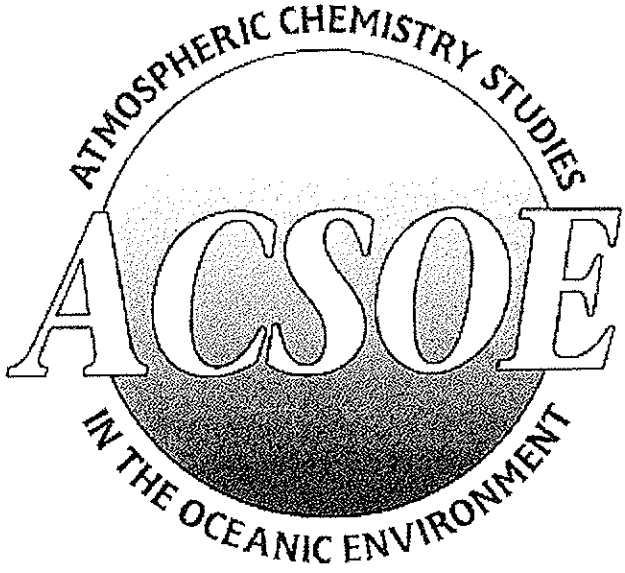
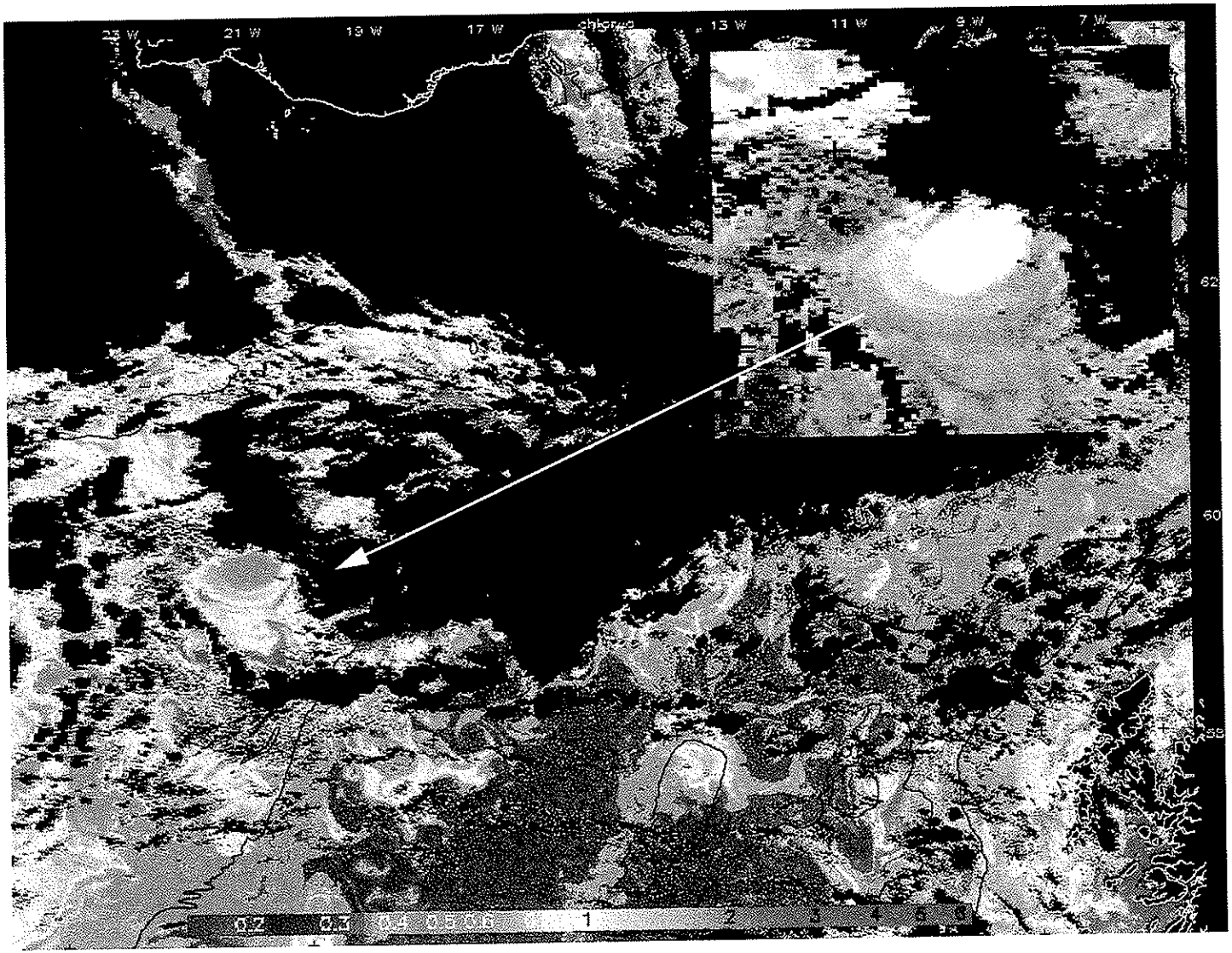


North Atlantic Experiment 1998

RRS Discovery
6 June - 9 July 1998

Coordinator: Dr. Wendy Broadgate
Principal Scientist: Professor Peter S. Liss

School of Environmental Sciences
University of East Anglia
Norwich NR4 7TJ
United Kingdom



SeaWiFS 16 June 1998: ACSOE eddy; main picture chlorophyll-a, inset Water-leaving irradiance at 555 nm (nL_w^{555}) showing coccolith scattering

Participants can obtain satellite images from RSDAS via the web site: http://www.npm.ac.uk/rsdas/projects/acsoe/

DISCOVERY 234 CRUISE

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

We would like to thank the master of *RRS Discovery*, Robin Plumley and his officers and crew for always being helpful and cooperative and ensuring the success of the cruise. Andy Louch and his team at the RVS Operations office, who were friendly and efficient, were invaluable in guiding us through the paperwork in advance of the cruise. As always, the RVS Scientific staff, Dave Teare, Pete Mason, Jeff Benson, Jeff Jones, Rob Lloyd and Martin Bridger were extremely helpful and willing to respond to the many and varied calls for help from scientists, as well as in keeping the instruments running throughout the cruise.

The success of this experiment was critically dependent on finding a stable patch of water to deploy the SF_6 and then to follow this patch for a period of weeks. We are indebted to several people who were not on board the ship, but dedicated much of their time, including many weekends, to the cruise. Steve Groom, Peter Miller and Tim Smyth, from the Remote Sensing Data Analysis Service in Plymouth, provided us with daily satellite images of the area and helpful interpretation of the data. Dave Meldrum, from Dunstaffnage Marine Laboratory, Oban, kindly lent us his GPS buoy and sent us regular faxes of its position throughout the cruise.

We would also like to thank Rosie Cullington for her pre- and post-cruise administrative help and for typing and formatting much of the cruise report.

LIST OF CRUISE PARTICIPANTS

School of Environmental Sciences, University of East Anglia, Norwich

Peter Liss
Fiona Carse
Wendy Broadgate
Tim Jickells
Adrian Thompson
Jonathan Baker
Michael Steinke
Jonathan Delaney
Marie Hamren-Larsson
Laura Cárdenas

Plymouth Marine Laboratory, Plymouth

Phil Nightingale
Malcolm Liddicoat
Claire Stelfox
Steve Archer

Portaferry Marine Laboratory, Queens University of Belfast

Gwen Moncoiffé

Department of Biological Sciences, Napier University, Edinburgh

Linda Gilpin

Southampton Oceanography Centre, Southampton

Jane Read

BODC, Bidston Observatory, Merseyside

Polly Machin

Department of Marine Sciences and Coastal Management

Tom Frost

Institut de Ciencies del Mar, CSIC, Spain

Rafel Simó
Carlos Pedrós-Alió

Environment Centre, University of Leeds

Andrea Jackson

RVS Marine, NERC, Southampton Oceanography Centre, Southampton

Pete Mason	SEG
Jeff Jones	SEG
Rob Lloyd	ISG
Martin Bridger	ISG
Dave Teare	SIG
Jeff Benson	SIG

INTRODUCTION TO ACSOE

ACSOE is a 4 year UK NERC Thematic Research Programme to investigate the chemistry of the lower atmosphere (0 - 12 km) over the oceans. The studies aim to bring about a clearer understanding of natural processes in the remote marine atmosphere, and how these processes are affected by atmospheric pollution originating from the continents. This information is vital in understanding regional and global-scale changes in atmospheric chemistry and climate.

ACSOE consits of three consortia:

1. **OXICOA** (OXIdising Capacity of the Ocean Atmosphere), a study of oxidant, radical and related gas chemistry within the clean and moderately polluted marine atmosphere
2. **MAGE** (Marine Aerosol and Gas Exchange), a study of aspects of air-sea exchange relevant to atmospheric chemistry and aerosol production.
3. **ACE** (Aerosol Characterisation Experiment), a study of gas and aerosol processing through hill cap clouds and subtropical marine stratocumulus.

The **North Atlantic Experiment** is the final in the series of ACSOE-MAGE experiments.

More information on ACSOE can be found on the web site:
http://www.uea.ac.uk/~acsoe/welcome.html

THE NORTH ATLANTIC EXPERIMENT

Discovery Cruise D234

6 June - 9 July, 1998

Introduction

The exchange of gases and particles across the air-sea interface can have important impacts on the biogeochemistry of both the oceans and atmosphere. For example, air-sea transfer of CO_2 is a large flux in both the natural and man-perturbed cycles of this radiatively active gas. Further, the flux of dimethyl sulphide (DMS, produced by marine algae) from sea to air plays an important role in the production of atmospheric acidity and cloud condensation nuclei (CCN). In the case of transfer of particles, the oceans are a sink for terrestrial mineral dust; a major source of iron which appears to be a limiting nutrient for marine primary production in some important oceanic areas.

The air-sea exchange of trace gases (CO_2, DMS, and many others) is closely coupled with their production or consumption by the biota in the surface oceans. Hence the processes regulating marine biological production are crucial to understanding, and quantifying, gas exchange. Key factors are the fluxes of the major (N, P, Si) and minor (Fe, Mn, Zn) nutrient elements, some of which in turn are being supplied from the atmosphere, notably N and Fe. Thus, there is an intimate coupling between the inward and outward fluxes of material across the sea surface, which make their combined study, as proposed here, both appropriate and rewarding.

It is well known that concentration distributions of biogeochemical variables in the oceans exhibit marked 'patchiness' on a wide range of temporal and spatial scales. Although much of this variability is intrinsic to the driving forces and biogeochemical processes, 'patchiness' also arises from the way that parameters are observed and measured. Traditionally, biogeochemical observations have been made from ships or fixed platforms. These give insight into variations over the large scale, but only limited information on the nature of processes, since sequential measurements will almost certainly not be in the same body of water biologically (or biogeochemically) speaking. Thus, the nature of many biogeochemical signals is blurred by inadequate deconvolution of the chemical and biological processes from the spatial and temporal variability.

To solve this fundamental problem it is necessary to carry out as near as possible a truly lagrangian experiment, in which the observing system moves with the body of water. Tracking water movement with drogued buoys alone is often unsuccessful, particularly under rough conditions, and gives no information on the effects of small-scale lateral and vertical mixing on the biogeochemical signals. Studies of iron enrichment in the equatorial Pacific (IronEx I and II) and recent studies of bloom development during the PRIME study in the N. E. Atlantic have shown the success and value of deployment of sulphur hexafluoride (SF_6) as a deliberate tracer for small-scale lagrangian experiments in the open ocean. It is, however, not enough to make detailed process studies at the micro-scale level in such lagrangian experiments if we also require a full understanding of biogeochemical systems. In addition it is necessary to have a proper measure of the meso-scale variability within which to interpret the small-scale observations.

Objectives

In the ACSOE North Atlantic Experiment we plan to address three main objectives, which are closely integrated.

1. To examine the biogeochemical controls of trace gas production, cycling of these gases within the water column and their air-sea exchange by;

- measurement of a number of climatically important gases in air and water,
- examination of factors which control trace gas production in the water column, e.g. phytoplankton species, nutrient status, grazing pressure and bacterial activity,
- estimation of the net fluxes of gases across the air-sea interface,
- construction of trace gas budgets for the mixed layer.

2. To investigate the kinetics of air-sea exchange processes by;

- using deliberately added tracers in order to better constrain the fluxes of the gases across the air-sea interface during the experimental period,
- to further advance the state of knowledge concerning the kinetics of gas exchange at sea, particularly in open ocean systems.

3. To investigate the coupling of atmospheric inputs to water column biogeochemistry by;

- measuring the deposition fluxes of metals and nutrients to surface seawater,
- investigating the biogeochemical cycling of metals and nutrients in surface seawater, particularly their response to atmospheric inputs,
- examining changes in the plankton community in the patch of water over the period of the experiment,
- looking at short time scale changes in nutrient and trace gas concentrations and biology in surface waters in response to rain events.

North Atlantic Experiment Cruise Plan can be found on the website:
http://www.uea.ac.uk/~acsoe/wnortha.htm

Modes of Operation during the ACSOE North Atlantic Experiment, 6 June - 9 July, 1998

Mode	Measurements	Location	Timing
HYDROGRAPHIC SURVEYS			
Seasoar Survey	Seasoar, T, sal, ADCP, fluorescence, chlorophyll, HPLC, nutrients, trace gases and biological parameters[#]	Seasoar to 300 m and surface water, occasional CTDs	48 - 60 hr at start, 12 hr at middle and 48 - 60 hr at end of each patch
DAILY ROUTINE			
SF_6 Survey	SF_6, T, sal, ADCP, fluorescence, chlorophyll, HPLC, nutrients, trace gases and biological parameters[#]	surface water, occasional depth profiles	11.5 hours/dy 1430-0200
Atmospheric	Aerosols and rain (major ions, trace metals, DON, N & S isotopes, organics, CN, surface area), trace gases, NO_x, SO_2, O_3, H_2O_2.	Head-to-wind	11.5 hours/dy 0300-1430
	Nutrients, HPLC at 1030, chloro phyll, trace gases and biological parameters[#], SF_6 profiles	Head-to-wind, surface water, CTD at 1400	11.5 hours/dy 0300-1430
Productivity	^{14}C primary productivity (size fractionated?), DOC excretion, ^{15}N uptake, nutrients, trace gases[#], DMS and its precursors, bacteria, phytoplankton taxonomy, microzooplankton grazing	Centre of patch pre-dawn CTDs to 300 m, incubations	1 hour/dy 0200-0300
EVENTS			
Rain	Rain collection for major ions, trace metals, DON, N & S isotopes, possible $^3He/SF_6$ collection for gas exchange study, bacterial heterotrophic activity	Head-to-wind	whenever it rains!
Diel	Lagrangian water measurements for 48 hours: nutrients, chlorophyll, trace gases and biological parameters[#], SF_6, incubations (trace gase production and biological parameters), Atmospheric measurements (when head-to-wind)	centre of patch next to buoy, CTDs at 2 hourly intervals	48 hours - 1 diel study per patch
CONTINUOUS	met, wind stress, waves, instruments on buoys (pCO_2)	on ship or buoys	continuous

[#] Trace gases and biological parameters includes DMS, halocarbons, hydrocarbons, N_2O, CH_4, ^3He, DMS/DMSP cycling, pH, pCO_2, TCO_2, bacterial activity, phytoplankton (abundance, biomass, taxonomic change with time, discrete samples), microzooplankton grazing, some samples will be taken for subsequent Fe and DMSe analyses.

D234 Timetable of events and main sampling modes

Day	JD	Date/Time	General comments	Approx time, GMT		
				02:30-04:30	04:30-15:00	15:00-02:30
1	157	06/06/98	Sailed from Fairlie			
2	158	07/06/98	Passage			
3	159	08/06/98	Passage		C_{01}	C_{02-03}
4	160	09/06/98	Passage, hove to			
5	161	10/06/98	Seasoar survey 1	S	S, C_{04}	S
6	162	11/06/98	Seasoar survey 1	S	S	S
7	163	12/06/98	Seasoar survey 1	S	S	S
8	164	13/06/98	Deployment of SF_6, Day 0	S	C_{05-06}	
9	165	14/06/98	Day 1	C_{07-09}	A	S
10	166	15/06/98	Day 2	C_{10-12}	A	C_{13}, S
11	167	16/06/98	Day 3	C_{14-16}	A	B,S
12	168	17/06/98	Day 4	C_{17-19}	A	H_1, A, S
13	169	18/06/98	Day 5	C_{20-21}, H_2	A	S
14	170	19/06/98	Day 6, STORM, Diurnal I	C_{22}	-	-
15	171	20/06/98	Day 7, STORM	-	S	S, C_{23}
16	172	21/06/98	Day 8	C_{24-25}	A	C_{26},H_3,S,A
17	173	22/06/98	Redeployment of SF6	A	A,S,C_{27},H_4	S
18	174	23/06/98	Diurnal II, transect to Iceland	C_{28-29}	C_{30-33},H_5,S	
19	175	24/06/98	Heimaey Island, Iceland			H_6
20	176	25/06/98	transect from/back to Iceland		H_7	H_{8-10}, A
21	177	26/06/98	transect to 59N 21W		A	A, C_{34}, H_{11}
22	178	27/06/98	transect to 59N 21W	C_{35-36}, H_{12}	S	C_{37}, H_{13}, S
23	179	28/06/98	Day 15 Seasoar deployed	C_{38-39}	S,C_{40}	S, A
24	180	29/06/98	Seasoar Survey 2	S	S, A	S, A
25	181	30/06/98	Seasoar Survey 2	S	S	S, A
26	182	01/07/98	Seasoar Survey 2	S, A	S	S, A
27	183	02/07/98	Survey 2, deep CTD transect	S	S	C_{41-43}
28	184	03/07/98	Deep CTD transect	C_{44}	C_{45-48}	C_{49-50}
29	185	04/07/98	Final CTDs in study area	C_{51}	C_{52}, A	C_{53}, A
30	186	05/07/98	Passage		H_{14}, A	H_{15}, A
31	187	06/07/98	Passage		C_{54}, H_{16}	H_{17}
32	188	07/07/98	Passage		H_{18}	H_{19}
33	189	08/07/98	Docked Southampton 2030			
34	190	09/07/98	Unloading			

Key

S - underway sampling in survey mode

$C_{\#\#}$ - CTD No. ##

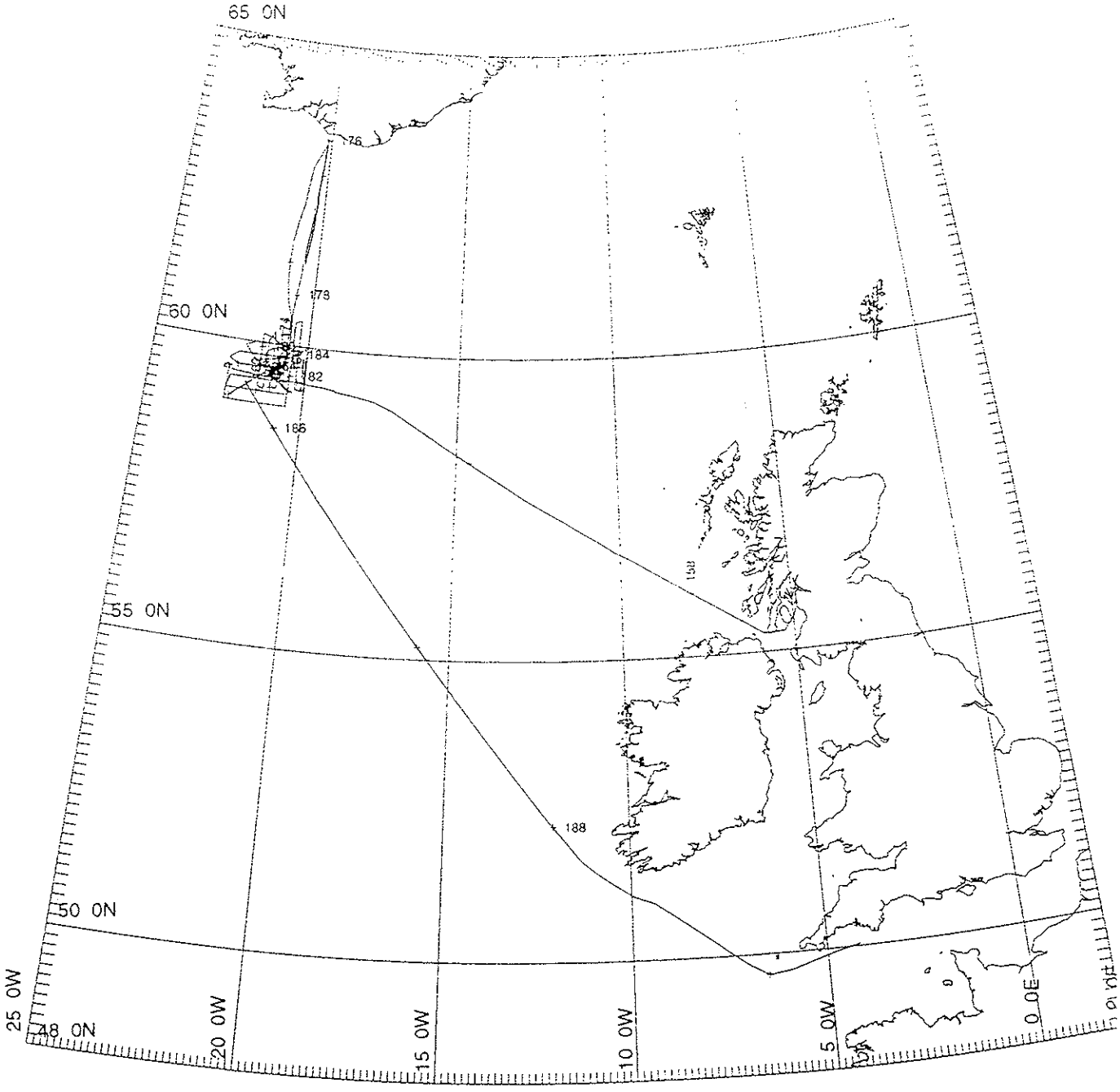
A - atmospheric sampling head-to-wind

H - hydrowire sampling

B - small boat work

CRUISE TRACK

Figure 1 - Cruise Track of Discovery 234 from Fairlie, Scotland on 6 June to Southampton, England, on 9 July, 1998



CRUISE REPORTS FROM INDIVIDUAL PARTICIPANTS

Physical Oceanography

Jane Read
Southampton Oceanography Centre, Southampton, UK

The main objectives for the cruise were first, to find and survey an eddy and to locate the centre of the eddy for injection of the tracer gas SF_6, and second, to investigate the structure and dynamics of the eddy, its temporal variability and the processes involved in its evolution. To achieve these objectives three primary instruments were used to obtain upper ocean currents (ADCP), upper ocean hydrogaphy (SeaSoar) and the baroclinic field (full depth CTDs). Ancillary data were collected as described below.

The cruise began with a SeaSoar and ADCP survey of a feature identified from satellite imagery as an anticyclonic eddy. The data collected confirmed this. Over 3 days a grid pattern was worked with 6 east-west legs 60nm long, 12nm apart and ending with a diagonal line along a Topex/Poseidon satellite track that fortuitously passed almost exactly though the centre of the eddy. From the combination of SeaSoar and ADCP data the centre of the eddy was located to within about a mile, in the northeast quadrant of the survey. ADCP data collected during the ensuing SF_6 injection over a 4 square mile area showed that the tracer was deployed marginally off centre. However, velocity data at 30 and 100m showed there to be sufficient vertical shear in the system to preclude a more exact definition of the eddy centre.

The patch of SF_6 injected into the surface layer remained coherent throughout the next 10 days making any further survey work unnecessary. Further physical oceanography measurements were therefore postponed until the end of the cruise.

During the last week of the cruise a second SeaSoar survey was made. This time the grid was worked in a north-south direction with 8 legs 6nm apart and of varying length, 54-78nm. The close spacing was to enable the data to be analysed for vertical motion where the gradients in all directions need to be calculated. No satellite imagery had been received for over a week and the survey was centred on an estimate of the eddy's position from drifting buoy data. During the SeaSoar survey it gradually became clear that the eddy structure had moved to the east. The extent of the survey was restricted by time constraints and the eddy centre was only crossed on the last leg. It provides an excellent picture of the west side of the eddy but the east side remains unsurveyed.

The SeaSoar survey was followed by a short line of 9 full depth CTD profiles. These were planned to follow a second Topex/Poseidon satellite track that crossed the initial eddy position. During the first part of the cruise the eddy appeared stable and stationary, but during the second SeaSoar survey the eddy centre started translating eastwards and this movement continued throughout the CTD section. By the time the last CTD was worked the eddy centre was some 30nm to the east. The CTD stations therefore did not transect the centre of the eddy as planned but cut across the north west sector.

Acoustic Doppler Current Profiler (ADCP)

An RDI 150 kHz hull mounted ADCP was in operation throughout the cruise. During the previous two cruises it had been discovered that one of the four transducers was faulty so had been switched off. This meant that bottom tracking mode was not available, but as the survey region was in deep water and calibration coefficients had been obtained from a zig-zag run on cruise 232, this was not a problem. The ADCP worked well throughout cruise 234. Data were processed using the method established by the IOSDL Marine Physics Group as follows.

ADCP data were logged to a PC using the RDI Data Acquisition System (version 2.48). Two minute ensembles were collected over 64 bins, 8m bin length and 8m pulse length with 4m blank beyond transmit. Since the transducer head is located about 4.5m below the water line the first bin was centred at 13m. Nominal values were provided for speed of sound (1500m/s) and salinity (35.0), with a temperature offset of 45 and temperature scale of 50. Data were corrected for ships heading using the ships gyro. The two minute ensembles were automatically transferred to the ships level C computer and from here they were read into PSTAR data format every 24 hours. The data were first corrected for the ADCP PC clock drift. This ran fast and over the duration of the cruise the correction increased to about 10 minutes. The drift and oscillations of the gyro were corrected by the Ashtech ADU2 ships attitude measurements. Data were calibrated using a misalignment angle of 2.64° and scaling factor of 0.9917. Absolute velocities were obtained by removing the ships speed and direction estimated from the RVS bestnav data stream. Velocities from 101m were inspected daily and showed coherent structure, this was particularly noticeable during the SeaSoar surveys where currents of up to 1 knot were measured and the anticyclonic nature of the eddy was obvious.

SeaSoar CTD Measurements

Two SeaSoar surveys were made, the first of 3 days duration at the beginning of the cruise and the second of 3 days 18 hours during the last week of the cruise (table 1). The RVS SeaSoar and associated instrumentation had not been used since the PRIME cruise in June 1996 which might partly explain a number of problems encountered with the data collection.

Initially the SeaSoar failed to work and after 36 hours the fault was traced to a short circuit in the cable termination. Once deployed it was discovered that the level a logging (which averages the 8Hz data to 1 second) was throwing out large quantities of data. This was traced to the 'rate of change of pressure' editing routine, set up for CTD profiling where a much slower rate of change is expected. Replacement level a software was rapidly downloaded. But when data were transferred to PSTAR format for standard processing the salinity data appeared to be rubbish. After some time it was discovered that the level a software was no longer reducing the data to 1 second and 8Hz data were being logged. The time constant needed to compensate for the different response rates of the conductivity and temperature sensors is usually calculated during the data reduction, without this information conductivity was not corrected for time-lagged temperature effects thus generating very noisy salinity data. Averaging of the data showed it to be reasonably good and the old programmes used to process the data before the days of level a logging were resurrected to handle the data. By the time the data were suitably reduced it was found that the salinity data were drifting badly. During the course of the three day deployment the salinity drift amounted to approximately 0.3 psu. Serious fouling and shifts occurred in addition to this. The data are of doubtful quality but may be improved by comparison with the second survey. This sensor (CTD s/n

1055) should not be taken to sea again unless the cause of the problem is established and rectified. The temperature and conductivity sensors were replaced for the next SeaSoar deployment (s/n 2073). The SeaSoar also carried a fluorometer Aquatracker 3 (88-2960-160) and oxygen sensor. The latter was ignored since no oxygen analysis was done during the cruise, hence calibration is not possible and because of the known hysteresis problems of using oxygen sensors on rapidly profiling instruments. Chlorophyll samples were taken during the first SeaSoar survey for post-cruise analysis. From these it should be possible to obtain a calibration for fluorescence to chlorophyll a.

Salinity data collected during the second SeaSoar survey were a marked improvement on the first, once hysteresis had been minimised by increasing the time constant from 0.22 (standard) to 0.5. However offsets of conductivity were frequent, presumably due to biological fouling, and on one occasion were so severe as to necessitate recovery of the SeaSoar so that the conductivity cell could be cleaned. On redeployment salinity showed a significant increase. Such differences will be calibrated out by comparison with underway salinity samples drawn from the non-toxic sea-water supply. Samples were taken at 2 hour intervals on the first SeaSoar survey. These proved inadequate with the large scale drift that occurred and sampling was increased to every hour on the second survey.

Full Depth CTD Measurements

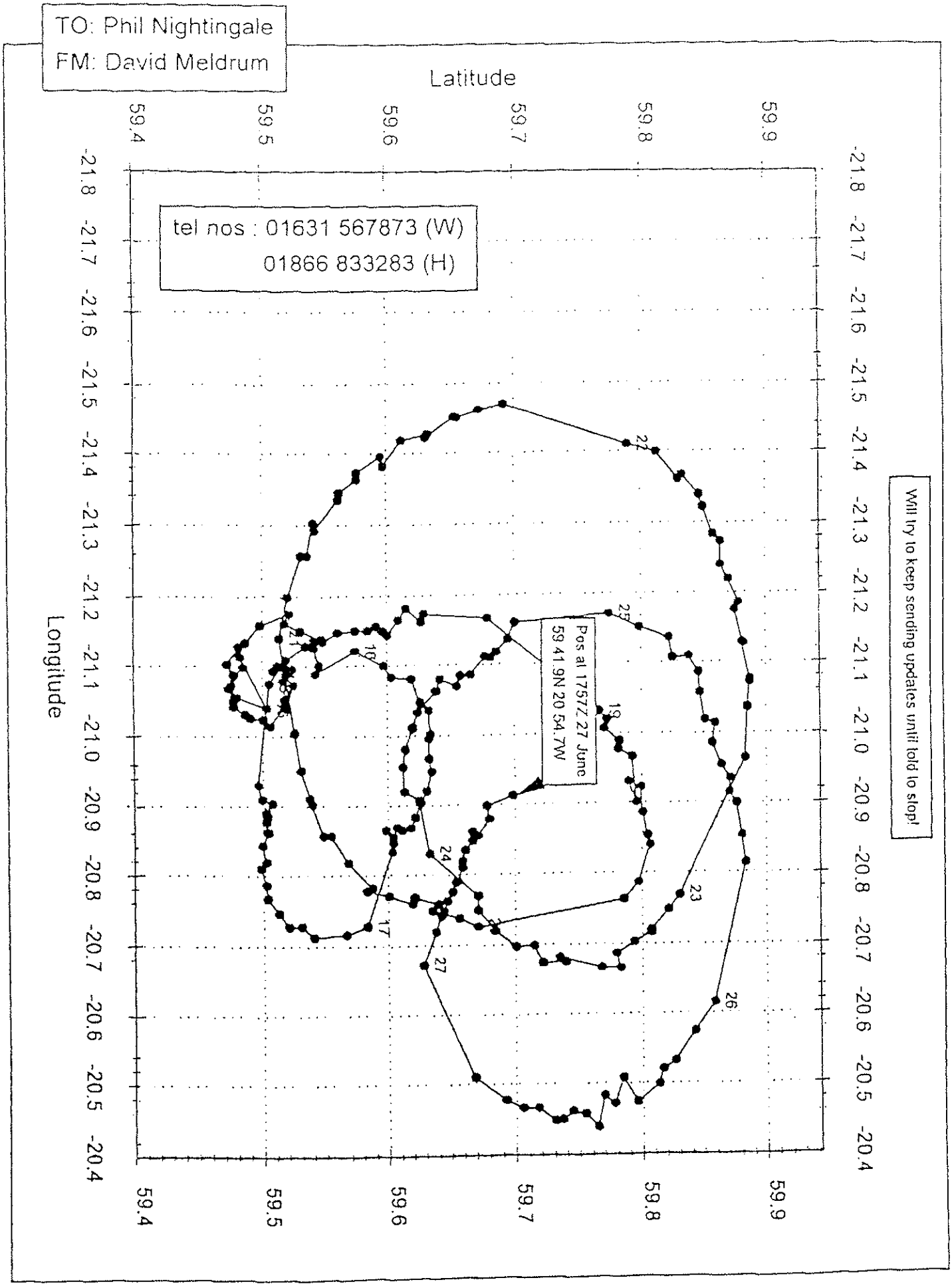
The RVS Neil Brown Mk 3 CTD (s/n 1195) with transmissometer (T1022), nephlometer (SA-244) and fluorometer (Aquatracker 2 SA226) was used to make 9 full depth profiles. Two irradiance meters (nos 1 and 8) used on the shallow casts during the lagrangian study were removed since they were only pressure rated to 1000m. Salinity data were collected from 9 depths; bottom (about 2700-2900m), 2000, 1500, 1000, 500, 200, 100, 50 ,0m.

The 'pinger' (B3) on the first cast gave inadequate returns on approaching the sea bed therefore the cast was stopped about 40m off. The pinger was replaced and the remaining casts were worked to within about 10m of the seabed.

Table 1 SeaSoar deployments

deployment day/time	recovery day time	duration days:hours	distance km
161/0753 (10/6)	164/0600 (13/6)	2:22	644
179/1600 (28/6)	182/0740 (1/7)	2:16	recovered because fouled
182/0900 (1/7)	183/0900 (2/7)	1:0	1252 (combined total)

Figure 2 - GPS Buoy track from Day 0 (13/6/98) of tracer release to Day 14 (27/6/98)



Use of Deliberate Tracers During the ACSOE D234/98 Cruise

Phil Nightingale, Fiona Carse** and Malcolm Liddicoat**
**Plymouth Marine Laboratory, Plymouth, UK*
*** School of Environmental Sciences, University of East Anglia, Norwich, UK*

The lagrangian component of this study was provided via a deliberate, controlled release of SF6. A known volume of seawater (2250) litres, saturated with SF6 and 3He, was released at a depth varying between 7 and 9 metres via gravity feed over the rear of the ship for a period of about 10 hours. The release grid chosen was an expanding box with tracks one mile apart and final dimensions of 4 * 4 miles. In order to avoid loss of tracer to the air while emptying the tank a header tank was used to replace outgoing tracer-tagged water with fresh seawater. The rate of release was increased periodically during the release in order to approximately allow for dilution of the tracer within the tank. Release rates were chosen such that the central one mile of the patch had the greatest concentration of tracer.

Four low profile surface drifting buoys were released during the early stages of the release, one of each corner of the central one mile box. Three of these (RVS owned) were drogued at 20m, the fourth (provided by D. Meldrum CCMS) was drogued at 10m. An in-situ pCO_2 instrument (provided by M. DeGrandpre Univ. Montana) was attached to buoy 1954 at a depth of approx. 16m. This was recovered towards the end of the cruise and will be returned to the US for data downloading.

The tracer patch was successfully tracked for the period of the cruise by using a newly constructed automated system that determined SF6 every 4 minutes. The patch was located after having been hove to during the period of high winds and after an extended period in transit to/from Iceland. Survey periods were used to define the size and movement of the patch and the ship then navigated to the centre of the patch for CTD casts. Samples for the vertical profiling of SF6 were taken from all casts. Samples of seawater were also collected from these casts and stored in cold welded copper tubes for the later analysis of 3He (by P. Schlosser LDEO) in order to derive estimates of gas exchange during the cruise.

The patch was re-infused once using a smaller (1000 litre) tank saturated with SF6 only. The release grid chosen was again an expanding box of final dimensions 2 by 2 miles over a 6 hour period. A check was made that the centre of the patch was indeed being re-infused by monitoring the SF6 in the non-toxic supply from the front of the vessel while the tracer was being released over the stern. The infused patch did indeed cover the centre of the old patch but also extended slightly to the north of the old one. The release was complicated by the movement of the water body at speeds of 1 - 1.5 knots. An attempt was made to allow for this by navigating the ship without attempting to correct for water currents while steaming along the release grid.

A preliminary analysis of the surface data suggests that the tracer in the surface water was sheared from the rest of the water column during the transit to-from Iceland and spread over a fairly large area.

Vertical profiling measurements of Sulphur Hexafluoride

Two sets of 7 profiles were obtained from each of the tracer releases.

Tracer I:
The profiles show high concentrations of SF6 (10 - 100 fmol/l) in the top 20m until the 18/6/98. After the storm of 19/6/98, profiles showed mixing to 70m, with surface levels of ~ 10 fmol/l.

Tracer II:
The profiles show high concentrations of SF6 (> 100 fmol/l) in the top 20m until the 23/6/98 0600, with lower values (possibly at very edge of patch) until 1330. After the detour to Iceland, the maximum values of SF6 were found at 40m depth, with levels only 2-4 times background in the surface waters.

CTD Section:
The first seven stations of the CTD cross-section through the eddy were sampled for SF6 . The first 5 profiles showed sub-surface SF6 maxima at 20m, with the final 2 showing minima at this depth. The bottom water samples showed a consistent 0.5 fmol/l SF6 at about 2800m. A contamination test was carried out on all Teflon Niskin bottles in Rockall Trough deep water. This showed negligible SF6 contamination.

Data will be used to calculate vertical diffusivity of the tracer patches in the ACSOE eddy. The CTD section has provided interesting data, particularly the elevated levels of SF6 in the bottom waters.

Nutrients, Atmospheric Aerosols, Rain and Iron

Tim Jickells
School of Environmental Sciences, University of East Anglia, Norwich, UK

Water Column Nutrients

Nutrients were analysed on a Skalar San system located in the Chemistry Laboratory. Samples were analysed unfiltered but, in open ocean waters using the standard chemical procedures employed, measured concentrations are assumed to approximate to the dissolved fraction. The instrument was run with three channels analysing for dissolved inorganic phosphorus (henceforth phosphate), dissolved silicon (henceforth silicate) and dissolved nitrate plus nitrite. On one occasion a profile over the upper 200m was analysed for nitrite and concentrations were below detection limit, which is conservatively estimated at $0.5\mu Ml^{-1}$. Hence results for nitrate plus nitrite are subsequently refereed to as nitrate. The same terms are used in the data submitted to BODC.

The instrument set up and analysis procedures were essentially identical to those detailed in previous cruise reports (Sanders R. in Heywood K.B. and King, B.A. 1996 WOCE Section A23 Cruise Report, University of East Anglia Cruise report Series Number 1 and Sanders R. and Jickells T in King B.A. JCR27 Cruise Report in preparation). The instrument generally ran satisfactorily apart from occasional jumps in baseline which occurred simultaneously for

phosphate and silicate, suggesting an occasional electronic fault. This problem made computer data processing inaccurate and the results were therefore derived manually from the chart paper readout. On one occasion a temporary computer fault also required manual processing of data. Comparisons of manual and computer generated results on some runs showed satisfactory agreement, so the different data processing procedures are presumed not to introduce any bias. However, manual processing cannot quantify the extremely low silicate concentrations encountered in surface waters at some stations, and hence the detection limits are different for the two processing procedures. Manually a detection limit of 0.5 μMl^{-1} has been used and by computer $0.05\mu Ml^{-1}$. The occasions when manual data processing was carried out are identified in the data set submitted to BODC. For nitrate and phosphate no samples that could not be readily quantified were encountered so a detection limit is not reported.

Samples were analysed in batches necessitating refrigerated storage for up to 24 hours, but generally less. The only exception was on the passage leg home when the low sampling density meant samples were stored for up to 50 hours prior to analysis.

Accuracy

Standardisation was based on preparation of a stock solution for each analyte in MQ water at the start of the cruise using pre-weighed powders prepared in our home laboratory. Dilute mixed working standards were prepared regularly (usually daily) from these stock solutions.

One set of Sagami nutrient standard reference materials were analysed several times during the cruise. The Sagami silicate standard has a reported concentration of $100\mu Ml^{-1}$, well outside the range expected in these waters and outside the range of standards used. This standard was therefore diluted five fold in artificial seawater to give an anticipated concentration of 20 μMl^{-1}. The results in Table 1 are the means of 3 (nitrate and phosphate) or four (silicate) analyses over the period of the cruise and carry the implicit assumption that the standards store satisfactorily once opened.

Table 1 Measured and certified concentrations of Sagami standard reference solutions. All concentrations as μMl^{-1}

	Nitrate	Phosphate	Silicate*
Measured	19.4±0.1	1.78±0.07	20.2±0.8
Certified value	20	2.0	20

*After dilution, see text.

The nitrate and silicate results agree well with the certified values. Problems with the Sagami phosphate standard have been discussed previously (Sanders in Heywood 199? and Sanders and Jickells in King 1998) and the results here agree reasonably well with the results we reported previously for other Sagami phosphate standards.

Precision

In the early sample analysis runs all samples were run in duplicate. Subsequently sample numbers made this procedure impossible and instead one or more samples were analysed in

triplicate in each analytical run. Based on all these results, the precision of analyses within a single analytical run is estimated at ± 0.1 μMl^{-1} nitrate, ± 0.02 μMl^{-1} phosphate and ± 0.02 μMl^{-1} for silicate. Almost all the replicates were run on low nutrient surface waters. The average of the three deep water precision estimates is essentially identical to those for surface waters. On CTD54, 8 Niskin bottles on the rosette were fired at the same depth, hence providing a check of precision of sampling and analysis. The means and standard deviations for these samples were nitrate 21.5 ± 0.1 μMl^{-1}, phosphate 1.39 ± 0.01 μMl^{-1} and silicate 35.5 ± 0.1 μMl^{-1}.

Long term (between batch) precision was not assessed directly since it seem unlikely that surface seawater samples could be assumed to store without changing concentration. However, an estimate of long term precision can be gained in two ways. Firstly the precision of the re-analyses of the Sagami standard imply precision for high nutrient samples of better than $\pm 5\%$. Another approach is to consider the analyses of 200m water from the eddy re-sampled throughout the cruise. As the deepest sample, this seems likely to have been most stable physically and biogeochemically and hence to provide an upper limit on long term precision, though inevitably this is based on deeper water samples with higher nutrient concentrations. Based on 10 re-visitations of the eddy from CTD 6 to CTD 40, long term precision is estimated to be $\pm 6\%$ or better for all three analytes.

General Features of the Data

In total about 480 samples were analysed for nutrients from samples collected from underway sampling and CTD casts. The data set has been deposited at BODC. In addition, some extra samples were run at various times as part of incubation experiments and to look for nitrite. Full interpretation of the data set will obviously take some time but some features are already evident.

In Figure 3 the nutrient results from the first of the deep CTDs are shown. The profiles show the anticipated low surface water concentrations increasing with depth. Nitrate and phosphate concentrations peak at about 1000m, but silicate peaks in the bottom water suggesting a small component of southern water masses creeping this far north.

The surface water nutrient concentrations were generally low in the area when we first arrived, but far from being totally nutrient depleted. Surface water nitrate concentrations were in the range 5-7.5 μMl^{-1}, phosphate 0.3-0.4 μMl^{-1} and silicate 0.2-1.2 μMl^{-1}. At the time of the first seasoar survey, the eddy structure stands out particularly as a feature with higher surface waters silicate concentrations (Figure 4), presumably due to local upwelling within the eddy.

Throughout the cruise nutrient concentrations appear to decline, though it is difficult to document at this stage from individual profiles since there are marked gradients within the eddy itself. However, comparison of the eddy at the end of the second seasoar survey does imply that nutrient concentrations had indeed fallen, as well as confirming the movement of the eddy. Surface water nitrate concentrations were down to 3.5-6 μMl^{-1}, phosphate 0.2-0.3 μMl^{-1} and silicate concentrations had fallen to effectively zero. The eddy is, however, still identifiable as a region of at least elevated surface water nitrate and phosphate concentrations (Figure 4). At the time of the more detailed second survey there is evidence of another feature with higher nutrient concentrations to the south-west which is also evident in the first survey. There is also a notable region of higher silicate to the north of the eddy which is presumably

associated with upwelling and yet is not associated with higher nitrate levels. An explanation of these features should arise from combining the physical data with both the chemical results and those for phytoplankton growth rates and abundance.

During the cruise, there were several storms passed through the area. These appear to result in important changes in the nutrient profiles due to mixing. In Figure 5 nitrate profiles over the top 200m are shown before and after the first storm that we encountered. The storm has homogenised the water column over the upper 50m and thereby increased nitrate concentrations in surface waters by almost 2 μMl^{-1}, with a matching decrease in concentrations in the 30-60m depth range. Silicate concentrations were also increased from 0.3 to 0.8 μMl^{-1}. Given that these very low silicate concentrations may be restricting diatom growth, such storm mixing events may be an important process.

Figure 3 - Nutrients, CTD 44

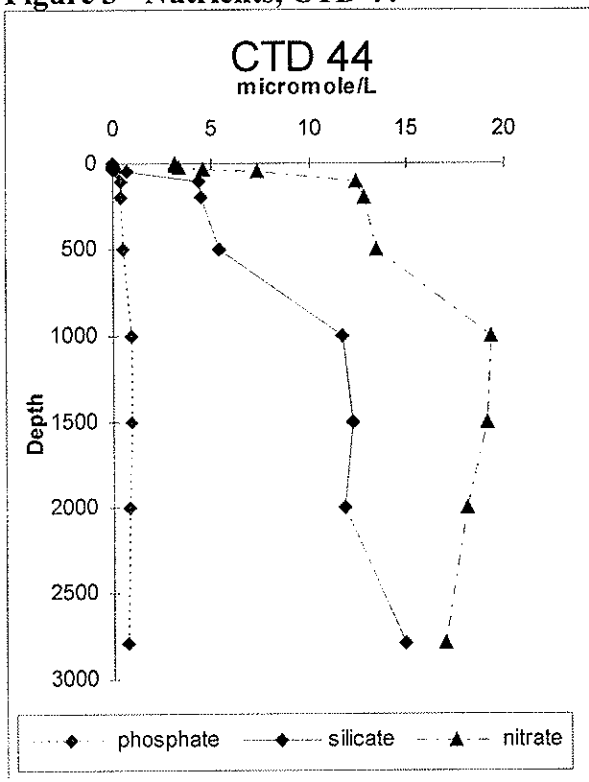
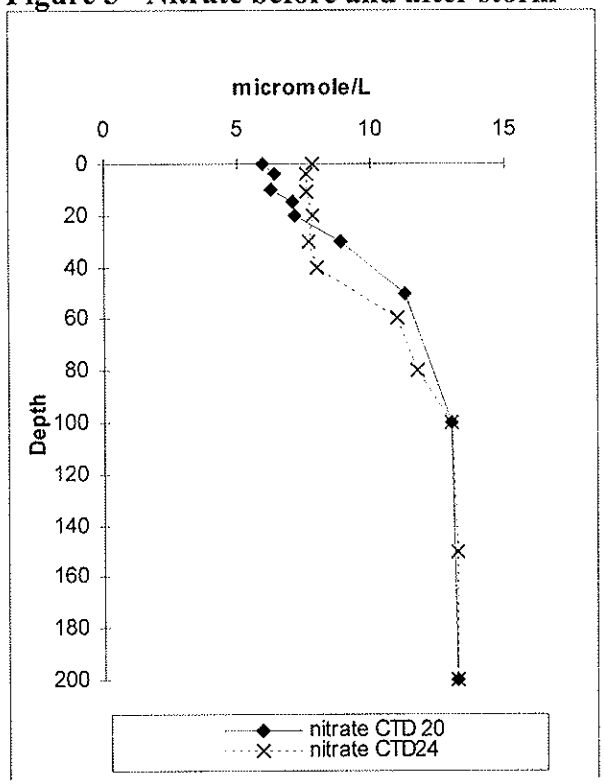


Figure 5 - Nitrate before and after storm

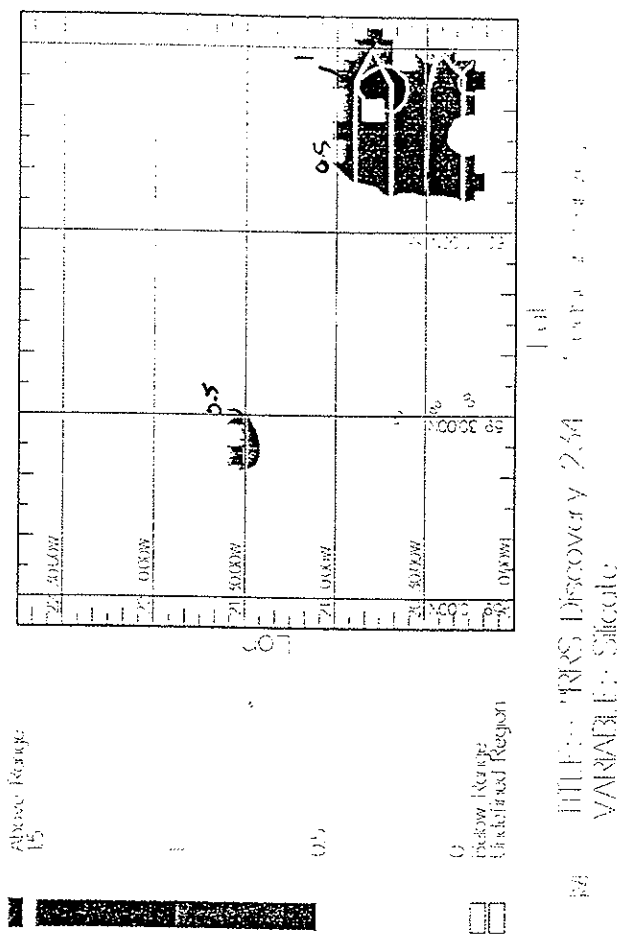


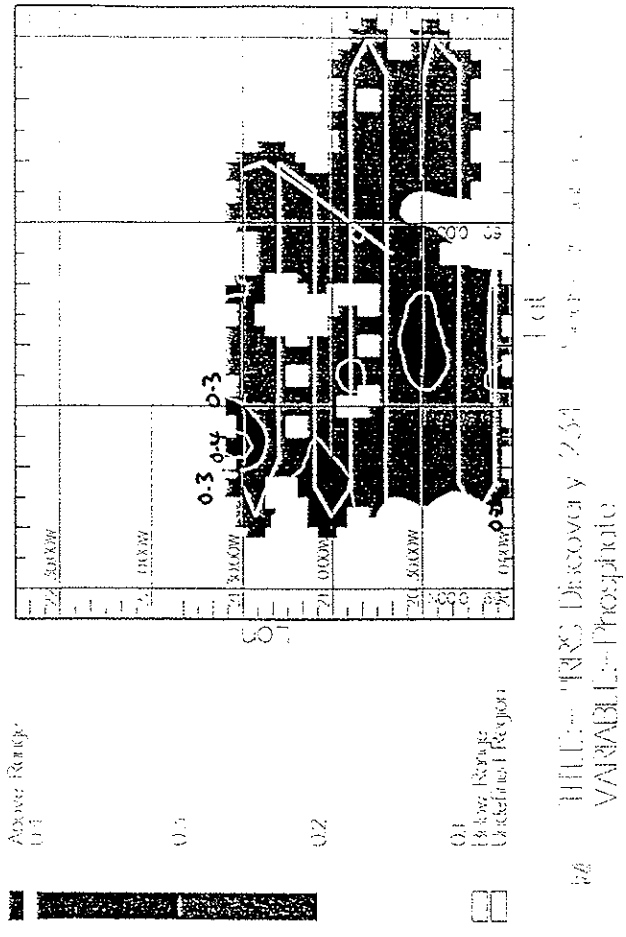
Iron

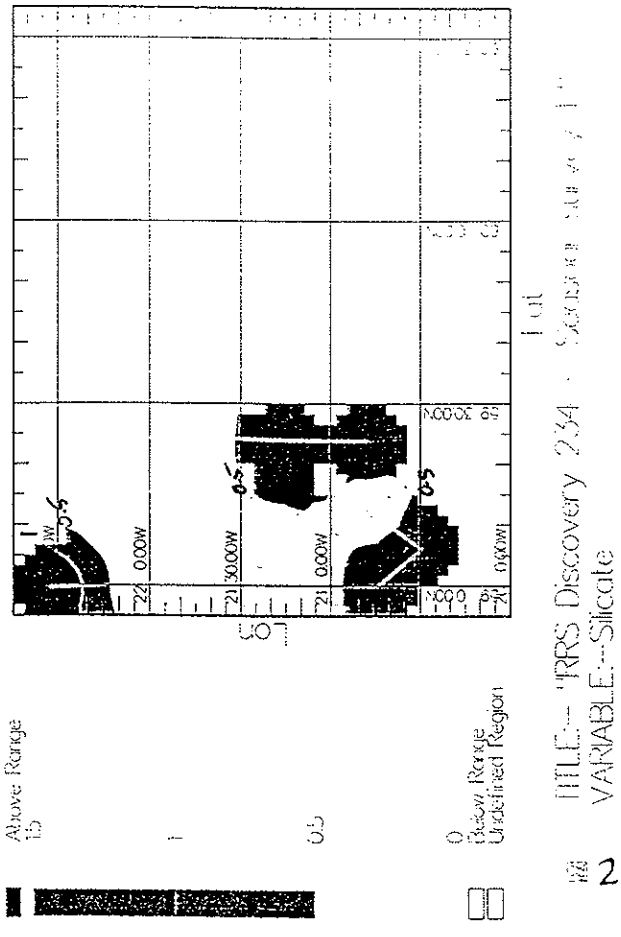
Dissolve iron is now recognised as an important nutrient for phytoplankton growth, and hence it is of interest to the ACSOE programme to define its abundance in the waters surveyed. Andy Bowie of Plymouth Marine Laboratory kindly agreed to analyse a small number of samples from the cruise.

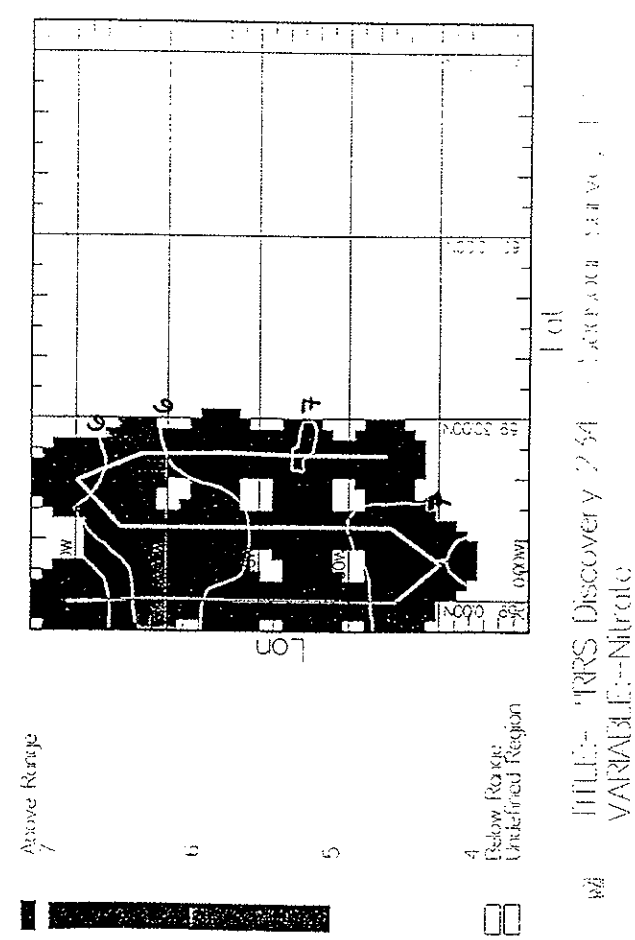
Sampling and analysis for iron is a particularly demanding task since the ship is obviously a major potential source of contamination. Surface water samples from within the eddy were therefore collected by hand using the ship's rubber boat about 1 mile from the ship.
Sampling from deeper waters was more difficult. The cruise was not originally designed to collect trace metal clean samples and we had not therefore requested clean GoFlo bottles and Kevlar line. We had hoped to use the CTD system with 30l Niskin bottles with teflon coated

Figure 4 - Nutrients during surveys 1 and 2









springs. Unfortunately upon inspection the coating on the springs had obviously been damaged and there was clear rust staining on the springs making these bottles unsuitable. The RVS technicians were able to provide one spring in much better condition and this was used in a 10l Niskin bottle for which they rigged a short length of plastic coated stainless steel wire mounted on an auxiliary winch to allow sampling of surface waters.

A few deeper water samples were also collected using the CTD bottles with rubber springs. Sampling was arranged so that these bottles had already been extensively used and hence may have been cleaned effectively by use. We will have to await results to see if this procedure has been successful.

Samples were stored frozen after collection for subsequent transport to Plymouth.

Atmospheric Sampling

(a) Aerosols

Our original plan had been to operate the two aerosol samplers on the bridge deck. Unfortunately communication problems meant that the ship's crew had not been informed of this and several problems ensued, firstly over locating any equipment where it might interfere with the ship's lifeboats and secondly over the absence of a power supply. The former problem was overcome by locating the samplers at the very front of the bridge deck and the latter problem was overcome by the ship's chief engineer agreeing to have power leads led into his cabin and plugged in there. Subsequently earthing problems were found with one of the aerosol samplers and both had to be removed to the laboratory for subsequent repair. After this it was decided to relocate the samplers to the monkey island where more straightforward power supply could be achieved. This transfer was possible only due to the exceptionally calm weather we enjoyed at that time. The samplers were fixed to the aft rail on the port side of the monkey island with power running from sockets at the top of the access ladder. Subsequently this proved a very satisfactory sampling location being high to minimise spray effects and allowing good access even in poor weather. The ship's officers co-operated extremely well in alerting me for rain or changes in apparent or real wind direction.

Subsequent aerosol sampling proceeded well. The two samplers were run with different filtration heads, one with a cascade impactor to provide size segregated samples for subsequent analysis for major ions and trace metals, and the other with a glass fibre filter for collection of material for organic nitrogen analysis and a back up filter to collect SO_2 for isotopic analysis. After several days of sampling, one of the aerosol samplers failed with a suspected burnt out motor. Subsequently the one sampler was run with the different sampling heads on alternate sampling sessions. The winds remained generally from the north throughout the cruise so this alternate sampling strategy did not particularly compromise our primary goals of characterising the aerosol characteristics during the ACSOE experiment. Furthermore the GFC filter will be analysed for major ions so for these (including nitrate, sulphate and ammonium which are of particular interest in the context of this experiment) we will be able to provide as complete a coverage as the sampling regime allowed.

During designated atmospheric sampling periods the ship was turned head to wind, and sampling without the risk of ship contamination was straightforward. On other occasions

during passage or survey work sampling was conducted if it was judged likely that contamination could be avoided, thus maximising the sampling opportunities.

Filters were loaded and unloaded in the clean container and transported to and from the monkey island sealed in plastic bags. Full procedural blanks were run on several occasions. Samples have all been frozen for subsequent return to UEA for analysis. Table 2 provides a complete list of dates when aerosol samples were collected on the cruise.

(b) Rain

Holders for rain collectors were mounted on the front rail of the bridge deck. Initially these were mounted upright but subsequently angled into the wind to improve collection efficiency. Two parallel collections were made with one for trace metals and the other for major ions and organic nitrogen. Clean funnels and bottles were prepared for deployment in the clean room and then transported to the bridge sealed in plastic bags. Collectors were in general deployed but covered in anticipation of imminent rain and then uncovered as rain started, assuming the apparent wind direction was such that sampling could be conducted without risk of sample contamination from the ship's funnel. In practice this strategy was not always possible since I was sometimes asleep as rain appeared. In these cases the collectors were deployed as rapidly as possible after rain started and the ships heading allowed clean sampling. The ship's officers were extremely helpful in alerting me to sampling opportunities and to problems arising from changes in wind direction or the ship's heading. During designated atmospheric sampling periods the ship was turned head to wind and sampling without risk of ship contamination was straightforward. On other occasions during passage or survey work sampling was conducted if it was judged likely that contamination could be avoided, thus maximising the sampling opportunities. A complete list of the occasions when rain samples were collected is provided in Table 3, but it should be noted that some of the collected samples may be too small to allow subsequent analysis. In addition several full procedural blanks have been collected.

Table 2 Aerosols Sampling Periods

D1 14/6/98 04.30-15.17
D2 15/6/98 04.25-14.48
D3 16/6/98 04.33-13.40
D4 17/6/98 04.30-20.43
D5 18/6/98 04.30-15.15
D6 21/6/98 04.27-14.47
D7 21/6/98 21.42-22/6/98 08.53
D8 25/6/98 14.30- 26/6/98 03.40
D9 26/6/98 10.30-18.23
D10 28/6/98 16.06-16.40, 21.45 - 29/6/98 08.57
D11 29/6/98 09.31-16.52
D12 29/6/98 19.58- 30/6/98 10.35
D13 30/6/98 22.00 - 1/7/98 07.00
D14 1/7/98 14.48-22.38
D15 4/7/98 05.37- 17.51
D16 5/7/98 10.28-19.07

Table 3 Rain Sampling Periods

all times GMT unless noted

D1	6/6/98 21.30(BST)-7/6/98 06.30(BST)
D2	17/6/98 22.30-18/6/98 06.15
D3	19/6/98 06.30-10.30
D4	19/6/98 15.00-21.30
D5	20/6/98 09.00-13.00
D7&8	23/6/98 07.30-15.00
D10	24/6/98 21.30-23.15
D11	25/6/98 00.30-09.00
D12	4/7/98 06.00-13.00
D13	4/7/98 16.45-18.42
D14	5/7/98 12.30-13.30

Collection of Water Samples for Phytoplankton Enumeration, Pigment Analysis and Quantification of Volatile Selenium Species

Marie Hamren-Larssen and Peter Liss
School of Environmental Sciences, University of East Anglia, Norwich, UK

Phytoplankton Enumeration

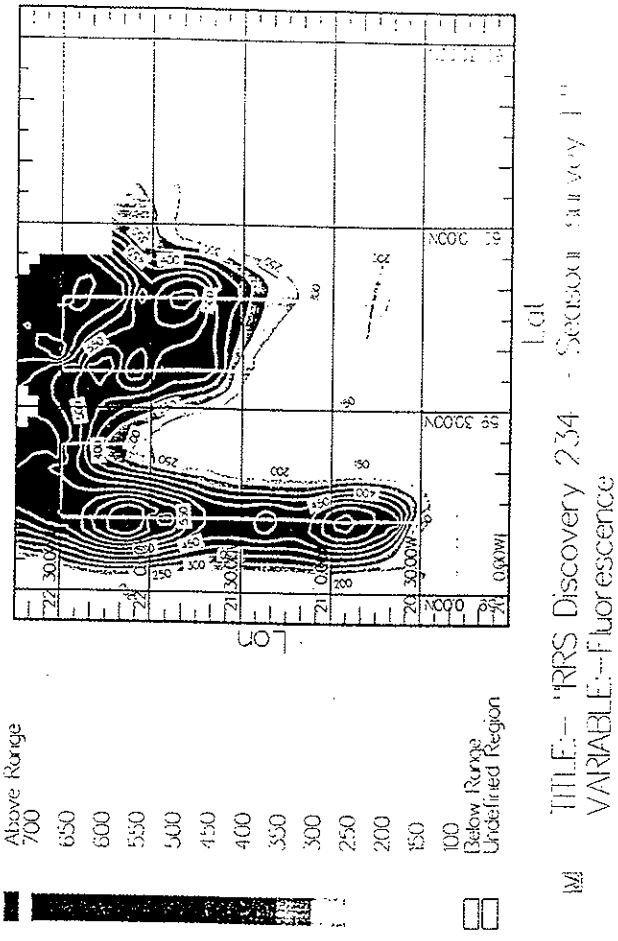
A total of 213 water samples were preserved for subsequent enumeration of phytoplankton species. For each sample two 100ml subsamples were taken, one was preserved by the addition of 2ml of formalin, the other had 1ml of Lugol's iodine solution added. Sample bottles were stored in the dark until counted.

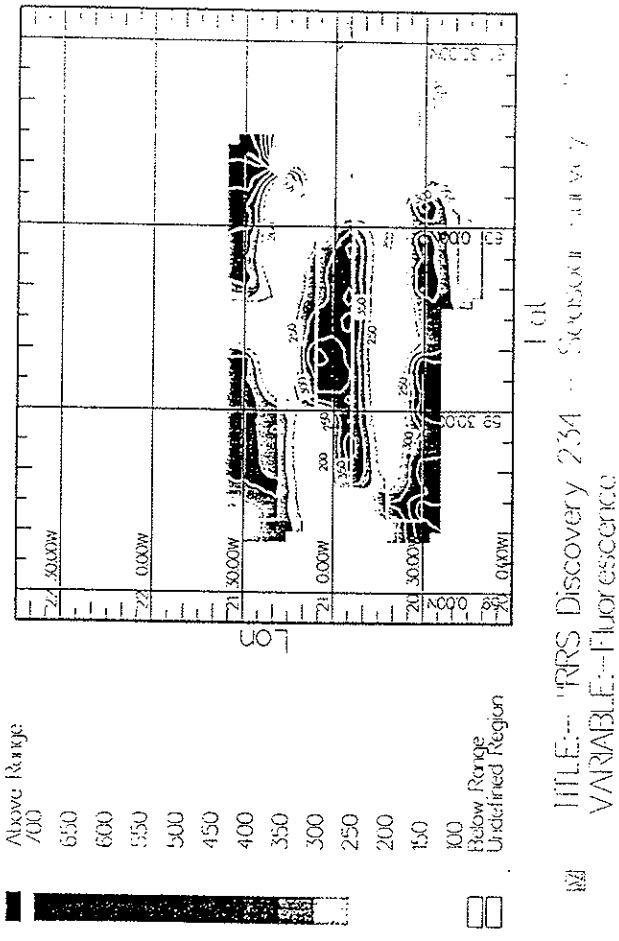
Pigment Analysis

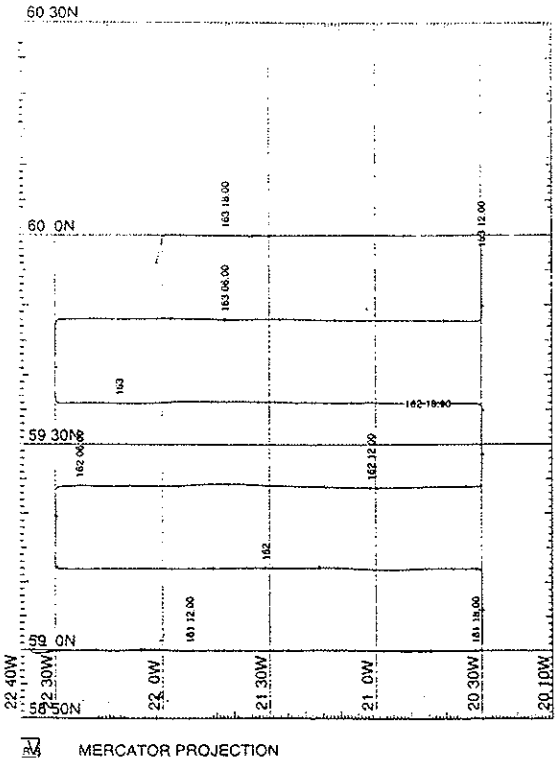
635 water samples were taken for standard chlorophyll and phaeopigment analysis. Phytoplankton cells were harvested by vacuum filtration of 100ml of sample through a Whatman 25mm GF/F filter. Immediately after filtration the filters were wrapped in aluminium foil and rapidly flash frozen by immersion in liquid nitrogen. Subsequently samples were stored at -80 degrees centigrade prior to extraction and pigment analysis back at UEA. The underway samples were collected from the deck lab (old) non toxic seawater supply direct from the hull and NOT through the debubbling tank. Dave Teare (RVS) informed us towards the end of the cruise that there is a new supply direct from the hull to the TSG and fluorometer which was installed during the refit this winter. After this date (2/7/98) underway trace gas samples, chlorophyll and phytoplankton samples were collected from the outlet of the TSG and fluorometer. Care must be taken when using discrete chlorophylls to calibrate the underway fluorometer before this date as they were taken from different supplies.

In addition 2.15 litre volumes of 160 water samples were filtered through Whatman GF/F filters for subsequent analysis for a range of pigments by HPLC. After filtration the filters were put in plastic vials and flash frozen by immersion in liquid nitrogen. Subsequently the vials were kept at liquid nitrogen temperature until analysed by Stuart Gibb at Plymouth Marine Laboratory.

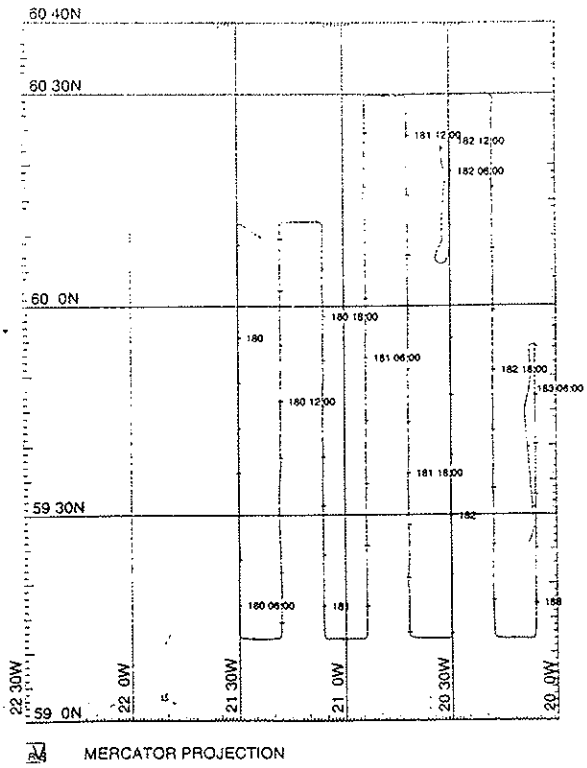
Figure 6 - Underway fluorescence and cruise track for Survey 1 and Survey 2







RRS Discovery 234 SeaSoar Survey 1



RRS Discovery 234 SeaSoar Survey 2

Volatile Selenium

It has been known for many years that the global budget for selenium cannot be balanced without a flux of some volatile form(s) of the element from the ocean to the atmosphere, with subsequent deposition onto land. However, because of the very low levels of volatile selenium in seawater, it is extremely difficult to prove the emission of selenium from seawater by analytical measurement. Indeed, essentially no measurements of volatile selenium in seawater exist for open ocean situations. In order to try to rectify this deficiency 30 samples of mainly surface seawater were collected using a specially cleaned Niskin bottle attached to a Kevlar line. Within a few hours of sub-sampling of the Niskin into a Schott bottle, the volatile selenium species were extracted from the water using a purge and trap apparatus. The extracted volatiles were trapped using liquid nitrogen and stored in a cryocontainer containing this coolant until analysesd on land. Analysis was carried out by David Amouroux and Emmanuel Tessier using an ultra sensitive GC-MS system in their laboratory at the University of Pau (France).

Volatile Halocarbons in Air and Seawater

Jon Baker
School of Environmental Sciences, University of East Anglia, Norwich, UK

Initial aims were to measure a wide range of volatile halocarbons in air and seawater using a gas chromatograph coupled to a mass spectrometer. Of particular interest was seawater concentrations of CH_3Br as there is much speculation concerning the source strength of this compound.

Preliminary results suggest that CH_3Br was undersaturated (30-50%) in surface water of the area sampled. There was very little temporal or spatial variation. Depth profiles showed there to be a surface maximum with concentrations droppping rapidly below the thermocline. Similar trends were observed for CH_3CH_2Br.

Other bromine compounds measured ($CHBr_3$, CH_2Br_2, $CHBr_2Cl$) generally had sub-surface maximum concentrations at approximately 40-20 m.

CH_3I was generally supersaturated in surface waters at approximately 40-400%. Depth profiles demonstrated there to be a maximumn at a similar depth to the thermocline on a number of occasions. Similar results were observed for CH_3CH_2I, CH_2ClI and CH_2I_2.

CH_3Cl was generally undersaturated in surface waters.

Non-Methane Hydrocarbons in Seawater and Air

Wendy Broadgate
School of Environmental Sciences, University of East Anglia, Norwich, UK

Non-methane hydrocarbons (NMHCs) are important reactive gases in the atmosphere, which provide a sink for the hydroxyl radical (OH) and are key players in the production and destruction of ozone in the troposphere. One reactive hydrocarbon, isoprene (2-methyl 1,3-

butadiene), has strong sources in the terrestrial biosphere, and the ocean as a source has only recently been identified. The mechanism of production of NMHCs in seawater is poorly understood but it is believed to be a combination of both photochemistry and direct emission of NMHCs (and their precursors) from phytoplankton.

Seawater and air samples were collected throughout the cruise and analysed *in situ* by Gas Chromatography (Al_2O_3 PLOT column) and Flame Ionisation Detection. A 1.4 litre sample of seawater was purged with CP nitrogen and the volatile trace gases in the nitrogen stream were passed through several water traps before being cryogenically concentrated and injected into the GC. Approx. 30 aliphatic C_2 - C_7 NMHCs were separated and quantitatively analysed for each sample

Seawater samples were collected from the stainless steel sprung niskin bottles on the CTD, the hydrowire and the ship's underway seawater supply, conincidently with the other trace gases, chlorophyll and phytoplankton samples. The underway samples were collected from the deck lab (old) non toxic seawater supply direct from the hull and NOT through the debubbling tank. This supply was contaminated with some higher hydrocarbons and halocarbons which were not present in CTD samples collected at the same time. Dave Teare (RVS) informed me towards the end of the cruise that there is a new supply direct from the hull to the TSG and fluorometer which was installed during the refit this winter. This supply is of constant flow, is cleaner than the old supply and more reliable. After this date (2/7/98) underway trace gas samples, chlorophyll and phytoplankton samples were collected from the outlet of the TSG and fluorometer.

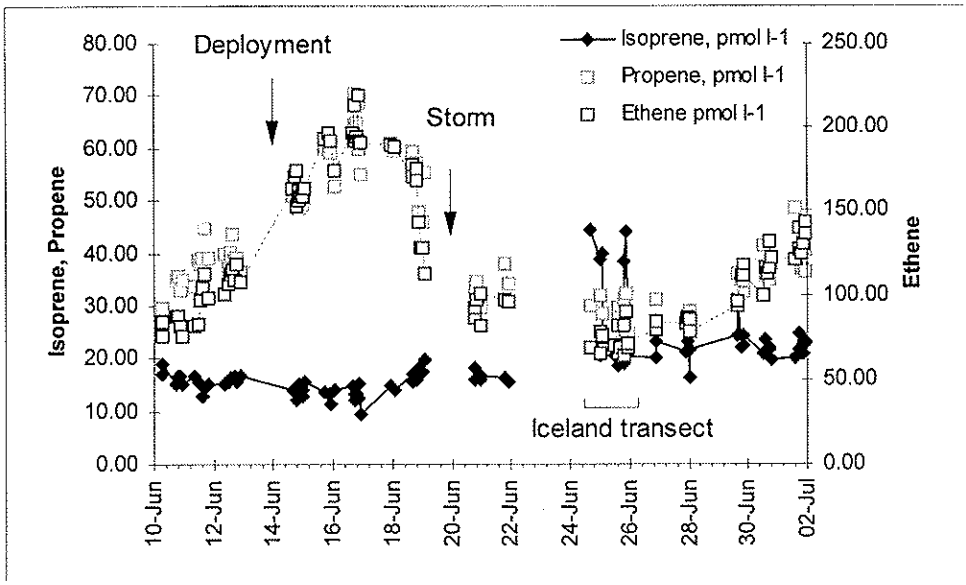
Air samples were collected via 50 m of 3/4" nylon tube (shared with Jon Baker) mounted on the forward boat deck and pumped into the laboratory via a Charles Austin metal bellows pump at 15 l min^{-1}. Upstream of the pump the samples were pumped directly into the analytical system through 1/8" stainless steel tubing. In addition a small number of samples were collected in 3.2 l stainless steel canisters at the inlet of the nylon tube using a battery operated pump.

Underway hydrocarbon water samples were collected routinely during survey mode ie. between ca. 1500 and 0300. Many of the productivity casts were also sampled at ca. 5 depths in the surface 100 m. In addition, samples were collected on the first transects to and from Iceland. Air samples were also collected ca. once daily to confirm the direction of the flux. In all, 101 underway water samples and 81 CTD samples were collected and analysed for NMHCs. CTD casts analysed were numbers 4, 6, 15, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 33, 35, 36, 38, 42, 43, 44, 48, 50 and 51. A grazing study (dilution method) was conducted with Claire Stelfox and Steve Archer using samples from 4 m on CTD 51 and 52. The experiment was conducted over 52 hours.

Initial results have only been calculated for three hydrocarbons shown in Figure 7. The isoprene concentration was quite uniform across the patch and the eddy and increased by ca. 30% in the patch over the duration of the experiment. However, on the transect to Iceland we passed through two regions of higher phytoplankton levels which coincided with isoprene increases of a factor of 2. This is consistent with previous data which show a correlation between chlorophyll and isoprene concentration. Ethene and propene increased during the first 7 days of the experiment during sunny, calm weather. Diurnal increases during the day

can be seen for both alkenes during this period. These data support the theory that alkenes are photochemically produced in seawater.

Figure 7 - Surface water NMHC concentrations throughout cruise D234



Depth profiles showed a sub-surface maximum of isoprene. The alkene profiles were of two types (i) exponential decrease from the surface, consistent with photochemical production, and (ii) sub surface maxima in the region of the fluorescence max., perhaps due to the availability of precursors. Two CTD stations (29 and 30) had isoprene levels a factor of 2 higher than all other CTDs in the patch.

Carbon Dioxide - pCO_2 and TCO_2

Jonathan Delaney
School of Environmental Sciences, University of East Anglia, Norwich, UK

During the ACSOE research cruise my aim was to measure TCO_2 (total dissolved inorganic carbon) and pCO_2. The pCO_2 instrument was loaned for this cruise from the University of Bergen and was designed to make routine unattended automated measurements of the CO_2 partial pressure in the ocean surface and overlying marine atmosphere. Unfortunately the pCO_2 instrument ceased to function properly shortly after the start of the cruise, attempts were made to fix it, but as I am unfamiliar with the system I was unsuccessful in obtaining any useful data.

I also had difficulty in using the TCO_2 at the start of the cruise. Generally the problems were electronic faults and programming errors, but one and a half weeks into the research I was in a position to be able to use the TCO_2 instrument. Most of the sampling was under-way analysis from the non-toxic supply onboard, (from a depth of around five meters). This sampling was done both from within the patch and during the detour that was made to Iceland. Where possible I also sampled from the CTD casts that were made.

The results I have obtained are as yet uncorrected and so I will not be in a position to draw any conclusion from the data until my return to UEA. During the research a buoy making pCO_2 measurements was deployed and so I hope to have access to this data in order to compliment my TCO_2 data.

Nitrous Oxide and Methane in the North Atlantic

Thomas Frost
Ocean Research Group, Department of Marine Sciences and Coastal Management, University of Newcastle-Upon-Tyne, UK

The climatically influential trace gases nitrous oxide and methane have been simultaneously measured in both surface and deep water samples of the North Atlantic. Measurement was by a high precision headspace equilibrium gas chromatographic technique, configuration of the system is such that two standard gases and a bow air sample are analysed for every discrete water sample, thus allowing concentrations and saturations to be accurately determined for each sample. A total of 188 underway samples were analysed from the non-toxic water supply and 124 samples were analysed from CTD drops, samples being taken from 23 CTDs. The system performed excellently and only 0.5 days of nitrous oxide data was lost due to an electrical fault with the electron capture detector of the gas chromatograph.

The raw chromatograms have been integrated and the peak areas have undergone preliminary correction for temperature, atmospheric pressure and salinity, although these will be revised when more accurate CTD information is available.

The data will give very detailed coverage of the study area. Upon preliminary investigations into the nitrous oxide data a persistently undersaturated feature was observed during surveys of the study site from the non-toxic supply, as was a subsurface maximum at around 50m.

DMS in seawater and air

Adrian Thompson and Laura Cárdenas, School of Environmental Sciences, University of East Anglia, Norwich, UK

Water sampling - introduction

During the daily SF_6 patch surveys surface water was sampled for analysis of dimethyl sulphide (DMS) and its algal precursor, particulate dimethylsulphoniopropionate ($DMSP_p$), resulting in a total of 180 DMS samples and around 100 $DMSP_p$ samples. After each survey, samples were taken from pre-dawn casts for analysis of DMS, $DMSP_p$, and dissolved dimethylsulphoniopropionate ($DMSP_d$), an intermediate phase in the $DMSP_p$ to DMS reaction. Along with occasional mid-afternoon casts and casts from aborted diurnals, these data make up a total of twenty depth profiles. Occasionally 10l bottles were used for sampling of DMSe, from which water was also taken for DMS and $DMSP_p$ analysis. In addition, there was a comparison of different CTD bottles, non-tox/CTD bottle/Niskin bottle, and of two different non-tox supply lines.

Surface water samples were collected from the ship's non-toxic pumped supply (in the Deck Lab) while the ship was in survey mode to determine the spatial and temporal variation in the tracer patch, and to calculate sea-to-air fluxes from the area.

Water samples were collected from bottles on a 'CTD rosette' from a range of depths, usually comprising 5 samples from above the thermocline, and one from below it. Water was collected through a teflon tube into a glass bottle which was rinsed and allowed to overflow to let any degassed water to be replaced with non-degassed water.

The water was analysed immediately (up to 2.5 hours stored in cold dark conditions for some CTD samples) for DMS, by injection through a depth filter into a solid-sorber purge and trap system, followed by flame photometric gas chromatographic detection. The filter was stored in strong alkali (to decompose $DMSP_p$ to DMS) for analysis at a later date. For waters from depth profile, the purged water sample was quantitatively transferred to a second purge and trap system containing strong alkali (to decompose $DMSP_d$ to DMS) and analysed using the same gas chromatographic equipment.

Comparison of results, from samples taken from the same CTD bottle, between Rafel Simo, Michael Steinke, and myself showed very good agreement.

(NB. DMS units are given in ngS l^{-1}. 1ngS l^{-1} = 32nM)

1. Surface water

Preliminary results suggest that at the start of the study there was an area of high DMS (max = 350ngS l^{-1}) at the edge of the survey area, which increased in size to cover the whole survey area over the course of 3-4 days. Following a day of high winds (to force 9) the concentration of DMS dropped to a fairly uniform low, then increased again quickly.

A transect from the patch area to Heimaey was compiled from parts of the two trips north. These show two areas of high DMS: one on the flanks of the Reykjanes Ridge; and one around 62.4N which was associated with increased phytoplankton numbers and hydrocarbon levels.

2. Depth Profiles

Preliminary results suggest that the depth profiles tend to fall into two types: profiles with a subsurface maximum (DMS and $DMSP_d$) at 20m or less; profiles with a shallow or even surfacial maximum, and a second maximum at around 40m.

The concentration of DMS seen in the top twenty metres ranged from 50-580ngS l^{-1}, and below the thermocline the concentrations were typically around 10-20ngS l^{-1}. The range of concentrations of $DMSP_d$ at the same depths were 46-1280ngS l^{-1} and 10-40ngS l^{-1} respectively. For both DMS and $DMSP_d$, the lowest concentrations were seen after the period of high winds.

3. Measurements of DMS in the marine background atmosphere

Introduction

The importance of DMS in the atmosphere has been widely recognised due to its role in climate change. It is a precursor of cloud formation through the production of sulfate aerosol which forms cloud condensation nuclei. These are involved in climate by affecting temperature and radiation (Charlson et al., 1987; Charlson and Wigley, 1994).

The oceanic source of DMS was estimated as about 34% of the total natural sources and about 20% from the total (natural and anthropogenic) (estimate from 1976 in Finlayson-Pitts and Pitts, 1986) making these studies of significance in climate change.

Atmospheric DMS has been measured in the marine background atmosphere on board ships and on shore. Aircraft measurements are also reported in the literature (Andreae et al., 1993; Gregory et al., 1993). Concentrations are below 230 pptv in marine tropical air, (Andreae et al., 1993), below 150 pptv over the Atlantic Ocean (Gregory et al., 1993).

2. Experimental

2.1. Site. Measurements of DMS were carried out in the North Atlantic at locations between during the ACSOE (Atmospheric Chemistry Studies in the Oceanic Environment) EAE98 (Eastern Atlantic Experiment 1998) campaign between the 9-6-98 and 6-7-98. Unfortunately, problems with the technique and instrumentation did not allow us to carry out continuous measurements for the duration of the campaign.

2.2. Method. Analysis of DMS in the gas phase requires preconcentration of the sample. Gas chromatography is the analytical technique used for further analysis being flame photometry the most commonly used. Interference by oxidants has been observed before, especially from ozone and OH radicals.

In this work the following steps were carried out for the determination of DMS:

- Oxidant removal, by means of a KI trap. This trap was located close to the sample inlet on the mast at about 20 m height. The trap was contained in a cool box inside an ice bath and in series there was a water trap inside an acetone/liquid nitrogen/ice bath (temperature about -20xC). This produced condensation of any water vapour coming from the KI trap (Gregory et al., 1993).

- Preconcentration of the sample. The sample inlet was located at 20 m above sea level and passed through the oxidant and water traps as explained above. Teflon tubing 1/4" O.D. was used for all the sample line. Inside the lab the sample passed through a series of water traps including a glass wool trap (for water drops), an empty glass trap (U-shape) immersed in an ice/water/salt bath and a counter flow system. This one consisted of a nafion membrane inserted in a Teflon tube with a N2 flow of about 400 mL/min going in the opposite direction to the air sample. The air flow was 200 mL/min and it was driven by an air pump located in the outlet of the GC and controlled by a mass flow controller located between the pump and the instrument. Sample was preconcentrated in a loop made of Teflon PFA tubing 1/8" O.D., filled with glass beads and immersed in liquid N2 (temperature about -150xC). Trapping times varied according to the signal obtained (longer times were used when obtaining small chromatographic peaks). Desorbing from this trap was carried out by immersing the trap in boiling water and directing the sample to a second loop made of Teflon PFA tubing 1/16" O.D., filled with Tenax and immersed in an ice/water/salt bath. The presence of a second loop allows to obtain narrower peaks in the chromatograms.

- Sample analysis. Desorption of the sample from the Tenax loop was carried out by inversion in boiling water. By using a 6-port valve the sample could be injected into the GC. For the first period of the campaign a GC VARIAN 3800 equipped with a Pulse Flame Photometric

Detector was used for the analysis. Problems with this instrument made us use a GC SHIMADZU equipped with Flame Photometric Detector available at the site for the DMS water analysis.

- Calibration. Calibration of the detector was carried out by using liquid standards containing DMSP of a known concentration. Reaction of DMSP with NaOH produces DMS which is then trapped by the two loops and analysed by GC. However, this method does not test for any losses occurring in the water traps and/or the sampling line. Ideally, a gas phase calibration is desired in order to test the system fully. For this purpose two gas phase standards were used, a permeation tube belonging to ICM-CSIC with a concentration of DMS of 5.37 ngS ml-1. A second permeation tube was calibrated against the former one and a calibration curve was obtained in order to determine the linearity of the analytical system. This gave a linear regression with a coefficient of determination of 99.5% for levels of sulfur below 16 ng.

Measurements were carried out on days 21-22/6/98, 25-26/6/98 and 2-6/7/98.

2.3. Results. Atmospheric levels of DMS were between 0.2 and 2 ppbv. Figure 1 shows the results for days 25-26/7 when simultaneous water measurements were performed during the transect South-North to Iceland. Although it is not very clear that there is a direct relationship, a certain similar trend is observed in both sets of data. The levels seem to be higher than levels reported by Andreae et al. (1993) and Gregory et al., 1993. Results presented by Johnson and Bates (1993) at heights below 600 m showed levels below 150 pptv over the North Atlantic and below 104 pptv over the Tropical Atlantic.

Our results seem to be higher than other published data. This could be due to the difference in locations (different productivity areas) among other factors such as meteorology. This must be studied in more detail in conjunction with the measurements carried out in the water.

2.3 References

Andreae, T.W., M.O. Andreae and H.G. Bingemer (1993) Measurements of dimethylsulfide and H2S over the western North Atlantic and the tropical Atlantic, J. Geophys. Res. 98: 23389-23396.

Charlson, R.J., J.E. Lovelock, M.O. Andreae and S.G. Warren (1993) Nature, 326: 655-661.

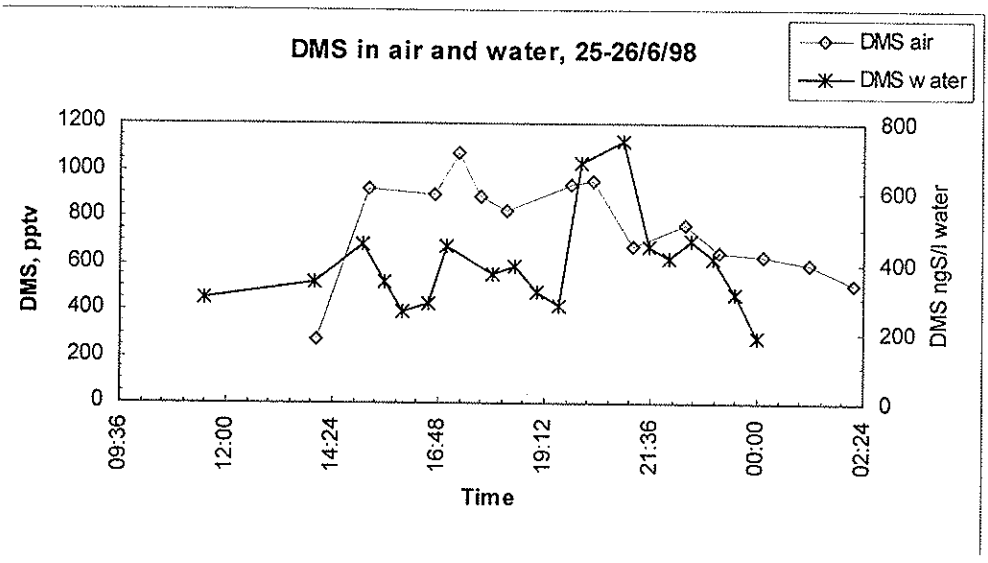
Charlson, R.J. and T.M.L. Wigley (1994) Sulfate aerosol and climate change, Scientific American, February, p. 48-57.

Finlayson-Pitts, B.J. and J.N. Pitts Jr., Atmospheric chemistry, John Wiley & Sons, U.S.A., 1986.

Gregory, G.L., L.S. Warren, D.D. Davis, M.O. Andreae, A.R. Bandy, R.J. Ferek, J.E. Johnson, E.S. Saltzman and D.J. Cooper (1993), An intercomparison of instrumentation for tropospheric measurements of dimethylsulfide: aircraft results for concentrations at the parts-per-trillion level, J. Geophys. Res. 98: 23373-23388.

Johnson, J.E. and T.S. Bates (1993), Atmospheric measurements of carbonyl sulfide, dimethylsulfide, and carbon disulfide using the electron capture sulfur detector, J. Geophys. Res., 98: 23411-23421.

Figure 8 - DMS_{water} and DMS_{air} measured simultaneously on the transect to and from Iceland



This was a successful campaign overall during which we achieved all of our original objectives except for a slightly lower survey sampling resolution, and the lack of time to complete high resolution shallow depth profiles.

Many thanks to the crew, officers, RVS, fellow scientists and Peter Liss for making this cruise successful and enjoyable. Particular thanks also go to Wendy Broadgate for an impressive display of scientific, logistical, and administrative juggling.

Gaseous peroxides

Andrea Jackson
Environment Centre, University of Leeds, Leed, UK

Aim

Gas phase hydrogen peroxide (H_2O_2) and organic hydroperoxide (ROOH) measurements were made as part of the ACSOE cruise in order to:

- provide an indication of the extent of tropospheric free radical chemistry occurring in the marine boundary layer
- to assist in the interpretation of other chemical measurements
- to provide input to the chemical modelling study

Method

Samples were collected during head to wind periods from 10th June to 2nd July 1998. Measurements could not be made after this time due to a technical failure with the analytic equipment.

Samples were collected by a previously used nebulisation-reflux concentrator for a period of thirty minutes at hourly intervals. This technique provides peroxide extraction from a large

volume of air sample into a small volume of refluxed trapping solution, providing significant preconcentration of the sample, and hence giving good sensitivity.

Samples were analysed immediately by direct injection into a high pressure liquid chromatography (HPLC) system. Analysis is based on the horseradish peroxidase enzyme-catalysed dimerization of p-hydroxyphenylacetic acid. This forms a dimer whose quantitation is based on fluorescence detection. This method is capable of detecting individual ROOH species to a concentration as low as 20 pptv.

Preliminary Results

Hydrogen peroxide, methyl hydroperoxide (CH_3OOH) and hydroxymethyl hydroperoxide ($CH_2(OH)OOH$) were detected in samples. Hydrogen peroxide was the predominant species being present in almost all samples. It appears that concentrations were mainly in the region 0.25 to 0.75 ppbv but calibrations and corrections are yet to be made. Methyl hydroperoxide was also detected throughout most of the cruise but in much lower concentrations, approximately 0.05 to 0.10 ppbv. This compares well with the few other peroxide measurements made in the marine boundary layer.

No significant diurnal variation in concentration was observed, however, on a couple of occasions a peak in both H_2O_2 and CH_3OOH concentration was measured between 8 and 9am.

Conclusion

Gas phase H_2O_2 and ROOH measurements were successfully made during the ACSOE cruise. Data will now be processed and interpreted with respect to other atmospheric measurements made throughout the study. Peroxide measurements will be available in their corrected format as soon as ozone and temperature data can be obtained.

Continuous Measurements of Nitrogen Oxides, ozone, condensation particle number and aerosol surface area

Andrew Allen and Roy Harrison, Institute of Public and Environmental Health, University of Birmingham, UK

Data collection periods

Measurements were made between 15:24GMT June 5th and 18:15GMT July 7th, 1998. No data are available for the following periods:

All measurements: 18:15-18:35 June 17th, 13:35-14:45 June 25th, 10:25-16:35 June 30th.
O_3 only: 17:00-23:59 June 9th, 00:00-23:59 June 10th, 00:00-10:15 June 11th, 23:35-23:59 June 14th, 00:00-03:55 June 15th, 07:35-08:55 June 19th, 20:05-23:59 June 21st, 00:00-10:55 June 22nd, 18:45-23:59 June 23rd, 00:00-03:25 16:05-23:59 June 24th, 00:00-11:55 June 25th, 13:45-18:15 July 3rd.

Instrumentation

Inlets to all instruments were located on the upper foredeck of R.V. Discovery. The condensation particle counters and Epiphaniometer used inlets of 1.5m lengths of 0.25" diameter copper tubing, while O_3 and NO_x were transferred to the instruments via a 20m length of 0.25" PTFE tubing. The combined air flow rate through this tubing was 1.7 L min^{-1}. All inlets were fitted with small plastic rain and spray covers.

Condensation particle number concentrations were measured using TSI 3022A and TSI 3025A instruments (TSI Inc., St. Paul, Minnesota, USA), which can count particles having aerodynamic diameters of >7 nm (50 % cut-off) and >3 nm (50 % cut-off), respectively. Sampled submicron particles are drawn, at an air flow rate of 300 cm^3 min^{-1}, through a chamber containing supersaturated butanol vapour, where they are much enlarged by condensation growth, and into an optical detector where they are counted using either "real-time" or "live-time" modes. The detection ranges of the instruments are from <0.01 particles cm^{-3} up to 10^6 particles cm^{-3} (model 3022A) and up to 10^5 cm^{-3} (model 3025A). Mean particle concentrations were calculated from the analog output voltage and recorded at one minute intervals using the Squirrel datalogger (Grant Instruments Cambridge, UK) also used to record the outputs of all other instruments except the Epiphaniometer.

Nitrogen dioxide (NO_2) and nitric oxide (NO) were determined using an API Model M200 analyser (Advanced Pollution Instrumentation Inc., San Diego, California, USA), which monitors the chemiluminescence produced during reaction of NO with ozone. NO_2 is measured following prior reduction (to NO) in a heated molybdenum converter. This instrument has a detection limit of around 1ppbv.

Ozone (O_3) was measured by UV absorption with a Monitor Labs Model 8810 analyser.

Aerosol surface area was measured using a PSI epiphaniometer (Paul Scherer Institute, Switzerland), in which ^{211}Pb atoms are attached to the surface of atmospheric particles. Subsequent decay of the radioisotopes, measured following collection of the aerosol on a filter, provides an estimate of the Fuchs (or "available") surface area. Data were recorded as 30 minute means using the internal logging system. The design of the instrument inlet allows sampling of particles having diameter <5 μm.

Summary of results

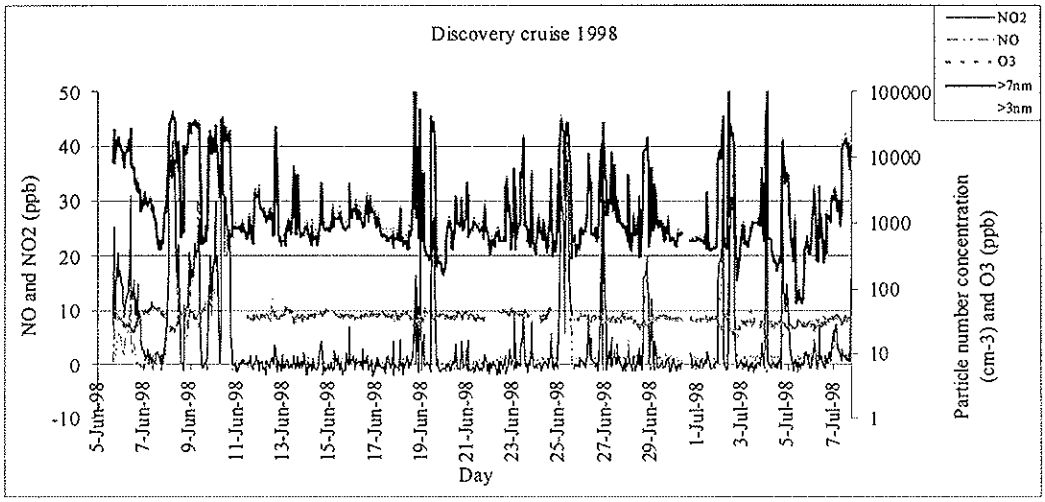
Data are illustrated in Figure 9 (a) (all data for NO, NO_2, O_3 and aerosol number concentrations, as 60 minute averages for the entire campaign), and (b) (all surface area data, as 30 minute averages).

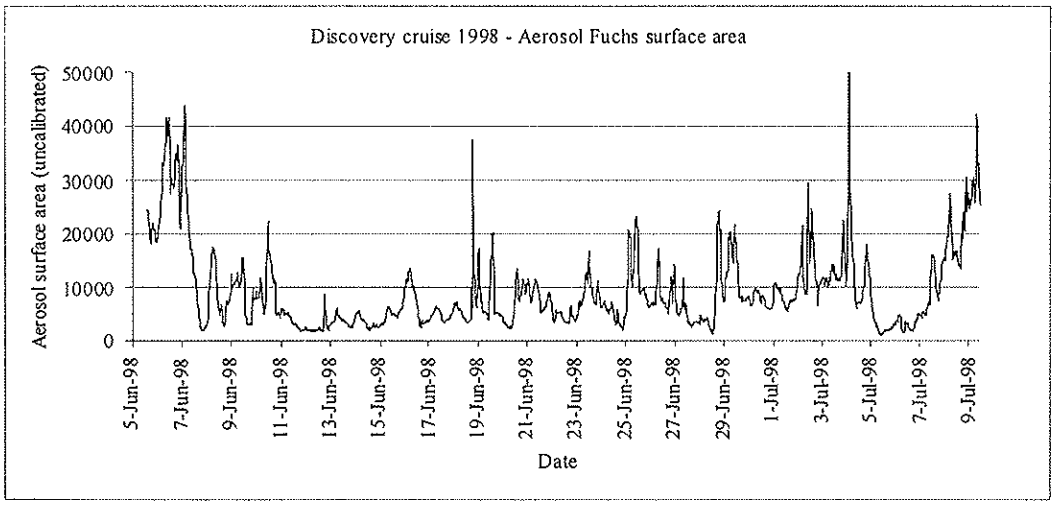
NO_x concentrations exceeding baseline levels indicate pollution events from sources on Discovery or more distant sources, as do frequent rapid increases in condensation particle number concentrations. Background NO_x levels were low, and usually close to detection limits although a small increase in background NO concentration occurred after June 22nd. Periods of anti-correlation between NO_x and O_3 indicate reaction of locally-emitted NO with O_3. Aerosol Fuchs surface area provides a good indicator of both local aerosol pollution (when increases of surface area occur in line with similar increases of particle number concentration), as well as of the origin of the background air mass (Fuchs surface area is

higher in air masses containing a continental component, when accumulation mode particles having anthropogenic origin provide much of the available surface).

There was no evidence for nanoparticle nucleation during this period. No divergence occurred between the signals of the two particle counters, showing that no production of particles in the range 3-7nm occurred. This is in marked contrast with the coastal environment, where we have previously identified massive photochemical nanoparticle formation, probably driven by oxidation of marine biogenic hydrocarbons emitted by flora within the inter-tidal zone.

Figure 9 (a) Concentrations of NO, NO_2, O_3 and condensation particle number (>7nm and >3nm diameter) and (b) Aerosol Fuchs surface area





Microzooplankton Grazing and DMS Production

Stephen Archer and Claire Stelfox
Plymouth Marine Laboratory, Plymouth, UK

Grazing by microzooplankton on phytoplankton is an important process in the biogeochemistry of both sulphur and carbon in marine surface waters. Microzooplankton are often major consumers of phytoplankton production and therefore carbon and are a key biotic control of phytoplankton population biomass and taxonomic composition. As major consumers of phytoplankton, microzooplankton may play an important role in the fate of phytoplankton DMSP and therefore DMS production.

To understand the role that microzooplankton play in controlling phytoplankton populations and in the production of DMS we:

1. Collected water samples from the dawn depth profiles to determine temporal and spatial variations in the microzooplankton community structure. Water samples were fixed in acid Lugols, hexamine buffered formaldehyde and glutaraldehyde.

2. Carried out grazing experiments using the dilution approach to quantify the temporal changes in microzooplankton grazing pressure on the phytoplankton community within the SF6 patch and outside the eddy.

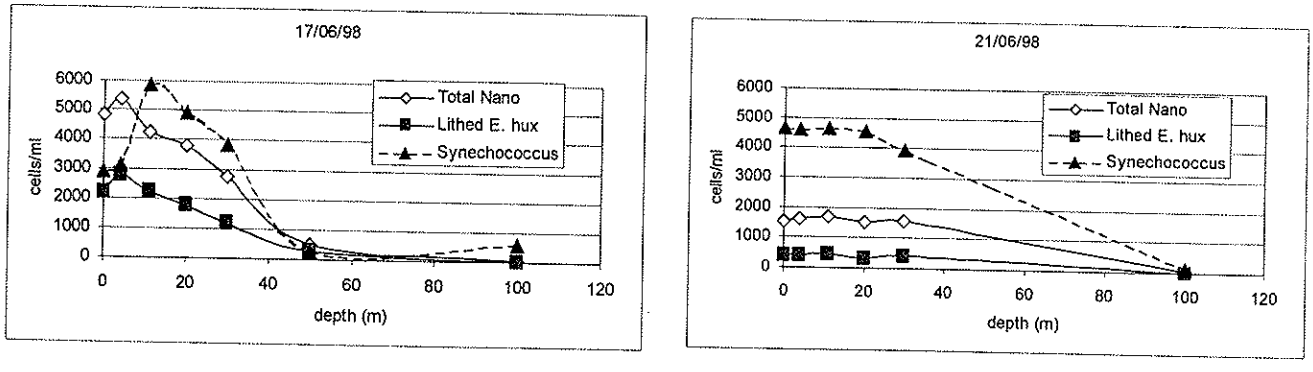
3. Collected water from the dawn depth profiles, CTD transects and during the Seasoar surveys to examine temporal and spatial variations in plankton (picoplankton and nanoplankton) community composition by Analytical Flow Cytometry.

4. Carried out incubations in parallel with the dilution experiments from which we hope to budget the fate of DMSP when ingested by microzooplankton and therefore the extent of microzooplankton mediated DMS production.

Some Preliminary Results:

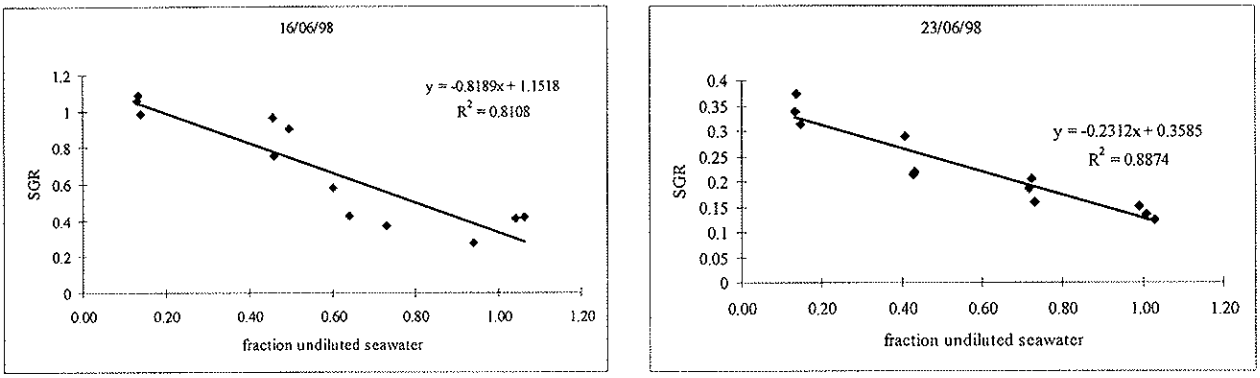
Phytoplankton populations

Figure 10. The two plots illustrate the change in depth distribution of the nano- and picophytoplankton before and after the gale force winds



Microzooplankton Grazing

Figure 11. The two plots are the results of two dilution experiments. They illustrate the lowest and highest grazing pressures measured during the study. Ingestion rates are 13 to 40 ug Chl a l^{-1} d^{-1}, equivalent to a daily turnover rate of 13 % and 56 % of the phytoplankton community in surface waters. The slope of the regression equates to phytoplankton mortality due to grazing (SGR = phytoplankton specific growth rate)



Size-Fractionated Primary Production and Chlorophyll

Linda C Gilpin
Napier University, Edinburgh, UK

The object of this work was to determine both the rates of primary production and the photosynthetic characteristics of the planktonic assemblages sampled during the ACSOE NAE 1998.

Primary production in the euphotic zone was determined at eight stations using 24hr incubations in an on deck incubator. Water was collected from a predawn CTD cast at 6 depths corresponding to 97, 55, 20, 7, 5 and 1% of surface irradiance - throughout the cruise the depth of the euphotic zone was calculated to be 30 ± 4 m. Six 60 ml samples and two dark bottles were inoculated with ^{14}C bicarbonate in subdued light and incubated for 24hrs under the irradiance from which the water was sampled. Following incubation, samples were fractionated under minimal vacuum using 5, 2 and 0.2μm polycarbonate membrane filters. Samples of the filtrate were collected for the determination of ^{14}DOC. Half of the filters were fumed over HCl in order to expel inorganic ^{14}C such as that incorporated in the liths of coccolithophores while the other filters were not fumed and therefore retained both organic and inorganic fixed carbon. Due to an unfortunate set of circumstances, the particulate incorporation of labelled bicarbonate could not be measured on board. The resulting profiles of carbon uptake per day will be used to determine depth integrated primary production over the euphotic zone at each station.

Attempts to study the diel periodicity in the photosynthetic characteristics of the plankton in a lagrangian mode proved impossible so I undertook two time course experiments with Carlos where a sample was incubated on-deck and subsampled every 4 hours. The photosynthetic characteristics were determined from a photosynthesis versus irradiance (P:I) curve produced following sample inoculation with ^{14}C sodium bicarbonate and incubation under a range of 24 irradiances using a photosynthetron. Following the incubation, any remaining inorganic^{14}C was displaced using acidification and agitation and incorporation of ^{14}C in the particulate and dissolved components will be measured using a scintillation counter back in the lab.

During the ctd transect, P:I characterisations were made at 5 of the stations. Although these stations occurred at various times of the day, the diel pattern determined from the PI time courses can be used to correct for this. Estimates of column production can be derived from the characteristics by assuming attenuation, chlorophyll distribution and PAR data for the stations sampled.

Size-fractionated chlorophyll measurements were made for each water sample collected during the cruise. Samples were size-fractionated using 5, 2 and 0.2μm membrane filters and the chlorophyll concentration determined fluorometrically following acetone extraction. Results indicate that concentrations ≤ 1 μg l^{-1} were recorded during the initial stages of the lagrangian experiment. Following our return from Iceland, concentrations up to 1.3 μg l^{-1} were recorded. Higher values of 2 μg l^{-1} were observed during the transect and during the aborted diel study.

Duplicate plankton samples from a variety of stations were preserved in 50ml amber bottles using Lugols iodine and Glutaraldehyde solutions.

Cast	Expt	Cast	Expt
5	Si enrichment	39	On deck 7
8	On deck 1	42	PI
11	On deck 2	43	Chlorophyll & taxonomy
15	On deck 3	44	PI time series 2
18	On deck 4	45	Chlorophyll & taxonomy
25	On deck 5	46	PI
29	PI	47	Chlorophyll & taxonomy
30	PI	48	PI
32	PI	49	Chlorophyll & taxonomy
35	PI time series	50	PI
36	On deck 6	52	On deck 8

Primary Production and Size-Fractionated Chlorophyll

Linda C Gilpin
The Queen's University of Belfast, Portaferry, UK

The object of this work was to determine the species composition, size distribution and photosynthetic characteristics of the phytoplankton assemblages located throughout the LOIS SES working area during the period of the cruise. Stations were sampled across the survey

area to provide spatial coverage of the on shelf, shelf break and oceanic regions; special emphasis was placed on a study of the S and N lines (Table 1).

The photosynthetic characteristics of the planktonic assemblages were determined from a photosynthesis versus irradiance (P:I) curve produced following sample inoculation with ^{14}C sodium bicarbonate and incubation under a range of irradiances using a photosynthetron. Following the incubation, any remaining ^{14}C was displaced using acidification and agitation. The incorporation of ^{14}C in the particulate component will be measured using a scintillation counter back in the lab. A time series P:I study was carried out; a 4 litre sample was incubated on deck with seven subsamples collected between dawn and dusk for the determination of P:I characteristics, chlorophyll concentration and plankton taxonomy.

Primary production in the euphotic zone was determined at four stations using 24hr incubations in an on deck incubator. At station S140 where the euphotic zone was well mixed a sample was collected at 15m from a predawn CTD cast. The depth of the euphotic zone at stations S1500 and N1500 was unknown at the time of sampling so 5m samples were collected. However, at station S700 water samples were collected from a pre-dawn CTD cast at 10 depths selected to represent 97, 55, 33,20,14,7,5,3,2 and 1% surface incident irradiance; the light levels simulated in the incubator. Triplicate 60 ml samples and one dark bottle were inoculated with ^{14}C bicarbonate in subdued light and incubated at each of the ten light levels in the on deck incubator. Following incubation, samples were fractionated under minimal vacuum using 18, 2 and 0.2μm polycarbonate membrane filters and the particulate incorporation of labelled bicarbonate will be measured using a scintillation counter. The resulting profiles of carbon uptake per day will be used to determine depth integrated primary production over the euphotic zone at each station.

Size-fractionated chlorophyll measurements were made for each water sample collected during the cruise. Samples were size-fractionated using 18, 2 and 0.2μm membrane filters and the chlorophyll concentration determined fluorometrically following acetone extraction.

Duplicate plankton samples from each station were preserved in 50ml amber bottles using Lugols iodine and Glutaraldehyde solutions.

Size-Fractionated Nitrogen Uptake and Ammonium Regeneration

Gwenaëlle Moncoiffé
Queen's University of Belfast, Portaferry, UK

The main objective of this work was to study daily and diel changes in some aspects of nitrogen cycling by microplankton community in the euphotic zone during a lagrangian experiment. Nitrate uptake and ammonium uptake and remineralisation were measured using stable isotope nitrogen-15 techniques. The rates of uptake were assessed in two size-fractions: <200 μm and <5 μm. Samples were collected under three modes: daily pre-dawn CTD casts, diel CTD casts and CTD casts along a cross-section of the eddy studied during the lagrangian experiment.

Under the daily pre-dawn CTD mode, samples were collected from 6 depths within the euphotic zone (estimated from the depth of the 1% isolume). Profiles of light penetration did not change significantly over the course of the experiment and the depths sampled were: 1-2 m (97% of surface irradiance), 4 m (55%), 11 m (20%), 17 m (7%), 20 m (4.5%) and 30 m (1%). Aliquots of water from each depth was prefiltered through 200 μm mesh and separated into two carboys. Each carboys were spiked with small amounts of sodium ^{15}N-nitrate and ^{15}N-ammonium chloride respectively. Spike concentration were calculated so that nutrient enrichment from ^{15}N addition would not exceed 10% of ambient concentration. For nitrate addition, this amount was estimated from the *in situ* profiles obtained on board by Tim Jickells. Measurement of *in situ* ammonium concentration was not available during the cruise, however literature data from previous experiments carried out at this time of year in this area have shown that ammonium concentration is generally in the nanomolar range in the euphotic zone. As a result minimum additions of 0.02 to 0.04 μM were selected.

Immediately after spike addition, aliquots of water were subsampled and analysed for determination of initial nutrient concentration, nutrient isotopic enrichment and particulate organic nitrogen (PON) concentration. The remaining of the spiked water was incubated on deck under simulated *in situ* light condition. Incubation period was 6 hours for ammonium-spiked samples and 12 hours for nitrate-spiked samples.

Seven experiments were carried out under the pre-dawn CTD mode on 14/6, 15/6, 16/6, 17/6, 21/6, 27/6 and 28/6/98. One of this experiment (27/6) was carried out on the way down from Iceland and was outside the SF6 patch.

From these experiments, profiles of size-fractionated (<200 μm and <5 μm) particulate organic nitrogen, of size-fractionated nitrate and ammonium uptake, and of ammonium remineralisation rates by the microplankton community will be obtained. In addition, *in situ* profiles of ammonium concentration in the upper 30 m of water column will be obtained using an indirect sensitive method based on the isotopic composition of the ammonium pool immediately after ^{15}N-spike addition.

Under the diel CTD mode, sampling frequency from CTD cast at the centre of the SF6 patch was scheduled for every 6 hours in order to carry out four experiments of four hours incubation period daily. Samples were collected from two depths (surface and 20 m) and processed as above. Due to adverse conditions, all attempts to carry out a complete diel study during the cruise failed and ^{15}N data from such experiments will only be available from CTD casts 29 (04:00) and 31 (08:00) on 23 June.

Five ^{15}N experiments were carried out along the CTD line across the eddy area between 02 and 04 July. These were made on alternate CTD casts (42, 44, 46, 48 and 52) with water sampled from the surface and 20 m. Because samples were drawn from different water masses and at different time of the day, incubation period was extended to 24 hours so as to allow meaningful comparison between stations. Extra volume of water was also collected at the surface from the first CTD station in order to carry out a 24 h time-course experiment and correct for potential losses of ^{15}N tracers associated with long incubation periods.

Finally, a silicate enrichment experiment was conducted on 13 June 1998 at the end of the first Seasoar survey prior to SF6 release with water collected at a station located along the southern edge of the eddy chosen for SF6 release. The decision to carry out such experiment

was made after surface mapping of nutrient concentration during the Seasoar survey revealed that silicate concentration was below 1 μM across the area surveyed and hence could have been an important factor limiting diatom growth and possibly nitrate uptake in the area. Water for the experiment was drawn from 10 m (CTD 5) and distributed into four 4.5 L incubation bottles. Two bottles received 3 μM of silicate and ^{15}N-nitrate tracer (10% of ambient concentration) and two were used as controls spiked with ^{15}N-nitrate but not silicate addition. The experiment was stopped after 24 h. In addition to nitrate uptake rates, subsamples for nutrients analysis (Tim Jickells), ^{14}C uptake (Linda Gilpin), Chl a (Linda Gilpin and Claire Stelfox) and analytical flow cytometry/phytoplankton composition (Claire Stelfox and Steve Archer) were drawn either on a time-course basis or at the beginning and end of the incubation.

The time-course of nutrient concentration in the control and silicate-enriched bottle suggested that silicate addition had no apparent effect on the phytoplankton community over 24 h; while the evolution in nitrate and phosphate concentrations indicated that considerable uptake was taking place over the 24 h incubation period changes were not significantly different in the silicate-enriched sampled compared to the control. Furthermore, the time-course of silicate concentration indicated that the addition of 3 μM of silicate did not trigger any uptake response by the phytoplankton community suggesting that either diatoms were absent from the mixed layer or that their response-time to silicate enrichment was longer than 24 h. The outcome of this experiment may prove useful in interpreting some of the development in the nutrient field distribution reported by Tim Jickells (and perhaps phytoplankton dominance?) after the storm during the second half of the cruise; following an initial increase of surface silicate concentration due to a deepening of the mixed layer, silicate decreased down to level below analytical detection over most of the survey area indicating that diatom growth had taken place after the storm.

Time course of nutrient concentration (nitrate, phosphate and silicate) in control and in water sample enriched with 3 μM of silicate during 24 h incubation period.

Bacterial Production and Diversity

Carlos Pedrós-Alió
Departament de Biologia Marina i Oceanografia, Institut de Ciències del Mar, CSIC, Barcelona, Spain

Objectives

1. To determine genetic diversity of planktonic microorganisms (Bacteria, Archaea and Eukarya) along a Lagrangian time series and through several water masses (eddy transect).
2. To determine abundance and heterotrophic production of bacterioplankton.

Methods

1. Collect microbial biomass on 2 μm polycarbonate filters and on 0.2 μm Sterivex filters. Extract DNA, PCR for 16S rRNA genes with Bacterial, Archaeal and Eukaryal

primers, and carry out denaturing gradient gel electrophoresis (DGGE). On selected samples clone PCR products and sequence.

2. Fix samples in paraformaldehyde plus glutaraldehyde and freeze in liquid nitrogen. Determine pico and nanoplankton abundance by flow cytometry. Fix samples in formalin, filter through 0.2 μm polycarbonate filters and stain with DAPI. Determine prokaryotic abundance and cell volume by image analysis.
3. Incubate samples with tritiated leucine and tritiated thymidine. Stop incubations with TCA, centrifuge, rinse with TCA and add scintillation cocktail. Determine radioactivity incorporation by liquid scintillation counting. Determine conversion factors between leucine and thymidine incorporation and bacterial heterotrophic production in filtration-dilution cultures.

Summary of work

A. Samples processed

52	Filters (0.2μm) for bacterial numbers and cell volume by epifluorescence
325	Samples fixed for picoplankton abundance by flow cytometry
218	Leucine incorporation determinations
275	Thymidine incorporation determinations
72	Filters (0.2μm) for Archaeal and Bacterial genetic diversity
72	Filters (2 μm) for Nanoplankton genetic diversity
72	Filters (GF/F) for >2μm and <2μm chlorophyll determination
12	Filters for Coccolithophorid diversity by SEM

B. Lagrangian time series

Ten (6 consecutive) daily vertical profiles of picoplankton abundance, bacterial heterotrophic production and pico- and nanoplankton genetic diversity.
One profile outside eddy and one prior to seeding of patch with SF6.

C. Transect across eddy

Eight vertical profiles of picoplankton abundance, bacterial heterotrophic production (6 depths each) and pico- and nanoplankton genetic diversity (0m and 500m).

D. Diurnal cycles

Two experiments with on deck incubations of surface water. Seven points covering 24 hour periods taken in each one for bacterial heterotrophic production. Bacterial abundance at the beginning and end of incubation (in collaboration with Linda Gilpin).

E. Miscellaneous

Two experiments to determine conversion factors from leucine and thymidine incorporation to bacterial heterotrophic production.
One experiment to determine linearity of incorporation of thymidine and leucine with time.
Three experiments to determine the effect of chloroform, n-serve and DMDS on bacterial heterotrophic production (with Rafel Simó).

DMS, DMSP, DMSO Speciation and Cycling

Rafel Simó
Departament de Biologia Marina y Oceanogrfia
Institut de Ciencies del Mar, CSIC, Barcelona, Spain

Objectives

1. To determine the speciation of DMS (including DMSPd, DMSPp, DMSOd and DMSOp) along a Lagrangian time series.
2. To estimate the biological production and consumption rates of DMS and DMSP along a Lagrangian times series.
3. To study the short-term variability of both the speciation and the transformation rates in a 24 h time series.

Methods

1. Collect water samples from CTD bottles in glass flasks, and run immediate DMS analyses in GF/F filtrates by purge&cryotrap gas chromatography.
2. Hydrolyse the sparged filtrates with NaOH for at least 6 h. Determine DMSPd as the evolved DMS. Neutralise the sample and determine DMSOd by borohydride reduction to DMS.
3. Hydrolise the GF/F filters with NaOH for aat least 12 h. Determine DMSPp as the evolved DMS. Neutralise the sample and detrmine DMSOp by borohydride reduction to DMS.
4. Incubate whole seawater samples in dark 2-L bottles with and without addition of dimethyldisulphide (DMDS) as an inhibitor of DMS consumption. DMS production rate is estimated from the slope of the time course of DMS concentration in the inhibited sample. DMS consumption rate is calulated as the difference of the slopes of the inhibited and the control samples. DMSP consumption rate is estimated from the slope of the time course of DMSPp+DMSPd concentrations in the control sample.

Summary of Work

A. Lagrangian time series

DMS speciation in 11 surface water samples out of a 15-day time series. Most from pre-dawn casts. Production and consumption rates in 7 of the water samples mentioned above.

B. Non-lagrangian waters

DMS speciation in 6 surface water samples outside the SF6 patch, or even outside the eddy. Production and consumption rates in 5 of the samples mentioned above.

C. Diurnal cycle

DMS speciation and production&consumption rates in on-deck incubated water. Seven time points covering a 24 h period. DMSP and DMSO conccentrations from this experiment to be determined in Barcelona.

D. Miscellaneous

Incubation experiment with addition of N-serve -an inhibitor of mono-oxigenase in nitrifying bacteria- to study the potential role of these bacteria in DMS cconsumption and DMSO production. DMSP and DMSO to be analysed in Barcelona.

Determination of DMSOd in Michael Steinke's experiments of DMS photochemistry. Most of DMSO concentrations to be determined in Barcelona.

Main Achievements

In the lagrangian time series, DMS concentrations ranged 2.8-9.8 nM; DMSPd 6.9-24.5 nM; DMSPp 25.3-174.4 nM; DMSOd 2.1-11.5 nM; and DMSOp 1.9-33.4 nM.

DMSP consumption rates ranged 8-78 nM/d; DMS production 1-19 nM/d; and DMS consumption 0-7 nM/d. These rates were quite variable, showing a dynamic coupling/decoupling of production and consumption processes.

This dynamics was also evident in a 24-h basis. Interestingly, biological transformation rates predicted very well the short-term measured variability of DMS in the diurnal cyle experiment.

Measurements of DMSP Lyase Activity in Plankton Samples

Michael Steinke
School of Environmental Sciences, University of East Anglia, Norwich, UK

Objectives

Is algal DMSP lyase present during a coccolithophorid bloom, or are bacterial pathways the major source of DMS?

Brief Description of Methods

On board experiments were carried out to investigate the DMSP lyase activity in particulate samples from various depths. Water samples were filtered (about 2 litres per enzyme test) and filters suspended in a buffer before particles were homogenised with an ultrasonic probe. The resulting crude extract was analysed for enzymatic production of dimethyl sulphide (DMS) from exogenous dimethyl sulfoniopropionate (DMSP) in an *in vitro* assay.

A gravity size-fractionation of particles (18 (10)-200 µm, 5-18 (10) µm, 2-5 µm and 0.2 to 2 µm) was used to investigate relative enzyme activity in phytoplankton size classes compared to bacterial DMSP lyases.

Sampling

Water samples (56 enzyme tests total) were taken from the surface using either bucket sampling (4), the non-toxic seawater supply system (4), Niskin bottle samples (SEB; 2 tests), CTD surface bottles (16) or within the upper 100 m from CTD depth profiles (30). Most of the CTD depth profiles (4 out of 6) were taken during a transect from CTD #42 to CTD #50. An intensive surface sampling was carried out during a passage from and towards Iceland which includes a comparison between coastal and oceanic waters.

Additionally, water samples were taken for the isolation of various plankton organisms, which will later be tested for DMSP lyase activity.

Preliminary Results

DMSP lyase activity was present in particles >2 μm *in situ*. Most of the previous research on enzymatic DMS production focused on isolated cultures of bacteria, phytoplankton and benthic macroalgae. Only one study investigated the DMSP lyase activity during a *Phaeocystis* bloom in coastal waters of the North Sea (Stefels, J. *et al.* 1995. *Marine Ecology Progress Series* 123:235-243). Therefore, this is the first evidence that algal DMSP lyases may be important for the production of DMS within an oceanic coccolithophorid bloom.

Snap-freezing of filters in liquid nitrogen followed by storage for several weeks at -80°C resulted in only minor loss of DMSP lyase activity (less than 10 %).

Outlook

Activity measurements of samples brought back from the field is underway including a partial characterisation of DMSP lyases. Nutrient and plant pigment data, bacterial counts, bacterial metabolic activity and phytoplankton speciation will be needed to discuss the results and to highlight plankton groups most probably involved in enzymatic DMS production.

Data Processing and Management

Polly Machin
Bidston Observatory, Birkenhead, UK

Aims

- To obtain a complete record of all sampling events on the cruise
- To monitor the performance of the underway meteorological data
- To assist with SeaSoar and ADCP processing
- General watchkeeping/ sampling duties as required.

1) Data Logging

Thanks to the efforts of everyone, a complete record of all sampling events was kept. These included :

54 CTD casts
11 (successful) XBT profiles
12 bucket samples
19 ten litre water bottle deployments
381 samples taken from the non-toxic supply
x air samples
16 aerosol samples
11 rain samples

These will be used to create a relational database which is effectively a record of everything (scientific!) that went on during the cruise. This can then be used to answer questions such as :

- what other measurements were made at the same time as my non-toxic sample ?
- what measurements were made within 5 minutes of my air sample ?
- what was the daily integrated solar radiation for the Lagrangian experiment prior to the first storm ?
- how much did the ship drift during each of the deep CTDs ?
- what historical data is there in this geographic area ?

A complete listing – in time order – of all sampling events is given in Appendix 1.

2) Meteorological Data

Checks were made on the continuously recorded meteorological data as follows :

PAR and solar radiation data were checked to see that output was sensible.

Air temperature was checked against the bridge sensors and found to correlate well.

Barometric pressure was checked against the bridge barometer and found to read consistently low by 2-3 millibars. This is partly due to the fact that the bridge barometric pressure is corrected to a height of 10 metres above sea level.

Relative wind velocities were converted to absolute and checked against the 6 hourly observations made the ship's officers. Approximately 80% of the wind speeds agreed to within 5 knots and about 70% of the wind directions agreed to within 25 degrees. There were a few instances when the estimated and measured wind directions differed wildly, but in all cases this was at low wind speeds and probably due to the wind swirling. The anemometer was noted to be slow to respond to changes in wind direction. This will be investigated in more detail at BODC.

The assistance of the Captain and Officers of *RRS Discovery* in making their 6 hours met.obs. books available is gratefully acknowledged.

3) Where were those CTDs ??

CTD1,CTD2,CTD3	59 20 North, 19 West	outside the eddy
CTD4	59 North, 22 30 West	outside the eddy
CTD5	59 15 08 North, 20 32 45 West	outside
CTD6	59 30 20 North, 21 07 55 West	inside
CTD7,CTD8,CTD9	59 30 19 North, 21 07 47 West	inside
CTD10,CTD11,CTD12	59 28 44 North, 21 04 50 West	inside
CTD13	59 32 50 North, 21 03 34 West	outside
CTD14,CTD15,CTD16	59 33 59 North, 21 06 54 West	outside upwelling region
CTD17,CTD18,CTD19	59 33 45 North, 20 46 07 West	inside
CTD20,CTD21,CTD22	59 31 26 North, 21 00 01 West	inside
CTD23,CTD24,CTD25	59 33 12 North, 21 01 36 West	inside
CTD26	59 34 47 North, 21 08 38 West	edge
CTD27	59 53 North, 21 15 23 West	edge
CTD28,CTD29,CTD30	59 54 19 North, 20 44 30 West	inside
CTD31,CTD32	59 52 03 North, 20 34 17 West	edge
CTD33	59 50 52 North, 20 39 35 West	edge/outside
CTD34	61 11 50 North, 20 31 14 West	outside
CTD35,CTD36	60 25 54 North, 20 39 37 West	inside upwelling region
CTD37	59 45 38 North, 21 West	inside
CTD38,CTD39	59 48 26 North, 20 57 53 West	inside
CTD40	59 49 57 North, 20 41 47 West	edge/outside
CTD41,CTD42	59 59 56 North, 20 04 02 West	feature to North
CTD43	59 53 04 North, 20 21 48 West	outside
CTD44	59 46 22 North, 20 39 11 West	edge
CTD45	59 39 41 North, 20 56 58 West	outside
CTD46	59 32 42 North, 21 13 48 West	outside
CTD47	59 25 43 North, 21 31 24 West	salty feature
CTD48	59 18 45 North, 21 48 21 West	outside
CTD49	59 11 38 North, 22 05 20 West	outside
CTD50	59 04 31 North, 22 21 53 West	outside
CTD51,CTD52	59 20 22 North, 21 44 43 West	outside
CTD53	59 20 30 North, 21 55 28 West	outside
CTD54	54 24 30 North, 14 50 10 West	outside

N.B. The position of the CTDs relative to the patch/eddy was determined by the concentration of SF_6 in most cases. In CTDs 42 to 54, it was determined with reference to the preceding SeaSoar survey and in CTDs 14,15,16,35, and 36 it was determined by examining the silicate concentrations.

Technicians Cruise Report

Dave Teare and Jeff Benson
RVS Operations, SOC, Southampton, UK

CTD

1) A total of 54 CTD casts were completed during this cruise. The sensor configuration was as follows:

   Aux 1) Transmissometer
   Aux 2) Fluorimeter
   Aux 3) Down-welling irradiance
   Aux 4) Up-welling irradiance
   Aux 5) Nephelometer
   Aux 6) Not Used

2) Transmissometer serial number T-1022D was used from cast 001 through cast 009; transmissometer serial number T-1018D was used from cast 010 onwards. The change in sensors was for the purpose of investigating viability of the second transmissometer. Data from sensor T-1018D was consistent with the nephelometer for the duration of the cruise.

3) Fluorimeter serial number SA-226 was replaced with fluorimeter serial number SA-234 beginning with cast number 010 because of consistently low voltage readings from sensor SA-226, (less than 0 VDC below the chlorophyll peak.)

4) Irradiance sensors removed for deep casts, number 041 through number 050, and number 54.

5) A small quantity of water was observed in the oxygen sensor housing after cast 33, and the amount of water observed increased after the deep casts, (041 through 050). The oxygen sensor and 'O' ring were changed before the cruise due to water ingress; the housing itself may be at fault.

6) Continuous power module for the rosette failed during cast number 002, and was replaced with the power module for the duration of the cruise.

7) All other instruments/sensors functioning properly.

ADCP

1) With the exception of the three-beam operational status (beginning with cruise DY232), no problems experienced.

SURFMET

1) The surfmet system consisted of the following sensor suite:

A) starboard and port 2-pi par light meters
B) starboard and port total irradiance light sensors
C) air temperature
D) relative humidity
E) barometric air pressure
F) wind speed and direction
G) transmissometer/fluorometer
H) housing/remote surface sea water temperature
I) conductivity/salinity for surface sea water

2) Both the transmissometer and fluorometer were removed and cleaned, with open air values taken from each, once per week at the beginning of the cruise and for the first two weeks into the cruise. Thereafter the sensors were cleaned on a schedule of twice per week to the end of the cruise.

3) Port and starboard 2-pi PAR light meters reading different values, with an offset of approximately 1.5 between the two sensors. Calibration data not available onboard.

Fixed Equipment

1) Chernikeef log repeaters reported no working problems.

2) Shipborne Wave Recorder would periodically report transfer byte errors and stop logging. Logging was successfully resumed after each error.

3) Simrad EA-500 echosounder not working on both port and starboard hull transducers. Both 10kHz and 12 kHz frequencies were tested with similar non-functioning results. PES fish deployed mid-cruise and functioned with no problems to the maximum depth recorded of 2800+ metres.

4) A total of 11 XBT's were launched on the cruise; all were T-5 probes and were transmitted to GOES. Not included in these launches were a total of 5 failures, due all or in part to rough weather, excessive ship speed, or probe malfunction.

PORTASAL

1) The portasal was installed in the constant temperature lab or the darkroom for the cruise and reported no problems with the exception of occasional air bubbles becoming trapped in the far upper end of the conductivity cell. Light, gentle blowing into the flush port removed the bubbles.

2) A total of 112 CTD/TSG salinity samples were taken on this cruise.

SEASOAR

1) The Seasoar system consisted of the following sensor suite:

A) Mark IIIB CTD

B) Fluorimeter

2) The installed CTD, serial number 01-1055, was found to have a drifting conductivity sensor during the first Seasoar deployment. The associated oxygen sensor was also prone to periods of spiking in the data. For the second deployment, CTD serial number 01-2073 was used, with the exception of the pressure sensor and card, which was removed from CTD 01-1055 and installed in 01-2073. No further sensor problems were reported for the second deployment, with the exception of one recovery of the Seasoar necessitated by biological fouling of the conductivity cell.

Miscellaneous

1) The 10kHz pinger used on the 24 way CTD frame was discovered to have a ping repetition rate of greater than once per second (57 pings per minute). This resulted in difficulty in bottom tracking for the deep CTD casts for the first station, but bottom resolution was obtained to the target depth of bottom minus 20 metres for the rest of the casts.

SHIP'S DAILY LOG

from Chief Scientist and Master

Date	Time (LT)	Event
01/06/98		Safety Radio Survey completed
02/06/98	0900	17 RVSM staff changeover
		Continue and complete demobilisation
		Commence taking off old trawl wire
03/06/98		Commence mobilisation and taking 271 T of bunkers. Damage to Scintillation counter
		Commence winding on new trawl wire
		De-Rat inspection completed
		Trawl wire storage drum shaft sheared
04/06/98		Continue mobilisation and taking bunkers
		IOPP survey completed
05/06/98		Continue mobilisation and taking bunkers
	1500	28 Non-RVSM staff join v/l
	1515	Inspection of galley, fridges and storerooms by North Ayrshire Council (Port Health Department)
	1530	Basic Safety Familiarisation briefing for 23 non-RVSM personnel joining in Fairlie
	1700	Complete mobilisation
06/06/98		Weather dull and overcast with occasional rain
	0900	Basic Safety Familiarisation briefing for 3 RVS Scientific personnel absent at previous day's briefing
		Continue securing
	1136	Clear of berth. No pilot taken
	1212	Clear of Hunterston Channel. Continue securing
		Non-toxic supply turned on mid afternoon
	1600	All secure
	1615-1650	Emergency Drill and Boat Muster
07/06/98		Weather rougher overnight (F5-6), but moderated during the day
	2359	Clocks retarded to GMT
08/06/98	1330	V/l hove to at 59-19.2N 19-00.2W
	1346-1430	CTD
	1519-1540	CTD
	1625-1704	CTD
	1706	Unable to use Seasoar so proceed towards 59-20N 19-00W
09/06/98	1115	V/l hove to at 59-30N 22-40W, waiting for Seasoar
10/06/98	0000	Reposition to Seasoar start site
	0530	V/l hove to at 59-30N 22-30W
	0559-0637	CTD
	0655-0718	Reposition
	0727	Deploy Seasoar in 58-57.9N 22-30.7W. Commence grid survey
11/6/98		Weather warm and sunny, some clouds. Sea pretty calm
12/6/98		Weather somewhat dull but dry, sea pretty flat
13/06/98		Weather sunny all day, the sea really calm
	0557	Seasoar recovered in 59-14.3N 22-22.5W
	0617-1042	Reposition to eddy centre (EC1) at 59-30.3N 21-07.8W
	1047-1142	Test deploy Drifting buoys
	1306-1338	CTD at EC1
	1434	Spar buoy deployed at EC1
	1546	Commence deploying SF6 tracer in 4Nm grid around EC1
	1503	1st Argos buoy deployed
	1606	2nd Argos buoy deployed
	1635	3rd Argos buoy deployed
	1657	4th Argos buoy deployed
14/06/98		Weather fine all day, sea state calm. Several schools of pilot whales sighted close

		to ship
	0043	Complete deployment of SF6 tracer
	0220-0244	CTD at EC1
	0316-0328	CTD at EC1
	0419-0425	CTD at EC1
	0425-1516	Remain hove to at EC1 for air sampling
	1614	Spar buoy recovered due to beacon failure
	1624-	
15/06/98	0226	Underway sampling survey around EC2 now determined at 59-28.7N 21-04.7W Weather once again fine and sunny, sea calm.
	0227-0250	CTD at EC2
	0323-0343	CTD at EC2
	0407-0415	CTD at EC2
	0415-1506	Stationary air sampling at EC2
	1505-1526	CTD at EC2
	1602-	
16/06/98	0215	Underway sampling around EC3 now determined at 59-33.9N 21-07.0W Weather fine and sunny; sea state calm, becoming oleagenous in the evening
	0216-0235	CTD at EC3
	0305-0320	CTD at EC3
	0401-0407	CTD at EC3
	0415-1300	Stationary air sampling at EC3
	1344-1440	RIB Workboat away from ship for remote surface sampling
	1455-	
17/06/98	0155	Underway sampling around EC3 Weather today somewhat more overcast than recent days, but still warm and with occasional sun; sea state still pretty calm
	0213-0235	CTD at EC3
	0309-0324	CTD at EC3
	0416-0422	CTD at EC3
	0428-2110	Stationary air sampling at EC3
	2110-	
18/06/98	0250	Underway sampling around EC4 now determined at 59-33.8N 20-46.1W Weather cloudy but bright, sea state a bit rougher than the last few days - slight chop. In the evening sea got distinctly rougher
	0302-0321	CTD at EC4
	0353-0355	CTD at EC4
	0411-0424	CTD at EC4
	0436-1542	Stationary air sampling around EC4
	1542-	
19/06/98	0208	Underway sampling around EC4 Weather and sea state poor all day (F8/9) and planned 48 hour diurnal cycle of sampling at patch centre abandoned. Rain collection continues!
	0238-0248	CTD at EC4
	0248	Scientific activities suspended due to adverse conditions. V/l hove to
20/06/98		Gale abated overnight. Weather dull with showers, F4-5.
	1248	Resume scientific activities
	1248-2105	Underway sampling around EC5 now determined at 59-33.3N 21-01.2W
	2210-2232	CTD at EC5
21/06/98		Weather dull all day, sea state moderate
	0101-0302	Underway sampling around EC5
	0302-0320	CTD at EC5
	0348-0359	CTD at EC5
	0359-1506	Stationary air sampling at EC5 Eddy centre now determined at 59-34.9N 21-09.3W, EC6
	1507-1533	CTD at EC6
	1611-1614	CTD at EC6
	1642-2140	Underway sampling around EC6. Eddy centre now determined at 59-39N 21-20W, EC7

	2140-	
22/06/98	1150	Stationary air sampling at EC7
		Weather rather overcast. Sea calm.
	1150-1158	CTD at EC7
	1200-1223	CTD at EC7
	1223-2014	Reseeding patch with SF6
	2015-	
23/06/98	0254	Underway sampling around EC7. Eddy centre now determined at 59-54.3N 20-44.4W, EC8
		Weather dull and rainy with increasing wind, sea lumpy with significant swell. Start of 48 hour diurnal.
	0254-0300	CTD at EC8
	0322-0341	CTD at EC8
	0600-0616	CTD at EC8
	0805-0820	CTD at EC8
	1025-1043	CTD at EC8
	1043-1304	Survey patch
	1304-1306	CT at EC8
	1311-1335	CTD at EC8
	1400	Proceed to Vestmannaeyjar to land seaman for compassionate reasons
24/06/98		Wind and sea state moderated during afternoon and evening.
	1300	Off Vestmannaeyjar. Unable to enter due to problem with hand steering control
		Pilot tug collects seaman
	1507	Steering control fixed. Proceed into Vestmannaeyjar entrance
	1518	Waiting 4 cables off harbour entrance for replacement seaman. Unable to land
	1614-1836	scientist to doctor due to adverse conditions
		Missed flight so proceed back out to sea
	1836	Proceed into Vestmannaeyjar to collect replacement
	2153	Waiting 3 cables off harbour entrance
	2215-2337	Replacement seaman embarked
	2337	V/l clear of harbour approaches and returning to work area
	2348	
25/06/98	1115-1117	Water sample bottles at 61-27N 20-25W
	1218	After advice from RNH Haslar doctor, decision made to return to
		Vestmannaeyjar for scientist to see doctor about eye problem
26/06/98	0530	V/l hove-to off Vestmannaeyjar
	0710	Scientist disembarked to pilot tug close to harbour entrance
	0923	Scientist re-embarked from pilot tug close to harbour entrance
	0936	V/l clear of harbour approaches and returning to work area
	1615-1655	Emergency drill and boat muster
	2106-2128	Water bottle samples at 61-12N 20-31W
27/06/98	0218-0241	CTD at 60-26N 20-40W
	0308-0310	Water sample bottles at 60-26N 20-40W
	0326-0345	CTD at 60-26N 20-40W
	0422	Resume passage to work area
	0907-2120	SF6 patch survey
	2129-2148	CTD at 59-45.7N 20-59.5W
	2226-	
28/06/98	0152	SF6 patch survey
		Weather generally fine but somewhat overcast, with a rain shower in the afternoon. Sea state pretty calm.
	0208-0233	CTD at 59-48.4N 20-58.0W
	0319-0341	CTD at 59-48.4N 20-58.0W
	0423	Commence drifting buoy search
	0905	Recover RVS 1954 buoy
	0933	Recover RVS 1953 buoy
	1002	Recover DML buoy. Resume search for RVS 03945 buoy
	1405	Cease search. DF USELESS
	1418-1501	CTD at 59-50.0N 20-41.0W

	1506-1508	Seasoar deployed. Commence grid survey
	1557	
29/06/98		Sea calm, weather overcast.
		Continue Seasoar grid survey
30/6/98		Weather warm and calm, with sun in the evening. Sea state calm.
		Continue Seasoar grid survey
01/07/98		Sea calm, weather overcast but only light wind and quite warm.
	0740	Seasoar recovered due to dirty sensor
		Seasoar redeployed. Resume grid survey
02/07/98		Weather quite windy (F5), sea moderately choppy.
	0855	Seasoar recovered. Commence search for missing Argos buoy 03945
	1308	Search for buoy cancelled due to poor Argos position information and poor DF determination signals
	1310-1652	Reposition to start of CTD transect across eddy
	1704-1709	CTD at 59-59.8N 20-03.8W
	1710-1730	Reposition
	1736-1940	CTD at 60-00.0N 20-04.3W
	1949-2122	Reposition
	2125-2325	CTD at 59-53.2N 20-21.6W
	2345	
03/07/98	0115	Reposition
		Weather similar to 2/7/98
	0121-0306	CTD at 59-46.4N 20-39.2W
	0310-0439	Reposition
	0443-0634	CTD at 59.39.7N 20-57.0W
	0641-0805	Reposition
	0815-1013	CTD at 59-32.5N 21-13.9W
	1020-1130	Reposition
	1140-1336	CTD at 59-25.7N 21-31.4W
	1340-1450	Reposition
	1453-1646	CTD at 59-18.8N 21-48.4W
	1650-1818	Reposition
	1822-2014	CTD at 59-11.6N 22-05.4W
	2018-2214	Reposition
	2218-	
04/07/98	0008	CTD at 59-04.5N 22-21.9W
	0008-0400	High productivity survey
	0442-0453	CTD at 59-20.4N 21-44.6W
	0512-0533	CTD at 59-20.3N 21-44.5W
	0533-1830	Stationary air sampling
	1834-1841	CTD at 59-20.4N 21-55.7W
	1900	Proceed towards Southampton
05/07/98		Weather overcast but calm and reasonably warm
	0654-0712	Water bottle at 57-39.2N 19-24.2W
06/07/98		Weather calm but overcast
	0612-0833	CTD at 54-24.6N 14-50.2W
	0841-0843	Water bottle at 54-24.2N 14-50.3W
	1615-1640	Emergency drill and boat muster
	1900-1912	Water bottle at 52-58.6N 12-57.8W
07/07/98		Weather calm but overcast.
	0650-0702	Water bottle at 51.27.9N 10-52.9W
	1848-1906	Water bottle at 50-16.9N 7-56.0W
08/08/98		Weather warm and sunny.
	1830	Entering Needles Channel
	1952	Pilot on board at East Lepe
	2106	V/l secure stbd side to SOC berth, Empress Dock

SAMPLES COLLECTED DURING D234

Tables compiled by Polly Machin and Wendy Broadgate

Table 1 - Underway Water Sampling Log

Table 2 - Log of Events - CTD, Hydrowire, Underway, Air, XBTs

Table 3 - CTD Stations - Date, Lat, Long, Depths

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG001	09/06/98 09:31					y					tom	59.49058	-22.30255
PG002	09/06/98 09:37					y					tom	59.49159	-22.32546
PG003	09/06/98 10:11					y					tom	59.49581	-22.44829
PG004	09/06/98 10:14					y						59.49619	-22.45903
PG005	09/06/98 11:12					y					tom	59.50593	-22.66487
PG006	09/06/98 12:56					y					tom	59.51863	-22.66508
PG007	09/06/98 14:03					y					tom	59.52162	-22.64683
PG008	10/06/98 06:35							AFC			steve	58.99236	-22.50809
PG009	10/06/98 06:37	11 (chl)		S5.02	y							58.99217	-22.50853
PG010	10/06/98 09:00	12 (chl)	12							145		58.99406	-22.54231
PG011	10/06/98 11:00	13 (chl)						AFC2				59.00296	-22.09881
PG012	10/06/98 11:13		13							146		59.00341	-22.04980
PG013	10/06/98 11:18							y			claire	59.00336	-22.03096
PG014	10/06/98 13:00	14 (chl)	14							147		58.99992	-21.64128
PG015	10/06/98 13:05							AFC3				58.99983	-21.62208
PG016	10/06/98 15:00	15 (chl)										59.00051	-21.18720
PG017	10/06/98 15:01		15					AFC4				59.00053	-21.18353
PG018													
PG019	10/06/98 15:03									148		59.00051	-21.17612
PG020	10/06/98 17:03	16 (chl)	16	S4.03	y			y AFC5		149		58.99819	-20.73081
PG021	10/06/98 19:00	17 (chl)	17	S1.03	y			y AFC6	S1	150		59.10005	-20.49884
PG022	10/06/98 21:00	18 (chl)	18	S2.03	y			y AFC7	S2	151		59.19947	-20.76832
PG023	10/06/98 22:59	19 (chl)	19	S2.04	y			AFC8	S3	152		59.20278	-21.26619
PG024	11/06/98 01:00	20	20						S4	153		59.20125	-21.76887
PG025	11/06/98 03:00	21	21							154		59.20042	-22.26237
PG026	11/06/98 05:00	22 (chl)	22							155		59.32789	-22.49708
PG027	11/06/98 07:00	23 (chl)	23					AFC9		156		59.40092	-22.15385
PG028	11/06/98 08:59	24 (chl)	24	S2.05	y			AFC10	S5	157		59.40534	-21.69618
PG029	11/06/98 09:06					y						59.40535	-21.66979
PG030	11/06/98 09:09					y						59.40535	-21.65856
PG031	11/06/98 10:58	25 (chl)	25	S2.06		y		AFC11	S6	158		59.39853	-21.24949
PG032	11/06/98 12:51		26									59.39678	-20.83466
PG033	11/06/98 12:59	26 (chl)		S2.07	y			AFC12	S7	159		59.39699	-20.80503
PG034	11/06/98 14:58	27	27	S2.08	y			AFC13	S8	160		59.47377	-20.49790
PG035	11/06/98 17:03		28	S2.09	y			AFC14	S9			59.59911	-20.69568
PG036	11/06/98 17:06	28								161		59.59924	-20.70651
PG037	11/06/98 19:00	29	1	S2.10	y				S10	162		59.60089	-21.11738
PG038	11/06/98 19:05							AFC15				59.60084	-21.13545
PG039	11/06/98 21:02	30	2		y			AFC16		163		59.60327	-21.56073
PG040	11/06/98 23:00	31	3		y			AFC17		165	sal bottle broke	59.60138	-21.98865
PG041	12/06/98 01:00	32	4							166		59.59922	-22.42539
PG042	12/06/98 03:00	33	5							167		59.80010	-22.46628
PG043	12/06/98 05:00	34	6							168		59.80177	-21.95815
PG044	12/06/98 07:00	35	7					AFC8	S11	97		59.80127	-21.45067
PG045	12/06/98 08:48					UW011					tom	59.79798	-20.97986
PG046	12/06/98 08:59	36	8	S2.11		UW012		AFC9	S12	98		59.79794	-20.93200
PG047	12/06/98 09:33					UW013						59.79700	-20.78654
PG048	12/06/98 10:07					UW014						59.79580	-20.64451
PG049	12/06/98 10:38					UW015						59.79547	-20.51719
PG050	12/06/98 11:00	37,39,43	9	S2.12	y	UW016		AFC20	S13	99	DMSP and lyase	59.83271	-20.49755
PG051	12/06/98 11:30					UW017						59.89257	-20.49780
PG052	12/06/98 12:31					UW018						60.00075	-20.53406
PG053	12/06/98 13:00	38	10	S2.13	y	UW019		AFC21	S14	100		60.00029	-20.64658
PG054													
PG055	12/06/98 13:30					UW020						60.00019	-20.75913
PG056	12/06/98 14:32					UW021						60.00142	-20.98559
PG057	12/06/98 15:00	40	11	S2.14	y	UW022						60.00187	-21.08935
PG058	12/06/98 15:08								S15			60.00155	-21.11854
PG059	12/06/98 16:57	41	12	S2.15	y	UW023		AFC23	S16	102		59.99860	-21.49938
PG060	12/06/98 17:40					UW024						59.99788	-21.63999
PG061	12/06/98 18:30					UW025						59.99966	-21.80868

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG062	12/06/98 18:57		13							103		60.00016	-21.90322
PG063	12/06/98 19:03	42		S2.16	y	UW026		AFC24	S17			60.00019	-21.92484
PG064	12/06/98 19:40					UW027						59.96847	-22.01004
PG065	12/06/98 20:04					UW028						59.92572	-22.03242
PG066	12/06/98 21:01	44	14	S2.17	y	UW029		AFC25	S19	104		59.83681	-21.96453
PG067	12/06/98 23:00	45	15							105		59.68751	-21.57491
PG068	13/06/98 01:00	46	16							106		59.53621	-21.20706
PG069	13/06/98 03:00	47	17							107		59.38864	-20.85245
PG070	13/06/98 05:05	48	18							108		59.25118	-20.50245
PG071	13/06/98 05:54									109	SeaSoar 5m	59.23828	-20.37664
PG072	13/06/98 07:15							AFC26				59.25500	-20.53216
PG073	13/06/98 09:40					UW030						59.39378	-20.91230
PG074	13/06/98 10:05					UW031						59.43614	-21.00289
PG075	13/06/98 11:32					UW032						59.51122	-21.13514
PG076													
PG077	14/06/98 16:03	71	11	S3.03		UW033			S20			59.47853	-21.06055
PG078	14/06/98 16:37					UW034						59.45913	-21.05089
PG079	14/06/98 17:03	72	12	S3.04		UW035		1	S21			59.42995	-21.02873
PG080	14/06/98 17:35					UW036						59.43022	-21.18532
PG081	14/06/98 18:05	73	13	S3.05		UW037			S22			59.45542	-21.26329
PG082	14/06/98 18:35					UW038						59.45496	-21.13746
PG083	14/06/98 19:02	82	14	S3.06		UW039			S23			59.45434	-21.02424
PG084	14/06/98 19:32					UW040		2				59.48073	-21.06751
PG085	14/06/98 20:07	83	15	S3.07		UW041			S24			59.48154	-21.21085
PG086	14/06/98 20:38					UW042						59.50624	-21.24936
PG087	14/06/98 21:00	84	16	S3.08		UW043		3	S25			59.50550	-21.16523
PG088	14/06/98 21:30					UW044						59.50088	-21.05155
PG089	14/06/98 22:01	85	17	S3.09	y	UW045			S26			59.53037	-21.03541
PG090	14/06/98 22:31					UW046						59.53056	-21.14853
PG091	14/06/98 23:00	86	18	S3.10	y	UW047		4	S27			59.55678	-21.10056
PG092	14/06/98 23:30					UW048						59.50987	-21.07320
PG093	14/06/98 23:59	87	19	S3.11	y	UW049			S28			59.45190	-21.07209
PG094	15/06/98 00:30					UW050						59.40302	-21.05228
PG095	15/06/98 01:00	88	20		y	UW051		5	S29			59.40447	-20.94631
PG096	15/06/98 01:25					UW052						59.44670	-20.94260
PG097	15/06/98 02:23	89	21									59.47900	-21.08038
PG098	15/06/98 16:00	103	1									59.55435	-20.96806
PG099	15/06/98 17:05	106	2	S1.06		UW053		6	S30			59.55600	-21.20189
PG100	15/06/98 18:01	107	3			UW054			S31			59.57965	-21.16376
PG101	15/06/98 19:02	108	4			UW055		7	S32			59.54583	-20.97824
PG102	15/06/98 20:06	109	5	S2.20	y	UW056			S33			59.53156	-21.20439
PG103	15/06/98 21:01	110	6		y	UW057		8	S34			59.50733	-21.18862
PG104	15/06/98 21:33					UW058						59.50484	-21.07009
PG105	15/06/98 22:02	111	7	S5.05	y	UW059			S35			59.49597	-20.97734
PG106	15/06/98 23:00	112	8		y	UW060		9	S36			59.51244	-21.13479
PG107	15/06/98 23:30					UW061						59.57544	-21.13397
PG108	16/06/98 00:01	113	9		y	UW062			S37			59.60483	-21.06181
PG109	16/06/98 00:30					UW063			S38			59.62007	-20.97659
PG110	16/06/98 01:01	114	10	S5.06	y	UW064		10	S39			59.63053	-21.07472
PG111	16/06/98 01:30					UW065			S40			59.59744	-21.15366
PG112	16/06/98 02:00	115	11		y	UW066			S41			59.56541	-21.11941
PG113	16/06/98 16:00	128	1	S2.22	y	UW067			S42			59.60711	-20.92318
PG114	16/06/98 16:30					flask smashed			S43			59.60825	-20.98299
PG115	16/06/98 17:00	129	2	S2.23	y	UW068		14	S44			59.62940	-21.05568
PG116	16/06/98 18:00	130	3	S1.08	y	UW069			S45			59.63219	-20.80603
PG117	16/06/98 18:35	131				UW070			S46			59.59347	-20.73957
PG118	16/06/98 19:00	132	4		y	UW071		15	S47			59.58391	-20.82058
PG119	16/06/98 19:30	133				UW072			S48			59.58417	-20.93570
PG120	16/06/98 20:00	134	5	S1.09	y	UW073			S49			59.58450	-21.05185
PG121	16/06/98 20:30	141				UW074			S50			59.55678	-21.03562
PG122	16/06/98 21:00	142	6	S2.24	y	UW075		16	S51			59.55671	-20.91735

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG123	16/06/98 21:30	143				UW076			S52			59.55502	-20.79775
PG124	16/06/98 22:00	144	7	S1.10	y	UW077			S53			59.53709	-20.71021
PG125	16/06/98 22:31	145				UW078			S54			59.53219	-20.82659
PG126	16/06/98 23:03	146	8			UW079		17	S55			59.53325	-20.95610
PG127	16/06/98 23:30	147				UW080			S56			59.50739	-20.94694
PG128	17/06/98 00:01	148	9			UW081			S57			59.50577	-20.82505
PG129	17/06/98 00:30	149				UW082			S58			59.50468	-20.71103
PG130	17/06/98 01:01	150	10			UW083		18	S59			59.53751	-20.65933
PG131	17/06/98 01:35	151				UW084			S60			59.56248	-20.72834
PG132	17/06/98 01:59	152	11			UW085			S61			59.56384	-20.76833
PG133	17/06/98 21:10	164	1		y	UW086			S62			59.46775	-20.78956
PG134	17/06/98 21:30	165				UW087			S63			59.43994	-20.80093
PG135	17/06/98 22:00	166	2		y	UW088			S64			59.43343	-20.88315
PG136	17/06/98 22:30	167				UW089			S65			59.46716	-20.90434
PG137	17/06/98 23:00	168	3	s2.25	y	UW090		19	S66			59.47962	-20.86320
PG138	17/06/98 23:30	169				UW091			S67			59.43462	-20.84713
PG139	17/06/98 00:01	170	4		y	UW092						59.50577	-20.82505
PG140	18/06/98 00:30	171				UW093			S68			59.43310	-21.10324
PG141	18/06/98 01:00	172	5	s1.11		UW094		20	S69			59.50145	-21.09826
PG142	18/06/98 01:30	173				UW095			S70			59.50019	-20.98134
PG143	18/06/98 01:34			S2.26								59.50011	-20.96560
PG144	18/06/98 02:00	174		S3.15		UW096			S71			59.50411	-20.86867
PG145	18/06/98 02:30	175				UW097			S72			59.53411	-20.95360
PG146	18/06/98 16:03	186	1	S4.08	y	UW098			S73			59.55688	-20.93999
PG147	18/06/98 16:31					UW099						59.58099	-20.96734
PG148	18/06/98 17:00	187	2		y	UW100		22	S74			59.59113	-20.92041
PG149	18/06/98 17:30	188				UW101			S75			59.56603	-20.89972
PG150	18/06/98 18:34	189			y	UW102			S76			59.58991	-20.99672
PG151	18/06/98 19:00	190	3	S4.09		UW103		23	S77			59.60798	-20.93508
PG152	18/06/98 19:20				y							59.60526	-20.86578
PG153	18/06/98 19:32	191				UW104			S78			59.58418	-20.86646
PG154	18/06/98 20:02	192	4	S4.10		UW105			S79			59.52516	-20.87121
PG155	18/06/98 20:31	193				UW106			S80			59.52629	-21.01185
PG156	18/06/98 21:01	194	5	S1.12		UW107		24	S81			59.58102	-21.03676
PG157	18/06/98 21:31	195				UW108			S82			59.62492	-20.99502
PG158	18/06/98 21:43	196		S4.11		UW109			S83			59.62609	-20.94962
PG159	18/06/98 22:33	197				UW110			S84			59.64379	-20.95782
PG160	18/06/98 23:00	198	6	S4.12		UW111		25	S85			59.64476	-21.08132
PG161	18/06/98 23:31	199				UW112			S86			59.63601	-21.17663
PG162	19/06/98 00:00	200	7	S4.13		UW113			S87			59.60272	-21.17136
PG163	19/06/98 00:31	201							S88			59.60280	-21.09186
PG164	19/06/98 01:00	202	8			UW114		26	S89			59.66359	-21.08891
PG165	19/06/98 01:10				y							59.68564	-21.08840
PG166	19/06/98 01:55	203	9		y	UW115			S90			59.67158	-21.05391
PG167	19/06/98 10:30				y							59.61963	-20.85804
PG168	20/06/98 15:08					UW116						59.55126	-21.03507
PG169	20/06/98 15:30				y							59.51242	-21.15234
PG170	20/06/98 16:03					UW117						59.59733	-21.16696
PG171	20/06/98 17:00	206	11	S1.13	y	UW118		28	S91			59.60178	-20.95115
PG172	20/06/98 18:00	207	12	S2.27	y	UW119			S92			59.56047	-20.96526
PG173	20/06/98 19:00	208	13	S4.14	y	UW120		29	S93			59.55485	-21.26765
PG174	20/06/98 19:32	209				UW121			S94			59.52926	-21.19685
PG175	20/06/98 20:00	210	14		y							59.52723	-21.08229
PG176	20/06/98 20:03			S2.28		UW122			S95			59.52715	-21.07011
PG177	20/06/98 20:30	211				UW123			S96			59.52732	-20.95976
PG178	20/06/98 21:00	212	15	S4.15	y			30	S97			59.52949	-20.83675
PG179	20/06/98 22:28	214	17	S2.29	y	UW124			S98			59.54857	-21.05085
PG180	21/06/98 19:00	y	10	S1.17	y	UW125		42	S99			59.63003	-21.41667
PG181	21/06/98 19:33	y				UW126			S100			59.62141	-21.30354
PG182	21/06/98 20:00	y	11	S3.19	y	UW127			S101			59.59828	-21.38061
PG183	21/06/98 20:30	y			y	UW128			S102			59.60679	-21.51025

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG184	21/06/98 21:00	y	12		y	UW129		47	S103			59.65246	-21.46979
PG185	21/06/98 21:30	y			y	UW130			S104			59.65195	-21.34081
PG186	22/06/98 14:15					UW131						59.91260	-21.16943
PG187	22/06/98 15:15					UW132						59.93777	-21.16712
PG188	22/06/98 16:00					UW133						59.91483	-21.14630
PG189	22/06/98 17:00					UW134						59.90693	-21.06322
PG190	22/06/98 18:15					UW135						59.93914	-20.99551
PG191	22/06/98 18:44					UW136						59.95582	-20.97865
PG192	22/06/98 19:00	257	1		y	UW137			S105			59.96326	-20.97404
PG193	22/06/98 19:36	258				UW138			S106			59.96163	-20.99771
PG194	22/06/98 20:01	259			y	UW139			S107			59.96003	-21.01374
PG195	22/06/98 20:35	260			y	UW140			S108			59.95839	-21.03631
PG196	22/06/98 21:02	261	2			UW141		56	S109			59.95732	-21.05553
PG197	22/06/98 21:30	262							S110			59.95663	-21.07486
PG198	22/06/98 22:00	263							S111			59.95585	-21.00281
PG199	22/06/98 22:30	264							S112			59.91632	-20.96078
PG200	22/06/98 23:02	265	3					57	S113			59.91818	-20.89681
PG201	22/06/98 23:30	266							S114			59.95053	-20.81384
PG202	23/06/98 00:01	267							S115			59.92346	-20.77318
PG203	23/06/98 00:31	268							S116			59.90706	-20.79963
PG204	23/06/98 01:00	269	4					58	S117			59.94399	-20.86312
PG205	23/06/98 01:31	270							S118			59.93995	-20.86441
PG206	23/06/98 02:00	271							S119			59.91704	-20.83949
PG207	23/06/98 02:32	y				UW142			S120			59.90814	-20.77762
PG208	23/06/98 03:35	y			y							59.90521	-20.73821
PG209	25/06/98 00:01	305	17	S2.37	y	UW143		84	S121		lyase	63.41313	-20.13305
PG210	25/06/98 00:21	308				UW144			S122			63.34961	-20.13785
PG211	25/06/98 00:41	306			y	UW145		AFC	S123		flow ch 2	63.28443	-20.14866
PG212	25/06/98 01:00	307	18	S2.48	y	UW146		85/AFC	S124		lyase	63.22382	-20.15723
PG213	25/06/98 01:20	309				UW147		AFC	S125			63.16084	-20.16666
PG214	25/06/98 01:39	310			y	UW148		AFC	S126			63.10060	-20.17504
PG215	25/06/98 02:00	311	19	S2.39	y	UW149		86/AFC	S127		lyase	63.03520	-20.18420
PG216	25/06/98 02:16	312				UW150			S128			62.98537	-20.19670
PG217	25/06/98 02:30	313			y	UW151		AFC	S129			62.94184	-20.20677
PG218	25/06/98 02:45	314				UW152			S130			62.89517	-20.21321
PG219	25/06/98 03:00	315	20	S2.40	y	UW153		87/AFC	S131			62.84886	-20.21884
PG220	25/06/98 14:00	317	22	S2.42				89/AFC	S132			61.55928	-20.44696
PG221	25/06/98 15:04	318	23	S2.43		UW154		90/AFC	S133			61.72004	-20.38848
PG222	25/06/98 15:35	320				UW155			S134			61.80113	-20.38064
PG223	25/06/98 16:34	322				UW156			S135			61.86854	-20.36940
PG224	25/06/98 17:00	323	25			UW157		92	S136		CO2	61.93488	-20.35472
PG225	25/06/98 18:00	324	26	S2.45	y	UW158		93/AFC	S137			62.09394	-20.32449
PG226	25/06/98 18:30	326				UW159			S138			62.17418	-20.30416
PG227	25/06/98 19:31	327				UW160			S139			62.25034	-20.26446
PG228	25/06/98 20:01	328		S2.46		UW161			S140			62.31704	-20.24338
PG229	25/06/98 20:04		28					95/AFC				62.32328	-20.24142
PG230	25/06/98 20:58	329	1	S4.22	y	UW162		96/AFC	S141			62.45287	-20.23056
PG231	25/06/98 21:32	330			y	UW163			S142			62.53824	-20.24818
PG232	25/06/98 22:32	333			y	UW164			S143			62.61113	-20.24046
PG233	25/06/98 23:00	332	3	S2.48	y	UW165		98	S144			62.67951	-20.23394
PG234	25/06/98 23:30	334			y	UW166			S145			62.75354	-20.21851
PG235	26/06/98 00:01	225	4	S4.23	y	UW167		99	S146			62.83288	-20.20635
PG236	26/06/98 19:55									2		61.36990	-20.50204
PG237	26/06/98 21:25			S2.49	y	UW168			S147	cf CTD34		61.19748	-20.51596
PG238	27/06/98 00:02									3		60.83126	-20.58936
PG239	27/06/98 03:59									6		60.42691	-20.66558
PG240	27/06/98 23:02	359		S1.24				139	S148			59.80339	-21.06989
PG241	28/06/98 00:08	360		S1.25				140	S149			59.81433	-20.86216
PG242	28/06/98 01:30	361		S1.26				141	S150			59.79899	-20.96655
PG243	28/06/98 04:08									10		59.80760	-20.94622
PG244	28/06/98 16:00		23/30							?		59.84825	-20.65705

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG245	28/06/98 17:04		27							60		59.91937	-20.68222
PG246	28/06/98 18:04		28									59.98153	-20.84644
PG247	28/06/98 19:00		1							61		60.04080	-21.01555
PG248	28/06/98 20:00		2							62		60.10451	-21.20001
PG249	28/06/98 20:59		3							63		60.16313	-21.38975
PG250	28/06/98 22:00		4							64		60.14451	-21.50038
PG251	28/06/98 23:00		5							65		60.03850	-21.49848
PG252	29/06/98 00:00		6							66		59.92431	-21.49879
PG253	29/06/98 01:00		7							67		59.81584	-21.49967
PG254	29/06/98 02:00		8							68		59.70713	-21.50144
PG255	29/06/98 03:00		9							69		59.60096	-21.50153
PG256	29/06/98 04:00		10							70		59.49726	-21.49978
PG257	29/06/98 05:00		11							71		59.39051	-21.49747
PG258	29/06/98 06:00		12							72		59.28070	-21.50051
PG259	29/06/98 07:00		13							73		59.19989	-21.43544
PG260	29/06/98 08:03		14							74		59.24687	-21.30135
PG261	29/06/98 09:00		15							75		59.36159	-21.30132
PG262	29/06/98 10:00		16							76		59.50000	-21.30797
PG263	29/06/98 11:00		17							77		59.63850	-21.30176
PG264	29/06/98 12:03		29							78		59.78076	-21.30095
PG265	29/06/98 13:00		18				45			79		59.90708	-21.30002
PG266	29/06/98 14:00		19				46			80		60.03805	-21.29996
PG267	29/06/98 15:00		20				47			81		60.16072	-21.29976
PG268	29/06/98 15:03	385				UW169		156	S31			60.16694	-21.29988
PG269	29/06/98 15:59	386				UW170	48	157	S152			60.20002	-21.12604
PG270	29/06/98 16:02		21	S5.17						82		60.19919	-21.11334
PG271	29/06/98 16:58	387		S2.52		UW171	49	158	S153			60.09021	-21.10004
PG272	29/06/98 17:00		22							83		60.08633	-21.10016
PG273	29/06/98 18:00		23							84		59.97419	-21.09742
PG274	29/06/98 18:35					UW172						59.91251	-21.09949
PG275	29/06/98 18:38								S154			59.90727	-21.09976
PG276	29/06/98 19:01	387	24	S2.53		UW173	50	159	S155	85		59.86716	-21.10020
PG277	29/06/98 20:01	389	25	S2.54		UW174		160	S156	86		59.75732	-21.10154
PG278	29/06/98 21:02	390	y	S2.55		UW175		161	S157			59.63543	-21.10178
PG279	29/06/98 21:00		26							12		59.63910	-21.10165
PG280	29/06/98 22:00		27							87		59.52164	-21.10249
PG281	29/06/98 23:00		28							88		59.40172	-21.10158
PG282	30/06/98 00:00		1							89		59.92431	-21.49879
PG283	30/06/98 01:00		2							90		59.20033	-21.01035
PG284	30/06/98 02:00		3							91		59.28027	-20.89975
PG285	30/06/98 03:00		4							92		59.42640	-20.90010
PG286	30/06/98 04:00		5							93		59.57681	-20.89956
PG287	30/06/98 05:00		6							94		59.72790	-20.89910
PG288	30/06/98 06:00		7							95		59.87719	-20.90026
PG289	30/06/98 07:00		8							96		60.01864	-20.89915
PG290	30/06/98 08:00		9							13		60.15348	-20.89706
PG291	30/06/98 09:00	1	10						S158	14		60.28368	-20.90330
PG292	30/06/98 09:47									15		60.38393	-20.89995
PG293	30/06/98 10:00	2	11						S159	16		60.41082	-20.89817
PG294	30/06/98 11:00	3	12				S1		S160	17		60.49669	-20.80553
PG295	30/06/98 12:00	4/397	13				S2		S161	18		60.40188	-20.70026
PG296	30/06/98 13:00	5/394		S2.56		UW176	S3	162	S162			60.26117	-20.70017
PG297	30/06/98 13:03		14							19		60.25411	-20.70003
PG298	30/06/98 14:00	1/395	15	S2.57		UW177	S4	163	S163	20		60.11920	-20.69911
PG299	30/06/98 15:00	2/396	16	S2.58		UW178	S5	164	S164	21		59.98054	-20.69943
PG300	30/06/98 16:00	1/398	17	S3.27		UW179		AFC/165	S165	22		59.84805	-20.70090
PG301	30/06/98 16:30					UW180						59.78429	-20.69947
PG302	30/06/98 17:00	2/399	18	S3.28		UW181		AFC/166	S166	23		59.72192	-20.70112
PG303	30/06/98 17:59	1/400		S3.29		UW182		AFC/167	S167			59.60129	-20.70242
PG304	30/06/98 18:00		19							24		59.59916	-20.70243
PG305	30/06/98 19:00	401	20	S3.30		UW183		AFC/168	S168	97		59.47494	-20.70136

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG306	30/06/98 20:00		21							98		59.34615	-20.70618
PG307	30/06/98 20:09	402										59.32666	-20.70422
PG308	30/06/98 21:00		22							115		59.21457	-20.70208
PG309	30/06/98 22:00		23							99		59.21453	-20.50338
PG310	30/06/98 23:00		24							100		59.35572	-20.50226
PG311	01/07/98 00:00		25							101		59.27874	-21.10228
PG312	01/07/98 01:00		26							102		59.64483	-20.49825
PG313	01/07/98 02:00		27							103		59.78746	-20.49835
PG314	01/07/98 03:00		28							104		59.92488	-20.49917
PG315	01/07/98 04:00		1							105		60.05884	-20.49892
PG316	01/07/98 05:00		2							106		60.19160	-20.50091
PG317A	01/07/98 06:00		3							107		60.31779	-20.49943
PG317	01/07/98 09:05									108	SeaSoar 5m	60.15327	-20.53629
PG318	01/07/98 10:00		4							109		60.12410	-20.50252
PG319	01/07/98 11:00		5							110		60.25459	-20.49861
PG320	01/07/98 11:50		6							111		60.36677	-20.49657
PG321	01/07/98 13:01		7							112		60.49908	-20.43787
PG322	01/07/98 14:00		8							113		60.42481	-20.29954
PG323	01/07/98 15:00		9							116		60.27935	-20.30108
PG324	01/07/98 15:06	10/411		S3.31			S6	169				60.26486	-20.30004
PG325	01/07/98 15:42	412										60.17831	-20.29990
PG326	01/07/98 16:00		10							117		60.13469	-20.29995
PG327	01/07/98 16:59	427		S3.32				170/AFC1	S169			59.99104	-20.29875
PG328	01/07/98 17:00		11							118		59.98868	-20.29883
PG329	01/07/98 18:04	443	12	S2.59		UW184		171/AFC2	S170	119		59.83501	-20.30023
PG330	01/07/98 19:00	444	13	S3.33		UW185	S7	172/AFC3	F	120		59.70150	-20.30204
PG331	01/07/98 19:20					UW187						59.65538	-20.30021
PG332	01/07/98 20:02		14	S2.60		UW187	58	**173**/afc	S171	49		59.55849	-20.30088
PG333	01/07/98 20:59						59					59.42902	-20.30098
PG334	01/07/98 21:01		15			UW188		**174**/afc	S172	50		59.42454	-20.30135
PG335	01/07/98 21:10			S3.34								59.40464	-20.30312
PG336	01/07/98 21:46			S4.28					S173			59.32304	-20.30428
PG337	01/07/98 21:50			S1.28					S174			59.31418	-20.30402
PG338	01/07/98 22:00		16							51		59.29179	-20.30295
PG339	01/07/98 22:02							afc				59.28732	-20.30266
PG340	01/07/98 23:00		17							52		59.20030	-20.20594
PG341	01/07/98 23:17											59.19955	-20.13230
PG342	02/07/98 00:00		18							53		59.28650	-20.10027
PG343	02/07/98 01:00		19							54		59.41966	-20.10040
PG344	02/07/98 02:00		20							55		59.54931	-20.09865
PG345	02/07/98 03:00		21							57		59.66996	-20.09828
PG346	02/07/98 04:00		22							58		59.78694	-20.09958
PG347	02/07/98 05:00		23							59		59.90281	-20.09992
PG348	02/07/98 05:14	473							S175			59.89757	-20.12780
PG349	02/07/98 05:15								S176			59.89547	-20.12780
PG350	02/07/98 05:41	474							S177			59.83824	-20.12136
PG351	02/07/98 05:42								S178			59.83612	-20.12128
PG352	02/07/98 06:00		24							60		59.79841	-20.12988
PG353	02/07/98 06:13	475							S179			59.77055	-20.14246
PG354	02/07/98 06:18											59.75976	-20.14724
PG355	02/07/98 06:40								S180			59.70844	-20.14479
PG356	02/07/98 06:41	482							S181			59.70601	-20.14440
PG357	02/07/98 07:00	483							S182			59.66025	-20.13617
PG358	02/07/98 08:00		25						S183			59.51640	-20.11407
PG359	02/07/98 08:52		26						S184	61		59.42985	-20.13321
PG360	03/07/98 07:08									62		59.63589	-21.01688
PG361	04/07/98 18:58									63		59.33984	-21.93346
PG362	04/07/98 19:57	1							S	64		59.21224	-21.73355
PG363	04/07/98 21:00	2							S	4		59.05168	-21.48510
PG364										147			
PG365	05/07/98 10:45								S185			57.13943	-18.63741

Polly Machin, BODC

D234 Underway water sampling log

Sample	Date/ Time (GMT)	chl/pigs	nuts	hydro	halo	N20/CH4	bac	phyto	DMS	sal	Taken by?	lat	lon
PG366	05/07/98 11:38								S186			57.00775	-18.45381
PG367	05/07/98 12:37								S187			56.86152	-18.24894
PG368	05/07/98 13:41								S188			56.70455	-18.02467
PG369	05/07/98 14:42								S189			56.55622	-17.80527
PG370	05/07/98 15:36								S190			56.42102	-17.62000
PG371	05/07/98 16:35								S191			56.27708	-17.41571
PG372	05/07/98 17:33								S192			56.12899	-17.20925
PG373	05/07/98 18:40								S193			55.95595	-16.97316
PG374	05/07/98 19:57								S194			55.82492	-16.78990
PG375	05/07/98 21:10								S195			55.64604	-16.52616
PG376	06/07/98 10:53								S196			54.11125	-14.45480
PG377	06/07/98 10:57	630		S1.34								54.10063	-14.44552
PG378	06/07/98 13:14	631		S2.65					S197			53.78046	-14.00784
PG379	06/07/98 15:04	632		S3.37					S198			53.52076	-13.66339
PG380	06/07/98 20:16									13		52.80463	-12.74414

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS3058	07/02/98 17:30			Halocarbons
AS3059	07/02/98 18:20			Halocarbons
AS3060	07/02/98 18:40			Halocarbons
AS3061	07/02/98 19:30			Halocarbons
AS3062	07/03/98 02:35			Halocarbons
AS3063	07/03/98 10:34			Halocarbons
AS3064	07/03/98 13:10			Halocarbons
AS3065	07/03/98 14:14			Halocarbons
AS3066	07/03/98 16:37			Halocarbons
AS3067	07/03/98 20:30			Halocarbons
AS3068	07/04/98 05:13			Halocarbons
AS3069	07/04/98 09:42			Halocarbons
AS3070	07/04/98 10:11			Halocarbons
AS3071	07/04/98 13:19			Halocarbons
AS3072	07/04/98 18:37			Halocarbons
AS3073	07/05/98 19:09			Halocarbons
RS1	06/06/98 20:30	07/06/98 05:30	D1	
AS3074	07/06/98 13:47			Halocarbons
AS3075	07/06/98 19:06			Halocarbons
PG001	09/06/98 09:31			
PG002	09/06/98 09:37			
PG003	09/06/98 10:11			
PG004	09/06/98 10:14			
PG005	09/06/98 11:12			
PG006	09/06/98 12:56			
CTD1	09/06/98 13:47	09/06/98 14:13	13554	
PG007	09/06/98 14:03			
CTD2	09/06/98 15:18	09/06/98 15:40	13555	
CTD3	09/06/98 16:29	09/06/98 17:05	13556	
CTD4	10/06/98 06:01	10/06/98 06:38	13557	
PG008	10/06/98 06:35			
PG009	10/06/98 06:37			
AS5001	10/06/98 09:00			hydrogen peroxide,methylhydroperoxide
PG010	10/06/98 09:00			
AS5002	10/06/98 09:45			hydrogen peroxide,methylhydroperoxide
AS5003	10/06/98 10:35			hydrogen peroxide,methylhydroperoxide
PG011	10/06/98 11:00			
PG012	10/06/98 11:13			
PG013	10/06/98 11:18			
AS5004	10/06/98 13:00			hydrogen peroxide,methylhydroperoxide
PG014	10/06/98 13:00			
PG015	10/06/98 13:05			
AS5005	10/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG016	10/06/98 15:00			
PG017	10/06/98 15:01			
PG019	10/06/98 15:03			
AS5006	10/06/98 16:00			hydrogen peroxide,methylhydroperoxide
AS5007	10/06/98 17:00			hydrogen peroxide,methylhydroperoxide
PG020	10/06/98 17:03			
AS5008	10/06/98 19:00			hydrogen peroxide,methylhydroperoxide
PG021	10/06/98 19:00			
PG022	10/06/98 21:00			
PG023	10/06/98 22:59			
PG024	11/06/98 01:00			
PG025	11/06/98 03:00			
PG026	11/06/98 05:00			
PG027	11/06/98 07:00			
PG028	11/06/98 08:59			
PG029	11/06/98 09:06			
PG030	11/06/98 09:09			
AS5009	11/06/98 10:00			hydrogen peroxide,methylhydroperoxide
PG031	11/06/98 10:58			
AS5010	11/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5011	11/06/98 11:30			hydrogen peroxide,methylhydroperoxide

Polly Machin, BODC

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS5012	11/06/98 12:35			hydrogen peroxide,methylhydroperoxide
PG032	11/06/98 12:51			
PG033	11/06/98 12:59			
PG034	11/06/98 14:58			
AS5013	11/06/98 15:00			hydrogen peroxide,methylhydroperoxide
AS5014	11/06/98 16:00			hydrogen peroxide,methylhydroperoxide
AS5015	11/06/98 17:00			hydrogen peroxide,methylhydroperoxide
PG035	11/06/98 17:03			
PG036	11/06/98 17:06			
AS5016	11/06/98 18:00			hydrogen peroxide,methylhydroperoxide
AS5017	11/06/98 19:00			hydrogen peroxide,methylhydroperoxide
PG037	11/06/98 19:00			
PG038	11/06/98 19:05			
PG039	11/06/98 21:02			
PG040	11/06/98 23:00			
PG041	12/06/98 01:00			
PG042	12/06/98 03:00			
PG043	12/06/98 05:00			
PG044	12/06/98 07:00			
PG045	12/06/98 08:48			
PG046	12/06/98 08:59			
PG047	12/06/98 09:33			
PG048	12/06/98 10:07			
AS5018	12/06/98 10:20			hydrogen peroxide,methylhydroperoxide
PG049	12/06/98 10:38			
AS5019	12/06/98 11:00			hydrogen peroxide,methylhydroperoxide
PG050	12/06/98 11:00			
PG051	12/06/98 11:30			
AS5020	12/06/98 12:00			hydrogen peroxide,methylhydroperoxide
PG052	12/06/98 12:31			
AS5021	12/06/98 13:00			hydrogen peroxide,methylhydroperoxide
PG053	12/06/98 13:00			
PG055	12/06/98 13:30			
AS5022	12/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG056	12/06/98 14:32			
AS5023	12/06/98 15:00			hydrogen peroxide,methylhydroperoxide
PG057	12/06/98 15:00			
PG058	12/06/98 15:08			
PG059	12/06/98 16:57			
AS5024	12/06/98 17:00			hydrogen peroxide,methylhydroperoxide
PG060	12/06/98 17:40			
PG061	12/06/98 18:30			
AS1	12/06/98 18:45	12/06/98 19:15		Hydrocarbons
PG062	12/06/98 18:57			
AS5025	12/06/98 19:00			hydrogen peroxide,methylhydroperoxide
PG063	12/06/98 19:03			
PG064	12/06/98 19:40			
AS5026	12/06/98 20:00			hydrogen peroxide,methylhydroperoxide
PG065	12/06/98 20:04			
AS5027	12/06/98 21:00			hydrogen peroxide,methylhydroperoxide
PG066	12/06/98 21:01			
PG067	12/06/98 23:00			
PG068	13/06/98 01:00			
PG069	13/06/98 03:00			
PG070	13/06/98 05:05			
PG071	13/06/98 05:54			
CTD5	13/06/98 07:04	13/06/98 07:55	13558	
PG072	13/06/98 07:15			
PG073	13/06/98 09:40			
PG074	13/06/98 10:05			
PG075	13/06/98 11:32			
CTD6	13/06/98 13:05	13/06/98 14:00	13559	
AS5028	13/06/98 16:00			hydrogen peroxide,methylhydroperoxide
AS5029	13/06/98 17:00			hydrogen peroxide,methylhydroperoxide

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
CTD7	14/06/98 02:20	14/06/98 02:43	13560	
CTD8	14/06/98 03:15	14/06/98 03:28	13561	
AS5030	14/06/98 04:00			hydrogen peroxide,methylhydroperoxide
CTD9	14/06/98 04:19	14/06/98 04:26	13562	
EAHV1	14/06/98 04:30	14/06/98 15:17		
AS5031	14/06/98 05:00			hydrogen peroxide,methylhydroperoxide
AS5032	14/06/98 06:00			hydrogen peroxide,methylhydroperoxide
AS5033	14/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS5034	14/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS5035	14/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5036	14/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS5037	14/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5038	14/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5039	14/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5040	14/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS2	14/06/98 14:28	14/06/98 14:58		Hydrocarbons
AS5041	14/06/98 15:00			hydrogen peroxide,methylhydroperoxide
XBT1	14/06/98 15:12			
PG077	14/06/98 16:03			
PG078	14/06/98 16:37			
PG079	14/06/98 17:03			
PG080	14/06/98 17:35			
PG081	14/06/98 18:05			
PG082	14/06/98 18:35			
PG083	14/06/98 19:02			
PG084	14/06/98 19:32			
PG085	14/06/98 20:07			
PG086	14/06/98 20:38			
PG087	14/06/98 21:00			
PG088	14/06/98 21:30			
PG089	14/06/98 22:01			
PG090	14/06/98 22:31			
PG091	14/06/98 23:00			
PG092	14/06/98 23:30			
PG093	14/06/98 23:59			
PG094	15/06/98 00:30			
PG095	15/06/98 01:00			
PG096	15/06/98 01:25			
PG097	15/06/98 02:23			
CTD10	15/06/98 02:27	15/06/98 02:51	13563	
CTD11	15/06/98 03:23	15/06/98 03:43	13564	
AS5042	15/06/98 04:00			hydrogen peroxide,methylhydroperoxide
CTD12	15/06/98 04:08	15/06/98 04:15	13565	
EAHV2	15/06/98 04:25	15/06/98 14:48		
AS5043	15/06/98 05:00			hydrogen peroxide,methylhydroperoxide
AS5044	15/06/98 06:00			hydrogen peroxide,methylhydroperoxide
AS5045	15/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS5046	15/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS5047	15/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5048	15/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS5049	15/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5050	15/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5051	15/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5052	15/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS3	15/06/98 14:16	15/06/98 15:02		Hydrocarbons
AS5053	15/06/98 15:00			hydrogen peroxide,methylhydroperoxide
CTD13	15/06/98 15:03	15/06/98 15:30	13566	
PG098	15/06/98 16:00			
PG099	15/06/98 17:05			
PG100	15/06/98 18:01			
PG101	15/06/98 19:02			
PG102	15/06/98 20:06			
PG103	15/06/98 21:01			
PG104	15/06/98 21:33			

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
PG105	15/06/98 22:02			
PG106	15/06/98 23:00			
PG107	15/06/98 23:30			
PG108	16/06/98 00:01			
PG109	16/06/98 00:30			
PG110	16/06/98 01:01			
PG111	16/06/98 01:30			
PG112	16/06/98 02:00			
CTD14	16/06/98 02:15	16/06/98 02:35	13567	
CTD15	16/06/98 03:05	16/06/98 03:20	13568	
CTD16	16/06/98 04:01	16/06/98 04:09	13569	
EAHV3	16/06/98 04:33	16/06/98 13:40		
AS5054	16/06/98 06:15			hydrogen peroxide,methylhydroperoxide
AS5055	16/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS5056	16/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS5057	16/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5058	16/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS5059	16/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5060	16/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5061	16/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5062	16/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS5063	16/06/98 15:00			hydrogen peroxide,methylhydroperoxide
PG113	16/06/98 16:00			
PG114	16/06/98 16:30			
PG115	16/06/98 17:00			
PG116	16/06/98 18:00			
PG117	16/06/98 18:35			
PG118	16/06/98 19:00			
PG119	16/06/98 19:30			
PG120	16/06/98 20:00			
PG121	16/06/98 20:30			
PG122	16/06/98 21:00			
PG123	16/06/98 21:30			
PG124	16/06/98 22:00			
PG125	16/06/98 22:31			
PG126	16/06/98 23:03			
PG127	16/06/98 23:30			
PG128	17/06/98 00:01			
PG139	17/06/98 00:01			
PG129	17/06/98 00:30			
PG130	17/06/98 01:01			
PG131	17/06/98 01:35			
PG132	17/06/98 01:59			
CTD17	17/06/98 02:14	17/06/98 02:35	13570	
CTD18	17/06/98 03:09	17/06/98 03:24	13571	
CTD19	17/06/98 04:15	17/06/98 04:22	13572	
EAHV4	17/06/98 04:30	17/06/98 20:43		
AS5064	17/06/98 05:00			hydrogen peroxide,methylhydroperoxide
AS5065	17/06/98 06:00			hydrogen peroxide,methylhydroperoxide
AS5066	17/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS5067	17/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS5068	17/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5069	17/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS5070	17/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5071	17/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5072	17/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5073	17/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS4	17/06/98 14:26	17/06/98 15:31		Hydrocarbons
AS5074	17/06/98 15:00			hydrogen peroxide,methylhydroperoxide
AS5075	17/06/98 16:00			hydrogen peroxide,methylhydroperoxide
BOT1	17/06/98 16:15	17/06/98 16:20	13573	
AS5076	17/06/98 17:00			hydrogen peroxide,methylhydroperoxide
AS5077	17/06/98 18:00			hydrogen peroxide,methylhydroperoxide
AS5078	17/06/98 19:00			hydrogen peroxide,methylhydroperoxide

Polly Machin, BODC

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS5079	17/06/98 20:00			hydrogen peroxide,methylhydroperoxide
AS5080	17/06/98 21:00			hydrogen peroxide,methylhydroperoxide
PG133	17/06/98 21:10			
PG134	17/06/98 21:30			
AS5081	17/06/98 22:00			hydrogen peroxide,methylhydroperoxide
PG135	17/06/98 22:00			
PG136	17/06/98 22:30			
RS2	17/06/98 22:30	18/06/98 06:15	D2	
PG137	17/06/98 23:00			
PG138	17/06/98 23:30			
PG140	18/06/98 00:30			
PG141	18/06/98 01:00			
PG142	18/06/98 01:30			
PG143	18/06/98 01:34			
PG144	18/06/98 02:00			
PG145	18/06/98 02:30			
CTD20	18/06/98 03:03	18/06/98 03:22	13574	
BOT2	18/06/98 03:53	18/06/98 03:55	13575	
CTD21	18/06/98 04:11	18/06/98 04:24	13576	
EAHV5	18/06/98 04:30	18/06/98 15:15		
AS5082	18/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS5083	18/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS5084	18/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5085	18/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS5086	18/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5087	18/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5088	18/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5089	18/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS1001	18/06/98 14:10			DMS
AS5090	18/06/98 15:00			hydrogen peroxide,methylhydroperoxide
AS1002	18/06/98 15:32			DMS
AS5091	18/06/98 16:00			hydrogen peroxide,methylhydroperoxide
PG146	18/06/98 16:03			
PG147	18/06/98 16:31			
PG148	18/06/98 17:00			
PG149	18/06/98 17:30			
PG150	18/06/98 18:34			
PG151	18/06/98 19:00			
PG152	18/06/98 19:20			
PG153	18/06/98 19:32			
PG154	18/06/98 20:02			
PG155	18/06/98 20:31			
PG156	18/06/98 21:01			
PG157	18/06/98 21:31			
PG158	18/06/98 21:43			
PG159	18/06/98 22:33			
PG160	18/06/98 23:00			
PG161	18/06/98 23:31			
PG162	19/06/98 00:00			
PG163	19/06/98 00:31			
PG164	19/06/98 01:00			
PG165	19/06/98 01:10			
PG166	19/06/98 01:55			
CTD22	19/06/98 02:39	19/06/98 02:46	13577	
RS3	19/06/98 06:30	19/06/98 10:30	D3	
AS5092	19/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS5093	19/06/98 10:00			hydrogen peroxide,methylhydroperoxide
PG167	19/06/98 10:30			
AS5094	19/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5095	19/06/98 13:00			hydrogen peroxide,methylhydroperoxide
RS4	19/06/98 15:00	19/06/98 21:30	D4	
AS5096	19/06/98 19:00			hydrogen peroxide,methylhydroperoxide
RS5	20/06/98 09:00	20/06/98 13:00	D5	
AS5097	20/06/98 10:00			hydrogen peroxide,methylhydroperoxide

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS5098	20/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5099	20/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS5100	20/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG168	20/06/98 15:08			
PG169	20/06/98 15:30			
AS5101	20/06/98 16:00			hydrogen peroxide,methylhydroperoxide
PG170	20/06/98 16:03			
AS1003	20/06/98 16:15			DMS
AS5	20/06/98 16:57	20/06/98 17:40		Hydrocarbons
PG171	20/06/98 17:00			
PG172	20/06/98 18:00			
PG173	20/06/98 19:00			
PG174	20/06/98 19:32			
PG175	20/06/98 20:00			
PG176	20/06/98 20:03			
PG177	20/06/98 20:30			
PG178	20/06/98 21:00			
CTD23	20/06/98 22:09	20/06/98 22:33	13578	
PG179	20/06/98 22:28			
AS6	21/06/98 00:46	21/06/98 00:59		Hydrocarbons
AS7	21/06/98 01:56	21/06/98 02:31		Hydrocarbons
CTD24	21/06/98 03:02	21/06/98 03:20	13579	
CTD25	21/06/98 03:47	21/06/98 03:59	13580	
AS5102	21/06/98 04:00			hydrogen peroxide,methylhydroperoxide
AS1004	21/06/98 04:04			DMS
EAHV6	21/06/98 04:27	21/06/98 14:47		
AS1005	21/06/98 05:00			DMS
AS5103	21/06/98 05:00			hydrogen peroxide,methylhydroperoxide
AS1006	21/06/98 06:00			DMS
AS5104	21/06/98 06:00			hydrogen peroxide,methylhydroperoxide
AS1007	21/06/98 07:00			DMS
AS5105	21/06/98 07:00			hydrogen peroxide,methylhydroperoxide
AS1008	21/06/98 08:00			DMS
AS5106	21/06/98 08:00			hydrogen peroxide,methylhydroperoxide
AS1009	21/06/98 09:00			DMS
AS5107	21/06/98 09:00			hydrogen peroxide,methylhydroperoxide
AS1010	21/06/98 10:00			DMS
AS5108	21/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS1011	21/06/98 10:59			DMS
AS5109	21/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS1012	21/06/98 11:59			DMS
AS5110	21/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS1013	21/06/98 12:59			DMS
AS5111	21/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS1014	21/06/98 14:00			DMS
AS5112	21/06/98 14:00			hydrogen peroxide,methylhydroperoxide
AS8	21/06/98 14:56	21/06/98 15:51		Hydrocarbons
AS1015	21/06/98 15:00			DMS
AS5113	21/06/98 15:00			hydrogen peroxide,methylhydroperoxide
CTD26	21/06/98 15:05	21/06/98 15:33	13581	
AS1016	21/06/98 15:50			DMS
AS5114	21/06/98 16:00			hydrogen peroxide,methylhydroperoxide
BOT3	21/06/98 16:15	21/06/98 16:20	13582	
PG180	21/06/98 19:00			
PG181	21/06/98 19:33			
PG182	21/06/98 20:00			
PG183	21/06/98 20:30			
PG184	21/06/98 21:00			
PG185	21/06/98 21:30			
EAHV7	21/06/98 21:42	22/06/98 08:53		
AS9	22/06/98 00:02	22/06/98 00:48		Hydrocarbons
AS1017	22/06/98 09:00			DMS
AS1018	22/06/98 09:20			DMS

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS5115	22/06/98 09:20			hydrogen peroxide,methylhydroperoxide
AS1019	22/06/98 09:58			DMS
AS5116	22/06/98 10:00			hydrogen peroxide,methylhydroperoxide
AS1020	22/06/98 10:53			DMS
AS5117	22/06/98 11:00			hydrogen peroxide,methylhydroperoxide
CTD27	22/06/98 12:00	22/06/98 13:00	13583	
AS5118	22/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5119	22/06/98 13:00			hydrogen peroxide,methylhydroperoxide
BOT4	22/06/98 13:05	22/06/98 13:10	13584	
AS1021	22/06/98 13:37			DMS
AS5120	22/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG186	22/06/98 14:15			
AS1022	22/06/98 14:22			DMS
AS5121	22/06/98 15:00			hydrogen peroxide,methylhydroperoxide
PG187	22/06/98 15:15			
XBT2	22/06/98 15:30			
PG188	22/06/98 16:00			
PG189	22/06/98 17:00			
PG190	22/06/98 18:15			
PG191	22/06/98 18:44			
PG192	22/06/98 19:00			
PG193	22/06/98 19:36			
PG194	22/06/98 20:01			
PG195	22/06/98 20:35			
PG196	22/06/98 21:02			
PG197	22/06/98 21:30			
PG198	22/06/98 22:00			
PG199	22/06/98 22:30			
PG200	22/06/98 23:02			
PG201	22/06/98 23:30			
PG202	23/06/98 00:01			
PG203	23/06/98 00:31			
PG204	23/06/98 01:00			
PG205	23/06/98 01:31			
PG206	23/06/98 02:00			
PG207	23/06/98 02:32			
CTD28	23/06/98 02:53	23/06/98 02:59	13585	
CTD29	23/06/98 03:22	23/06/98 03:42	13586	
PG208	23/06/98 03:35			
AS5122	23/06/98 04:00			hydrogen peroxide,methylhydroperoxide
AS5123	23/06/98 05:00			hydrogen peroxide,methylhydroperoxide
CTD30	23/06/98 05:58	23/06/98 06:17	13587	
AS5124	23/06/98 06:00			hydrogen peroxide,methylhydroperoxide
AS5125	23/06/98 07:00			hydrogen peroxide,methylhydroperoxide
RS6	23/06/98 07:30	23/06/98 15:00	D7 and D8	
CTD31	23/06/98 08:05	23/06/98 08:20	13588	
AS5126	23/06/98 10:00			hydrogen peroxide,methylhydroperoxide
CTD32	23/06/98 10:23	23/06/98 10:43	13589	
AS5127	23/06/98 11:00			hydrogen peroxide,methylhydroperoxide
AS5128	23/06/98 12:00			hydrogen peroxide,methylhydroperoxide
BOT5	23/06/98 13:04	23/06/98 13:06	13589	
CTD33	23/06/98 13:11	23/06/98 13:35	13591	
BOT6	24/06/98 16:50	24/06/98 16:55	13592	
RS7	24/06/98 21:30	24/06/98 23:15	D10	
PG209	25/06/98 00:01			
PG210	25/06/98 00:21			
RS8	25/06/98 00:30	25/06/98 09:00	D11	
PG211	25/06/98 00:41			
PG212	25/06/98 01:00			
PG213	25/06/98 01:20			
PG214	25/06/98 01:39			
PG215	25/06/98 02:00			
PG216	25/06/98 02:16			
PG217	25/06/98 02:30			

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
PG218	25/06/98 02:45			
PG219	25/06/98 03:00			
BOT7	25/06/98 11:15	25/06/98 11:30	13593	
BK1	25/06/98 11:20		SEB7	DMSP lyase
AS5129	25/06/98 12:00			hydrogen peroxide,methylhydroperoxide
AS5130	25/06/98 13:00			hydrogen peroxide,methylhydroperoxide
AS1023	25/06/98 13:40			DMS
AS5131	25/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG220	25/06/98 14:00			
EAHV8	25/06/98 14:30		26/06/98 03:40	
AS1024	25/06/98 14:53			DMS
AS5132	25/06/98 15:00			hydrogen peroxide,methylhydroperoxide
PG221	25/06/98 15:04			
PG222	25/06/98 15:35			
BK2	25/06/98 16:00		SEB8	DMSP lyase
BOT8	25/06/98 16:03	25/06/98 16:05	13594	
PG223	25/06/98 16:34			
AS1025	25/06/98 16:35			DMS
AS5133	25/06/98 17:00			hydrogen peroxide,methylhydroperoxide
PG224	25/06/98 17:00			
AS1026	25/06/98 17:07			DMS
AS10	25/06/98 17:29	25/06/98 18:10		Hydrocarbons
AS1027	25/06/98 17:37			DMS
AS5134	25/06/98 18:00			hydrogen peroxide,methylhydroperoxide
PG225	25/06/98 18:00			
AS1028	25/06/98 18:04			DMS
PG226	25/06/98 18:30			
AS5135	25/06/98 19:00			hydrogen peroxide,methylhydroperoxide
BOT9	25/06/98 19:01	25/06/98 19:03	13595	
BK3	25/06/98 19:02		SEB9	DMSP lyase
PG227	25/06/98 19:31			
AS1029	25/06/98 19:40			DMS
AS5136	25/06/98 20:00			hydrogen peroxide,methylhydroperoxide
PG228	25/06/98 20:01			
PG229	25/06/98 20:04			
AS1030	25/06/98 20:09			DMS
PG230	25/06/98 20:58			
AS5137	25/06/98 21:00			hydrogen peroxide,methylhydroperoxide
AS1031	25/06/98 21:00			DMS
PG231	25/06/98 21:32			
AS5138	25/06/98 22:00			hydrogen peroxide,methylhydroperoxide
BOT10	25/06/98 22:00	25/06/98 22:02	13596	
BK4	25/06/98 22:02		SEB10	DMSP lyase
AS1032	25/06/98 22:15			DMS
PG232	25/06/98 22:32			
AS5139	25/06/98 23:00			hydrogen peroxide,methylhydroperoxide
AS1033	25/06/98 23:00			DMS
PG233	25/06/98 23:00			
PG234	25/06/98 23:30			
AS5140	26/06/98 00:00			hydrogen peroxide,methylhydroperoxide
AS1034	26/06/98 00:00			DMS
PG235	26/06/98 00:01			
AS5141	26/06/98 01:00			hydrogen peroxide,methylhydroperoxide
AS1035	26/06/98 01:02			DMS
AS5142	26/06/98 02:00			hydrogen peroxide,methylhydroperoxide
AS1036	26/06/98 02:00			DMS
EAHV9	26/06/98 10:30	26/06/98 18:23		
XBT3	26/06/98 13:03			
XBT4	26/06/98 14:01			
XBT5	26/06/98 14:57			
XBT6	26/06/98 16:05			
XBT7	26/06/98 17:00			

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
XBT8	26/06/98 18:04			
XBT9	26/06/98 19:01			
PG236	26/06/98 19:55			
XBT10	26/06/98 19:57			
XBT11	26/06/98 20:55			
CTD34	26/06/98 21:05	26/06/98 21:30	13598	
BOT11	26/06/98 21:06	26/06/98 21:08	13597	
PG237	26/06/98 21:25			
PG238	27/06/98 00:02			
CTD35	27/06/98 02:18	27/06/98 02:41	13599	
BOT12	27/06/98 03:08	27/06/98 03:10	13600	
CTD36	27/06/98 03:25	27/06/98 03:45	13601	
PG239	27/06/98 03:59			
AS11	27/06/98 19:14	27/06/98 20:05		Hydrocarbons
CTD37	27/06/98 21:30	27/06/98 21:45	13602	
BOT13	27/06/98 21:50	27/06/98 21:55	13603	
PG240	27/06/98 23:02			
PG241	28/06/98 00:08			
PG242	28/06/98 01:30			
CTD38	28/06/98 02:09	28/06/98 02:33	13604	
CTD39	28/06/98 03:18	28/06/98 03:41	13605	
PG243	28/06/98 04:08			
CTD40	28/06/98 14:19	28/06/98 15:02	13606	
PG244	28/06/98 16:00			
EAHV10	28/06/98 16:06	29/06/98 08:57		not between 16:40 and 21:45
AS5143	28/06/98 16:10			hydrogen peroxide,methylhydroperoxide
PG245	28/06/98 17:04			
PG246	28/06/98 18:04			
PG247	28/06/98 19:00			
PG248	28/06/98 20:00			
PG249	28/06/98 20:59			
AS5144	28/06/98 21:00			hydrogen peroxide,methylhydroperoxide
AS5145	28/06/98 22:00			hydrogen peroxide,methylhydroperoxide
PG250	28/06/98 22:00			
AS5146	28/06/98 23:00			hydrogen peroxide,methylhydroperoxide
PG251	28/06/98 23:00			
AS5147	29/06/98 00:00			hydrogen peroxide,methylhydroperoxide
PG252	29/06/98 00:00			
AS12	29/06/98 00:45			Hydrocarbons
AS5148	29/06/98 01:00			hydrogen peroxide,methylhydroperoxide
PG253	29/06/98 01:00			
AS13	29/06/98 01:05	29/06/98 01:47		Hydrocarbons
AS5149	29/06/98 02:00			hydrogen peroxide,methylhydroperoxide
PG254	29/06/98 02:00			
AS5150	29/06/98 03:00			hydrogen peroxide,methylhydroperoxide
PG255	29/06/98 03:00			
AS5151	29/06/98 04:00			hydrogen peroxide,methylhydroperoxide
PG256	29/06/98 04:00			
AS5152	29/06/98 05:00			hydrogen peroxide,methylhydroperoxide
PG257	29/06/98 05:00			
PG258	29/06/98 06:00			
PG259	29/06/98 07:00			
PG260	29/06/98 08:03			
PG261	29/06/98 09:00			
EAHV11	29/06/98 09:31	29/06/98 16:52		
PG262	29/06/98 10:00			
PG263	29/06/98 11:00			
PG264	29/06/98 12:03			
PG265	29/06/98 13:00			
AS5153	29/06/98 14:00			hydrogen peroxide,methylhydroperoxide
PG266	29/06/98 14:00			
AS5154	29/06/98 15:00			hydrogen peroxide,methylhydroperoxide

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
PG267	29/06/98 15:00			
PG268	29/06/98 15:03			
PG269	29/06/98 15:59			
AS5155	29/06/98 16:00			hydrogen peroxide,methylhydroperoxide
PG270	29/06/98 16:02			
PG271	29/06/98 16:58			
AS5156	29/06/98 17:00			hydrogen peroxide,methylhydroperoxide
PG272	29/06/98 17:00			
AS14	29/06/98 17:33	29/06/98 18:13		Hydrocarbons
AS5157	29/06/98 18:00			hydrogen peroxide,methylhydroperoxide
PG273	29/06/98 18:00			
PG274	29/06/98 18:35			
PG275	29/06/98 18:38			
AS15	29/06/98 18:54			Hydrocarbons
AS5158	29/06/98 19:00			hydrogen peroxide,methylhydroperoxide
PG276	29/06/98 19:01			
EAHV12	29/06/98 19:58	30/06/98 10:35		
AS5159	29/06/98 20:00			hydrogen peroxide,methylhydroperoxide
PG277	29/06/98 20:01			
PG279	29/06/98 21:00			
PG278	29/06/98 21:02			
AS5160	29/06/98 22:00			hydrogen peroxide,methylhydroperoxide
PG280	29/06/98 22:00			
PG281	29/06/98 23:00			
PG282	30/06/98 00:00			
PG283	30/06/98 01:00			
PG284	30/06/98 02:00			
PG285	30/06/98 03:00			
PG286	30/06/98 04:00			
PG287	30/06/98 05:00			
PG288	30/06/98 06:00			
PG289	30/06/98 07:00			
PG290	30/06/98 08:00			
PG291	30/06/98 09:00			
PG292	30/06/98 09:47			
PG293	30/06/98 10:00			
PG294	30/06/98 11:00			
PG295	30/06/98 12:00			
PG296	30/06/98 13:00			
PG297	30/06/98 13:03			
PG298	30/06/98 14:00			
PG299	30/06/98 15:00			
PG300	30/06/98 16:00			
PG301	30/06/98 16:30			
PG302	30/06/98 17:00			
PG303	30/06/98 17:59			
PG304	30/06/98 18:00			
PG305	30/06/98 19:00			
AS16	30/06/98 19:35			Hydrocarbons
PG306	30/06/98 20:00			
PG307	30/06/98 20:09			
AS17	30/06/98 20:25	30/06/98 21:03		Hydrocarbons
PG308	30/06/98 21:00			
EAHV13	30/06/98 22:00	01/07/98 07:00		
PG309	30/06/98 22:00			
PG310	30/06/98 23:00			
PG311	01/07/98 00:00			
PG312	01/07/98 01:00			
PG313	01/07/98 02:00			
PG314	01/07/98 03:00			
PG315	01/07/98 04:00			

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
PG316	01/07/98 05:00			
PG317A	01/07/98 06:00			
PG317	01/07/98 09:05			
PG318	01/07/98 10:00			
PG319	01/07/98 11:00			
PG320	01/07/98 11:50			
PG321	01/07/98 13:01			
PG322	01/07/98 14:00			
EAHV14	01/07/98 14:48	01/07/98 22:38		
PG323	01/07/98 15:00			
PG324	01/07/98 15:06			
PG325	01/07/98 15:42			
AS5161	01/07/98 16:00			hydrogen peroxide,methylhydroperoxide
PG326	01/07/98 16:00			
PG327	01/07/98 16:59			
AS1037	01/07/98 17:00			DMS
AS5162	01/07/98 17:00			hydrogen peroxide,methylhydroperoxide
PG328	01/07/98 17:00			
AS5163	01/07/98 18:00			hydrogen peroxide,methylhydroperoxide
PG329	01/07/98 18:04			
PG330	01/07/98 19:00			
AS5164	01/07/98 19:00			hydrogen peroxide,methylhydroperoxide
PG331	01/07/98 19:20			
AS5165	01/07/98 20:00			hydrogen peroxide,methylhydroperoxide
PG332	01/07/98 20:02			
PG333	01/07/98 20:59			
AS5166	01/07/98 21:00			hydrogen peroxide,methylhydroperoxide
PG334	01/07/98 21:01			
PG335	01/07/98 21:10			
AS1038	01/07/98 21:40			DMS
PG336	01/07/98 21:46			
PG337	01/07/98 21:50			
PG338	01/07/98 22:00			
PG339	01/07/98 22:02			
PG340	01/07/98 23:00			
PG341	01/07/98 23:17			
PG342	02/07/98 00:00			
PG343	02/07/98 01:00			
PG344	02/07/98 02:00			
PG345	02/07/98 03:00			
PG346	02/07/98 04:00			
PG347	02/07/98 05:00			
PG348	02/07/98 05:14			
PG349	02/07/98 05:15			
PG350	02/07/98 05:41			
PG351	02/07/98 05:42			
PG352	02/07/98 06:00			
PG353	02/07/98 06:13			
PG354	02/07/98 06:18			
AS1039	02/07/98 06:25			DMS
PG355	02/07/98 06:40			
PG356	02/07/98 06:41			
PG357	02/07/98 07:00			
AS1040	02/07/98 07:24			DMS
PG358	02/07/98 08:00			
AS1041	02/07/98 08:36			DMS
PG359	02/07/98 08:52			
AS5167	02/07/98 09:00			hydrogen peroxide,methylhydroperoxide
AS1042	02/07/98 10:52			DMS
AS1043	02/07/98 11:21			DMS
AS1044	02/07/98 12:07			DMS

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
AS1045	02/07/98 12:30			DMS
AS5168	02/07/98 14:00			hydrogen peroxide,methylhydroperoxide
AS1046	02/07/98 14:08			DMS
AS5169	02/07/98 15:00			hydrogen peroxide,methylhydroperoxide
AS5170	02/07/98 16:00			hydrogen peroxide,methylhydroperoxide
AS5171	02/07/98 17:00			hydrogen peroxide,methylhydroperoxide
AS1047	02/07/98 17:04			DMS
CTD41	02/07/98 17:15	02/07/98 17:30	13607	
CTD42	02/07/98 17:40	02/07/98 19:40	13608	
AS1048	02/07/98 17:45			DMS
AS5172	02/07/98 18:00			hydrogen peroxide,methylhydroperoxide
BK5	02/07/98 18:36		CTD42	Microbial diversity
AS1049	02/07/98 18:43			DMS
AS5173	02/07/98 19:00			hydrogen peroxide,methylhydroperoxide
AS1050	02/07/98 19:36			DMS
AS1051	02/07/98 20:40			DMS
AS1052	02/07/98 21:15			DMS
CTD43	02/07/98 21:26	02/07/98 23:37	13609	
AS1053	02/07/98 21:55			DMS
BK6	02/07/98 22:16		CTD43	Microbial diversity
CTD44	03/07/98 01:20	03/07/98 03:06	13610	
BK7	03/07/98 03:18		CTD44	Microbial diversity
CTD45	03/07/98 04:40	03/07/98 06:34	13611	
BK8	03/07/98 06:51		CTD45	Microbial diversity
PG360	03/07/98 07:08			
CTD46	03/07/98 08:14	03/07/98 10:14	13612	
BK9	03/07/98 09:32		CTD46	Microbial diversity
CTD47	03/07/98 11:42	03/07/98 13:37	13613	
CTD48	03/07/98 14:53	03/07/98 16:46	13614	
BK10	03/07/98 16:56		CTD48	Microbial diversity
CTD49	03/07/98 18:22	03/07/98 20:15	13615	
BK11	03/07/98 19:59		CTD49	Microbial diversity
CTD50	03/07/98 22:20	04/07/98 00:07	13616	
BK12	03/07/98 23:30		CTD50	Microbial diversity
CTD51	04/07/98 04:42	04/07/98 04:52	13617	
CTD52	04/07/98 05:15	04/07/98 05:34	13618	
EAHV15	04/07/98 05:37	04/07/98 17:51		
RS9	04/07/98 06:00	04/07/98 13:00	D12	
RS10	04/07/98 16:45	04/07/98 18:42	D13	
CTD53	04/07/98 18:34	04/07/98 18:42	13619	
PG361	04/07/98 18:58			
PG362	04/07/98 19:57			
PG363	04/07/98 21:00			
BOT14	05/07/98 07:04	05/07/98 07:07	13620	
EAHV16	05/07/98 10:28	05/07/98 19:07		
PG365	05/07/98 10:45			
PG366	05/07/98 11:38			
RS11	05/07/98 12:30	05/07/98 13:30	D14	
PG367	05/07/98 12:37			
PG368	05/07/98 13:41			
PG369	05/07/98 14:42			
PG370	05/07/98 15:36			
PG371	05/07/98 16:35			
PG372	05/07/98 17:33			
PG373	05/07/98 18:40			
BOT15	05/07/98 19:02	05/07/98 19:04	13621	
PG374	05/07/98 19:57			
PG375	05/07/98 21:10			
CTD54	06/07/98 06:12	06/07/98 08:35	13622	
BOT16	06/07/98 08:41	06/07/98 08:42	13623	
PG376	06/07/98 10:53			
PG377	06/07/98 10:57			
PG378	06/07/98 13:14			

D234 Log of Events - CTD, Hydrowire, Air, Underway, XBTs

oid	start time	end time	gearcode	comments
PG379	06/07/98 15:04			
BOT17	06/07/98 19:00	06/07/98 19:01	13624	
PG380	06/07/98 20:16			
BOT18	07/07/98 05:57	07/07/98 05:58	13625	
AS3076	07/07/98 07:32			Halocarbons
BOT19	07/07/98 17:57	07/07/98 17:58	13626	
AS3077	07/07/98 19:09			Halocarbons
AS3001	06/10/98 06:40			Halocarbons
AS3002	06/10/98 16:48			Halocarbons
AS3003	06/10/98 22:20			Halocarbons
AS3004	06/11/98 08:50			Halocarbons
AS3005	06/11/98 12:35			Halocarbons
AS3006	06/11/98 14:40			Halocarbons
AS3007	06/12/98 10:44			Halocarbons
AS3008	06/12/98 14:27			Halocarbons
AS3009	06/12/98 19:41			Halocarbons
AS3010	13/06/98 12:48			Halocarbons
AS3011	14/06/98 01:53			Halocarbons
AS3012	14/06/98 07:10			Halocarbons
AS3013	14/06/98 08:10			Halocarbons
AS3014	14/06/98 08:40			Halocarbons
AS3015	14/06/98 09:10			Halocarbons
AS3016	14/06/98 09:40			Halocarbons
AS3017	14/06/98 14:40			Halocarbons
AS3018	15/06/98 13:13			Halocarbons
AS3019	15/06/98 13:43			Halocarbons
AS3020	15/06/98 14:14			Halocarbons
AS3021	15/06/98 22:35			Halocarbons
AS3022	16/06/98 02:39			Halocarbons
AS3023	16/06/98 13:07			Halocarbons
AS3024	16/06/98 13:37			Halocarbons
AS3025	16/06/98 22:03			Halocarbons
AS3027	17/06/98 15:15			Halocarbons
AS3028	17/06/98 15:55			Halocarbons
AS3029	17/06/98 16:15			Halocarbons
AS3030	17/06/98 17:27			Halocarbons
AS3031	17/06/98 17:47			Halocarbons
AS3032	17/06/98 18:18			Halocarbons
AS3033	17/06/98 19:14			Halocarbons
AS3034	18/06/98 12:55			Halocarbons
AS3035	18/06/98 13:26			Halocarbons
AS3036	18/06/98 13:57			Halocarbons
AS3037	18/06/98 14:27			Halocarbons
AS3038	18/06/98 14:57			Halocarbons
AS3039	19/06/98 02:42			Halocarbons
AS3040	19/06/98 04:30			Halocarbons
AS3041	19/06/98 10:11			Halocarbons
AS3042	20/06/98 18:49			Halocarbons
AS3043	21/06/98 00:34			Halocarbons
AS3044	21/06/98 02:15			Halocarbons
AS3045	21/06/98 22:27			Halocarbons
AS3046	21/06/98 23:55			Halocarbons
AS3047	22/06/98 00:26			Halocarbons
AS3048	22/06/98 19:43			Halocarbons
AS3049	23/06/98 02:03			Halocarbons
AS3050	25/06/98 00:01			Halocarbons
AS3051	26/06/98 01:19			Halocarbons
AS3052	26/06/98 21:00			Halocarbons
AS3053	27/06/98 00:00			Halocarbons
AS3054	27/06/98 21:07			Halocarbons
AS3055	28/06/98 02:29			Halocarbons
AS3056	28/06/98 03:54			Halocarbons
AS3057	28/06/98 07:49			Halocarbons
AS3026				Halocarbons

CTD 1 – 9/6/98 13:47-14:13, 59°20'N, 19°W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
0	4R					Y										Y			
0	14T							Y											
10	8R					Y									Y				
10	12R													Y	Y				
10	10T							Y											Y
30	6T					Y		Y											
45	24T					Y		Y											
50	22T					Y		Y								Y			
55	18T					Y		Y											
100	16T					Y		Y											
150	20R					Y		Y											
200	2T					Y				Y				Y		Y			

CTD2 – 9/6/98, 15:18-15:40, 59°20'N, 19°W, 0-50M Failed!, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
0	22T																		
0	24T																		
10	18T																		
10	20R																		
25	18T																		
25	14T																		
50	12R																		
50	10T																		
75	8R					Y													
75	6T																		
100	4R																		
100	2T																		

CDT3 – 9/6/98, 16:29-17:05, 59°20'N, 19°W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
500	2					Y	Y		Y			Y							
400	4R						Y												
300	6					Y	Y		Y										
250	8R						Y		Y										
200	10						Y					Y				Y			
150	12R	Y					Y									Y			
100	14	Y			Y		Y		Y	Y	Y					Y			
50	16	Y			Y		Y		Y	Y	Y					Y			
10	18	Y			Y		Y			Y	Y	Y			Y	Y		Y	
10	20R														Y				
0	22								Y	Y	Y	Y						Y	
0	24	Y			Y											Y			

CTD4 – 10/6/98, 06:01-06:38, 59°N, 22°30'W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
500	2					Y	Y												Y
400	4R					Y	Y												
300	6					Y	Y												
250	8R					Y	Y												
200	10					Y	Y												
150	12R					Y	Y												
100	14	Y				Y	Y			Y									
50	16	Y				Y	Y			Y	Y			Y	Y				
20	18	Y				Y	Y			Y	Y			Y	Y				Y
10	20R	Y				Y								Y	Y				
10	22									Y	Y								
0	24	Y				Y				Y	Y			Y	Y				

CTD5 – 13/6/98, 07:04-07:55, 59°15'08"N, 20°32'45"W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Chlor	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	CS	MS
500	2					Y	Y													Y
400	4R					Y	Y													
300	6					Y	Y													
250	8R	Y				Y	Y													
200	10	Y				Y	Y													
150	12R	Y				Y	Y													
100	14	Y			Y	Y	Y												Y	
50	16	Y			Y	Y	Y								Y				Y	
10	18					Y									Y					
10	20R	Y			Y		Y										Y	Y	Y	
0	22														Y					
0	24	Y			Y	Y													Y	

CTD6 – 13/6/98, 13:05-14:00, 59°30'20"N, 21°07'55"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	SF_6	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	FC	PN	MS
0	24T 8R	Y				Y		Y	Y	Y		Y	Y	Y	Y			Y	Y	
10	22T 20R	Y				Y		Y	Y	Y		Y		Y				Y	Y	Y
20	18T	Y			Y	Y		Y	Y	Y		Y		Y				Y	Y	
35	16T	Y			Y	Y		Y	Y	Y		Y		Y				Y		
50	14T	Y			Y	Y			Y	Y		Y		Y	Y			Y		
65	10T	Y			Y	Y						Y		Y				Y		
100	6T	Y			Y	Y		Y						Y	Y			Y		
150	4R	Y			Y	Y														
200	2T	Y			Y	Y		Y	Y	Y		Y			Y			Y		

CTD7 – 14/6/98, 02:20-02:43, 59°30'19"N, 21°07'47"W

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
200	2	Y								Y									
150	4R	Y																	
100	6	Y																	
80	10	Y																	
60	14	Y								Y									
40	16	Y								Y						Y			Y
20	18	Y								Y									
10	22									Y									
10	20R															Y			
10	12R																		
0	24									Y				Y					
0	8R				Y										Y				

CTD 8 – 14/6/98, 03:15-03:28, 59°30'19"N, 21°07'47"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
30	2	Y														Y			
30	4R																Y	Y	
20	6	Y														Y			
20	8R				Y												Y	Y	
17	10	Y																	
17	12R				Y											Y	Y	Y	
11	14																		
11	16	Y			Y	Y											Y	Y	
4	18	Y													Y				
4	20R				Y	Y										Y	Y	Y	
0	22																		
0	24	Y			Y	Y										Y	Y	Y	

CTD9 – 14/6/98, 04:20-04:26, 59°30'19"N, 21°07'47"W, Light Profile Only

CTD10 – 15/6/98, 02:27-02:51, 59°28'44"N, 21°04'50"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	MS
200	2	Y				Y	Y	Y								Y			
150	4R	Y				Y	Y												
100	6	Y				Y	Y	Y								Y			
80	10					Y	Y	Y											
60	14						Y	Y											
50	16						Y	Y						Y					
30	18						Y	Y											
10	22							Y											
10	12R															Y			
0	24							Y											
0	20R														Y				
0	8R														Y				

CTD11 – 15/6/98, 03:23-03:43, 59°28'44"N, 21°04'50"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
60	2																			
50	4R	Y			Y											Y				
45	6	Y																		
40	8R	Y																		
35	10	Y																		
30	12R	Y			Y	Y											Y	Y		
20	14	Y			Y	Y										Y	Y	Y		
17	16	Y			Y												Y	Y		
11	18	Y			Y											Y	Y	Y		
4	20R				Y															
4	22	Y				Y		Y									Y	Y		
0	24	Y				Y		Y								Y	Y	Y		

CTD12 – 15/6/98, 04:08-04:15, 59°28'44"N, 21°04'50"W, Inside, Light Only

CTD13 – 15/6/98, 15:03-15:30, 59°32'50"N, 21°03'34"W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
10	12R																			
10	16T	Y						Y	Y											
10	18T							Y	Y	Y	Y		Y							
10	20R																			
10	22T							Y	Y	Y	Y		Y							
10	24T							Y	Y	Y	Y		Y							
100	2T	Y						Y	Y	Y	Y		Y							
100	4R																			
100	6T							Y	Y											
100	8R																			
100	10T							Y	Y	Y	Y		Y							
100	14T							Y	Y	Y	Y		Y							

CTD14 – 16/6/98, 02:15-02:35, 59°33'59"N, 21°06'54"W, Outside Upwelling Region

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL		MS
200	2					Y	Y	Y								Y				PN	
150	4R					Y	Y														
100	6				Y	Y	Y	Y		Y						Y					
50	10					Y	Y														
25	14					Y	Y														
20	16					Y	Y	Y													
15	18					Y	Y														
10	22						Y	Y												Y	
10	12R					Y										Y					
0	20R														Y						
0	8R					Y									Y						
0	24							Y												Y	

CTD15 – 16/6/98, 03:05-03:20, 59°33'59"N, 21°06'54"W, Outside Upwelling Region

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
60	2	Y		Y	Y				Y	Y	Y		Y							
50	4R	Y														Y				
40	6	Y							Y	Y	Y		Y							
30	8R	Y															Y	Y		
20	10	Y							Y	Y			Y				Y	Y		
17	12R	Y			Y												Y	Y		
11	14	Y			Y												Y	Y		
4	16														Y		Y	Y		
4	18	Y			Y						Y				Y					
0	20				Y			Y									Y	Y		
0	22	Y							Y	Y	Y		Y							

CTD16 – 16/6/98, 04:01-04:09, 03:05-03:20, 59°33'59"N, 21°06'54"W, Outside Upwelling Region

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
4	2													Y						Y
4	4R													Y						Y

CTD17 – 17/6/98, 02:14-02:35, 59°33'45"N, 20°46'07"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
200	2	Y				Y	Y	Y								Y					
150	4R					Y	Y														
100	6	Y				Y	Y	Y													
35	10	Y				Y	Y									Y					
30	14	Y				Y	Y	Y													
25	16	Y				Y	Y	Y													
20	18	Y				Y	Y	Y													
10	22							Y												Y	
10	12R					Y	Y									Y					
0	20R														Y						
0	24							Y												Y	
0	8R					Y								Y	Y	Y					

CTD18 – 17/6/98, 03:09-03:24, 59°33'45"N, 20°46'07"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN
50	2	Y			Y											Y				Y
40	4R	Y																		
30	6				Y											Y	Y	Y		
20	8R	Y			Y											Y	Y	Y		
17	10																Y	Y		
11	12R				Y											Y	Y	Y		
4	14	Y			Y											Y	Y	Y		
4	16														Y					
0	18				Y												Y			Y
0	20R	Y														Y		Y		

CTD19 – 176/98, 04:15-04:22, 59°33'45"N, 20°46'07"W, Inside, Light Only

CTD20 – 18/6/98, 03:03-03:22, 59°31'26"N, 21°00'01"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
200	2						Y	Y	Y												
150	4R						Y														
100	6						Y	Y	Y							Y					
50	8R						Y									Y					
30	10						Y	Y	Y				Y								
25	14																				
20	16				Y		Y	Y			Y		Y								
15	18							Y	Y												
10	20R				Y											Y					
10	22							Y	Y		Y		Y							Y	
0	24							Y	Y		Y		Y							Y	
0	12R				Y																

CTD21 – 18/6/98, 04:11-04:24, 59°31'26"N, 21°00'01"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
100	2	Y														Y					
50	6	Y							Y		Y		Y			Y					
30	10	Y				Y															
20	14	Y														Y					
11	16	Y				Y										Y					
4	18	Y																			
4	22					Y															
0	24	Y						Y								Y					Y
0	20R																				Y

CTD22 – 19/6/98, 02:39-02:46, 59°31'26"N, 21°00'01"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
0	4R														Y						
0	2	Y	Y	27		Y				Y					Y	Y					
0	6				Y			Y						Y							Y

CTD23 – 20/6/98, 22:09-22:33, 59°33'12"N, 21°01'36"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
100	2							Y													
80	6							Y													
70	10							Y													
65	14							Y													
60	16							Y													
50	18							Y													
10	22							Y	Y											Y	
4	24	Y	Y		Y	Y		Y	Y	Y	Y		Y							Y	
4	20R																				
4	12R																				

CTD24 – 21/6/98, 03:02-03:20, 59°33'12"N, 21°01'36"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
200	2	Y					Y	Y								Y					
150	4R	Y					Y														
100	6	Y					Y	Y	Y	Y			Y		Y	Y					
80	10	Y					Y	Y					Y								
60	14	Y					Y	Y		Y			Y								
40	16						Y	Y		Y			Y			Y					
20	18						Y	Y													
10	22							Y		Y											
10	20R															Y					
0	24						Y	Y						Y							
0	12R														Y						
0	8R															Y					

CTD25 – 21/6/98, 03:47-03:59, 59°33'12"N, 21°01'36"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
30	2	Y			Y	Y							Y	Y			Y	Y			
20	6	Y			Y						Y	Y	Y	Y			Y	Y			
17	10				Y												Y	Y			
11	14	Y			Y	Y					Y	Y	Y	Y			Y	Y			
4	16	Y			Y	Y											Y	Y			
4	18										Y	Y	Y								
0	22													Y			Y				Y
0	24							Y			Y		Y		Y						
0	4R														Y						
0	8R	Y		32	Y	Y											Y	Y			

CTD26 – 21/6/98, 15:05-15:33, 59°34'47"N, 21°08'38"W, Edge

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Fe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	TJ
150	2T	Y	Y	40		Y		Y			Y	Y									
150	4R																				Y
80	6T	Y	Y	39		Y		Y				Y	Y								
80	8R																				Y
70	10T	Y	Y	38		Y		Y													
60	14T	Y	Y	37		Y		Y			Y		Y								
45	16T	Y	Y	36		Y		Y													
45	20R																				Y
40	18T	Y	Y	35		Y		Y			Y		Y								
25	22T	Y	Y	34		Y		Y			Y	Y	Y								
0	24T	Y	Y	33		Y		Y			Y		Y								
0	12R																				Y
0	10L	Y	Y	41		Y							Y						Y		Y

CTD27 – 22/6/98, 12:00-13:00, 59°53'N, 21°15'23"W, Edge

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
100	2T	Y		55		Y		Y		Y	Y		Y								
80	6T					Y		Y													Y
70	10T	Y		54		Y		Y			Y		Y								
60	14T	Y		53		Y		Y		Y	Y		Y								
50	16T	Y		52		Y		Y		Y	Y		Y								Y
25	18T	Y		51		Y		Y		Y	Y		Y								
10	20R	Y		50																Y	Y
10	22T					Y		Y		Y	Y		Y								
0	24T							Y		Y	Y		Y							Y	
0	4R	Y		49		Y									Y					Y	Y
0	10L	Y	Y	48		Y							Y						Y		

CTD28 – 23/6/98, 02:53-02:59, 59°54'19"N, 20°44'30"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN
0	2		Y									Y			Y					
0	4R														Y					
0	6															Y				

CTD29 – 23/6/98, 03:22-03:42, 59°54'19"N, 20°44'30"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	He	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	PN	MS
200	2	Y				Y	Y	Y	Y							Y					
100	4R	Y	Y	66		Y										Y					
100	6				Y			Y	Y	Y		Y	Y								
60	10	Y	Y	65		Y		Y	Y	Y	Y	Y	Y				Y				
40	14	Y	Y	64	Y	Y		Y	Y	Y	Y		Y			Y					
30	12R				Y												Y				
30	16	Y	Y	63		Y		Y	Y	Y	Y		Y			Y					
20	18	Y	Y	62	Y	Y		Y	Y	Y	Y		Y			Y	Y	Y			
10	22	Y		61	Y	Y		Y	Y	Y	Y		Y			Y	Y				
4	24	Y		60					Y				Y	Y			Y				Y
4	20R		Y			Y									Y						Y
0	8R	Y	Y	59	Y	Y	Y					Y				Y	Y	Y			Y

CTD30 – 23/6/98, 05:58-06:17, 59°54'19"N, 20°44'30"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
200	4R				Y	Y	Y												
100	2	Y			Y	Y		Y	Y							Y			
60	6	Y		73	Y	Y		Y	Y										
40	10	Y	Y	72	Y	Y		Y					Y			Y			
30	14	Y	Y	71	Y	Y		Y	Y				Y			Y			
20	16	Y	Y	70	Y	Y		Y	Y	Y			Y			Y			
10	18	Y	Y	69	Y	Y		Y	Y	Y			Y			Y			
4	20R				Y	Y													
4	22	Y	Y	68				Y	Y										
0	24	Y	Y	67	Y	Y	Y	Y	Y	Y	Y		Y	Y					
0	12R															Y	Y		

CTD31 – 23/6/98, 08:05-08:20, 59°52'03"N, 20°34'17"W, Edge

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
200	2						Y												
20	4R					Y												Y	
0	6					Y	Y		Y	Y								Y	

CTD32 – 23/6/98, 10:23-10:43, 59°52'03"N, 20°34'17"W, Edge

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
200	2						Y	Y												
100	6							Y								Y				
60	10							Y												
40	14							Y					Y			Y				
30	16							Y		Y			Y			Y				
20	18							Y		Y			Y			Y				
10	22							Y	Y	Y			Y			Y				
0	24	Y				Y	Y	Y	Y	Y	Y		Y	Y		Y	Y			Y

CTD33 – 23/6/98, 13:11-13:35, 59°50'52", 20°39'35"W, Edge/Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
200	2T	Y	Y	82		Y	Y	Y											
100	6T 4R	Y	Y	81	Y	Y		Y	Y		Y		Y		Y	Y			
60	10T	Y	Y	80	Y	Y		Y	Y		Y		Y		Y	Y			
40	14T	Y	Y	79	Y	Y				Y					Y	Y			
30	16T 12R	Y	Y	78	Y	Y			Y	Y	Y		Y		Y	Y			
20	18T	Y	Y	77	Y	Y			Y	Y	Y		Y		Y	Y			
10	22T	Y	Y	76	Y	Y				Y	Y		Y		Y	Y			
0	24T 20R 8R	Y	Y	75	Y	Y	Y		Y	Y	Y	Y			Y	Y			Y

CTD34 – 26/6/98, 21:05-21:30, 61°11'50"N, 20°31'14"W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24T	Y	Y	101		Y				Y			Y						
4	22T	Y	Y	102		Y			Y		Y	Y	Y						
20	18T	Y	Y	103		Y			Y		Y	Y	Y						
30	16T	Y	Y	104		Y							Y						
40	14T	Y	Y	105		Y			Y		Y		Y						
60	10T	Y	Y	106		Y			Y		Y		Y						
100	6T	Y				Y			Y										
200	2T	Y				Y			Y			Y			Y				

CTD35 – 27/6/98, 02.18:02.41, 60°25'54"N, 20°39'37"W, Inside Upwelling Region

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
200	2	Y	Y	128		Y	Y		Y							Y				
100	6								Y	Y	Y					Y				
60	10	Y	Y	108		Y			Y	Y	Y		Y							
40	14								Y	Y	Y		Y			Y				
10	16												Y							
4	4R														Y					
4	18														Y		Y			
0	22																			
0	24																			
0	8R						Y													Y

CTD36 – 27/6/98, 03:25-03:45, 60°25'54"N, 20°39'37"W, Inside Upwelling Region

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
30	4R	Y	Y	132	Y											Y	Y	Y	
20	6	Y	Y	131		Y			Y		Y		Y				Y	Y	
20	8R				Y											Y			
17	10				Y												Y	Y	
11	12R				Y											Y	Y	Y	
11	14	Y	Y	130		Y			Y	Y	Y		Y						
4	16				Y	Y			Y	Y	Y		Y				Y	Y	
4	18	Y	Y	129											Y				
0	24	Y	Y	127	Y				Y	Y	Y		Y			Y	Y		

CTD37 – 27/6/98, 21:30-21:45, 59°45'38"N, 21°W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
200	4R																			
100	2T	Y	Y	138		Y		Y	Y			Y				Y				Y
70	6T	Y	Y	137		Y		Y												Y
50	10T							Y	Y	Y		Y				Y				
40	14T	Y	Y	136		Y		Y		Y										Y
30	16T							Y	Y	Y						Y				
20	18T	Y	Y	135		Y		Y	Y	Y		Y				Y				Y
10	22T	Y	Y	134		Y		Y	Y	Y		Y				Y				Y
2	24T	Y	Y	133		Y		Y	Y	Y	Y	Y	Y							Y
2	8R															Y				

CTD38 – 28/6/98, 02:09-02:33, 59°48'26"N, 20°57'33"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
200	4R						Y									Y			
150	8R																		
100	6	Y			Y	Y		Y				Y				Y			
70	10	Y	Y	147	Y	Y		Y	Y	Y	Y	Y	Y						
60	14							Y											
50	16	Y				Y		Y		Y	Y		Y			Y			
40	18							Y											
30	22	Y	Y	145	Y	Y		Y	Y	Y			Y						
10	2	Y		144		Y		Y		Y	Y		Y			Y			
4	12R														Y				
4	20R	Y	Y	143	Y	Y	Y								Y				
0	24	Y				Y		Y			Y		Y	Y		Y			

CTD39 – 28/6/98, 03:18-03:41, 59°48'26"N, 20°57'33"W, Inside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Chl
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	LG
50	2	Y	Y	146	Y															Y
30	6				Y												Y	Y		
20	10		Y		Y												Y	Y		
20	14	Y		148		Y														
17	16																Y	Y		
11	18																			
11	20R		Y	144	Y												Y	Y		Y
4	22												Y		Y					
4	8R				Y												Y	Y		
4	12R														Y					
0	24		Y	142																Y
0	4R				Y												Y	Y		

CTD40 – 28/6/98, 14:19-15:02, 59°49'57"N, 20°41'47"W, Edge/Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
500	4R						Y												
400	8R						Y												
300	12R						Y												
250	20R						Y												
200	2T	Y	Y	155	Y	Y	Y	Y				Y			Y				Y
150	6T	Y				Y	Y	Y											
100	10T	Y				Y	Y	Y					Y			Y			
50	14T	Y	Y	154	Y	Y	Y	Y				Y	Y			Y			Y
40	16T	Y	Y	153	Y	Y		Y				Y	Y			Y			Y
25	18T	Y	Y	152	Y	Y		Y				Y	Y			Y			Y
10	22T	Y	Y	151	Y	Y	Y	Y					Y		Y	Y			Y
0	24T	Y	Y	150	Y	Y		Y				Y	Y	Y		Y			Y

CTD41 – 2/7/98, 17:15-17:30, 59°59'56"N, 20°04'02"W, Feature to N, 3 bottles fired at 13 m

CTD42 – 2/7/98, 17:50-19:40, 59°59'56"N, 20°04'02"W, DEEP #1

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24T	Y	Y	173	Y	Y		Y	Y	Y	Y		Y			Y	Y	Y	
10	22T	Y	Y	174	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y			
20	18T	Y	Y	175	Y	Y		Y	Y	Y	Y	Y	Y			Y		Y	
30	16T	Y	Y	176	Y	Y		Y	Y	Y			Y			Y			
50	14T	Y	Y	177	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y			
100	10T	Y	Y	178		Y	Y	Y	Y	Y		Y	Y			Y			
200	6T	Y	Y	179		Y	Y	Y	Y		Y					Y			
500	20R					Y	Y					Y				Y			
1000	12R					Y	Y												
1500	8R					Y	Y												
2000	4R					Y	Y												
2700	2T					Y	Y	Y	Y	Y	Y								

CTD43 – 2/7/98, 21:26-23:57, 59°53'04"N, 20°21'48"W, Outside, DEEP #2

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Chl	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	GM	MS
2760	2						Y	Y	Y												
2000	4R						Y														
1500	8R						Y														
1000	12R						Y														
500	20R						Y									Y					
200	6						Y	Y													
100	10						Y	Y	Y							Y					
50	14						Y	Y	Y				Y			Y		Y		Y	
30	16				Y			Y							Y	Y		Y		Y	
20	18	Y	Y	181	Y	Y		Y	Y	Y			Y		Y	Y		Y		Y	
10	22				Y		Y	Y					Y		Y			Y		Y	
0	24	Y	Y	180	Y	Y		Y	Y	Y	Y		Y		Y	Y		Y		Y	Y

CTD44 – 3/7/98, 01:20-03:06, 59°46'22"N, 20°39'11"W, Edge, DEEP #3

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Fe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	TJ	MS
0	24	Y	Y	182		Y		Y	Y	Y	Y		Y		Y	Y		Y			Y
10	22	Y	Y	183		Y	Y	Y	Y	Y	Y		Y		Y	Y					Y
20	18	Y	Y	184		Y		Y	Y	Y	Y		Y		Y	Y		Y			Y
30	16	Y	Y	185		Y		Y	Y				Y		Y	Y					Y
50	14	Y	Y	186		Y	Y	Y	Y	Y	Y		Y		Y	Y					Y
100	10	Y	Y			Y	Y	Y	Y		Y	Y	Y		Y	Y					
200	6	Y	Y			Y	Y	Y	Y												
500	20R					Y	Y					Y				Y				Y	
1000	12R					Y	Y													Y	
1500	8R					Y	Y													Y	
2000	4R					Y	Y													Y	
2790	2					Y	Y	Y	Y		Y										

CTD45 – 3/7/98, 04:40-06:34, 59°39'41"N, 20°56'58"W, Outside, DEEP #4

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24	Y	Y	187				Y								Y	Y		
10	22						Y	Y								Y			
20	18	Y	Y	188				Y								Y			
30	16							Y								Y			
50	14						Y	Y								Y			
100	10						Y	Y								Y			
200	6						Y	Y											
500	20R						Y									Y			
1000	12R						Y												
1500	8R						Y												
2000	4R						Y												
2804	2						Y	Y											

CTD46 – 3/7/98, 08:14-10:14, 59°32'42"N, 21°13'48"W, Outside, DEEP #5

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
0	24	Y	Y	189	Y	Y		Y	Y	Y			Y		Y	Y	Y	Y		Y
10	22	Y	Y	190	Y	Y	Y	Y	Y	Y			Y		Y	Y				
20	18	Y	Y	191	Y	Y		Y	Y	Y			Y		Y	Y	Y	Y		
30	16	Y	Y	192	Y	Y		Y	Y				Y		Y	Y	Y			
50	14	Y	Y	193	Y	Y	Y	Y	Y	Y			Y		Y	Y				
100	10	Y	Y		Y	Y	Y	Y	Y				Y		Y	Y				
200	6	Y	Y		Y	Y	Y	Y	Y											
500	20R					Y	Y									Y				
1000	12R					Y	Y													
1500	8R					Y	Y													
2000	4R					Y	Y													
2840	2					Y	Y	Y	Y											

CTD47 – 3/7/98, 11:42-13:37, 59°25'43"N, 21°31'24"W, Salty Feature, DEEP #6

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24T	Y	Y	194		Y		Y		Y						Y			
10	22T						Y	Y				Y				Y			
20	18T	Y	Y	195		Y		Y		Y						Y			
30	16T							Y				Y				Y			
50	14T						Y	Y				Y				Y			
100	10T						Y	Y								Y			
200	6T						Y	Y											
500	20R						Y					Y							
1000	12R						Y												
1500	8R						Y												
2000	4R						Y												
2850	2T						Y	Y											

CTD48 – 3/7/98, 14:53-16:46, 59°18'45"N, 21°48'21"W, Outside, DEEP #7

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24T	Y	Y	196	Y	Y		Y	Y	Y	Y		Y			Y			
10	22T	Y	Y	197	Y	Y	Y	Y	Y	Y	Y		Y			Y			
20	18T	Y	Y	198	Y	Y		Y	Y	Y	Y	Y	Y			Y			
30	16T	Y	Y	199	Y	Y		Y	Y	Y	Y		Y			Y			
50	14T	Y	Y	200	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y			
100	10T	Y	Y			Y	Y	Y	Y			Y	Y			Y			
200	6T	Y	Y			Y	Y	Y	Y										
500	20R					Y	Y												
1000	12R					Y	Y												
1500	8R					Y	Y												
2000	4R					Y	Y												
2800	2T					Y	Y	Y	Y		Y								

CTD49 3/7/98, 18:22-20:15, 59°11'38"N, 22°05'20"W, Outside, DEEP #8

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
0	24T	Y	Y	201		Y			Y	Y						Y			
10	22T						Y									Y			
20	18T	Y	Y	202		Y			Y	Y						Y			
30	16T															Y			
50	14T						Y		Y							Y			
100	10T						Y		Y							Y			
200	6T						Y												
500	20R						Y												
1000	12R						Y												
1500	8R						Y												
2000	4R						Y												
2783	2T						Y		Y										

CTD50 – 3/7/98, 22:20-00:07, 59°04'31"N, 22°21'53"W, Outside, DEEP #9

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	Chl	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
0	24	Y	Y	203	Y	Y			Y		Y		Y		Y	Y	Y		Y	Y
10	22	Y	Y	204	Y	Y	Y	Y	Y				Y		Y	Y			Y	Y
20	18	Y	Y	205	Y	Y			Y				Y		Y	Y	Y		Y	Y
30	16	Y	Y	206	Y	Y			Y				Y		Y	Y	Y		Y	Y
50	14	Y	Y	207	Y	Y	Y		Y				Y		Y	Y			Y	Y
100	10	Y	Y		Y	Y	Y		Y				Y		Y	Y				
200	6	Y	Y			Y	Y		Y											
500	20R					Y	Y									Y				
1000	12R					Y	Y													
1500	8R					Y	Y													
2000	4R					Y	Y													
2770	2					Y	Y		Y				Y						Y	

CTD51 – 4/7/98, 04:42-04:52, 59°20'22"N, 21°44'43"W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	PN	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
4	2														Y				
4	4R														Y				
4	6										Y								

CTD52 – 4/7/98, 05:15-05:34, 59°20'22"N, 21°44'43"W, Outside

Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	Chl	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	PN	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
50	2				Y	Y				Y								Y	
30	6				Y	Y				Y							Y		
20	8R				Y	Y											Y	Y	
20	10									Y									
17	14					Y				Y							Y		
11	12R				Y												Y		
11	16					Y				Y									
4	24				Y					Y							Y		
4	20R				Y										Y				
4	4R				Y										Y				
0	18				Y	Y				Y									
0	22																Y	Y	

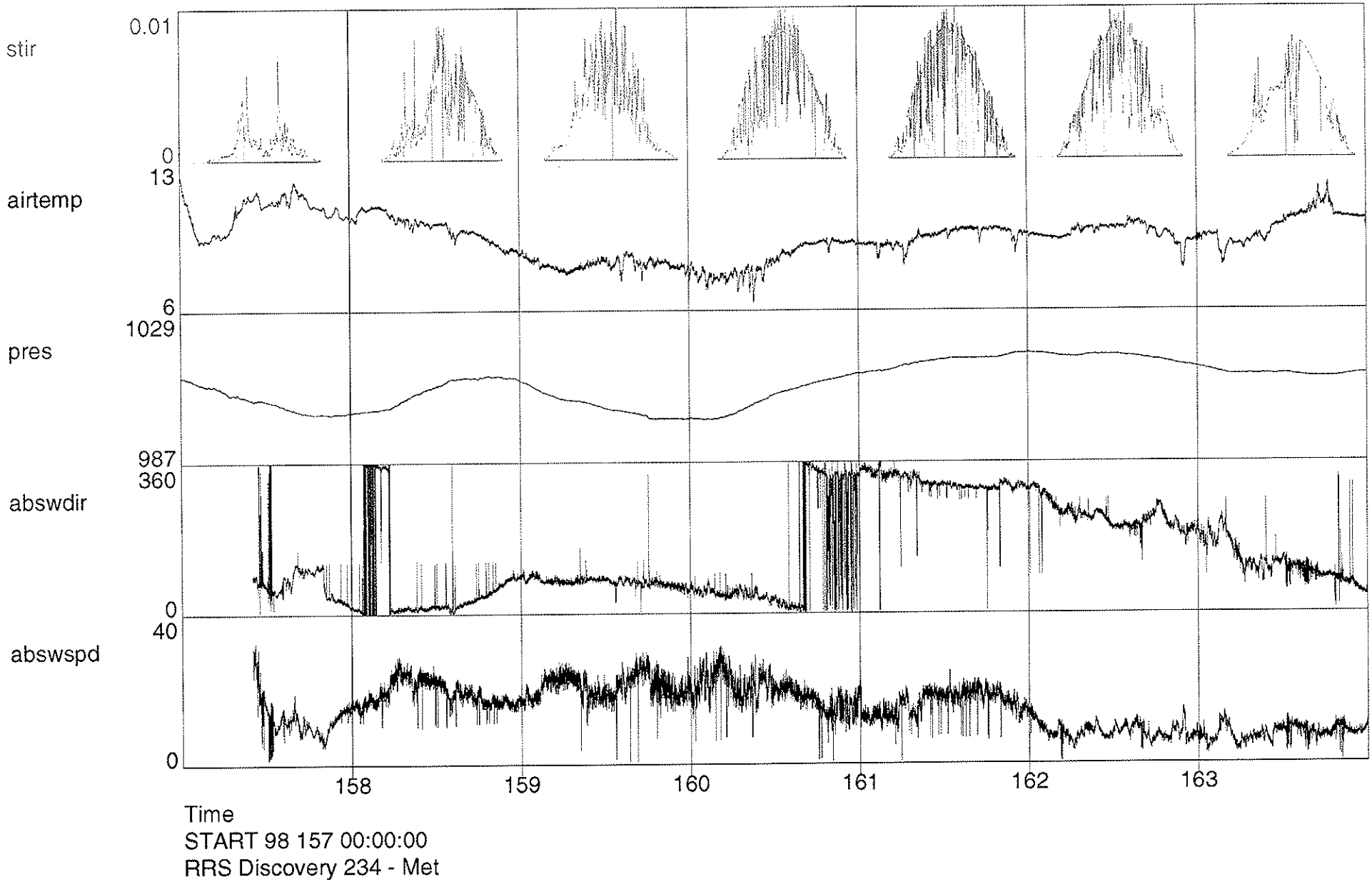
CTD53 – 4/7/98, 18:34-18:42, 59°20'30"N, 21°55'28"W, Outside

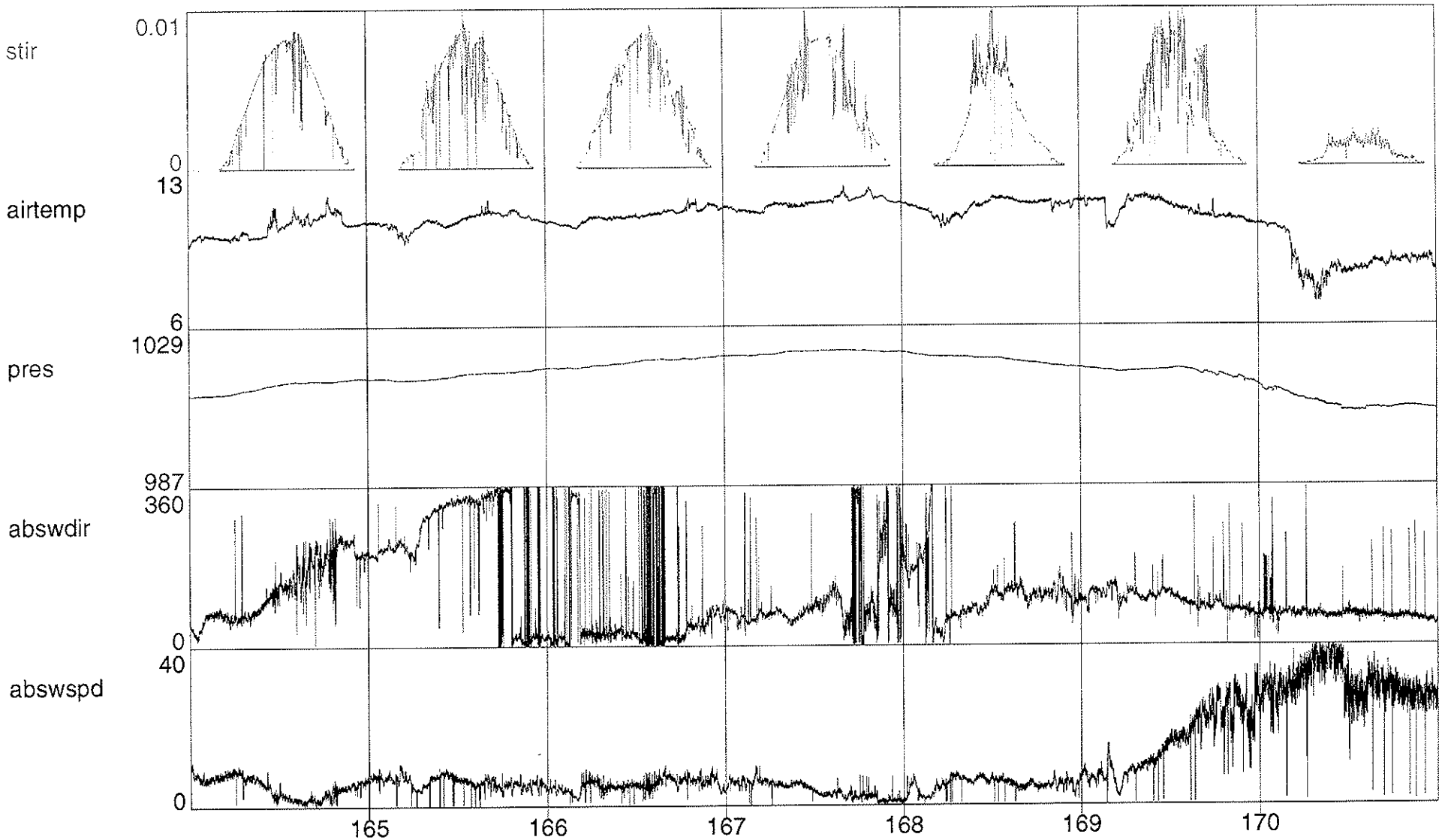
Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe	Lyase
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL	MS
0	18T														Y					
0	22T	Y	Y	208	Y															Y

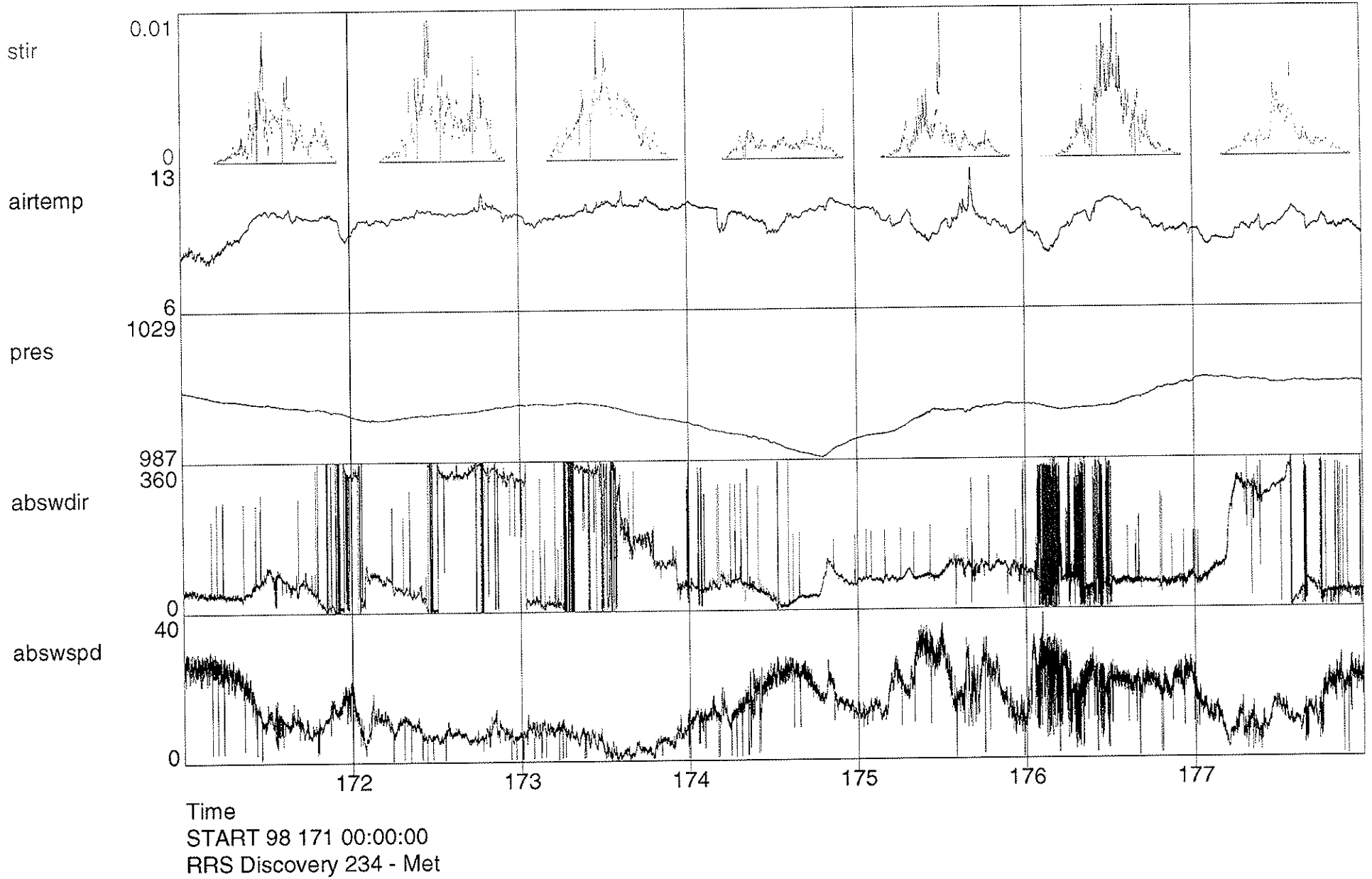
CTD54 – 6/7/98, 06:12-08:35, 54°24'30"N, 14°50'10"W, Outside

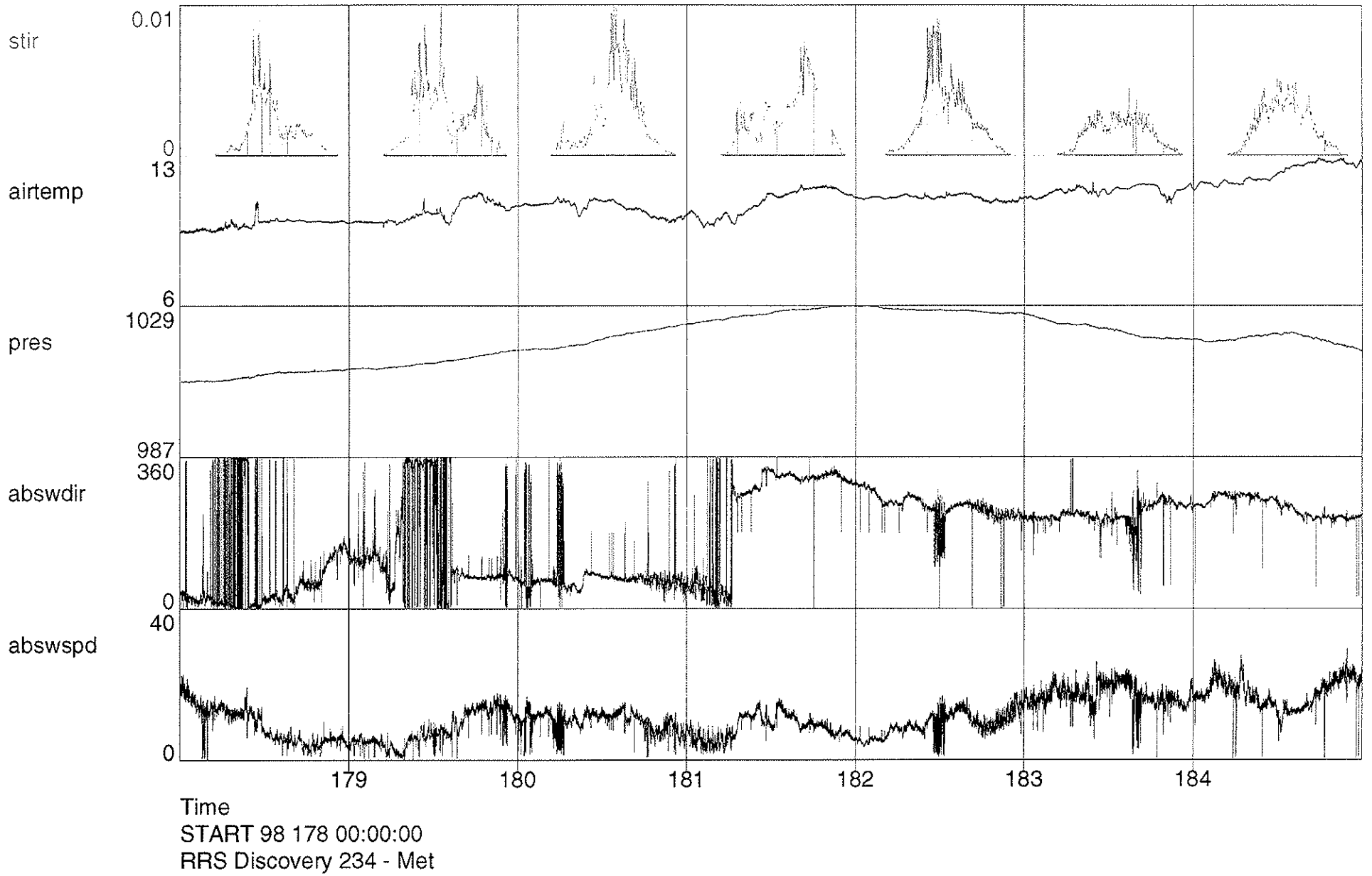
Depth	Bottle	Chl	HPLC	Phyto	AFC Phyto	Nuts	Sal	SF_6	N_2O	Halo	Hydr	TCO_2	DMS		Zoo	Bact	^{14}C	^{15}N	DMSe
		MHL	MHL	MHL	SA	TJ	JR	FC	TF	JB	WB	JD	AT	RS	CS	CPA	LG	GM	PL
2710	2					Y	Y	Y	Y										
2710	4R					Y	Y												
2710	6					Y	Y	Y	Y										
2710	8R					Y	Y												
2710	10					Y	Y	Y	Y										
2710	12R					Y	Y												
2710	14					Y	Y	Y											
2710	16					Y	Y	Y											
2710	18					Y	Y	Y											
2710	20R					Y	Y												
2710	22					Y	Y	Y		Y									
2710	24					Y	Y	Y											

METEOROLOGICAL DATA - WEEKLY PLOTS

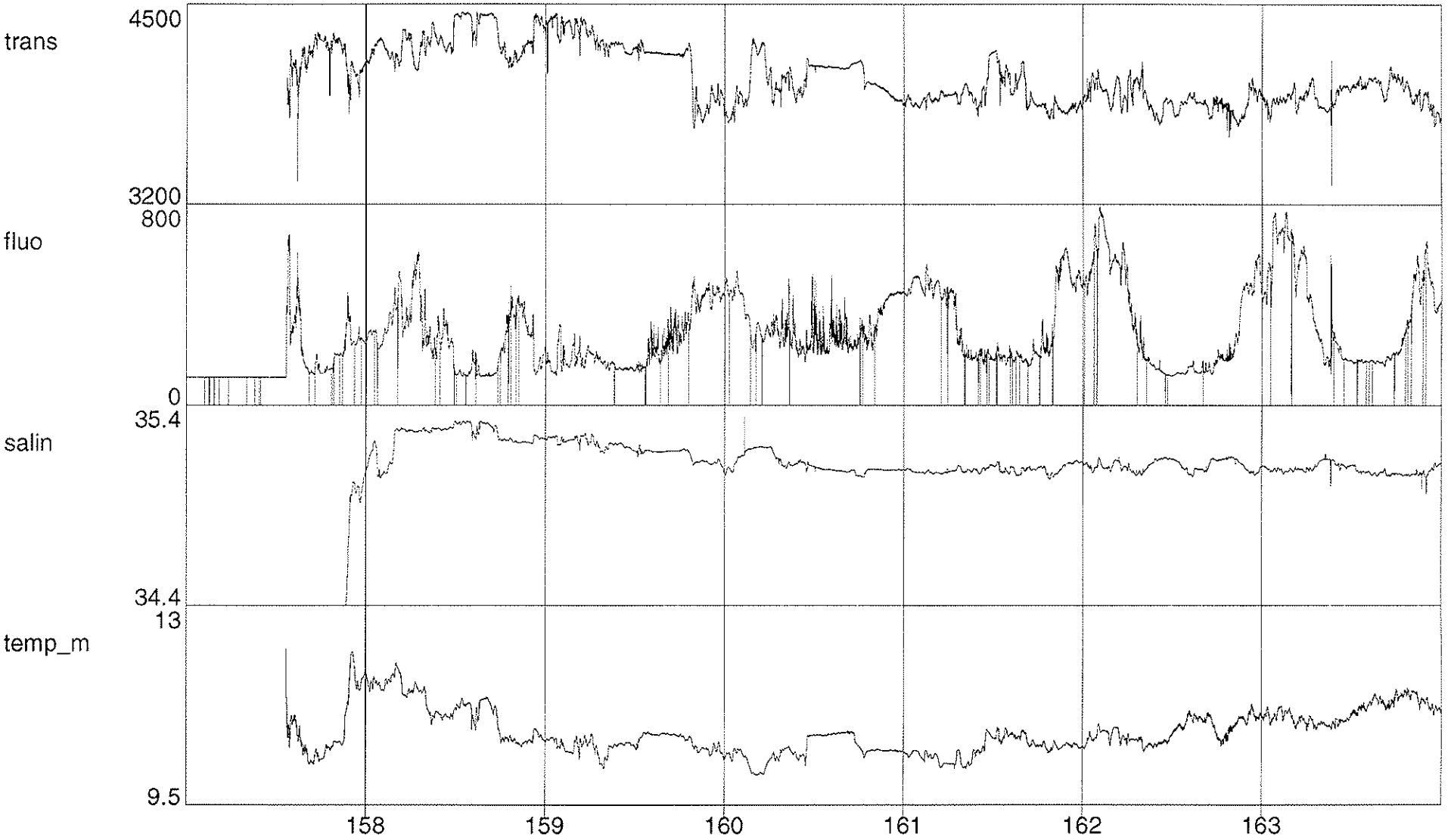

stir
0.01
0
airtemp
13
6
pres
1029
987
abswdir
360
0
abswspd
40
0
158
159
160
161
162
163
Time
START 98 157 00:00:00
RRS Discovery 234 - Met

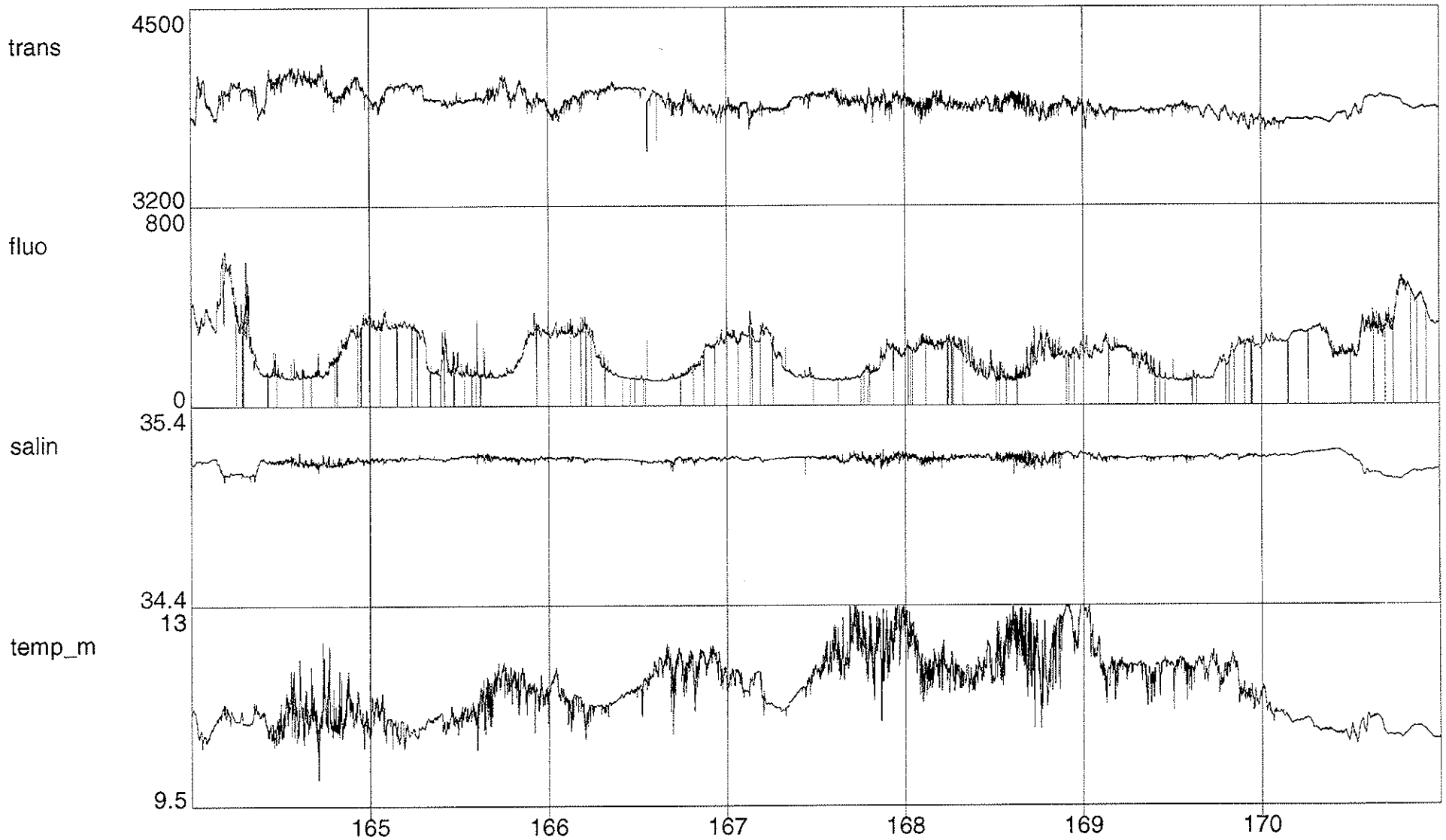

stir
0.01
0
airtemp
13
6
pres
1029
987
abswdir
360
0
abswspd
40
0
165
166
167
168
169
170
Time
START 98 164 00:00:00
RRS Discovery 234 - Met

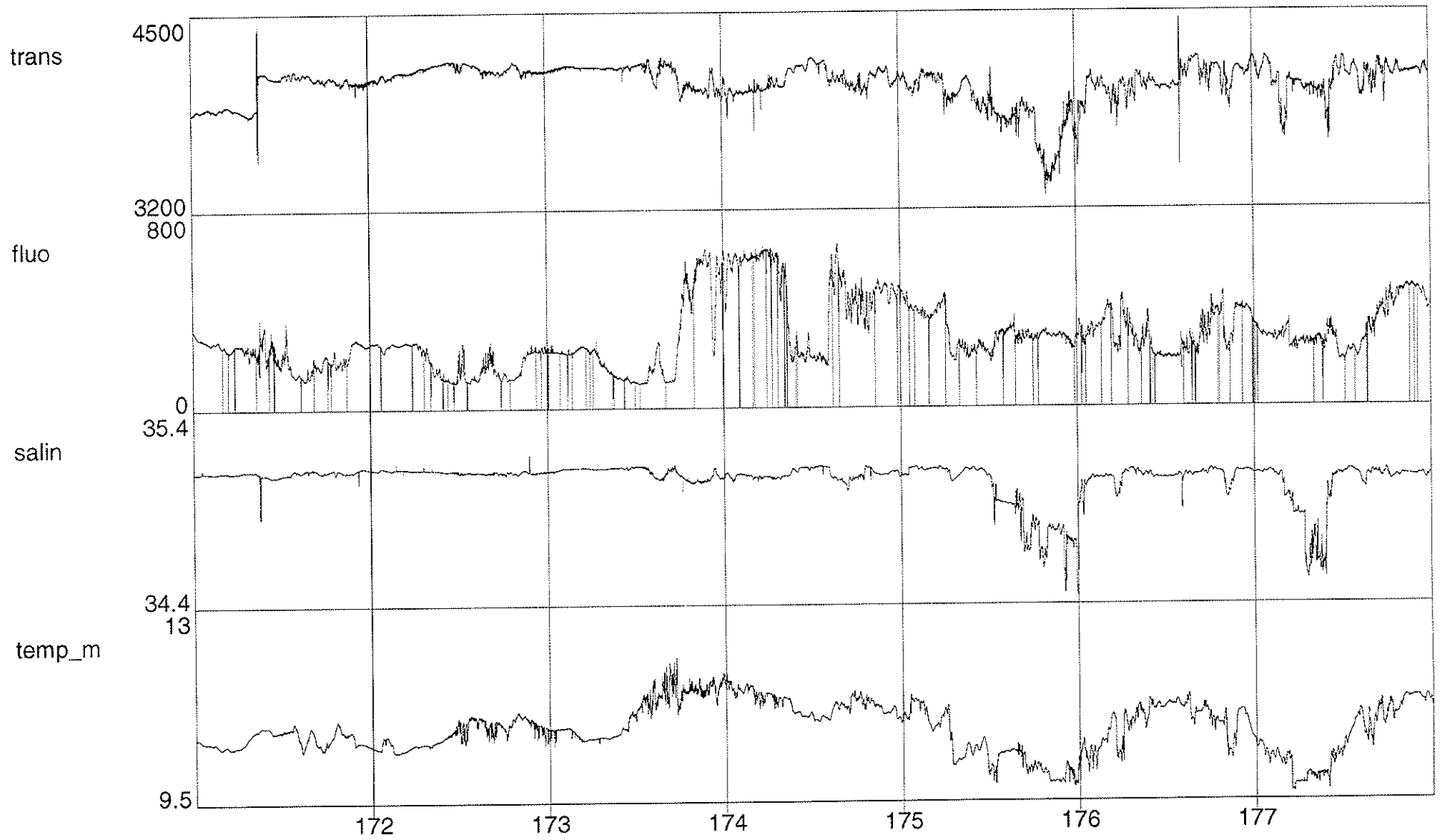

stir
0.01
0
airtemp
13
6
pres
1029
987
absdir
360
0
abswspd
40
0
172
173
174
175
176
177
Time
START 98 171 00:00:00
RRS Discovery 234 - Met

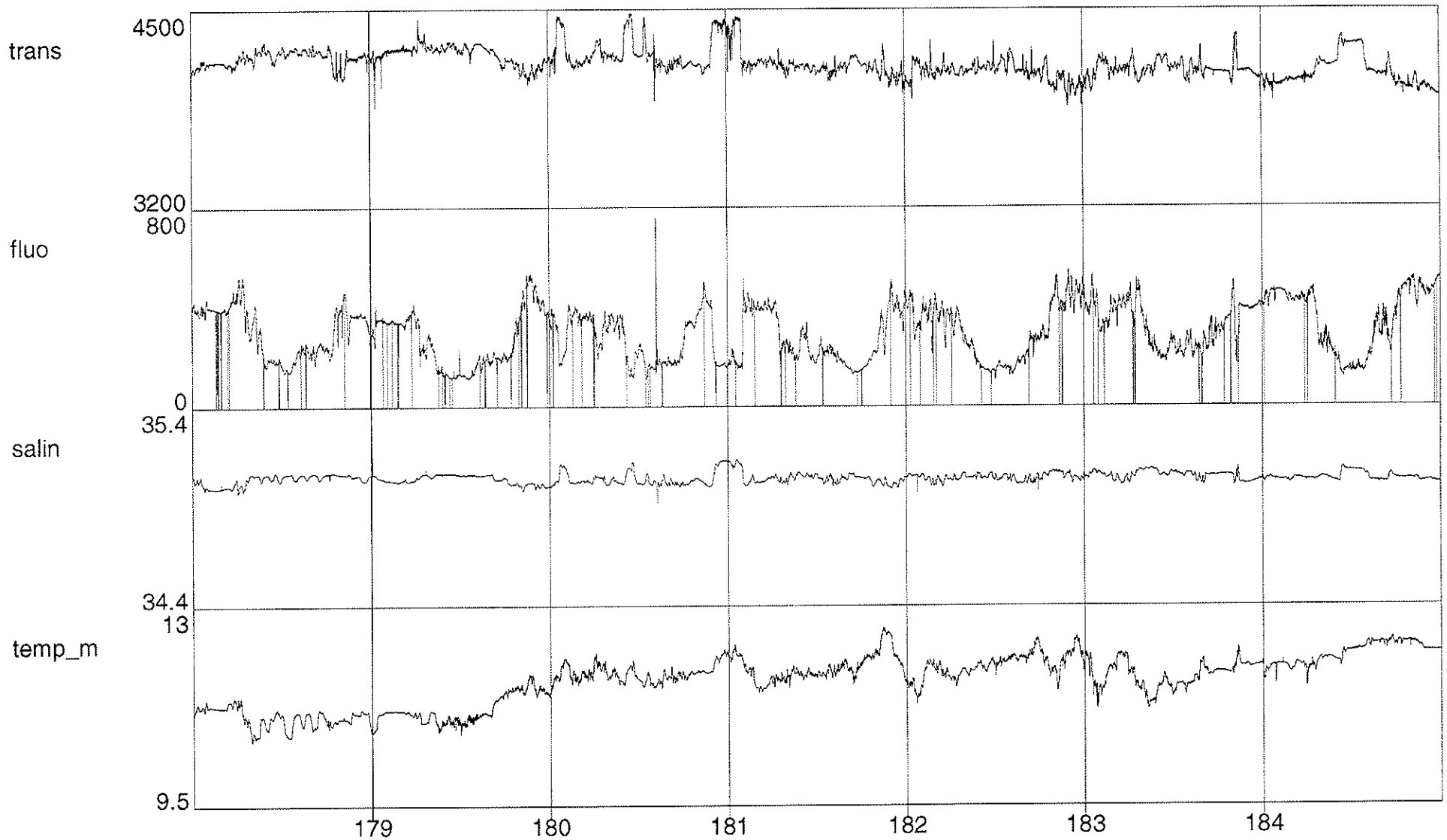

stir
0.01
0
airtemp
13
6
pres
1029
987
abswdir
360
0
absswspd
40
0
179
180
181
182
183
184
Time
START 98 178 00:00:00
RRS Discovery 234 - Met

WEEKLY UNDERWAY PLOTS
- TEMPERATURE, SALINITY, TRANSMISSOMETER AND FLUORESCENCE

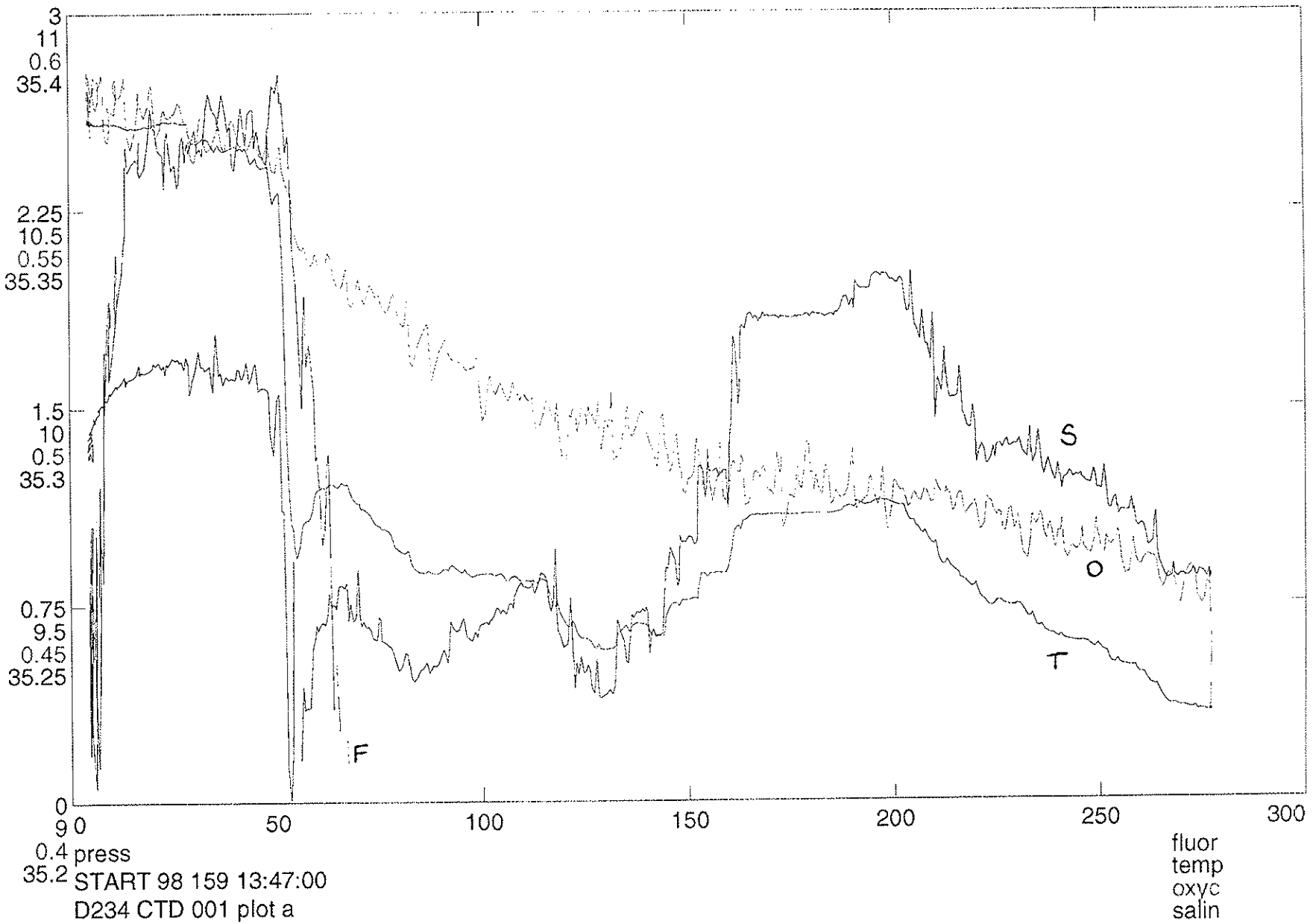

trans
4500
3200
fluo
800
0
salin
35.4
34.4
temp_m
13
9.5
158
159
160
161
162
163
Time
START 98 157 00:00:00
RRS Discovery 234 - Surface

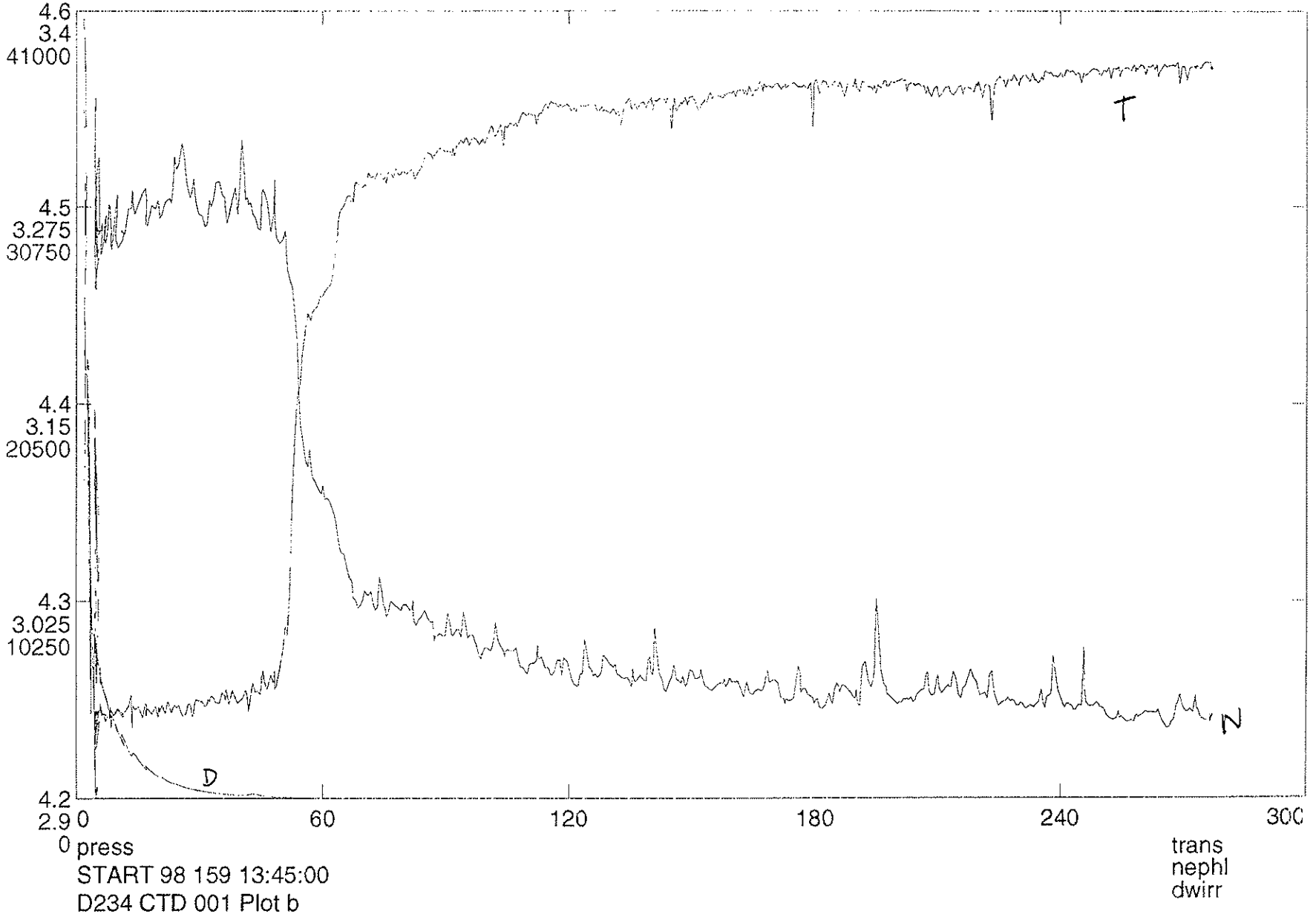

trans
4500
3200
fluo
800
0
salin
35.4
34.4
temp_m
13
9.5
165
166
167
168
169
170
Time
START 98 164 00:00:00
RRS Discovery 234 - Surface

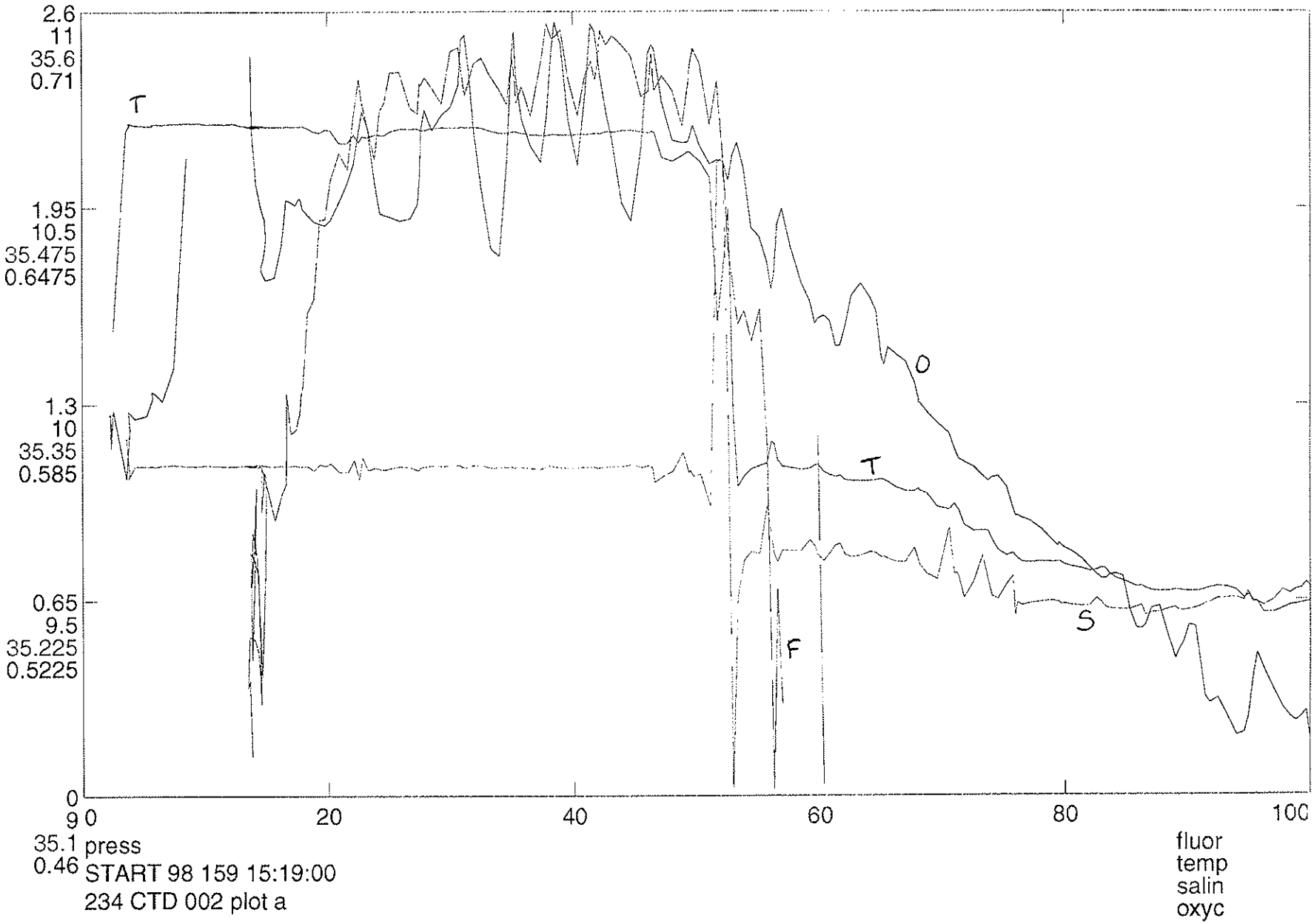

trans
4500
3200
fluo
800
0
salin
35.4
34.4
temp_m
13
9.5
172
173
174
175
176
177
Time
START 98 171 00:00:00
RRS Discovery 234 - Surface

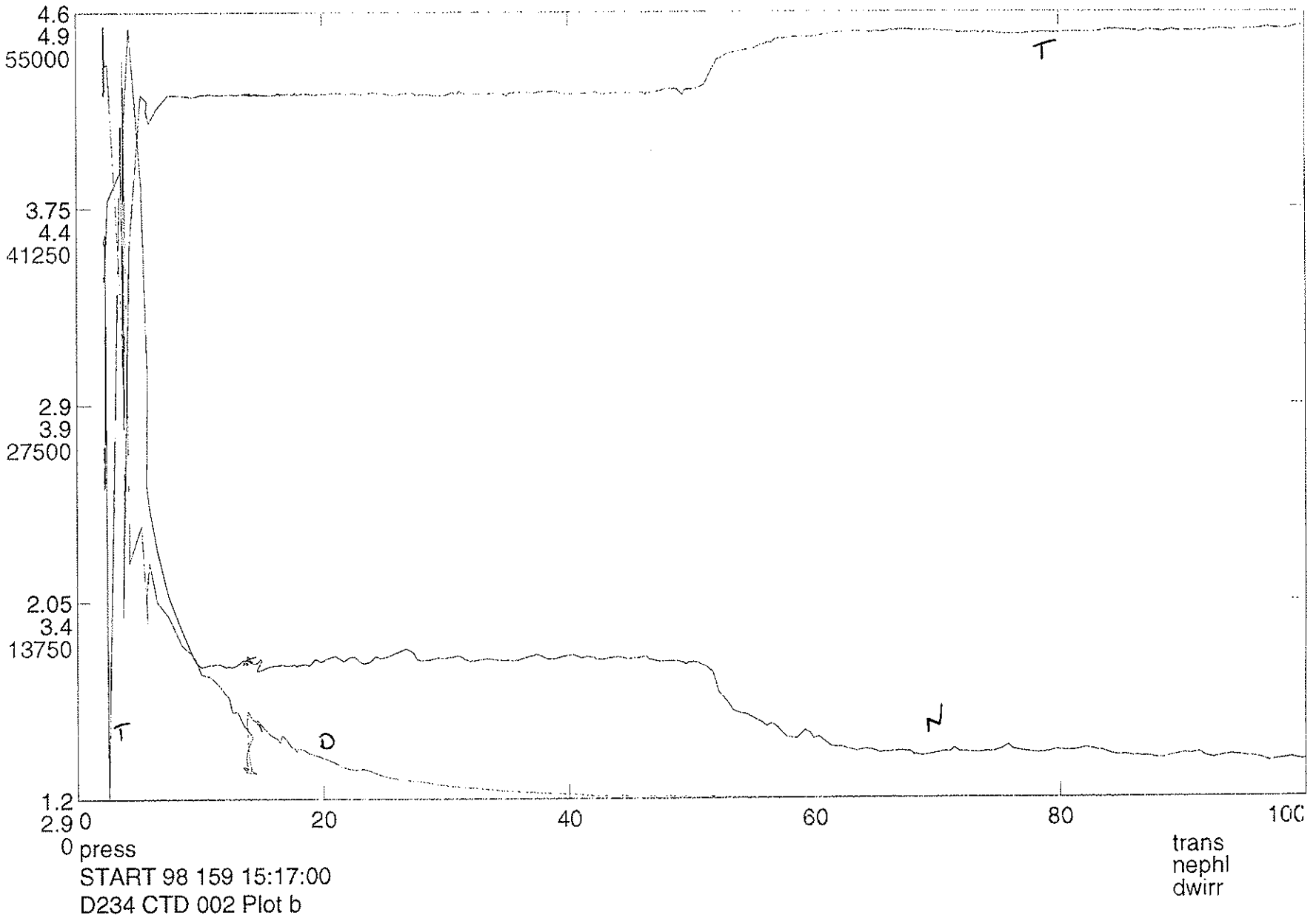

trans
4500
3200
fluo
800
0
salin
35.4
34.4
temp_m
13
9.5
179
180
181
182
183
184
Time
START 98 178 00:00:00
RRS Discovery 234 - Surface

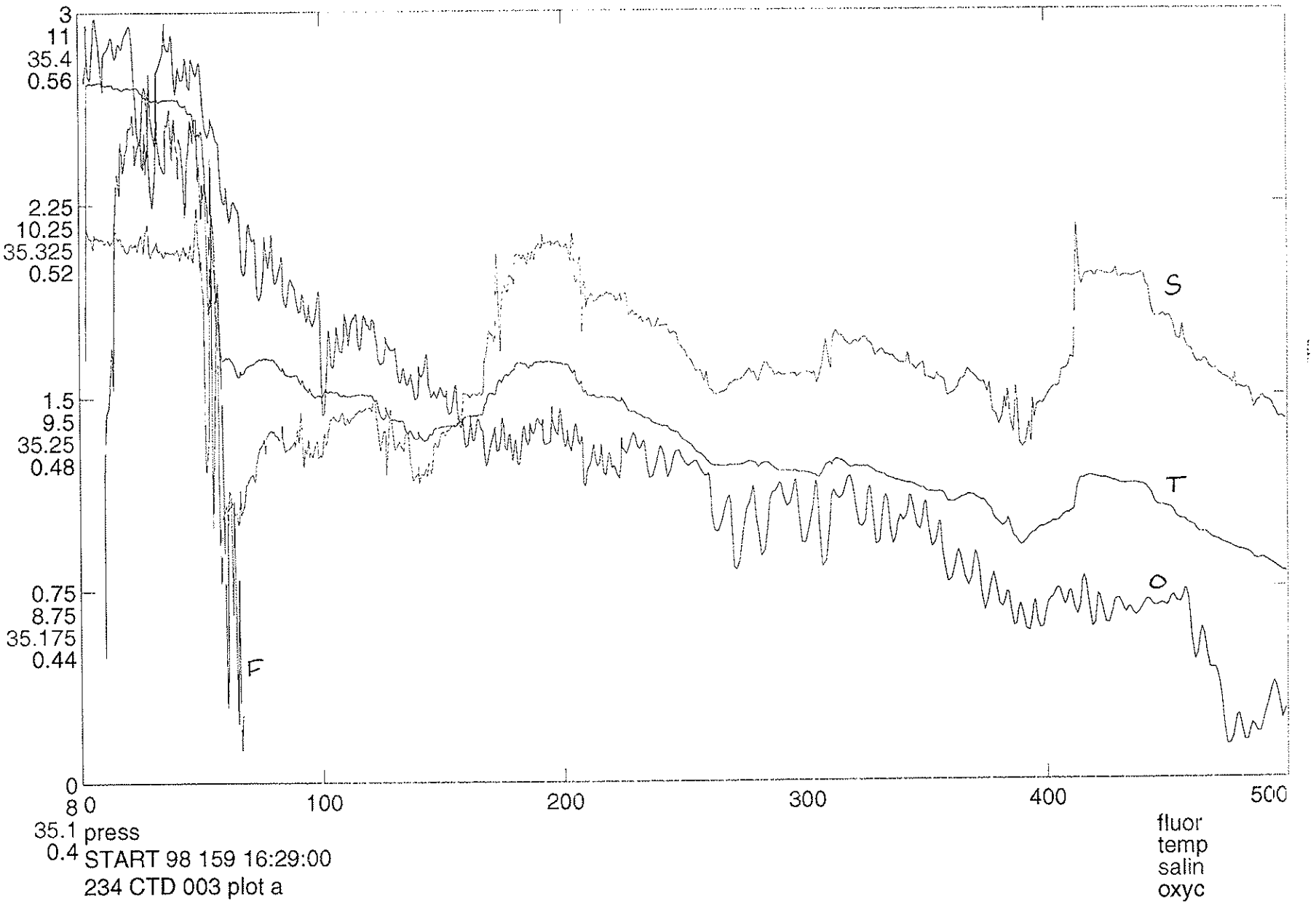
CTD PLOTS

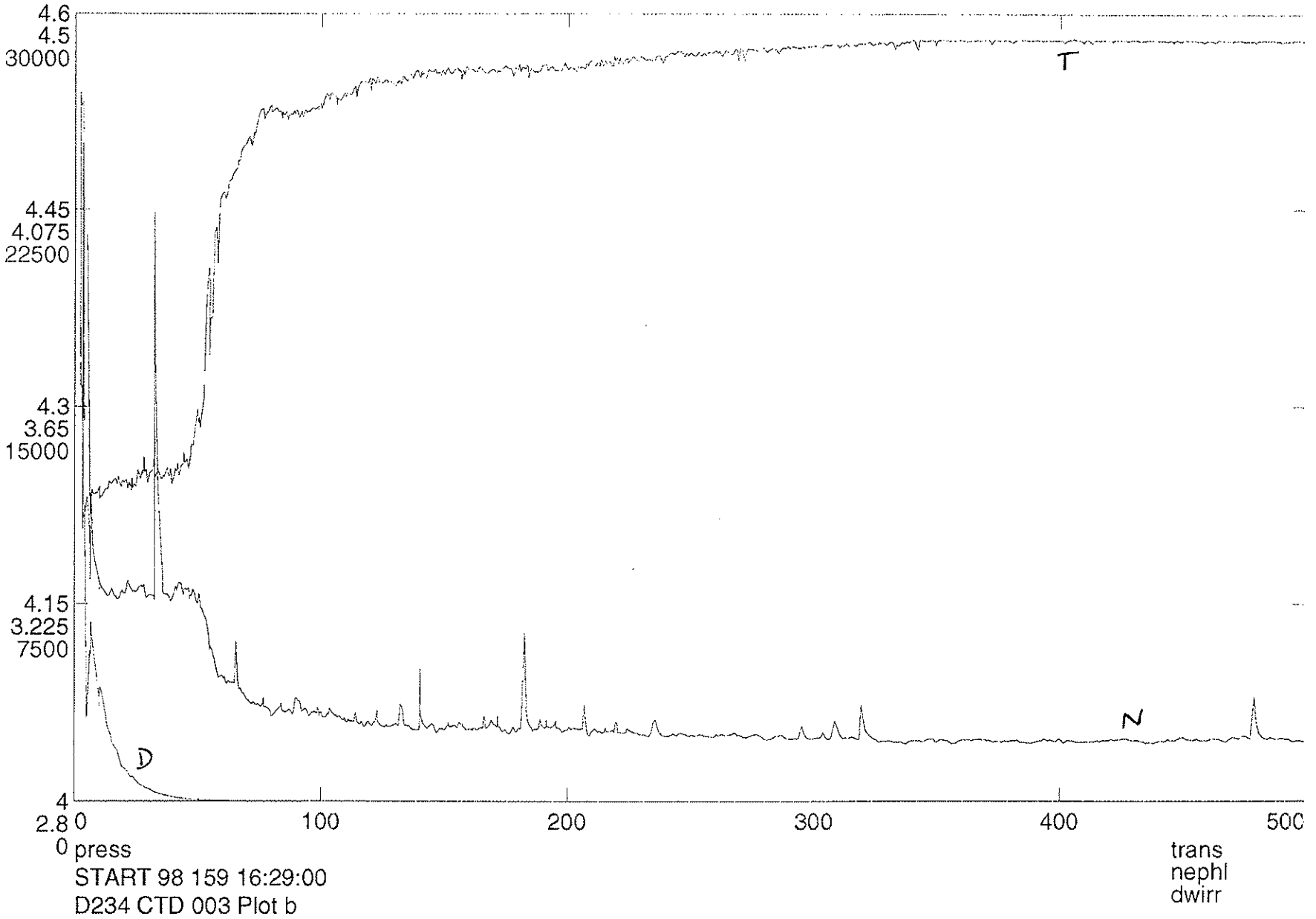

3
11
0.6
35.4
2.25
10.5
0.55
35.35
1.5
10
0.5
35.3
0.75
9.5
0.45
35.25
0
9
0.4
35.2
0
50
100
150
200
250
300
S
O
T
F
press
START 98 159 13:47:00
D234 CTD 001 plot a
fluor
temp
oxyc
salin

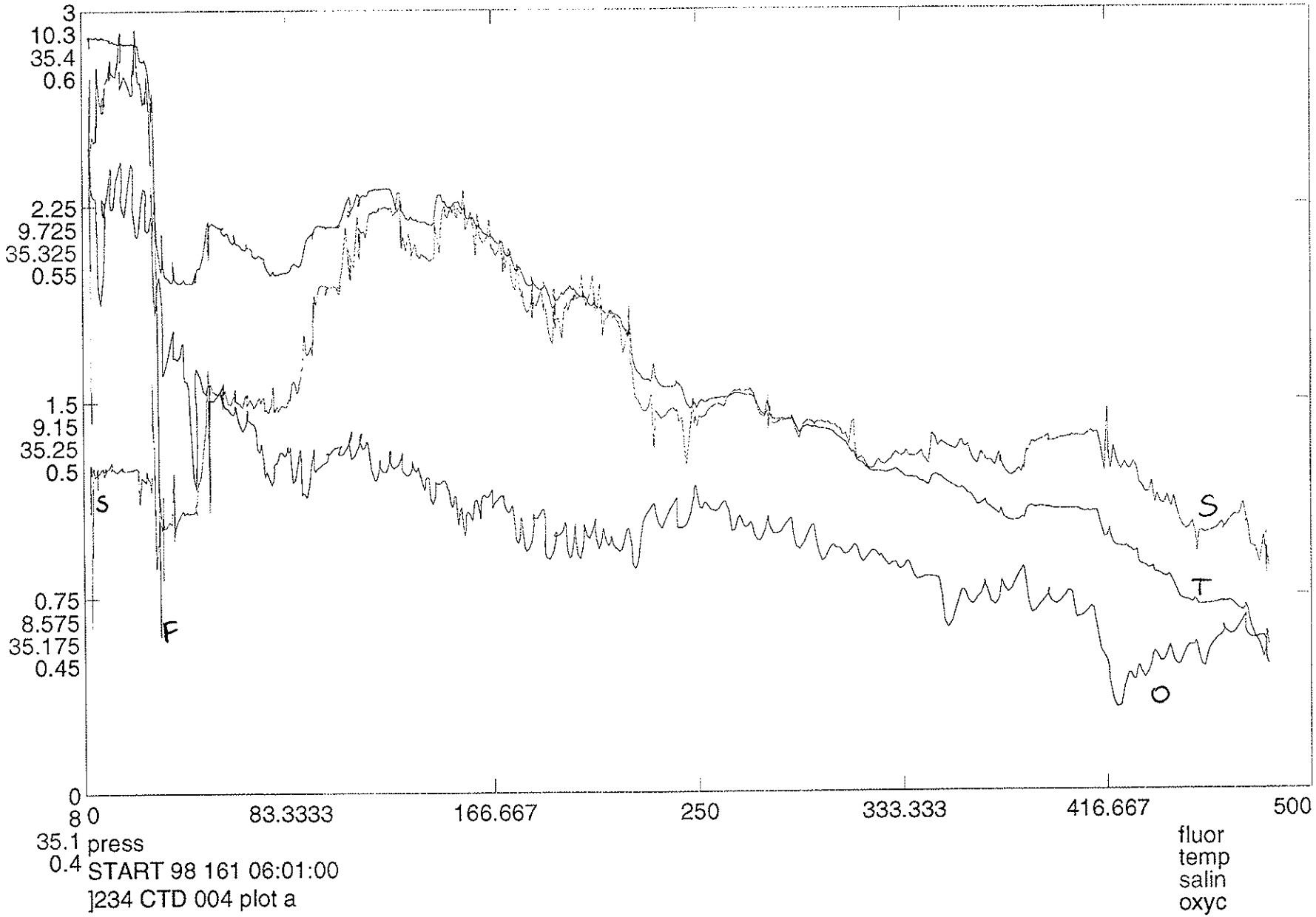

4.6
3.4
41000
4.5
3.275
30750
4.4
3.15
20500
4.3
3.025
10250
4.2
2.9
0
0
60
120
180
240
300
press
trans
nephl
dwirr
T
D
N
START 98 159 13:45:00
D234 CTD 001 Plot b

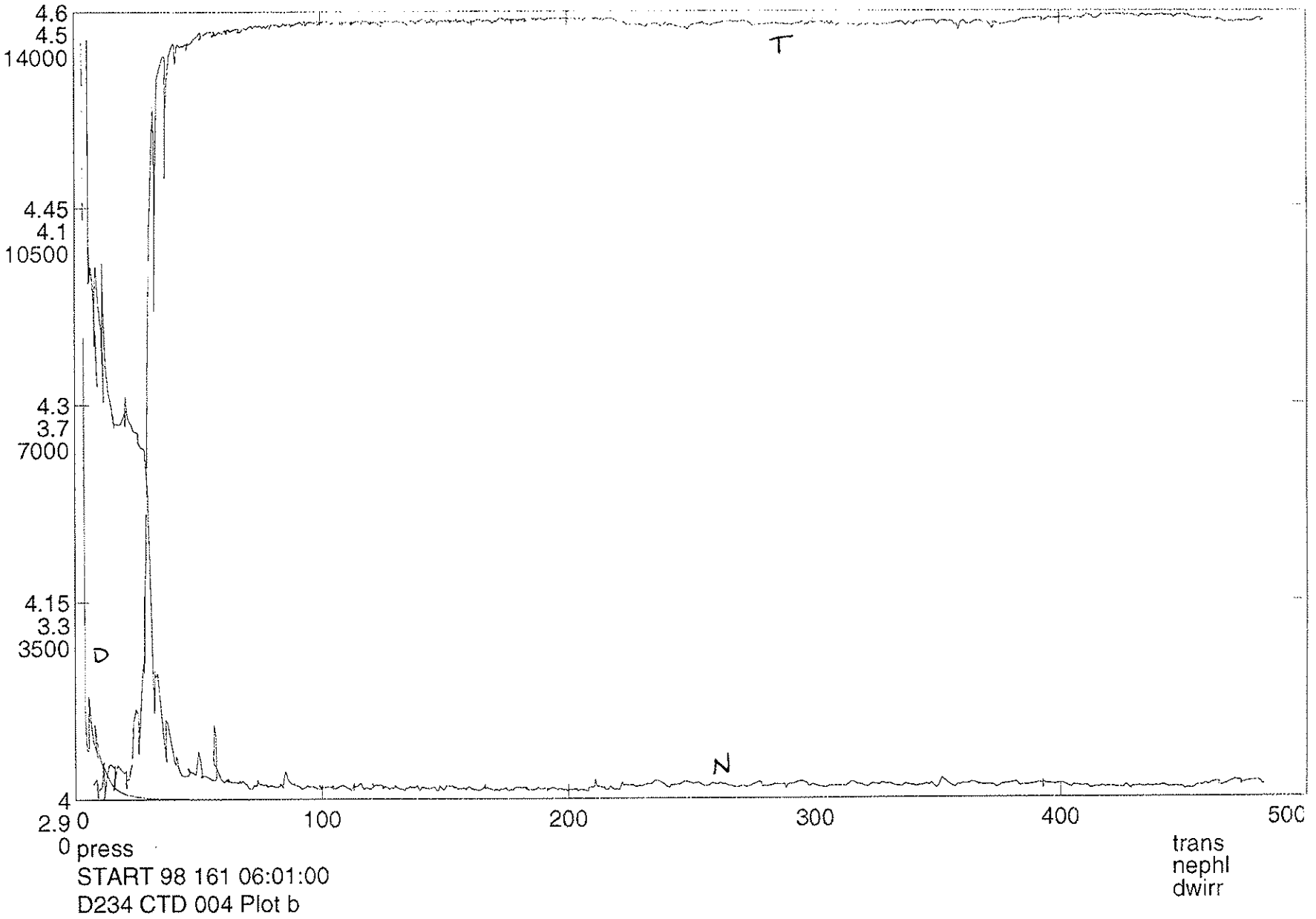

2.6
11
35.6
0.71
1.95
10.5
35.475
0.6475
1.3
10
35.35
0.585
0.65
9.5
35.225
0.5225
0
9
35.1
0.46
T
T
O
F
S
0
20
40
60
80
100
press
START 98 159 15:19:00
234 CTD 002 plot a
fluor
temp
salin
oxyc

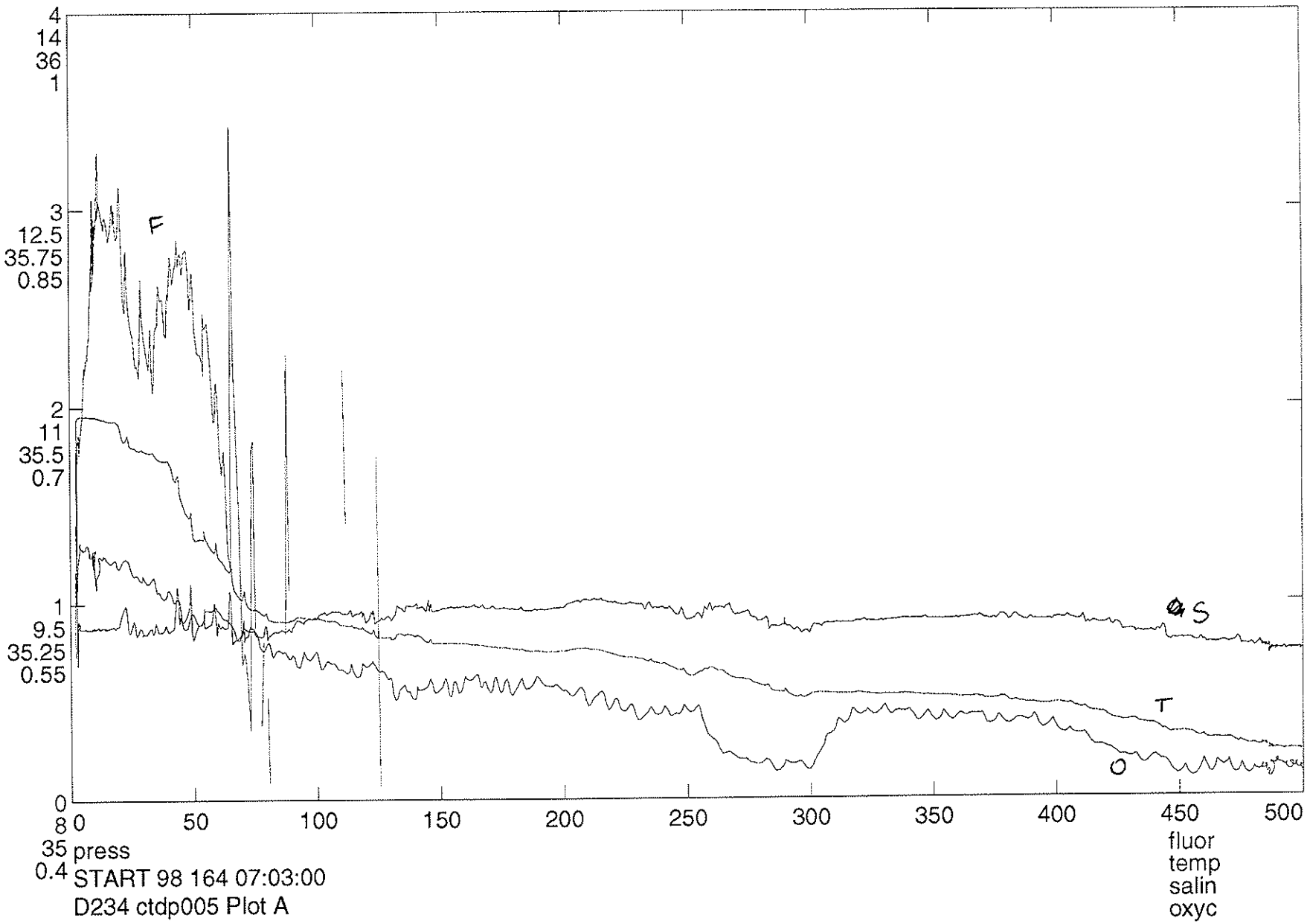

4.6
4.9
55000
3.75
4.4
41250
2.9
3.9
27500
2.05
3.4
13750
1.2
2.9
0
0
20
40
60
80
100
T
T
D
N
0 press
START 98 159 15:17:00
D234 CTD 002 Plot b
trans
nephl
dwirr

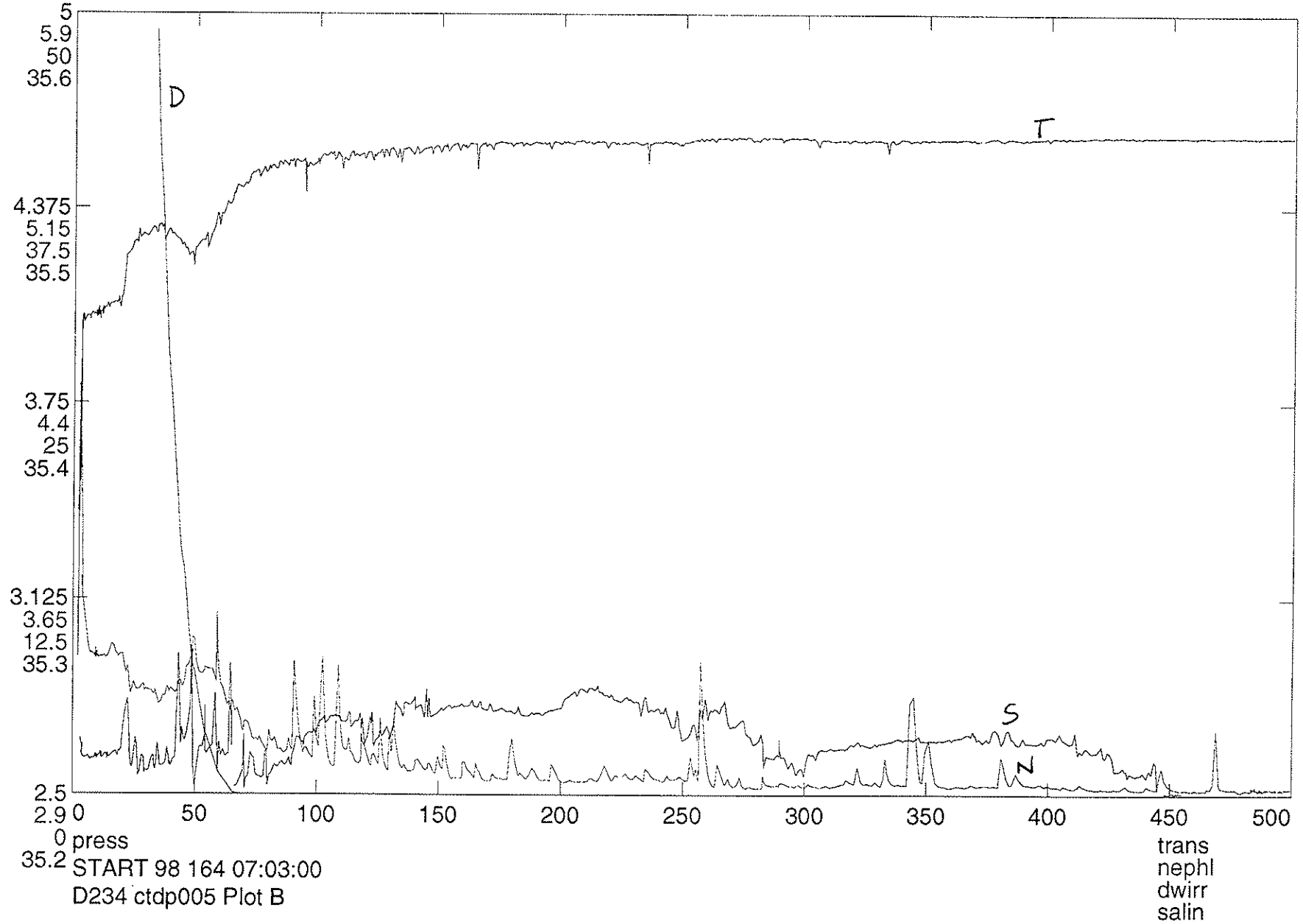

3
11
35.4
0.56
2.25
10.25
35.325
0.52
1.5
9.5
35.25
0.48
0.75
8.75
35.175
0.44
0
8
35.1
0.4
0
100
200
300
400
500
S
T
O
F
press
START 98 159 16:29:00
234 CTD 003 plot a
fluor
temp
salin
oxyc

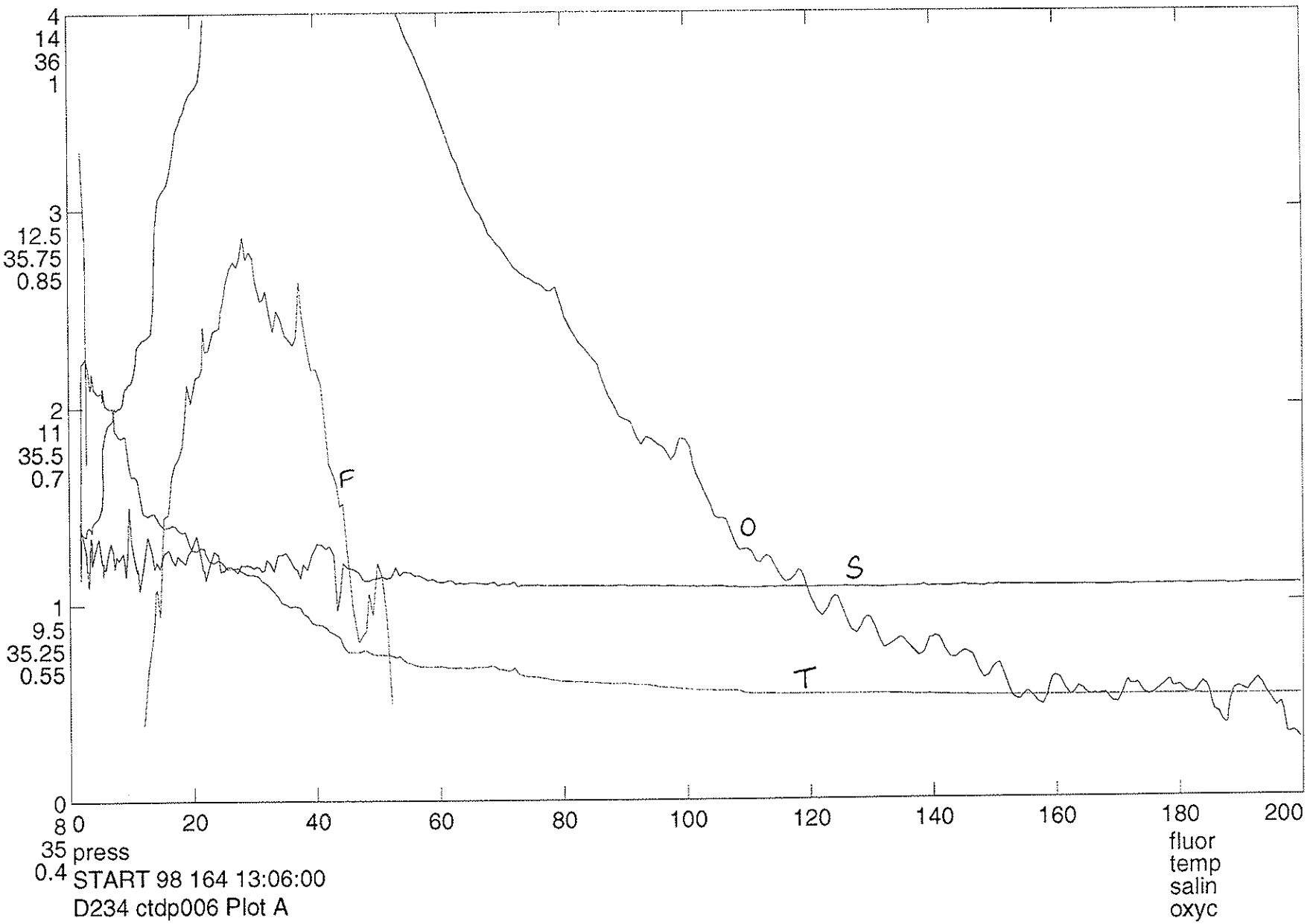

4.6
4.5
30000
4.45
4.075
22500
4.3
3.65
15000
4.15
3.225
7500
4
2.8
0
0
100
200
300
400
500
press
START 98 159 16:29:00
D234 CTD 003 Plot b
T
N
D
trans
nephl
dwirr

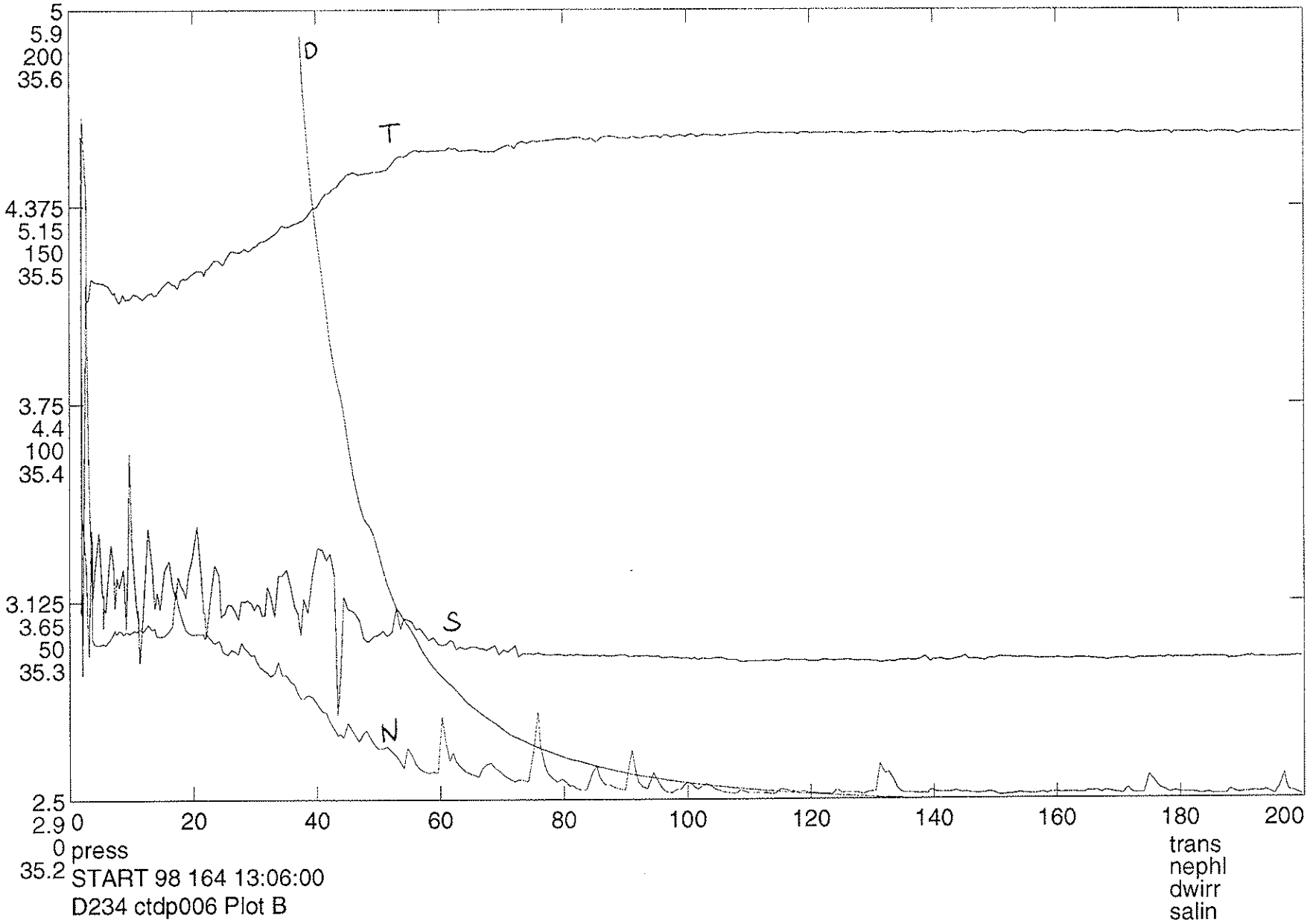

3
10.3
35.4
0.6
2.25
9.725
35.325
0.55
1.5
9.15
35.25
0.5
0.75
8.575
35.175
0.45
0
8
35.1
0.4
0
83.3333
166.667
250
333.333
416.667
500
press
START 98 161 06:01:00
]234 CTD 004 plot a
fluor
temp
salin
oxyc
S
F
S
T
O

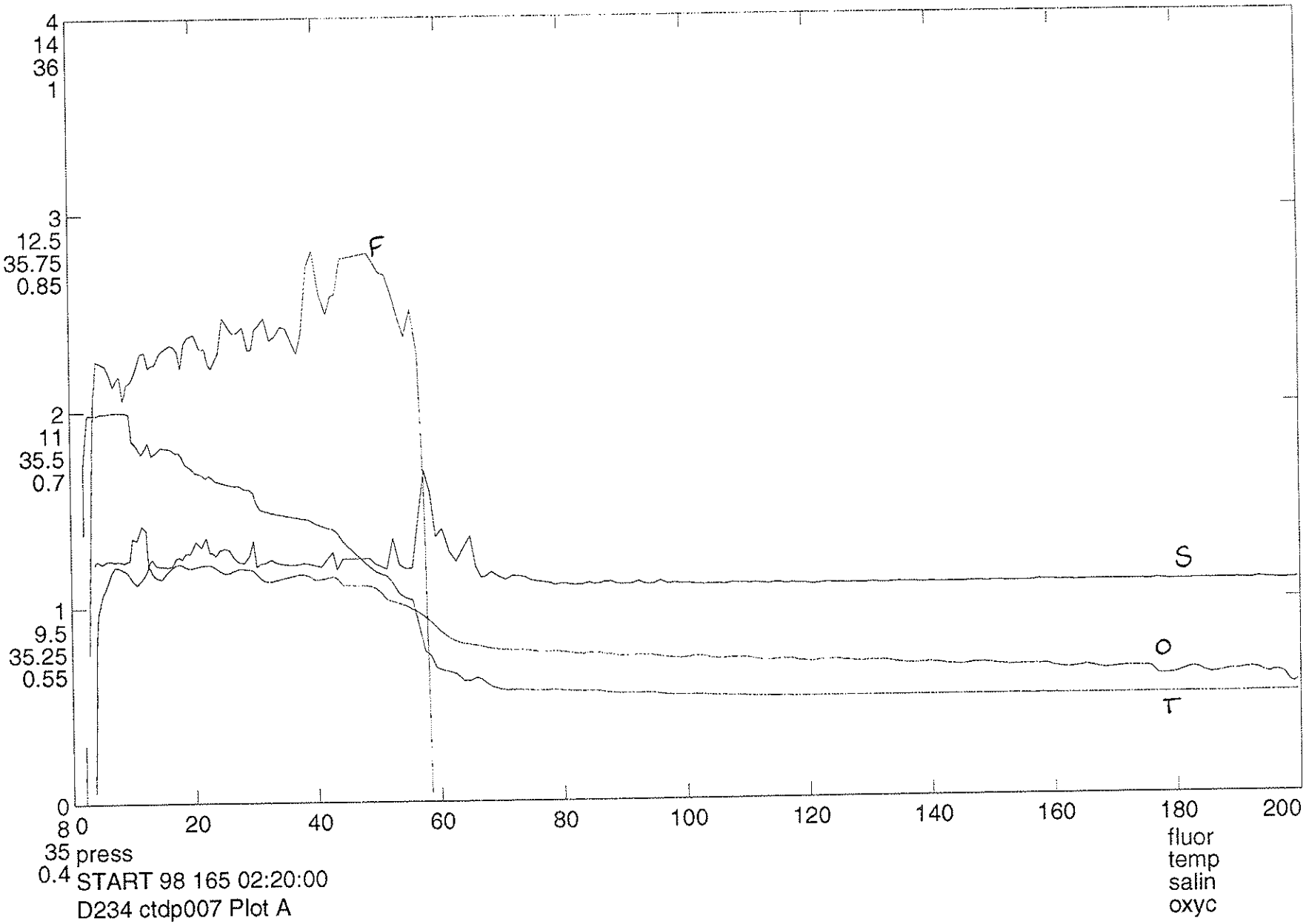

4.6
4.5
14000
4.45
4.1
10500
4.3
3.7
7000
4.15
3.3
3500
4
2.9
T
D
N
0
100
200
300
400
500
0 press
START 98 161 06:01:00
D234 CTD 004 Plot b
trans
nephl
dwirr

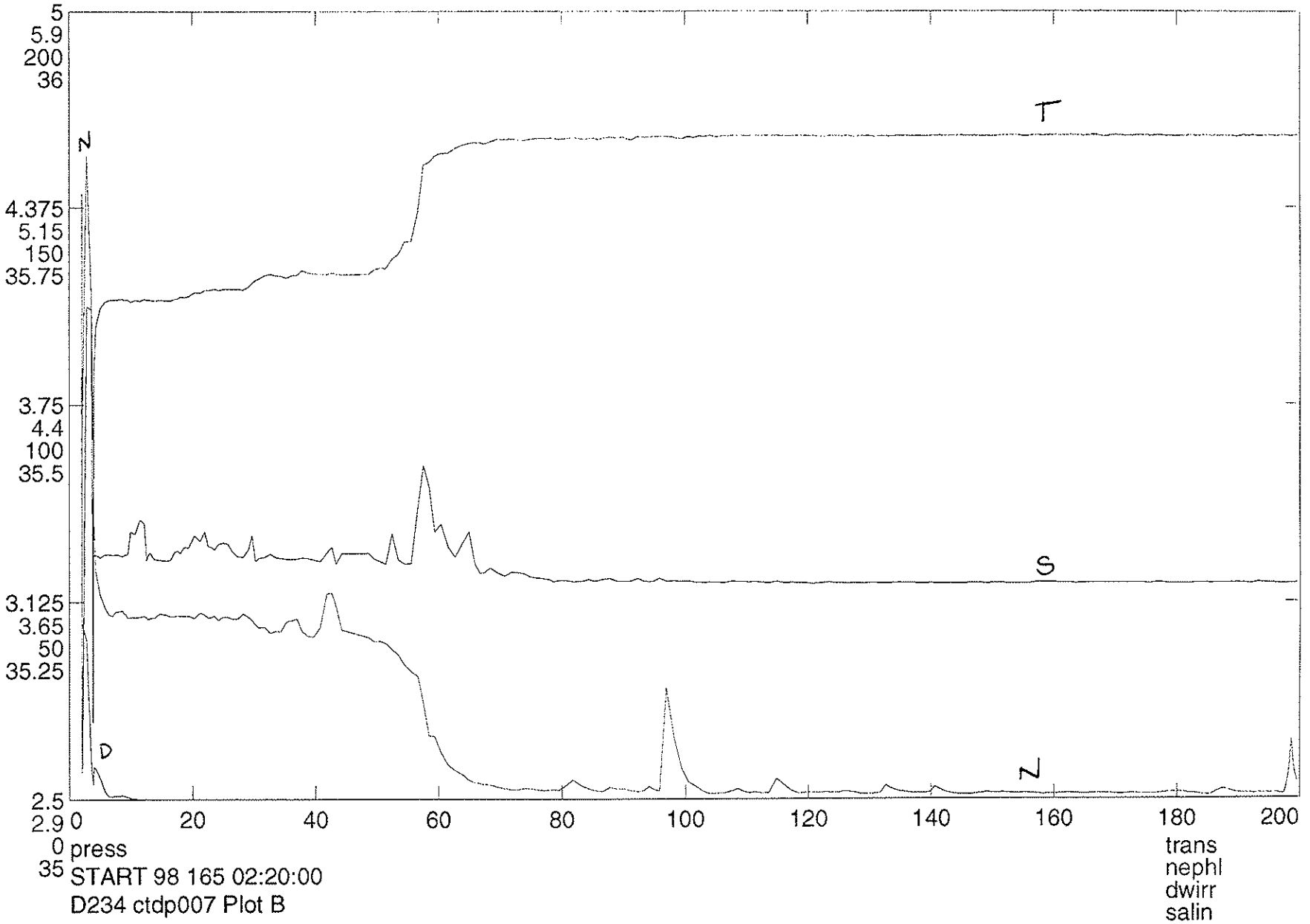

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
F
S
T
O
0
50
100
150
200
250
300
350
400
450
500
press
fluor
temp
salin
oxyc
START 98 164 07:03:00
D234 ctdp005 Plot A

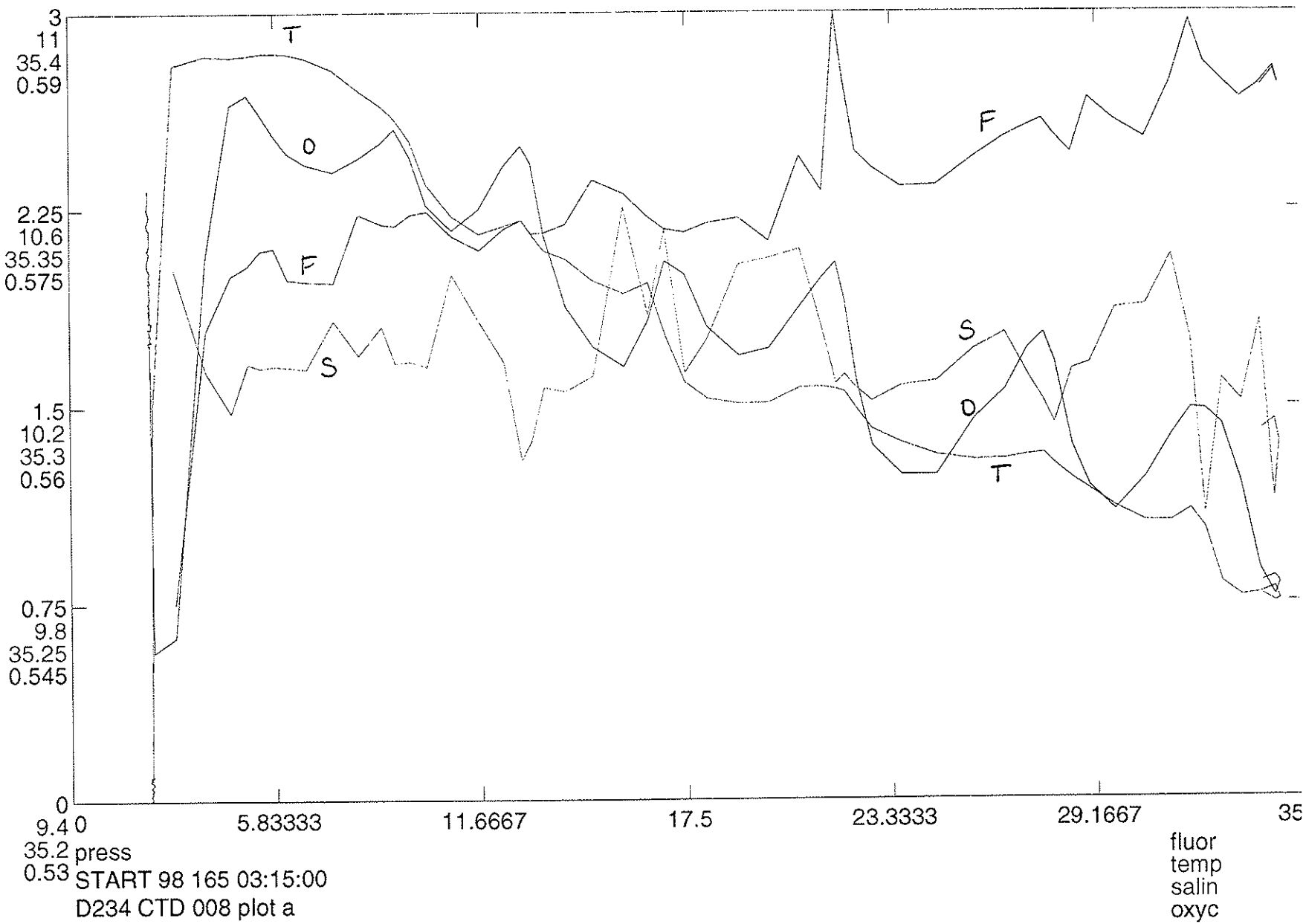

5
5.9
50
35.6
D
T
4.375
5.15
37.5
35.5
3.75
4.4
25
35.4
3.125
3.65
12.5
35.3
S
N
2.5
2.9
0
50
100
150
200
250
300
350
400
450
500
0 press
35.2
START 98 164 07:03:00
D234 ctdp005 Plot B
trans
nephl
dwirr
salin

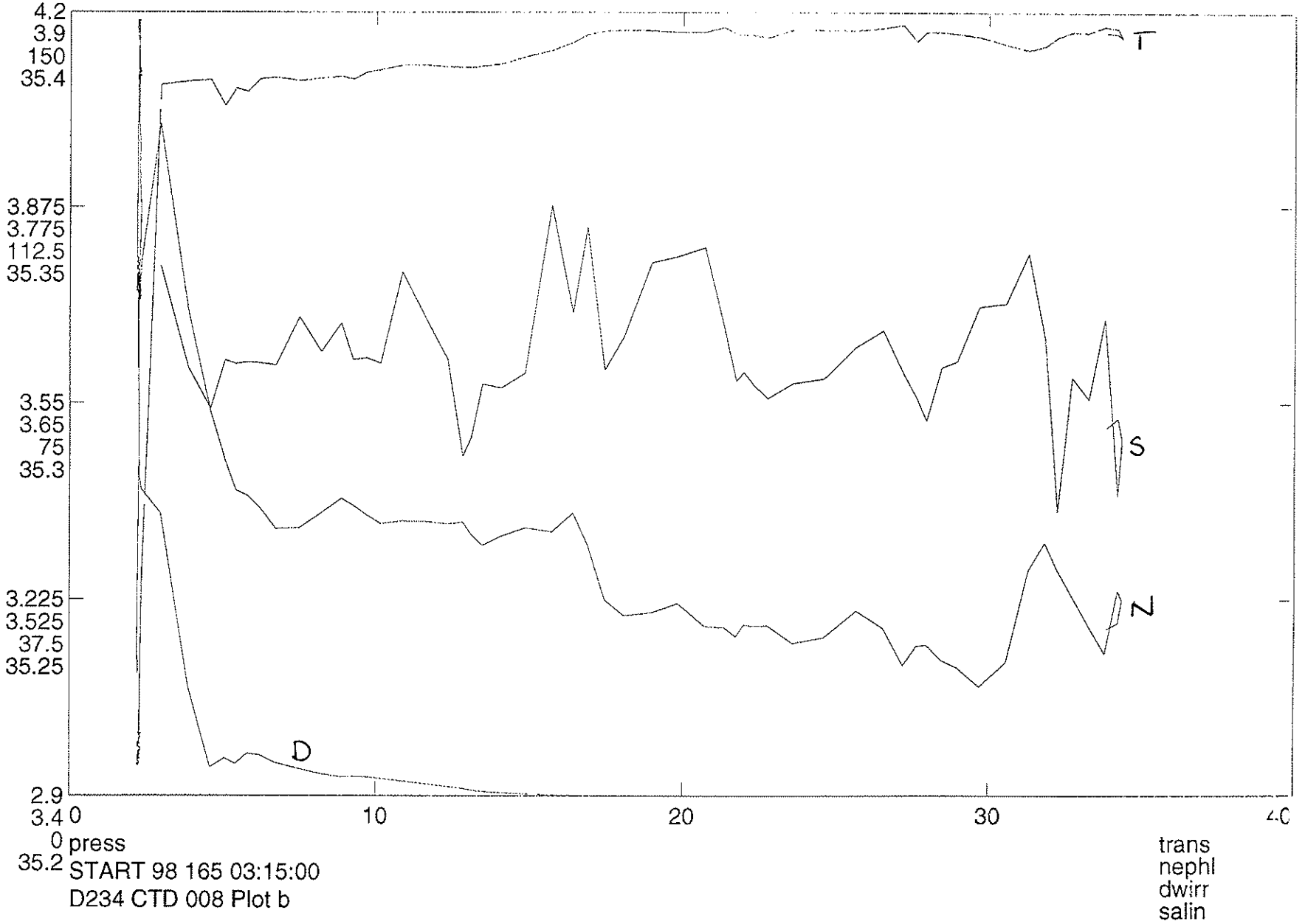

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
20
40
60
80
100
120
140
160
180
200
fluor
temp
salin
oxyc
F
O
S
T
START 98 164 13:06:00
D234 ctdp006 Plot A

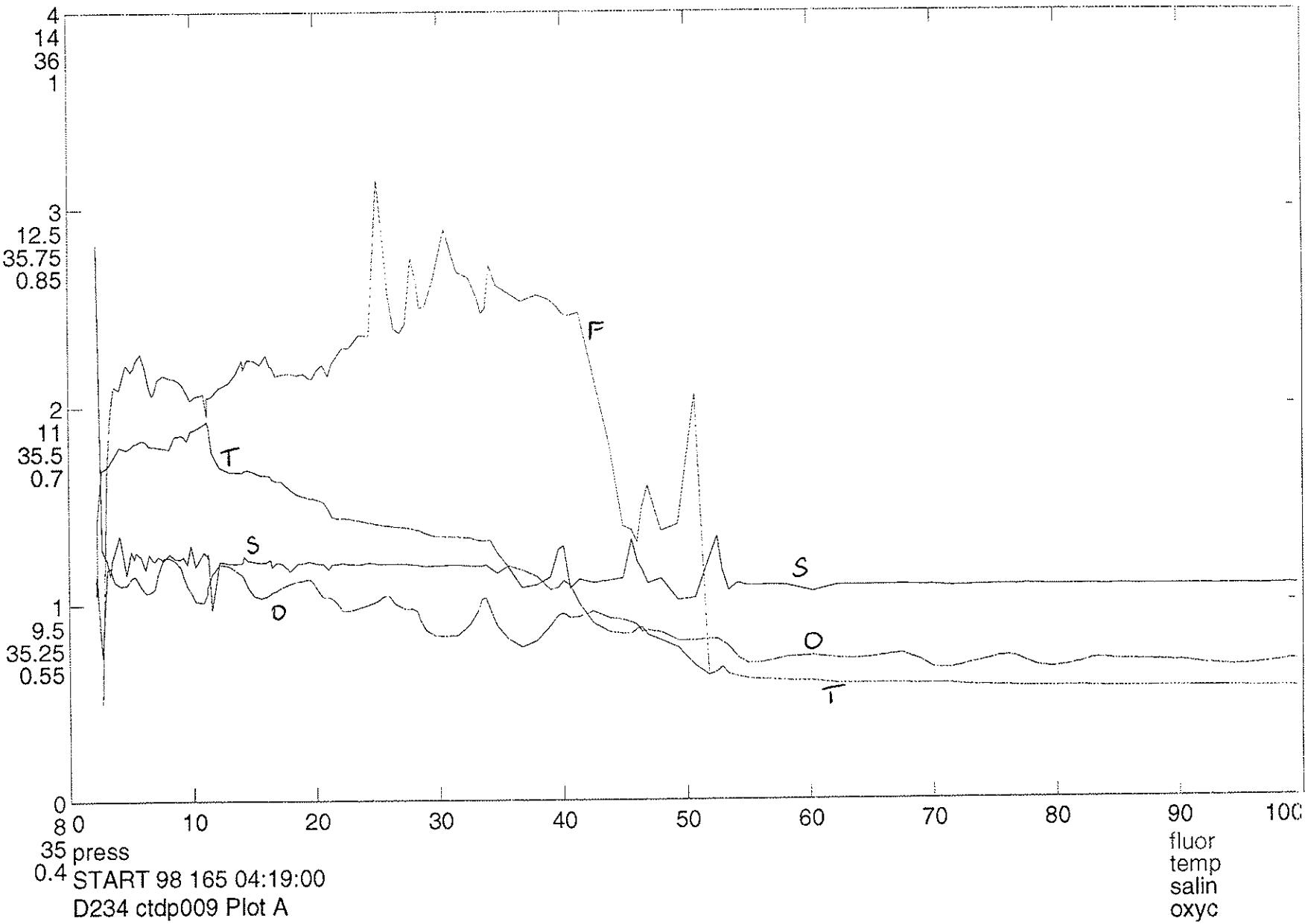

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
D
T
S
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 164 13:06:00
D234 ctdp006 Plot B
trans
nephl
dwirr
salin

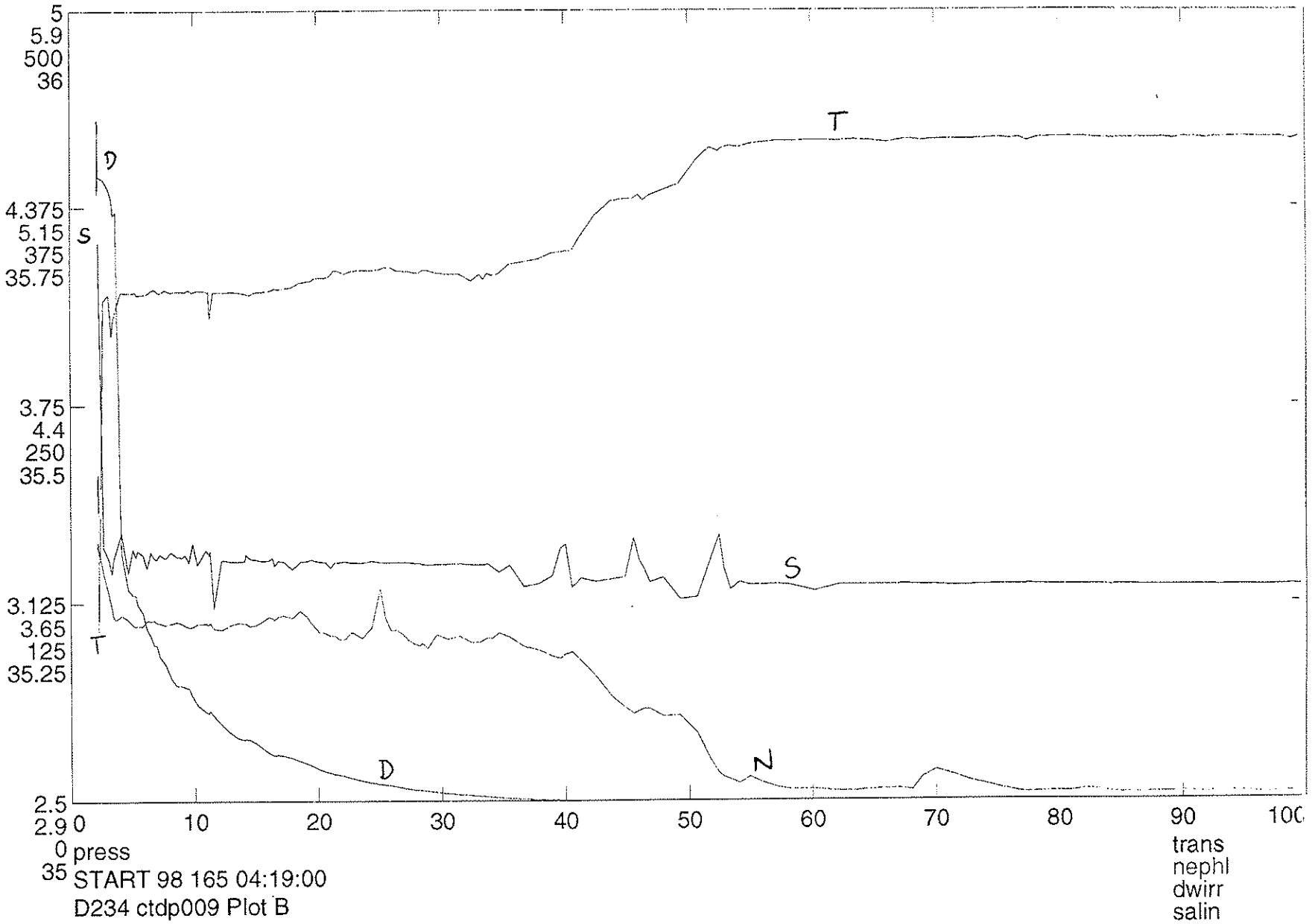

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
F
S
O
T
0
20
40
60
80
100
120
140
160
180
200
press
START 98 165 02:20:00
D234 ctdp007 Plot A
fluor
temp
salin
oxyc

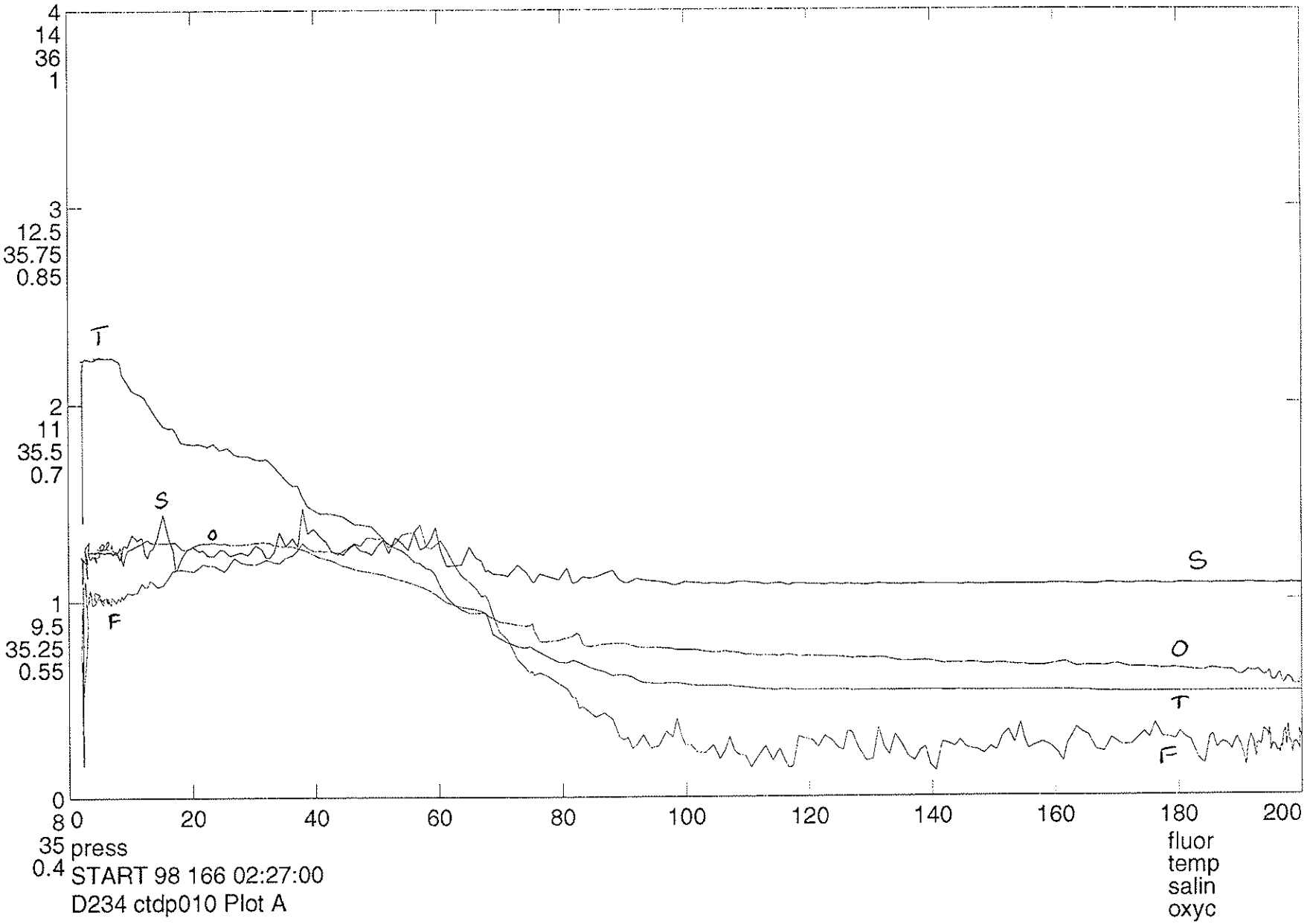

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
0
35
N
D
T
S
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 165 02:20:00
D234 ctdp007 Plot B
trans
nephl
dwirr
salin

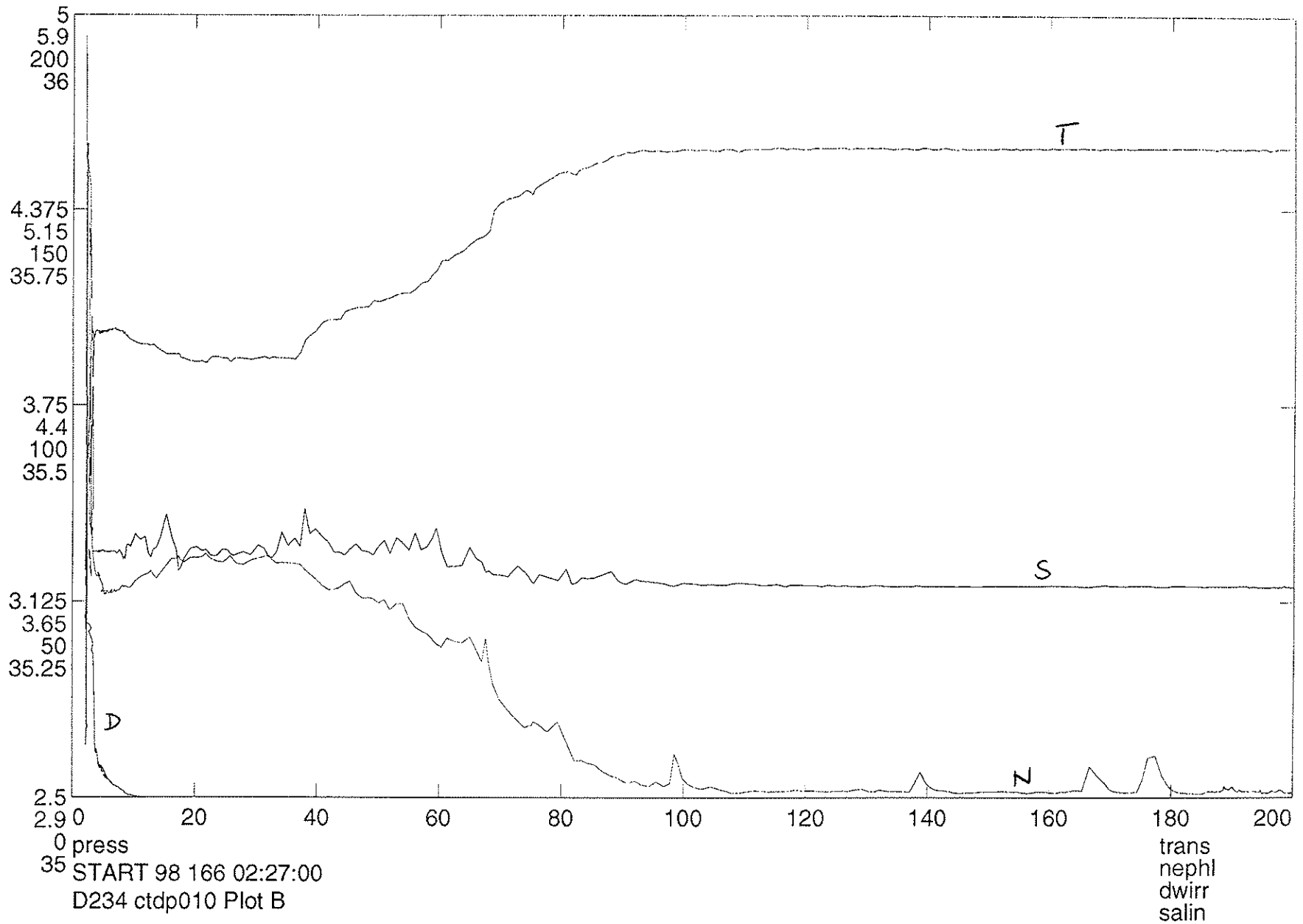

3
11
35.4
0.59
2.25
10.6
35.35
0.575
1.5
10.2
35.3
0.56
0.75
9.8
35.25
0.545
0
9.4
35.2
0.53
T
O
F
S
F
S
O
T
0
5.83333
11.6667
17.5
23.3333
29.1667
35
press
START 98 165 03:15:00
D234 CTD 008 plot a
fluor
temp
salin
oxyc

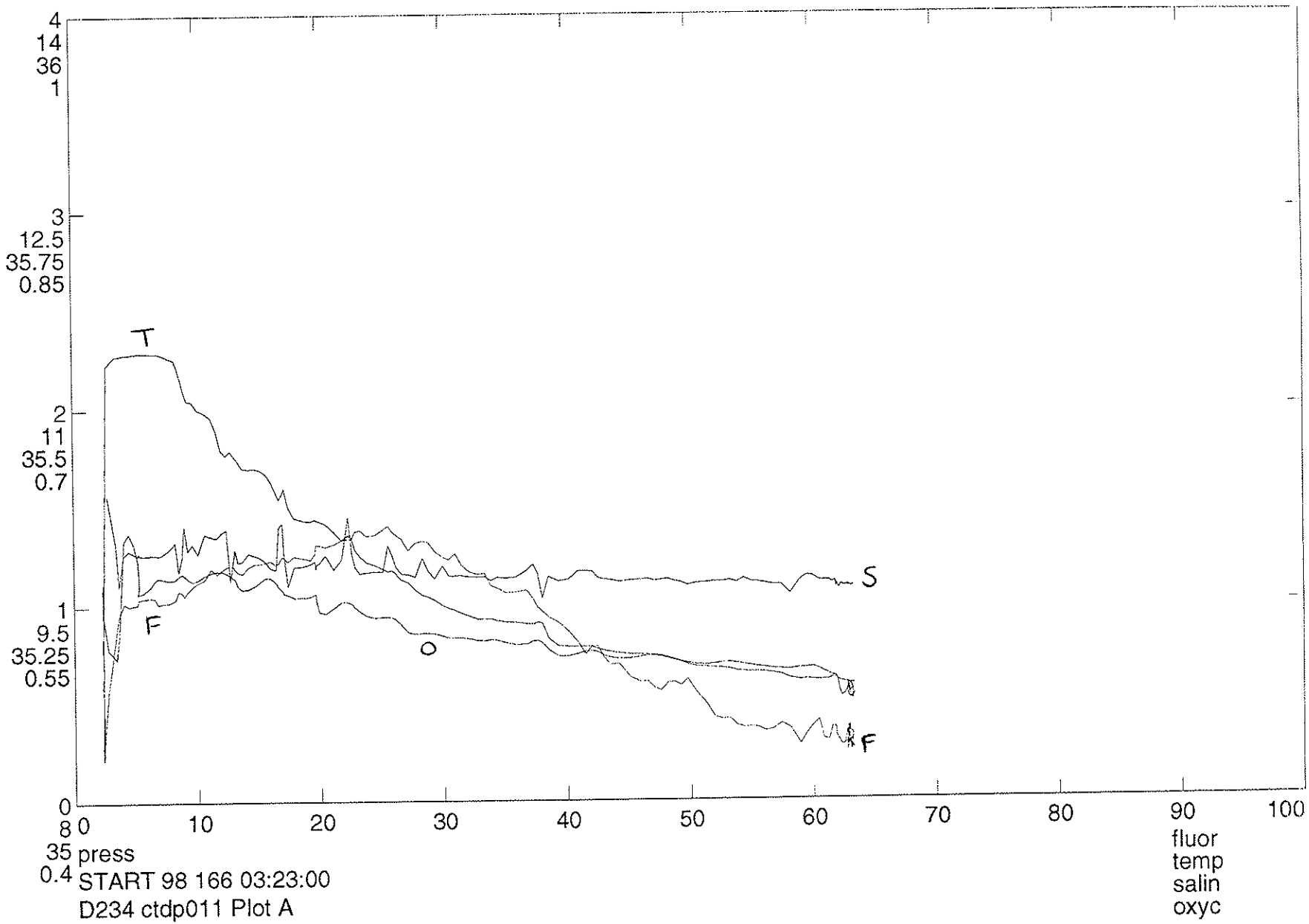

4.2
3.9
150
35.4
3.875
3.775
112.5
35.35
3.55
3.65
75
35.3
3.225
3.525
37.5
35.25
2.9
3.4
0
35.2
T
S
N
D
0
10
20
30
40
0 press
START 98 165 03:15:00
D234 CTD 008 Plot b
trans
nephl
dwirr
salin

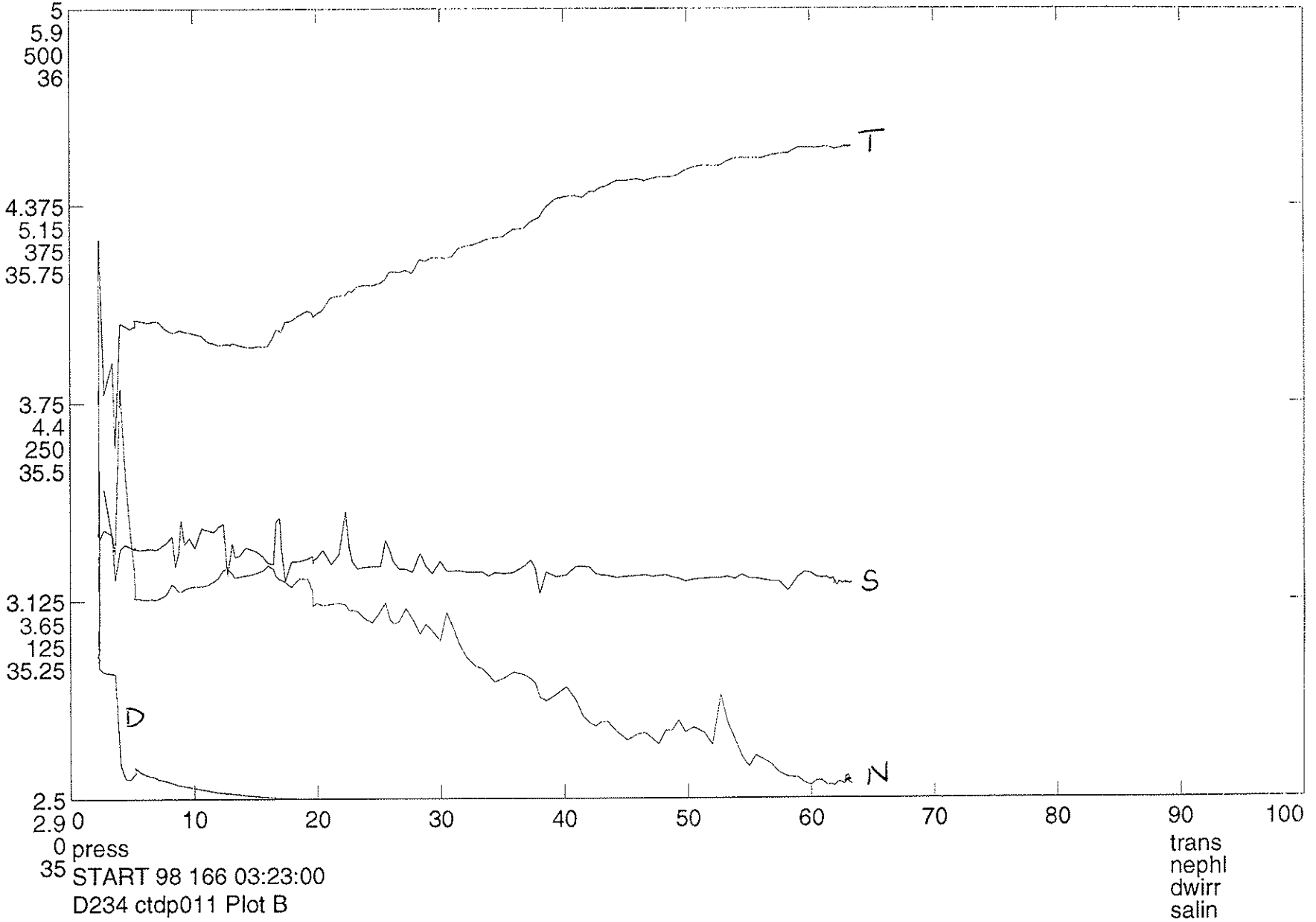

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
F
T
S
O
T
S
O
START 98 165 04:19:00
D234 ctdp009 Plot A

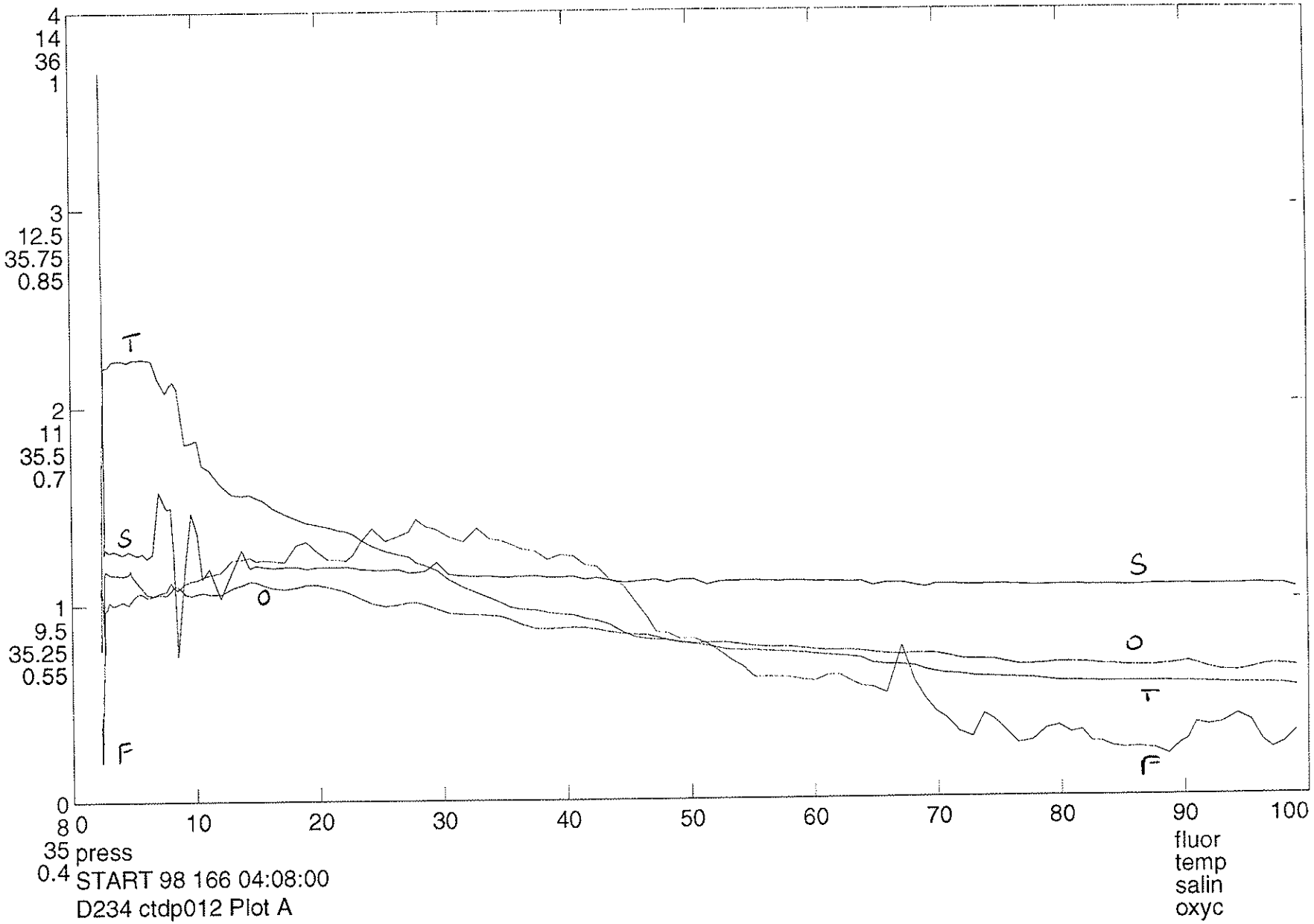

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
0
10
20
30
40
50
60
70
80
90
100
T
S
D
N
D
S
T
0 press
START 98 165 04:19:00
D234 ctdp009 Plot B
trans
nephl
dwirr
salin

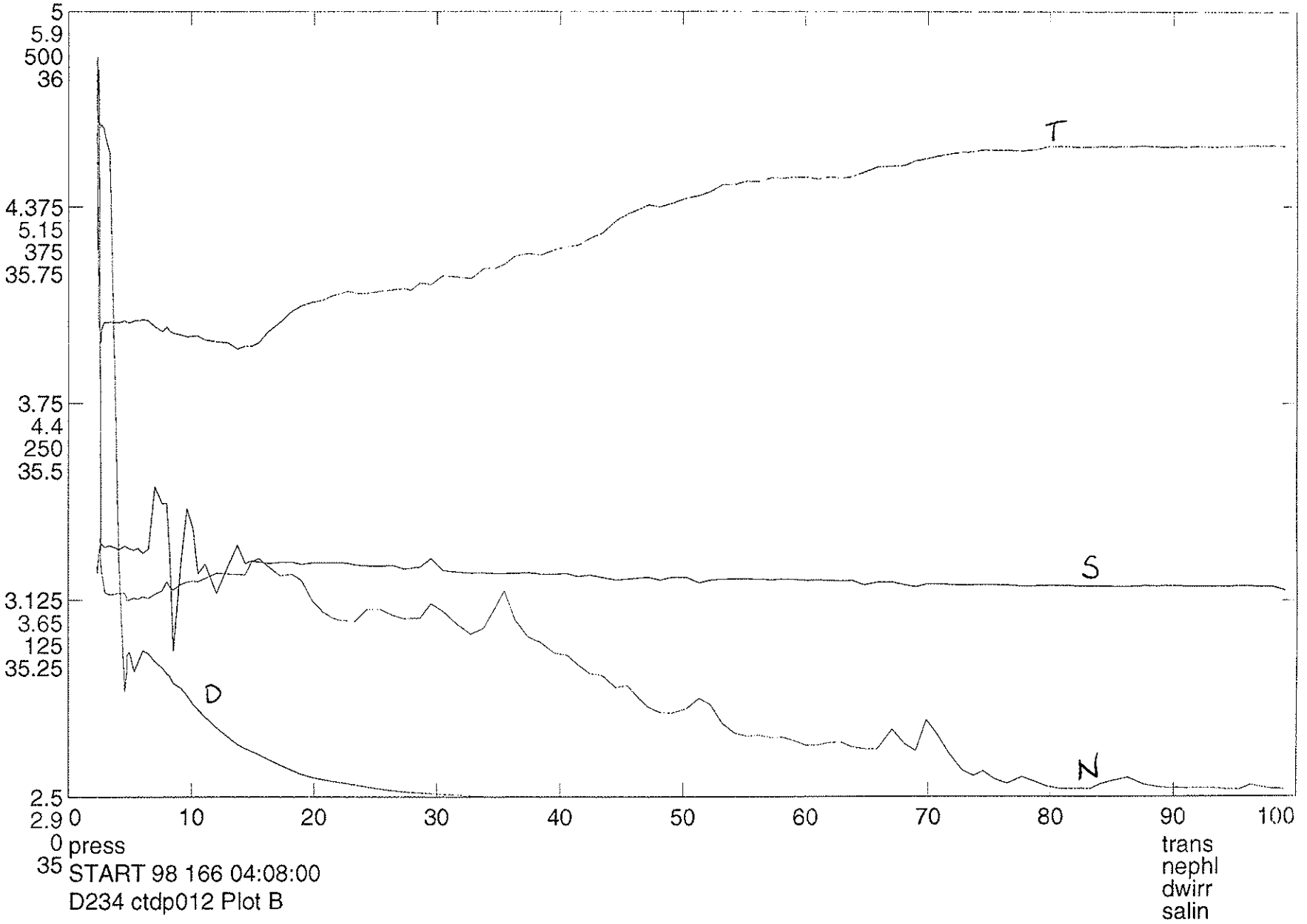

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 166 02:27:00
D234 ctdp010 Plot A
fluor
temp
salin
oxyc

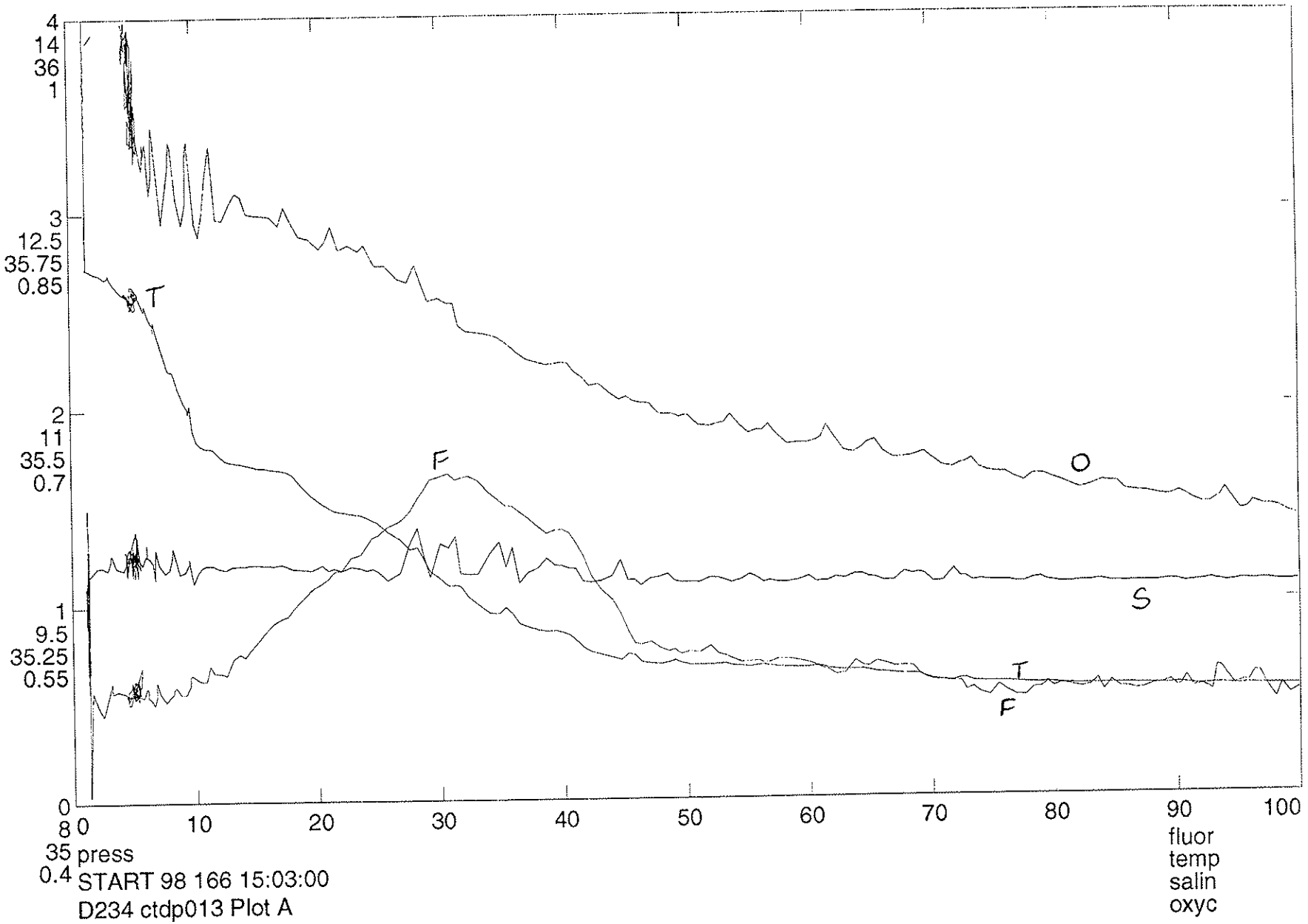

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
0
35
T
S
D
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 166 02:27:00
D234 ctdp010 Plot B
trans
nephl
dwirr
salin

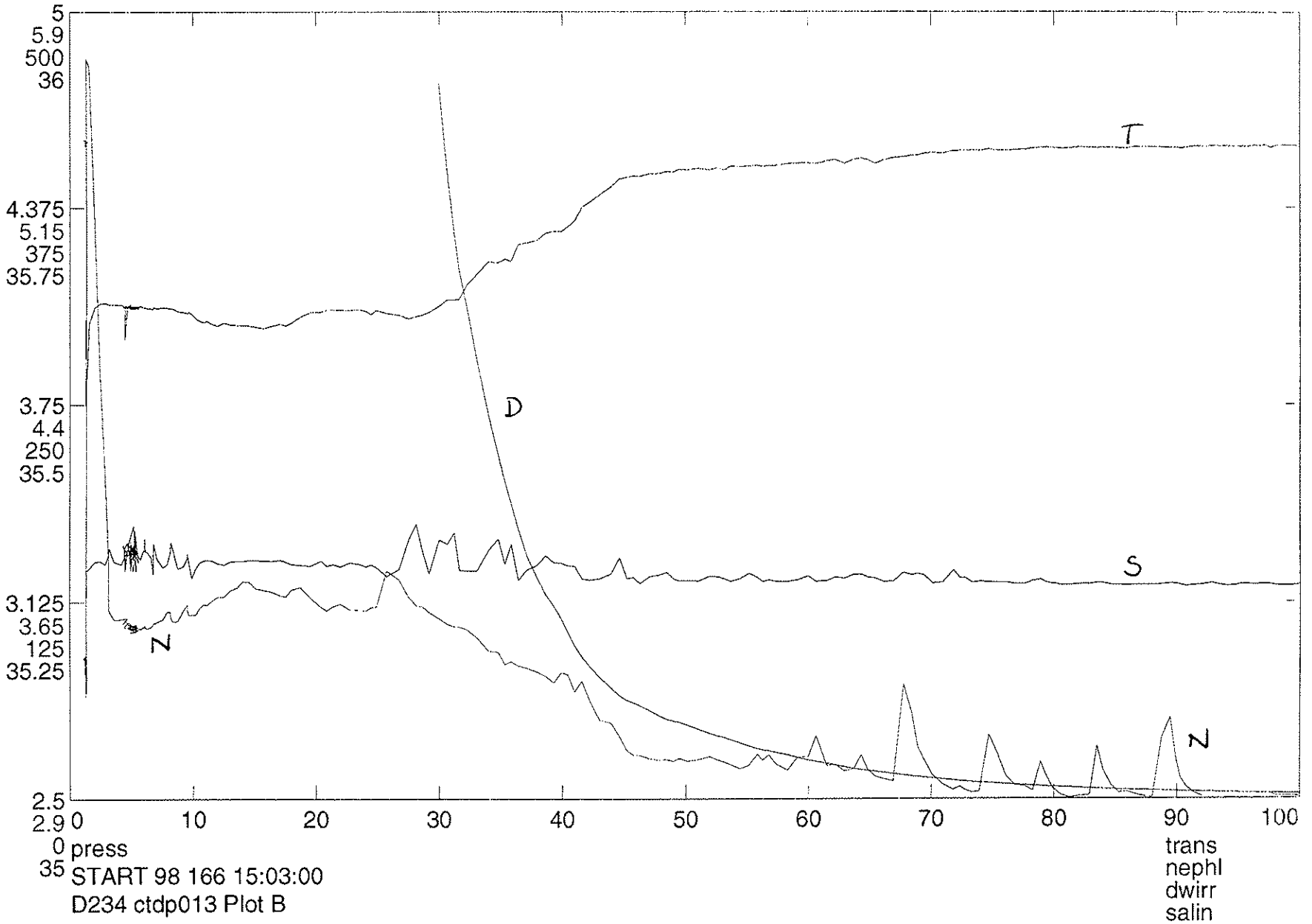

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
F
0
10
20
30
40
50
60
70
80
90
100
press
START 98 166 03:23:00
D234 ctdp011 Plot A
fluor
temp
salin
oxyc

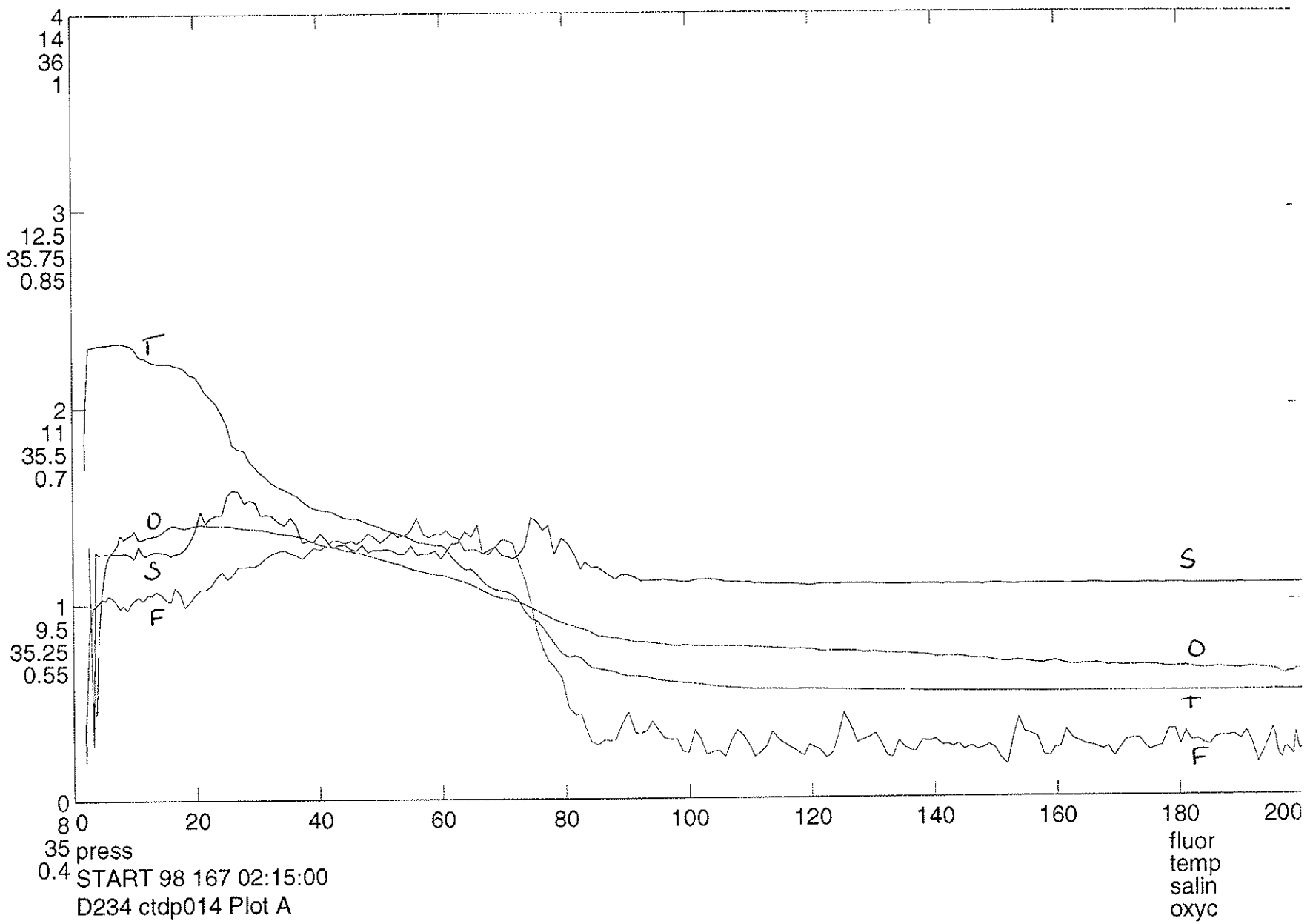

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
T
S
D
N
0
10
20
30
40
50
60
70
80
90
100
press
START 98 166 03:23:00
D234 ctdp011 Plot B
trans
nephl
dwirr
salin

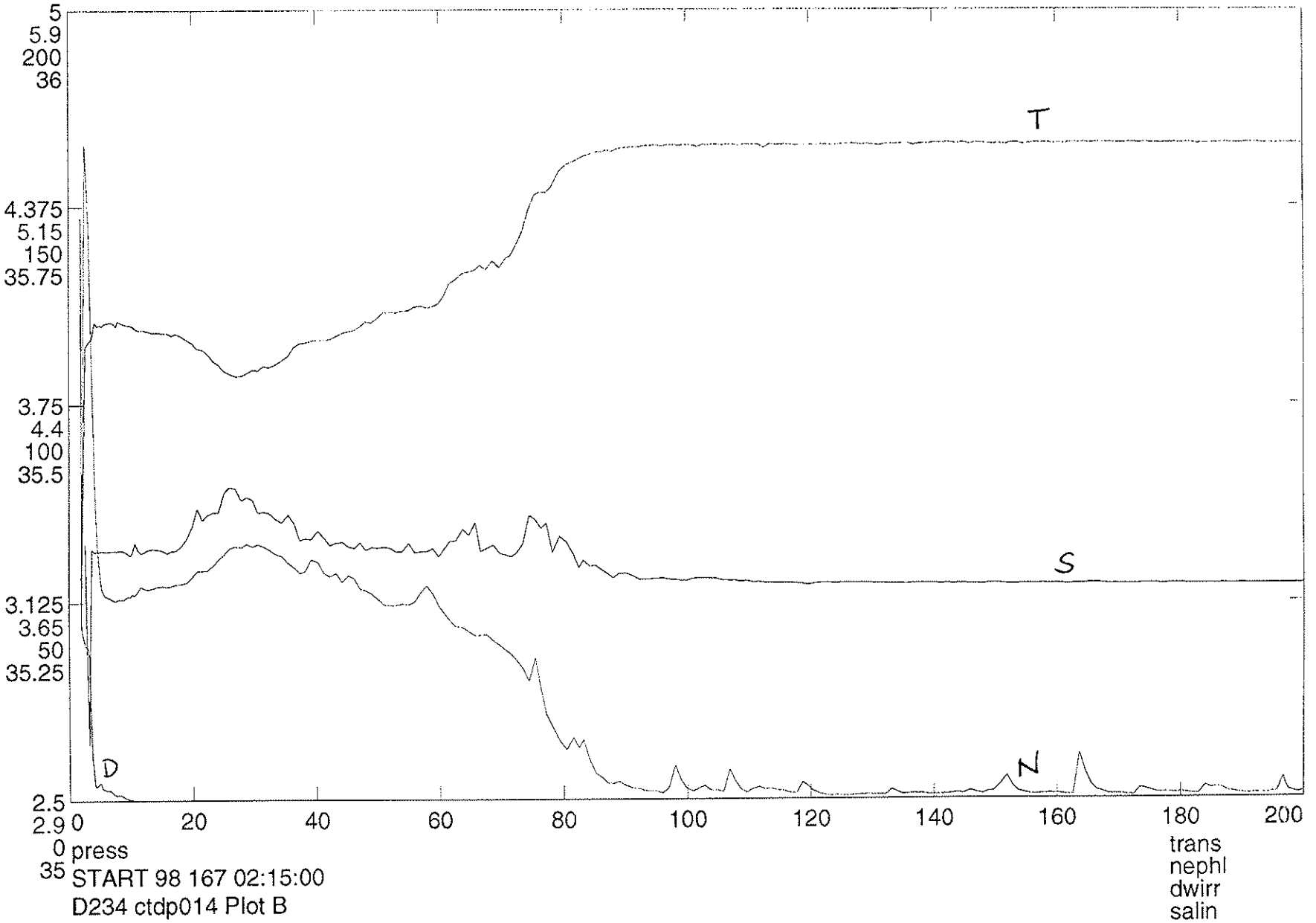

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
0
10
20
30
40
50
60
70
80
90
100
press
START 98 166 04:08:00
D234 ctdp012 Plot A
fluor
temp
salin
oxyc

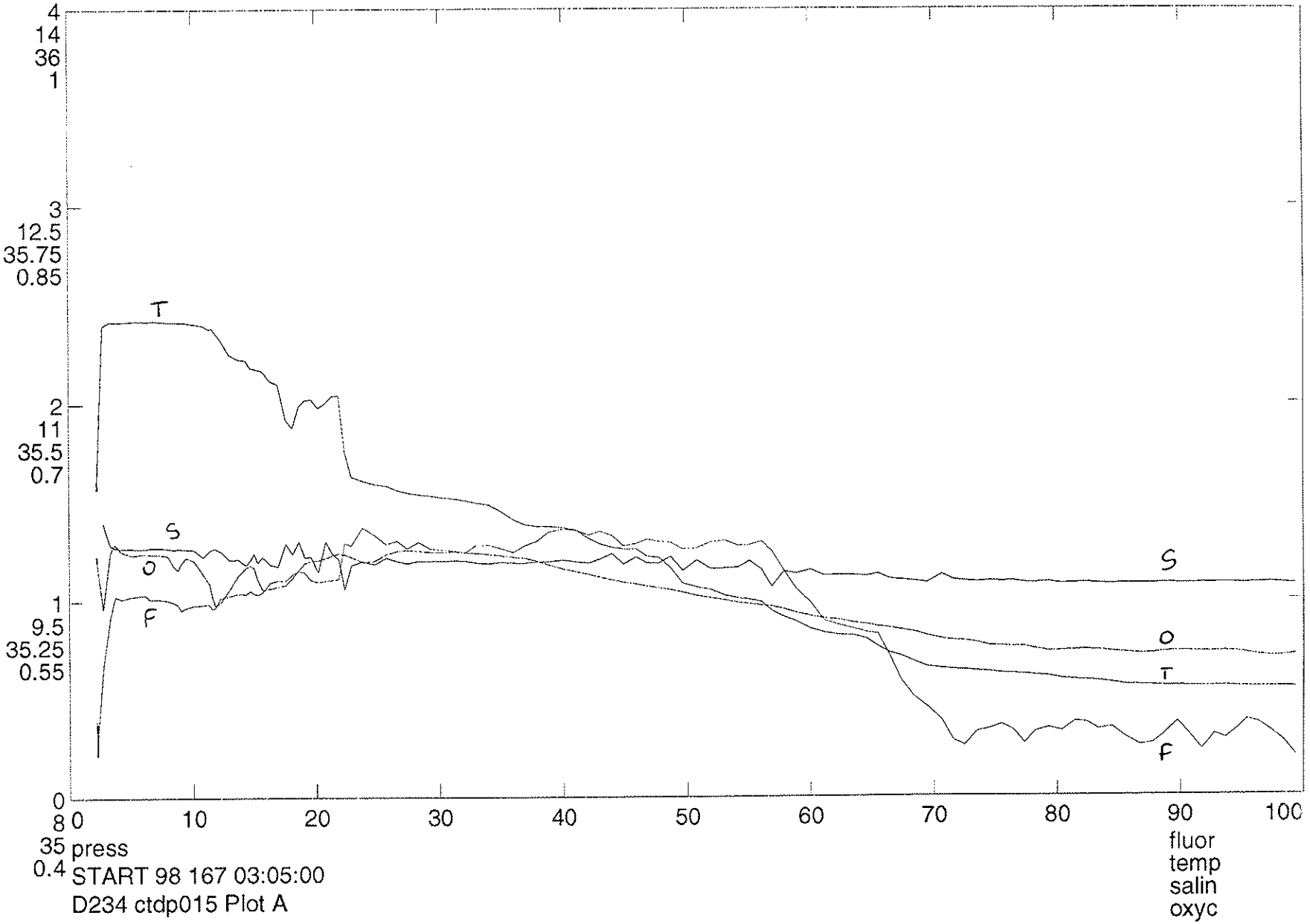

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
0
10
20
30
40
50
60
70
80
90
100
T
S
D
N
press
START 98 166 04:08:00
D234 ctdp012 Plot B
trans
nephl
dwirr
salin

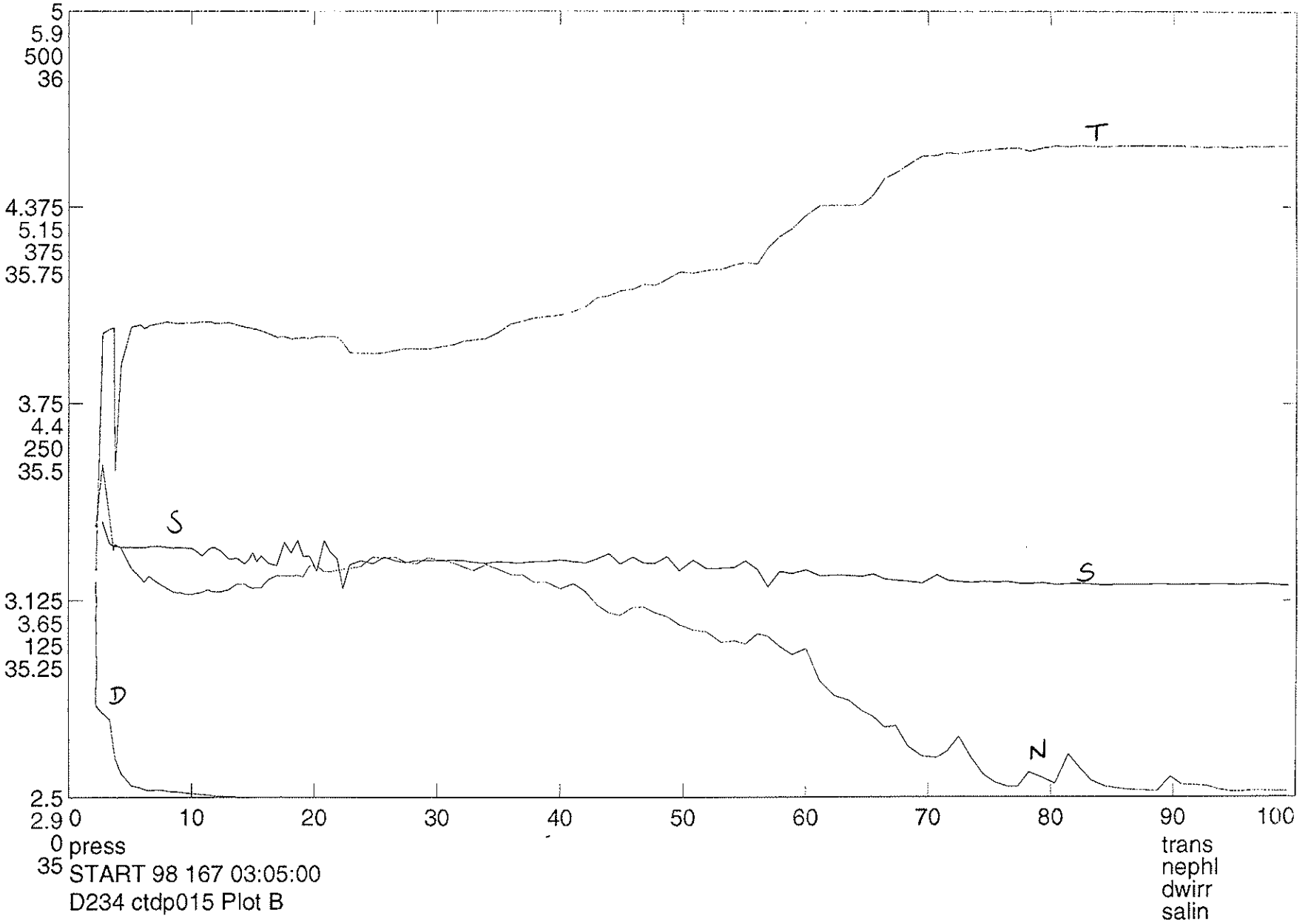

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
START 98 166 15:03:00
D234 ctdp013 Plot A
T
F
O
S
T
F
0
10
20
30
40
50
60
70
80
90
100
fluor
temp
salin
oxyc

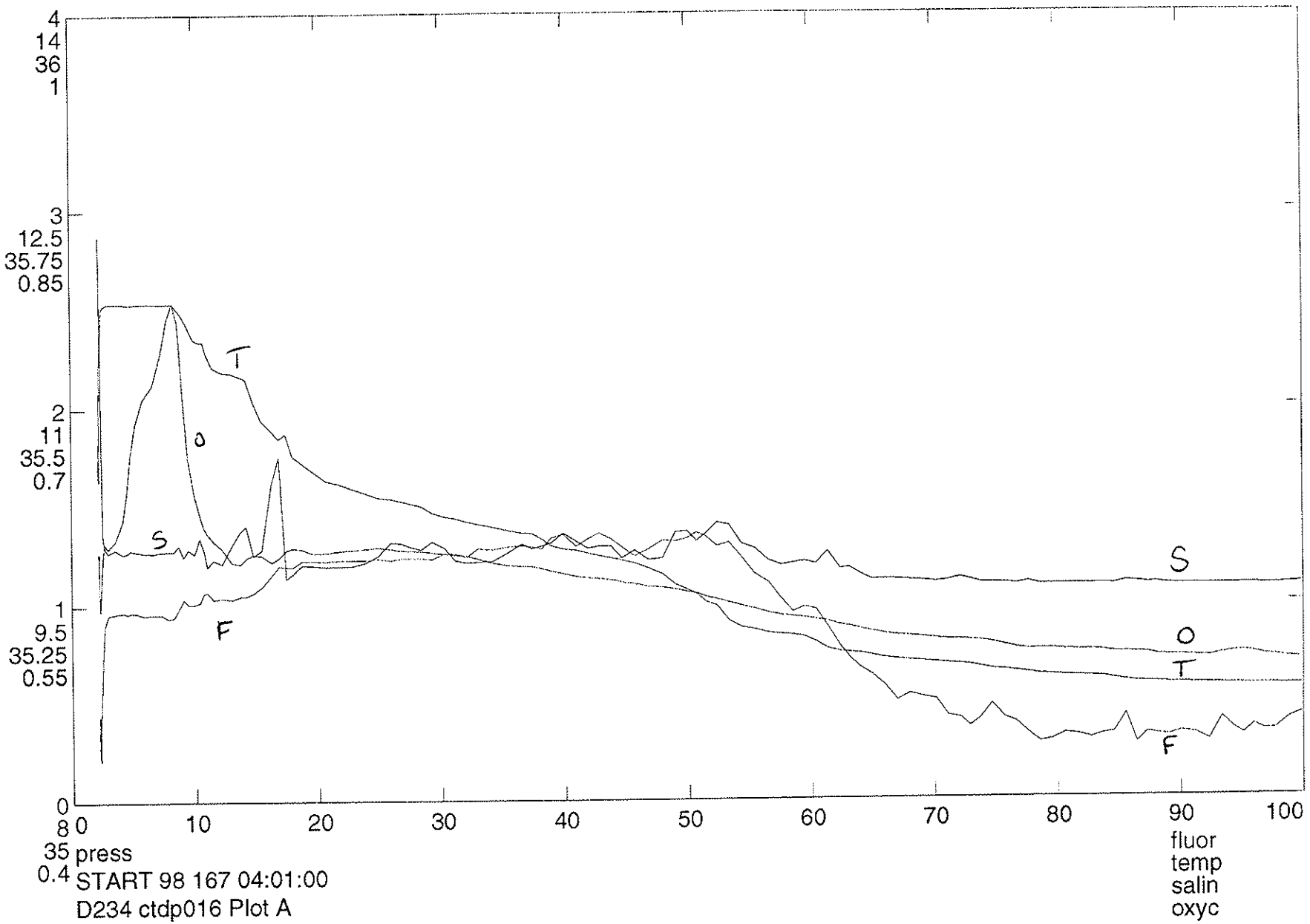

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
0
10
20
30
40
50
60
70
80
90
100
T
D
S
N
N
0 press
START 98 166 15:03:00
D234 ctdp013 Plot B
trans
nephl
dwirr
salin

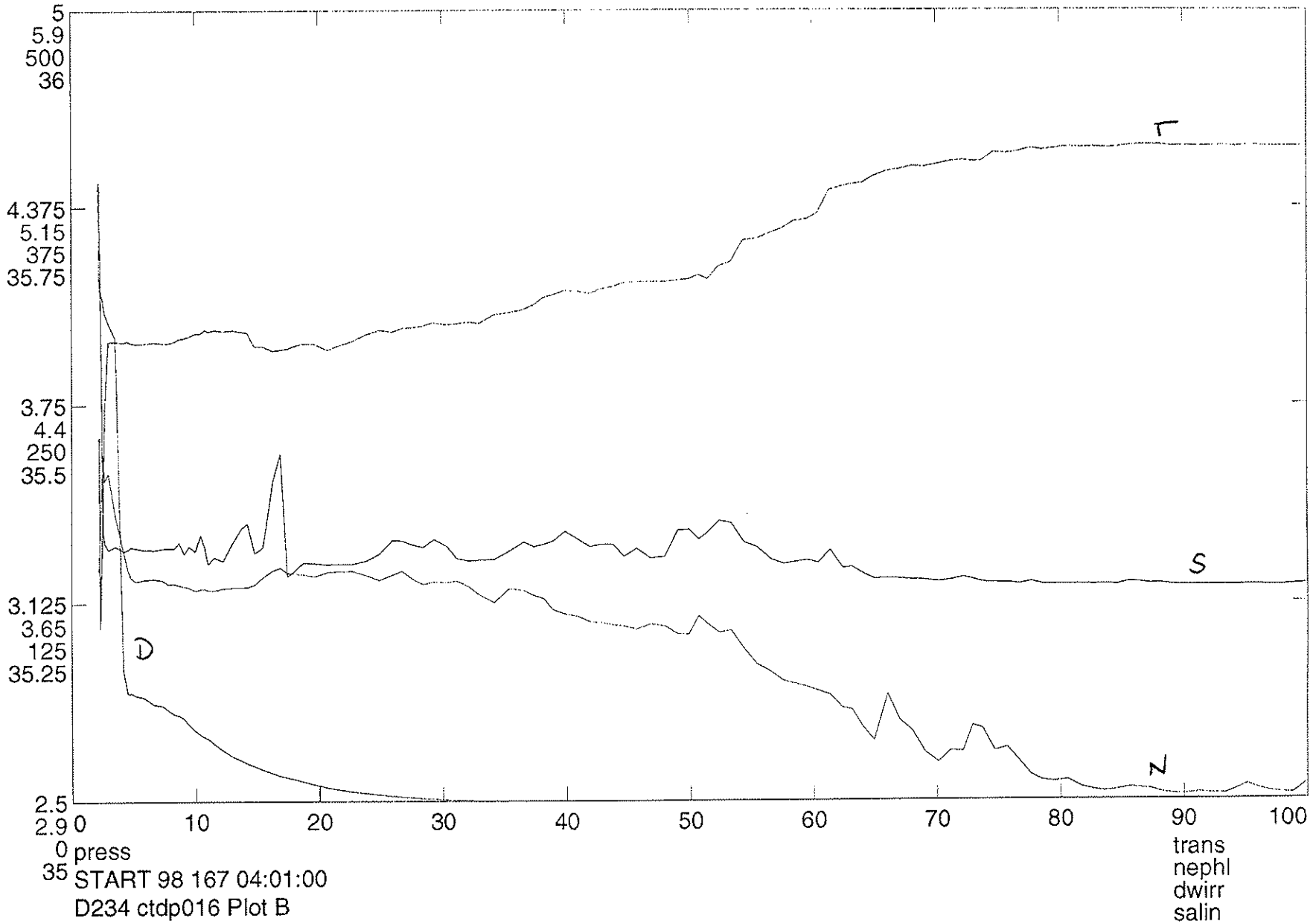

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
S
F
S
O
T
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 167 02:15:00
D234 ctdp014 Plot A
fluor
temp
salin
oxyc

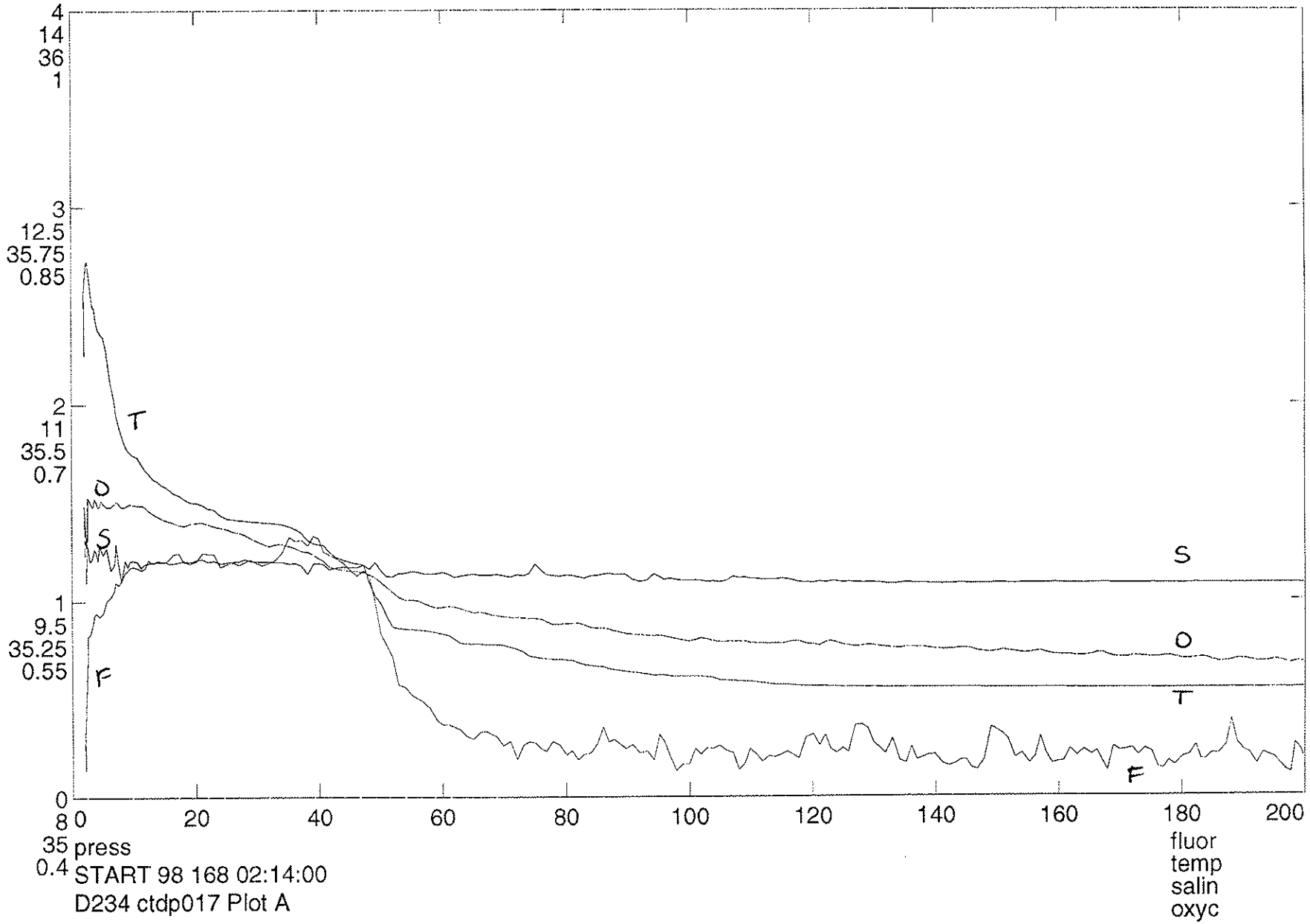

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
T
S
D
N
0
20
40
60
80
100
120
140
160
180
200
0 press
35
START 98 167 02:15:00
D234 ctdp014 Plot B
trans
nephl
dwirr
salin

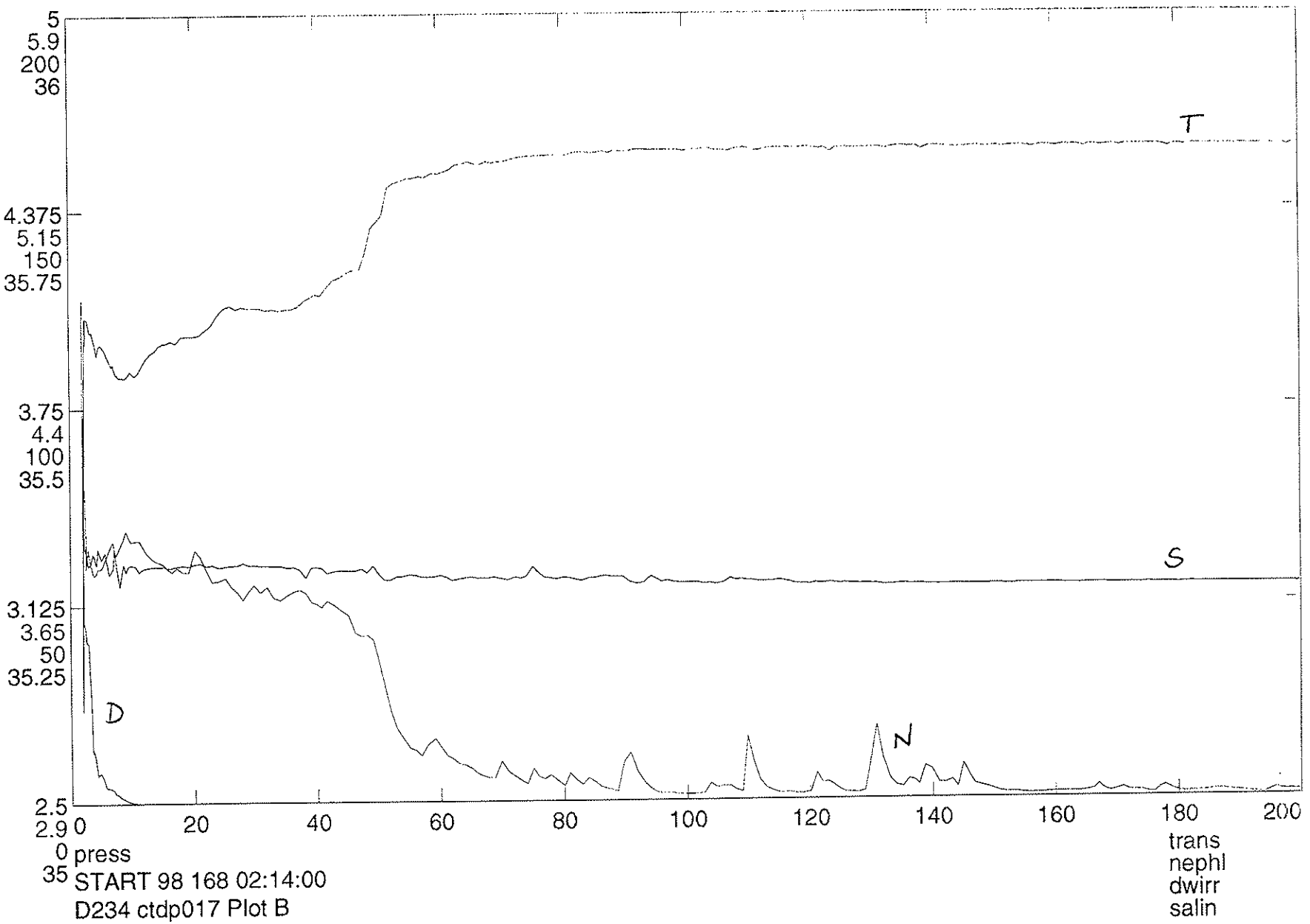

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
0
10
20
30
40
50
60
70
80
90
100
press
START 98 167 03:05:00
D234 ctdp015 Plot A
fluor
temp
salin
oxyc

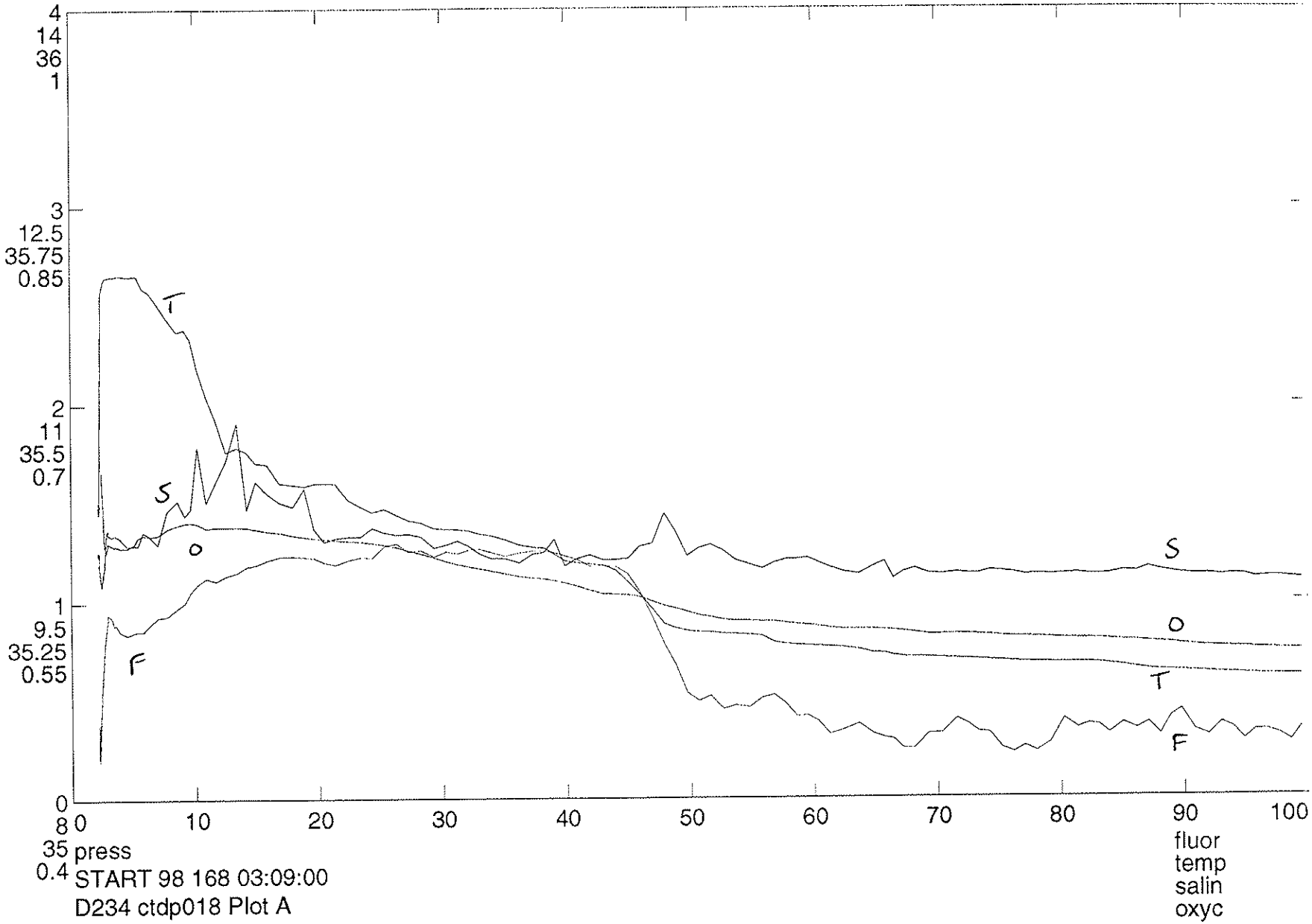

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
T
S
S
D
N
0
10
20
30
40
50
60
70
80
90
100
0 press
START 98 167 03:05:00
D234 ctdp015 Plot B
trans
nephl
dwirr
salin

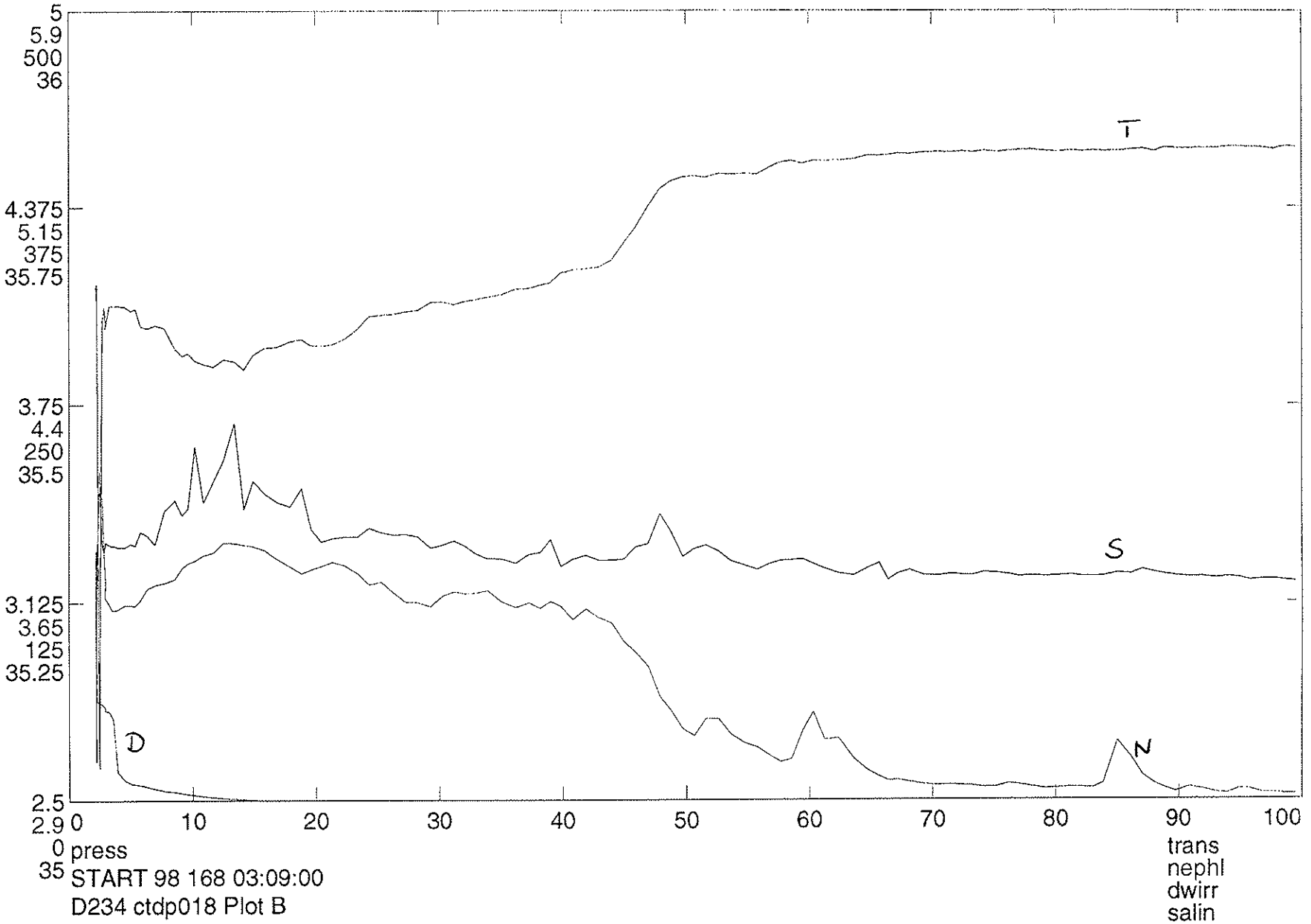

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
10
20
30
40
50
60
70
80
90
100
fluor
temp
salin
oxyc
T
O
S
S
O
T
F
F
START 98 167 04:01:00
D234 ctdp016 Plot A

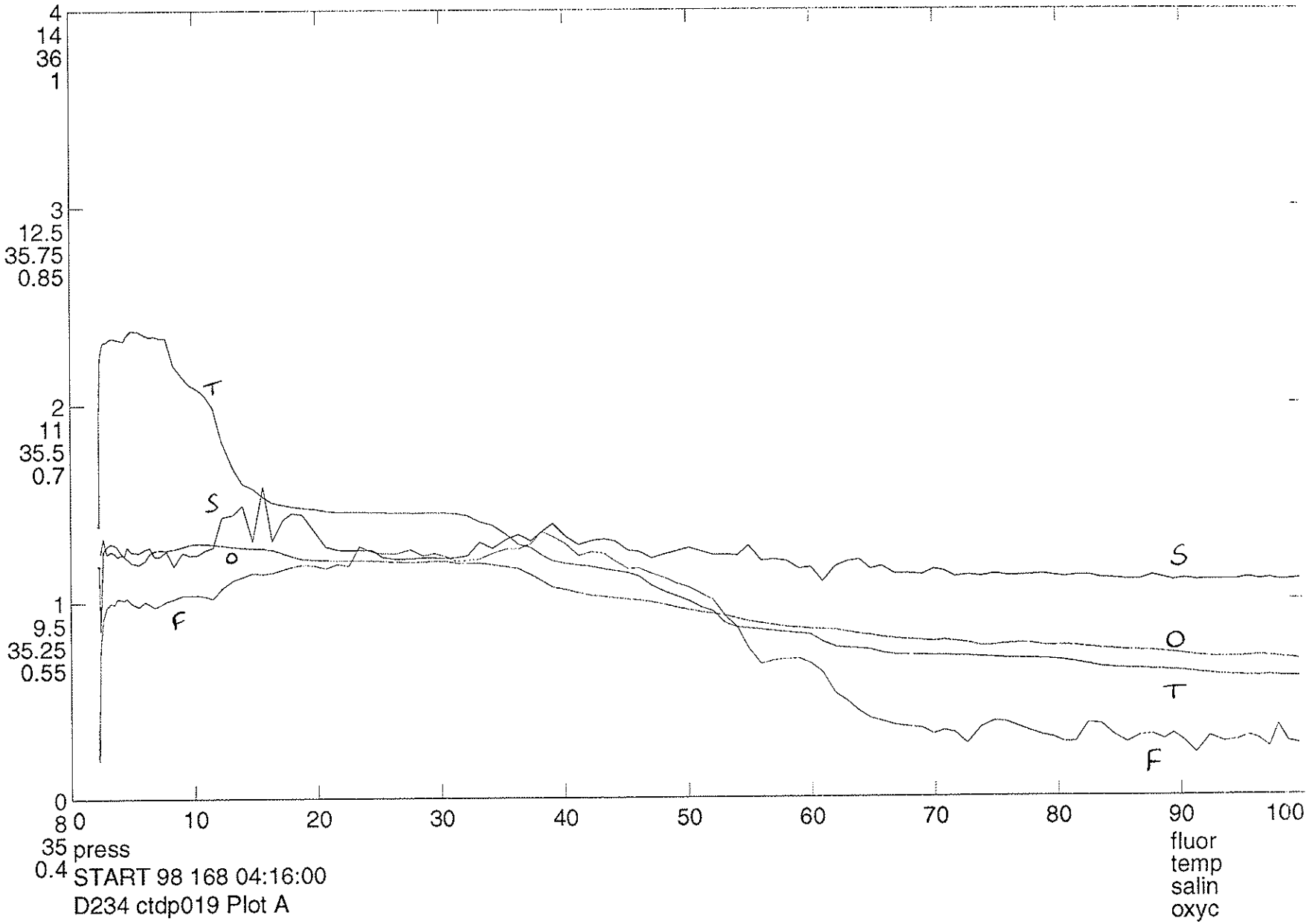

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
0
10
20
30
40
50
60
70
80
90
100
T
S
D
N
0 press
START 98 167 04:01:00
D234 ctdp016 Plot B
trans
nephl
dwirr
salin

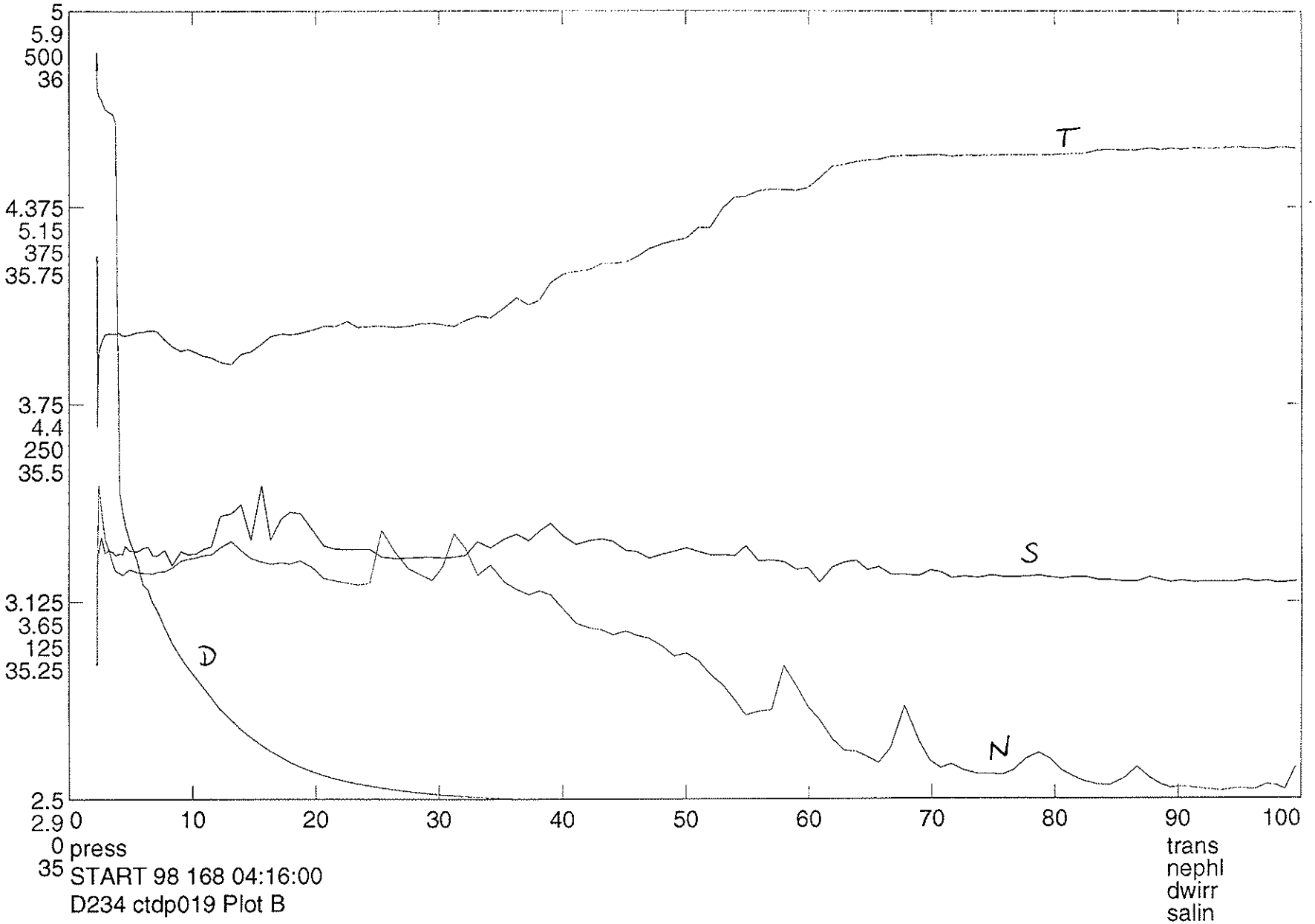

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
S
F
S
O
T
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 168 02:14:00
D234 ctdp017 Plot A
fluor
temp
salin
oxyc

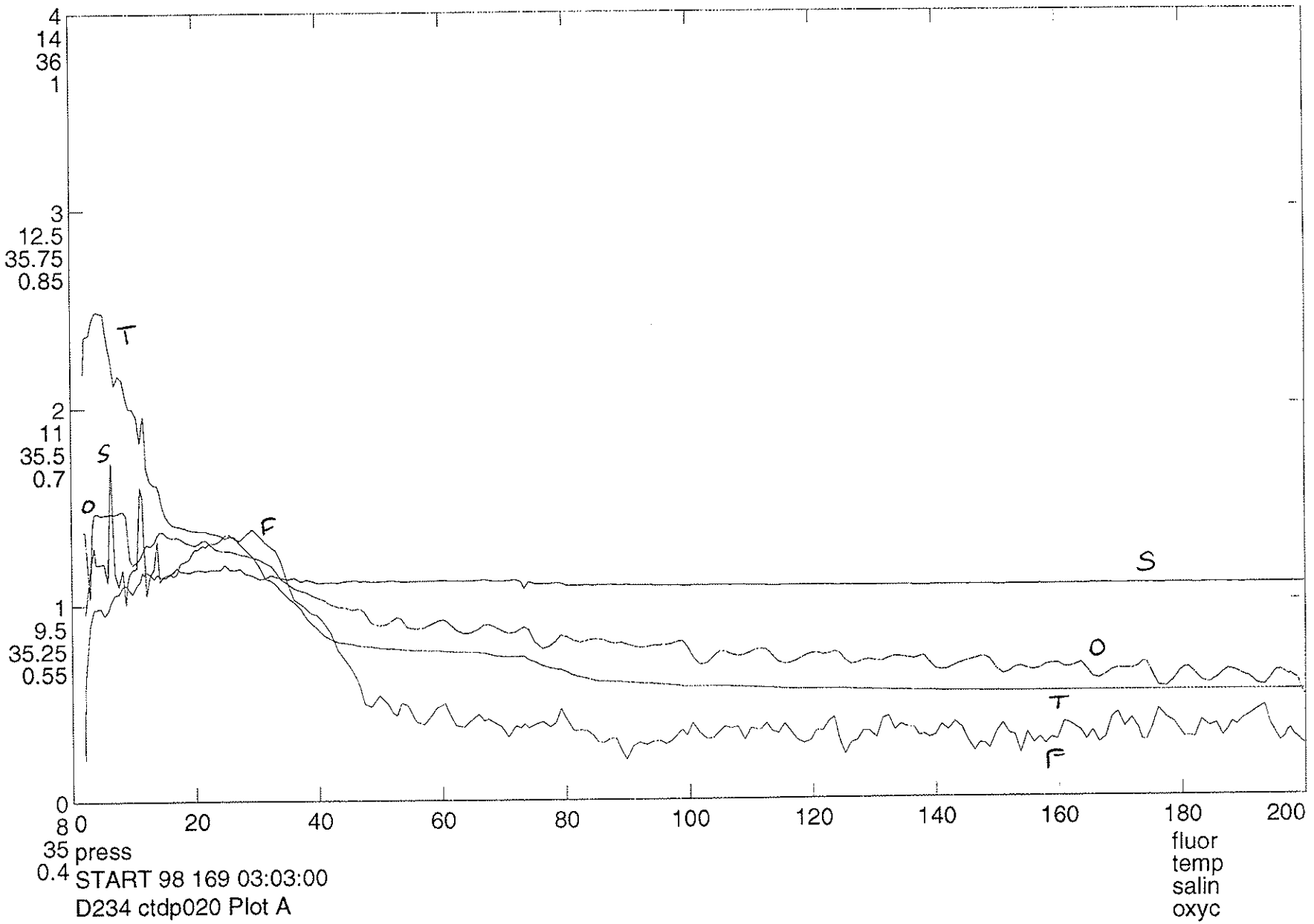

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
0
35
T
S
D
N
0
20
40
60
80
100
120
140
160
180
200
press
START 98 168 02:14:00
D234 ctdp017 Plot B
trans
nephl
dwirr
salin

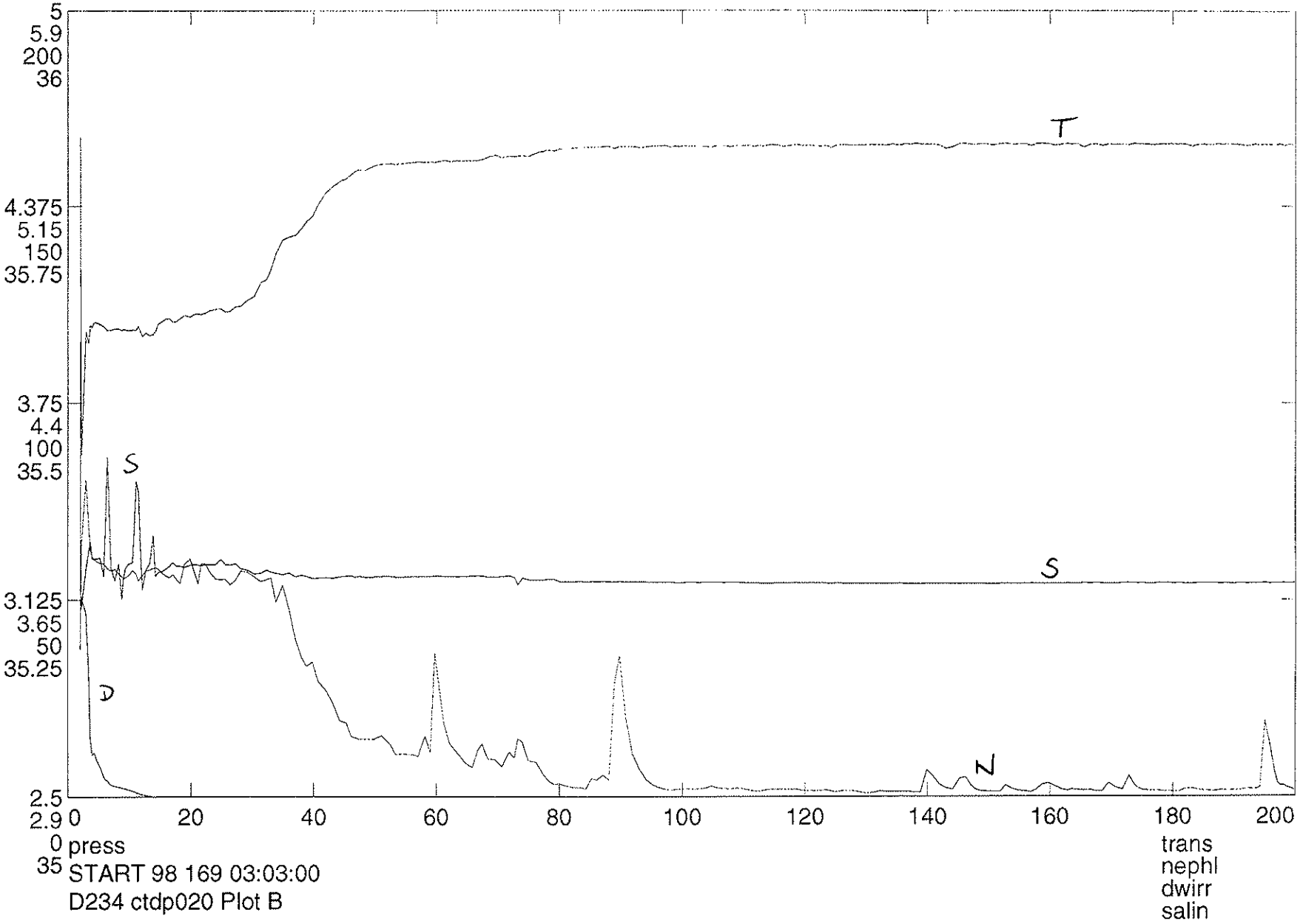

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
S
O
T
F
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
START 98 168 03:09:00
D234 ctdp018 Plot A

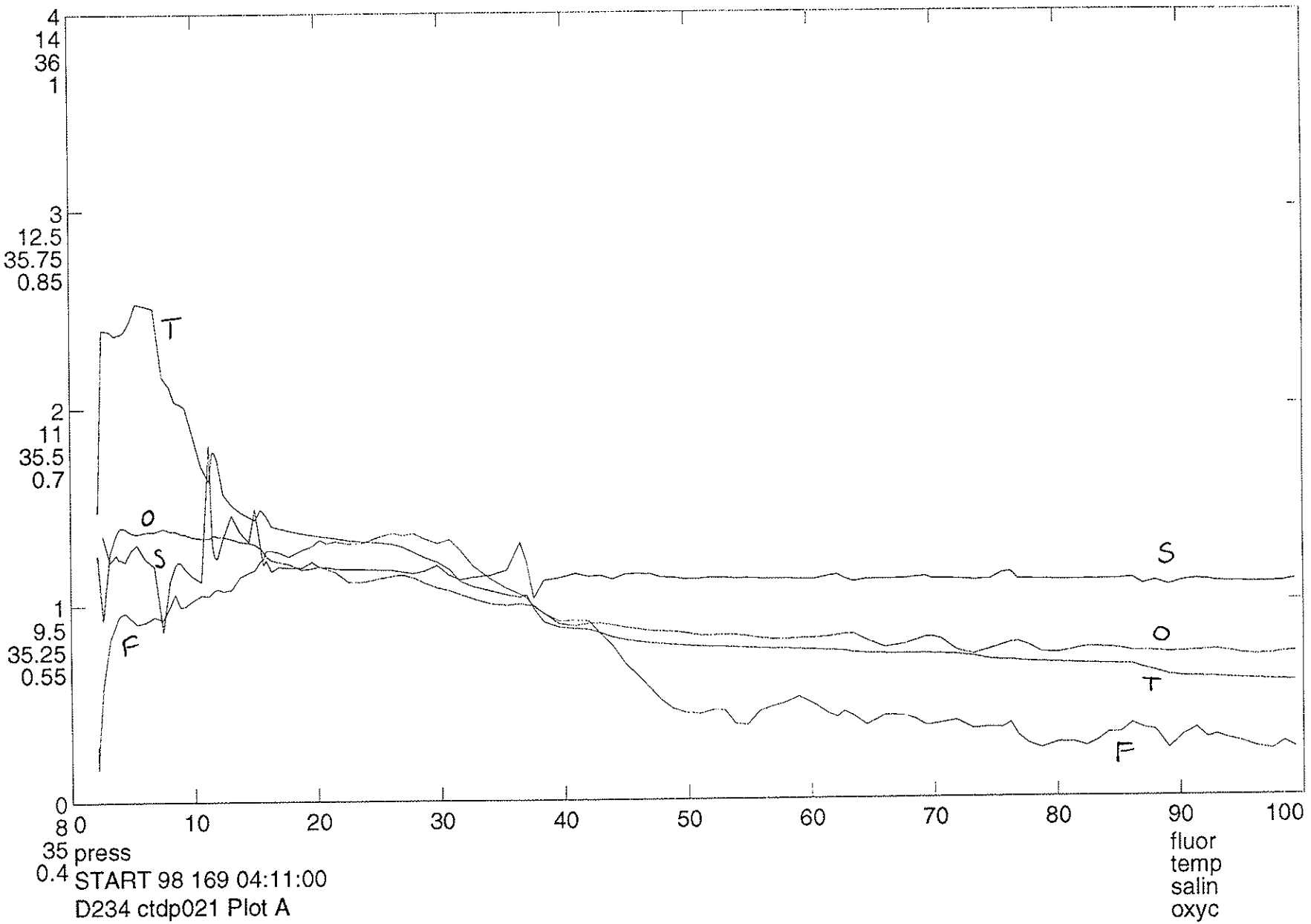

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
T
S
D
N
0
10
20
30
40
50
60
70
80
90
100
0 press
START 98 168 03:09:00
D234 ctdp018 Plot B
trans
nephl
dwirr
salin

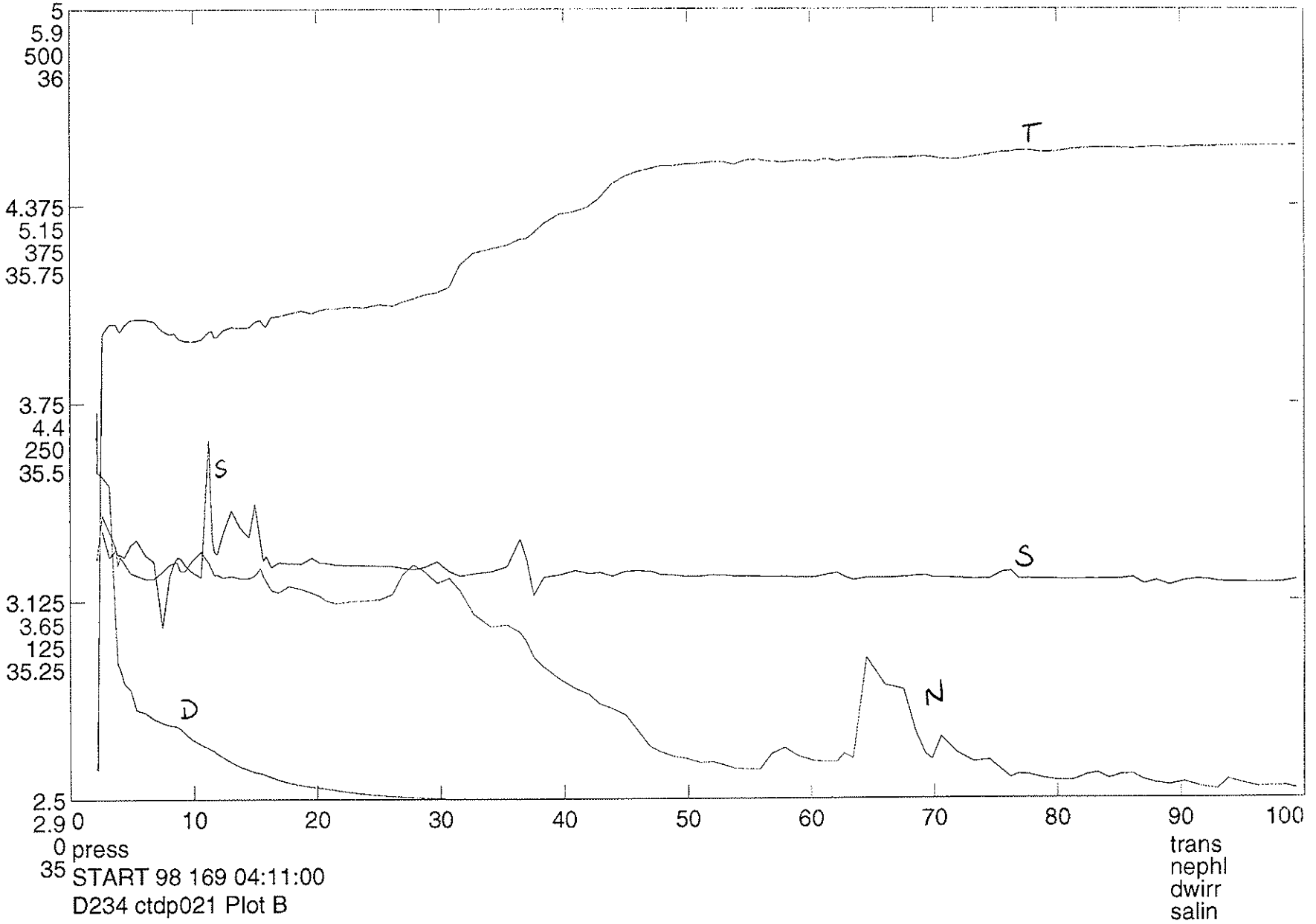

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
press
START 98 168 04:16:00
D234 ctdp019 Plot A
fluor
temp
salin
oxyc
T
S
O
F
S
O
T
F

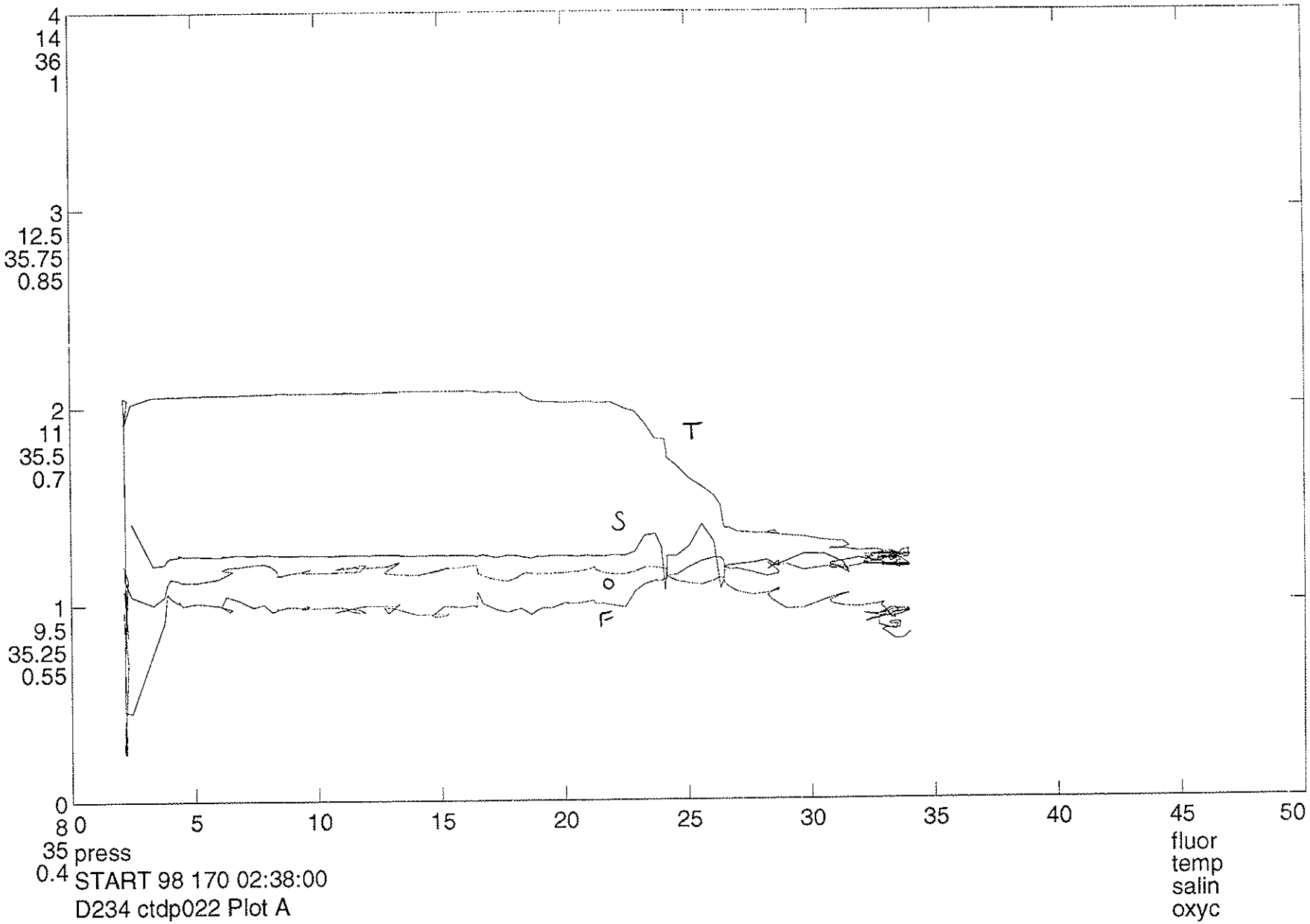

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
T
S
D
N
0
10
20
30
40
50
60
70
80
90
100
press
START 98 168 04:16:00
D234 ctdp019 Plot B
trans
nephl
dwirr
salin

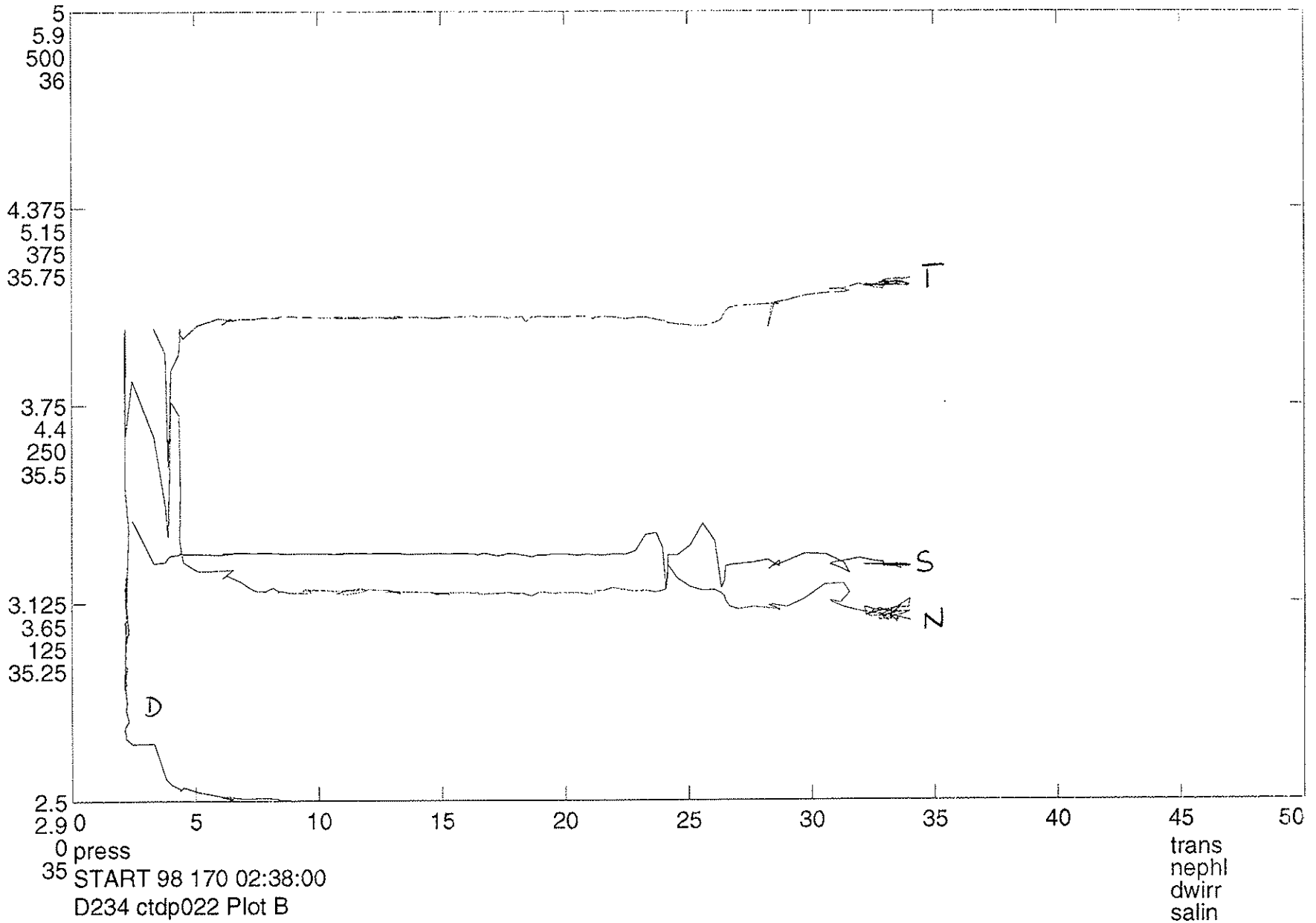

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 169 03:03:00
D234 ctdp020 Plot A
fluor
temp
salin
oxyc

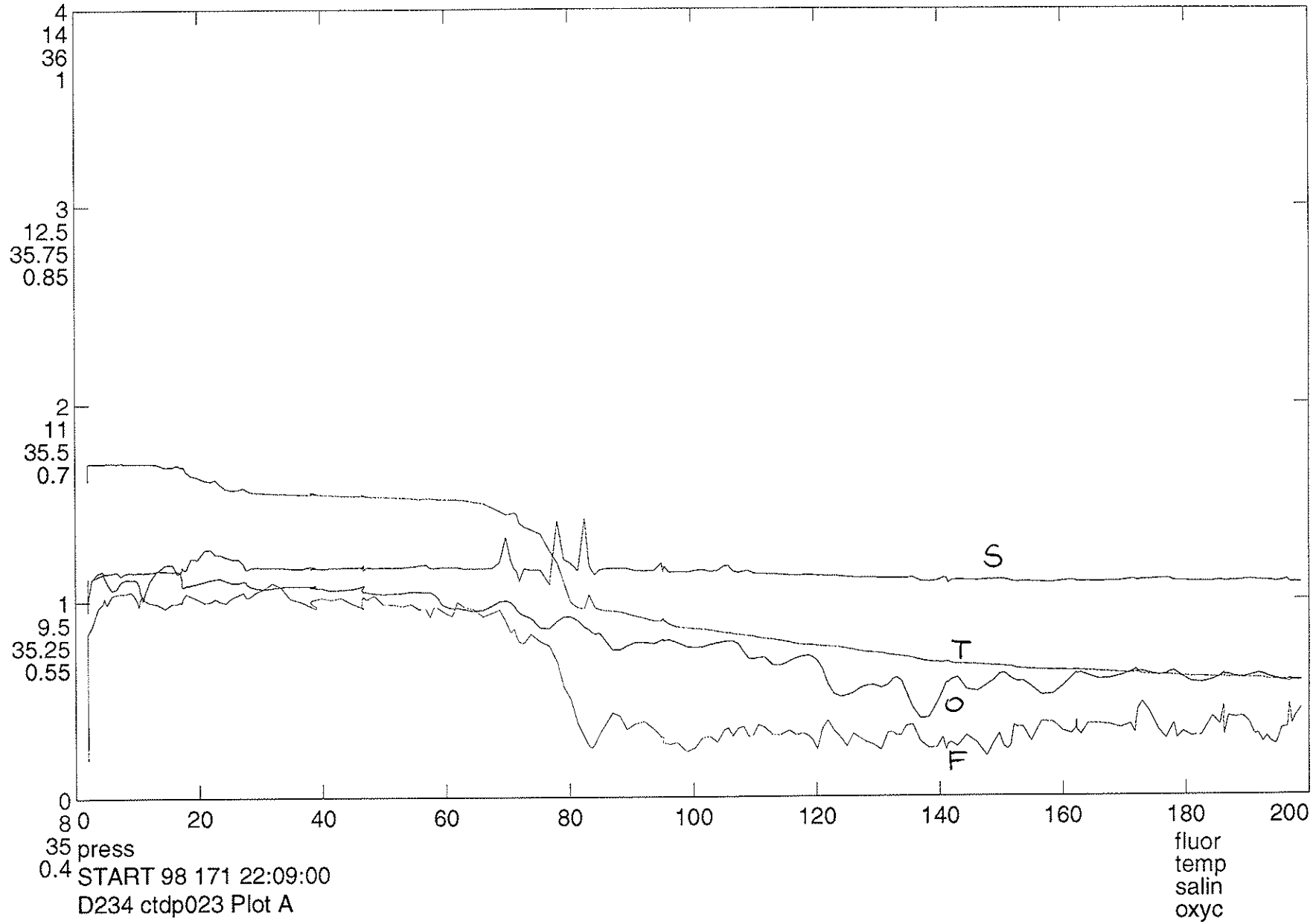

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
0
35
T
S
S
D
N
0
20
40
60
80
100
120
140
160
180
200
press
START 98 169 03:03:00
D234 ctdp020 Plot B
trans
nephl
dwirr
salin

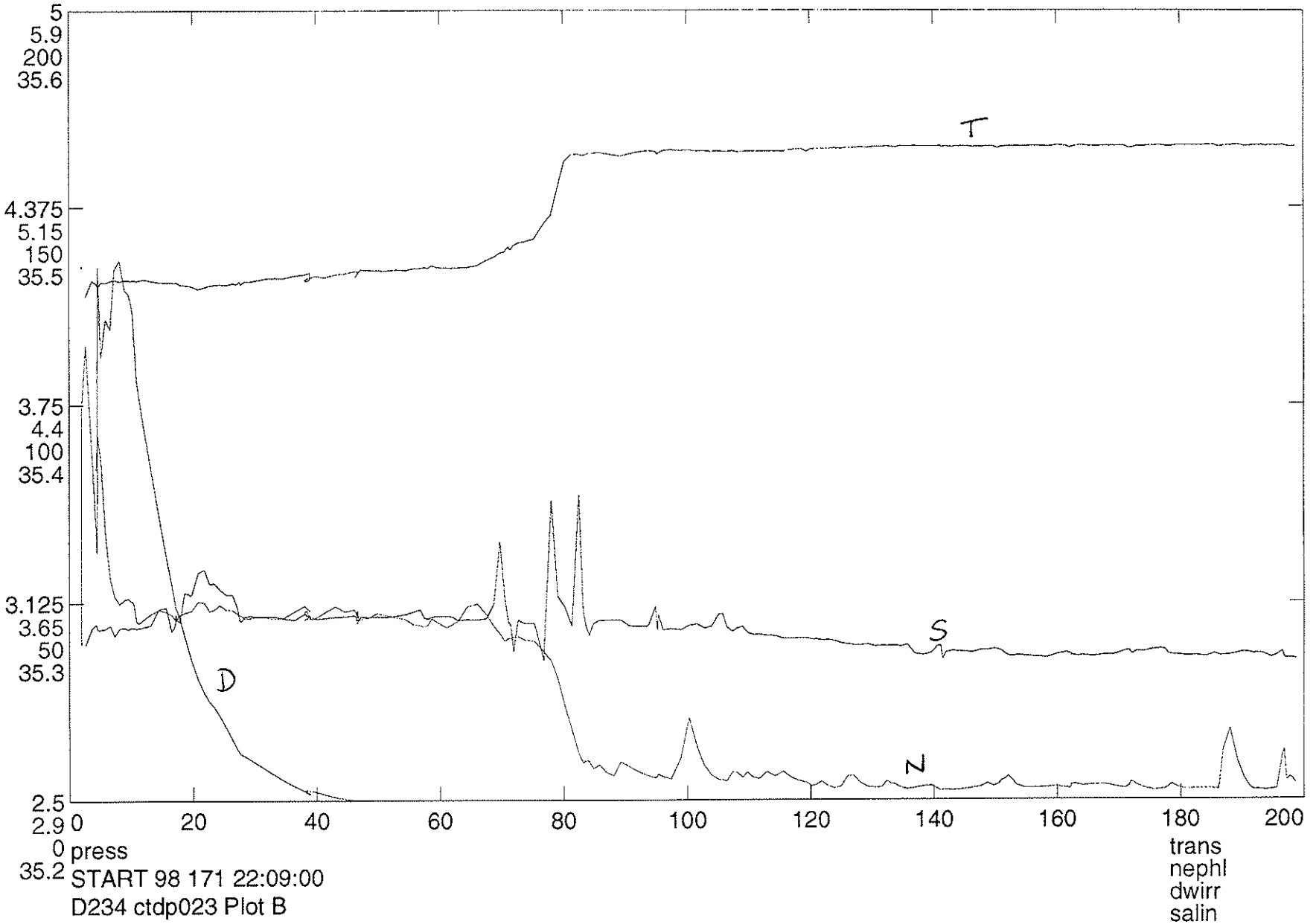

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
S
F
S
O
T
F
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
START 98 169 04:11:00
D234 ctdp021 Plot A

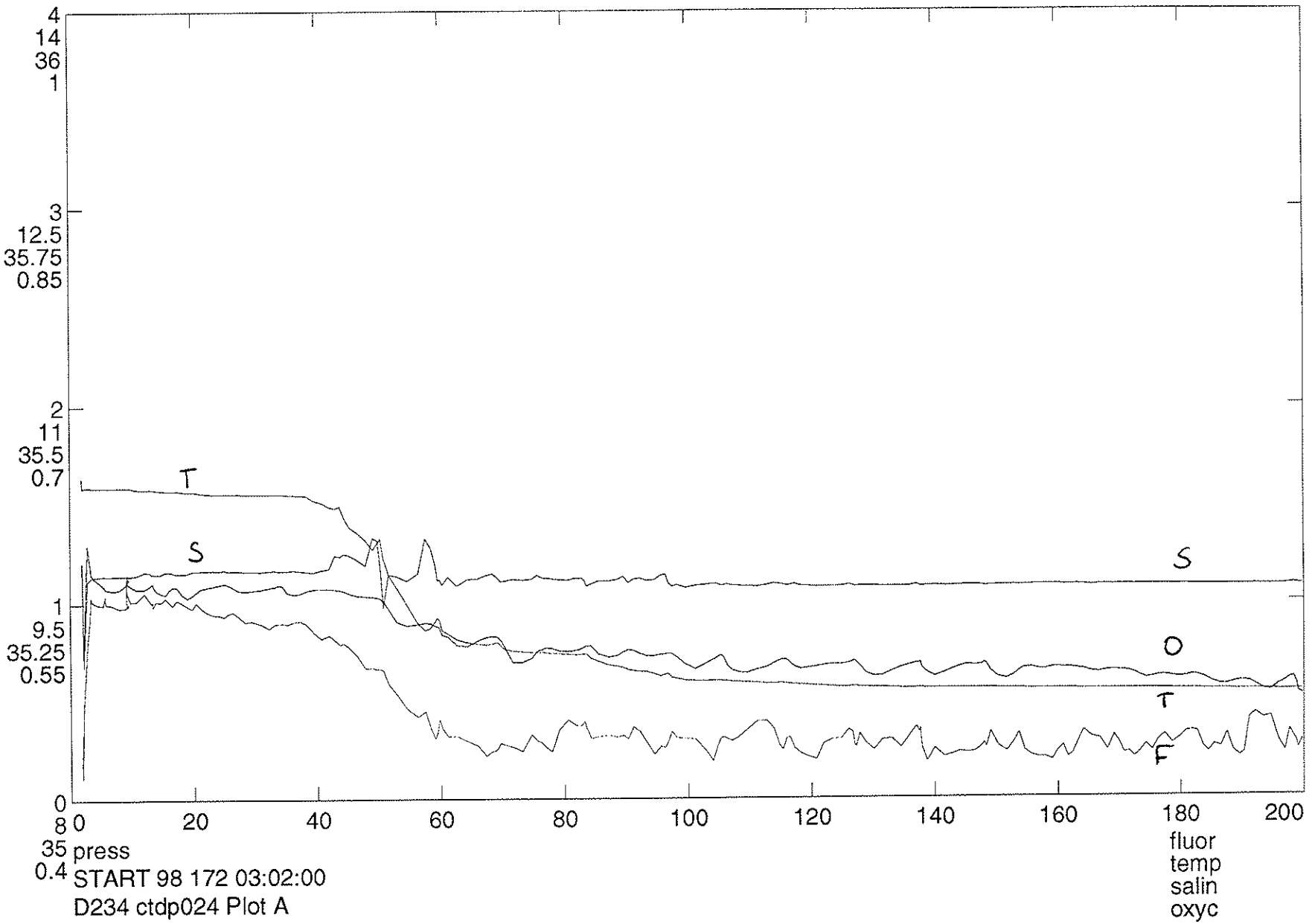

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0 10 20 30 40 50 60 70 80 90 100
0 press
35
START 98 169 04:11:00
D234 ctdp021 Plot B
T
S
S
D
N
trans
nephl
dwirr
salin

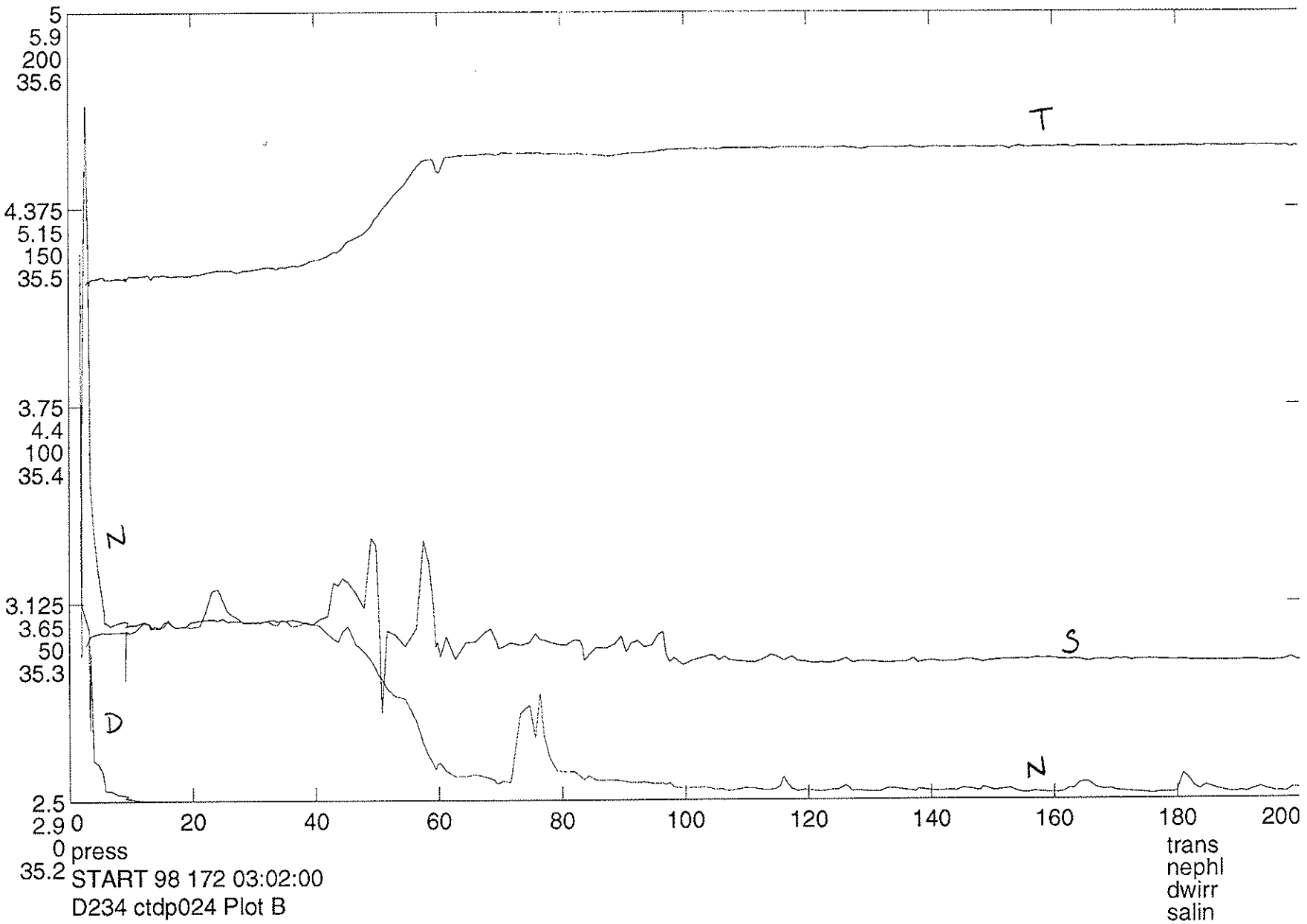

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
5
10
15
20
25
30
35
40
45
50
T
S
O
F
press
START 98 170 02:38:00
D234 ctdp022 Plot A
fluor
temp
salin
oxyc

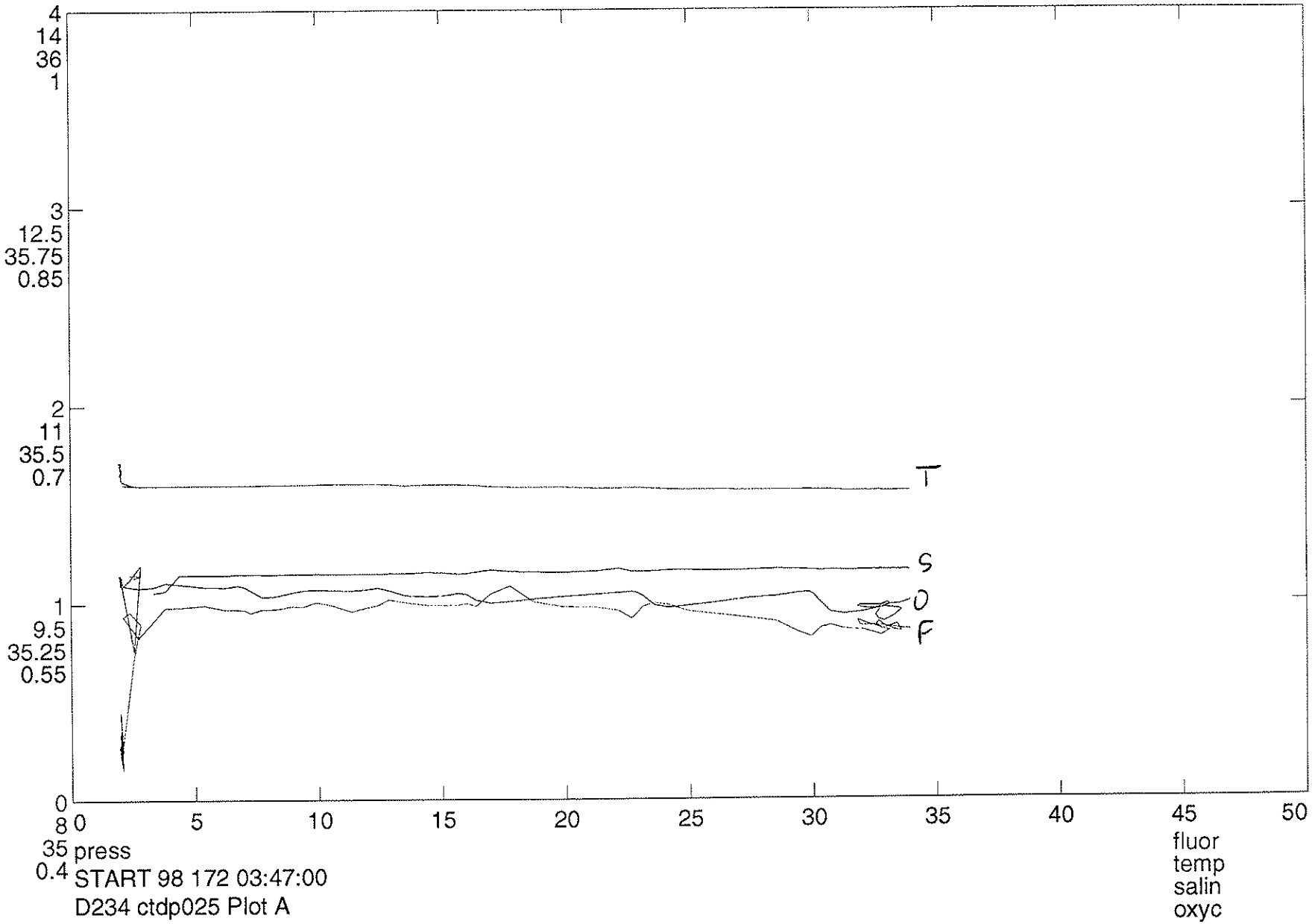

5
5.9
500
36
4.375
5.15
375
35.75
3.75
4.4
250
35.5
3.125
3.65
125
35.25
2.5
2.9
0
35
T
S
N
D
0
5
10
15
20
25
30
35
40
45
50
0 press
START 98 170 02:38:00
D234 ctdp022 Plot B
trans
nephl
dwirr
salin

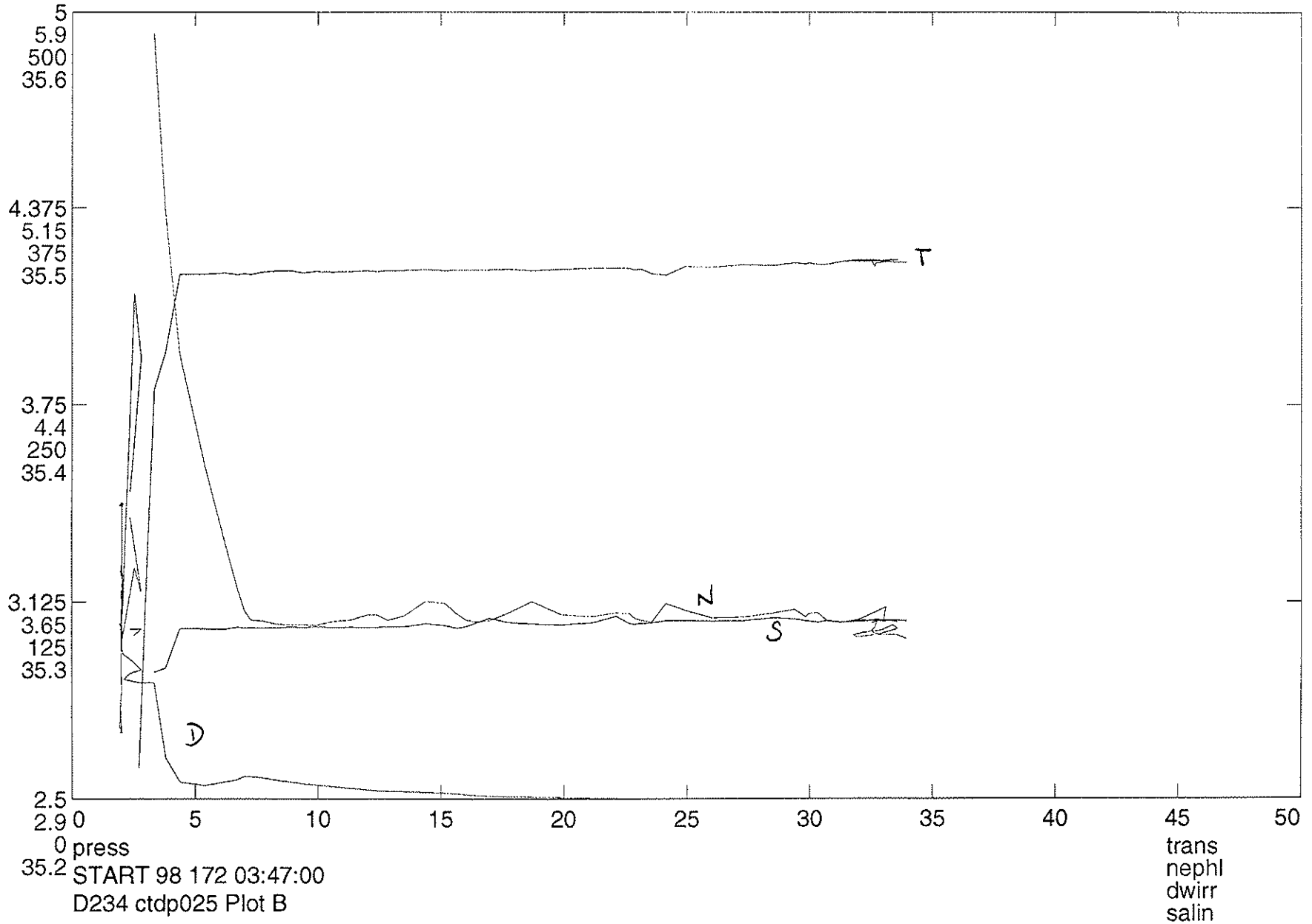

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
20
40
60
80
100
120
140
160
180
200
S
T
O
F
press
START 98 171 22:09:00
D234 ctdp023 Plot A
fluor
temp
salin
oxyc

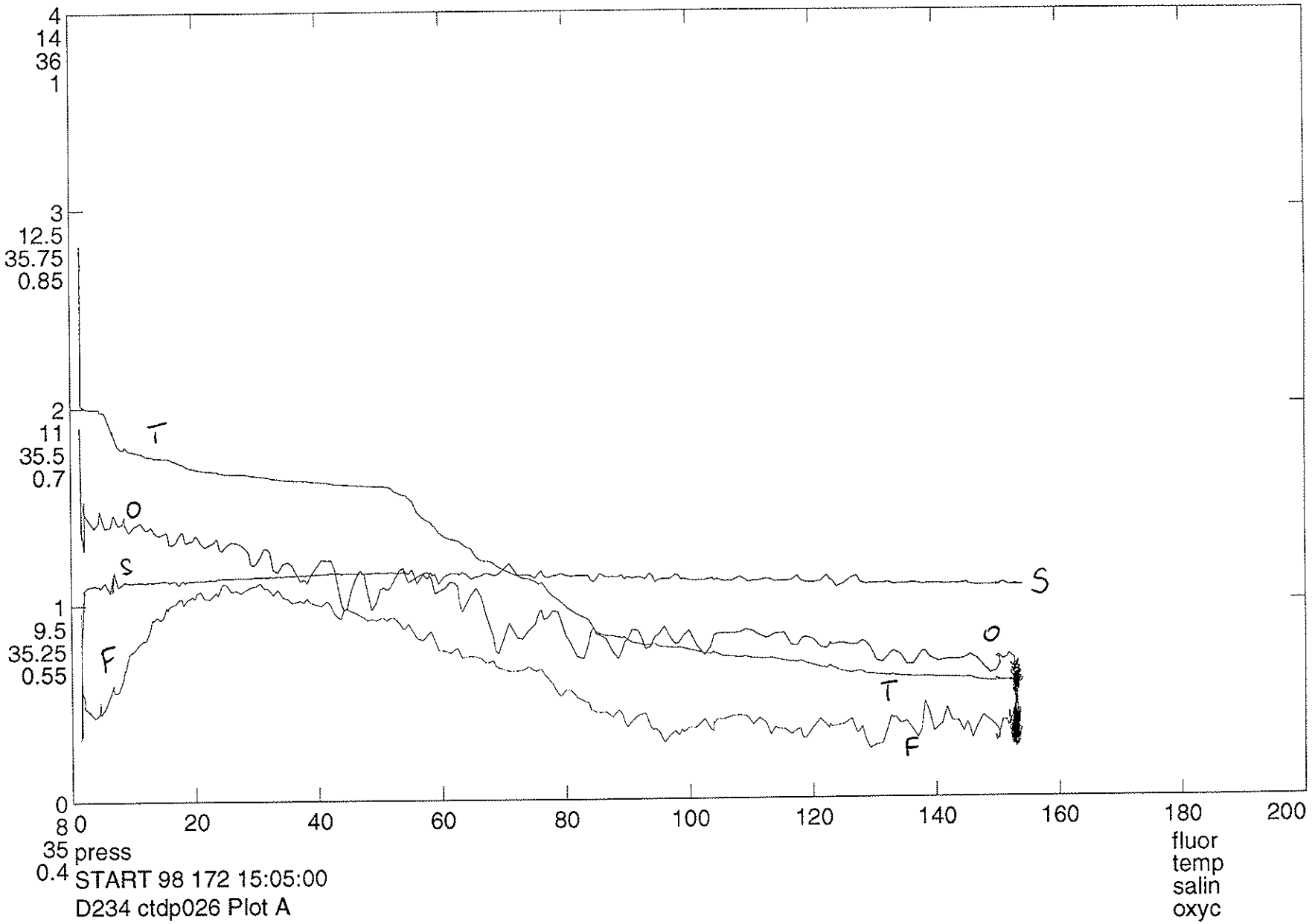

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
S
D
N
0
20
40
60
80
100
120
140
160
180
200
press
trans
nephl
dwirr
salin
START 98 171 22:09:00
D234 ctdp023 Plot B

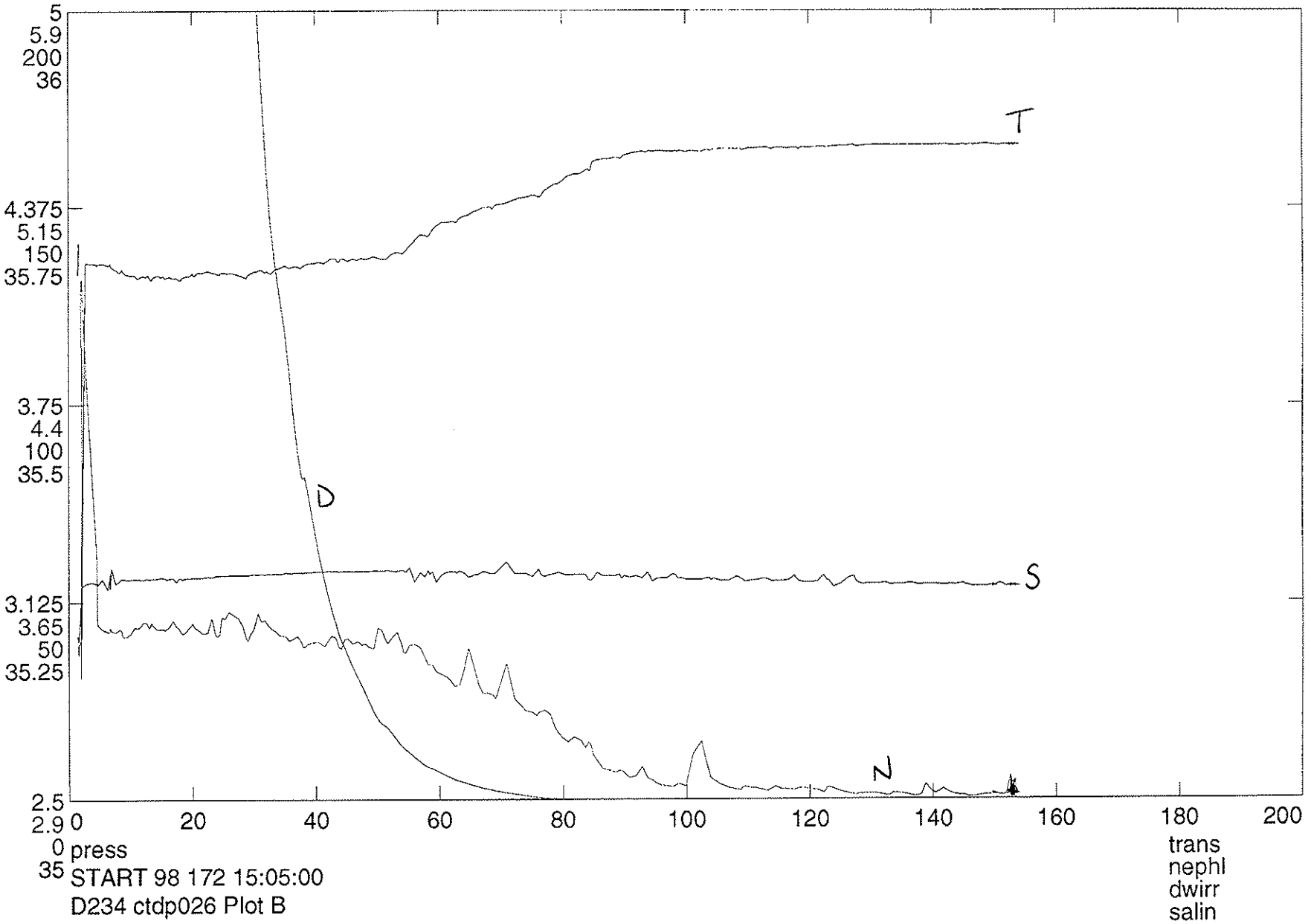

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
S
O
T
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 172 03:02:00
D234 ctdp024 Plot A
fluor
temp
salin
oxyc

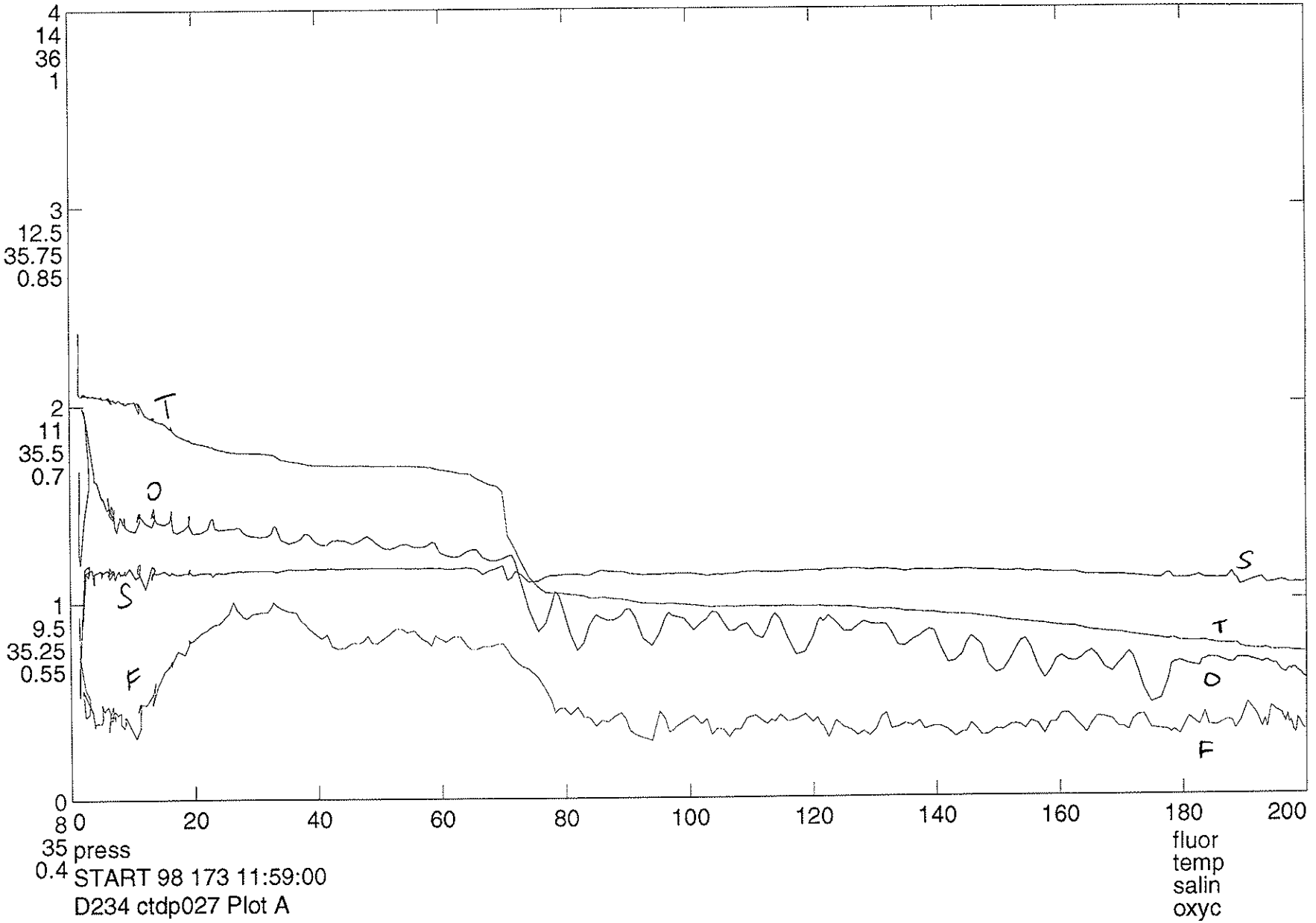

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
S
N
D
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 172 03:02:00
D234 ctdp024 Plot B
trans
nephl
dwirr
salin

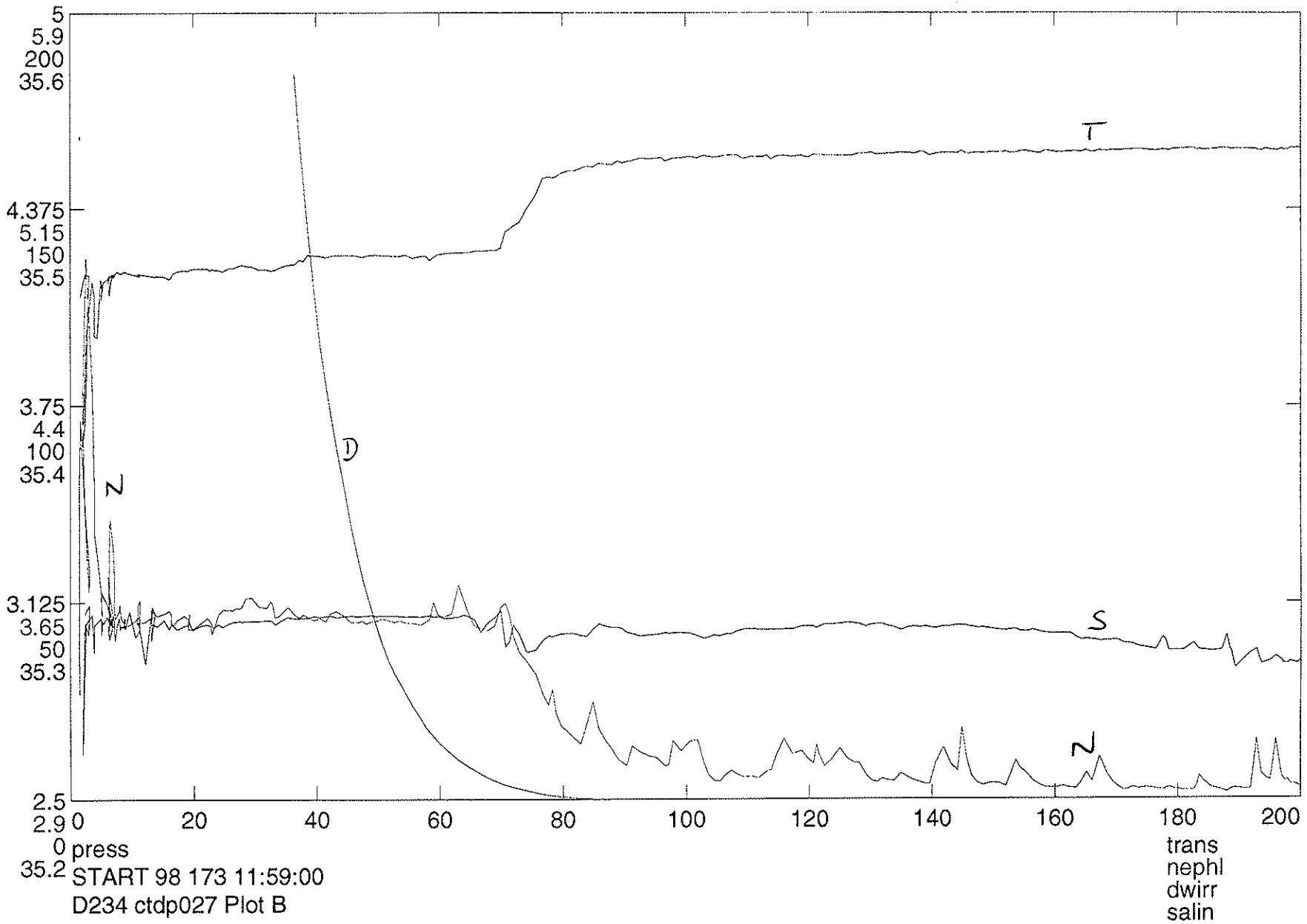

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
5
10
15
20
25
30
35
40
45
50
T
S
O
F
press
fluor
temp
salin
oxyc
START 98 172 03:47:00
D234 ctdp025 Plot A

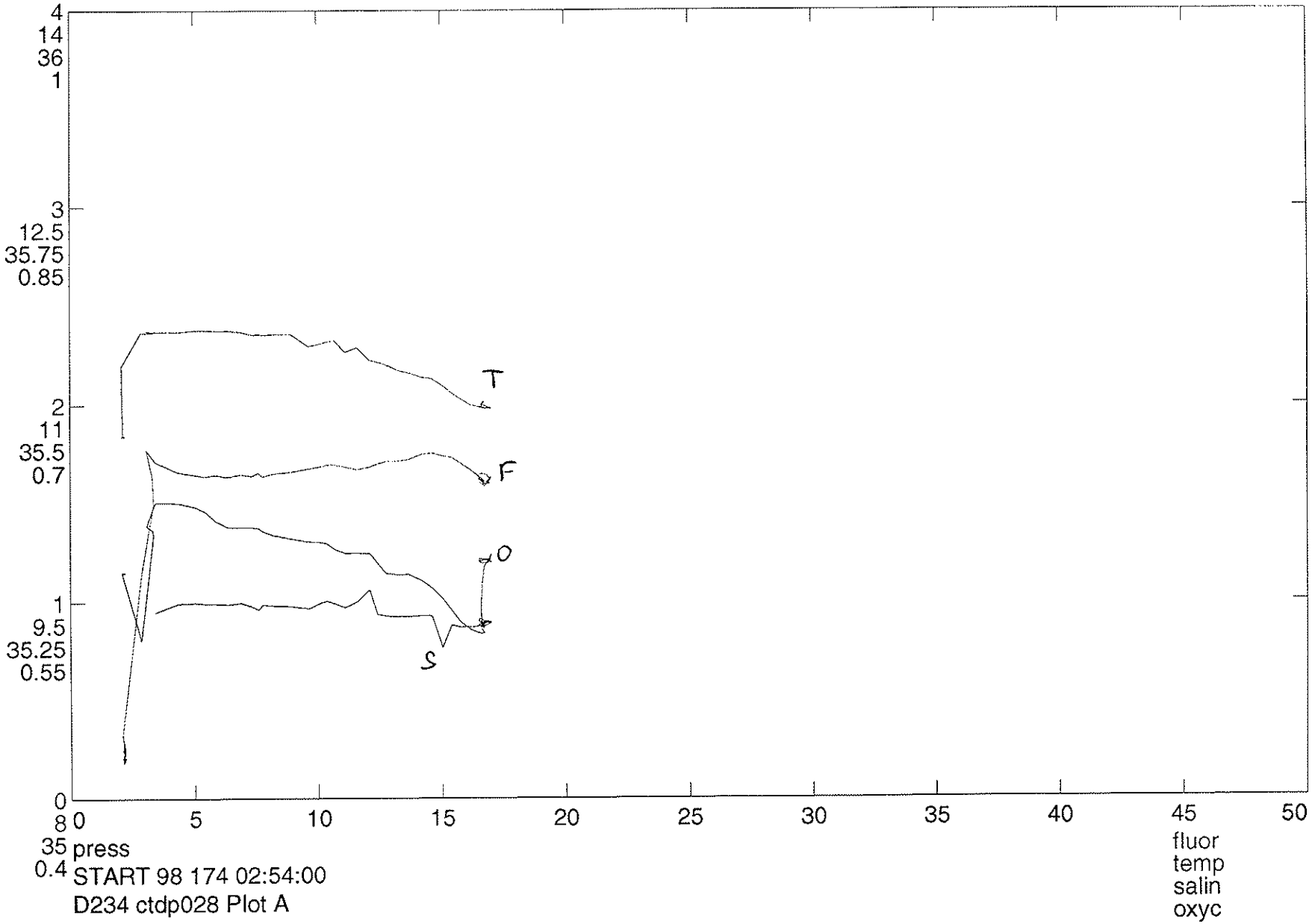

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
5
10
15
20
25
30
35
40
45
50
T
N
S
D
press
START 98 172 03:47:00
D234 ctdp025 Plot B
trans
nephl
dwirr
salin

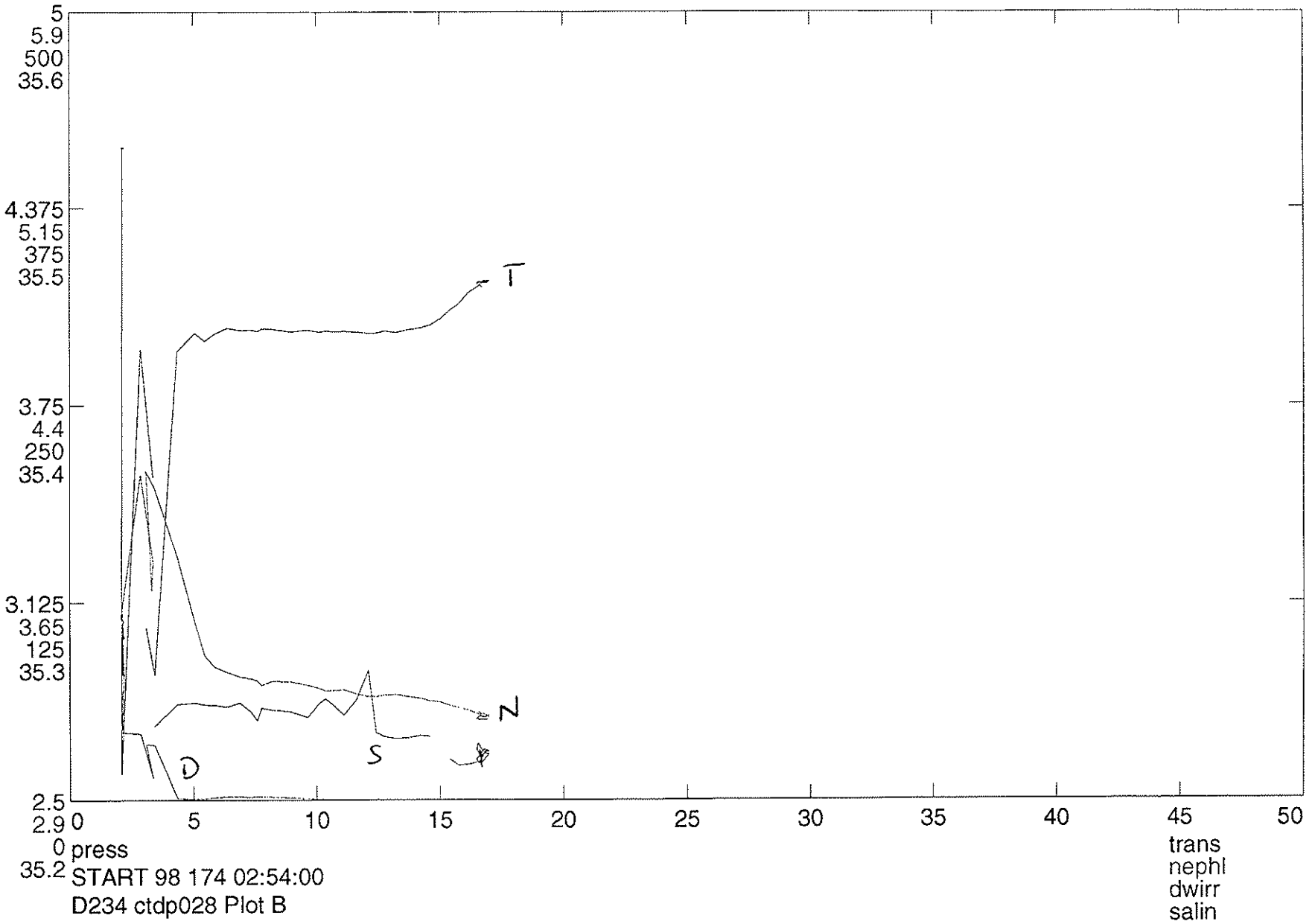

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
S
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 172 15:05:00
D234 ctdp026 Plot A
fluor
temp
salin
oxyc

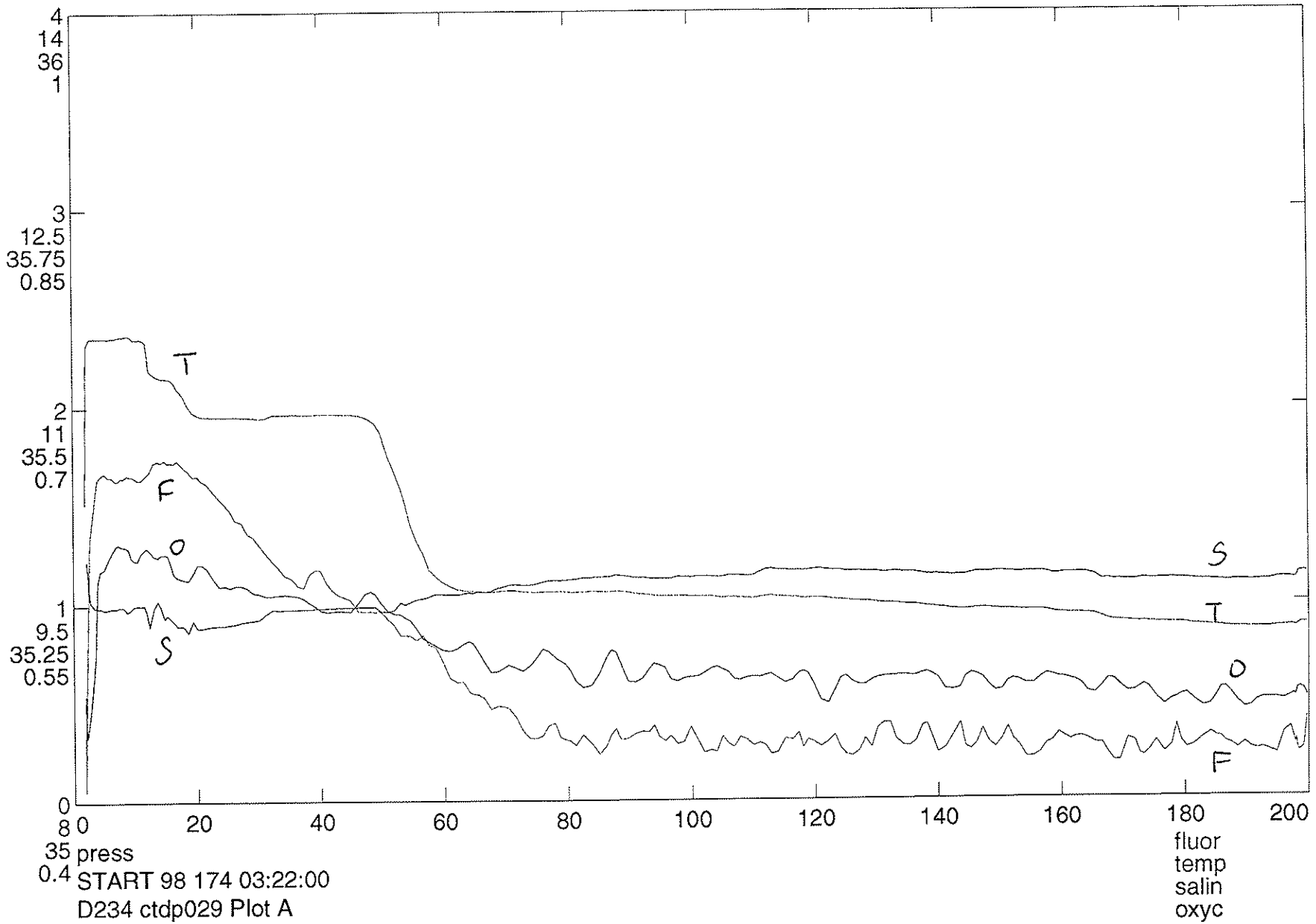

5
5.9
200
36
4.375
5.15
150
35.75
3.75
4.4
100
35.5
3.125
3.65
50
35.25
2.5
2.9
0
35
T
D
S
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 172 15:05:00
D234 ctdp026 Plot B
trans
nephl
dwirr
salin

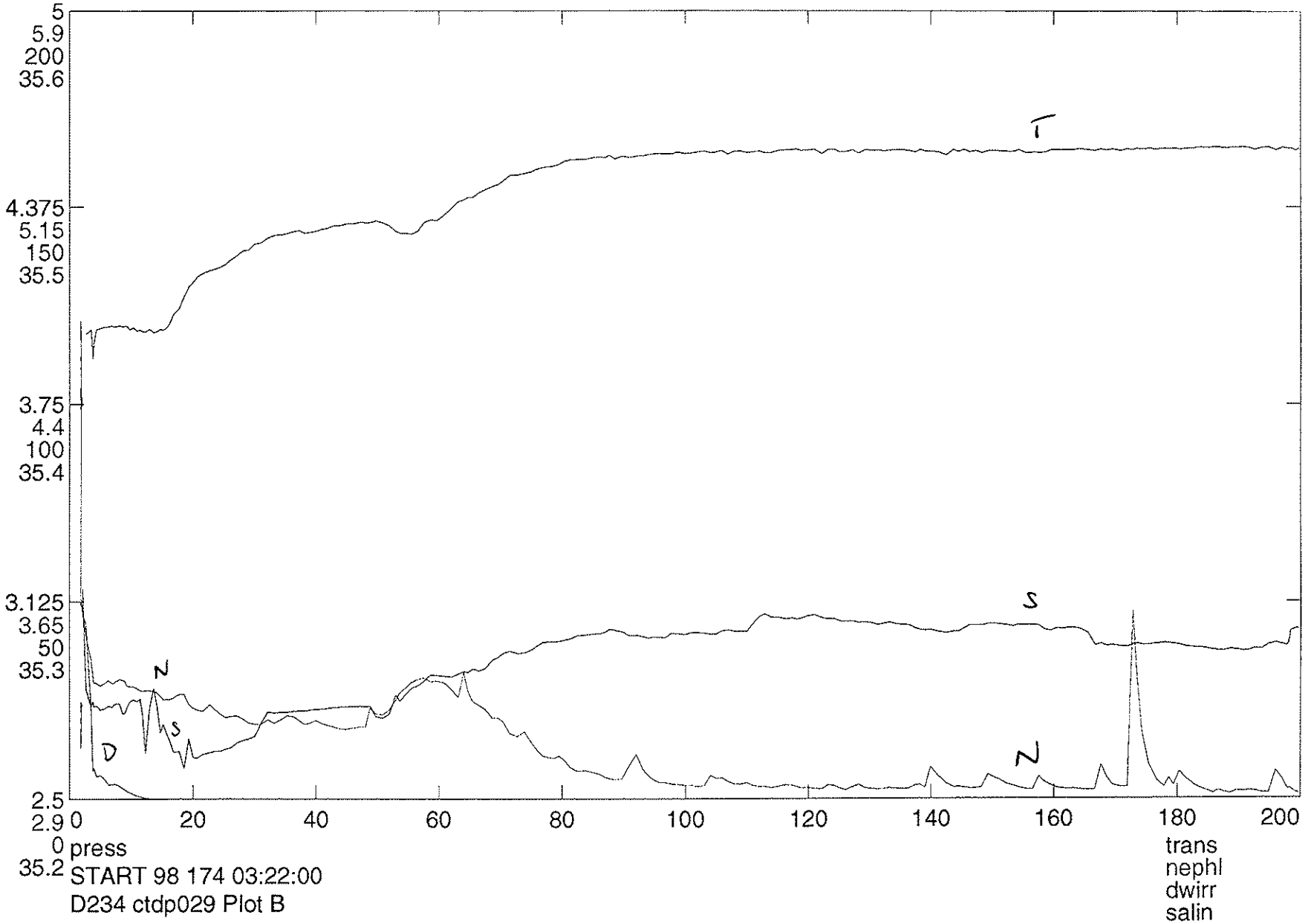

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
S
F
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 173 11:59:00
D234 ctdp027 Plot A
fluor
temp
salin
oxyc

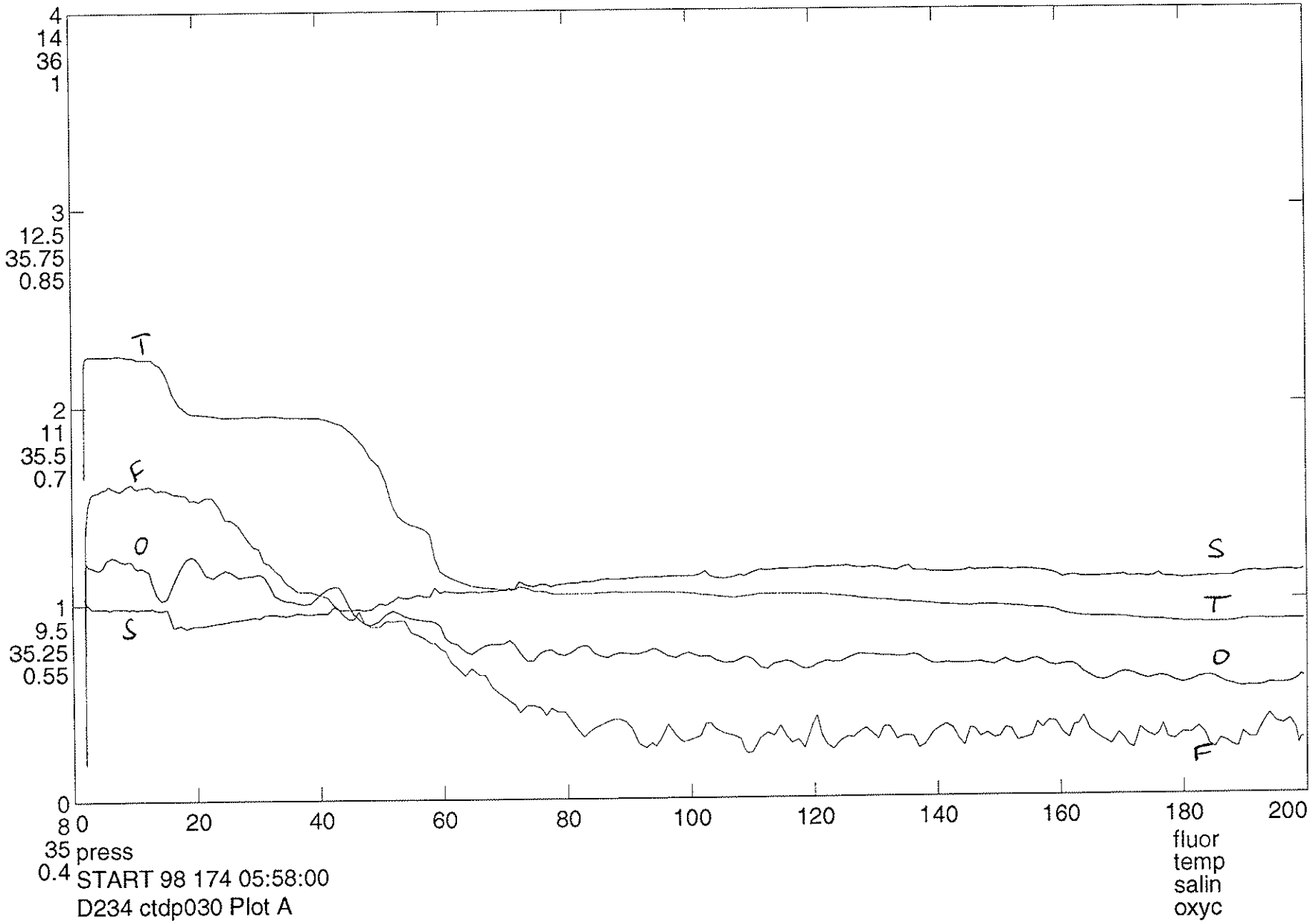

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
0
20
40
60
80
100
120
140
160
180
200
T
D
N
S
N
0 press
START 98 173 11:59:00
D234 ctdp027 Plot B
trans
nephl
dwirr
salin

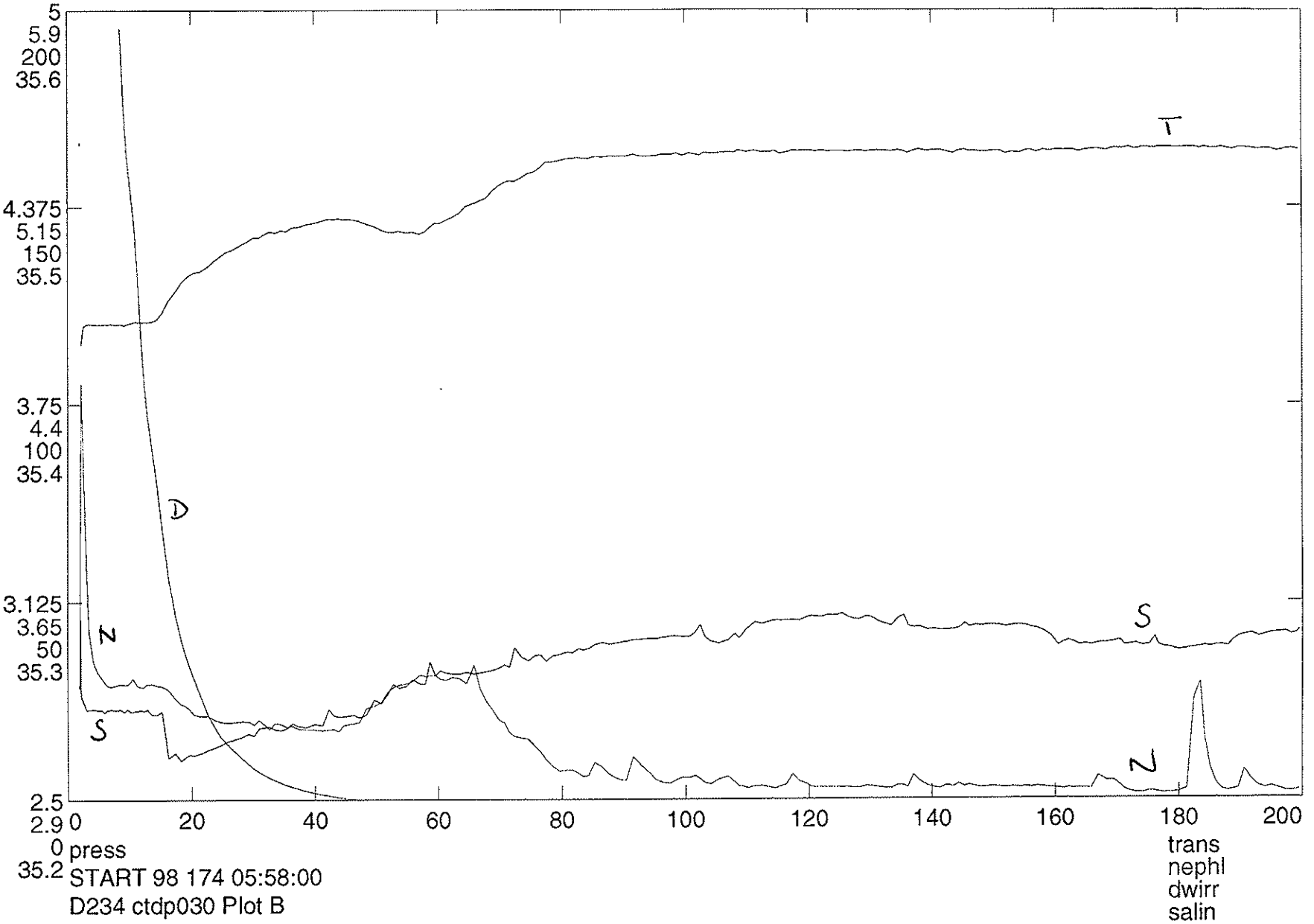

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
5
10
15
20
25
30
35
40
45
50
fluor
temp
salin
oxyc
T
F
O
S
START 98 174 02:54:00
D234 ctdp028 Plot A

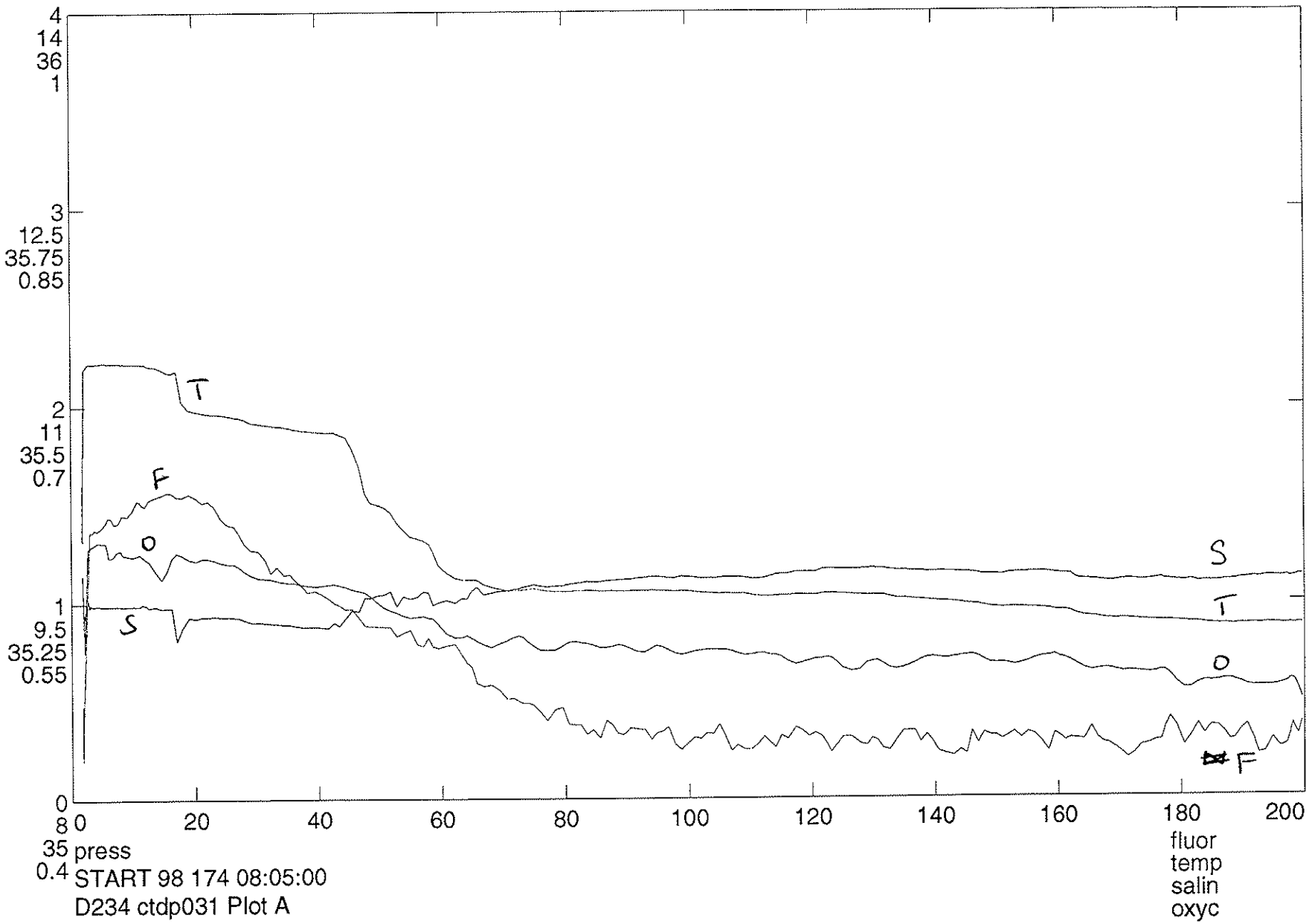

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
5
10
15
20
25
30
35
40
45
50
T
N
S
D
press
START 98 174 02:54:00
D234 ctdp028 Plot B
trans
nephl
dwirr
salin

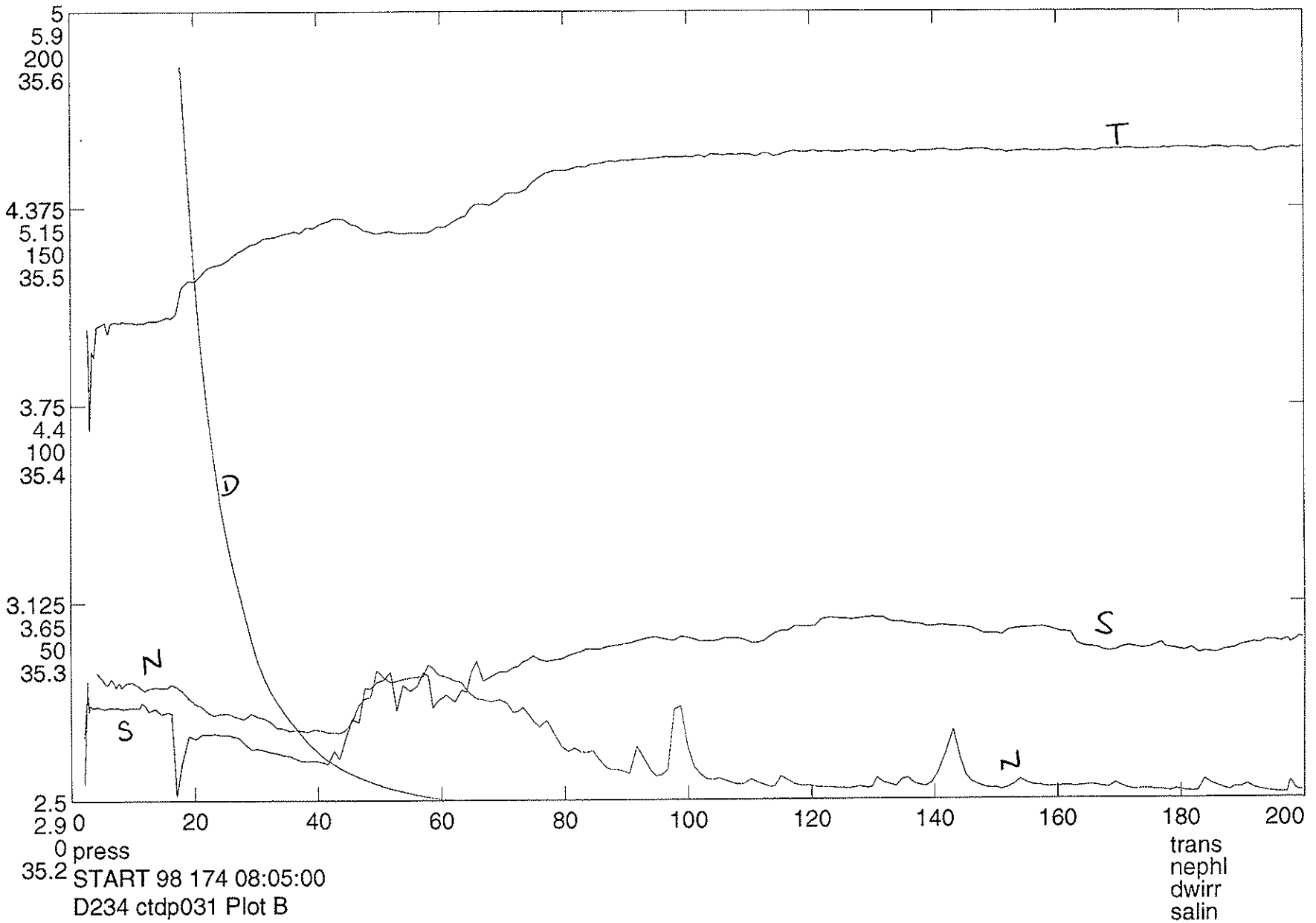

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 174 03:22:00
D234 ctdp029 Plot A
fluor
temp
salin
oxyc

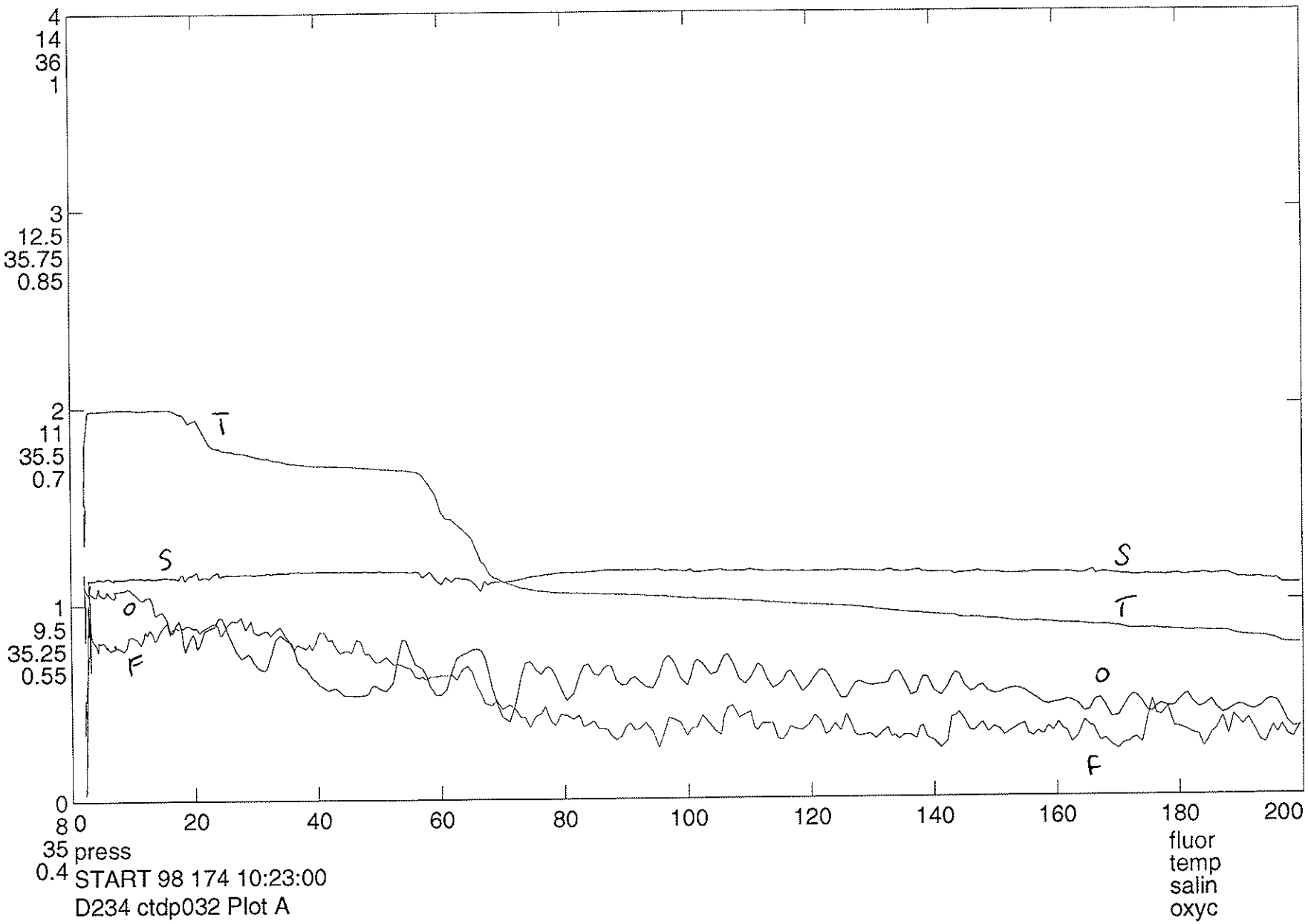

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
0
20
40
60
80
100
120
140
160
180
200
T
S
N
D
S
N
press
START 98 174 03:22:00
D234 ctdp029 Plot B
trans
nephl
dwirr
salin

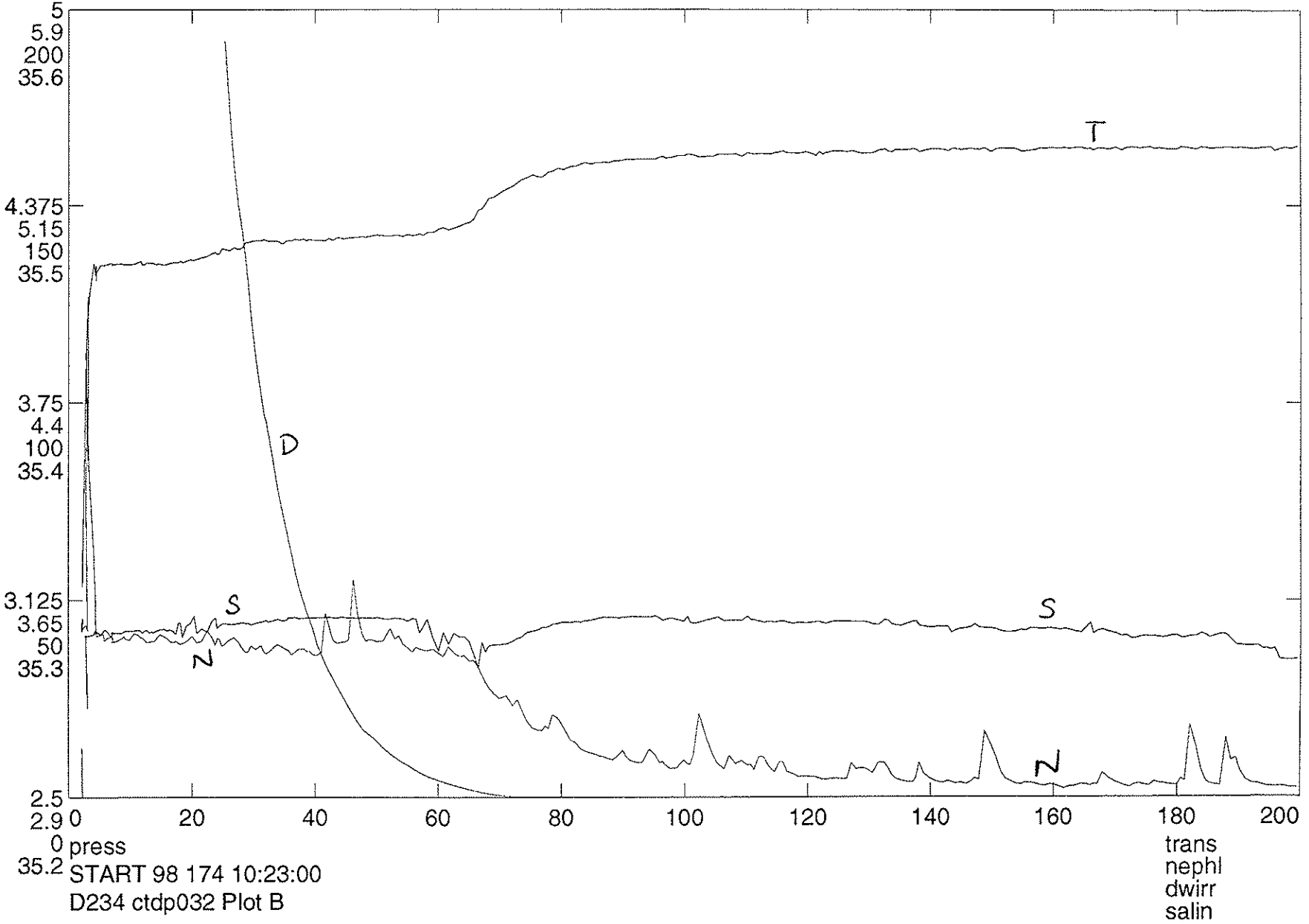

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 174 05:58:00
D234 ctdp030 Plot A
fluor
temp
salin
oxyc

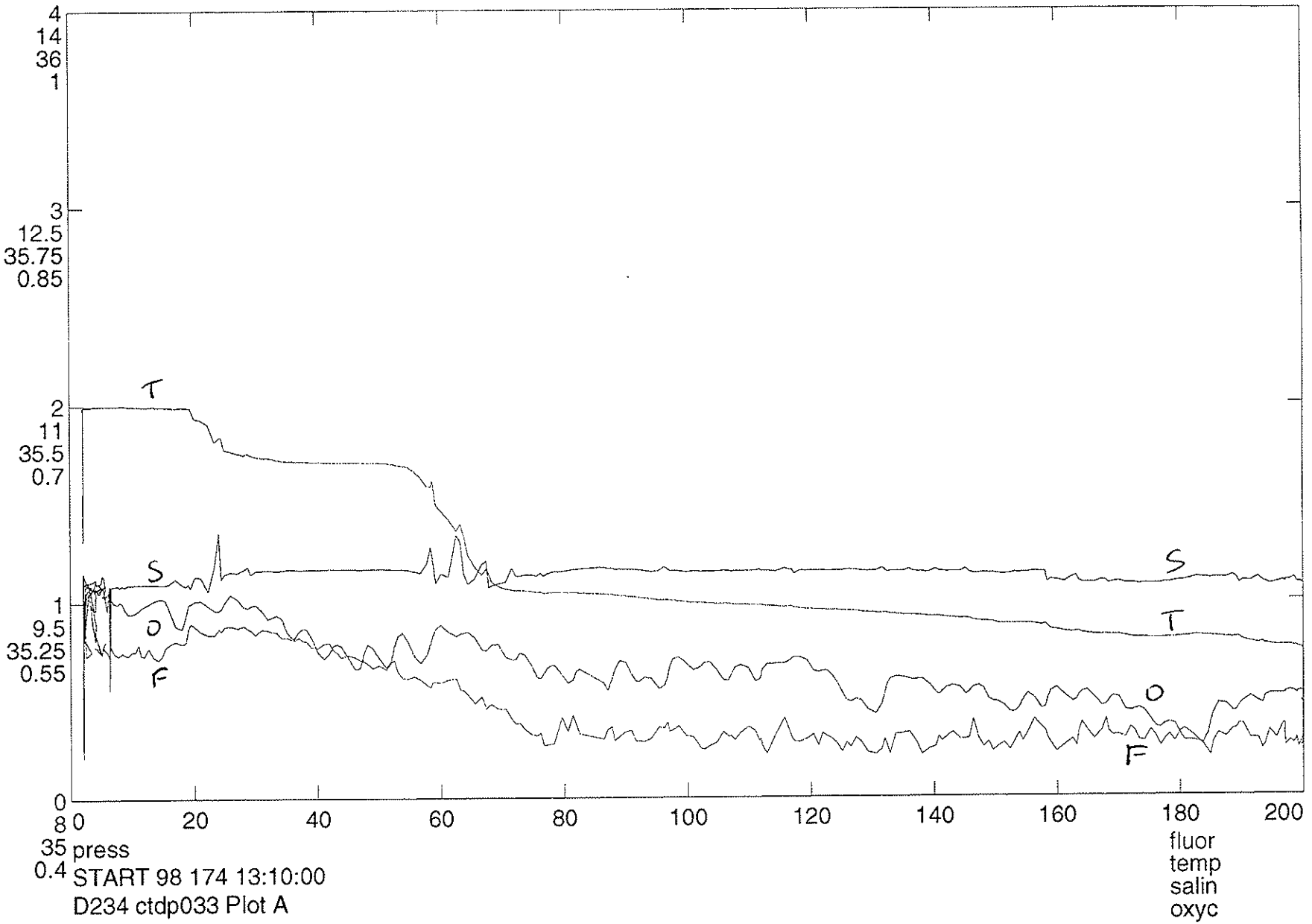

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
D
N
S
S
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 174 05:58:00
D234 ctdp030 Plot B
trans
nephl
dwirr
salin

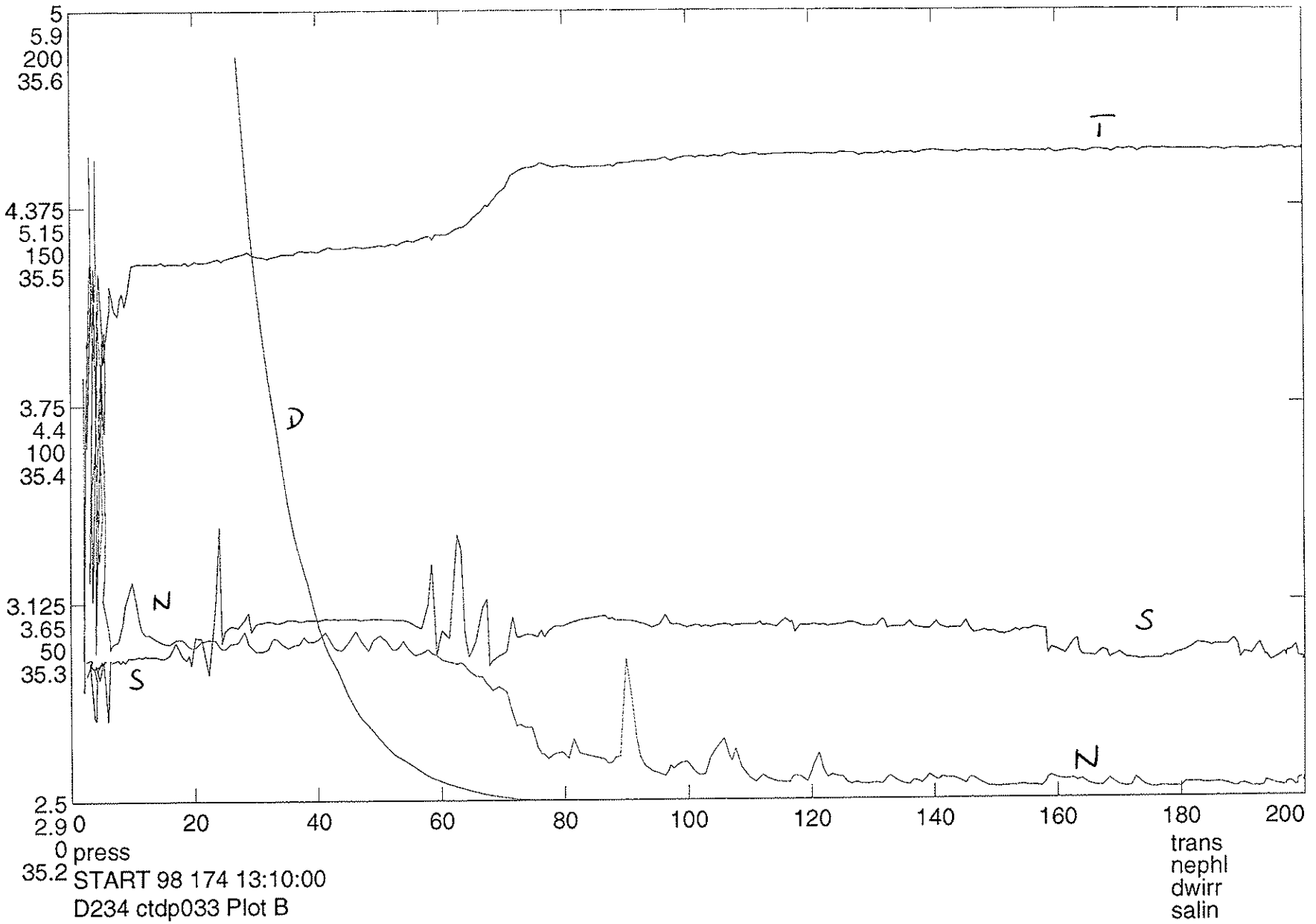

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
20
40
60
80
100
120
140
160
180
200
T
F
O
S
S
T
O
F
press
START 98 174 08:05:00
D234 ctdp031 Plot A
fluor
temp
salin
oxyc

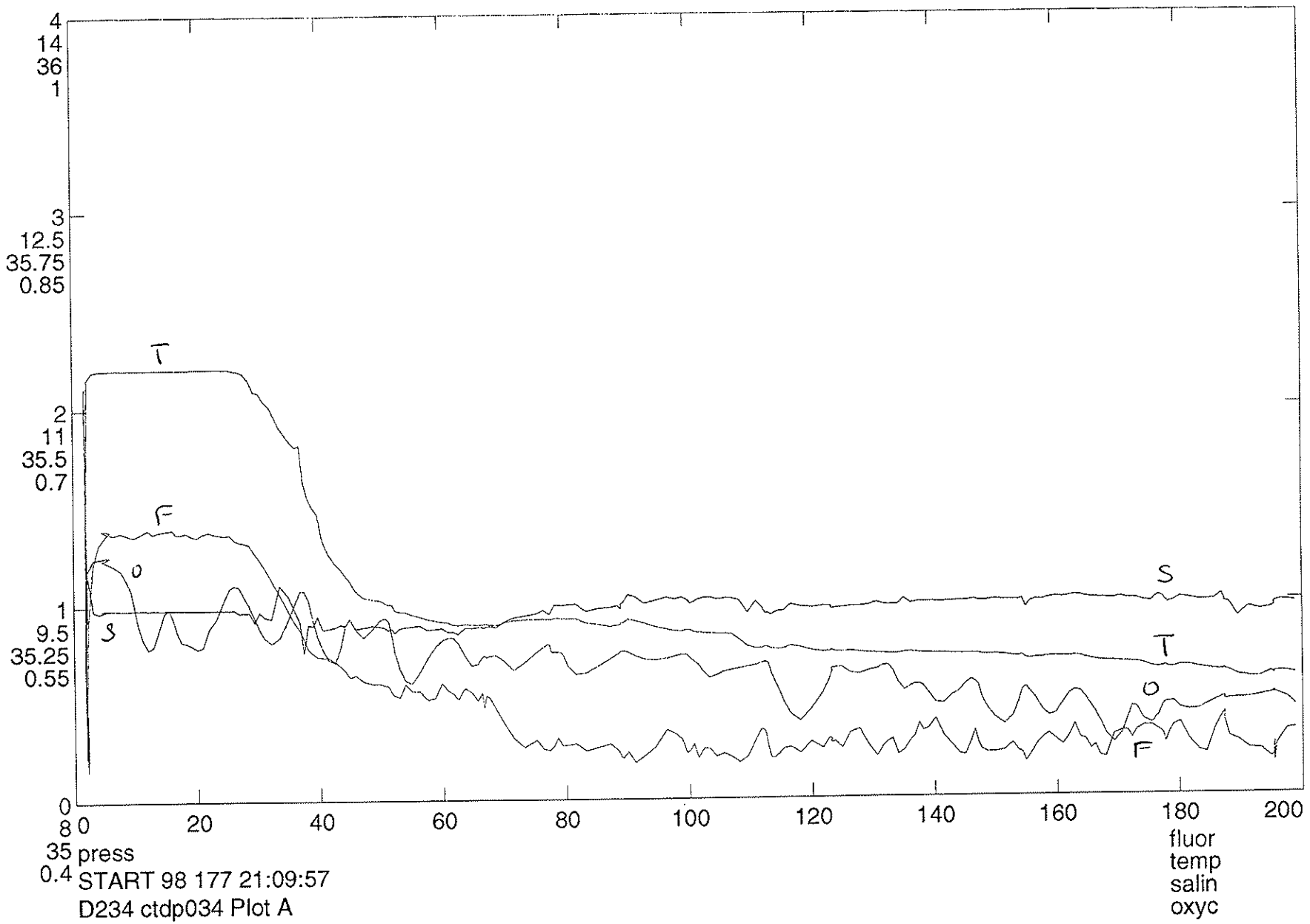

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
D
N
S
S
N
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 174 08:05:00
D234 ctdp031 Plot B
trans
nephl
dwirr
salin

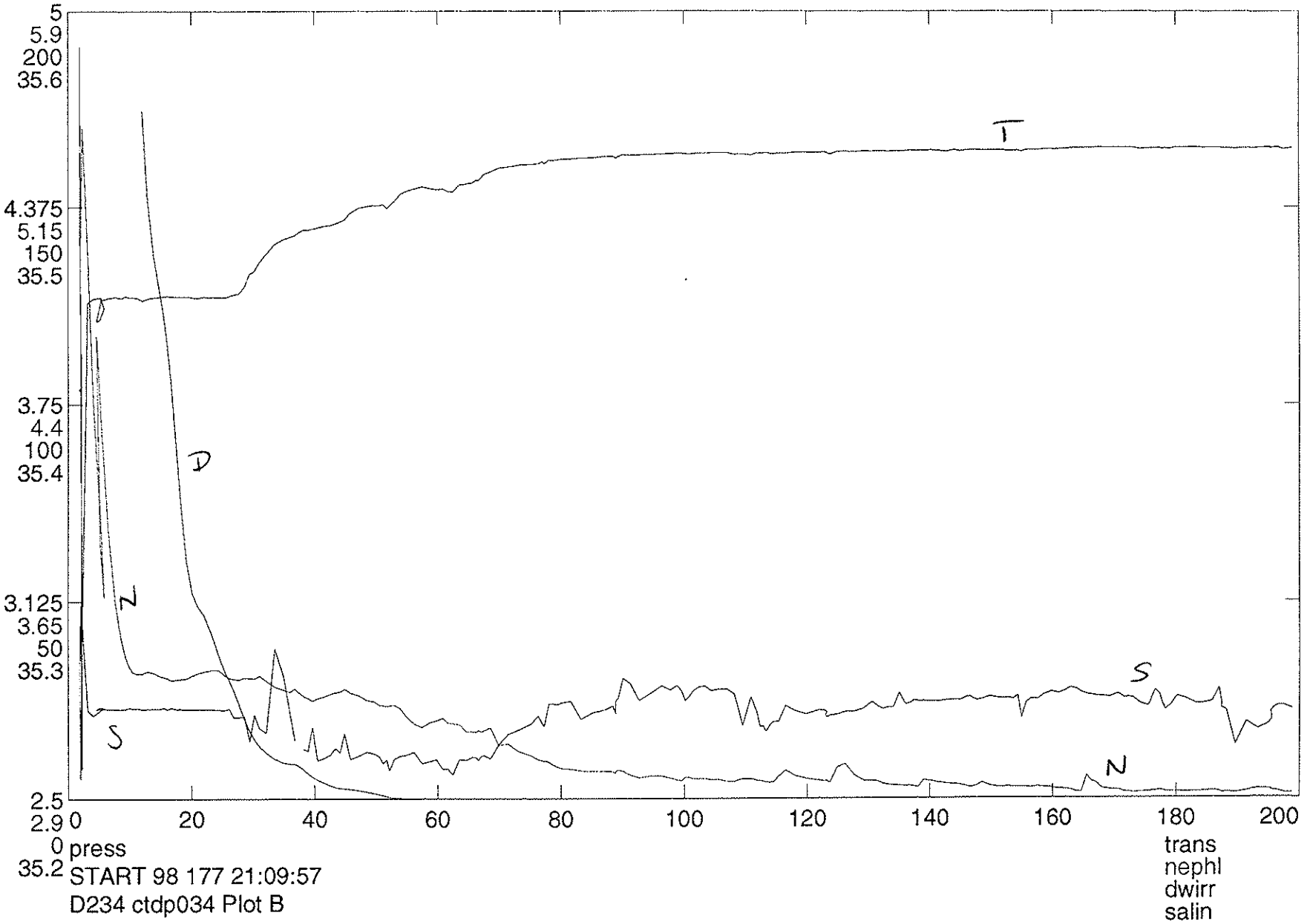

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 174 10:23:00
D234 ctdp032 Plot A
fluor
temp
salin
oxyc

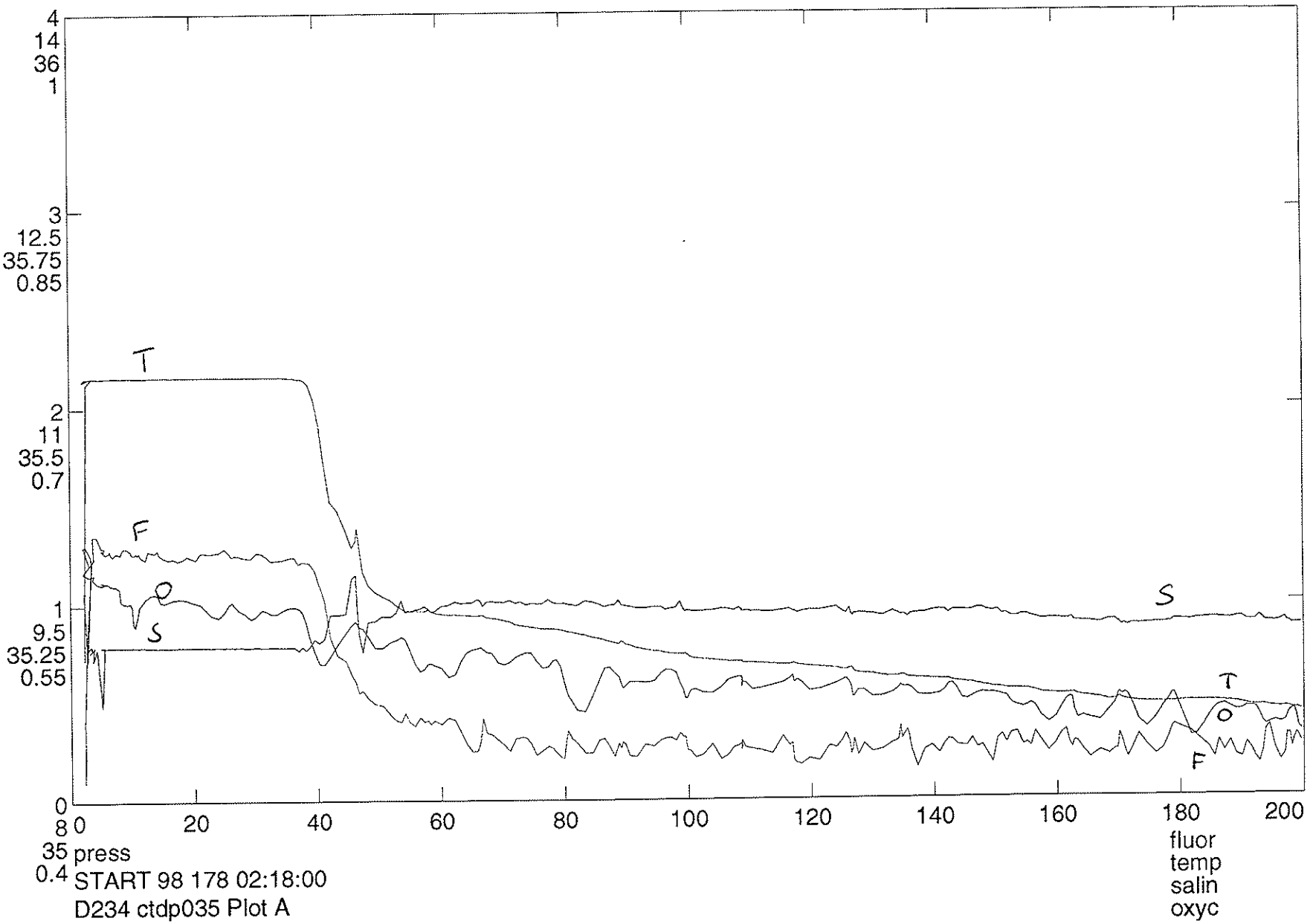

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
0
20
40
60
80
100
120
140
160
180
200
T
D
S
N
S
N
0 press
START 98 174 10:23:00
D234 ctdp032 Plot B
trans
nephl
dwirr
salin

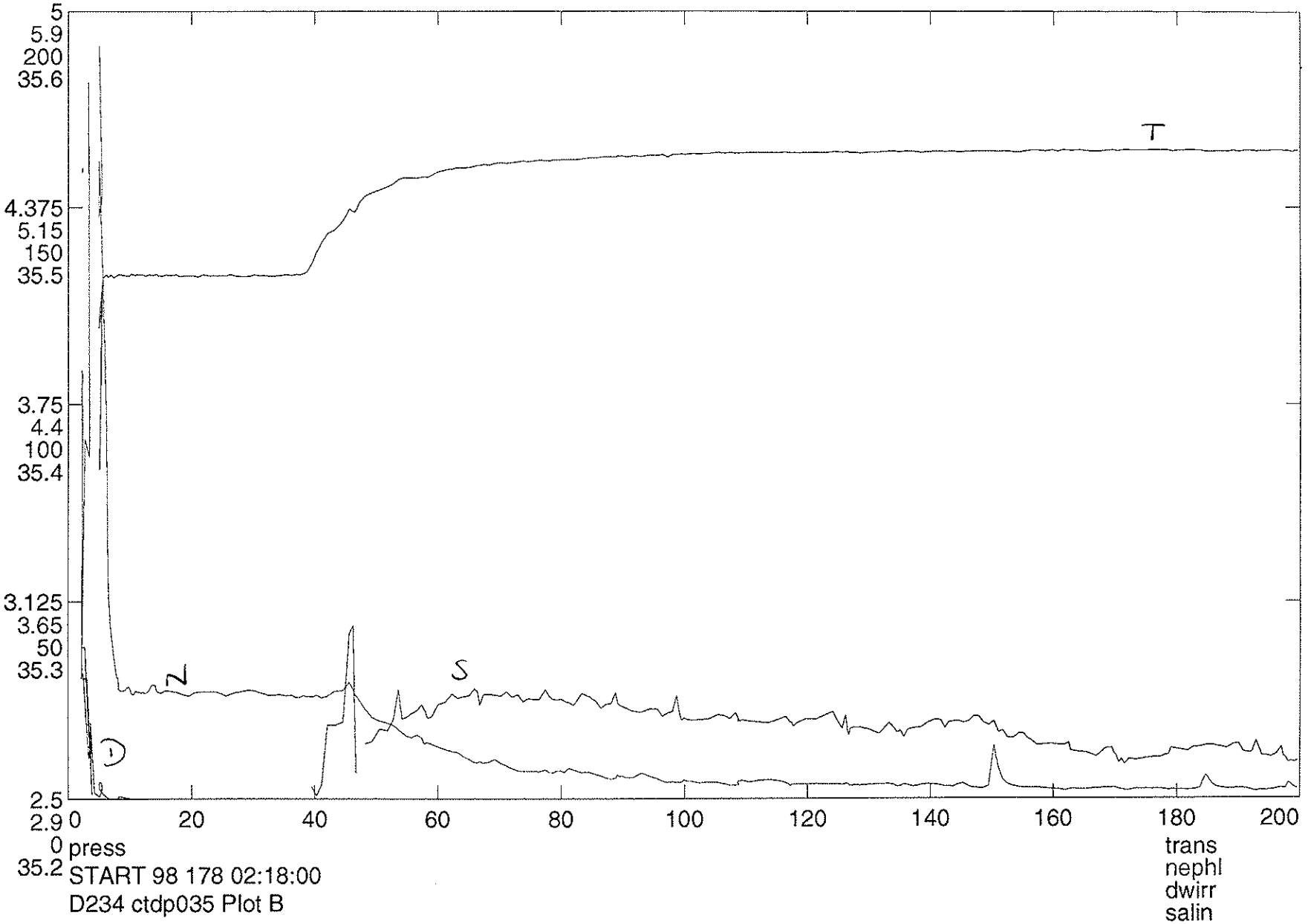

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 174 13:10:00
D234 ctdp033 Plot A
fluor
temp
salin
oxyc

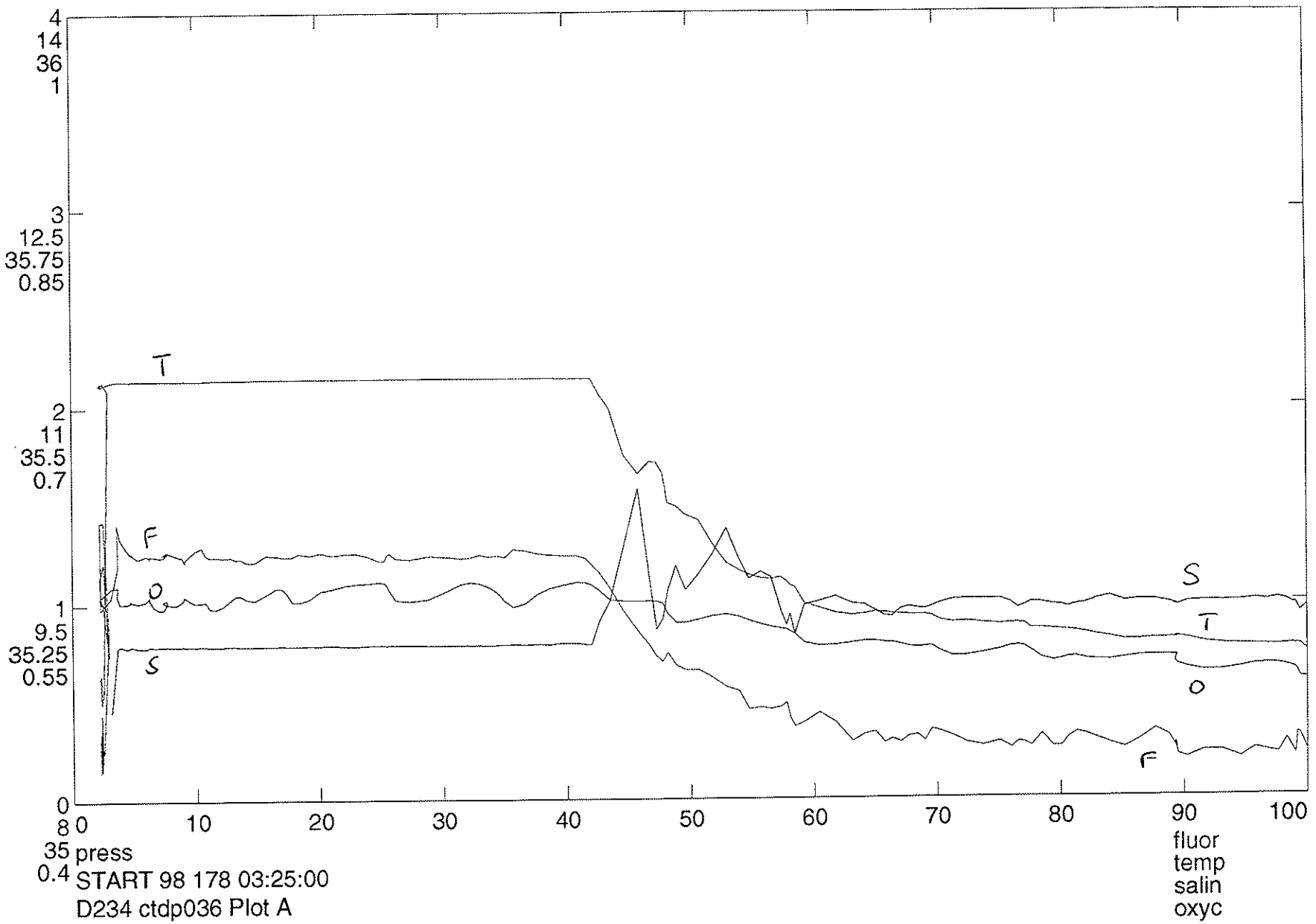

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
0
20
40
60
80
100
120
140
160
180
200
T
D
N
S
S
N
0 press
START 98 174 13:10:00
D234 ctdp033 Plot B
trans
nephl
dwirr
salin

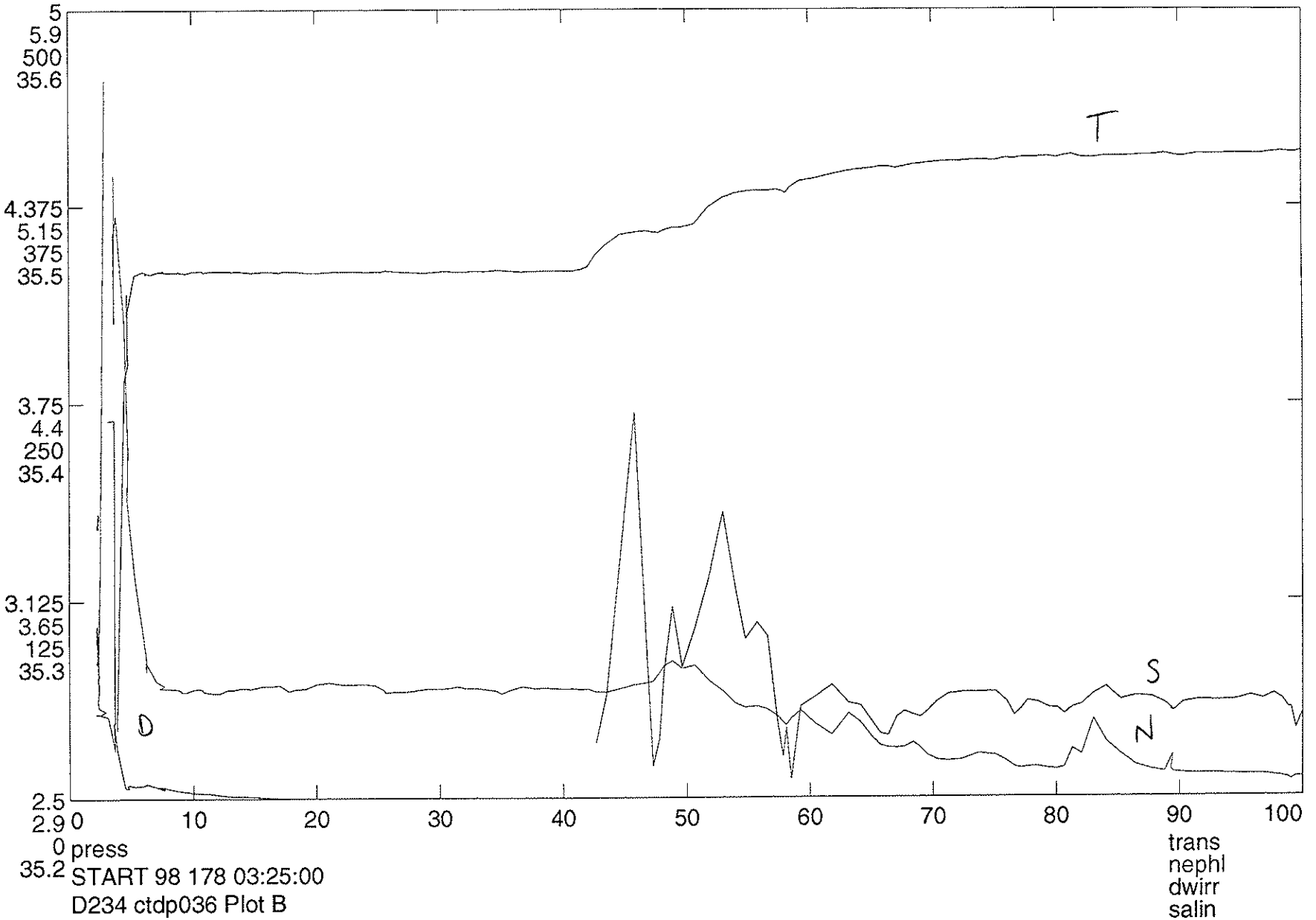

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 177 21:09:57
D234 ctdp034 Plot A
fluor
temp
salin
oxyc

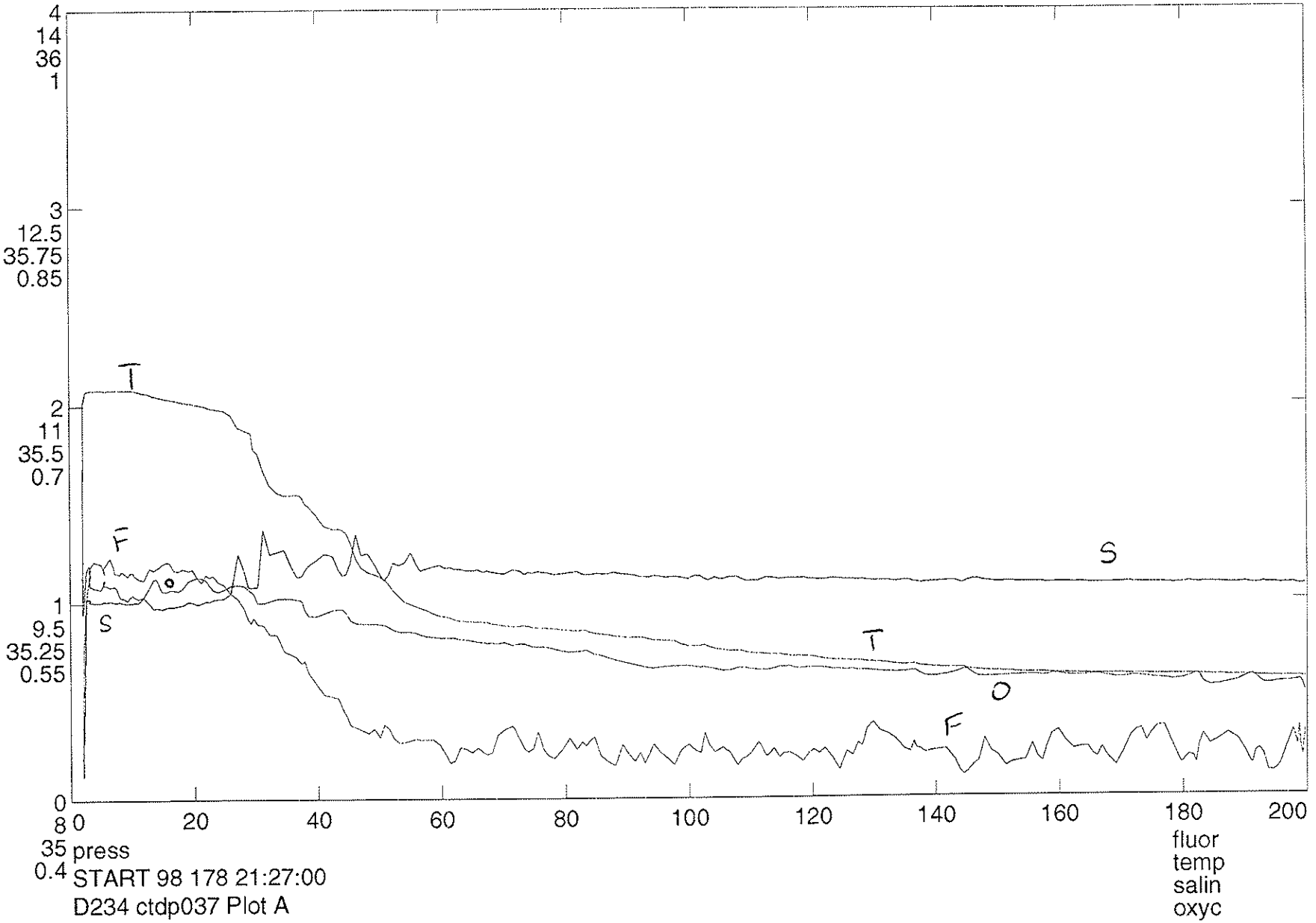

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
0
20
40
60
80
100
120
140
160
180
200
T
D
Z
S
S
N
0 press
START 98 177 21:09:57
D234 ctdp034 Plot B
trans
nephl
dwirr
salin

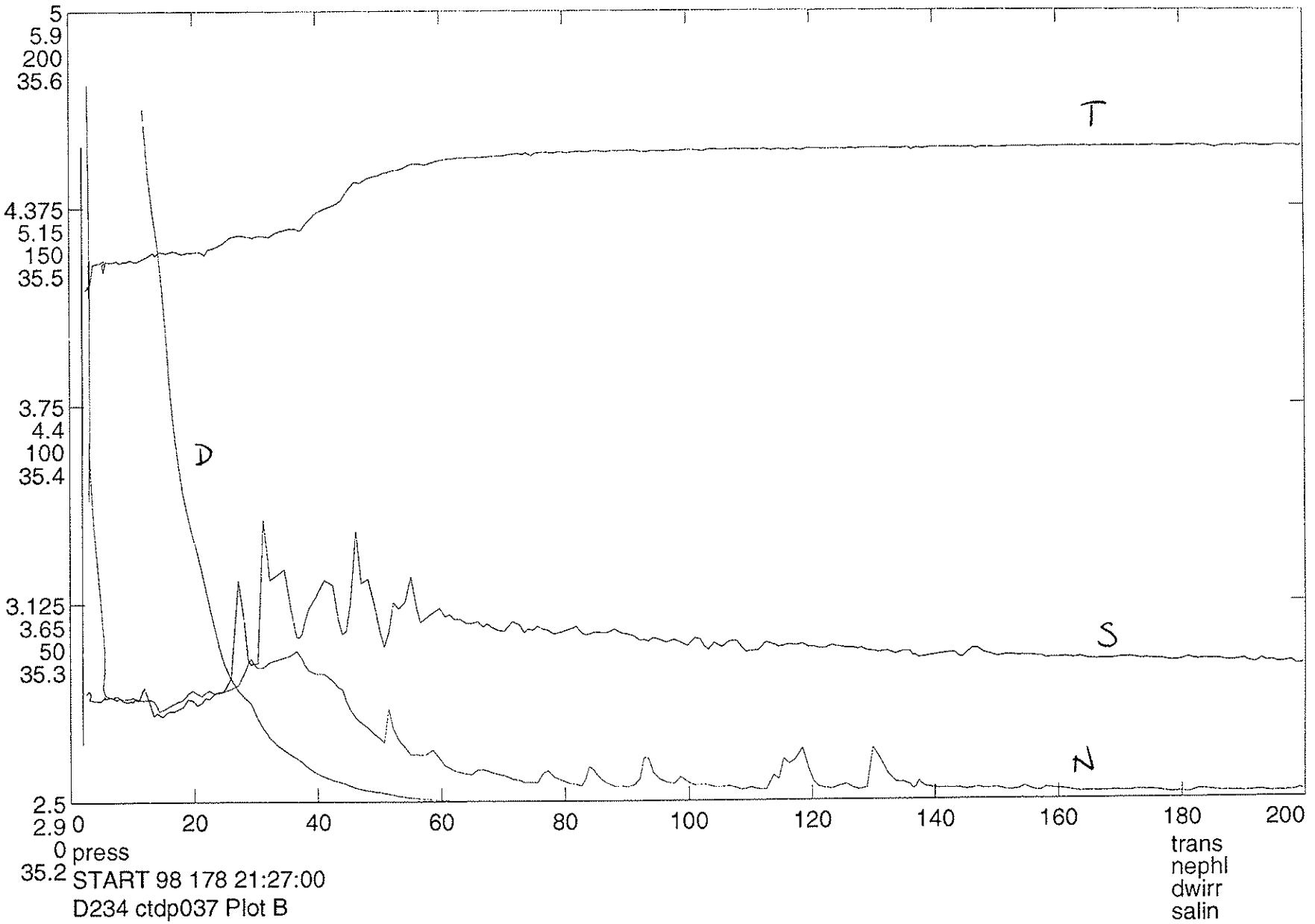

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 178 02:18:00
D234 ctdp035 Plot A
fluor
temp
salin
oxyc

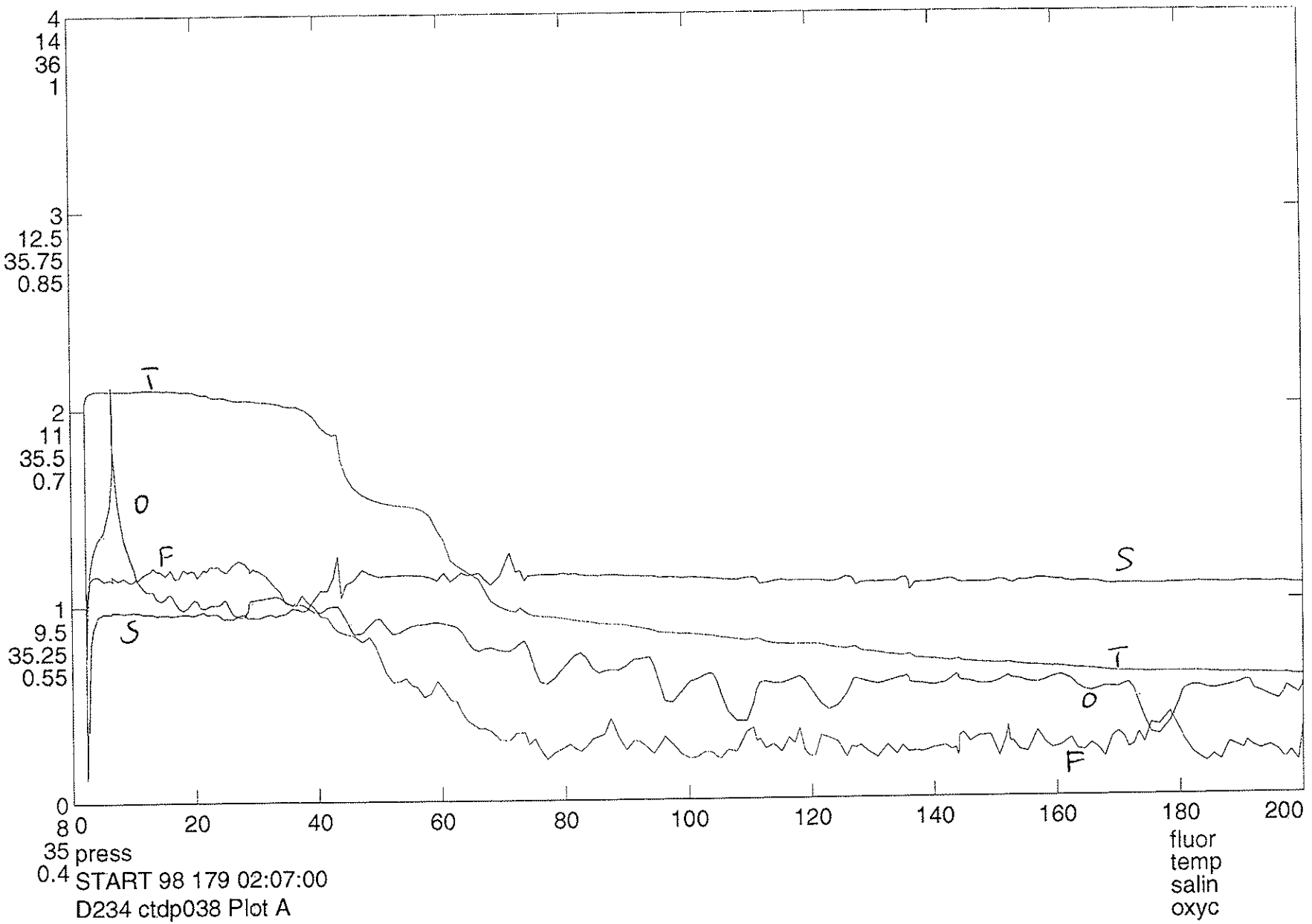

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
N
S
D
0
20
40
60
80
100
120
140
160
180
200
0 press
START 98 178 02:18:00
D234 ctdp035 Plot B
trans
nephl
dwirr
salin

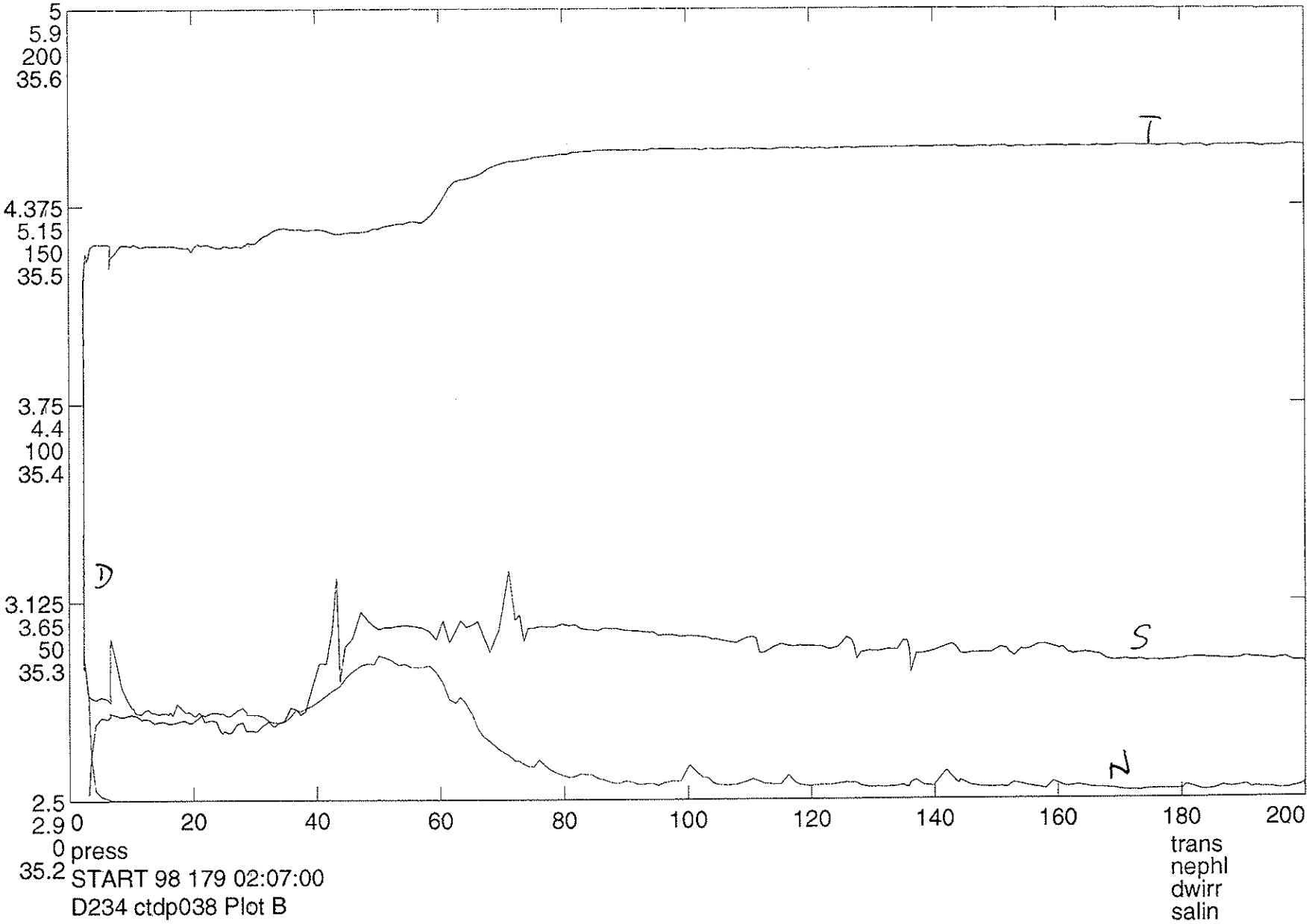

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
10
20
30
40
50
60
70
80
90
100
press
START 98 178 03:25:00
D234 ctdp036 Plot A
fluor
temp
salin
oxyc

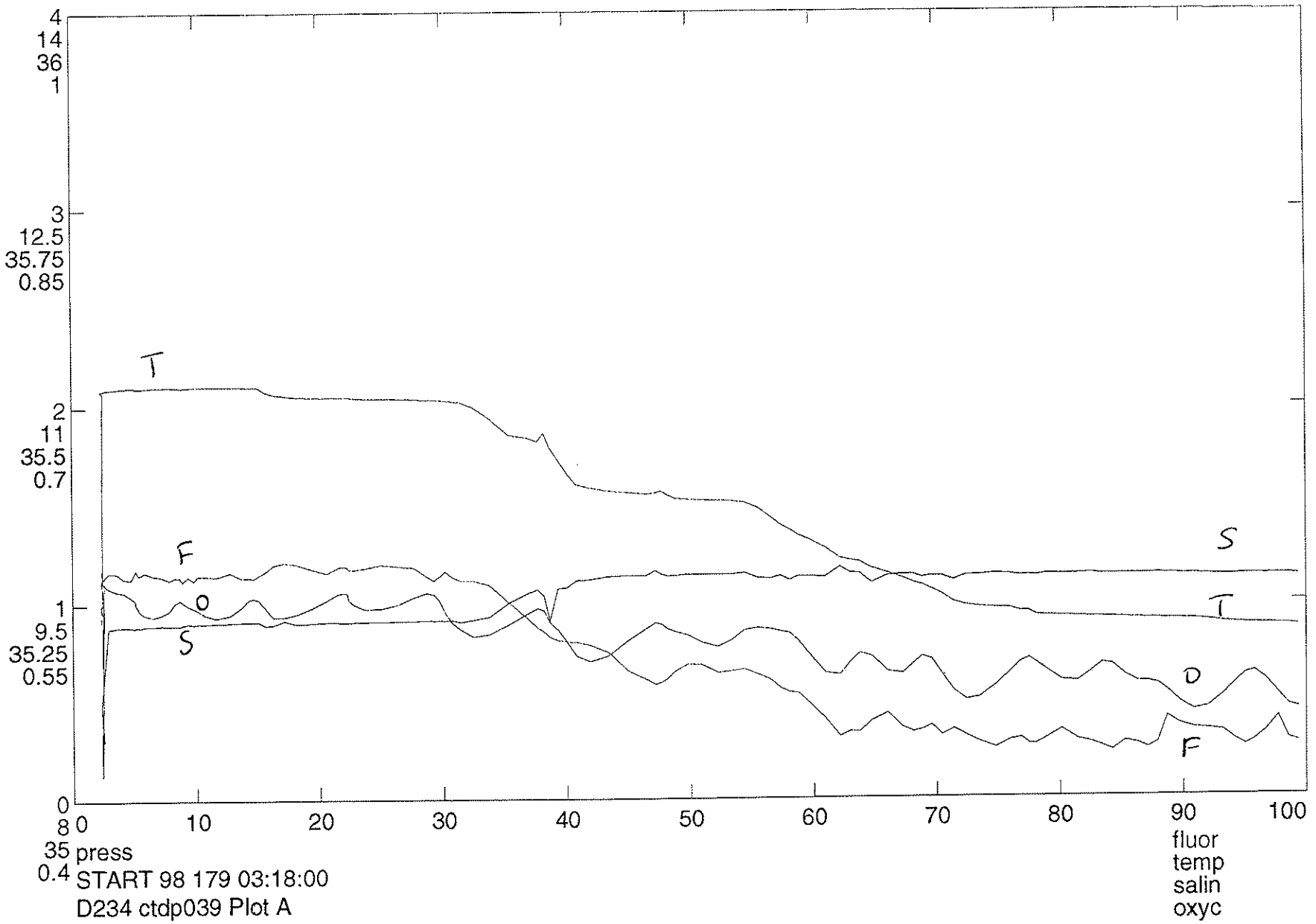

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
D
0 press
START 98 178 03:25:00
D234 ctdp036 Plot B
trans
nephl
dwirr
salin

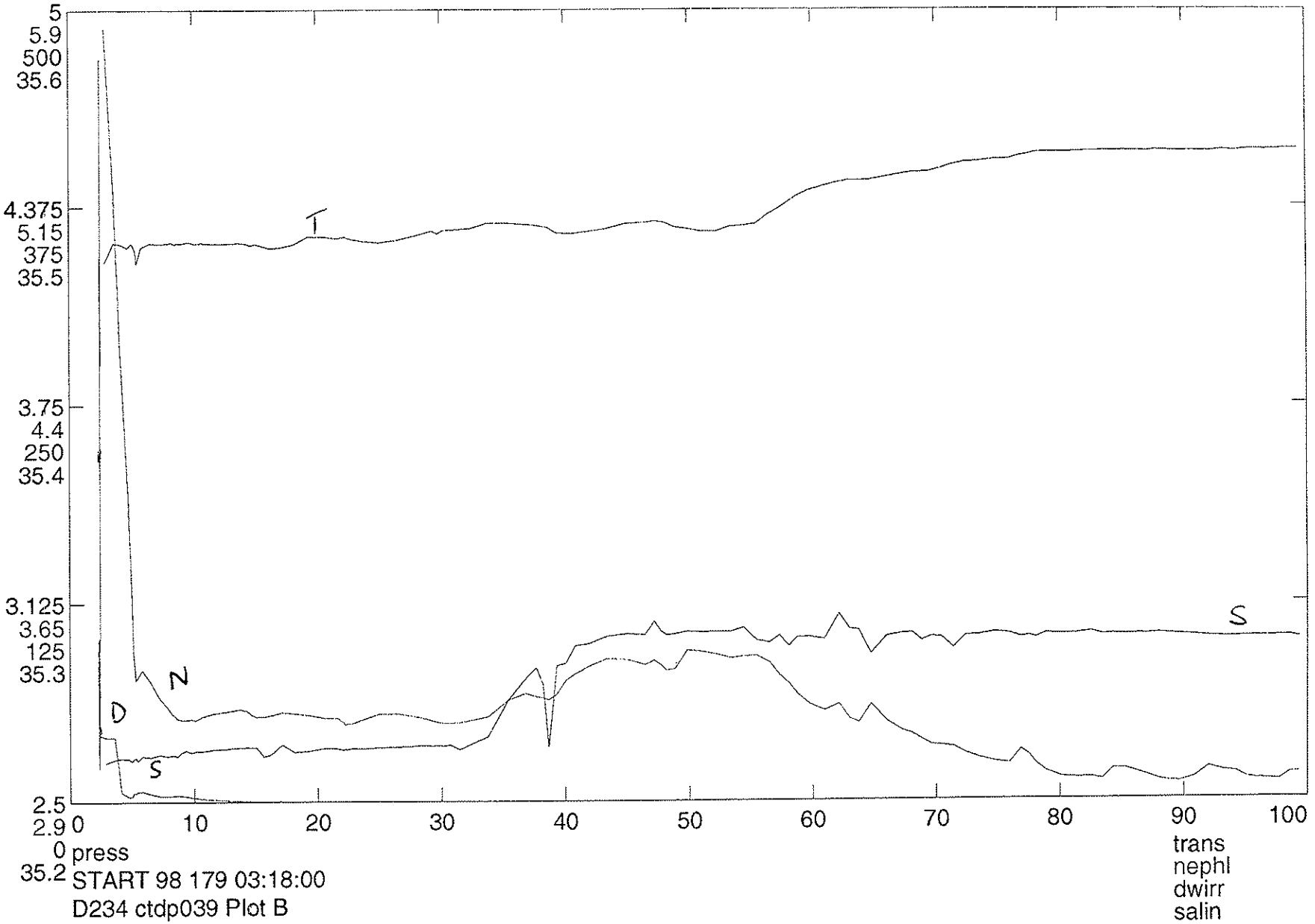

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
S
O
0
20
40
60
80
100
120
140
160
180
200
press
fluor
temp
salin
oxyc
START 98 178 21:27:00
D234 ctdp037 Plot A

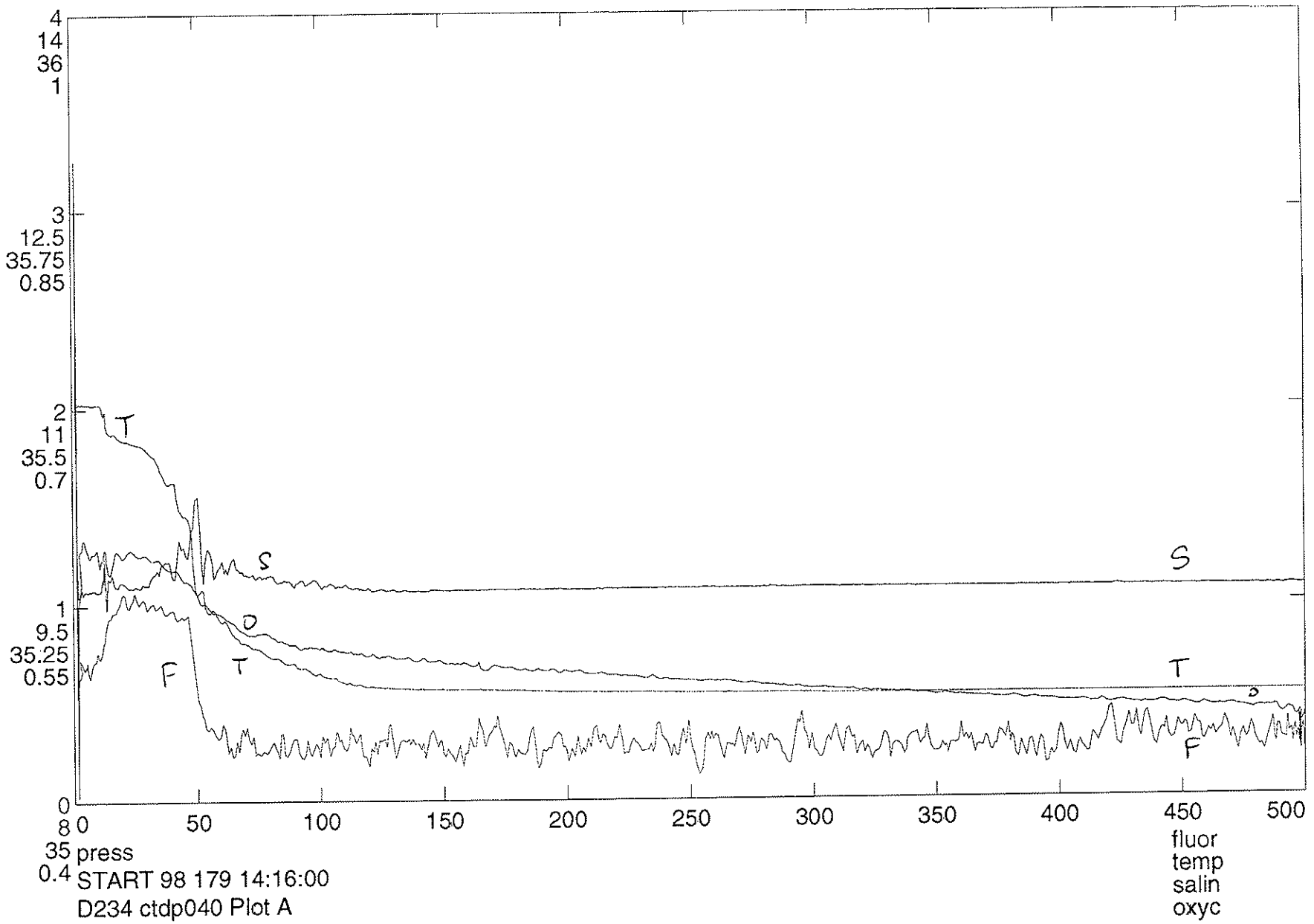

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
D
S
N
0
20
40
60
80
100
120
140
160
180
200
press
trans
nephl
dwirr
salin
START 98 178 21:27:00
D234 ctdp037 Plot B

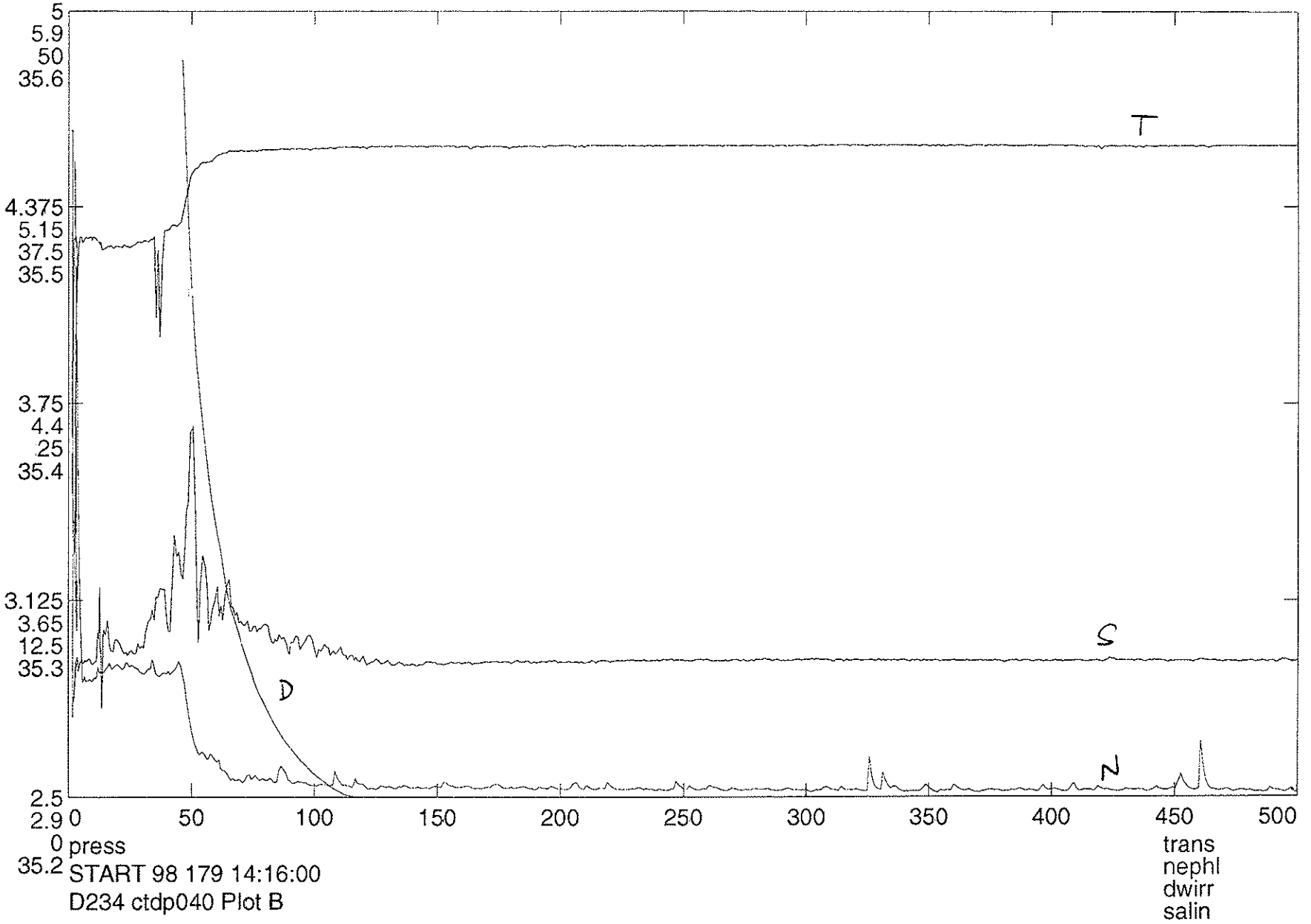

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
F
S
S
T
O
F
0
20
40
60
80
100
120
140
160
180
200
press
START 98 179 02:07:00
D234 ctdp038 Plot A
fluor
temp
salin
oxyc

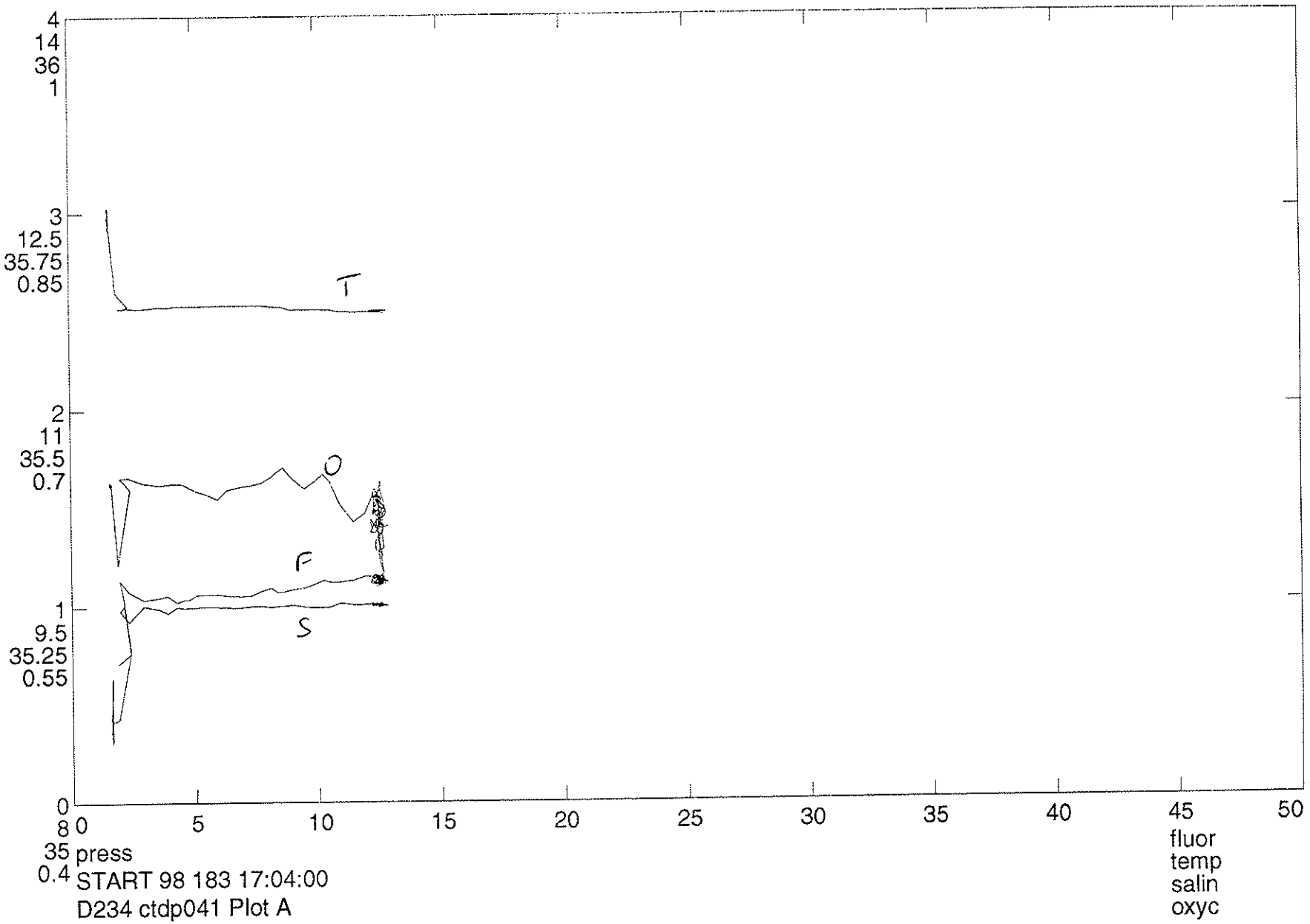

5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
S
D
N
0
20
40
60
80
100
120
140
160
180
200
press
trans
nephl
dwirr
salin
START 98 179 02:07:00
D234 ctdp038 Plot B

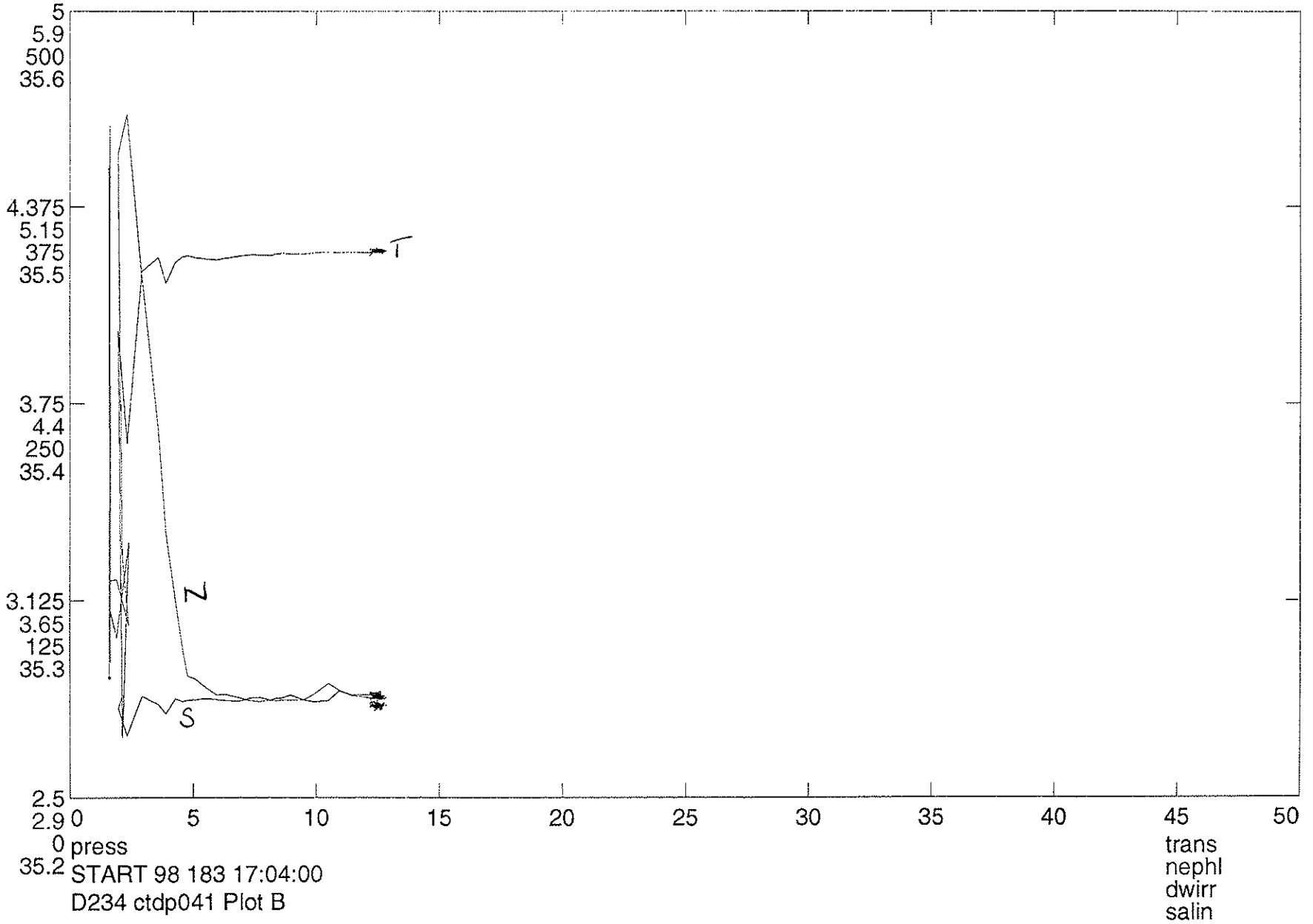

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
F
O
S
S
T
O
F
0
10
20
30
40
50
60
70
80
90
100
press
START 98 179 03:18:00
D234 ctdp039 Plot A
fluor
temp
salin
oxyc

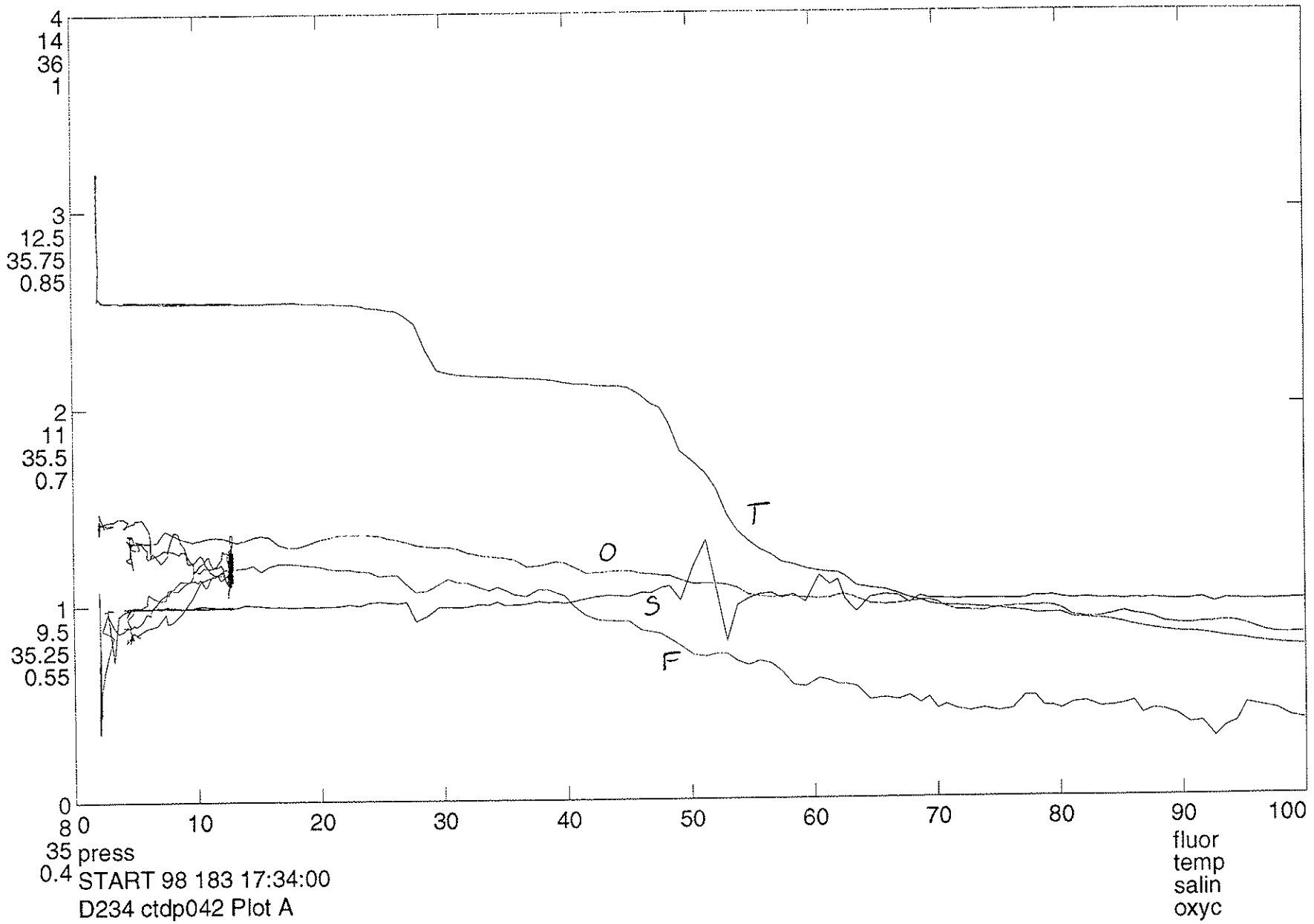

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
T
N
D
S
S
0
10
20
30
40
50
60
70
80
90
100
0 press
START 98 179 03:18:00
D234 ctdp039 Plot B
trans
nephl
dwirr
salin

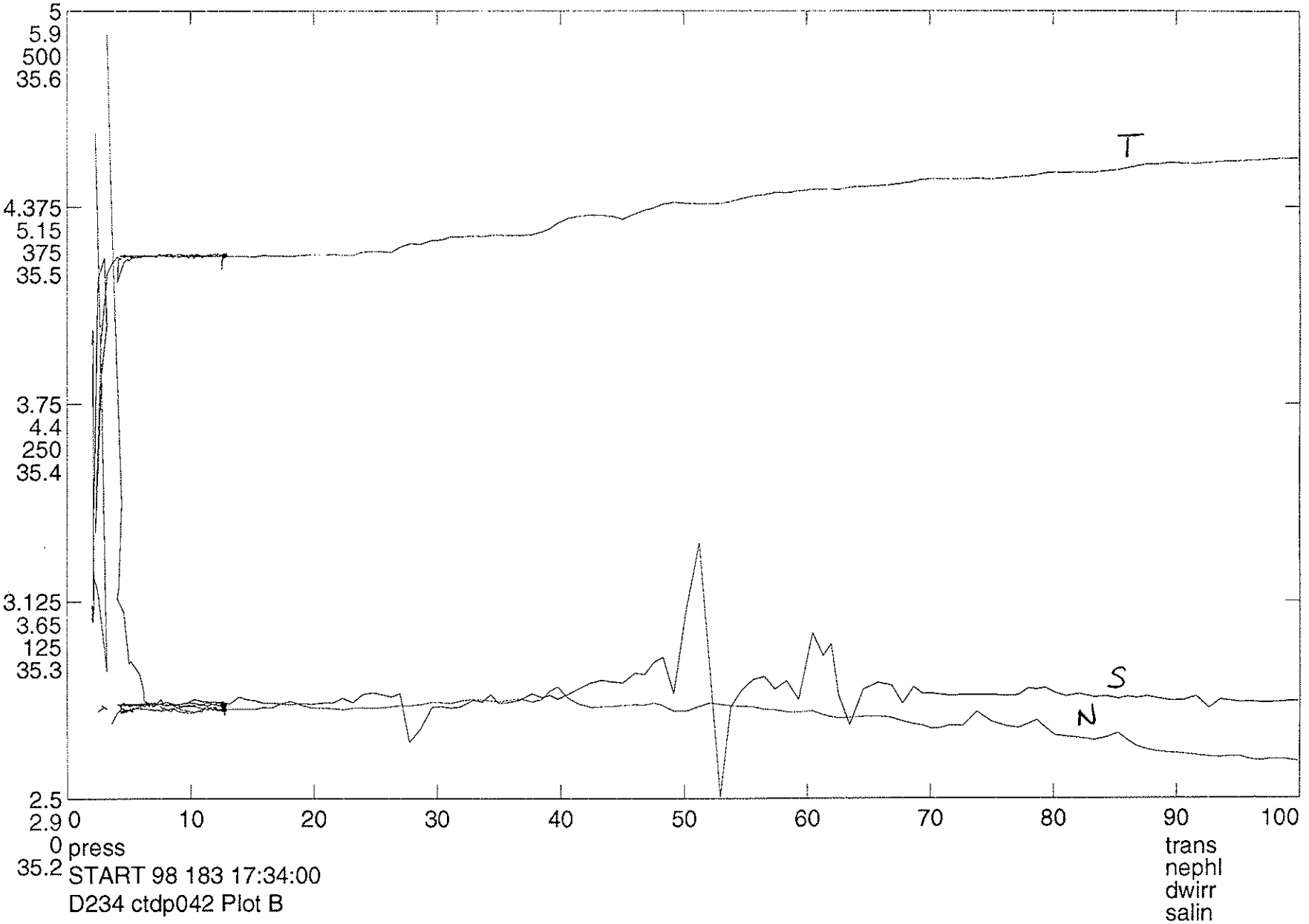

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
D
T
F
S
T
D
F
0
50
100
150
200
250
300
350
400
450
500
press
START 98 179 14:16:00
D234 ctdp040 Plot A
fluor
temp
salin
oxyc

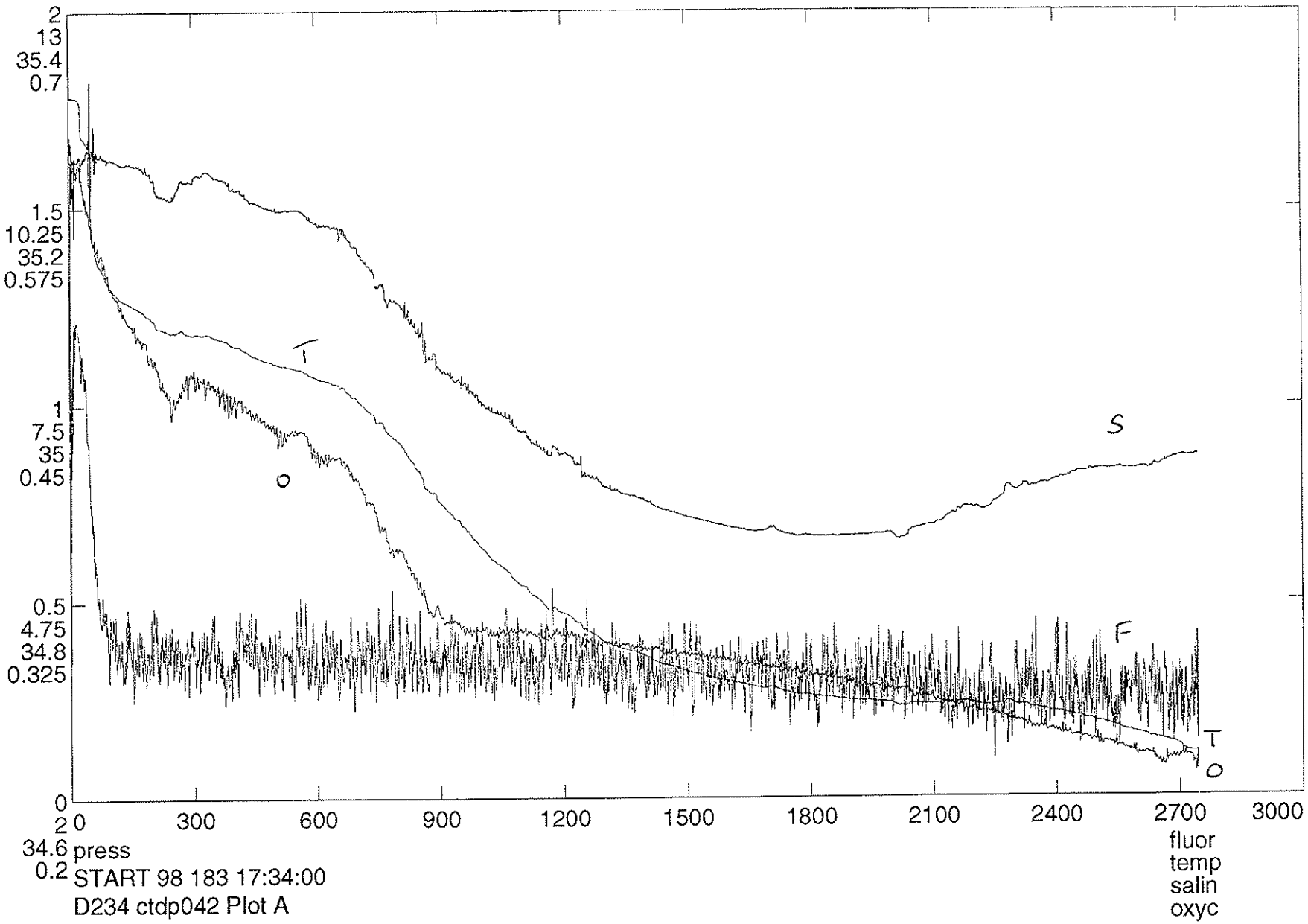

5
5.9
50
35.6
4.375
5.15
37.5
35.5
3.75
4.4
25
35.4
3.125
3.65
12.5
35.3
2.5
2.9
0
35.2
0
50
100
150
200
250
300
350
400
450
500
T
S
D
N
0 press
START 98 179 14:16:00
D234 ctdp040 Plot B
trans
nephl
dwirr
salin

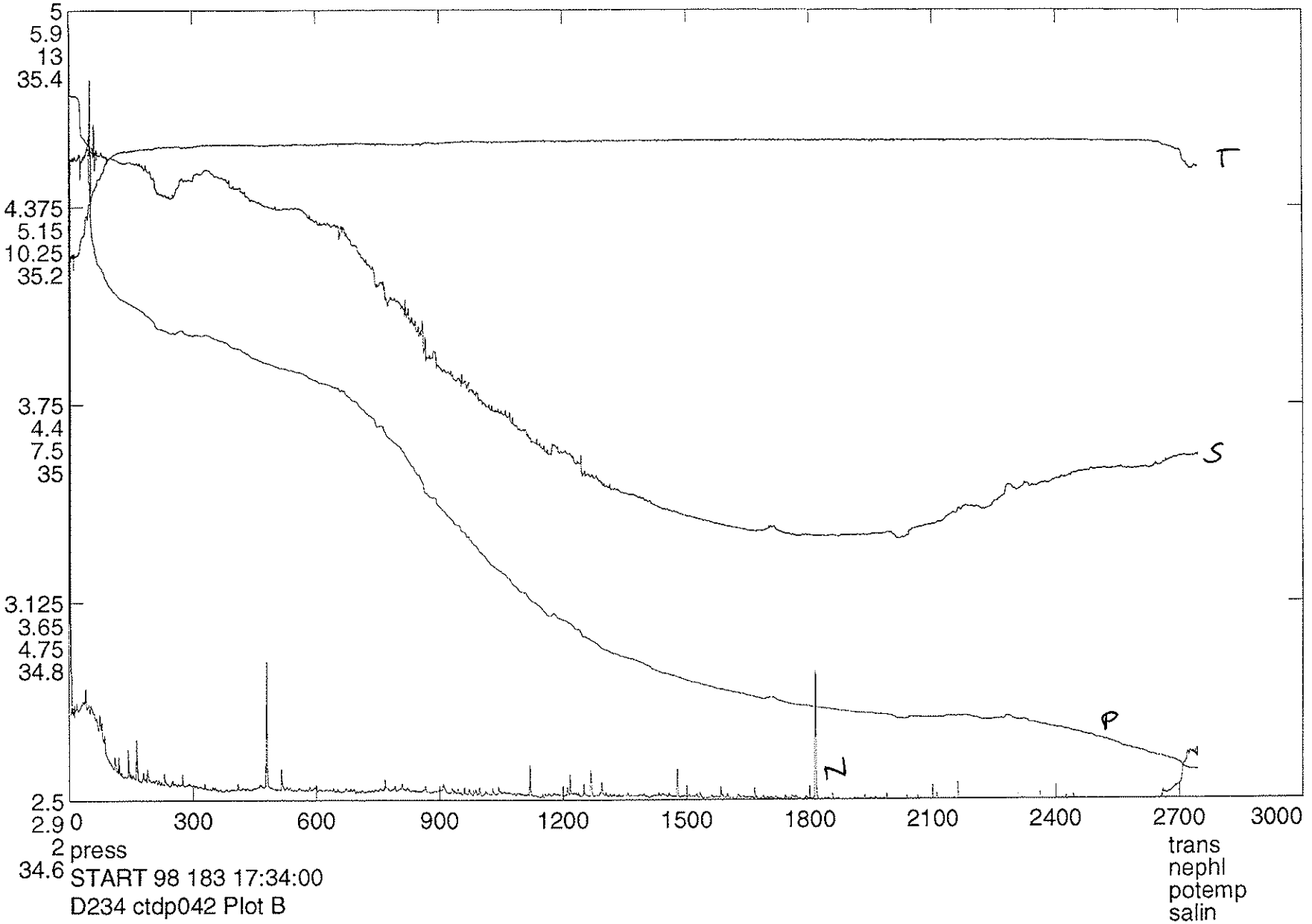

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
F
S
0
5
10
15
20
25
30
35
40
45
50
press
START 98 183 17:04:00
D234 ctdp041 Plot A
fluor
temp
salin
oxyc

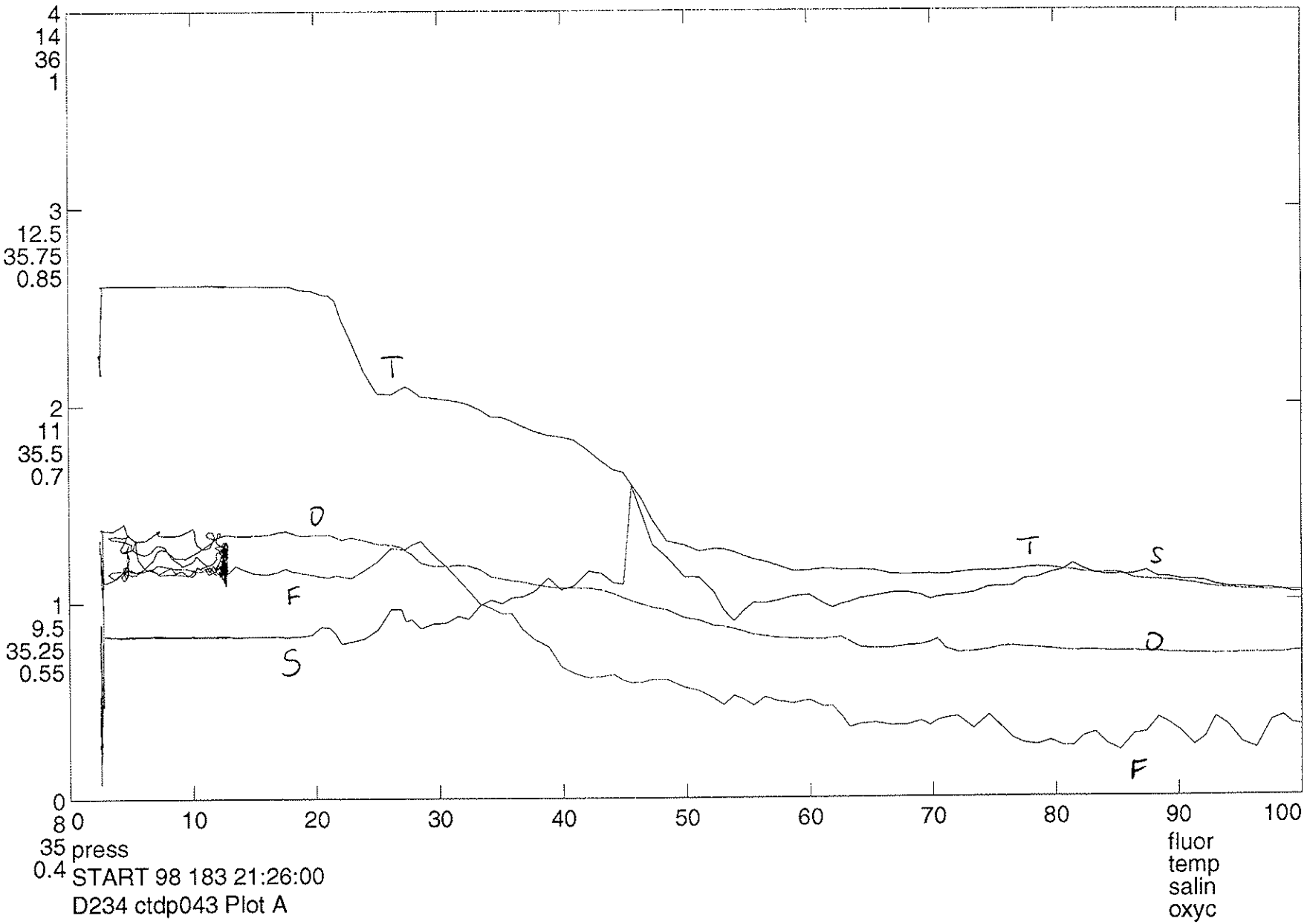

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
T
Z
S
0
5
10
15
20
25
30
35
40
45
50
0 press
START 98 183 17:04:00
D234 ctdp041 Plot B
trans
nephl
dwirr
salin

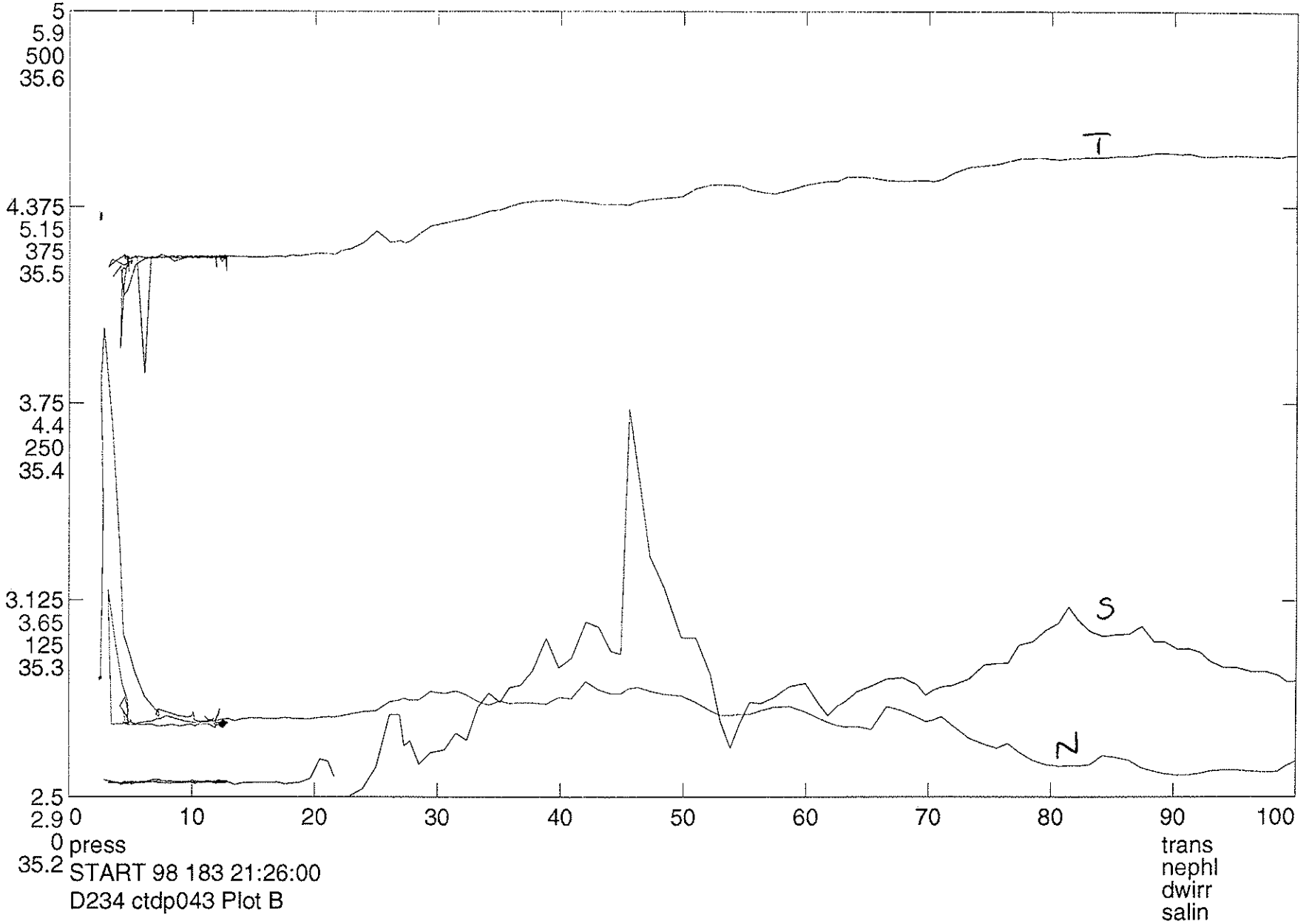

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
T
O
S
F
press
START 98 183 17:34:00
D234 ctdp042 Plot A
fluor
temp
salin
oxyc

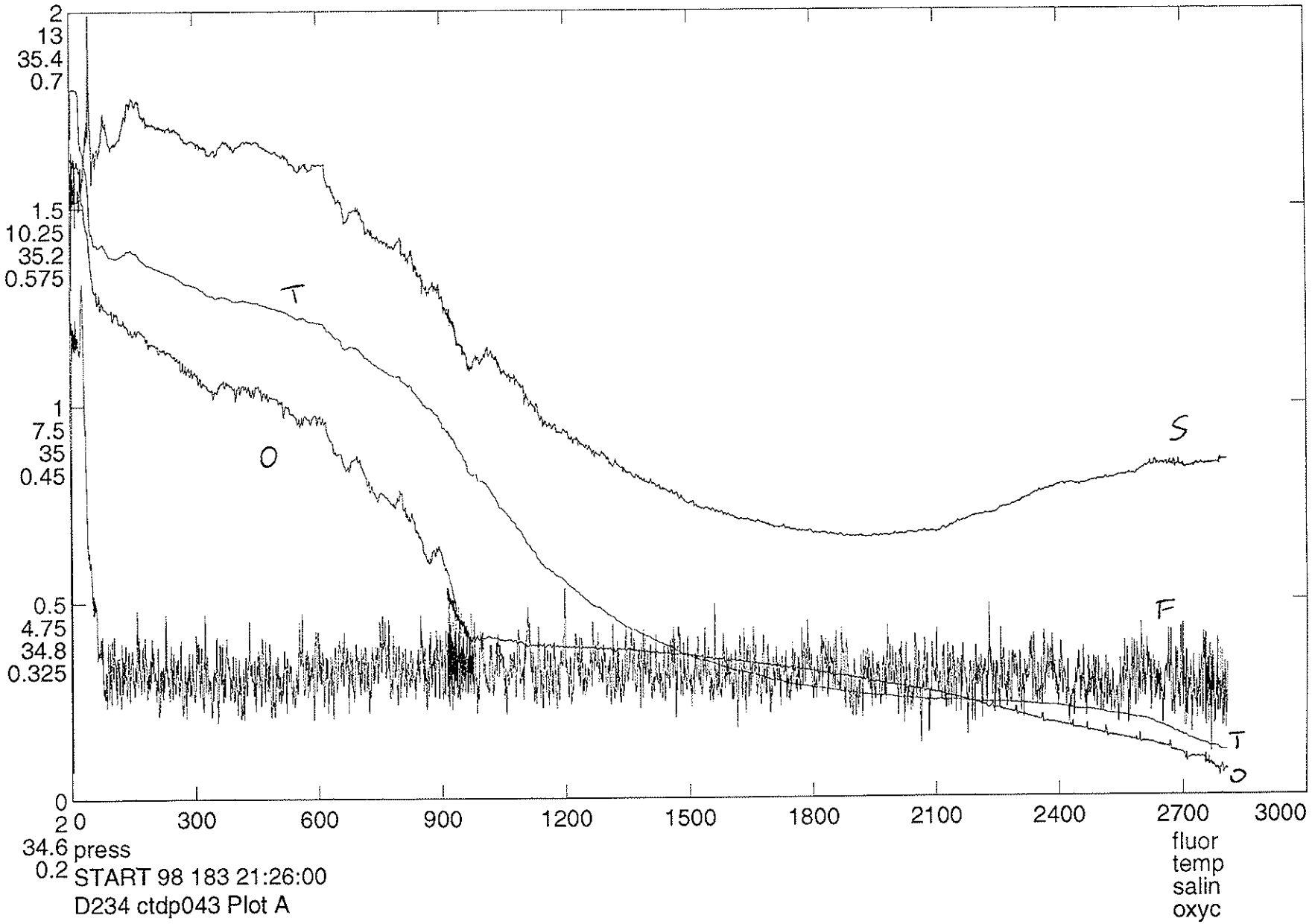

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
press
START 98 183 17:34:00
D234 ctdp042 Plot B
trans
nephl
dwirr
salin

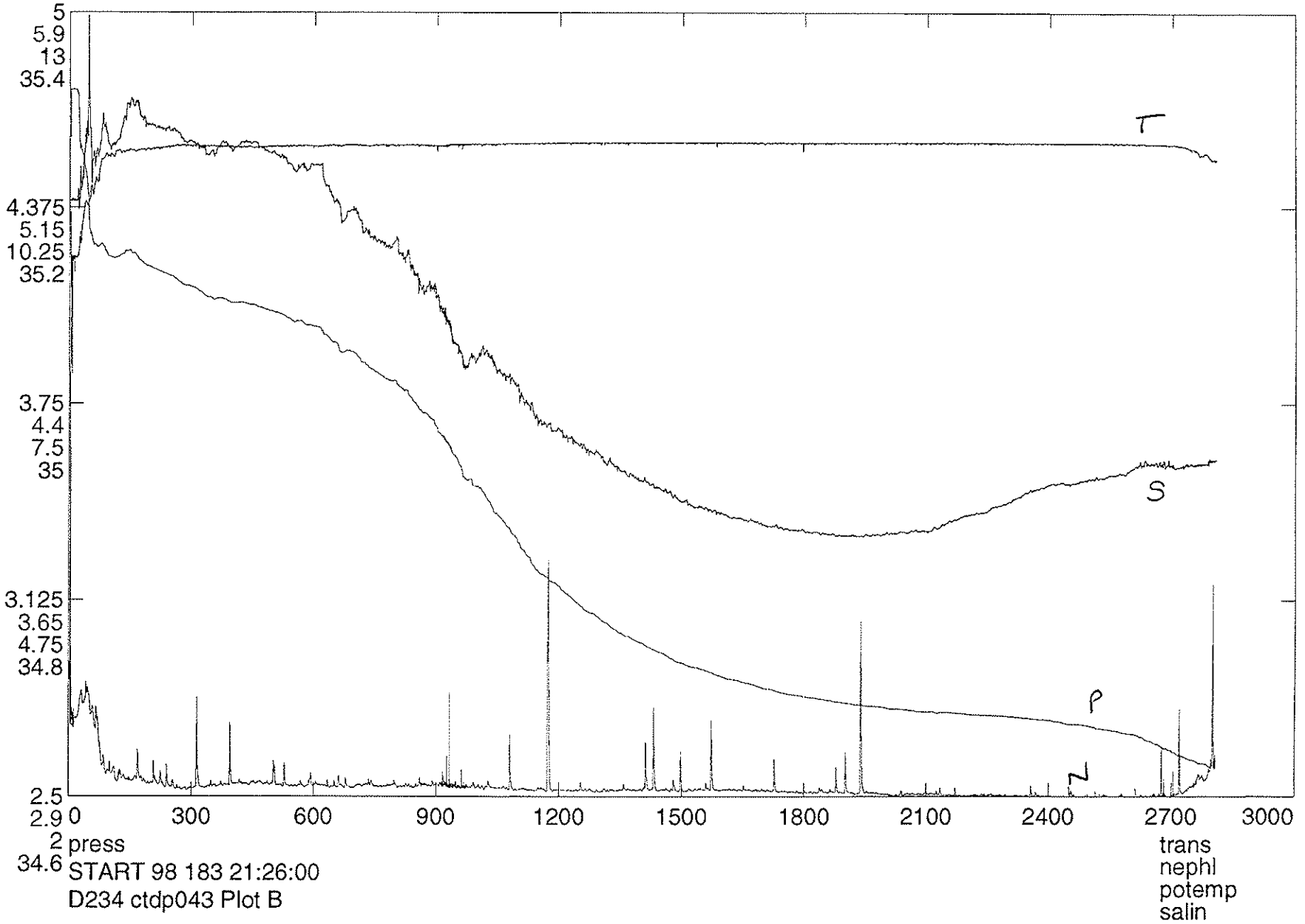

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
T
S
O
F
T
O
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
2 0
34.6 press
0.2
START 98 183 17:34:00
D234 ctdp042 Plot A
fluor
temp
salin
oxyc

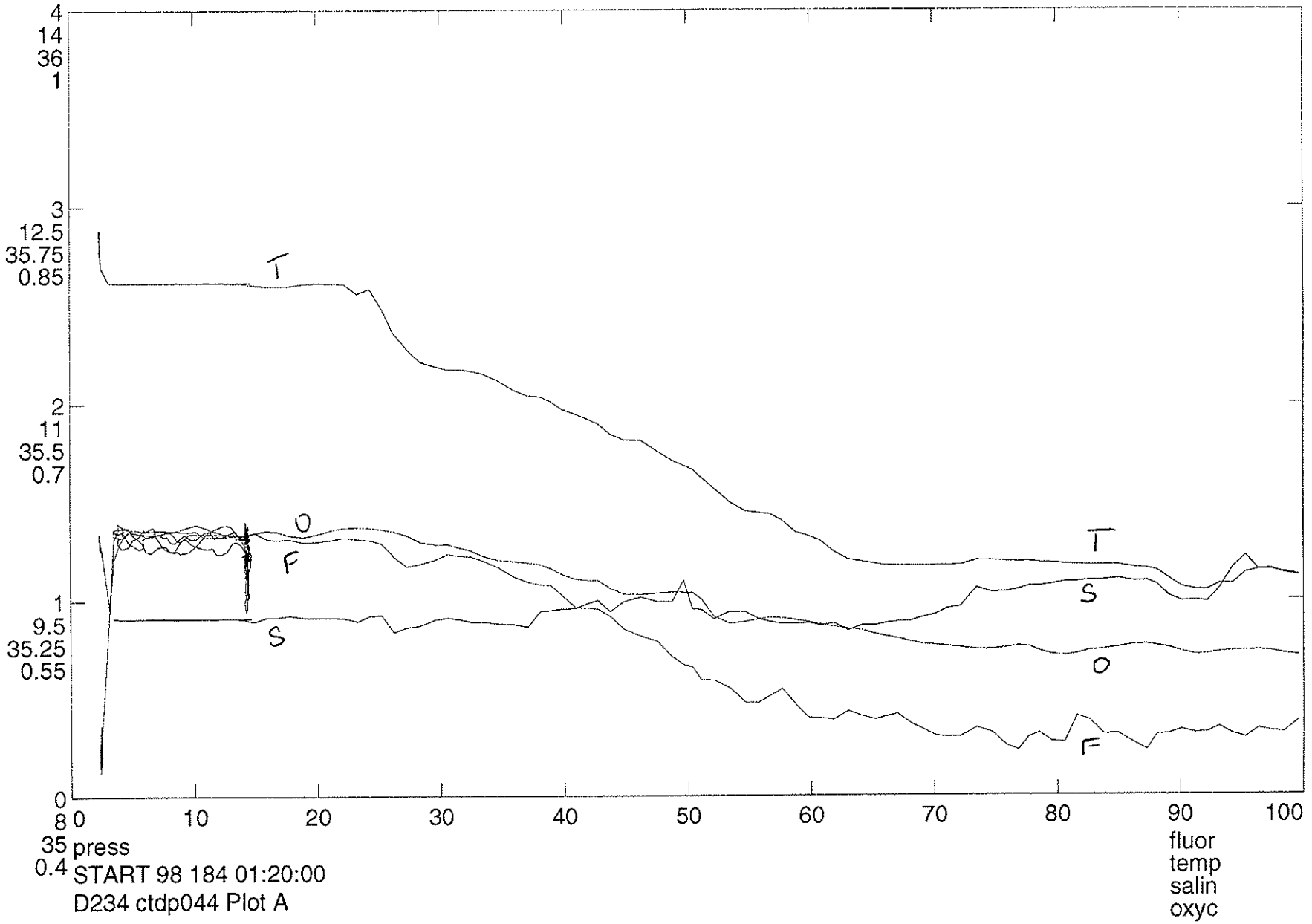

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 183 17:34:00
D234 ctdp042 Plot B
T
S
P
trans
nephl
potemp
salin

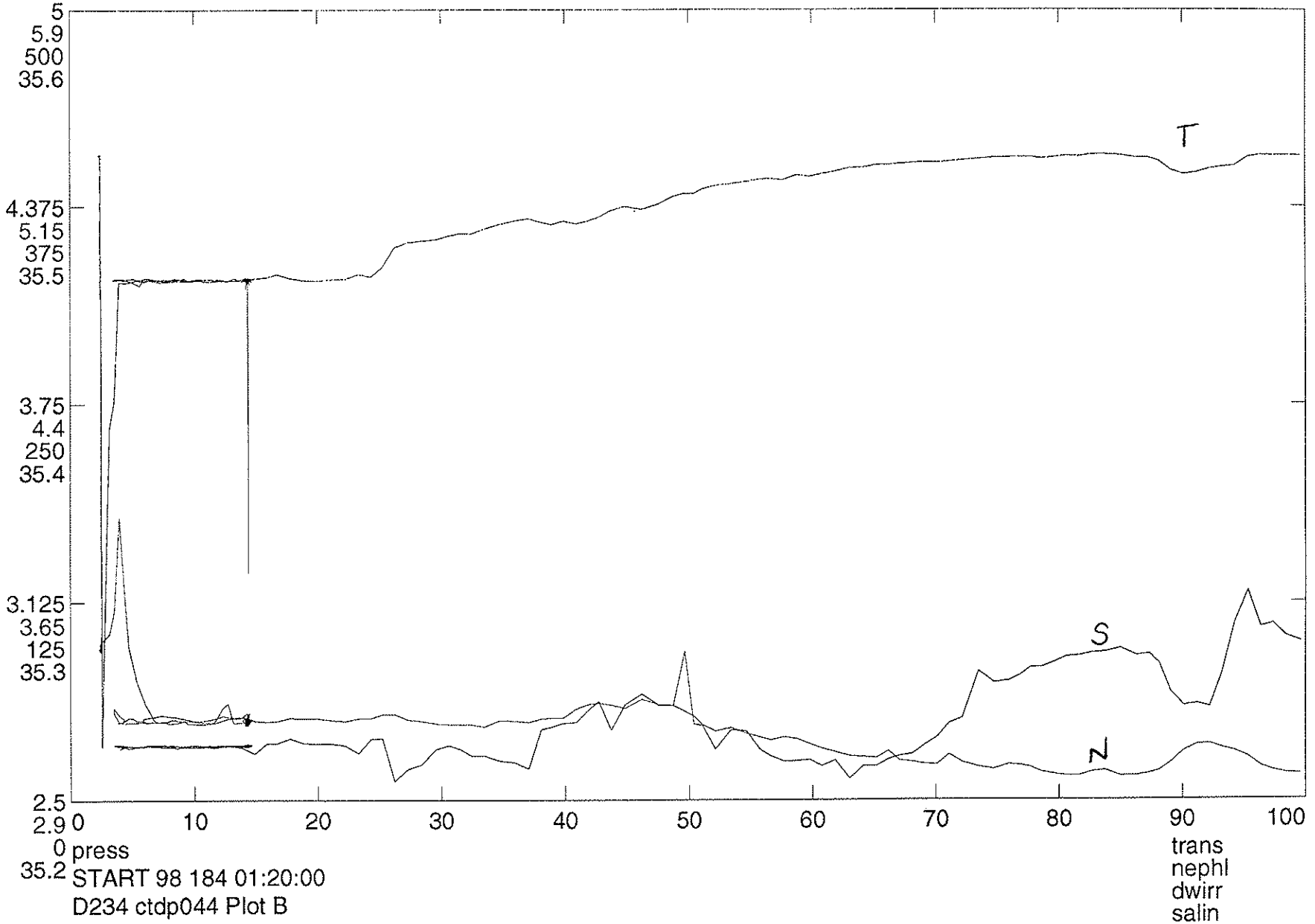

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
press
START 98 183 21:26:00
D234 ctdp043 Plot A
fluor
temp
salin
oxyc
T
D
F
S
T
S
D
F

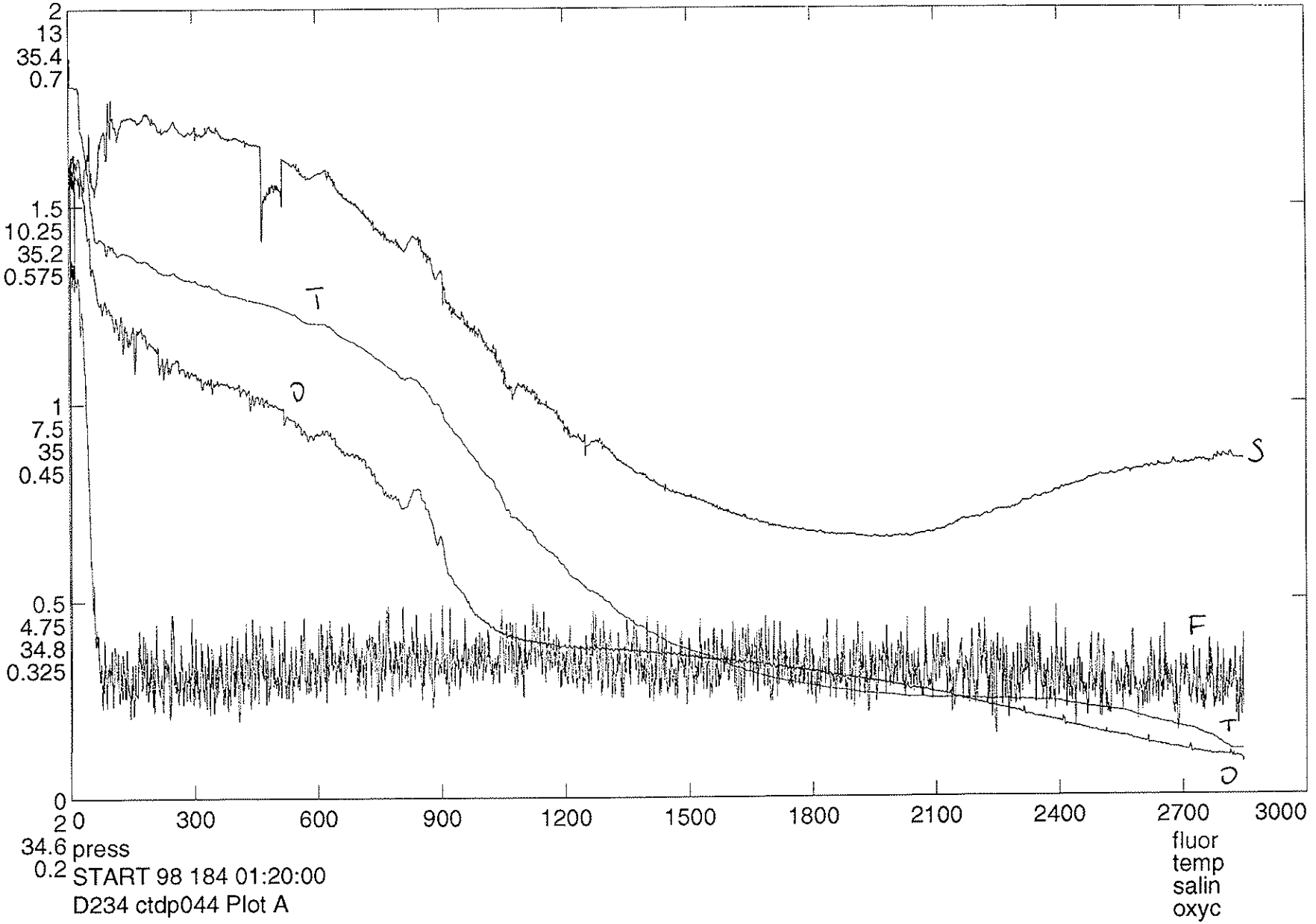

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 183 21:26:00
D234 ctdp043 Plot B
trans
nephl
dwirr
salin

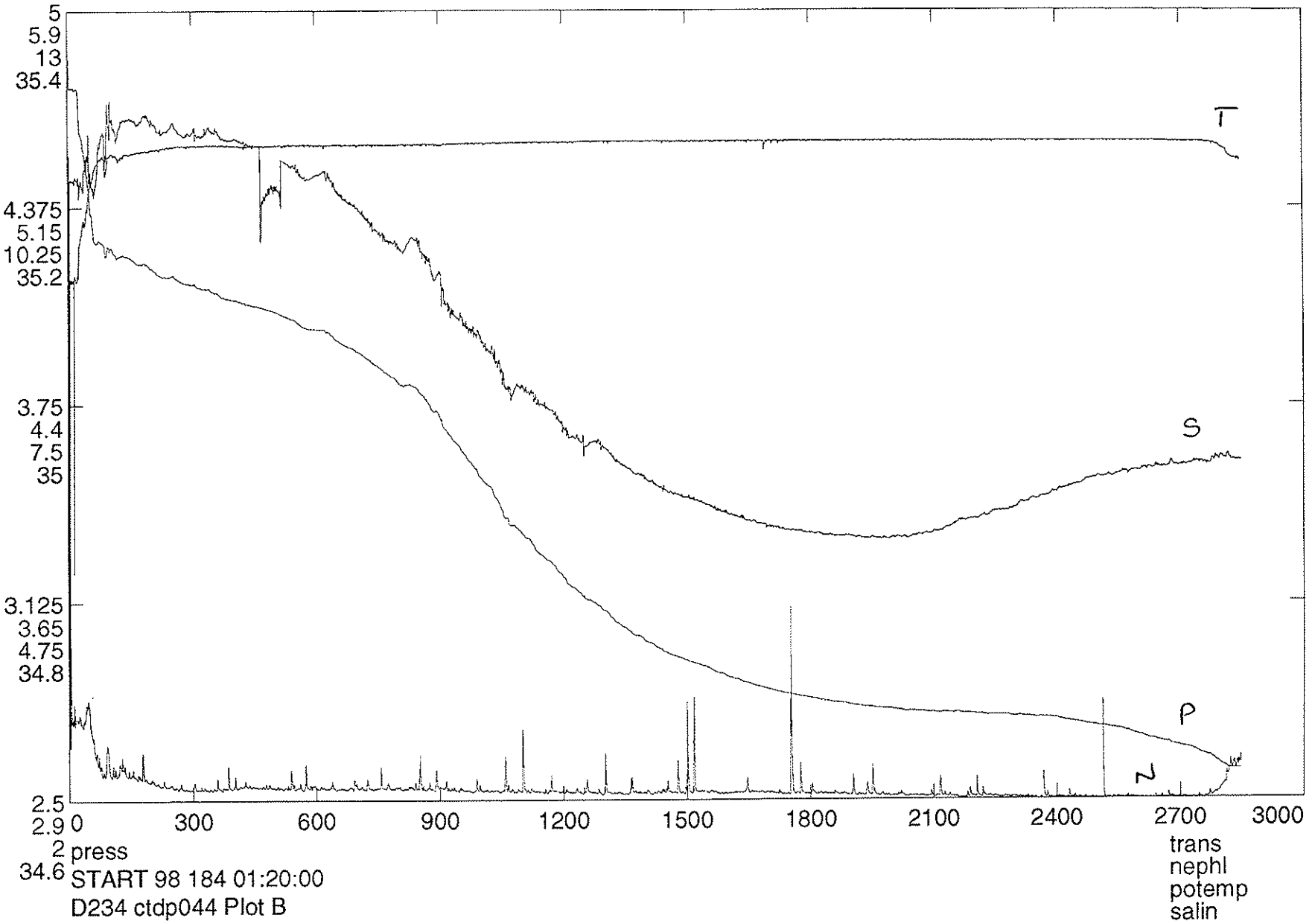

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
press
T
O
S
F
T
O
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
fluor
temp
salin
oxyc
START 98 183 21:26:00
D234 ctdp043 Plot A

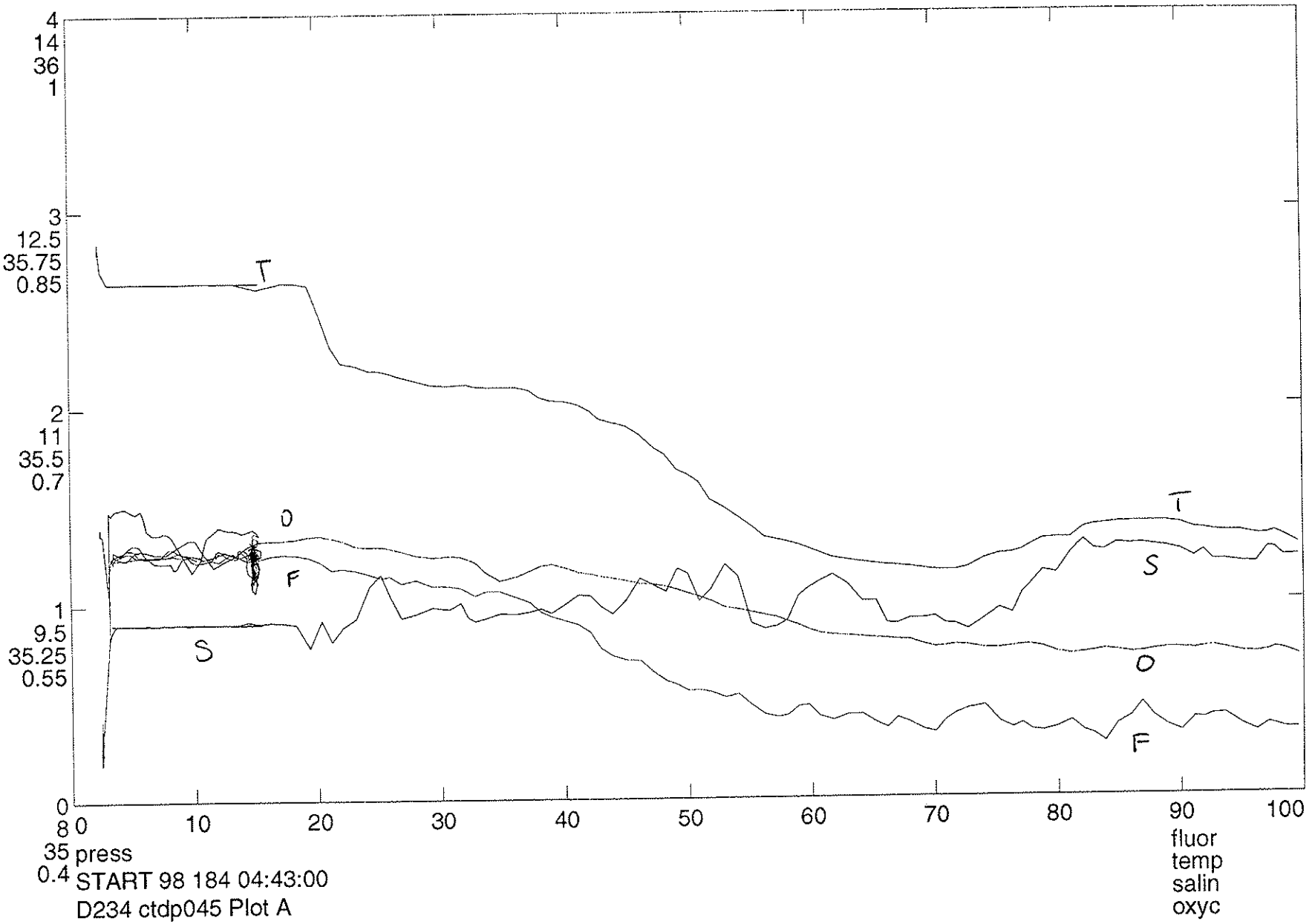

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 183 21:26:00
D234 ctdp043 Plot B
trans
nephl
potemp
salin
T
S
ρ
N

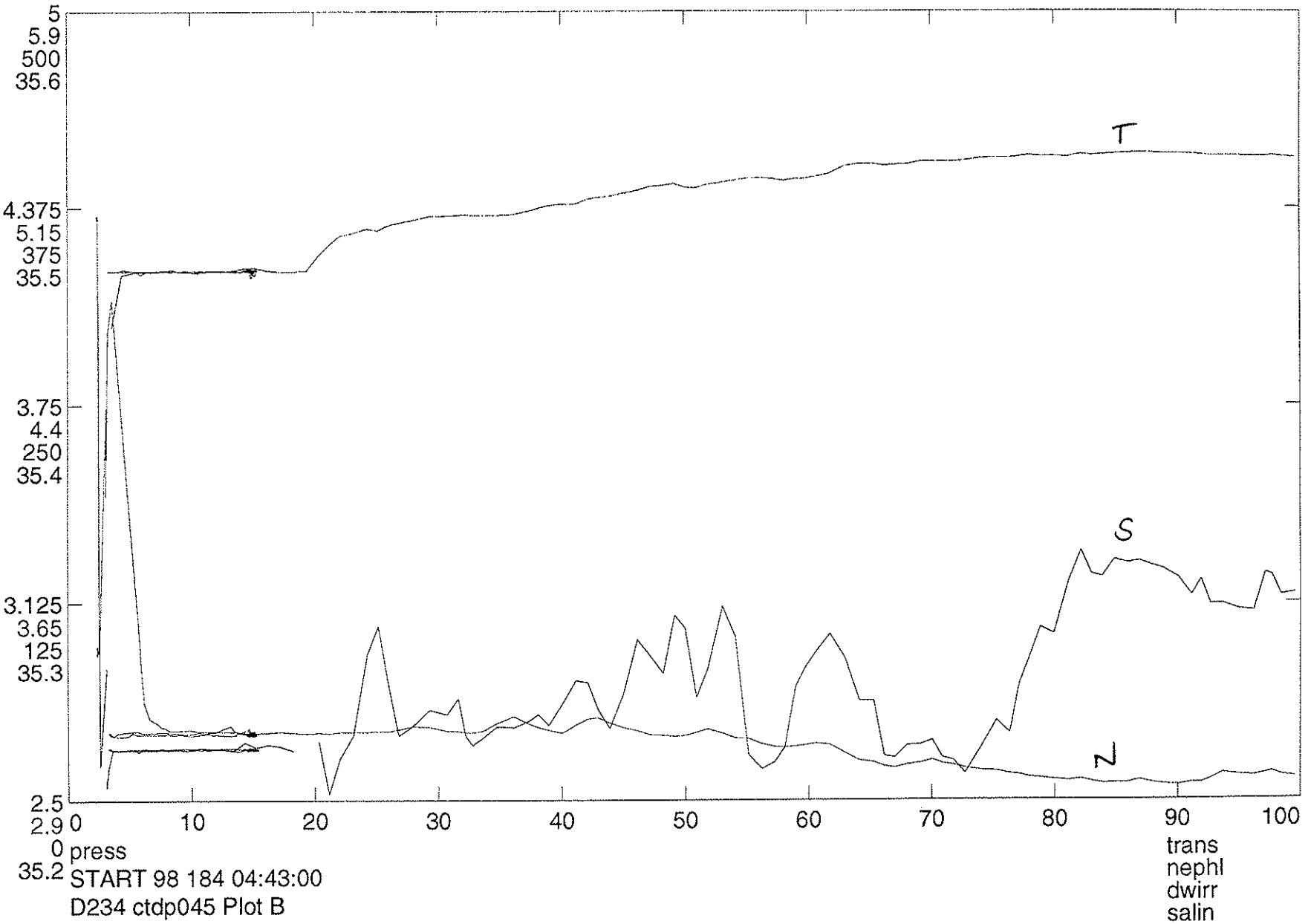

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
F
S
0
10
20
30
40
50
60
70
80
90
100
press
START 98 184 01:20:00
D234 ctdp044 Plot A
fluor
temp
salin
oxyc

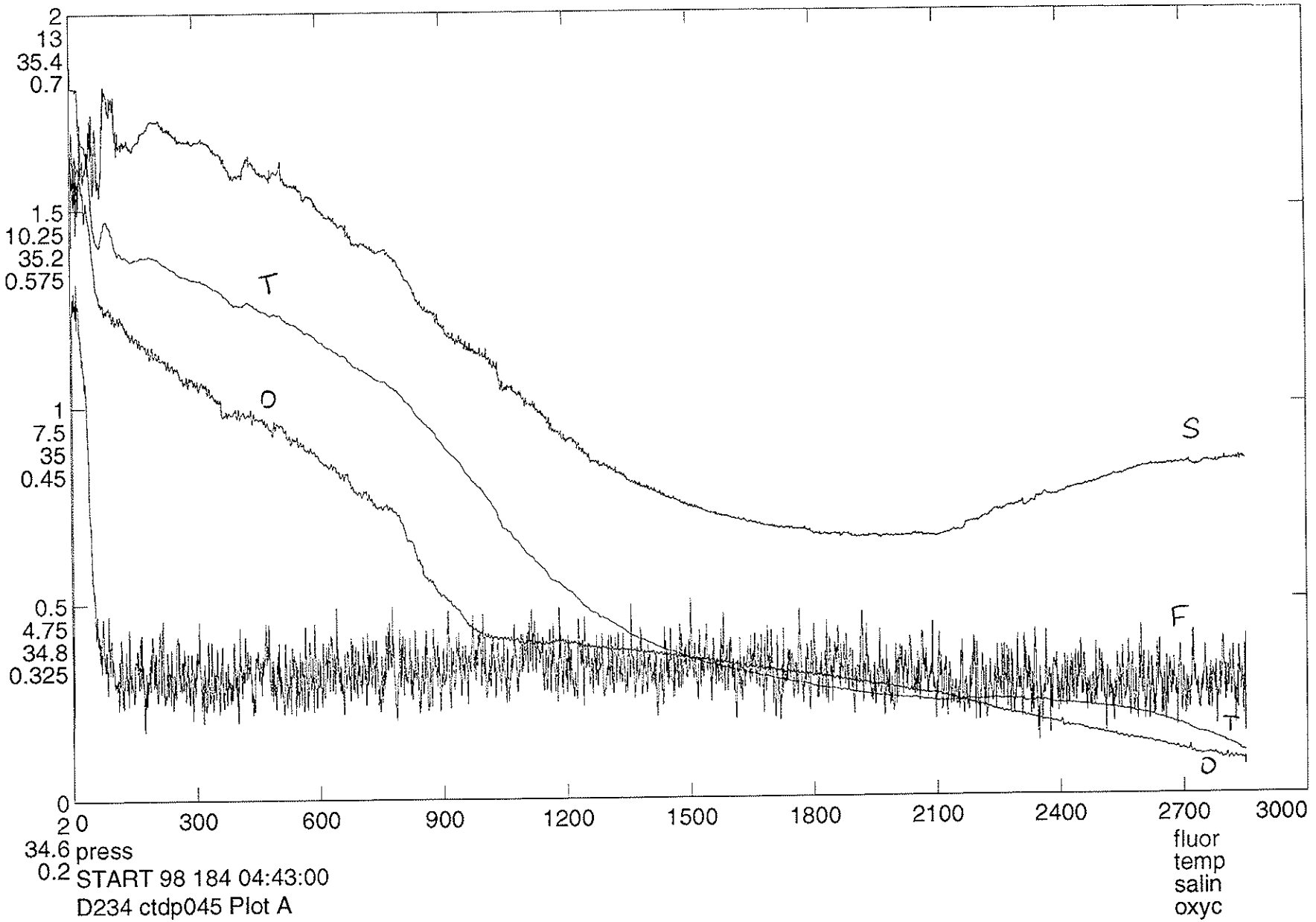

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 01:20:00
D234 ctdp044 Plot B
trans
nephl
dwirr
salin

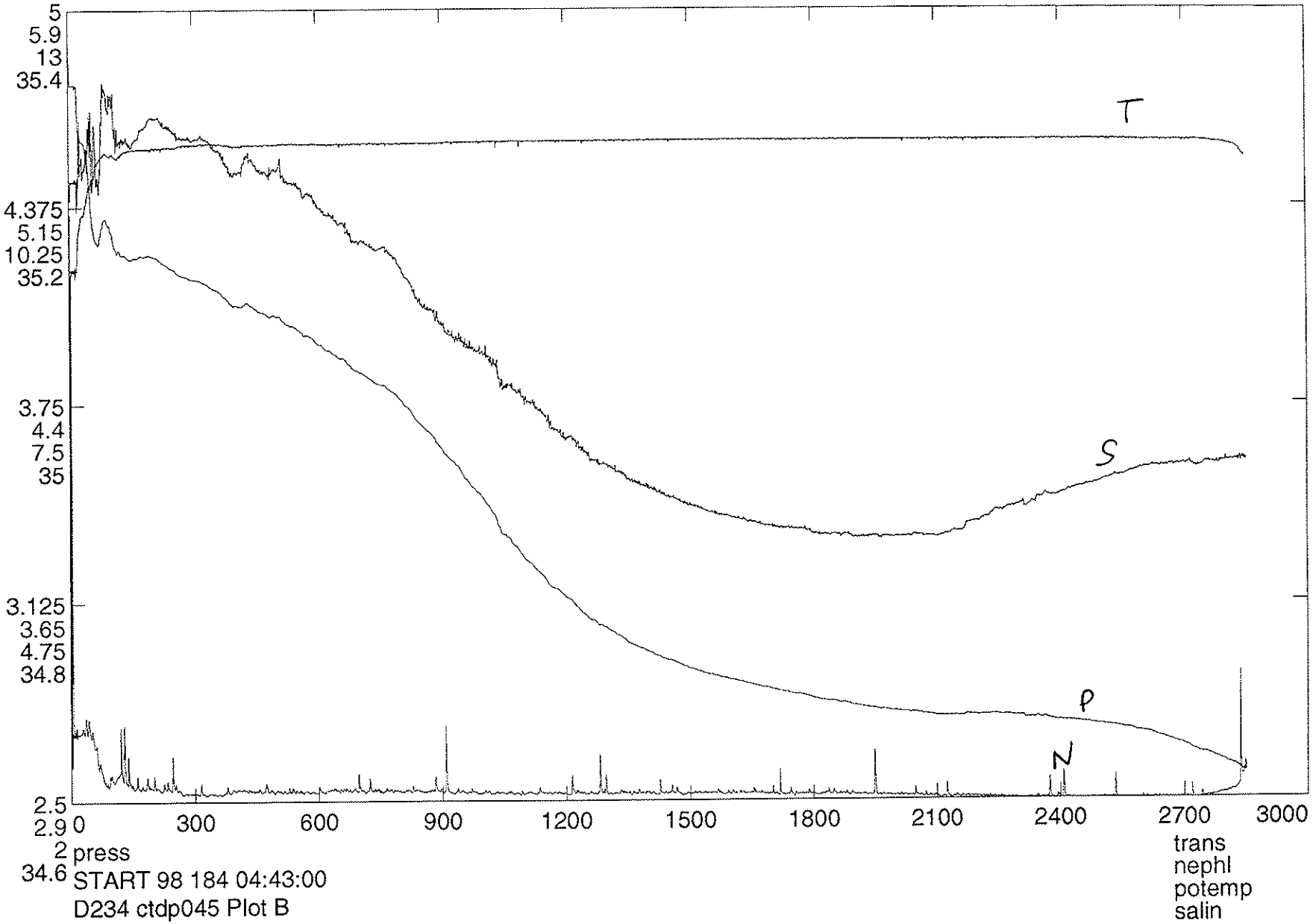

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 01:20:00
D234 ctdp044 Plot A
fluor
temp
salin
oxyc
T
C
S
F

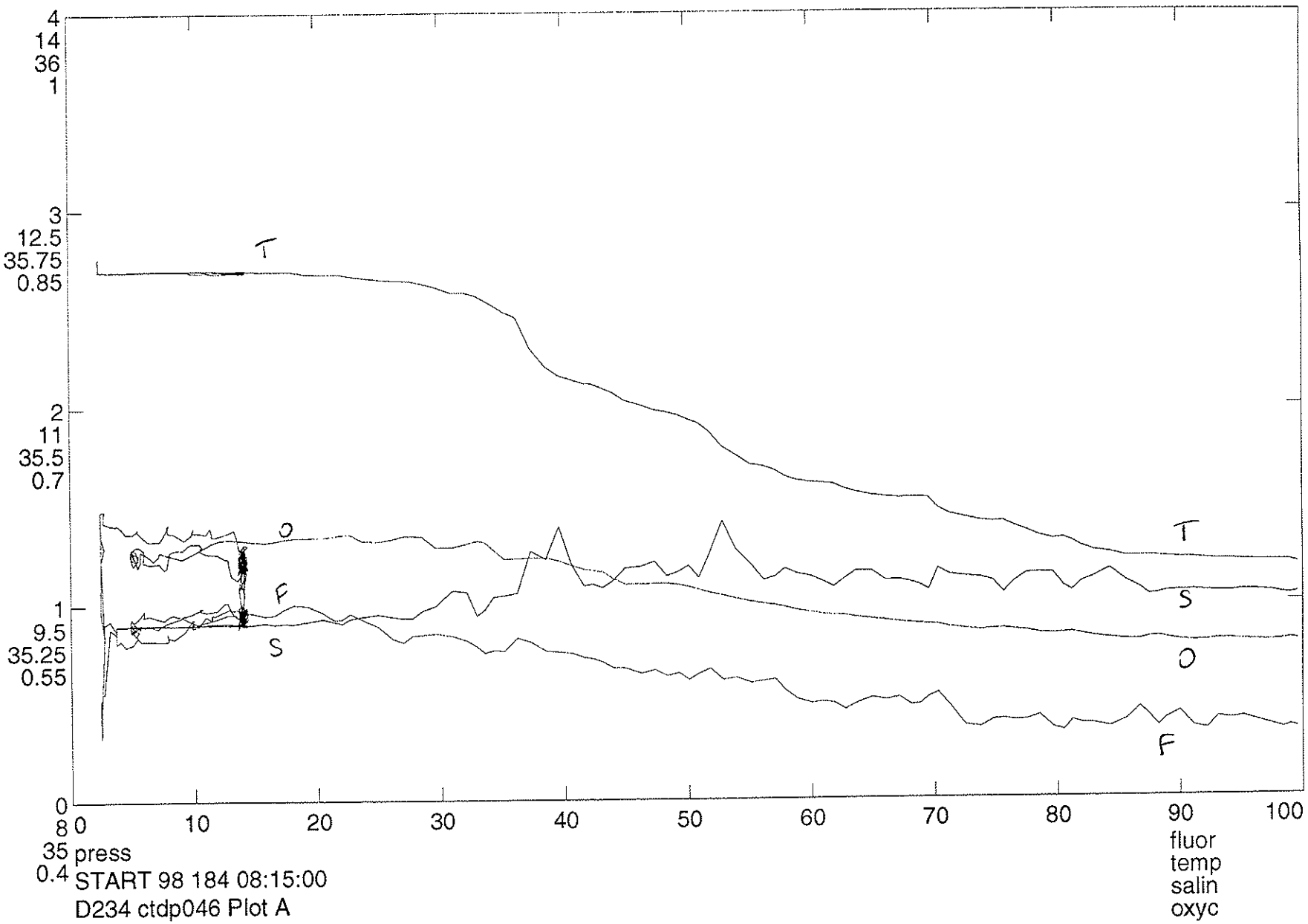

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
T
S
P
N
press
START 98 184 01:20:00
D234 ctdp044 Plot B
trans
nephl
potemp
salin

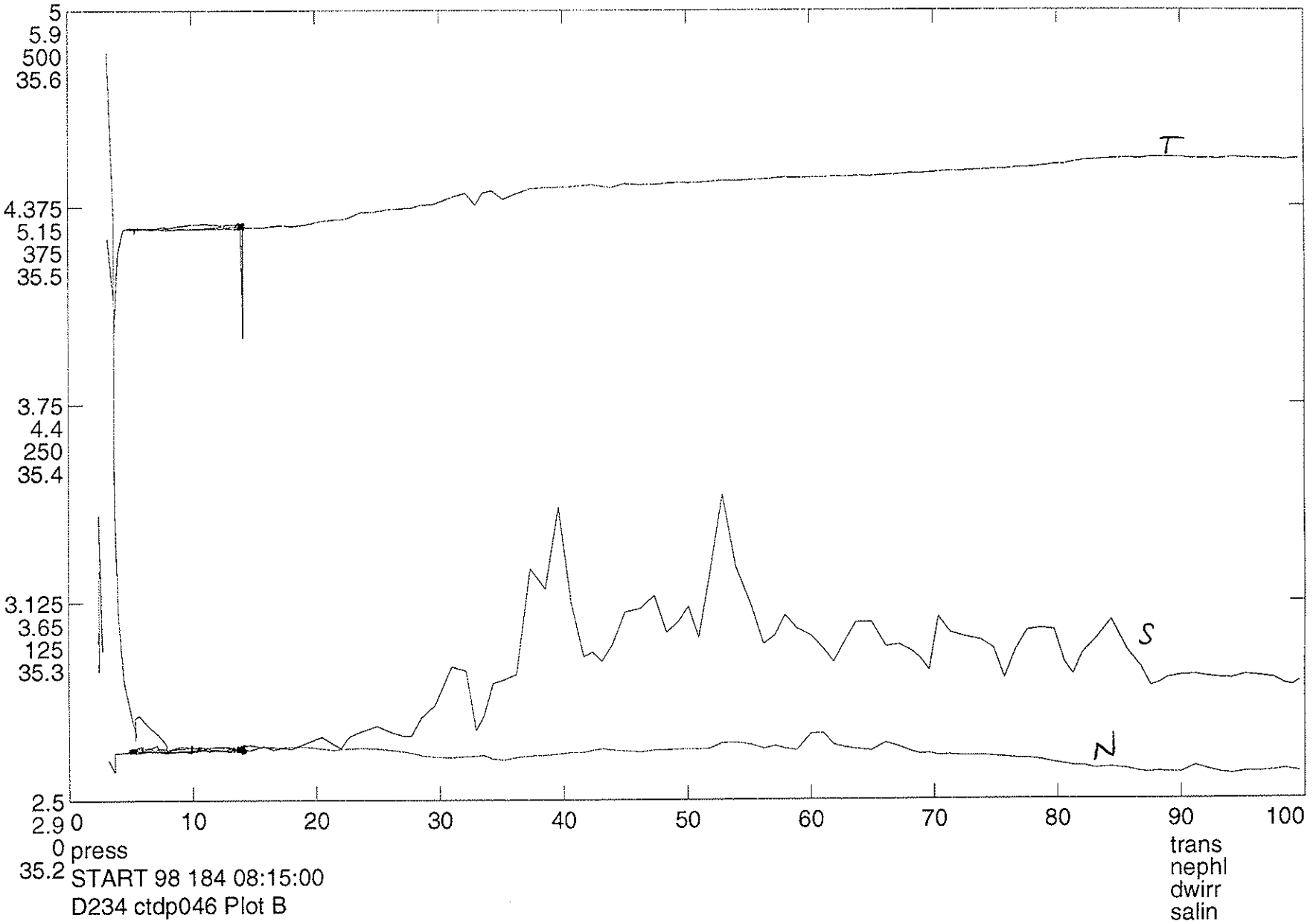

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
D
F
S
T
S
O
F
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
START 98 184 04:43:00
D234 ctdp045 Plot A

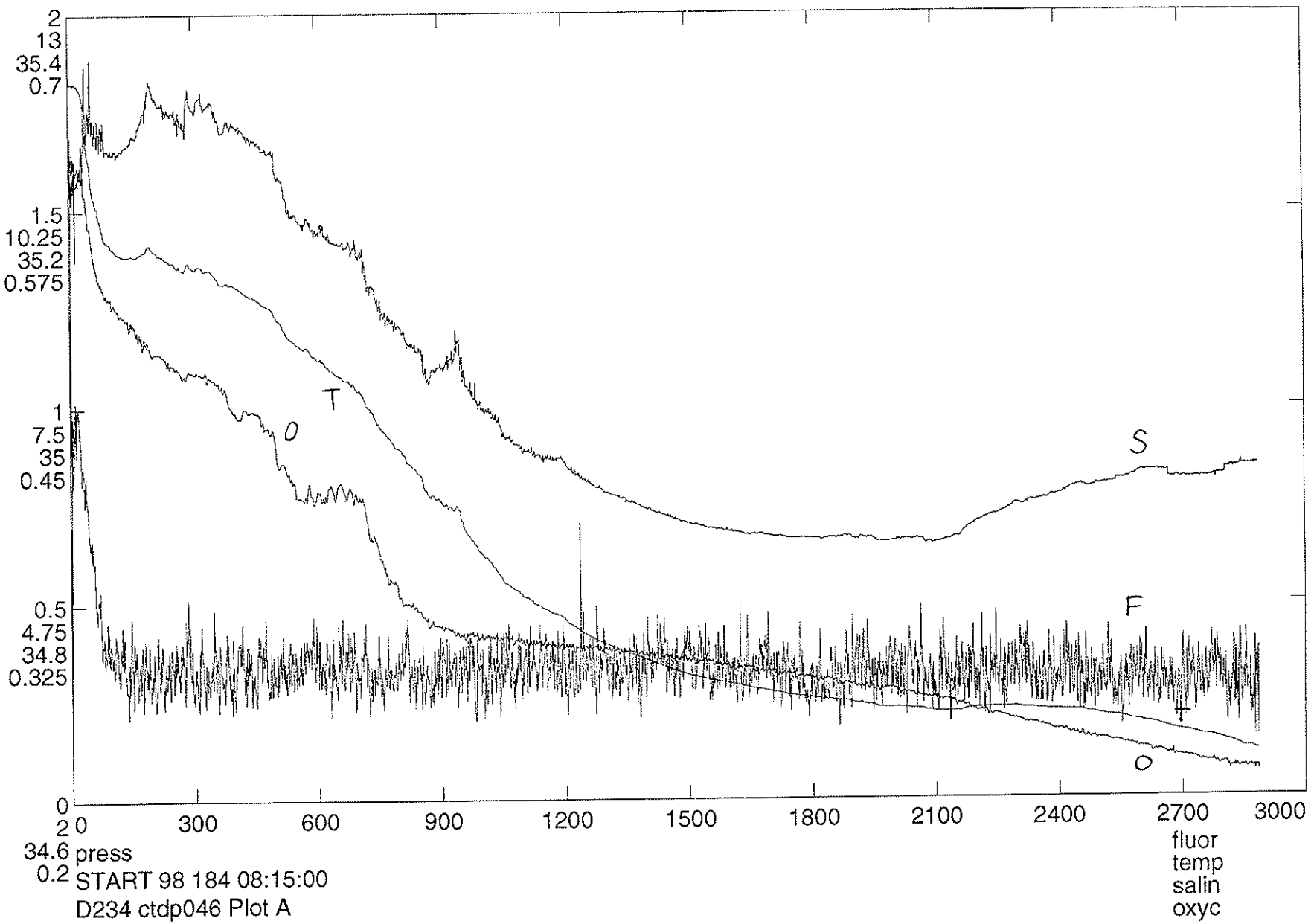

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 04:43:00
D234 ctdp045 Plot B
trans
nephl
dwirr
salin

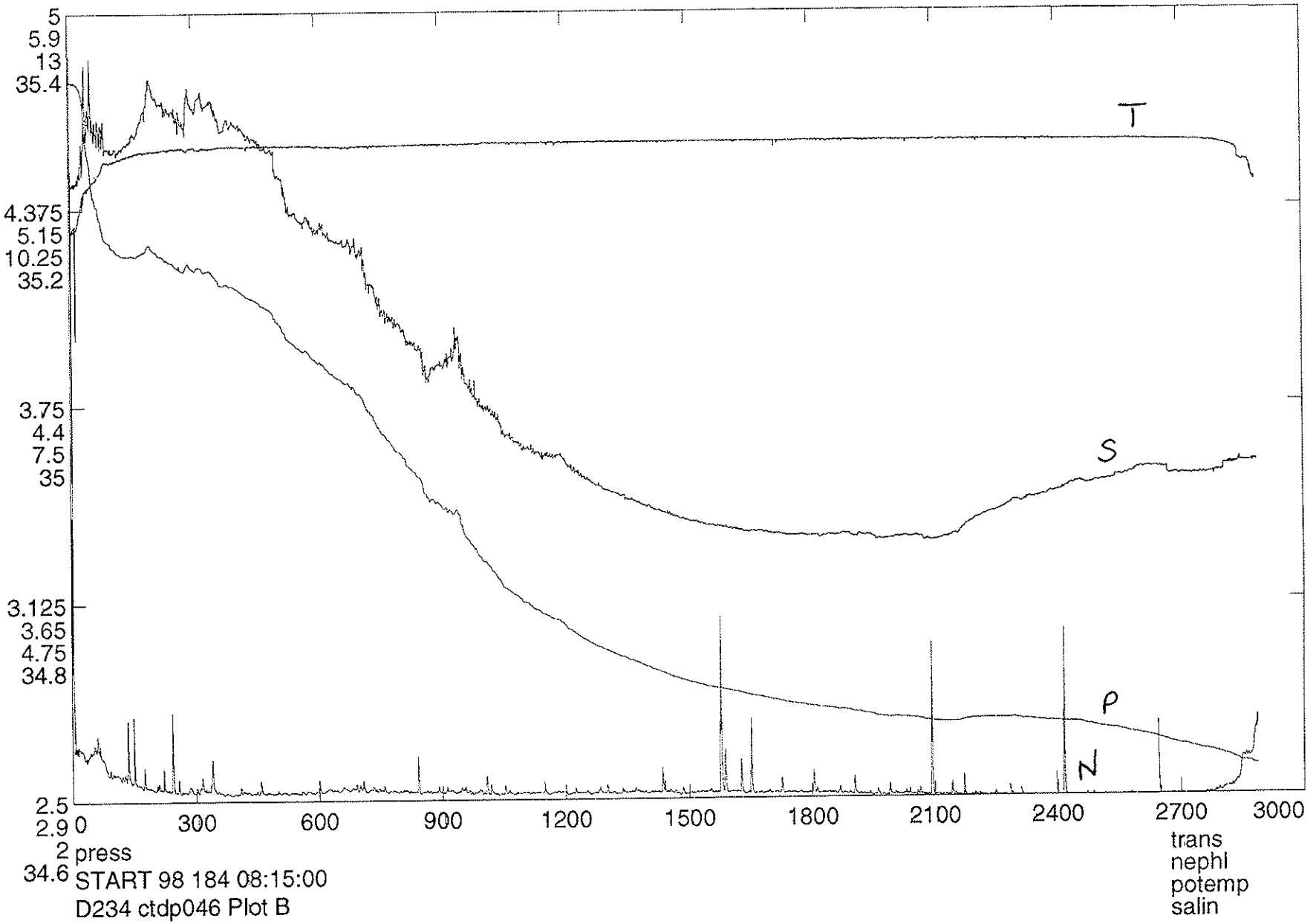

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
T
O
S
F
T
O
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
2
34.6
0.2
press
START 98 184 04:43:00
D234 ctdp045 Plot A
fluor
temp
salin
oxyc

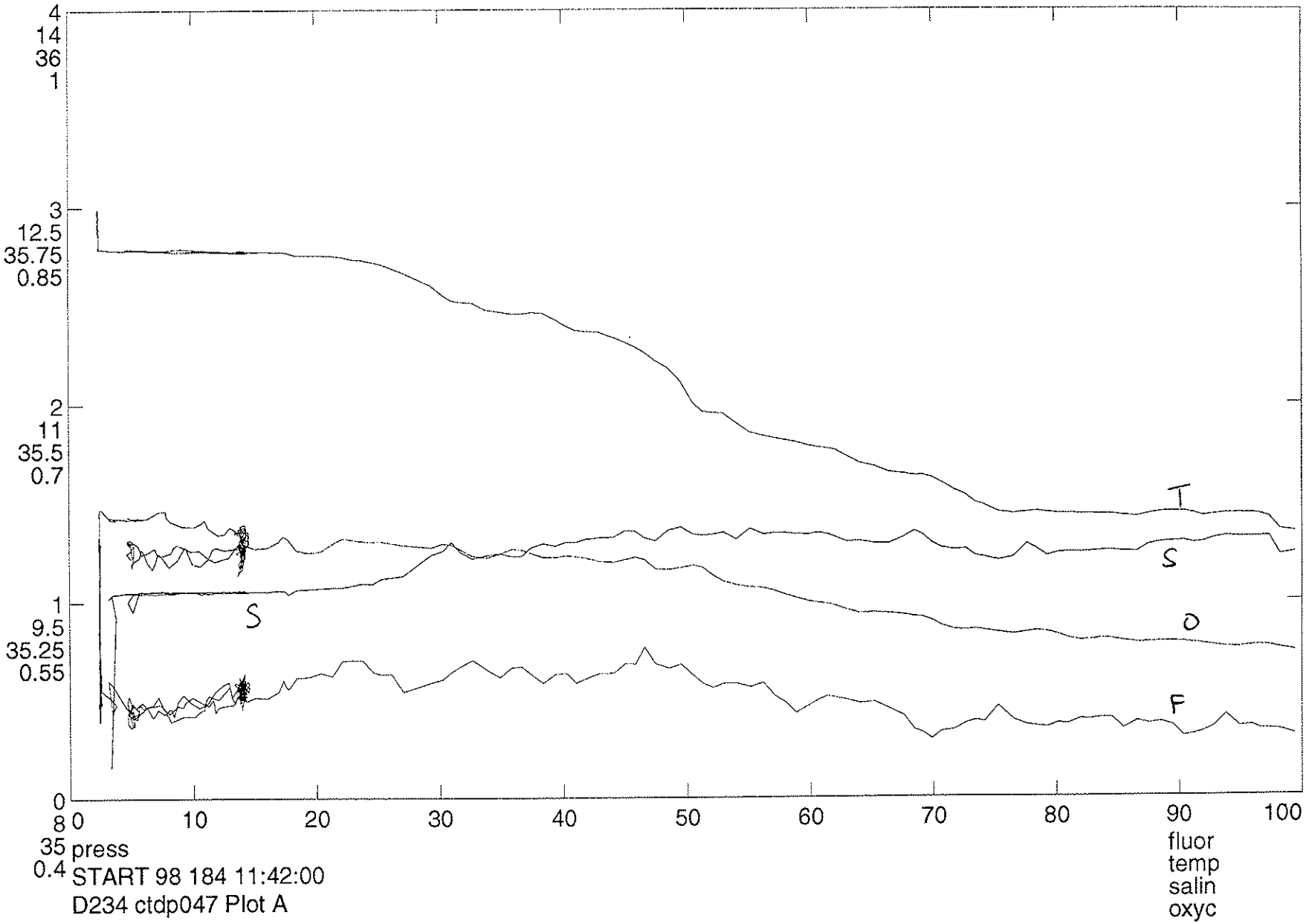

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
T
S
ρ
N
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 04:43:00
D234 ctdp045 Plot B
trans
nephl
potemp
salin

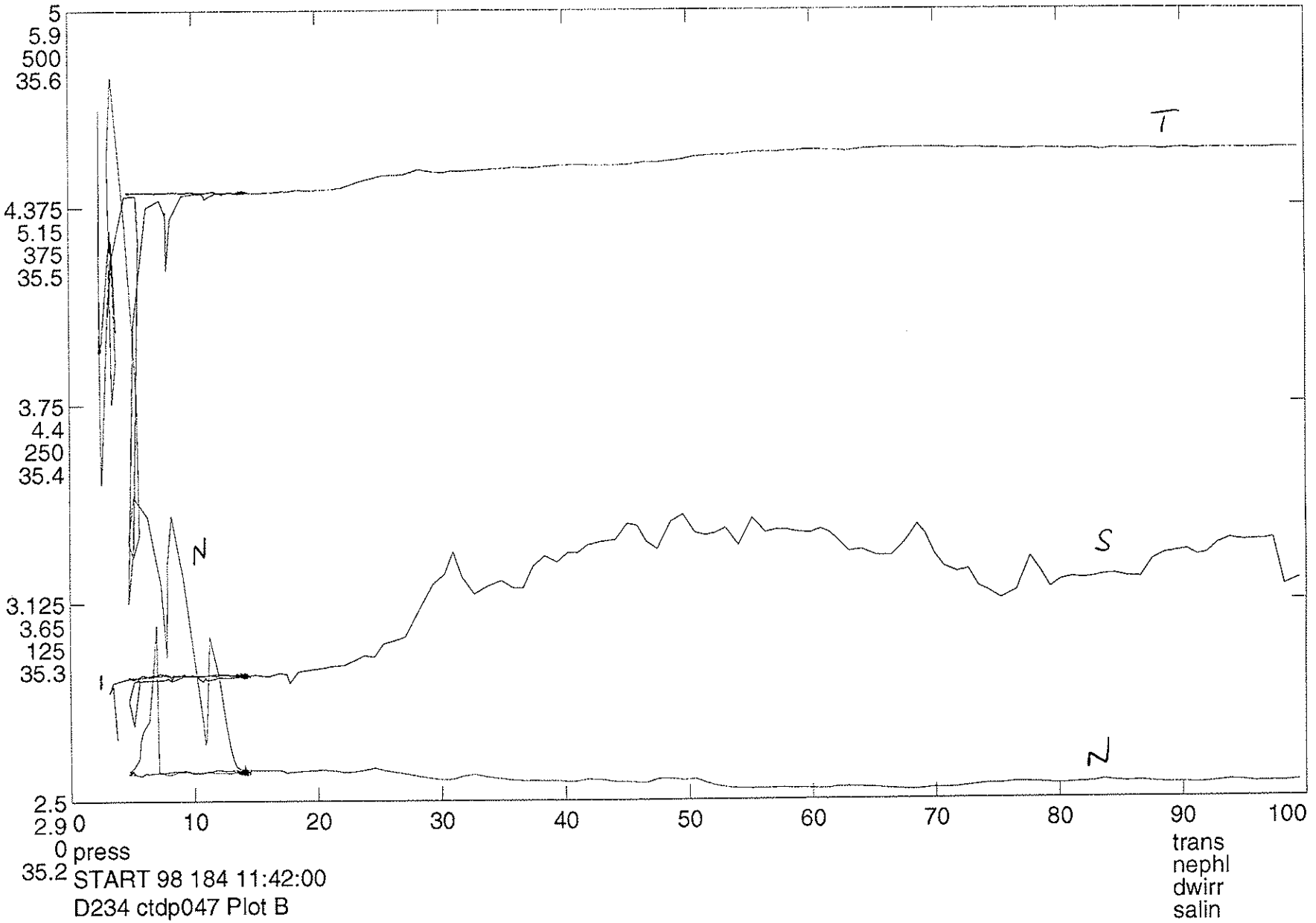

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
F
S
T
S
O
F
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
START 98 184 08:15:00
D234 ctdp046 Plot A

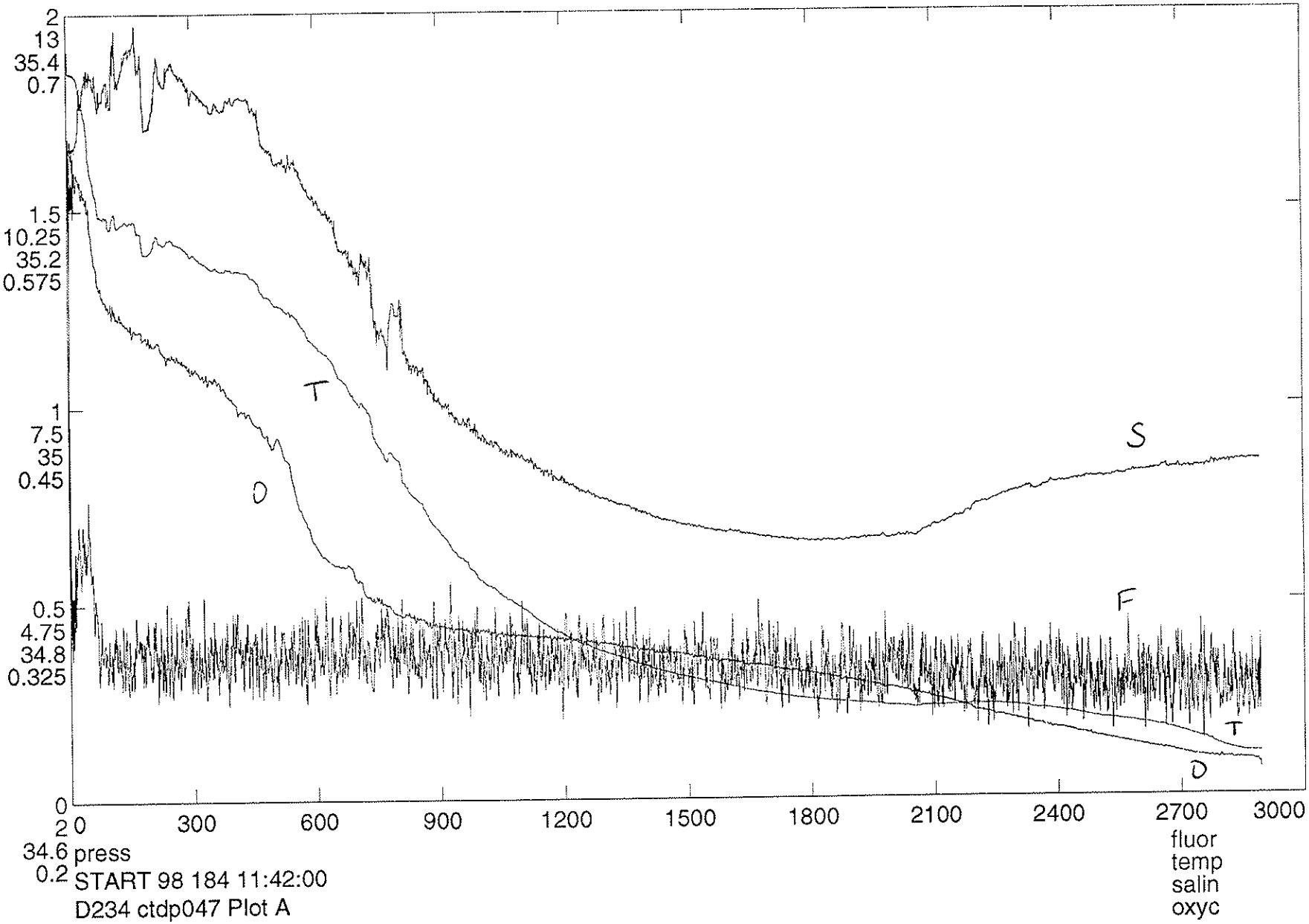

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 08:15:00
D234 ctdp046 Plot B
trans
nephl
dwirr
salin

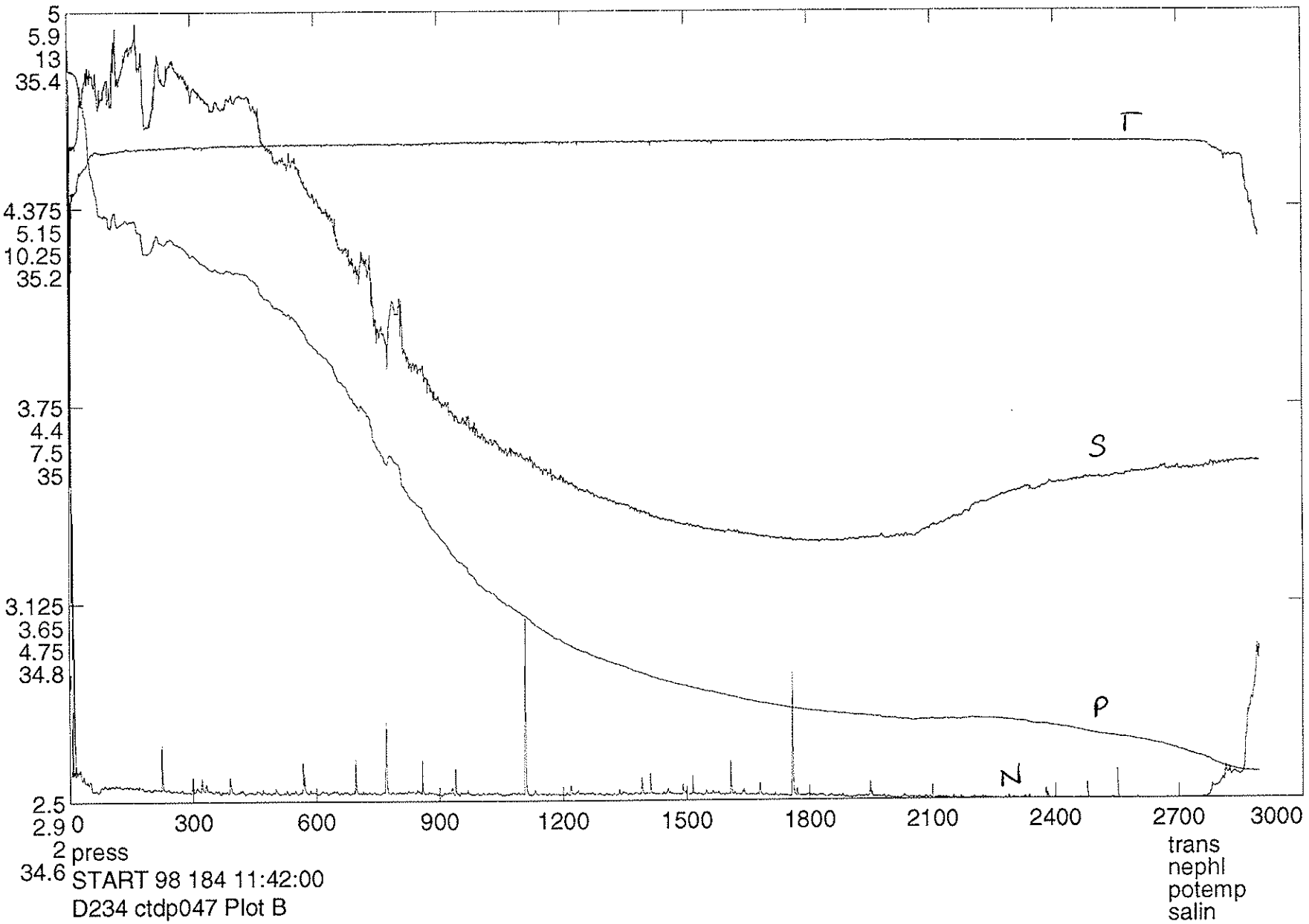

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
press
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
fluor
temp
salin
oxyc
T
O
S
F
O
START 98 184 08:15:00
D234 ctdp046 Plot A

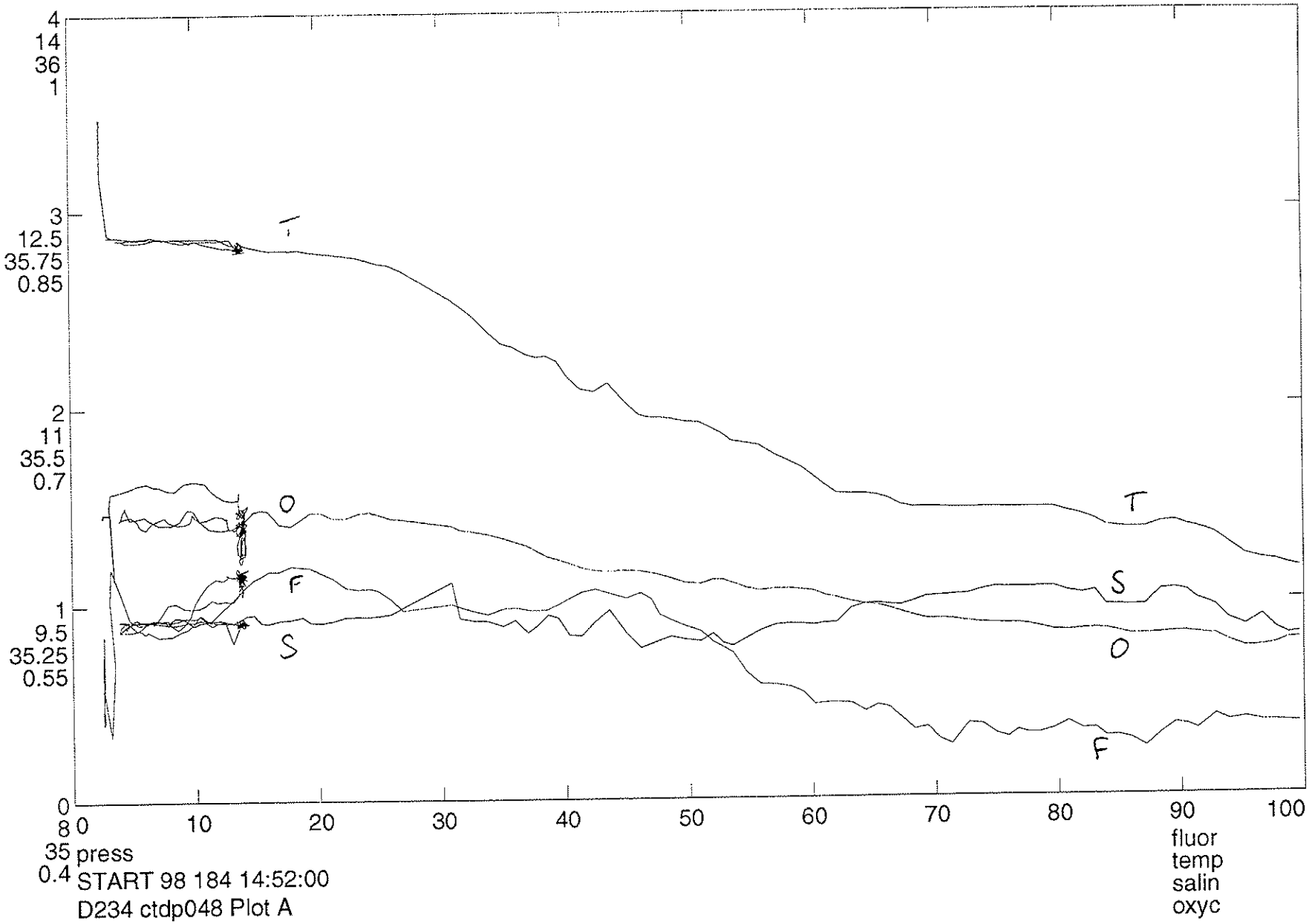

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 08:15:00
D234 ctdp046 Plot B
T
S
ρ
N
trans
nephl
potemp
salin

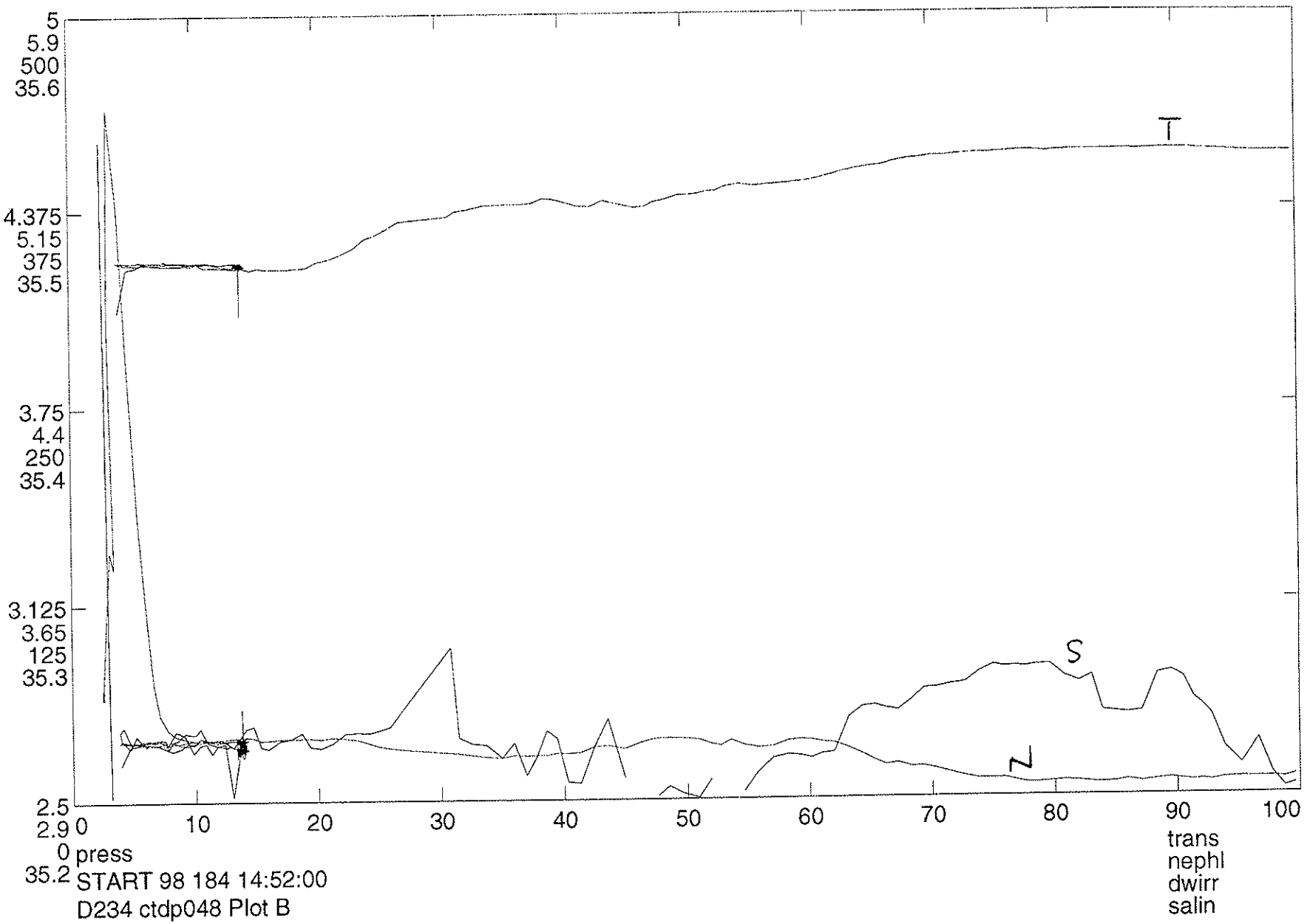

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
10
20
30
40
50
60
70
80
90
100
fluor
temp
salin
oxyc
T
S
S
O
F
START 98 184 11:42:00
D234 ctdp047 Plot A

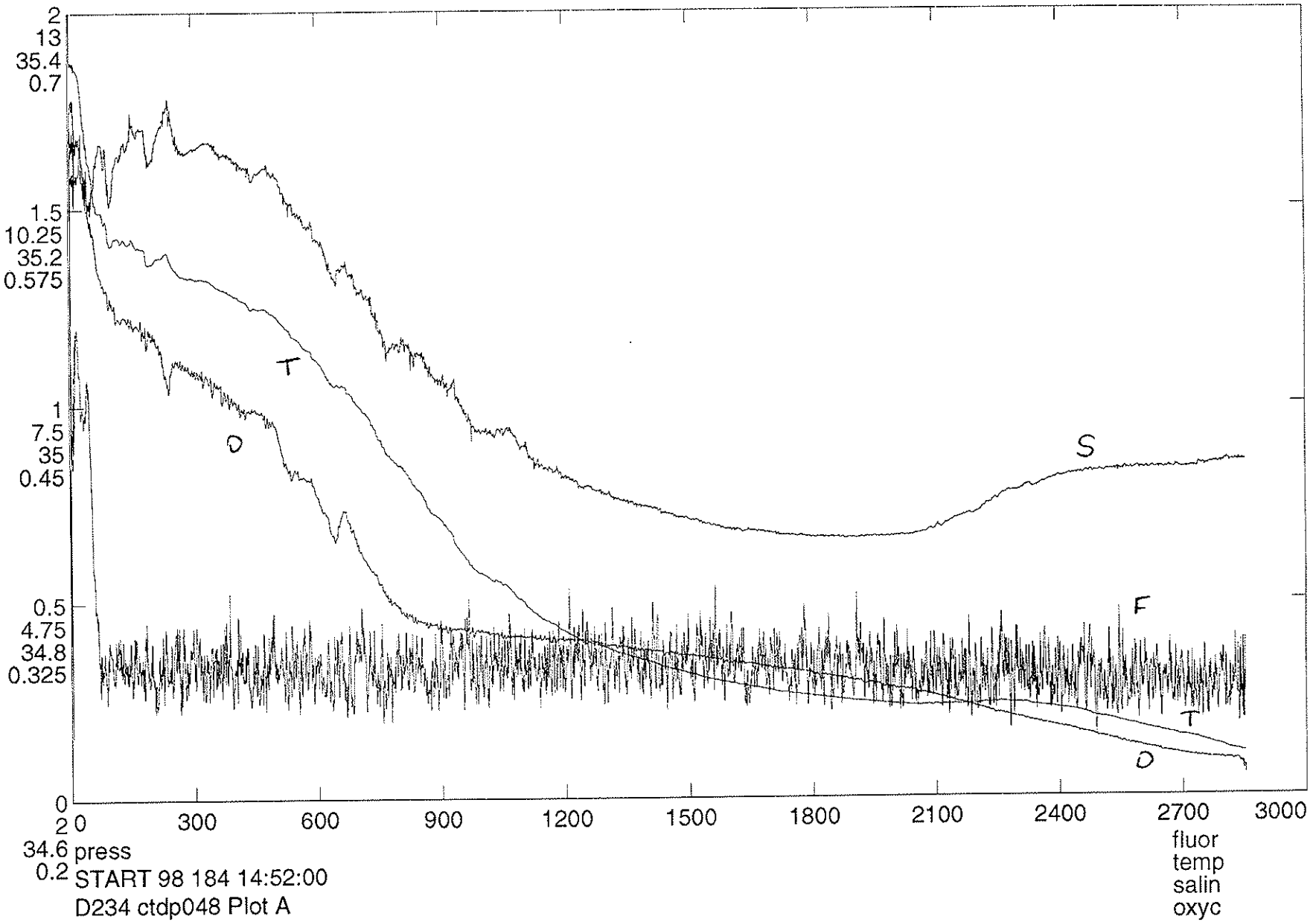

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
N
0 press
START 98 184 11:42:00
D234 ctdp047 Plot B
trans
nephl
dwirr
salin

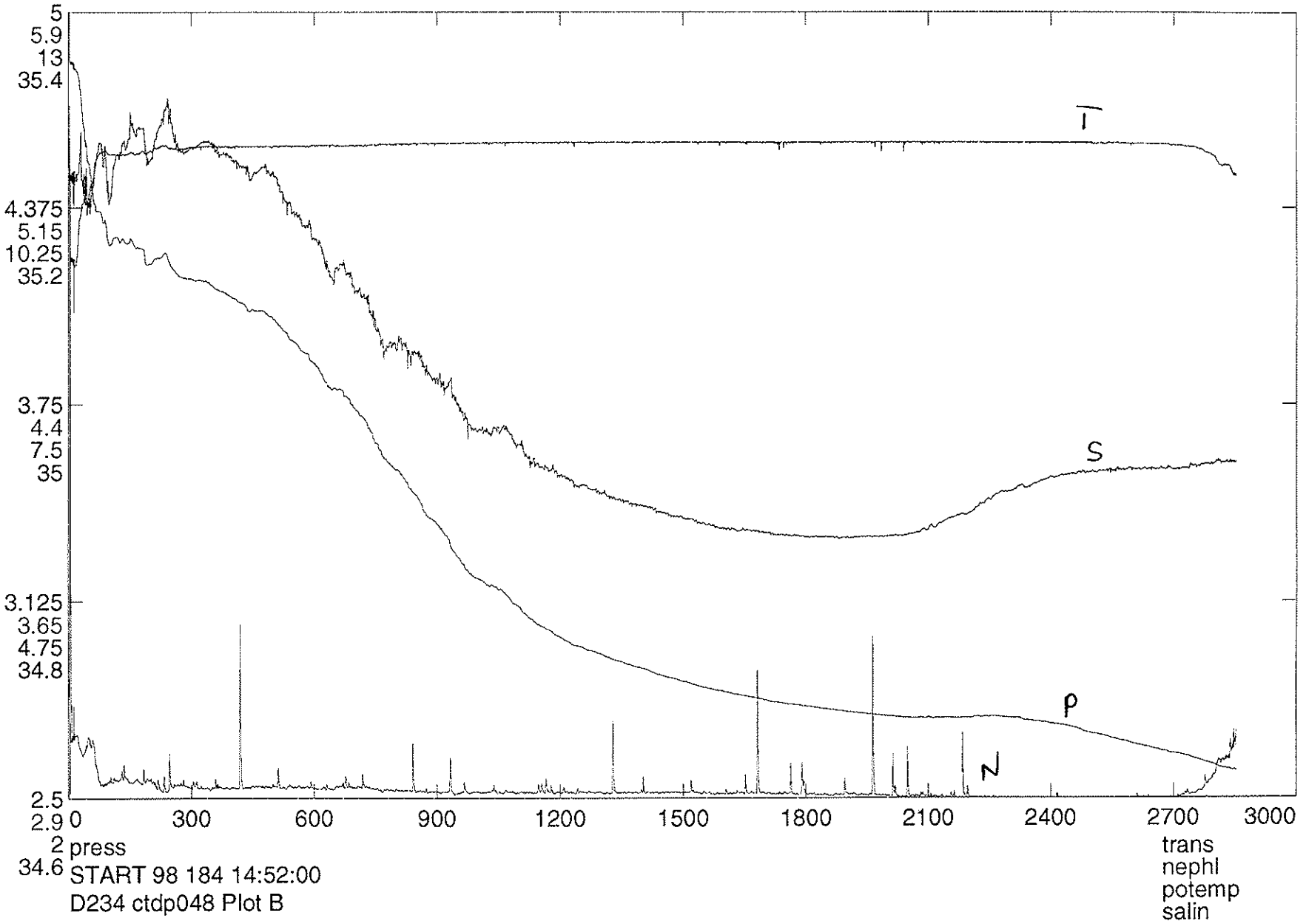

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
press
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
fluor
temp
salin
oxyc
T
D
S
F
T
D
START 98 184 11:42:00
D234 ctdp047 Plot A

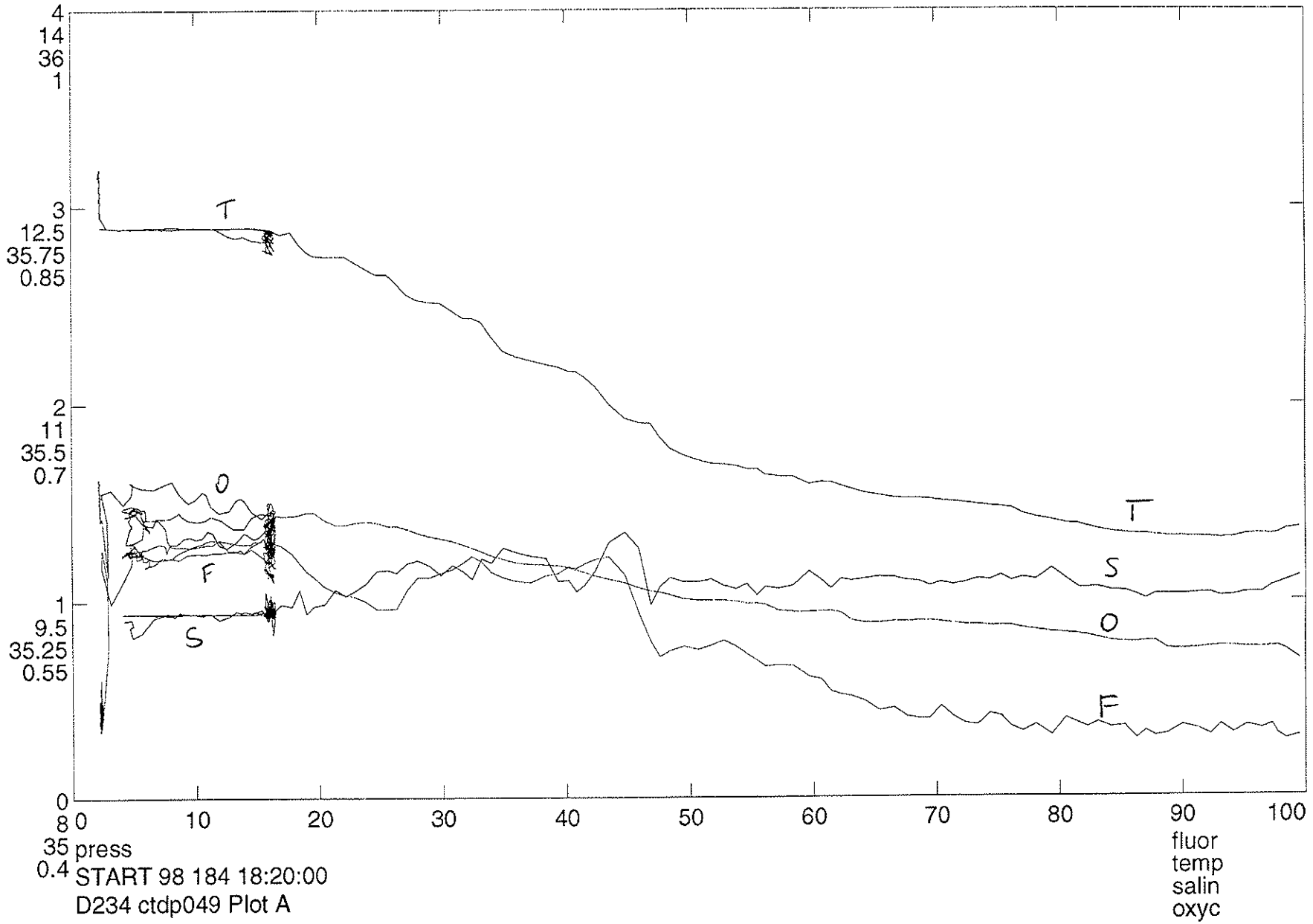

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
T
S
P
N
press
START 98 184 11:42:00
D234 ctdp047 Plot B
trans
nephl
potemp
salin

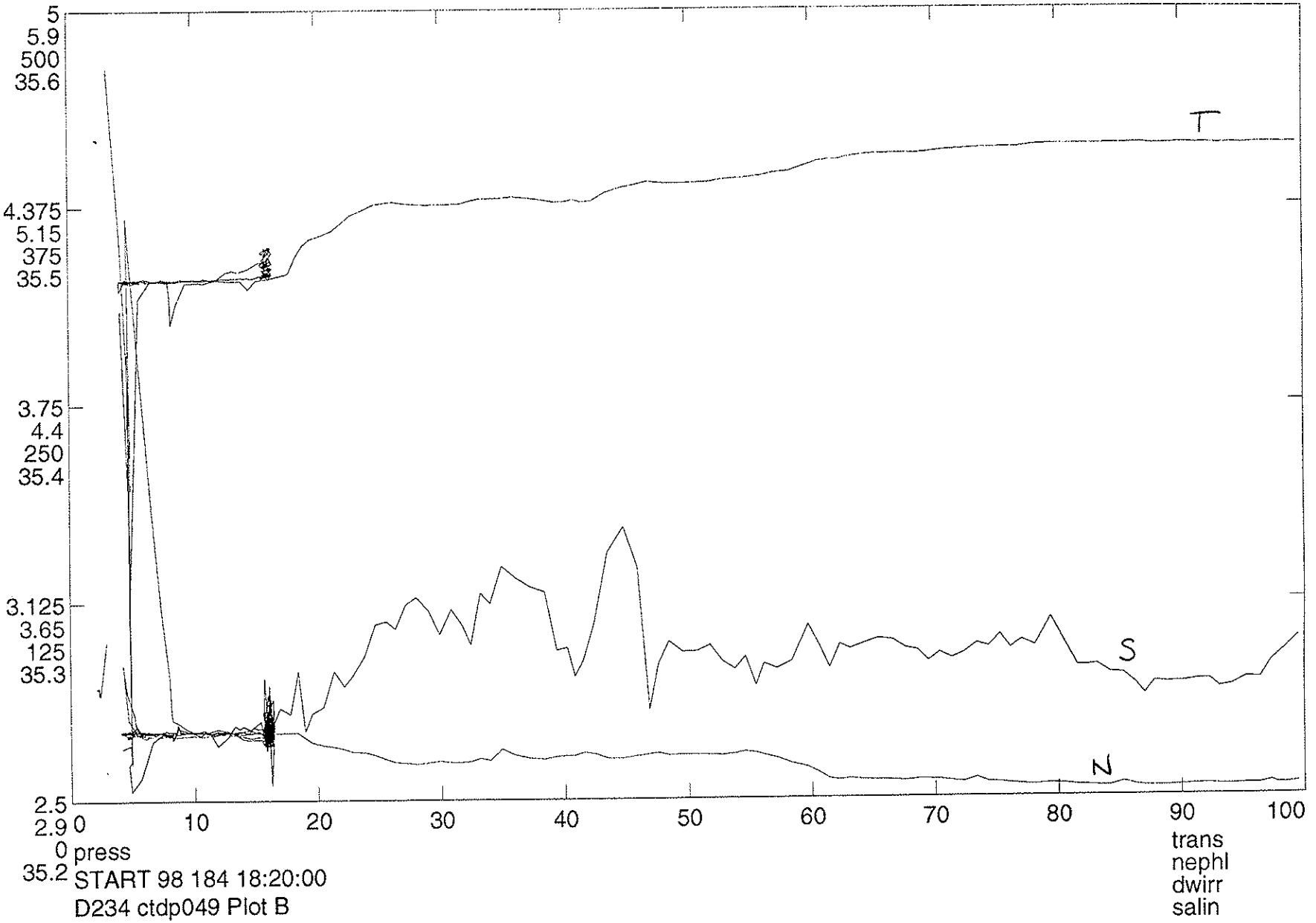

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
T
O
F
S
START 98 184 14:52:00
D234 ctdp048 Plot A

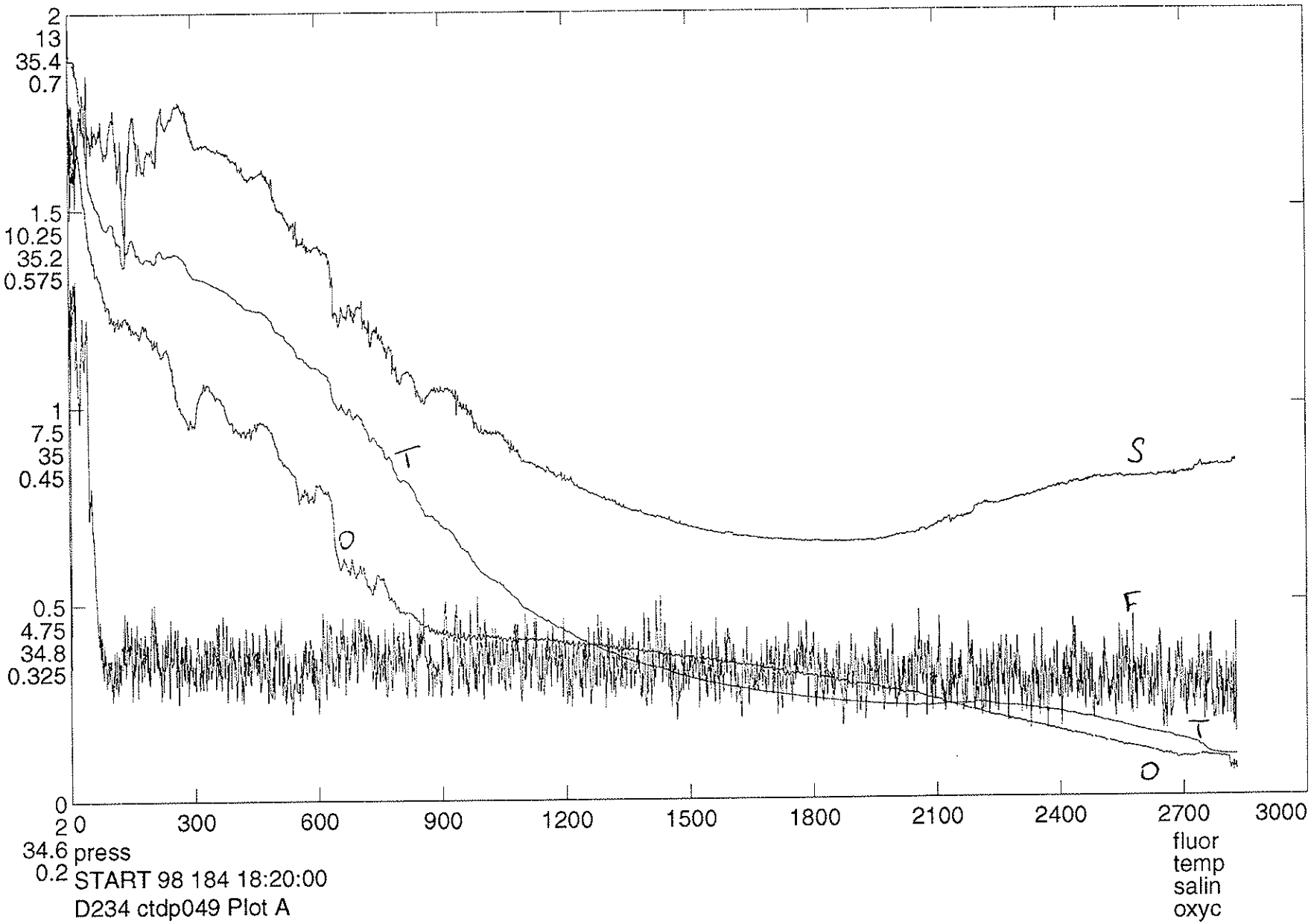

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 14:52:00
D234 ctdp048 Plot B
trans
nephl
dwirr
salin

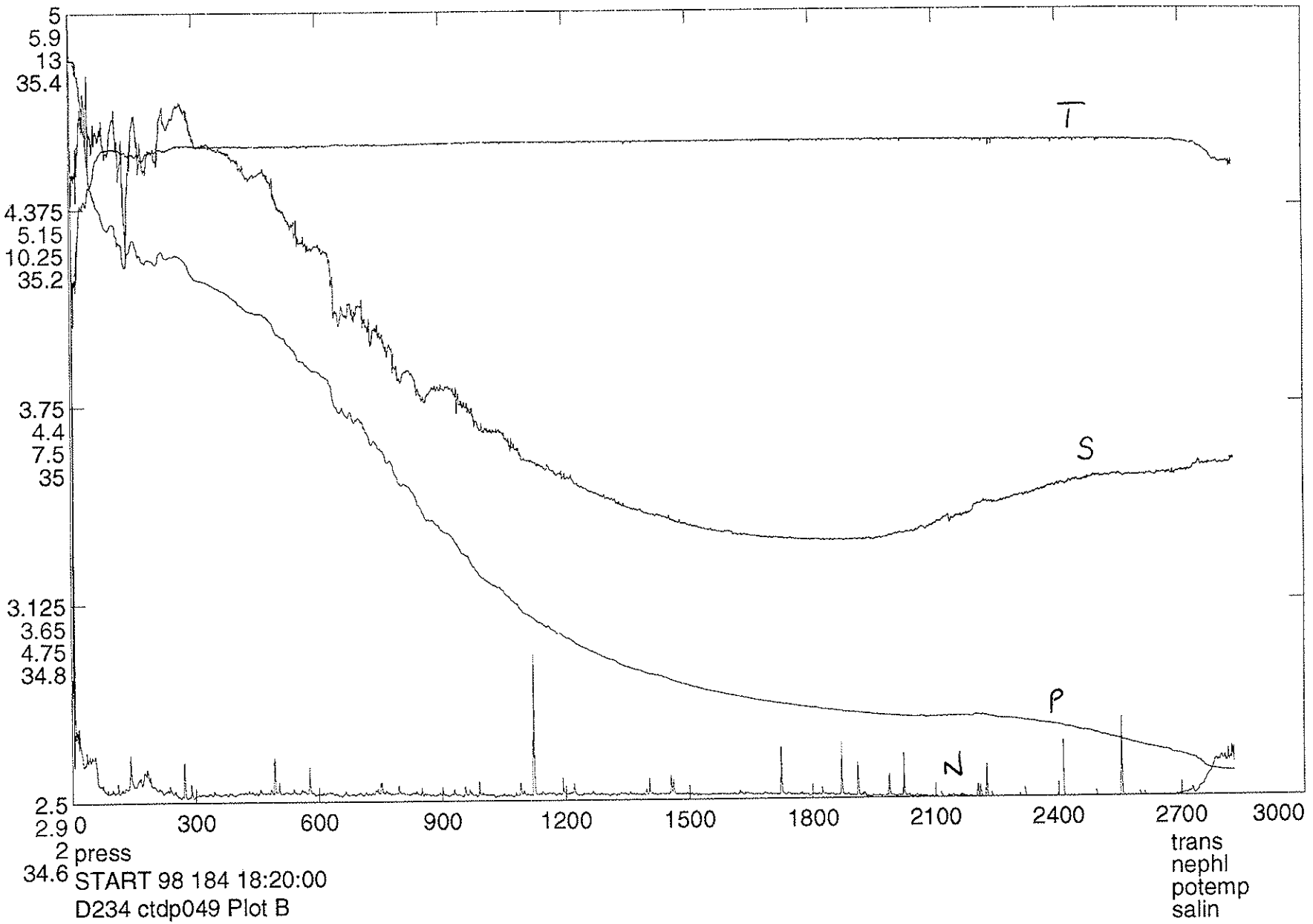

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
press
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
T
D
S
F
T
D
START 98 184 14:52:00
D234 ctdp048 Plot A
fluor
temp
salin
oxyc

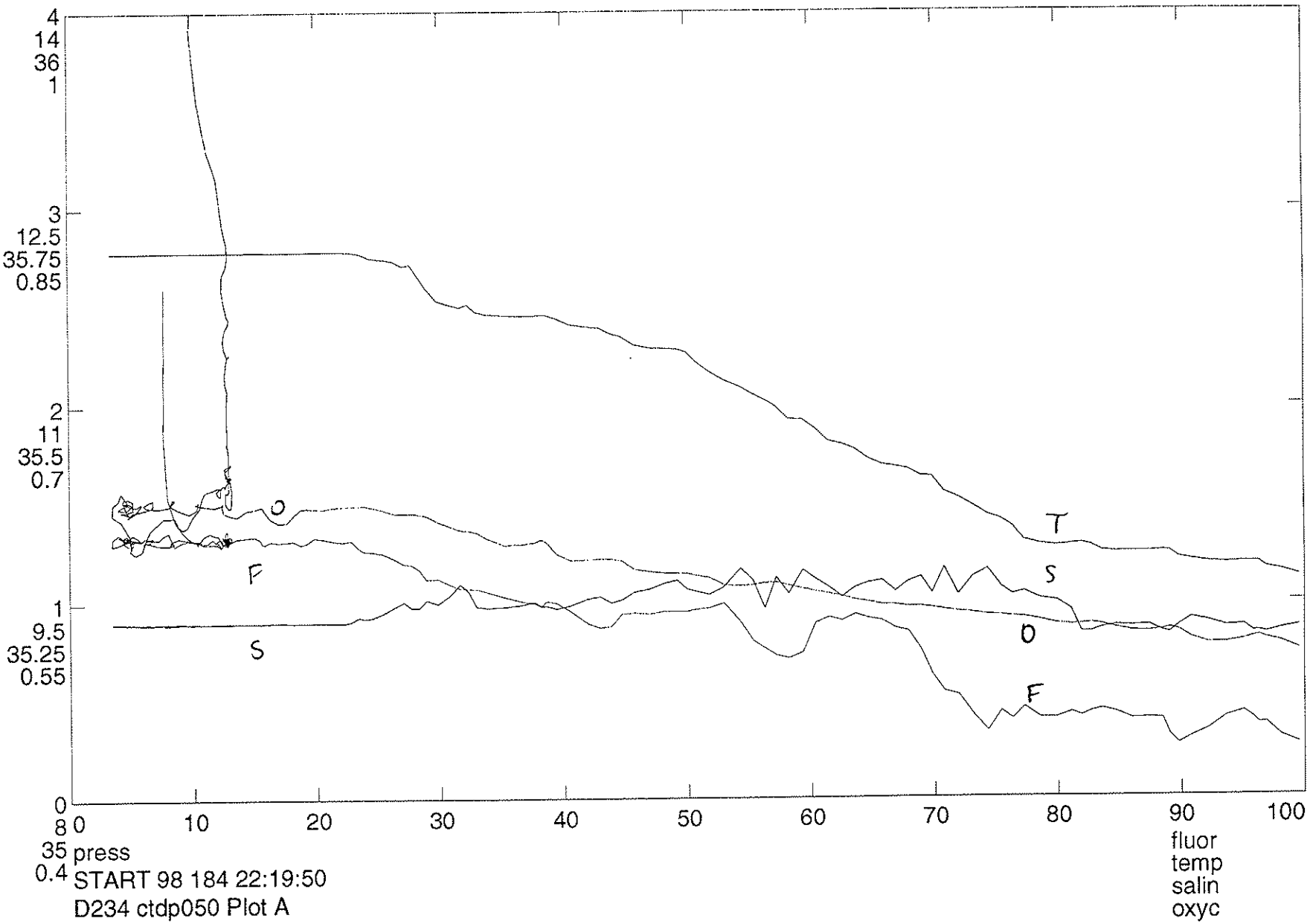

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 14:52:00
D234 ctdp048 Plot B
T
S
ρ
N
trans
nephl
potemp
salin

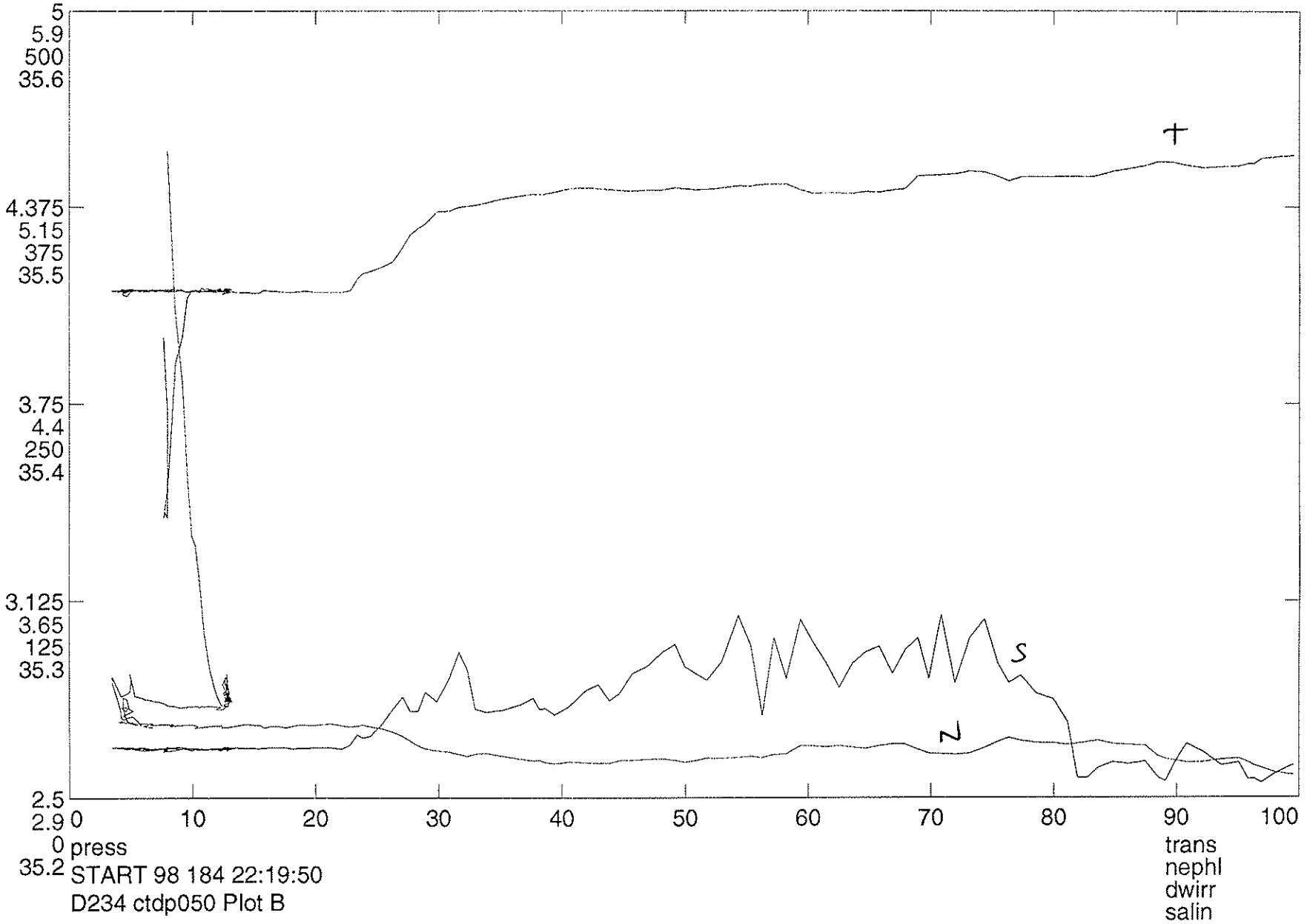

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
10
20
30
40
50
60
70
80
90
100
fluor
temp
salin
oxyc
T
O
F
S
T
S
O
F
START 98 184 18:20:00
D234 ctdp049 Plot A

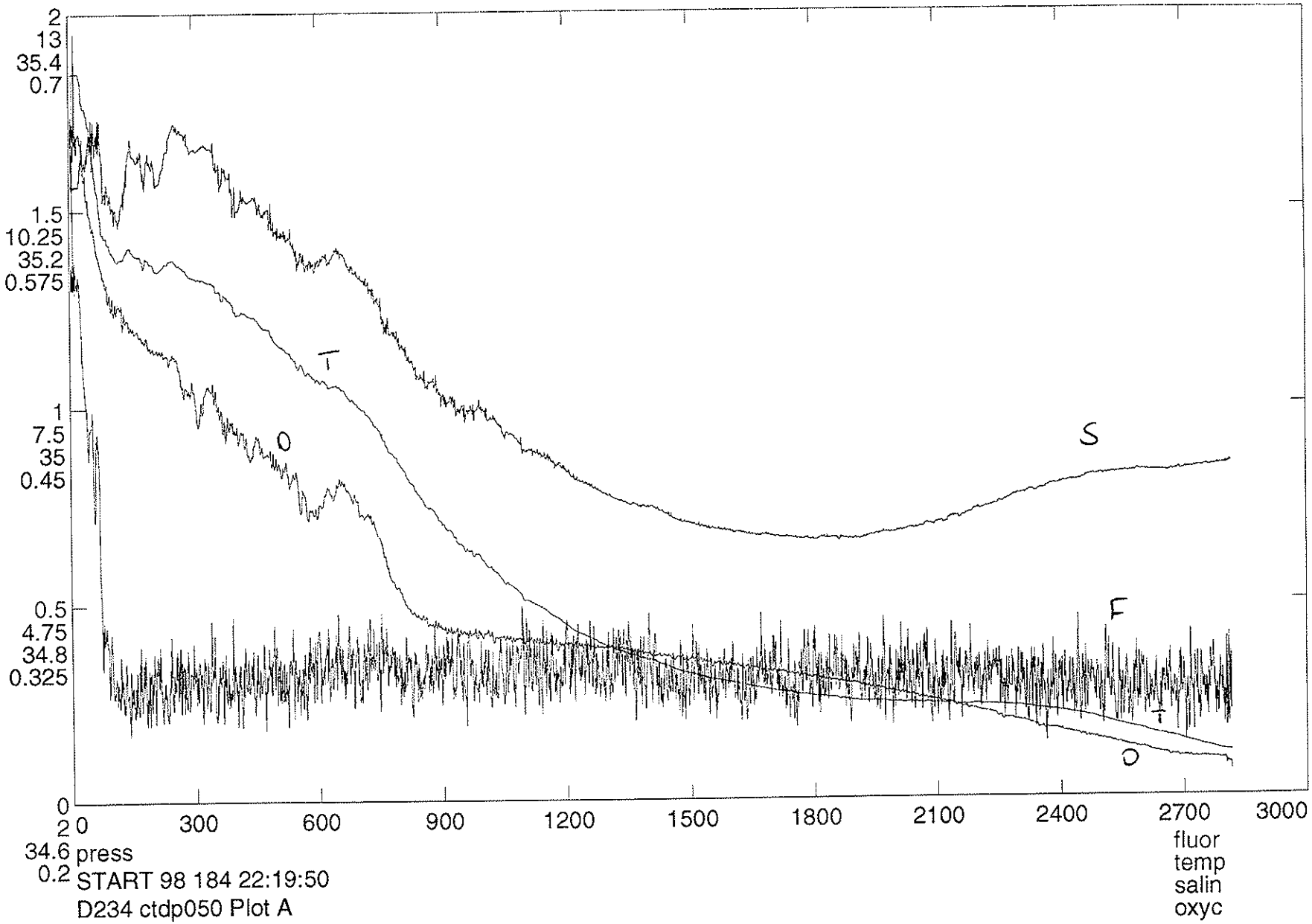

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 18:20:00
D234 ctdp049 Plot B
trans
nephl
dwirr
salin

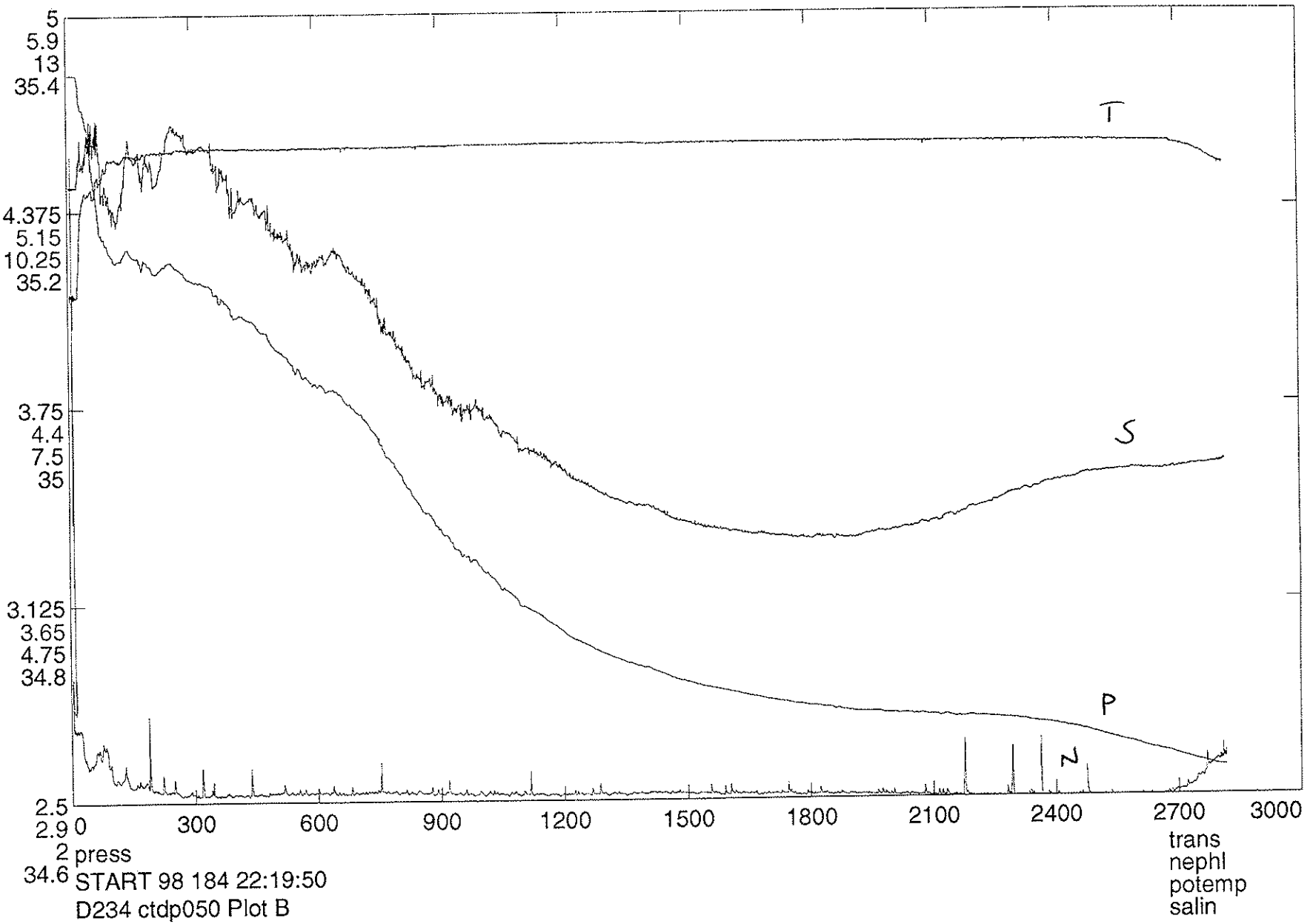

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2 0
300
600
900
1200
1500
1800
2100
2400
2700
3000
34.6 press
0.2
START 98 184 18:20:00
D234 ctdp049 Plot A
fluor
temp
salin
oxyc
T
S
O
F
T
O

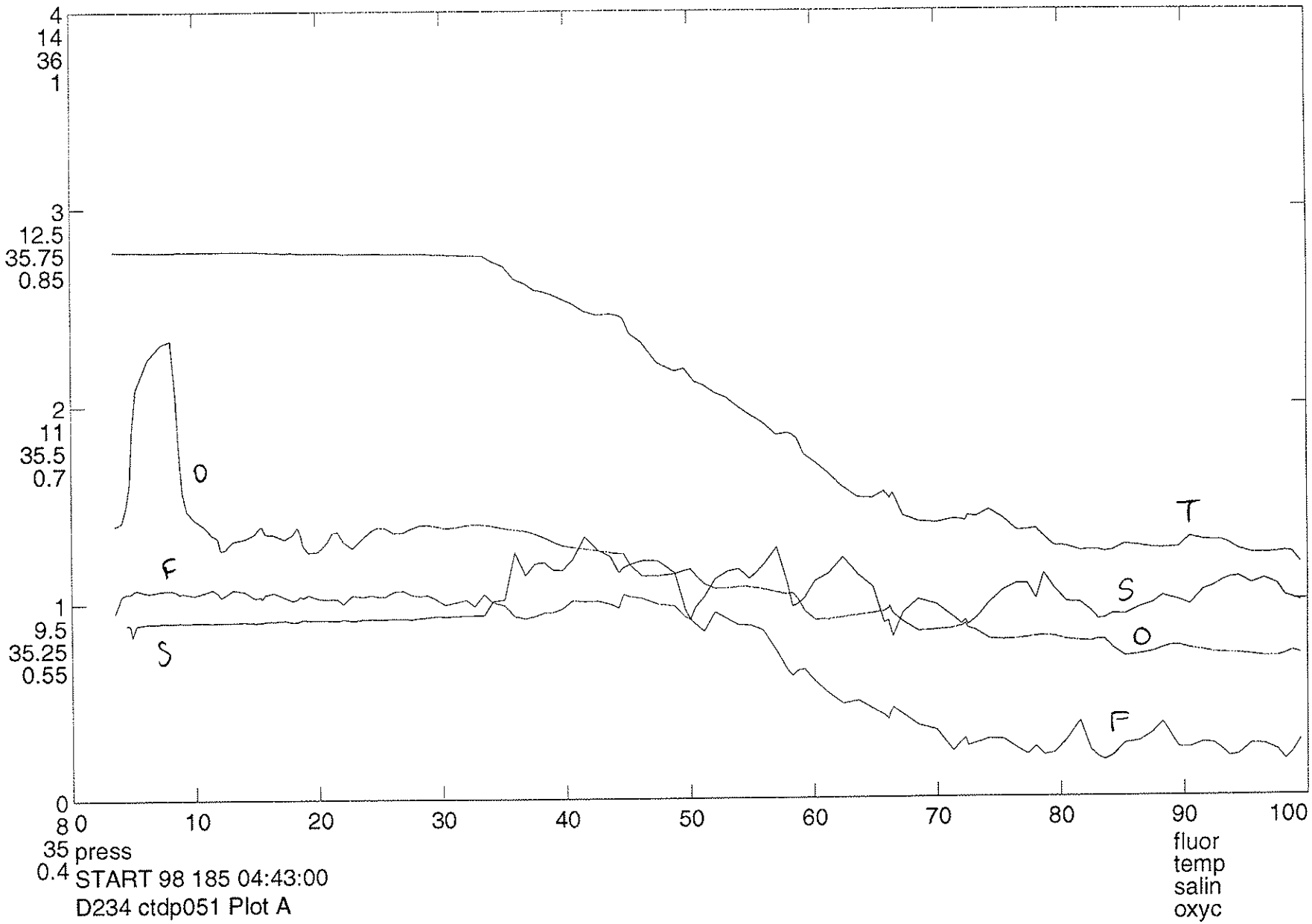

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 18:20:00
D234 ctdp049 Plot B
T
S
P
N
trans
nephl
potemp
salin

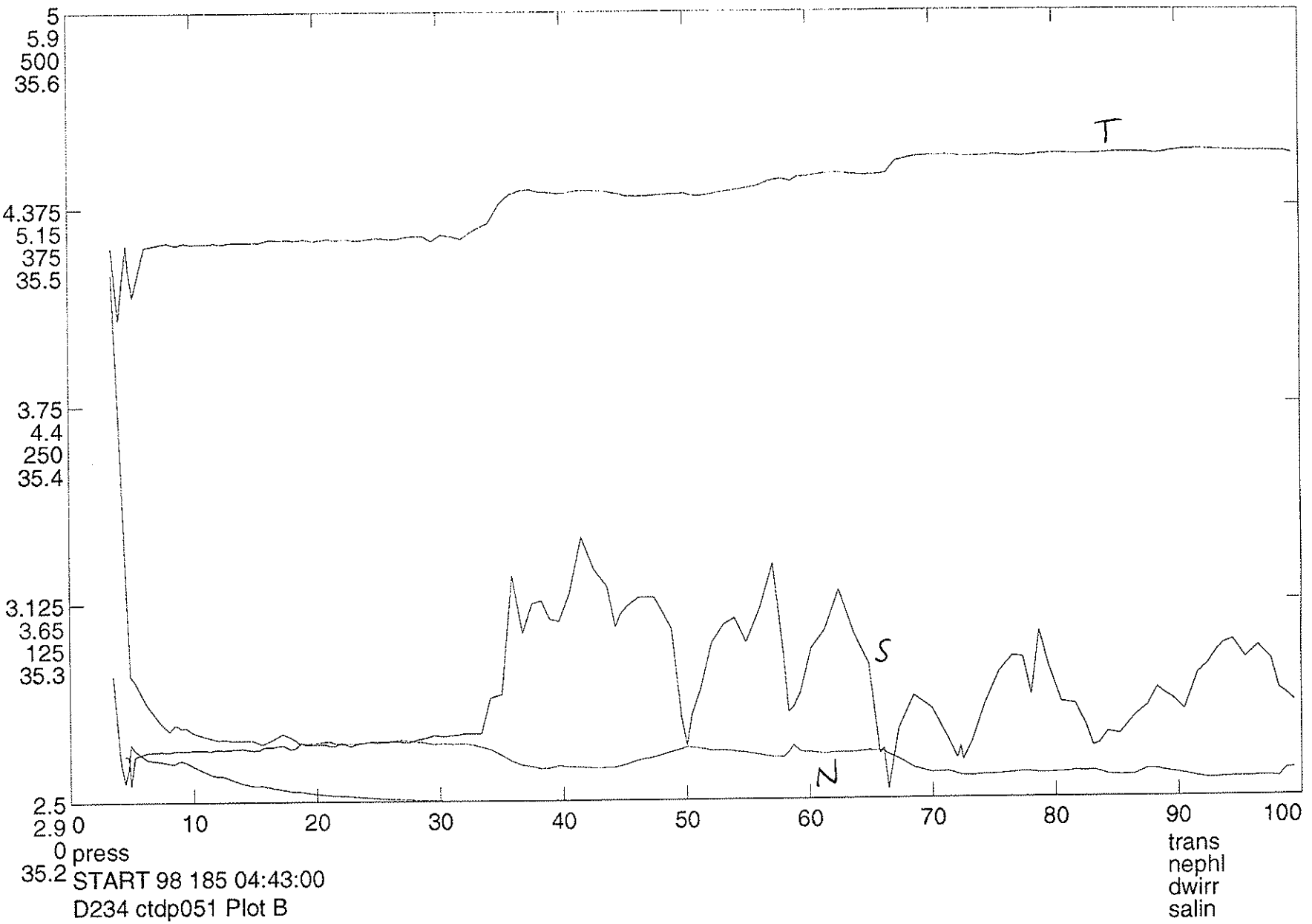

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
0
10
20
30
40
50
60
70
80
90
100
press
fluor
temp
salin
oxyc
T
S
O
F
S
O
F
START 98 184 22:19:50
D234 ctdp050 Plot A

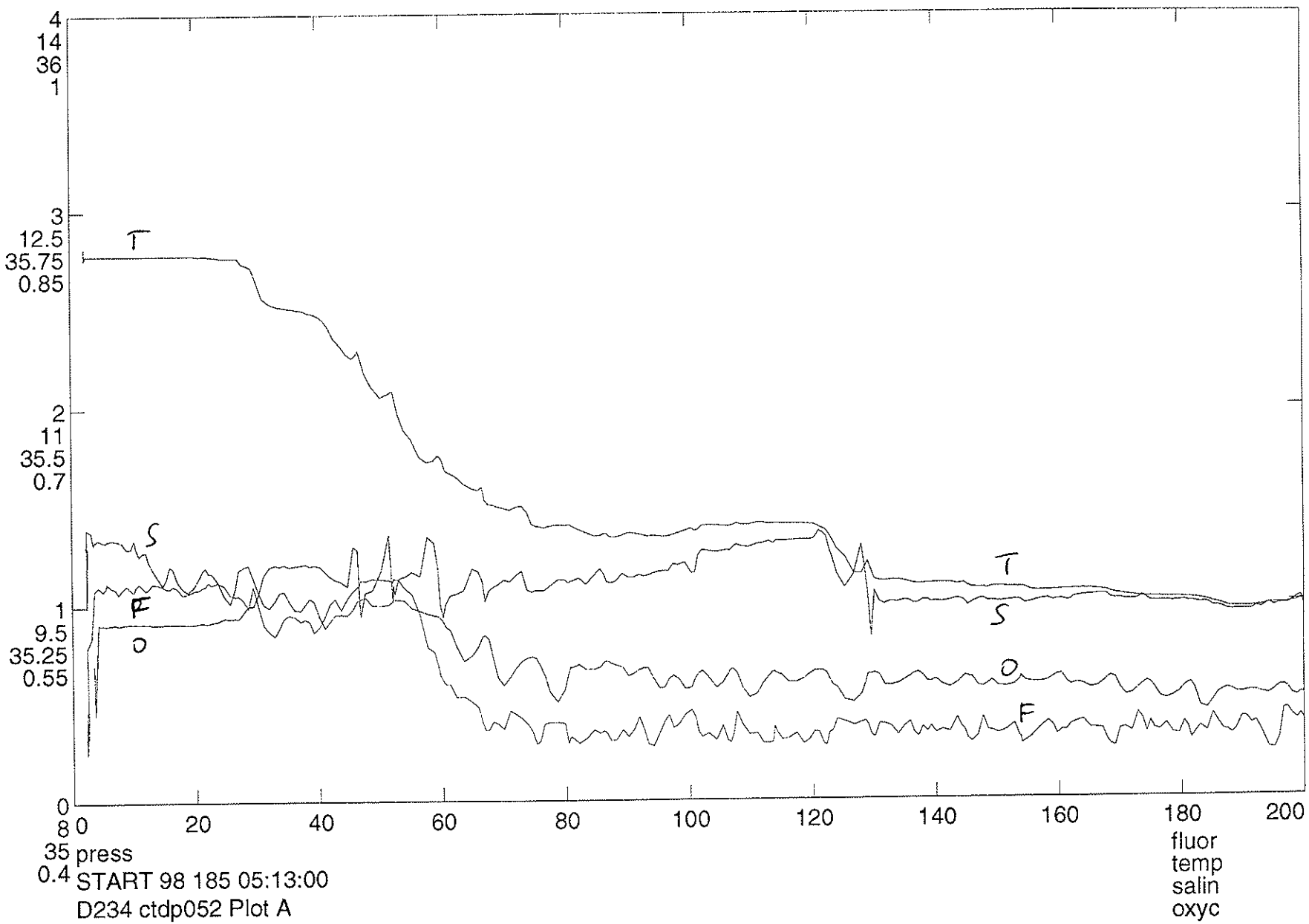

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 184 22:19:50
D234 ctdp050 Plot B
trans
nephl
dwirr
salin

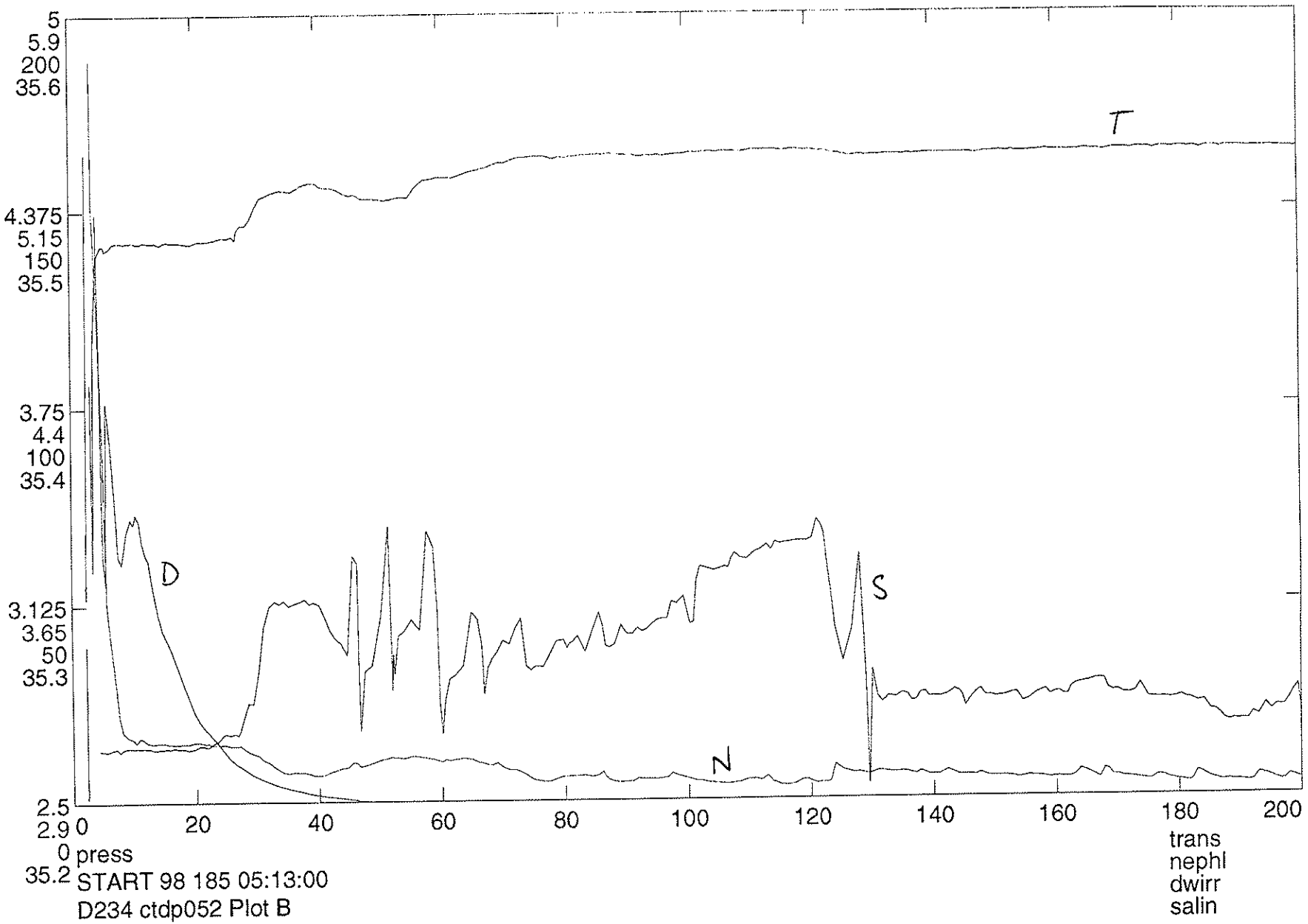

2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
2
34.6
0.2
T
O
S
F
t
O
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
START 98 184 22:19:50
D234 ctdp050 Plot A
fluor
temp
salin
oxyc

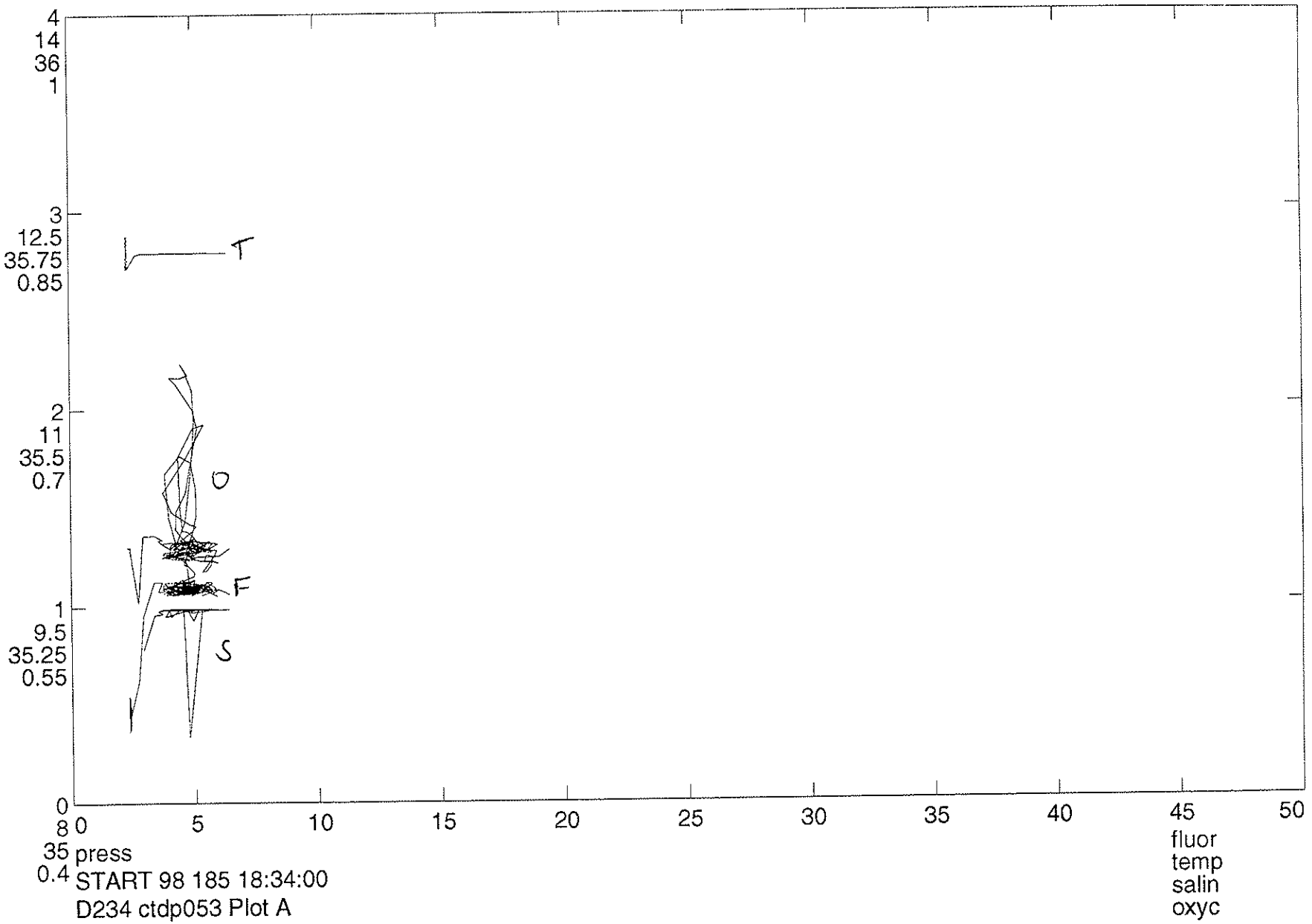

5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
T
S
P
press
START 98 184 22:19:50
D234 ctdp050 Plot B
trans
nephl
potemp
salin

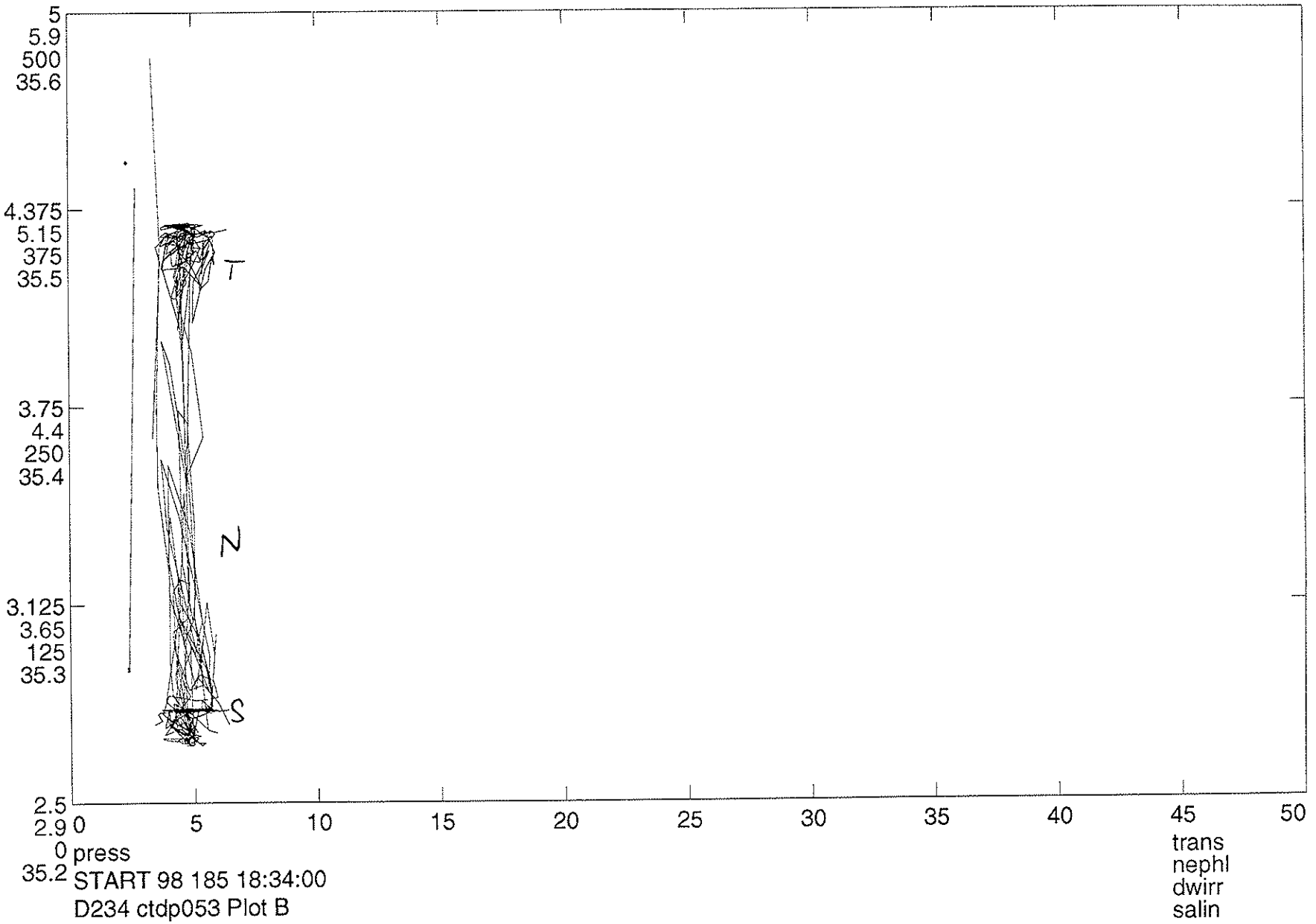

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
press
0
10
20
30
40
50
60
70
80
90
100
fluor
temp
salin
oxyc
O
F
S
T
S
O
F
START 98 185 04:43:00
D234 ctdp051 Plot A

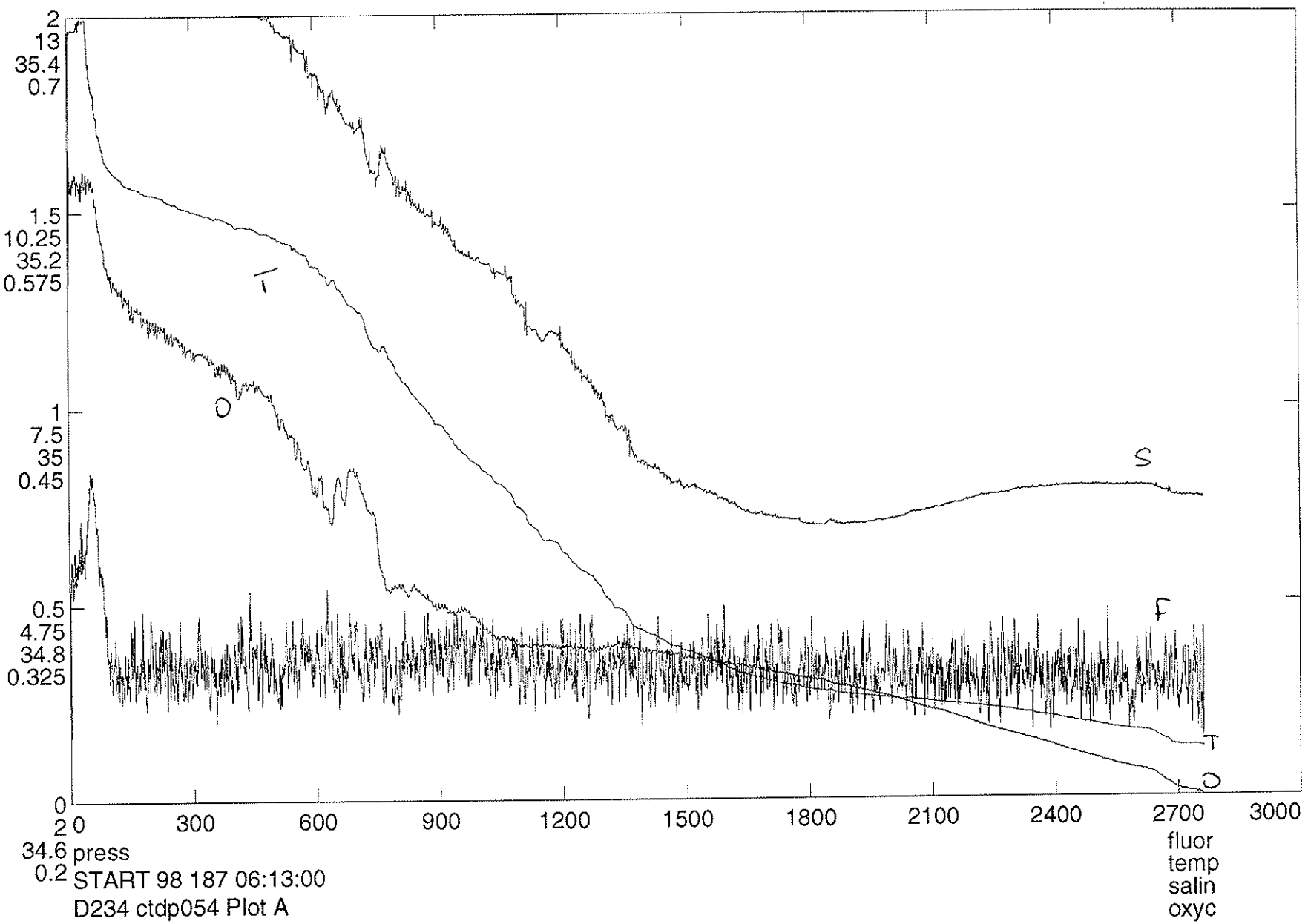

5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
0
10
20
30
40
50
60
70
80
90
100
T
S
N
0 press
START 98 185 04:43:00
D234 ctdp051 Plot B
trans
nephl
dwirr
salin

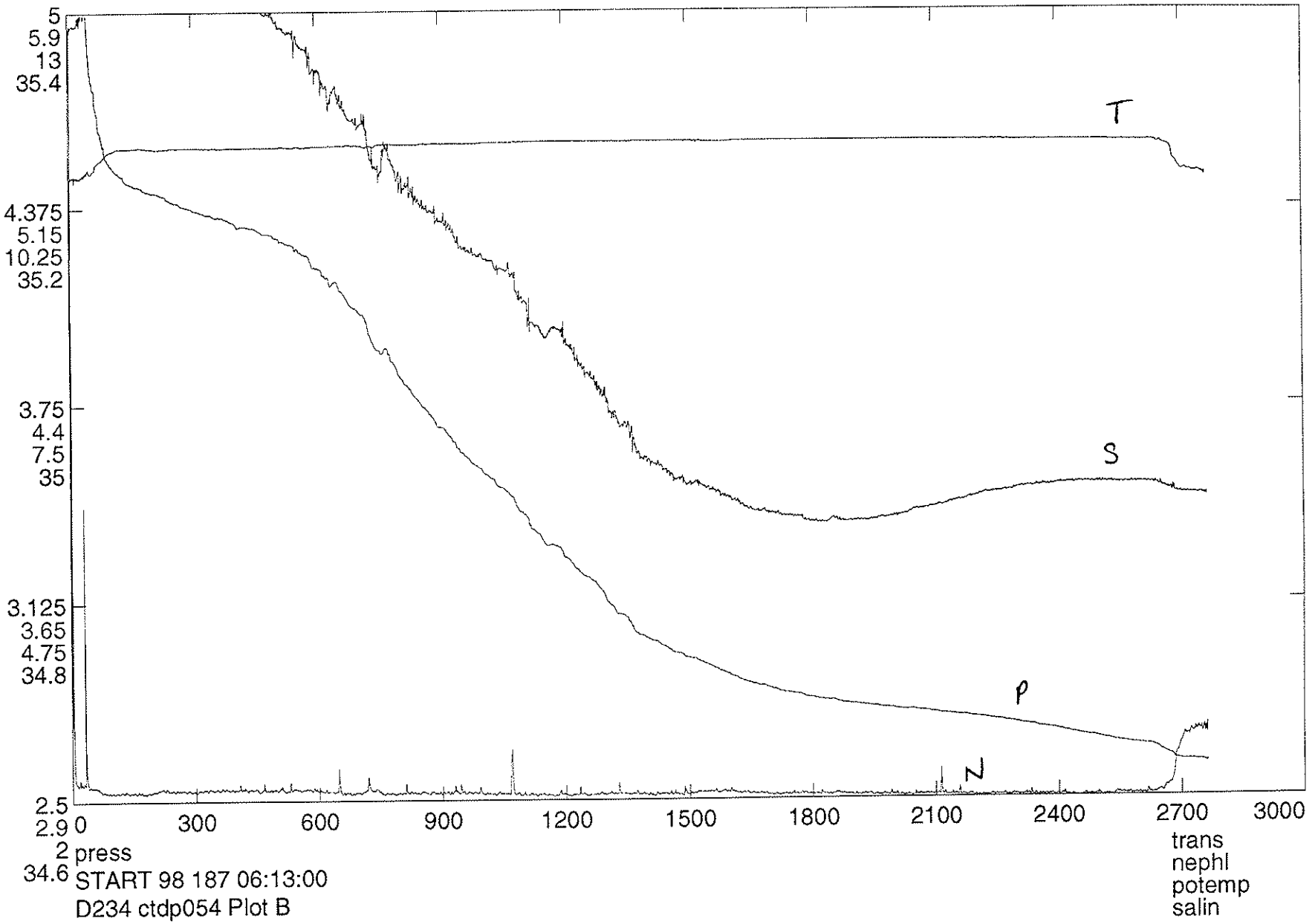

4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
S
F
O
0
20
40
60
80
100
120
140
160
180
200
press
START 98 185 05:13:00
D234 ctdp052 Plot A
fluor
temp
salin
oxyc


5
5.9
200
35.6
4.375
5.15
150
35.5
3.75
4.4
100
35.4
3.125
3.65
50
35.3
2.5
2.9
0
35.2
T
D
S
N
0
20
40
60
80
100
120
140
160
180
200
press
trans
nephl
dwirr
salin
START 98 185 05:13:00
D234 ctdp052 Plot B


4
14
36
1
3
12.5
35.75
0.85
2
11
35.5
0.7
1
9.5
35.25
0.55
0
8
35
0.4
T
O
F
S
0
5
10
15
20
25
30
35
40
45
50
press
START 98 185 18:34:00
D234 ctdp053 Plot A
fluor
temp
salin
oxyc


5
5.9
500
35.6
4.375
5.15
375
35.5
3.75
4.4
250
35.4
3.125
3.65
125
35.3
2.5
2.9
0
35.2
T
N
S
0
5
10
15
20
25
30
35
40
45
50
0 press
START 98 185 18:34:00
D234 ctdp053 Plot B
trans
nephl
dwirr
salin


2
13
35.4
0.7
1.5
10.25
35.2
0.575
1
7.5
35
0.45
0.5
4.75
34.8
0.325
0
T
O
S
F
T
O
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
2 0
34.6 press
0.2
START 98 187 06:13:00
D234 ctdp054 Plot A
fluor
temp
salin
oxyc


5
5.9
13
35.4
4.375
5.15
10.25
35.2
3.75
4.4
7.5
35
3.125
3.65
4.75
34.8
2.5
2.9
2
34.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
press
trans
nephl
potemp
salin
T
S
ρ
N
START 98 187 06:13:00
D234 ctdp054 Plot B