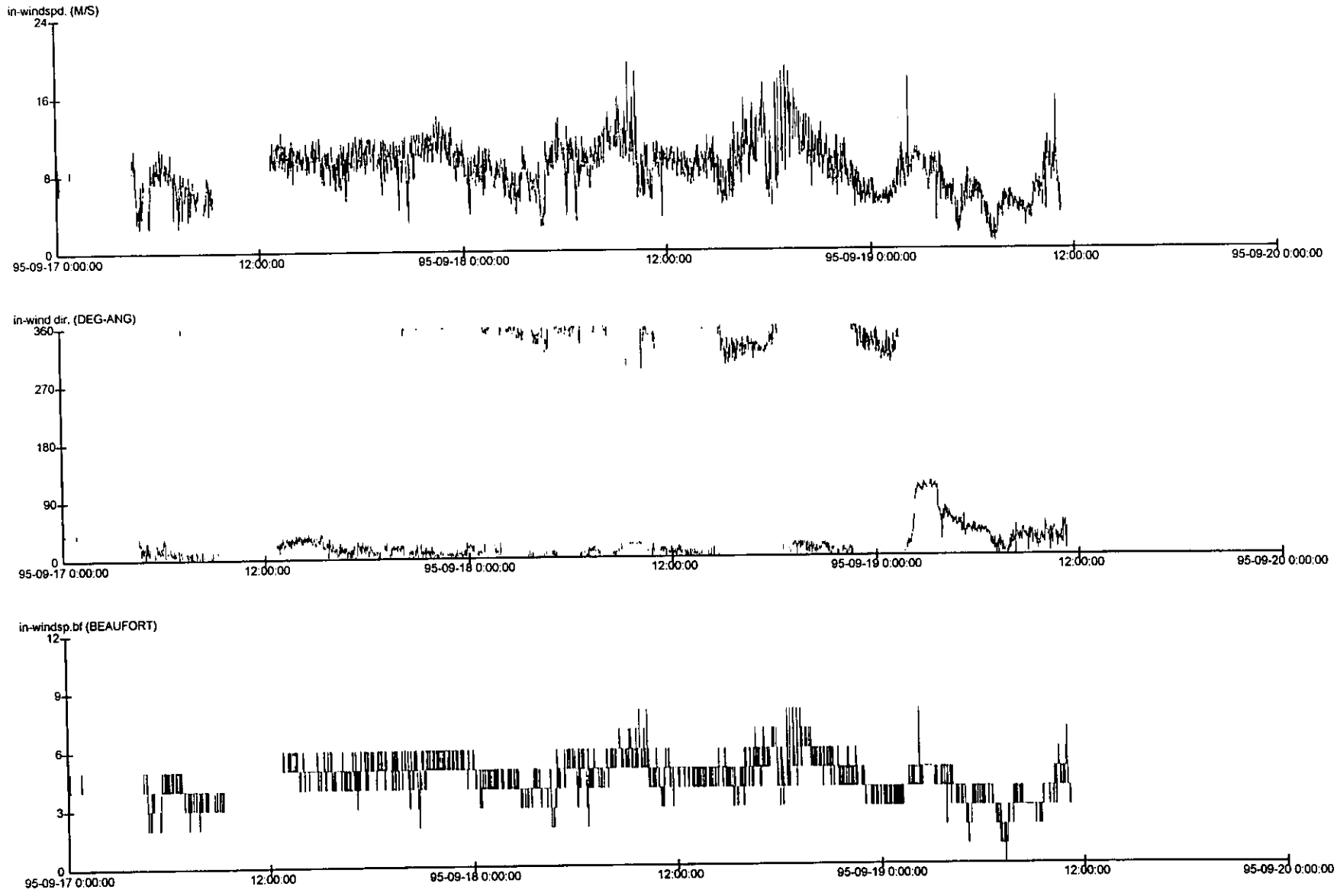
in-windsp.bf BEAUFORT

MUMM Meetdienst Oostende

RV BELGICA-CRUISE 95/21

17.09.95 0:00 - 19.09.95 23:59

Figure 7



in-windspd. M/S

in-wind dir. DEG-ANG

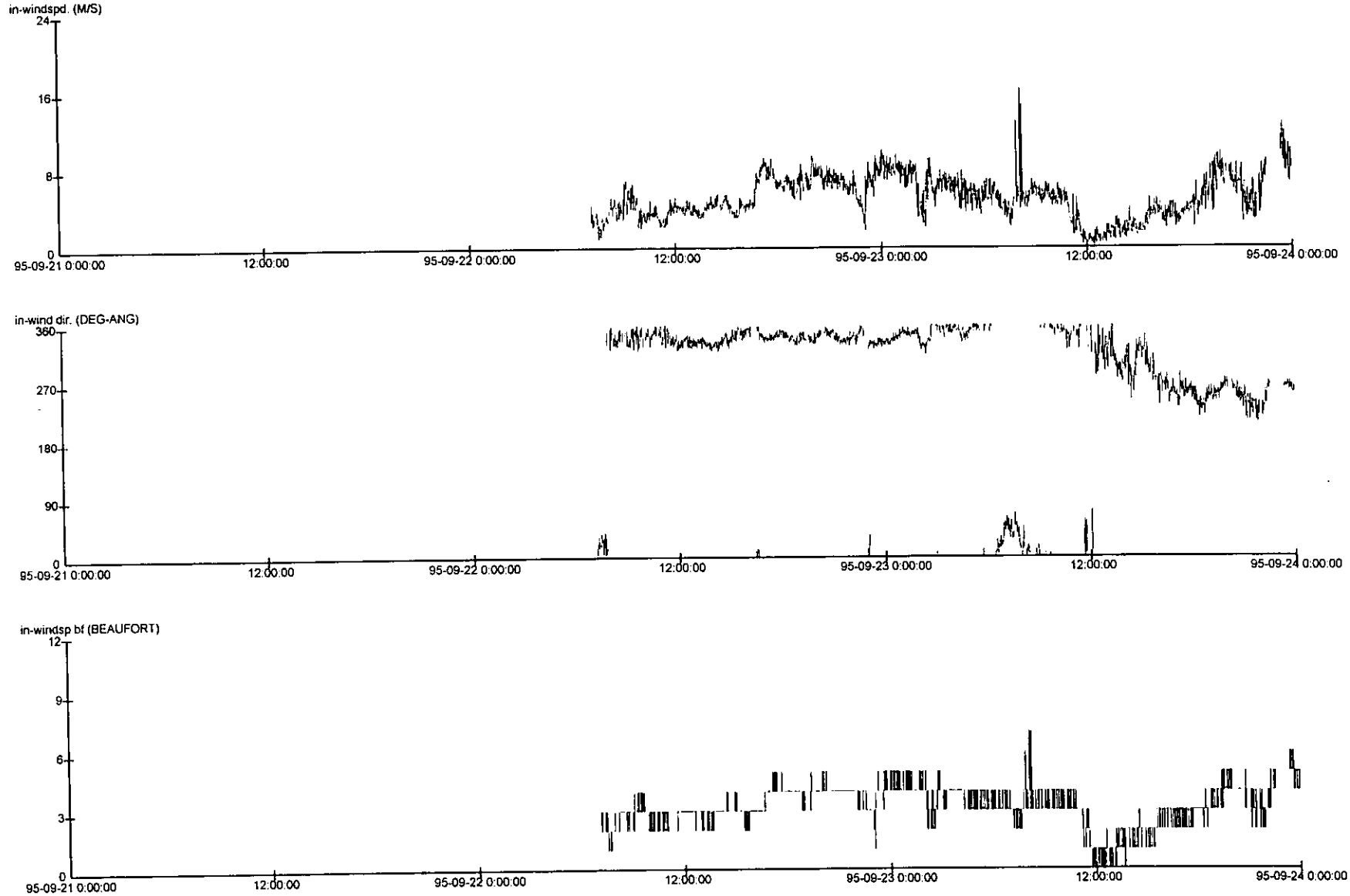
in-windsp.bf BEAUFORT

MUMM Meetdienst Oostende

RV BELGICA-CRUISE 95/22

21.09.95 0:00 - 23.09.95 23:59

Figure 8



in-windspd. M/S

in-wind dir. DEG-ANG

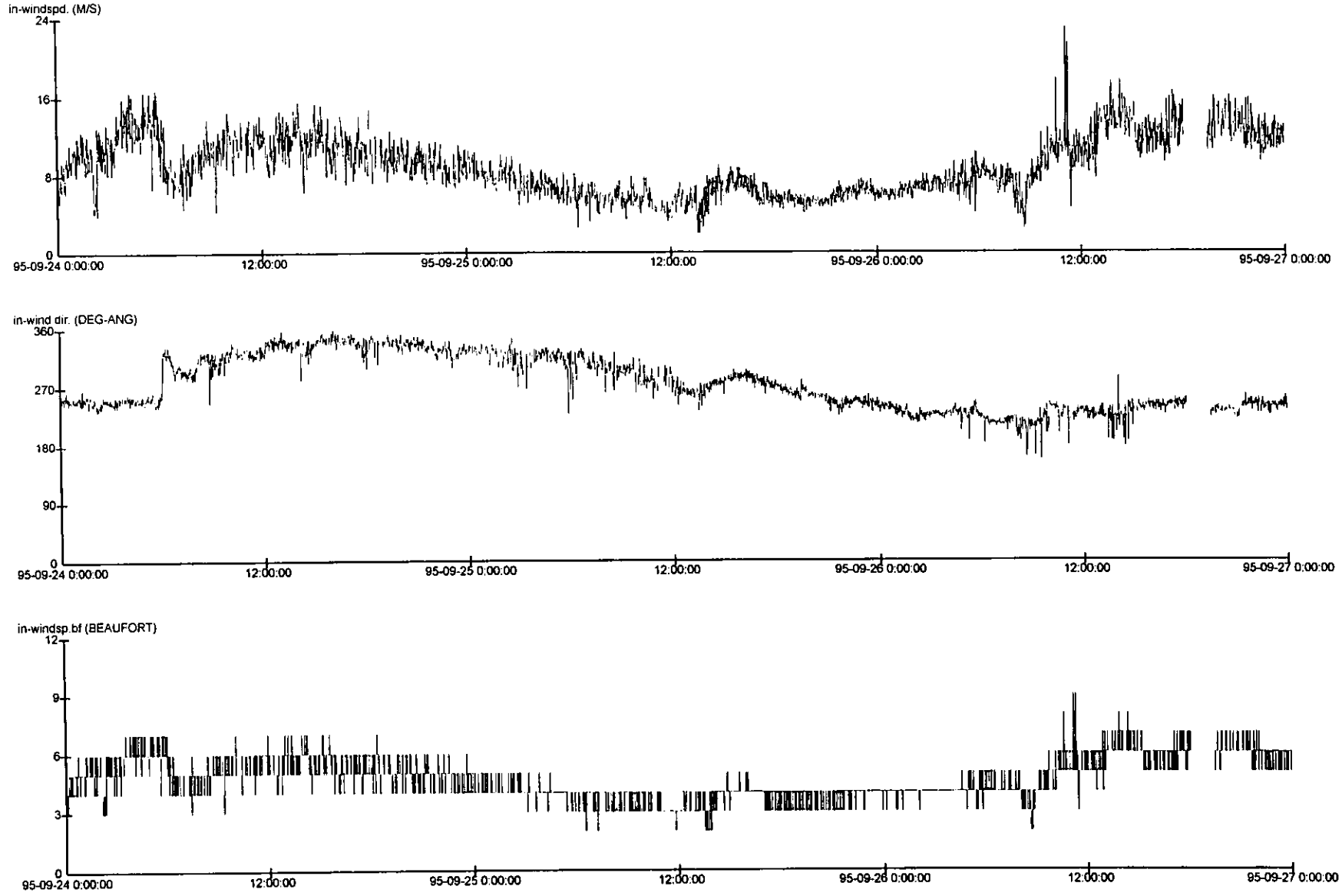
in-windsp.bf BEAUFORT

MUMM Meetdienst Oostende

Figure 9

RV BELGICA-CRUISE 95/22

24.09.95 0:00 - 26.09.95 23:59

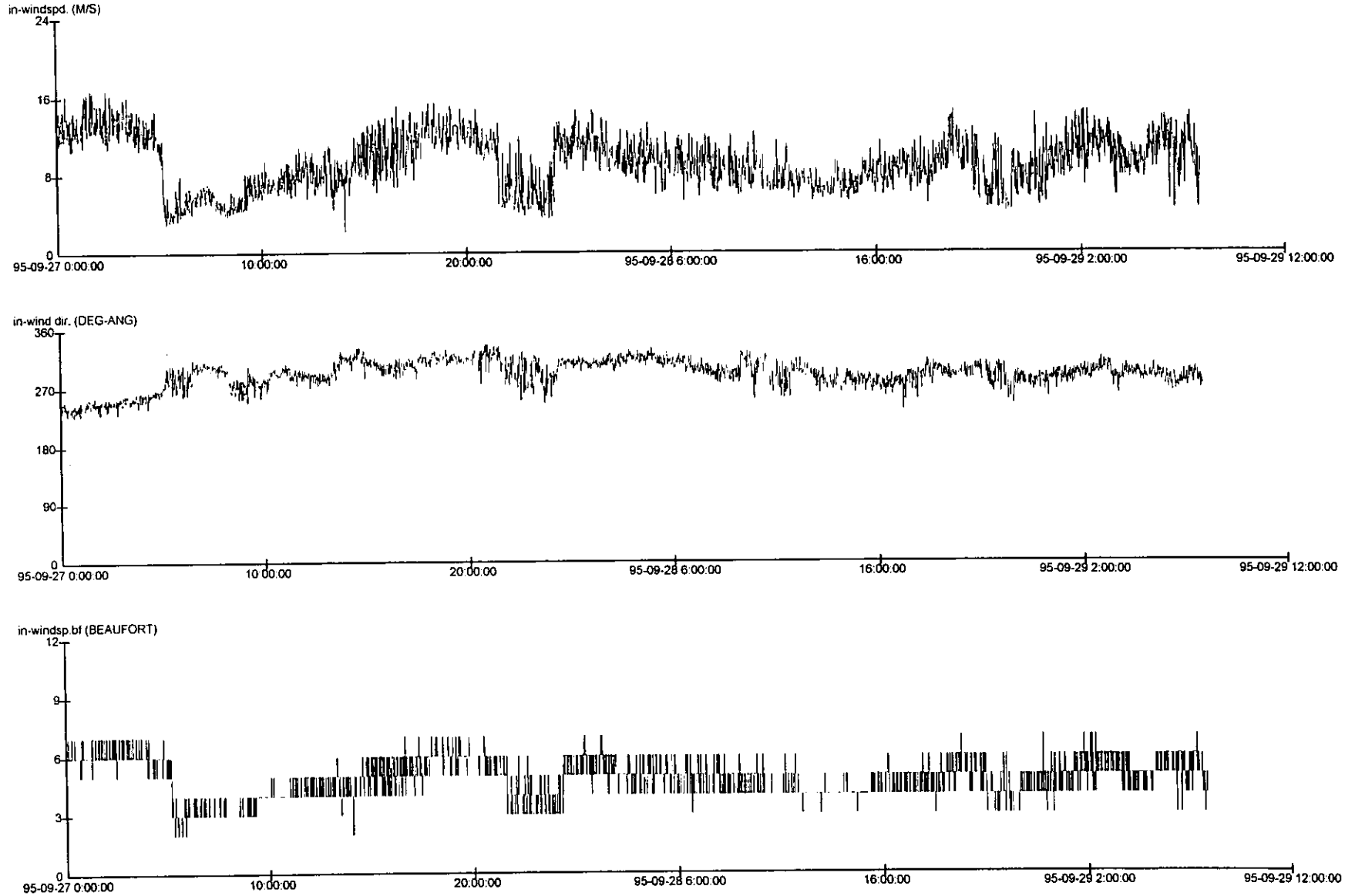


MUMM Meetdienst Oostende

Figure 10

RV BELGICA-CRUISE 95/22

27.09.95 0:00 - 29.09.95 12:00



in-windspd. M/S

in-wind dir. DEG-ANG

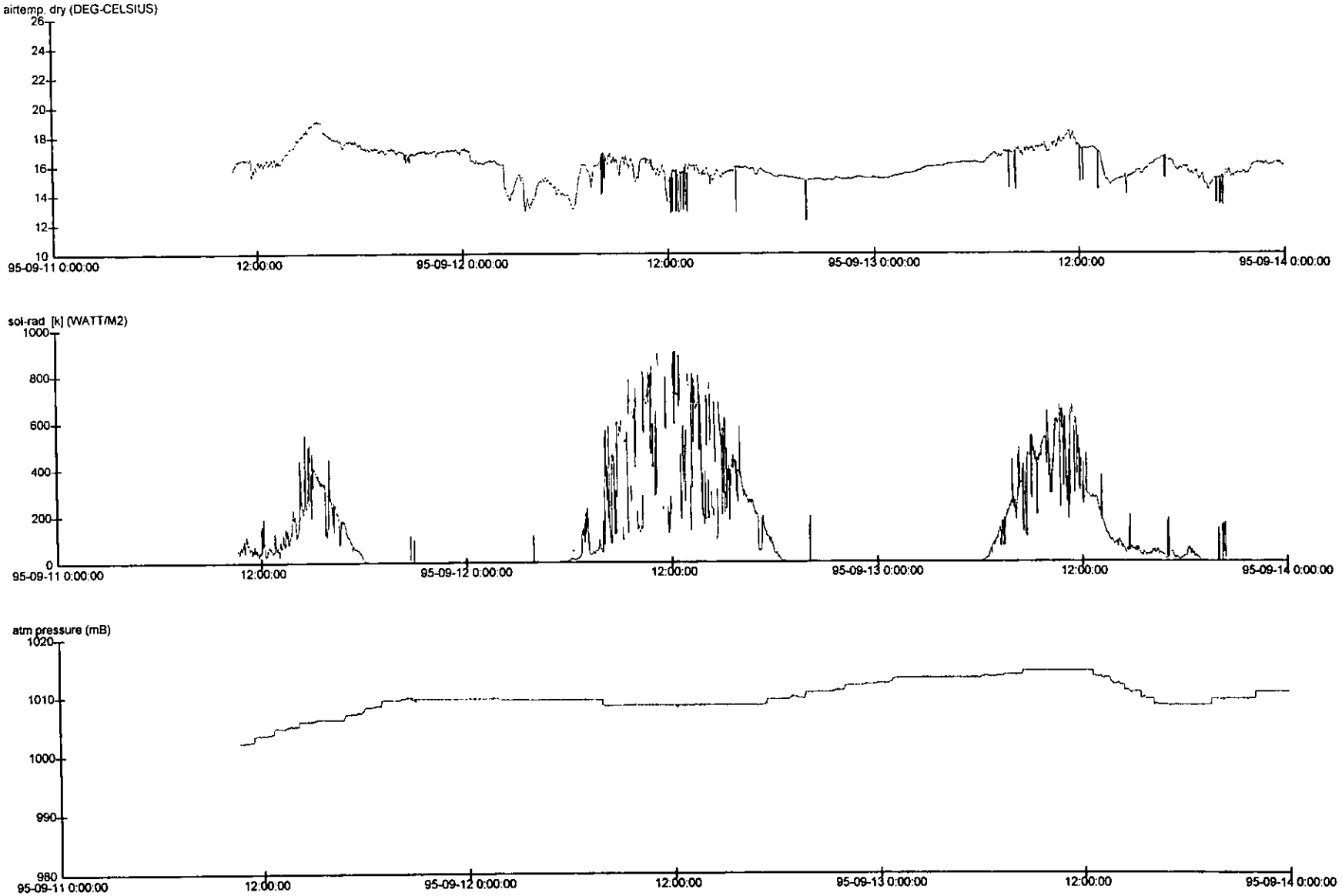
in-windsp.bf BEAUFORT

MUMM Meetdienst Oostende

RV BELGICA-CRUISE 95/21

11.09.95 0:00 - 13.09.95 23:59

Figure 11

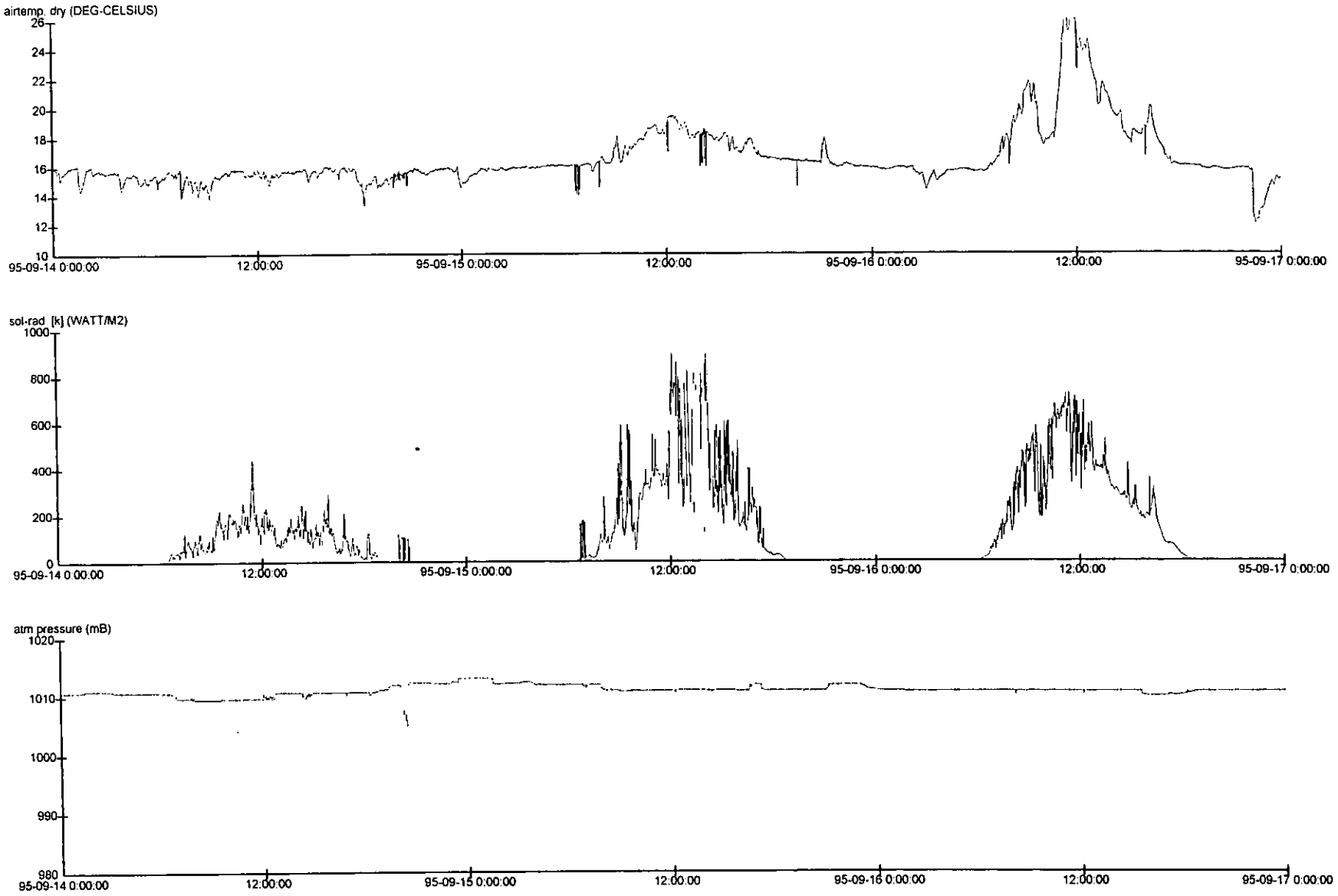


MUMM Meetdienst Oostende

Figure 12

RV BELGICA-CRUISE 95/21

14.09.95 0:00 - 16.09.95 23:59

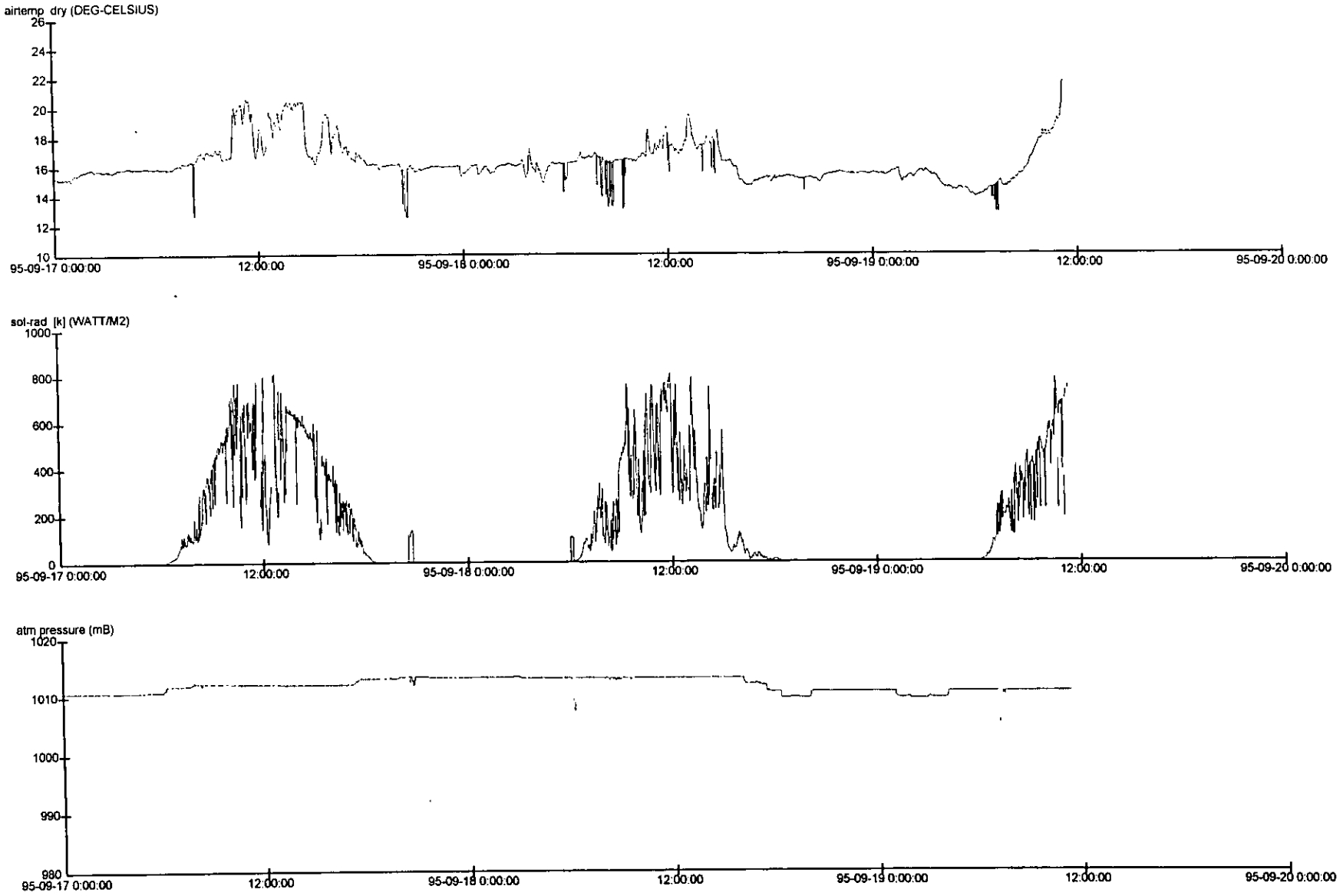


MUMM Meetdienst Oostende

Figure 13

RV BELGICA-CRUISE 95/21

17.09.95 0:00 - 19.09.95 23:59



airtemp. dry DEG-CELSIUS

sol-rad [k] WATT/M2

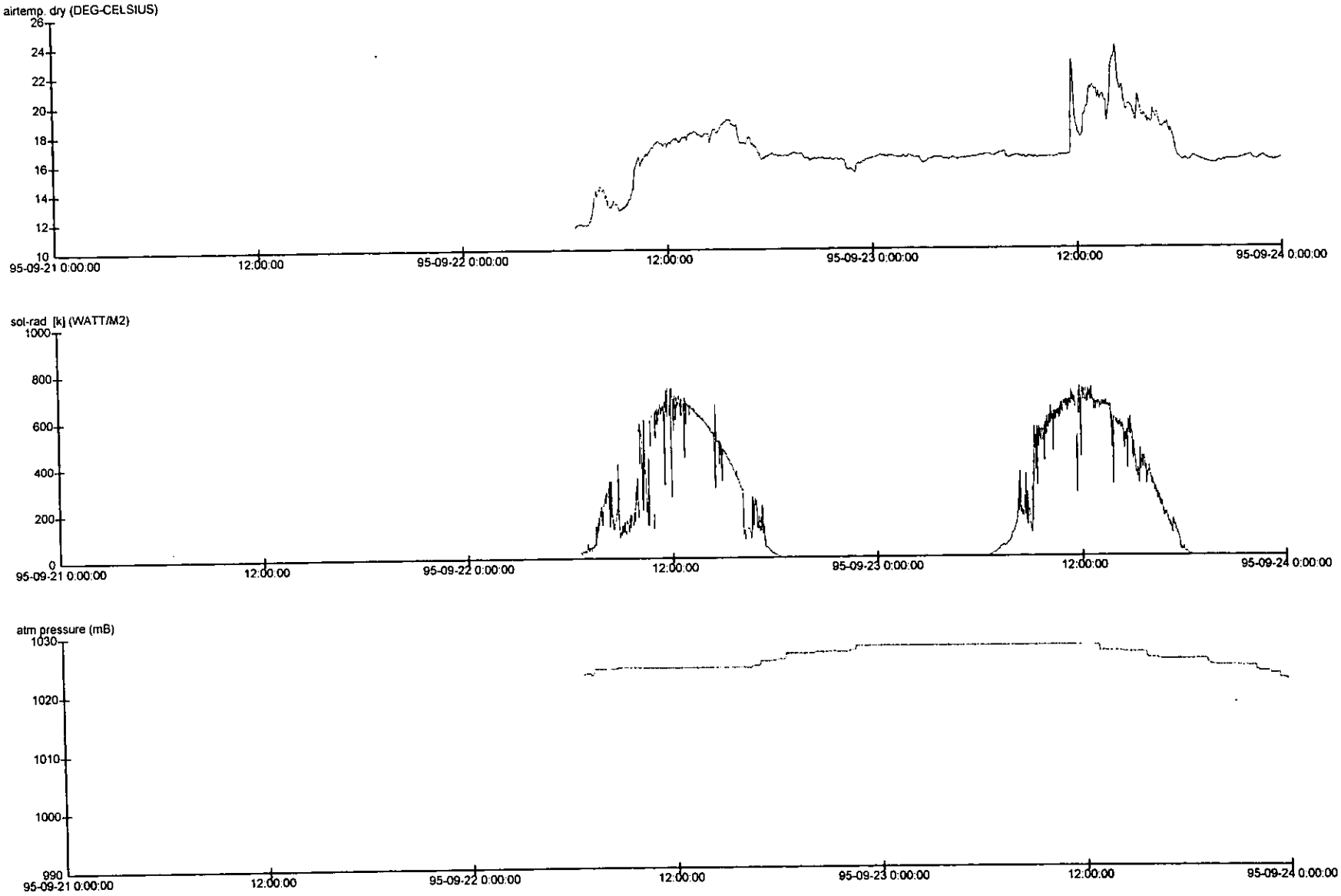
atm pressure mB

MUMM Meetdienst Oostende

Figure 14

RV BELGICA-CRUISE 95/22

21.09.95 0:00 - 23.09.95 23:59

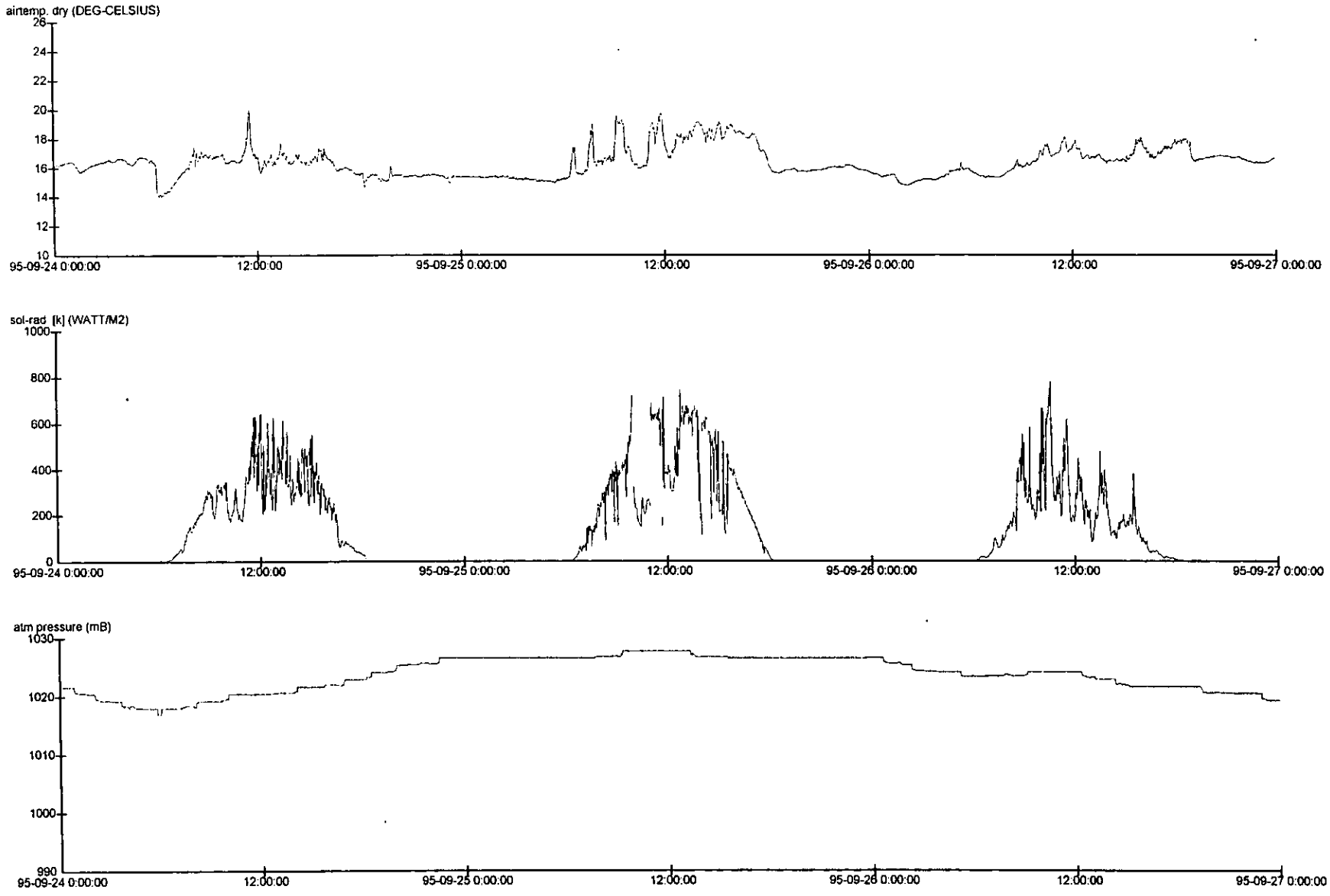


MUMM Meetdienst Oostende

Figure 15

RV BELGICA-CRUISE 95/22

24.09.95 0:00 - 26.09.95 23:59

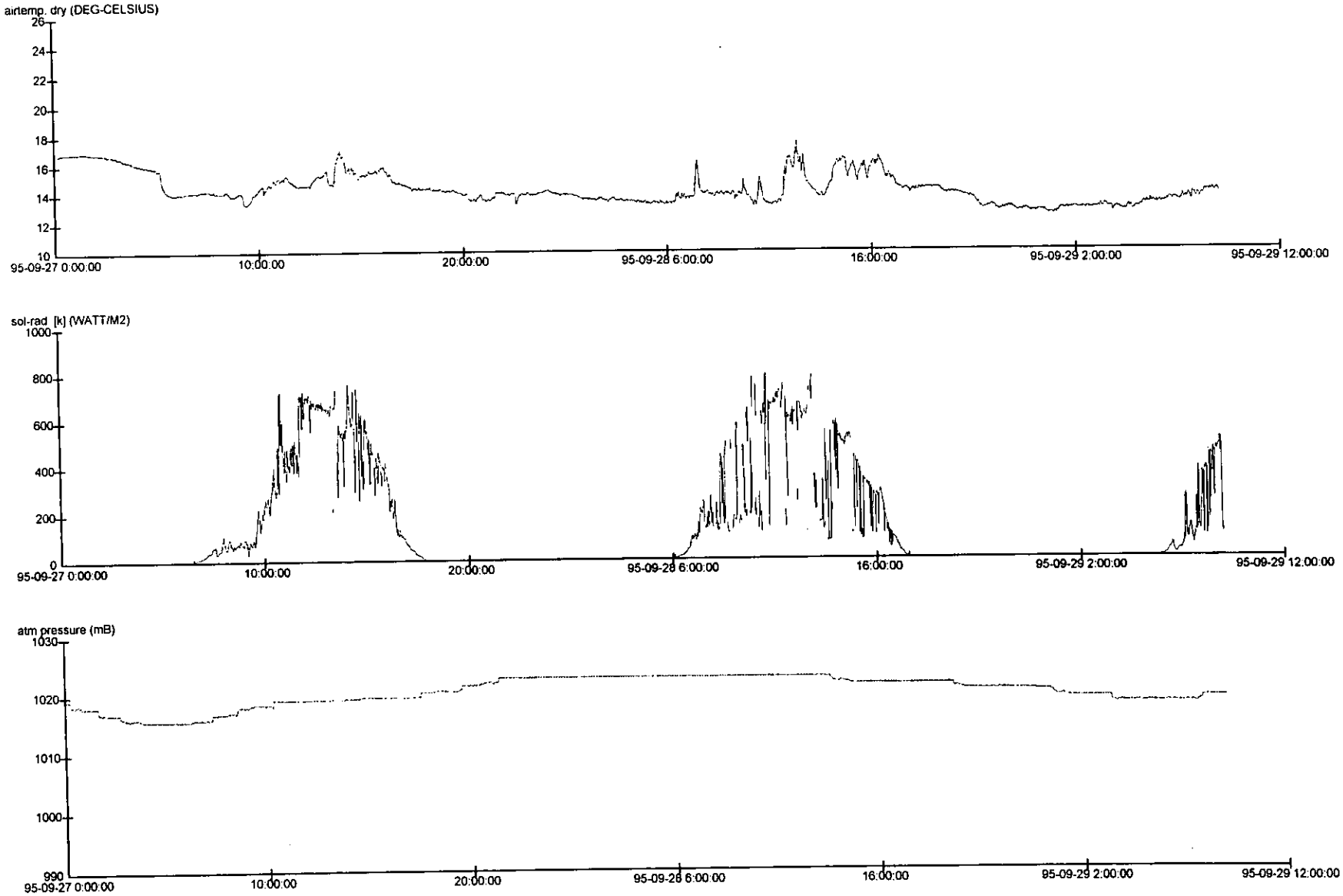


MUMM Meetdienst Oostende

Figure 16

RV BELGICA-CRUISE 95/22

27.09.95 0:00 - 29.09.95 12:00



MUMM Meetdienst Oostende

Appendix 3.

Horizontal profiles.

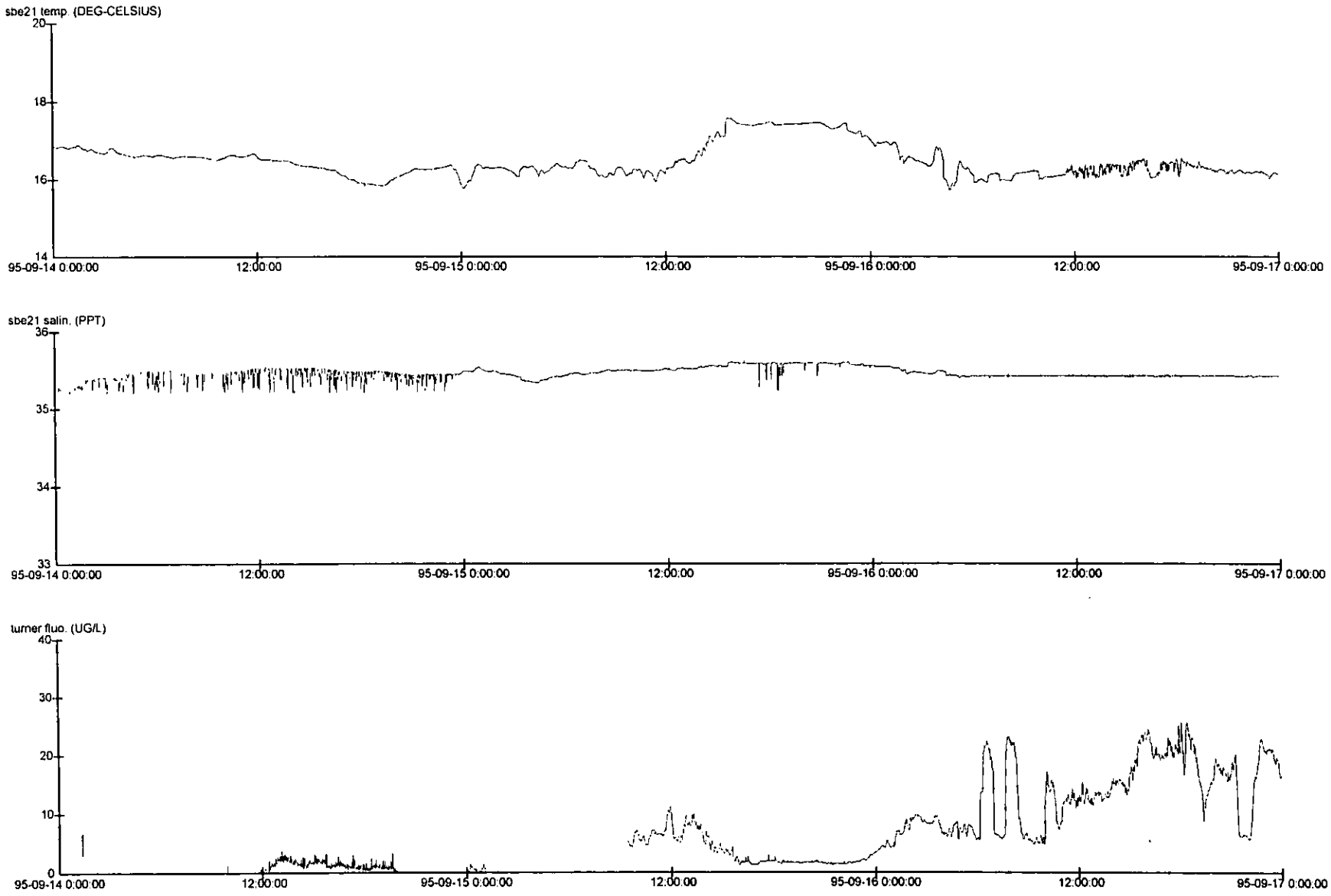
SEA-BIRD SBE21 : watertemperature, salinity

TURNER DESIGNS : fluorescence

RV BELGICA-CRUISE 95/21

14.09.95 0:00 - 16.09.95 23:59

Figure 18

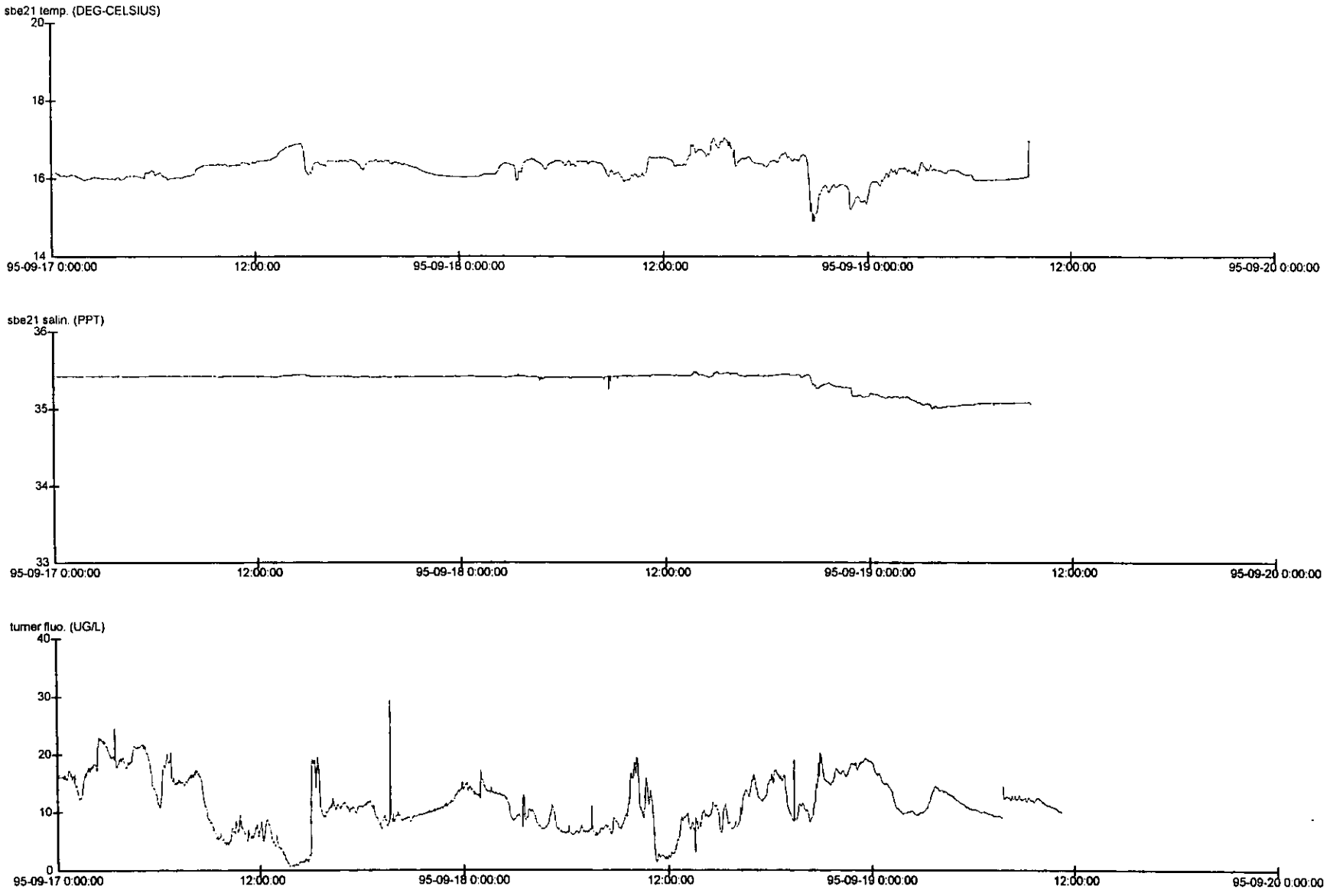


MUMM Meetdienst Oostende

RV BELGICA-CRUISE 95/21

17.09.95 0:00 - 19.09.95 23:59

Figure 19



sbe21 temp. DEG-CELSIUS

sbe21 salin. PPT

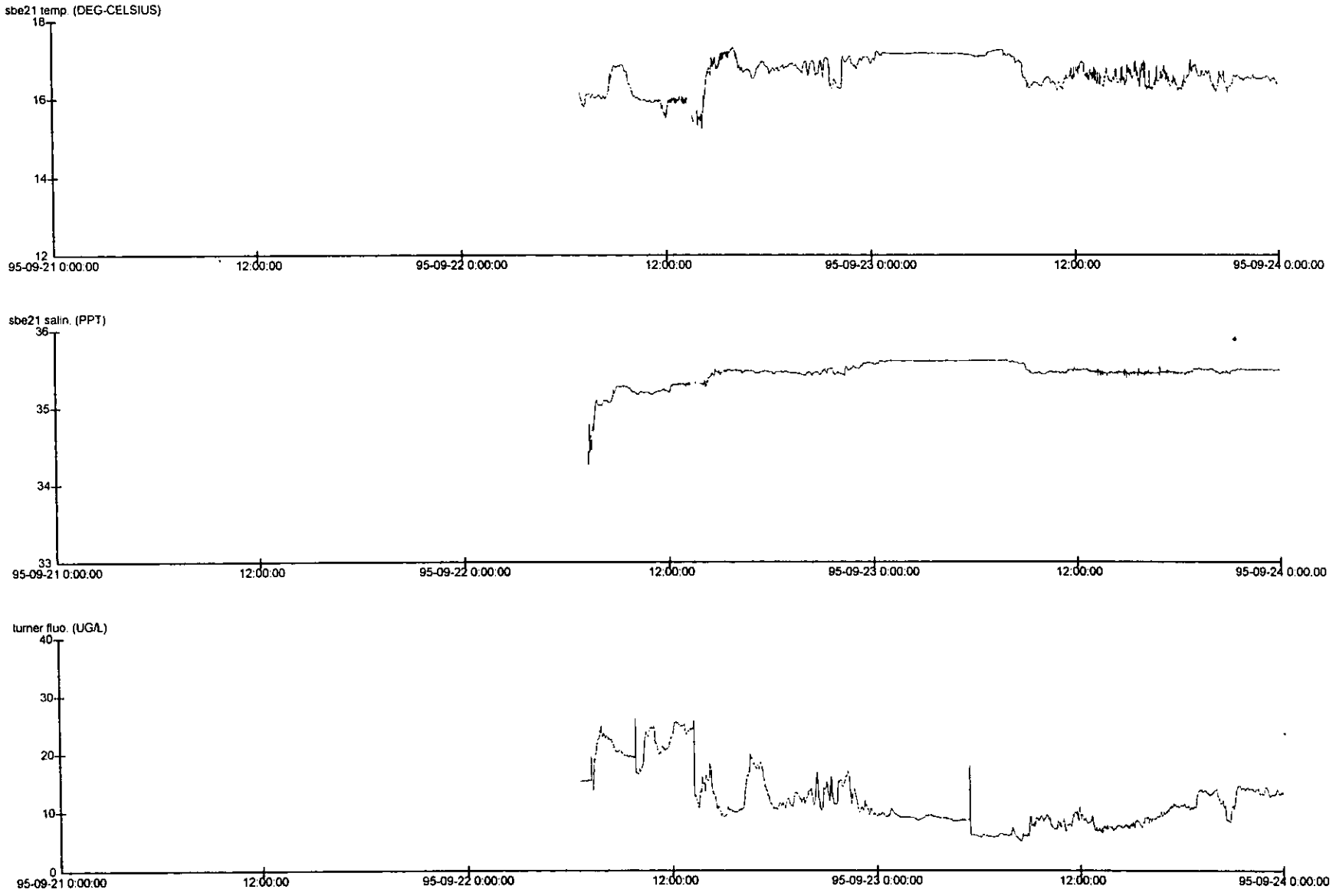
turner fluo. UG/L

MUMM Meetdienst Oostende

Figure 20

RV BELGICA - CRUISE 95/22

21.09.95 00:00 - 23.09.95 23:59



sbe21 temp.
DEG-CELSIUS

sbe21 salin.
PPT

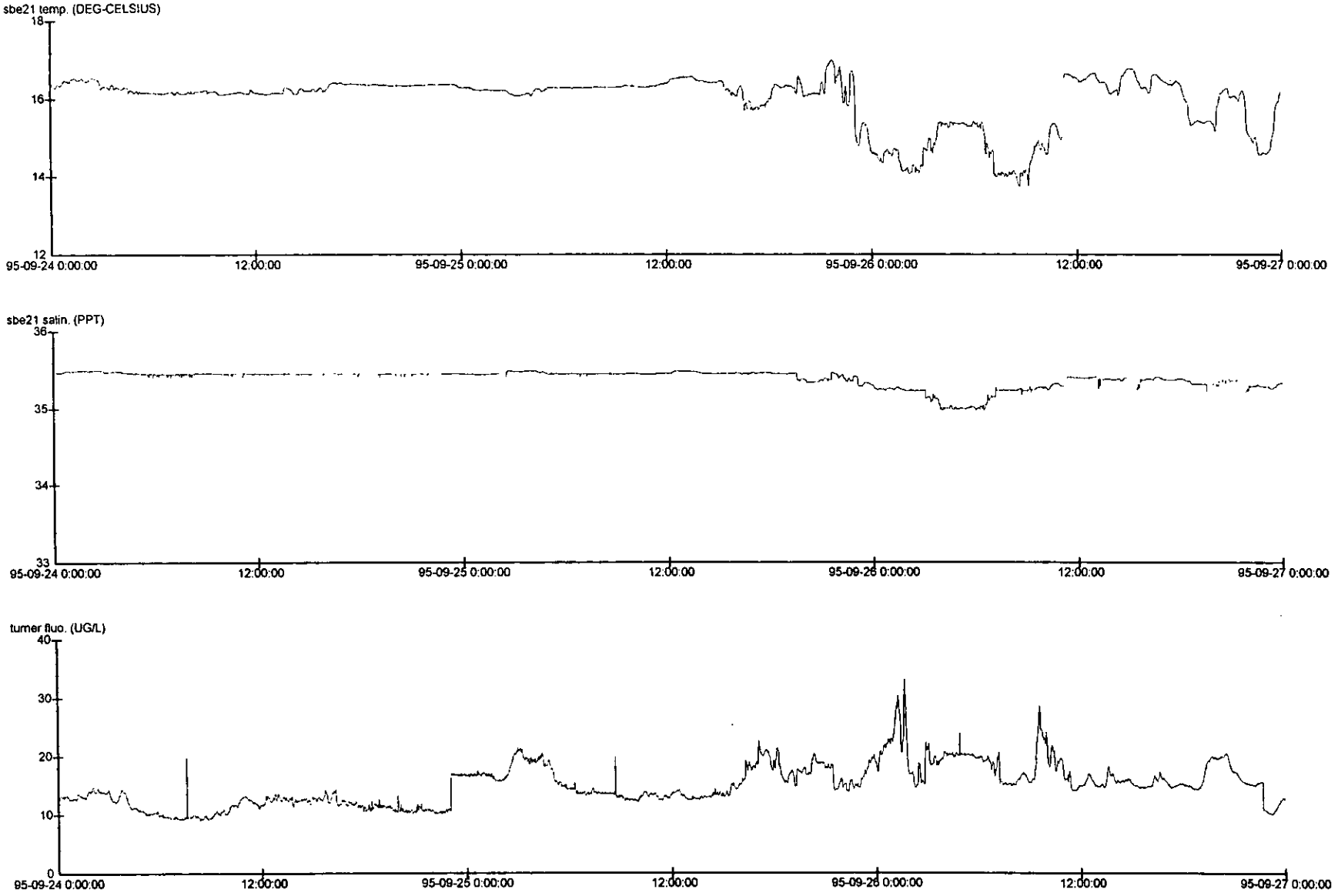
turner fluo.
UG/L

MUMM Meetdienst Oostende

Figure 21

RV BELGICA - CRUISE 95/22

24.09.95 00:00 - 26.09.95 23:59

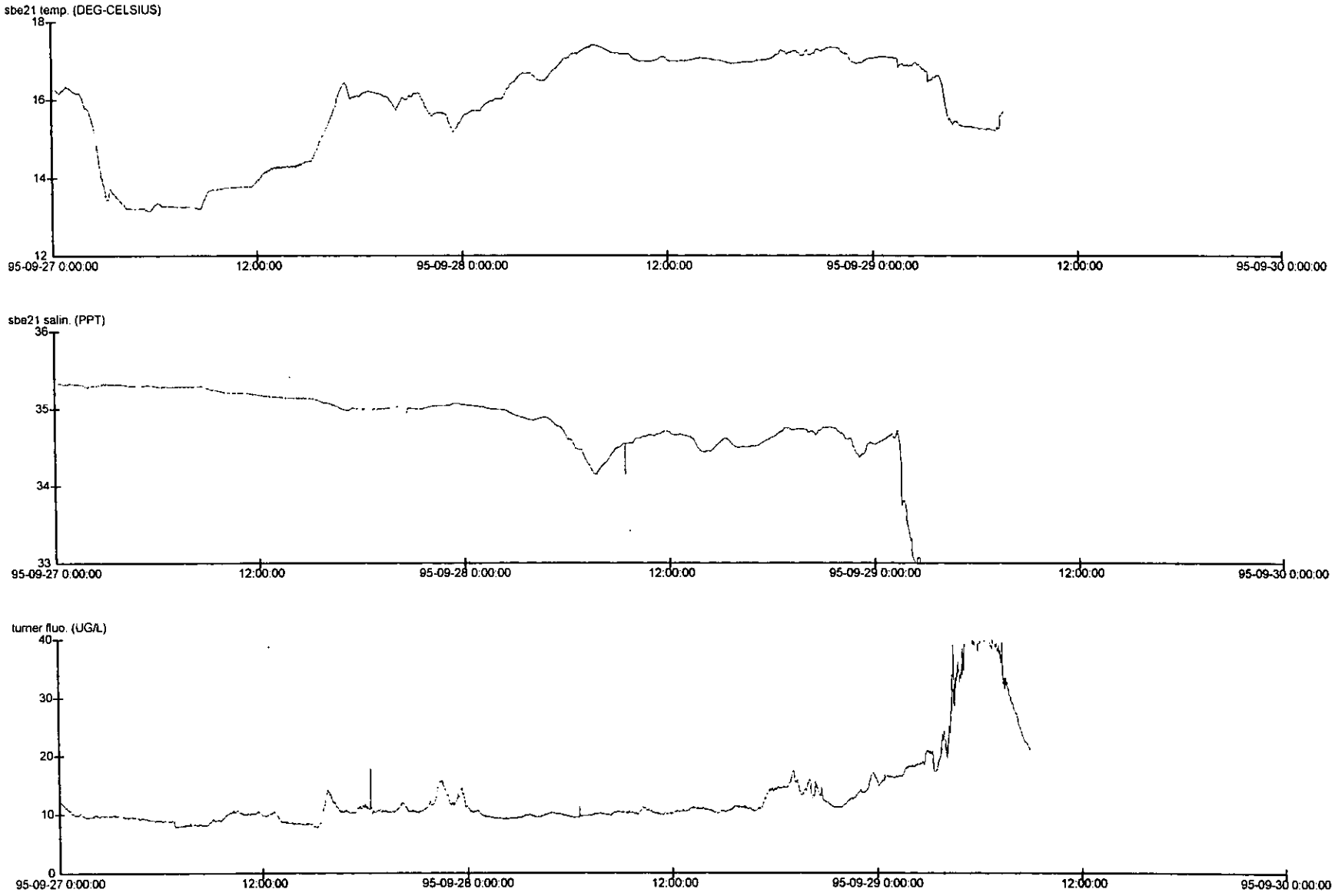


MUMM Meetdienst Oostende

Figure 22

RV BELGICA - CRUISE 95/22

27.09.95 00:00 - 29.09.95 23:59



sbe21 temp.
DEG-CELSIUS

sbe21 salin.
PPT

turner fluo.
UG/L

MUMM Meetdienst Oostende

Appendix 4.

SCTD data at the sampling depths.

SEA-BIRD SBE09*plus* : salinity, watertemperature, density,
DO, backscatterance

Table 2

Profile: Station 1 Cast A

Date: 13.09.96

DOWNCAST: starttime: 16h34 GMT

Bathy depth: 131 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
5	Ni	10,11,12	6.2	17.19	35.44	247	3.42	25.80
20	Ni	8,9	19.8	17.20	35.44	246	3.35	25.80
40	Ni	7	40.3	11.72	35.47	251	3.32	27.01
45	Ni	4,5,6	43.6	10.78	35.49	238	3.32	27.20
60	Ni	3	60.5	10.52	35.49	230	3.26	27.24
80	Ni	2	79.0	10.52	35.49	231	3.19	27.24
100	Ni	1	100	10.53	35.49	231	3.15	27.24

Table 3

Profile: Station 2 Cast A

Date: 13.09.95

DOWNCAST: starttime: 19h29 GMT

Bathy depth: 144 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	11,12	4.8	17.21	35.43	243	3.30	25.79
20	Ni	9,10	20.5	17.20	35.43	244	3.22	25.79
35	Ni	6,7,8	34.9	13.97	35.46	253	3.20	26.55
40	Ni	5	40.6	11.96	35.50	245	3.17	26.99
60	Ni	4	60.4	10.97	35.52	233	3.17	27.19
80	Ni	3	78.4	10.81	35.51	229	3.17	27.21
100	Ni	2	99.9	10.77	35.51	229	3.15	27.21
120	Ni	1	120	10.72	35.51	229	3.13	27.22

Table 4

Profile: Station 3 Cast A

Date: 13.09.95

DOWNCAST: starttime: 22h24 GMT

Bathy depth: 149 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ^2l/kg)	OBS	density sig. Θ
3	Ni	9,10,11	4.2	16.90	35.34	253	3.30	25.79
20	Ni	8	20.1	16.90	35.34	251	3.25	25.79
50	Ni	5,6,7	50.1	12.56	35.54	252	3.10	26.90
60	Ni	4	58.7	12.17	35.55	249	3.05	26.98
80	Ni	3	80.2	11.56	35.55	247	3.08	27.10
100	Ni	2	101	11.18	35.53	243	3.05	27.16
130	Ni	1	131	10.93	35.52	239	3.17	27.19

Table 5

Profile: Station 4 Cast A

Date: 15.09.95

DOWNCAST: starttime: 16h47 GMT

Bathy depth: 1870 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	10,11,12	5.6	17.38	35.64	242	3.35	25.91
20	Ni	9	19.3	17.38	35.64	241	3.30	25.91
40	Ni	6,7,8	38.9	17.37	35.64	241	3.32	25.91
60	Ni	5	57.3	17.27	35.62	247	3.22	25.93
80	Ni	4	79.4	13.39	35.60	242	3.22	26.78
100	Ni	3	99.8	12.39	35.59	239	3.20	26.97
150	Ni	2	150	11.46	35.56	237	3.20	27.13
200	Ni	1	198	11.29	35.55	237	3.17	27.15

Niskin bottle no 8 was not closed.

Table 6

Profile: Station 4 Cast B

Date: 15.09.95

DOWNCAST: starttime: 18h34 GMT

Bathy depth: > 2000 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
250	Ni	12	250	11.24	35.54	262	3.22	27.16
300	Ni	11	299	11.13	35.54	259	3.27	27.17
350	Ni	10	349	11.00	35.51	256	3.27	27.19
400	Ni	9	399	10.87	35.51	249	3.27	27.21
450	Ni	8	450	10.73	35.51	243	3.25	27.23
500	Ni	7	500	10.61	35.50	239	3.25	27.25
550	Ni	6	548	10.48	35.50	235	3.25	27.26
600	Ni	5	599	10.36	35.49	226	3.25	27.29
700	Ni	4	697	10.02	35.46	215	3.27	27.32
800	Ni	3	796	9.89	35.51	208	3.30	27.38
900	Ni	2	898	9.41	35.55	201	3.27	27.49
1000	Ni	1	996	8.81	35.57	203	3.30	27.61

Table 7

Profile: Station 5 Cast A

Date: 16.09.96

DOWNCAST: starttime: 06h10 GMT

Bathy depth: ± 2000 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
40	Ni	1 → 12	39.8	15.91	35.47	245	3.27	26.13

Table 8

Profile: Station 5 Cast B

Date: 16.09.95

DOWNCAST: starttime: 07h51 GMT

Bathy depth: ± 2000 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
300	Ni	12	298	11.11	35.54	245	3.27	27.18
350	Ni	11	350	11.05	35.54	239	3.25	27.20
400	Ni	10	399	10.81	35.51	237	3.27	27.22
450	Ni	9	448	10.61	35.49	233	3.22	27.23
500	Ni	8	499	10.48	35.48	228	3.30	27.25
550	Ni	7	548	10.38	35.49	217	3.32	27.28
600	Ni	6	598	10.27	35.50	210	3.30	27.30
700	Ni	5	699	9.90	35.53	196	3.32	27.40
800	Ni	4	797	9.95	35.66	190	3.37	27.49
900	Ni	3	899	9.84	35.71	189	3.32	27.55
1000	Ni	2	999	9.67	35.75	190	3.30	27.62
1200	Ni	1	1199	8.24	35.58	202	3.27	27.71

Table 9

Profile: Station 5 Cast C

Date: 16.09.95

DOWNCAST: starttime: 12h28 GMT

Bathy depth: ± 2000 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ²l/kg)	OBS	density sig. Θ
3	Ni	10,11,12	4.3	16.11	35.48	252	3.42	26.09
20	Ni	7,8,9	19.7	15.90	35.47	247	3.32	26.13
35	Ni	5,6	34.2	15.08	35.50	246	3.22	26.34
60	Ni	3,4	59.0	13.00	35.58	245	3.17	26.84
75	Ni	1,2	73.5	12.11	35.57	244	3.15	27.01

Table 10

Profile: Station 5 Cast D

Date: 16.09.95

DOWNCAST: starttime: 14h11 GMT

Bathy depth: ± 2000 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	12	3.7	16.29	35.47	253	3.39	26.04
20	Ni	11	19.1	15.97	35.47	252	3.42	26.12
35	Ni	10	34.2	15.93	35.47	250	3.37	26.13
40	Ni	9	39.6	15.91	35.47	249	3.35	26.13
60	Ni	8	59.9	15.59	35.50	247	3.25	26.23
75	Ni	7	73.2	15.44	35.51	248	3.22	26.27
100	Ni	6	100	13.48	35.57	249	3.20	26.74
150	Ni	5	149	11.56	35.56	245	3.17	27.11
200	Ni	3,4	198	11.48	35.57	249	3.15	27.13
250	Ni	1,2	250	11.35	35.56	248	3.17	27.15

Table 11

Profile: Station 5 Cast E

Date: 17.09.95

DOWNCAST: starttime: 05h05 GMT

Bathy depth: 1785 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
30	Ni	1 → 12	30.3	16.03	35.47	247	3.42	26.10

Table 12

Profile: Station 6 Cast A

Date: 17.09.96

DOWNCAST: starttime: 07h07 GMT

Bathy depth: 1512 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	12	3.4	16.35	35.48	254	3.47	26.03
40	Ni	11	38.8	15.76	35.47	254	3.39	26.17
100	Ni	10	97.9	12.00	35.56	249	3.35	27.02
150	Ni	9	149	11.55	35.57	254	3.30	27.12
250	Ni	8	250	11.31	35.56	246	3.32	27.16
400	Ni	7	399	10.92	35.55	231	3.32	27.22
500	Ni	6	501	10.54	35.51	224	3.30	27.27
600	Ni	5	600	10.13	35.50	210	3.30	27.33
700	Ni	4	700	10.08	35.55	207	3.35	27.38
800	Ni	3	800	9.88	35.60	199	3.35	27.45
900	Ni	2	899	9.66	35.65	194	3.35	27.53
1000	Ni	1	1000	9.43	35.66	193	3.35	27.59

Table 13

Profile: Station 7 Cast A

Date: 17.09.95

DOWNCAST: starttime: 11h28 GMT

Bathy depth: 1196 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	8,9,10	2.5	16.38	35.47	255	3.37	26.02
20	Ni	7	20.3	16.12	35.47	259	3.39	26.08
40	Ni	4,5,6	39.6	15.87	35.47	256	3.32	26.14
60	Ni	3	59.1	13.90	35.54	247	3.20	26.62
80	Ni	2	79.3	12.70	35.55	249	3.22	26.88
100	Ni	1	99.0	12.27	35.57	251	3.25	26.98

Table 14

Profile: Station 7 Cast B

Date: 17.09.95

DOWNCAST: starttime: 12h30 GMT

Bathy depth: 968 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ²l/kg)	OBS	density sig. Θ
150	Ni	12	151	11.53	35.56	246	3.27	27.11
200	Ni	11	200	11.38	35.55	246	3.25	27.14
250	Ni	10	251	11.31	35.55	242	3.25	27.15
300	Ni	9	301	11.12	35.55	239	3.30	27.19
350	Ni	8	350	11.00	35.55	235	3.27	27.21
400	Ni	7	400	10.88	35.55	230	3.30	27.23
450	Ni	6	451	10.73	35.54	227	3.25	27.25
500	Ni	5	500	10.66	35.54	224	3.27	27.26
600	Ni	4	600	10.34	35.52	215	3.25	27.31
700	Ni	3	698	9.96	35.57	204	3.25	27.42
800	Ni	2	791	9.87	35.60	202	3.22	27.46
900	Ni	1	895	9.61	35.65	201	3.25	27.54

Table 15

Profile: Station 8 Cast A

Date: 17.09.95

DOWNCAST: starttime: 15h53 GMT

Bathy depth: 197 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	10,11,12	4.3	16.34	35.48	257	3.47	26.04
20	Ni	8,9	19.6	16.25	35.48	258	3.39	26.06
40	Ni	6,7	39.5	15.74	35.47	252	3.37	26.17
60	Ni	5	59.1	14.91	35.51	245	3.27	26.38
80	Ni	4	78.7	13.05	35.52	239	3.25	26.79
100	Ni	3	99.4	12.26	35.53	239	3.25	26.95
150	Ni	2	150	11.97	35.54	241	3.25	27.01
180	Ni	1	182	11.93	35.54	245	3.25	27.02

Table 16

Profile: Station 9 Cast A

Date: 17.09.96

DOWNCAST: starttime: 20h18 GMT

Bathy depth: 750 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	10,11,12	4.2	16.39	35.47	253	3.42	26.02
20	Ni	7,8,9	18.5	16.01	35.47	250	3.39	26.11
40	Ni	4,5,6	40.1	15.30	35.49	246	3.25	26.29
60	Ni	3	58.7	13.54	35.54	241	3.20	26.70
80	Ni	2	78.6	12.81	35.55	242	3.22	26.86
100	Ni	1	101	12.32	35.57	240	3.22	26.97

Table 17

Profile: Station 9 Cast B

Date: 17.09.95

DOWNCAST: starttime: 21h12 GMT

Bathy depth: 686 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
150	Ni	9	150	11.66	35.57	249	3.27	27.09
200	Ni	8	199	11.50	35.56	244	3.30	27.12
250	Ni	7	251	11.33	35.55	241	3.30	27.15
300	Ni	6	299	11.13	35.55	239	3.27	27.19
350	Ni	5	349	11.03	35.55	237	3.30	27.20
400	Ni	4	401	10.95	35.55	234	3.27	27.22
450	Ni	3	450	10.79	35.55	232	3.25	27.25
500	Ni	2	501	10.63	35.55	229	3.30	27.28
550	Ni	1	550	10.46	35.53	228	3.27	27.30

Table 18

Profile: Station 10 Cast A

Date: 18.09.95

DOWNCAST: starttime: 06h14 GMT

Bathy depth: 475 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ²l/kg)	OBS	density sig. Θ
3	Ni	10,11,12	5.3	11.97	35.46	248	3.47	26.01
20	Ni	7,8,9	19.8	12.13	35.47	249	3.44	26.05
40	Ni	4,5,6	39.4	13.16	35.48	246	3.39	26.23
60	Ni	3	58.6	15.50	35.53	237	3.35	26.77
80	Ni	2	80.0	16.24	35.54	231	3.35	26.98
100	Ni	1	101	16.41	35.55	229	3.44	27.02

Table 19

Profile: Station 10 Cast B

Date: 18.09.95

DOWNCAST: starttime: 07h38 GMT

Bathy depth: 502 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
150	Ni	11,12	150	11.78	35.56	246	3.52	27.06
200	Ni	9,10	200	11.59	35.56	246	3.44	27.11
250	Ni	7,8	250	11.33	35.56	240	3.47	27.16
300	Ni	5,6	300	11.06	35.55	236	3.44	27.20
350	Ni	3,4	348	10.99	35.55	235	3.42	27.21
400	Ni	1,2	402	10.82	35.55	235	3.47	27.24

Table 20

Profile: Station 11 Cast A

Date: 18.09.95

DOWNCAST: starttime: 12h00 GMT

Bathy depth: 162 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	11,12	4.2	16.53	35.49	251	3.57	26.00
20	Ni	9,10	20.6	15.84	35.48	252	3.59	26.15
35	Ni	7,8	34.2	14.77	35.49	242	3.47	26.40
45	Ni	5,6	44.9	14.25	35.51	240	3.44	26.53
70	Ni	3,4	70.2	13.09	35.52	236	3.44	26.78
100	Ni	2	99.7	12.10	35.55	237	3.44	27.00
140	Ni	1	140	11.85	35.55	236	3.47	27.04

Niskin bottle no 12 is not closed.

Table 21

Profile: Station 12 Cast A

Date: 23.09.96

DOWNCAST: starttime: 01h09 GMT

Bathy depth: > 2200 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
35	Ni	1 → 12	34.7	16.75	35.64	235	3.27	26.07

Table 22

Profile: Station 12 Cast B

Date: 23.09.95

DOWNCAST: starttime: 02h57 GMT

Bathy depth: 2200 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
200	Ni	12	202	11.36	35.55	238	3.32	27.14
250	Ni	11	250	11.17	35.53	236	3.27	27.17
300	Ni	10	301	11.03	35.52	236	3.30	27.18
350	Ni	9	351	11.00	35.53	231	3.27	27.20
400	Ni	8	399	10.84	35.51	230	3.27	27.21
450	Ni	7	448	10.69	35.50	228	3.25	27.23
500	Ni	6	501	10.47	35.47	227	3.32	27.25
600	Ni	5	599	10.19	35.45	215	3.27	27.28
700	Ni	4	700	10.00	35.46	205	3.32	27.33
800	Ni	3	803	9.60	35.48	196	3.30	27.40
900	Ni	2	901	9.40	35.55	193	3.30	27.50
1000	Ni	1	1001	9.20	35.62	197	3.32	27.59

Table 23

Profile: Station 12 Cast C

Date: 23.09.95

DOWNCAST: starttime: 05h06 GMT

Bathy depth: > 2200 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ²l/kg)	OBS	density sig. Θ
3	Ni	10,11,12	3.0	17.14	35.66	241	3.47	25.99
20	Ni	7,8,9	20.0	17.13	35.66	243	3.42	25.99
40	Ni	6	40.0	16.07	35.63	244	3.39	26.22
60	Ni	4,5	59.6	14.17	35.61	243	3.35	26.62
80	Ni	3	81.4	12.64	35.59	243	3.30	26.92
100	Ni	2	101	12.07	35.59	243	3.32	27.03
150	Ni	1	149	11.58	35.57	244	3.30	27.11

Table 24

Profile: Station 13 Cast A

Date: 23.09.95

DOWNCAST: starttime: 11h56 GMT

Bathy depth: 201 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	8,9	3.1	16.63	35.54	244	3.25	26.02
20	Ni	7	19.7	16.27	35.53	242	3.22	26.09
40	Ni	6	39.5	14.86	35.53	234	3.00	26.41
60	Ni	5	58.3	14.12	35.53	233	3.00	26.57
80	Ni	4	83.6	13.11	35.53	231	2.98	26.78
100	Ni	3	100	12.15	35.54	230	3.00	26.98
198	Ni	1,2	197	11.65	35.55	235	3.00	27.08

Table 25

Profile: Station 14 Cast A

Date: 24.09.95

DOWNCAST: starttime: 06h02 GMT

Bathy depth: 253 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	9,10	3.8	16.14	35.50	248	3.42	26.10
20	Ni	8	20.5	16.12	35.50	249	3.39	26.10
40	Ni	7	40.9	14.45	35.52	241	3.17	26.49
60	Ni	6	58.2	12.70	35.54	237	3.20	26.87
80	Ni	5	80.4	12.43	35.54	239	3.17	26.92
100	Ni	4	103	12.10	35.54	238	3.20	26.99
200	Ni	3	199	11.29	35.55	242	3.22	27.15
220	Ni	1,2	219	11.18	35.55	244	3.22	27.17

Table 26

Profile: Station 15 Cast B

Date: 24.09.96

DOWNCAST: starttime: 08h55 GMT

Bathy depth: 312 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	3,4	4.8	16.21	35.51	247	3.44	26.09
305	Ni	1,2	305	11.11	35.55	244	3.27	27.19

Table 27

Profile: Station 16 Cast A

Date: 24.09.95

DOWNCAST: starttime: 12h03 GMT

Bathy depth: 360 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	10,11,12	4.0	16.13	35.50	248	3.39	26.10
20	Ni	8,9	20.0	16.05	35.51	246	3.42	26.13
50	Ni	6,7	49.6	15.64	35.51	243	3.20	26.22
75	Ni	5	75.6	13.39	35.53	238	3.15	26.72
100	Ni	4	100.6	12.50	35.54	239	3.15	26.91
200	Ni	3	199	11.62	35.55	241	3.15	27.09
300	Ni	1,2	349	10.97	35.54	240	3.25	27.21

Table 28

Profile: Station 18 Cast A

Date: 25.09.95

DOWNCAST: starttime: 06h53 GMT

Bathy depth: 592 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (μ²l/kg)	OBS	density sig. Θ
3	Ni	12	3.3	16.28	35.50	250	3.27	26.06
20	Ni	11	19.9	16.28	35.50	250	3.25	26.07
40	Ni	10	38.7	16.28	35.50	250	3.25	26.07
60	Ni	9	58.8	15.84	35.49	247	3.13	26.16
80	Ni	8	79.7	14.01	35.55	243	3.08	26.61
100	Ni	7	99.9	12.98	35.57	242	3.03	26.84
200	Ni	6	200	11.37	35.55	239	3.03	27.14
300	Ni	5	301	11.09	35.55	235	3.03	27.19
400	Ni	4	400	10.68	35.51	231	3.00	27.24
500	Ni	3	501	10.30	35.51	219	3.00	27.31
574	Ni	1,2	574	10.13	35.55	216	3.00	27.37

Table 29

Profile: Station 18 Cast B

Date: 25.09.95

DOWNCAST: starttime: 08h16 GMT

Bathy depth: 583 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	6,7,8	3.9	16.29	35.50	253	3.32	26.06
30	Ni	3,4,5	29.1	16.29	35.50	254	3.32	26.06
50	Ni	2	51.0	16.00	35.48	255	3.25	26.12
75	Ni	1	74.9	13.90	35.56	247	3.13	26.64

Table 30

Profile: Station 19 Cast A

Date: 25.09.95

DOWNCAST: starttime: 11h44 GMT

Bathy depth: 695 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	11.12	2.6	16.50	35.53	253	3.30	26.04
20	Ni	10	18.4	16.43	35.53	254	3.30	26.05
40	Ni	9	40.6	16.39	35.52	256	3.22	26.06
60	Ni	8	59.4	15.00	35.56	259	3.10	26.41
80	Ni	7	78.2	12.21	35.57	247	3.08	26.99
100	Ni	6	101	11.90	35.57	248	3.10	27.05
200	Ni	5	200	11.37	35.56	249	3.05	27.15
300	Ni	4	300	11.20	35.54	243	3.05	27.17
400	Ni	3	400	11.00	35.53	239	3.08	27.20
500	Ni	2	500	10.70	35.50	234	3.00	27.23
689	Ni	1	690	10.15	35.55	218	3.05	27.37

Table 31

Profile: Station 20 Cast A

Date: 26.09.95

DOWNCAST: starttime: 12h00 GMT

Bathy depth: 127 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	3,4	3.9	16.49	35.45	246	3.22	25.98
118	Ni	1,2	118	12.18	35.48	219	3.49	26.93

Table 32

Profile: Station 21 Cast A

Date: 27.09.96

DOWNCAST: starttime: 07h26 GMT

Bathy depth: 107 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	7,10	3.0	13.25	35.34	201	3.39	26.60
102	Ni	1,4	100	13.26	35.34	216	3.49	26.61

Table 33

Profile: Station 22 Cast A

Date: 27.09.95

DOWNCAST: starttime: 10h36 GMT

Bathy depth: 98 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	7,10	3.2	13.74	35.26	238	3.42	26.44
89	Ni	1,4	87.7	13.74	35.26	236	3.57	26.45

Table 34

Profile: Station 23 Cast A

Date: 27.09.95

DOWNCAST: starttime: 13h58 GMT

Bathy depth: 87 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µ²l/kg)	OBS	density sig. Θ
3	Ni	7,10	2.8	14.29	35.19	235	3.22	26.27
79	Ni	1,4	79.3	14.23	35.19	231	3.17	26.29

Table 35

Profile: Station 24 Cast A

Date: 27.09.95

DOWNCAST: starttime: 17h47 GMT

Bathy depth: 79 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	7,10	3.6	16.08	35.06	237	3.20	25.77
30	Ni	1,4	75.2	16.09	35.06	235	3.22	25.77

Table 36

Profile: Station 25 Cast A

Date: 28.09.95

DOWNCAST: starttime: 18h30 GMT

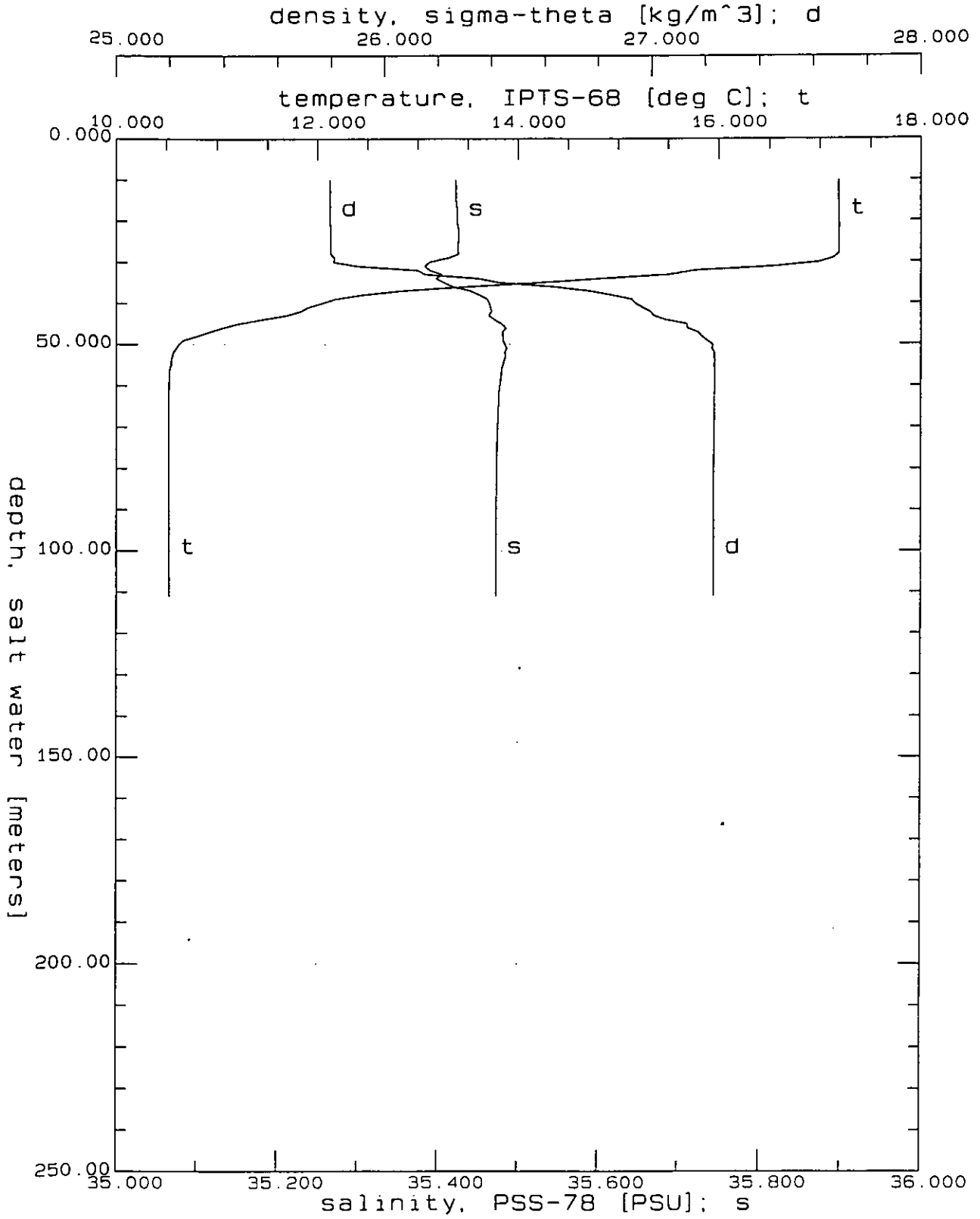
Bathy depth: 39 m

sampling			SCTD values					
depth	bottle type	bottle no.(s)	depth (m)	temp. (°C)	salinity (PSU)	DO (µml/kg)	OBS	density sig. Θ
3	Ni	7,10	2.4	17.17	34.76	236	3.22	25.29
20	Ni	1,4	35.2	17.15	34.75	235	3.35	25.29

Appendix 5.

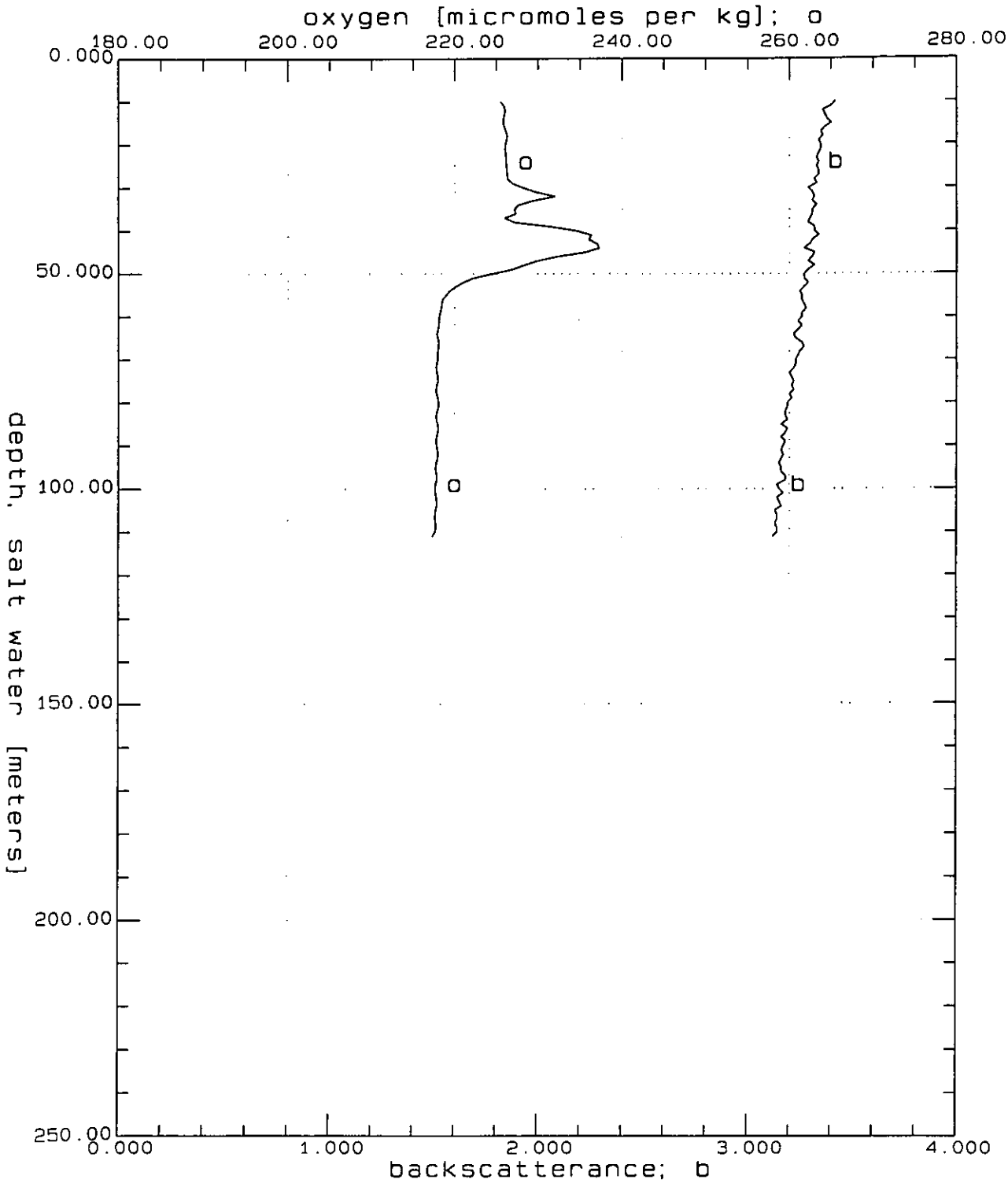
Vertical profiles with SCTD.

SEA-BIRD SBE09*plus* : salinity, watertemperature, density, DO



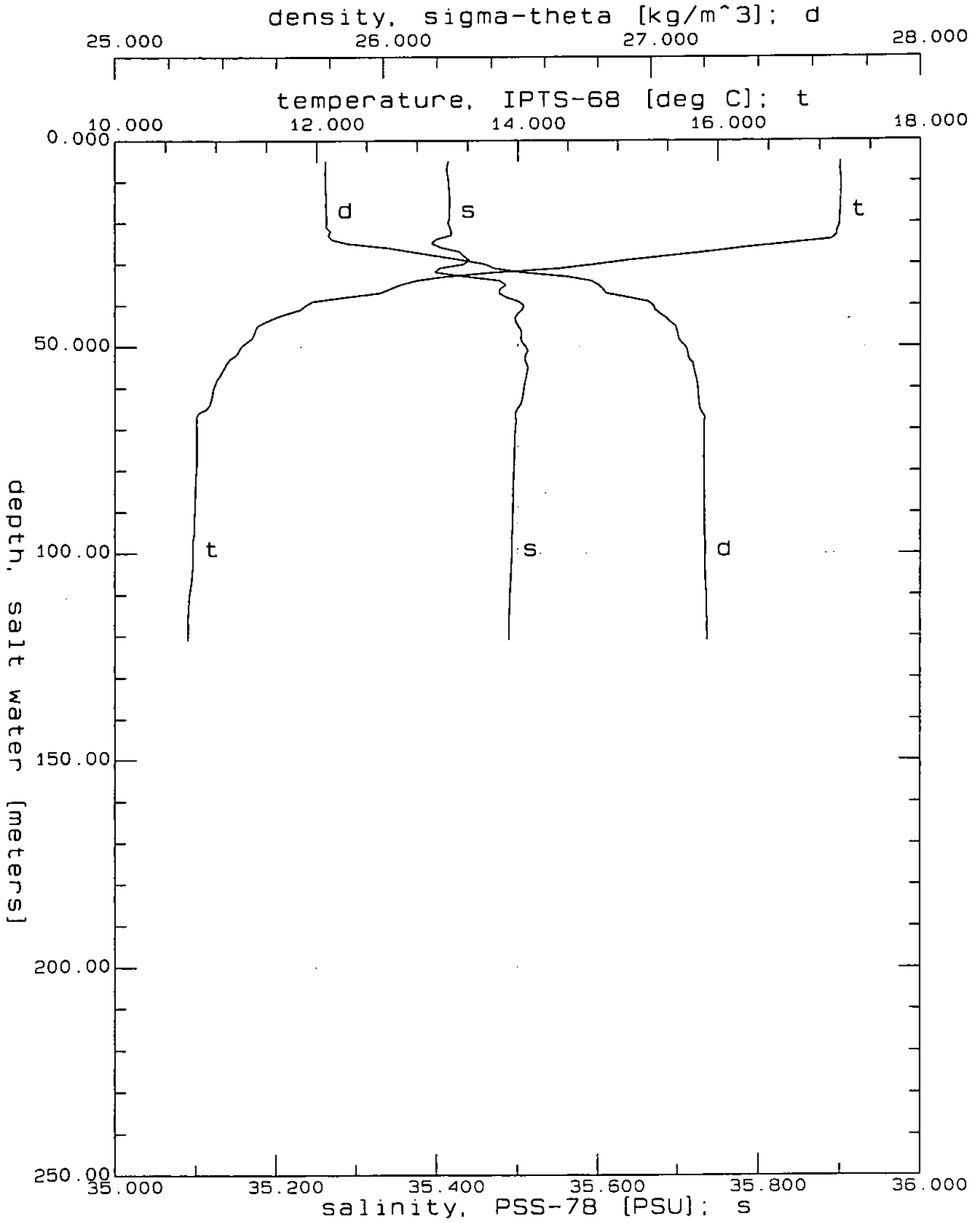
OM9501A.CNV: OMEX 95/21 Station 1 Cast A

Figure 23a



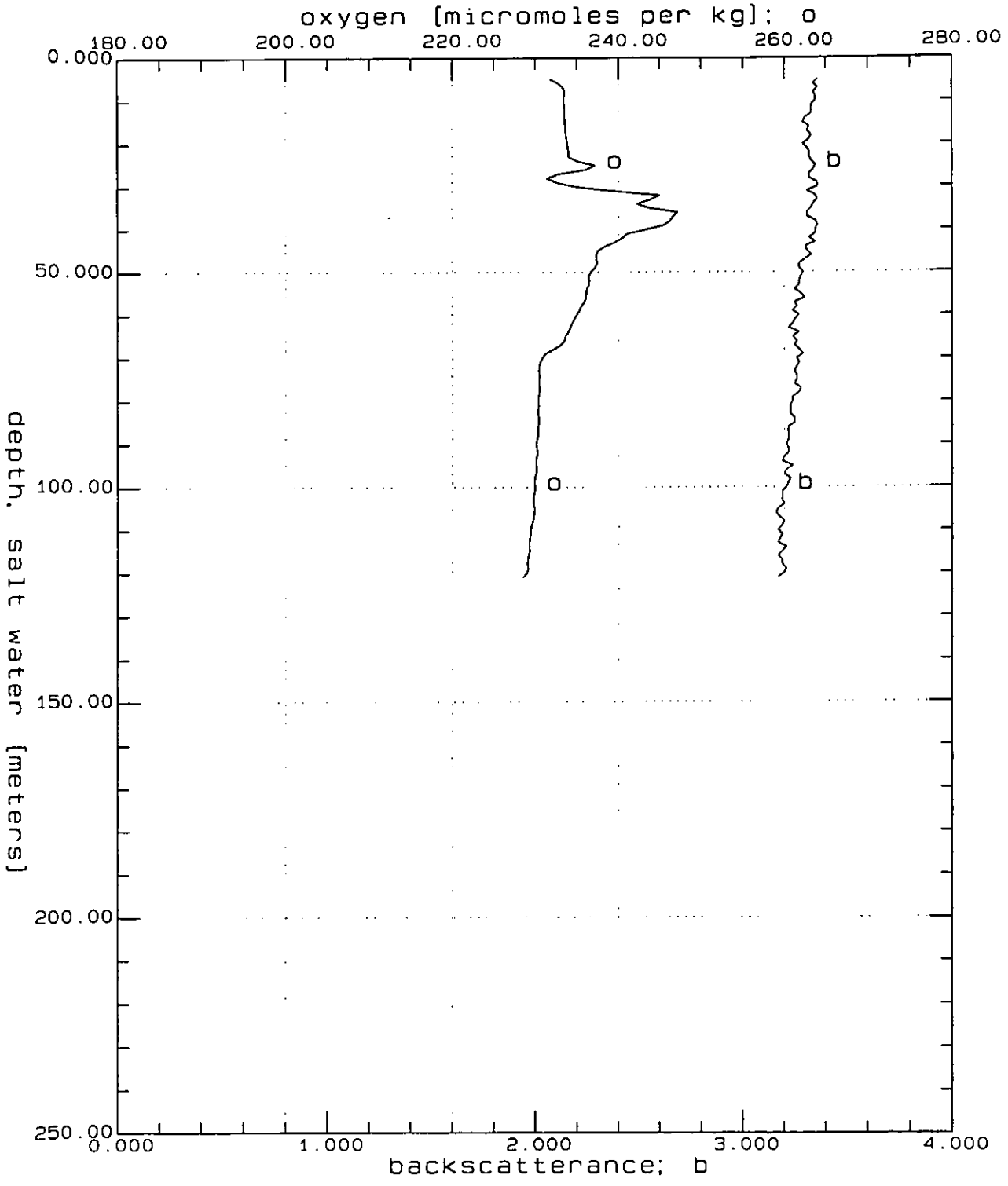
OM9501A.CNV: OMEX 95/21 Station 1 cast A

Figure 23b



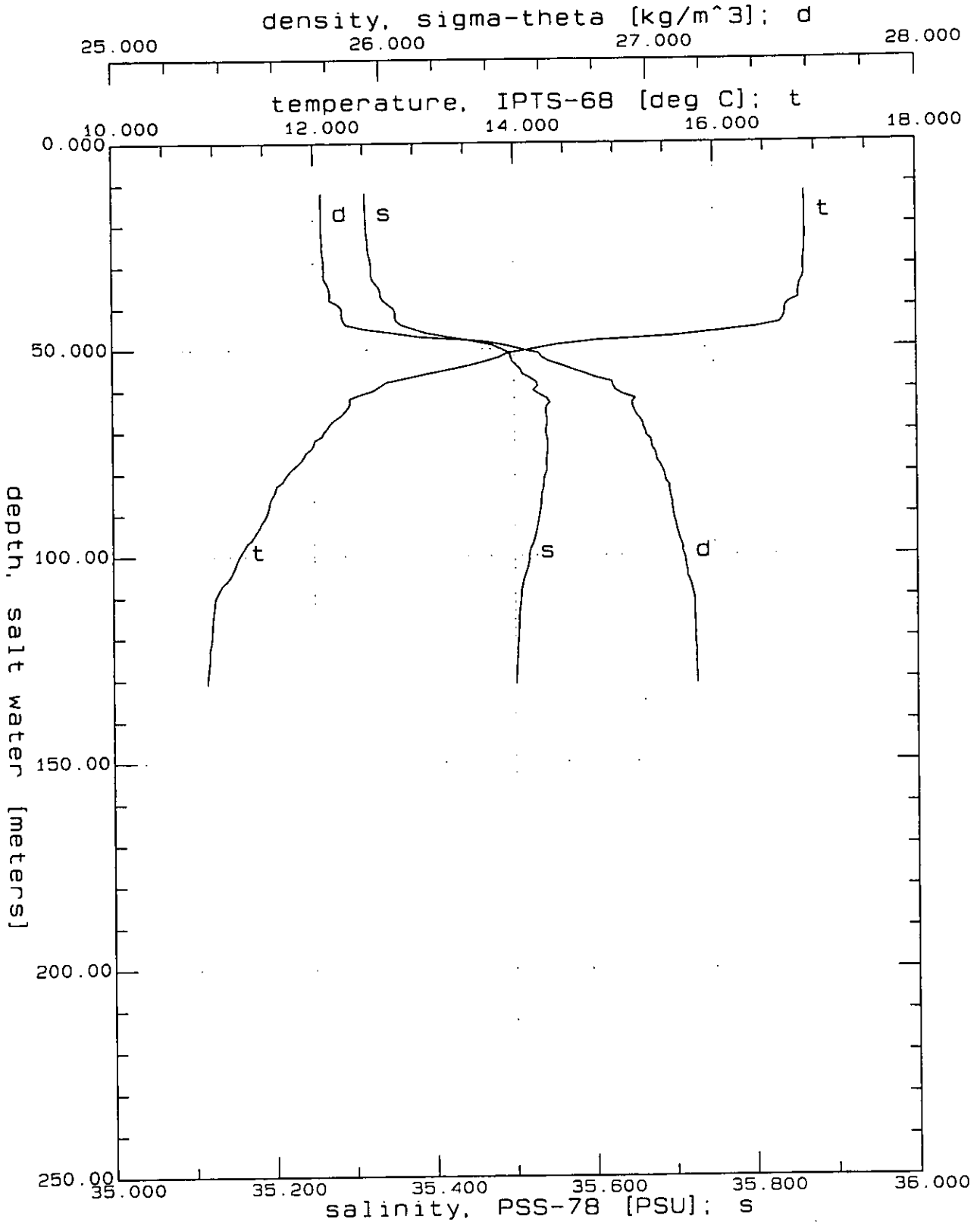
OM9502A.CNV: OMEX 95/21 Station 2 Cast A

Figure 24a



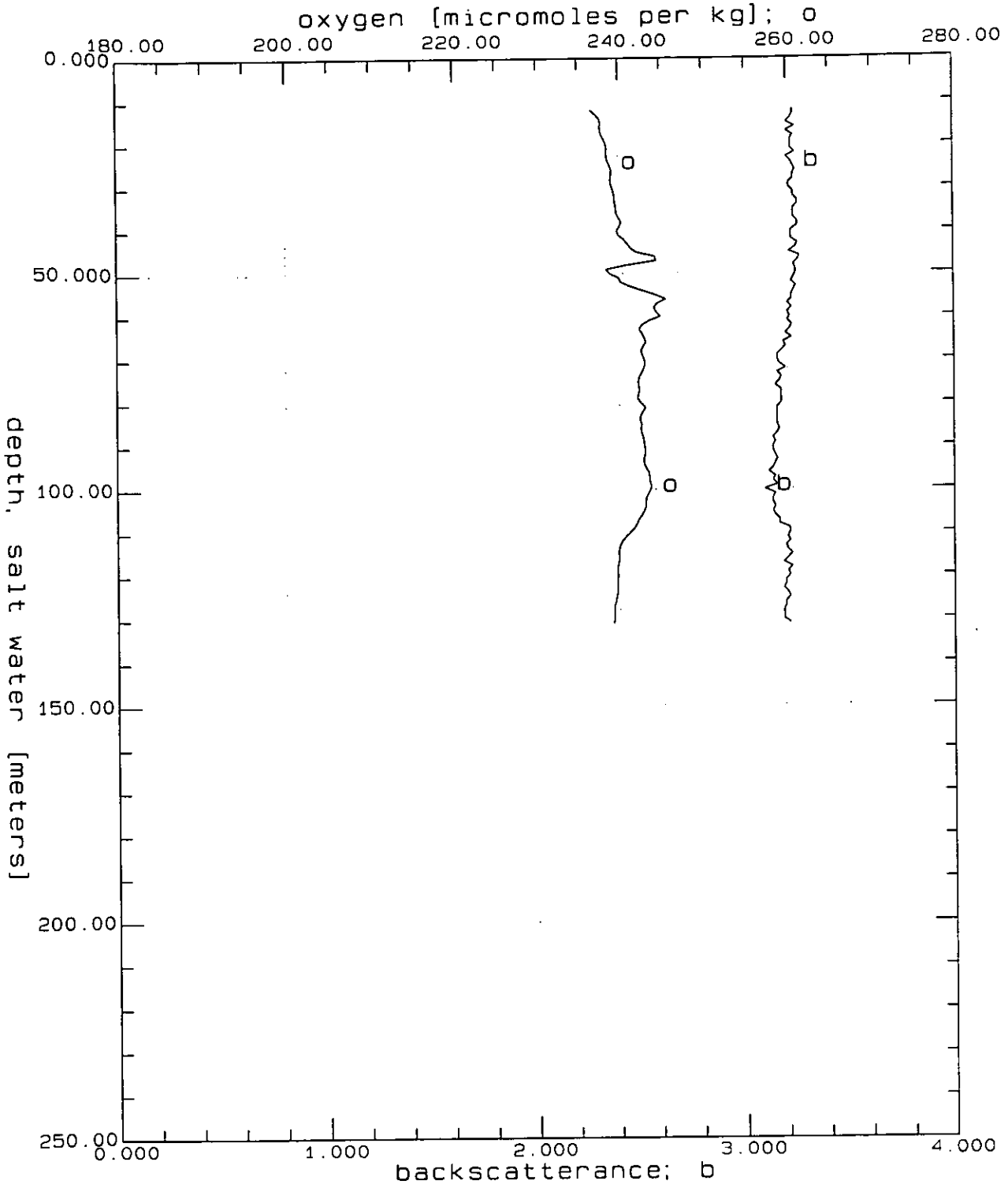
OM9502A.CNV: OMEX 95/21 Station 2 cast A

Figure 24b



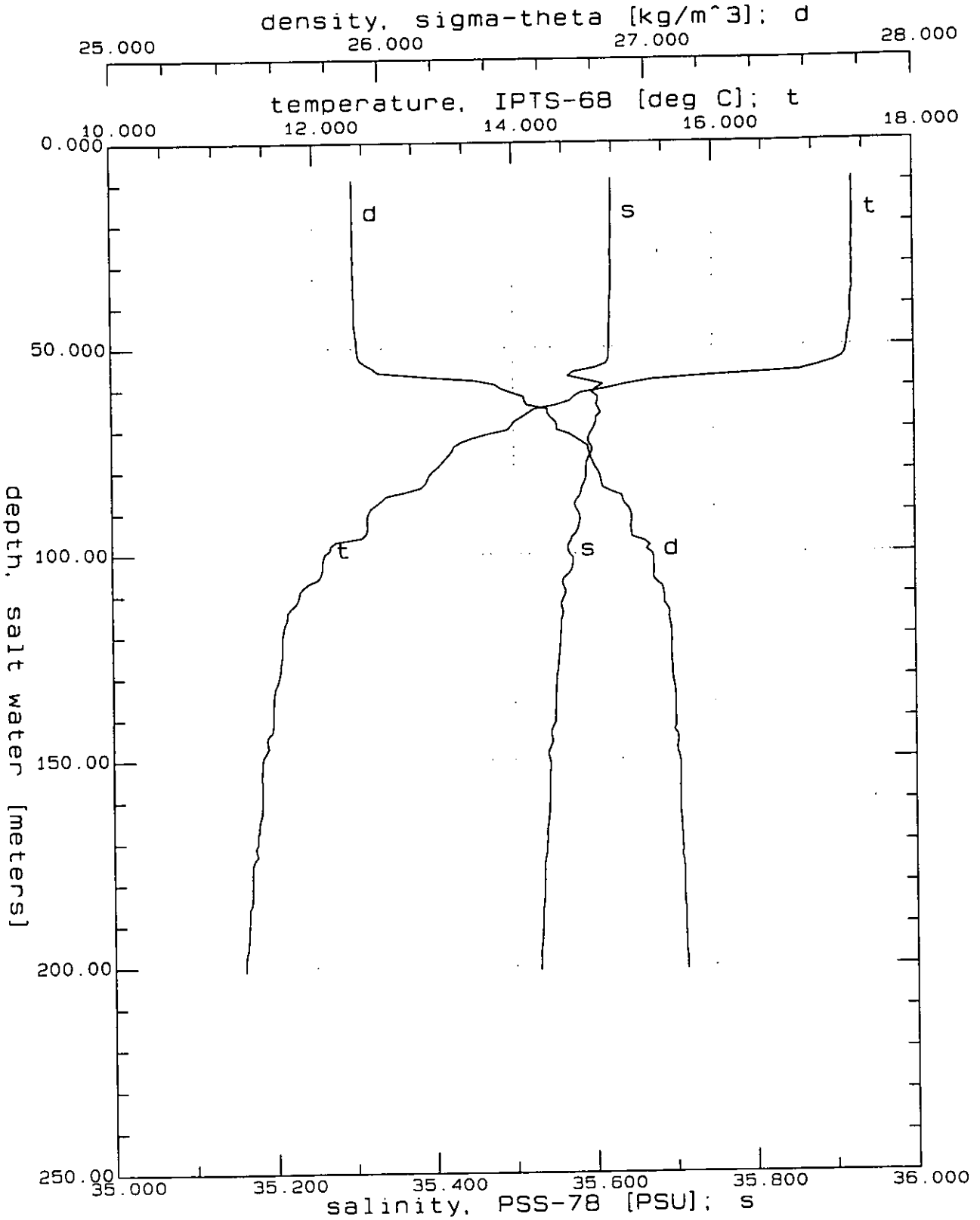
OM9503A.CNV: OMEX 95/21 Station 3 Cast A

Figure 25a



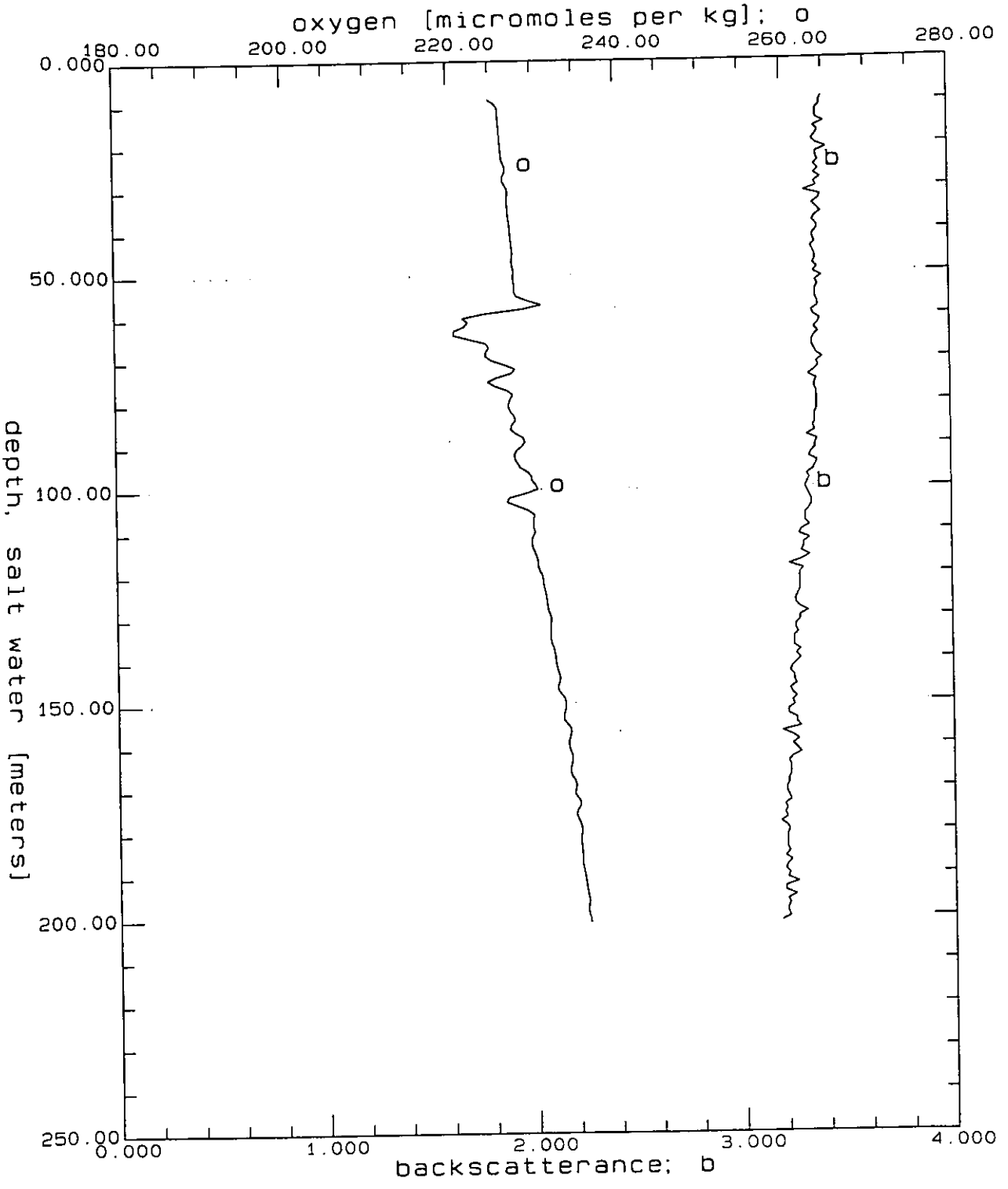
OM9503A.CNV: OMEX 95/21 Station 3 cast A

Figure 25b



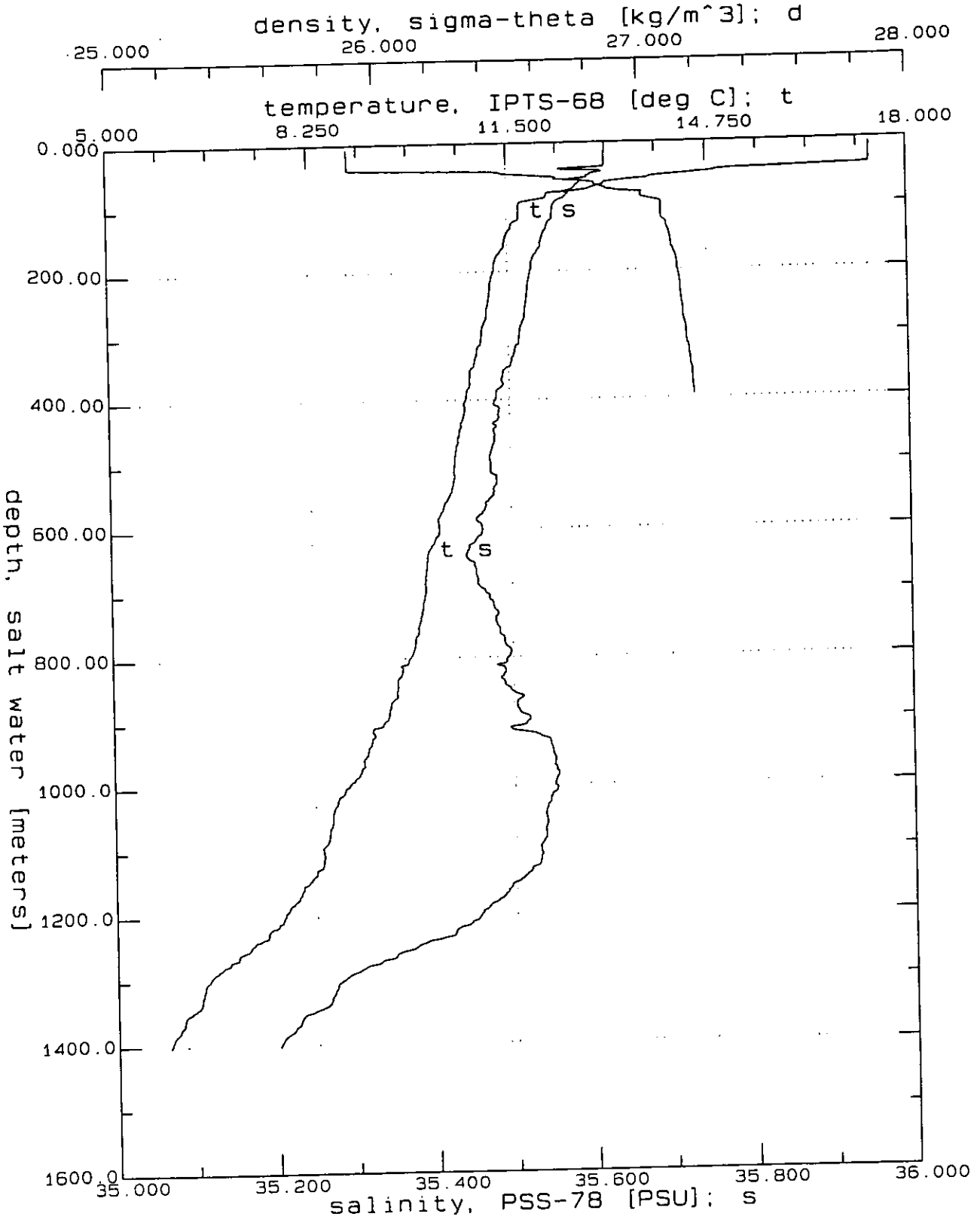
OM9504A.CNV: OMEX 95/21 Station 4 Cast A

Figure 26a



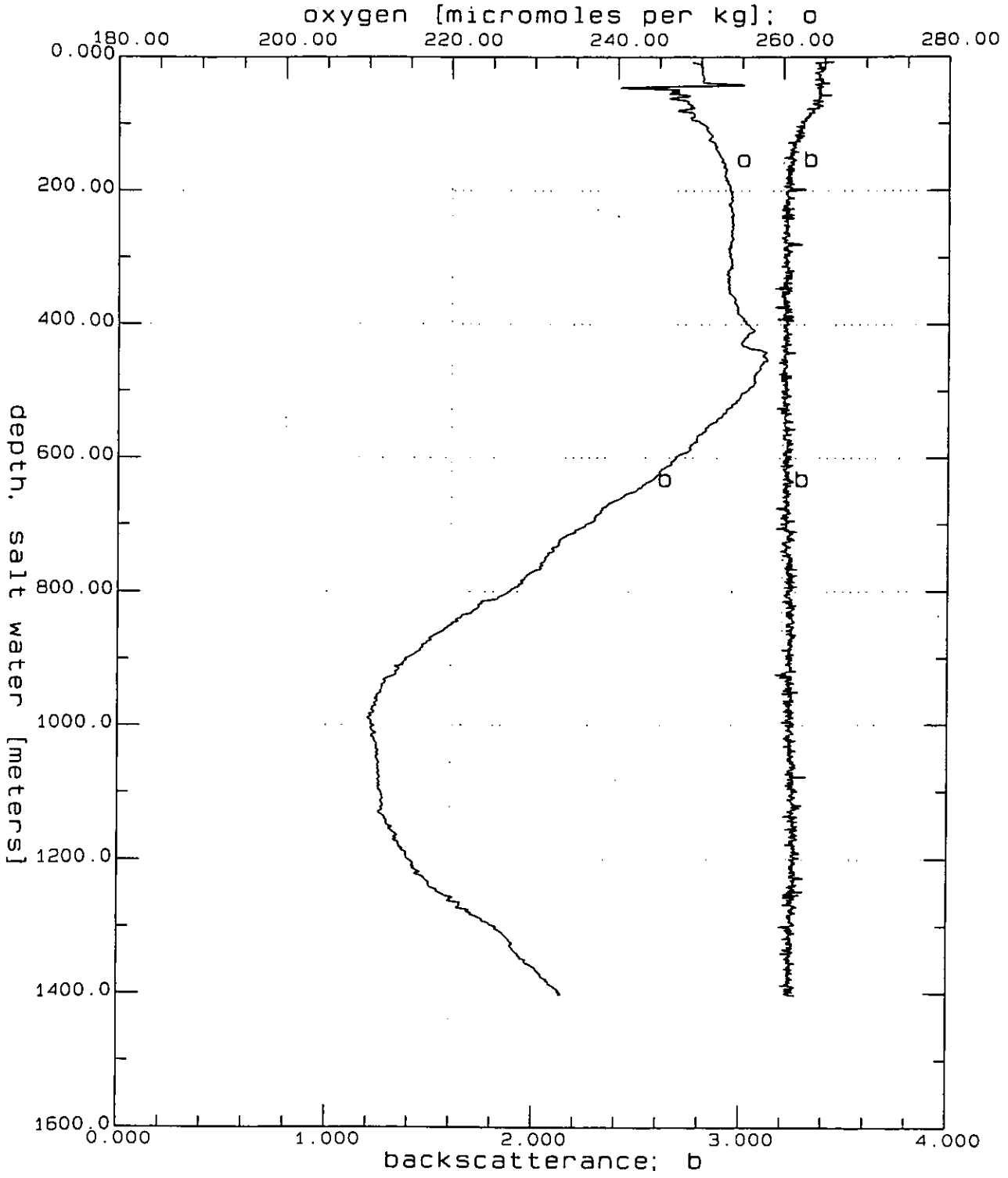
OM9504A.CNV: OMEX 95/21 Station 4 cast A

Figure 26b



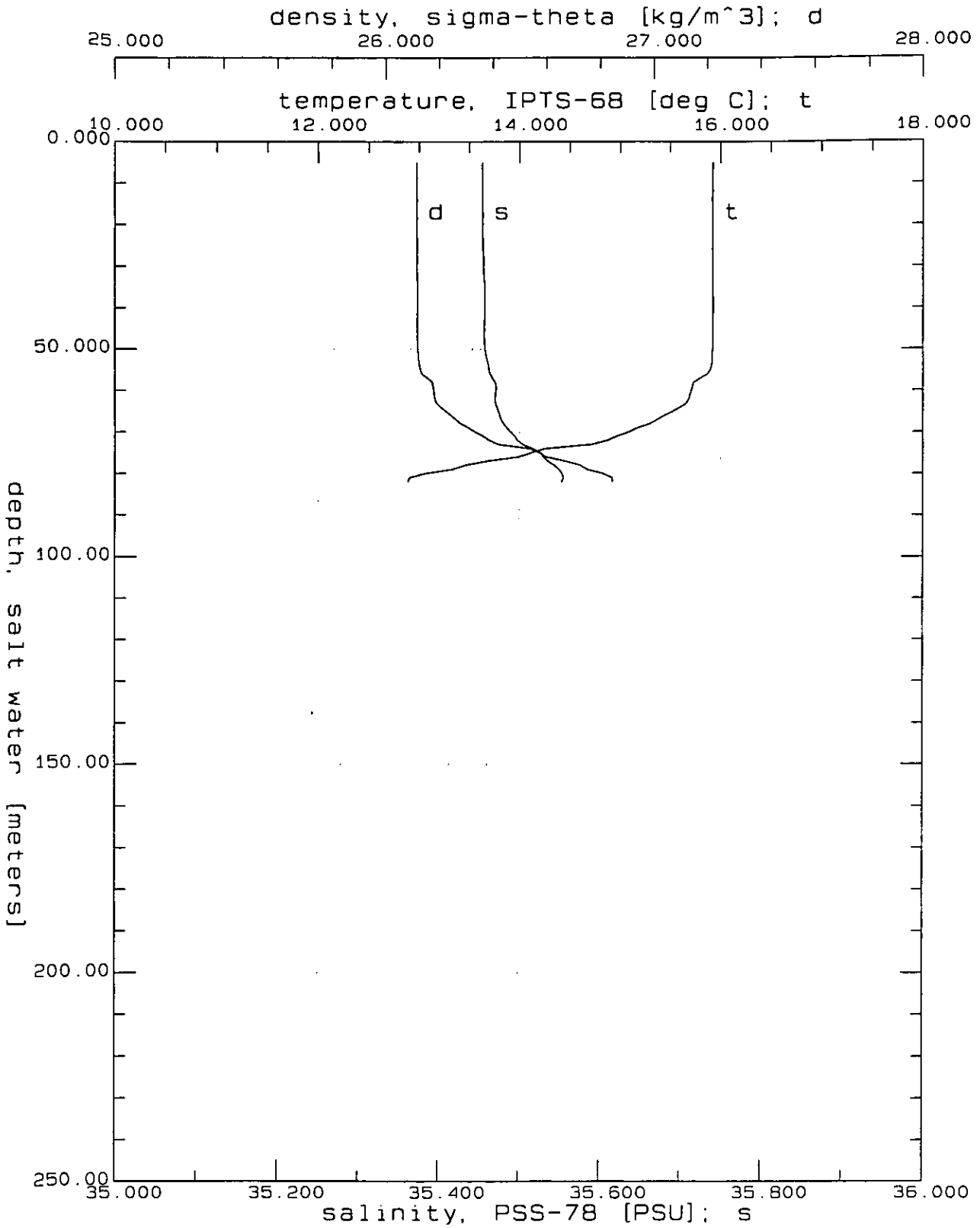
OM9504B.CNV: OMEX 95/21 Station 4 Cast B

Figure 27a



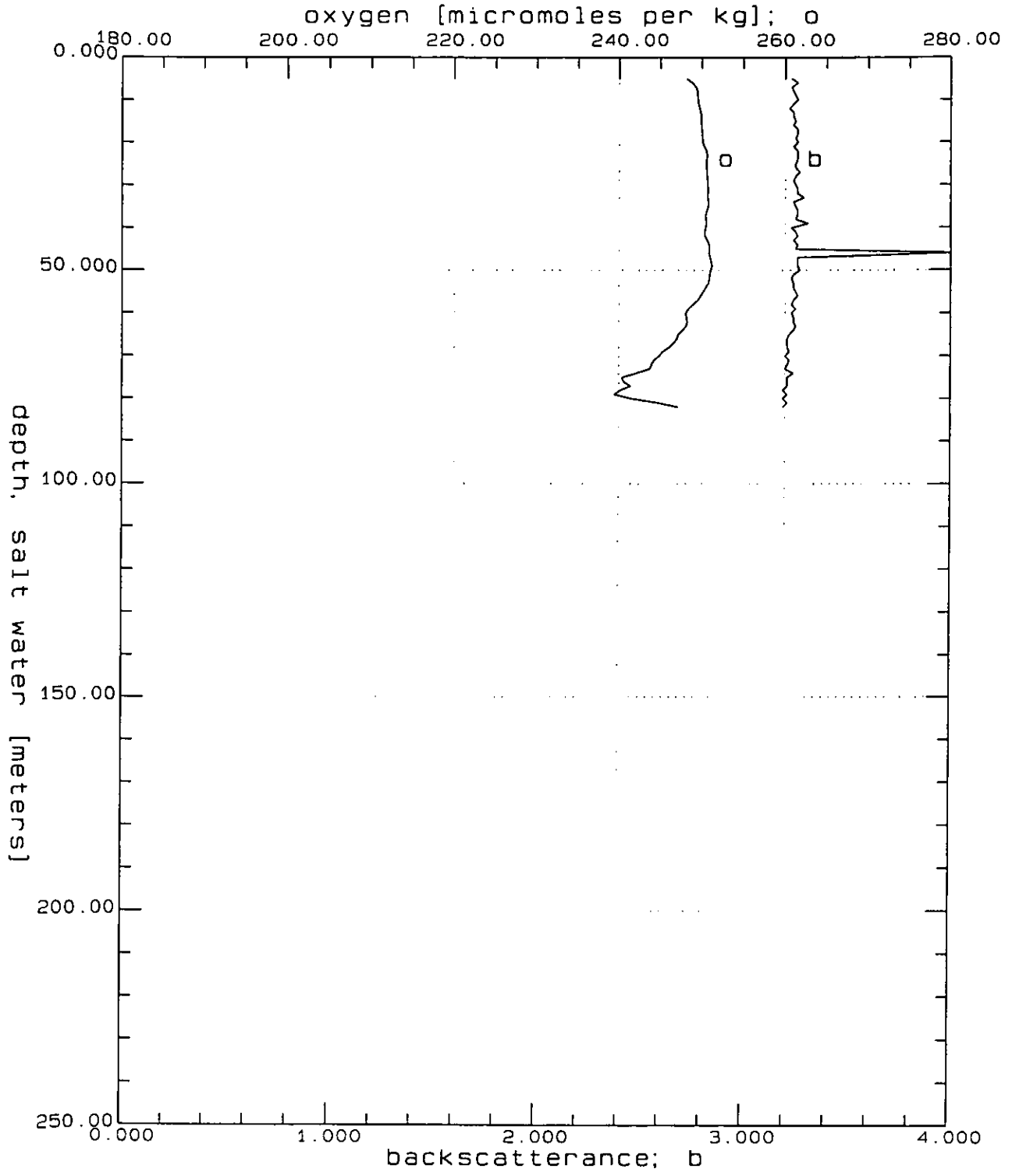
OM9504B.CNV: OMEX 95/21 Station 4 cast B

Figure 27b



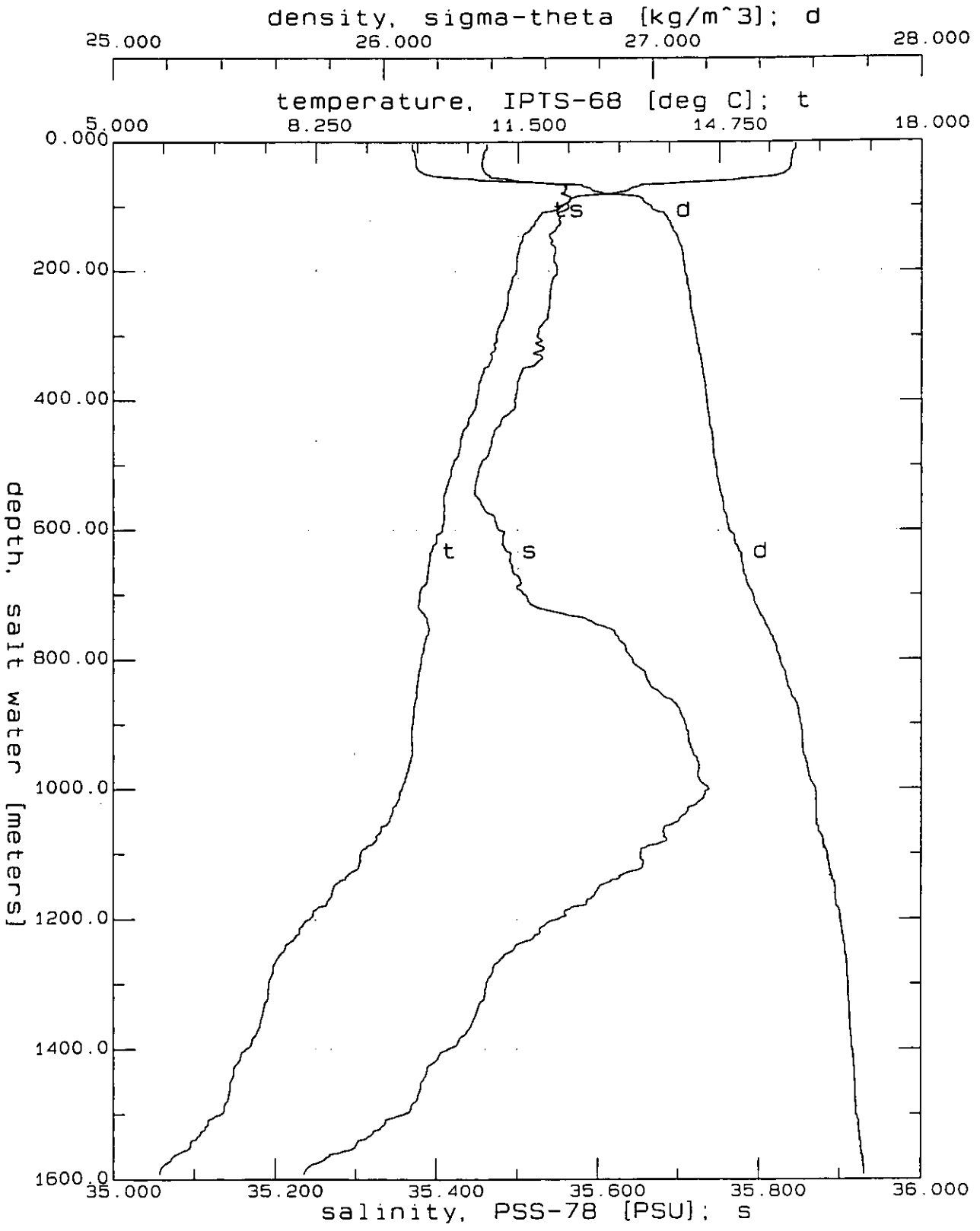
OM9505A.CNV: OMEX 95/21 Station 5 Cast A

Figure 28a



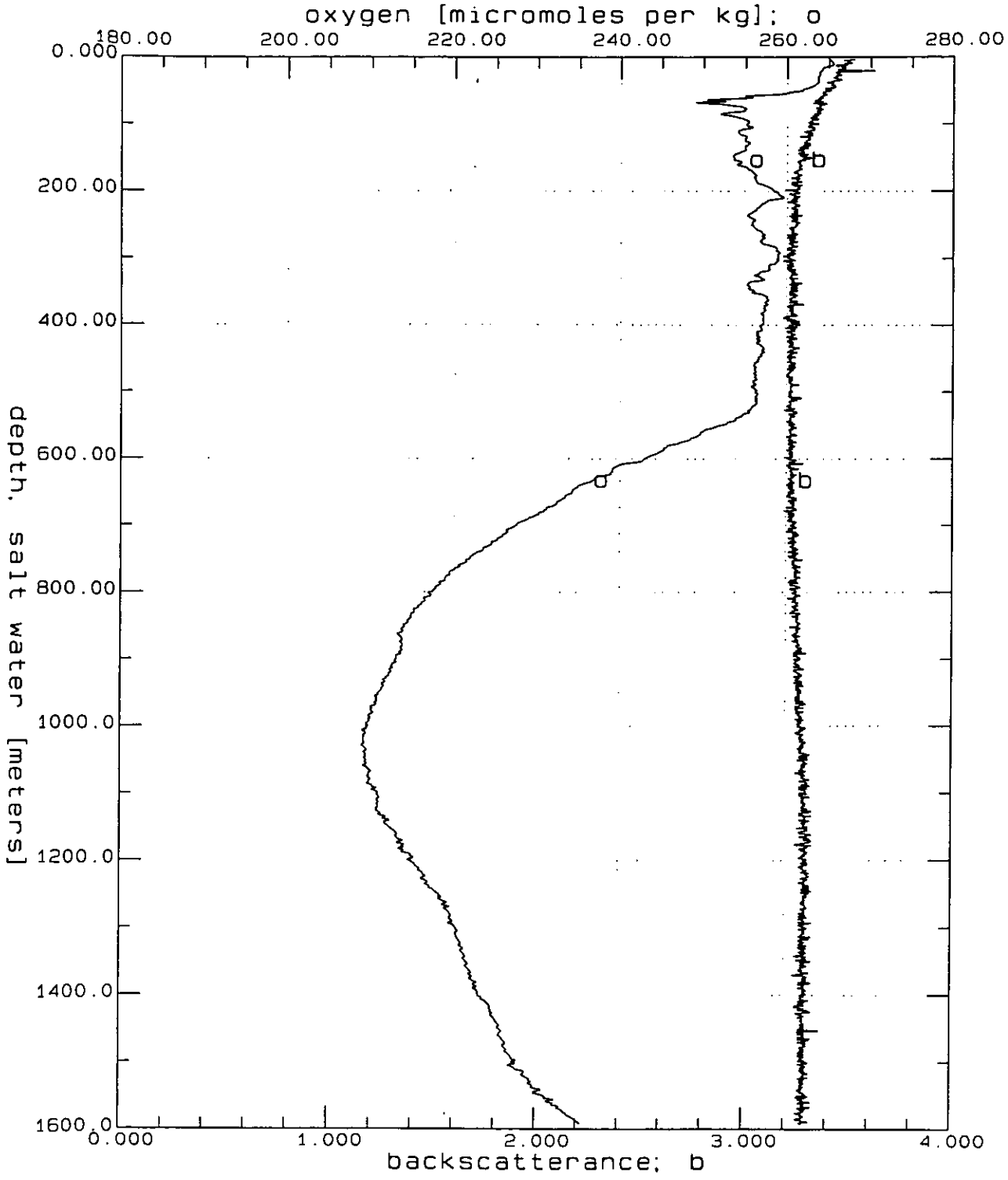
OM9505A.CNV: OMEX 95/21 Station 5 cast A

Figure 28b



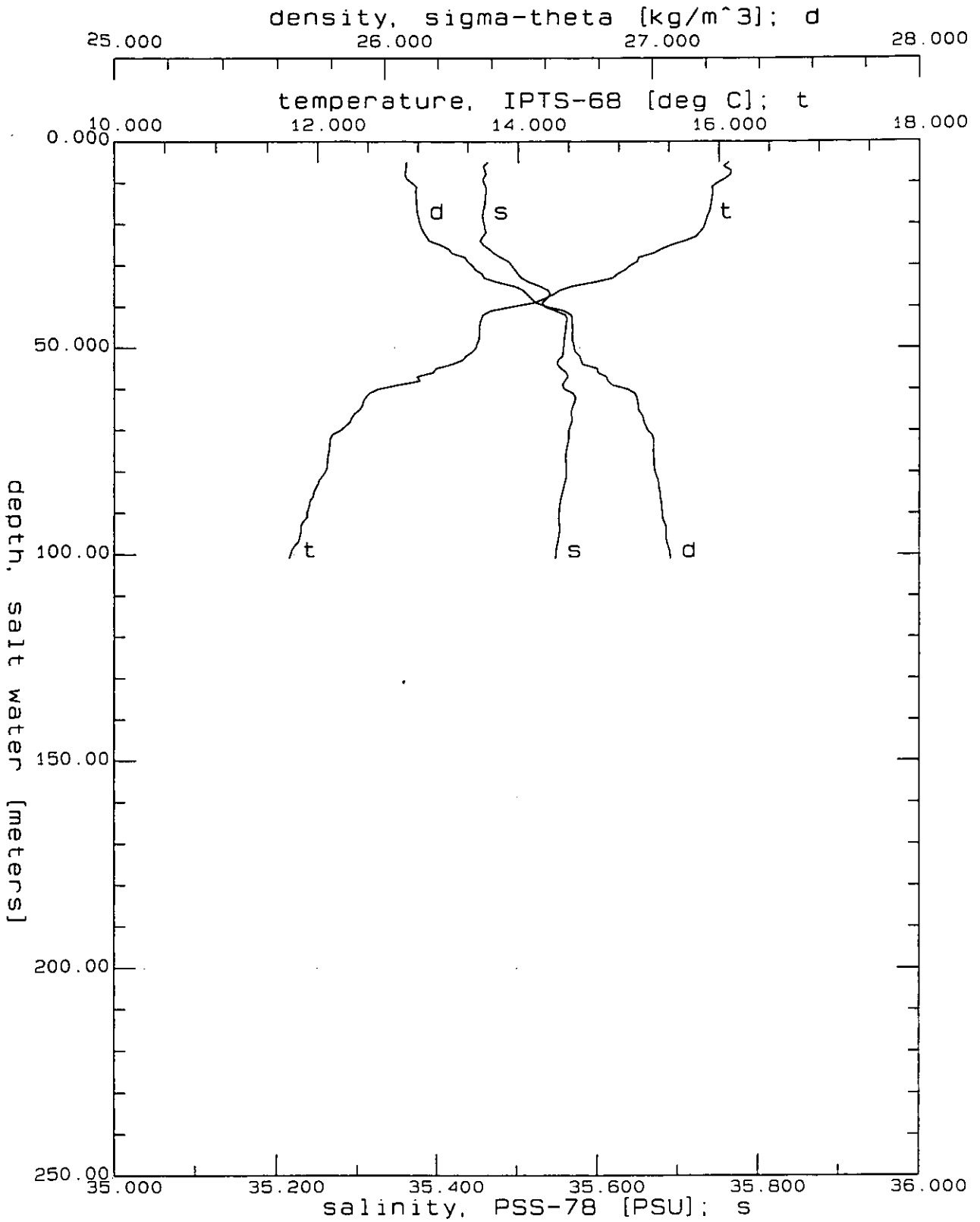
OM9505B.CNV: OMEX 95/21 Station 5 Cast B

Figure 29a



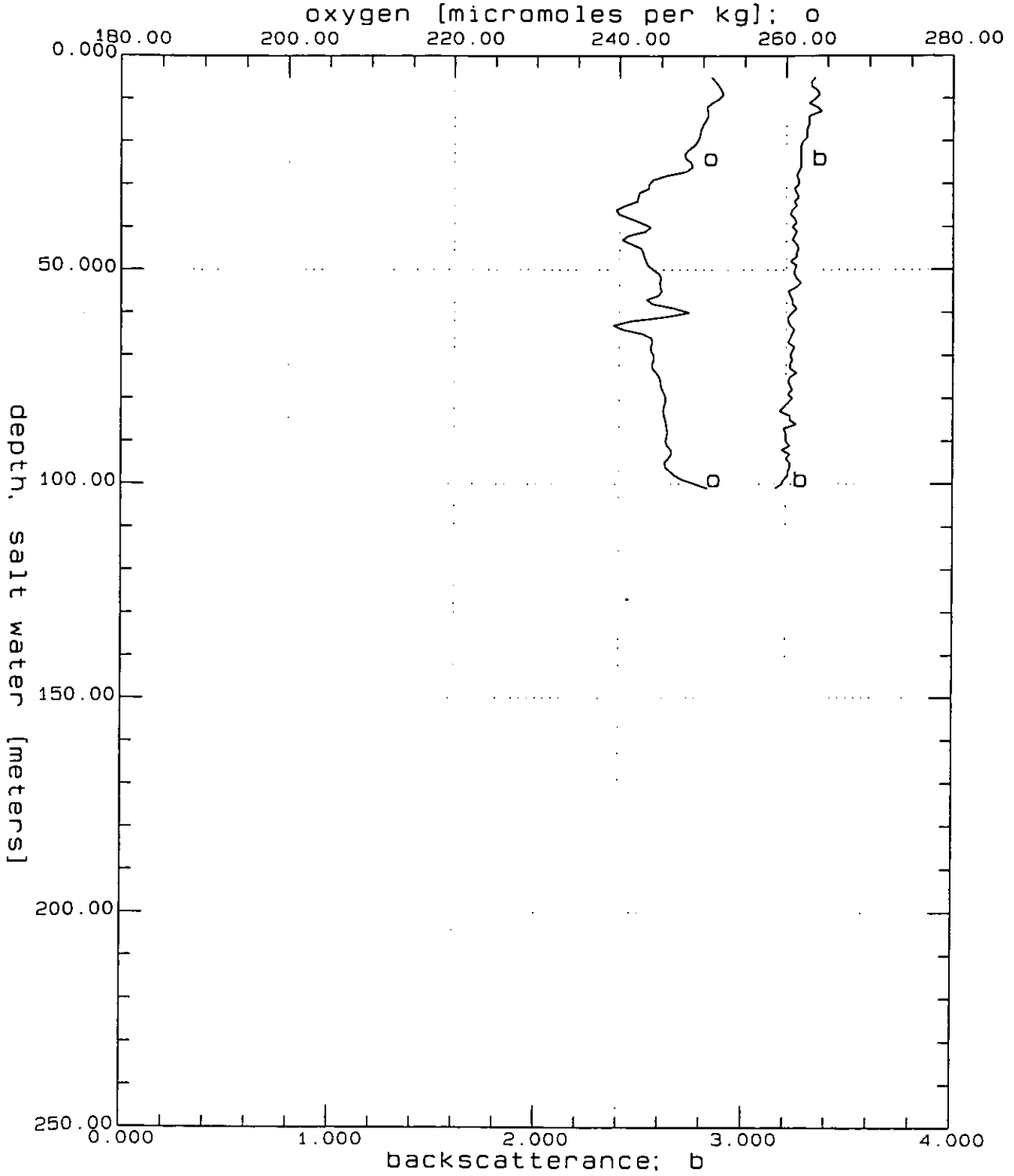
OM9505B.CNV: OMEX 95/21 Station 5 cast B

Figure 29b



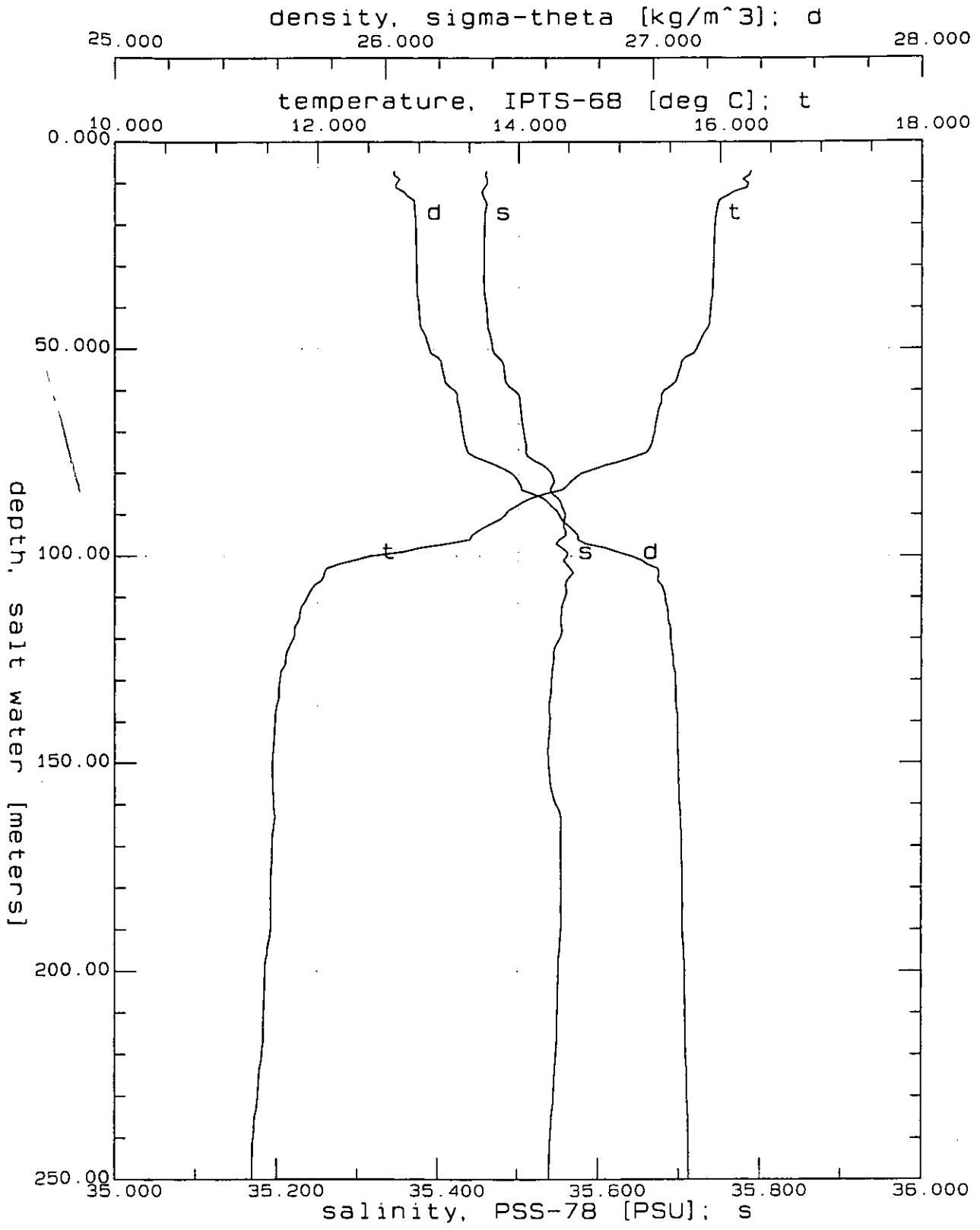
OM9505C.CNV: OMEX 95/21 Station 5 Cast C

Figure 30a



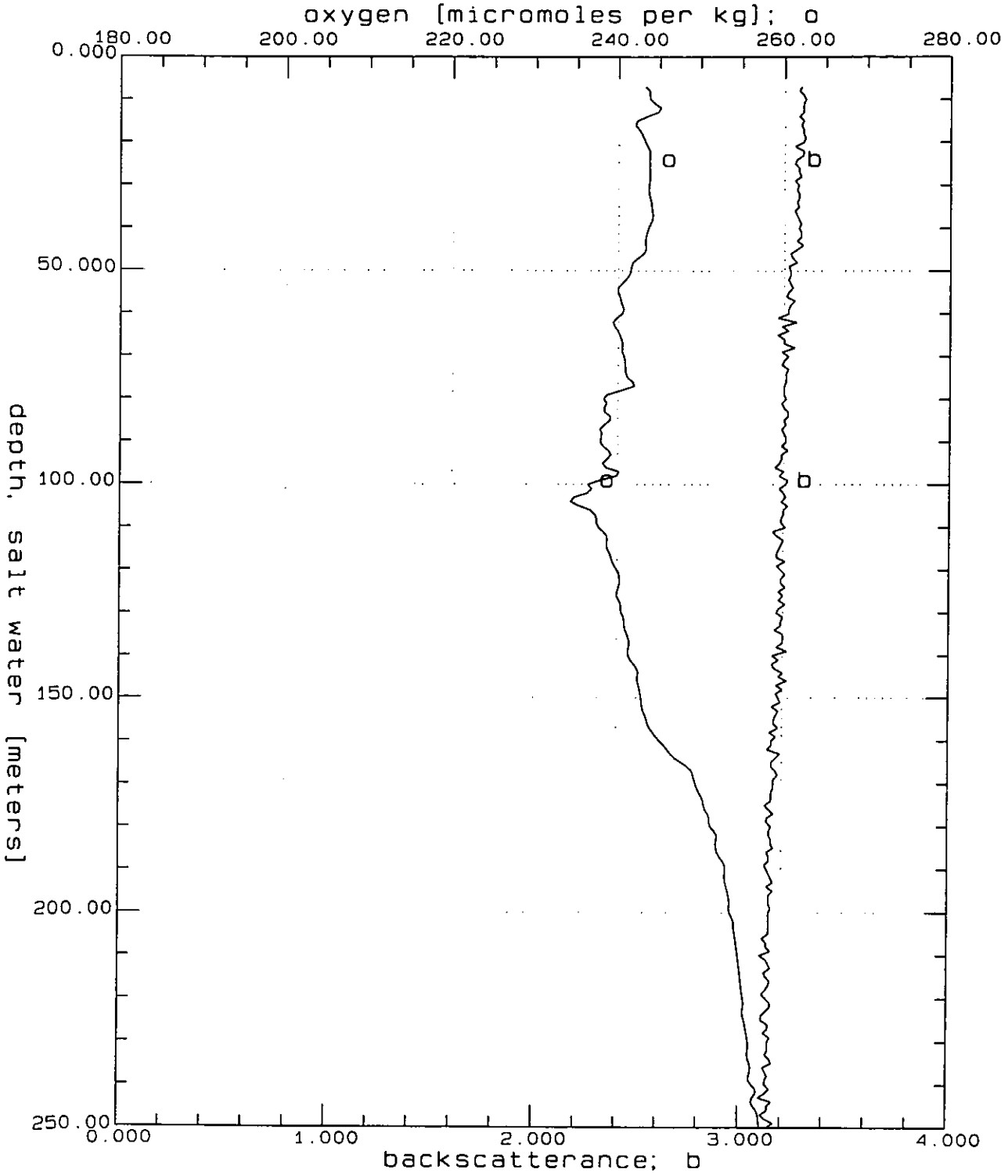
OM9505C.CNV: OMEX 95/21 Station 5 cast C

Figure 30b



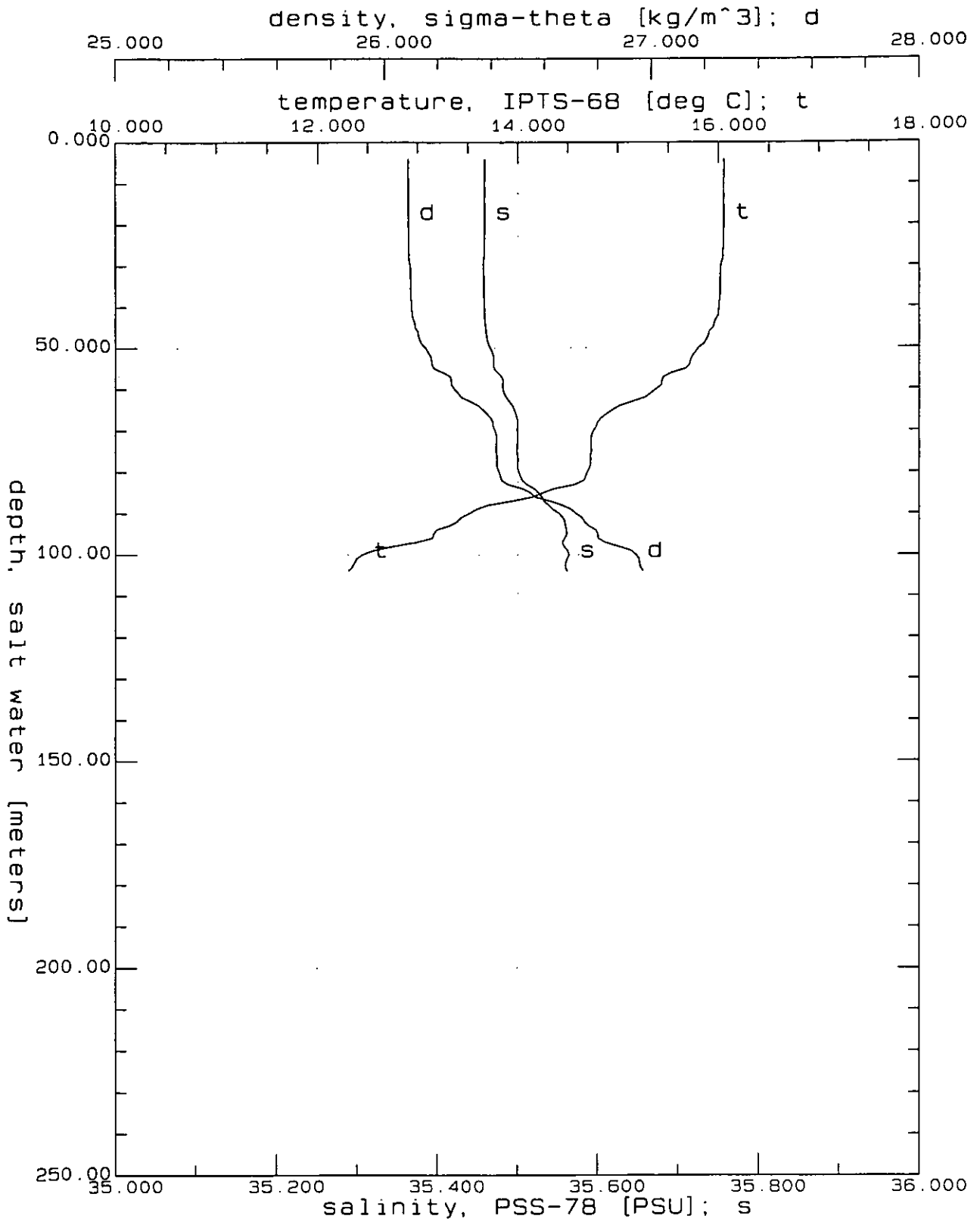
OM9505D.CNV: OMEX 95/21 Station 5 Cast D

Figure 31a



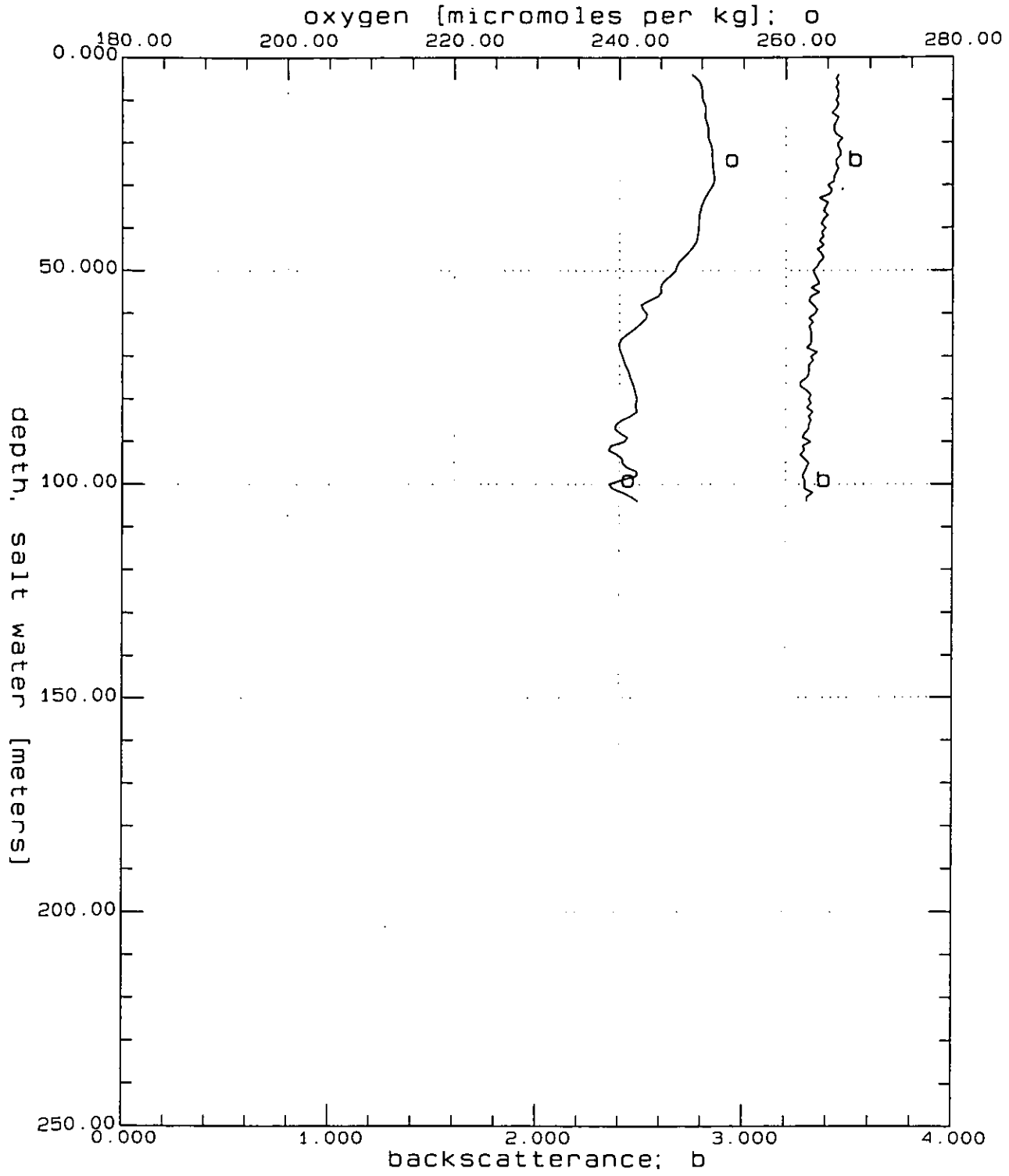
OM9505D.CNV: OMEX 95/21 Station 5 cast D

Figure 31b



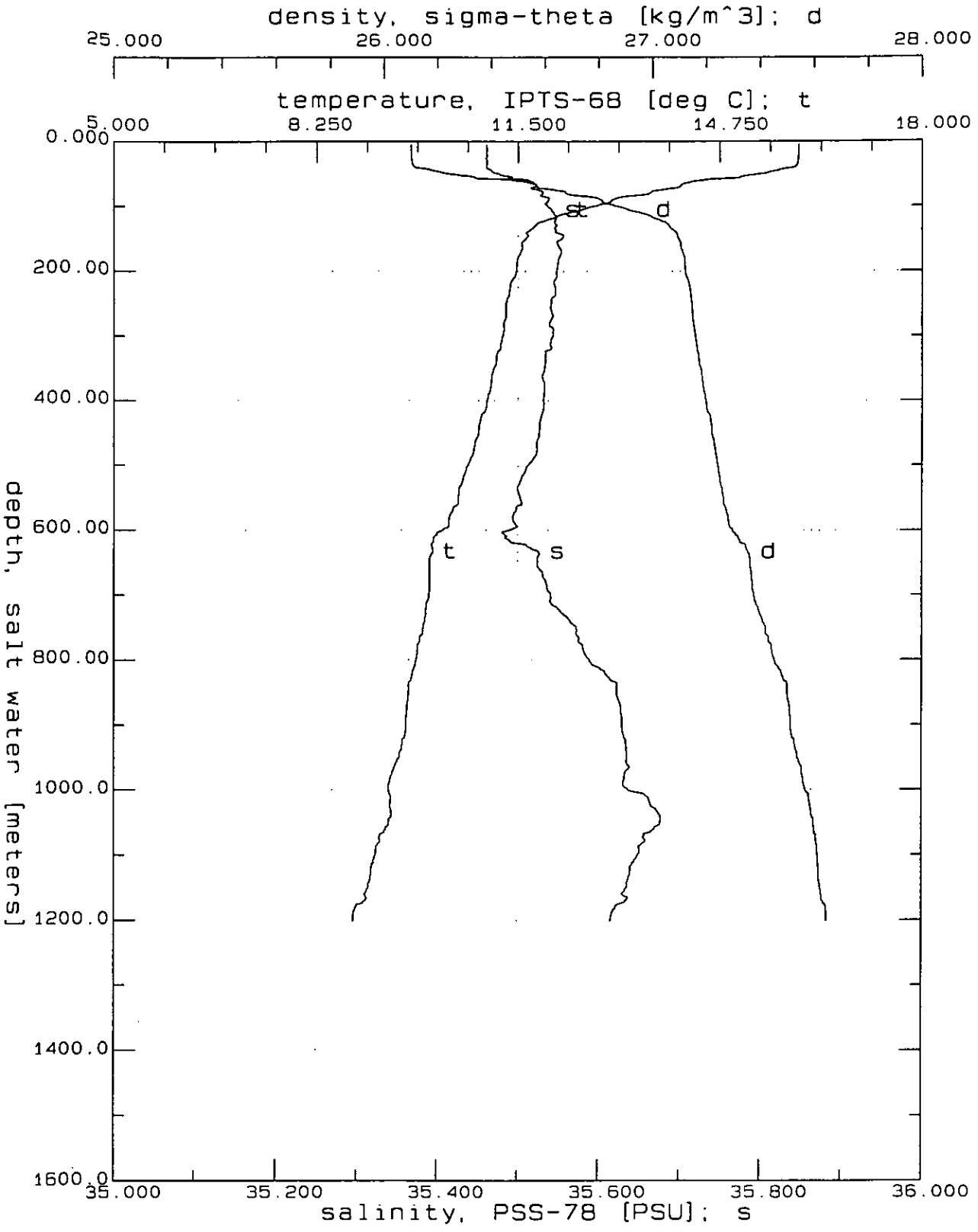
OM9505E.CNV: OMEX 95/21 Station 5 Cast E

Figure 32a



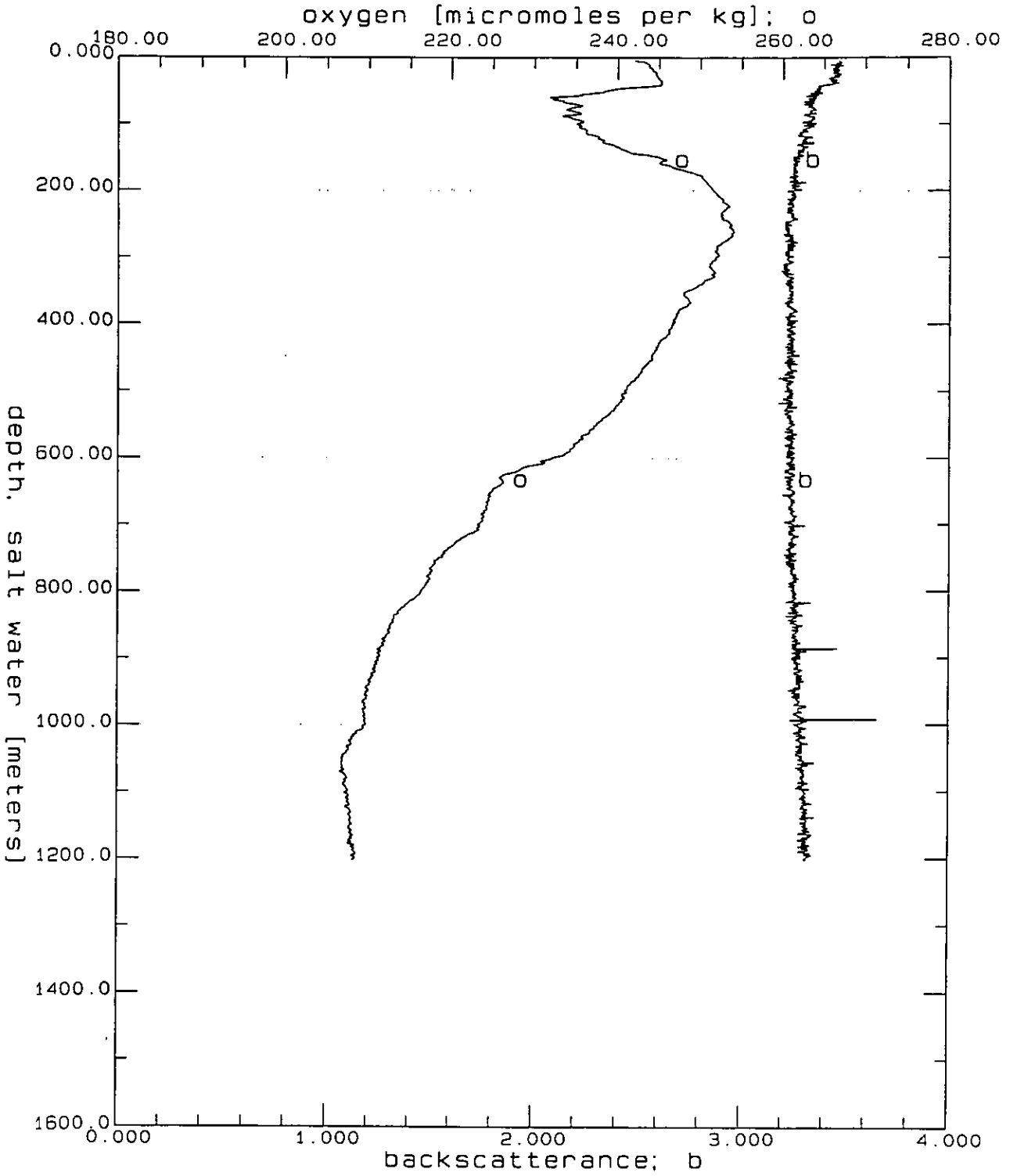
OM9505E.CNV: OMEX 95/21 Station 5 cast E

Figure 32b



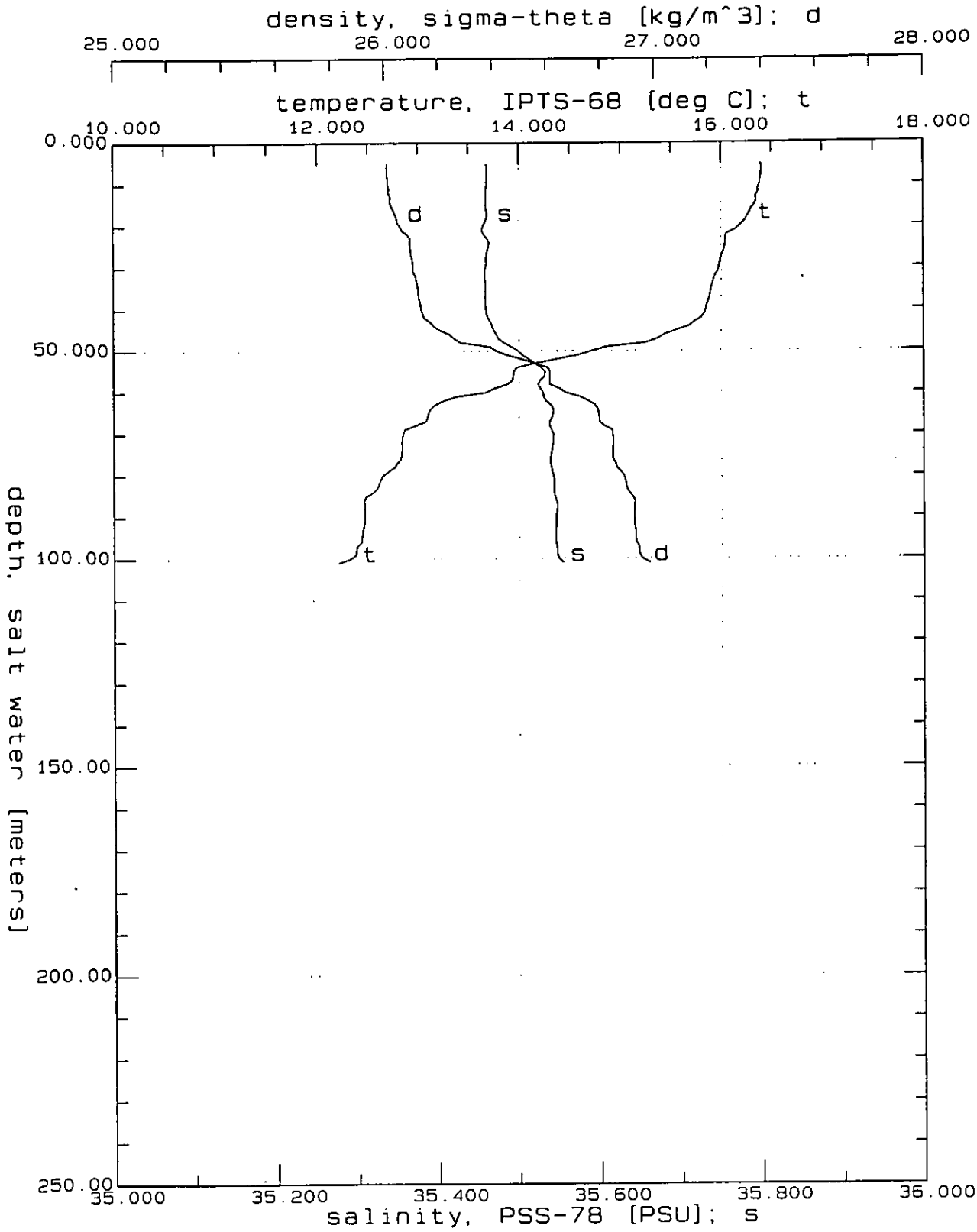
OM9506A.CNV: OMEX 95/21 Station 6 Cast A

Figure 33a



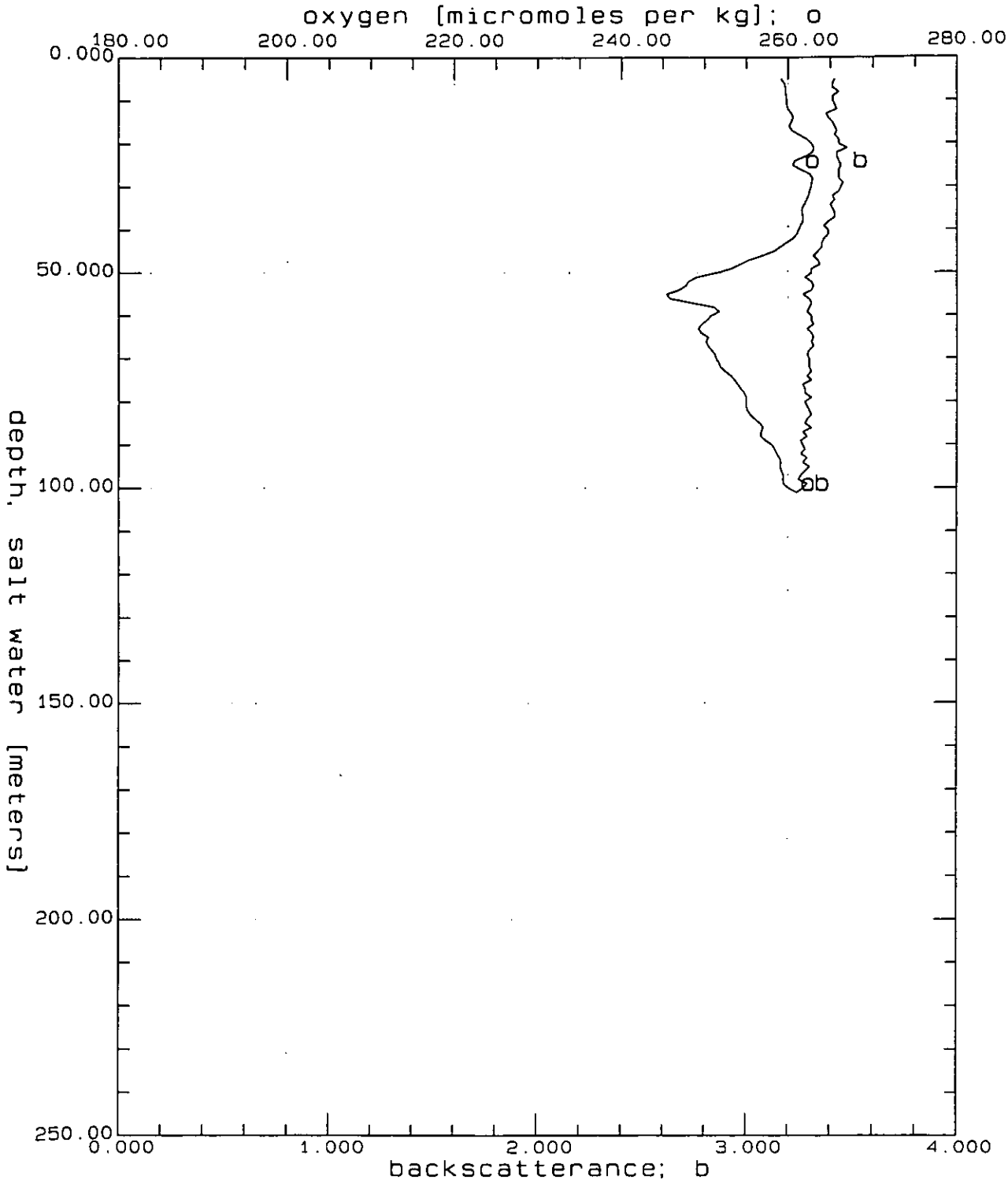
OM9506A.CNV: OMEX 95/21 Station 6 cast A

Figure 33b



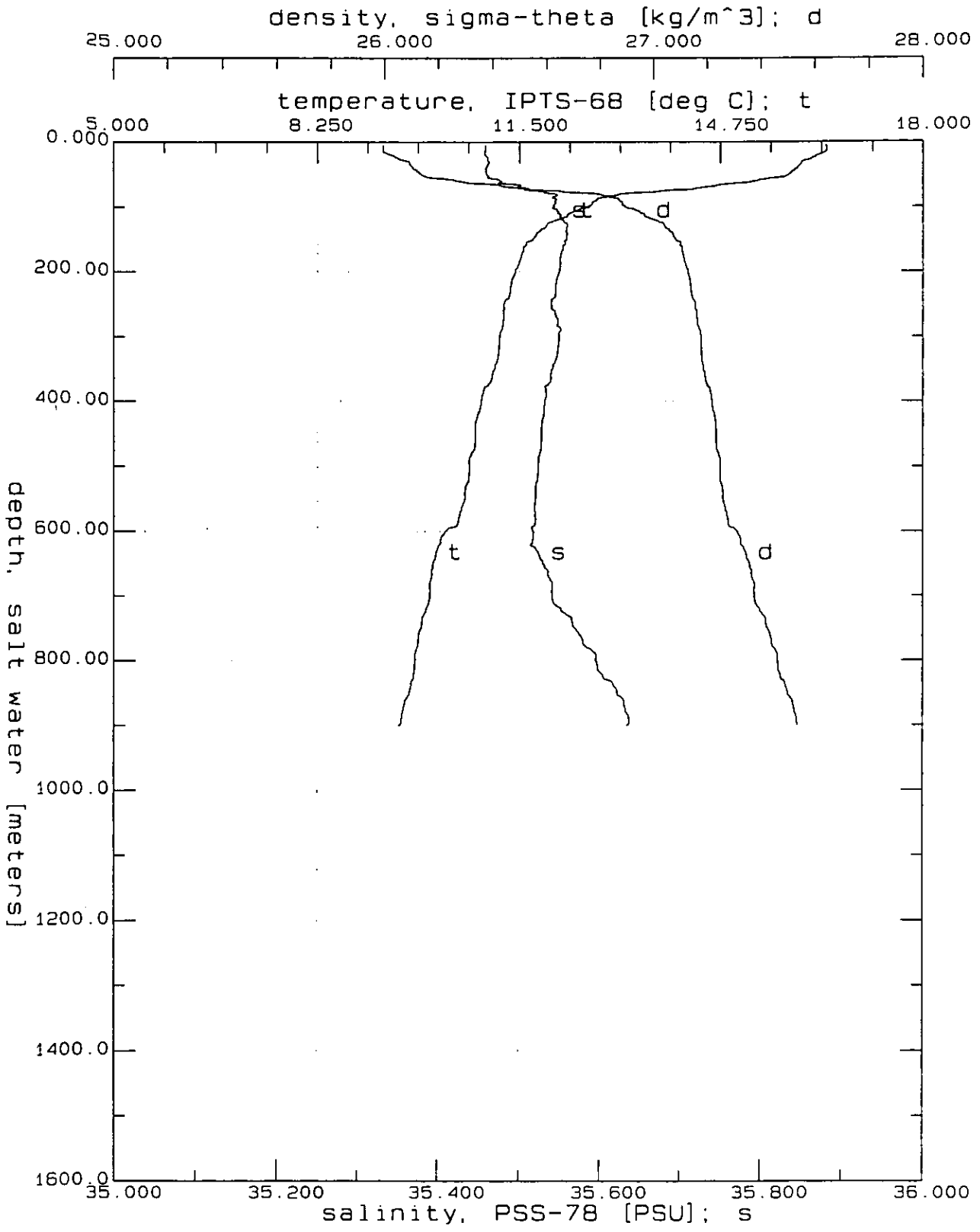
OM9507A.CNV: OMEX 95/21 Station 7 Cast A

Figure 34a



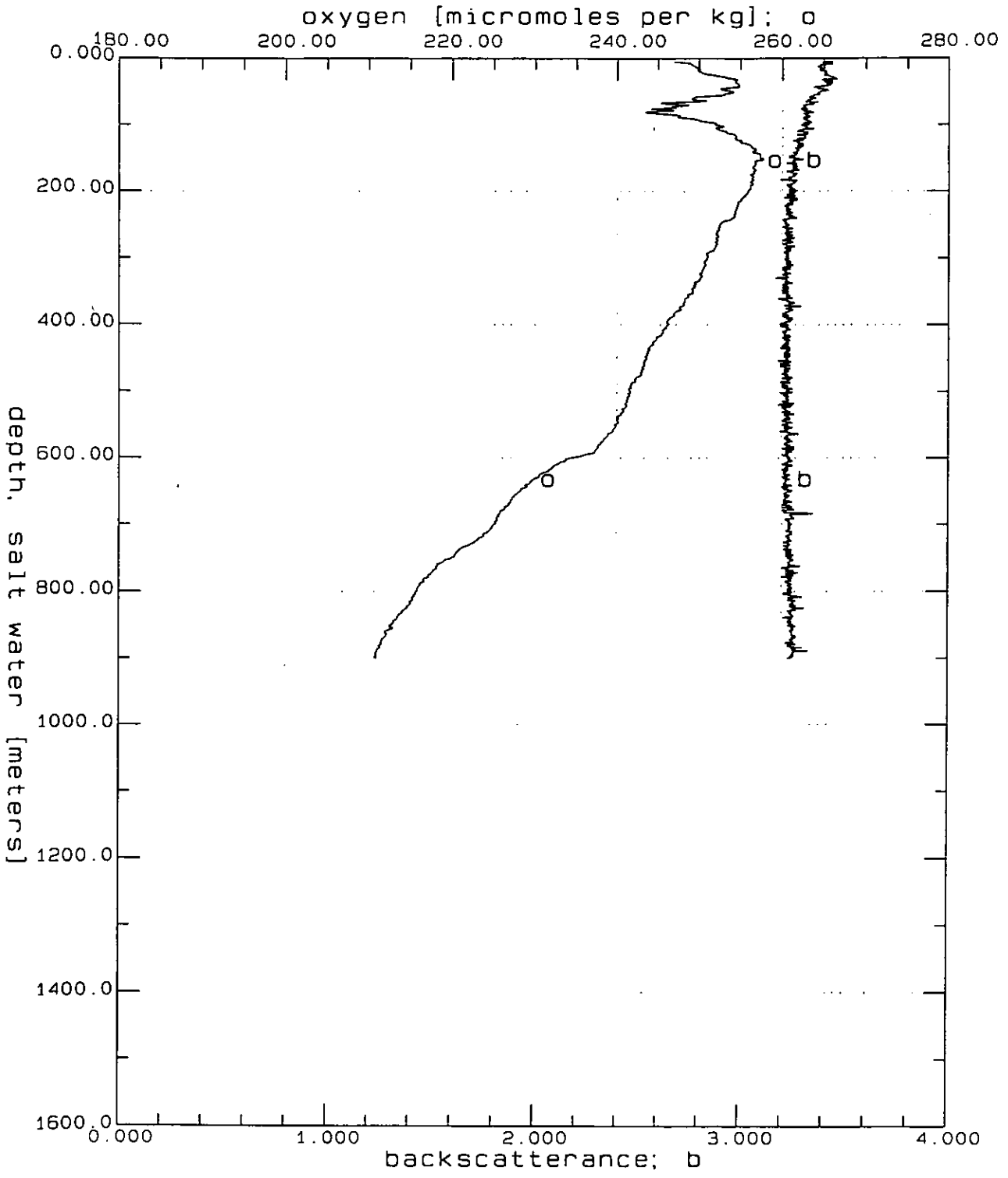
OM9507A.CNV: OMEX 95/21 Station 7 cast A

Figure 34b



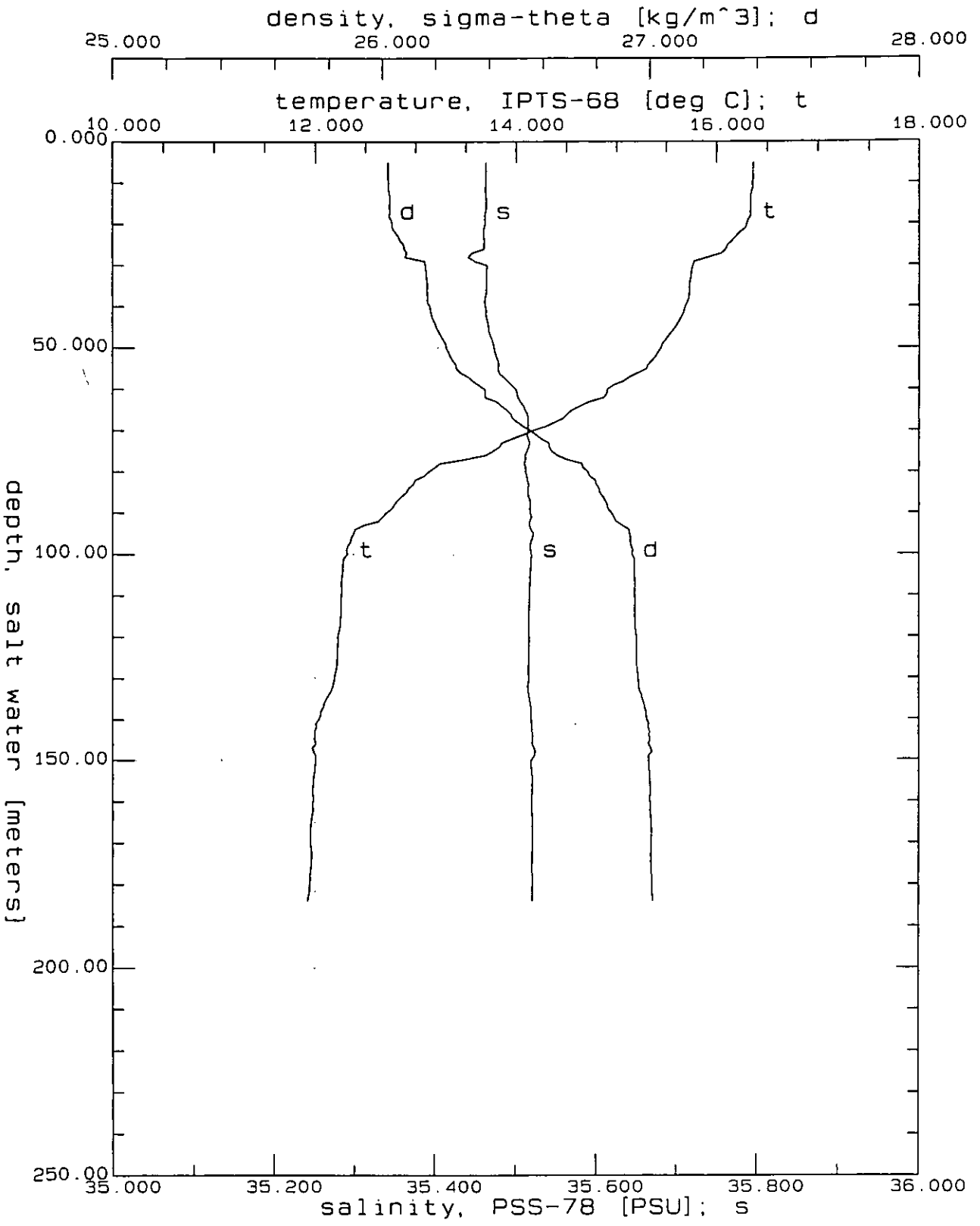
OM9507B.CNV: OMEX 95/21 Station 7 Cast 8

Figure 35a



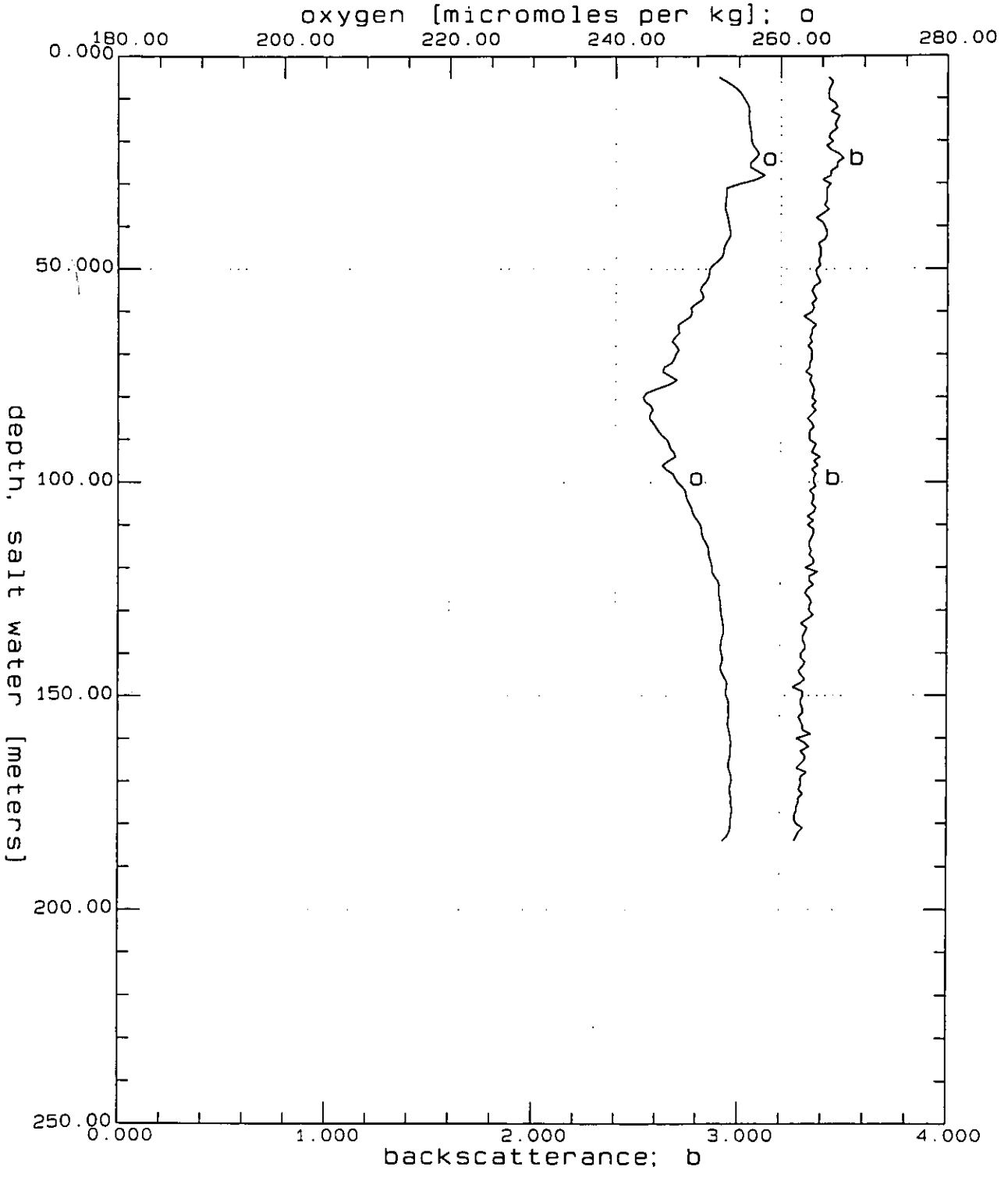
OM9507B.CNV: OMEX 95/21 Station 7 cast B

Figure 35b



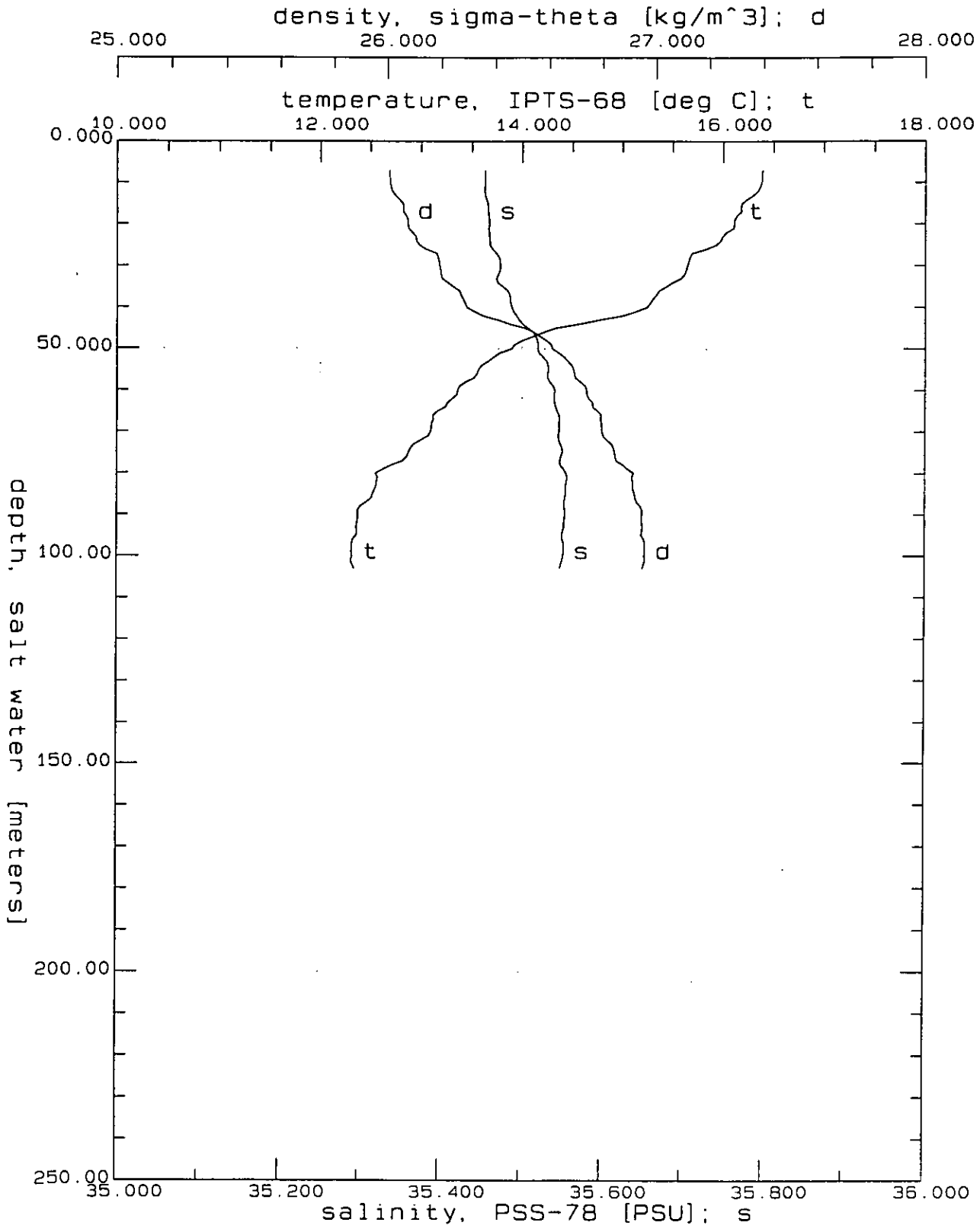
OM9508A.CNV: OMEX 95/21 Station 8 Cast A

Figure 36a



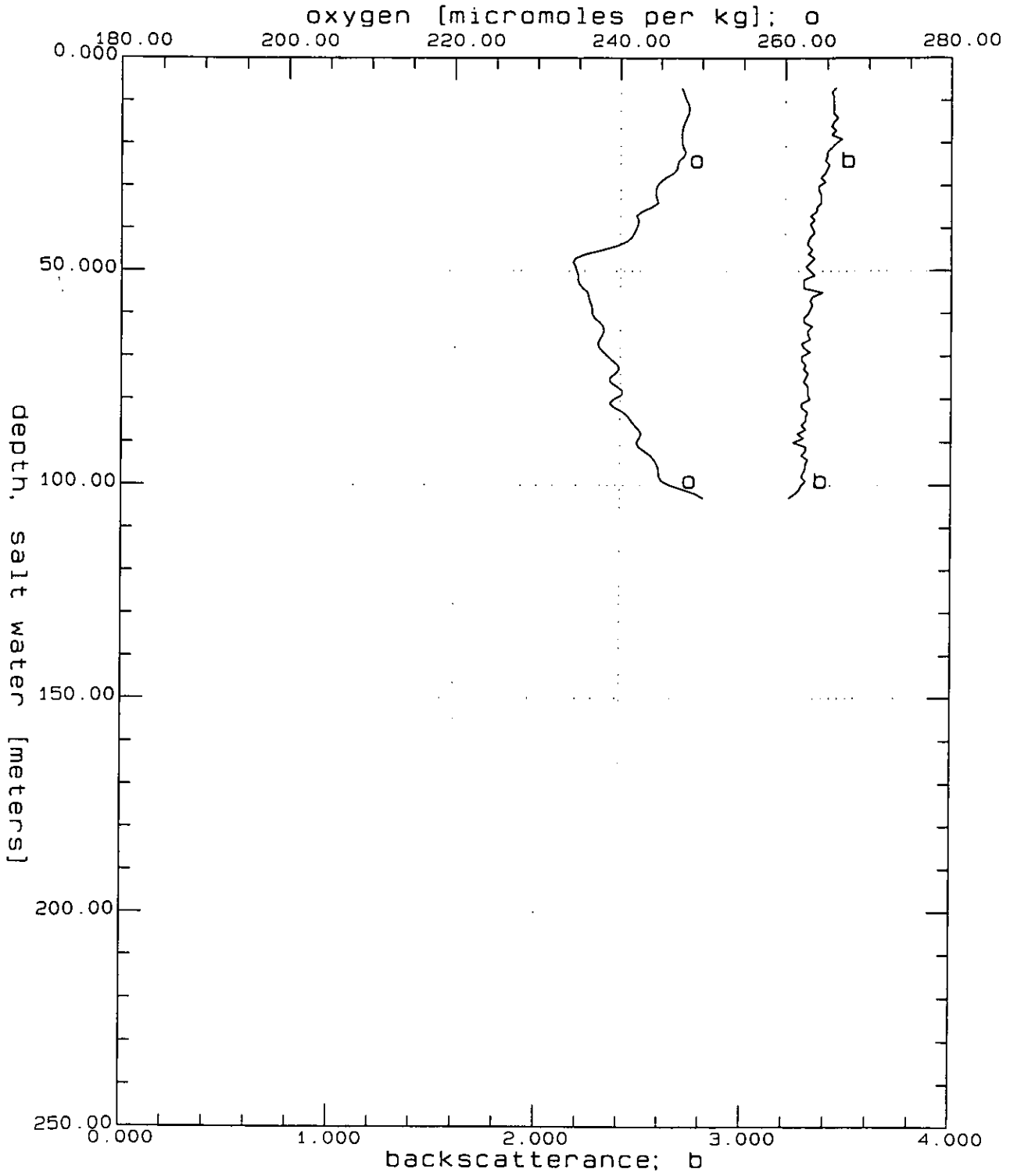
OM9508A.CNV: OMEX 95/21 Station 8 cast A

Figure 36b



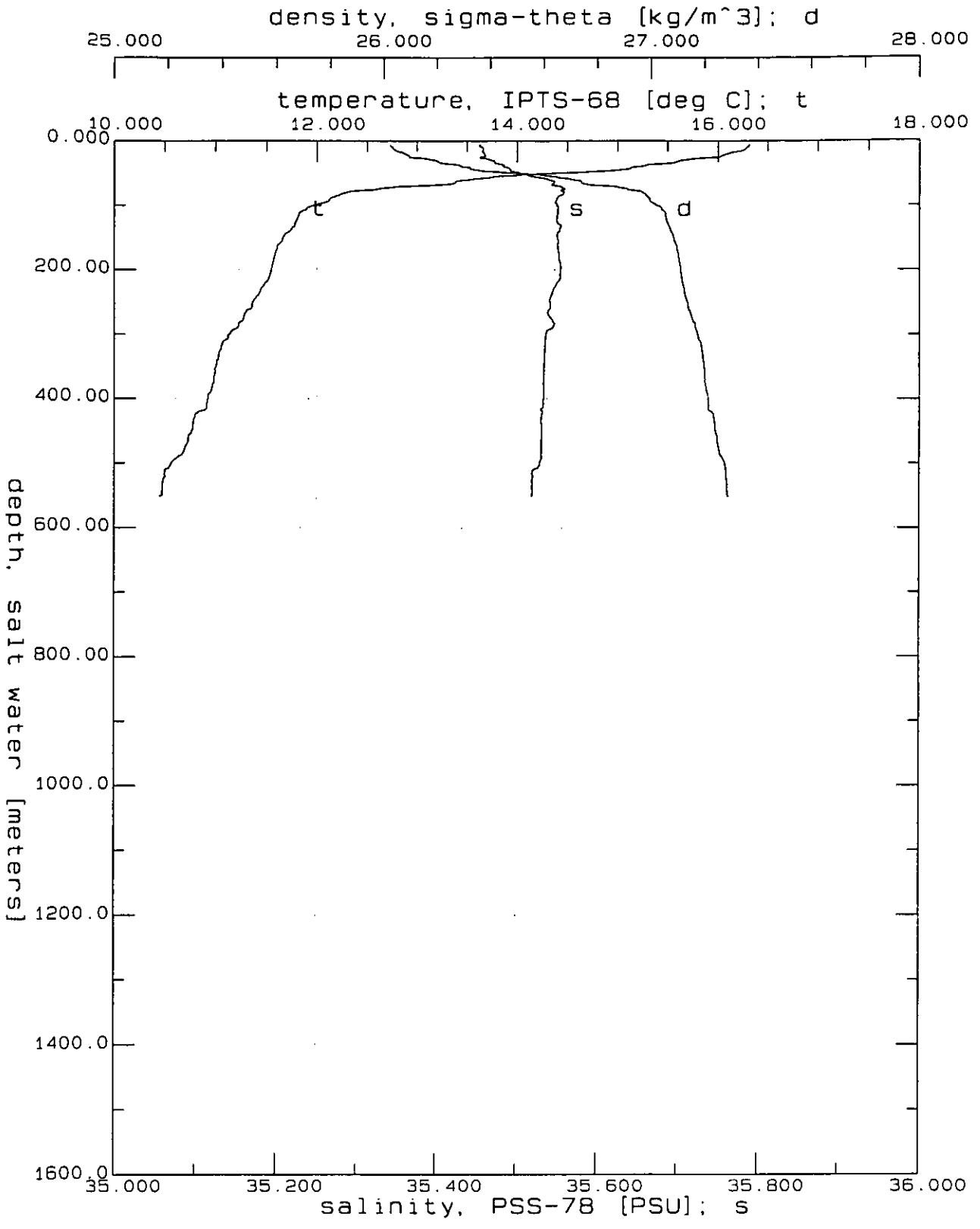
OM9509A.CNV: OMEX 95/21 Station 9 Cast A

Figure 37a



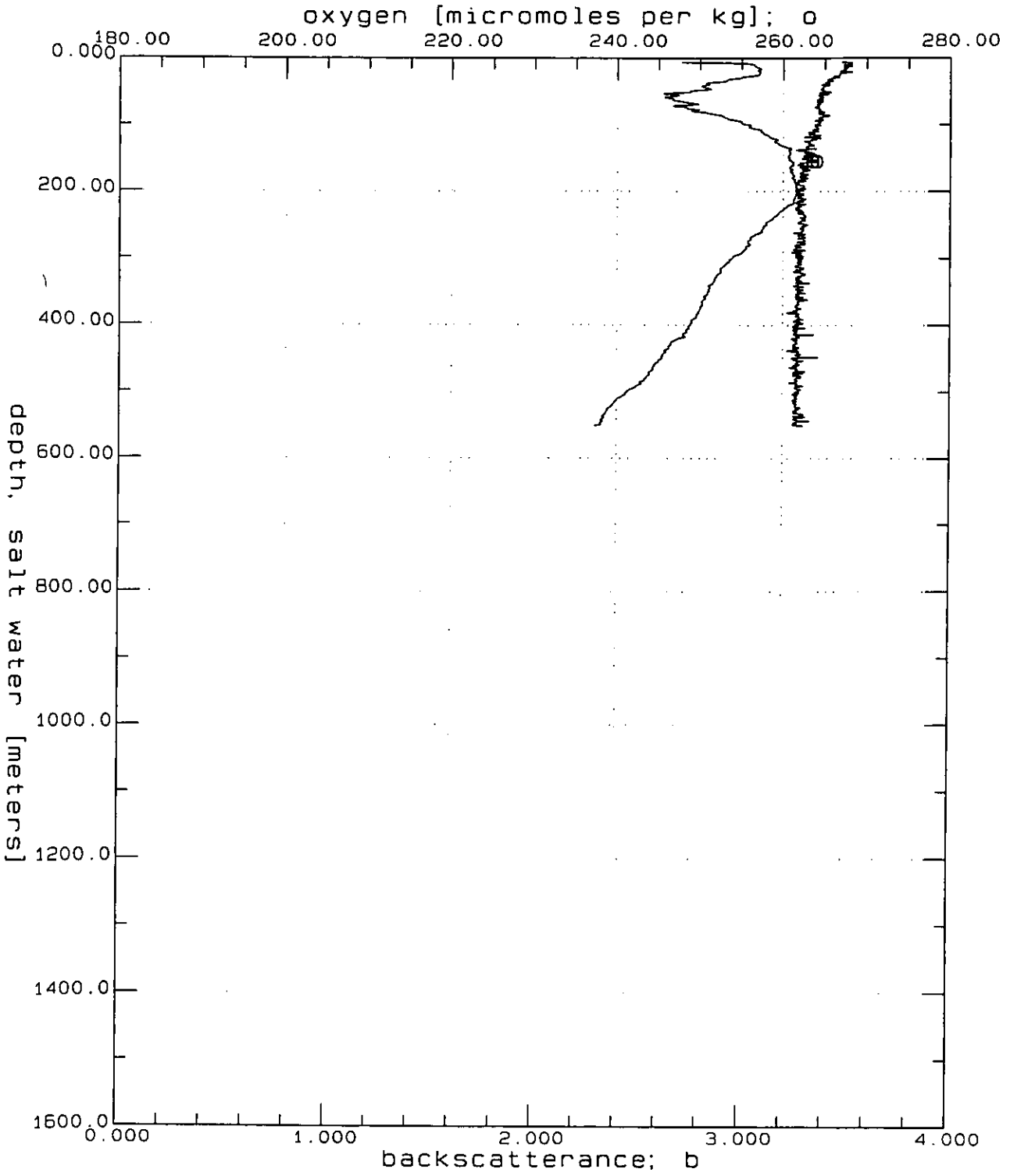
OM9509A.CNV: OMEX 95/21 Station 9 cast A

Figure 37b



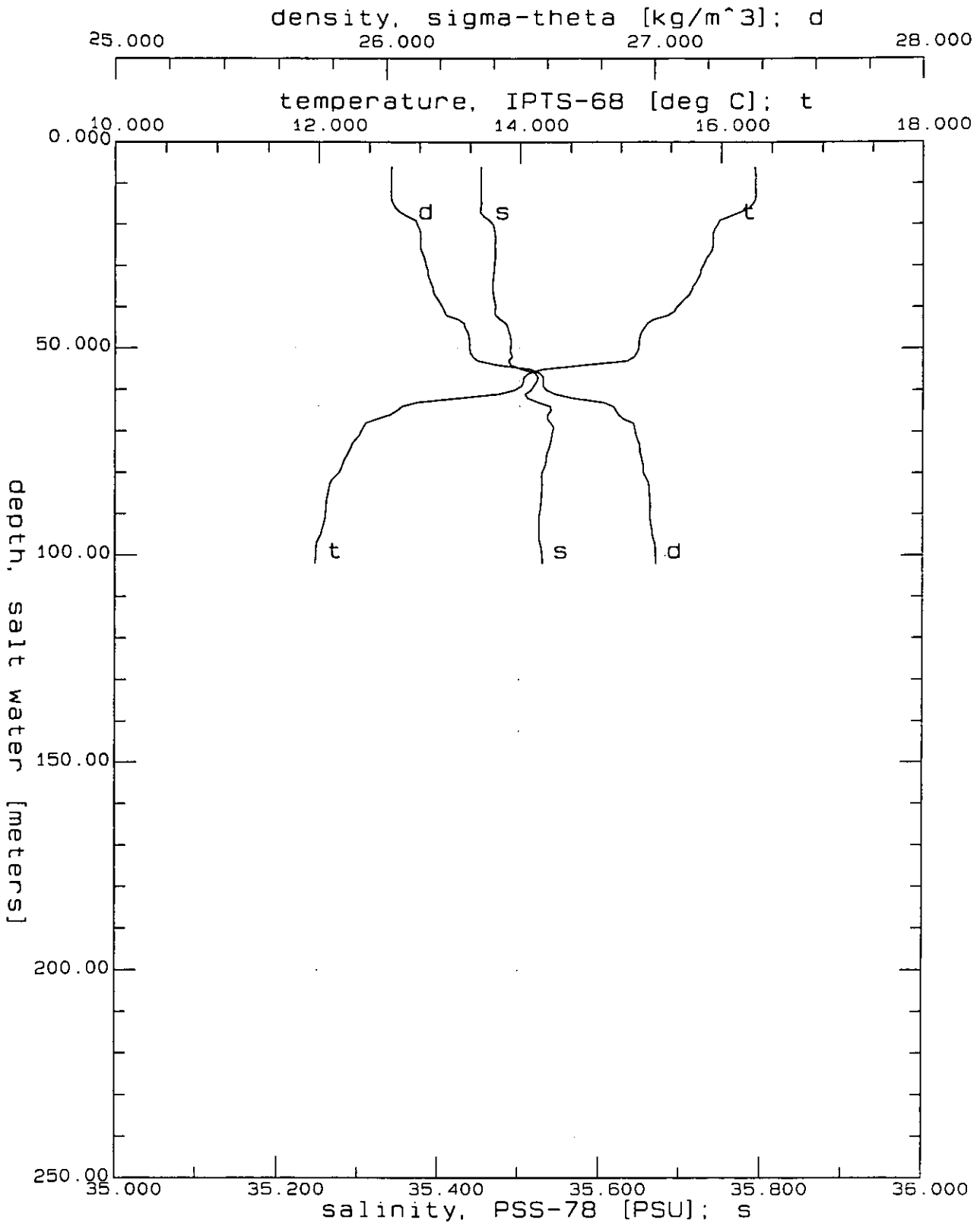
OM9509B.CNV: OMEX 95/21 Station 9 Cast B

Figure 38a



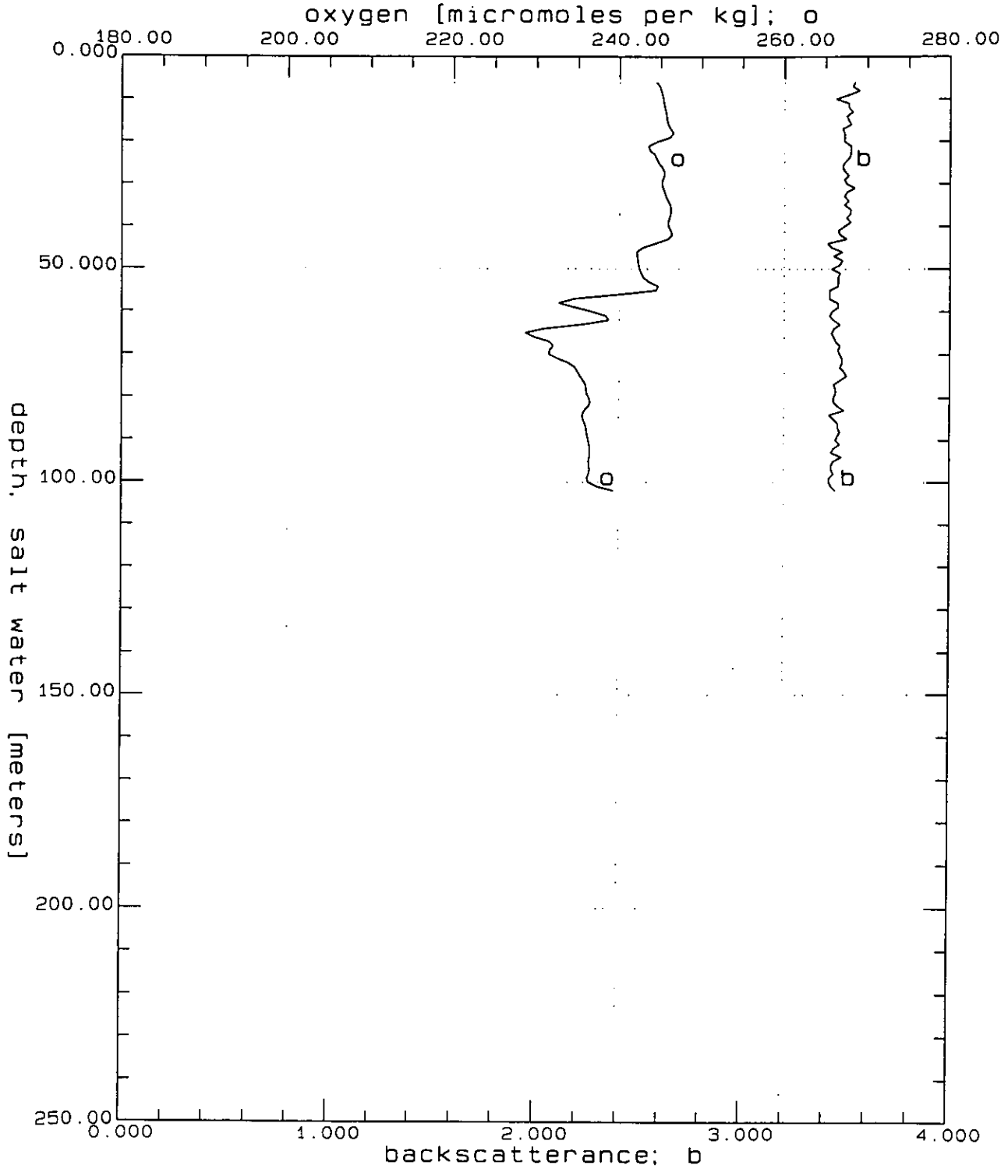
OM9509B.CNV: OMEX 95/21 Station 9 cast B

Figure 38b



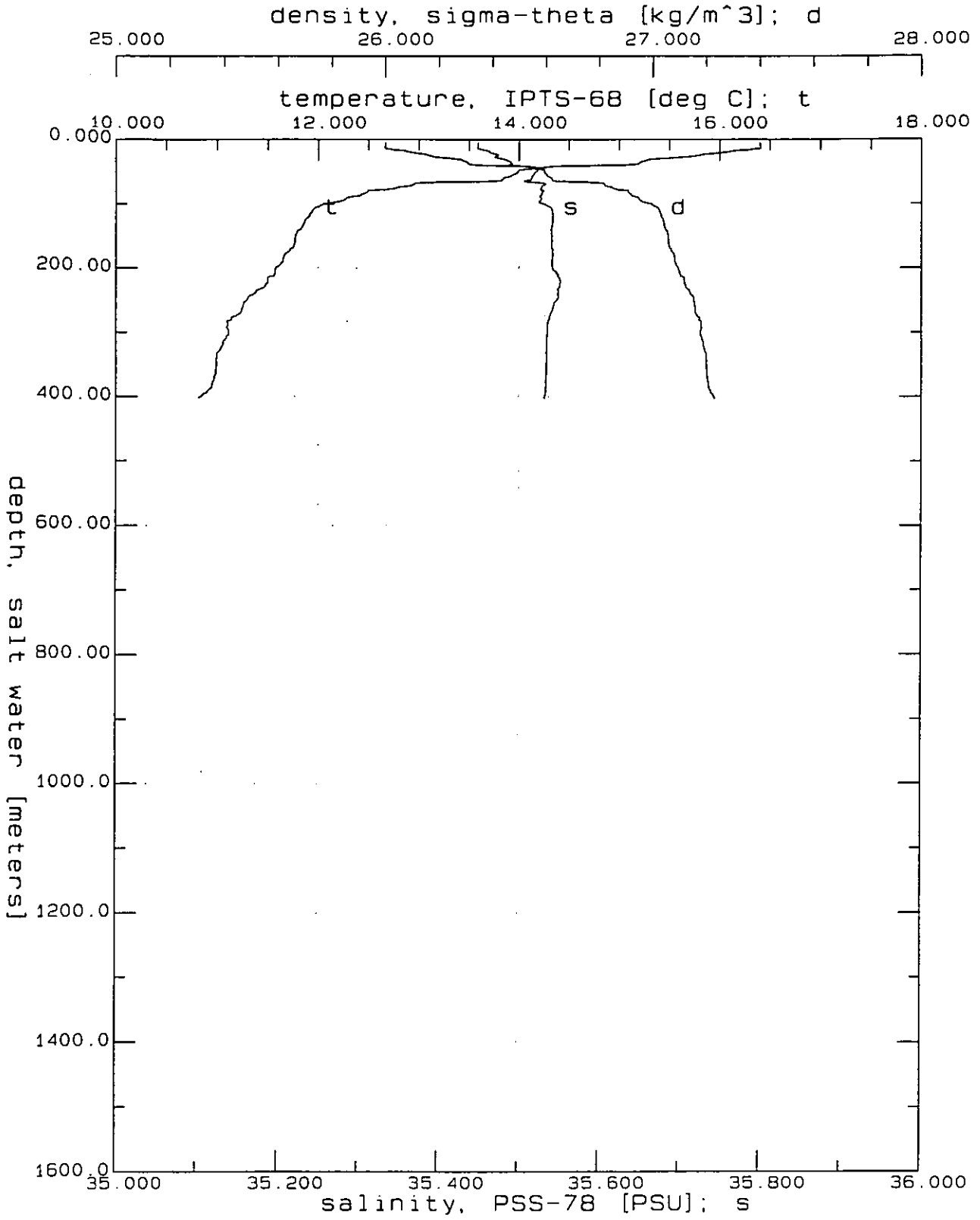
OM9510A.CNV: OMEX 95/21 Station 10 Cast A

Figure 39a



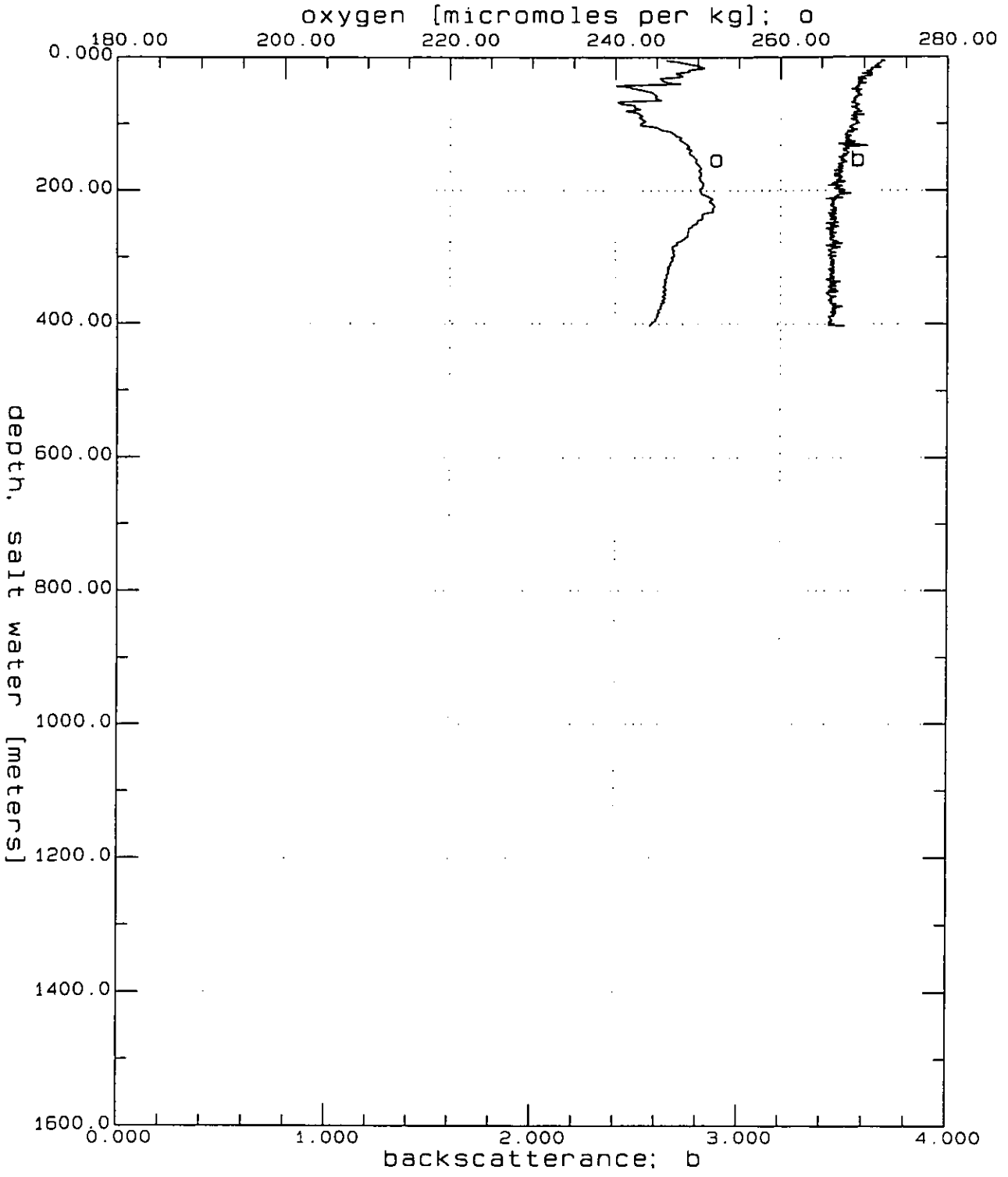
OM9510A.CNV: OMEX 95/21 Station 10 cast A

Figure 39b



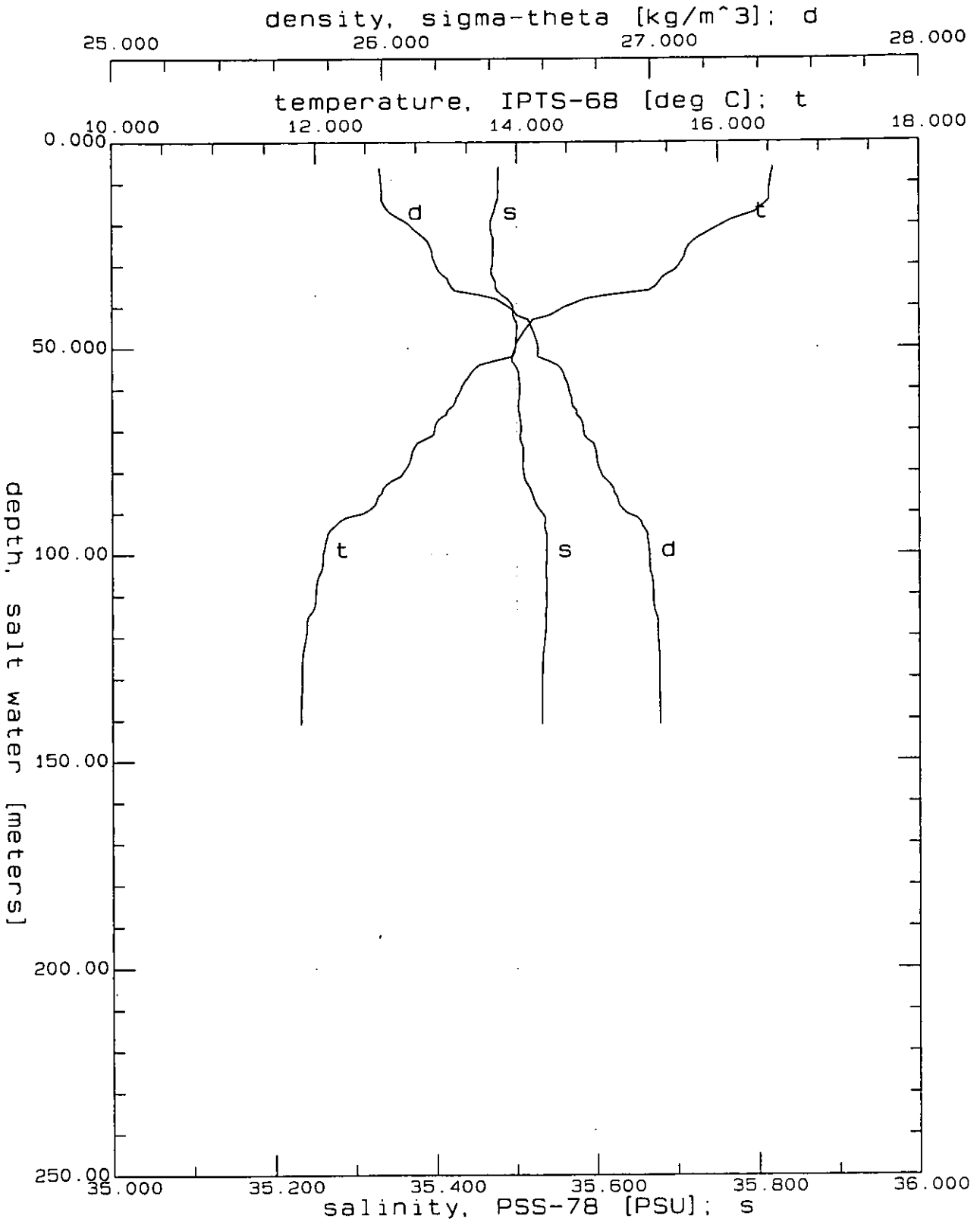
OM9510B.CNV: OMEX 95/21 Station 10 Cast B

Figure 40a



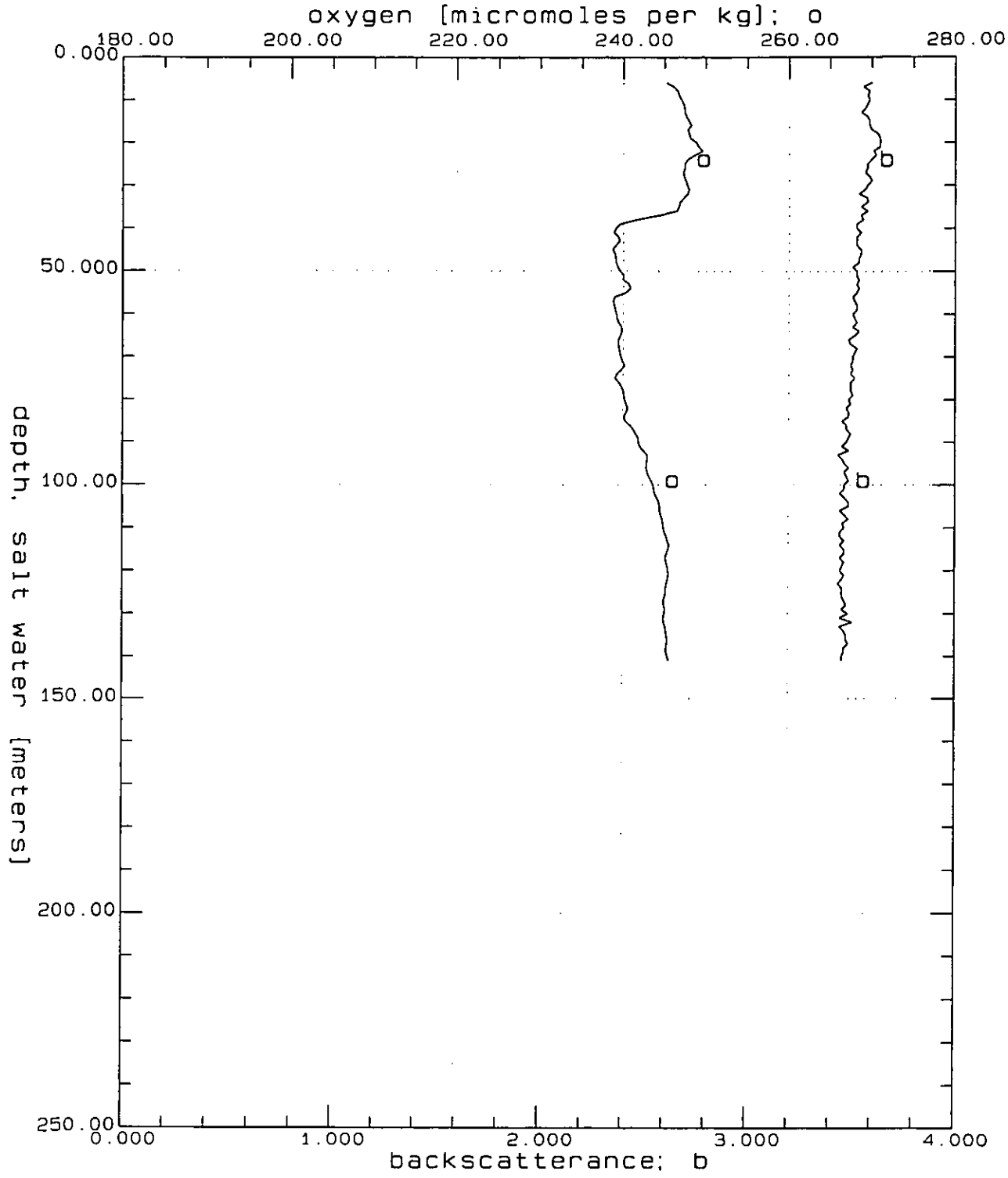
OM9510B.CNV: OMEX 95/21 Station 10 cast B

Figure 40b



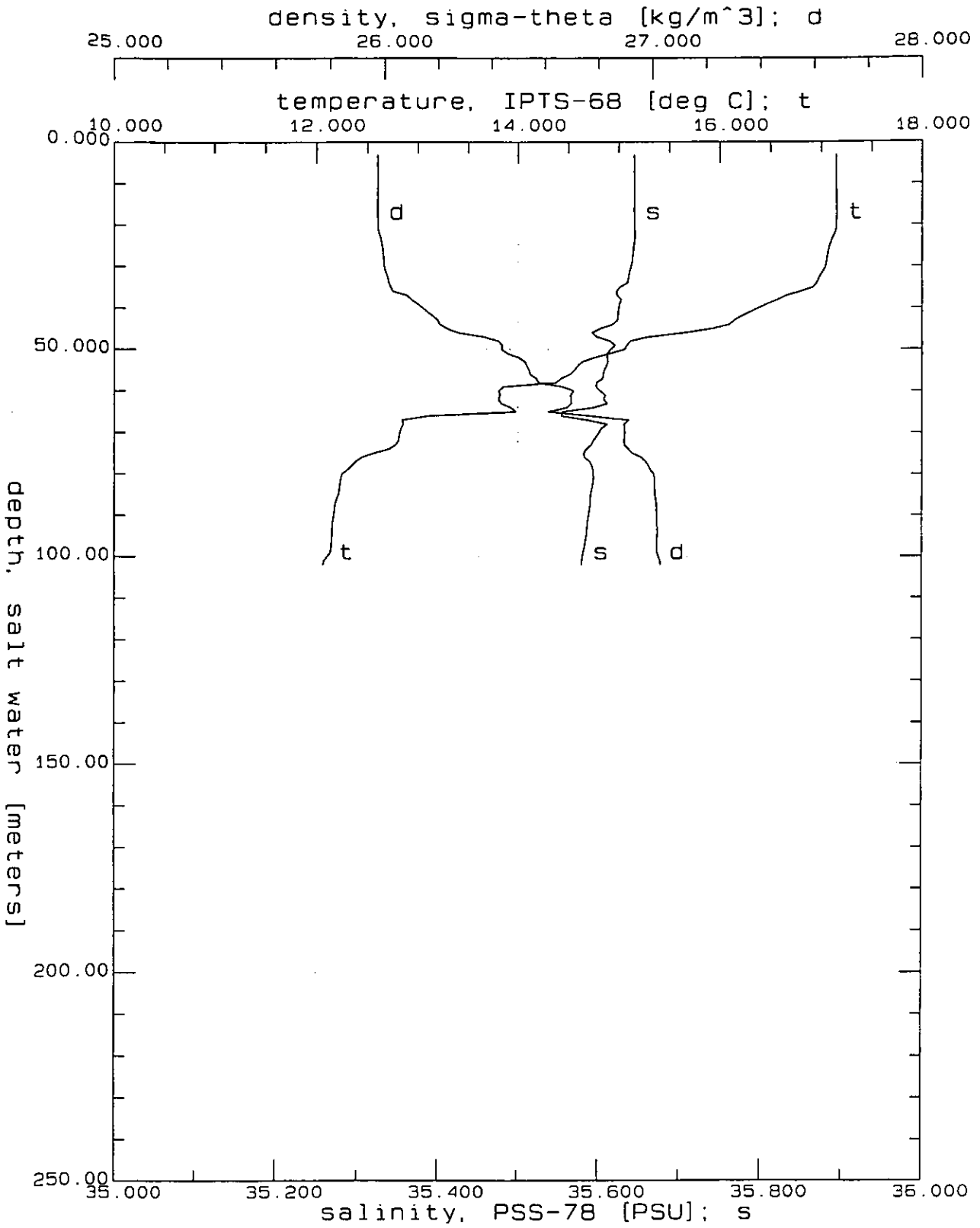
OM9511A.CNV: OMEX 95/21 Station 11 Cast A

Figure 41a



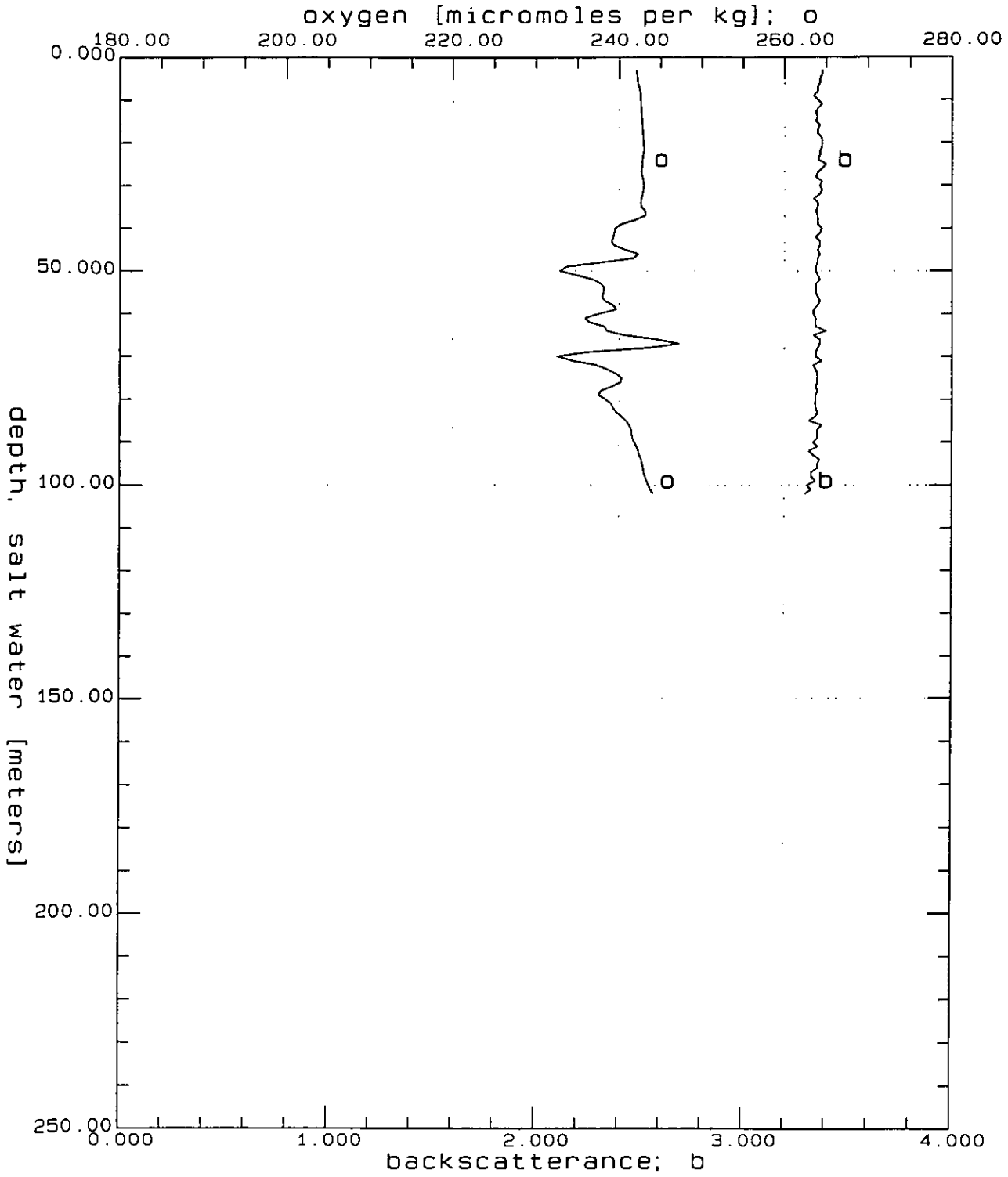
OM9511A.CNV: OMEX 95/21 Station 11 cast A

Figure 41b



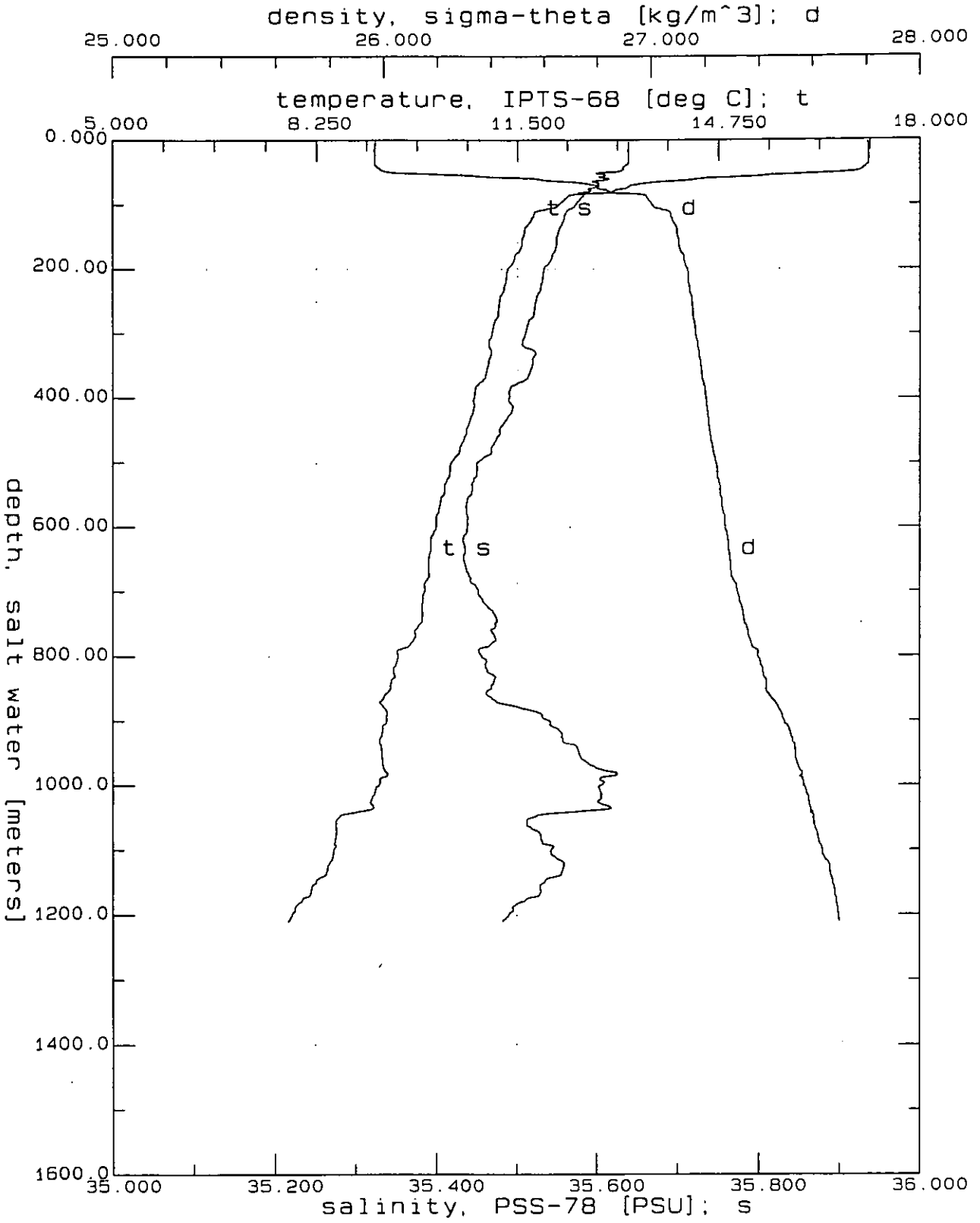
OM9512A.CNV: OMEX 95/22 Station 12 Cast A

Figure 42a



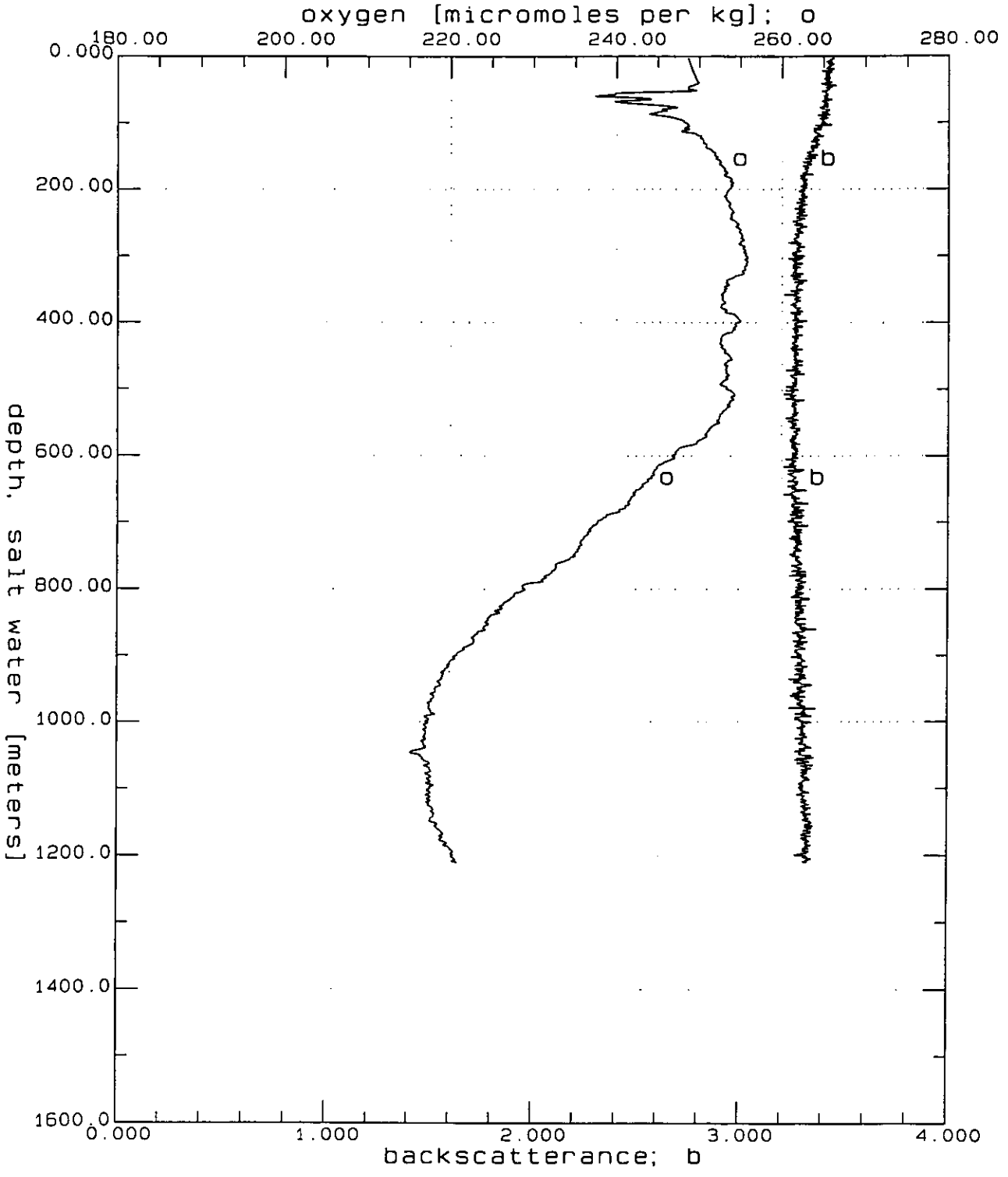
OM9512A.CNV: OMEX 95/22 Station 12 cast A

Figure 42b



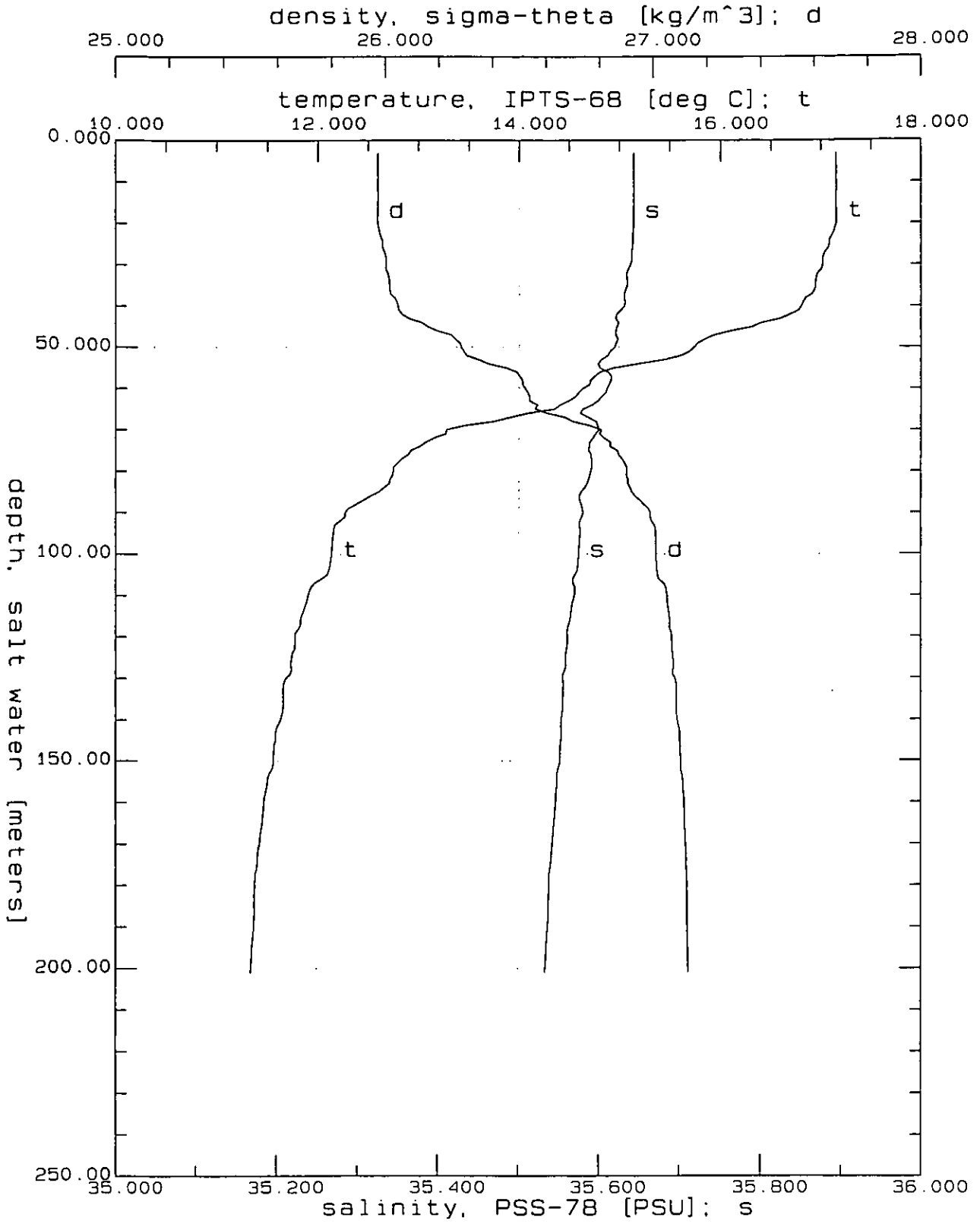
OM9512B.CNV: OMEX 95/22 Station 12 Cast B

Figure 43a



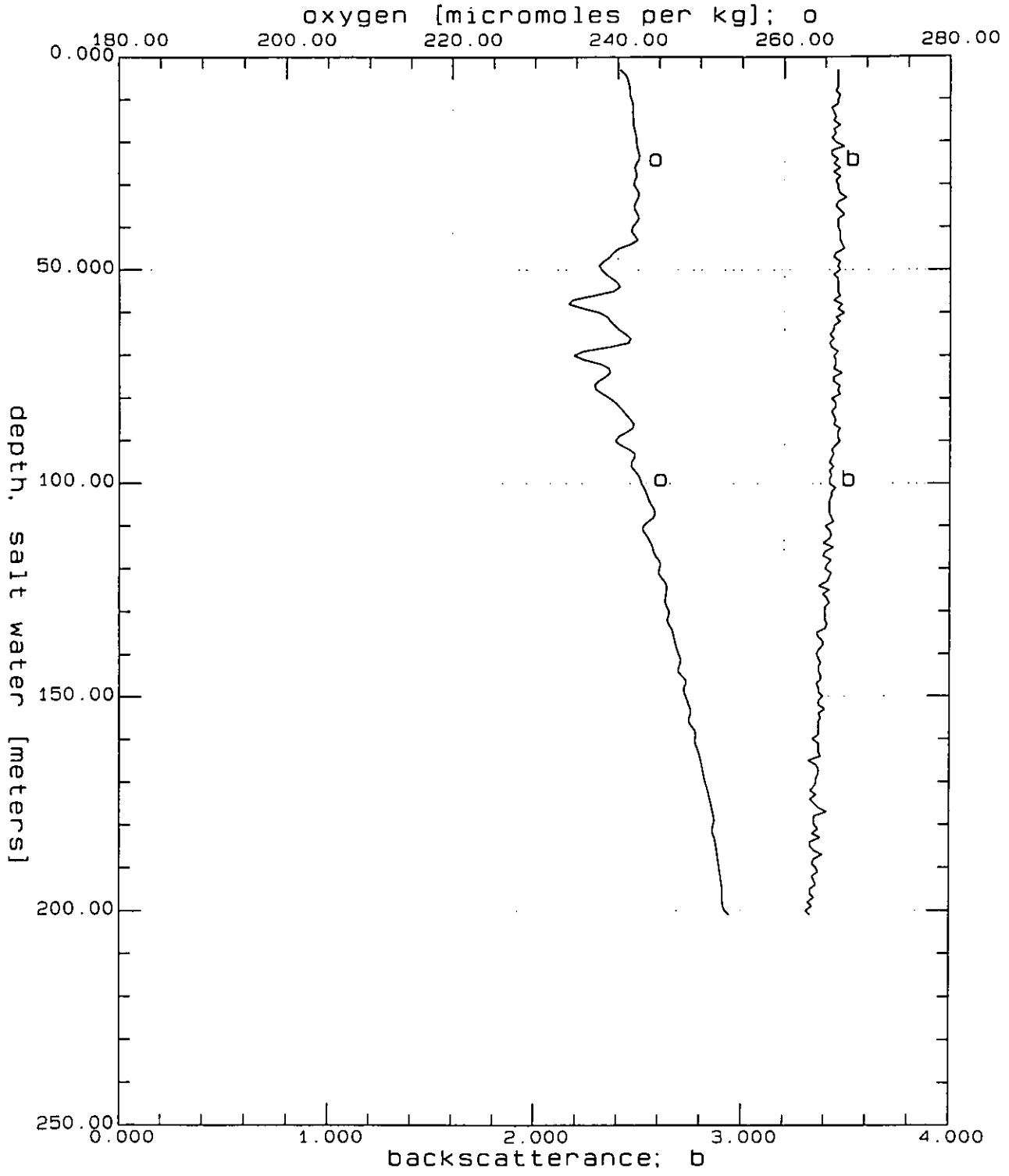
OM9512B.CNV: OMEX 95/22 Station 12 cast B

Figure 43b



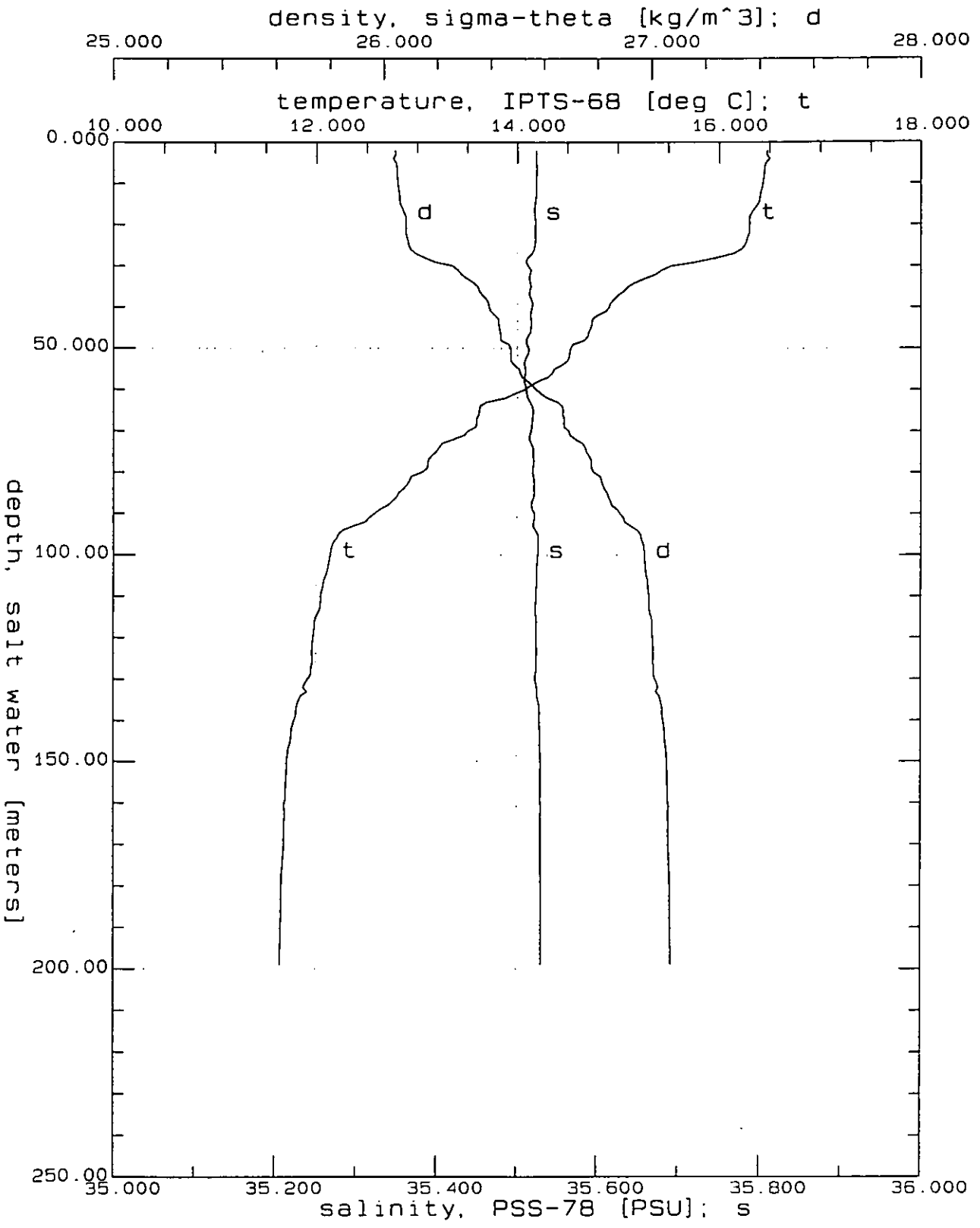
OM9512C.CNV: OMEX 95/22 Station 12 Cast C

Figure 44a



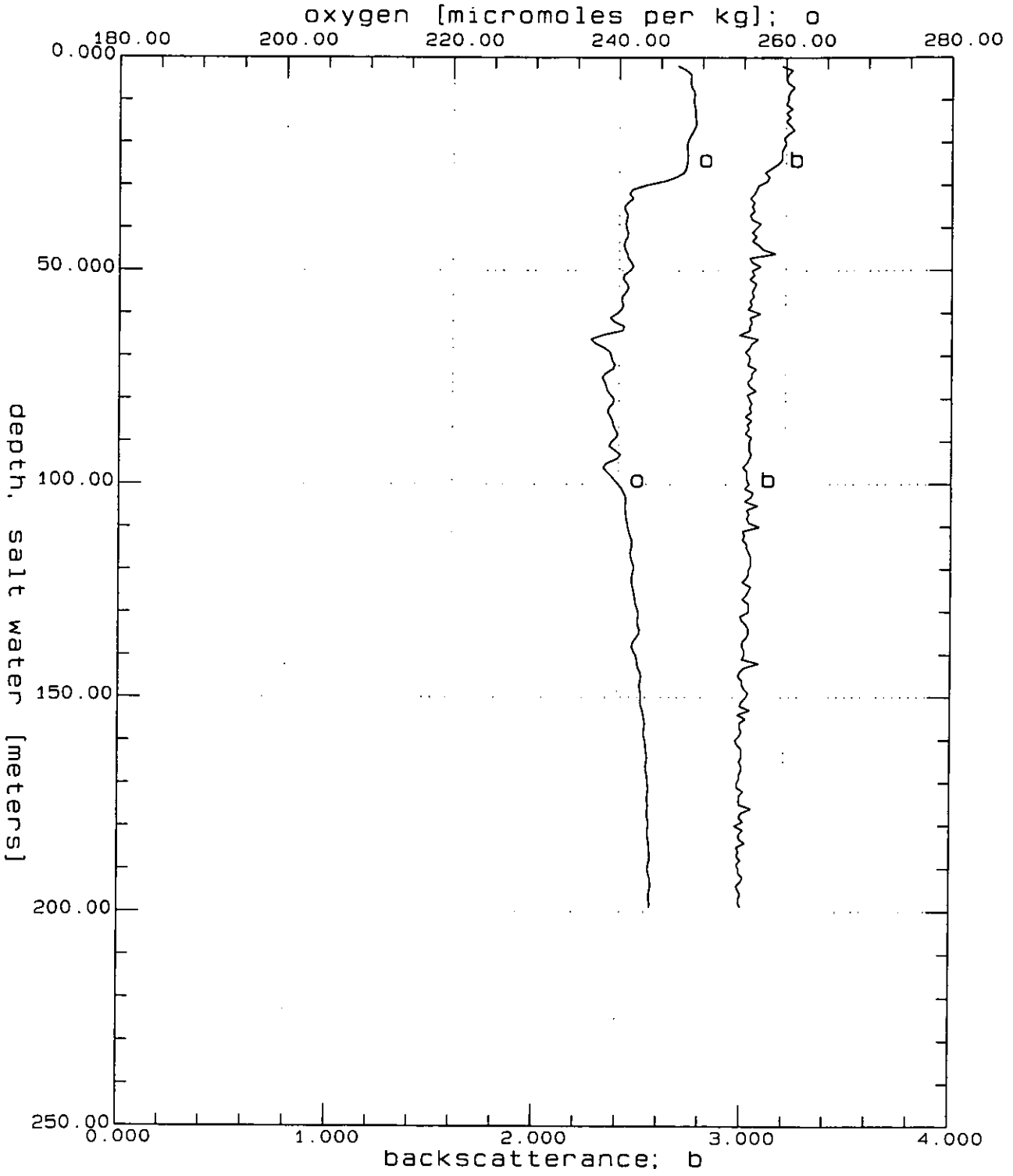
OM9512C.CNV: OMEX 95/22 Station 12 cast C

Figure 44b



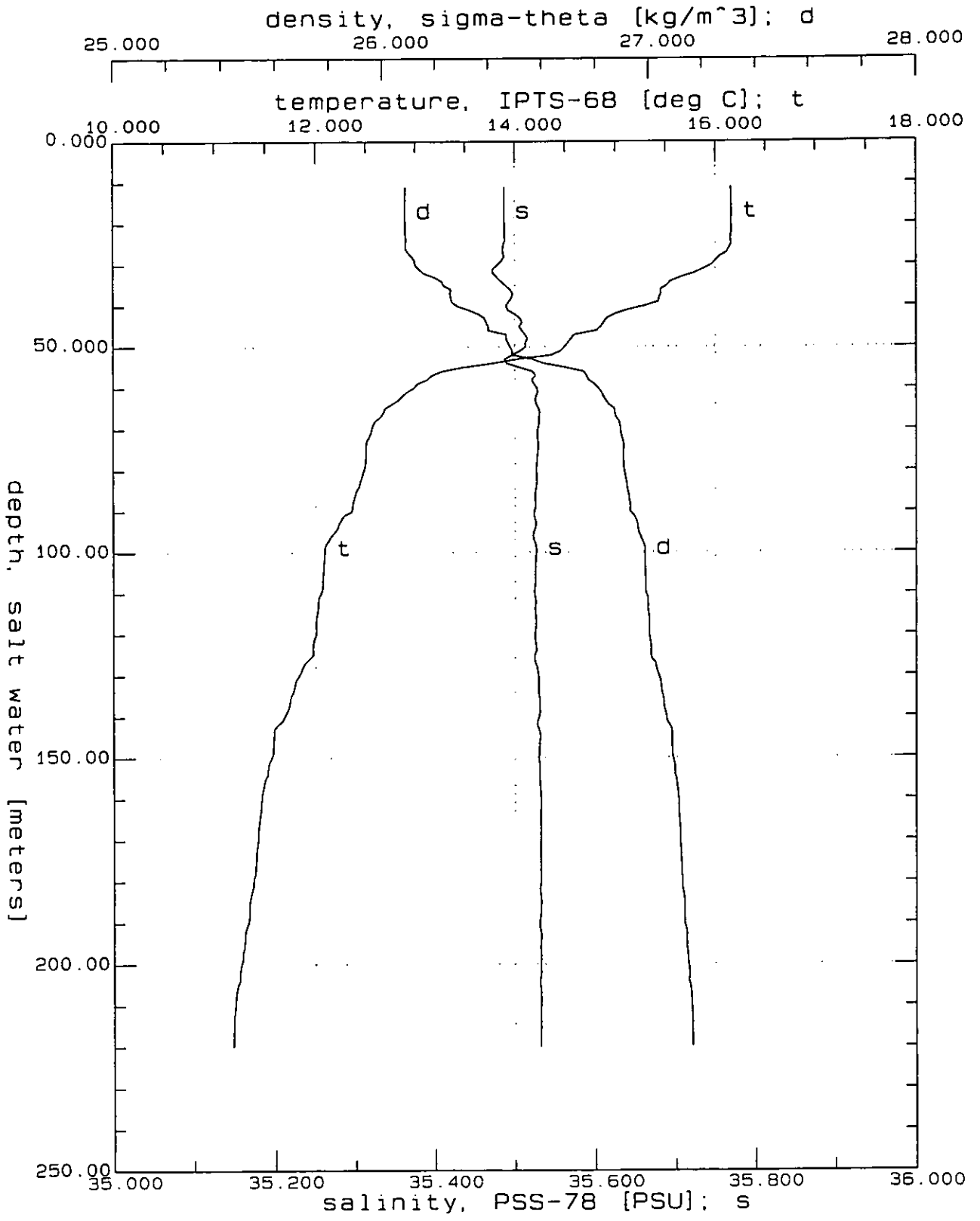
OM9513A.CNV: OMEX 95/22 Station 13 Cast A

Figure 45a



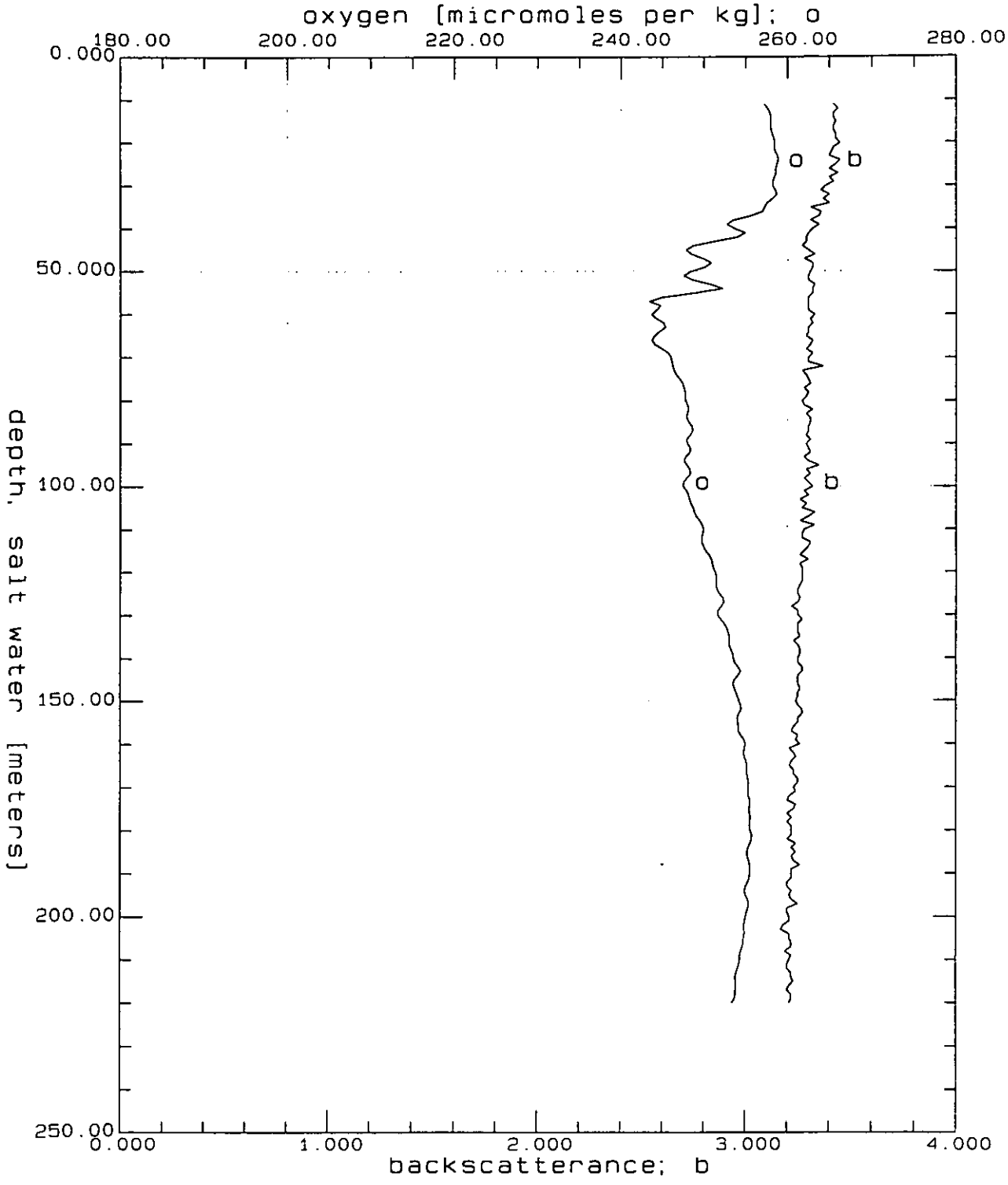
OM9513A.CNV: OMEX 95/22 Station 13 cast A

Figure 45b



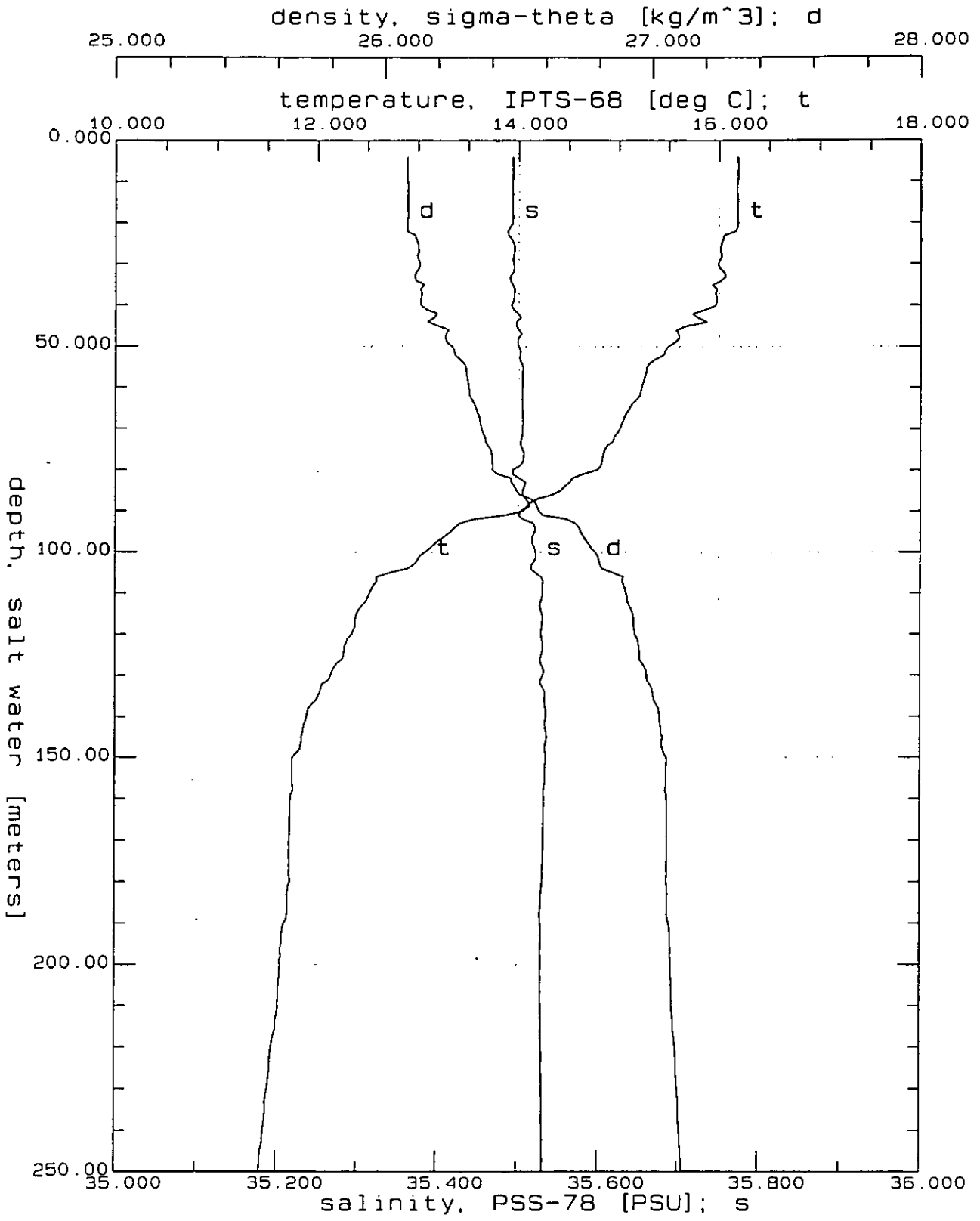
OM9514A.CNV: OMEX 95/22 Station 14 Cast A

Figure 46a



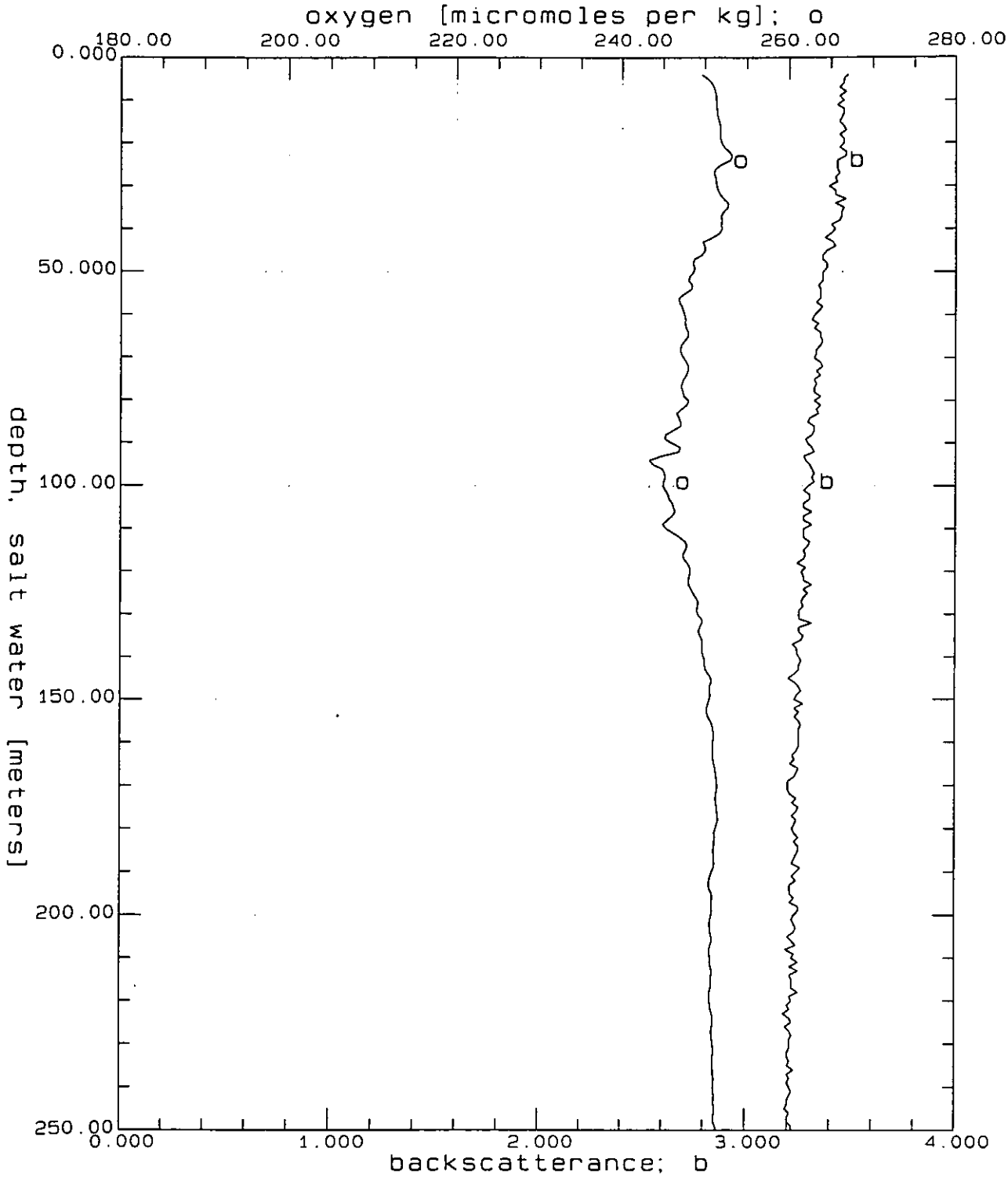
OM9514A.CNV: OMEX 95/22 Station 14 cast A

Figure 46b



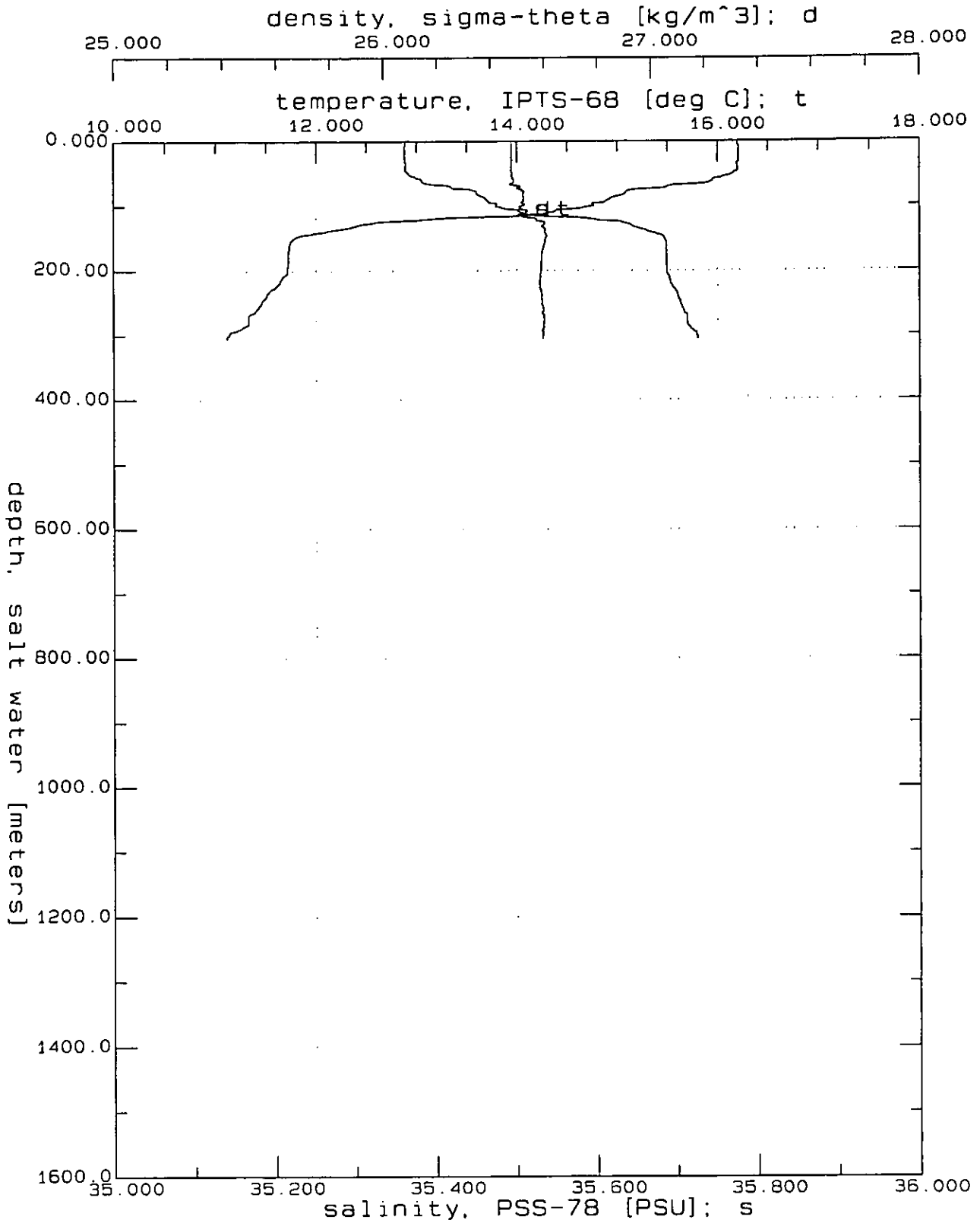
OM9515A.CNV: OMEX 95/22 Station 15 Cast A

Figure 47a



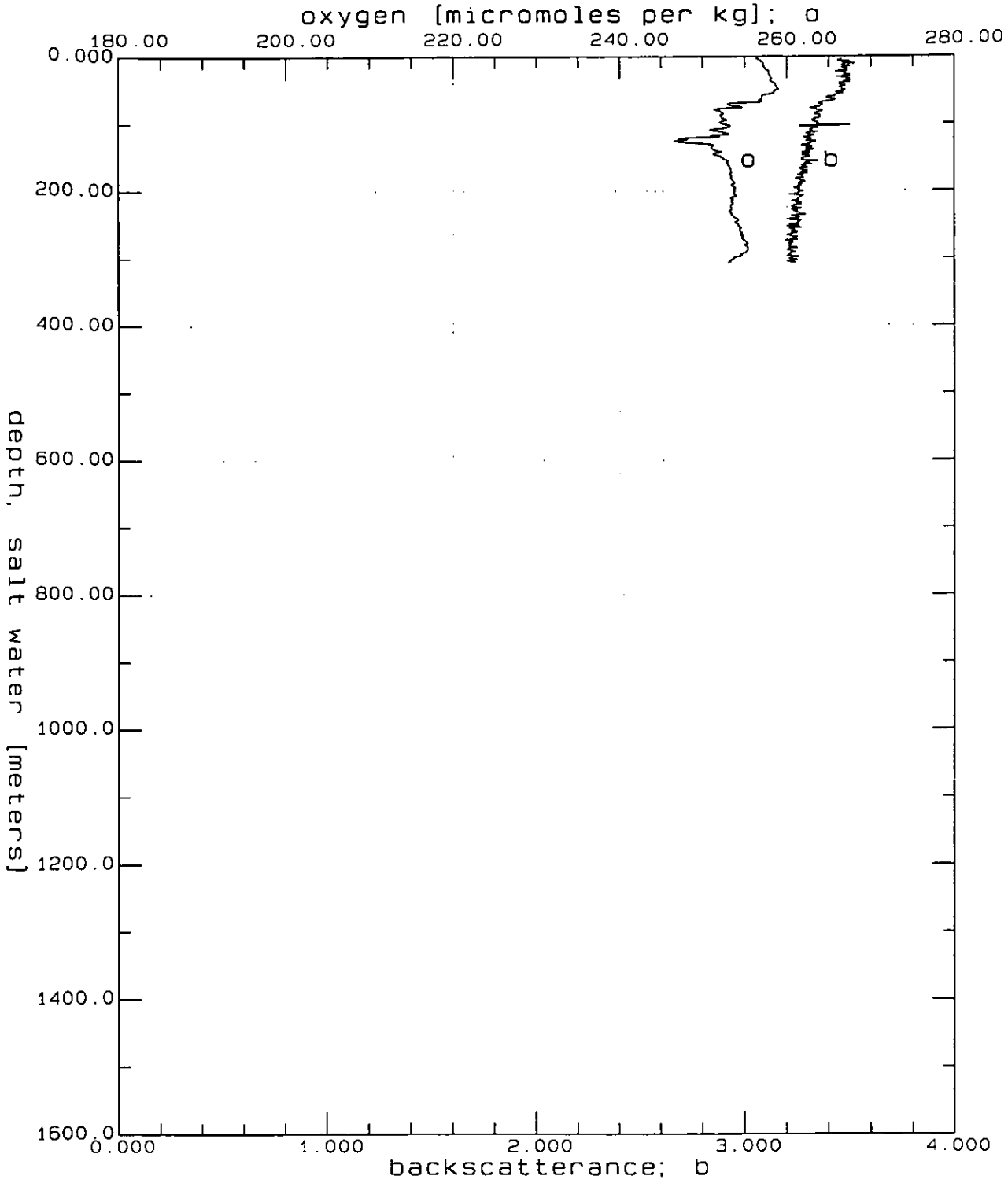
OM9515A.CNV: OMEX 95/22 Station 15 cast A

Figure 47b



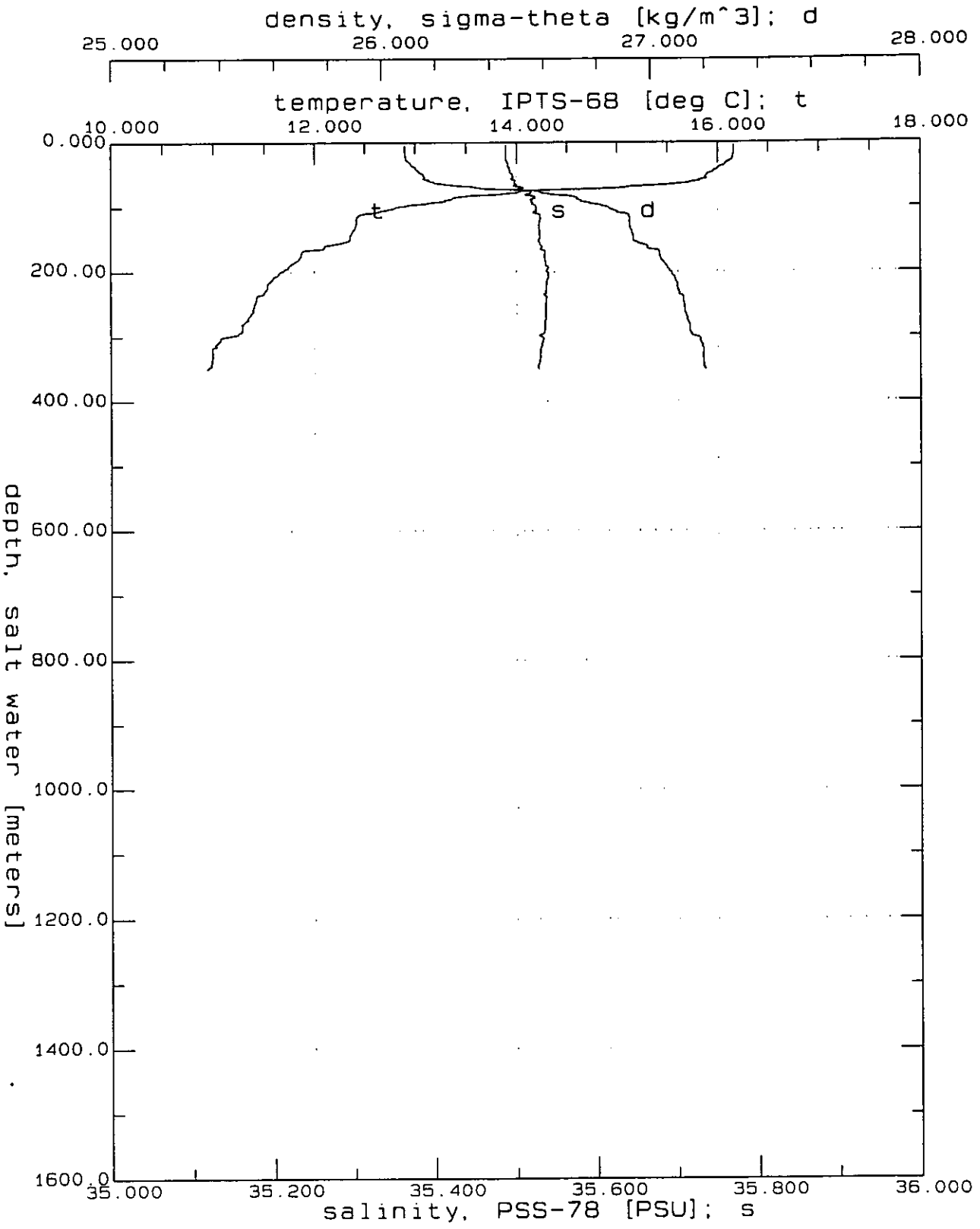
OM9515B.CNV: OMEX 95/22 Station 15 Cast B

Figure 48a



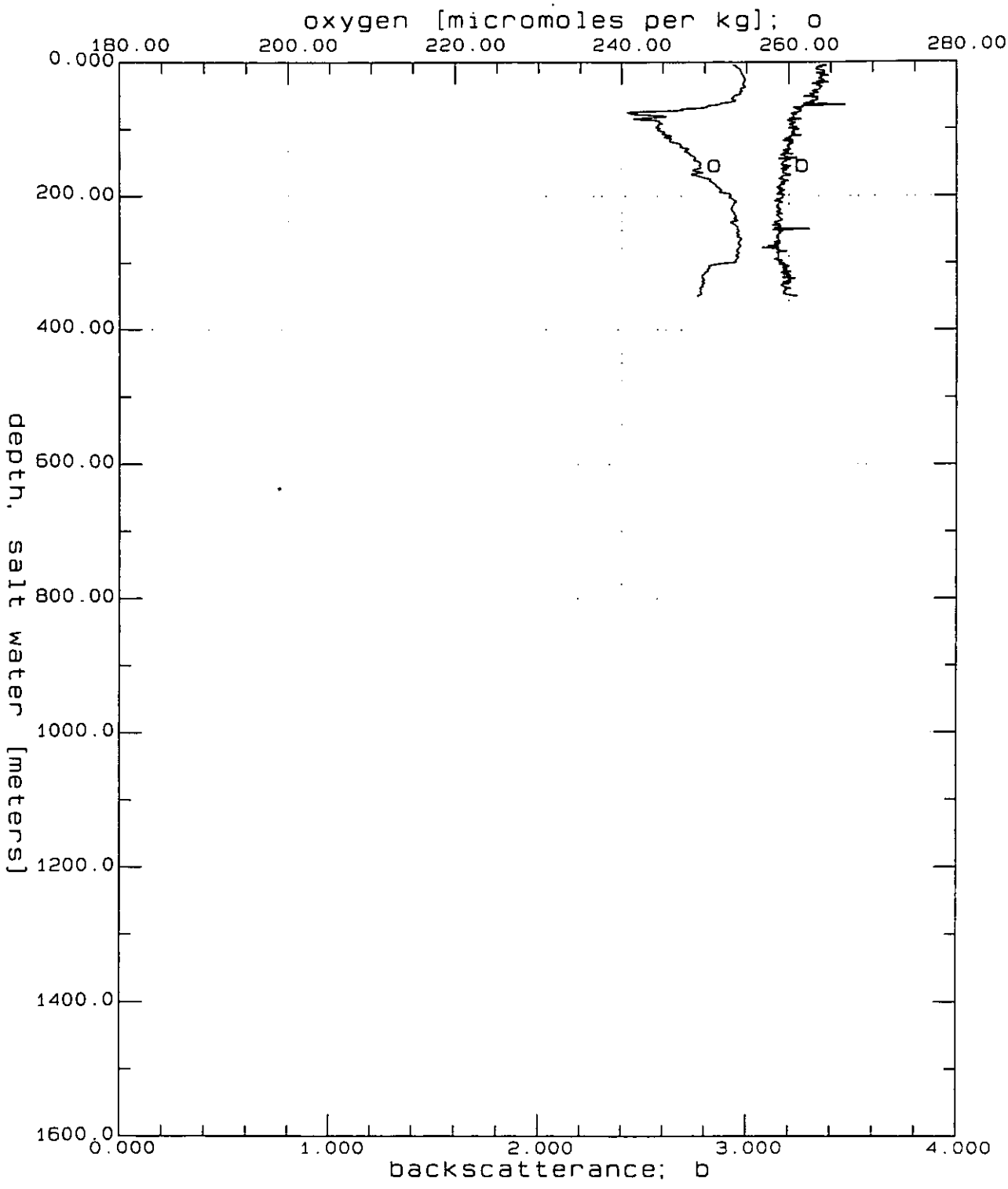
OM9515B.CNV: OMEX 95/22 Station 15 cast 8

Figure 48b



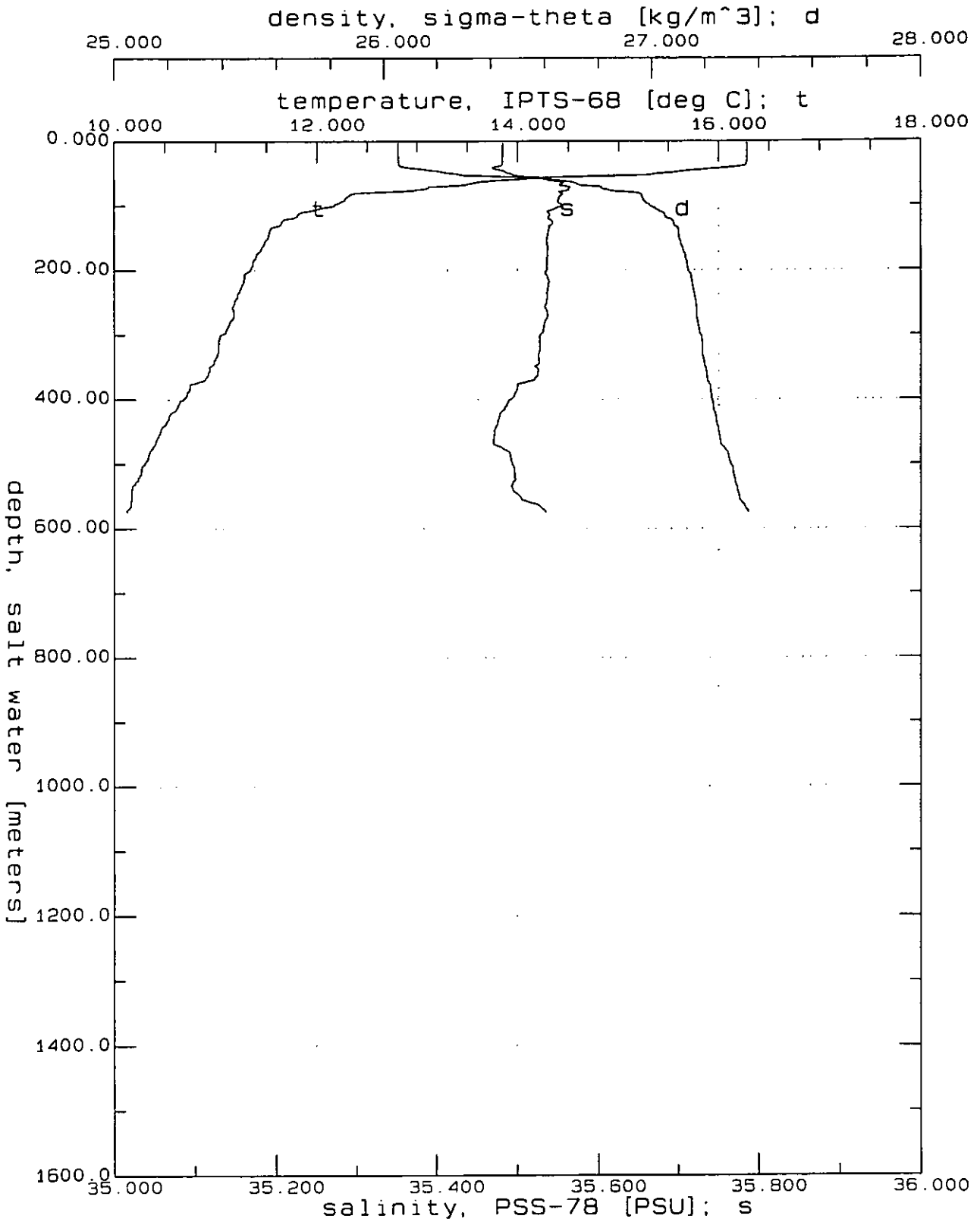
OM9516A.CNV: OMEX 95/22 Station 16 Cast A

Figure 49a



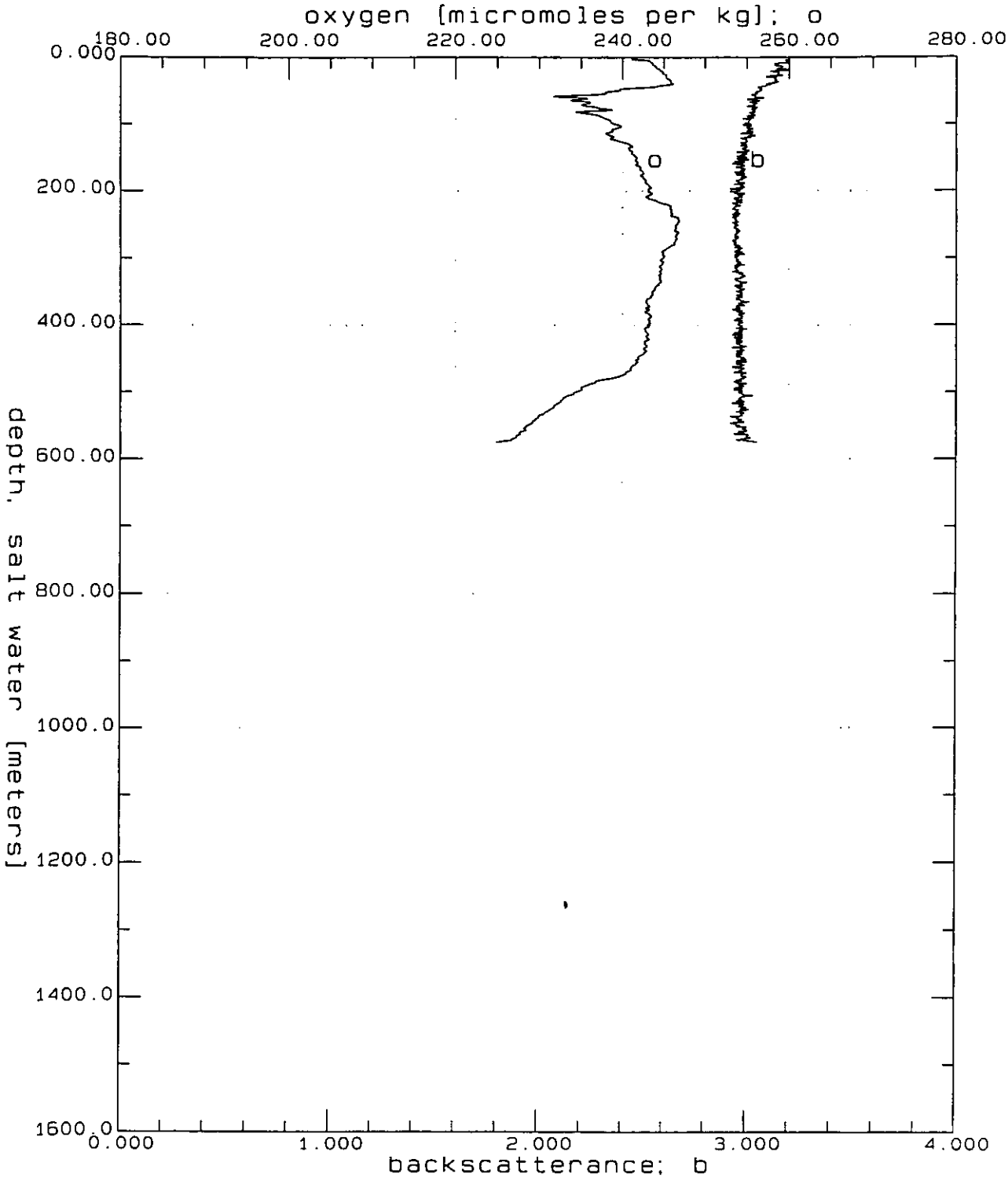
OM9516A.CNV: OMEX 95/22 Station 16 cast A

Figure 49b



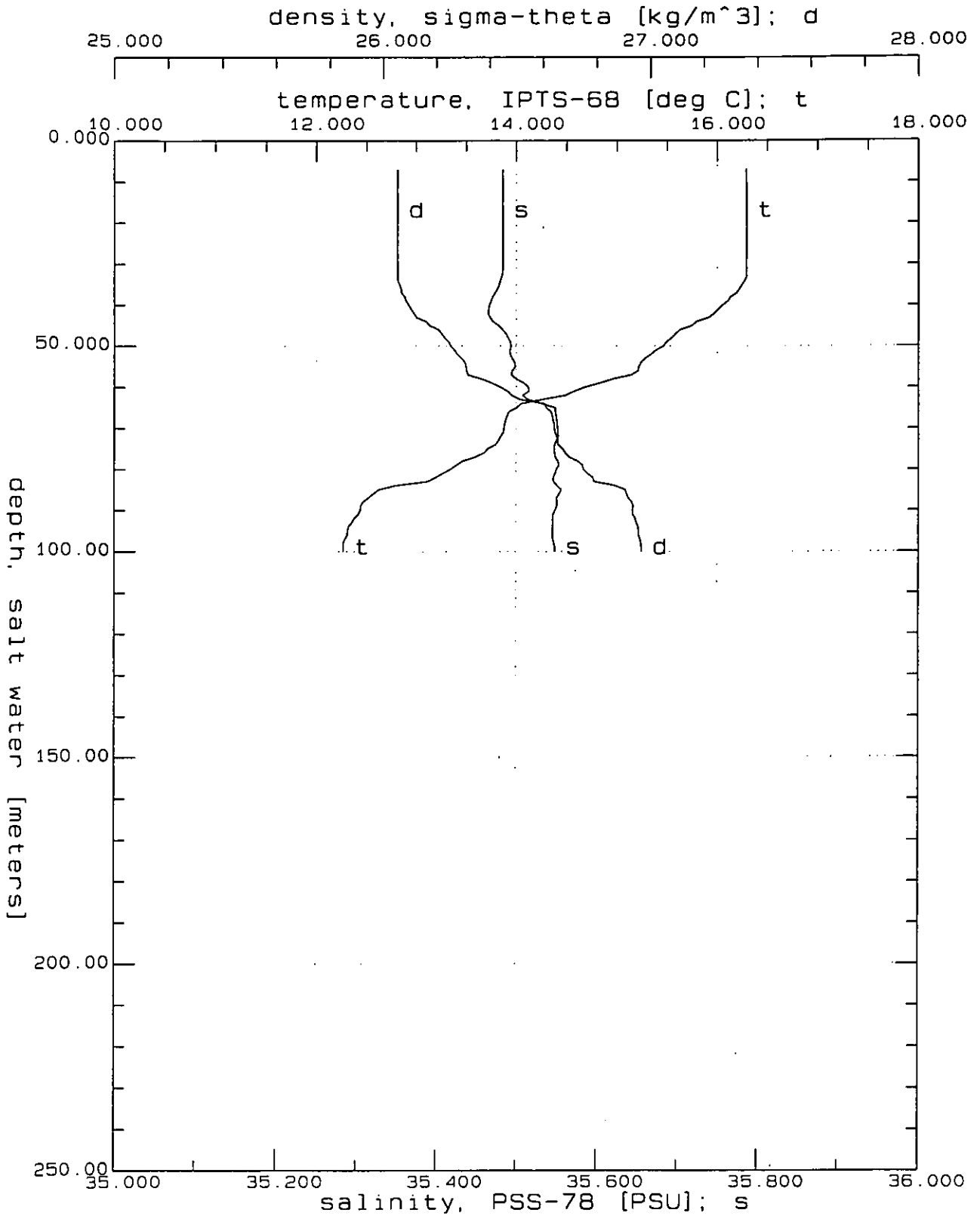
OM9518A.CNV: OMEX 95/22 Station 18 Cast A

Figure 50a



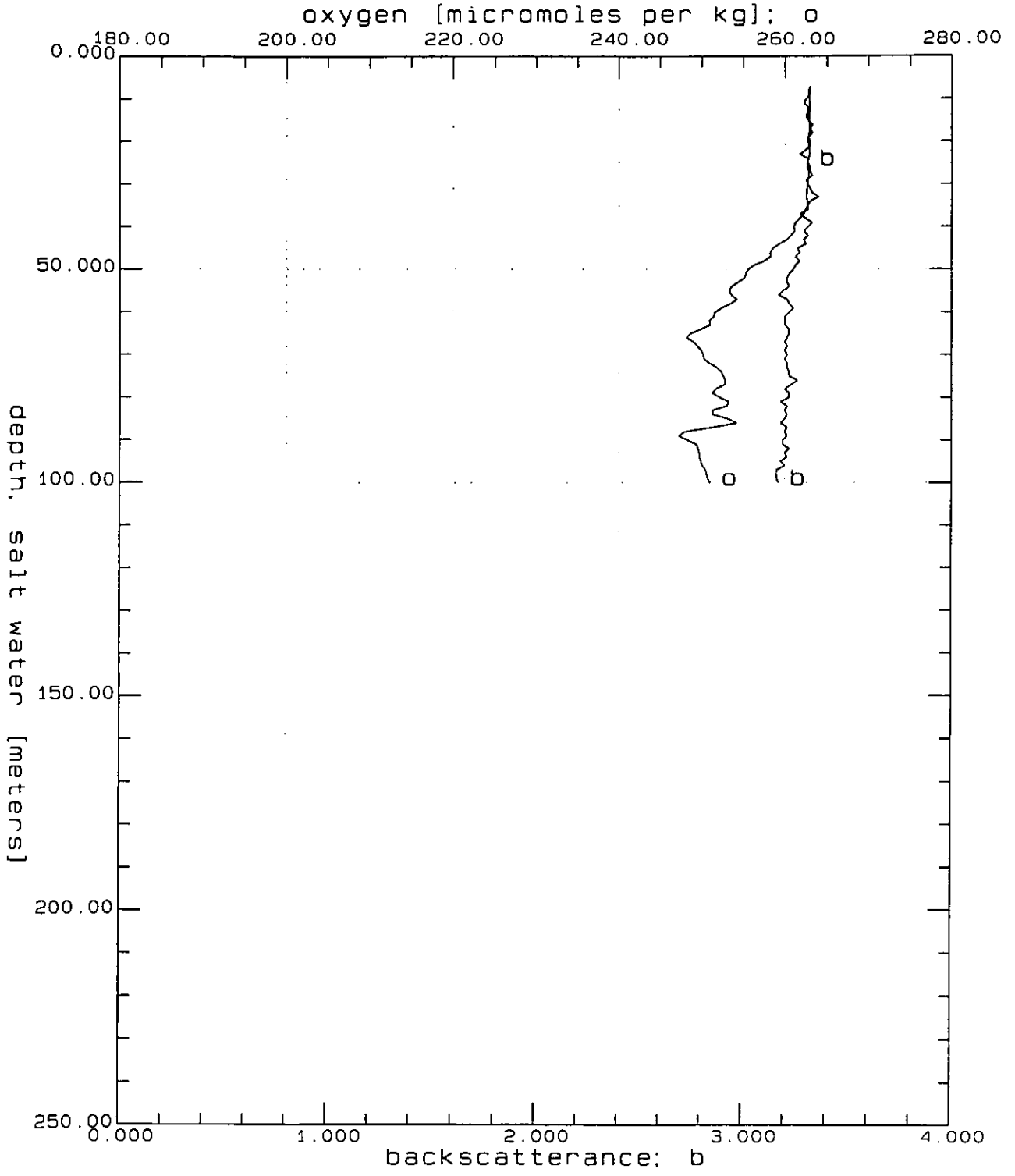
OM9518A.CNV: OMEX 95/22 Station 18 cast A

Figure 50b



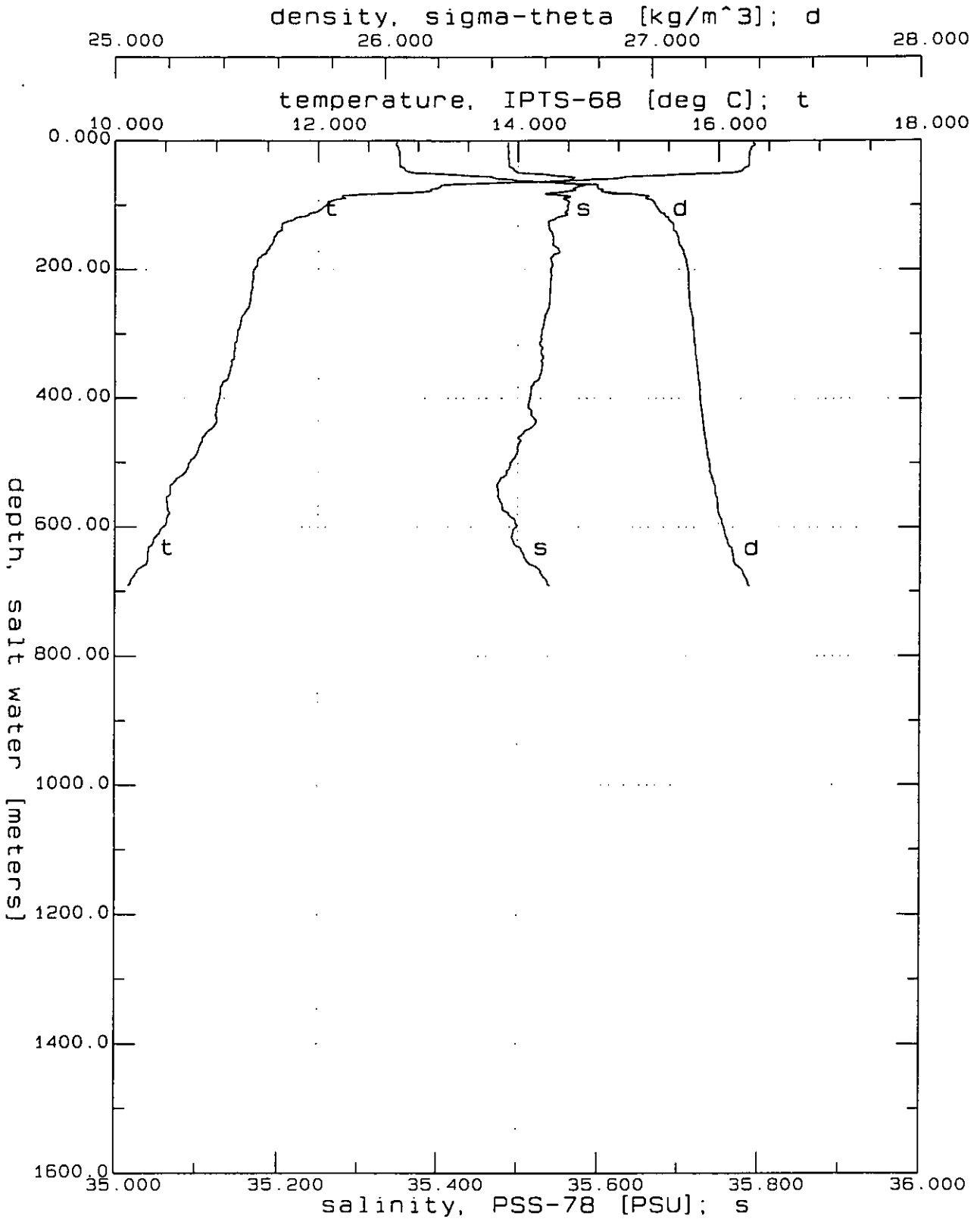
OM9518B.CNV: OMEX 95/22 Station 18 Cast B

Figure 51a



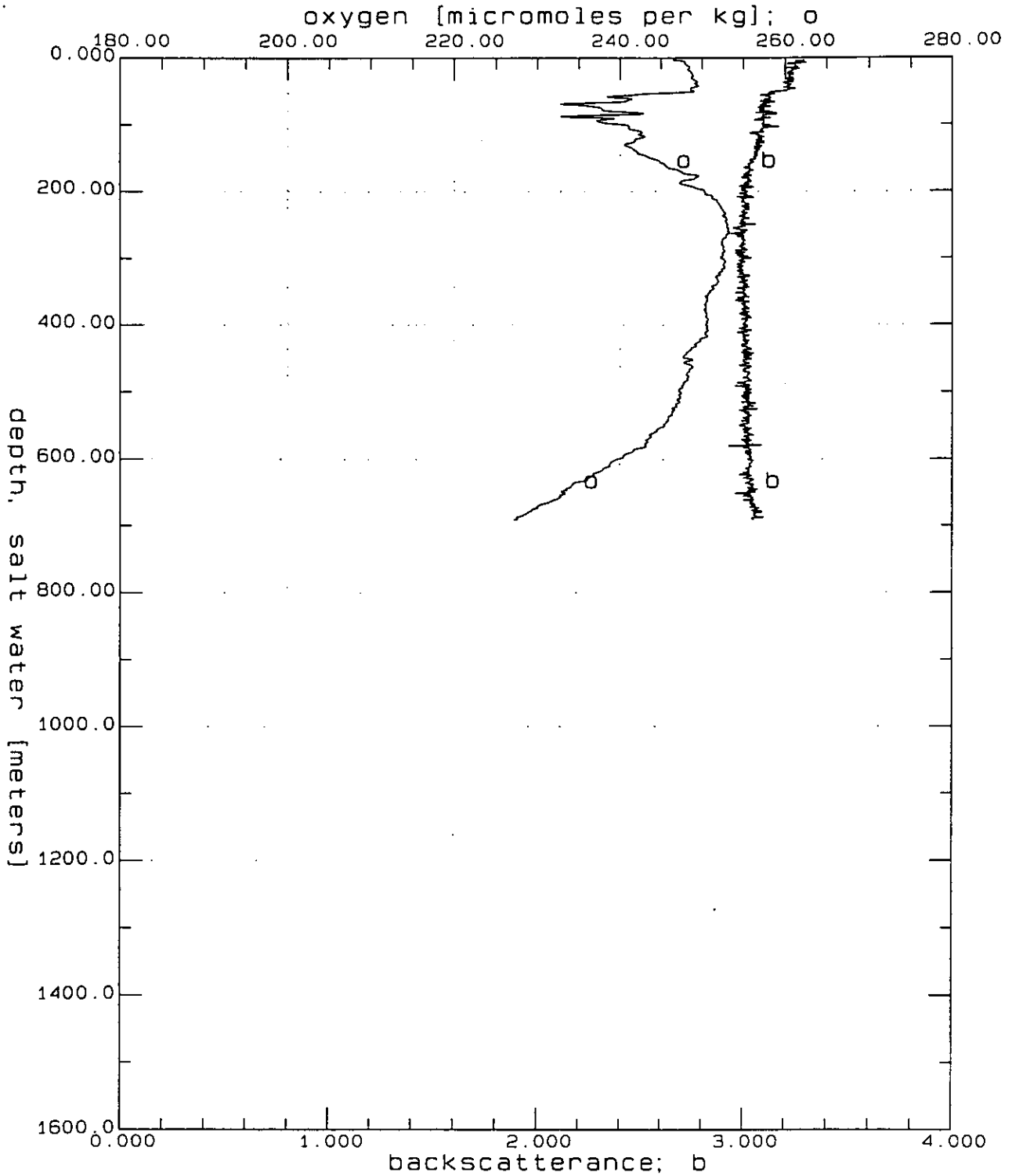
OM9518B.CNV: OMEX 95/22 Station 18 cast B

Figure 51b



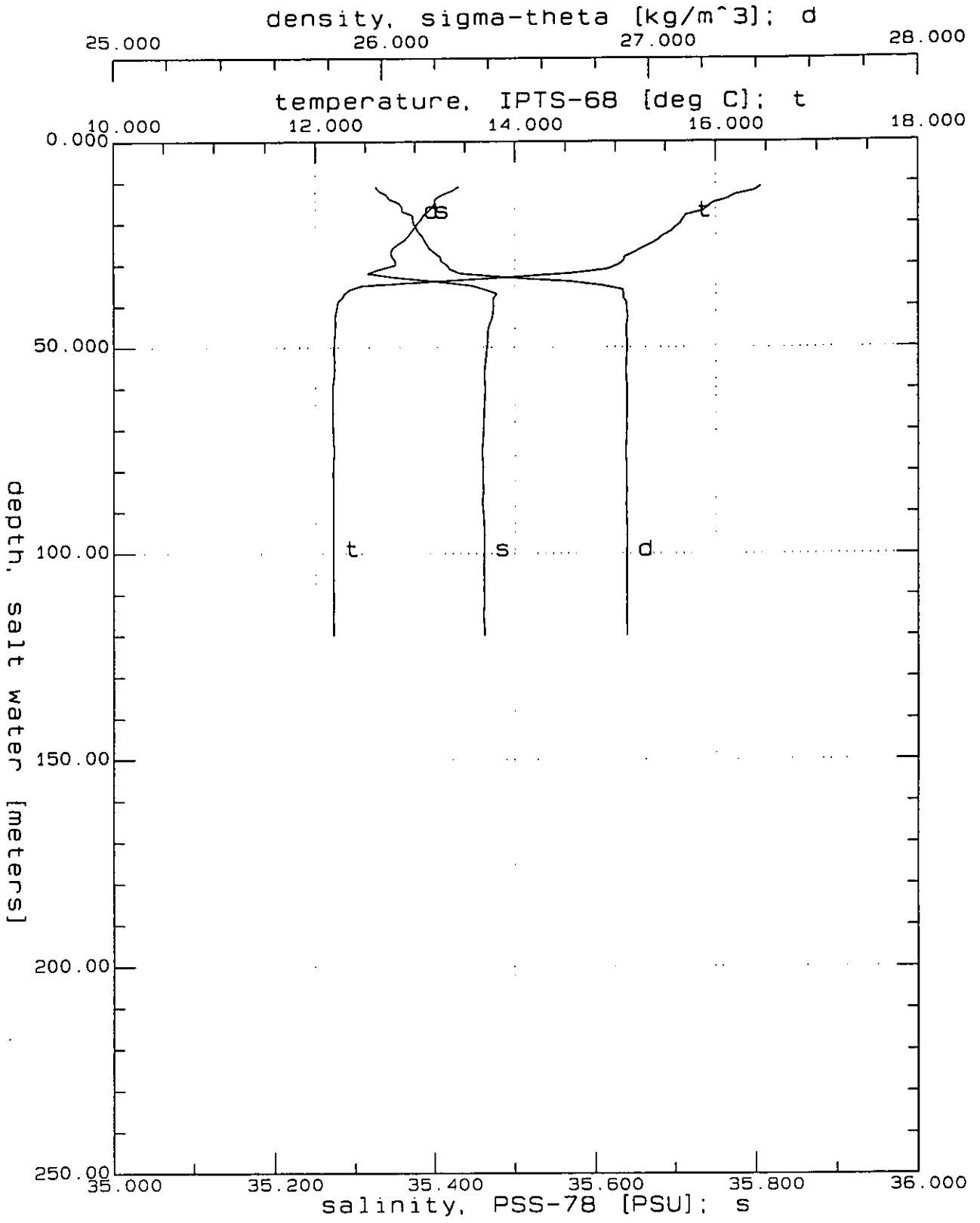
OM9519A.CNV: OMEX 95/22 Station 19 Cast A

Figure 52a



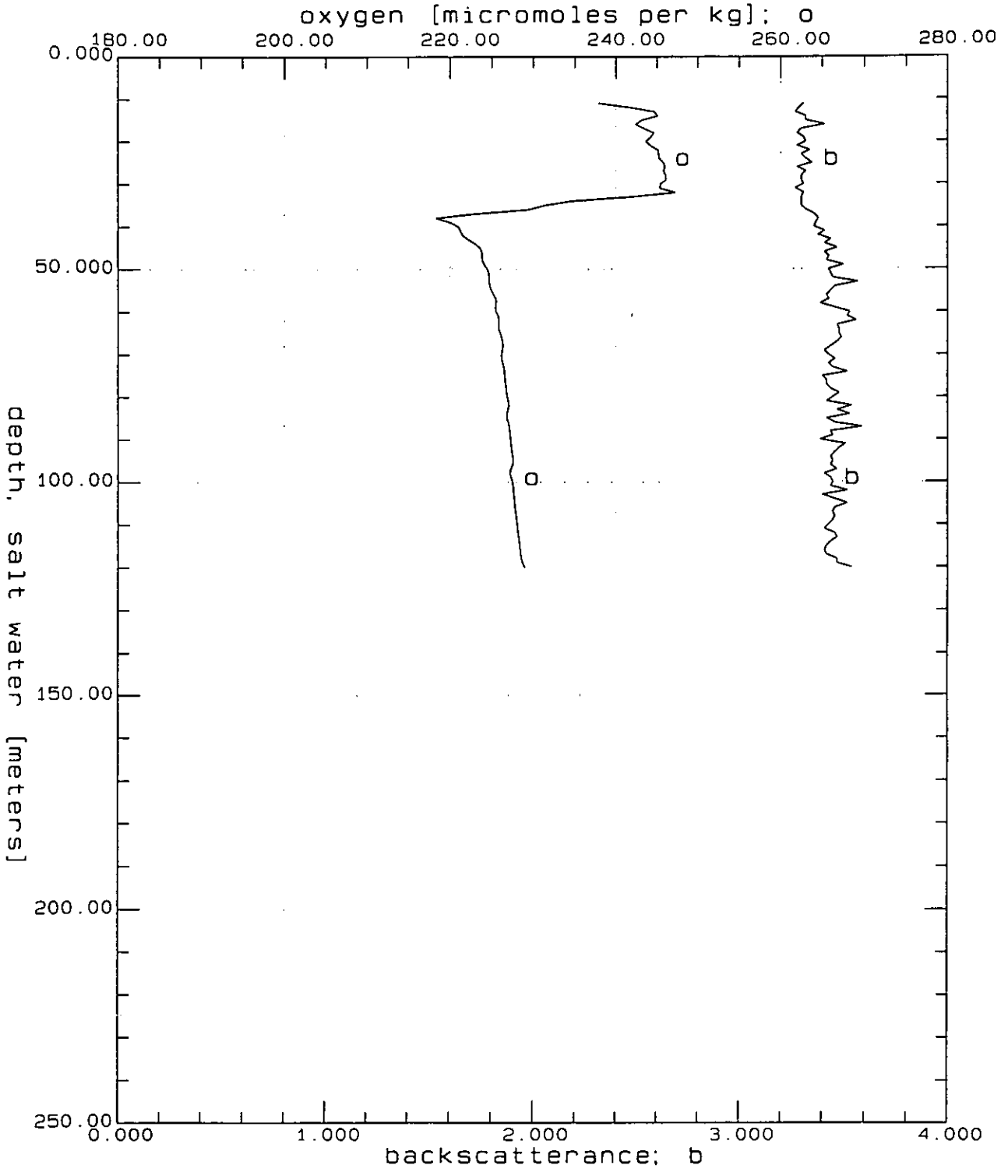
OM9519A.CNV: OMEX 95/22 Station 19 cast A

Figure 52b



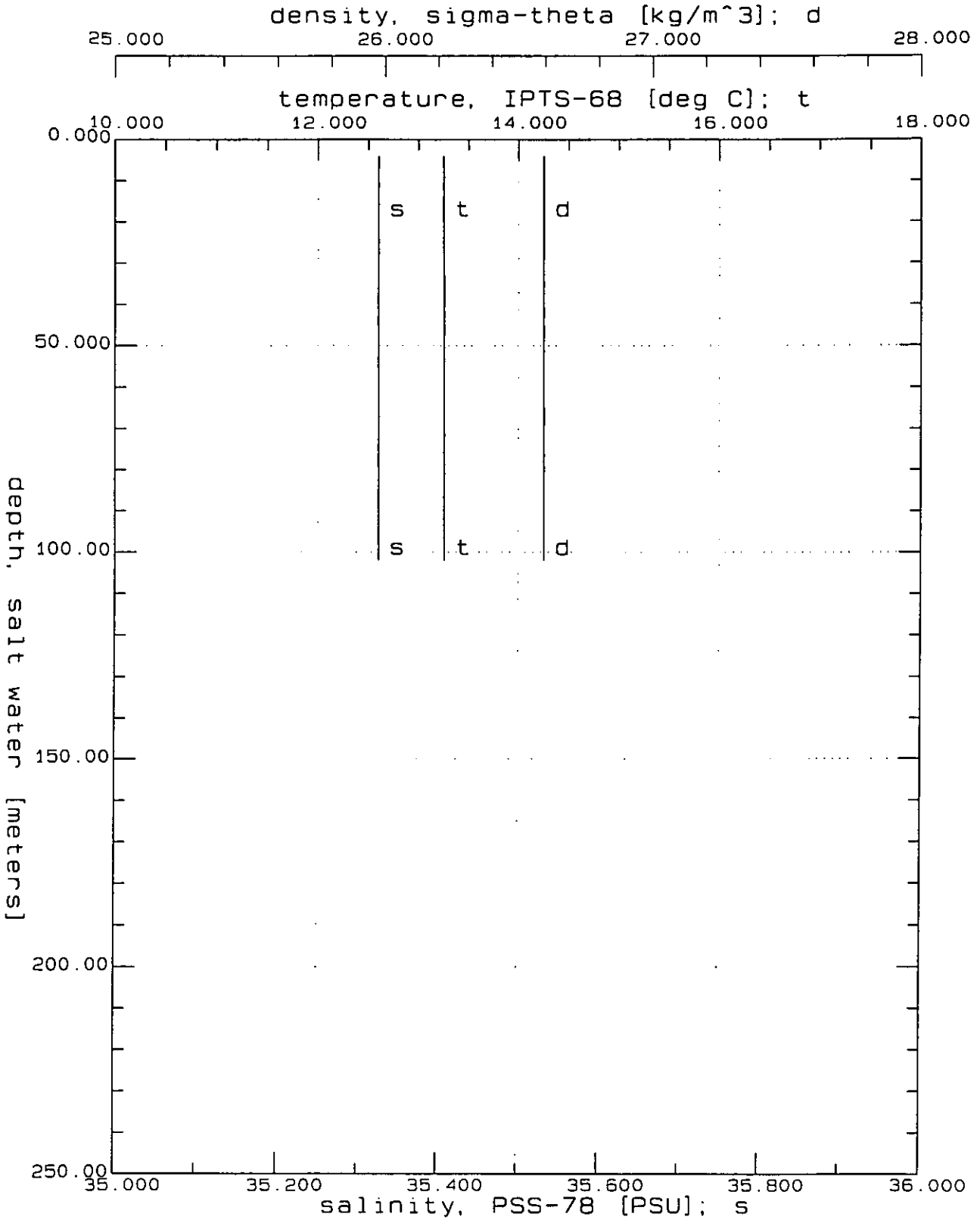
OM9520A.CNV: OMEX 95/22 Station 20 Cast A

Figure 53a



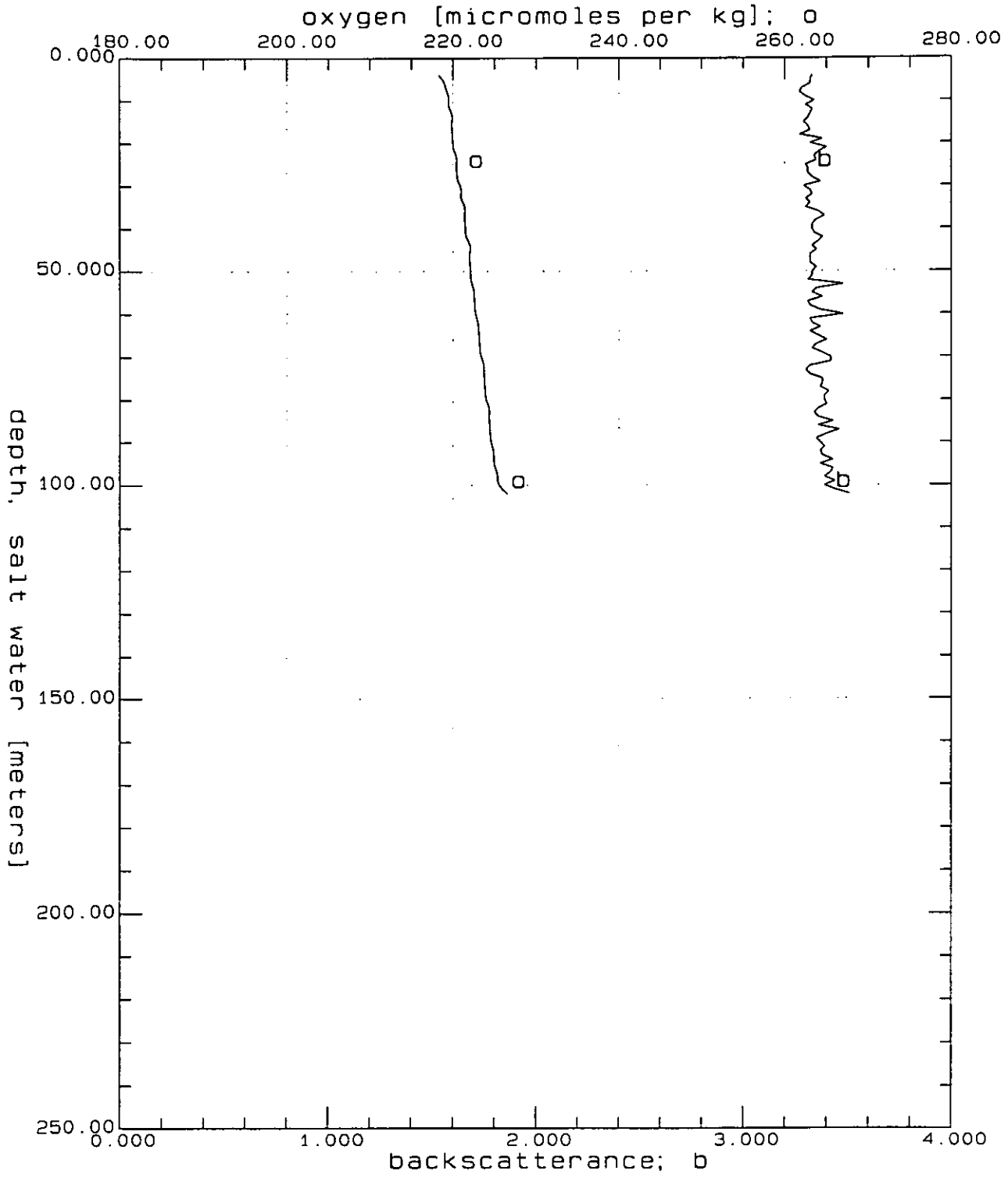
OM9520A.CNV: OMEX 95/22 Station 20 cast A

Figure 53b



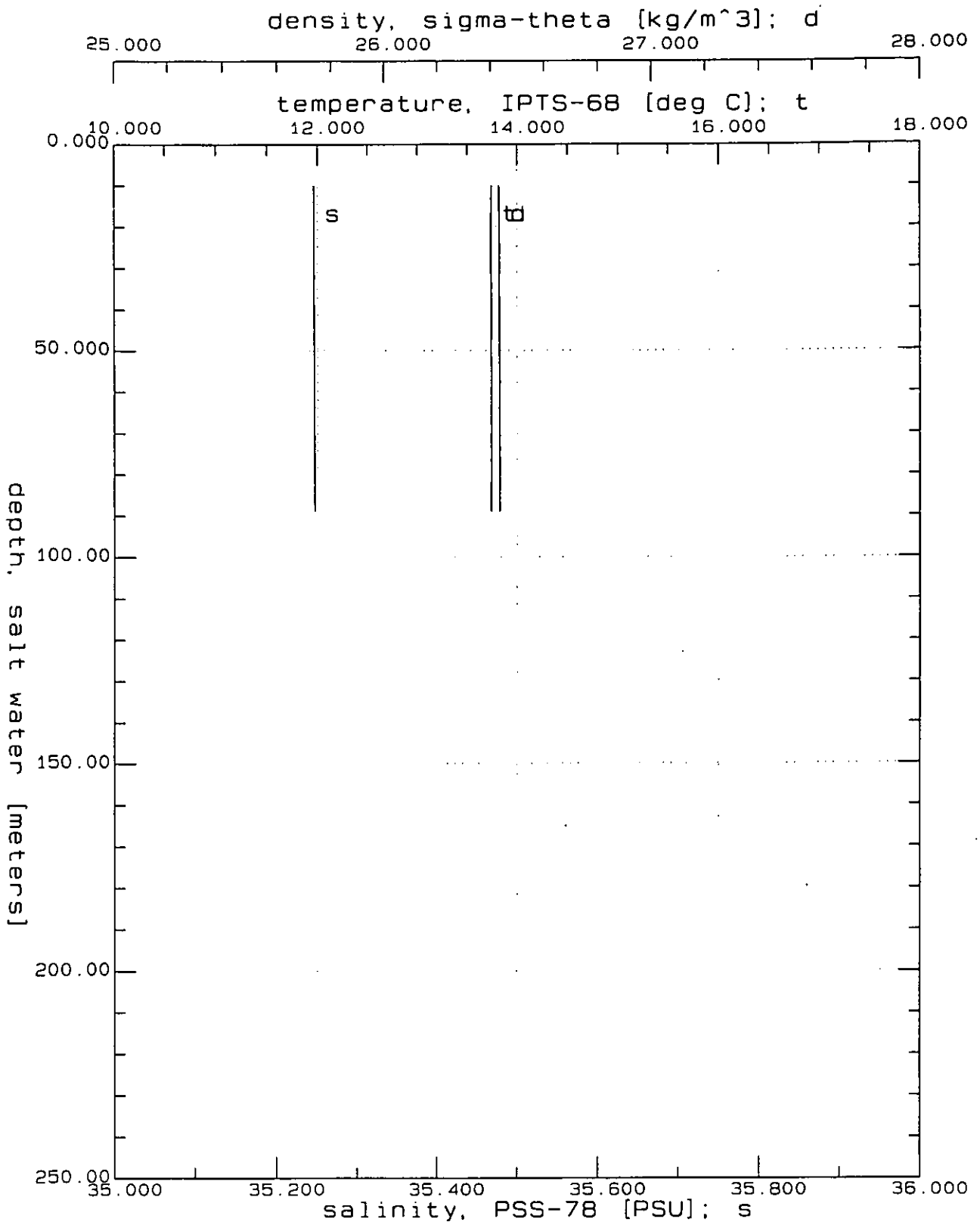
OM9521A.CNV: OMEX 95/22 Station 21 Cast A

Figure 54a



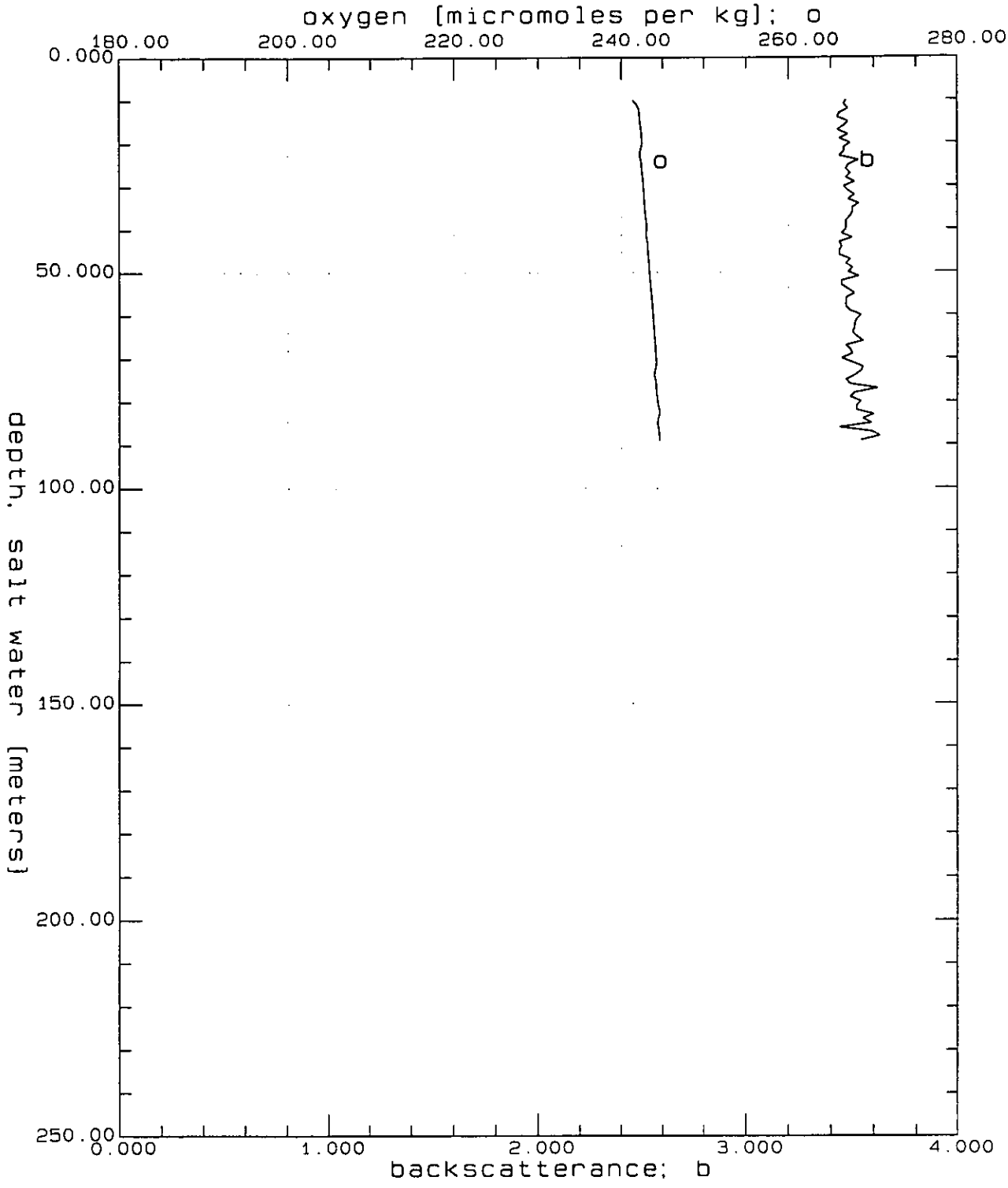
OM9521A.CNV: OMEX 95/22 Station 21 cast A

Figure 54b



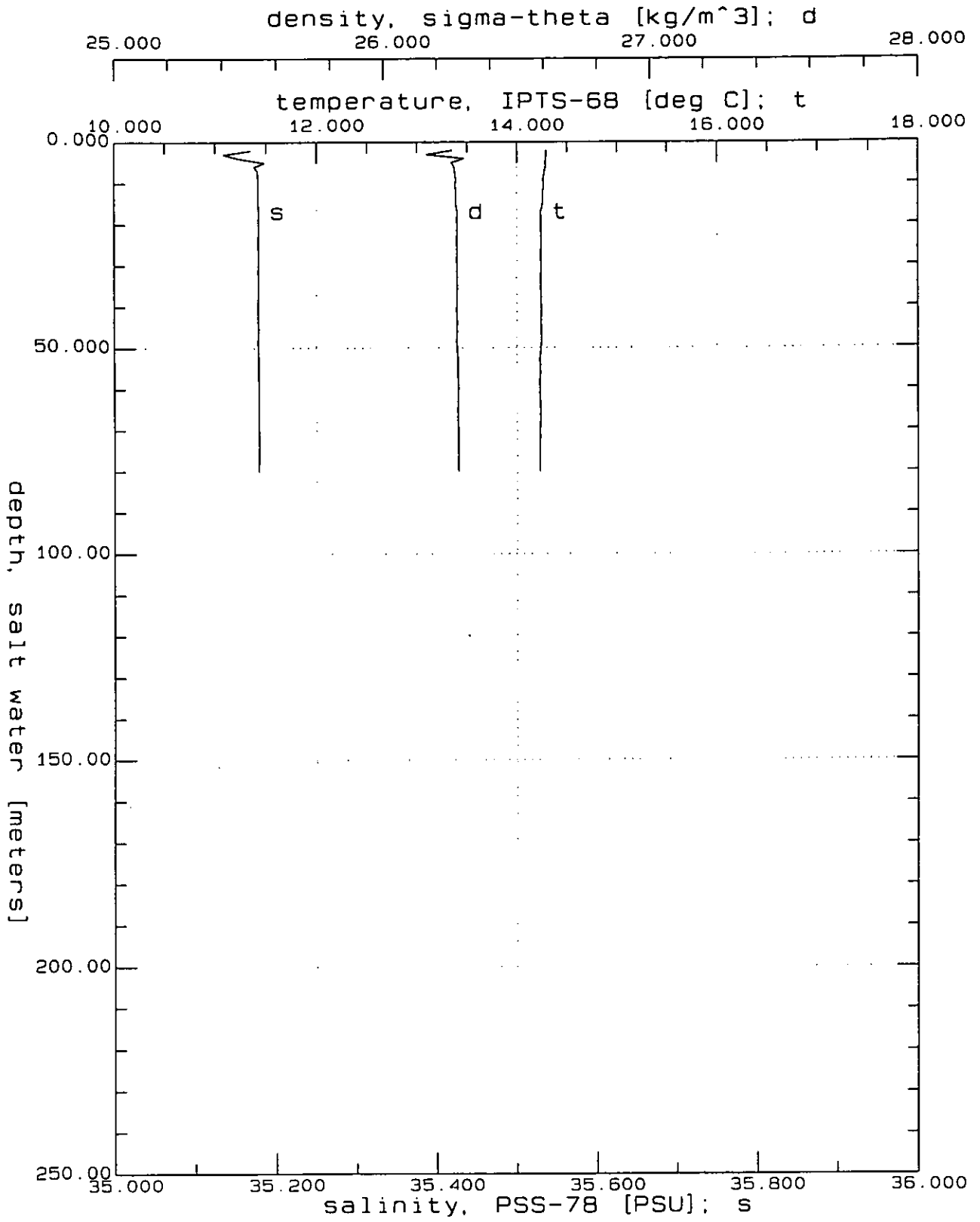
OM9522A.CNV: OMEX 95/22 Station 22 Cast A

Figure 55a



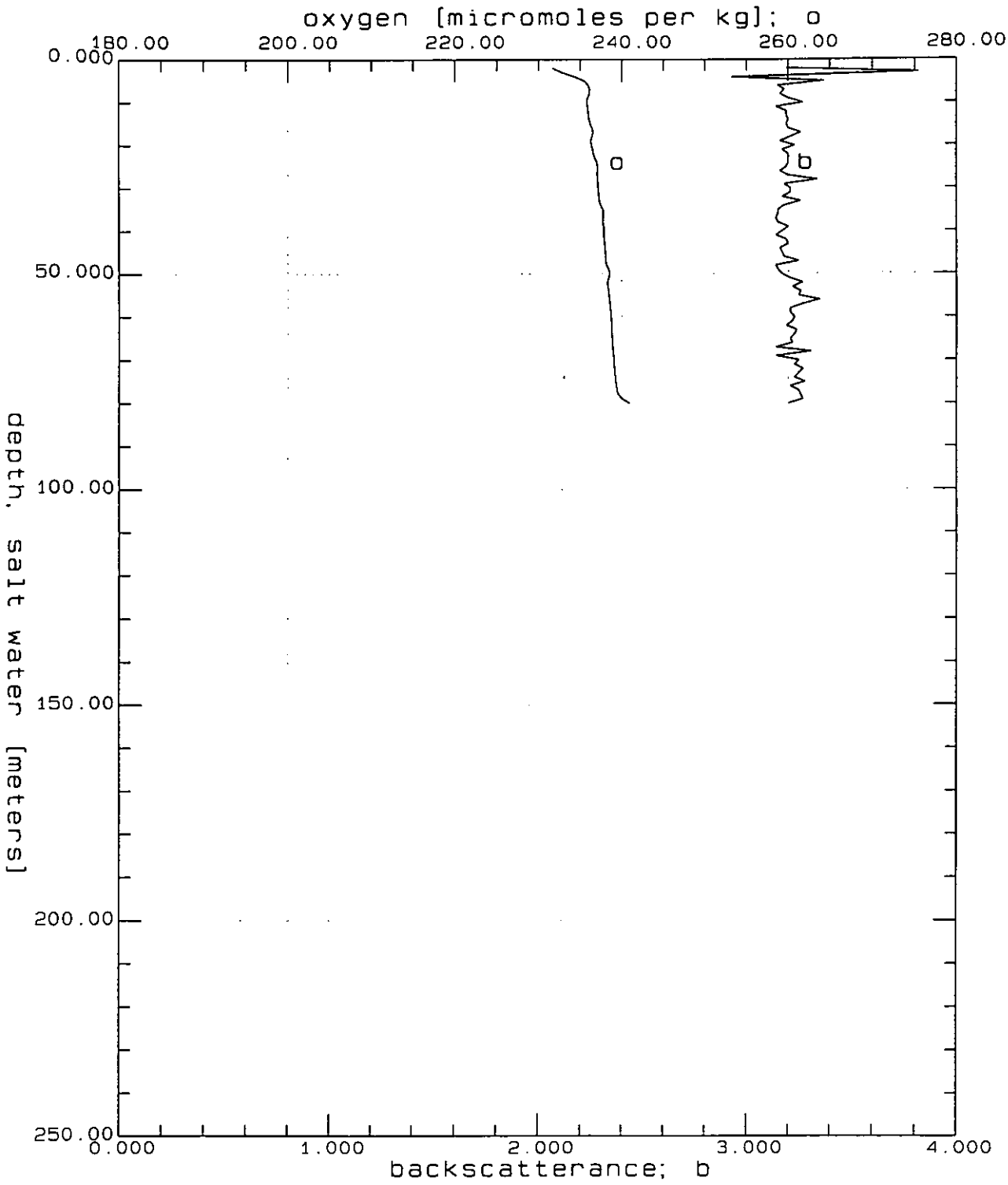
OM9522A.CNV: OMEX 95/22 Station 22 cast A

Figure 55b



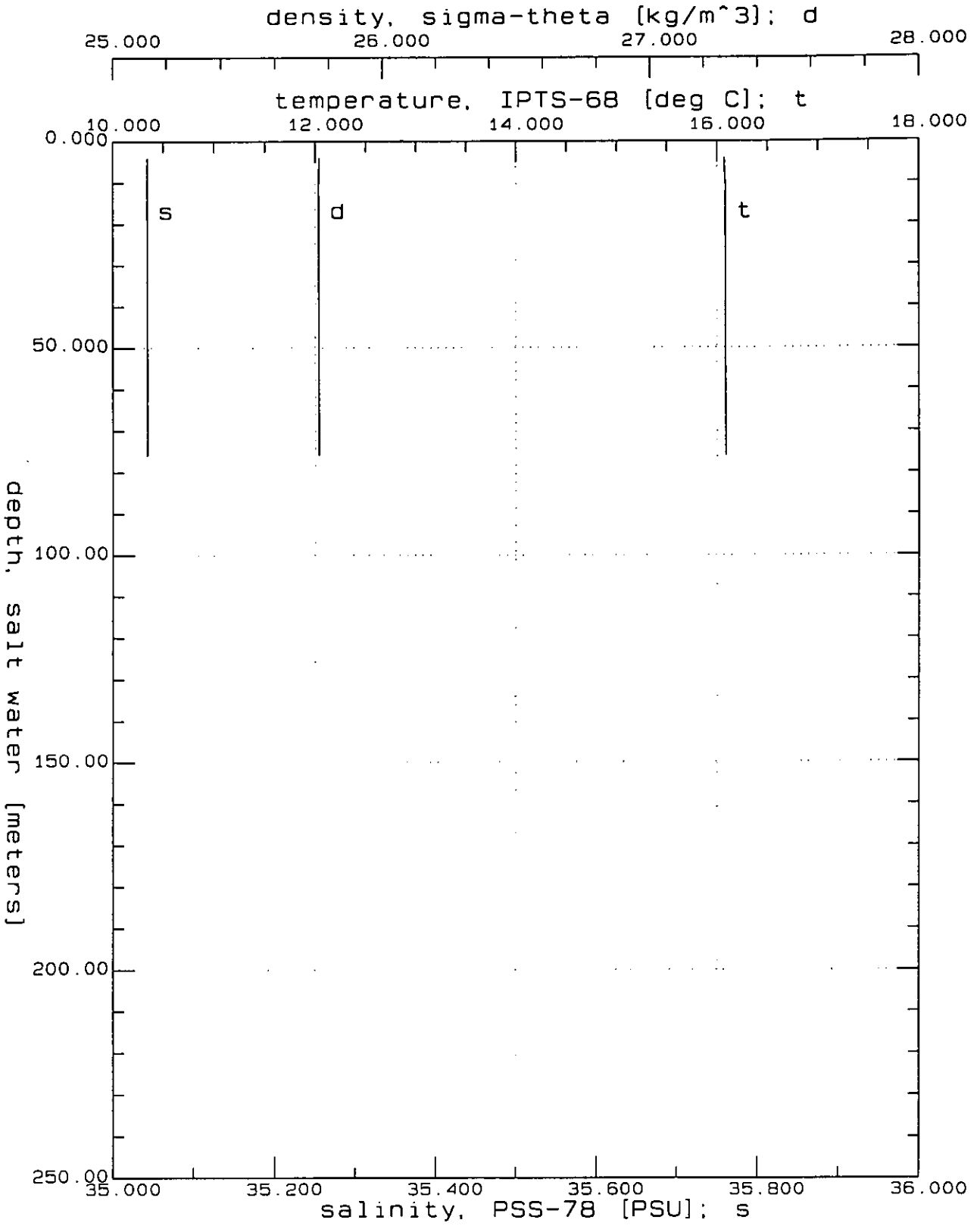
OM9523A.CNV: OMEX 95/22 Station 23 Cast A

Figure 56a



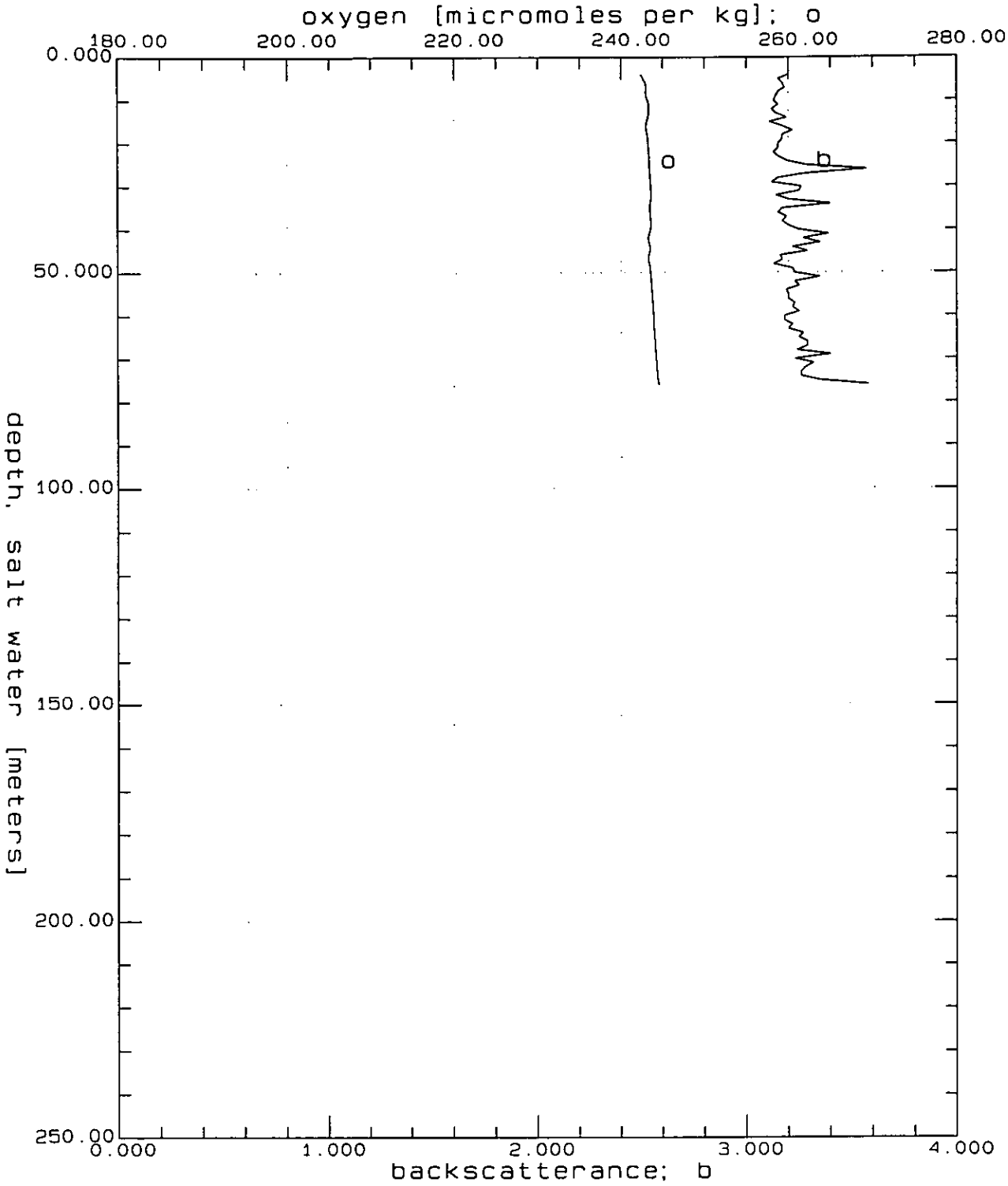
OM9523A.CNV: OMEX 95/22 Station 23 cast A

Figure 56b



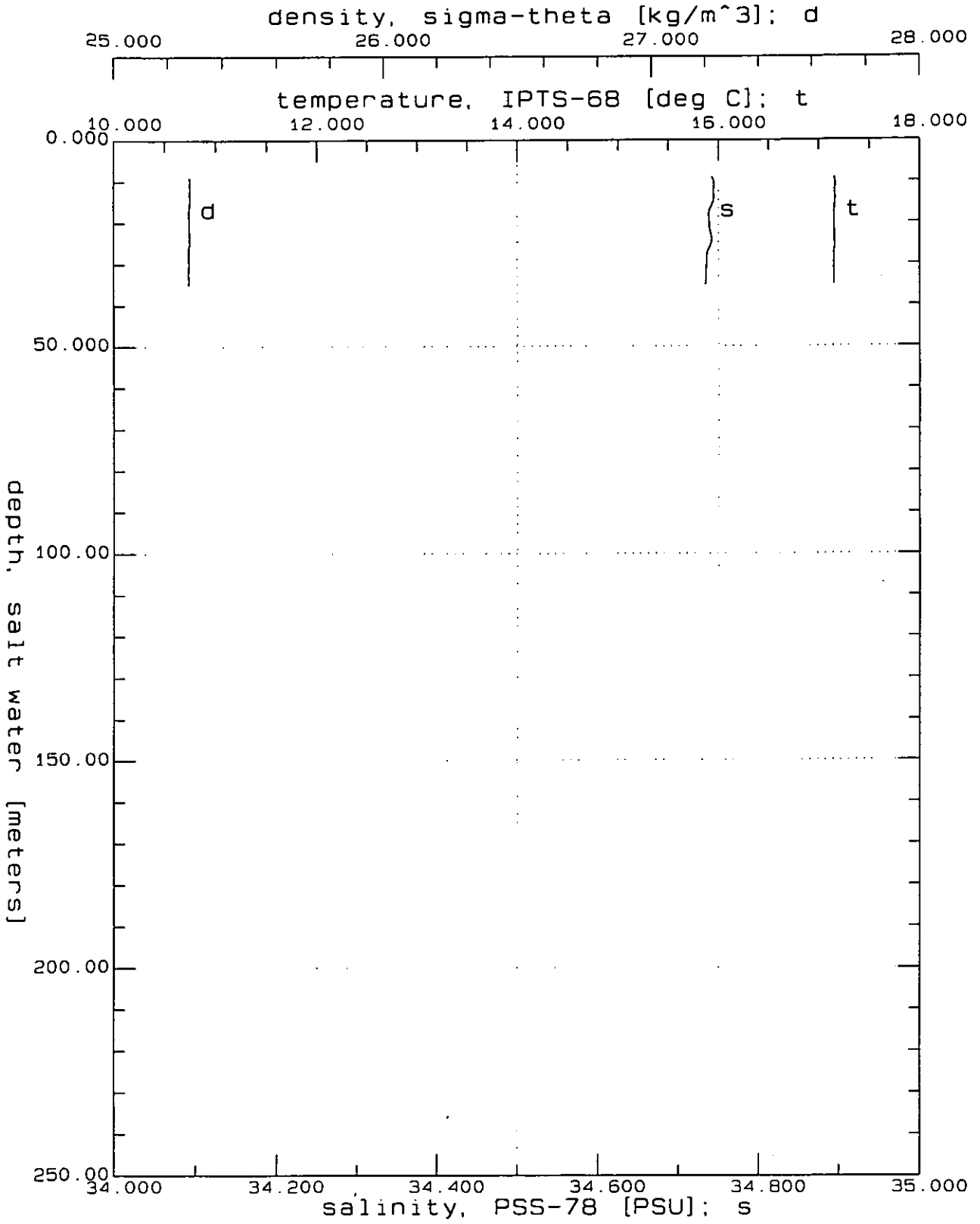
OM9524A.CNV: OMEX 95/22 Station 24 Cast A

Figure 57a



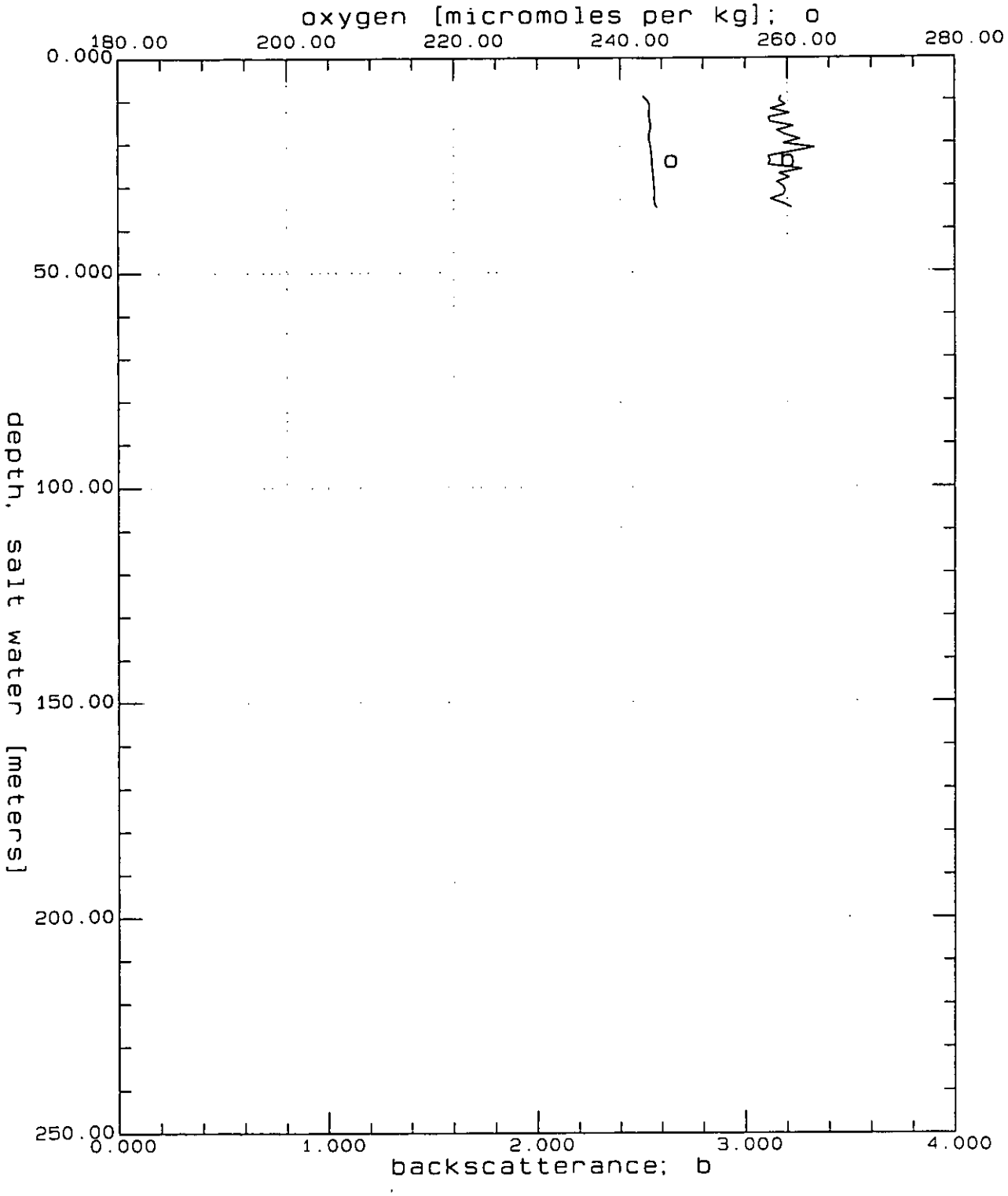
OM9524A.CNV: OMEX 95/22 Station 24 cast A

Figure 57b



OM9525A.CNV: OMEX 95/22 Station 25 Cast A

Figure 58a

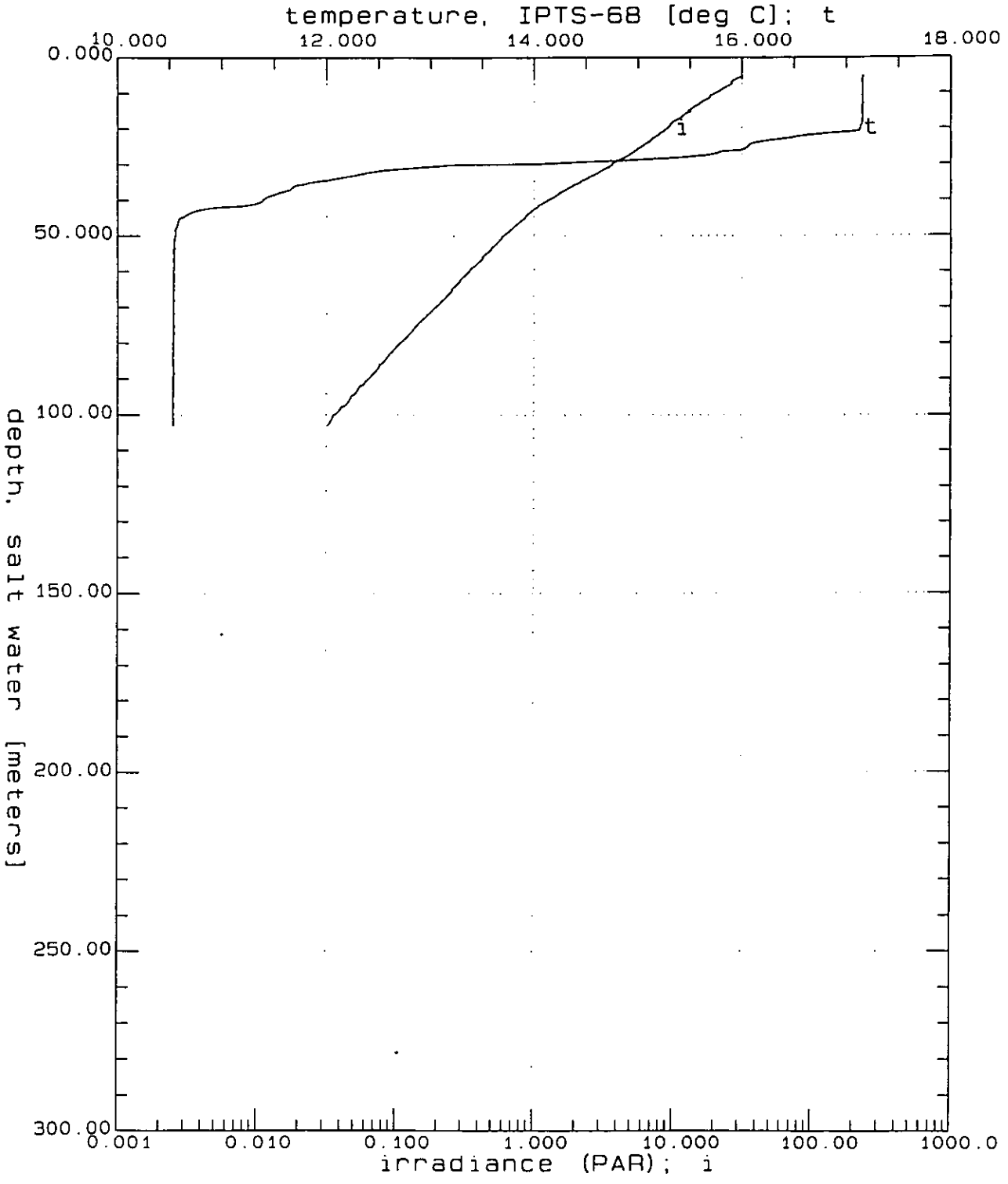


OM9525A.CNV: OMEX 95/22 Station 25 cast A

Figure 58b

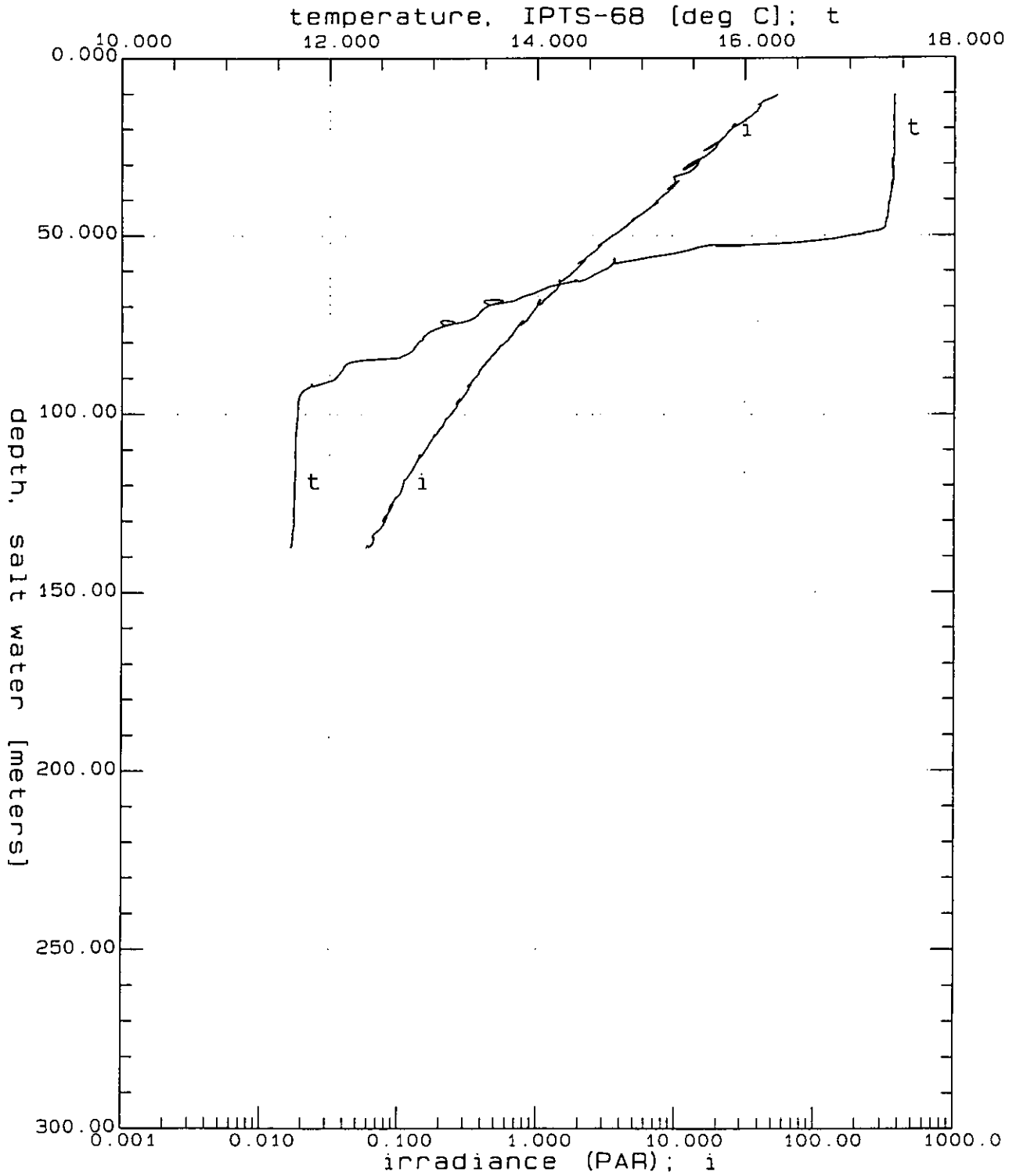
Appendix 6.

Vertical profiles of incident light (PAR sensor).



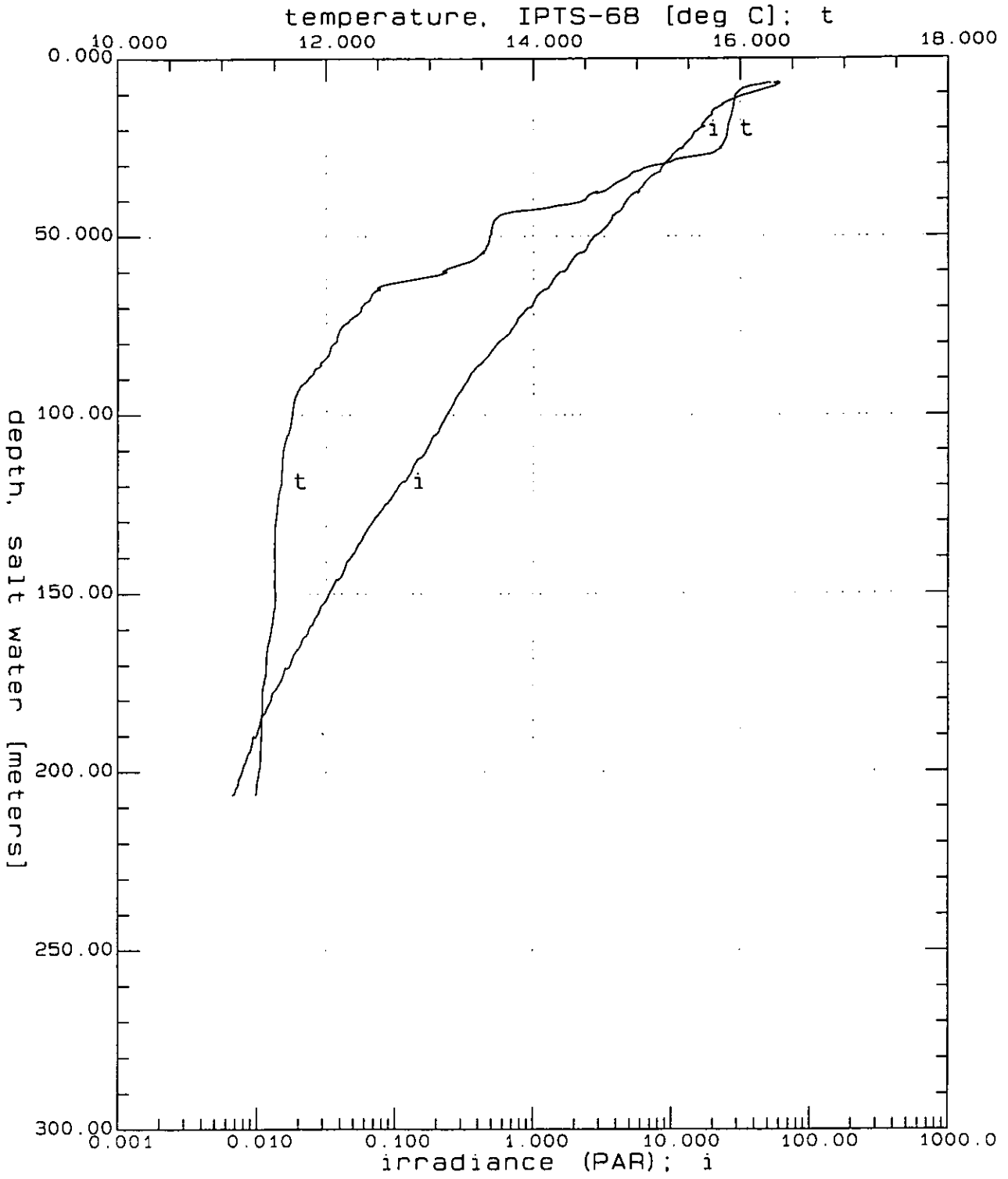
OMX01B00.CNV: OMEX 95/21 Station 1 light profile B

Figure 59



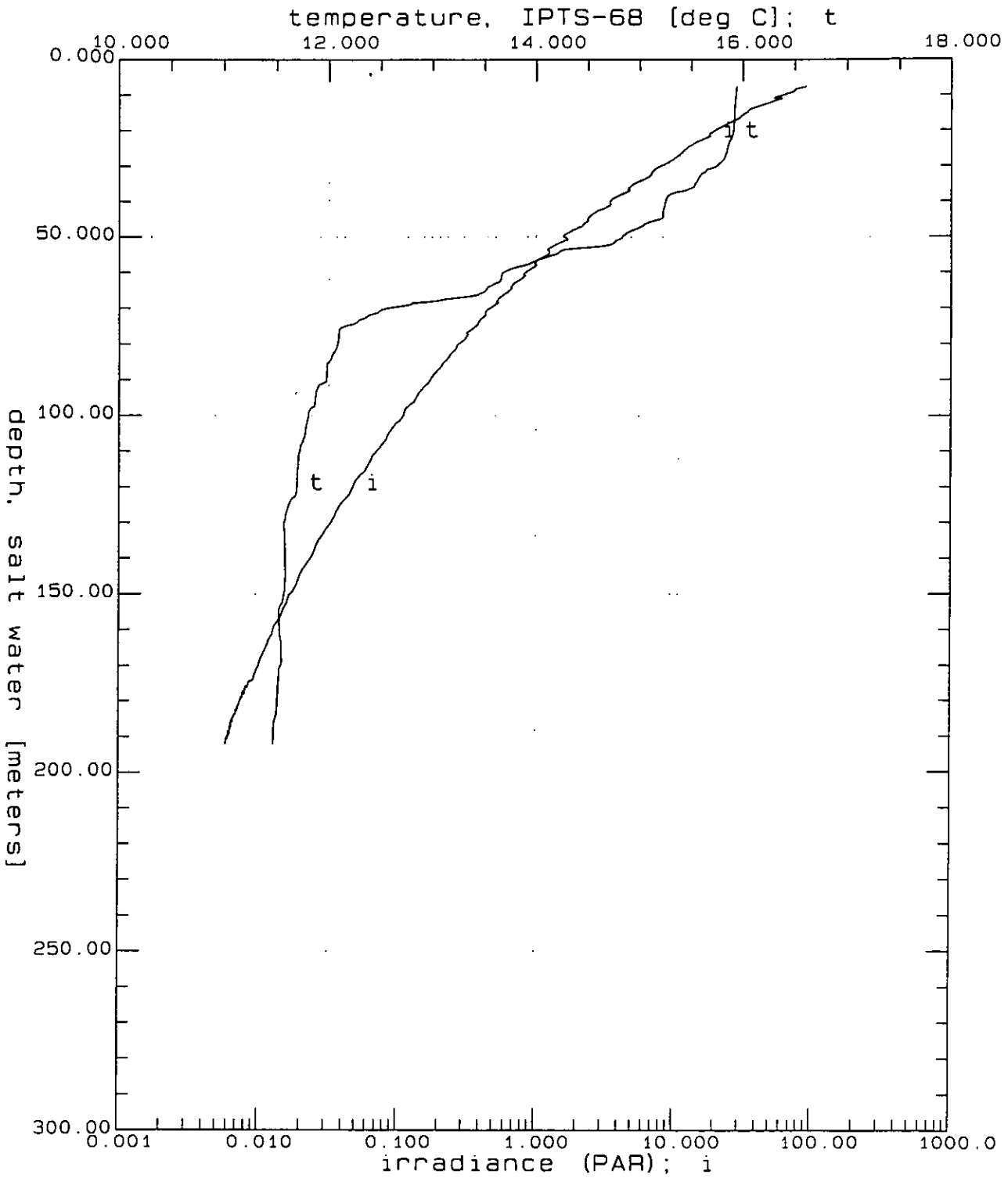
OMX04A00.CNV: OMEX 95/21 Station 4 light profile A

Figure 60



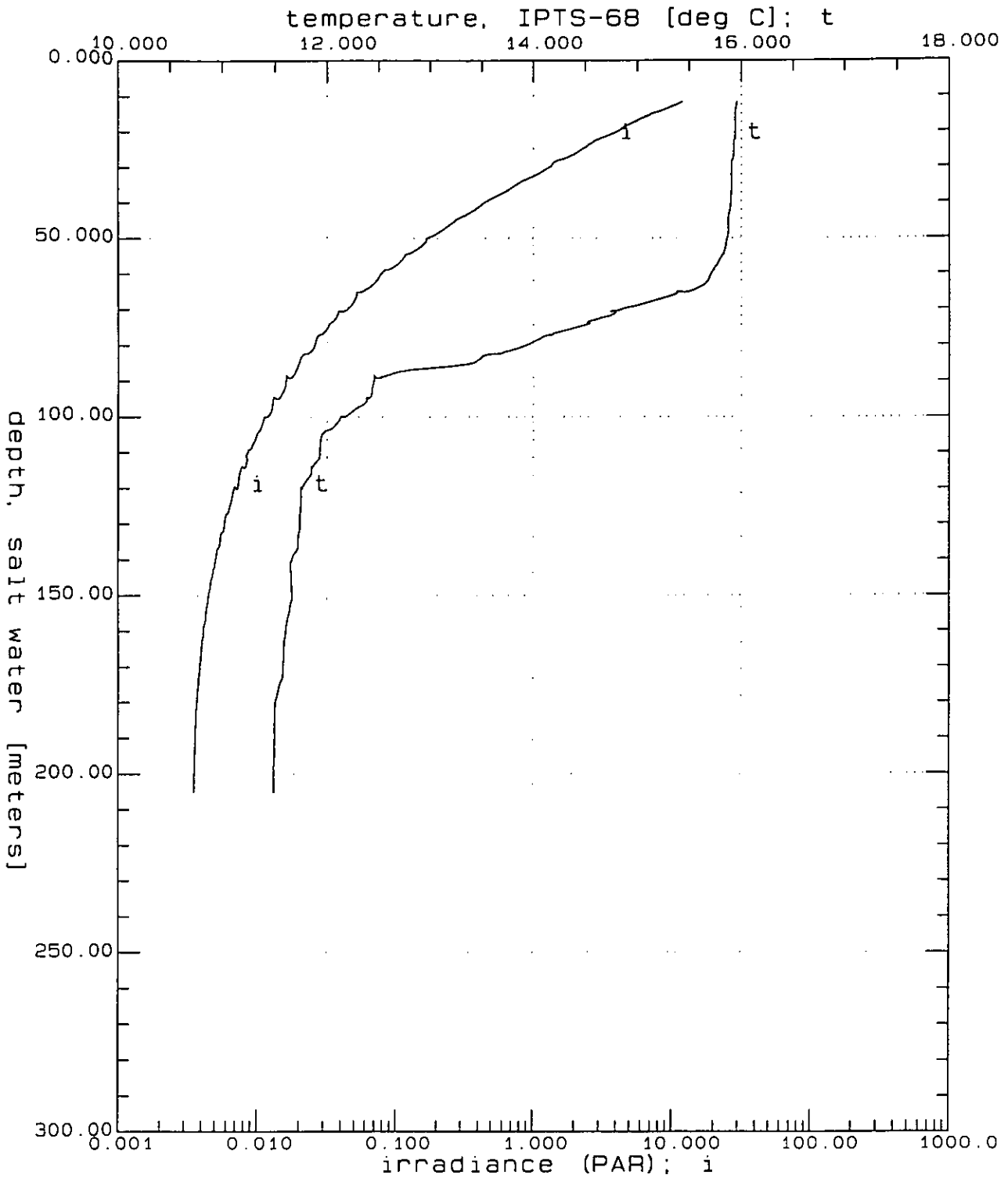
OMX05B00.CNV: OMEX 95/21 Station 5 light profile B

Figure 61



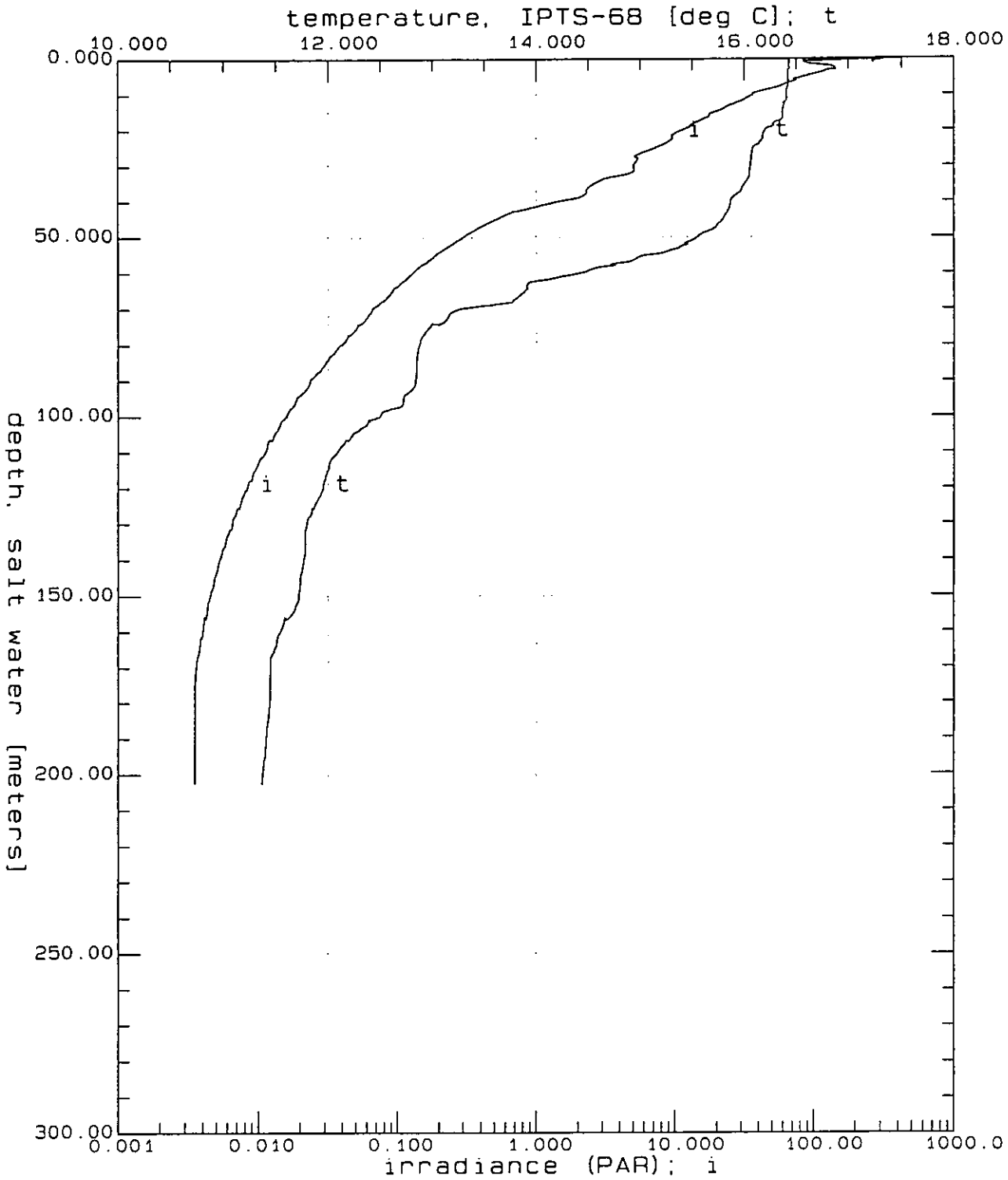
OMX05C00.CNV: OMEX 95/21 Station 5 light profile C

Figure 62



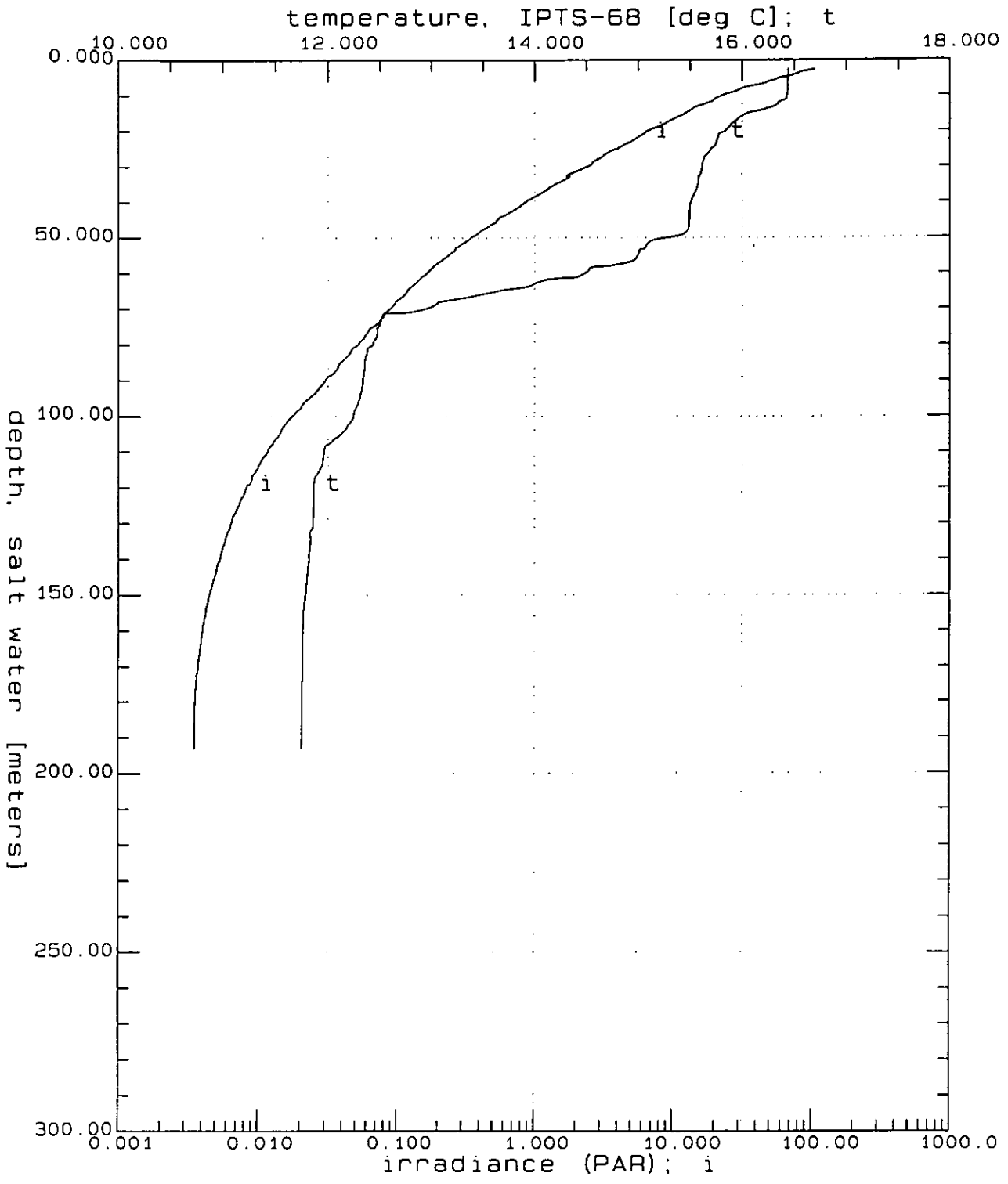
OMX05D00.CNV: OMEX 95/21 Station 5 light profile D

Figure 63



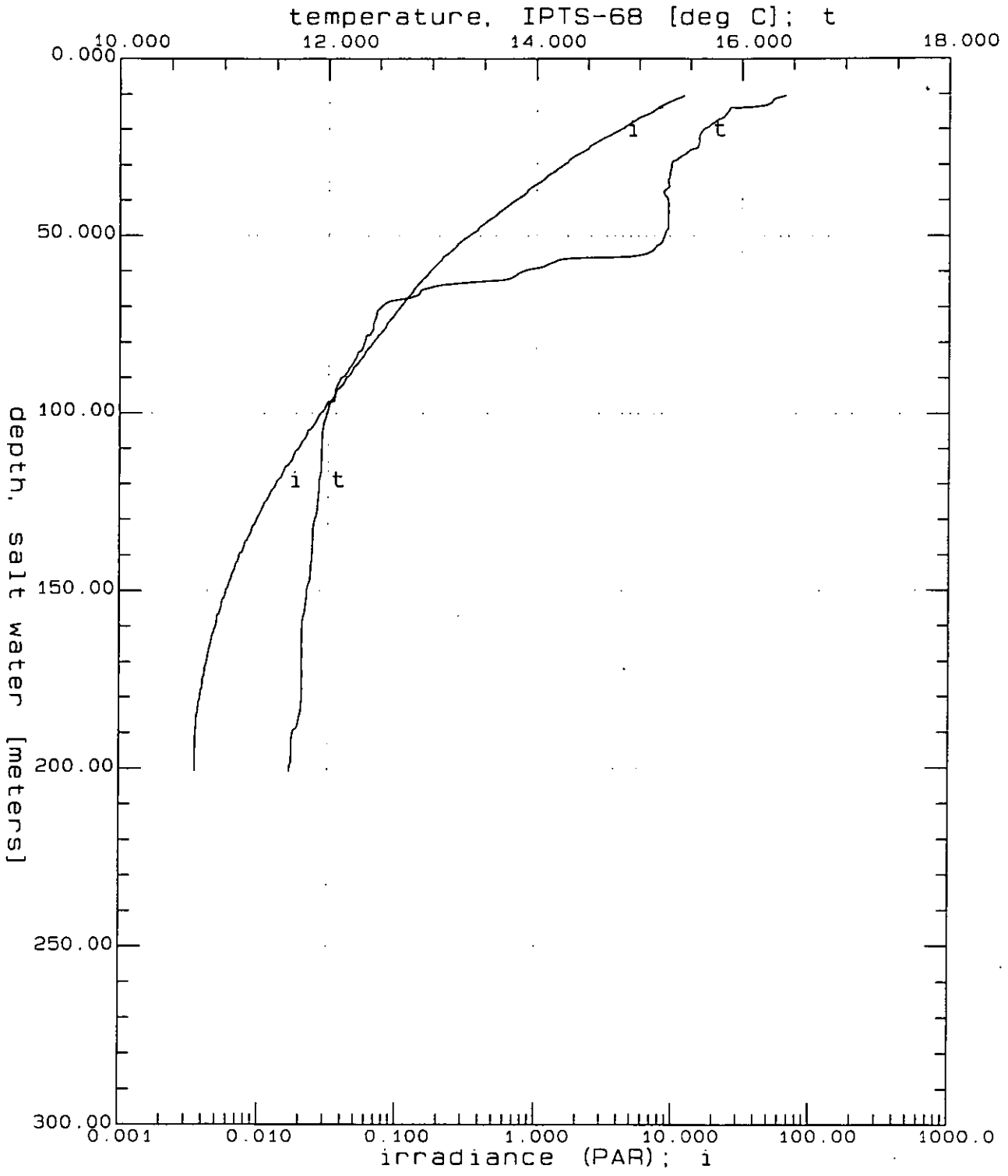
OMX07A00.CNV: OMEX 95/21 Station 7 light profile A

Figure 64



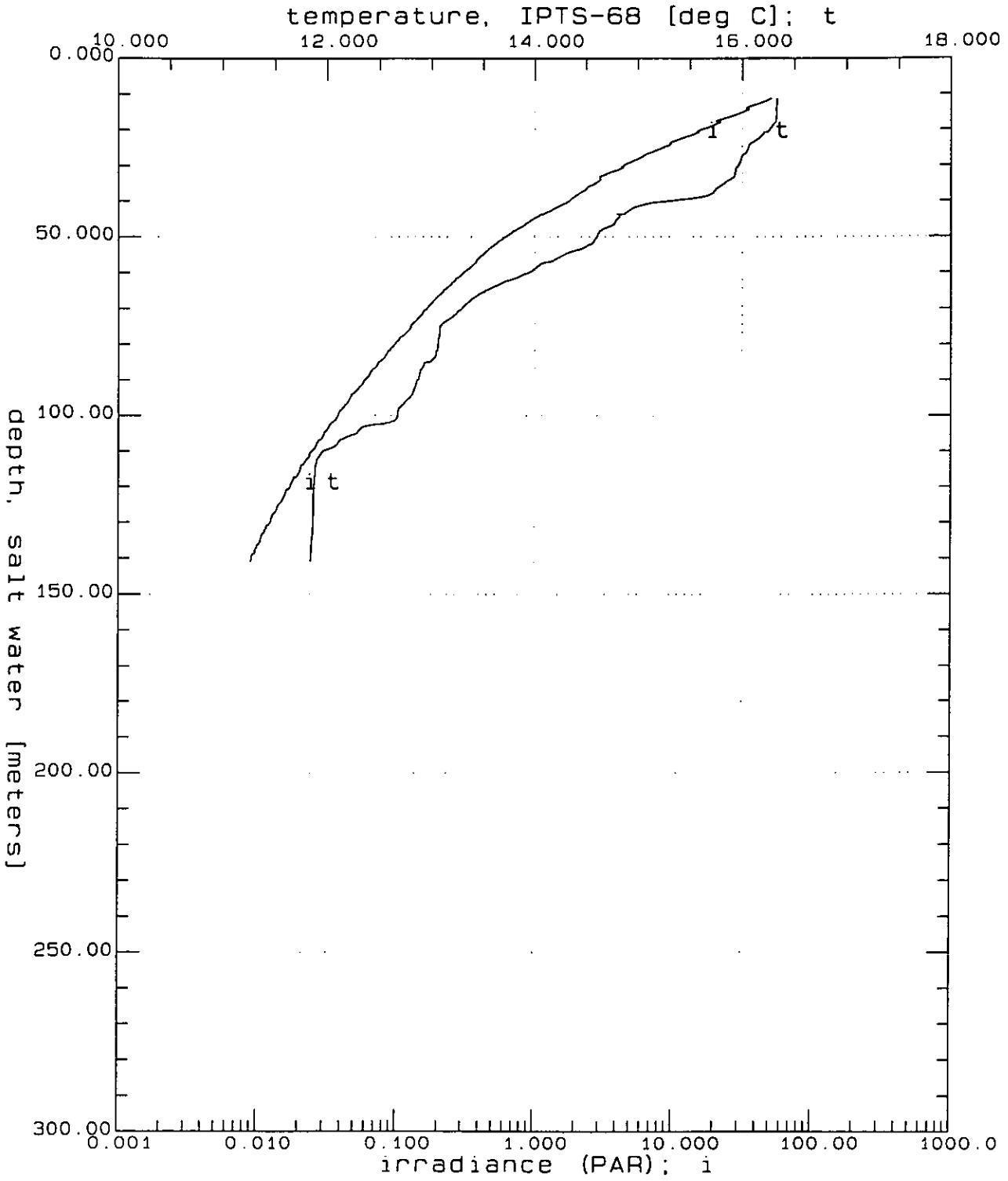
OMX08A00.CNV: OMEX 95/21 Station 8 light profile A

Figure 65



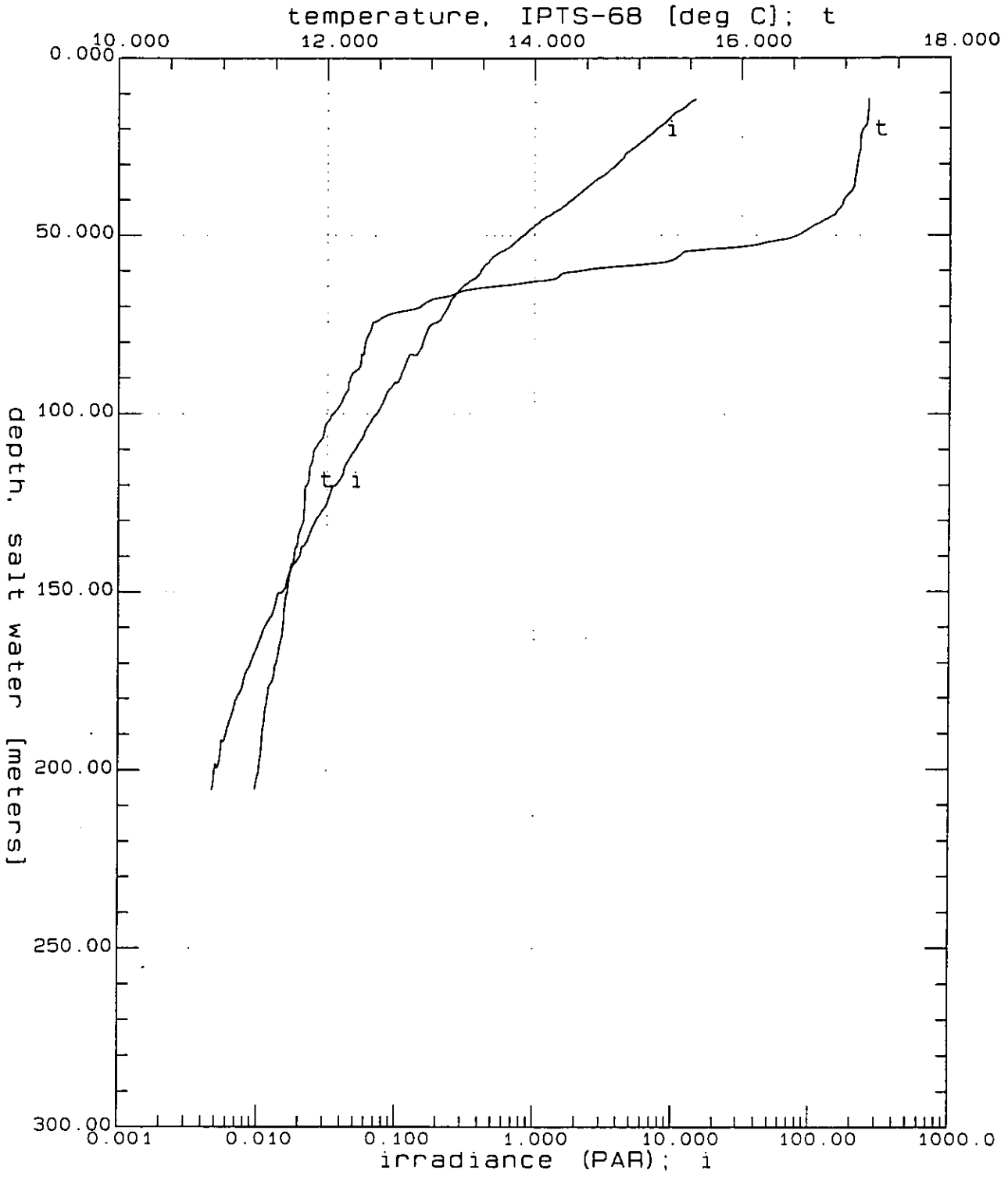
OMX10A00.CNV: OMEX 95/21 Station 10 light profile A

Figure 66



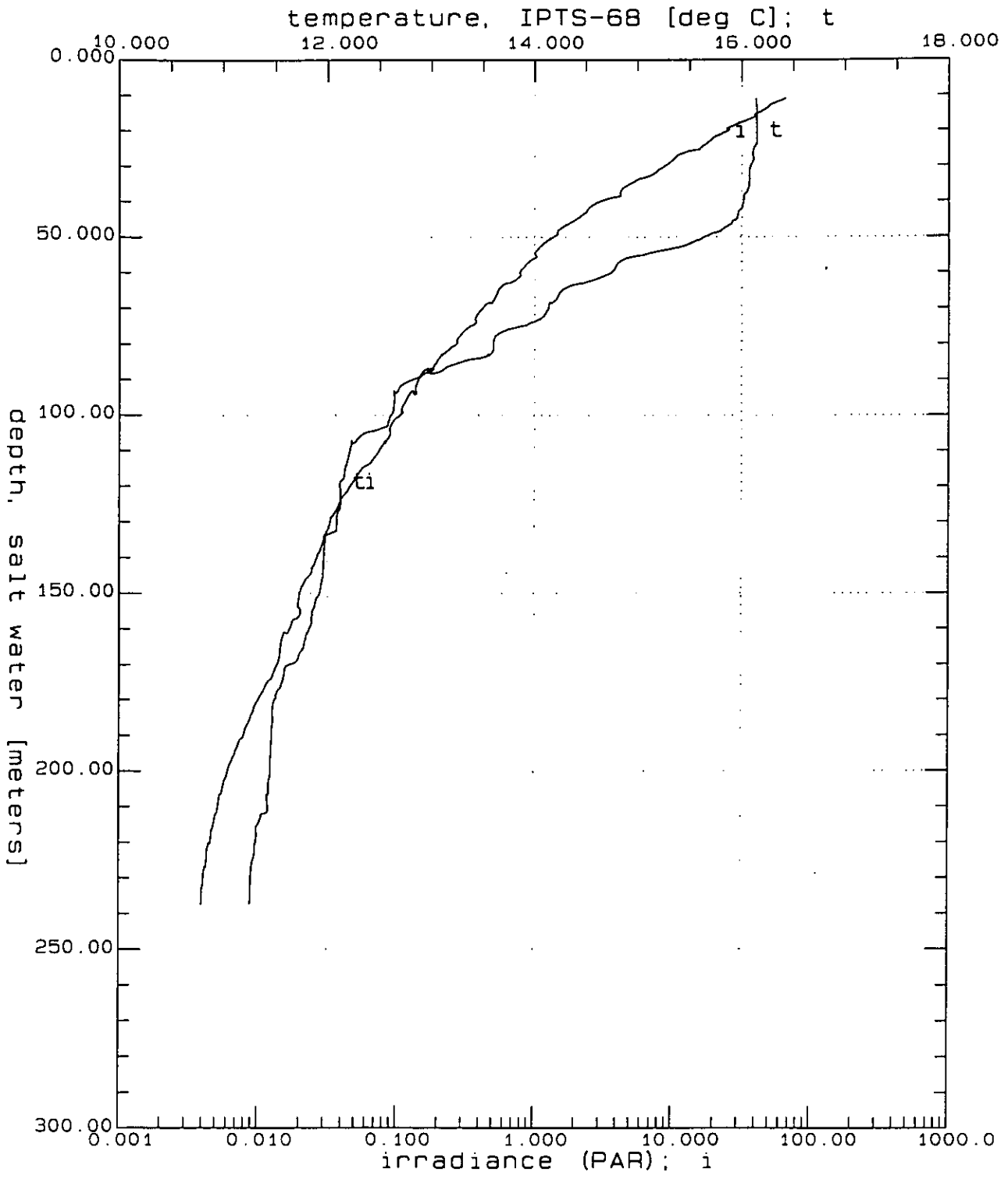
OMX11A00.CNV: OMEX 95/21 Station 11 light profile A

Figure 67



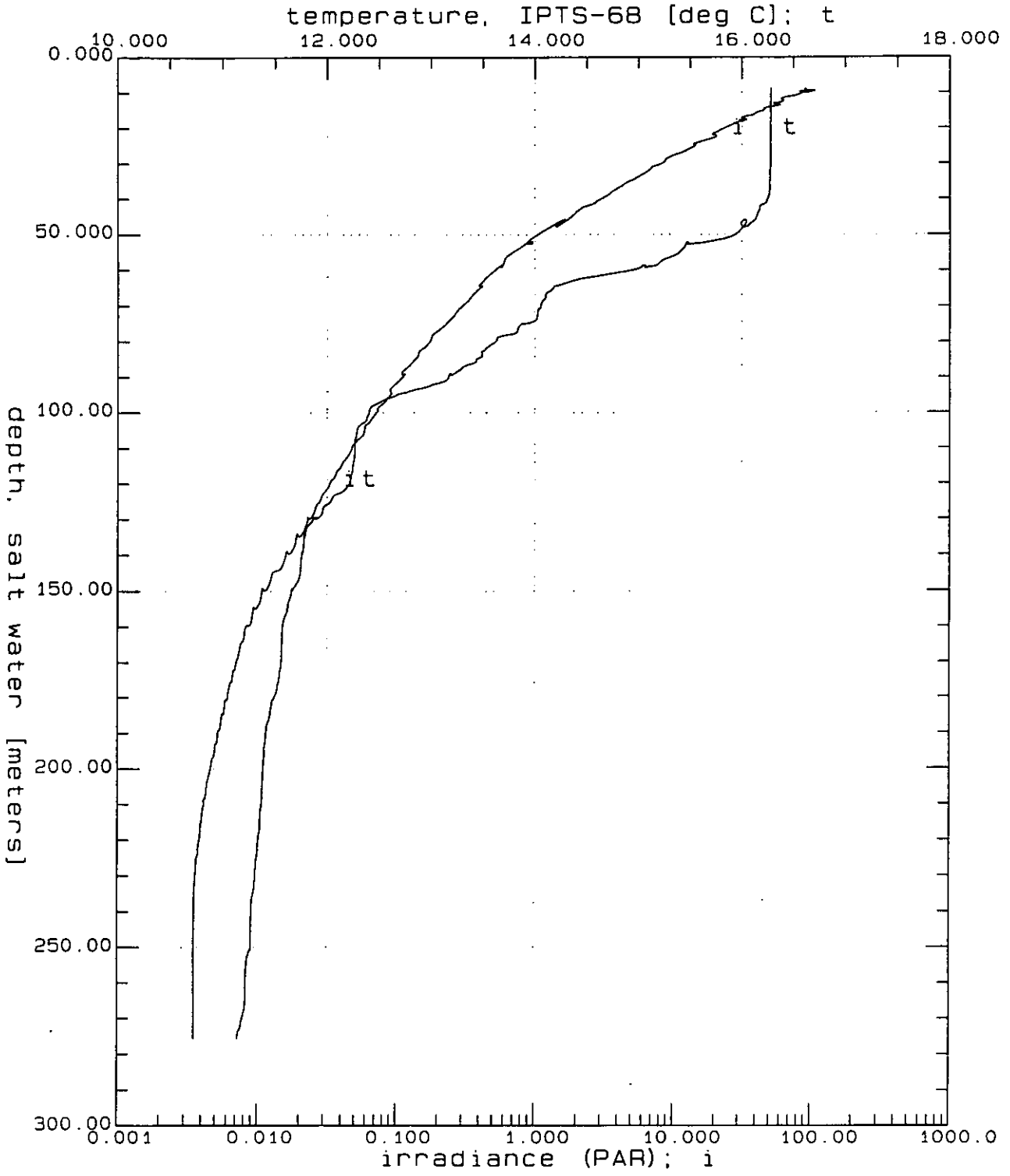
OMX12A00.CNV: OMEX 95/22 Station 12 light profile A

Figure 68



OMX16A00.CNV: OMEX 95/22 Station 16 light profile A

Figure 69



OMX18A00.CNV: OMEX 95/22 Station 18 light profile A

Figure 70