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POSEIDON - Reise 173/2
vom 14. August bis 10 September 1990

Pelagisches System und vertikaler Partikelfluß im Herbst in der Grönländischen See, Jan Mayen Strom

Teilprojekt A1 und A4 des Sonderforschungsbereiches 313
der Universität Kiel

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Aug. 14th - Nov. 10th

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1. Fahrtverlauf der POSEIDON-Reise 173/2

Im Laufe des 12.08.90 trafen die ersten Teilnehmer der Reise in Reykjavik ein. Am nächsten Tage wurde auf der POSEIDON umgestaut und der Container mit wissenschaflichem Gerät entladen. Desweiteren wurde damit begonnen die Labors seefest einzurichten. Am Abend des 13.August trafen die restlichen Fahrtteilnehmer ein.

Bei günstigen Winden lief POSEIDON am 14.August um 08.00 Uhr in Richtung des ersten Arbeitsgebietes bei 59 02,5'N;21 04,9'W aus (Abb.1). Die Stationsarbeiten begannen am 15.August um 16.00Uhr. Es wurde ein CTD-Profil aufgenommen und einige Proben zur Biomassebestimmung des Phytoplanktons gesammelt. Dabei wurde eine neue Rosette mit 12 Schöpfern mit je 121 erfolgreich getestet. Im Verlaufe der Nacht wurden Netze zur Gewinnung von Zooplanktonmaterial für Freßexperimente eingesetzt, sowie $1m^3$-Tanks für experimentelle Zwecke gefüllt. Die Erprobung von RAFOS-Floats der Abteilung Meeresphysik des Instituts für Meereskunde in Kiel verlief erfolgreich, sodaß zwei Floats bei Ablaufen aus dem Arbeitsgebiet eingesetzt werden konnten.

Am Morgen des 16.August wurde eine Verankerung mit 5 Sinkstoffallen der Abteilungen Meereschemie und Marine Planktologie des Instituts für Meereskunde in Kiel ausgelöst und erfogreich geborgen. Diese Verankerung war im Mai/Juni 1989 auf der METEOR-Reise M10/2 im Rahmen der internationalen Pilotstudie der JGOFS (Joint Global Ocean Flux Study) ausgebracht worden. Das gewonnene Datenmaterial stellt einen wichtigen Beitrag zu dieser Studie dar, die die Untersuchung der Prozesse im Pelagial und den resultierenden vertikalen Partikelfluß im Nordatlantik von 18N bis 72N umfaßte.

Am 16.August mittags wurde die Rückreise nach Reykjavik angetreten, wo POSEIDON aufgrund des außergewöhnlich günstigen Wetters am 17.August um 19.00 Uhr festmachte. Am 18.August wurden noch einmal die Geräte umgestaut. Am Abend fand der Austausch von 4 Wissenschaftlern statt. Um 21.00 Uhr lief Poseidon mit Kurs auf das Arbeitsgebiet des Sonderforschungsbereiches 313 der Universität Kiel nördlich von Jan Mayen aus.

Am 21.August erreichten wir die Position 72 00,7'N;07 02,5'W, an der auf der METEOR-Reise M10/3 im Juli 1989 eine Verankerung (OG3) mit 3 Sinkstoffallen ausgesetzt worden war (Abb.1). Im November 1989 versuchten wir diese Verankerung mit VALDIVIA aufzunehmen, um die Sinkstoffallen nach neuesten Erkenntnissen zu überholen. Diese Aufnahme scheiterte, da die Bordeinheit des Auslösesystems nicht einwandfrei arbeitete. Am 21.August jedoch konnte die Verankerung mit der überholten Bordeinheit problemlos ausgelöst und anschließend geborgen werden. Die Sinkstoffallen hatten im Vergleich zu den vorhergehenden Jahren endlich gut gearbeitet, wir erhielten 90% der angestrebten Proben. Damit wurde zum ersten Male überhaupt in der Grönländischen See ein kompletter Jahresgang des vertikalen Partikelflusses in 3 Tiefenhorizonten (500m, 1000m und

2400m) aufgenommen.

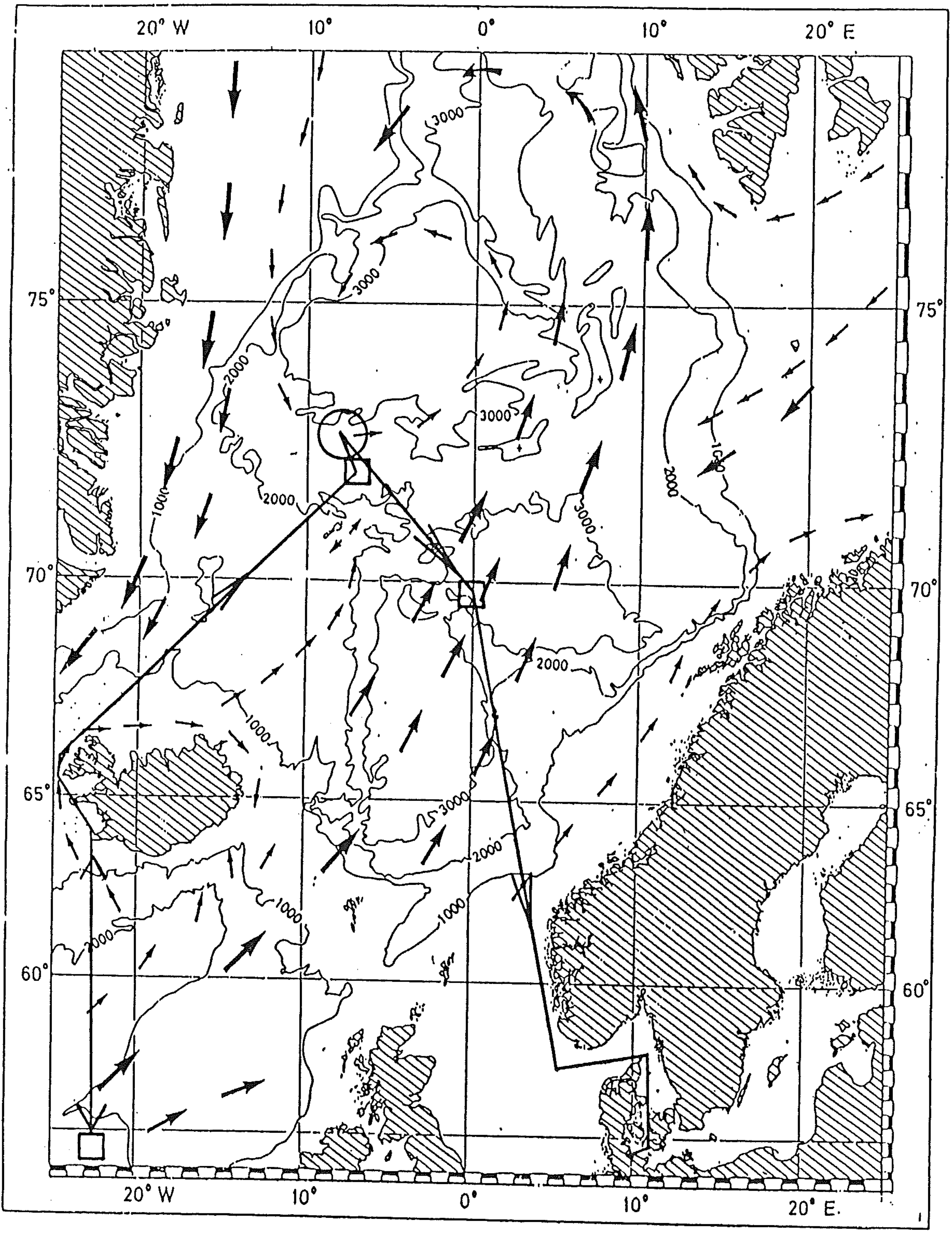

Fig.1: Cruise-track of RV POSEIDON 173/2 from 14.August to 10.September 1990. Squares indicate mooring positions of sediment traps, circle indicates the area of the drift study.

Nach dem Bergen der Verankerung wurde an der Position eine Station mit CTD-Profil, Wasserprobennahme und diversen Netzfängen bis in Bodennähe (2700m) abgearbeitet.

Die Ergebnisse der Driftstudie des Jahres 1989 hatten gezeigt, daß in diesem Seegebiet mesoskalige, wirbelartige Strukturen anzutreffen sind, in denen auf kleinen Distanzen erhebliche Unterschiede in der vertikalen Verteilung von physikalischen, chemischen und biologischen Parametern beobachtet wurden. Durch die Nähe der Arktisfront (etwa 50 bis 60sm südlich) konnte auch die laterale Beimengung von Atlantikwasser aus dem Norwegenbecken nicht völlig ausgeschlossen werden. Daher liefen wir von der Verankerungsposition 30sm nach Norden ab, um dort mit der CTD- und Fluoreszenzsonde (als Indikator für die Chlorophyllverteilung) das angestrebte Arbeitsgebiet zu erkunden.

In etwa 5sm Abstand wurden auf einem angenäherten Dreieckskurs 12 vertikale Profile aufgenommen (Abb.2), zwischen den Meßpunkten wurden Salzgehalt und Temperatur der Oberfläche mit dem Thermosalinographen aufgezeichnet. Schon auf der Anfahrt zur Verankerungsposition OG3 fanden wir eine starke Beeinflußung des Oberflächensalzgehaltes (um $32*10^{-3}$) durch Schmelzwasser (Abb.4), obwohl die Packeisgrenze 150sm weiter westlich lag. Die Erkundungsfahrt zeigte, daß in den oberen 50m eine starke Variabilität der vertikalen Struktur von Salzgehalt, Temperatur und Chlorophyll auftrat. Im westlichen Teil des abgefahrenen Dreieckes fanden wir niedrigere Salzgehalte und Temperaturen (Abb.5 und 6), sowie eine höhere Chlorophyllbiomasse. Der Einfluß von Atlantikwasser im westlichen Teil des Erkundungsgebietes konnte ausgeschlossen werden. Aufgrund dieser Phänomene erschien es interessant die Untersuchungen innerhalb dieses Gebietes zu beginnen.

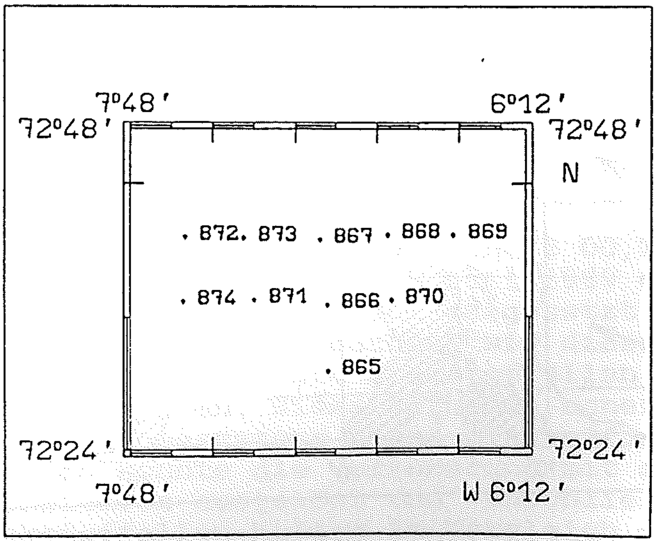

Fig.2: Survey grid 30 nautical miles north of the OG3 mooring.

Am 23.August setzen wir einen Drifter aus, der aus zwei Monofallen in 100m und einer Multifalle in 300m Wassertiefe bestand. Unterhalb der Fallen war jeweils ein Strommesser angebracht. Die Gläser an den Monofallen, von denen eines vergiftet und das andere unvergiftet war, wurden täglich bei der Aufnahme des Drifters gewechselt. Die Probengläser der Multifalle waren auf einen täglichen Wechsel programmiert.

Um den aktuellen, vertikalen Partikefluß bis in größere Wassertiefen zu verfolgen, wurde ebenfalls am 23.August eine Kurzzeitverankerung ausgebracht, die aus einer Multifalle in 100m und jeweils einer Monofalle in 500m, 1000m und 2200m Wassertiefe bestand (Abb.3).

Nach dem Aussetzen des Drifters und der Kurzzeitverankerung begann die tägliche Beprobung der Wassersäule entlang der Drifttrajektorie. Für die nächsten neun Tage wurde täglich das folgende Programm abgearbeitet:

Um 05.00Uhr begann die Station am Drifter mit dem Ablesen der Secchitiefe. Danach folgte die Aufnahme eines Fluoreszenzprofiles bis etwa 80m Wassertiefe. Daran schloß sich die Aufnahme des CTD-Profiles und die Wasserbeprobung mit der Schöpferrosette von 300m Tiefe, durch die euphotische Zone bis zur Wasseroberfläche an.

Zwischen 07.15 und 07.30 wurde der Drifter bis zu den 100m-Fallen aufgenommen, und die Probengläser wurden gewechselt. Beim Aussetzen wurde an der Driftboje ein Inkubationsgestell befestigt, an dem Flaschen für die Bestimmung der gesamten und der neuen Produktion bis in 60m Tiefe inkubiert wurden. Das Aussetzen des Drifters und des Inkubationsgestelles war jeweils um 08.00 ± 10min beendet.

Danach wurden verschiedene Netze (Apsteinnetz mit 20µ-; Multinetz mit 100 und 200µ- und Ringnetz mit 500µ-Maschenweite) zum Fang von Phytoplankton, Proto- und Mesozooplankton eingesetzt. Vom späten Vormittag bis in den späten Nachmittag wurden in-situ Tauchpumpen zur Anreicherung von partikulärem und gelöstem Material für die Bestimmung von Radioisotopen bis in große Wassertiefen eingesetzt. Insbesondere in den ersten Tagen wurden in situ Lichtprofile zu verschiedenen Tageszeiten aufgenommen, um die Photoperiode des Phytoplanktons zu ermitteln.

Um 18.00Uhr wurde das Inkubationsgestell eingeholt. Aus den Lichtprofilen entsprach eine Inkubationszeit von 10Stunden der täglichen Photoperiode des Phytoplanktons von 08.00 bis 18.00Uhr. Die Nachtstunden wurden für die Aufnahme von CTD-Profilen in der Umgebung des Drifters genutzt, um eine bessere Beurteilung der mesoskaligen hydrographischen Verhältnisse in Bezug zur Drifttrajektorie zu ermöglichen.

Neben diesem Routineprogramm wurden Probennahmen für die verschiedenen an Bord geplanten Experimente, wie Phytoplanktonwachstum in Tanks, Freßverhalten und Kotballenproduktion von Mikrozooplankton und Copepoden, sowie verschiedene Abbauexperimente mit Kotballen und Phytodetritus, durchgeführt. Desweiteren wurden Proben mit hoher vertikaler Auflösung in der Tiefe des Nitritmaximums und in Bodennähe genommen. Um Aufschluß über größere, sinkende Partikel zu erhalten, wurden aus verschiedenen Tiefen Partikel aus größeren Mengen Wassers sorgfältig durch Netzgaze angereichert.

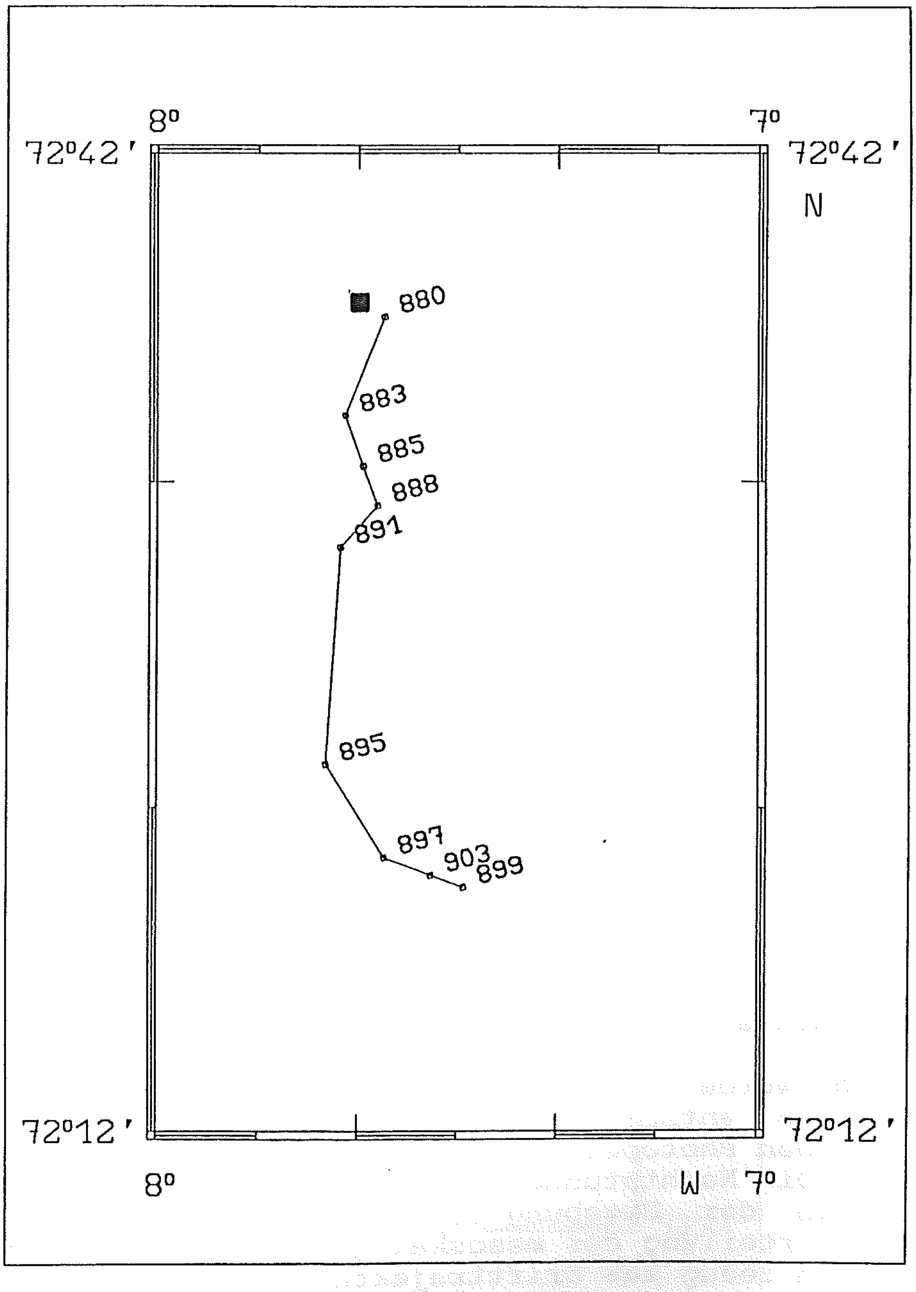

Fig.3: Trajectory of the drifting sediment traps, stations of water column sampling and position of the short-term mooring.

Nach Beendigung des Morgenprogrammes am 01.September liefen wir vom Drifter zur Kurzzeitverankerung ab, von der der Drifter im Verlaufe von 10 Tagen etwa 25 Seemeilen in überwiegend südlicher Richtung verdriftet worden war (Abb.3). Die Verankerung konnte sicher geborgen werden, alle Fallen hatten einwandfrei gearbeitet. In der folgenden Nacht wurden am Drifter die restlichen Stationsarbeiten und Probenwünsche erledigt. Diese Arbeiten wurden am Morgen des 02.Septembers mit einer Morgenroutine beendet.

Danach liefen wir die Position der neuen Jahresverankerung OG4 bei 72 24,3'N; 07 36.6'W an. Die Verankerung wurde um 08.00 ausgesetzt. Sie enthielt 3 Multifallen, die in 500m, 1000m und 2300m bei einer gesamten Wassertiefe von 2700m installiert werden sollten. Etwa eine halbe Stunde nach dem Wegsetzen des Grundgewichtes stellten wir fest, daß die oberen Kugelstränge (Benthosfloats für den Auftrieb) nicht abtauchten. Es stellte sich heraus, daß zwischen der zweiten und dritten Falle das letzte 300m Stück der Meteorleine sich im Gillruder verfangen hatte und zerrissen war. Die noch aufschwimmenden Teile der Verankerung wurden wieder an Bord geholt. Danach wurde der abgetauchte Teil der Verankerung vom Grundgewicht ausgelöst und nach dem Aufschwimmen geborgen. Alle Teile der Verankerung waren, bis auf die besagte 300m Meteorleine, um 16.00 wieder unbeschädigt an Bord.

Es wurde eine neue Verankerung zusammengestellt. In der Zwischenzeit liefen wir zum Drifter ab und nahmen beide Fallen und Strommesser um 17.30 Uhr an Bord. Alle Geräte hatten einwandfrei gearbeitet. Am Abend wurde die OG4 erneut ausgesetzt. Nach dem Abtauchen der Kopfboje wurden die Auslöser angesprochen und wieder auf Ruhestellung gebracht. Hiermit waren die Arbeiten im Jan Mayen Strom beendet.

Um 22.00 Uhr wurde das Arbeitsgebiet mit Richtung Norwegenbecken verlassen. Nach etwa 23 stündiger Dampfzeit erreichten wir am Abend des 3.September die Position 69 57,9'N;00 10,9'E, an der eine weitere Verankerung (NB5) mit drei Sinkstoffallen aufgenommen und wieder ausgebracht werden sollte. In der Nacht wurden verschiedene Stationsarbeiten mit Fluoreszenz- und CTD-Sonde, Wasserschöpfern, Netzen und Tauchpumpen durchgeführt.

Am Morgen des 4.September um 06.30Uhr versuchten wir die Verankerung auszulösen. Trotz des Einsatzes von zwei Bordeinheiten konnte kein Kontakt zu den Auslösern hergestellt werden. Nach mehreren Auslöseversuchen wurde nach Ablauf der zu erwartenden Aufstiegszeit der Verankerung kein Signal vom Sender der Kopfboje empfangen. Bei ausgezeichneten See- und Sichtverhältnissen wurde um die Verankerungsposition ein Suchschnitt gefahren. Die Verankerung wurde nicht gesichtet. Um 20.00Uhr wurde die Suche aufgegeben. Es muß angenommen werden, daß die Verankerung nicht ausgelöst hat. Beim Aussetzen der Verankerung von METEOR im Juni 1989 fiel das Grundgewicht zu früh aus dem Schlipphaken. Es besteht daher die Möglichkeit, daß die Auslöser hart an die Bordwand schlugen und beschädigt wurden. Es soll baldmöglichst versucht werden, mit einem Tiefseedraht nach der Verankerung zu dredgen.

Am 4.September um 20.00Uhr traten wir die Heimreise an. Durch die günstigen Wetterverhältnisse, wie sie auch auf der gesamten Fahrt vorherrschten, erreichten wir Kiel am 9.September. POSEIDON machte um 15.00Uhr an der Pier des Instituts für Meereskunde fest.

Danksagung: An dieser Stelle möchten sich die eingeschifften Wissenschaftler bei Schiffsführung und Besatzung für die Zusammenarbeit bedanken. Wie schon auf anderen Ausfahrten, haben wir die freundschaftliche Atmosphäre auf POSEIDON sehr genossen. Diese hat viel zu dem Erfolg der Reise beigetragen. Herzlichen Dank an alle.

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2. Purpose of the cruise

The European Northern Seas, i.e. the Greenland and Norwegian Seas, are the major investigation area of the Special Research Project 313 (Sonderforschungsbereich) of Kiel University: "Sedimentation in the European Northern Seas". The project comprises studies of the pelagic system, vertical particle flux, benthic processes, bottom near transport of particles and the sedimentary record. Its aim is to describe the recent patterns of biological processes in the pelagial and benthal as well as sediment accumulation as an expression of contemporary circulation patterns, and to reconstruct from the sedimentary record the paleoproductivity and paleocirculation for this region.

This cruise was carried out by the subproject A1: "Vertical particle flux from the watercolumn" and subproject A4: "Chemical fluxes through the benthic boundary layer". Additionally, the programme of the cruise was designed to fit in the JGOFS (Joint Ocean Global Flux Study) and to continue the spring/early summer investigations of 1989 on METEOR-cruise M10, leg 3, in the frame work of the North Atlantic Spring Bloom Pilot Study.

The main purpose of this cruise was to investigate primary production and trophic relationships in the pelagial as well as the resulting vertical export of particulate matter under late summer/autumn conditions in the Jan Mayen Current at about 72 N;07 W (2700m water depth). At this site sediment trap samples from previous years showed a second seasonal maximum of vertical particle flux in September, although not as pronounced as that following spring growth in the period of April to June. After depletion of nutrients in the shallow mixed layer, caused by melt water and seasonal warming, a chlorophyll maximum in 10 to 20m water depth was found during summer in this area in previous investigations.

In this region a year round mooring with one sediment trap in 500m was anchored from summer 1988 to summer 1989. A long-term mooring with sediment traps in 3 horizons (500m, 1000m, 2300m) first deployed in 1989 will be maintained for several years to come.

The working hypothesis for the investigations during this cruise was that due to the low angle of the sun in late summer/autumn the light climate in the euphotic zone deteriorates rapidly leading to the breakdown of the pelagic system and consequent increase in the vertical export of particulate organic matter.

3. Cruise programme and methods

During the first part of the cruise the ship sailed from Reykjavik to a position at 59 N;21 W, where a mooring with 5 sediment traps was deployed during the JGOFS-North Atlantic Pilot Study in June 1989 by RV METEOR (leg 2 of cruise M10). The mooring was recovered safely. At this site a new rosette sampler was successfully tested. Two isopycnal floats for hydrographic measurements were also tested and released for a one week measuring period. After these deployments the ship returned to Reykjavik and called at port on the evenning of 17.August to exchange scientists and equippment. On August 18th POSEIDON left Reykjavik again to sail to the main investigation area north of Jan Mayen (Fig.1).

On 21.August the mooring OG3 with 3 sediment traps, which was deployed during METEOR-cruise M10/3 at 72 00,7'N;07 02,5'W, was recovered safely. Inorganic nutrients in the supernatant water were measured immediately after recovery and the rest of the samples were stored away for later analysis ashore.

The position of the annual mooring was situated approximately 60 nautical miles north of the Arctic Front. Under extreme circumstances lateral advection of Atlantic water from the Norwegian Basin is possible. We therefore moved another 30 nautical miles north, where a survey of the hydrographical situation and vertical distribution of phytoplankton biomass by means of CTD and in-vivo flourescence profiles was carried out (Fig.2).

The northwestern part of this grid (fig.2), where the influence of melt-water in the upper column was most pronounced, was chosen to start with the main investigation. Near stn.872 a short-term mooring with four sediment traps was deployed. The traps were installed 100m, 500m, 1000m and 2000m below the surface at a total water depth of 2700m. The upper trap was equipped with a multi-collector device, and the sampling period for each cup was set at a 24hour interval. The other 3 traps had only one sampling cup collecting material over the entire mooring period from 23.August to 1.September. Besides being a substantial part of the actual investigations, these short-term moorings also serve to fill the gap in the long-term monitoring of particle flux between recovery and deployment of the annual moorings.

Cups were poisoned with mercuric chloride. This deviation from the JGOFS standard, by which formaldehyde is recommended, was necessary because the trap material is also analysed for stable carbon isotopes.

Approximately 0.5 nautical miles to the northwest a drift-rigg with 3 sediment traps was launched (Fig.3). Two traps each with a single collector cup were installed side by side 100m below the sea surface. One cup was poisoned with mercuric chloride, the other cup was left without any poison. The third trap, equipped with a multi collector device, was 300m below the sea surface and collected in 24 hours intervals. All cups of this trap were poisoned. All traps used in moorings and drift-rigg were funnel-shaped Kiel traps with 0.5m^2 sampling area. Traps were equipped with a baffle (aspect ratio of 5:1).

The drift period lasted from noon of 23.August to late afternoon of 2.September. Each morning at 07.00 hours the drift-rigg was lifted up to the two upper traps and the collector cups were replaced to also obtain daily sampling intervals.

Prior to the work at the drifter water column sampling was carried out. This morning station began at 05.00 hours with a reading of the secchi-depth, followed by an in-vivo floures-cence- and CTD-profile (ME-Kieler Multisonde). The CTD-probe was combined with a rosette sampler. Samples for the salinometer and temperature readings of reverse thermometers were taken for later correction of the CTD-data. The CTD-data were stored on a VAX-computer. In situ light measurements (as PAR) were carried out with a LICOR-probe in the morning as well as at different times of the day to evaluate the length of the photo period of the phytoplankton. Total incoming PAR was also recorded on deck of the ship.

Discrete water samples were taken every day from 300m, 100m and 8 depths within the euphotic zone corresponding to the 100, 50, 30, 20, 10, 5, 1 and 0.1% light levels. In each depth 2 water bottles were closed. From one bottle samples for particulate parameters were taken, whereas the other bottle was sampled for dissolved parameters and rate measurements.

Occasionally sampling with high spatial resolution close to the sea bottom and around the nitrite maximum in 80m water depth was carried out. Twice during the investigation the water column was sampled down to greater waterdepth (2500m). For particulate parameters up to 4l of water were filtered as duplicates to obtain reliable deep water numbers for budget calculations.

Water samples were analysed on board for dissolved oxygen, the nutrient salts phosphate, silicate, ammonia, nitrite and nitrate, for urea and dissolved organic phosphorus, for chlorophyll (fluorometrically) and particulate phosphorus. Samples for dissolved organic carbon and nitrogen, particulate organic carbon and nitrogen, seston, carbonate, opal as well as samples for microscopical evaluation of species composition were stored for later analyses on shore.

Samples for total primary production and new production were taken from 8 depths and were incubated in situ in 250ml and 4l polycarbonate bottles respectively. The bottle rack was tied to the drift rigg from 08.00 to 18.00hours. In situ light measurements at different times of the day showed that this time corresponded to the photo period of phytoplankton. On several days exudation of ^{14}C-labelled DOC was measured along with total production. New production was also measured via nitrate decrease in incubations using the NOX-box method for nitrate estimates.

Besides the discrete sampling a variety of vertical net hauls were done. Samples from an Apstein-net with 20µm gauze were briefly analysed on board to get a first impression of the species composition among the larger phytoplankton. These samples were also used for DAPI-staining and observations of autoflourescence.

Samples for microzooplankton were taken from discrete depths; feeding experiments with fluorescent beeds, ammonia regeneration and dilution experiments were conducted.

Vertical tows with an opening-closing net were carried out over a variety of depth intervals. For radiolarians, acantharians and foraminifera a 100µ gauze and for metazooplankton a 200µ gauze was used. A large ring-net with 500µm gauze served for sampling large numbers of animals for experimental purposes, e.g. the collection of great amounts of fresh faecal pellets. Zooplankton samples were splitted in subsamples for species identification and biomass measurements. Animals were also sorted out for measurements of gut fluorescence.

Two plastic containers were filled with $1m^3$ of seawater from 5m and 40m water depth, i.e. from nutrient depleted and nutrient rich layers, to observe the growth of the natural phytoplankton population under constant light conditions corresponding to the 40% light level.

Sediment trap samples from the drifter and the short-term mooring were splitted on board. Chlorophyll and phaeopigments were measured fluorometrically immediately thereafter. Aliqouts on filters and liquid subsamples were stored.

In situ pumps were used to sample for dissolved and particle adsorbed ^{234}Th. Pumping time was between 2 and 3 hours, the volume of water filtered varied between 100 and 1000l depending on water depth. During the investigation period samples were pumped from 25 discrete depths.

During the night CTD-profiles were taken in the vincinity of the drift-track in order to get better informations on the hydrographic situation on a mesoscale basis. Altogether 95 profiles down to at least 300m waterdepth were obtained (fig.9 and 10).

Besides this programme a variety of experiments were started on board, which will be continued in the laboratory ashore. Among these were: decay of pigments and dissolution of opal in phytodetritus and faecal pellets; the change of composition in stable isotopes (^{13}C and ^{15}N) over time in detritus; cultures of the natural diatom population in F2-medium; decay over time in the sediment trap collections from the short-term mooring. The latter experiments serve to simulate long-term deployment and to observe processes and alterations of the sample over different time intervals.

At the end of the drift experiment a new mooring (OG4) with 3 sediment traps was deployed at 72 24,3'N;07 36,6'W. This mooring will be recovered in August 1991. After finishing work in the Jan Mayen current on 2.September we sailed to a position at 70 N;00 W in the Norwegian Basin to recover and redeploy another mooring with 3 sediment traps. Unfortunately the mooring could not be recovered, most likely due to malfunctioning of the releasing systems. We will dredge for the mooring in February 1991. After this we sailed home, and POSEIDON docked at the pier of the Institut für Meereskunde, Kiel in the afternoon of September 9th.

4. Prelimenary Results

Although many important parameters from this investigation have not been measured as yet, the information obtained on board reveal an interesting scenario of a late phase of the growth season in the southern Greenland Sea. The hydrograhical data presented below need corrections via the salinometer measurements and reverse thermometer readings; however, in this state they serve well to demonstrate the mesoscale variability of hydrographical features in the surface layer of the investigation area. Primary production, chlorophyll-biomass, particulate organic carbon and nitrogen are final data as are those for nutrients and oxygen. A boon of information came from the microscopical work on board ship; however, this cursory look at the various materials sampled will have to be confirmed by detailed analysis at a later time.

The relationship between pelagic processes and vertical particle flux to greater water depths (>1000m) may be falsified by the fact that particles collected in the deeper traps may have left the surface layer prior to the begin of our investigation, depending on their sinking velocity. The first sampling intervals of the traps in the new annual mooring are set at weekly intervals. After its recovery next year data will be obtained, which will complement this year's study.

4.1 Hydrography

(Sigrid Podewski; Bodo v.Bodungen)

On the way from Iceland into investigation area north of Jan Mayen relative warm water (about 5 C) with low salinity (around $32*10^{-3}$) was recorded at the sea surface by the thermo-salinograph. The T/S-relations for the vertical profile taken at the mooring position OG3 (fig.4) indicates a shallow layer at the surface influenced by melt-water and seasonal warming, which overlies the Polar Water (PW), the Atlantic Intermediate Water (AIW) and the Greenland Sea Deep Water (GSDW).

Within the survey grid about 30 nautical miles north of the OG3 position (fig.2) salinity and temperature in surface waters varied between 32.3 and 32.5 $*10^{-3}$ and +5.5 and +6.2 C respectively. Small scale differences were most pronounced in the vertical structure of the upper 50m of the water column (fig.5, 6 and 7). The most obvious feature was the temperature minimum between 10 and 20m water depth at some stations (fig.5). Near stn. 872 the drifter was launched and the short-term mooring was deployed.

In fig.8 the T/S-relations of all CTD-profiles taken in the vincinity of the trajectory of the drifter are depicted. Lowest salinities (about $30*10^{-3}$) and temperatures ($\leq$+3.5 C) in the upper few meters were observed in the northwestern corner of the investigation area. The measured range in surface salinities and temperatures indicates that melt water of different age was encountered in that region. The pack-ice during the investigation period was approximately 150 nautical miles to the west, according to the available satellite information. This information also showed that the investigation area was ice-free as early as May/June in 1990. The still visible strong influence of the melting process, as evident particularly from the low salinities, may be the result of little vertical mixing after the recedence of the pack-ice and/or lateral advection from the pack-ice border with the eastward flowing Jan Mayen current.

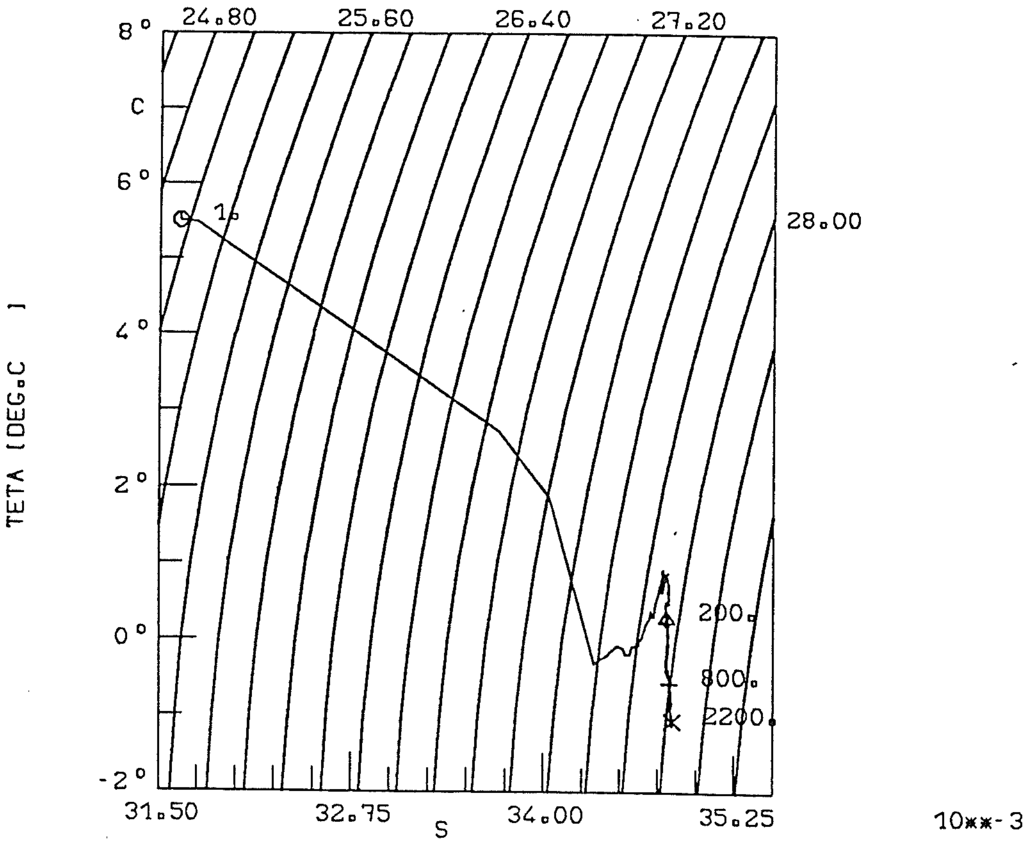
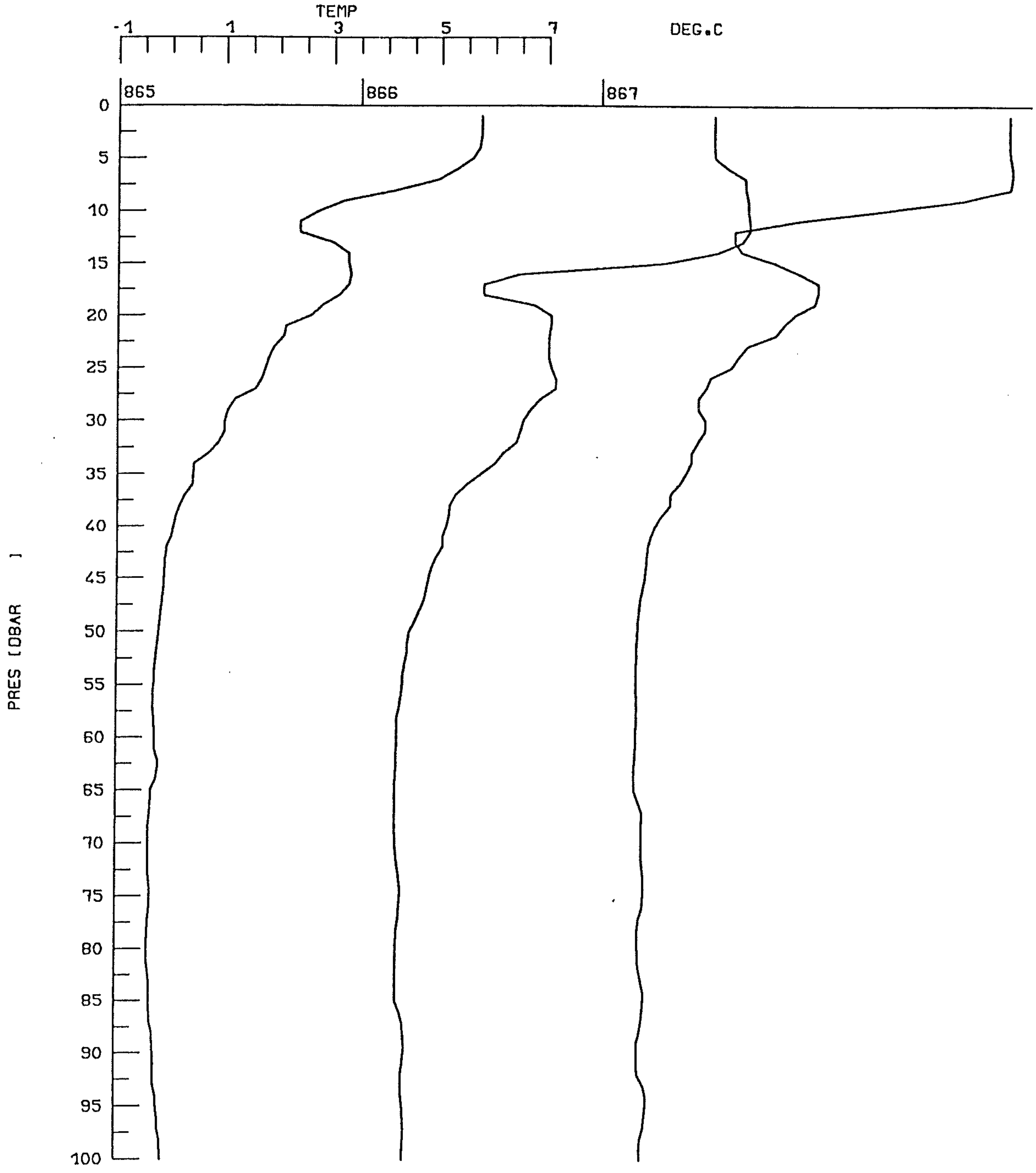


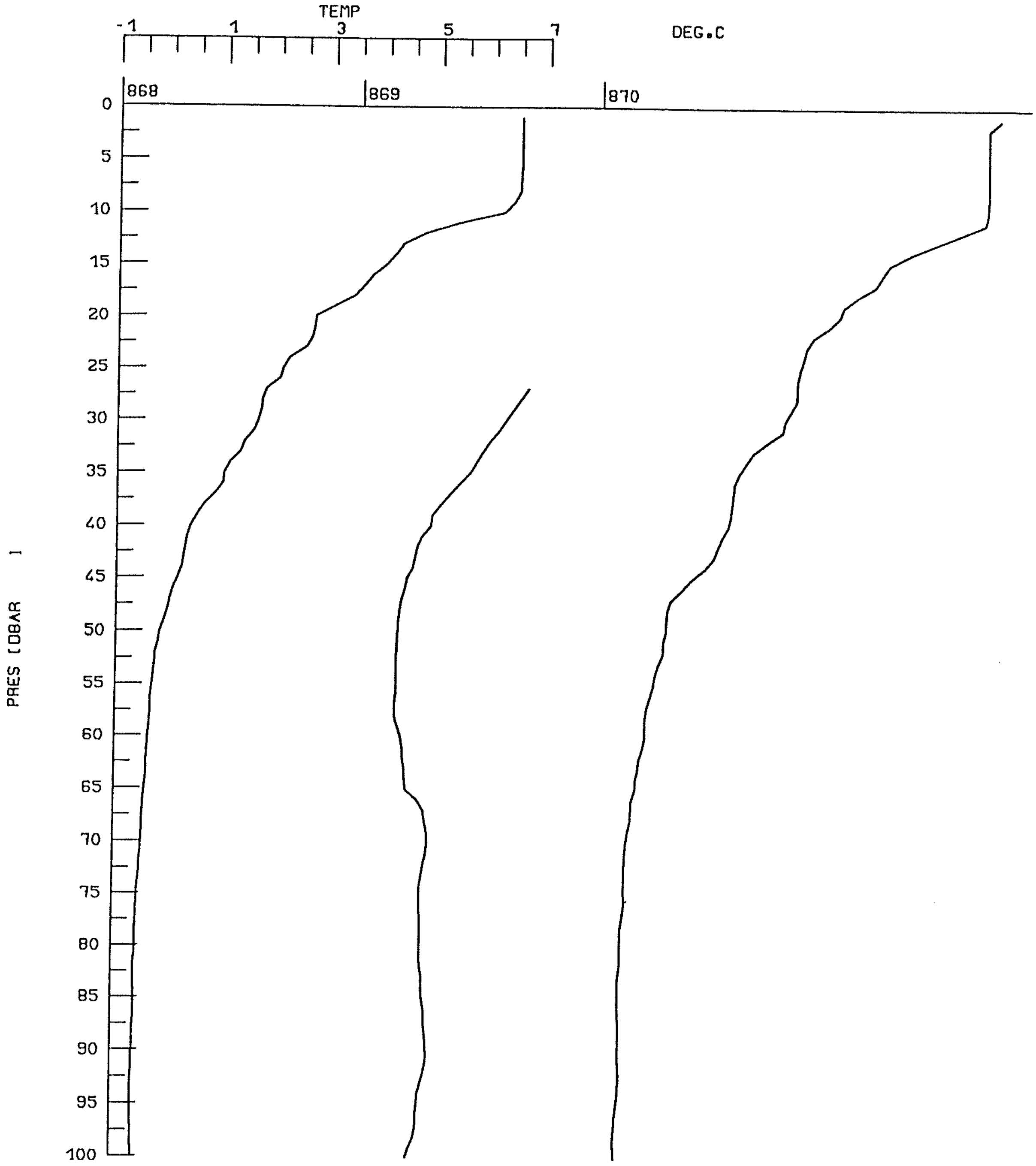
Fig.4: T/S-diagram from station 860 at the position of the OG3 mooring in the Jan Mayen Current.

Fig.5 (next 3 pages): Vertical distribution of temperature in the upper 100m of the water column at stations 865 - 874. Compare Fig.2 for position of stations.



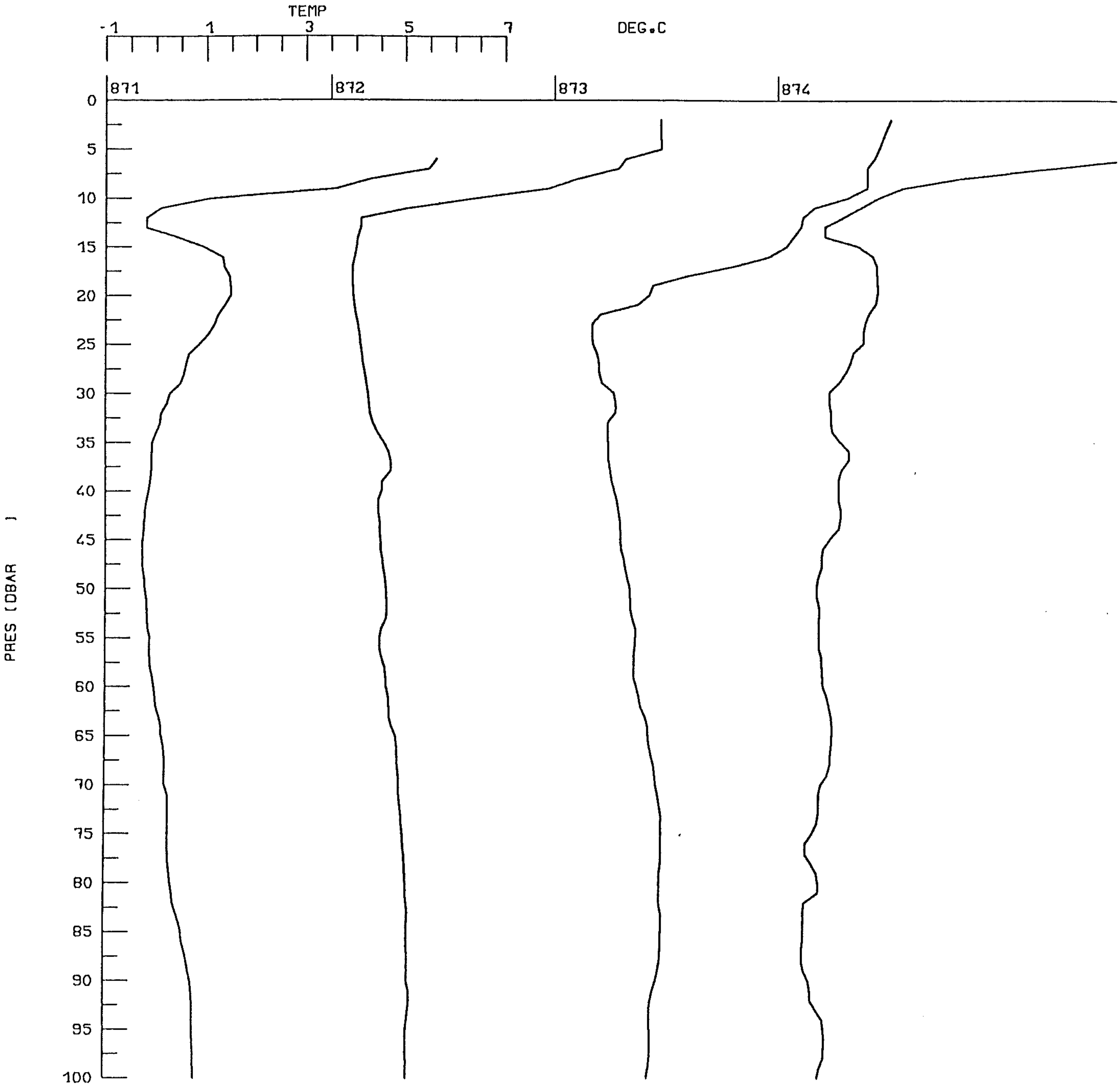
POSEIDON 173/2: CTD-RAWDATA PROFILES 5-7

(Fig. 5a)



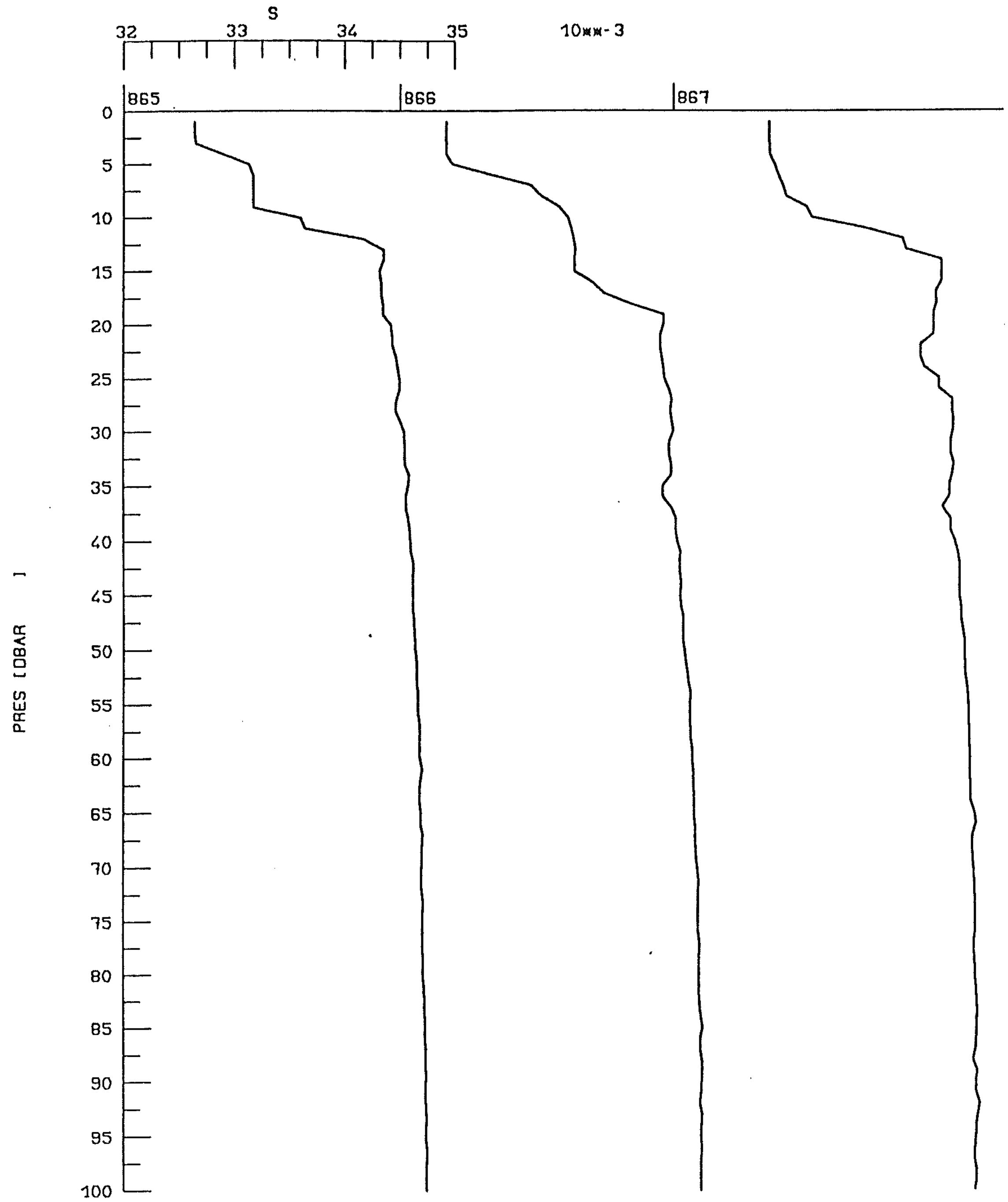
POSEIDON 173/2: CTD-RAWDATA PROFILES 8-10

(Fig. 5b)



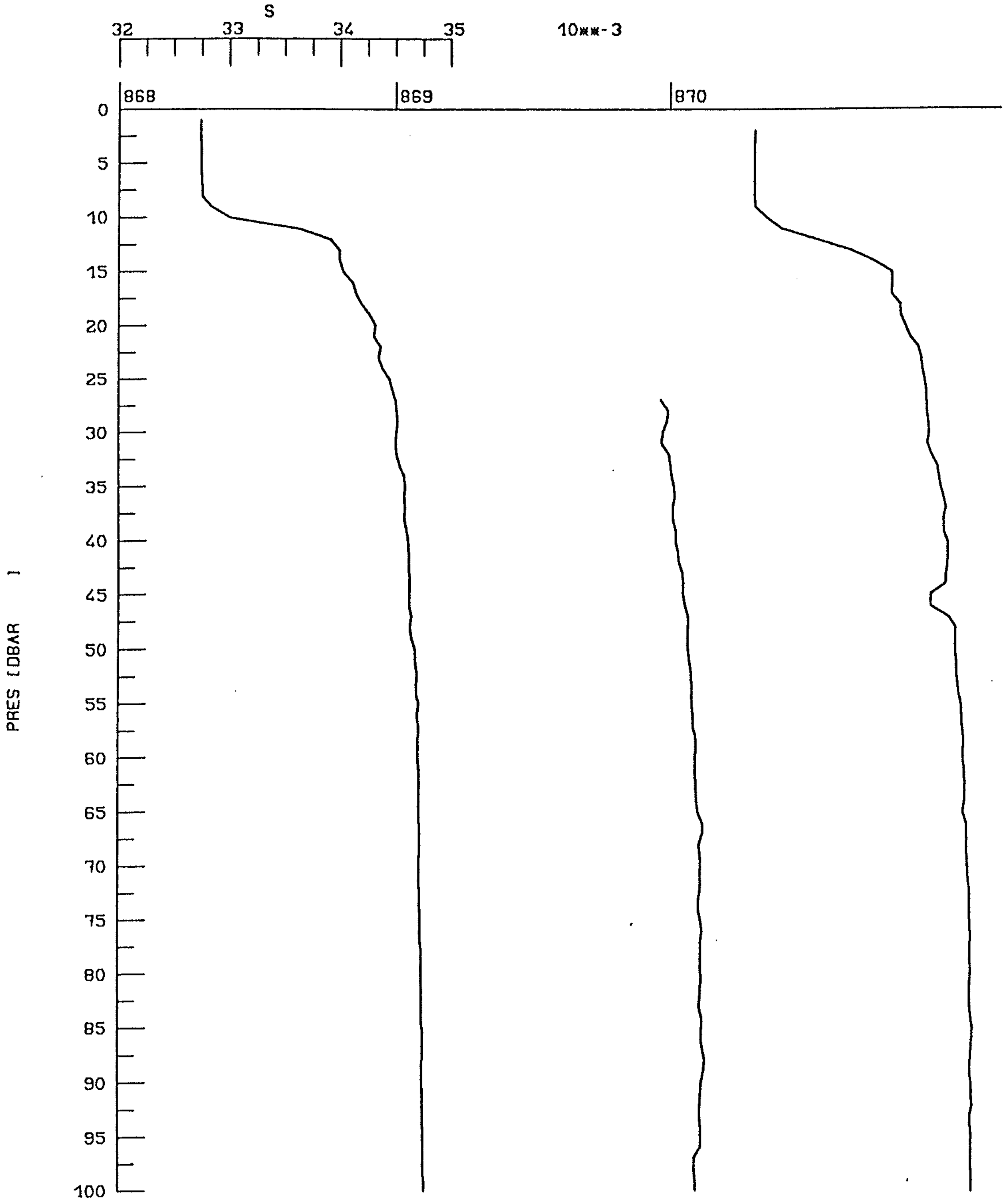
POSEIDON 173/2: CTD-RAWDATA PROFILES 11-14

(Fig. 5c)



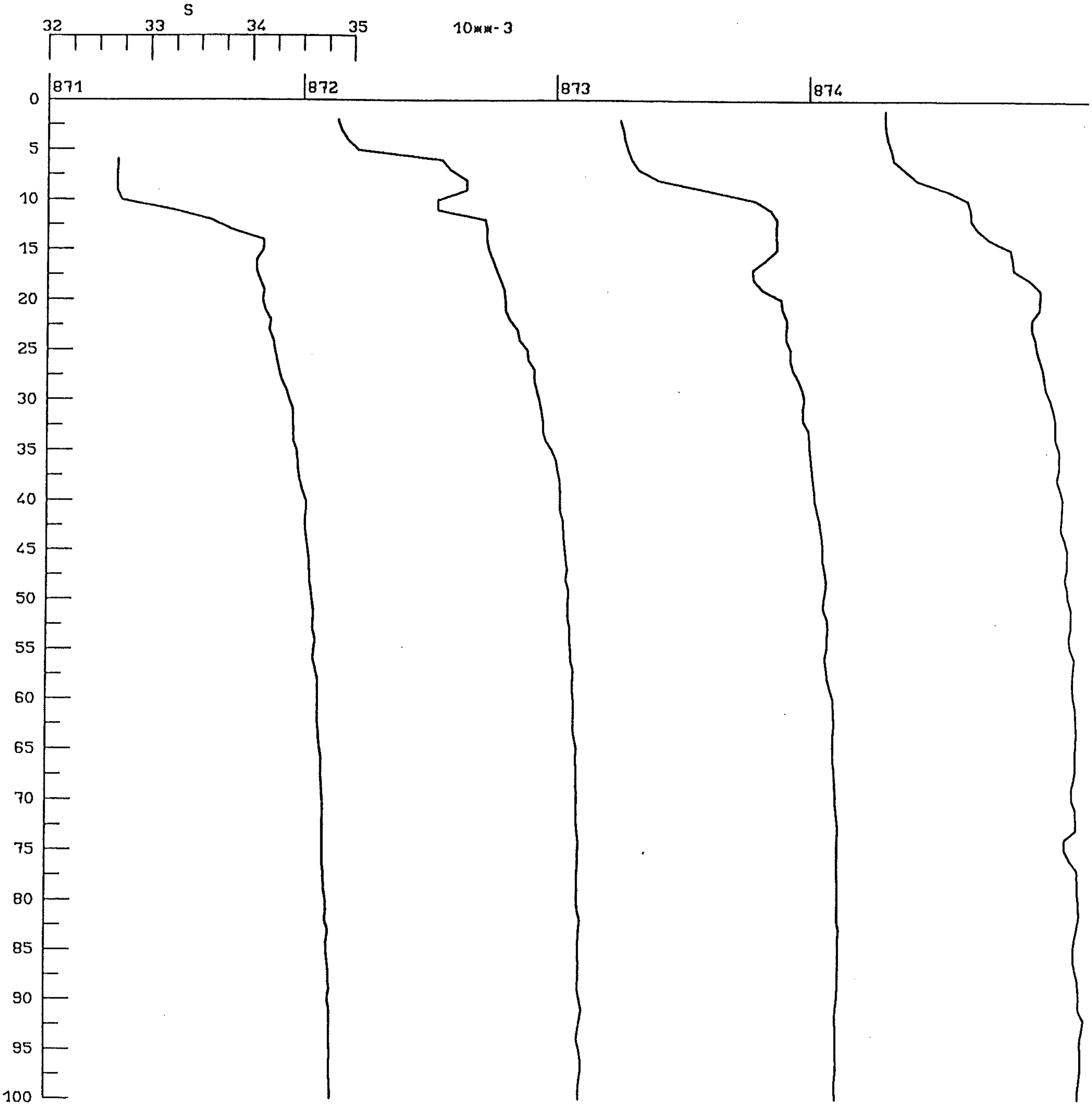
POSEIDON 173/2: CTD-RAWDATA PROFILES 5-7

Fig.6 (this page and next 2 pages): Vertical distribution of salinity in the upper 100m of the water column at stations 865 - 874. Compare Fig.2 for position of stations.



POSEIDON 173/2: CTD-RAWDATA PROFILES 8-10

(Fig. 6b)



POSEIDON 173/2: CTD-RAWDATA PROFILES 11-14

(Fig. 6c)

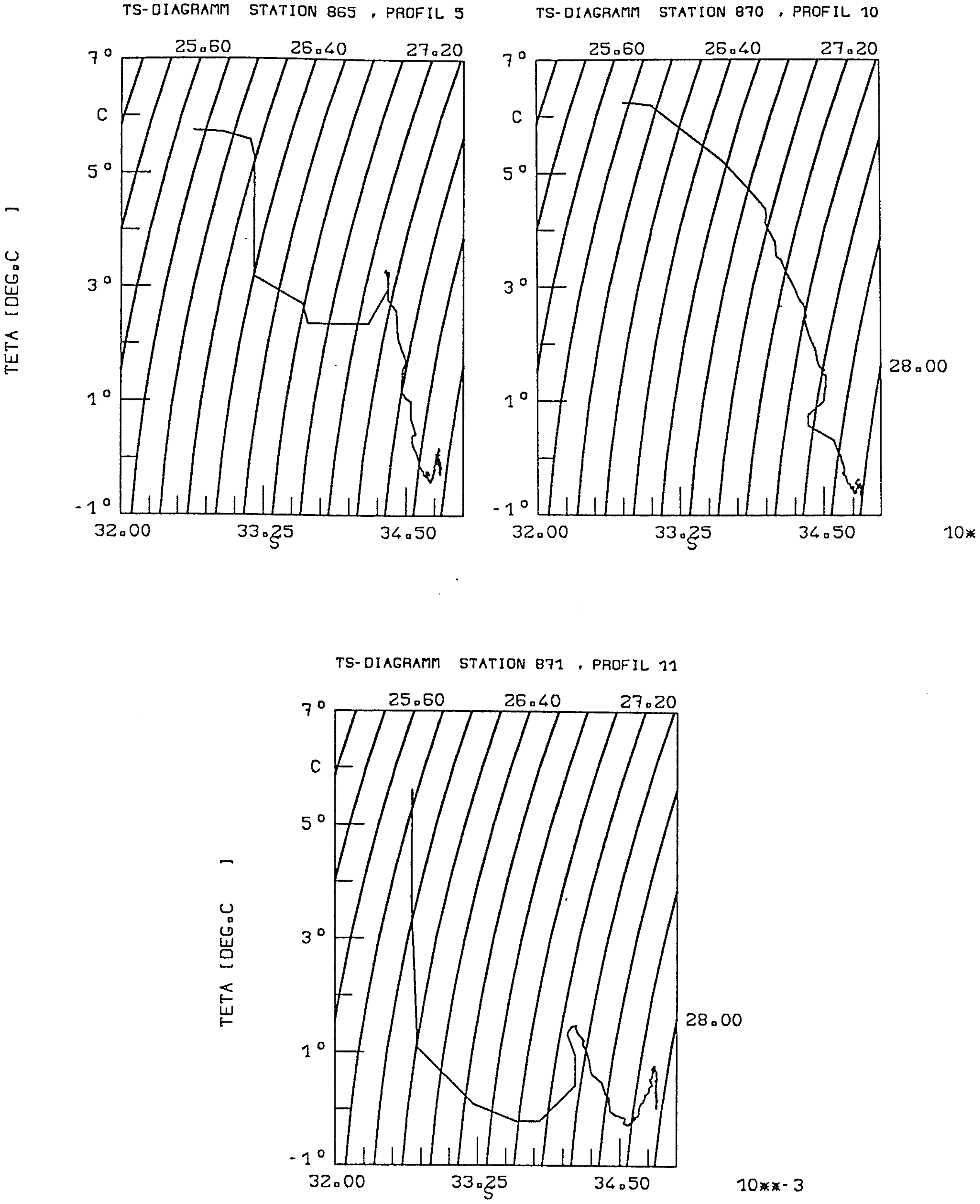


Fig.7: T/S-diagram of stations 865, 870 and 871. Compare Fig.2 for position of stations.

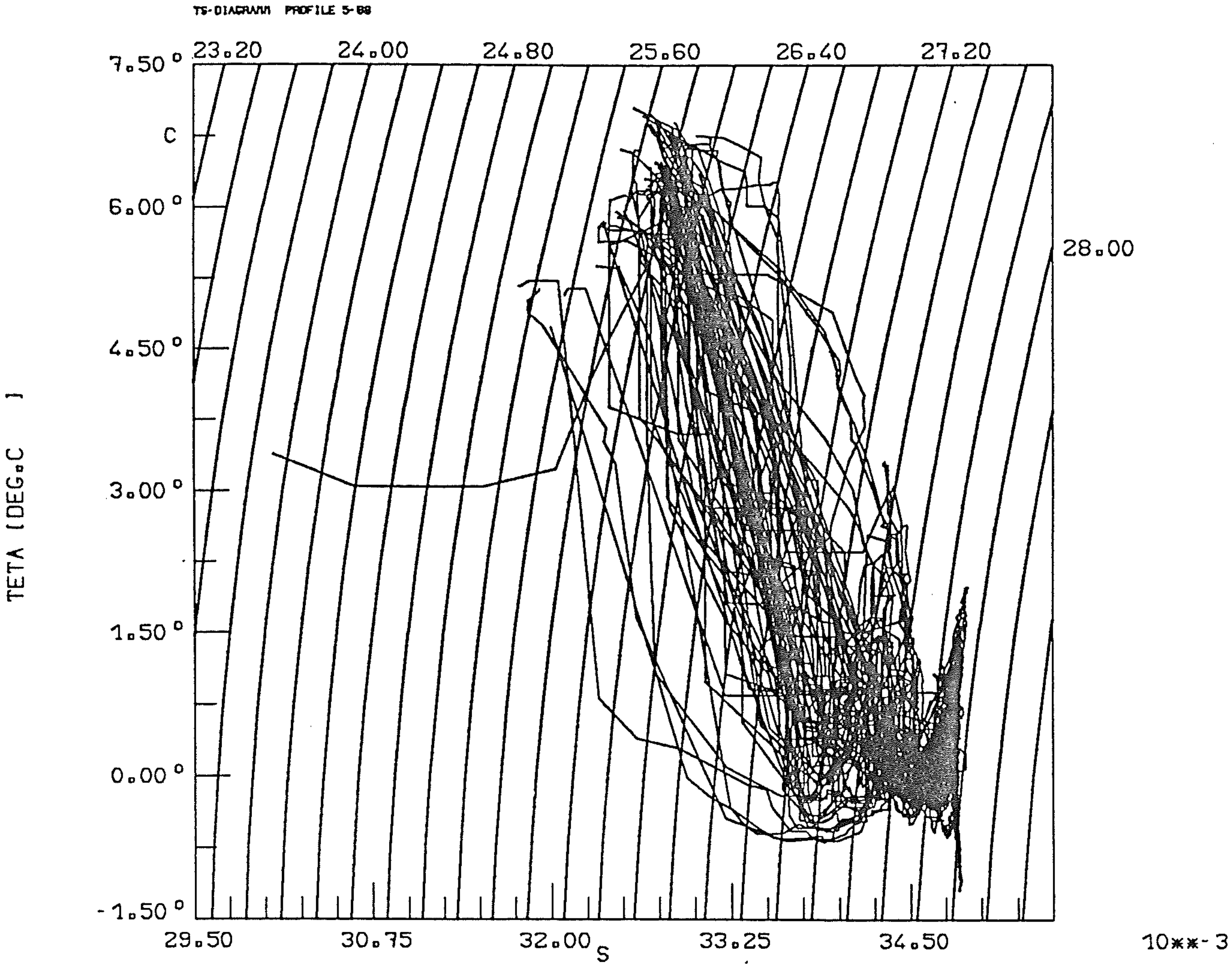


Fig.8: T/S-diagram of all stations within the investigation area. Compare Fig.9, 10 and CTD-stations in Appendix 2 for position of stations.

In fig.9 and 10 the isolines of density, calculated from the uncalibrated data, are plotted for the 5 and 50 dbar level. An anticyclonic eddy like structure emerges directly below the thermocline. The density isolines along a cross section through the eddy (fig.11) from west to east also indicate the existence of this anticyclonic structure.

The drifter did not precisely follow these structures during the 12 days of deployment. From a first cursory comparison of the more or less southbound drifter, with the meteorological data recorded on the ship, it appears that the drifter was not driven by winds, which blew mainly from the south west.

There is no clear evidence from the hydrographical data as yet, whether current shear occurred between surface floats and the 100m trap or between the 100 and 300m trap of the drifter, which may have influenced the observed drift of the entire rigg. The evaluation of the ADCP-recordings (Acoustic-Doppler-Sonar-Profiler), which was installed in the well of the ship, will help to further elucidate the hydrographical structure of the water column. The distribution of melt water and frontal areas in the upper 5m of the water column will be better resolved after complete analysis of the continuous recordings of the thermo-salinograph is considered. Finally, the behaviour of the drifter in the physical ambiente encountered will be better described after evaluation of the recordings of two current meters, which were deployed below the 100m and the 300m trap of the drifter.

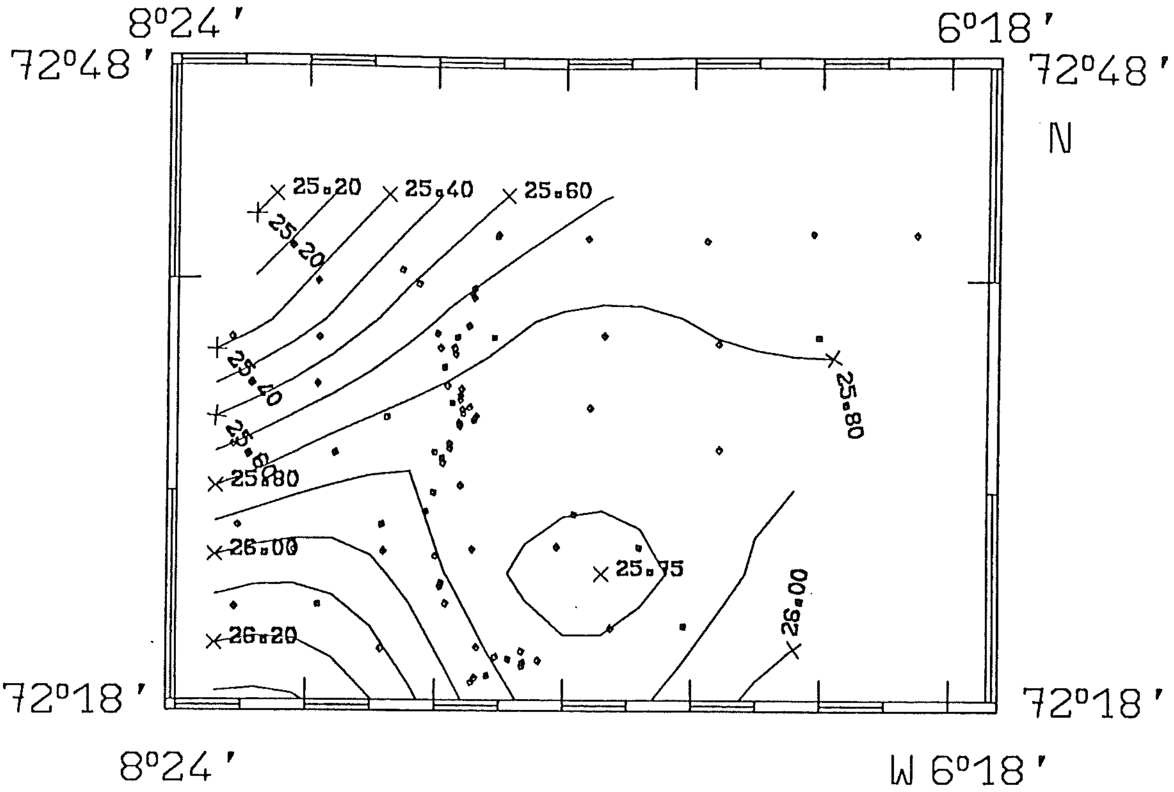


Fig.9: Isolines of density in the 5 dbar level for the investigation area.

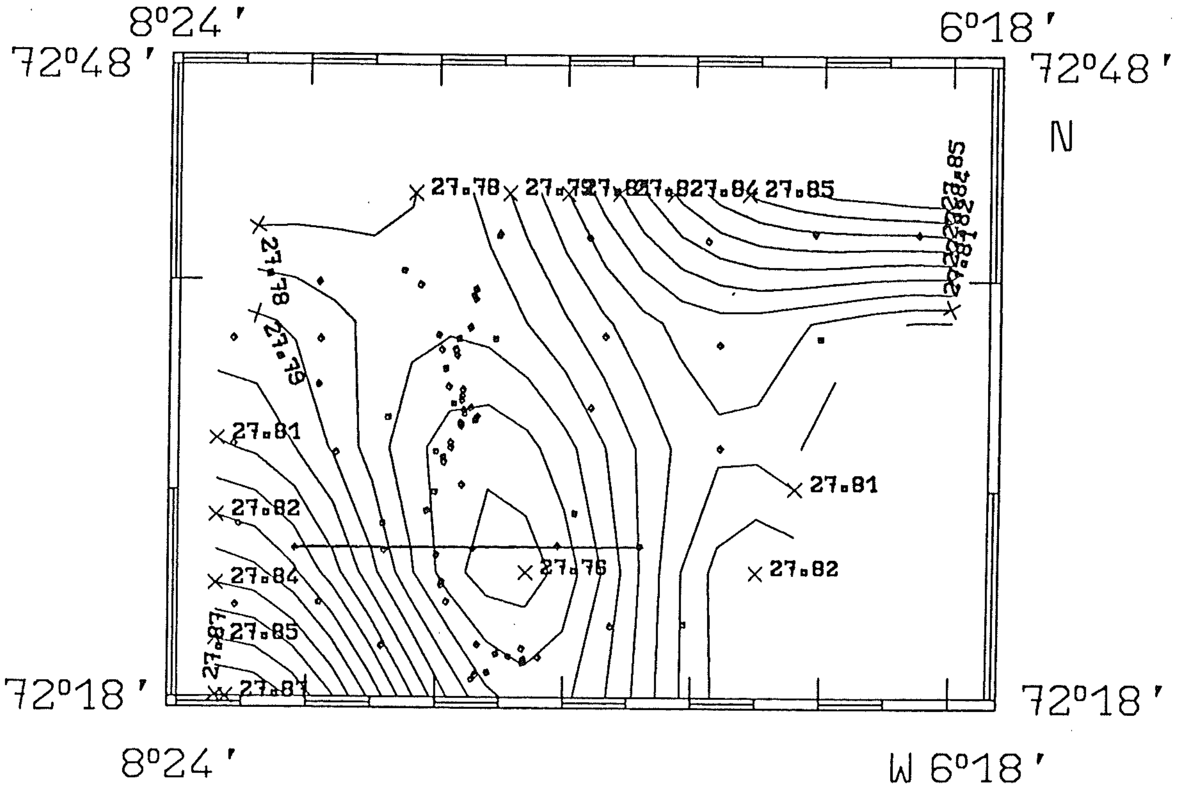


Fig.10: Isolines of density in the 50 dbar level for the investgation area. The horizontal bar indicates to the transect depicted in Fig.11.

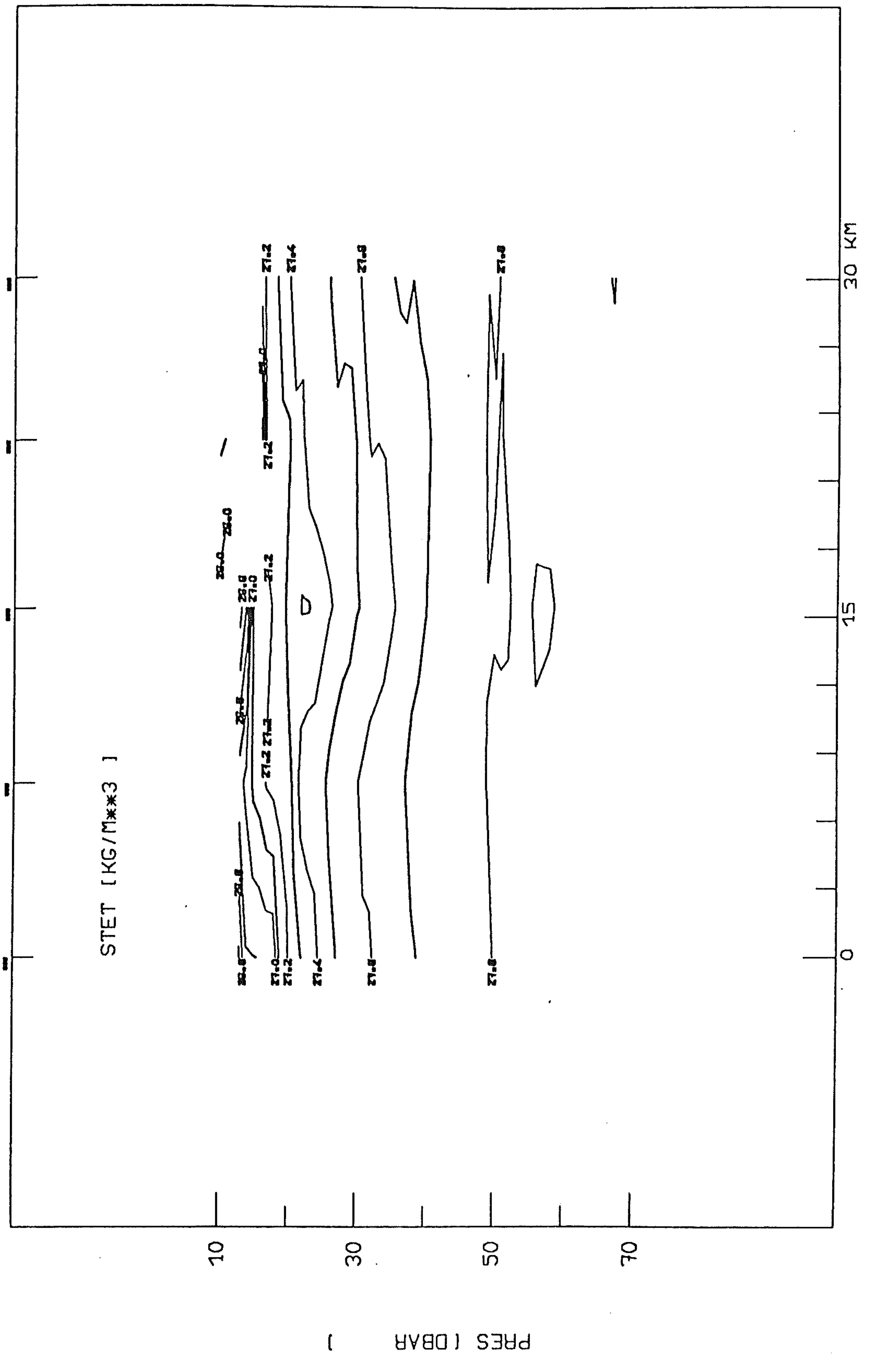


Fig.11: Isolines of density along a transect through the eddy like structure in the investigation area (left to right corresponds to west to east). For location of the transect compare Fig.10.

4.2 Oxygen and nutrient distribution

(Eunice Machado, Christoph Humborg, Wolfgang Koeve, Maren Voß, Marita Wunsch)

Within the investigation area, there was apparently some variability in the balance between primary production and respiration, as evidenced by the oxygen measurements. The content in the upper few meters of the water column ranged between 6.99 and 7.41 ml l^{-1}, corresponding to a saturation of 98.4 to 103.7%. Depending on the vertical gradients in temperature and salinity, highest contents for oxygen between 7.83 and 8.93 ml l^{-1} were found in the 10m to 30m depths range, where oxygen saturation reached 110.2 to 122.4%. The maximum oxygen saturations were restricted to the depths range between 10 and 15m, corresponding to the upper part of the nitracline. In the lower part of the euphotic zone, which extended to depths between 57 and 65 meters, variability was most pronounced (7.21 to 8.11 ml l^{-1}) with saturations between 101.2 and 91.9% (fig. 12).

The oxygen content of 7.64 to 7.30 ml l^{-1} in the AIW (below the PW about 150m) decreased gradually with depth, reaching values around 7.06 ml l^{-1} in the near bottom GSDW (95.6 to 84.7% saturation.

Nitrate was almost exhausted in the upper 10m of the water column; concentrations were below 0.05 µM (fig. 13). Below the nutricline (between 8 and 14m) concentrations within the euphotic zone increased to well above 6 µM and >9µM in 100m. Concentrations in the deeper water rose to the typical values between 11.8 and 12.3 µM.

Phosphate and silicate showed the same vertical distribution with the former less than 0.1 µM and the latter less than 0.2 µM above the nutricline (fig. 14). In the lower part of the euphotic zone concentrations were between 0.5-0.8 µM and 3.0-5.1 µM for phosphate and silicate respectively. Concentrations in the AIW and GSDW rose from 0.8 to >1.1 µM for phosophorus and from 6.5 to 12.2 µM for silicate.

In the upper few meters of the euphotic zone ammonium varied between 0.1 and 0.2 µM. At all stations there was a distinct increase in the lower part of the euphotic zone to concentrations between 0.8 and 1.1 µM (fig. 15). These maximum values occurred at depths between 25 and 45m. Obviously nitrogen regeneration in this depth range exceeded the nitrogen demand of primary production (see also 4.3). Below the euphotic zone ammonium concentrations decreased towards 100m water depth to levels in the range of that at the sea surface.

Between the bottom of the euphotic zone and 100m, a maximum in nitrite was observed. Whereas values within the euphotic zone and below 100m were between 0.01 and 0.08 µM, concentrations between 60m and 100m were elevated at >0.20 and <0.45 µM, corresponding well to the decline in oxygen saturation and ammonia in this depth range. fig. 16 shows the distribution of these properties with a higher vertical resolution than normally sampled during the morning stations.

Between the surface and 500m water depth no distinct gradient in urea was observed. Concentrations were variable but very low (0.1 to 0.5 µM). In the water below 500m urea was at detection limits.

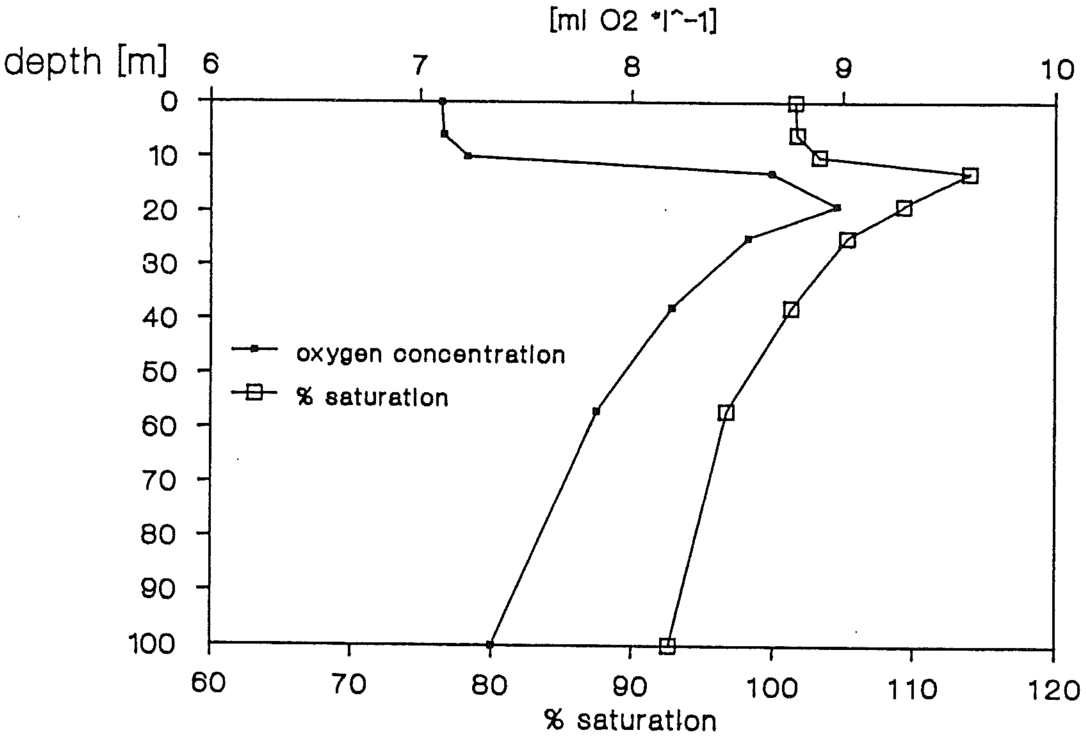


Fig.12: Typical profiles for oxygen content and saturation in the upper 100m of the water column (station 891, 8/28/1990).

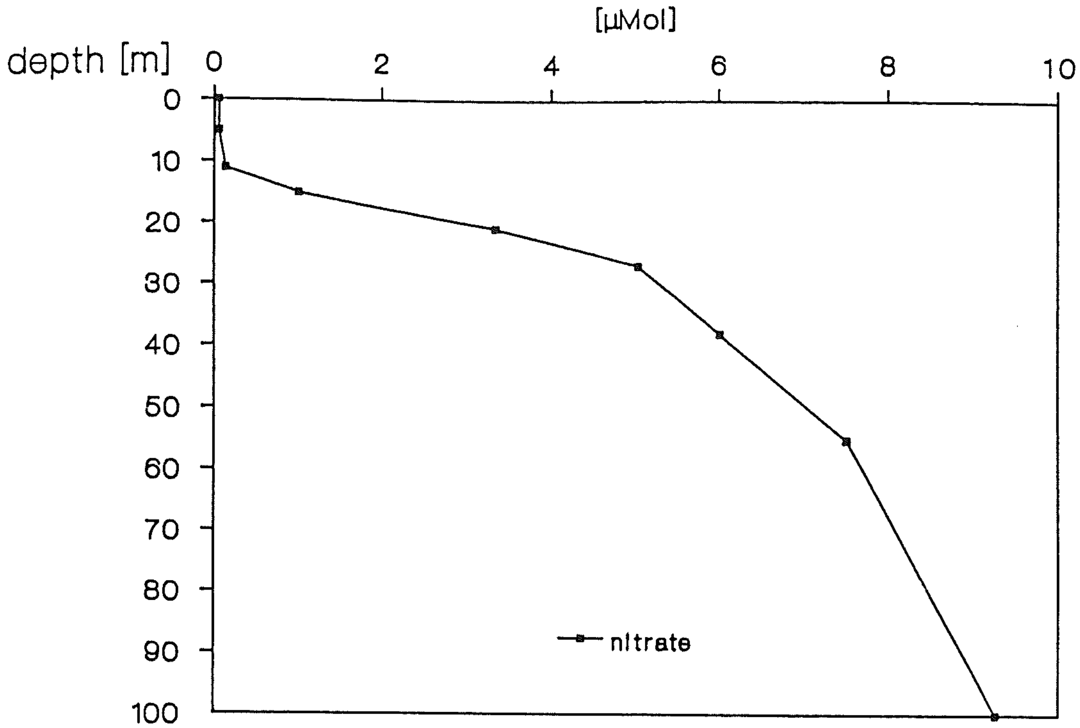


Fig.13: Typical profile for nitrate in the upper 100m of the water column (station 891, 8/28/1990).

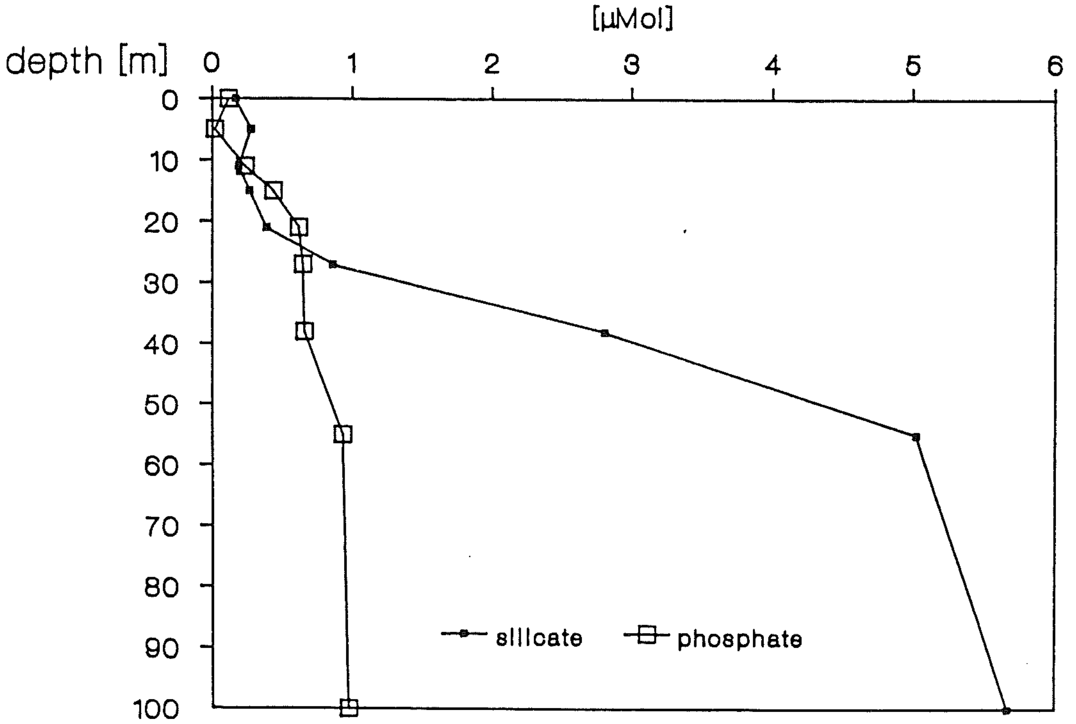


Fig.14: Typical profiles for phosphate and silicate in the upper 100m of the water column (station 891, 8/28/1990).

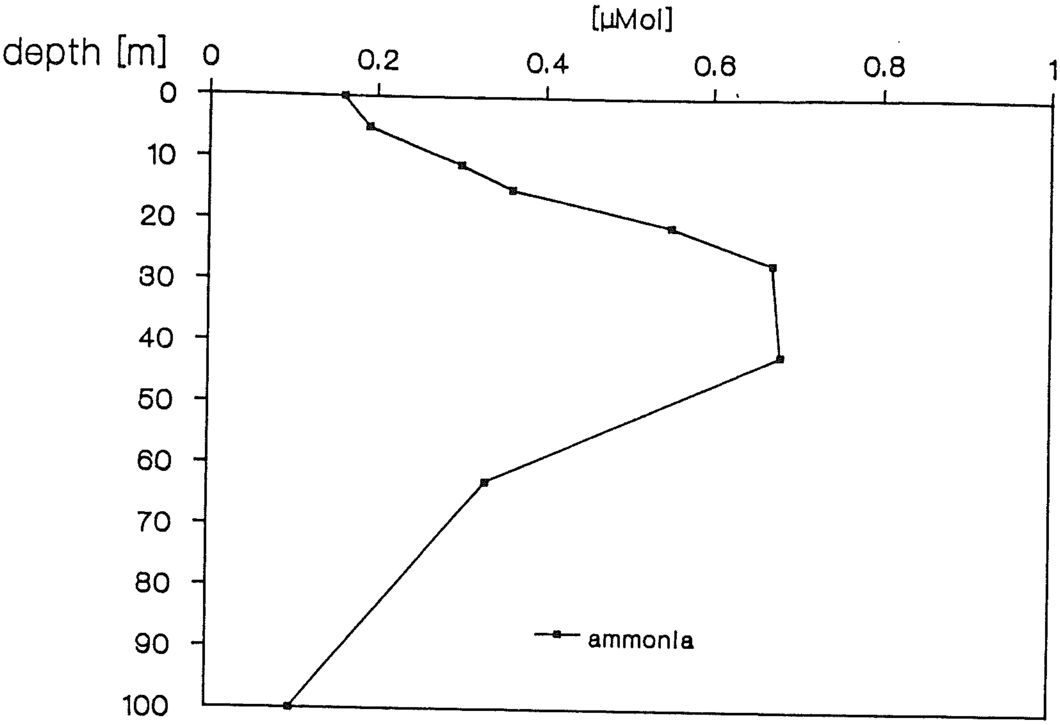


Fig.15: Typical profile of ammonium in the upper 100m of the water column (station 895, 8/30/1990)

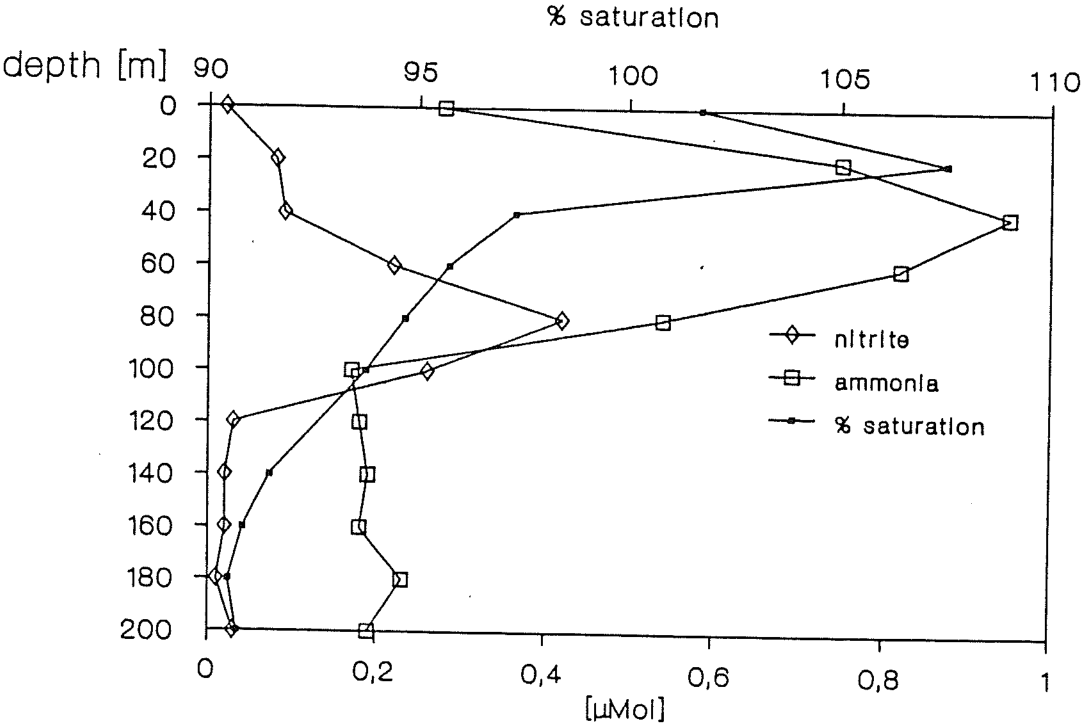


Fig.16: Vertical profiles for nitite, ammonia and oxygen in the upper 200m of the water column at station 891.1 (8/28/1990)

4.3 Phytoplankton species composition, biomass and primary production

(Avan Antia, Eduard Bauerfeind, Bodo v.Bodungen,
Moshira Hassan, Christoph Humborg, Wolfgang Koeve,
Marita Wunsch)

Species composition

Information about species composition of the phytoplankton given in this chapter was mainly derived from onboard microscopy of tows with a 20µm-Apstein net through the euphotic zone. Thus, the following description is neither quantitative nor complete for the species spectrum. However, fractionated filtration for chlorophyll revealed that a substantial portion of the phytoplankton was larger than 20µm (tab.1).

Table 1: Contribution of different size classes of phytoplankton as percentage of total, estimated from size fractionated measurements of chlorophyll.

Size class	Percentage of total
<20µ	65%
<10µ	60%
< 5µ	55%
< 2µ	10%

Diatoms seemed to be most numerous in the >20µm size fraction. In terms of species it appeared that no single species dominated the phytoplankton. Among the diatoms species of the genus *Rhizosolenia* and the genus *Chaetoceros* were seen regularly in large amounts in the net hauls. Besides the vegetative cells of *Rh.alata, Rh.hebetata* and in lesser numbers *Rh.setigera* and *Rh.styliformis,* numerous frustules without visible plasma content were observed. *Rh.alata* exhibited different stages of auxospore formation as well as young cells in division. Some cells of *Rh. hebetata,* which is known for its dimorphism, showed a transition from the form *hiemalis* to the form *semispina,* a phenomenon already observed by Gran at the beginning of this century. Within the genus *Chaetoceros* chain-forming cells of *Ch.convolutus* and *Ch.concavicorne,* which are barely differentiable, were numerous. Other species of this genus were *Ch.decipiens, Ch.atlanticum* and some smaller as yet unidentified forms.

Besides these species *Asteromphalus heptacis, Eucampia zoodiacus, Thallassiosira decipiens* and *spp., Thallassiothrix sp., Coscinodiscus sp.* and species of the genus *Nitschzia* and *Fragillaria* were also present among the diatoms.

The main species among the autotrophic dinoflagellates were *Ceratium arcticum* and the less numerous *C. macroceros* and *C.lineatum. Peridinium spp.* were seen in all samples though not very numerous.

In all net hauls there were a few cells of *Dictyocha speculum* and numerous specimens of *Coccolithus pelagicus*. In order to better enumerate the abundance of these smaller species onboard, 50 ml of a discrete sample was allowed to settle in a chamber and was counted under an inverted microscope. About 10,000 cells l^{-1} of *Coccolithus pelagicus* were enumerated. Naked flagellates in the size range 5 to 12µm were very abundant, which were mostly autotrophs as seen by their strong autofluorescence. Some of these flagellates were autotrophic dinoflagellates.

There is no information as yet about a vertical differentiation of species composition. Although the phytoplankton looked "healthy", besides the empty frustules of some diatoms, and auxospore formation seemed to indicate an active growing population of diatoms, this was not corroborated by the net growth performance of the population (see below).

Biomass

From the position of the annual mooring OG3 towards the eastern part of the survey grid (depicted in fig. 2) the distribution of chlorophyll (chla) showed its maximum at the surface with values between 0.5 to 0.9 mg m^{-3}. A pronounced subsurface maximum was found in the north western part of the grid (fig. 17).

In fig. 18 the chla depths distribution from the morning stations along the trajectory of the drifter are depicted. At the beginning of the drift study, which was started near stn. 872 (fig. 2), the subsurface maximum was still existing with a maximum chla-content of >1.5 mg m^{-3} at about 20m water depth (fig. 18, stn.880). This vertical pattern weakened with time and chla in the euphotic zone decreased to values around 0.5 mg m^{-3}. Integrated values down to the depth of the euphotic zone were 57 mg chla m^{-2} at the first station and after that variable between 30 and 40 mg m^{-2}. There was also a considerable amount of phaeopigments measured in the water column (fig. 19). The change in chla-content and vertical distribution was not acompanied by a change in phytoplankton species as evidenced from the onboard microscopical analysis.

In the depths of the pigment maximum corresponding values of 120 to 320 mg m^{-3} and 28 to 52 mg m^{-3} were found for particulate organic carbon (POC) and nitrogen (PON) respectively. The minimum values within the euphotic zone varied between 48 and 76 mg m^{-3} for POC and <10 and 16 mg m^{-3} for PON. The C:N-ratios ranged between 6.2 and 7.3 (by atoms) indicating that detritus presented the smaller fraction of the organic substance. The POC and PON contents of the euphotic zone are given in Table 2.

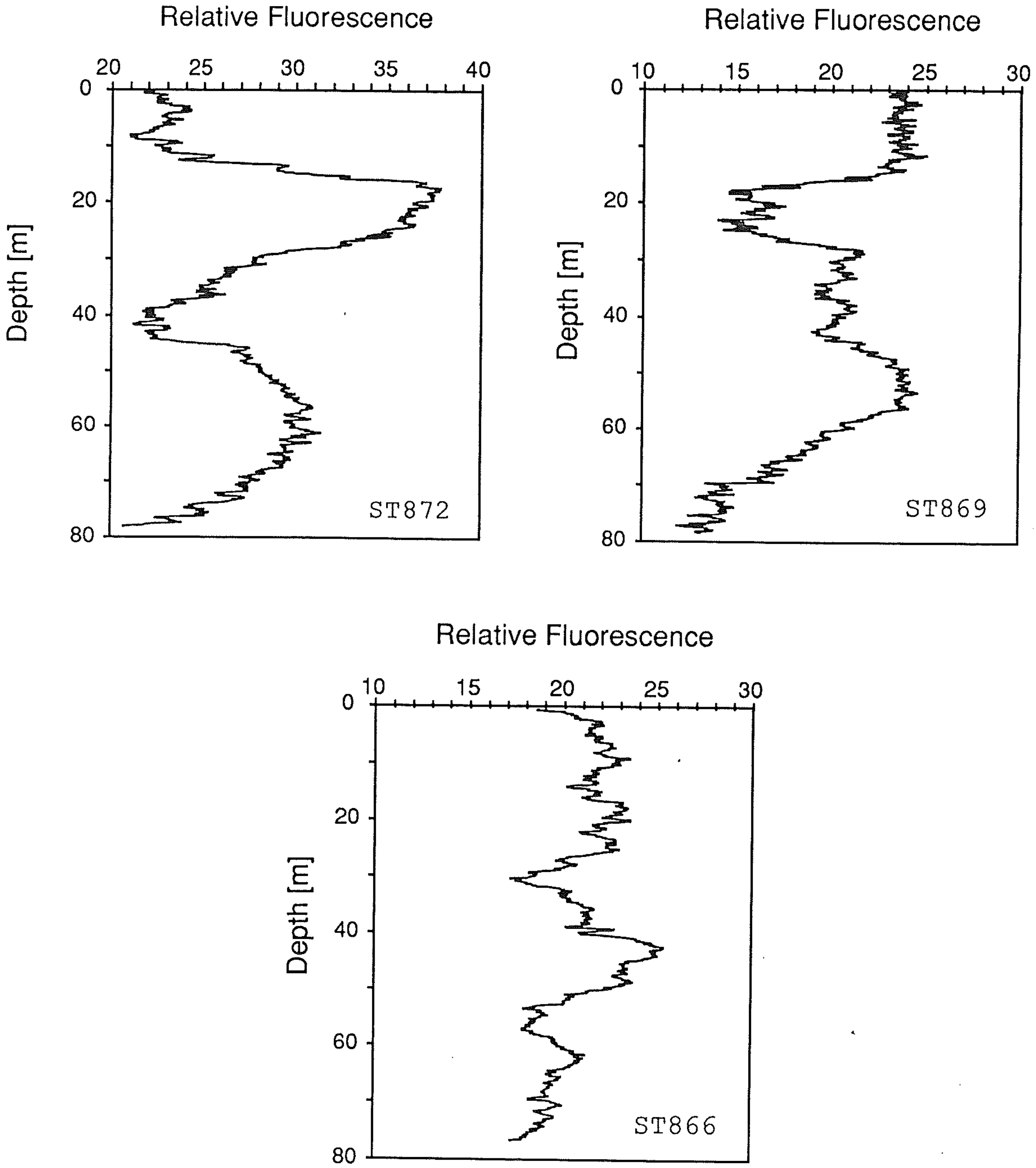


Fig.17: Selected in vivo fluorescence profiles from the survey grid. Compare fig. 2 for position of stations.

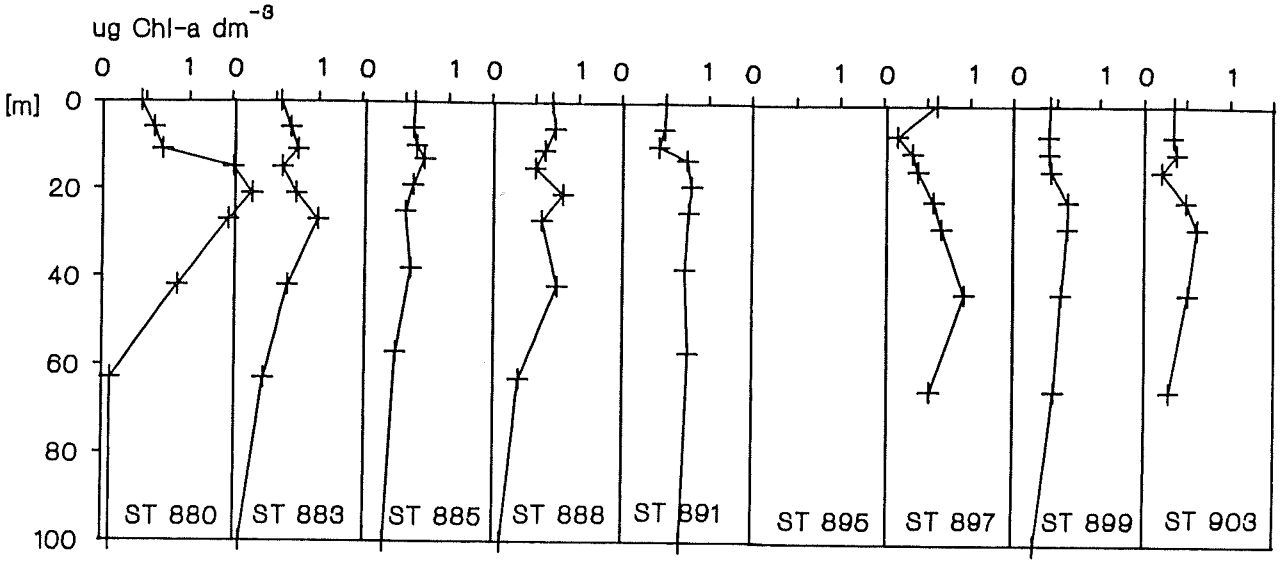


Fig.18: Depth distribution of chlorophyll (chl$\underline{a}$) at the morning stations sampled along the trajectory of the drifter. Compare fig. 3 for position of stations.

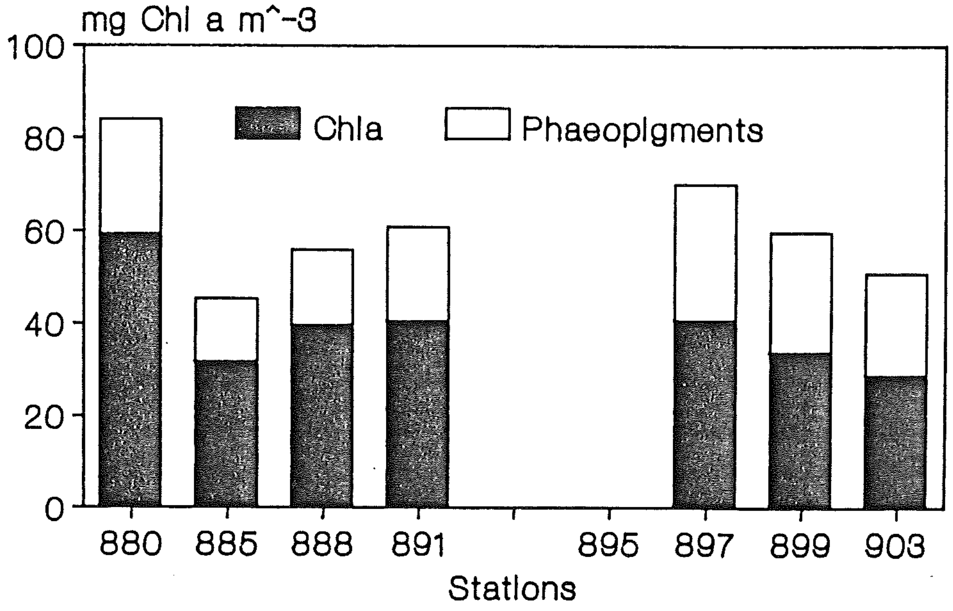


Fig.19: Chl$\underline{a}$ and phaeopigments content of the euphotic zone for the stations during the drift study. Compare fig. 3 for positions of stations.

Table 2: POC and PON content and total primary production (PP) integrated to the depth of the euphotic zone (upper numbers) and to 100m water depth (lower numbers) . Compare fig.3 for position of the stations.

Station	Date	POC g m^{-2}	PON g m^{-2}	PP mg C $m^{-2}d^{-1}$
880	24.08.	9.4 13.3	1.6 2.1	210.3
883	25.08.	11.1 15.8	1.7 2.2	97.3
885	26.08.	9.4 14.4	1.5 2.0	161.3
888	27.08.	8.2 10.8	1.6 1.9	175.4
891	28.08.	8.6 10.6	1.4 1.8	141.9
895	30.08.	8.3 11.8	1.3 1.8	98.9
897	31.08.	--	-	134.5
899	01.09.	9.0 12.1	1.5 2.1	155.3
903	02.09.	--	-	99.1

Primary production

Primary production was measured in situ from 08.00 to 18.00 hours. This time corresponded approximately to the diel light period in the water column. In fig. 20 daily incoming PAR is depicted for an average cloudy/foggy day, which prevailed during the investigation. There were a few days with less and 2 days with more light. The horizontal bars in fig. 19 show the time during which light levels in the respective depths were above 4 µEinstein $m^{-2}s^{-1}$.

At the surface primary production rates varied between 4 and 8 mgC $m^{-3}d^{-1}$. Production maxima of 8 to 10 mgC $m^{-2}d^{-1}$ were observed in depths between 6 and 22m, corresponding to light penetration of between 50 and 20% of surface illumination. Only twice were production maxima observed at the sea surface (stn.897 and 899, see fig. 21). The subsurface production maxima were clearly related to fluctuations in daily incoming light. The euphotic zone was clearly divided in an upper nutrient limited and a lower light limited layer. For integrated production in the euphotic zone see Table 2.

Assimilation numbers (C Chl$\underline{a}^{-1}h^{-1}$) were between 0.4 and 1.3 in the upper 20m and between 0.2 and 0.8 in the lower part of the euphotic zone. These numbers are comparable to those found during early summer 1989 in this region. In fig. 22 an in situ and an in vitro profile for primary production at stn.895 are shown. In vitro production refers to an incubation of all samples at the 100% light level on deck. Unfortunately no reliable chl$\underline{a}$ data exist for this station. However, from the two profiles one may assume that the population did not exhibit pronounced differences in light adaptation above and below the thermocline.

Albeit this growth performance of the phytoplankton from the lower part of the euphotic zone no biomass accumulation was observed in a batch culture experiment. For this purpose a 1 m^{-3} container on deck was filled with nutrient rich water from 30 to 40m water depth and the natural phytoplankton population. Large zooplankton was excluded by filtration through a 200µ-net gauze. In the container light levels were about 40% of the incident radiation. Primary production rates were in the same range as those from the upper euphotic zone. However, no nutrient depletion and hence no biomass accumulation was observed during a period of 10 days (fig. 23).

Exudation of dissolved organic carbon (DOC) was measured by means of release of ^{14}C-labelled DOC along with the primary production measurements. In situ and in the container DOC release was between 10 and 30% of primary production. From the container phytoplankton was seperated and kept in F/2 culture medium at light levels about 100 µEinstein $m^{-2}sec^{-1}$. After 3 weeks in the lab the diatoms started growing again.

New production has not been measured as yet. However, from oxygen profiles and those for total production it appears that new production was highest in the 10 to 15m depth range.

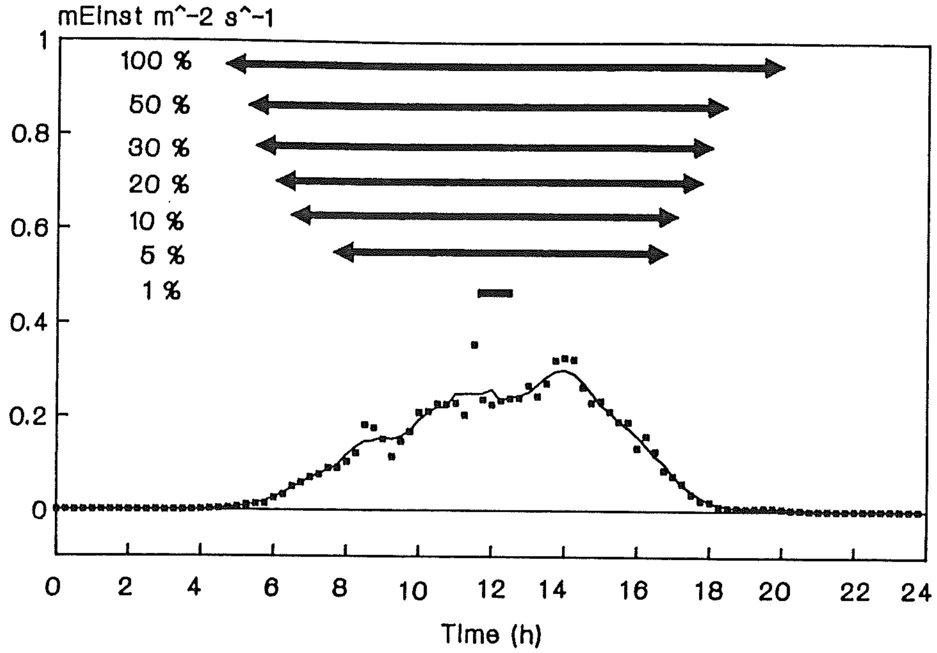


Fig.20: Daily incoming PAR on a cloudy/foggy day (8/31/1990). Bars indicate time of the day during which PAR was >4 µEinstein $m^{-2}sec^{-1}$.

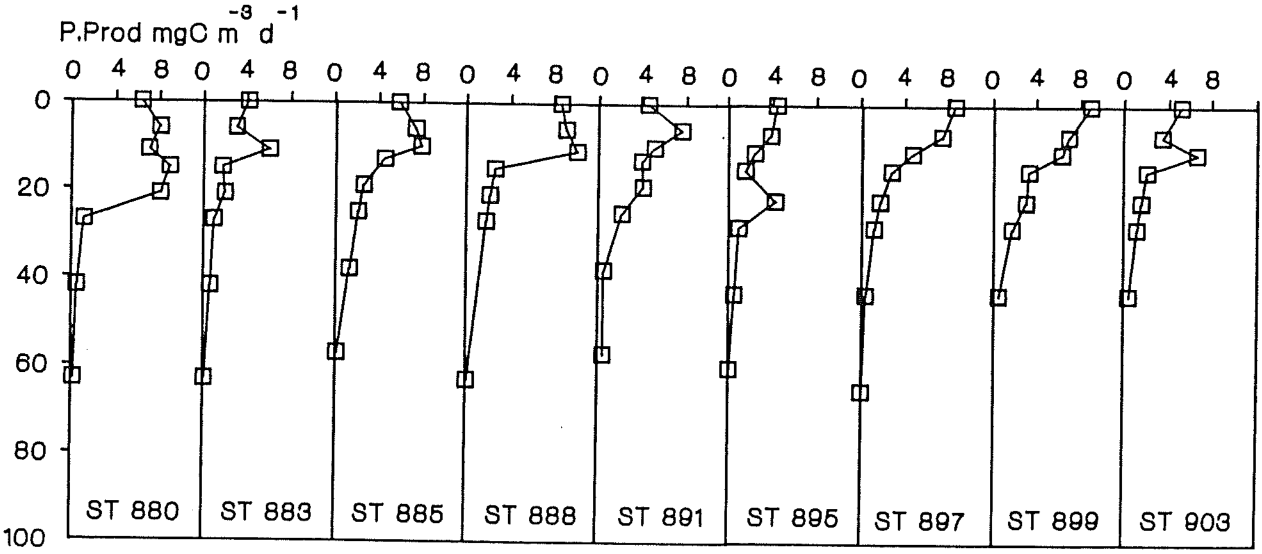


Fig.21: Daily primary production at the morning stations sampled along the trajectory of the drifter. Compare fig. 3 for positions of stations.

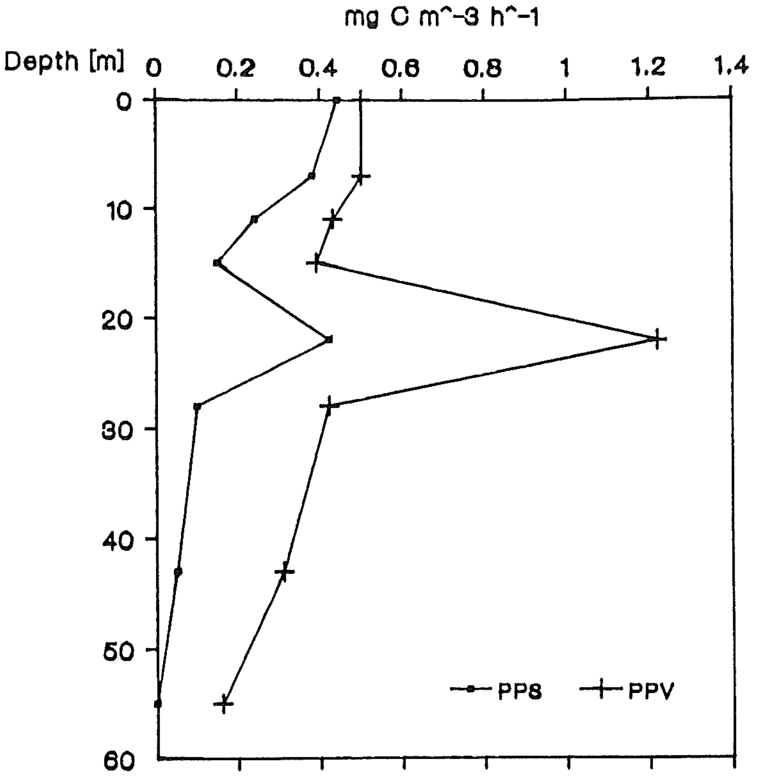


Fig.22: In situ profile of primary production (PPs) and in vitro profile of primary production (PPv) for station 895. In vitro measurements were carried out at 100% light in an incubator on deck.

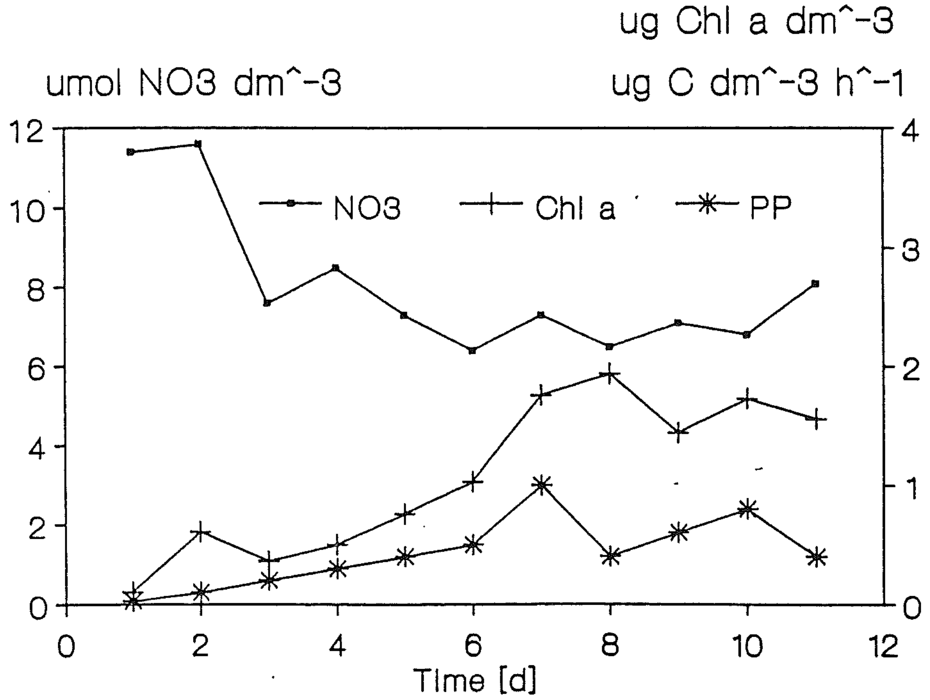


Fig.23: Primary production, chl$\underline{a}$ and nitrate in a 1 m^{-3} batch culture of the natural phytoplankton population.

4.4 Microzooplankton

(Avan Antia)

Some first information on the microzooplankton composition stems from onboard microscopy of 20µm-net hauls in the upper 50m and from 100µm-net hauls in 50m intervals from 250m to the surface. These observations are by no means quantitative as yet.

Many heterotrophic dinoflagellates were observed throughout the investigation. Besides the regular occurrence of *Dinophysis arctica* a few specimen of *D.rotundata* were observed. These species showed a bright orange autofluorescence under UV light excitement. Several different species of *Protoperidinium* were quite abundant, some of them exhibiting an often observed, but as yet unexplained, strong bright green fluorescence. Choanoflagellates were observed in dense colonies.

Among the tintinnids *Favella* sp., *Parafavella* sp. and *Ptychocyclis* sp. were most abundant. In both *Favella* and *Parafavella* round to oval shaped bodies (about 20µm in diameter) with strongly thickened cell walls occurred. These bodies, which could be cysts, contained nuclei as evident from DAPI staining, but showed no autofluorescence. The lorica of *Parafavella* contained 3 to 11 of these bodies (see plates), whereas in that of *Favella* only one was observed.

Abundance of naked ciliates could not be evaluated onboard. A cursory look at these organisms, however, failed to reveal the presence of autotrophic or mixotrophic ciliates.

Foraminifera were much less abundant than in previous investigations in this area. A predominant feature of the microzooplankton was the occurrence of several species of acantharians. The most abundant was a spherical species (200 to 250µm in diameter) with no spines protuding out of the cell body (see plate), although broken spines were found in the samples. The cells contained dark red pigments, which were concentrated in droplet-like bodies close to cell wall. This species ressembled those of the *Sphaerocapsidae* , as described by Popofsky (1904). The strontium sulfate skeleton was verified by EDAX-analysis under a SEM. The distribution of this species showed lower numbers in the upper 100m of the water column and a pronounced maximum between 100 and 150m. The acantharian population was settling out of the water column (see below). Whether these organisms were in a vegetative state or in the process of cyst formation is yet to be clarified. Total numbers decreased during the duration of the drift experiment.

In feeding experiments fluorescent beads (about 2µ) were taken up extensively by small copepods and preadult stages and were also observed in their faecal pellets. Beads (6 to 20 in number) were also seen in the lorica of the tintinnids.

Dilution experiments with microzooplankton yielded between 0 and 17% grazing of the chl*a*-standing stock. Surprisingly no ammonia excretion was measured in experiments with microzooplankton, whereas with copepods unaccountably high excretion rates were found.

4.5 Mesozooplankton

(Maren Voß, Ilka Peeken)

Only a few specimen of *Calanus hyperboreus*, the usual dominant zooplankter in the surface waters of this region, were encountered in the upper 250m. Smaller copepods, such as those of *Metridia lucens* and *Metridia* sp., copepodits, sagittarians and a few amphipods (*Themisto* spp.) were the most abundant zooplankton in this layer. Zooplankton sampling with the 200µm opening/closing net was done in 50m intervals. In the 50m hauls the net was clogged with phytoplankton albeit its low biomass. The JGOFS standard procedure of taking aliquots for carbon analysis can be seriously biased in such cases, as phytoplankton was adhered to the zooplankton and could not completely be rinsed off.

The main occurrence of *C.hyperboreus* was found between 500 and 1500m. Net hauls with a large ring net (500µm-gauze) revealed that this species occurred also in much higher densities between 300 and 500m as compared to the upper 250m. Surprisingly, the guts of *C. hyperboreus* from this deeper layer were well filled with a greenish phytoplankton debris.

In feeding experiments only the smaller copepods were seen to ingest food as evidenced by the small faecal pellets, which were isolated after the experiments. The large faecal pellets of *C. hyperboreus* were also collected in defaecation containers. These faeces will be analysed for phytopigment decay and silica dissolution.

4.6 Vertical particle flux

(Eduard Bauerfeind, Bodo v.Bodungen, Jan Scholten, Marita Wunsch)

In the mooring OG3 sinking particles were collected in 3 depth horizons (500, 1000 and 2200m) from 15.July 1989 to 1.August 1990 in 20 different time intervals. The first optical inspection of the samples showed a sharply decreasing particle flux in October. From November 1989 through February 1990 large amounts of swimmers (amphipods, sagittarians) entered the traps in 500 and 1000m. Maximum particle flux was clearly confined to 2 samplings intervals each of 2 weeks duration in May 1990. Thereafter particle flux decreased to levels similar to the first sampling periods from July to September 1989.

From the drifting traps and those of the short-term mooring a small aliquot of the sample was withdrawn with a pasteur pipette immediately on trap recovery and used for onboard light and autofluorescence microscopy. This aliquot then was stored for subsequent REM/SEM analysis.

The trap material was very heterogeneous. Phytoplankton cells (*Coccolithus pelagicus, Asteromphalus sp., Rhizosolenia sp., Nitzschia sp.)* were prominent. In all depths large numbers of small cysts or spores, probably of chrysophytes, were found in the trap collections (see plate). The protozooplankton in the trap samples comprised foraminifera, tintinnids containing cyst-like bodies, and at least two species of acantharians.

Due to the rapid dissolution of the strontium sulfate shells of the acantharians these have already been enumerated in these samples. The spherical acantharian (tentatively identified as *Sphaerocapsidae* sp.) was the dominant organism in the samples. In the 100m-trap of the drifter 76800 to 110600 individuals $m^{-2}d^{-1}$ were collected, and numbers showed no recognizable trend over time. Whether these numbers represent sinking or active motion of the organisms into the trap cannot be decided before enumeration of the net hauls above the trap depth is completed. In the 300m trap of the drifter between 41600 and 57216 individuals $m^{-2}d^{-1}$ were found. These numbers very likely represent sedimentation of the acantharians, as this trap was far below the depth of the maximum occurrence of these organisms in the water column and vertical migration of these protozoans to that extent seems unlikely.

In the short-term mooring fewer acantharians were collected in the 100m trap (25 600 to 35 800 individuals $m^{-2}d^{-1}$) as compared to the drifter traps. It is not clear whether these differences are due to differences in trapping efficiency between moored and drifting traps (see also below). As the drifter sailed 25 nautical miles south from the position of the short-term mooring, and considering the mesoscale hydrographic structures in the area (see **4.1**), spatial heterogeneity in distribution and sinking behaviour of the acantharians may be partly responsible for these observations.

In 500m, 1000m and 2200m of water depth flux rates sharply declined to 3460, 420 and 12 individuals $m^{-2}d^{-1}$ respectively. As neither the duration of this sedimentation event nor the sinking velocity are known, the fate of the acantharians with regard to dissolution of their celestite ($SrSO_4$) shells in the water column or at the sediment surface is yet to be clarified. The preliminary results, however, clearly demonstrate the importance of celestite formation and export from the surface by acantharians for the strontium budget in the ocean.

Besides this important constituent of the particle flux in autumn in the Greenland Sea, zooplankton faeces of different size also sank out of the water column. Long faecal strings (>2mm) may originate from feeding activies of the amphipods (*Themisto* spp.) encountered in the surface waters. More prominent in the trap collections were oval shaped faecal pellets of 250 to 350µm length, which contained undestroyed diatoms, coccolithospheres, tintinnids and foraminifera.

Coccoliths and coccolithospheres were seen to form sticky aggregates. Other aggregates consisted of entangled spines (acantharian?) together with small diatoms, coccoliths and unidentifiable organic debris (see Plate).These aggregates of several mm in length were also found in deep net hauls from 2500 to 2200m. Subsequent to this observation 60l of water from different depths in this range were carefully sieved through a 200µ net gauze. By this procedure 2 to 4 of these aggregates were obtained out of this volume.

Daily sedimentation rates in 100m increased over time (fig.24). In terms of chl$\underline{a}$-eq. (sum of chl$\underline{a}$ and phaeopigments) daily sedimentation rates in the 100m drifting trap amounted to maximal 0.38% of the standing stock in the euphotic zone at end of the drift period. The results from the poisoned and unpoisoned sample of the twin trap show a general good agreement. Both samples were retrieved daily and processed immediately. In other years such comparisons did not yield that good results, because the unpoisoned sample was processed immediately and the poisoned sample was stored in the collecting cup for 4 or more weeks. Obviously pigments are degraded in relative short time despite mercuric chloride poisoning.

From the comparison of the poisoned and unpoisoned trap vertical POC flux appeared to be somewhat higher in the poisoned trap (fig.25). The C:N ratios (by atoms) ranged between 6.3-7.0 and 6.4-7.9 in the unpoisoned and poisoned trap respectively. The trend of increased flux rates towards the end of the investigations is not as distinct as seen in the vertical export of chlorophyll. More than 50% of the POC export was found in the size fraction of >200µm. This fraction was almost exclusively made up by the acantharians.

Vertical export of POC, when expressed as percentage of the standing in the euphotic zone, increased from 0.22% to 0.78% in the second half of the investigation period. Compared to primary production export was much higher. Export of POC amounted to between 16% and 58% of daily primary production. Over the investigation period of 9 days vertical export of POC corresponded to 31% of primary production.

The vertical POC flux in 300m water depth, as measured in the 300m trap of the drifter, exhibited a similar temporal pattern to that in 100m (fig.26). C:N ratios in the deeper trap ranged between 6.1 and 10.9 (by atoms). Between 100m and 300m flux decreased by 23% indicating relatively low decomposition rates of organic matter in this water layer.

At the site of the short-term mooring, which was deployed near the location where the drift study began and higher chlorophyll biomass was observed in the water column, export of POC decreased over time (fig.27). Within the investigation period, however, export out of the upper 100m of the water column was very similar to that observed along the drift trajectory (fig.27). Between 50 and 70% of the POC flux was found in the fraction >200µm, which was composed mostly of acantharians. The C:N ratios varied between 6.8 and 8.7 (by atoms).

Compared to the vertical flux of POC in 100m rates decreased by 34%, 56% and 78% in 500m, 1000m and 2200m respectively. The contribution of the fraction >200µm decreased to <40%. The C:N ratios increased from 9.5 to 10.2. Further detailed analysis of the sedimented material will reveal whether these numbers indicate the decrease in particle flux during the investigation period or whether the flux found in deeper water layers has to be contributed to processes prior to our arrival in the investigation area.

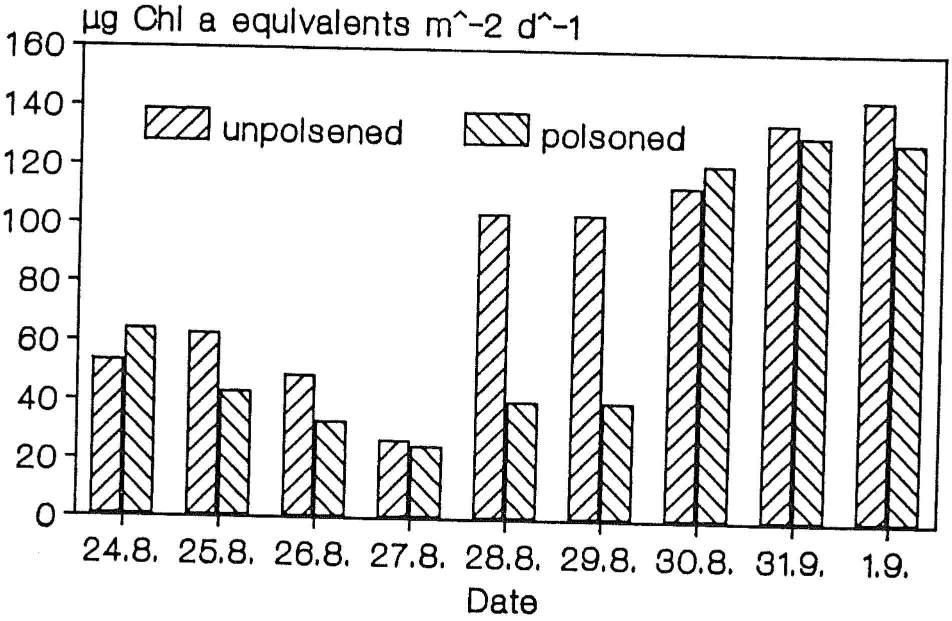


Fig.24: Daily sedimentation rates of chl$\underline{a}$-eq. in 100m water depth. Results from the poisoned and unpoisoned collecting cup of the twin trap drifter are depicted.

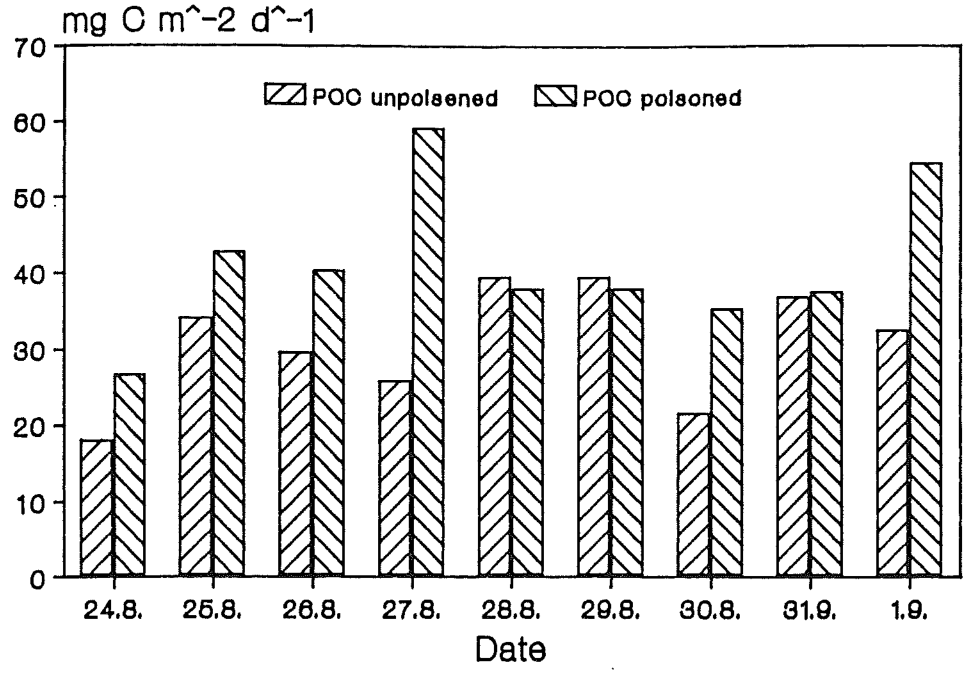


Fig.25: Daily sedimentation rates of particulate organic carbon (POC) in 100m water depth. Results from the poisoned and unpoisoned collecting cup of the twin trap drifter are depicted.

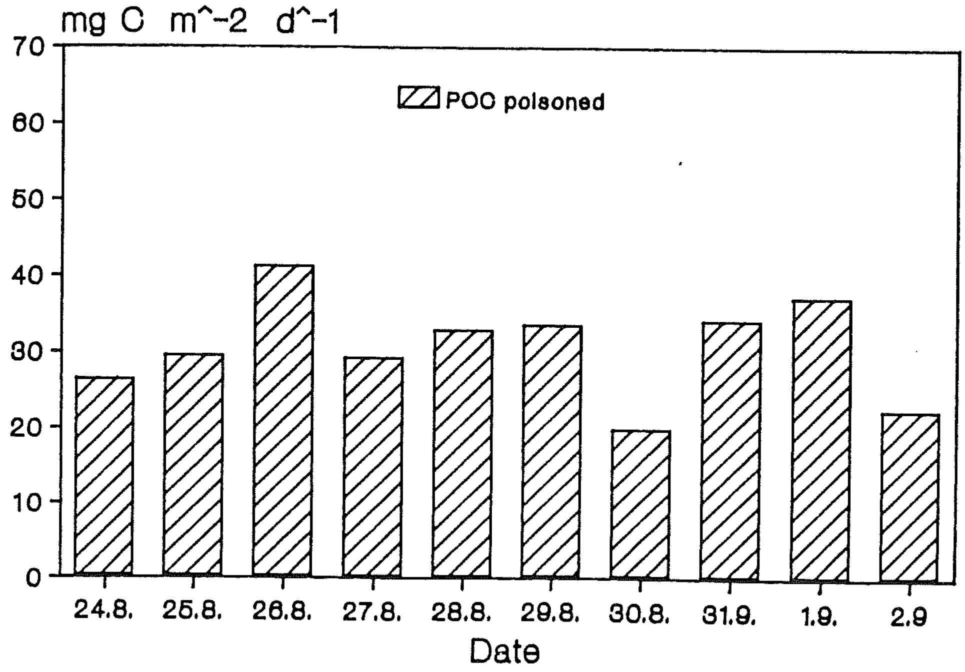


Fig.26: Daily sedimentation rates of POC in 300m water depth, as measured with the drifter.

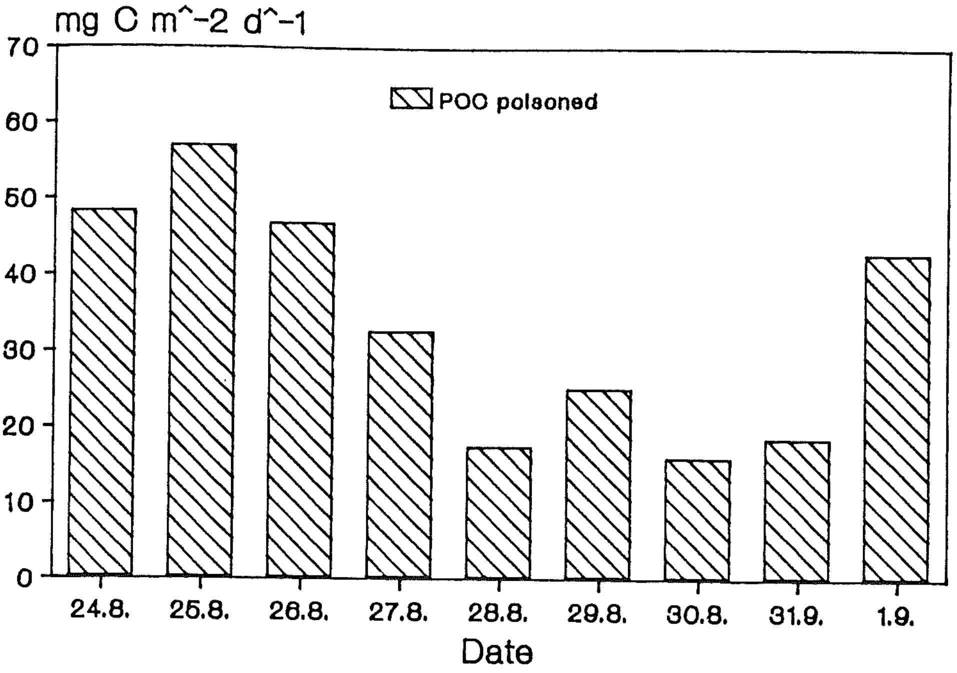


Fig.27: Daily sedimentation rates of POC in the 100m trap of the short-term mooring.

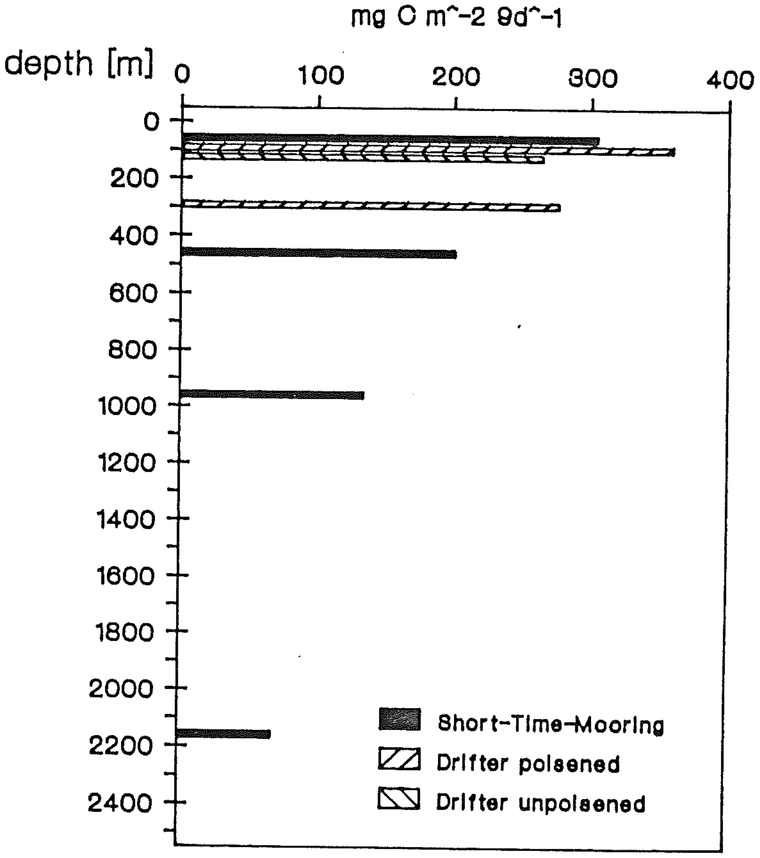


Fig.28: Sedimentation rates of POC for the period of 9 days for all depth from the drifting and the moored traps.

5. Summary

The situation encountered in the south western Greenland Sea during late August/early September 1990 exhibited an "aged" pelagic system in which the biological processes seemed to subside. Species composition in both phyto- and protozooplankton was highly diverse. Several species in the pelagial showed spore and/or cyst formation, which were also found in the traps in all water layers.

Primary production was low throughout the investigation period, albeit a considerable nutrient reservoir in the euphotic zone below 15m water depth. Biomass and grazing of mikrozooplankton was low. One of the main grazers in the mesozooplankton, *Calanus hyperboreus*, was only found in deeper water. Defaecation experiments indicated that the zooplankton in surface waters was not grazing at high rates.

The composition of settling particles was very heterogeneous. In the fraction <200µm a large variety of phyto- and protozooplankton cells was observed. The fraction >200µm was almost exclusively made up by acantharian cysts. In terms of standing stock in the euphotic zone vertical export rates were low, however, in terms of primary production export exceeded 30%. In comparison only <15% of primary production was exported during investigations in 1989 shortly after an ice-edge bloom. Decrease of export flux with depth was moderate indicating that fast sinking particles left the surface layer. Export of carbon to 500m, 1000m and 2200m during the 9 days period amounted 7%, 12% and 11% of the respective annual fluxes.

The observations in the water column seem to support the hypothesis that the pelagic system "is decaying" in late August to September. The absolute amount of vertical particle export, however, was lower than expected. In the euphotic zone 8-9 g POC m^{-2} with C:N ratios of 6.2 to 7.5 and POC:Chl<u>a</u> of >200 were still present, indicating that most of the POC was tied up in heterotrophic and detrital pools. Comparisons of saisonal nitrate profiles yield an annual new production between 28 and 40 g C m^{-2}, of which 80% is produced by June/July. Thus, a large amount of the production is still found in the euphotic zone at the end of the phytoplankton growth season. In an annual mooring a flux of 1.8 g POC m^{-2} was recorded in a 500m trap in the period from October to April. Whether the remaining POC is oxydised above the 500m horizon during winter month has to be clarified as yet.

Similar to the study in June/July 1989 the drift of the sediment trap array during this study was influenced strongly by mesoscale eddy like structures. In 1989 these mesoscale variabilities in the physical environment were also seen in the biological properties. The latter exhibited on small spatial scales different stages in the seasonal development of the pelagic system. In the "aged" pelagic system the spatial heterogeneity in biological properties was much less pronounced.

List of Stations: POSEIDON-cruise No.173/2

a) Reykjavik-Reykjavik 14.8.-17.8.1990

Stn.No.	Position		Date	Time	
	Latitude	Longitude			
857	59 04,09N	21 03,90W	15.08.90	15:55	CTD to 2000m (1)
	59 06,37N	21 05,93W		18:36	FL
	59 06,78N	21 05,85W		19:07	RAFOS
	59 06,27N	21 06,62W		19:28	RN 2X to 100m RN 1X to 100-50m
	59 07,37N	21 09 42W		23:00	tank-filling
	59 07,24N	21 10,00W		23:51	RAFOS
	59 07,27N	21 10,06W	16.08.90	00:00	tank-filling
	59 07,45N	21 14,50W		00:55	RAFOS
	59 07,49N	21 15,08W		04:10	floats
858	59 00,20N	21 03,90W		08:49	mooring No 323 released
				11:36	on board

b) Reykjavik-Kiel 18.08.90-10.09.90

Stn.No.	Position		Date	Time	
	Latitude	Longitude			
859	72 00,60N	07 02,90W	21.08.90	16:13	mooring OG3 released
				19:30	on board
860	72 01,21N	07 02,07W		20:00	SC, FL,
	72 01,21N	07 59,07W			CTD to 2500m (2)
861	72 01,00N	07 01,32W		23:46	CTD to 300m (3)
862	72 00,71N	07 02,52W	22.08.90	01:03	CTD to 1000m (4) MN - test, RN 3X to 50m, PN
863	72 00,80N	07 02,52W		07:11	SC,FL, MN to 200m
864	72 01,40	06 59,00W		08:48	FL, RN 3X to 50m
865	72 29,92N	06 59,84W		12:55	SC, FL,
	72 29,97N	06 59,72W			CTD to 300m (5)
866	72 34,90N	06 59,94W		14:46	FL, CTD to 300m (6)
867	72 39,90N	06 59,60W	22.08.90	16:18	FL, CTD to 300m (7)
868	72 40,04N	06,45,21W		17:59	FL, CTD to 300m (8)
869	72 40,01N	06 29,24W		19:24	FL, CTD to 300m (9)
870	72 35,16N	06 44,77W		21:20	FL, CTD to 300m (10)
871	72 35,07N	07 19,50W		23:37	FL, CTD to 300m (11)

Stn.No.	Position		Date	Time	
	Latitude	Longitude			
872	72 40,03N	07 34,66W	23.08.90	01:44	FL, CTD to 300m (12), PN
873	72 39,90N	07 20,40W		03:28	FL, CTD to 300m (13)
874	72 35,04N	07 34,84W		05:00	FL, CTD to 300m (14)
875	72 35,00N	07 29,40W		09:12	TP-Test (300m)
876	72 39,98N	07 34,53W		12:05	FL, CTD to 300m (15)
877	72 39,18N	07 32,12W		13:32	drifter into water
878	72 39,80N	07 35:50W		15:30	OG 3A deployment
				18:32	ancor
879	72 40,04N	07 35,49W		19:47	FL, PN 80-40m,30-0m SC, RN 50-0m, 2X 75-0m, tank-filling
880	72 37,02N	07 37,36W	24.08.90	08:08	FL, SC,
	72 37,03N	07 39,60W		08:42	CTD to 300m (16)
	72 37,02N	07 38,50W		09:50	CTD to 100m (17)
	72 37,11N	07 38,07W		10:40	CTD to 100m (18)
					PN 60-0m, MN to 250m, RN 6X 50-0m
				16:24	TP
				17:45	drifter recovery
881	72 35,75N	07 39,51W		18:45	CTD to 2000m (19)
882	72 32,30N	07 40,18W		22:06	CTD to 1000m (20)
	72 28,28N	07 40,02W		23:33	CTD to 1000m (21)
	72 31,43N	07 51,61W	25.8.90	01:46	CTD to 1000m (22)
	72 35,23N	07 40,68W		05:04	CTD to 25m (23)
883	72 34,77N	07 40,65W		05:04	SC, FL,
	72 34,76N	07 40,82W		05:10	CTD to 300m (24),
	72 34,71N	07 40,97W		06:30	CTD to 100m (25)
883	72 34,04N	07 41,30W	25.08.90	07:20	drifter on board
				07:58	inkubationrigg into water
	72 33,80N	07 42,80W		08:40	CTD to 30m (26)
					MN to 250m, PN 70-0m
	72 33,74N	07 43,34W		10:20	TP
				17:08	MN to 250m
	72 33,47N	07 41,03W		17:45	inkubationrigg recovered
					RN 7X 50-0m, PN 50-0m
884	72 32,89N	07 42,12W		20:12	CTD to 1000m (27)
	72 37,74N	07 46,67W		22:10	CTD to 1000m (28)
	72 37,90N	08 02,18W	26.08.90	00:06	CTD to 1000m (29)
	72 33,00N	08 02,30W		02:32	CTD to 500m (30)

Stn.No.	Position Latitude	Longitude	Date	Time	
885	72 32,86N	07 40,02W		05:00	SC, FL,
	72 32,77N	07 39,93W		05:31	CTD to 300m (31)
	72 32,47N	07 03,95W		06:24	CTD to 100m (32)
				07:27	drifter on board
				07:58	inkubationrigg to water PN 100-0m, MN to 200m, FL, RN 2X 50-0m
	72 32.10N	07 41,40W	26.08.90	10:17	CTD to 500m (33)
	72 32,29N	07 41,48W		11:26	TP
				12:24	FL at starboard
				14:17	FL at starboard, PN
					releasertest
				17:10	FL at starboard
				18:45	FL
886	72 31,83N	07 38,70W		19:17	CTD to 2517m (34)
	72 31,63N	07 39,79W		22:32	CTD to 500m (35)
	72 31,84N	07 39,82W	27.08.90	00:07	CTD to 500m (36)
887	72 31,90N	07 19,79W		02:24	CTD to 500m (37)
888	72 31,45N	07 37,38W		05:07	SC, FL
	72 31,45N	07 37,77W		05:40	CTD to 300m (38)
	72 31,24N	07 38,04W		06:42	CTD to 100m (39)
				07:52	Drifter an Deck
				08:03	inkubationrigg to water, PN
	72 31,00N	07 39,70	27.08.90	08:53	MN to 250m,
	72 31,00N	07 40,70W		09:39	CTD to 100m (40), RN 3X 450-0m, 250-0m,380-0m
	72 31,28N	07 40,82W		11:54	TP
				17:00	releasertest
				17:45	inkubationrigg recovered
	72 30,99N	07 40,28W		18:20	CTD to 100m (41)
889	72 29,78N	07 44,13W		19:33	CTD to bottom (2570m), (42)
890	72 34,80N	07 43,20W		23:09	CTD to 500m (43)
	72 38,04N	07 49,20W	28.08.90	00:49	CTD to 500m (44)
	72 29,80N	07 59,50W		03:02	CTD to 500m (45)
891	72 30,10N	07 41,08W		04:59	SC, FL,
	72 30,20N	07 41,80W		05:30	CTD to 300m (46)
	72 29,99N	07 41,75W		06:40	CTD to 100m (47)
				07:44	drifter on board
				07:54	inkubationrigg to water PN 150-0m
	72 29,50N	07 43,20W	28.08.90	09:24	CTD to 200m (48) RN 3X to 450m
	72 20,39N	07 44,91W		11:23	TP
				16:27	MN to 2000m
				17:07	PN 2X
	72 29,30N	07 43,60W		18:00	inkubationrigg recovered,
	72 29,31M	07 42,85W		18:51	CTD to 500m (49)

Stn.No.	Position		Date	Time	
	Latitude	Longitude			
892	72 22,50N	08 02,11W		21:08	CTD to 500m (50)
	72 22,39N	08 14,95W		22:28	CTD to 500m (51)
	72 26,23N	08 14,69W		23:46	CTD to 500m (52)
	72 30,17N	08 15,40W	29.08.90	01:12	CTD to 500m (53)
	72 35,21N	08 15,59W		02:48	CTD to 500m (54)
	72 35,19N	08 02,04W		04:08	CTD to 500m (55)
893	72 28,50N	07 43,95W		06:30	TP
	72 27,30N	07 44,00W		09:37	FL, SC,
	72 27,20N	07 44,06W		10:07	CTD to 100m (56)
	72 27,04N	07 45,03W		10:48	CTD to 25m (-)
	72 26,96N	07 45,63W	29.08.90	11:18	CTD to 300m (57), RN 3X to 450m PN 2X to 50m
	72 26,50N	07 46,04W		15:28	TP
				17:30	PN 3X to 50m, MN to 500m, MN to 200m, PN 3X,
	72 24,89N	07 43,80W		22:05	CTD to 300m (58)
894	72 26,36N	07 52,44W		23:03	CTD to 500m (59)
	72 20,47N	07 52,49W	30.08.90	00:34	CTD to 500m (60)
	72 16,74N	07 52,81W		01:54	CTD to 500m (61)
	72 18,81N	07 38,35W		03:23	CTD to 500m (62)
895	72 23,55N	07 43,73W		05:02	SC, FL
	72 23,54N	07 42,97W		05:46	CTD to 300m (63)
	72 23,35N	07 43,18W		06:48	CTD to 100m (64)
				07:40	drifter on board
				08:01	inkubationrigg to water PN 2X, MN to 250m,
	72 22,60N	07 42,20W		09:29	CTD to 100m (65)
	72 22,12N	07 42,57W		10:40	TP
				16:35	RN 2X,300-0m, 450m-0m
	72 21,60N	07 41,50W		17:45	inkubationrigg recovered, PN 2X
896	72 26,85N	07 22,34W		20:06	CTD to 500m (66)
	72 21,48N	07 05,20W		21:42	CTD to 500m (67)
	72 21,36N	07 16,59W		22:50	CTD to 500m (68)
	72 17,76N	07 05,76W	31.08.90	00:15	CTD to 500m (69)
	72 13,89N	07 05,85W		01:30	CTD to 500m (70)
	72 13,90N	07 22,45W		02:59	CTD to 500m (71)
	72 17,98N	07 22,02W		04:13	CTD to 500m (72)
897	72 20,40N	07 37,87W		06:04	SC, FL,
	72 20,48N	07 37,34W		06:40	CTD to 300m (73)
				07:42	drifter on board
897	72 20,26N	07 36,08W	31.08.90	08:04	inkubatonrigg to water PN,
	72 20,00N	07 34,70W		09:23	CTD to 100m (74) MN to 2200m, MN to 1000m,
	72 19,15N	07 35,92W		13:04	CTD to 300m (75)
	72 18,90N	07 36,94W		14:12	CTD to 150m (-)

Stn.No.	Position Latitude	 Longitude	Date	Time	
897 Forts.	72 19,00N	07 37,60W		14:58	CTD to 2100m (76), PN 2X 100m-0m, 50m-0m
	72 19,60N	07 34,10W		18:15	inkubationrigg recovered
898	72 25,27N	07 12,18W		20:23	CTD to 500m (77)
	72 25,21N	07 25,15W		21:45	CTD to 500m (78)
	72 25,15N	07 38,30W		23:00	CTD to 500m (79)
	72 25,03N	07 52,16W	01.09.90	00:16	CTD to 500m (80)
	72 25,18N	08 05,83W		01:34	CTD to 500m (81)
	72 17,41N	08 06,20W		03:29	CTD to 300m (82)
899	72 19,49N	07 30,61W		05:41	SC, FL,
	72 19,63N	07 30,38W		06:10	CTD to 300m (83),
	72 19,80N	07 30,21W		07:11	CTD to 100m (84)
	72 19,59N	07 29,33W		07:46	drifter on board
				08:06	inkubatonrigg to water PN,
	72 20,00N	07 27,50W		09:18	CTD to 500m (85)
900	72 37,70N	07 42,20W		13:02	OG 3A recovered
	72 35,00N	07 44,00W		16:00	CTD to 300m (86)
901	72 19,97N	07 30,56W		18:28	inkubationrigg recovered
	72 20,38N	07 30,53W		19:02	CTD to 2000m (87), MN to 250m, MN to 300m
902	72 19,64N	07 29,35W		23:00	RN 3X 450-0m, 1X 380-0m
903	72 19,78N	07 32,82W	02.09.90	05:35	SC, FL,
	72 19,93N	07 32,64W		06:07	CTD to 300m (88) PN
904	72 22,80N	07 41,20W		08:46	OG4 deployed
904	72 24,30N	0736,60W	02.09.90	10:24	anchor to water
				12:57	recovery of the top buoy and 2 traps
				14:00	release
				16:19	OG4 totally recovered and on board
905	72 18,29N	07 33,55W		17:58	recovery of the drifter
				18:22	drifter on board
906	72 22,73N	07 42,21W		19:17	OG4 top buoy into water
				21:19	ancor
	72 23,00N	07 42,70W		21:40	no direction finding any more

Stn.No.	Position		Date	Time	
	Latitude	Longitude			
907	69 59,34N	00 06,51E	03.09.90	21:07	FL, CTD to 3000m (89)
			04.09.90	00:22	CTD to 100m (90)
	69 59,49N	00 09,58E		01:02	TP
	69 58,79N	00 08,98E		06:34	hydrophon into water
				09:40-11:24	survey grid
	69 57,60N	00 10,79W		17:20	hydrophon into water, no answer LB5 mooring could not be recovered
				20:00	sailing home

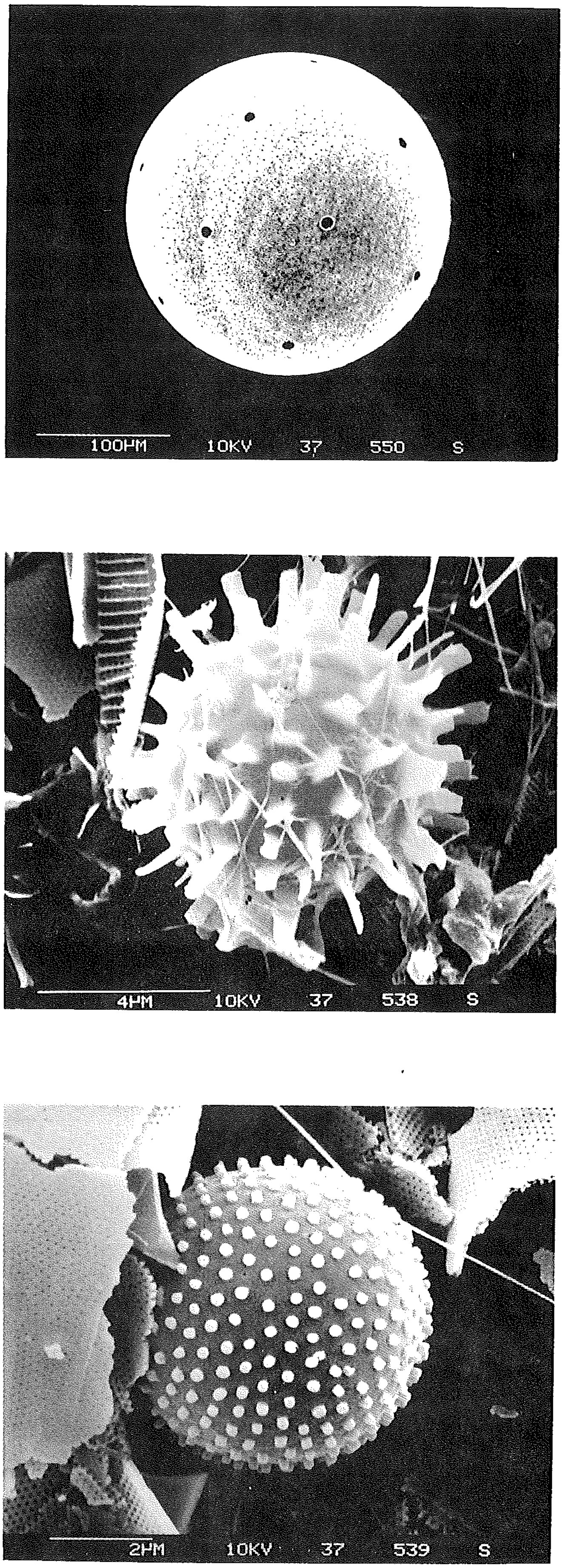
FL : flourescence-probe
RN : ring-net
TP : large volume pumps
MN : multi-net
SC : secchi disc
PN : plankton-apstein net
RAFOS: isopycnal float

STATION	PROFILE	DATE	TIME (UTC)	LATITUDE	LONGITUDE	WIRE-LENGTH	NOTES
857	1	15-AUG-1990	15:52	59 4.00' N	21 3.80' W	2000	JV
860	2	21-AUG-1990	20:21	72 1.30' N	7 1.36' W	2500	OG2
861	3	21-AUG-1990	23:47	72 0.99' N	7 1.36' W	300	OG2
862	4	22-AUG-1990	1: 3	72 0.72' N	7 2.61' W	1000	OG2
865	5	22-AUG-1990	13:29	72 29.99' N	6 59.72' W	300	GRID
866	6	22-AUG-1990	15: 6	72 34.96' N	6 59.91' W	300	GRID
867	7	22-AUG-1990	16:41	72 39.84' N	7 1.80' W	300	GRID
868	8	22-AUG-1990	18:20	72 40.18' N	6 45.26' W	300	GRID
869	9	22-AUG-1990	19:45	72 40.15' N	6 29.20' W	300	GRID
870	10	22-AUG-1990	21:40	72 35.28' N	6 44.31' W	300	GRID
871	11	23-AUG-1990	0:17	72 35.35' N	7 17.77' W	300	GRID
872	12	23-AUG-1990	2: 4	72 40.04' N	7 34.53' W	300	GRID
873	13	23-AUG-1990	3:48	72 39.97' N	7 20.36' W	300	GRID
874	14	23-AUG-1990	5:17	72 35.22' N	7 34.98' W	300	GRID
876	15	23-AUG-1990	12:24	72 40.13' N	7 34.36' W	300	PBL LD
880	16	24-AUG-1990	8:41	72 37.25' N	7 38.36' W	300	LD
880	17	24-AUG-1990	9:48	72 37.54' N	7 38.04' W	100	LD
880	18	24-AUG-1990	10:39	72 37.11' N	7 38.12' W	100	LD
881	19	24-AUG-1990	18:45	72 35.77' N	7 38.92' W	2000	LD
882	20	24-AUG-1990	22: 5	72 32.27' N	7 40.23' W	1000	GRID
882	21	24-AUG-1990	23:33	72 28.25' N	7 40.12' W	1000	GRID
882	22	25-AUG-1990	1:45	72 31.44' N	7 51.62' W	1000	GRID
882	23	25-AUG-1990	4: 0	72 35.23' N	7 40.70' W	65	LD
883	24	25-AUG-1990	5:32	72 34.73' N	7 41.18' W	300	LD
883	25	25-AUG-1990	6:29	72 34.43' N	7 40.97' W	100	LD
883	26	25-AUG-1990	8:39	72 33.80' N	7 42.68' W	30	LD
884	27	25-AUG-1990	20:11	72 32.92' N	7 42.21' W	1000	LD
884	28	25-AUG-1990	22:10	72 37.75' N	7 46.67' W	1000	OG3A
884	29	26-AUG-1990	0: 6	72 37.86' N	8 2.29' W	1000	GRID
884	30	26-AUG-1990	2:32	72 33.01' N	8 2.29' W	500	GRID
885	31	26-AUG-1990	5:30	72 32.79' N	7 40.00' W	300	LD
885	32	26-AUG-1990	6:23	72 32.49' N	7 40.14' W	100	LD
885	33	26-AUG-1990	10:16	72 32.10' N	7 41.47' W	500	LD
886	34	26-AUG-1990	19:11	72 31.92' N	7 38.78' W	2517	LD
886	35	26-AUG-1990	22:32	72 31.63' N	7 39.81' W	500	LD
886	36	27-AUG-1990	0: 5	72 31.82' N	7 39.85' W	500	LD
887	37	27-AUG-1990	2:21	72 31.92' N	7 19.93' W	500	GRID
888	38	27-AUG-1990	5:38	72 31.49' N	7 37.72' W	300	LD
888	39	27-AUG-1990	6:41	72 31.30' N	7 38.12' W	100	LD
888	40	27-AUG-1990	9:39	72 31.18' N	7 40.35' W	100	LD
888	41	27-AUG-1990	18:20	72 31.04' N	7 40.28' W	100	LD
889	42	27-AUG-1990	19:29	72 29.81' N	7 44.20' W	2570	LD
890	43	27-AUG-1990	23: 7	72 34.71' N	7 43.27' W	500	GRID
890	44	28-AUG-1990	0:46	72 38.41' N	7 49.24' W	500	GRID
890	45	28-AUG-1990	3: 0	72 29.77' N	7 59.59' W	500	GRID
891	46	28-AUG-1990	5:29	72 30.22' N	7 41.87' W	300	LD
891	47	28-AUG-1990	6:39	72 30.00' N	7 41.80' W	100	LD
891	48	28-AUG-1990	8:56	72 29.54' N	7 43.08' W	200	LD
891	49	28-AUG-1990	18:51	72 29.31' N	7 42.86' W	500	LD
892	50	28-AUG-1990	21: 7	72 22.52' N	8 2.12' W	500	GRID
892	51	28-AUG-1990	22:26	72 22.41' N	8 15.00' W	500	GRID
892	52	28-AUG-1990	23:44	72 26.33' N	8 14.55' W	500	GRID
892	53	29-AUG-1990	1:11	72 30.16' N	8 15.40' W	500	GRID
892	54	29-AUG-1990	2:46	72 35.22' N	8 15.59' W	500	GRID
892	55	29-AUG-1990	4:10	72 35.20' N	8 2.05' W	500	GRID
893	56	29-AUG-1990	10: 7	72 27.90' N	7 44.30' W	100	LD
893	57	29-AUG-1990	11:18	72 27.00' N	7 45.50' W	300	LD

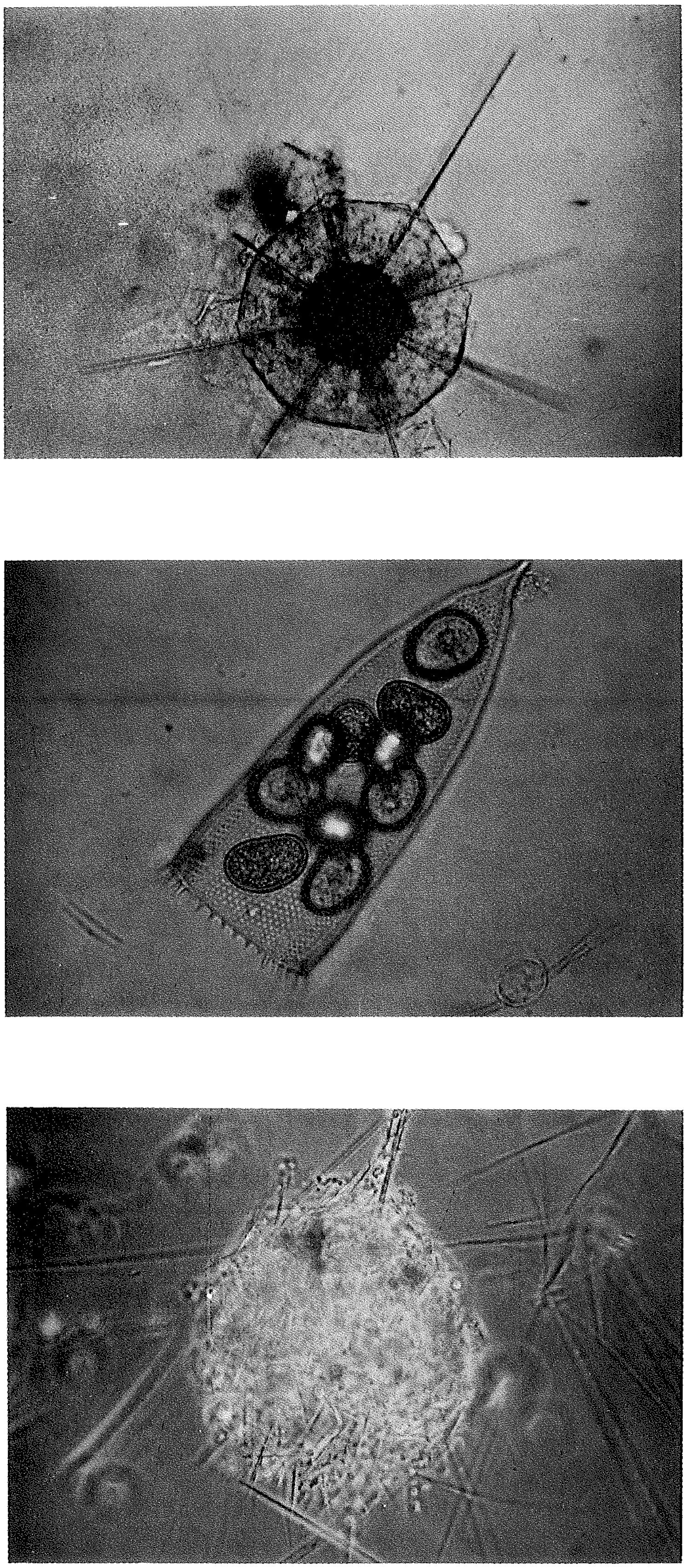
STA- TION	PRO- FILE	DATE	TIME (UTC)	LATITUDE	LONGITUDE	WIRE- LENGTH	NOTES
893	58	29-AUG-1990	22: 3	72 24.85' N	7 43.94' W	300	LD
894	59	29-AUG-1990	23: 2	72 26.38' N	7 52.34' W	500	GRID
894	60	30-AUG-1990	0:32	72 20.45' N	7 52.42' W	500	GRID
894	61	30-AUG-1990	1:52	72 16.73' N	7 52.80' W	500	GRID
894	62	30-AUG-1990	3:20	72 18.84' N	7 38.29' W	500	GRID
895	63	30-AUG-1990	5:44	72 23.55' N	7 43.02' W	300	LD
895	64	30-AUG-1990	6:46	72 23.38' N	7 43.23' W	100	LD
895	65	30-AUG-1990	9:29	72 22.57' N	7 42.32' W	100	LD
896	66	30-AUG-1990	20: 6	72 26.86' N	7 22.39' W	500	GRID
896	67	30-AUG-1990	21:40	72 21.51' N	7 5.14' W	500	GRID
896	68	30-AUG-1990	22:49	72 21.40' N	7 16.60' W	500	GRID
896	69	31-AUG-1990	0:14	72 17.79' N	7 5.58' W	500	GRID
896	70	31-AUG-1990	1:28	72 13.89' N	7 5.85' W	500	GRID
896	71	31-AUG-1990	2:57	72 13.90' N	7 22.45' W	500	GRID
896	72	31-AUG-1990	4:10	72 17.96' N	7 22.09' W	500	GRID
897	73	31-AUG-1990	6:35	72 20.51' N	7 37.45' W	300	LD
897	74	31-AUG-1990	9: 6	72 20.06' N	7 34.46' W	100	LD
897	75	31-AUG-1990	13: 2	72 19.17' N	7 35.84' W	300	LD
897	76	31-AUG-1990	15: 4	72 19.06' N	7 37.71' W	2000	LD
898	77	31-AUG-1990	20:24	72 25.27' N	7 12.18' W	500	GRID
898	78	31-AUG-1990	21:49	72 25.29' N	7 25.08' W	500	GRID
898	79	31-AUG-1990	22:58	72 25.17' N	7 38.21' W	500	GRID
898	80	1-SEP-1990	0:15	72 25.07' N	7 52.05' W	500	GRID
898	81	1-SEP-1990	1:33	72 25.17' N	8 5.82' W	500	GRID
898	82	1-SEP-1990	3:28	72 17.39' N	8 6.24' W	500	GRID
899	83	1-SEP-1990	6: 7	72 19.62' N	7 30.39' W	300	LD
899	84	1-SEP-1990	7: 9	72 19.80' N	7 30.22' W	100	LD
899	85	1-SEP-1990	9:14	72 19.89' N	7 27.87' W	500	LD
900	86	1-SEP-1990	15:57	72 35.39' N	7 43.80' W	100	OG3A
901	87	1-SEP-1990	19: 0	72 20.31' N	7 30.44' W	2000	LD
903	88	2-SEP-1990	6: 6	72 19.94' N	7 32.48' W	300	LD
907	89	3-SEP-1990	21:29	69 59.54' N	0 4.10' E	3000	LB5
907	90	4-SEP-1990	0:20	69 59.53' N	0 9.20' E	100	LB5

NOTES:

OG2 = ANNUAL MOORING
PBL LD = CTD-POSITION BEFORE LAUNCHING THE LONGTERM DRIFTER
LD = LONGTERM DRIFTER
OG3A = SHORTTERM MOORING
LB5 = ANNUAL MOORING



SEM-photographs of different cysts observed in the sediment traps. Upper photograph: Acantharian cyst. Middle and lower photograph: unidentified cysts of possible Crysophyceen origin.



Light microscopy photographs of suspended and sedimenting material. Upper photograph: vegetative form of an uniditified Acantharian species (diameter: 200 µm). Middle photograph: lorica of Parafavella sp. containing cysts (length of lorica 310 µm, diameter of cysts 18-20 µm. Lower photograph: aggregated seston material with phytodetritus (diameter 1.4 mm).