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I Introduction

The OMEX programme (Ocean Margin Experiment) is an EC-MAST-II funded multidisciplinary exercise in which Belgian , British, Dutch, French, German, Irish, and Spanish research institutes cooperate.
It will be be executed in its first phase in the period 1993 - 1996.
The benthic subprogramme within OMEX focuses on transport and modes of transport of (organic) matter from the shelf to the deep, and on questions as how the differences in organic carbon input to the seafloor at different locations is reflected in the geochemistry (early diagenesis) and biology (abundances and activities of macro- and meiofauna, and of heterotrophic bacteria)

The present cruise (11-31 October 1993) with the Dutch RV PELAGIA started with an **acoustic reconnaissance** by towing (5-7 knots) of an acoustic transponder/receiver (EdoWestern; 10kW, 3.5 kHz) along two transects going from the shallow Celtic Sea to the abyssal plain (see cruise track). Sampling occurred, apart from stat.3, at the OMEX transect starting in the Celtic Sea., then passing the Goban Spur, the Pendragon Escarpment, and ending in the Porcupine Abyssal Plain. Based on the acoustic reconnaissance stations representing different rates of deposition were selected. The transect comprises nine stations, covering a depth range from 200 - 4600 m. Three of these, OMEX I, II, and III at depths of 670, 1425, and 3650 m. respectively, will be visited during futural OMEX cruises. At the OMEX-I, II, and III stations moored sediment traps and a lander equipped with near bottom current meters, ctd, and nephelometers were deployed in June 1993 by the Kiel/NIOZ group on board RV POSEIDON.

At the stations on this transect CTD (Sea-Bird Electronics) casts were carried out to gain information concerning **physico-chemical and biological characteristics of the watercolumn.** Apart from the CTD sensor the instrument contained an oxygen probe (Beckman), and a transmissometer (SeaTech, 25 cm pathlength). From the 24 NOEX bottles (12 l.), mounted on the Rosette frame, samples for shipboard analyses of nutrients and oxygen and for laboratory measurements on microzooplankton (Elaine Edwards, PML, UK), and total suspended matter, were taken.

More detailed information on the **physico-chemical characteristics of the Benthic Boundary layer** were gained from the bottom water sampler (BWS) which samples 12 l of water at 40, 20, 10, and 5 cm above the seafloor. This instrument is also equipped with optical back scatter sensors and thermistor current velocity meters. For more details see cruise report of Dr. L. Thomsen (page 10-12).

Sediment and porewater sampling was carried out by boxcoring (50 cm diameter cylindrical boxcorer; NIOZ) and by application of a MultiCorer (see cruise report Dr. Th. Soltwedel; page 20 - 22). Because of the restricted cable lenght, box- and multicoring was possible at waterdepths of < 3000 m.

In-situ measurements of pore water oxygen profiles and of electrical resistivity were made by deployment of the NIOZ lander TROL (Temperature Resistivity Oxygen Lander). Details are given in the report by Dr. W. Helder and E. Epping (page 23 - 24).

Benthic fluxes of oxygen and nutrients were measured **in-situ** with the NIOZ lander BOLAS (Benthic Oxygen Lander System). The instrument is equipped with two benthic chambers, which are pushed into the sediment and closed hydraulically. The enclosed overlying water in the chambers is continuously monitored for diss. O_2. At regular time intervals samples are withdrawn by spring loaded syringes. The results on fluxes from the Bolas will be compared with those resulting from on-deck incubations of whole boxcores. More information is given in the report of Berghuis, van der Weele and Visser (page 25 - 27).

Both BOLAS and TROL are equipped with BENTHOS acoustic releases. Before deployments at the stations OMEX I, II, and III, we communicated with GEOMAR-Kiel to be sure that our release codes did not overlap with those of the moored sdiment traps at these stations. At stat. OMEX III such an overlap was found indeed and we had to change the acoustic release on TROL! It is recommended that all acoustic release types and codes to be used within the OMEX programme are gathered by the OMEX coordination and distributed to the participants.

II General cruise information

II.1 List of participants

E. Berghuis	NIOZ - Benthic Systems
M. Dekker	NIOZ - Organic Geochemistry
E. Epping	NIOZ - Chemical Oceanography
H. Franken	NIOZ- Electronics
Dr. W. Helder	NIOZ - Chemical Oceanography
J. Kalf	NIOZ - Marine Geology
A. van Koutrik	NIOZ - Chemical Oceanography
J. van Ooijen	NIOZ - Chemical Oceanography
S. Peter	University Hamburg, Hydrobiol.Institute.
H. de Porto	NIOZ - Marine Technics
A. Sandee	Centre for Estuarine Marine Research, Yerseke, Netherlands
Dr. Th. Soltwedel	University Hamburg, Hydrobiol Institute
Dr. L. Thomsen	GEOMAR-Environmental Geology, Kiel
H. Visser	NIOZ - Benthic Systems
J. van der Weele	NIOZ - Benthic Systems

II.2 Overall cruise logistics

The cruise was planned to start Monday 11 Oct.from the NIOZ harbour at Texel and to finish there at 29 Oct. The leave had to be postponed due to electrical grounding problems of the ship. The actual leave was at Wednesday 13 Oct., and after consultation with NIOZ ships management, the loss of two days was compensated for by extending the cruise to 31 Oct.

The research area was reached in the evening of 15 Oct. and thereafter acoustic reconnaissance (3.5kH) of the two transects (see maps in Appendix) was carried out with a tawed transponding/receiving system. Inspection on deck of the acoustic system was combined with a CTD try-out at 17 Oct.

At Monday 18 Oct. 08.15 hr sampling started at stat. A at transect-I. On this transect 9 stations in the depth range 200- 4600 m were carried out till Thursday 28 Oct., including a repetition of the shallow, sandy stat. A, where boxcoring failed earlier. The location of

stations is given in the map in Appendix. The ship reached the NIOZ harbour safely at 31 Oct, 09.00 hr. During the cruise the weather conditions were extremely good considering the time of the year. Windforce was 6 Bf. at maximum, and sampling at stations was not restricted by wind and/or swell.

II.3 Position of stations

The positions and depths tabulated below were recorded when the CTD bottom trigger reached the seafloor. Thanks to the DGPS based positioning of the PELAGIA, casts with other instrumentation than CTD (boxcoring, multicoring, Bottom Water Sampler, TROL, BOLAS) have essentially the same position as given below.

station	transect	position N	position W	depth (m)	date
3	2	50° 04.95'	11° 55.00'	2100	17/10
A	1	49° 28.44'	11° 12.27'	206	18/10
OMEX-I	1	49° 24.72'	11° 31.86'	670	19/10
B	1	49° 21.99'	11° 48.09'	1034	20/10
OMEX-II	1	49° 11.20'	12° 49.18'	1425	21/10
C	1	49° 09.58'	12° 59.35'	1961	22/10
D	1	49° 07.70'	13° 10.51'	2760	23/10
OMEX-III	1	49° 05.00'	13° 25.80'	3650	24/10
E	1	49° 02.29'	13° 42.23'	4460	24/10
F	1	49° 09.06'	13° 05.40'	2182	25/10
A2	1	49° 28.98'	11° 07.97'	208	26/10

II.4 Sampling activity at stations:

station	CTD	BWS	MC	BC	TROL	BOLAS
3	+	-	-	-	-	-
A	+	+	+	-	+	-
OMEX-I	+	+	+	+	+	+
B	+	+	+	+	-	-
OMEX-II	+	+	+	+	+	+
C	+	+	+	+	-	-
D	+	+	+	+	-	-
OMEX-III	+	+	-	-	+	+
E	+	+	-	-	+	-
F	+	+	+	+	+	+
A2	+	+	+	+	-	-

II.4.a. CTD

The continuous data output during the downcasts was stored and graphic outputs are included in this report under the heading: IV Data CTD profiles. During the upcast the CTD output at the depths of bottle closure is given in the data report under the heading: overlying water chemistry.

In all bottles the following parameters were measured on board:

oxygen, nutrients (nitrate, nitrite, ammonia, fosfate, silicate)

From bottles closed at depths < 200 m samples were taken and preserved for later analyses of micro-zooplankton (Elaine Edwards, PML).

Bottles from 10 m above bottom were sampled (5 -10l) and filtered over Nucleopore 0.4 µm, for later determination of content of suspended matter and organic and inorganic carbon content.

Occasionally 2-3 bottles of waterdepths > 1000 m were sampled for salinity determination in the NIOZ laboratory, to be able to calibrate the conductivity sensor of the SeaBird CTD system.

II.4.b. Boxcores

At all stations where boxcoring was possible, 4-5 cores were taken. The measured/to be measured parameters can be listed as follows.

Geochemistry:

1) Sub-cores with overlying water on top were taken for determination of resistivity profiles with a 4-terminal resistivity probe.
2) Similar cores as above were taken for shipboard oxygen profiling
3) Sub-cores without overlying water were sampled and sliced for porewater and determination of nitrate, nitrite, ammonia, fosfate, diss.Si, diss. Mn., diss. Fe, and sulfate
4) Sub-cores with no overlying water were sliced in segments for later determination of porosity.
5) Subcores with no overlying water on top were sliced for later determination of solid phase parameters as: org.C, carbonates, biogenic silicate, Pb-210 and Th-isotopes.

Biology:

1) Two or sometimes one boxcore were used as a whole for shipboard incubation to evaluate the fluxes of oxygen and nutrients.
2) Subcores were taken for depth distribution of phytopigments and for RNA/DNA.
3) Subcores for abundance of macrofauna for abundance and depth distribution of meiofauna.

II.4.c. MultiCorer and BottomWaterSampler

Sampling from the MultiCorer and the BottomWaterSampler is indicated in the reports of Soltwedel and Thomsen.

III Reports

III.1 On board chemical analyses

III.1.a. Nutrients, diss. Mn., - Fe, and sulfate

C. van Ooijen and A. van Koutrik
Chemical Oceanography (NIOZ)

Summary: During this oceanographic cruise we analysed for the following nutrients: Ammonium, Phosphate, Nitrate, Nitrite and Silicate in overlying water and pore water and dissolved Iron, dissolved Manganese and Sulphate in porewater. Samples were obtained from a CTD-rosette sampler, a boxcorer, a bottomwater sampler, a multicorer and a benthic lander. We also got pore-water samples and samples of incubation experiments. The analyses were carried out on a TRAACS 800 autoanalyser except for the determination of sulphate, wich was carried out manually on a Skalar 6100 field Spectrophotometer. Methods: Samples from the CTD-Rosette bottles and of the bottomwater sampler were taken in polyethylene bottles. These samples were not filtered and therefore analysed as soon as possible, mostly within 4 hours. In the meantime they were stored cool (2-4 C) and dark. All other samples were filtered through a 0.2 or 0.45 um filter and analysed within 24 hours, stored dark and cool (2-4 C). The iron and manganese samples were, after filtering, acidified with hydrochloric acid Supra pure to a 0.1% acid solution and analysed within 3 days. Working standards were freshly prepared every day by diluting stock standards to the required concentration with natural aged seawater (low nutrients concentration). This water was also used as wash water between the samples. The concentration of nutrients in the natural aged seawater was determined manually. Every day we used a second mixed nutrient stock as an independent external check. This cocktail, which is poisened with 0.2 % chloroform, is used for the third consecutive year and has proved on several cruises to be a reliable standard producing the same values every time. Pipettes and volumetric flasks were calibrated before the cruise and fresh stock standards were measured against the previous ones and our "nutscocktail". The accuracy of our analyses is about 1% of full scale values. In the case of phosphate and ammonium this is about 2%. The results of our analyses are published elsewhere in this report.

Methods used for the analyses:

Ammonium:	Phenol method
Phosphate :	Ammoniummolybdate/Ascorbic acid method
Nitrate/Nitrite:	Sulphanylamide/Naphtylethylenediamine method using a copperized Cadmium coil for reduction
Silicate:	Ammoniummolybdate/Ascorbic acid method
Diss.Iron:	Ferrozine/hydroxylammoniumchloride method
Diss.Manganese:	Ammoniumironsulfate/hydroxylammonium-chloride method
Sulphate:	Bariumchloride/Gelatine method

Comparison of solute concentrations in the overlying water as obtained from different sampling techniques.

Ammonium	Station:	A	A-2	B	C	D	E	F	O-I	O-II	O-III
umol/L	CTD	0.3	0.4	1	0.5	0.3	0.3	0.5	0.3	0.1	0.3
	Box		2.2	3.3	3.6			2.1	0.7	1.1	
	BWS	0.1	0.2	0.6	0.2				0.2	0.2	
	Niskin							0.9	1.3		0.9
	Multicore		0.5					0.5			

Phosphate	Station:	A	A-2	B	C	D	E	F	O-I	O-II	O-III
umol/L	CTD	0.77	0.7	1.12	1.21	1.39	1.52	1.24	0.94	1.16	1.48
	Box		1.14	1.41	1.69			1.47	0.94	1.29	
	BWS	0.73	0.65	1.06	1.19				0.91	1.1	
	Niskin							1.24	0.96		1.55
	Multicore		0.66					1.25			

Nitrate	Station:	A	A-2	B	C	D	E	F	O-I	O-II	O-III
umol/L	CTD	11.6	11.2	17.7	18.2	20.4	22.3	18.9	14.8	18.6	22.5
	Box		11.2	17.9	18.1			18.6	14.8	18.3	
	BWS	11.4	10.6	17.3	18.3				14.7	18.2	
	Niskin							19.9	15.1		22.7
	Multicore		10.6					18.1			

Silicate	Station:	A	A-2	B	C	D	E	F	O-I	O-II	O-III
umol/L	CTD	4.3	4	10.5	15.8	30.8	46.6	19.2	7.2	12.9	43.1
	Box		4.2	10.8	17.3			21.1	7.4	13.4	

	BWS	4.7	4	10.8	15.6			7.7	13.2		
	Niskin						19.3	6.9		43.9	
	Multicore		3.8				18.1				

Oxygen	Station:	A	A-2	B	C	D	E	F	O-I	O-II	O-III
umol/L	CTD	250	245	209	284	263	252	273	229	241	252
	Box		246	210	275			271	224	248	
	Niskin							273	230		251
	Multicore	243	244	209		261		268	225	239	

III.1.b. Oxygen

M. Dekker
NIOZ - Organic Geochemistry

Samples came from the NOEX bottles mounted on the CTD-Rosette frame, from the overlying water in the boxcores, as well as from the multicores and furthermore from the shipboard sediment incubation experiments.

The method of analyses followed, with minor modifications the classical Winkler procedure, as given in Strickland and Parsons(1968):
Calibrated glass stoppered oxygen bottles (about 100 ml) were carefully rinsed and filled with sample. The oxygen bottles were stoppered after at least three times flow-through of sample, without trapping of air.
Directly after sampling 1 ml of solution A and 2 ml of solution B (for composition see below) were added and the closed bottles were vigorously shaken, which was repeated after settling of the precipitate. Samples were stored under water. The stoppers were closed well by attaching an elastic band around the bottles.

Prior to analyses about 25 ml of the supernatant was removed by syringe and then 1 ml 20 N sulfuric acid was added. Titration was carried out with 0.01N sodiumthiosulfate in a Brand Digital Burette.
When the solution in the bottles turned light yellow 0.5 ml. 1% starch solution was added and titration was continued till the solution became colourless. The thiosulfate solution was made by dilution from a 0.1N ampouled stock solution.(Merck) and its strenght was regularly checked by titration with 0.01N KIO_3. Blanks were made by the procedure as given in Strickland and Parsons.

Composition Reagent A: 600 g. $MnCl2 . 4 H2O$ / l.
Reagent B: 250 g. NaOH and 350 g. KI / l.

The accuracy of the method is estimated to be within 1%
All samples were at least run in duplicate. All oxygen data are given in the data section of this report (IV Data bottle-files).

III.2 BENTHIC BOUNDARY LAYER CHARACTERISTICS

Thomsen, Graf GEOMAR, Kiel

Aims
Aim of this first study was to qualify and quantify the near bed transport of particulate and dissolved matter, to measure flow velocity at 30 cm height above bottom [a.b.] and to measure optical backscatter of the particles.

Sampling
An in situ bottom water sampler, the Bioprobe system was used to collect 12 l. water of each at heights of 5, 10, 20 and 40 cm above sea floor. The sampling system consisted of 4 Plexi-bottles with inner Polyethylene bags. Below the bottles, tubes were mounted which enlarge to a cone (diameter 6 cm) with a 2 mm wide horizontal slit as water inlet. The bottles were connected to two centrifugal pumps in an upper instrument cage. Three Optical backscatter sensors, located at 20, 40 and 80 cm height a.b., one thermistor flow meter, located at 30 cm height a.b. and a compass with vane gave information about physical near bottom processes. A video camera was used to make pictures of the sea floor and to estimate the penetration deth of the device. During sampling procedure fresh water in the four bottles is replaced by near bottom water, which is passivly sucked into the Polyethylene bags. These bags separate the fresh water from the near bottom water. Once the bottles are filled, ball valves at each water sampler close by gravitation and by pressure when the instrument is heaved on board. The normal launch technic involved lowering the instrument to the sea floor using a one conductor cable. One buoy was tied to the cable 30 m above the instrument to prevent resuspension by the cable. During deployment 30 - 50 m of the wire was added so that it was slack enough to prevent disturbance by ship movements. Before sampling a waiting period of 3 to 5 min was necessary to allow material resuspended during deployment to drift away with the current.

The device was controlled via the one conductor cable (flow velocity, pumping). Additional water samples from 500 to 800 cm a.b. were taken using 12 l Niskin bottles on a CTD cast.

Analysis

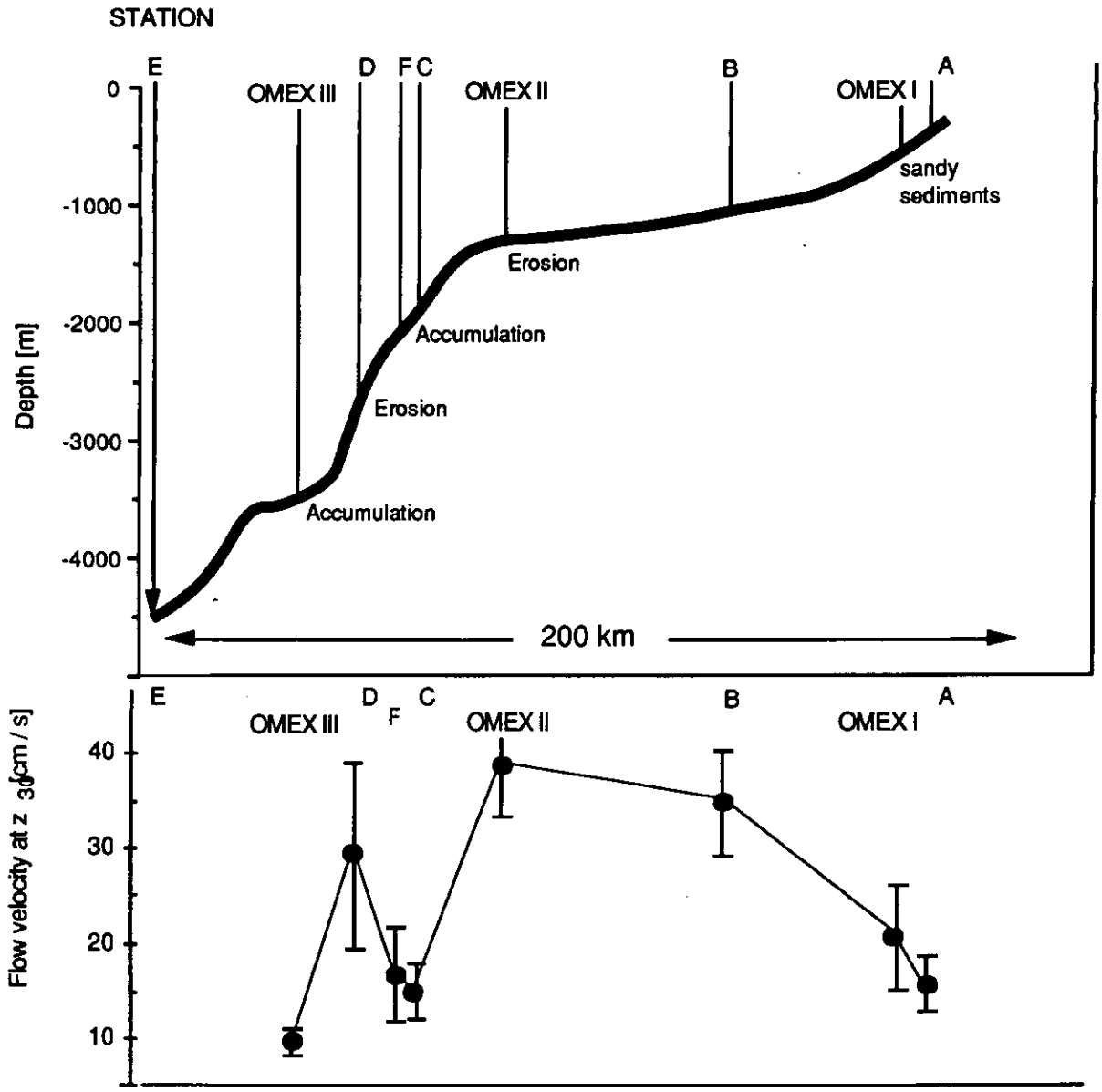
Samples will be analyzed for the following parameters: POC, PON, Chlorophyll, Total particulate matter, nutrients (NIOZ), grain size analyses, and size distribution and organic content of bacterioplankton.

Peliminary results:

Flow velocity, which was measured at z30 (30 cm a.b.) varied between 10±1 cm/s and 39±5 cm/s . There was an increase of flow velocity from 230 m (sta.A) to1470 m (OMEX II) waterdepth from 15±3 to 39±5 cm/s. Between 1470 m and 1960 m (sta.C) flow velocity decreased to 13±3 cm/s and then increased upto 30±10 cm/s at station D (2800 m), which was situated at the steep slope beween 2000 and 3000 m waterdepth. At 3600 m (OMEX III) lowest flow velocity of 10±1 cm/s was found. Highest particle transport in the near bottom water, measured with the OBS sensors occured at station B (1025 m, 35±6 cm flow velocity), where sediments consisted of sandy silt.

Nutrient contend in the near bottom water were similar to those found 500 to 800 cm a.b. and showed no decrease above the sea floor (NIOZ).

Although the flow measurements were just spot measurements of 10 to 15 min each, there seems to be a correlation between flow velocity data and sediment accumulation. Areas with high flow velocity showed low accumulation (OMEX II), whereas sediment accumulation was highest at station OMEX III where low current velocities were measured.



Diagrammatic representation of the OMEX-1 transect (upper panel) and measured flow velocities at indicated stations (lower panel).

III.3 Early diagenesis

Eric Epping and Marlèn Dekker
NIOZ, Chemical Oceanography & Organic Geochemistry

Introduction

Organic carbon present in sediments in principle originate from pelagic production, in situ benthic production or from lateral transport processes. This carbon can be classified with respect to its degradability. In fact this characteristic reflects the 'life history', or ' apparent age' of the carbon. Well degradable fractions like proteins, sugars, short chain fatty acids and other low molecular weight compounds will be removed at the onset of mineralisation, leaving the more refractory carbon. Assuming regular sedimentation, the age of organic carbon can be expected to increase with depth in the sediment and therefore the degradability will decrease with depth. However, lateral transport processes may be catastrophically by nature thus disturbing the carbon gradients.
In order to calculate carbon budgets, in- and output variables for carbon must be estimated. The most important output variables are lateral transport and mineralisation. Carbon mineralisation can be assessed from turn over rates of the electron acceptors involved, like oxygen, nitrate/nitrite, ferric iron, manganese oxide, sulphate and carbon dioxide. Mineralisation can also be calculated from production rates of end products of mineralisation, like ammonium. Turn-over or production rates can be estimated by applying ion specific transport-reaction models on depth distribution of the solutes. If turn-over rates of these compounds are known, the amount of decomposed carbon can be calculated from stoichiometric relations.
In order to calculate sediment carbon mineralisation at sites ranging from 200 to 2175 m waterdepth, the following set of parameters were determined:

depth distribution of:
- porosity,
- resistivity
- particulate organic carbon and organic nitrogen content
- solid phase iron and manganese
- oxygen
- nitrate/nitrite

- ammonium
- ferrous iron
- dissolved manganese
- sulphate
- silicate

For fine tuning of the flux calculations a new technique was tested to calculate sediment diffusion coefficients for oxygen, by applying an agar overlay to the sediment.

Methods

Sampling

Boxcores, and occasionally multicores were taken at station 2A (200 m), OMEX-I (670 m), station B (1000 m), OMEX-III (1445 m), station C (2000 m) and station F (2175 m). The overlying water was analysed for oxygen and nutrient concentration. Subsamples for porewater analysis were taken from 'virtually undisturbed' box- or multicores by inserting plexi-glass tubes (i.d.35 or 54 mm), leaving approximately 4 cm of overlying water. Samples were taken to laboratory, conditioned at in situ temperature.

Oxygen measurements

The sediment was monitored as soon as possible (within 10 min after subsampling) for oxygen by microelectrode techniques. An automated micromanipulator, constructed at the NIOZ workshop, was equipped with two Clark type microelectrodes with tip diameter of 35 and 40 micron (Diamond #737). Oxygen concentrations were recorded at every 100 micrometer or when high penetration depth was to be expected at every 250 micrometer.

Porewater collection

Sixteen cores were sliced according to the following scheme:

sample	depth interval (mm)
1	0 - 2.5
2	2.5 - 5
3	5 - 7.5
4	7.5 - 10
5	10 - 15

6	15 - 20
7	20 - 25
8	25 - 30
9	30 - 40
10	40 - 50
11	50 - 60
12	60 - 70
13	70 - 90
14	90 - 110
15	110 - 130
16	130 - 150

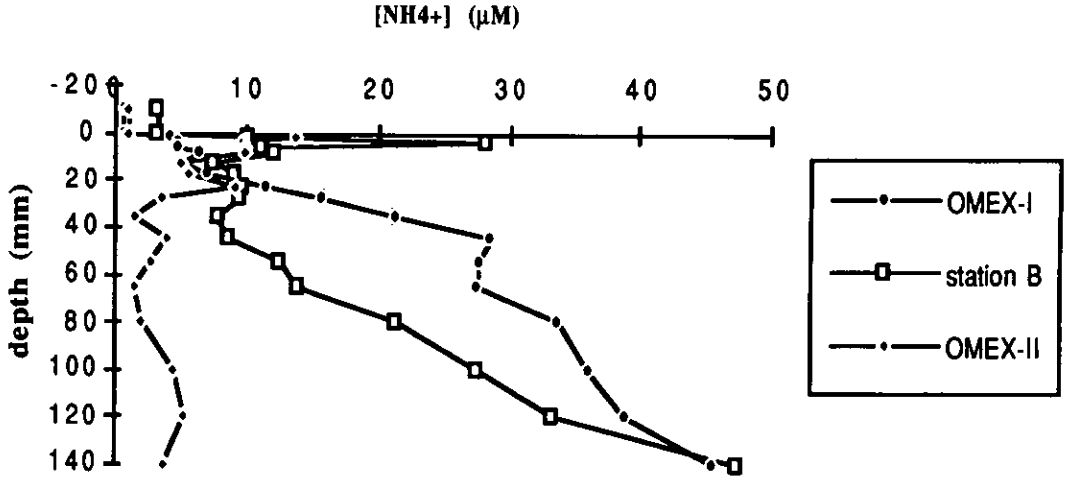
Sediment from corresponding depth intervals were collected in polypropylene centrifuge tubes connected to 0.2 mm cellulose acetate filters. Samples were immediately stored under nitrogen until centrifugation. This technique was only applicable to coarse grained sediment. In the case of clayish sediments, porewater was collected by sqeezing techniques after Reeburgh.
Porewater was analysed for solutes as described by Jan van Ooyen and Annette van Koutrik.

Porosity
Three cores were sliced in 0.5 cm intervals down to 5 cm and collected in glass vials. Porosity will be calculated from weight loss after drying 24 h at 105 °C.

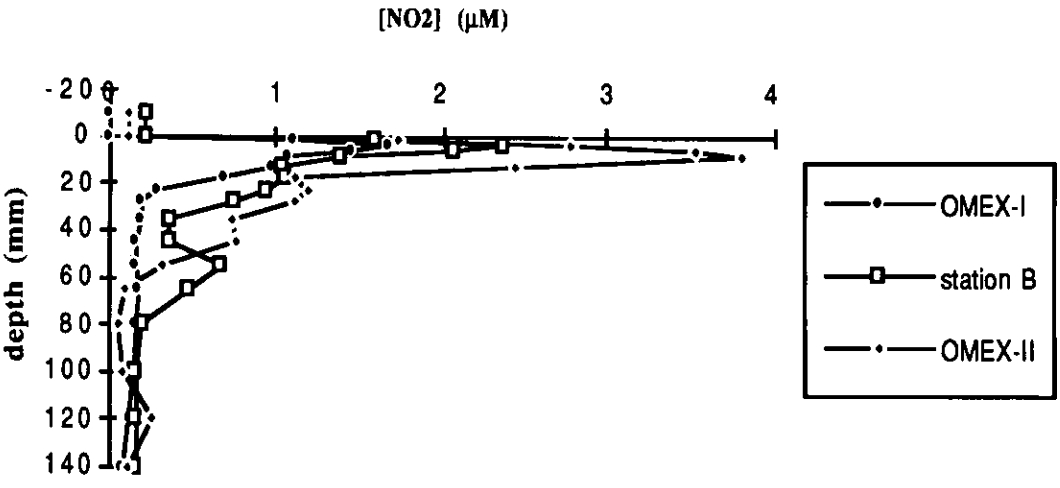
Resistivity
Resistivity was measured with a four wired platinum electrode after Andrews and Bennett, at 1 mm depth intervals. From these profiles the formation factor can be calculated at the sediment-water interface, necessary for converting a free solution molecular diffusion coefficient into a sediment molecular diffusion coefficient.

Results
A few examples of the porewater results for station OMEX-I, B and OMEX-II are given in the next graphs (fig.1-8).

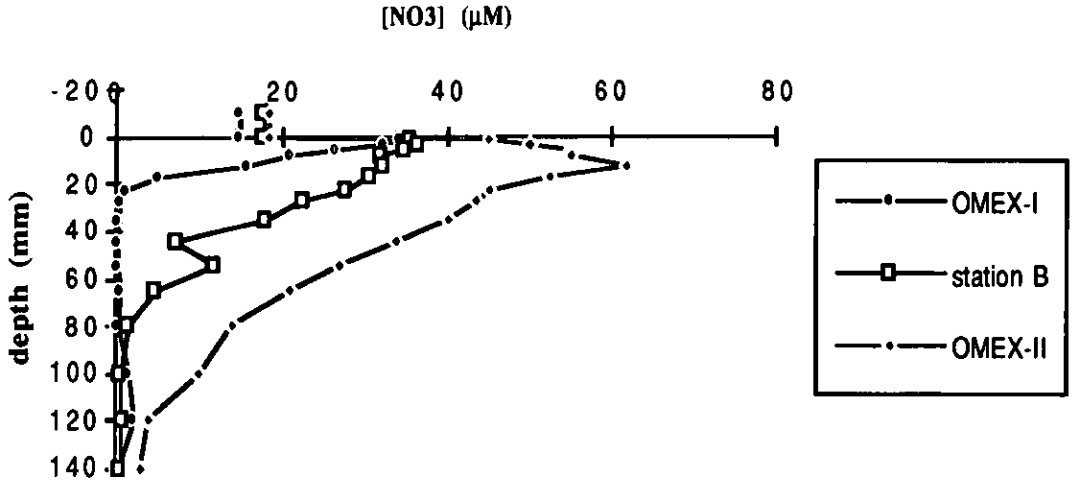
Ammonium profiles transect 1 OMEX 1993



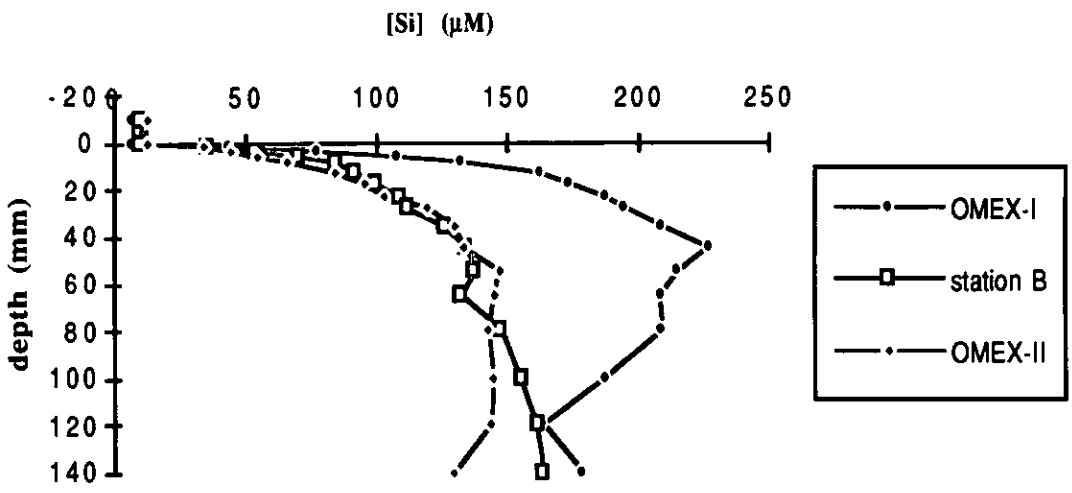
Nitrite profiles transect 1 OMEX 1993



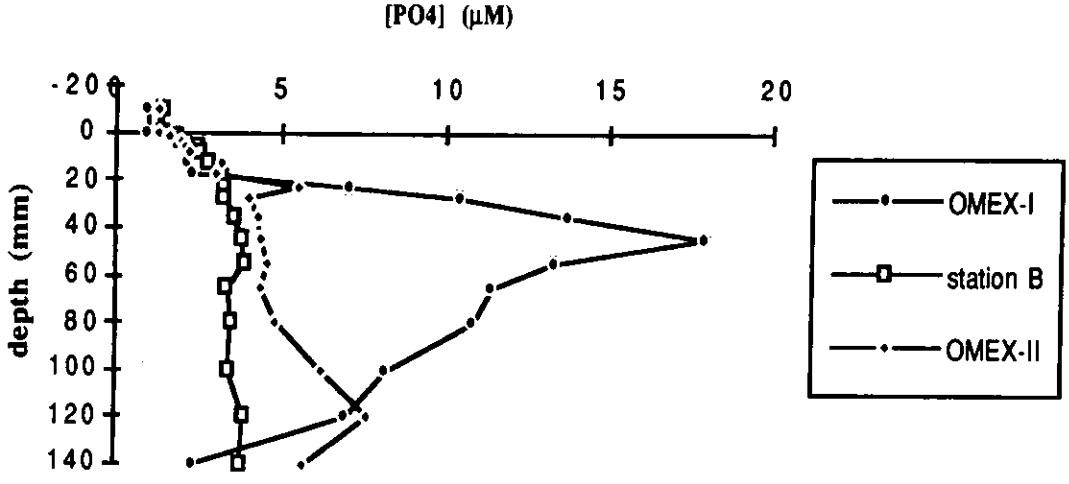
Nitrate profiles transect 1 OMEX 1993



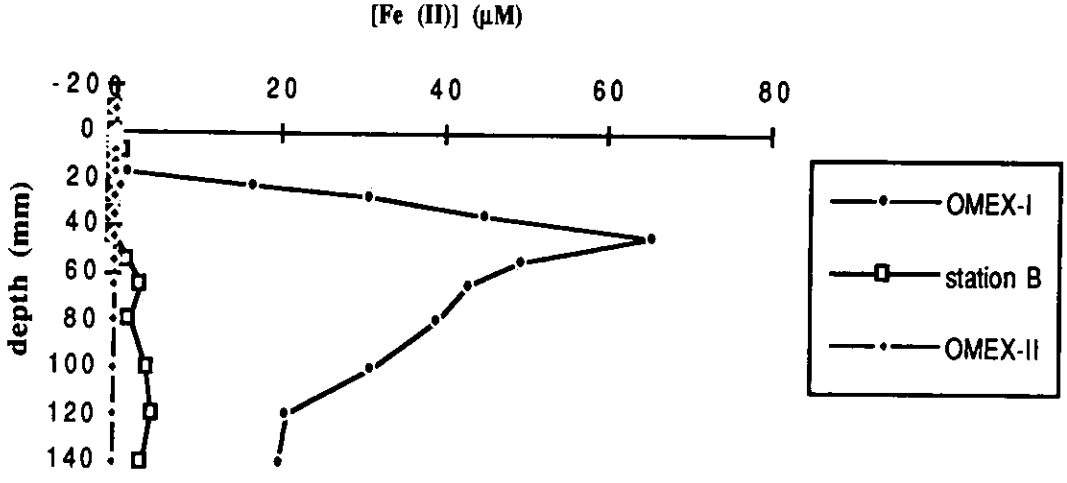
Silicate profiles transect 1 OMEX 1993



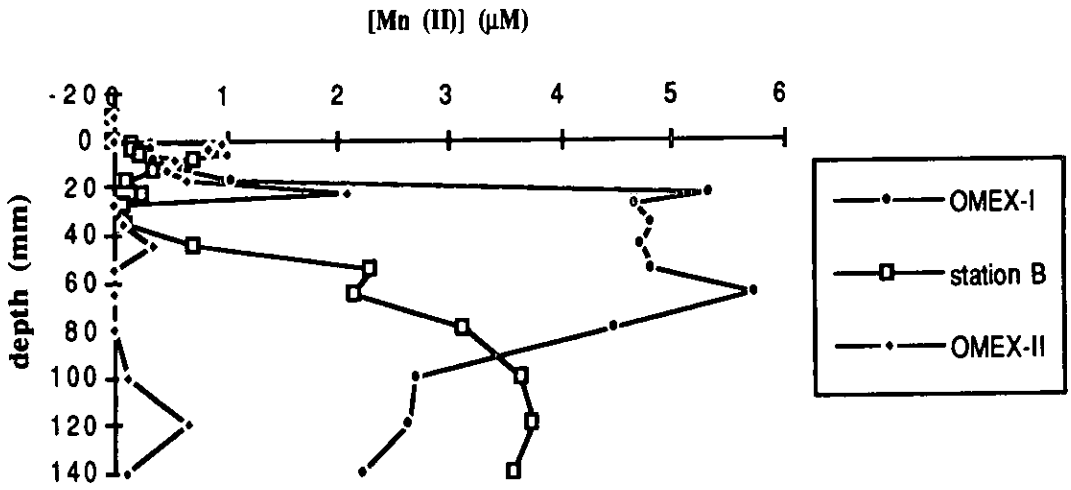
Phosphate profiles transect 1 OMEX 1993



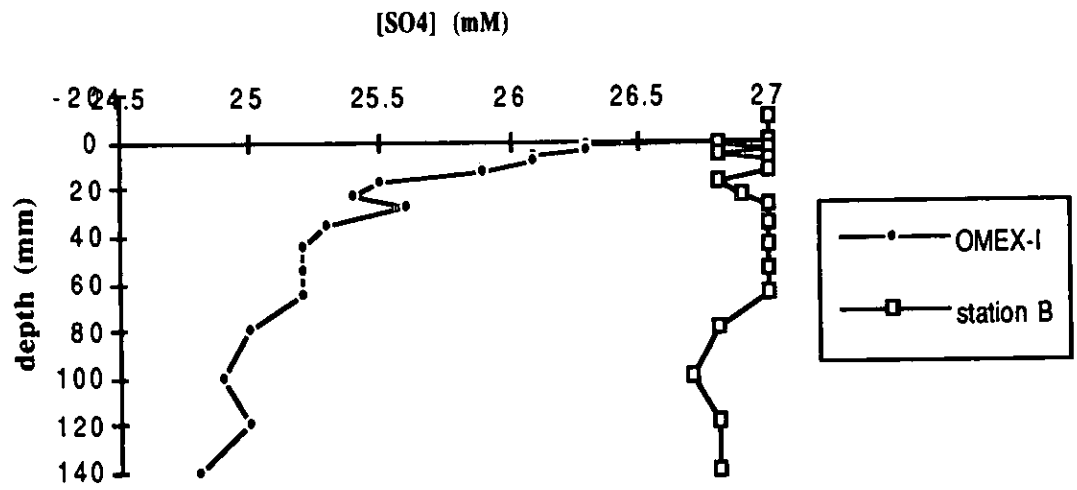
Dissolved-iron profiles transect 1 OMEX 1993



Dissolved-manganese profiles transect 1 OMEX 1993



Sulphate profiles transect 1 OMEX 1993



III.4 Carbon mineralization by the benthic community

T. Soltwedel, S. Peter; University of Hamburg

Objectives of this OMEX subproject are to develop an understanding of biological, chemical and physical processes that are important in the benthic carbon cycling via the consumption and decomposition of organic matter as well as to assess the distribution and variability of carbon fluxes in the benthal.
Benthic biomass is subject to spatial and seasonal variations in response to sedimentation of particulate organic matter. Input of phytodetritus will be assessed by measurements of sediment bound chlorophyll a concentrations, changes in activity and biomass of the benthic infauna by a series of biochemical assays:

- esterases with fluoresceindiacetat, FDA (activity)
- adenosinetriphosphate, ATP (activity)
- total adenylates, ATP+ADP+AMP (biomass)
- desoxyribonucleinacid, DNA (biomass)
- phospholipids (biomass)
- particulate proteines (biomass)

Additionally, samples were taken for grainsize analyses and to determine the sediment water content. Our investigations are restricted to the upper 10 cm of the sediments.
On the OMEX transect, a total of 6 stations (200 - 2800 m) were done with success using a multiple corer, MC (for description see below) to get virtually undisturbed sediment samples. On station C (2000 m) the MC failed twice for unknown reasons and subsamples for biochemical analyses were taken from th NIOZ box corer.
Depending on the wire lenght of winches, maximum water depth attainable for 'multi-coring' was about 2800 m (station D). Angle of the slope at this station is about 20° and sediments consist of a sandy upper layer (3-4 cm) with pebbles and bigger stones followed by a deeper layer of clay. Nevertheless, the MC works perfectly and gave excellent results.
To avoid a loss of activity, esterase measurements were done immediately after recovery of the bottom gear; adenylate measurements were taken to a certain step when deep frozen extracts could be stored. Other subsamples for biochemical assays were shock-frozen (-80°C) and than stored (-20°C) for later analyses at the home laboratory.

A first glance at the raw data of activity parameters (esterase activity) already shows some general trends: while on the deeper stations a very steep gradient with maximum values in the upper few centimeters could be detected, we found a high variability within the upper 10 cm of sediments from the of sediments from the shallow stations, indicating higher bioturbation rates on the shelf.

IV.1 The Multiple Corer (MC)

The SMBA (Scottish Marine Biological Association) multiple corer (BARNETT et al. 1984) is based on the principle of the Craib (1965) corer, which takes sediment samples with virtually no disturbance. The corer consists basically of four units: (1) a cone-shaped supporting framework, (2) a hydraulic damper supporting (3) a sliding framework which carries (4) an assembly of core sampling tubes.
The modified MC version of the Institut für Hydrobiologie und Fischereiwissenschaft (IHF), Universität Hamburg carries a total of 14 sampling tubes: 4 tubes with a diameter of 56 mm (25 cm^2 surface area) and 10 tubes with 75 mm diameter (44 cm^2 surface area). Core depth is varying depending on the compactness of the sediment and the number of weights and core tubes being used.

Operating principle:

When the MC is lowered to the sea bed (lowering speed can be as high as 90 m/min. but the corer should be placed on the bottom at a speed no greater than 50 m/min.) the framework rests on the bottom supporting the coring assembly in its upper position through a sliding framework and a hydraulic damper. As the wire from the ship's winch is slacked, the hydraulic damper gently lowers the core assembly so that the core tubes penetrate the seabed. The corer should be left on the bottom for at least 1-2 min. to allow for maximum penetration of the sampling tubes.
When the wire to the ship is heaved (wire speed about 50 m/min.), a special mechanism first closes valves on the top of each tube and releases bottom core catchers, which swing down until they rest on the sea bed. Continued heaving then pulls the core tubes out of the bottom; the sediment cores being retained by the seal of each top valve. As tubes are lifted out of the sediment, the bottom catchers swing into place and help retain the cores from

beneath during the ascent to the surface. The recovery speed to the surface can be as high as 120 m/min..

After sampling and just before the corer is lowered to the deck, a stopper inserted between the sliding and the supporting frameworks prevents the core assembly from being lowered onto the deck as the weight is taken off the wire. For recovery of the sampling tubes, rubber bungs are pushed into the bottom of each core tube, replacing the bottom catchers. Each core tube may then be withdrawn from beneath by releasing the retaining clips.

literature:

BARNETT, P.R.O., J. WATSON & D. CONELLY (1984): A multiple corer for taking virtually undisturbed samples from shelf, bathyal and abyssal sediments.
Oceanol. Acta, Vol. 7, No. 4: 399 - 408.

CRAIB, J.S. (1965): A sampler for taking short undisturbed marine cores.
J. Cons. Perm. Int. Explor. Mer, 30: 34 - 39.

III.5 TROL Deployments

W. Helder, E. Epping, H. Franken
NIOZ Chemical Oceanography and Electronics

The Temperature, Resistivity, Oxygen Lander is a tripodal lander equipped with a profiler containing 6 oxygen micro-electrodes and a resistivity probe. The instrument was designed to measure in-situ oxygen profiles across the sediment-water interface. TROL measures with a resolution of 100 µm. over a total length of 85 mm at maximum. During this Omex cruise TROL was deployed and recovered at the following stations:

station	depth (m)	date
A	206	17/10
OMEX-I	670	19/10
OMEX-II	1425	21/10
OMEX-III	3650	23/10
E	4460	24/10
F	2182	25/10

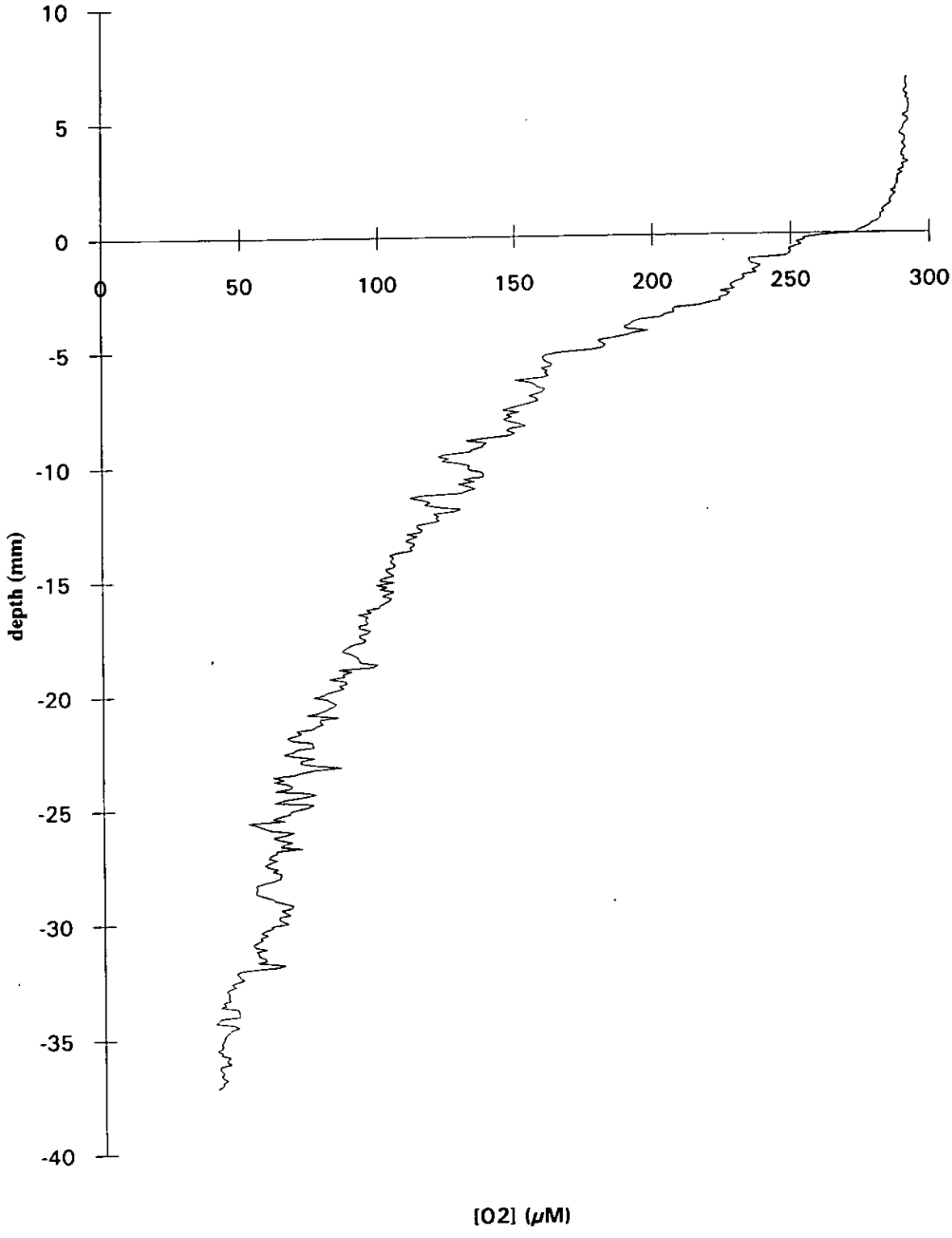
The in-situ profiles made by TROL will be compared with those made on deck in boxcores, to be able to detect artefacts caused by coring and decompression. The profiles are fitted according to a diagenetic model assuming two layer 0-order oxygen consumtion, with high (R1), respectively low (R2) consumption rate in surface and deeper sediment layers. The thus calculated sediment-water oxygen fluxes are in the following table compared to those measured in-situ by BOLAS and on-deck:

Oxygen fluxes ($mmol.m^{-2}.d^{-1}$)

station	depth (m)	TROL	BOLAS	deckincubation
A	206	6.80		
OMEX-I	670	3.09	3.2	
OMEX-II	1425	2.09	1.9	
F	2180	1.77	1.4	
OMEX-III	3650	3.86		
E	4460	1.49		

Some examples of TROL profiles and of model calculations are given on the next pages.

Average oxygen profile station F



Two layer zero order oxygen consumption in deep sea sediments

Date:	29-Oct-93	Remarks:	T=10.06°C
File:	OMEX-I		0
Profile:	avg		

VARIABLES			CONSTANTS		
Co	0.21288	[mol/m3]	DO2	0.0001356	[m2/d]
R1	0.27820	[mol/m3.d]	poro.	0.9	[-]
R2	0.06379	[mol/m3.d]	F	1.38	[-]
Zc	0.00785	[m]	T	10.06	
Zs	0.01423	[m]	Deff.	0.0001092	[m2/d]

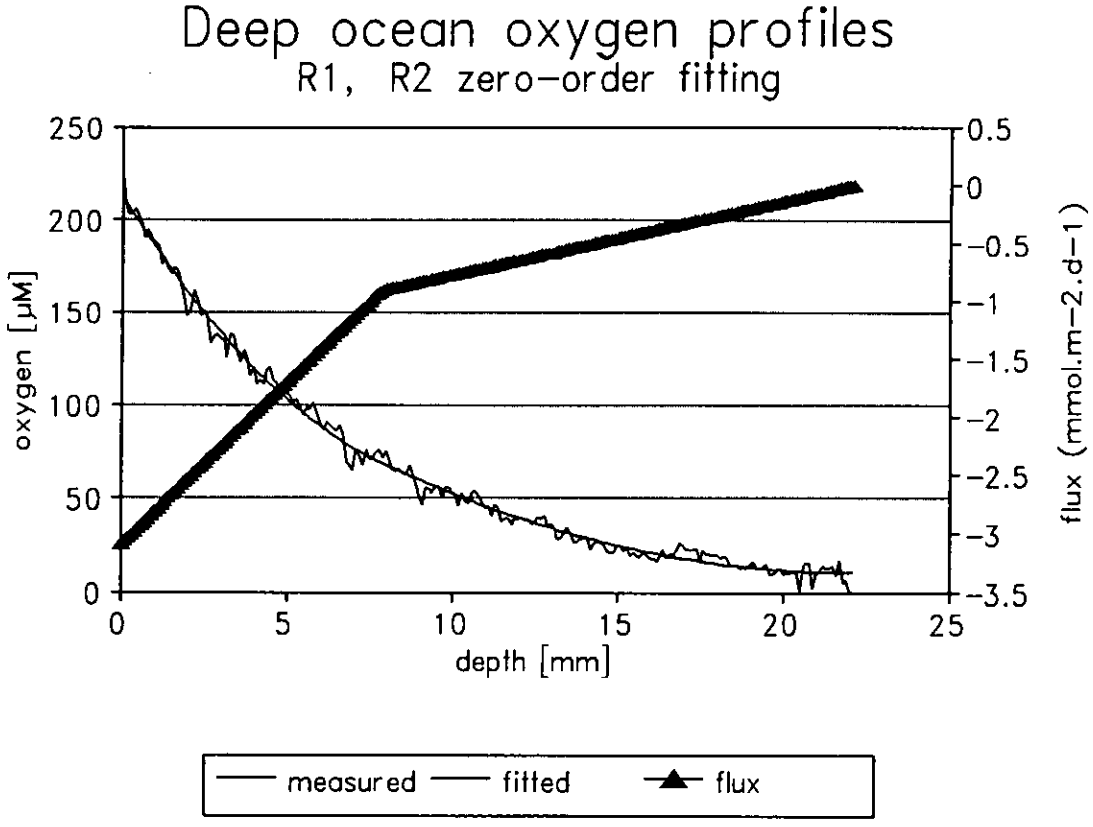
DERIVED VARIABLES		FLUXES		
R1/D	2547.49887	J(02) at depth 0 =	-0.003091	[mol/m2.d]
R2/D	584.0977366	J(02) at depth Zc=	-0.000907	[mol/m2.d]
		cons. 0 < z < Zc =	0.0021837	[mol/m2.d]
		cons. Zc< z < Zs =	0.0004067	[mol/m2.d]

Solution cell

4077.122 (Residual sum of squares)

686705 (Total sum of squares)

99.406 (% variance explained, not adjusted)



Two layer zero order oxygen consumption in deep sea sediments

Date: 29-Oct-93
File: station E
Profile: avg

Remarks: T=2.51°C
0

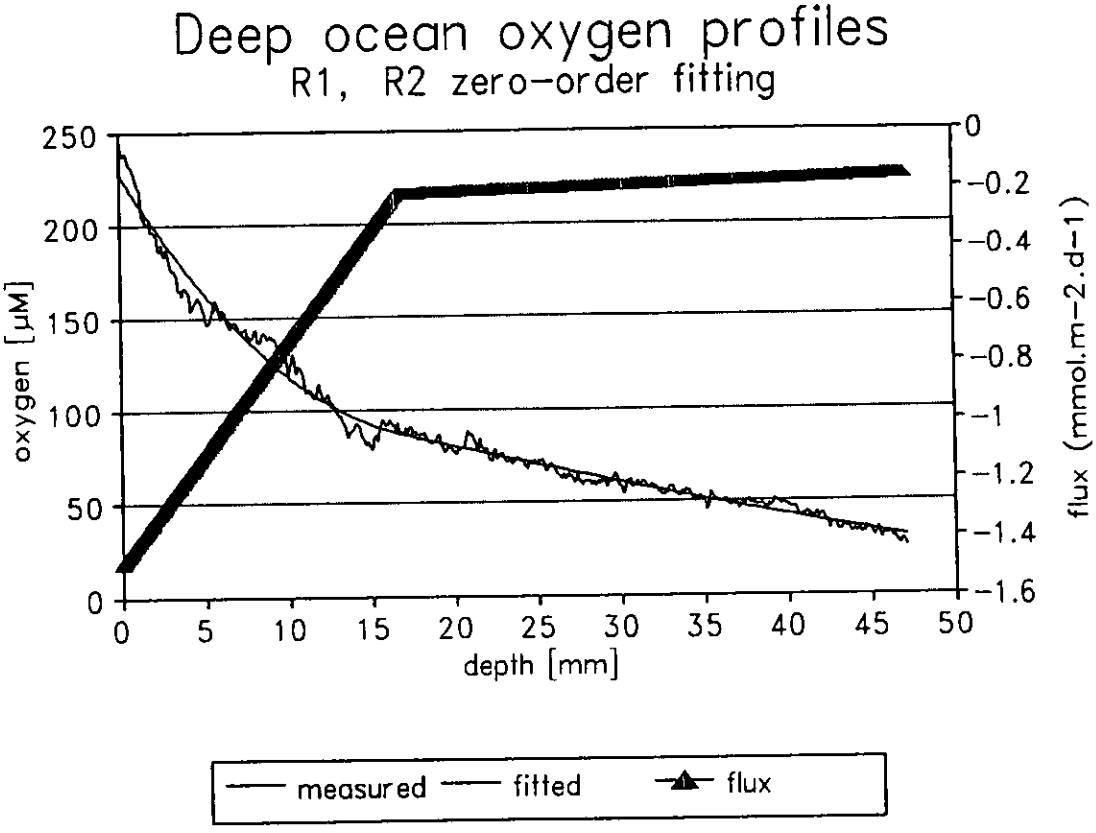
VARIABLES			CONSTANTS		
Co	0.22776	[mol/m3]	DO2	0.000109	[m2/d]
R1	0.07642	[mol/m3.d]	poro.	0.9	[-]
R2	0.00189	[mol/m3.d]	F	1.2	[-]
Zc	0.01661	[m]	T	2.51	
Zs	0.11464	[m]	Deff.	0.000101	[m2/d]

DERIVED VARIABLES	
R1/D	756.94289
R2/D	18.67795042

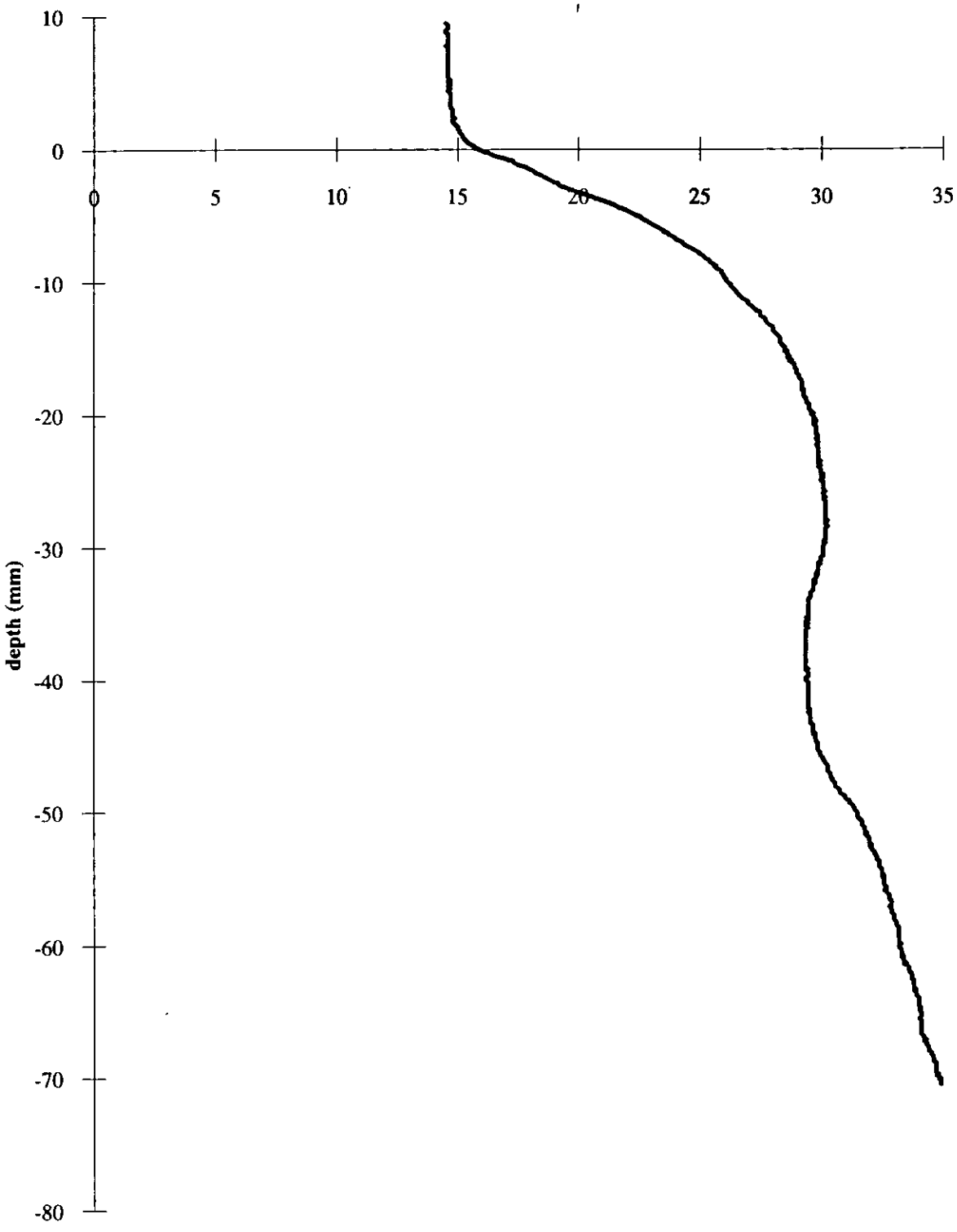
FLUXES		
J(O2) at depth 0 =	-0.001486	[mol/m2.d]
J(O2) at depth Zc=	-0.000216	[mol/m2.d]
cons. 0 < z < Zc =	0.0012695	[mol/m2.d]
cons. Zc< z < Zs =	0.0001849	[mol/m2.d]

Solution cell
13879.266 (Residual sum of squares)

1117758 (Total sum of squares)
98.758 (% variance explained, not adjusted)



Resistivity profile station E



III.6 Benthic respiration and nutrient fluxes

Jacob van der Weele, Eilke Berghuis, and Hester Visser
NIOZ department of Benthic Systems

The department of Benthic Systems from the Netherlands Institute for Sea Research participates in the subgroup benthic systems within the OMEX-project. The effect of the input of organic carbon on infauna in shelf-, slope- and deep-sea sediments is the main objective for research. For this, sediment oxygen demand (SOD) was measured during the Pelagia OMEX 1993 cruise by deck incubation as well as in-situ by using the Benthic Oxygen Lander System (BOLAS). Other parameters used are RNA/DNA ratios of infauna and nutrient fluxes from sediment to water column from deck incubations as well from the BOLAS deployments. Phytopigments in near bottom water and in sediment are used as a tracer to examine the sedimentation and initial burial of organic carbon in sediments and the role of macrobenthos in this process.

Sediment Oxygen Demand.
The SOD is used as a standard for the energy level of the sediment. The SOD is measured by deck incubation and by BOLAS to detect differences between SOD and nutrient fluxes shipboard and in in-situ. BOLAS has also been deployed at Stat. OMEX-III (3650 m depth). There was no possibility for boxcoring at this atation due to the restricted cable lenght, and thus the comparison between shipboard and in-situ measurements could not be made at OMEX-III.

Deck incubation.
The deck incubation method is used for measuring SOD shipboard. Boxcores (50 cm diameter) were collected at stations from 200 to 2200 m depth and placed in a temperature-controlled water bath. The temperatures were kept at bottom water temperature. The respiration is measured continuously in a 31 cm diameter chamber which is placed in the boxcore, and for periods up to 24 hrs, depending on the expected sediment oxygen demand. Nutrient samples were taken from the deck incubation periodically for measurements of sediment-water nutrient fluxes.

Benthic Lander.

The benthic lander has been deployed for in-situ SOD measurements at stations from 670 to 3600 m depth. For periods up to 30 hrs two chambers (32.5 cm diameter) are hydroulically pressed into in the sediment and oxygen concentration in the enclosed overlying water from both chambers is measured continuously, using pressure compensated dissolved oxygen sensors. Nutrient samples are taken by spring loaded syringes at the beginning, middle an end of the incubation period.
Results of deck incubation and BOLAS will be compared from stations where both have been deployed.

RNA/DNA.

RNA/DNA ratios can serve as an indication for metabolic activity. In an actively metabolising organism, the amount of RNA will rise whereas the DNA-content will stay more or less the same.
On this cruise cores of 2.6 cm diameter were taken from the same boxcores that were used for shipboard SOD measurements. The top 3 mm of these cores was sliced off and stored at -80^{o}C for further analysis. The overall ratio of RNA and DNA will be determined, thus including bacteria and larger organisms present in the sediment.
Additional samples were taken from BOLAS at Stat. Omex I and Omex III.

Phytopigments.

Phytopigments serve as a tracer to study the fate of organic carbon in water and sediment. On the Pelagia OMEX cruise phytopigment samples were taken at stations from 200 m up to 2200 meter depth and will be analysed at NIOZ for phytopigment content by reverse phase HPLC technique using a photo-diode array system. The quality and quantity of phytopigments in water and sediment will be used to examine the initial burial of organic matter in sediments. Also macrofauna samples were taken to examine the influence of macrobenthos on the burial of phytopigments.

Sampling stations and deployments.

In Table I are all stations given where samples were taken. At stations OMEX D and OMEX E no samples were taken.

Table I: Sample stations and deployments.

station	depth (m)	deckincub.	BOLAS	RNA/DNA	phytopigm.
2A	206	+		+	+
OMEX-I	670	+	+	+	+
B	1034	+		+	+
OMEX-II	1425	+	+	+	+
C	1961	+		+	+
F	2182	+		+	+
OMEX-III	3650		+	+	+

Preliminary Results.

Preliminary results show that sediment oxygen demand decreases with waterdepth. In Graph I an example is given of decrease in oxygen concentration at station OMEX F from BOLAS. The y-axis is in nAmperes and can be converted to $\mu mol.l^{-1}$ with the Winkler titration values. From the graph a decrease in oxygen concentration can be read of 11% in 20 hrs.Comparison of community respiration measured with deck incubation and BOLAS show that there is little difference up to 2200 m depth.

III.7 Benthos

Adri Sandee
Centre for Estuarine Marine Research, CEMO, Yerseke

In order to characterize the abundance, biomass, and functional and species diversity of benthic organisms as related to sediment characteristics, sediment samples were taken that allowed for detailed investigation of meio- as well as macrofauna. The sampling stategy represented a balance between statistical requirements and availibility of sediment material.

Meiofauna:
At each station duplicate 10 cm^3 subsamples were taken from two boxcores and one core from the multicorer. sampling was done at various depth intervals to amaximum of 10 cm.

Macrofauna:
At each station, the intervals 0-5 and 5-10 cm from one boxcore were sampled.
To further document the samples, at each station photographs and samples for organic carbon, nitrogen, chlorophyll and grain-size distribution have been taken.

IV Data

Bottle files
CTD graphs

STATION3.xls

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
17/10/93	3	22	4	13.4	81.32	4.1812	35.4333	269	0.9	0	0.17	0.08	2.2
	50 04.99 N	21	4	13.4	81.34	4.18111	35.4329	268	0.9	0.1	0.19	0.08	2.3
	11 54.74 W	20	50	13.37	81.73	4.17923	35.4287	264	0.9	0.3	0.21	0.09	2.4
		19	102	11.44	84.47	4.0003	35.496	253	2.6	0	0.61	0.02	10.2
		18	200	10.9	84.66	3.94979	35.4624	258	3.7	0	0.69	0.02	11.2
	LEK ? NO	17	402	10.52	84.64	3.9208	35.4493	257	4.5	0.5	0.79	0.02	12.4
		16	678	9.93	83.57	3.87589	35.4447		7	0.3	0.98	0.01	15.4
		15	678	9.93	83.57	3.87601	35.4452	251	5.5	0.6	0.87	0.02	13.5
		14	1010	8.65	84.76	3.77781	35.5348	236	7.2	0	0.94	0	15.2
		13	1520	4.67	84.76	3.38183	34.9953	264	11.6	0	1.24	0	19
		12	2089	3.4	84.1	3.28585	34.9258	281	15.3	0.8	1.27	0.01	18.8
	LEK ?	11	2088	3.4	84.1	3.28586	34.9259	251	7.6	0	0.95	0.01	14.6
		10	2087	3.4	84.1	3.28562	34.9261		15.4	0	1.23	0.01	18.6
		9	2087	3.4	84.1	3.2855	34.9259		15.3	0	1.21	0	18.5
		8	2090	3.4	84.08	3.2855	34.9266		15.4	0.1	1.22	0	18.6
		7	2090	3.4	84.1	3.28563	34.9266		15.4	0.2	1.23	0.01	18.6
	LEK ?	6	2089	3.4	84.13	3.28596	34.9259		12.9	0.6	1.19	0.02	17.9
		5	2090	3.4	84.13	3.28546	34.927		15.2	1	1.26	0.02	18.8
		4	2088	3.41	84.1	3.286	34.9255		15.3	0.7	1.24	0.02	18.6
		3	2087	3.41	84.13	3.2858	34.9259		15.2	0.1	1.21	0.02	18.5
		2	2083	3.41	84.13	3.28584	34.9254		15.2	1	1.31	0.03	18.7
17/10/93	3	1	2084	3.41	84.15	3.286	34.9252		15.3	0.7	1.26	0.02	18.7

STATIONA.xls

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
18/10/93	A	21	3	13.28	82.69	4.16357	35.3839	263	0.9	0.4	0.16	0.1	2
	49 28.44 N	20	4	13.27	82.67	4.16339	35.384	262	0.9	0.5	0.21	0.11	2.1
	11 12.27 W	19	24	13.27	82.71	4.1643	35.3839	262	1	0.2	0.16	0.1	2
		18	50	13.25	83.14	4.16278	35.3851	265	0.9	0.2	0.18	0.11	2.1
		17	101	11.73	84.82	4.03049	35.5101	252	2.7	0.2	0.59	0.04	9.4
		16	150	11.09	84.49	3.9689	35.4923		3.8	0.1	0.7	0.03	11.1
		15	150	11.1	84.48	3.969	35.4921		3.8	0.2	0.72	0.03	11.1
		14	150	11.09	84.4	3.96868	35.4918	248	3.9	0.1	0.71	0.02	11.2
		13	199	10.95	82.28	3.95916	35.4823	249	4.3	0.1	0.74	0.04	11.5
		12	198	10.95	82.33	3.9561	35.482		4.4	0.5	0.78	0.05	11.6
		11	199	10.95	82.26	3.95611	35.4825		4.3	0.1	0.75	0.04	11.6
		10	199	10.95	82.29	3.95616	35.4826		4.3	0.2	0.77	0.05	11.5
		9	198	10.95	82.31	3.95608	35.4824		4.3	0	0.74	0.03	11.6
		8	198	10.95	82.27	3.95608	35.4824		4.3	0.1	0.77	0.05	11.6
		7	198	10.95	82.32	3.95622	35.4827		4.2	0.2	0.78	0.06	11.7
		5	198	10.95	82.26	3.95625	35.4831		4.3	0.6	0.77	0.06	11.6
		4	199	10.95	82.27	3.95627	35.4831		4.4	0.5	0.78	0.06	11.5
		3	198	10.95	82.26	3.95622	35.483		4.2	0.1	0.74	0.06	11.6
		2	199	10.95	82.24	3.95627	35.4831		4.3	0.8	0.79	0.06	11.7
18/10/93	A	1	198	10.95	82.27	3.95618	35.4827	250	4.3	0.6	0.79	0.07	11.8

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
19/10/93	Omex1	20	2.5	13.56	82.74	4.2	35.4835	262	1.1	0.3	0.2	0.11	2.4
	49 24.79 N	19	2.5	13.56	82.76	4.2	35.4827	263	1.2	0.3	0.21	0.12	2.3
	11 32.01 W	18	74	12.3	85.23	4.09	35.5361	250	2.3	0.3	0.5	0.05	7.9
		17	74	12.31	85.23	4.09	35.5355	250	2.5	0.4	0.54	0.06	8
		16	294	10.87	85.12	3.95	35.4931	248	4.5	0.2	0.73	0.03	11.6
		15	292	10.88	85.13	3.95	35.4929		4.5	0.1	0.73	0.03	11.6
		14	565	10.29	85.15	3.91	35.479	235	6.3	0.2	0.85	0.02	13.8
		13	564	10.28	85.13	3.91	35.4789		6.3	0.2	0.86	0.03	13.8
		12	669	10.05	84.61	3.89	35.4753	227	7.2	0.3	0.93	0.03	14.9
		11	668	10.05	84.64	3.89	35.475		7.1	0.3	0.94	0.02	14.9
		10	668	10.05	84.62	3.89	35.4754		7.1	0.4	0.96	0.03	14.9
		9	668	10.05	84.62	3.89	35.4751		7.1	0.2	0.93	0.03	14.9
		8	668	10.05	84.62	3.89	35.4758		7.2	0.3	0.94	0.03	14.9
		7	668	10.05	84.61	3.89	35.4751		7.1	0.1	0.94	0.02	14.9
		6	668	10.05	84.64	3.89	35.4755		7.1	0.4	0.95	0.04	14.8
		5	668	10.05	84.62	3.89	35.476		7.1	0.2	0.93	0.04	15
		4	668	10.05	84.62	3.89	35.4754		7.1	0.3	0.94	0.03	14.8
		3	668	10.05	84.64	3.89	35.4755		7.2	0.2	0.93	0.05	14.9
		2	668	10.05	84.64	3.89	35.4766		7.2	0.4	0.95	0.05	14.9
		1	668	10.05	84.64	3.89	35.476	231	7.2	0.5	0.97	0.05	15.1

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
20/10/93	Omex B	21	3	13.58	85.84	4.19831	35.4248	262	1	0.4	0.18	0.09	1.9
	49 21.99 N	20	3	13.58	85.84	4.19831	35.4248	262	1	0.7	0.18	0.1	1.8
	11 48.09 W	19	84	12.21	85.62	4.08309	35.5813		1.2	0.8	0.22	0.1	2.8
		18	84	12.21	85.62	4.08309	35.5813	255	1.3	0.7	0.25	0.11	3.5
		17	148	11.47	85.89	4.00981	35.5336	250	3.1	0.2	0.62	0.05	9.7
		16	200	11.2	85.86	3.98165	35.4999	255	3.7	1.2	0.7	0.05	10.6
		15	350	10.91	85.96	3.96058	35.4941	249	4.5	0.5	0.74	0.03	11.9
		14	530	10.37	86.01	3.91002	35.4333	242	5.6	1	0.83	0.03	13.5
		13	1020	8.77	85.35	3.79158	35.5511	209	10.5	0.8	1.12	0.02	17.7
		12	1023	8.77	85.35	3.79158	35.5511		10.6	0.9	1.13	0.02	17.7
		11	1023	8.77	85.35	3.79158	35.5511		10.5	0.8	1.12	0.01	17.7
		10	1023	8.77	85.35	3.79158	35.5511		10.5	1	1.11	0.02	17.7
		9	1023	8.77	85.35	3.79158	35.5511		10.5	0.8	1.12	0.01	17.7
	Lek?	8	1023	8.77	85.35	3.79158	35.5511		3	1.9	0.67	0.07	9.5
		7	1023	8.77	85.35	3.79158	35.5511		10.6	1	1.12	0.02	17.7
		6	1023	8.77	85.35	3.79158	35.5511		10.6	1.1	1.16	0.05	17.8
		5	1023	8.77	85.35	3.79158	35.5511		10.5	1	1.14	0.04	17.8
		4	1023	8.77	85.35	3.79158	35.5511		10.6	1	1.12	0.05	17.6
		3	1023	8.77	85.35	3.79158	35.5511		10.5	0.9	1.12	0.04	17.7
		2	1023	8.77	85.35	3.79158	35.5511		10.6	1.1	1.17	0.03	17.8
		1	1023	8.77	85.35	3.79158	35.5511	208	10.6	1.1	1.1	0.02	17.7

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
21/10/93	Omex 2	23	3	13.87	83.9	4.23842	35.538	262	1	0.3	0.15	0.08	1.8
		22	2	13.86	83.96	4.23766	35.5377		1	0.2	0.15	0.08	1.8
	49 11.35 N	21	2	13.87	83.99	4.23815	35.538	255	1.5	0.4	0.33	0.1	4.8
	12 49.08 W	20	73	13.22	85.52	4.18133	35.576		1.7	0.2	0.32	0.09	4.9
		19	73	13.25	85.52	4.18351	35.5752		1.7	0.1	0.34	0.06	5.1
		18	73	13.25	85.51	4.18366	35.5733	255	3.6	0	0.64	0	10.7
		17	201	11.08	86.25	3.96948	35.4872	239	6.1	0.2	0.86	0	14.1
		16	481	10.29	86.28	3.90252	35.45	227	7.6	0.2	0.97	0	15.7
		15	631	9.8	86.37	3.85721	35.4049	208	10.2	0	1.1	0	18
		14	978	8.95	86.42	3.80678	35.5591	244	12.9	0.1	1.17	0	18.5
		13	1442	5.89	86.2	3.50784	35.2035	241	12.9	0	1.18	0.02	18.7
		12	1443	5.89	86.2	3.50775	35.2031		12.9	0.1	1.18	0	18.7
		11	1443	5.89	86.2	3.50812	35.2035		12.9	0.1	1.17	0	18.6
		10	1443	5.89	86.21	3.50852	35.2048		12.8	0.1	1.17	0.01	18.6
		9	1443	5.89	86.21	3.5086	35.2039		12.8	0.2	1.19	0	18.7
		7	1443	5.9	86.21	3.50879	35.2043		12.8	0.1	1.19	0.02	18.7
		6	1443	5.9	86.2	3.50852	35.2042		12.8	0	1.18	0	18.6
		5	1443	5.89	86.2	3.50828	35.2041		12.8	0	1.18	0.01	18.6
		4	1442	5.89	86.2	3.50823	35.204		12.9	0.2	1.17	0.01	18.7
		3	1442	5.89	86.2	3.50807	35.2038		12.9	0.1	1.16	0.02	18.6
		2	1443	5.89	86.23	3.50808	35.2037		12.9	0.1	1.17	0.02	18.7
		1	1442	5.89	86.2	3.50799	35.2034	241	12.9	0.1	1.18	0	18.6

3
73
201
481
631
978
1442

Looks like 1424 Bottle fired @ 1442

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
22/10/93	C	21	3	13.97	84.45	4.25302	35.5885	264	0.8	0.4	0.16	0.08	1.6
	49 09.58 N	20	2	13.97	84.45	5.25388	35.5893		0.8	0.4	0.16	0.09	1.6
	12 59.35 W	19	3	13.97	84.35	4.25407	35.5893	262	0.9	0.4	0.17	0.08	1.6
		18	61	13.73	85.46	4.23216	35.5828		1.4	0.3	0.29	0.11	4
		17	61	13.56	85.7	4.2144	35.5759	256	1.5	0.4	0.31	0.11	4.3
		16	192	11.17	86.61	3.97712	35.4834	261	3.9	0.3	0.66	0.01	10.7
		15	457	10.71	86.62	3.94514	35.4914	244	5.1	0.3	0.76	0.02	12.4
		14	874	8.62	86.89	3.75877	35.4229	207	10.2	0.4	1.13	0.02	18.1
		13	1518	4.98	86.89	3.41657	35.0772	258	13.2	0.3	1.17	0.02	18.5
		12	1985	3.5	86.79	3.29137	34.9372	285	15.7	0.3	1.19	0.02	18.2
		11	1985	3.5	86.79	3.2914	34.9375		15.8	0.3	1.2	0.02	18.3
		10	1987	3.5	86.79	3.29141	34.9373		15.8	0.3	1.2	0.01	18.2
		9	1986	3.5	86.79	3.29142	34.9372		15.7	0.3	1.2	0.01	18.2
	LEK ?	8	1987	3.5	86.79	3.29145	34.9375		1.5	0.4	0.34	0.1	4.7
		7	1987	3.5	86.79	3.29149	34.9368		15.9	0.1	1.21	0	18.3
		6	1987	3.5	86.79	3.29149	34.9373		15.9	0.7	1.2	0.02	18.3
		5	1987	3.5	86.79	3.29142	34.9374		15.7	0.7	1.22	0.03	18.2
		4	1988	3.5	86.79	3.29143	34.937		16	0.7	1.23	0.03	18.3
		3	1986	3.5	86.79	3.29135	34.9374		15.8	0.4	1.2	0.02	18.1
		2	1990	3.5	86.79	3.29148	34.9373		15.9	0.6	1.21	0.03	18.2
		1	1989	3.5	86.77	3.29154	34.9368		15.8	0.5	1.21	0.04	18.2

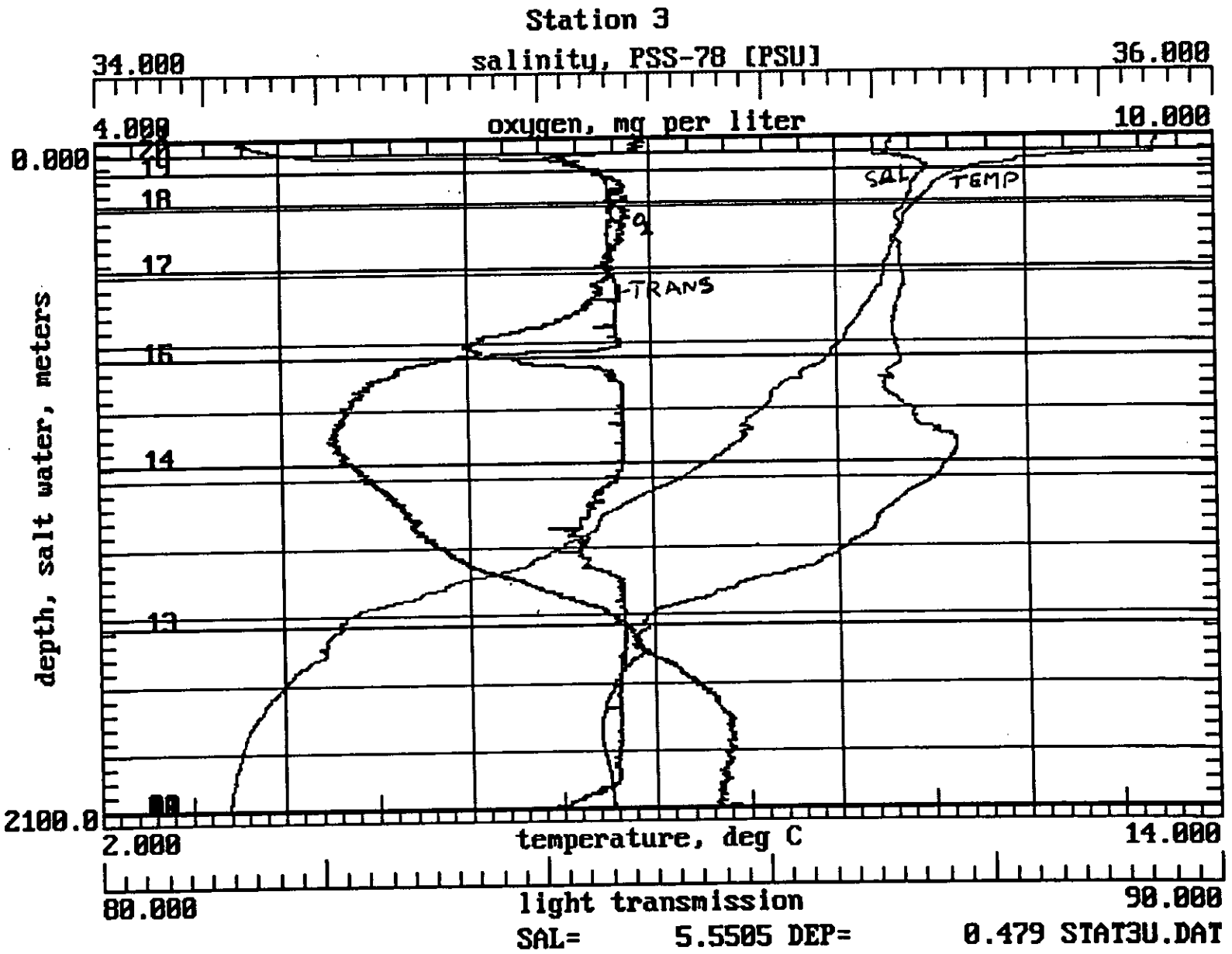
Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
23/10/93	Omex D	18	3	13.65	83.73	4.21842	35.5517	271	0.9	0.1	0.16	0.07	1.7
	49 07.70 N	17	3	13.65	83.74	4.21806	35.5512	271	0.9	0.4	0.18	0.08	1.8
	13 10.51 W	16	85	12.22	86.41	4.08321	35.5726	249	2.4	0.3	0.53	0.04	8.5
		15	178	11.18	86.61	3.97787	35.4824		4	0.1	0.68	0.01	10.9
		14	179	11.18	86.71	3.97783	35.4822	254	4	0.2	0.68	0.01	11
		13	551	10.08	86.79	3.87925	35.3876	236	6.8	0.2	0.94	0.01	15
		12	909	8.69	86.83	3.76836	35.4512	208	10.3	0.8	1.14	0.02	18.3
		11	1745	3.624	86.79	3.28893	34.8935	283	11.8	0.5	1.19	0.01	17.9
		10	2803	2.942	86.81	3.27348	34.9333	262	30.9	0.4	1.39	0.01	20.5
		9	2803	2.942	86.81	3.27348	34.9333		30.8	0.4	1.4	0.01	20.7
		8	2803	2.942	86.81	3.27348	34.9333		30.9	0.4	1.38	0.01	20.5
		7	2803	2.942	86.81	3.27348	34.9333		30.9	0.3	1.37	0.01	20.6
		6	2803	2.942	86.81	3.27348	34.9333		30.7	0.4	1.38	0	20.4
		5	2803	2.942	86.81	3.27348	34.9333		29.3	0.6	1.38	0.03	20.5
		4	2803	2.942	86.81	3.27348	34.9333		30.7	0.7	1.43	0.02	20.5
		3	2803	2.942	86.81	3.27348	34.9333		30.8	0.2	1.37	0.02	20.5
		2	2803	2.942	86.81	3.27348	34.9333		30.9	0.4	1.4	0.01	20.7
		1	2803	2.942	86.81	3.27348	34.9333	263	30.8	0.1	1.39	0.02	20.4

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
24/10/93	Omex 3		dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
	49 05.34 N	20	3	13.54	84.7	4.20478	35.5332	264	0.7	0.4	0.11	0.08	1.7
	13 25.66 W	19	3	13.54	84.15	4.20462	35.5304	263	0.7	0.4	0.12	0.08	1.7
		18	71	11.98	86.58	4.05087	35.49	249	2.1	0.2	0.53	0.03	9.3
		17	71	12.03	86.55	4.05536	35.4882		2	0.7	0.6	0.07	9.2
		16	201	10.74	87.06	3.93082	35.4284		3.9	0.1	0.67	0.01	11.3
		15	796	8.7	87.25	3.75499	35.3459	211	10.2	0.3	1.11	0	18.2
		14	1146	6.73	87.29	3.57914	35.2712	230	12	0.3	1.15	0	18.8
		13	1469	4.36	87.33	3.34979	34.9673	252	12.1	0.3	1.17	0.01	18.5
		12	1753	3.63	87.34	3.29037	34.8994	283	12.1	0.5	1.15	0	18
		11	3724	2.53	87.28	3.26834	34.9008	253	43.4	0.4	1.49	0.01	22.5
		10	3724	2.53	87.29	3.26843	34.9009	252	43.2	0.4	1.49	0.01	22.5
		9	3724	2.53	87.29	3.26836	34.9008		43.5	0.3	1.49	0	22.5
		8	3722	2.53	87.3	3.26828	34.901		43.5	0.5	1.5	0.01	22.5
		7	3721	2.53	87.3	3.26824	34.9011		43.4	0.4	1.49	0.01	22.6
		6	3720	2.53	87.28	3.26819	34.9008		43.2	0.5	1.51	0.03	22.6
	LEK ?	5	3720	2.53	87.29	3.26821	34.9008		39.3	0.5	1.45	0.02	22
		4	3719	2.53	87.3	3.26815	34.9008		43.5	0.4	1.5	0.02	22.6
		3	3720	2.53	87.29	3.26816	34.9009		43.4	0.3	1.48	0.03	22.4
		2	3719	2.53	87.29	3.26817	34.9004		43.1	0.4	1.49	0.02	22.7
		1	3719	2.53	87.29	3.26817	34.9004	251	42.9	0.3	1.49	0.02	22.6

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
24/10/93	E		dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
	49 02.3 N	8	3	13.45	84.45	4.19752	35.541	265	1	0.6	0.21	0.09	1.9
	13 42.2 W	7	85	11.52	86.95	4.00837	35.5078	251	2.7	0.3	0.62	0.04	9.9
		6	202	10.83	87.1	3.93928	35.4306	255	4	0.3	0.72	0.03	11.3
		5	815	8.51	87.33	3.7351	35.3245	211	10.4	0.2	1.17	0	18.5
		4	1839	3.68	87.4	3.29987	34.9234	283	13.5	0.3	1.2	0.02	17.8
		3	2391	3.19	87.35	3.28123	34.9476	267	24.2	0.3	1.31	0.03	19.7
		2	4550	2.52	87.29	3.29431	34.8892	251	46.6	0.4	1.57	0.03	22.4
		1	4550	2.52	87.29	3.29428	34.6696	252	46.7	0.3	1.56	0.03	22.9

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
26/10/93	F		dbar	C	o/o		o/oo	umol/L	umolL	umolL	umolL	umolL	umolL
	49 09.06 N	17	3	13.35	85.7	4.18789	35.5444	265	0.8	0.5	0.18	0.09	1.7
	13 05.40 W	16	3	13.35	85.7	4.18789	35.5444	265	0.8	0.5	0.19	0.08	1.8
		15	75	13.37	85.8	4.19164	35.5378		1	0.4	0.22	0.1	2.4
		14	75	13.37	85.8	4.19164	35.5378	262	1	0.4	0.22	0.09	2.5
		13	197	10.98	87.17	3.95568	35.454	253	4.3	0.3	0.68	0	11.5
		12	815	9.02	87.4	3.79441	35.4336	205	10.1	0.3	1.13	0	18.2
		11	1746	3.59	87.45	3.2869	34.8999	285	12.5	0.3	1.16	0.01	18.1
		10	2182	3.22	87.4	3.27843	34.9443	273	19.2	0.3	1.21	0	19.2
		9	2182	3.22	87.4	3.27843	34.9443		19.2	0.3	1.22	0.01	18.9
		8	2182	3.22	87.4	3.27843	34.9443		19.2	0.3	1.22	0.01	18.9
		7	2182	3.22	87.4	3.27843	34.9443		19.3	0.6	1.23	0.01	19
		6	2182	3.22	87.4	3.27843	34.9443		19.3	0.6	1.26	0.04	18.9
		5	2182	3.22	87.4	3.27843	34.9443		18.9	0.5	1.23	0.02	18.7
		4	2182	3.22	87.4	3.27842	34.9443		19.2	0.5	1.24	0.02	19
		3	2182	3.22	87.4	3.27843	34.9443		19.2	0.5	1.24	0.03	18.7
		2	2182	3.22	87.4	3.27843	34.9443		19.2	0.6	1.26	0.02	19
		1	2182	3.22	87.4	3.27843	34.9443		19.1	0.5	1.25	0.04	19.1

Date	Station	Bottle	Depth	Temp	Transmis	Cond s/m	Salinity	O2 winkler	silicate	ammonia	phosphate	nitrite	nitrate
			dbar	C	o/o		o/oo	umol/L	umol/L	umol/L	umol/L	umol/L	umol/L
28/10/93	2A	17	3	12.99	84.25	3.97611	35.4989	264	1.4	0.5	0.25	0.14	3.4
		16	3	12.99	84.51	3.97639	35.4991	262	1.3	0.5	0.25	0.14	3.4
49 28.98 N		15	130	12.4	86.37	3.97643	35.4991	251	2.3	0.1	0.48	0.07	7.7
11 07.97 W		14	129	12.43	86.38	3.97693	35.4994		2.3	0.2	0.48	0.06	7.8
		13	162	11.47	86.64	3.97717	35.4997		3.6	0.4	0.64	0.04	10.4
		12	162	11.39	86.56	3.97728	35.4996	245	3.6	0.4	0.63	0.03	10.5
		11	194	11.15	85.22	3.9773	35.4999	243	4	0.4	0.69	0.07	11.1
		10	194	11.15	85.21	3.97746	35.5001		4	0.2	0.69	0.07	11.2
		9	194	11.15	85.21	3.97762	35.5002		4	0	0.69	0.07	11.1
		8	195	11.15	85.13	3.97768	35.5002		4.1	0.4	0.7	0.08	11.2
		7	195	11.15	85.14	3.9991	35.5067		4	0.5	0.69	0.08	11.2
		6	195	11.15	85.16	4.00811	35.5145		4	0.5	0.69	0.09	11.2
		5	195	11.14	85.11	4.09948	35.5058		4	0.2	0.69	0.08	11.2
		4	195	11.14	85.1	4.09664	35.5066		4	0.7	0.72	0.1	11.2
		3	195	11.14	85.1	4.14496	35.4788		3.9	0.5	0.69	0.08	11.2
		2	195	11.14	85.09	4.14502	35.4796	245	3.9	0.4	0.72	0.08	11.2
		1	195	11.14	85.09	4.14502	35.4796		3.9	0.4	0.69	0.09	11.2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temperature, deg C
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light transmission
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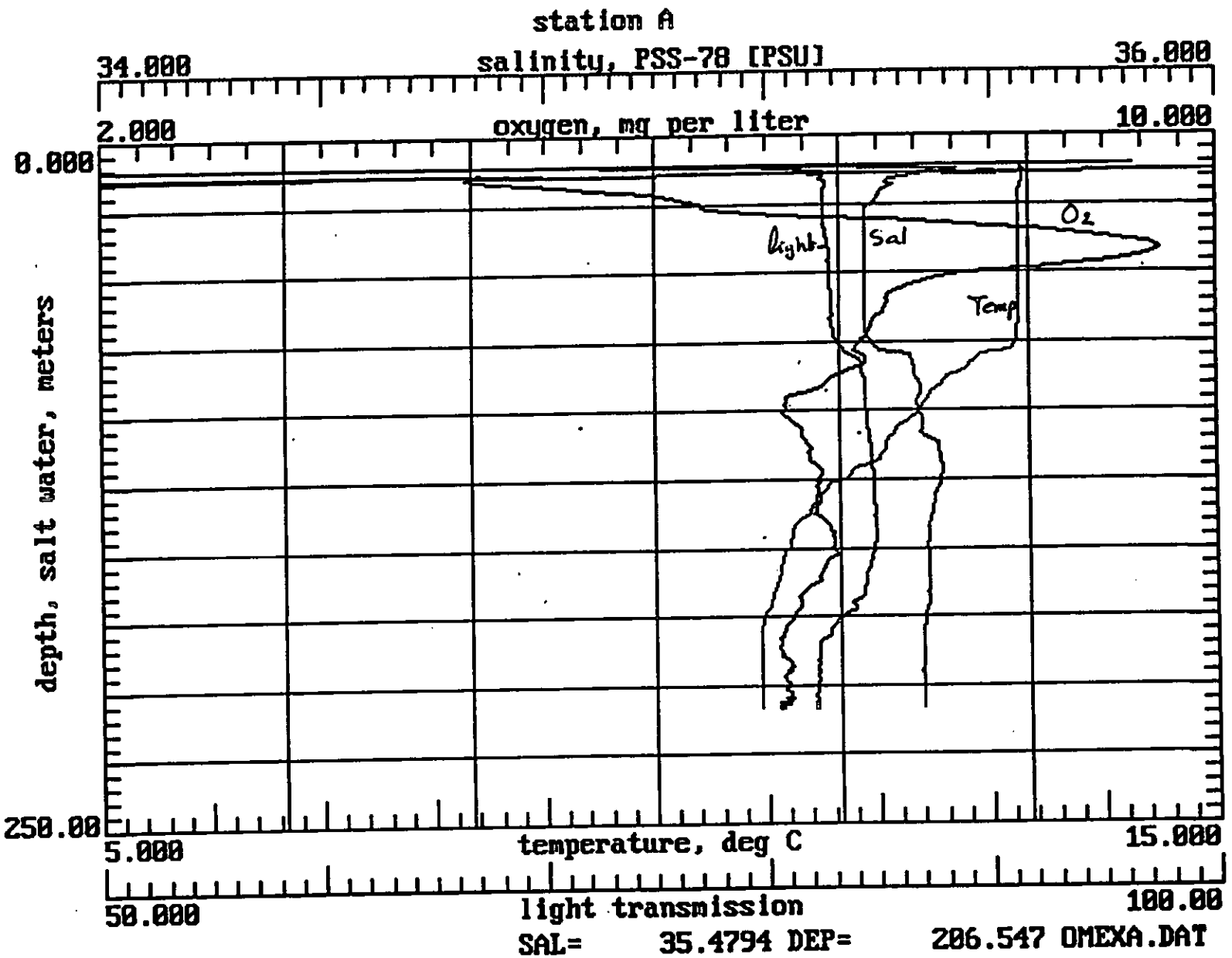
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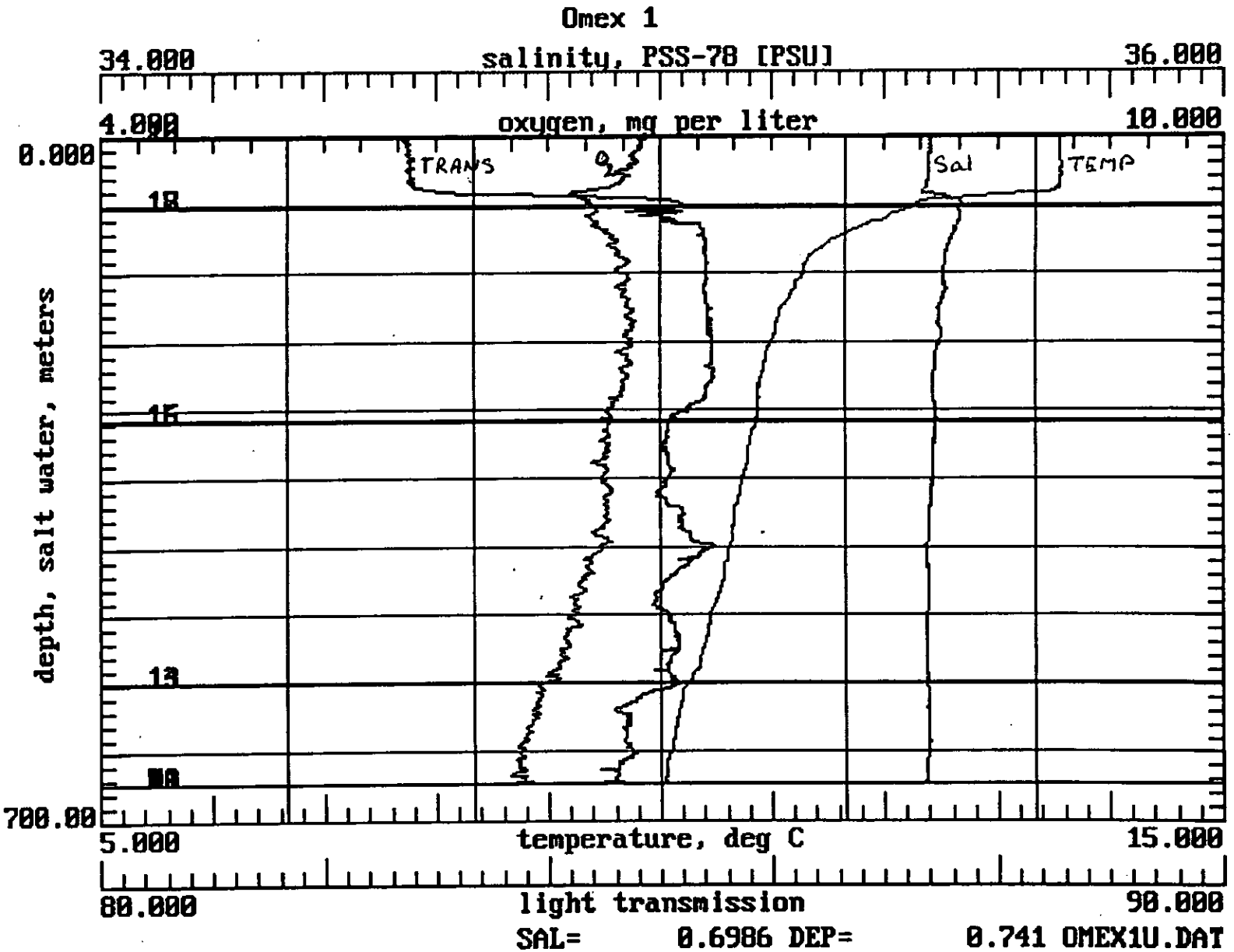
Sal
Temp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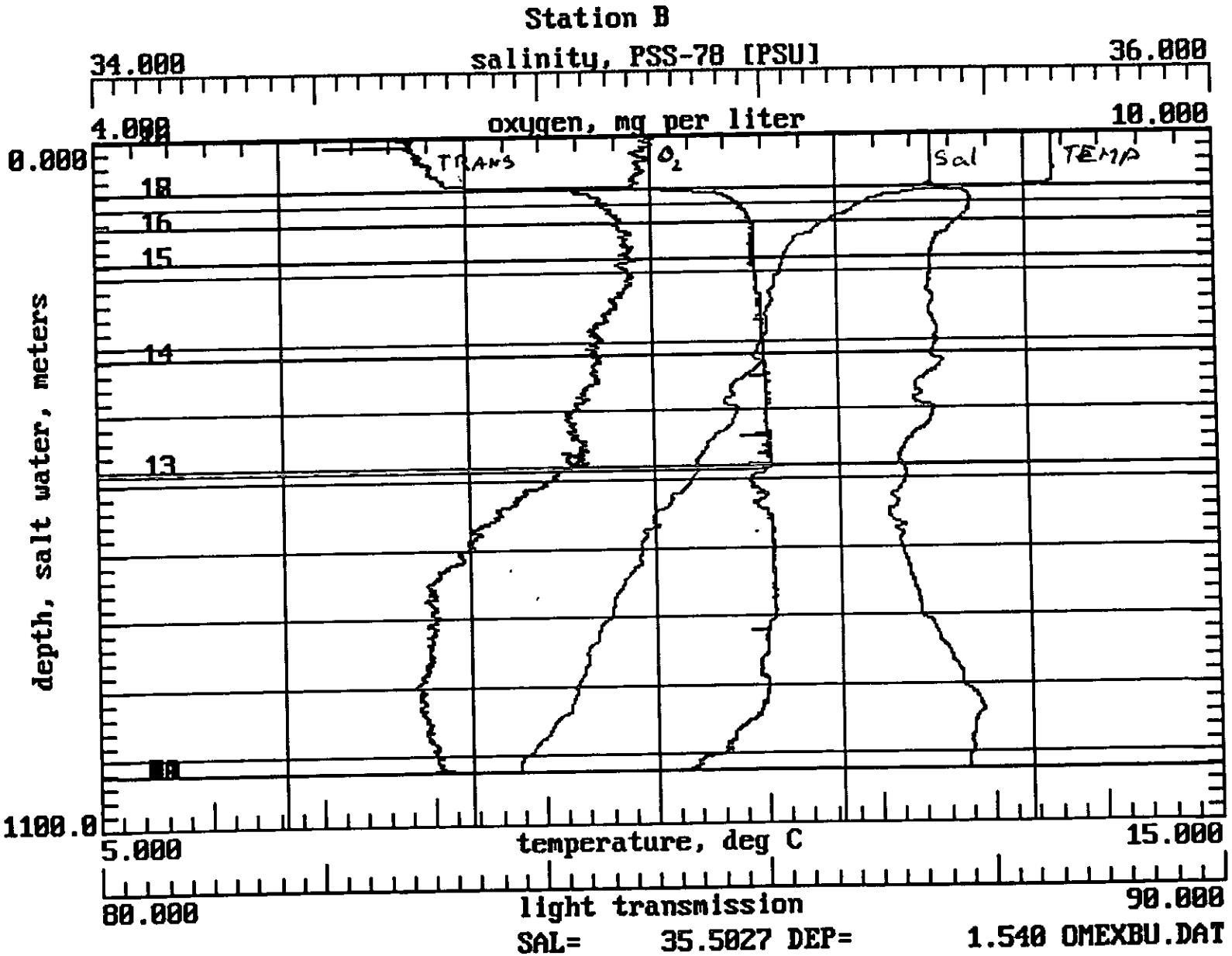
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TRANS
O2
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16
15
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depth, salt water, meters
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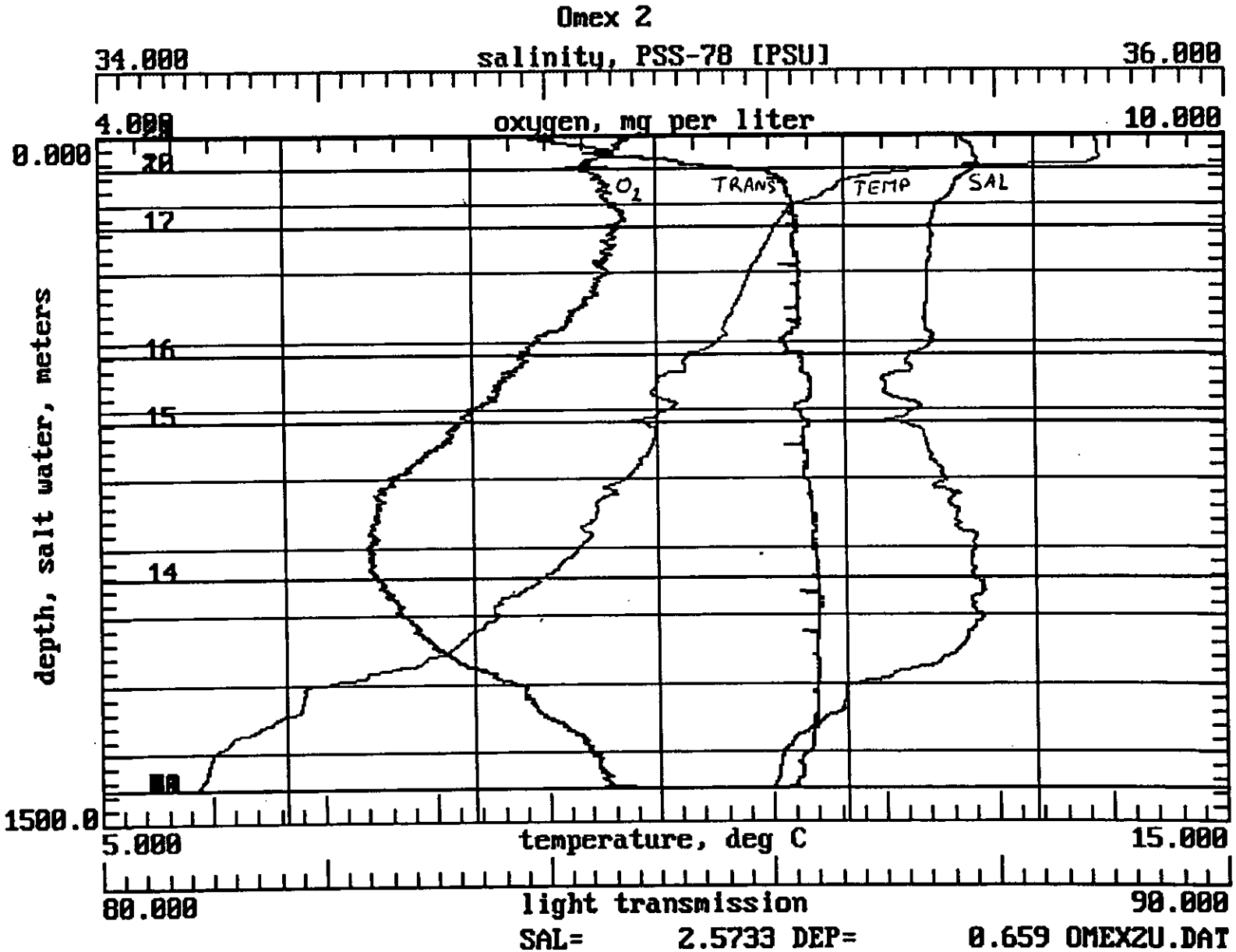
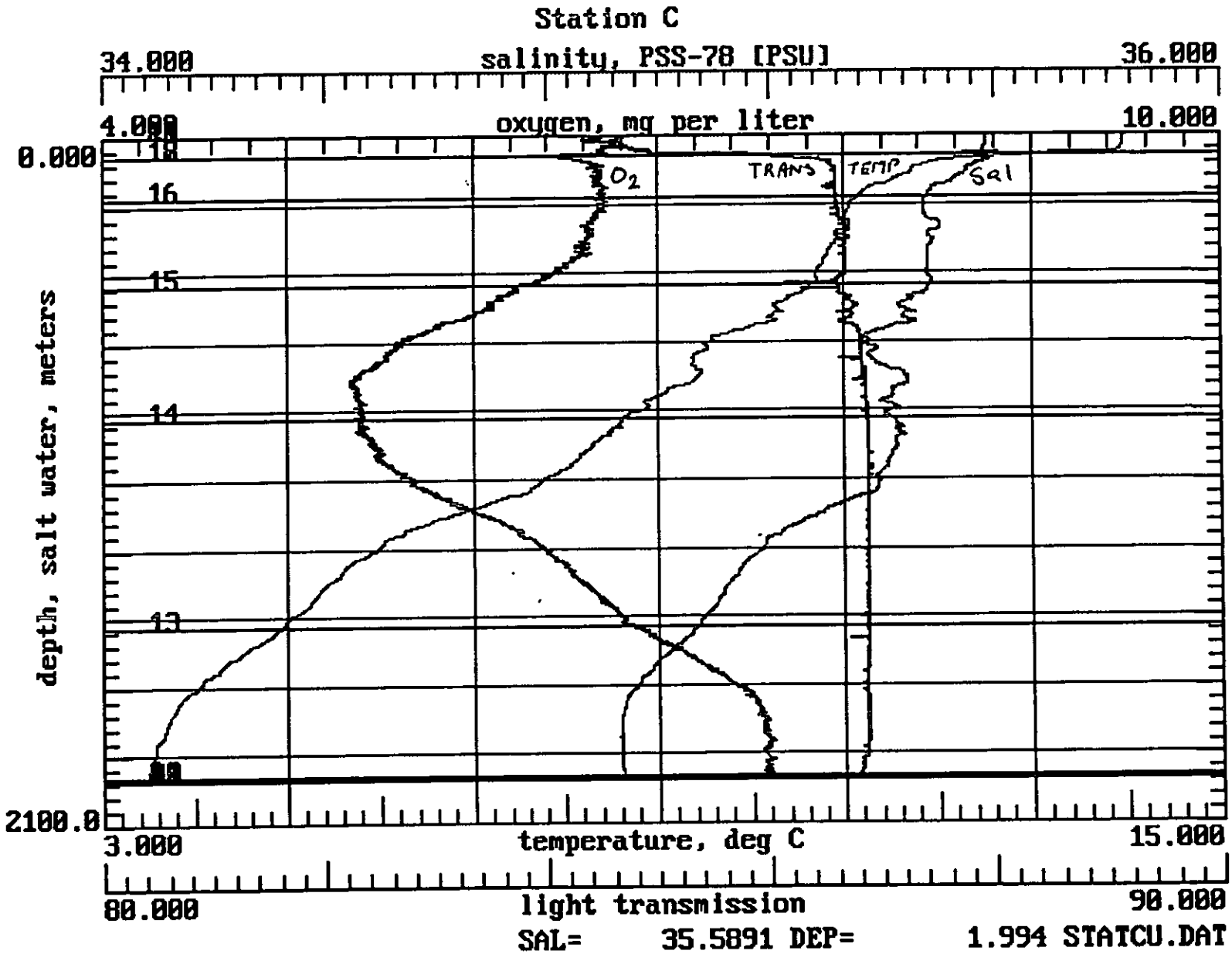
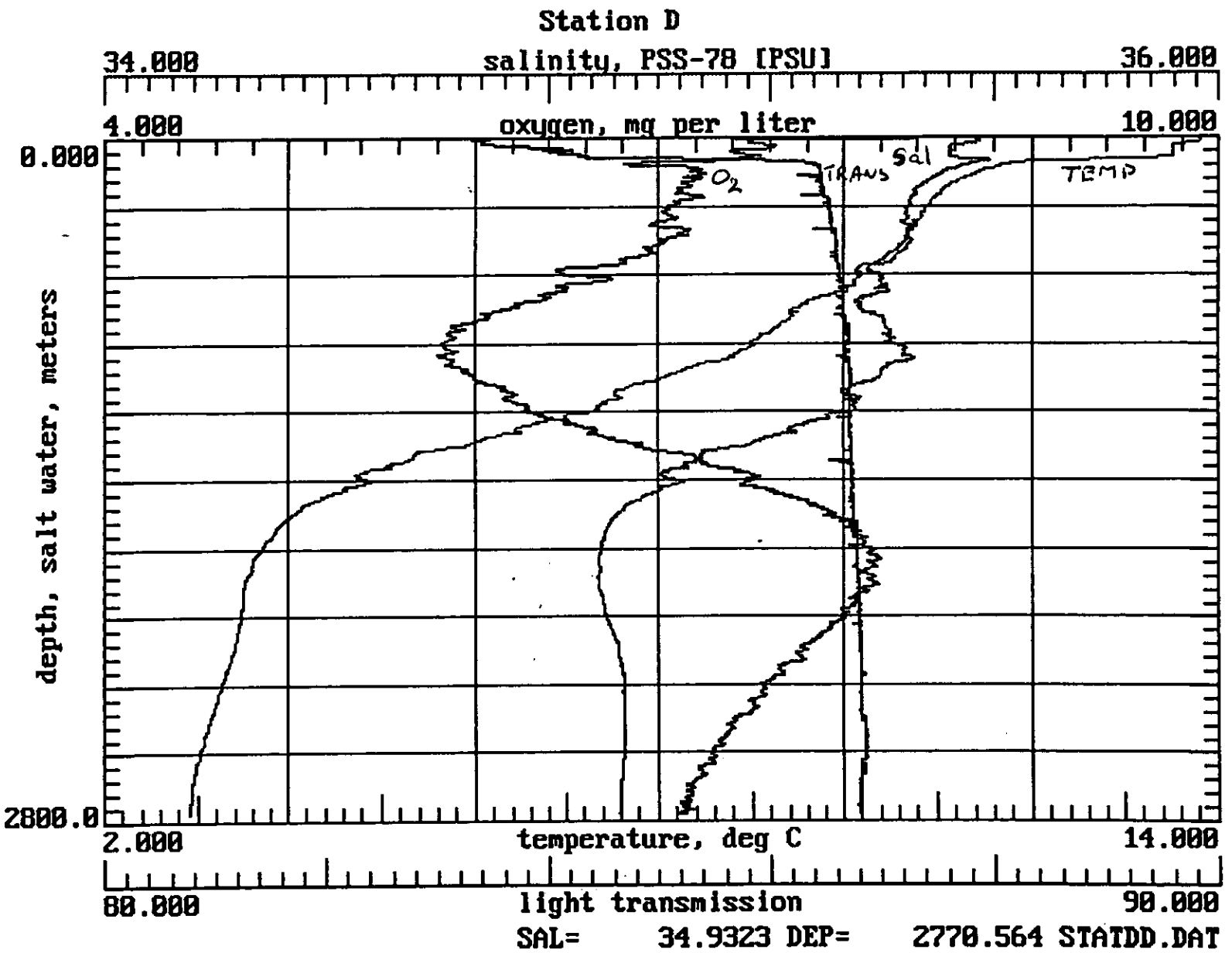
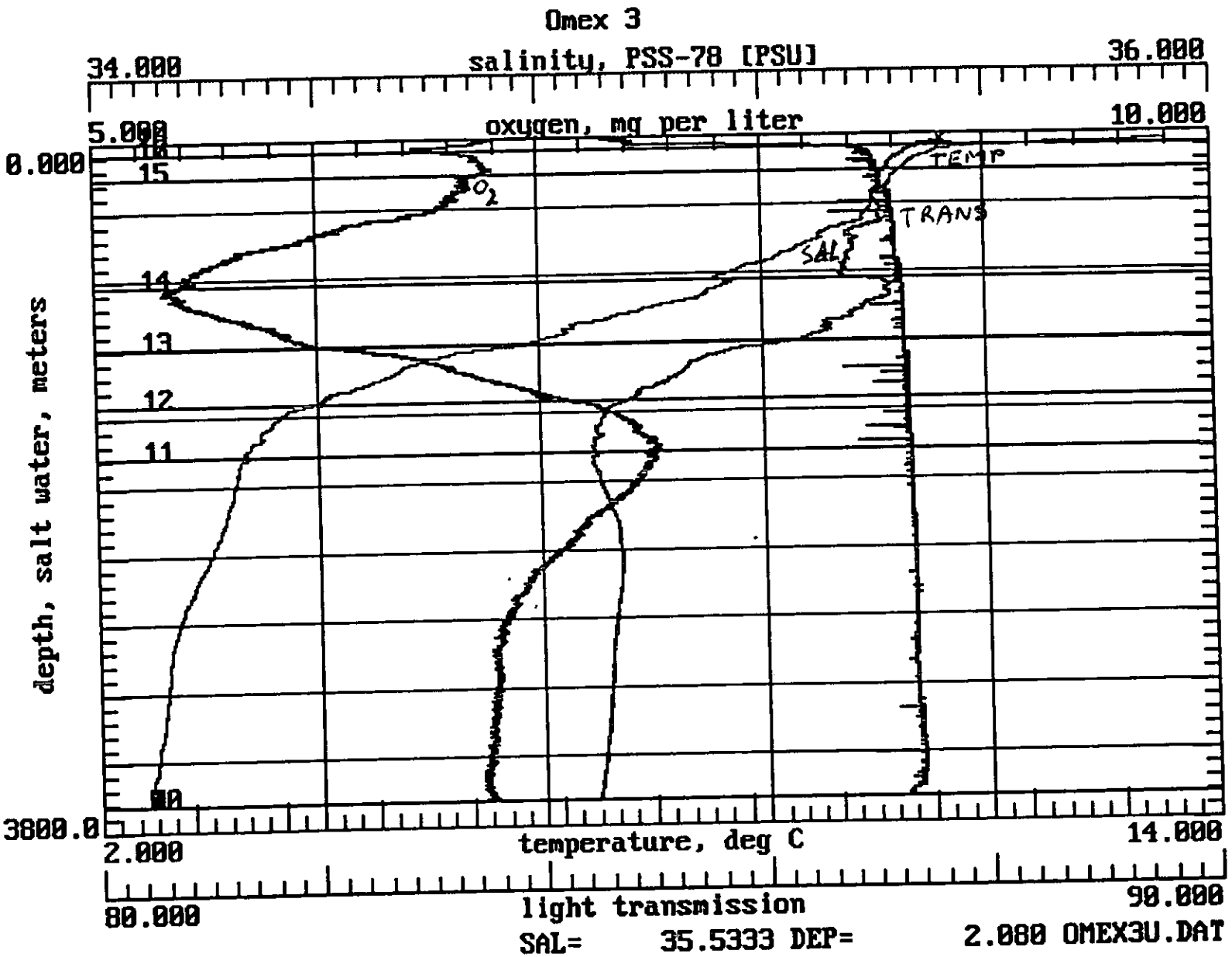
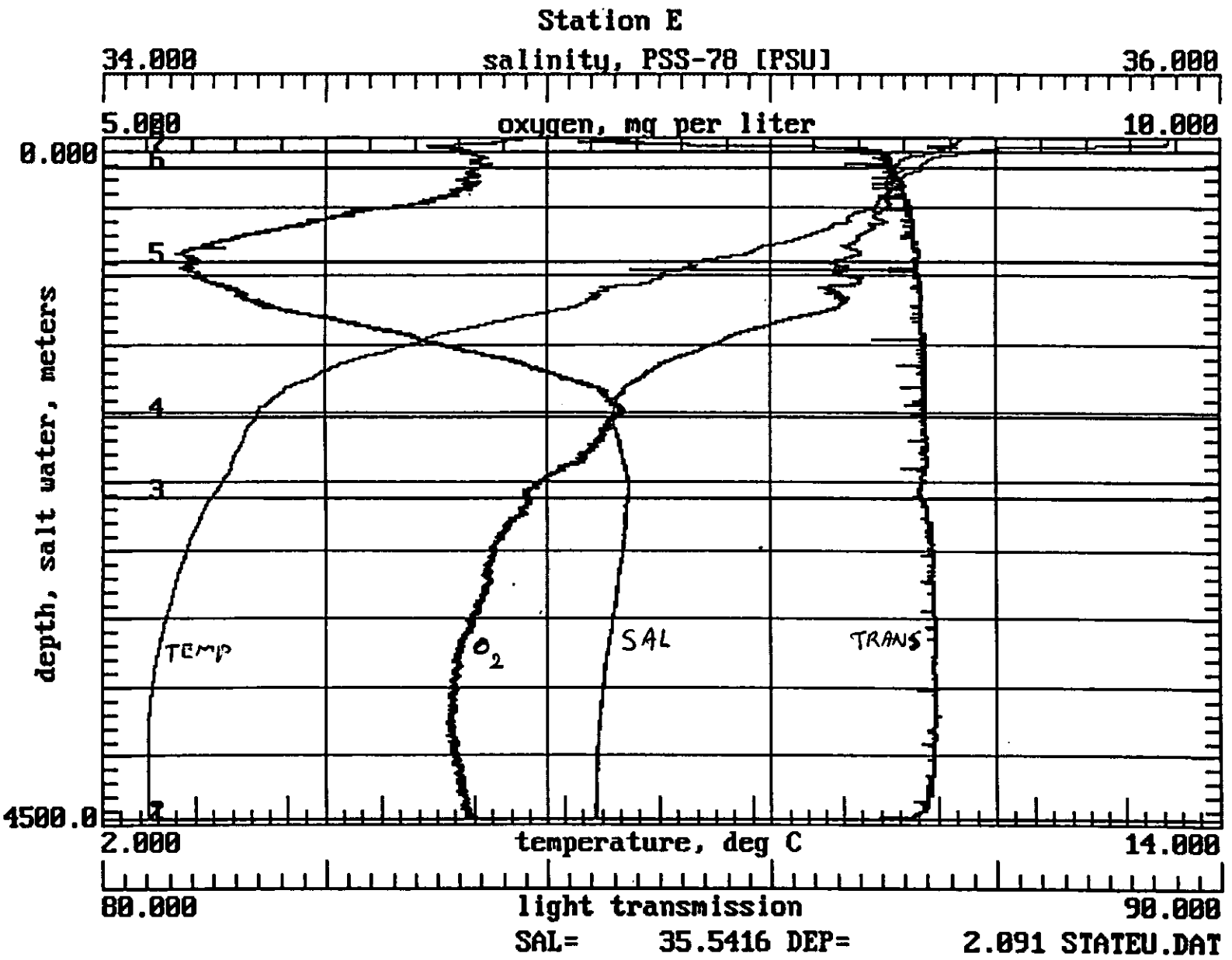
5.000
temperature, deg C
15.000
80.000
light transmission
90.000
SAL= 35.5027 DEP= 1.540 OMEXBU.DAT

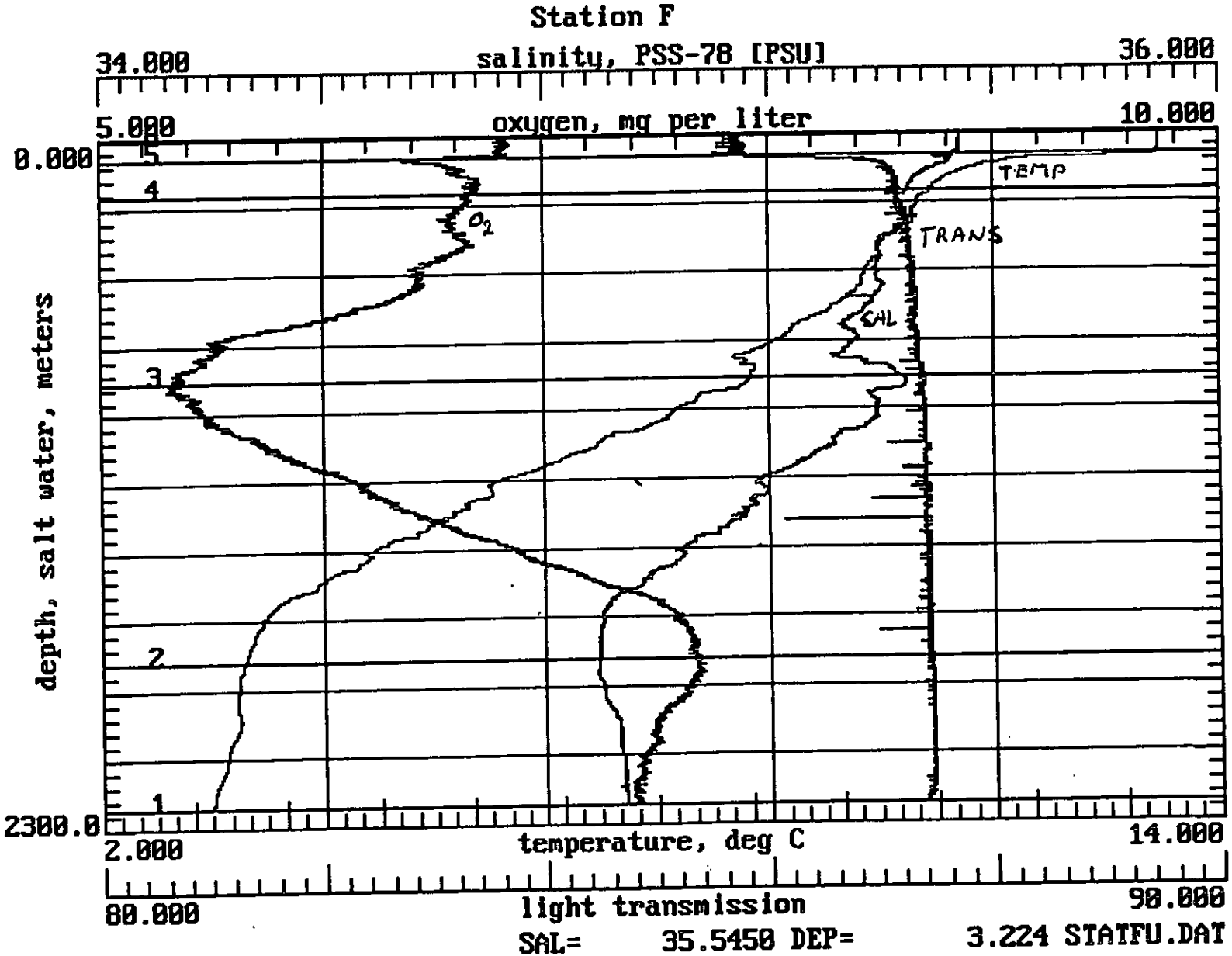

Omex 2
34.000
salinity, PSS-78 [PSU]
36.000
4.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
1500.0
O2
TRANS
TEMP
SAL
12
16
15
14
5.000
temperature, deg C
15.000
80.000
light transmission
90.000
SAL= 2.5733 DEP= 0.659 OMEX2U.DAT

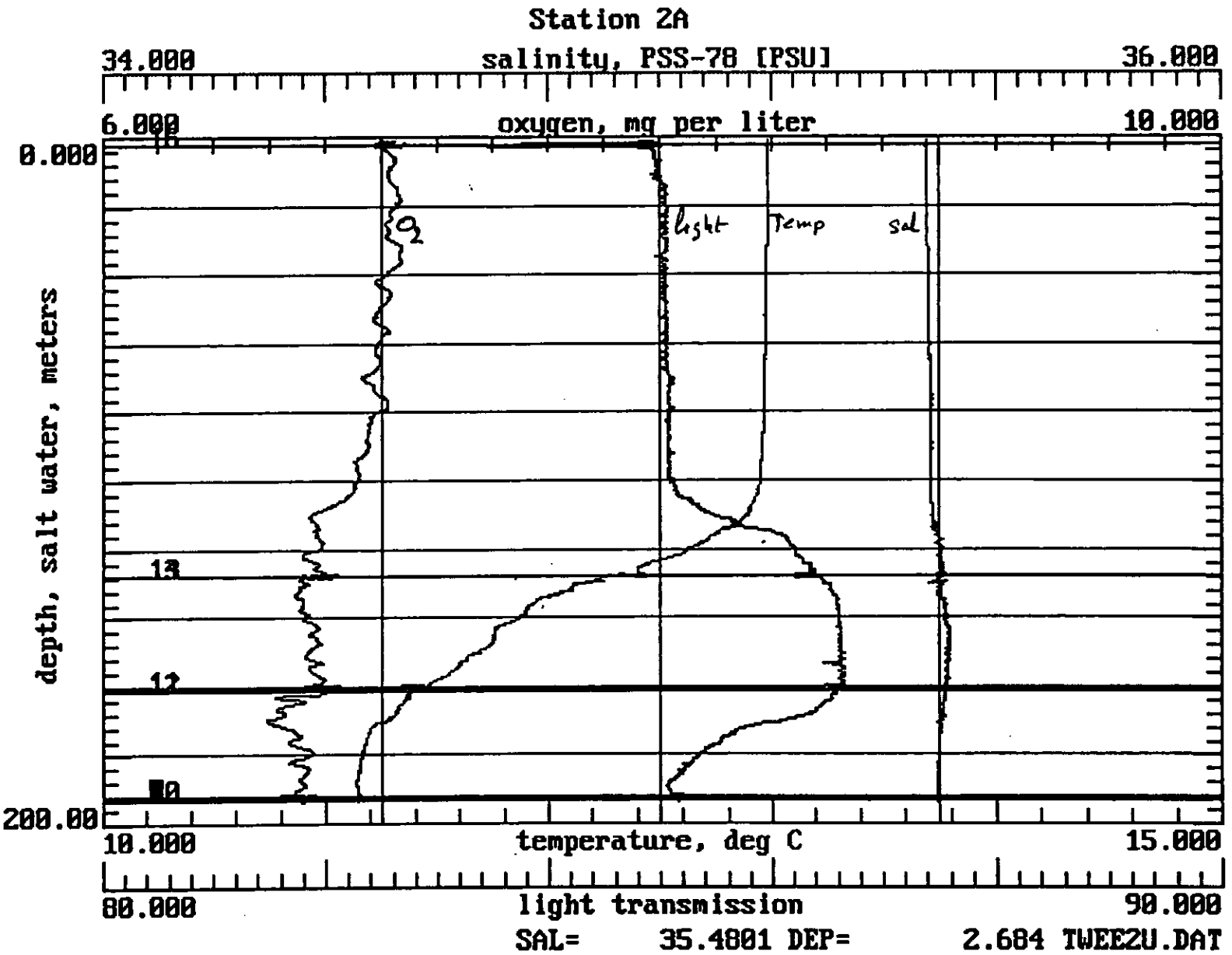

Station C
34.000
salinity, PSS-78 [PSU]
36.000
4.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
2100.0
O2
TRANS
TEMP
Sal
16
15
14
13
3.000
temperature, deg C
15.000
80.000
light transmission
90.000
SAL= 35.5891 DEP= 1.994 STATCU.DAT

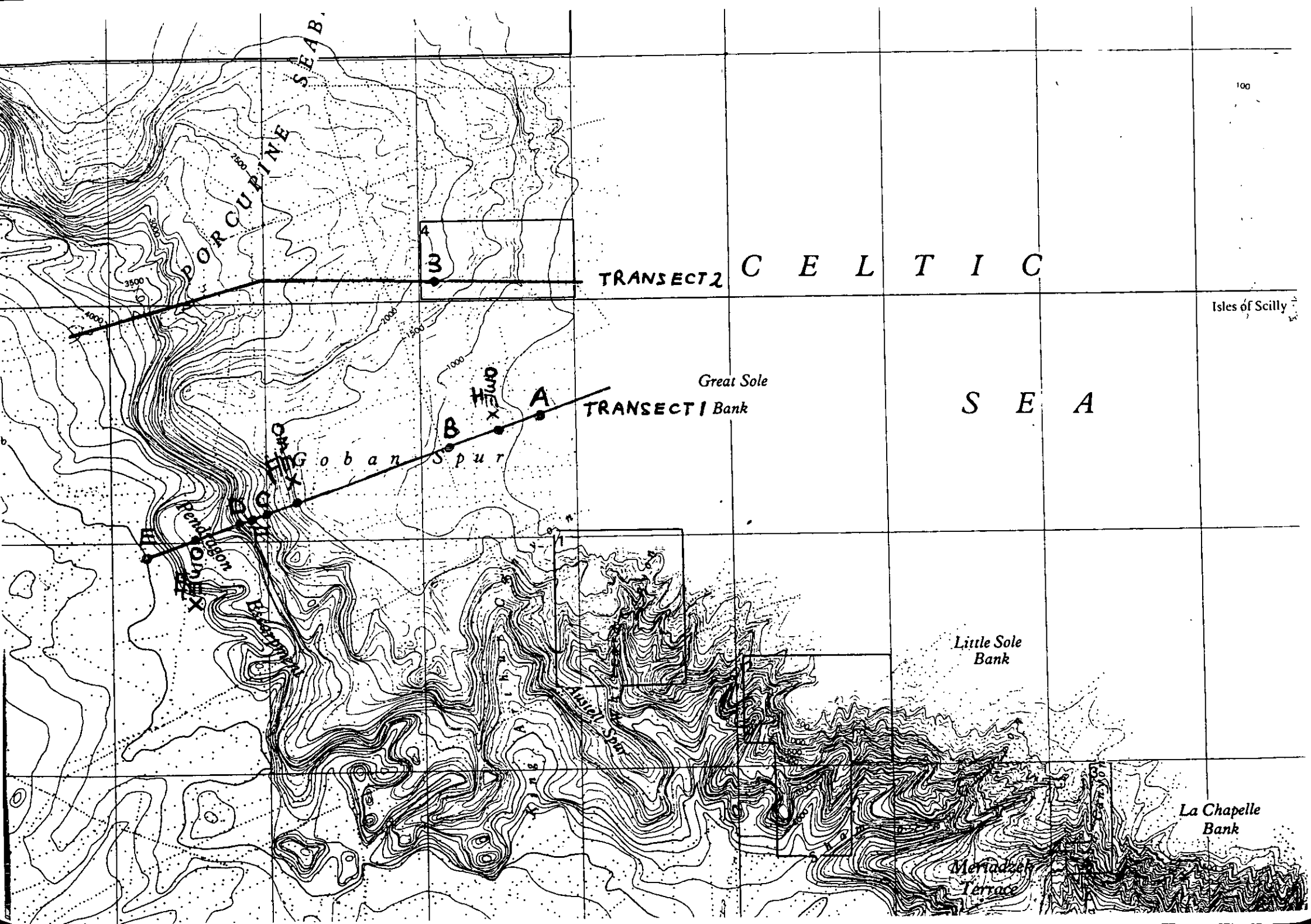

Station D
34.000
salinity, PSS-78 [PSU]
36.000
4.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
2800.0
O2
TRANS
Sal
TEMP
2.000
temperature, deg C
14.000
80.000
light transmission
90.000
SAL= 34.9323 DEP= 2770.564 STATDD.DAT


Omex 3
34.000
salinity, PSS-78 [PSU]
36.000
5.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
3800.0
2.000
temperature, deg C
14.000
80.000
light transmission
90.000
TEMP
TRANS
SAL
O2
SAL= 35.5333 DEP= 2.080 OMEX3U.DAT


Station E
34.000
salinity, PSS-78 [PSU]
36.000
5.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
4500.0
TEMP
O2
SAL
TRANS
2.000
temperature, deg C
14.000
80.000
light transmission
90.000
SAL= 35.5416 DEP= 2.091 STATEU.DAT


Station F
34.000
salinity, PSS-78 [PSU]
36.000
5.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
2300.0
5
4
3
2
1
O_2
TEMP
TRANS
SAL
2.000
temperature, deg C
14.000
80.000
light transmission
90.000
SAL= 35.5450 DEP= 3.224 STATFU.DAT


Station 2A
34.000
salinity, PSS-78 [PSU]
36.000
6.000
oxygen, mg per liter
10.000
0.000
depth, salt water, meters
O2
light
Temp
sal
13
12
10
200.00
10.000
temperature, deg C
15.000
80.000
light transmission
90.000
SAL= 35.4801 DEP= 2.684 TWEE2U.DAT


PORCUPINE SEAB.
TRANSECT 2
TRANSECT 1
C E L T I C
S E A
Isles of Scilly
Great Sole Bank
Goban Spur
Pendragon Escarpment
Austell Spur
Little Sole Bank
La Chapelle Bank
Meriadzek Terrace
A
B
C
D
E
3
4
100
2500
3000
3500
4000
2000
1500
1000