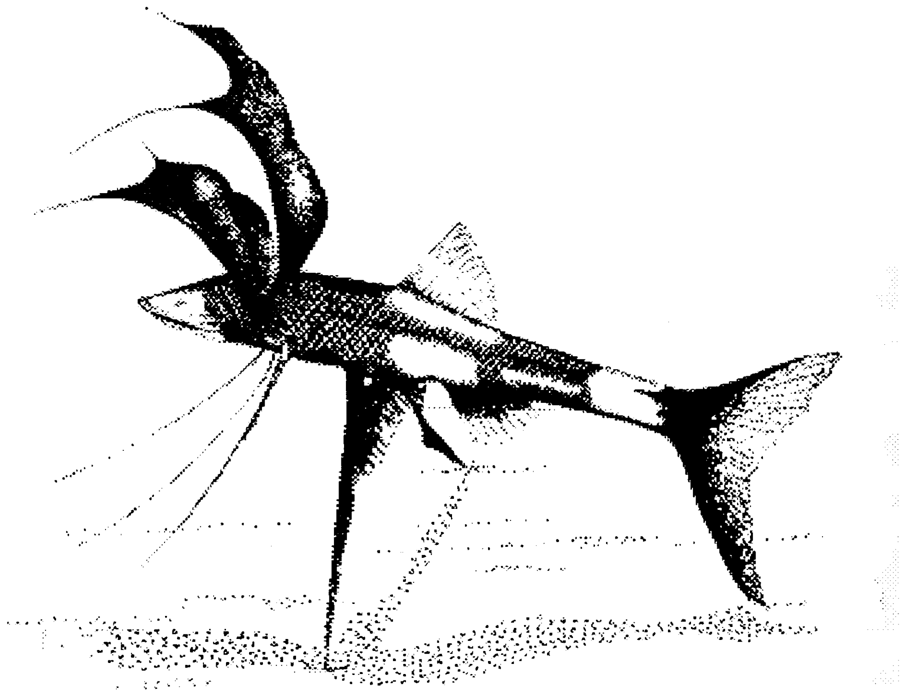
SHIPBOARD REPORT

RV. PELAGIA CRUISE 108
OMEX II -leg 1
Benthic Biology of the Iberian Upwelling Margin

23 June - 14 July 1997



G.C.A. Duineveld
M.S.S. Lavaleye

Netherlands Institute of Sea Research, Texel

AUG 1997

PARTICIPANTS

Gerard Duineveld	chief scientist	(dept. MEE, NIOZ)
Marc Lavaleye	scientist	(")
Eilke Berghuis	analytical technician	(")
Albert Kok	analytical technician	(")
Ian Jenness	scientist	(American Univ. of Cairo, Davis & Elkins College, US)
Adri Sandee	analytical technician	(NIOO/CEMO, Yerseke)
Willem Polman	technician	(dept. Zeetechniek, NIOZ)
Jan Blom	technician	(")
Jan Derksen	electronic technician	(dept. Electronics, NIOZ)
A. Souwer	Master	(Crew RV Pelagia)
H. Groot	First officer	(")
M. van Duyn	Officer	(")
J. Pieterse	Chief Engineer	(")
J. Seepma	Engineer	(")
P. Saalmink	boatsman	(")
R. v/d Heide	technician	(")
S. Kuipers	technician	(")
G. Steenhuizen	cook	(")

ACKNOWLEDGMENTS

We acknowledge the skillful assistance by and good cooperation with the crew of the RV Pelagia and the NIOZ -technicians during the shipboard operations. We also wish to thank Theo Buisman for the logistical support they have provided. The ship-time of this cruise was funded by NIOZ. Marc Lavaleye is employed under the EU OMEX-II contract (MAS3-CT97-0076). Partial support for Ian Jenness was provided by an institutional grant from the American University of Cairo.

1. BACKGROUND AND OBJECTIVES

Near continental margins cross-shelf and subsequent downslope transport of shelf-derived organic matter (OM) may add to the vertical rain of local production over the slope. As a result, sediments on the continental rise and slope may become deposit centres of organic carbon and consequently of augmented benthic mineralisation and benthic biomas as was found to be the case on the US atlantic and Pacific margins.

During OMEX-I, concerted efforts were made to find evidence for similar processes occurring on the Celtic slope (Goban Spur, NE-Atlantic). The oxygen consumption of the sediment communities (SCOC) on the slope, which on an annual basis equals the carbon consumption, showed a more or less constant level on the upper and mid slope (500-1500m) followed by a steep drop beyond this depth zone. These results indicate that there are no pronounced accumulations of easily degradable OM. The biomass distributions of meio- and macrofauna consistently showed similar down-slope decreases supporting the outcome of the SCOC measurements. By contrast, the large megafauna showed two distinct deep biomass maxima. One was a belt of filter-feeding sponges located at the mid-slope where increased current velocity and turbulence was measured near the sea floor. The second megafauna biomass peak was found at the lower slope (>3500m) and consisted solely of large sea-cucumbers. Stations where these large deposit-feeding organisms were caught were, at the time of the collection, covered with a mucus layer of phytodetritus which originated from an offshore late-summer bloom. Analysis of the gut contents of the sea-cucumbers made it clear that they had exclusively fed on the mucus top-layer of the sediment suggesting a close link between these organisms and the phytodetritus layer. Nevertheless, since the phytodetritus pulse was clearly an offshore event, it did not contribute to the evidence for the importance of lateral transport of OM to abyssal depths across the Goban Spur.

A more pronounced lateral export of organic matter is to be expected on highly productive shelf edges with coastal upwelling. The OMEX-II project, therefore, focuses on the Atlantic Iberian continental margin where in summer upwelling occurs due to prevailing northern winds. The upwelling systems on the Pacific and West African coast, both of which are driven by eastern boundary currents, have a deep, high deposition maximum in common with high rates of benthic respiration that are fueled by lateral transport. Also in other major upwelling systems, such as off Peru and Oman, lateral transport plays an important role in the redistribution and accumulation of organic material produced in the near-shore photic zone.

The response of benthos in terms of abundance to the enhanced productivity in upwelling systems seems to be quite variable. This is partly due to the local hydrographic conditions and especially on the oxygen saturation of the water over the slope. An observation common to all the benthic studies carried out in upwelling as well as non upwelling slopes, is the comparatively prominent response of megafauna to an increase of the food supply. This makes the megafauna a promising instrument for discriminating regions with varying organic supplies. A second reason why megabenthos forms a suitable tool for delimiting habitats, is their broad size range in combination with their morphological diversity. Because of this, the group gives a much more clearer signal about changing conditions than do macro- and meiofauna which are subject to constraints imposed by the surrounding sediment. Megafauna may also have a significant impact on the cycling of OM as well. Large animals are responsible for many of the topographical features (e.g. casts, crawl tracks) on the deep seafloor and thereby contribute to sediment mixing and subsequent burial or mineralisation of carbon.

The present and subsequent benthic biology cruises aim at investigating the existence of depo-centers of labile organic carbon on the Iberian margin (through a benthos surveys), to measure the importance of such centers in terms of carbon assimilation (by in-situ SCOC and growth measurements), and attempt to trace the sources fueling such centers (phytopigment analyses). Next to insight into the coupling between responses of benthic communities and the fluxes of carbon in the OMEX area, separate results of our contribution are of importance for other OMEX disciplines. While the video/trawl survey yields a basis for planning benthic sampling, the *in-situ* SCOC data form an important deliverable for the modeling efforts in OMEX-II.

2. METHODOLOGY

The present cruise is a pilot study with the primary aim to make an extensive survey of the sea floor topography and its inhabitants prior to any detailed local sampling and *in-situ* measurements in later cruises. Sampling was initially planned along three transects (see below) i.e. one crossing the shelf and slope off La Coruna and ending on the abyssal plain. The objective of this transect was to compare the data with those of OMEX-I where similar depths were reached. Another transect was planned at latitude 42° 40'N ending at the Galicia Bank. The last transect was scheduled along latitude 42° N. Unfortunately, time turned out to be too short to actually sample all three transects and sediment sampling on the last transect had to be cancelled

A seismic survey was made of each transect with a 3.5 Kc to locate proper sampling locations. A video-Agassiz trawl was used for mapping the megafauna and the small-scale topography (ripple marks, burrows, mounds etc.) of the sea floor. As a standard procedure, trawling was preceded by a small-scale survey with the 3.5 Kc Echosounder. At each trawling station, we made a CTD profile of the water column and simultaneously collected samples from the near-bottom water. Sediment samples were also collected with box- or multi-corer for the following analysis: macrofauna (>0.5 mm), meiofauna (> 0.3 mm), mesofauna, phytopigments, nucleic acids, C/N and porosity.

As in the OMEX-I program, individual phytopigments in the near-bottom water and the surface sediment will be used as biomarkers for quality and origin of the phytodetritus. As an indicator for the growth condition of epifaunal and infaunal organisms, we will use their RNA:DNA ratio's. For this purpose, also tissue samples of various megafauna organisms were collected.

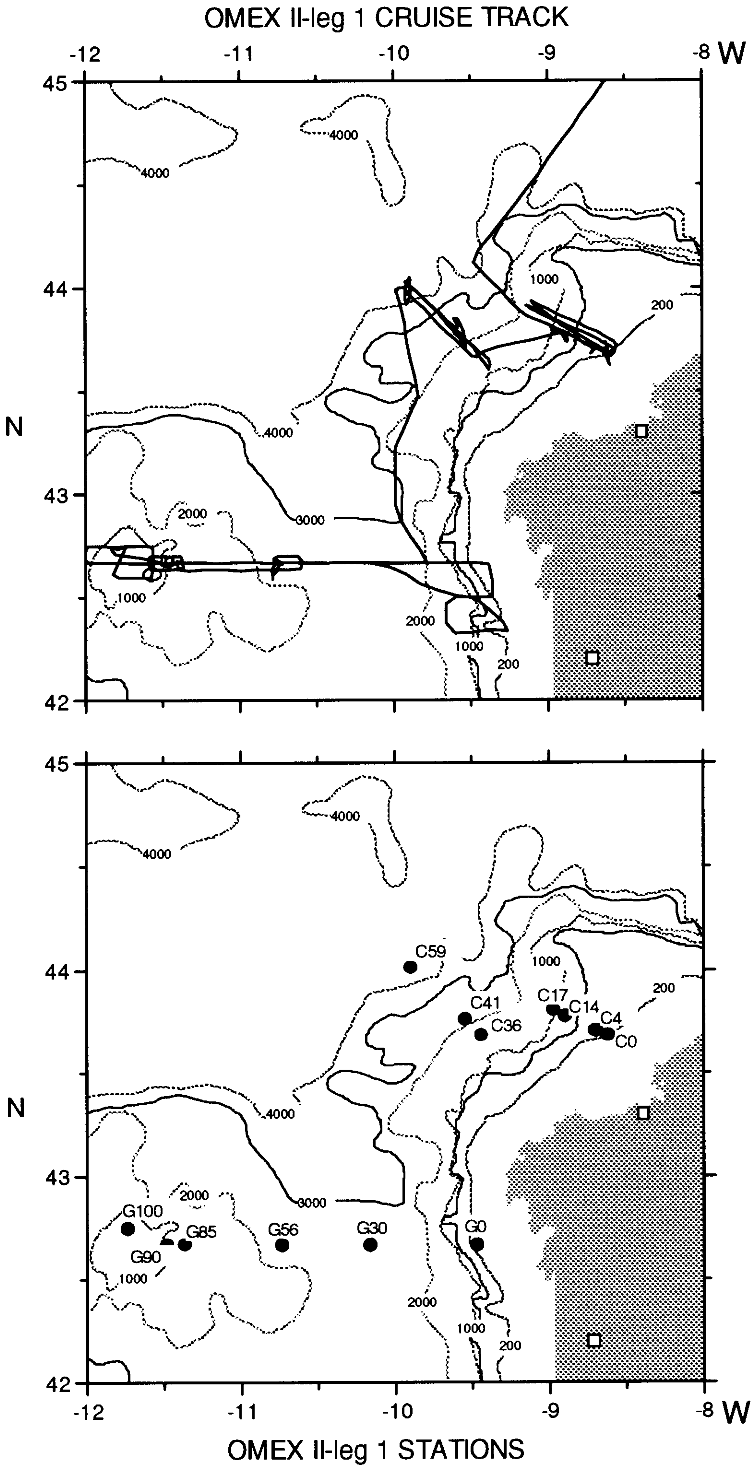
Finally, we made preliminary measurements of SCOC in shipboard incubated cores of 30 cm diameter. The latter measurements are supplemented with diffusive O_2 flux estimated based on shipboard micro-profiles of porewater oxygen. Later cruises are scheduled to continue these studies with in-situ measurements of sediment community respiration (SCOC). For more details on the methods used, consults the relevant chapters.

3. STUDY AREA and STATION LIST

Fig.1 shows the cruise track within the study area with the geographic position of the sampling stations depicted.

All the relevant information on the geographic position of the station, the date and time of sampling, the type of samples has been compiled in Appendix A representing a diary of events.

Fig.1



OMEX II-leg 1 CRUISE TRACK
-12
-11
-10
-9
-8 W
45
44
43
42
N
4000
4000
4000
3000
2000
1000
2000
1000
200
1000
200
G100
G85
G90
G56
G30
G0
C59
C41
C36
C17
C14
C4
C0
OMEX II-leg 1 STATIONS

4. TECHNICAL REPORT "DIENST ZEETECHNIEK" (W. Polman, Jan Blom)

Dinsdag 24 juni zijn we begonnen met het opspoelen van de kevlar kabel, en het aansluiten van de containers op water en gassen. Na aankomst in het gebied zijn we vrijdag 27 juni begonnen met het prepareren van de Agassiz trawl en sleep wand. De Agassiz trawl moet nog voorzien worden van een verstel strip voor de sleep spruit, zodat de trawl goed ten opzichte van de bodem afgesteld kan worden.
De accu van de power pack gaf onvoldoende stroom om de start motor rond te laten draaien, ondanks dat de accu aan de lader stond. We hebben de accu nog geladen maar dat mocht niet baten, toen maar de nieuwe accu geinstalleerd.
Zaterdag 28 Juni is begonnen met de bodem bemonstering met de box-corer, multi-corer, Agassiz trawl. Op sommige stations kregen we niet meer dan 5 - 15 cm in de boxcorers (K5 en K12). Hetzelfde gold voor de multi-corer. Dit als gevolg van een harde, compacte bodem onder een dunne laag zacht sediment.
Geregeld blijkt dat de multicore niet optimaal werkt. De grote pijpen lopen leeg omdat de onderste dop er niet goed onder komt. We hebben het elastiek en de veren strakker afgesteld, maar veel helpt dit niet. De volgende werkzaamheden zijn tijdens de reis uitgevoerd aan de box-corers: frame van de K5 gelast omdat dit was gescheurd, en bij de K12 zat er een braam aan de vergrendel pen zodat de corer niet tripte. Dit werd met de vijl verholpen. Daarna werkte de boxcore weer prima. Verder is gebleken dat 1 mes en 2 bodemplaten met rubber matjes te kort materiaal is om goed mee te kunnen werken. De boxcore kisten behorend bij de K5 en K12 hadden aangevuld moeten worden door de vorige DZT ploeg.

5. TECHNICAL REPORT ELECTRONICS (Jan Derksen)

CTD. Het CTD systeem heeft het gedurende de hele tocht goed gedaan. De configuratie van de Seabird SBE 911 plus CTD was als volgt:

Temperatuur sensor, Seabird SBE-3
conductiviteit sensor, Seabird SBE-4
Zuurstof sensor, Seabird
Fluorometer, Chelsea
Transmissometer, Seatech 25cm pathlength

Tijdens de cruise heeft het "onderweg meetsysteem (ABC systeem)" bijgestaan en zijn de volgende gegevens verzameld:

navigatie:	DGPS, sercel
	GPS, furuno
	log, log ben
	Gyro compas
diepte:	echolood brug, furuno
	echolood meetlab, 3.5 KC NIOZ
opp. water:	temperatuur, Chelsea
	saliniteit, Chelsea
	fluorescentie, Chelsea

Deze gegevens worden naar het NIOZ gebracht op tape. Deze gegevens worden alleen op verzoek verder verwerkt. Kontakt verloopt via DMG op het NIOZ. Tijdens het gebruik van de CTD bleek dat de stappenmotor wat aan de zware kant draait; deze moet eigenlijk weer een keer schoon gemaakt worden.Tijdens de tocht is er gelegenheid gegeven voor het testen van de nieuwe CTD. Voor de resultaten hiervan, zie vaarverslag afd. Elektronica.

3.5 KC echolood. In het begin kregen we heel veel 9999 waardes uit de depth digitizer. Ik kon niet zo snel vinden wat er aan de hand was en heb toen de TVG wat opgevoert, dat leek wel een beetje te helpen, maar dat was het niet helemaal. Ik kon hem namelijk bij blijven stellen. Ik heb besloten om hem maar een keer van voor tot achter af te regelen, mede doordat hij zo af en toe via de ingang terug aan het fluiten was, als de TVG wat meer ging versterken. Dit heb ik verholpen door de koppel condensator na de uitgang van de TVG weg te halen. Nadat de TVG weer goed in te stellen was, kwam ik er al snel achter dat het echte probleem lag aan het blanking circuit. Dit circuit is behoorlijk instabiel en loopt op een gegeven moment vast tegen de voedings spanning. Ik heb dit circuit nu losgekoppeld en de blanking uit de TVG print gehaalt. Daar zat er namelijk ook nog een. Die heb ik domweg via een diode aan de bottom detect pin aangesloten, werkt perfect. Verder heb ik de condensator over de weerstand aan de + ingang van de gelijkrichter weggehaal. Dit leverde een veel beter signaal op na de intergrator.

Chirp. We hebben de chirp maar heel even in combinatie met de 3.5 KC gebruikt. door de interlace functie van de chirp met de 3.5 KC heb je toch wel veel blinde plekken in het diepte bereik mede doordat er veel diepteverschil was en dat men de plaatjes van de 3.5 KC erg op prijs stelde hebben we besloten om alleen de 3.5 KC te gebruiken. Zelfs zo veel dat ik niet eens in de gelegenheid geweest ben om een traject met de chirp te varen zonder de 3.5 KC (om het signaal op te kunnen nemen.)

Video camera. Een lamp van de camera bleef continue branden. Het bleek dat de stuur FET kapot was. Die heb ik vervangen en sindsdien werkt de kamera uitstekend. Ik vermoed dat dit gekomen is doordat er een keer een lamp kapotgeslagen is en sluiting veroorzaakt heeft. Er was namelijk ook een zekering gesprongen.

6. SHIPBOARD OXYGEN CONSUMPTION (E. Berghuis, A. Kok)

Sediment community oxygen consumption (SCOC) was measured in decompressed cores of 30 cm diameter on board ship. For these measurements we took two intact boxcore samples contained in their original (polyester) coretube. The boxcorer used for collecting these,, and other cores is equipped with a top valve to prevent leakage during ascent. This was checked by comparing concentrations of dissolved O_2 in the overlying water with those in the deepest CTD bottle. After sealing the incubation cores with a lid holding a stirrer and O_2 probes (Yellow Spring Instr.), they were transferred to a thermostatically controlled incubator set at bottom temperature. The O_2 decrease in the overlying water was continuously monitored and recorded. The initial linear decrease of O_2 was used for calculating the sediment respiration. The electrode readings were checked with the O_2 concentration which was determined following the spectrophotometric method of Pai *et al.* (1993).

The multi-core samples used for porewater oxygen profiling were collected with dividable coretubes in order to reduce the degree of disturbance due to manipulations. The microprofiles were made on board in a thermostattically controlled room using a NIOZ microprofiler equipped with Diamond ® electrodes (>20 um tip). A stepwise resolution of 0.01 mm was used. During profiling the headspace was continuously 'stirred' by means of a Gilson pump. A resistivity profile was made of each core. Fig.2 shows examples of a O_2 profile in a shelf sediment and a deep sea sediment.

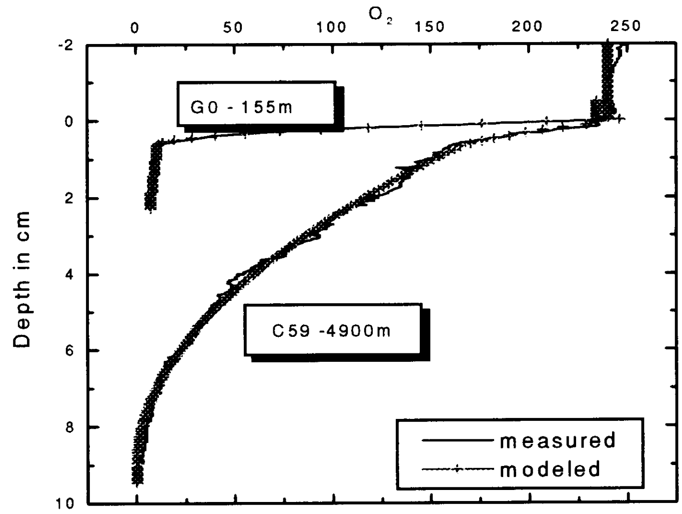


Fig.2. O_2 profile in sediment.

7. SEDIMENT and TISSUE SAMPLES (M.I. Jenness)

At each station sediment cores were collected for laboratory analysis of phytopigments (HPLC) and of nucleic acids (RNA, DNA). The cores, 62 mm in diameter, were taken either with the multi-corer, or as sub-cores from 0.25 m^2 box-cores. When possible, replicate cores from two samples were taken at each station. The sub-cores were immediately transferred to a thermostatically controlled container (2-11°C) where the remaining overlying water was gently removed and the sediment core subsequently sectioned to provide samples of 0 – 1 mm, 1-5 mm, 5-10 mm, 10-20 mm and 20 – 30 mm. Selected cores from each site were also sampled at 1 cm. intervals from 3 cm to 7 cm. All samples were immediately deep frozen at – 80° C.

Tissues for nucleic acid analysis and flow cytometric analysis was removed from selected species obtained from trawl samples. In the laboratory these tissues will be analysed with respect to their G_1/G_2 ratio (flow cytometer) and the RNA/DNA ratio (HPLC) both ratios being an expression of the activity on a cellular level (growth or metabolism). Species were selected for inclusion in this study based on a number criteria including: occurrence over a wide range of depth, large enough to provide sufficient tissue for testing and most importantly for their presumed importance in food web of the sediment surface. Animals selected for sampling were immediately removed from the trawl sample and transferred to a container where the temperature was maintained at a level consistent with the bottom water temperature. The animals were measured and dissected to remove various tissue components. In certain echinoderm species, gut contents were also removed for pigment analysis. Tissue samples were immediately frozen in liquid nitrogen and placed in the –80° C deep-freezer for transport back to the lab.

The top one centimeter of selected sediment cores (95 cm diameter) was collected for the analysis of foraminiferans and nematodes. Samples were preserved in 5% formalin for transport to the lab.

8. MEGAFAUNA SURVEY (M. Lavaleye)

The megabenthos was sampled with a 3.5m Agassiz-trawl equipped with a net of 1cm mesh-size.Two odometers were mounted on the trawl to measure the length of the fishing track. A door in the mouth of the net prevents catching pelagic animals during lowering and hauling. The beam of the trawl carries a programmable video camera, which provides a view just in front of the trawl. The trawl was successfully operated at the12 stations that were visited. The video camera worked well, except at station C0 where no pictures were obtained because of an accident with the light. Following is short account of the major features exposed by the video camera and the trawl catch.

The C (-oruña) transect: At the shallow shelf station C0 (180m), filter-feeding crinoids were very abundant. Surprisingly these crinoids were completely absent at the deeper station C4 (250m) situated just below the shelfbreak. It thus seems as if the shelf-break forms a marked border for some benthic species. Filter-feeders appear to be most abundant near the shelf-break though also on the deeper stations (C14, C17 and C36) filter feeders form the most important aspect of the megafauna community. Remarkably, the filter-feeding species differ at the different stations, starting with solitary corals (*Flabellum*) at C14, colonial corals (*Lophelia*) at C17, and small colonial sea-anemones at C36. The sea floor at all three station showed current ripples which run parallel to the coastline. At C36, next to these ridges, we saw terraces with short (40-50cm) but steep drop-offs at more or less regular intervals. In a cross section, the sea floor would look like a stair case with long low steps. The length of the terraces could be less than 25 meters. Both features, the ripple marks and terraces, point to relatively high current speeds which are oriented perpendicular to the coast. We noticed that both the corals at C14 and the sea-anemone at C36 lived in the depressions between ripples. At C41, filter-feeders still occur but deposit-feeders in the form of small purple sea-urchins (Irregularia) have gained numerical dominance. At C59, situated at the abyssal plain, deposit-feeders (holothurians) are completely dominating. Our first impression was that the benthic biomass at this station was relatively rich in comparison to the usually low biomass of megabenthos out on the atlantic abyssal plain. The proximity of C59 to the steep slope and the continent could be a reason for the relative high biomass at this depth. Both the deep stations C41 and C59 have a rather smooth bottom, with some "Lebensspuren" like small hills, pits and tracks.

The G(-alicia Bank) transect: The area around the shelf-break (G0) looked similar as on the C (-orunña) transect, i.e. crinoids are abundant above or at the shelf-break. Below the shelf break, crinoids are absent but filter-feeders remain relatively important in the form of small sea-pens (*Pennatula*). The steep continental slope did not allow to sample depths between 300 and 2000m. At the Galicia Bank this was only possible at the west-side of the Bank at 760m. Here, at station G100, the sediment looked coarse and consisted completely of pelagic foraminiferan shells. The colonial coral *Lophelia* is the most prominent megabenthos species on top of Galicia Bank. The video pictures showed it to occur in patches which are more or less evenly distributed over the area. In the areas between these patches, we observed solitary corals (*Flabellum*). The video furthermore showed that the bottom topography on Galicia Bank was similar as at C36, namely current ripples and terraces. Between Galicia Bank and the coast of NW Spain, we trawled at 2300m depth (G56 and G30) on both sides of a deep (3000m) channel. Strikingly, the megafauna at each station is dominated by a single species of sea-cucumber though the species are different. A difference between G56 and G30 is the common appearance of small (1cm) swimming clams (Pectinidae) at the latter stations. In other aspects the stations are very alike: on both we observed sparse Xenophyophoracea (too brittle to show up in the trawl-catch) and long filiform Gorgonaria.. The most abundant animal in the short haul at G85 (1800m) was a tusk-shell (Dentaliidae).

9. MACRO en MEIOFAUNA ONDERZOEK (A. Sandee, NIOO/CEMO)

Voor zowel de macro- als de meiofauna is een bemonstering uitgevoerd om de diverse soorten benthische organismen per diepte-laag te kunnen relateren aan de parameters: C, N, Chorophyll, korrelgrootte en porositeit.

Voor de macrofauna analyse is er per boxcore diepte-verdeling gemaakt van 0-10, 10-30, 30-50, 50-100 en 100-150 mm. Daarnaast is er een core genomen voor de mesofauna die vervolgens in dezelfde lagen is verdeeld.

Op ieder station zijn uit twee verschillende monsters (meestal de multi-cores) duplicaat monsters genomen voor meiofauna van 10 cm^2. Deze cores zijn onderverdeeld in de volgende lagen: 0-5, 5-10, 10-15, 15-20, 20-30, 30-40, 40-50 en 50-100mm.

Op station G56, zijn 3 extra boxcores (50cm diameter) genomen waaruit elk 2 vierkante subcores zijn gestoken. Deze laatsten zijn afgesloten met deksel en gekoeld opgeslagen aan boord. In de flume-tank in het NIOO/CEMO in Yerseke zal er met deze kernen experimenten worden uitgevoerd onder verschillende stroomsnelheden (samenwerking L. Thomsen, GEOMAR).

Op elk station is er een core genomen (meestal uit multicore) ten behoeve van een diepte profiel van de volgende sediment parameters: C, N, chlorophyll, korrelgrootte en porositeit. Deze cores gesneden in de lagen: 0-5, 5-10, 10-15, 15-20, 20-30, en verder in 10 mm dikke slices tot 100mm diepte.

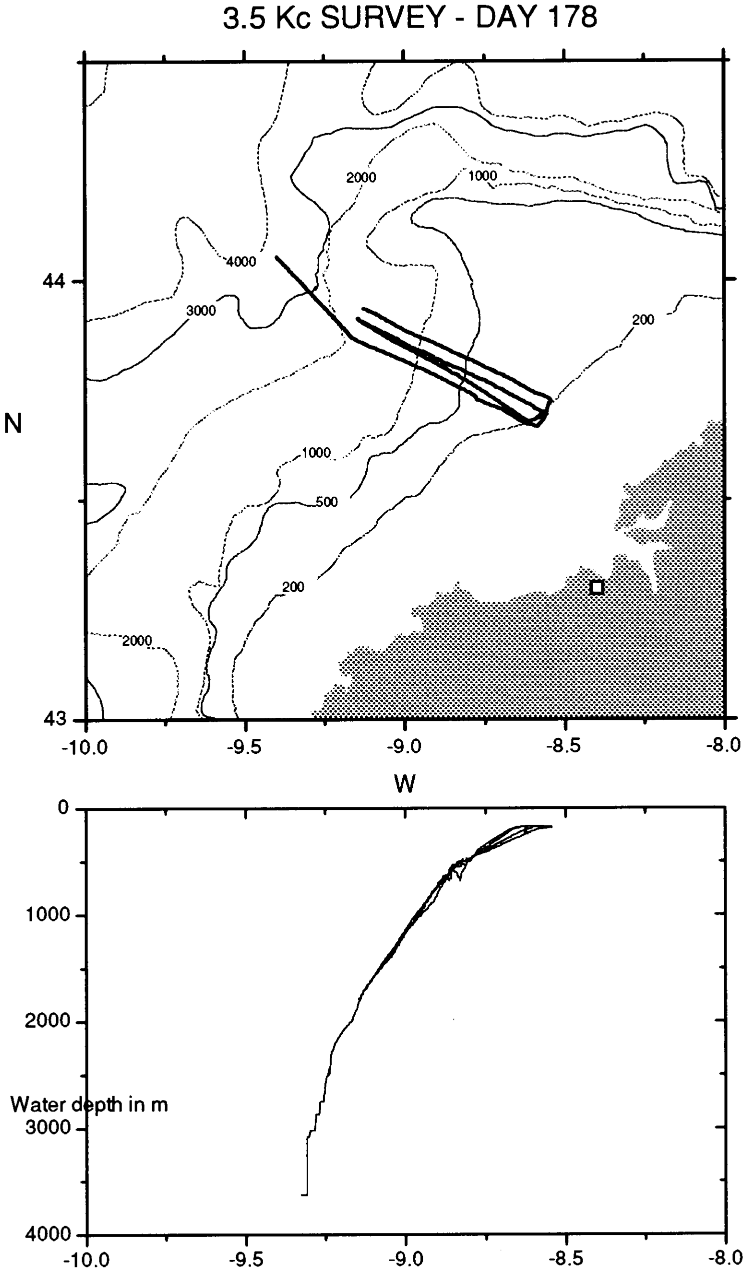
10. ECHOSURVEYS (M. Lavaleye)

During the compilation of this report, the data from two echosurveys were available for plotting. Fig. 3 and 4 show the position of the transects and the resulting depth profile. On both transect the steepness of the slope on the Iberian continental margin is clearly visible. Few areas were observed with noticeable layers of sediment. The plots will be available upon request for other parties going to sample the area.

11. CTD casts

Appendix B shows the CTD plots made at the sampling stations. There were no samples taken for nutrients. In the deepest sample from the near-bottom water, the oxygen concentration was determined in order to compare it with the value in the water overlying the boxcore samples.

Fig.3. Track of echo-survey with depth profile.



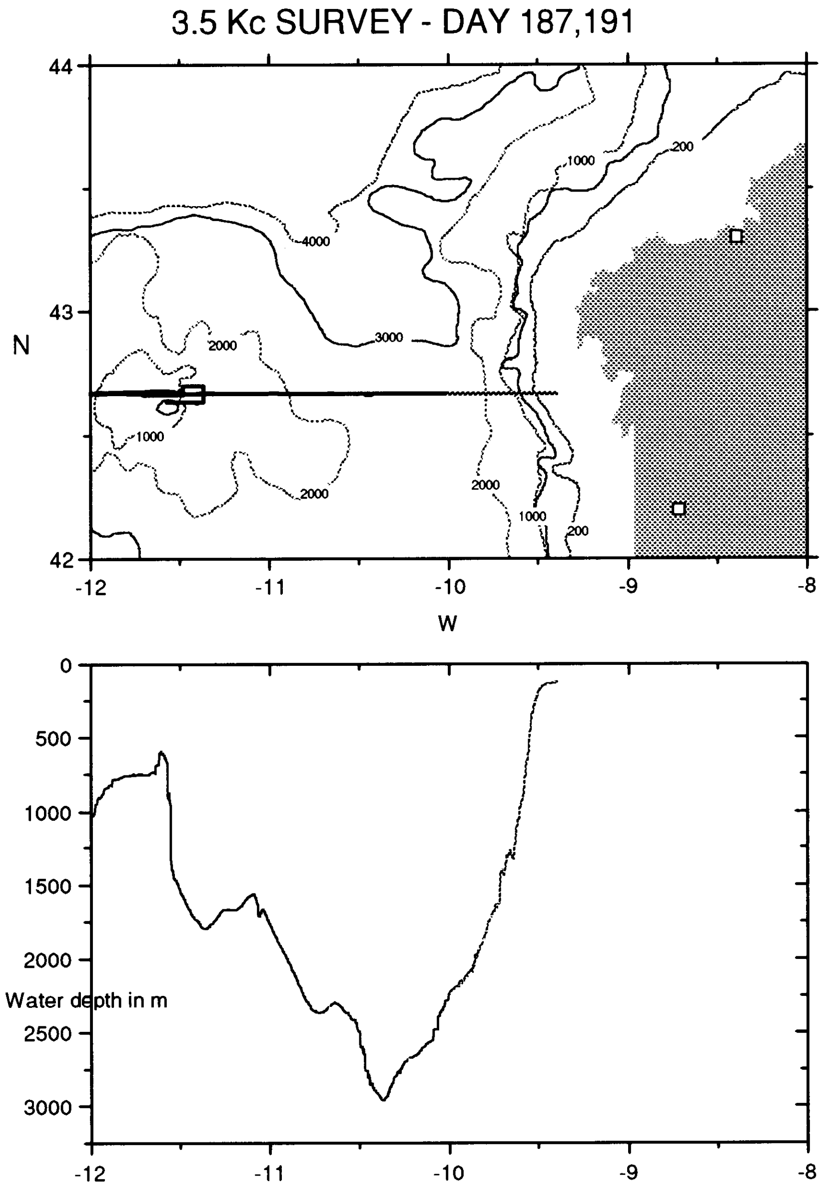


Fig.4. Track of echo-survey with depth profile.

Appendix A -Journal of events, including table with data.

Time is local time (GMT = local time minus 2 hours).

Monday, 23 June
Due to problems with the new CTD cable, the start of the OMEX II- leg 1 cruise is delayed which allows last-minute storage of some equipment. At 17.00 everything is ready, and the RV. Pelagia leaves the NIOZ-harbor at Texel, heading for NW Spain.

Tuesday-Thursday, 24-26 June
The continuously rough weather turns the 4 days it takes to reach to NW Spain at a speed of 10 knots into an unpleasant journey. The rolling ship, moreover, prevents any preparatory activity such as unpacking of materials, and the preparation of laboratories and equipment. The first satellite pictures of the surface temperature around NW Spain are coming in by e-mail via Peter Miller, showing there is indeed up-welling close to the coast of Cap Finistère.

Friday, 27 June.
At 01.00 a start is made with the survey of the La Coruña transect using the 3.5KC penetrating echo-sounder. We observe an abrupt transition between the flat abyssal plain at 4900m water depth and the steep continental rise. The survey of the margin itself reveals steep slopes, now and then intersected by sharp peaks or trenches. The echoes returning from the seabed are thin and dark showing no laminated deposits. This picture does not change much until the shelf-break is reached. The possibilities for sampling stations seem small. As the weather is improving and the ship is cruising at low speed for the echo survey, the laboratories and equipment can be prepared. Two other (shorter) echo-surveys are made 2 and 4 miles parallel to the first transect. In the evening, the first cast with the CTD at station C0 (178m) is made. A previous trial with the new CTD system failed, because the bottles of the rosette sampler didn't close.

Saturday, 28 June
At 03.00 the echo-survey is finished. At 08.00 sampling at station C0 is started. After a CTD, sediment sampling begins with the 30 cm diameter box-corer. After an initial failure, sampling proceeds smoothly. The bottom consists of fine sand, making the sieving for macrofauna over a 0.5mm mesh-size easy. Before lunch (12.30), the two cores for the deck-incubation are collected and the measurement of SCOC (sediment community oxygen consumption) is started. In the afternoon two successful drops are made with the multi-corer followed by the deployment of the Agassiz-trawl and video-camera. The catch contains many crinoids, shrimps and *Galathea*'s. Unfortunately, the video-lamp is broken and the images of the bottom are dark. During trawling, many sea-gulls gather around the ship turning the deck into a dangerous place to walk because of the rain of droppings.

Sunday, 29 June
Today is devoted to trawling. The trawl is successfully deployed at three different stations, viz. C4(250m), C14(700m), and C17(1000m). At C4 lots of shrimps and *Galathea*'s are caught. Strikingly crinoids, which were abundant at C0 (178m), are totally absent. Part of the Galathea's are prepared by the cook and eaten by the crew. Our expedition leader too tries them out, but quite soon has to pay tribute for this to the sea. At C14 (700m), the video shows

a rather coarse grained sediment with current ripples. In-between the crests of the ripples solitary corals (*Flabellum*) are living. They are the most abundant animals in the trawl. Station C17 (1000m) yields a similar picture, except that the solitary corals are replaced by colonial corals (*Lophelia*). Sea-cucumbers are getting more abundant here too, while large red crabs (*Geryon*), sea-urchins (*Cidaris* and soft bodied-urchins), a scorpion fish and a black shark belong to the conspicuous animals in the catch. Unfortunately, one of the coral patches has caused the loss of our second video lamp. Although the accident happened at the end of the haul and we get plenty of video-images, we have only one lamp left for the remainder of the cruise. To preserve this lamp, a safety cage is build. Sieving, sorting and dissecting of the animals from the trawl at C17 takes quite some time. As the trawl came on deck around 23.00 this working day becomes a long one.

Monday, 30 June
As the "Lophelia"-station C17 (1000m) looks the most interesting one of the three after comparison of the video images, we decide to sample there more intensively. However, the corers hardly penetrate into the sediment. After 5 failures with the small box-corer (empty, disturbed or not enough material) and another with the large box-corer, we give up and proceed to C14 (700m). However, the sediment appears to be more or less the same as at C17, and so are the results with the box-corers. As a last option we deploy the multi-corer and this, unexpectedly, yields the first successful samples. In the evening we steam to a transect 10 miles more to the west in the hope to find a more suitable sediment. During the whole night, echo-surveys are made of two parallel transects between 1500 to 4910m depth.

Tuesday, 1 July
The results of the echo-survey are not very promising. There is one spot at a depth of 1500m which is less steep than the rest of the transect, and we decide to make this station C36. Despite the hard echo of the bottom, sampling goes well. After the CTD, the multi-corer, large and small box-corer all come up with undisturbed samples. Having sieved the sediment, large brown tube-like Foraminifera (2cm) show up. Just before the trawl is lowered to the sea-floor we discover a problem in the video-camera. After a quick deliberation, we decide to go on with trawling. During trawling the tension of the cable shows large but regular fluctuations for which we don't have an explanation. The catch is good, a lot of fish especially *Synaphobranchus* and *Bathypterois* (see front cover). The most abundant animals, however, are small soft colonial anemones. The video images explain the variable tension readings i.e. the seabed consists of a series of terraces separated by a steep slope of about 40-50 cm height. At the sloping edges of the terraces the trawl got stuck but eventually broke loose with increasing tension. Everywhere the sediment on the terraces has ripple marks.

Wednesday, 2 July
The echoes from the seabed at station C41 (2200m) show a nice lamination, and for the first time during the cruise we have a soft muddy sediment. After the CTD, we lower the Agassiz trawl and fish for half an hour (standard procedure) over the bottom. Back at the surface, the net appears to be filled with mud and we have some problems with getting this load safely on board. Sea-urchins appear to be particularly common in the catch, especially a blue-purple Irregularia. Further the gorgonarian *Acanella* is abundant. A spectacular item is the large red spider-crab *Neolithodes*. A successful multi-core and large box-core complete the day.

Thursday, 3 July
Today we finish work at C41 by taking another large box-core sample for macrofauna, two incubation cores for SCOC and a multi-core. While sieving the cores we find a layer of very stiff clay at 15 to 20 cm depth. Large rigid, branched Foraminifera show up on the sieves. At 15.00 we steam to the last suitable sampling site left on this transect, i.e. the abyssal plain. During the transit we again observe on the echo-recordings the abrupt change from the steep slope to the flat abyssal plain covered with sediment layers. After arrival at station C59 (4910m) there is still time to take a CTD.

Friday, 4 July
The multi-corer at C59 does not function as good in this kind of sediment (deep-sea clay) as we had hoped, i.e. all the 4 large diameter cores are empty. We have some problems with the large box-corer as well: after one good sample, the second one failed. The box-corer has not been released, and we almost loose the core-tube as it almost detached itself from the frame. Fortunately, the third attempt is successful again. On the sediment surface we observe several whitish spherical Foraminifera (ca. 8mm in diameter). The first incubation core is almost a failure, because it penetrated very deep into the sediment. In the meantime a group of more than 10 pilot whales pays us a visit. We finish the sampling with a second incubation core.

Saturday, 5 July
Although we have tightened the springs operating the closing lids on the multi-corer, the instrument still does not function well though the sediment is easy to sample with a manual corer. Again several multi-core tubes are empty. Trawling at this depth takes about five hours. The actual fishing time of this period is only one hour. Although the catch at a first sight looks meager, we find five large sea-cucumbers in the net which is quite a lot for this depth and the distance covered. The sea-cucumbers are immediately dissected at 2º C for tissue and gut content analyses. The video-images are very clear, and prove that we have solved the problem of the dust clouds by removing the protective ground net from the trawl. Comparatively speaking, the abyssal plain at C59 seems to be rather rich in animal life. After a second unsuccessful trial with the new CTD, we leave the La Coruña transect and steam to the Galicia Bank transect.

Sunday, 6 July
At 01.00 we start with an echo-survey of the new transect. The deeper part in-between the coast and the Bank is not as flat as we had expected, and parts with soft sediment (as indicated by lamination in the echo signal) are rare. The decision where to sample can, however, be postponed because the sea is too rough to work with heavy equipment. So everybody can catch up with his work, and besides we have a birthday party. In the meantime the echo-survey is continued.

Monday, 7 July
During the night, an echo-survey is made of the Galicia Bank proper. At the west side of its top we find a plateau with a somewhat irregular surface. The echo-recordings suggest that it is covered by a hard substrate. Because there are no other possibilities at this depth (800m), we take the risk and make the plateau station G100. After the CTD, we take 8 small box-core samples. The sediment is rather coarse-grained like sand, and the overlying water in the box-core samples is always cristal clear. Microscopic examination of the sediment shows it to

consist entirely of pelagic Foraminifera, mainly *Globigerina*. Because of the coarse sediment we do not deploy the multi-corer nor the large box-corer, but instead take sub-cores from the small box-core samples. At 16.00 the Agassiz-trawl is deployed. After 22 minutes fishing time (instead of the normal 30 minutes at this depth) we start hauling. This turns out to be a wise decision as the net is completely packed with large pieces of the colonial coral *Lophelia*. With some effort we manage to get the whole load on deck without severe damage to the net. In-between the chunks of coral we notice several species of fish, large sea-urchins (*Cidaris*), and solitary corals. We also find numerous Bivalvia and Brachiopoda attached to the coral branches and polychaetes (Onuphidae) living inside the hollow stems. It takes a whole day to sort the catch properly. The video-images show that the corals grow in small patches amidst of large ripples. The latter indicate that the bottom currents must be rather high..

<u>Tuesday</u>, 8 July
G90 is our next station, situated at a depth of 1600m. On the basis of the echo-survey we do not expect serious problems with sampling. That is true for the CTD, but the multi-corer comes up empty. Two attempts with the large and heavy box-corer produce the same result. The sediment is so stiff that the rubber in the spade of the box-corer is wrinkled. After another unsuccessful attempt with the small box-corer, we leave for another station. The first sample at G85 (1800m) with the small box-corer is fine. The sediment is the same as at station G90, but beneath 20 to 30 cm there is a layer of much softer clay. Because we have no faith in the multi-corer or large box-corer here, we continue with the small box-corer. After the promising start the quality of the samples gets worse and worse, and the 4 extra trials only result in a few sub-cores. To make something of this disappointing day, we decide to deploy the trawl. At 20.00 the net disappears below the water surface. Again something is going wrong. Probably because of the humidity the tension gauge produces false readings and because of this the actual fishing distance is too short resulting in a meager catch. The large scaphopods in the catch make something up for this day, as we are using them for growth studies of deep-sea organisms.

<u>Wednesday</u>, 9 July
With new energy, we continue work at station G56 (2370m) situated west of the 3000m deep channel between the Galicia Bank and the coast of NW Spain. Sampling proceeds well, i.e. after three samples with the small box-corer, a successful multi-core sample is taken. Than there is set-back. After hearing a sharp hard noise, the chief engineer discovers that one of the ships hydraulic cranes is almost broken off, meaning that it is out of order for the rest of the cruise. Pleased that no personal accidents have happened, and after some delay, sampling is continued. Just before 12.30 the CTD is deployed. The time we hoped to gain by working during lunch-time is lost because the first large box-core sample is a failure due to a technical problem. The second large box-core sample for macrofauna is fine, but the multi-corer did not penetrate deep enough in the sediment. Just before dinner (18.00) the Agassiz-trawl is lowered. At 22.00 it is along side the ship again, but there is so much sediment in the trawl that it is not possible to lift it on board immediately. After some washing we manage to retrieve a cubic meter of sediment. We discover that because of the large amount of dead pteropod-shells the net was clogged. The catch is good and contains a lot of large blue sea-cucumbers. The video shows several large (1m length) whip-like gorgonarians.

<u>Thursday</u>, 10 July
The second day at station G56 has not a good start. Because of the same technical problem with the large box-corer as we had the previous day, we get a bad sample. The next two

samples are fine again and will be used for the flume experiment at the NIOO. After another failure (not released), the last core for the flume experiment at this station is on board at 14.00. Then follows a transit of 2.5 hours to the next station G30 at 2600m depth. We begin sampling with the large box-corer. Both samples that we take are successful. At 20.00 we start with the echo-survey of the remaining part of the Galicia Bank transect, from station G30 to the shelf-break.

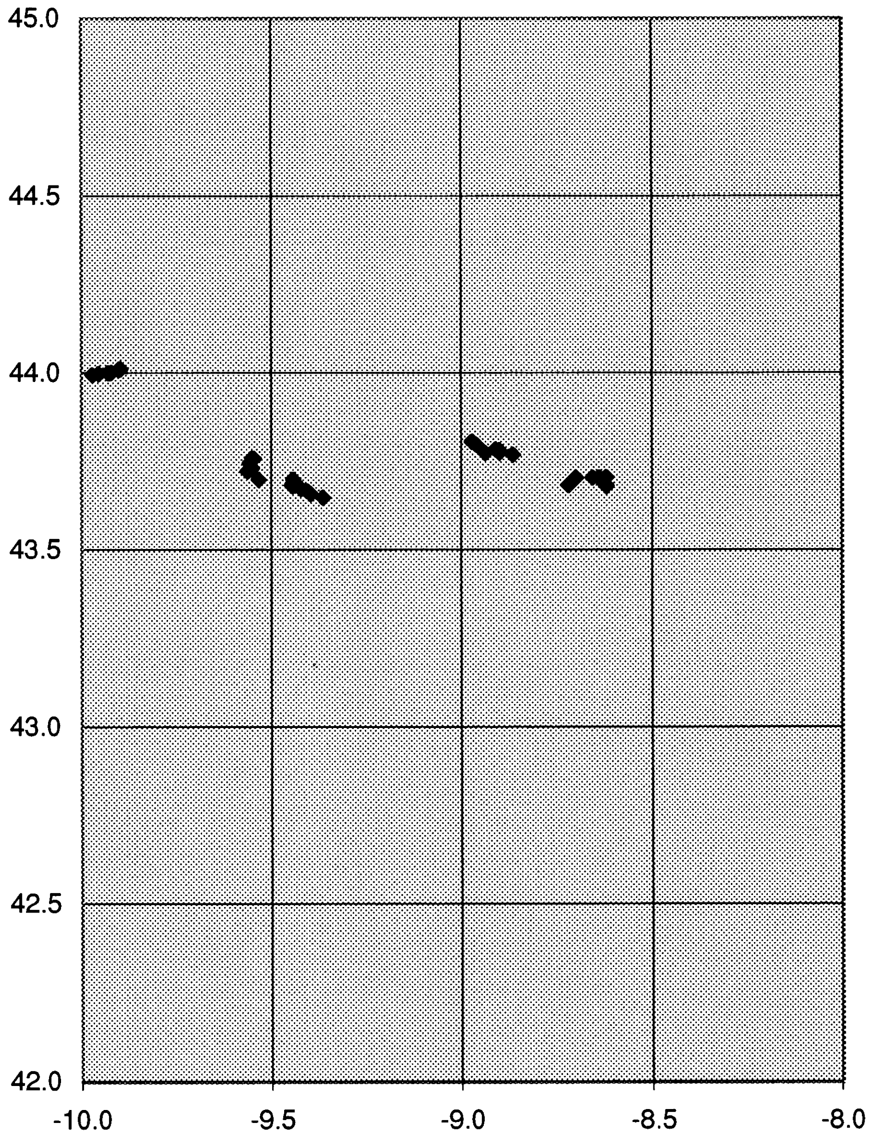
Friday, 11 July
As we do not find any suitable sampling site between 300 and 2500m depth on the continental slope, not even on two parallel transects south of the main transect, we decide to return to G30. After our arrival at 10.30 we try to collect two undisturbed cores for incubation measurements. However, all four samples that we take have large cracks at their surfaces and are subsequently sieved for macrofauna analysis. Trawling only takes 3.5 hours and the clean catch arrives on board at 20.40. The material is rather diverse but especially the 40 sea-cucumbers are welcome. The video-images show numerous small bivalves (Pectinidae) which by swimming try to escape from the net.

Saturday, 12 July
During the night we have made an echo-survey of the area around the shelf-break in order to find a suitable trawling track. Sediment sampling at station G0 (150m) proceeds rapidly. One CTD and 6 small box-core samples are coming up with good results. Only one of the box-core samples fails because the hard sediment (sandy-mud) has damaged the rubber sealing. Also the muli-corer is doing fine, i.e. all 12 cores are filled with sediment in the second multi-core drop. The trawl is deployed at a depth below the shelf-break (>200m) and is towed up-slope. The catch contains next to the expected crinoids, a lot of small *Pennatula*'s. The video-recordings reveal that the crinoids are absent below the shelf-break, but suddenly appear above that zone. The rest of the afternoon is devoted to an echo-survey of the southermost transect which will possibly be sampled during one of the next OMEX cruises. Meanwhile the crew enjoys a barbecue in splendid weather conditions.

Sunday, 13 July
While the echo-survey is continued, everybody is busy either finishing the last measurements or packing equipment and samples. At 17.00 we arrive in the harbor of Vigo. During the night the first draft of the shipboard report is finished.

Monday, 14 July
Still a lot of packing has to be done. The container with equipment for a cruise in Crete is packed in the morning and put on transport. A shipment of frozen samples is send by plane to the NIOZ while the crew and technicians are (un)loading equipment and containers for the next OMEX cruise. In the evening the participants of the first OMEX cruise, benthic biology, leave the ship. End of RV. Pelagia cruise 108.

TRACK



OMEX II-leg 1

3.5 Kc=	**SEISMIC SURVEY**
MC=	**MULTICORER**
klBC=	**BOXCORER 30cm diameter**
grBC=	**BOXCORER 50cm diameter**
TR=	**AGASSIZ-TRAWL & video**
Note=	**LMT=GMT + 2 Hrs**

STATION	DAY	DATE	TYPE	TIME	DEPTH	LAT		LON		COMMENTS	TIME LOC.
				GMT	m	degr N		degr W		(type of samples)	
	Fri	27-Jun-97	3.5 Kc							Start Survey	0050
	Fri	27-Jun-97	3.5Kc	0000		44	03.20	009	23.80		0200
	Fri	27-Jun-97	3.5Kc	0200		43	55.20	009	13.60		0400
	Fri	27-Jun-97	3.5Kc	0246		43	52.26	009	09.91		0446
	Fri	27-Jun-97	3.5Kc	0400		43	49.09	009	02.30		0600
	Fri	27-Jun-97	3.5Kc	0600		43	45.00	008	48.70		0800
	Fri	27-Jun-97	3.5Kc	0800						alter course	1000
	Fri	27-Jun-97	3.5Kc	0830		43	42.00	008	33.50	new transect	1030
	Fri	27-Jun-97	3.5Kc	1000		43	44.82	008	41.07		1200
	Fri	27-Jun-97	3.5Kc	1200		43	53.10	009	04.40		1400
C0	Fri	27-Jun-97	CTD	1830	175	43	40.98	008	37.18	file=OMEX001.CNV	2030
	Fri	27-Jun-97	3.5Kc	1930						start Survey transect	2130
	Fri	27-Jun-97	3.5Kc	2000		43	43.80	008	32.50	end Survey transect; start new transect	2200
	Sat	28-Jun-97	3.5 Kc	0110						end Survey Transect	
C0	Sat	28-Jun-97	CTD	0600	175	43	40.98	008	37.18	file=OMEX002.CNV	0800
C0	Sat	28-Jun-97	kl. BC	0624	175	43	40.88	008	37.15	failure	0824
C0	Sat	28-Jun-97	kl. BC	0651	175	43	40.89	008	37.21	macrofauna (NIOO)	0851
C0	Sat	28-Jun-97	kl. BC	0726	175	43	40.90	008	37.22	macrofauna (NIOO)	0926
C0	Sat	28-Jun-97	kl. BC	0829	175	43	40.92	008	37.23	macrofauna (NIOO)	1029
C0	Sat	28-Jun-97	kl. BC	0845	175	43	40.95	008	37.18	macrofauna (NIOO)	1045
C0	Sat	28-Jun-97	kl. BC	0903	175	43	40.96	008	37.22	macro+ mesofauna+porosity (NIOO)	1103

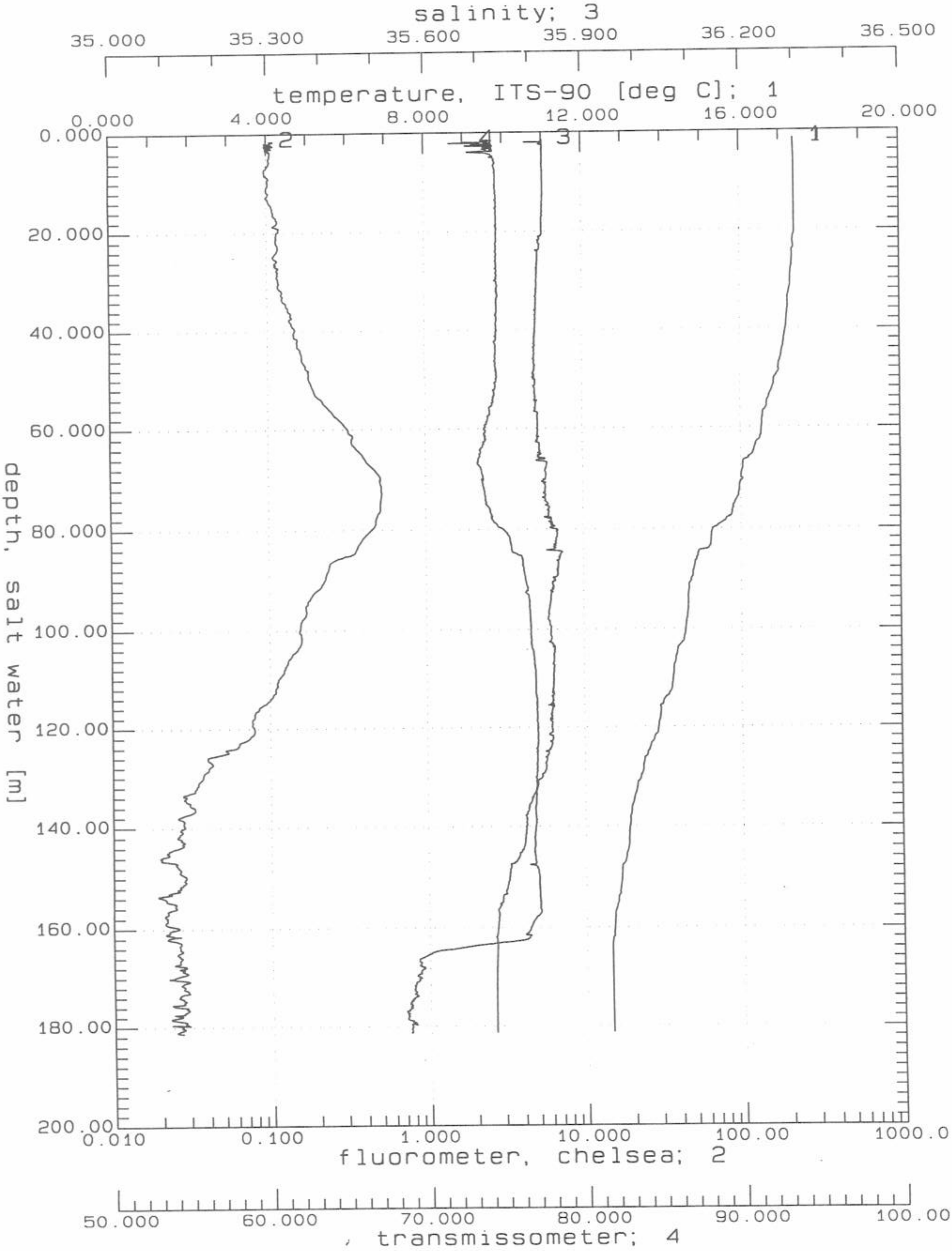
C0	Sat	28-Jun-97	kl. BC	0918	175	43	40.93	008	37.25	macrofauna (NIOO)	1118
C0	Sat	28-Jun-97	kl. BC	0934	175	43	40.96	008	37.25	deckincubation	1134
C0	Sat	28-Jun-97	kl. BC	0958	176	43	40.98	008	37.25	deckincubation	1158
C0	Sat	28-Jun-97	MC	1143	175	43	40.92	008	37.17	oxprof+resis+pigments/meio+CN+grainsize (NIOO)	1343
C0	Sat	28-Jun-97	MC	1217	174	43	40.94	008	37.19	oxprof+resis+pigments/CN+grainsize (NIOO)	1417
C0	Sat	28-Jun-97	TR	1422	194	43	42.27	008	38.33	bottom	1622
"	"	"	"	1516	201	43	42.29	008	39.31	lifted from bottom	1716
C0	Sat	28-Jun-97	MC	1658	181	43	40.97	008	37.17		1858
C4	Sun	29-Jun-97	CTD	0635	247	43	42.36	008	37.19	file=OMEX003.CNV	0835
C4	Sun	29-Jun-97	TR	0724	248	43	42.25	008	41.97	bottom	0924
"	"	"	"	0833	225	43	40.93	008	43.18	lifted from bottom	1033
C14	Sun	29-Jun-97	CTD	1228	748	43	46.86	008	54.05	file=OMEX004.CNV	1428
C14	Sun	29-Jun-97	TR	1425	766	43	47.03	008	54.62	bottom	1625
"	"	"	"	1607	620	43	46.17	008	51.93	lifted from bottom	1807
C17	Sun	29-Jun-97	TR	1808	982	43	47.75	008	57.56	bottom	2008
"	"	"	"	2018	780	43	46.51	008	56.28	lifted from bottom	2218
C17	Mon	30-Jun-97	CTD	0615	1025	43	48.32	008	58.32	file=OMEX005.CNV	0815
C17	Mon	30-Jun-97	kl BC	0722	1021	43	48.36	008	58.16	bad sample	0922
C17	Mon	30-Jun-97	kl BC	0848	1029	43	48.34	008	58.36	bad sample	1048
C17	Mon	30-Jun-97	kl BC	0944	1032	43	48.31	008	58.39	deckincubation	1144
C17	Mon	30-Jun-97	kl BC	1027	1026	43	48.34	008	58.28	bad sample	1227
C17	Mon	30-Jun-97	kl BC	1128	1026	43	48.28	008	58.24	bad sample	1328
C17	Mon	30-Jun-97	grBC	1239	1026	43	48.31	008	58.26	bad sample	1439
C14	Mon	30-Jun-97	grBC	1354	738	43	46.48	008	54.04	bad sample	1554
C14	Mon	30-Jun-97	MC	1456	733	43	46.85	008	54.03	meiofauna +porosity (NIOO)	1656
C14	Mon	30-Jun-97	MC	1549	734	43	46.89	008	54.00	CN+grainsize (NIOO)	1749
C36	Tue	01-Jul-97	CTD	0610	1540	43	40.99	009	26.53	file=OMEX006.CNV	0810
C36	Tue	01-Jul-97	MC	0744	1539	43	40.89	009	26.63	oxprof+resis+pigments/meiof+CN+grainsize+porosity (NIOO)	0944
C36	Tue	01-Jul-97	grBC	0901	1522	43	40.94	009	26.79	macrofauna (NIOO)	1101
C36	Tue	01-Jul-97	grBC	1003	1522	43	41.97	009	26.58	mesofauna (NIOO)	1203
C36	Tue	01-Jul-97	klBC	1140	1542	43	41.10	009	26.50	deckincubation	1340
C36	Tue	01-Jul-97	klBC	1227	1540	43	40.99	009	26.51	deckincubation	1427
C36	Tue	01-Jul-97	MC	1339	1540	43	41.06	009	26.46	oxprof+resis+pigments/meiof+CN+porosity (NIOO)	1539
C36	Tue	01-Jul-97	TR	1541	1470	43	40.42	009	25.34	trawl on bottom	1741
"	"	"	"	1623	1425	43	40.01	009	24.32	weight on bottom	1823
"	"	"	"	1656		43	39.52	009	23.81	start hauling	1856
"	"	"	"	1759	1306	43	38.93	009	21.89	lifted from bottom	1959
C41	Wed	02-Jul-97	CTD	0614	2204	43	45.51	009	32.82	file=OMEX007.CNV	0814
C41	Wed	02-Jul-97	TR	0951		43	44.75	009	33.49	bottom	1151
"	"	"	"	1033	2150	43	43.90	009	33.03	stop paying out cable	1233
"	"	"	"	1104		43	43.33	009	33.75	start hauling	1304
"	"	"	"	1251	1800	43	41.94	009	32.06	lifted from bottom	1451
C41	Wed	02-Jul-97	MC	1530	2200	43	45.52	009	32.71		1730

C41	Wed	02-Jul-97	grBC	1720	2200	43	45.46	009	32.77	macrofauna (NIOO)	1920
C41	Thu	03-Jul-97	grBC	0649	2200	43	45.43	009	32.81	macrofauna (NIOO)	0849
C41	Thu	03-Jul-97	klBC	0851	2200	43	45.37	009	33.00	deckincubation	1051
C41	Thu	03-Jul-97	klBC	0947	2200	43	45.47	009	33.00	deckincubation	1147
C41	Thu	03-Jul-97	MC	1147	2189	43	45.37	009	32.82	oxprof+resis+pigments/meiof+CN+grainsize+porosity (NIOO)	1347
C59	Thu	03-Jul-97	CTD	1652	4900	44	00.69	009	54.00	file=OMEX008.CNV	1852
C59	Fri	04-Jul-97	MC	0721	4909	44	00.67	009	54.06	oxprof+resis+pigments/meiofauna+CN+grainsize+porosity (NIOO)	0921
C59	Fri	04-Jul-97	grBC	0933	4909	44	00.63	009	54.10	macrofauna (NIOO)	1133
C59	Fri	04-Jul-97	grBC	1205	4909?	44	00.66	009	54.00	failure	1405
C59	Fri	04-Jul-97	grBC	1354	4909?	44	00.66	009	53.86	mesofauna (NIOO)	1554
C59	Fri	04-Jul-97	klBC	1541	4909	44	00.67	009	54.01	deckincubation	1741
C59	Fri	04-Jul-97	klBC	1738	4909	44	00.68	009	54.01	deckincubation	1938
C59	Sat	05-Jul-97	MC	0711	4909	44	00.68	009	54.04	oxprof+resis+pigments/meiof+CN (NIOO)	0911
C59	Sat	05-Jul-97	TR	0959	4909	44	00.10	009	55.28	trawl on bottom	1159
"	"	"	"	1020	4907	44	00.05	009	55.78	weight on bottom	1220
"	"	"	"	1121	4907	43	59.97	009	57.31	begin hauling	1321
"	"	"	"	1205		43	59.74	009	58.28	lifted from bottom	1405
	Sat	05-Jul-97	3.5Kc	2336						Start Survey 5 Knots	2536
	Sun	06-Jul-97	3.5Kc	0000		42	40.00	009	51.00	"	0200
	Sun	06-Jul-97	3.5Kc	0200		42	40.00	010	02.60	"	0400
	Sun	06-Jul-97	3.5Kc	0400		42	40.07	010	18.07	start transect 42o 40'	0600
	Sun	06-Jul-97	3.5Kc	0530		42	40.06	010	30.29	new course	0730
	Sun	06-Jul-97	3.5Kc	0630		42	39.79	010	26.16	new course to Galicia Bank due to sea	0830
	Sun	06-Jul-97	3.5Kc	1000		42	40.00	010	49.62		1200
	Sun	06-Jul-97	3.5Kc	1200		42	40.00	011	05.00		1400
	Sun	06-Jul-97	3.5Kc	1945		42	39.96	011	59.83	end of seismic transect	2145
G100	Mon	07-Jul-97	CTD	0802	763	42	44.96	011	44.14	file=OMEX009.CNV	1002
G100	Mon	07-Jul-97	klBC	0858	764	42	44.96	011	44.18	macrofauna (NIOO)	1058
G100	Mon	07-Jul-97	klBC	0927	764	42	45.06	011	44.13	macrofauna (NIOO)	1127
G100	Mon	07-Jul-97	klBC	0956	764	42	45.00	011	44.13	CN+grainsize (NIOO)	1156
G100	Mon	07-Jul-97	klBC	1125	764	42	44.93	011	44.08	deckincubation	1325
G100	Mon	07-Jul-97	klBC	1159	764	42	44.88	011	44.17	deckincubation	1359
G100	Mon	07-Jul-97	klBC	1235	764	42	44.85	011	44.33	meiof+CN+grainsize+porosity+mesofauna (NIOO)	1435
G100	Mon	07-Jul-97	klBC	1309	764	42	44.93	011	44.21	macrofauna (NIOO)	1509
G100	Mon	07-Jul-97	klBC	1341	764	42	44.91	011	44.22	macrofauna (NIOO)	1541
G100	Mon	07-Jul-97	Tr	1441	767	42	44.75	011	45.08	trawl on bottom	1641
"	"	"	"	1511	765	42	44.54	011	46.01	stop paying out cable	1711
"	"	"	"	1532	767	42	44.45	011	46.71	begin hauling	1732
"	"	"	"	1617	773	42	44.19	011	48.20	lifted from bottom	1817
G90	Tue	08-Jul-97	CTD	0610	1601	42	39.99	011	28.86	file=OMEX010.CNV	0810
G90	Tue	08-Jul-97	MC	0744	1597	42	39.92	011	28.91	bad sample	0944
G90	Tue	08-Jul-97	grBC	0842	1597	42	39.94	011	28.91	bad sample	1042

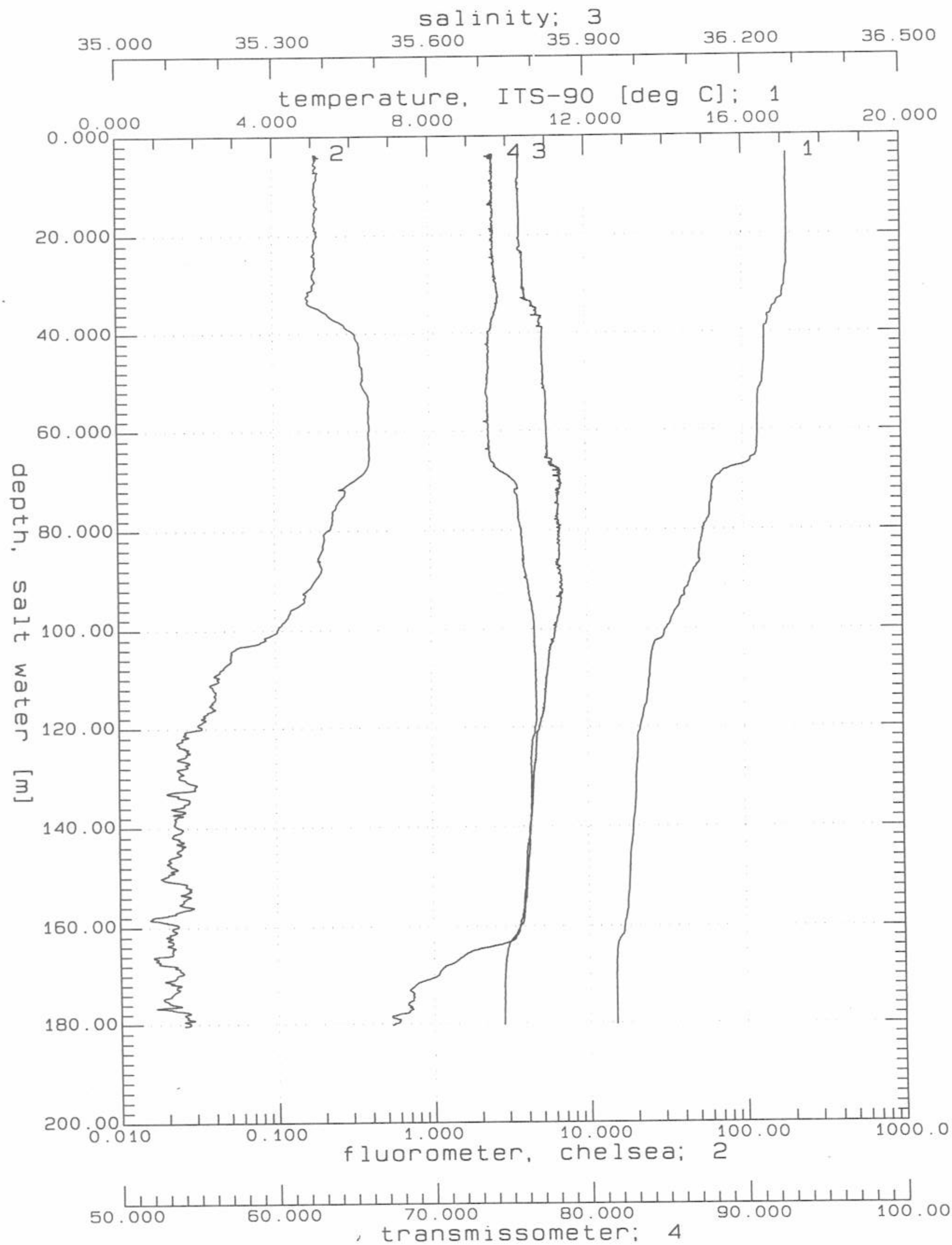
G90	Tue	08-Jul-97	grBC	0933	1593	42	39.94	011	28.99	bad sample	1133
G90	Tue	08-Jul-97	klBC	1133	1594	42	39.93	011	29.01	bad sample	1333
G85	Tue	08-Jul-97	klBC	1305	1794	42	40.06	011	22.08	macrofauna (NIOO)	1505
G85	Tue	08-Jul-97	klBc	1351	1798	42	40.98	011	22.04	mesofauna+meiofa+CN+grainsize+porosity (NIOO)	1551
G85	Tue	08-Jul-97	klBC	1441	1799	42	39.98	011	22.02	1 core (NIOO)	1641
G85	Tue	08-Jul-97	klBC	1525	1801	42	40.12	011	22.10	bad sample	1725
G85	Tue	08-Jul-97	klBC	1701	1801	42	40.08	011	22.06	bad sample	1901
G85	Tue	08-Jul-97	TR	1849	1770	42	40.74	011	24.21	trawl on bottom	2049
"	"	"	"	1906	1760	42	40.67	011	24.34	stop paying out cable	2106
"	"	"	"	1925	1755	42	40.55	011	24.41	start hauling	2125
"	"	"	"	2007	1750	42	39.98	011	24.24	lifted from bottom	2207
G56	Wed	09-Jul-97	klBC	0648	2378	42	40.02	010	43.98		0848
G56	Wed	09-Jul-97	klBC	0738	2378	42	40.00	010	43.98	deckincubation	0938
G56	Wed	09-Jul-97	klBC	0836	2368	42	39.96	010	44.01	deckincubation	1036
G56	Wed	09-Jul-97	MC	0934	2372	42	39.97	010	43.99	oxprof+resis+pigments/meiof+CN+grainsize+porosity	1134
G56	Wed	09-Jul-97	CTD	1016	2365	42	39.88	010	44.09	file=OMEX011.CNV	1216
G56	Wed	09-Jul-97	grBC	1239	2368	42	39.95	010	43.98	failure	1439
G56	Wed	09-Jul-97	grBC	1351	2373	42	39.95	010	43.97	macrofauna +mesofauna (NIOO)	1551
G56	Wed	09-Jul-97	MC	1505	2377	42	39.99	010	44.02	CN (NIOO)	1705
G56	Wed	09-Jul-97	TR	1645	2287	42	38.87	010	44.81	trawl on bottom	1845
"	"	"	"	1724	2226	42	38.01	010	44.36	stop paying out cable	1924
"	"	"	"	1758	2185	42	37.44	010	46.02	start hauling	1958
"	"	"	"	1851	2140	42	36.78	010	47.02	lifted from bottom	2051
G56	Thu	10-Jul-97	grBC	0706	2371	42	39.95	010	44.07	failure	0906
G56	Thu	10-Jul-97	grBC	0819	2371	42	39.93	010	43.94	1 flume exp+CN (NIOO)	1019
G56	Thu	10-Jul-97	grBC	0939	2372	42	39.97	010	44.14	2 flume exp+CN (NIOO)	1139
G56	Thu	10-Jul-97	grBC	1046	2374	42	39.94	010	44.22	failure	1246
G56	Thu	10-Jul-97	grBC	1140	2372	42	39.94	010	44.17	3 flume exp+CN (NIOO)	1340
G30	Thu	10-Jul-97	grBC	1515	2628	42	40.01	010	10.03	macrofauna+mesofauna (NIOO)	1715
G30	Thu	10-Jul-97	grBC	1715	2627	42	40.04	010	10.00	meiof+CN+grainsize+porosity (NIOO)	1915
	Thu	10-Jul-97	3.5Kc							start Survey transect	0200
											0200
										end Seismic survey	0200
G30	Fri	11-Jul-97	klBC	0945	2626	42	40.06	010	10.01	macrofauna (NIOO)	1145
G30	Fri	11-Jul-97	klBC	1046	2627	42	40.16	010	09.80	deckincubation	1246
G30	Fri	11-Jul-97	klBC	1144	2625	42	40.02	010	09.96	macrofauna (NIOO)	1344
G30	Fri	11-Jul-97	klBC	1244	2625	42	40.00	010	09.96	macrofauna (NIOO)	1444
G30	Fri	11-Jul-97	CTD	1334	2616	42	39.98	010	09.92	file=OMEX012.CNV	1534
G30	Fri	11-Jul-97	TR	1610	2626	42	39.53	010	10.81	trawl on bottom	1810
"	"	"	"	1628	2612	42	39.46	010	10.44	weight on bottom	1828
"	"	"	"	1708	2599	42	39.44	010	09.58	start hauling	1908
"	"	"	"	1727	2594	42	39.38	010	09.21	lifted from bottom	1927
G0	Sat	12-Jul-97	CTD	0614	154	42	39.87	009	28.46	file=OMEX013.CNV	0814

G0	Sat	12-Jul-97	kIBC	0642	153	42	39.79	009	28.20	macrofauna (NIOO)	0842
G0	Sat	12-Jul-97	kIBC	0704	153	42	39.79	009	28.19	macrofauna (NIOO)	0904
G0	Sat	12-Jul-97	kIBC	0720	150	42	39.80	009	27.92	failure	0920
G0	Sat	12-Jul-97	kIBC	0814	153	42	39.71	009	28.24	macrofauna (NIOO)	1014
G0	Sat	12-Jul-97	kIBC	0832	152	42	39.81	009	28.19	deckincubation	1032
G0	Sat	12-Jul-97	kIBC	0852	154	42	39.77	009	28.40	macrofauna (NIOO)	1052
G0	Sat	12-Jul-97	kIBC	0919	153	42	39.79	009	28.16	deckincubation	1119
G0	Sat	12-Jul-97	MC	0955	151	42	39.83	009	28.21	CN+chl+grainsize+porosity+meiof (NIOO)+oxprofs+resis+pigments	1155
G0	Sat	12-Jul-97	MC	1109	160	42	39.80	009	28.26	CN+meiof+mesof (NIOO)+oxprof+resis+pigments	1309
G0	Sat	12-Jul-97	TR	1205	206	42	37.97	009	28.37	trawl on bottom	1405
"	"	"	"	1217	193	42	38.05	009	28.31	stop paying out cable	1417
"	"	"	"	1258	181	42	38.30	009	28.18	start hauling	1458
"	"	"	"	1319	173	42	38.53	009	28.16	lifted from bottom	1519

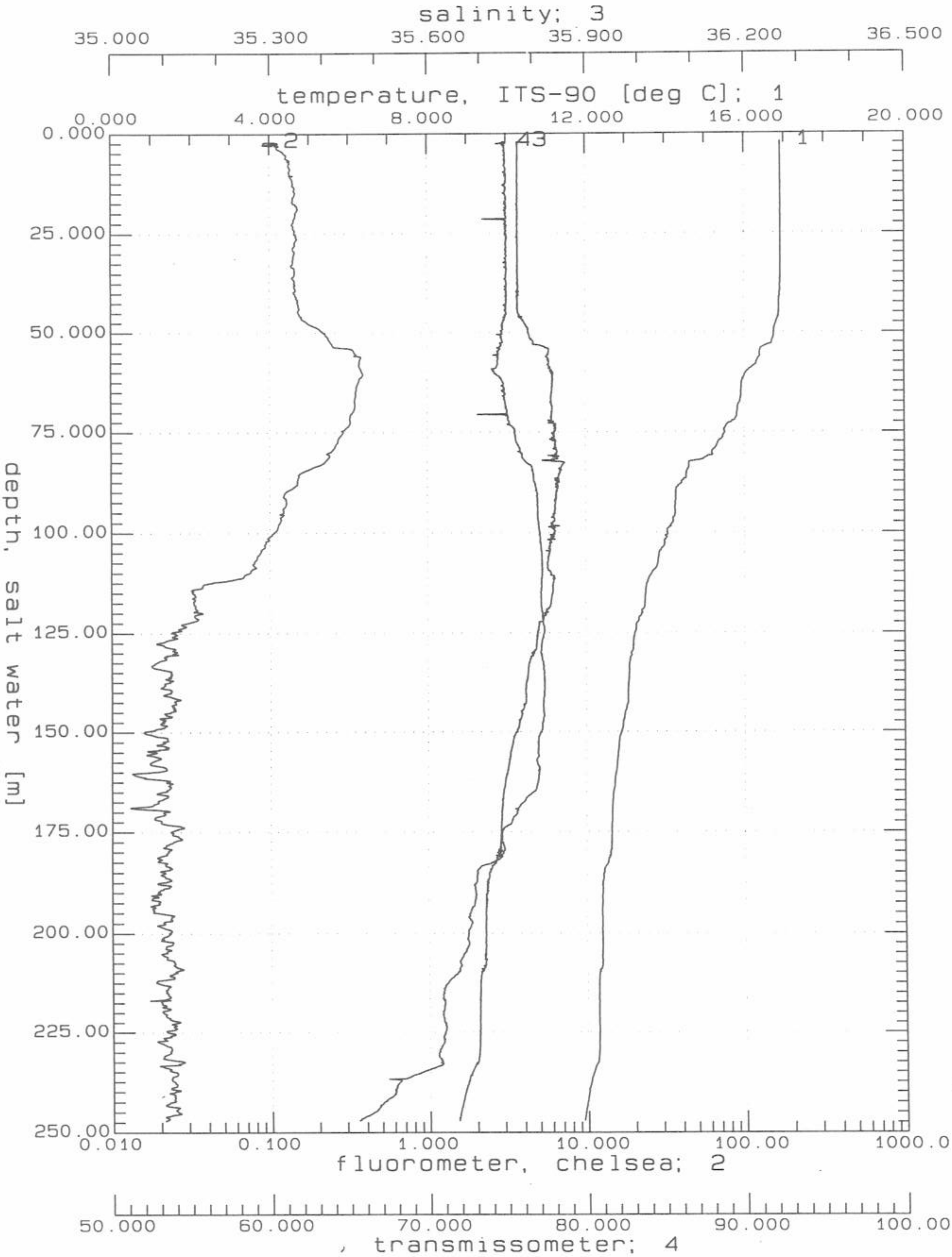
Appendix B-CTD plots.



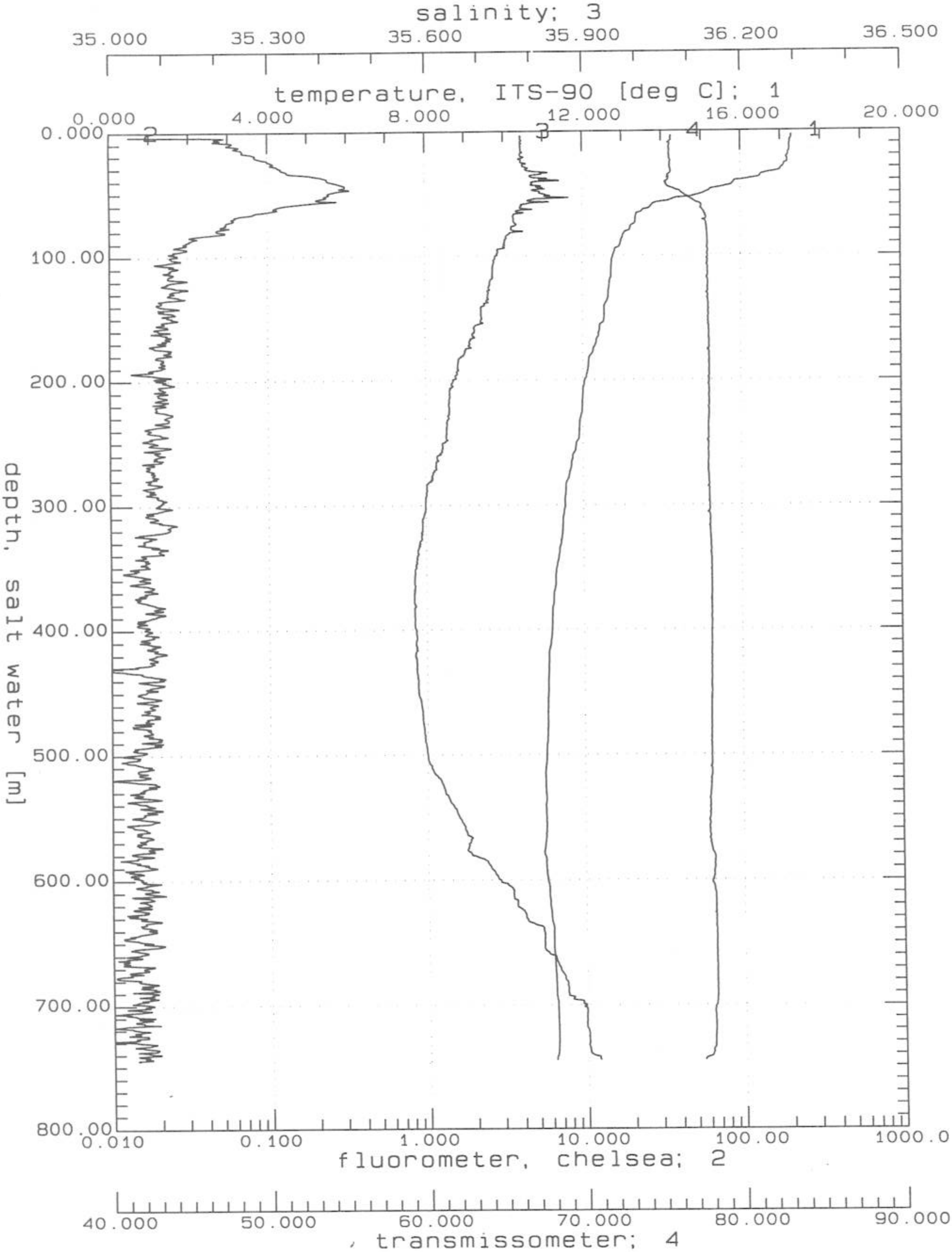
DOMEX001.CNV: OMEX-1 Leg 1 1997



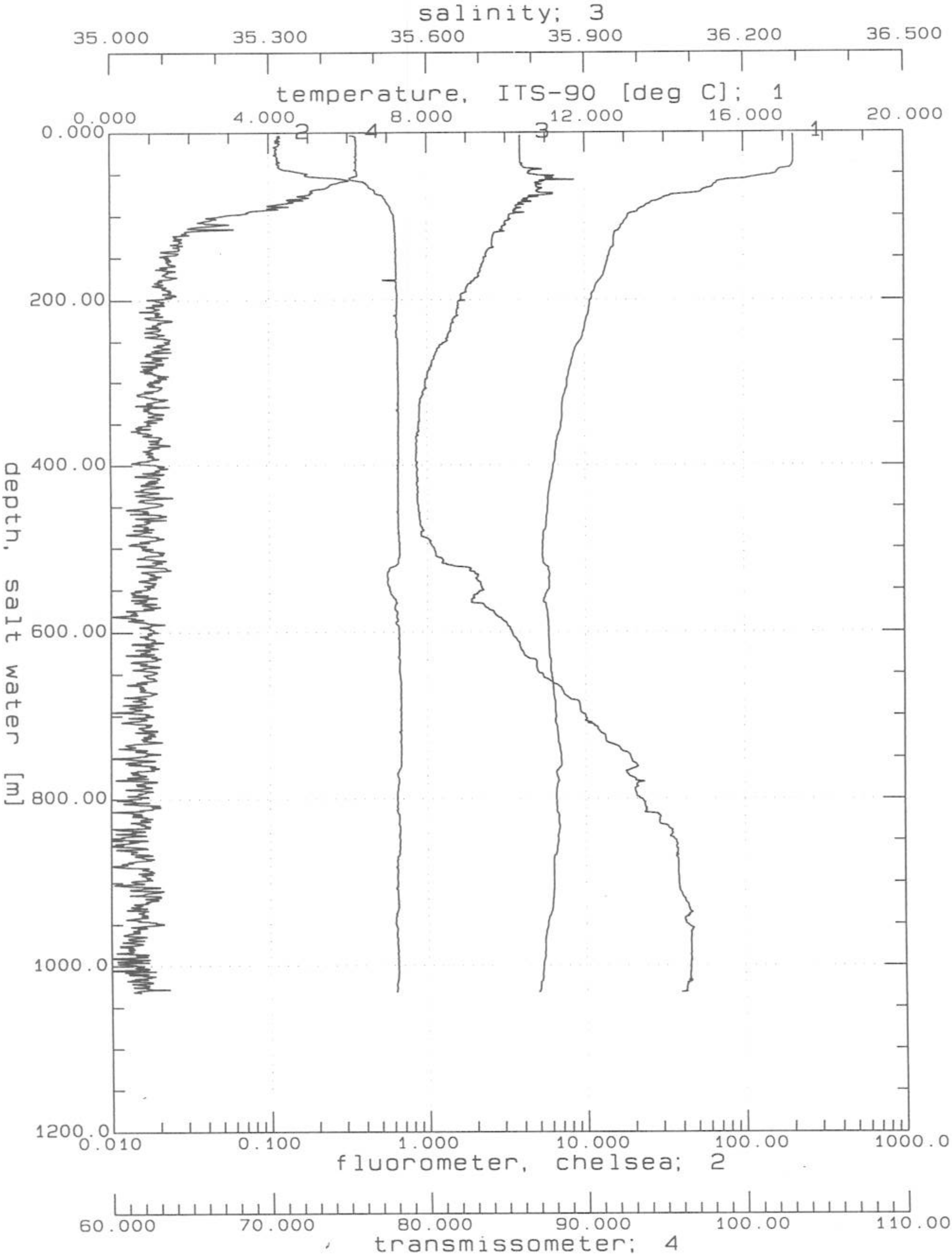
DOMEX002.CNV: OMEX-1 Leg 1 1997



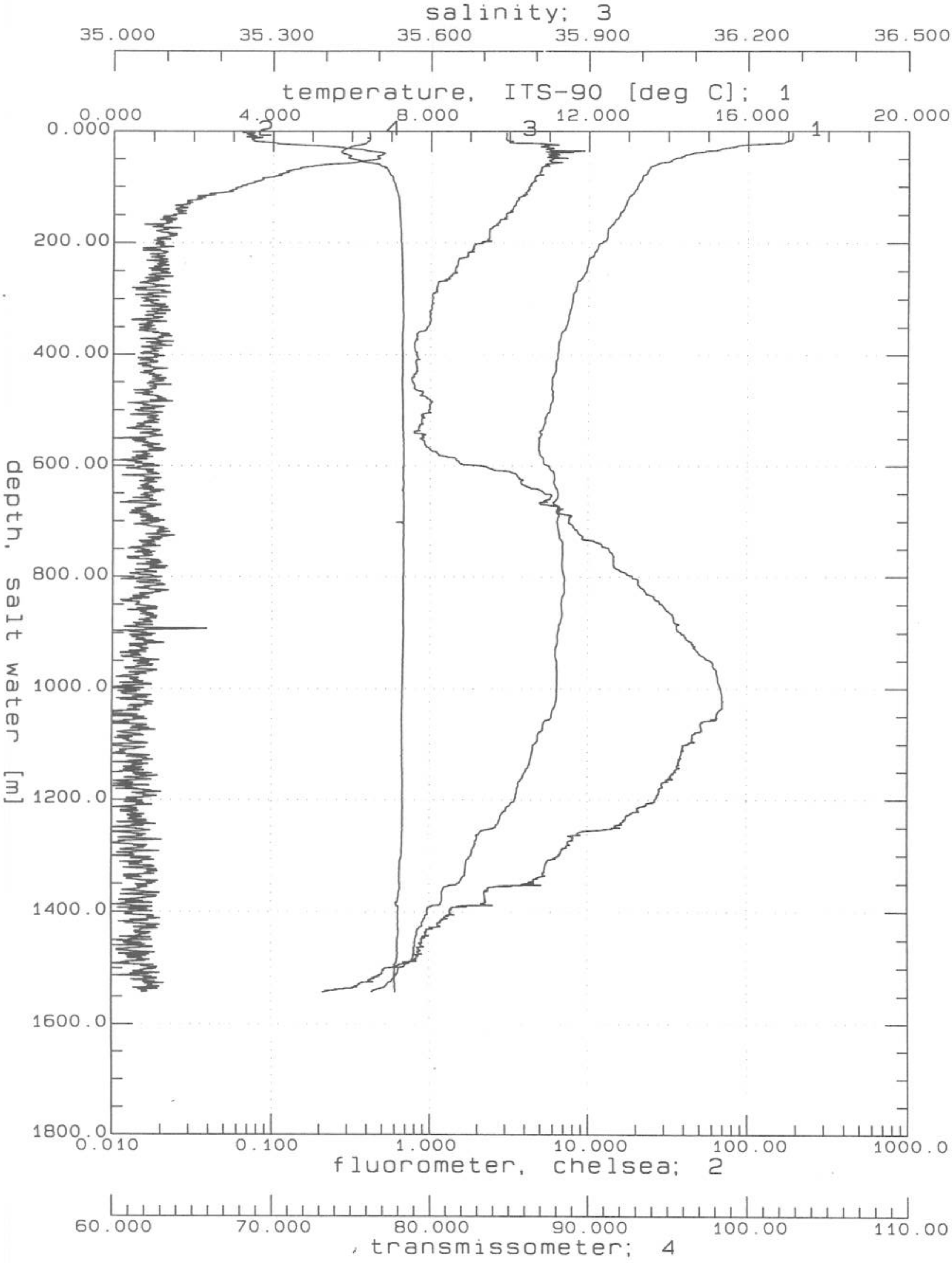
DOMEX003.CNV: OMEX-1 Leg 1 1997



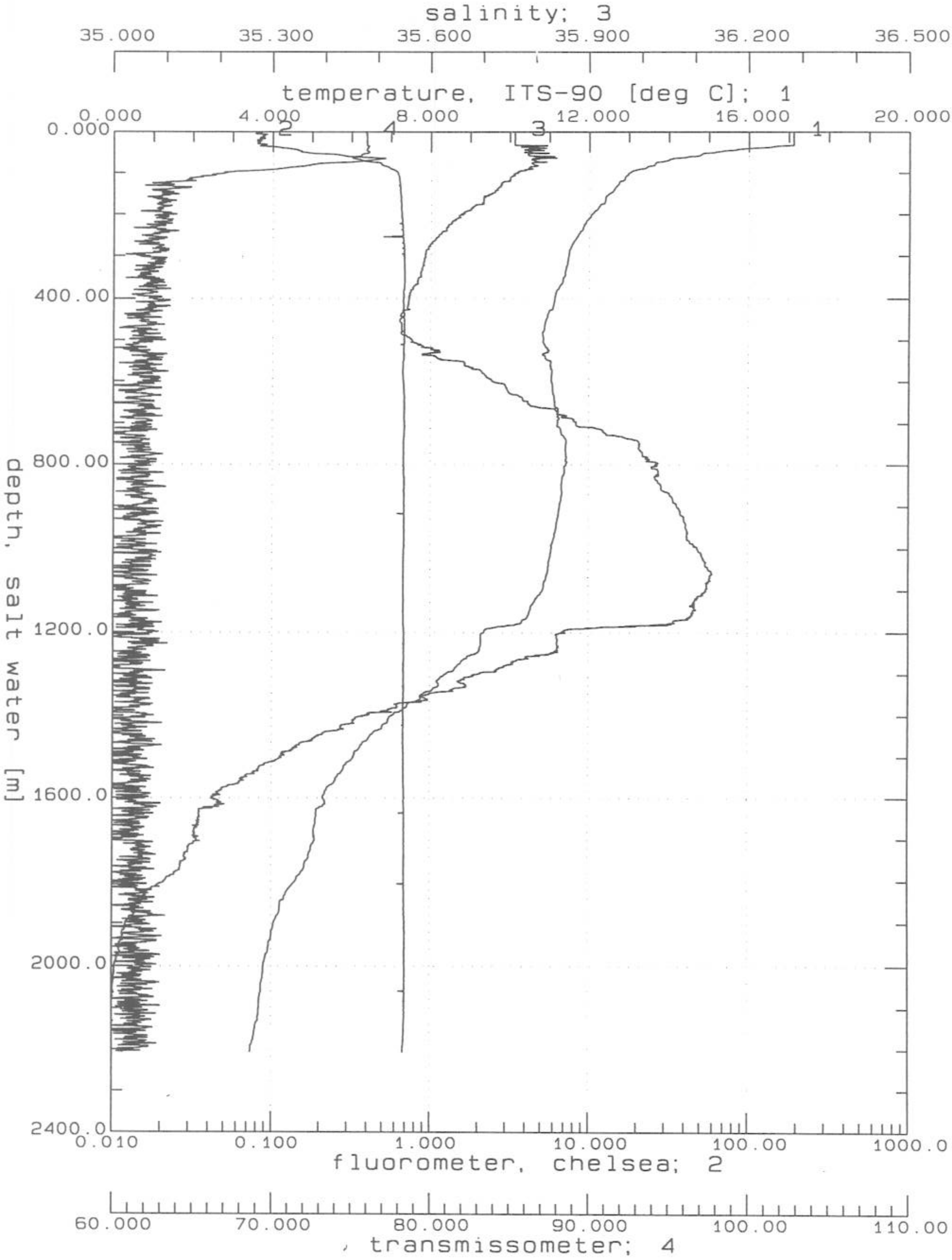
DOMEX004.CNV: OMEX-1 Leg 1 1997



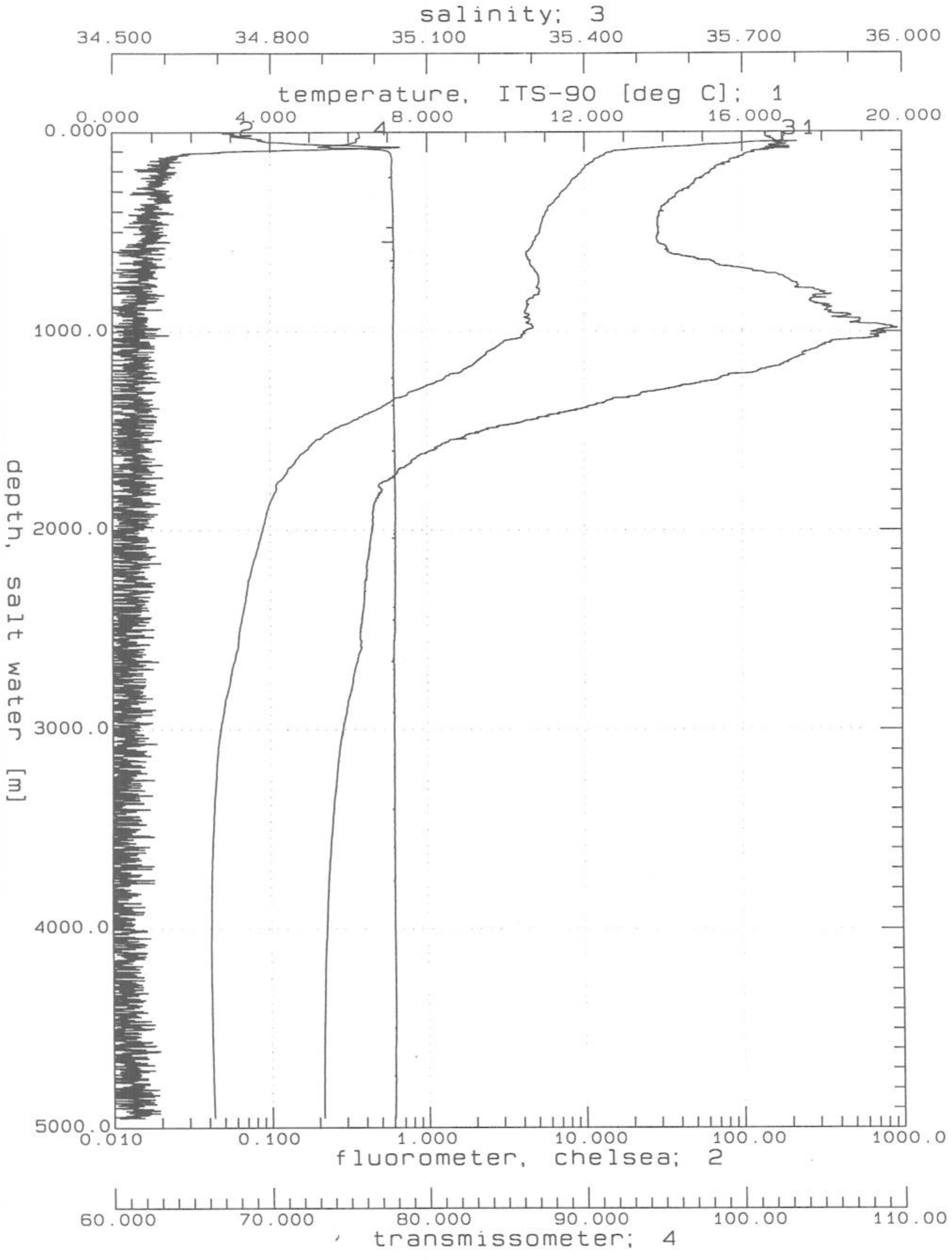
DOMEX005.CNV: OMEX-1 Leg 1 1997



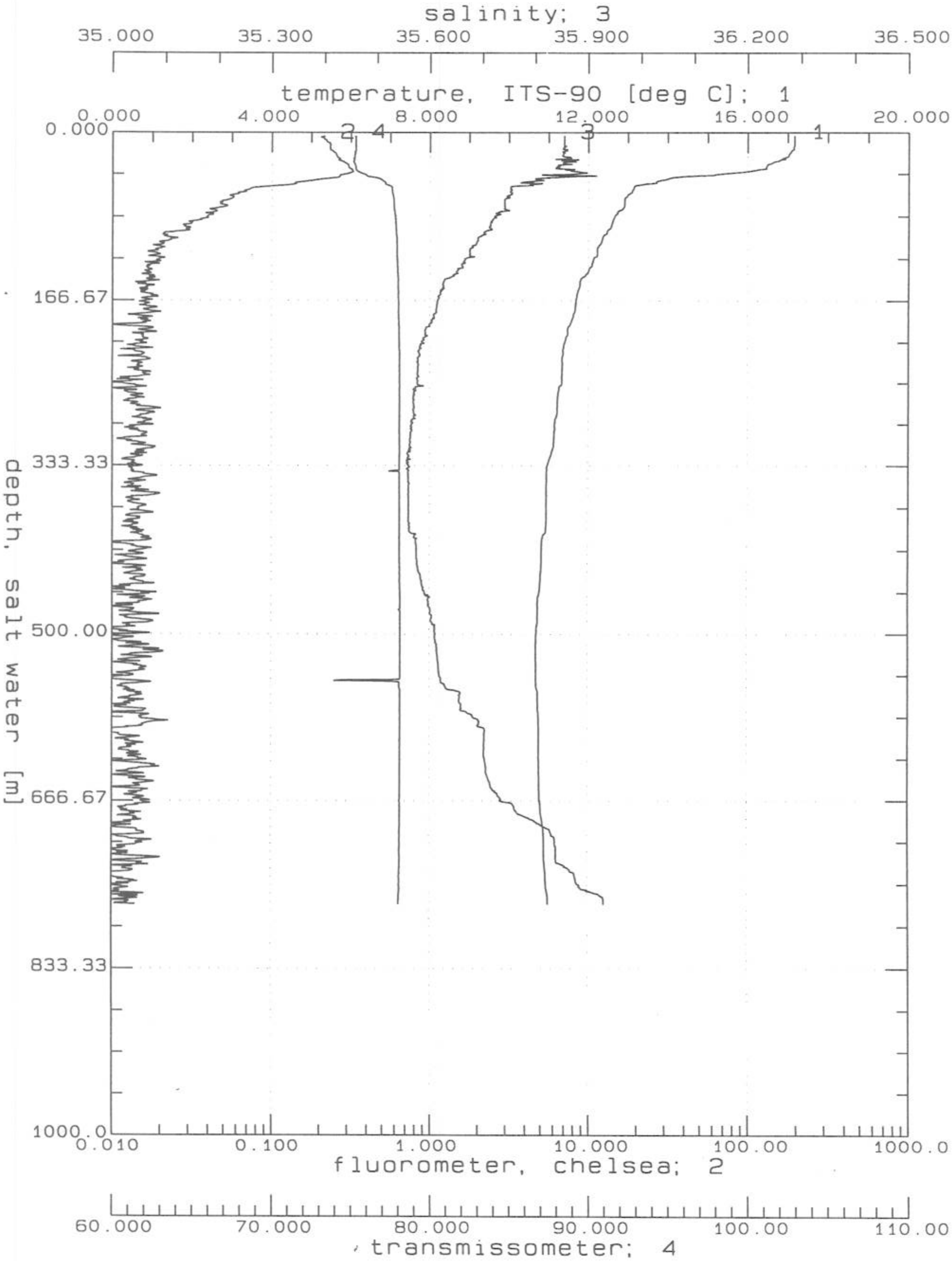
DOMEX006.CNV: OMEX-1 Leg 1 1997



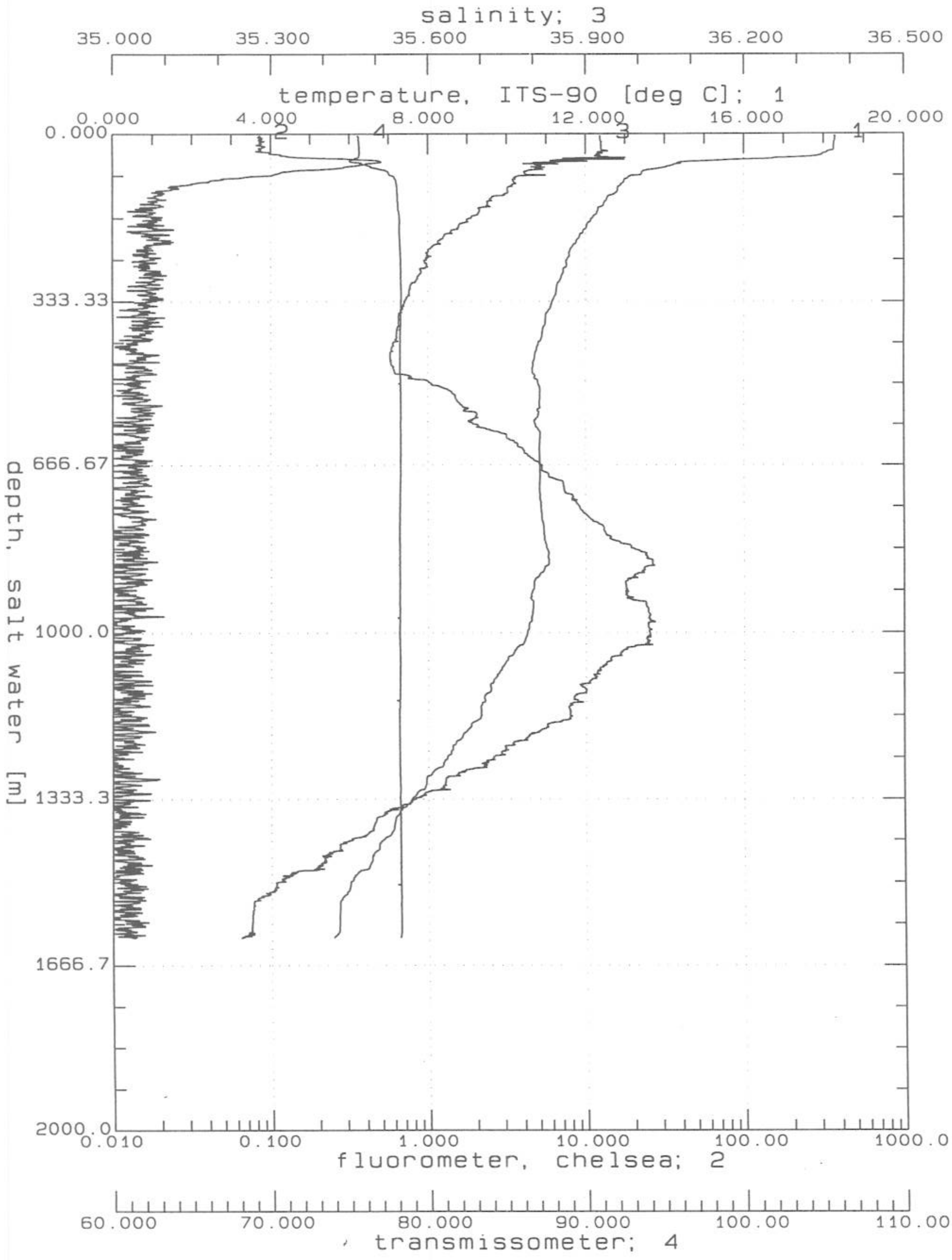
DOMEX007.CNV: OMEX-1 Leg 1 1997



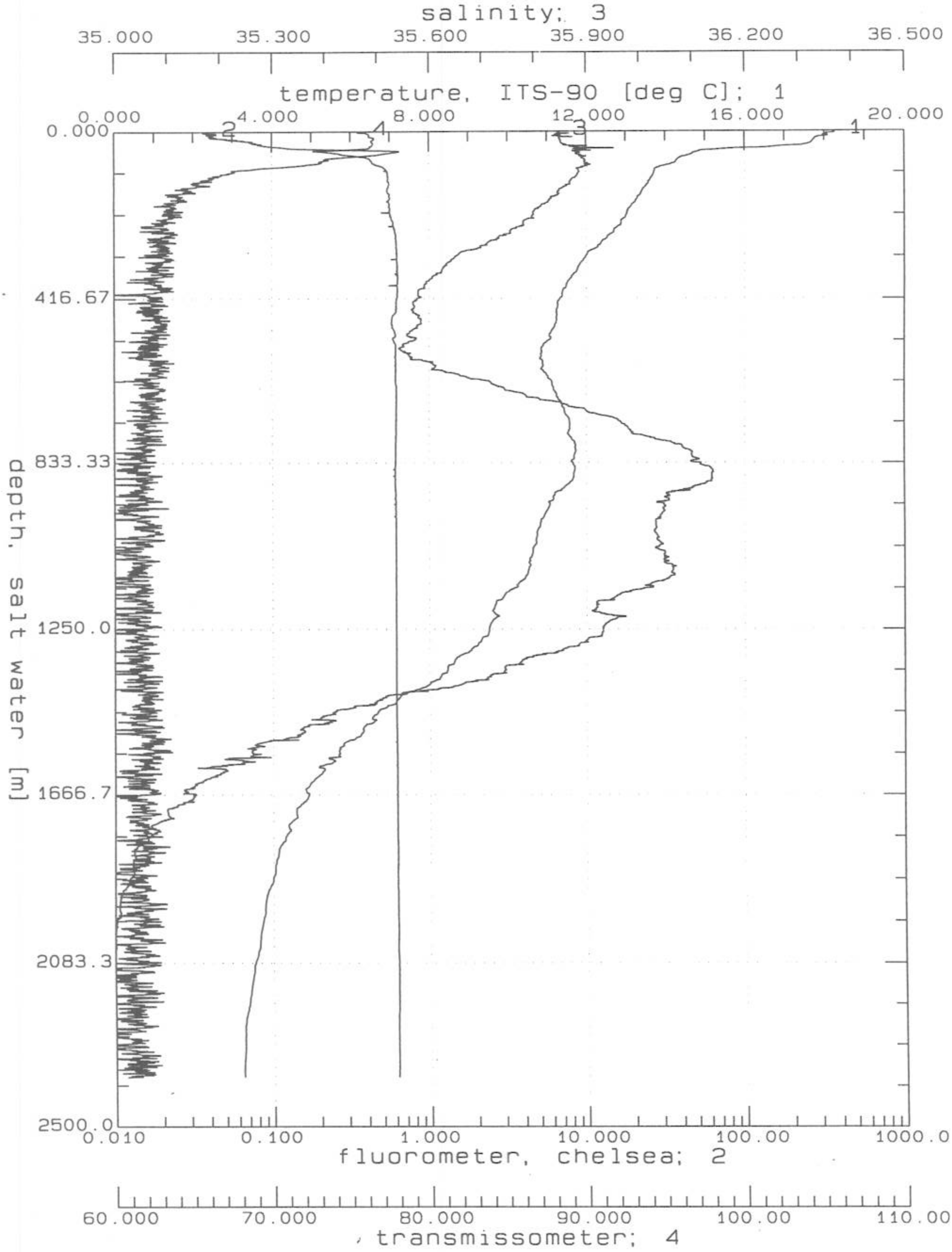
DOMEX008.CNV: OMEX-1 Leg 1 1997



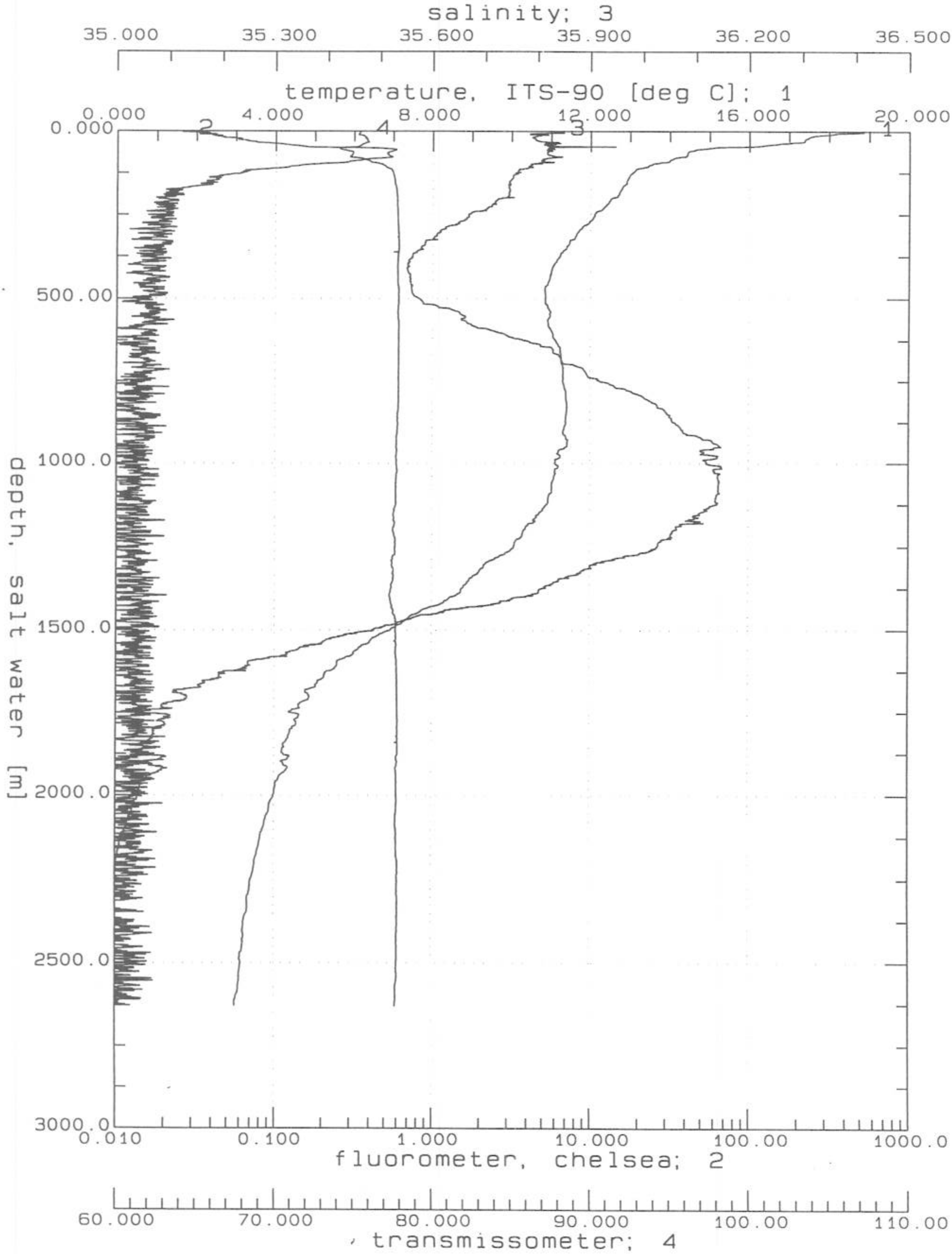
DOMEX009.CNV: OMEX-1 Leg 1 1997



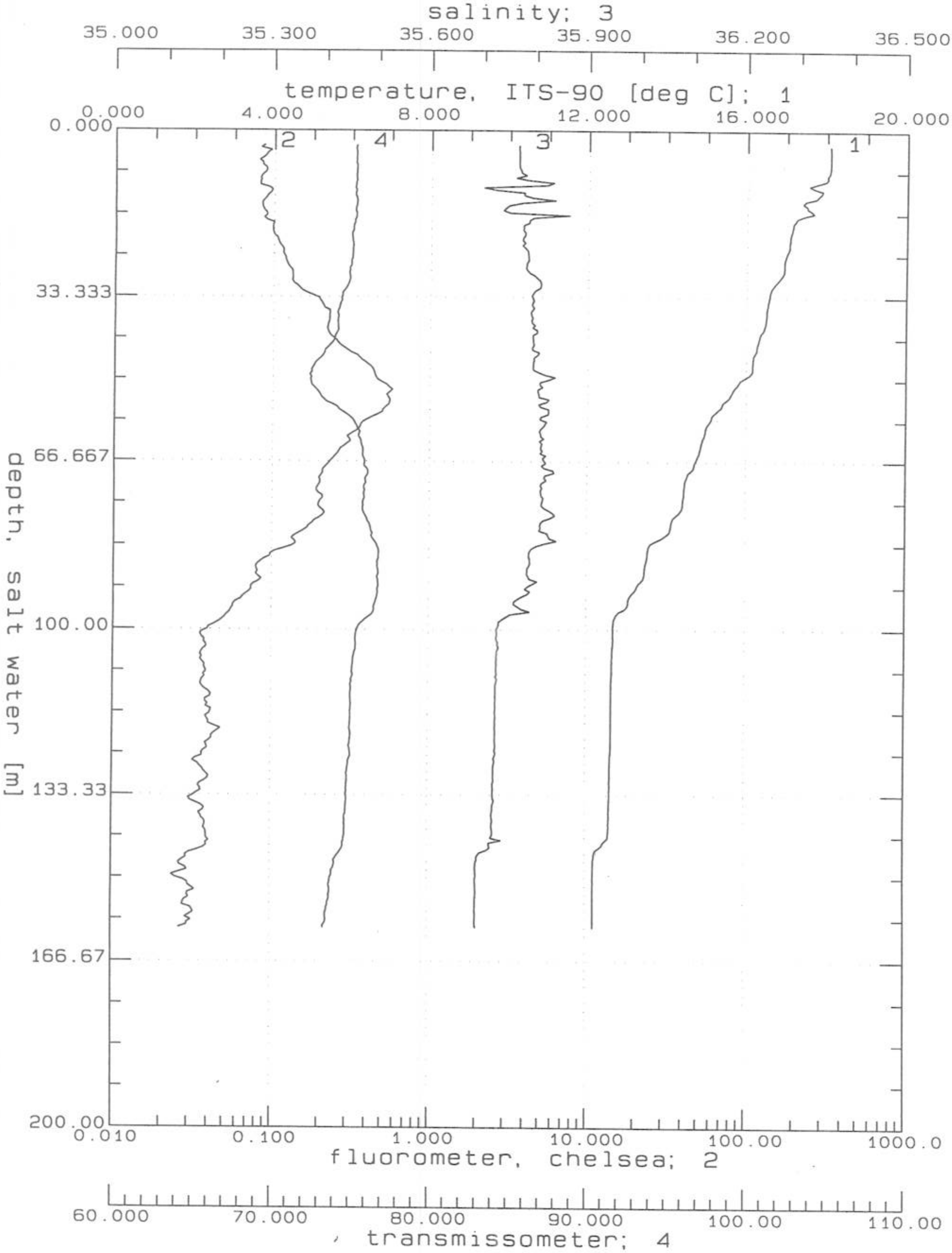
DOMEX010.CNV: OMEX-1 Leg 1 1997



DOMEX011.CNV: OMEX-1 Leg 1 1997



DOMEX012.CNV: OMEX-1 Leg 1 1997



DOMEX013.CNV: OMEX-1 Leg 1 1997