Les publications de

l'Institut Français pour la Recherche et la Technologie Polaires

Les rapports de campagnes à la mer

IMAGES MD 101

à bord du *Marion-Dufresne*
du 29 mai au 11 juillet 1995

Franck Bassinot
Laurent Labeyrie (chef de mission)

N° 96-1

INSTITUT FRANÇAIS POUR LA RECHERCHE ET LA TECHNOLOGIE POLAIRES
Expéditions Paul-Emile Victor

Institut
Français pour la
Recherche et la
Technologie
Polaires

Centre des
Faibles
Radioactivités

Laboratoire mixte CNRS/CEA

91198 Gif-sur-Yvette cédex

Les rapports de campagne à la mer
à bord du *Marion-Dufresne*

Campagne IMAGES
MD 101

du 29-05-95 au 11-07-95

rédigé par
Franck Bassinot et
Laurent Labeyrie (chef de mission),
avec les participants scientifiques.

édition : juin 1996

Édité par l'Institut Français pour la Recherche et la Technologie Polaires
Technopôle de Brest-Iroise - BP 75 - 29280 Plouzané - France
Tél : (33) 02 98 05 65 00 - fax (33) 02 98 05 65 55

IMAGES MD 101

BREST-MARSEILLE
29/05/95-11/07/95

A CORING CRUISE OF the R/V MARION DUFRESNE in the NORTH ATLANTIC OCEAN AND NORWEGIAN SEA

Cruise report prepared by F. Bassinot[1], L. Labeyrie[1,2], and the shipboard scientific party[3]

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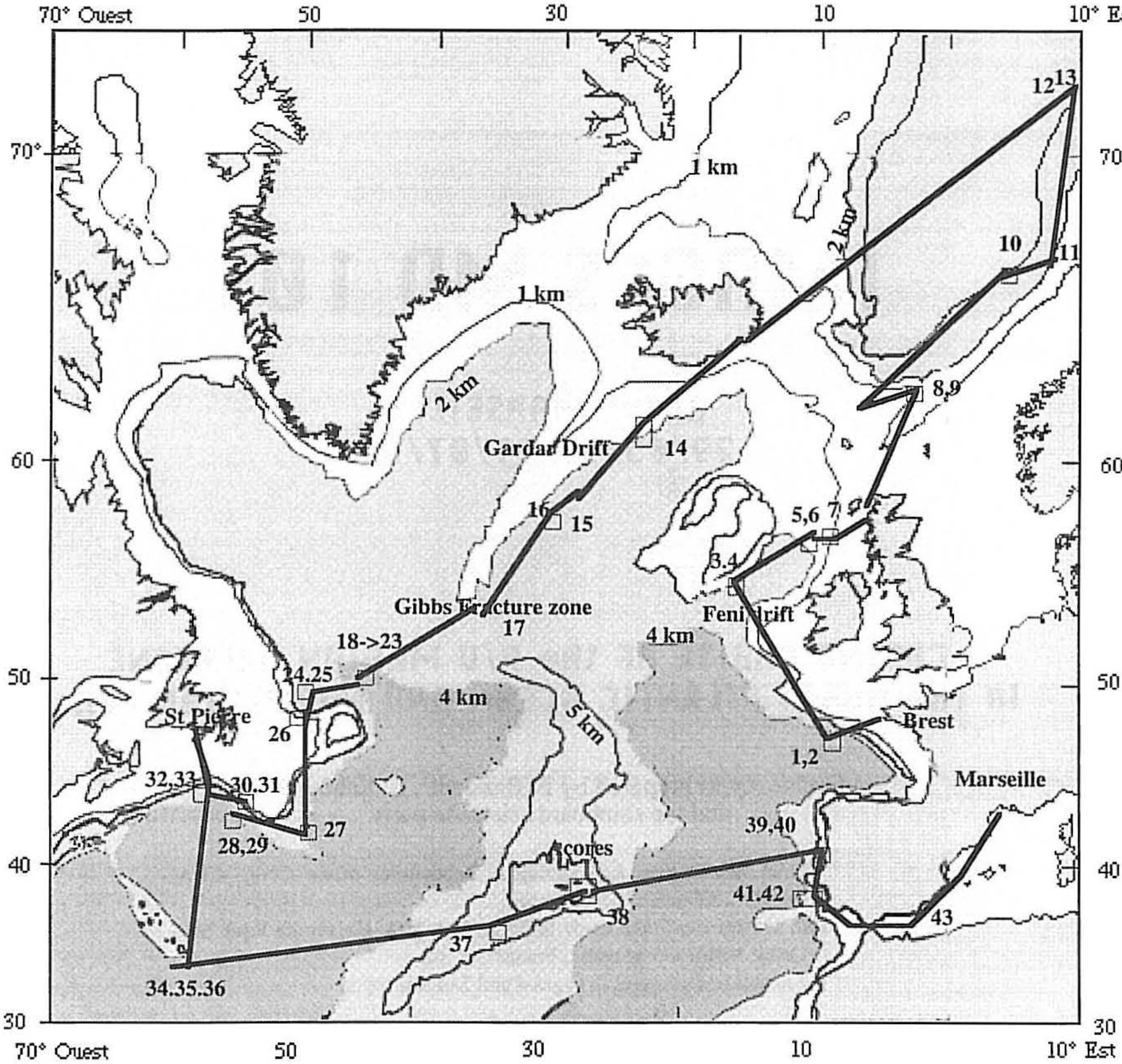
Many thanks go to C. Bassinot, B. Lehman and J. Tessier from the CFR for their help in the final stage of preparation of this report


70° Ouest
50
30
10
10° Est
70°
70
60
50
40
30
1 km
2 km
2 km
Gardar Drift
14
16
15
5,6
7
8,9
10
11
12
13
3,4
Gibbs Fracture zone
17
Feni drift
18->23
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CRUISE REPORT (english version)

THE FIRST *IMAGES* GIANT CORING CRUISE ON BOARD R/V *MARION DUFRESNE* (MD 101): HIGH RESOLUTION PALEOCEANOGRAPHY OF THE NORTH ATLANTIC .

Labeyrie, L. Centre des Faibles Radioactivités (CFR), CNRS/CEA, 91198 Gif/Yvette cedex and Département des Sciences de la Terre, Université Paris sud-Orsay, 91405 Orsay, France, Chief Scientist; **J.L. Turon** and **Y. Lancelot**, co-chief scientists; **F. Bassinot**, assistant Chief Scientist, **Y. Balut** Director for oceanographic operations and the **scientific party of IMAGES MD 101**.

1/ IMAGES objectives.

The IMAGES program addresses two major questions for paleoceanography:
-How have changes in ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and so modified climate.
-How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO_2 over the past 300 ka?

IMAGES aims at a global integration of ocean sediment records with the Greenland and Antarctic ice records within the climate dynamic modeling effort. A temporal resolution of the order of centuries or better is a prerequisite for these studies. IMAGES recommends as a strategy the continuous sampling and analysis of high resolution records with better than 10 cm/kyr sedimentation rates. Records longer than 250 kyr are needed to differentiate the linear response to the insolation external forcing from the non linear interactions of ice, ocean, atmosphere and continental crust systems. This demands long sediment cores (several tens of meters) and a combination of precise geochemical and micro-paleontological methods applied on sets of samples at discrete intervals (2 to 5 cm). Continuous and non-destructive physical properties records obtained on board on sediment cores will serve as proxies for high resolution (cm) interpolation of geochemical and micro-paleontological results.

2/ The IMAGES-MD101 cruise : objectives and results.

IMAGES coordinated a first international cruise in June and July 1995 over the North Atlantic and Norwegian sea on board the French R/V *Marion Dufresne* (MD 101, Brest - Stornoway (Lewis Island) - St-Pierre - Azores - Marseille).

Its main scientific objective was the collection of giant piston cores on rapidly sedimenting drifts and continental margins of the North Atlantic ocean and Norwegian Sea, along the track of the main thermohaline circulation. The cruise crossed the North-East Atlantic margins, the Feni Drift, the Scottish, North Faeroes and Norwegian margins (to 72°N), the Iceland South-East margins, the Gardar Drift, the NAMOC Channel, the Newfoundland margin, the Bermuda rise, the mid Atlantic ridge, and the Azores and Iberian margins.

Additional objectives covered :
- the contribution of Mediterranean waters to the North Atlantic intermediate waters, with 5 cores recovered across the slopes of the Iberian margin;
- the evolution of the NAMOC channel, in the deep North-West Atlantic basin, in relation to the growths and decays of the Laurentide ice sheet (8 Kullenberg and gravity cores).

This was the maiden cruise of the new *Marion Dufresne*, just 2 weeks out from her Le Havre shipyard. The ship had a very small number of problems, taking into account the number of things which were not ready just a few days before the departure. Two days were lost for engine problems.

70 scientists, students and technicians from 22 institutions (13 countries) participated to at least one of the three legs. 43 cores (mean length over 30 meters) have been retrieved during the cruise, described and measured for magnetic susceptibility, p-wave velocity, γ density and spectral light reflectance. The longest core, MD 95-2036 (52.64 m) was retrieved at 4461 m water depth on the Bermuda Rise. It covers about 150 kyr with a sedimentation rate over 30 cm/kyr. The Calypso corer worked properly, once a few problems encountered at the beginning of the cruise had been solved (i.e. sliced or imploded PVC liner).

This report presents preliminary results, mostly obtained on board: core descriptions, physical properties and micro-paleontological stratigraphy.

Color reflectance (between 40° and 55°N) and magnetic susceptibility (between 50° and 70°N) have been used for direct tuning of the time scales by cyclo-stratigraphy in the precession and obliquity bands. Ocean-wide correlations have been established over the last 250 kyr.

3/ Areas studied during the IMAGES-MD101 cruise.

Area 1 : Celtic continental slope at the southern end of the Channel (Trevelyan area, 3788 m, Core MD95-2001; Meriadzec area, 2174 m, Core MD95-2002).
These sites which present exceptionally high sedimentation rates (on the order of 50 cm/kyr during isotopic stage 3) made it possible to test the Calypso giant coring system. They are particularly suitable for high resolution studies of climatic and sedimentary variability during the last glacial period.

Area 2 : Feni Drift, east of Rockall Plateau (55° N 15°W):
This area is located along the initial pathway of the NADW in its journey towards the South and the West, and along the pathway of the main warm surface current of the North Atlantic (the North Atlantic Drift) in its journey towards the Norwegian Sea. Numerous cores from about 5 to 10 m in length have been studied previously on this sediment drift which is characterized by high sedimentation rates but irregular sedimentation processes. This area is a top priority for the CFR-DGO and German teams. About 5 cores were initially planned but, because of the 2 days of delay at the beginning of the cruise, only 2 cores have been retrieved (MD 95-2003 et 2004).

Area 3 : north -west of Scotland:
Coring of near coastal areas with very high sedimentation rates for the detailed study (temporal resolution on the order of 100 years) of climatic evolution since the last glacial maximum. Barra Fan, : Lat. 57°018N, 10°035 W, 2000 m (MD 95-2005 -boat drifted out of the planned target site- and MD 95-2006) and St Kilda Basin: 57°31'N, 08°23'W 158m (MD 95-2007). Objectives of the University of Edinburgh (W. Austin).

Area 4 : Faeroes Ridge:
This area has already been studied based on short piston cores. This sill located between the North Atlantic and the Nordic seas has an exceptional interest because the its sediments have recorded both variations of the northward penetration of surface waters from the north Atlantic and the response of deep waters. Two cores retrieved at about 62°58N, 2°22W, 1760m (MD 95-2008 et MD 95-2009). Sedimentation rate on the order of 10 cm/kyr. Top priority for the CFR-DGO group and the German teams (GEOMAR, Univ. of Kiel).

Area 5 : Vöring Plateau. This area is already well known from the study of short piston cores and from ODP Site 644. It presents an exceptional interest for the study of the evolution of the Scandinavian ice sheet in relationships with Greenland ice records (GISP and GRIP) and the changes of the thermohaline circulation in the Norwegian Sea. The sedimentation rates are high. Two sites were cored: MD 95-2010 66°58N, 07°38 E, 1048 m ; MD 95-2011 66°41N, 04°34 E, 1226 m. Priority of the Univ. of Bergen (E. Jansen) and the German laboratories (GEOMAR, Univ. of Kiel).

Area 6 : Bear Island. This area, which was located in front of the small Barents Sea ice cap during the last glacial period, plays an important role in the processes linked to the early deglaciation. The coring of a site with a high sedimentation rate was the main objective of the team from the Kiel University. Unfortunately, the two cores retrieved were badly damaged (PVC liners were badly sliced and imploded). (MD 95-2012 72°09N, 11°26E, 2094m et MD 95-2013 72°11N, 13°06E, 1638 m).

Area 7 : southern margin of Iceland (Reykyanes, 60°N-22°W). This area -which shows sedimentation rates on the order of 8-12 cm/kyr- has been previously studied during the Paleocinat 1 cruise of the R/V Suroît (cores SU 90-32 and 33, 10 and 15 m in length, respectively). This area makes it possible to study, over a few climatic cycles, the northward extension of the warm surface waters of the North Atlantic Drift, the links with the evolution of the Iceland ice sheet, and the intermediate waters history. Numerous ash layers can be dated with the Ar^{39}-Ar^{40} method to improve the time scale derived from orbital tuning of the isotopic stratigraphy. This area is a top priority for the CFR-DGO group. One core has been retrieved on the same location as core SU 90-33 (MD 95-2014 60°35 N, 22°05W, 2397 m).

Area 8 : Gardar Drift and mid-Atlantic Ridge (55°-57°N : 30-40°W). The last results obtained by the CFR-DGO group tend to show that deep water formation took place in this area during glacial periods. The mechanism is close to the one observed today in the Labrador Sea (modal waters). There was no good core available in this area prior to the IMAGES-MD101 cruise. This is a top priority objective for the CFR-DGO group. Two cores have been retrieved: MD95-

2015 à 58°46 N 25°58 W 2630 m et MD95-2016 à 57°43 N et 29°26 W 2318 m. The latter one has been retrieved on a location already studied by W. Ruddiman. The sedimentation rate is exceptionally high during interglacials (higher than 30 cm/kyr).

Areas 9-10 : north-east margin of North America (44°-50°N : 40°-55°W). Sediments of these areas provide the best records of the massive iceberg discharges which corresponded to the "Heinrich events" initiated in the northern part of the Laurentide. At deep water depths, one can analyze the variations of the NADW in its southward track, out of its formation areas. The sites have been selected based on previous records from numerous cores obtained by the Lamont (LDEO, Univ. of Columbia, NY), the Canadian teams, or by the CFR-DGO during the Paleocinat 1 cruise. This area represents the unique objective of the Canadian teams involved in the IMAGES program (Univ. Of Fredericton, Univ. of New Brunswick, GEOTOP). A "non-IMAGES" objective was raised by a group from McGhill University (Can.): a detailed sampling of the NAMOC canyon. This canyon follows on more than 2000 km the slope between the Labrador margin and the abyssal plain of the western Atlantic basin. It has been apparently dug by massive arrivals of turbid waters that flew out of the base of the Laurentide ice sheet during its periods of maximal extension. 8 cores have been retrieved on the NAMOC zone (MD 95-2018 à 23). The first core retrieved for the Canadian IMAGES program was located at one edge of the Gibbs fracture zone, on the mid-Atlantic Ridge, south-east of Gardar Drift (MD 95-2017 53° 03 N, 33°32W, 3100 m). Other cores were retrieved on the Canadian margin, north, east and south-west of Newfoundland, between 4150 and 878 m of water depth (cores MD 95 2024 to 2033).

Area 11 : Bermuda Rise. This high sedimentation rate area (> 30 cm/kyr) permits to reconstruct with a very good resolution the variations of surface subtropical waters from the Gulf Stream and the variations at depth of the boundary between the NADW and the AABW. Three cores have been obtained in order to cover the last climatic cycles (MD95-2034 to MD95-2036). The Core MD95-2036 is 52.64 m in length, the record for Kullenberg coring in the North Atlantic. These sites were the main objectives of the US teams.

Areas 12-13: Mid-Atlantic Ridge, Azores and western Iberian margin. The Azores and the Iberian margin areas have been previously studied during the 1980 and 1990 cruises of the R/V Suroît and cruises of the R/V Meteor. They present high sedimentation rates (between 10 and 50 cm/kyr). These areas are ideally located to study the evolution of the southernmost limit of the Polar Front during glacial periods and the contribution of the Mediterranean waters to the intermediate waters of the Atlantic. The sediments from the Azores have an exceptional interest for paleovolcanic and paleomagnetic studies. These areas are top priorities for the LGQ, the URA Orsay-Muséum, Ifremer-Brest, LODYC-Paris, the CFR-DGO group, the German (GEOMAR) and Portuguese teams (Portugal Geol. Surv.), and the British teams from the IOS and the Univ. of Cambridge. Between 8 and 10 cores were originally planned in this area, but only 6 could be retrieved because of the delay accumulated during the cruise (MD 95-2037 - 2042).

Area 14 : Western Mediterranean Sea. A high accumulation rate area in which it will be possible to reconstruct the paleoclimatic evolution of the southern part of Europe (based on pollens and bio-markers) in relationship with the Mediterranean hydrology. Priority of the Universities of Salamanca and Barcelona (and collaboration with Brest-Ifremer) : MD 95-2043 à 36°08 N, 02°37W, 1841 m).

RAPPORT DE CAMPAGNE (version française)

A - PREPARATION DE LA CAMPAGNE IMAGES-MD101

1/ Bases scientifiques: le programme IMAGES:

La communauté internationale des chercheurs travaillant sur les changements climatiques est de plus en plus concernée par le manque actuel de connaissance sur les origines, les mécanismes, et les conséquences des changements climatiques rapides observés dans les enregistrements paléoclimatiques (glaces, océans et continents). Il ne fait plus de doute que l'océan joue un rôle majeur dans ces changements, tant pour les transferts de chaleur que pour les contraintes physico-chimiques à long terme sur la teneur en CO_2 atmosphérique. Mais ce rôle est très imparfaitement évalué, faute de données suffisantes sur la variabilité dynamique et physico-chimique des océans. Les derniers résultats publiés dans Nature (Bond et al 1993, Grip 1993..) montrent l'importance probable du couplage entre la formation des eaux profondes nord atlantiques (North Atlantic Deep Water, NADW) et la dynamique des calottes de glace de la Laurentide, du Groenland et de la Fenno-Scandie; mais les transferts de chaleur entre hémisphères nord et sud, les flux de chaleur sensible et latente vers l'atmosphère, l'accumulation de CO_2 dissous dans les océans profonds, sont d'autres facteurs à considérer.

Les outils pour étudier les systèmes passés existent : composition isotopique de l'oxygène et du carbone des foraminifères planctoniques et benthiques, micropaléontologie, bio-marqueurs (Uk37) pour reconstruire les gradients de température et salinité, les flux de carbone, et la paléoproductivité, traceurs magnétiques, minéralogiques et géochimiques pour reconstruire les apports des continents.

Toutefois les carottes de sédiment existant dans les collections ne suffisent pas à ces études : les séries sont souvent incomplètes, et pas assez de matériel n'est disponible pour réaliser à très haute résolution les analyses nécessaires. De plus, ces carottes sont pour la plupart trop courtes pour couvrir une période de temps suffisante (au moins les deux derniers cycles glaciaires-interglaciaires) avec la résolution temporelle nécessaire à l'étude des changements du climat : cent à deux cent ans.

Ces réflexions ont conduit à la création du programme international IMAGES (International marine Global Change Study), animé par IGBP-PAGES (Past Global Changes) et SCOR (Scientific Committee on Oceanic research) et du programme US-NSF MESH (Marine Earth System History). Ces programmes mettent en priorité l'acquisition d'un grand nombre de carottes de sédiment marin (2000 pour les prochains 5-10 ans) de grande longueur, et disponibles pour toute une série d'analyses à très haute résolution permettant de décrire la variabilité des océans au cours des derniers 300 000 ans.

En France, le programme paléoclimatologie du PNEDC a lui aussi mis en toute première priorité la description de la variabilité hydrologique des masses d'eau superficielles et profondes de hautes latitudes, en particulier en Atlantique nord. Le Comité Scientifique International du PNEDC recommande une participation forte dans le programme de carottage IMAGES. La campagne Paléocinat, en cours d'exploitation, a fourni des informations très importantes, mais les carottes obtenues sur le SUROIT sont trop courtes (10 à 15 mètres): les derniers interglaciaires n'ont pu être échantillonnés que dans les zones à faibles vitesses de sédimentation, où la résolution est insuffisante pour des études paléoclimatiques quantitatives. Des carottages de grande longueur (40 m ou plus) sont indispensables à la poursuite du projet.

2/ Bases stratégiques:

La proposition IMAGES-MD 101 a été le résultat de plusieurs facteurs:

a/- Le Marion Dufresne II était disponible à partir de la France (Brest) au printemps 1995. Il devait disposer d'un sondeur multi-faisceaux moderne et de possibilités de carottages encore améliorées.

b/- IGBP-PAGES (Past Global Change) et SCOR ont décidé de lancer en septembre-octobre 1993 le programme international IMAGES d'étude du rôle de l'océan dans les changements climatiques. Le groupe de travail WG 100 du SCOR, qui en était le comité de planification, a mis comme première priorité la réalisation de campagnes internationales de carottage géant et d'étude à très haute résolution des sédiments le long de 5 profils à travers les différents océans. Il a été proposé d'obtenir de différentes agences scientifiques, au niveau international, un support financier suffisant pour permettre de réaliser la première campagne sur le MD, seul navire au monde pouvant réaliser en routine des carottes de 50 mètres. Il s'agissait de réaliser en priorité une couverture des différentes zones de l'Atlantique nord. La campagne devait servir de plate-forme de lancement pour le programme IMAGES, avec essais simultanés des différents modes de prélèvement et d'étude en continu des carottes de sédiment. La Grande Bretagne (NERC), les USA (NSF), le Canada (NSERC), l'Allemagne, l'Espagne et la Norvège ont donné leur accord pour participer à un financement international du MD.

c/ En France, la campagne a été approuvée par l'IFRTP et le PNEDC (C.S. décembre 1993), après examen très favorable de la Commission spécialisée Géosciences Marines de l'IFREMER.

3/ Bases financières et organisation pratique:

Les règles d'organisation et de financement de cette campagne "test" n'ont pas été celles qui seront adoptées définitivement pour les campagnes IMAGES à venir (encore en cours de discussion). A l'étape préliminaire actuelle, chaque investigateur principal étranger a financé par ses supports nationaux une quote-part, à partir d'un projet de participation sur des objectifs précis. Toutefois, les investigateurs principaux sont ensemble co-responsables des opérations de type IMAGES, en particulier l'étude en continu des paramètres physiques du sédiment et la stratigraphie, et des collaborations sont engagées sur l'ensemble du matériel prélevé. La faisabilité de ce type de collaboration est un test majeur pour la faisabilité du programme IMAGES.

B - PROGRAMME DE RECHERCHE ET DEROULEMENT DE LA CAMPAGNE

1/ Objectifs scientifiques principaux:

a-Reconstruction de la variabilité de l'hydrologie de surface de l'Atlantique nord, réponse de la circulation profonde, et évolution simultanée de la climatologie péri-Atlantique nord au cours des derniers cycles climatiques (objectif IMAGES).

Le thème principal de la campagne MD101 était l'étude de la variabilité hydrologique, dynamique, et physico-chimique des grandes masses océaniques de l'océan Atlantique, en liaison avec la climatologie globale et l'évolution des calottes de glace. Le but de cette étude était d'allonger les séries obtenues au cours des campagnes PALEOCINAT et des campagnes équivalentes étrangères, afin de mieux quantifier le rôle du forçage astronomique (et ses composantes autour de 20 et 40 ka) dans l'évolution du climat, tout en prenant en compte l'évolution non linéaire du système interactif formé par les calottes de glace, les mers polaires et la circulation profonde.

Le trajet principal de la campagne suit grossièrement la grande boucle de circulation thermohaline dans l'Atlantique nord: les bordures nord et ouest de l'Atlantique nord permettant d'étudier l'histoire de la NADW (North Atlantic Deep Water), et la bordure est permettant d'aborder les relations avec les eaux profondes antarctiques (Antarctic Bottom Water, AABW) et l'eau intermédiaire de Méditerranée. Des profils verticaux le long des marges et des reliefs sous marins ont été réalisés pour reconstituer la distribution verticale des masses d'eau. Une grande partie des carottes a été prélevée sur les marges et les rides sédimentaires où les vitesses de sédimentation supérieures à 10 cm/ 1000 ans permettent d'atteindre une résolution temporelle suffisante pour les études des processus climatiques (du siècle à quelques siècles) et permettre ainsi de préciser les relations de phase entre évolution de l'hydrologie de surface et réponse des océans profonds. De tels taux d'accumulations conduisent toutefois généralement à des systèmes sédimentaires instables, et une reconstitution précise de la structure des sédiments avec sondeurs multi-faisceaux et sismique 3.5 khz est nécessaire pour bien contraindre le choix des sites de carottage.

b-Plusieurs objectifs annexes sont aussi abordés:
b1- La variabilité haute résolution de l'aimantation rémanente des sédiments au cours des derniers 800 000 ans.

b2 : la variabilité du $\delta^{18}O$ des eaux interstitielles et la mémoire de l'évolution du $\delta^{18}O$ de l'océan au cours des derniers 150 000 ans.
b3 : l'évolution de la sédimentation dans le bassin nord-ouest de l'Atlantique et la canal profond du NAMOC, en liaison avec l'histoire de la calotte Laurentide et des chenaux fluviaux sous glaciaires.

2/ Stratégie d'approche et méthodes:

La stratégie d'approche a été celle définie par le Groupe WG 100 du SCOR pour IMAGES:

Lors de la campagne - Les sites de la campagne IMAGES-MD101 ont été présélectionnées au niveau international en se basant sur l'étude de carottes existantes et/ou des données sismiques 3.5 khz, ou parce que ces sites présentaient un intérêt potentiel exceptionnel pour le programme IMAGES. Lors de la campagne MD101, un court survol de chaque zone présélectionnée a permis de préciser les localisations de stations en analysant la structure des dépôts à l'aide d'un sondeur 3.5 khz. Un repérage au multi-faisceaux des zones sélectionnées devait être également effectué mais le système multi-faisceaux novateur qui est développé par Thompson sur le *Marion Dufresne* n'a pas été opérationnel à temps pour la mission. Plusieurs opérations différentes étaient prévues à chaque site: collecte des sédiments de surface et des eaux de fond, carottage gravité grand volume (1 à 3 m), carottage Kullenberg 20 m doublé par un carottage de 40 à 60 m si les sédiments le permettaient. En fait, pour gagner du temps, l'objectif de carottage de grande longueur a été privilégié. A bord, une batterie d'analyse en continu a été réalisée sur carottes ouvertes ou non, suivant le modèle établi lors des campagnes de l'Ocean Drilling Program (ODP): paramètres physiques (ondes-p, absorption γ, réflectance couleur, susceptibilité magnétique, images digitales), micropaléontologie, sédimentologie. Les équipements d'analyse ont été fournis par les différents laboratoires participants, et leurs résultats comparés en temps réel. L'acquisition par l'IFRTP, en dernière minute, d'une centrale d'acquisition en continu des propriétés physiques (GEOTEK) a permis de réaliser ces études avec le standard de qualité des campagnes ODP. Pendant la campagne IMAGES-MD101, 43 carottes ont été recueillies, parmi lesquelles 29 ont été ouvertes et décrites à bord et 5 ont été échantillonnées en continu (pas d'échantillonnage de 1 cm).

En laboratoire - Les paramètres habituels de la paléoclimatologie quantitative seront analysés par les équipes de pointe dans le domaine au niveau international : géochimie et composition isotopique des foraminifères, fonctions de transfert sur les foraminifères et autres micro-fossiles, bio-marqueurs (Uk37), propriétés magnétiques, études des minéraux transportés par les glaces, des cendres volcaniques et des argiles, granulométrie, datations AMS ^{14}C et, si possible, Ar^{39}/Ar^{40}. Pour les carottes situées à proximité des côtes, les pollens deviendront aussi un paramètre important.

Règles adoptées pour l'échantillonnage - Les moitiés archives d'au moins une carotte par station (ou groupe de station) resteront à Gif pour références futures. Chaque investigateur principal (P.I.) co-finançant a accès à un échantillonnage en continu (ex. U-channel) pour chaque projet approuvé par le Comité Scientifique IMAGES. Le volume de chaque échantillonnage en continu dépendra des études programmées (depuis les U-channels 2x2cm jusqu'à une moitié complète de carotte (12.5 cm). Les enregistrements continus non destructifs (imagerie couleur, MST) seront accessibles à tous. Le Comité Scientifique IMAGES est responsable de l'élaboration des coopérations et de la coordination internationale en liaison avec L. Labeyrie, le responsable de projet. F. Bassinot coordonne l'ensemble des échanges entre scientifiques pour l'exploitation de la campagne.

3/ Objectifs détaillés:

Zone 1 : pente continentale au débouché de la Manche (zones du replat de Trevelyan à 3788 m, MD 95-2001, et du replat de Meriadzec, 2174 m, MD 95-2002). Sites de test du matériel de carottage, à la sédimentation exceptionnellement rapide (de l'ordre de 50 cm/kyr pendant le stade isotopique 3). Ces sites sont donc très bien placés pour l'étude de la variabilité climatique et sédimentaire lors de la dernière période glaciaire.
Zone 2 : ride de Feni à l'est du plateau de Rockall (55° N 15°W). Sur le trajet de la branche initiale de NADW vers le sud et l'ouest, et des eaux de la dérive nord Atlantique quand elles remontent vers la Mer de Norvège. De nombreuses carottes de 5 à 10 m ont été étudiées sur cette ride à la sédimentation rapide mais assez irrégulière. Zone de haute priorité pour CFR-DGO et les co-associés Allemands. De l'ordre de 5 carottes étaient prévues, mais, compte tenu du retard, seulement 2 ont été réalisées (MD 95-2003 et 2004).
Zone 3: nord ouest de l'Ecosse. Echantillonnage de zones côtières à très haute vitesse de sédimentation pour l'étude à résolution centennale de l'évolution climatique depuis le dernier maximum glaciaire: Barra Fan, : Lat. 57°018N, 10°035 W, 2000 m (MD 95-2005 - en dehors du site optimal- et MD 95-2006) et St Kilda Basin: 57°31'N, 08°23'W 158m (MD 95-2007). Objectifs de l'Université d'Edinburg (W. Austin).
Zone 4 : Ride des iles Féroé. Zone déjà étudiée par des carottes courtes. Intérêt exceptionnel, car on retrouve enregistrées à la fois les oscillations de la pénétration de l'eau de surface nord Atlantique, et la réponse des eaux profondes au seuil vers l'Atlantique nord. 62°58N 2°22W 1760m. Vitesse de sédimentation environ 10 cm/ka. Zone de haute priorité pour le groupe CFR-DGO et les équipes Allemandes. 2 carottes réalisées (MD 95-2008 et MD 95-2009).
Zone 5 : Plateau de Vöring. Zone déjà connue pour l'étude de la période récente par des carottages courts, et pour la partie ancienne par le forage ODP 644. Intérêt exceptionnel pour suivre l'évolution de la calotte de glace scandinave en liaison avec les enregistrements du Groenland (GRIP et GISP) et l'évolution de la circulation thermohaline en Mer de Norvège. Vitesse de sédimentation rapide. Possibilité d'étendre la couverture existante en fonction de la proximité de la Norvège et de la profondeur d'eau. Sites réalisés MD 95-2010 66°58N, 07°38 E, 1048 m ; MD 95-2011 66°41N, 04°34 E, 1226 m. Priorité pour l'Univ. de Bergen (E. Jansen) et les équipes Allemandes.
Zone 6 : Bear Island: Cette zone, située en avant de la petite calotte de la Mer de Barentz lors de la dernière période glaciaire, joue un rôle exceptionnel dans la compréhension des processus liés au début des déglaciations. Le carottage d'une zone d'accumulation à forte vitesse de sédimentation constituait l'objectif prioritaire de l'équipe de l'Univ. de Kiel. Les carottes ont été malheureusement assez perturbées lors du prélèvement (MD 95-2012 72°09N, 11°26E, 2094m et MD 95-2013 72°11N, 13°06E, 1638 m).
Zone 7 : marge sud de l'Islande (Reykyanes, 60°N-22°W). C'est une zone explorée lors de la campagne Paleocinat 1 du N/O Suroît (carottes SU 90-32 et 33, 10 à 15 m de long à 8-12 cm/ka), très favorable à l'étude sur plusieurs cycles glaciaires-interglaciaires de la remontée vers le nord et la Mer de Norvège des eaux chaudes de la dérive nord Atlantique, les liens avec l'évolution de la calotte Islandaise, et l'évolution des eaux intermédiaires à partir de la composition isotopique des foraminifères benthiques. Nombreux niveaux de cendres volcaniques datables en Ar^{39}-Ar^{40}, quand la méthode sera fonctionnelle au CFR, pour améliorer la chronologie absolue dérivée de la stratigraphie isotopique. Objectif prioritaire CFR-DGO. Une carotte réalisée à l'emplacement de la carotte SU 90-33 (MD 95-2014 60°35 N, 22°05W, 2397 m).
Zone 8 : Ride de Gardar et ride médio-Atlantique (55°-57°N-30-40°W). Les derniers travaux du CFR et du DGO semblent montrer que c'est dans cette zone que se forment les eaux profondes en période glaciaire, par un mécanisme voisin de celui se déroulant actuellement en Mer du Labrador (eaux modales). Il n'existe pas de bonne carotte étudiée sur la zone. Objectif prioritaire CFR-DGO. Deux carottes ont été réalisées, MD 95-2015 à 58°46 N 25°58 W 2630 m et MD 95-2016 à 57°43 N et 29°26 W 2318 m. La seconde de ces carottes a été prélevée sur un site déjà échantillonné par W. Ruddiman, pour lequel la vitesse de sédimentation en période interglaciaire est exceptionnelle (supérieure à 30 cm/kyr).
Zones 9-10 : Marge nord est du continent Américain (44°-50°N : 40°-55°W). C'est la zone qui doit enregistrer de façon la plus sensible les arrivées d'icebergs associées aux débâcles des "niveaux de Heinrich" issus de la région nord de la Laurentide. En profondeur, on peut y enregistrer les caractéristiques des eaux profondes (NADW) dans leur trajet vers le sud, hors des zones de formation. Plusieurs zones carottées par le Lamont (LDEO, Univ. de Columbia, NY), les canadiens ou lors de la campagne Paléocinat 1, ont servi de cible. Cette zone est l'objectif unique des équipes canadiennes. Un autre objectif, lui aussi Canadien, vise un

échantillonnage serré d'une portion du canyon du NAMOC. Ce canyon suit pendant presque 2000 km la pente entre le talus continental du Labrador et les profondeurs du bassin ouest Atlantique. Le canyon est apparemment creusé par des masses d'eau turbides issues des écoulements sous glaciaires lors des périodes d'extension de la calotte Laurentide. 8 carottes, dont l'une de 34.8 m, ont été réalisés sur cette zone (MD 95-2018 à 23). La première des carottes pour le programme IMAGES Canadien a été réalisée en bordure de la fracture de Gibbs, sur la ride médio-Atlantique au sud-est de Gardar (MD 95-2017 53° 03 N, 33°32W, 3100 m). Les autres carottes ont été réalisées sur la marge Canadienne au nord, à l'est et au sud-ouest de Terre Neuve (MD 95 2024 à 2033), entre 4150 m et 878 m de profondeur.
Zone 11 : Ride des Bermudes. Zone de grand intérêt pour suivre à très haute résolution (vitesse de sédimentation de 30 cm/ka ou plus) les oscillations, en surface, des eaux subtropicales du Gulf Stream, et en profondeur la limite entre NADW et AABW. Trois carottages successifs ont été réalisés afin de couvrir les derniers cycles climatiques (MD95-2034 à MD95-2036). La carotte MD95-2036 fait 52.64 m de long, le record de longueur pour un carottage Kullenberg pour l'Atlantique). Principal objectif des équipes US.
Zones 12-13: Ride médio-Atlantique, Açores et Marge ouest de la Péninsule Ibérique (37°N 10°W). La zone comprenant la marge ibérique et la zone des Açores, étudiée en particulier par les campagnes de 1980 et 1990 du Suroît et des campagnes du Météor, présente une forte vitesse de sédimentation (entre 10 et 50 cm/1000 ans). Elle permet de suivre l'évolution de la bordure sud du front polaire en période glaciaire, et permet de reconstituer, à partir des foraminifères benthiques, la contribution des eaux de la Méditerranée aux eaux intermédiaires Atlantiques. Les carottes du pourtour des Açores offrent des enregistrements paléovolcaniques et paléomagnétiques d'un intérêt exceptionnel. Ces zones sont prioritaires pour les équipes du LGQ, de l'URA Orsay-Muséum, de l'IFREMER à Brest, du LODYC-Paris, du groupe CFR-DGO, les équipes allemandes (GEOMAR) et portugaises (Portugal Geol. Surv.), et les équipes anglaises de l'IOS et de l'Université de Cambridge. De 8 à 10 carottes de très grandes longueurs étaient prévues sur ces zones, mais seulement 6 ont pu être réalisées, faute de temps disponible (MD 95-2037 - 2042).
Zone 14 : Bordure ouest de la Méditerranée: Zone de forte accumulation où il sera possible de suivre l'évolution paléoclimatique de la bordure sud de l'Europe (par pollens et bio-marqueurs) en liaison avec l'hydrologie méditerranéenne. Priorité de l'équipe Univ. de Barcelone et de Salamanque (et collaboration avec Brest -Ifremer) : MD 95-2043 à 36°08 N, 02°37W, 1841 m).

Date	Station	GMT Time	Latitude (N)	Longitude (W)	Water depth (m)	Operation
05/29/95		23h00				Departure from Brest for station I
05/30/95	I	11h20				arrived on station (Trevelyan)
		14h59	46°48.17	08°40.28	3788	Calypso (22.37 m; MD 95-2001)
		19h30				departure for station II
	II	20h55				arrived on station (Mériadzec)
		23h07	47°27.12	08°32.03	2174	Calypso (29.99 m; MD 95-2002)
05/31/95		00h50				departure for station III
06/01/95	III	11h00				arrived on station (Feni Drift)
		12h07	55°10.61	14°45.32	2365	Calypso (26.93 m; MD 95-2003)
		14h52				departure for station IV
	IV	19h30				arrived on station (Feni Drift)
		20h55	55°28.07	14°40.51	2177	Calypso (28.485 m; MD 95-2004)
		22h54				departure for station V
06/02/95	V	10h02				arrived on station (Barra Fan)
		11h15	57°02	10°03.83	2130	Calypso (22.02 m; MD 95-2005)
						boat drifting, core taken 2 miles from the proposed site
		12h36				return to proposed site
		17h17	57°01.81	10°03.48	2122	Calypso (30.22 m; MD 95-2006)
		17h55				departure for station VI
06/03/95	VI	23h20				arrived on station (St-Kildas basin)
06/04/95		00h03	57°31.06	08°23.17	158	Calypso (19.35 m; MD95-2007)
		00h51				departure for station VII
	VII	13h35				arrived on station (Faeroes)
		14h08	62°44.35	03°59.64	1016	Calypso (21.5 m; MD 95-2008)
						Dynamic Positionning System test
06/05/95		06h51	62°44.25	03°59.86	1027	Calypso (32.43 m; MD 95-2009)
		10h30				departure for Faeroes port call, station VIII
06/06/95	VIII	09h48				arrived at the Faeroes port call, station VIII
		16h00	61°59.75	06°45.03	<100	Gravity core (MD 9508GR01)
06/07/95	IX	20h30				arrived on station (Vöring plateau)
		21h27	66°41.05	04°33.97	1226	Calypso (32.53 m; MD 95-2010)
		22h50			100	plankton tow (MD 95-IX-2)
06/08/95		01h10				departure for station X
06/08/95	X	06h45				arrived on station (Vöring Plateau)
		07h30	66°58.18	07°38.36E	1048	Calypso (17.49 m; MD 95-2011)
		09h06				departure for station XI
06/09/95	XI	05h42				arrived on station (Bear Island Fan)
		07h11	72°09.06	11°26.06E	2094	Calypso (19.76 m; MD 95-2012)
		08h24			100	plankton tow (MD 95-XI-3)
		09h00				departure for station XII

Date	Station	GMT Time	Latitude (N)	Longitude (W)	Water depth (m)	Operation
	XII	12h15				arrived on station (Bear Island slope)
		13h06	72°10.92	13°05.63E	1638	Calypso (13.10 m; MD 95-2013)
		14h45				departure for Iceland port call- station XIII
06/11/95	XIII	19h22				arrived at the Iceland port call (Hornfjordur)
		19h25	64°05.40	15°15.73	100	station XIII; Box core (empty)
		21h50				departure for station XIV
06/12/95	XIV	16h10				arrived on station (Reykyanes Ride)
		17h23	60°34.93	22°04.52	2397	Calypso (33.61 m; MD 95-2014)
		19h08			100	plankton tow (MD 95-XIV-4)
		19h32				departure for station XV
06/13/95	XV	06h36				arrived on station (Reykyanes Ride)
		08h34	58°45.74	25°57.54	2630	Calypso (34.42 m; MD 95-2015)
		08h00			100	plankton tow (MD-XV-5)
		10h31				departure for station XVI
	XVI	19h50				arrived on station (Reykyanes)
		20h45	57°42.46	29°25.44	2318	Calypso (32.83 m; MD 95-2016)
		21h12				departure for station XVII
06/14/95	XVII	19h03				arrived on station (Gibbs Fracture Zone)
		20h31	53°02.54	33°31.64	3100	Calypso; corer lost during removal from the sediment
		20h56			100	plankton tow (MD 95-XVII-6)
06/15/95		02h50	53°02.56	33°31.51	3100	Calypso (34.59 m; MD 95-2017)
		04h45				hydro cast
		05h55				departure for station XVIII
06/16/95	XVIII	08h00				arrived on station (Namoc)
		09h29	50°43.88	43°08.54	4221	Calypso (14.70 m; MD 95-2018)
		12h10				departure for station XIX
	XIX	15h03				arrived on station (Namoc)
		16h11	51°09.22	43°17.08	4360	Gravity core (empty; smear slide MD 9519GR02)
		17h30				departure for station XX
	XX	18h28				arrived on station (Namoc)
		20h03	51°05.68	43°13.27	4262	Calypso (12.86 m; MD 95-2019)
		21h41				departure for station XXI
	XXI	23h00				arrrived on station (Namoc)
06/17/95		00h30	51°02.42	43°00.62	4289	Calypso (8.63 m; MD 95-2020)
		01h51				departure for station XXII
	XXII	03h40				arrived on station (Namoc)
		05h15	50°59.76	42°55.19		Gravity core (1.21 m; MD 9522GR03) "petit-chef" first gravity core !!!
		06h45				departure for station XXIII

Date	Station	GMT Time	Latitude (N)	Longitude (W)	Water depth (m)	Operation
	XXIII	07h30				arrived on station (Namoc)
		09h00	50°51.81	42°44.49	4283	Calypso (4.48 m; MD 95-2021)
		10h50				departure for station XXIV
	XXIV	14h24				arrived on station (Namoc)
		15h43	50°34.38	43°03.51	4245	Calypso (18.37 m; MD 95-2022)
		16h14			100	plankton tow (MD 95-XXIV-7)
		17h23				departure for station XXV
	XXV	20h41				arrived on station (Namoc)
		23h48	50°58.32	43°13.04	4198	Calypso (34.68 m; MD 95-2023)
06/18/95		01h50				departure for station XXVI
	XXVI	10h00				arrived on station (Orphan Knoll)
		11h11	50°12.40	45°41.22	3539	Calypso (29.52 m; MD 95-2024)
		13h24				departure for station XXVII
	XXVIIa	13h45				arrived on station (Orphan Basin)
		18h31				core touched the bottom after releasing in the water
		18h34	49°47.41	46°49.03		core-catcher recovered in one bag (MD 95-XXVII-8; Attention: samples MD 95-XXVII-8 was renumbered after having registered MD 95-XXVII-7)
06/19/95	XXVIIb	00h20	49°47.65	46°41.85	3009	Calypso (35.12 m; MD 95-2025)
		02h13				departure for station XXVIII
	XXVIII	05h45				arrived on station (Orphan Basin)
		09h16	50°12.03	45°41.33	3539	Calypso (bent; empty)
						recovered core-catcher in one bag (MD 95-XXVIII-9; Attention: samples MD 95-XXVIII-9 was renumbered after having registered MD 95-XXVIII-7)
		12h45				departure for station XXIX
	XXIX	23h11				arrived on station (Sackville ridge)
		23h47	48°13.62	46°39.39	878	Calypso (27.91 m; MD 95-2026)
		23h40			100	plankton tow (MD 95-XXIX-10)
06/20/95		01h10				departure for station XXX
06/21/95	XXXa	05h49				arrived on station (S-E of Newfoundland)
		08h07 (?)	41°45.58	47°19.94		no visible release on the tensionmeter recording
						stones in the core-catcher, recovered in one bag (MD 95-XXX-11)
	XXXb	15h30	41°44.67	47°24.79	4112	Calypso (47.67 m; MD 95-2027)
		17h20				departure for station XXXI
06/22/95	XXXI	10h22				arrived on station (Fogo Seamount)
		11h37	42°05.99	52°44.85	3368	Calypso (34.20 m; MD 95-2028)
		13h20				departure for station XXXII
	XXXII	22h20				arrived on station (Laurentien Fan)
		22h49	43°06.78	55°15.96	4156	Calypso (35.10 m; MD 95-2029)

Date	Station	GMT Time	Latitude (N)	Longitude (W)	Water depth (m)	Operation
06/23/95		01h55				departure for station XXXIII
	XXXIII	11h00				arrived on station (Narwhal Area)
		12h41	44°19.14	53°43.44	1573	Calypso (35.59 m; MD 95-2030) core in very bad condition, redo
	XXXIV	21h47	44°18.45	53°44.14	1570	Calypso (27.72 m; MD 95-2031)
		23h00				departure for station XXXV
06/24/95	XXXV	05h32				arrived on station (Laurentien margin)
		07h06	44°39.46	55°37.14	1433	Calypso (28.54 m; MD 95-2032) departure for St-Pierre et Miquelon
		19h00				Arrived at the St-Pierre et Miquelon port call
06/26/95		08h24				Departure from St-Pierre et Miquelon for station XXXVI
	XXXVI	19h50				arrived on station (Laurentien margin)
		20h53	44°39.87	55°37.21	1412	Calypso (29.68 m; MD 95-2033)
		23h36			100	plankton tow (MD 95-XXXVI-12)
06/27/95		00h00				departure for station XXXVII
06/28/95	XXXVII	19h53				arrived on station (Bermuda Rise)
		21h24	33°41.46	57°34.55	4461.5	Calypso (47.16 m; MD 95-2034)
		21h53			100	plankton tow (MD 95-XXXVII-13)
06/29/95		00h05				departure for station XXXVIII
	XXXVII	04h01				arrived on station (Bermuda Rise)
		05h34	33°29.20	57°53.16	4286	Calypso (39.25 m; MD 95-2035)
		09h00				departure for station XXXIX
	XXXIX	12h14				arrived on station (Bermuda Rise)
		14h43	33°41.44	57°34.55	4461.5	Calypso (52.64 m; MD 95-2036)
		16h47				departure for station XL
07/03/95	XLa	02h38				arrived on station (South Lucky)
			37°05.22	32°01.82	~1800	Calypso; Kevlar cable broke; corer, piston and cable (~1800 m) lost on the bottom
	XLb	11h16	37°05.23	32°01.87	2159	Calypso (35.81 m; MD 95-2037)
		11h52			100	plankton tow (MD 95-XL-14)
		14h05				departure for station XLI
07/04/95	XLI	07h25				arrived on station
		08h26	37°45.15	27°11.21	2310	Calypso (37.85 m; MD 95-2038)
		10h25				departure for the Azores port call
		16h00				arrived at the Azores port call
		22h40				departure from Azores for station XLII
07/06/95	XLII	23h15				arrived on station
07/07/95		00h17	40°34.71	10°20.91	3381	Calypso (35.71 m; MD 95-2039)

Date	Station	GMT Time	Latitude (N)	Longitude (W)	Water depth (m)	Operation
		02h00				departure for station XLIII
07/07/95	XLIII	05h34				arrived on station
		06h52	40°34.91	09°51.67	2465	Calypso (35.24 m; MD 95-2040)
		08h15				departure for station XLIV
07/08/95	XLIVa	20h05				arrived on station
		21h18	37°49.97	09°30.62	1123	Calypso (piston not released)
	XLIVb	22h58	37°50	09°30.65	1123	Calypso (17.62 m; MD 95-2041)
07/09/95		00h00				departure for station XLV
		04h45				arrived on station
			37°48	10°09.99	3146	Calypso (39.56 m; MD 95-2042)
		08h10				departure for station XLVI
		09h10				arrived on station
		09h59	36°08.60	02°37.27	1841	Calypso (37.46 m; MD 95-2043)
		11h00				departure for Marseille

Date	Station	Water depth (m)	Latitude (N)	Longitude (W)	Location	Core #	Length (m)	Sections	Comments
05/30/95	I	3788	46°48.17	08°40.28	Trevelyan	MD 95-2001	22.37	XVI	**Giant Kullenberg core (Calypso)** **liner exploded between 0-533 cm; 3.5 Khz record was partially erased
05/30/95	II	2174	47°27.12	08°32.03	Meriadzec	MD 95-2002	29.99	XX	**Calypso core** *** OK
06/01/95	III	2365	55°10.61	14°45.32	Feni Drift	MD 95-2003	26.93	XVIII	**Calypso core** **Liner exploded on the upper 8m approx.; very perturbed sediments in sections I to IV (0-1050 cm) and section XIX (2683-2715 cm)
06/01/95	IV	2177	55°28.07	14°40.51	Feni Drift	MD 95-2004	28.485	XIX	**Calypso core** *** OK
06/02/95	V	2130	57°02	10°03.83	Barra fan	MD 95-2005	22.02	XV	**Calypso core** **boat drifting, core taken 2 miles from the proposed site; redo (MD 95-2006); numerous voids in the core
		2122	57°01.81	10°03.48	Barra fan	MD 95-2006	30.22	XX	**Calypso core** ***
06/04/95	VI	158	57°31.06	08°23.17	St Kildas Basin	MD 95-2007	19.35	XIII	**Calypso core** *** stopped on stones
06/04/95	VII	1016	62°44.35	03°59.64	Nord Faeroes	MD 95-2008	21.5	XVII	**Calypso core** ** liner scliced along from sections XIII to XV (1715-2075 cm); holocene missing from the top
		1027	62°44.25	03°59.86	Nord Faeroes	MD 95-2009	32.43	XXI	**Calypso core** **upper part of the core bent; liner sliced along between about 1330-2224 cm
06/06/95	VIII	< 100	61°59.75	06°45.03		MD 9508GR01		bag	**Gravity core** about 1 kg of mud and shells
06/07/95	IX	1226	66°41.05	04°33.97	Vöring plateau	MD 95-2010	32.53	XXI	**Calypso core** ** OK
		100				MD 95-IX-2			**plankton tow** (Attention: no sample n°1 -> gravity core from the site VIII was renumbered MD9508GR01 after having registered as a sample (MD 95-VIII-1))
06/08/95	X	1048	66°58.18	07°38.36E	Vöring plateau	MD 95-2011	17.49	XII	**Calypso core** Site location wrong, slumps. Bent core; liner imploded in the middle of the core; 30 cm of sediment of the top recovered in a 1/2 liner

Date	Station	Water depth (m)	Latitude (N)	Longitude (W)	Location	Core #	Length (m)	Sections	Comments
06/09/95	XI	2094	72°09.06	11°26.06E	Bear Isl. Fan	MD 95-2012	19.76	XV	**Calypso core** *trigger release jam, first touch without releasing; sent second messenger-> double touch. Bent core; broken liner; liner overlaped in section VI; between 1702-1976 cm, sediments extruded in the core and recovered in a liner
		100				MD 95-XI-3			**plankton tow**
06/09/95	XII	1638	72°10.92	13°05.63E	Bear Isl. Fan	MD 95-2013	13.1	IX	**Calypso core** bent core; sliced liner all along the core
06/11/95	XIII	100	64°05.40	15°15.73			0	0	**Gravity core** empty
06/12/95	XIV	2397	60°34.93	22°04.52	S. Iceland	MD 95-2014	33.61	XXIII	**Calypso core** *** OK; about 7 cm of sediment dropped on the deck when cutting between sections
		100				MD 95-XIV-4			**plankton tow**
06/13/199	XV	2630	58°45.74	25°57.54	Reykjanes Ridge	MD 95-2015	34.42	XXIII	**Calypso core** *** OK
		100				MD 95-XV-5			**plankton tow**
06/13/199	XVI	2318	57°42.46	29°25.44	Reykjanes Ridge	MD 95-2016	32.83	XXII	**Calypso core** *** OK; broken liner in sections I, II and VII; lost of liquid sediment at the top.
06/14/199	XVII	3100	53°02.54	33°31.64	Gibbs				**Calypso core** core lost during removal from the sediment, piston cable broke at16 tons
		100				MD 95-XVII-6			**plankton tow**
06/15/199		3100	53°02.56	33°31.51	Gibbs fracture	MD 95-2017	34.59	XXIV	**Calypso core** * suppy, expanded sediment in sections I to VIII (27-1200 cm); section XVI perturbed with many liquid pockets
		133							**hydro cast**
06/16/199	XVIII	4221	50°43.88	43°08.54	Namoc	MD 95-2018	14.7	X	**Calypso core** Sections I to IVa (0-525 cm) damaged and mostly empty; 140 cm of sediment missing between sections VI and VII

Date	Station	Water depth (m)	Latitude (N)	Longitude (W)	Location	Core #	Length (m)	Sections	Comments
06/16/199	XIX	4360	51°09.22	43°17.08	Namoc	MD 9519GR02	0	0	**Gravity core** empty; smear slide
06/16/199	XX	4262	51°05.68	43°13.27	Namoc	MD 95-2019	12.86	IX	**Calypso core** *** OK
06/17/1995	XXI	4289	51°02.42	43°00.62	Namoc	MD 95-2020	8.63	VI	**Calypso core** * upper 1-2m implosed; 20 cm of the sediment from the top was put in a liner (Ia), the rest of the sediment are in one bag (Ib), regular core cutting starts with section Ic (0-150 cm)
06/17/1995	XXII	4415	50°59.76	42°55.19	Namoc	MD 9522GR03	1.21	I	**Gravity core** ** first touch at very low speed in order to spot the bottom, core entered at 2 m/s;
06/17/1995	XXIII	4283	50°51.81	42°44.49	Namoc	MD 95-2021	4.48	III	**Calypso core** core cutter lost but core-catcher recovered, gravels at the base; upper part of the liner imploded above the sediment; top 0-30 cm recovered in one bag (Ia); 30-150 cm interval is half full (section Ib)
06/17/1995	XXIV	4245	50°34.38	43°03.51	Namoc	MD 95-2022	18.37	XIII	**Calypso core** * liner imploded at mid-pipe (~6m) ; overlapping of 3 liners in section IV; liquid
		100				MD 95-XXIV-7			**plankton tow**
06/17/1995	XXV	4198	50°58.32	43°13.04	Namoc	MD 95-2023	34.68	XXIV	**Calypso core** ** liquid pocket between sections IXb-X, partially recovered in one bag
06/18/1995	XXVI	3539	50°12.40	45°41.22	Orphan Knoll	MD 95-2024	29.52	XX	**Calypso core** ** liquid pocket between sections X-XI, partially recovered in one bag
06/18/1995	XXVIIa	2916	49°47.41	46°49.031	Orphan Basin	MD 95-XXVII-8	0	0	**Calypso core** the core touched the bottom after releasing in the water; core-catcher recovered in one bag (stones in core-catcher 1-3 cm diameter); Attention: samples MD 95-XXVII-8 was renumbered after having been registered MD 95-XXVII-7
06/19/199	XXVIIb	3009	49°47.646	46°41.85	Orphan Basin	MD 95-2025	35.12	XXIV	**Calypso core** *** OK; liquid pocket between sections IX-X

Date	Station	Water depth (m)	Latitude (N)	Longitude (W)	Location	Core #	Length (m)	Sections	Comments
06/19/199	XXVIII	3539	50°12.03	45°41.33	Orphan Knoll	MD 95-XXVIII-9	0	0	**Calypso core** bent and empty core; stones above the core-catcher; Attention: samples MD 95-XXVIII-9 was renumbered after having registered MD 95-XXVIII-7
06/19/199	XXIX	878	48°13.62	46°39.39	Sackville spur	MD 95-2026	27.91	XIX	**Calypso core** bent core; liquid pocket between sections V-VI; core catcher full of stones
		100				MD 95-XXIX-10			**plankton tow**
06/21/199	XXXa	4095	41°45.58	47°19.94	NewFoundland Slope	MD 95-XXX-11	0	0	**Calypso core** no visible release on the tensionmeter recording; empty core; stones in the core-catcher, recovered in one bag
06/21/199	XXXb	4112	41°44.67	47°24.79	NewFoundland Slope	MD 95-2027	47.67	XXXII	**Calypso core** *** OK
06/22/199	XXXI	3368	42°05.99	52°44.85	Fogo Sea Mount	MD 95-2028	34.2	XXIII	**Calypso core** *** OK; liquid pocket between sections VII-VIII (very fluid), partially recovered in
06/22/199	XXXII	4156	43°06.78	55°15.96	Laurentian fan	MD 95-2029	35.1	XXIV	**Calypso core** ** OK; liquid pockets partially recovered between sections IX-X and XI-XII; section I partially emptied during handling on deck
06/23/199	XXXIII	1573	44°19.14	53°43.44	Narwhal	MD 95-2030	35.59		**Calypso core** core in very bad condition, redo
06/23/199	XXXIV	1570	44°18.45	53°44.14	Narwhal	MD 95-2031	27.72	XIX	**Calypso core** ** OK; core slightly bent at the top (~5m); broken liner in sections VI and VII
06/24/199	XXXV	1433	44°39.46	55°37.14	upper Laurentian sl.	MD 95-2032	28.54	XX	**Calypso core** liner bent at the top (0-600 cm (sections I to IV)); upper 3 sections ± sliced
06/26/199	XXXVI	1412	44°39.87	55°37.21	upper Laurentian sl.	MD 95-2033	29.68	XX	**Calypso core** ** OK; ore slightly bent at the top; when extruding the liner, 70 cm of sediment fell on deck, recovered in a 1/2 liner (714-784 cm)
		100	44°39.15	55°36.50		MD 95-XXXVI-			
06/28/199	XXXVII	4461.5	33°41.46	57°34.55	Bermuda Rise	MD 95-2034	47.16	XXXII	**Calypso core**

Date	Station	Water depth (m)	Latitude (N)	Longitude (W)	Location	Core #	Length (m)	Sections	Comments
									*** OK; ections I to III very fluid; liner imploded in sections IX and X; bags of fluids sediments recoveried between sections XIII-XIV and XVI-XVII
		100	33°41.54	57°35.30	Bermuda Rise	MD 95-XXXVII-			**plankton tow**
06/29/199	XXXVII	4286	33°29.20	57°53.16	Bermuda Rise	MD 95-2035	39.25	XXVII	**Calypso core** *** OK; first touch without releasing, released on the second attempt
06/29/199	XXXIX	4461.5	33°41.44	57°34.55	Bermuda Rise	MD 95-2036	52.64	XXXVI	**Calypso core** *** OK; first touch without releasing, released on the second attempt; liner imploded in sections II and III; sections III et IV very fluid; one bag of fluid sediment recovered between sections XIV and XV
03/07/95	XLa	1800	37°05.22	32°01.82	AZORES/Sud Lucky		0	0	**Calypso core** piston cable broke; piston, corer and 1800 m of cable lost....
03/07/95	XLb	2159	37°05.23	32°01.87	AZORES/Sud Lucky	MD 95-2037	35.81	XIII	**Calypso core** *** OK; upper part of the core bent; 0-4 cm disturbed during core cutting; lost of sediment between 283-336 cm (section IIb)
		100				MD 95-XL-14			**plankton tow**
07/04/95	XLI	2310	37°45.15	27°11.21	AZORES	MD 95-2038	37.85	XXVI	**Calypso core** *** OK; many turbidites
07/07/95	XLII	3381	40°34.71	10°20.91	Porto Seamount	MD 95-2039	35.71	XXIV	**Calypso core**
07/07/95	XLIII	2465	40°34.91	09°51.67	Porto Seamount	MD 95-2040	35.24	XXIV	**Calypso core** core bent; section IIb jamed in the bent part of the core, recuperated in 1/2 liner
07/08/95	XLIVa	1123	37°49.97	09°30.62					**Calypso core** piston not released
07/08/95	XLIVb	1123	37°50	09°30.65	marge ibérique	MD 95-2041	17.62	XII	**Calypso core** upper part of the core bent; liner exploded in section Ia
07/09/95	XLV	3146	37°47.99	10°09.99	marge ibérique	MD 95-2042	39.56	XXVII	**Calypso core** ** OK; core bent
07/09/95	XLVI	1841	36°08.60	02°37.27	Alboran Sea	MD 95-2043	37.46	XXV	**Calypso core** *** OK; liner exploded in section VIII

Cores #	Water depth (m)	Latitude (N)	Longitude (W)	Length (m)
MD 95-2001	3788	46°48.17	08°40.28	22.37
MD 95-2002	2174	47°27.12	08°32.03	29.99
MD 95-2003	2365	55°10.61	14°45.32	26.93
MD 95-2004	2177	55°28.07	14°40.51	28.485
MD 95-2005	2130	57°02	10°03.83	22.02
MD 95-2006	2122	57°01.81	10°03.48	30.22
MD95-2007	158	57°31.06	08°23.17	19.35
MD 95-2008	1016	62°44.35	03°59.64	21.5
MD 95-2009	1027	62°44.25	03°59.86	32.43
MD 95-2010	1226	66°41.05	04°33.97	32.53
MD 95-2011	1048	66°58.18	07°38.36E	17.49
MD 95-2012	2094	72°09.06	11°26.06E	19.76
MD 95-2013	1638	72°10.917	13°05.632E	13.1
MD 95-2014	2397	60°34.93	22°04.52	33.61
MD 95-2015	2630	58°45.74	25°57.54	34.42
MD 95-2016	2318	57°42.46	29°25.44	32.83
MD 95-2017	3100	53°02.56	33°31.51	34.59
MD 95-2018	4221	50°43.88	43°08.54	14.7
MD 95-2019	4262	51°05.68	3°13.27	12.86
MD 95-2020	4289	51°02.42	43°00.62	8.63
MD 95-2021	4283	50°51.81	42°44.49	4.48
MD 95-2022	4245	50°34.38	43°03.51	18.37
MD 95-2023	4198	50°58.32	43°13.04	34.68
MD 95-2024	3539	50°12.40	45°41.22	29.52
MD 95-2025	3009	49°47.65	46°41.85	35.12
MD 95-2026	878	48°13.62	46°39.39	27.91
MD 95-2027	4112	41°44.67	47°24.79	47.67
MD 95-2028	3368	42°05.99	52°44.85	34.2
MD 95-2029	4156	43°06.78	55°15.96	35.1
MD 95-2030	1573	44°19.14	53°43.44	35.59
MD 95-2031	1570	44°18.45	53°44.14	27.72
MD 95-2032	1433	44°39.46	55°37.14	28.54
MD 95-2033	1412	44°39.87	55°37.21	29.68
MD 95-2034	4461.5	33°41.46	57°34.55	47.16
MD 95-2035	4286	33°29.20	57°53.16	39.25
MD 95-2036	4461.5	33°41.44	57°34.55	52.64
MD 95-2037	2159	37°05.23	32°01.87	35.81
MD 95-2038	2310	37°45.15	27°11.21	37.85
MD 95-2039	3381	40°34.71	10°20.91	35.71
MD 95-2040	2465	40°34.91	09°51.67	35.24
MD 95-2041	1123	37°50	09°30.64	17.62
MD 95-2042	3146	37°47.99	10°09.99	39.56
MD 95-2043	1841	36°08.60	02°37.27	37.46

Cores #	Water depth (m)	Latitude (N)	Longitude (W)	Length (m)
MD 9508GR01	< 100	61°59.75	06°45.03	0.2
MD 9519GR02	4360	51°09.22	43°17.08	0 (smear slide)
MD 9522GR03	4415	50°59.76	42°55.19	1.21

Samples #	Water depht (m)	Latitude (N)	Longitude (W)	Type of sampling
MD 95-IX-2	100	66°41.05	04°33.97	plankton tow
MD 95-XI-3	100	72°09.06	11°26.06E	plankton tow
MD 95-XIV-4	100	60°34.93	22°04.52	plankton tow
MD 95-XV-5	100	58°45.74	25°57.54	plankton tow
MD 95-XVII-6	100	53°02.54	33°31.64	plankton tow
MD 95-XXIV-7	100	50°34.38	43°03.51	plankton tow
MD 95-XXVII-8*	2916	49°47.41	46°49.03	core-catcher
MD 95-XXVIII-9**	3539	50°12.03	45°41.33	core-catcher
MD 95-XXIX-10	100	48°13.615	46°39.394	plankton tow
MD 95-XXX-11	4095	41°45.58	47°19.94	core-catcher
MD 95-XXXVI-12	100	44°39.15	55°36.50	plankton tow
MD 95-XXXVII-13	100	33°41.54	57°35.30	plankton tow
MD 95-XL-14	100	37°05.23	32°01.87	plankton tow

* samples MD 95-XXVII-8 was renumbered after having registered MD 95-XXVII-7
** samples MD 95-XXVIII-9 was renumbered after having registered MD 95-XXVIII-7

ON BOARD MEASUREMENTS

A. Preliminary report on physical properties measurements

Gavin Dunbar, Franck Bassinot, Kate Jarrett, and the physical properties shipboard scientists

Several types of physical properties measurements were performed on board the Marion Dufresne during the IMAGES-MD101 cruise. Near-continuous, non destructive measurements of bulk density, compressional wave velocity, and magnetic susceptibility were obtained with a GEOTEK MultiSensor Track (MST). Index properties measurements (bulk density, porosity, water content) were also performed on discrete samples obtained with a 10 cc syringe. The Minolta CM-2002 hand-held spectrophotometer was used to measure reflected visible light in thirty one 10-nm wide bands ranging from 400-700 nm. Measurements were usually performed every 5 cm. Continuous video scanning of the working half sections was performed using the system developed by the CFR.

All the physical properties data obtained on board the R/V Marion Dufresne during the MD101 cruise are available on a FTP server at the Centre des Faibles Radioactivités (access to the data base requires a specific user identification and password that are available to people involved in post-cruise studies. Contact: Franck.Bassinot@cfr.cnrs-gif.fr).

1. Continuous measurements of physical properties (MST).

High-resolution logging of physical properties was carried out on rounded cores on board the R/V *Marion Dufresne* using a GEOTEK Ltd Multi Sensor Core Logger (or MST, Multi Sensor Track). These measurements formed the basis for initial correlations between sites. When combined with the shipboard spectrophotometer data and the smear slide descriptions, these data enabled a tentative stratigraphy to be assigned to the cores within hours of recovery. Combined plots of selected MST and spectrophotometer data are shown elsewhere in this report.

1.1 Description of the Multi Sensor Core Logger

The shipboard multi sensor core logger system have three main sensor units (the configuration of the shipboard system is shown in figure 1):

- **1)** a P-WAVE LOGGER that consists of two transducers (piezzo-electric crystals) connected to an oscilloscope to measure the travel time of a 500 kHz compressional wave through the core. The travel time is then used to calculate P-wave velocity in the sediment.
- **2)** a GAMMA RAY SOURCE (137Cs) AND DETECTOR for measuring the bulk density by comparing the attenuation of gamma rays through the cores with attenuation through aluminum standards.
- **3)** a MAGNETIC SUSCEPTIBILITY METER for determining the amount of magnetically susceptible material present in the cores. In our case, a Bartington Instruments MS2 loop sensor with an internal diameter of 125 mm was used.

In order to calibrate the values derived from these sensors, core temperature and core diameter were measured on each section. The entire logging process, after loading each core section onto the conveyor track, is controlled by the MST microprocessor with the display and recording of data being handled by the host computer.

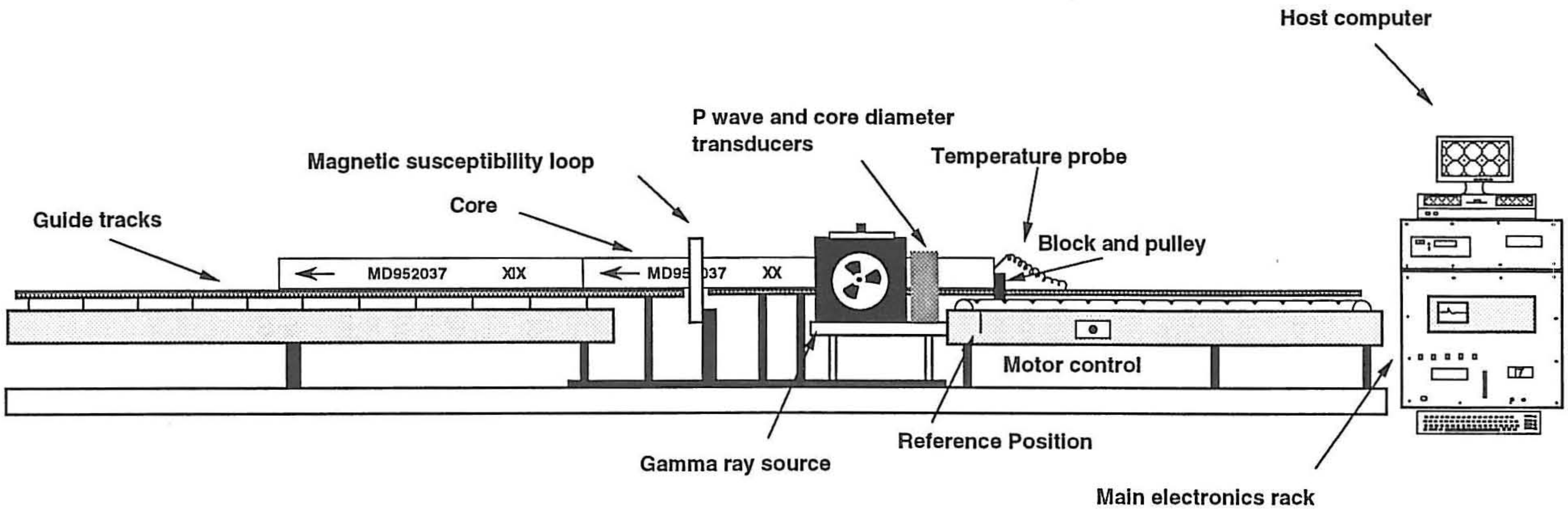
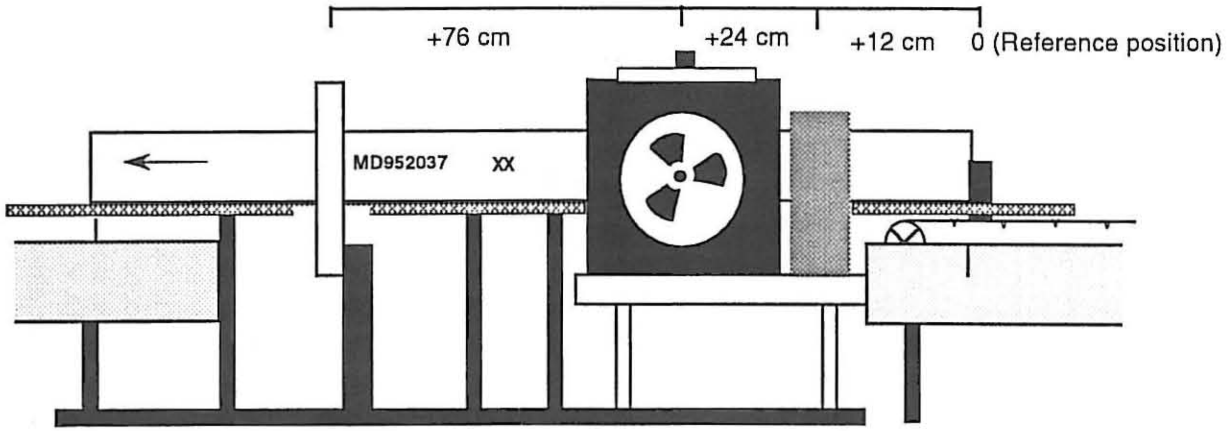


Figure 1
Configuration of the Multi sensor core logger installed on the RV Marion Dufresne for the IMAGES MD101 North Atlantic Cruise.



1.2 Core handling.

Unsplit cores were delivered to the MST lab in 1.5 m sections. The cores temperature temperature is low (few degrees Celsius) just after recovery but increases rapidly as soon as they are stored in the lab containers. Several hours (up to 24) of equilibration time proved necessary to bring the cores up to a stable room temperature before logging could begin. This equilibration is necessary to avoid that progressive temperature drifts take place during logging and affect physical properties results. At times, a temperature gradient of 4°C existed between the floor and the ceiling in the MST container. Because the container temperature could not be controlled accurately, it was necessary to store the cores in a horizontal position to ensure an homogeneous temperature along the length of the core.

1.3 Calibration and initial settings of the MST.

a) Core temperature - Changes in core temperature result in changes in P-wave velocities in the sediment which must be corrected for during processing. Sediment temperature was measured for each section and P-wave velocities were corrected using the formulae of Wilson (1960) and Wylie et al. (1956), and MacKenzie (1981).

b) External core diameter - Variations in core diameter cause variations in physical properties measurements which reflect the changing amount of sediment between the sensors instead of intrinsic sediment properties. For the P-wave velocity acquisition, the true diameter is measured for each measurement by an electronic caliper. For the gamma-ray attenuation measurements, the nominal external core diameter was reset after every four 1.5 m sections had been logged. Observed drift between calibrations was generally <0.2 mm. It is assumed that variations in external diameter are paralleled by changes in the internal diameter as it is not possible to measure this on a continuous basis. Only real changes in total offset are recorded.

c) Magnetic susceptibility - The drift of the susceptibility sensor over the course of the cruise was checked by measuring an iron ring of known susceptibility (527 cgs). The magnetic susceptibility of the core liners was measured by first setting the MS value to zero, then placing an empty section of liner inside the loop. During the cruise, two sets of PVC liner were used which didn't have the same physical properties signatures. Standards were constructed for both types of liner and different corrections were applied on bulk physical properties (i.e. the "old" liner appeared to have a higher magnetic susceptibility 'background' level than the new one).

d) Gamma ray attenuation - Gamma ray attenuation was calibrated on a semi-weekly basis for the two liner types used (or whenever density and porosity values obtained for our water standard -which were run after every 4 sections- differed greatly from theoretically determined values). An empty section of core liner was placed between the source and the detector. Aluminium plates 6 mm thick (0, 1, then 2 up to 8) were placed inside the liner and the gamma ray attenuation measured. The resulting plot of density.vs.ln(gamma counts) provided the density calibration slope and intercept values used to correct GRAPE measurements for the attenuation of the liner.

Conversion of the gamma attenuation measurements to sediment density was done using the relationship established by Boyce (1976) for quartz.

The gamma ray beam produced on the shipboard MST could be collimated through one of two possible collimators (5 and 2.5 mm diameter). On this cruise only the larger diameter collimator was used due to the large diameter of the sediment cores.

1.4 MST Logging Procedure

The logging procedure used in the MST lab generally followed that outlined in the manufacturers instruction manual. The new GEOTEK system is designed to log an entire core at once by measuring on a continuous basis one section after the other. The major drawback of this method is that no data storage is performed on the hardrive of the host computer before the entire core is logged. Any computer problem arising during the logging procedure results, therefore, in the loss of the entire data set obtained so far. To avoid this problem, we scanned the cores by intervals of four sections (a water standard was added on each 4 sections-run which allowed to have a close control on sensors calibration). This procedure also enabled a close check to be kept of the cumulative error in core length caused by non-straight cuts of the liner (the core length was precisely reset at the beginning of each block of four sections). Sampling interval was set to **2 cm** for all cores.

The following parameters were used for most logging runs:

Maximum core length (for four sections plus water standard)	800 cm
Core sampling interval	2 cm
Nominal core diameter	113 mm
Core diameter logging	YES
Magnetic susceptibility units	SI
Magnetic susceptibility sampling time	1 Sec
A-Gamma count time	3 Sec
P-wave travel time offset	9.056 usec (varies)

Once a stable temperature had been reached, the unsplit sediment core was placed on the core track at the right hand end of the conveyor system, and aligned to its start position with one end of the core at a predetermined reference position. In this case a piece of empty core liner was used to separate the P-wave transducers and mark the reference position. The core then is moved incrementally along the length of the track, pushed by a block fixed to the conveyor belt, past or through the various sensors.

In order to ensure a good acoustic coupling between the P-wave transducers and the core, the liner was wiped with a wet sponge prior to logging and, when necessary, during logging by dripping a little distilled water onto the contact. The quality of the P-wave signal could be observed in "real time" on the oscilloscope integrated into the MST unit. As sections were stored in a horizontal position, there often proved to be air gaps between the sediment and the liner resulting in poor quality P-wave transmission.

Where possible, the endcaps were removed from the core sections to minimize errors in determining core length. Where this was not possible (for example, with fluid sediment, usually only in the top sections of the core), thin, temporary core caps were used (because the standard endcaps were too large to fit through the magnetic susceptibility loop) and their thickness noted. Occasionally core sections expanded out of the liner once the core caps were removed. In these cases, the amount of core extending beyond the liner was noted down.

Very badly damaged sections were not logged by the MST, the primary constraint being the ability of the section to fit through the magnetic susceptibility loop sensor (internal diameter 125 mm). Great care was taken when running damaged sections to ensure that the P-wave transducers were not "rammed" by following sections of core on the conveyor track.

1.5 Data processing

The MST generates three data files for each core logged; 1) a file containing the configuration setup for that particular core; 2) a "skewed" ASCII text file containing the raw data (explained below) and; 3) a random access data file generated as the core is being logged.

At this stage it was possible to correct logging errors by editing the text data file prior to processing. Usually logging errors were due to the temperature probe not being inserted in the core until after the section had begun to be logged. Occasional "double samples" caused by the core pusher jamming were also edited out at this stage.

As the MST's sensors are set at different positions along the conveyor track, every sample taken records values offset by a predetermined amount from the reference position. The MST itself only saves data in this "skewed" format and prior to any other processing, the data must first be unskewed. This was done using a processing package provided by the University of New Brunswick (written by Kate Jarrett). The same package was also used to calculate corrected values for P-wave velocity, and Gamma attenuation for the effects of the liner and temperature variations. Density was also calculated as a function of gamma ray attenuation.

During processing a "Processing sheet" was kept on which all the relevant parameters were entered for each file. In general these consisted of:

Water depth
Depth of first sample
Liner thickness
Density intercept
Density calibration slope
P-wave travel time offset
Bottom water temperature (assumed to be 4 C)
Sediment density (assumed to be 2.7 g/cm3)
Input filename
Output filename

Processed data for each batch of four sections were saved with the water standard data included at the bottom of the file, as this provided a check on the accuracy of the calibrations being used. In addition a file containing data (with water values removed) for the entire core was accumulated by simply cutting and pasting the data for each group of for sections into one file. This file was then used to generate plots, using the Powermac application "Kaleidagraph".

1.6 Problems

No mechanical problems were experienced with the system during the cruise. On one occasion, a short circuit developed between the motor control unit and the conveyor track. This was fixed by simply cleaning and drying the connection.

Occasionally the core pusher proved insufficiently powerful to move two sections of core along the track. This problem was largely overcome by applying grease to the track to reduce friction.

Most problems were caused by software/computer errors, which disrupted the control system of the core logger. However, no computer related difficulties proved to be severe enough to prevent any core being logged.

The following notes refer mainly to the Microprocessor installed in the MST. This chip contains both RAM and PROM memory circuits. In order to operate the MST the instruction code for this microprocessor must first be downloaded from the host computer. Once installed in the PROM the code should then remain there without further downloading being necessary.

Initial software problems were an inability to access the test menu from the main menu. This was overcome by switching the system off (Computer and MST) and restarting. However, during the transfer of hex code between the host computer and MST when initializing the system, an error message suggesting that some of the code had become corrupted appeared (ERROR: BAD SYNTAX in line 9860).

A fault in the data display was also noted - sample number 13 was displayed twice on the screen every time it was recorded. Sample 13 itself was recorded without difficulty, however values for sample 14 were preceded by a repeat of those values recorded for sample 13.

As a result, only 12 cm of core could be logged before the system stopped. The motor would not advance and the software "froze", i.e. the data remained on the screen but nothing happened. Line 9860 in the MSCL21.I52 file on the C: drive was identical to that listed in the MST software printout. We also tried to start the MST from the A: drive with the same result (i.e. syntax error in the .I52 code). Therefore it appeared that the problem was with the software in the MST - ROM. An attempt to replace this with an MSCL21.I52 file off the backup disk (as per the instructions in the MST manual) was unsuccessful. We also tried to upload the MSCL21.I52 file from the ROM to compare its contents with those in the MST software manual and found that only the first half the code (up to line 5760, which is in mid-subroutine as well as being only halfway through the code) appeared to be present when the upload had been completed. An attempt to download uncorrupted code into the MST microprocessors RAM was initially unsuccessful due to an apparent failure of the "New" command to reset the memory. This resulted in a MEMORY ALLOCATION ERROR, which prevented a large section of the code from being transferred.

2. Discrete measurements of index properties

In order to calibrate correctly the continuous wet-bulk density records provided by the MST, discrete index properties measurements (bulk density, dry density, porosity) were performed on the IMAGES-MD101 cores (one measurement per section in most of the cores).

Calculations were based on the measurements of wet (Wm) and dry (Dm) mass of constant, 10.36-cm^3 plugs of sediment obtained with a precisely calibrated aluminium syringe. Dry weight were measured on samples after 24 hours drying in a 60°C oven. Sample mass was determined aboard the ship to a precision of ±0.01 g using a Scitech electronic balance. This balance is equiped with a double-plateau. Acceleration changes due to the ship motion are instantaneously evaluated and corrected by measuring in the same time the weight of a known mass.

Wet-bulk density (g/cm^3) : Wm/10.36

Dry-bulk density (g/cm^3) : Dm/10.36

Porosity was calculated assuming a density of 1.035 g/cm3 for pore water lost during drying. The volume of water was then calculated based on the weight loss : volume of pore water = Wm-Dm/1.035. And thus, the porosity formula is:

Porosity (%) : (((Wm-Dm)/1.035)/10.36) * 100

3. Spectrophotometry

The Minolta CM-2002 hand-held spectrophotometer was used to measure reflected visible light on sediment cores that were splitted on board the Marion Dufresne during the cruise. The visible spectrum is divided in thirty one, 10-nm wide bands ranging from 400-700 nm. Measurements were usually performed every 5 cm all along the cores. The color reflectances were measured as soon as possible after the cores were split, because redox-associated color changes may occur rapidly when deep-sea sediments are exposed to the atmosphere.

A few problems were encountered at the beginning of the cruise and it became rapidly apparent that these problems resulted from an incorrect use of the Minolta which was not always pressed flush against the sediment surface during the measurements. Incorrectly measured sections were rapidly re-done after this problem has been evidenced by Dr. Ed Boyle who was in charge of the spectrophotometer acquisition.

The color reflectance profiles proved to be extremely prowerful tools for preliminary stratigraphic and correlation purposes. Between 40° and 55°N, more particularly, color reflectance profiles have been succesfully used for the direct tuning of the time scales by cyclo-stratigraphy in the precession and obliquity bands.

4. Video imaging and pictures

In sediments from the North Atlantic, continuous records of color changes obtained by video proved to be extremely succesful in picking rapid climatic variability (Cortijo et al., 1995). The system developped at the CFR was brought aboard the R/V Marion Dufresne for the IMAGES-MD101 cruise.

Working half sections were digitized by intervals of 75 cm in length with a tri-CCD (Charged Coupled Device) color camera. The lighting was constitued by two neon glow lamps. In the resulting video images, one pixel represents approximately 1.3 mm of sediment. Because of the high sampling density of the video imaging, the resulting data files are huge and were stored on 1.2 Gigabytes magneto-optical disks.

Because of the time pressure during the cruise, the concatenation of the 75-cm images as well as the complete image processing could not be achieved on board the *Marion Dufresne*. The data processing will make it possible to eliminate illumination distorsions which result in relatively strong, 75-cm cycles in the unprocessed video images.

We took color pictures of the 75-cm intervals that were scanned.

5. References

Boyce, R.E., 1976. Definitions and laboratory techniques of compressional sound velocity parameters and wet-water content, wet bulk density, and porosity parameters by gravimetric and gamma ray attenuation techniques. In Schlanger, S.O., Jackson, E.D., et al., *Init. Repts. DSDP, 33*: 931-958. Washington (U.S. Govt. Printing Office).

Cortijo, E., Yiou, P., Labeyrie, L., and Cremer, M., 1995. Sedimentary record of rapid climatic variability in the North Atlantic Ocean during the last glacial cycle. *Paleoceanography*, 10(5), 911-926.

MacKenzie, K. V., 1981. Nine-term equation for sound speed in the oceans, *J. Acoust. Soc. Am.*, 70(3), 807-812.

Wilson, W. D., 1960. Speed of sound in sea water as a function of temperature, pressure and salinity, *J. Acoust. Soc. Am.*, 32(6), 641-644.

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B. Preliminary report on calcareous nannofossil biostratigraphy of IMAGES-MD101 cores

Luc BEAUFORT and Jacques GIRAUDEAU

Calcareous nannofossil assemblages were examined in core catchers of cores retrieved during the IMAGES-MD101 cruise in order to provide age estimates for the core bases. Conventional biostratigraphy, using highest and lowest occurence data of marker species, allows the identification of three biozones in the Late Pleistocene (NN21, NN20 and NN19; Martini, 1971). The NN19/20 boundary is marked by the last occurence of *Pseudoemiliania lacunosa*, and the NN20/21 boundary corresponds to the first occurence of *Emiliania huxleyi* . In order to increase the stratigraphic resolution, it is possible to use the "acmes" of some coccolithophore species.

Works of Pujos (1988) and Weaver (1993), give a stratigraphic framework based on isotopic stages that we used during the MD-IMAGE 101 cruise:

1 acme of *Emiliania huxleyi* during Stage 1 to 3
2 acme of *Gephyrocapsa mulleare* during Stage 5
3 acme of small *Gephyrocapsa* spp during Stage 6 to 8
4 acme of *Gephyrocapsa caribbeanica* during Stage 9 to 15

In addition to this framework, a higher resolution can be achieved by looking at the abundances of coccoliths which proved to be usually higher during odd isotopic stages in the North Atlantic Ocean.

The following table summarizes our observations using conventional biostratigraphy, acmes and abundance of coccolithophores.

Note : If conventional biostratigraphy (LAD, FAD) provides a reliable biochronological scale (the LAD of *P. lacunosa* and the FAD of *E. huxleyi* have been recognized as widely spread isochronous datums), the use of acmes and abundances is a recent improvement of the coccolith biostratigraphy. Their dependence on local ecological factors which could result in chronological discrepancies, has not been tested enough yet.

Martini, E., Standard Tertiary and Quaternary calcareous nannoplankton zonation, In *Proceedings of the 2nd plankton conference, Roma,* A. Farinacci (ed), pp. 739-777, Roma, 1971.

Pujos, A., Spatio-temporal distribution of some Quaternary coccoliths, *Oceanolog. Acta*, 11, 65-76, 1988.

Weaver, P.P.E., High resolution stratigraphy of marine Quaternary suqences, In *High resolution stratigraphy, 70*, E.A. Hailwood and R.B. Kidd (ed) , pp. 137-153, Geophysical Society Special Publication, 1993.

CORE (sample)	Depth	Martini Zones	Coccoliths	Iso. stage
MD95 2001 (cc)	22.37	NN21	>G.m.; E.h.	5
MD95 2002 (2890)		NN21	>G.m.; E.h.; RW	5
MD95 2002 (cc)	29.99	NN21	low abundance	6
MD952003 (cc)	27.55	NN19	>G.c ; P.l.	13
MD95 2004 (cc)	28.48	NN20	> G.c.	9 (or 10-11)
MD95 2005 (cc)	22.02		barren	
MD95 2008 (cc)	21.50		rare- small G.	
MD95 2009 (cc)	32.52		barren	
MD95 2010 (cc)	17.65	NN20	>G.c.; small G.	8-10
MD95 2011 (cc)	19.77	NN21	>G.m.; E.h.; RW	3-4
MD95 2012 (cc)	13.10	NN21	>RW (>G.m.; E.h.)	
MD95 2013 (cc)	33.54	NN21	>G.m. E.h.	5
MD95 2014 (3356)	34.50	NN19	>G.c.; ?P.l.	13
MD95 2015 (3267)	32.86	NN19	>G.c.; ?P.l.	13
MD95 2016 (3190)	32.86	NN19	>G.c.; ?P.l.	13
MD95 2017 (cc)	34.58	NN18	>G.c.(abund.)	9 or 11
MD95 2019 (1210)	12.86		barren	
MD95 2020 (cc)	8.63		barren	
MD95 2021 (cc)	4.48	NN21	>E.h., low abun.	2-3
MD95 2022 (cc)	18.34	NN19	>G.c.; P.l.	13 or 15
MD95 2023 (cc)	34.68		barren	
MD95 2027 (cc)	46.70	NN19	>G.c.; P.l.	13
(4640 / 4560)			HO P.l. (0.47 Ma)	
MD95 2030 (cc)	35.56	NN19	P.l.; Low abun,RW	>12
MD95 2031 (cc)	27.00		RW	
MD95 2034 (cc)	47.16	NN21	small G ,L.ab.	6
MD95 2035 (cc)	39.25	NN20	>G.c.	9
MD95 2036 (cc)	52	NN21	>small G.abund.	7
MD95 2037 (cc)	35.81	NN19	>G.c; P.l.	13-15
MD95 2038 (cc)	37.86	NN19	>G.c; P.l.	13-15
MD95 2039 (cc)	35.73	NN20	>G.c.(low abund.)	10
MD95 2040 (cc)	35.24	NN20	>G.c. (abund.)	9 or 11
MD95 2041 (cc)	17.62	NN21	>G.m.	5
MD95 2042 (cc)	39.58	NN21	>small G.	7
MD95 2043 (cc)	37.40	NN20	>sm.G.+ G.c+RW	8

Table 1: Coccolith biostratigraphy for the base of the cores retrievied during MD-IMAGE 101 cruise : > = acme; small G. = small *Gephyrocapsa* .sp., G.c. = *G.caribbeanica*; G.m. = *G. muellerae* ; E.h. = *E. huxleyi* ; P.l.= *Pseudoemiliania lacunosa*; RW = reworked species (pre-Pleistocene); HO = highest occurence, L.ab. = low abundance.

SITE REPORTS

The report for each site contains the following pieces of information:

* **First page :**
- a site description (location, water depth, length of core);
- a detailed map showing the core(s) location;
- 3.5 kHz site survey (when available).

* **Second page :**
- selected, high-resolution physical properties records
  - magnetic susceptibility;
  - GRAPE density;
  - color reflectance - parameter a, b or L

* **Third page :**
- the entire set of physical properties records obtained on board
  - magn. suscepti., acoustic veloc., GRAPE density (from MST);
  - L, a and b parameters (color reflectance data)

* **Fourth page :**
- sedimentological description of the core

Core description

Texture

Clay

Silty clay

clayey silt

silt

Sand

mud
(clay+silt+sand)

Constituants

Nannofosils

Siliceous skeletons

Detrital carbonate grains("detricarbonate")

carbonated silty clay (biogenic and detrital carbonate)

abundant volcanic glass

Dropstone

Coring disturbances

flow in

Slightly disturbed

highly disturbed

Soupy

void

The sediments were qualified according to the dominant constituants and the texture of the lithic fraction. Clayey ooze : >50 % biogenic skeletons, clay dominates the lithic fraction.

Colour

5Y4/2 — Munsel colour chart reference

Sharp change

Gradual change

Structure

burrowing

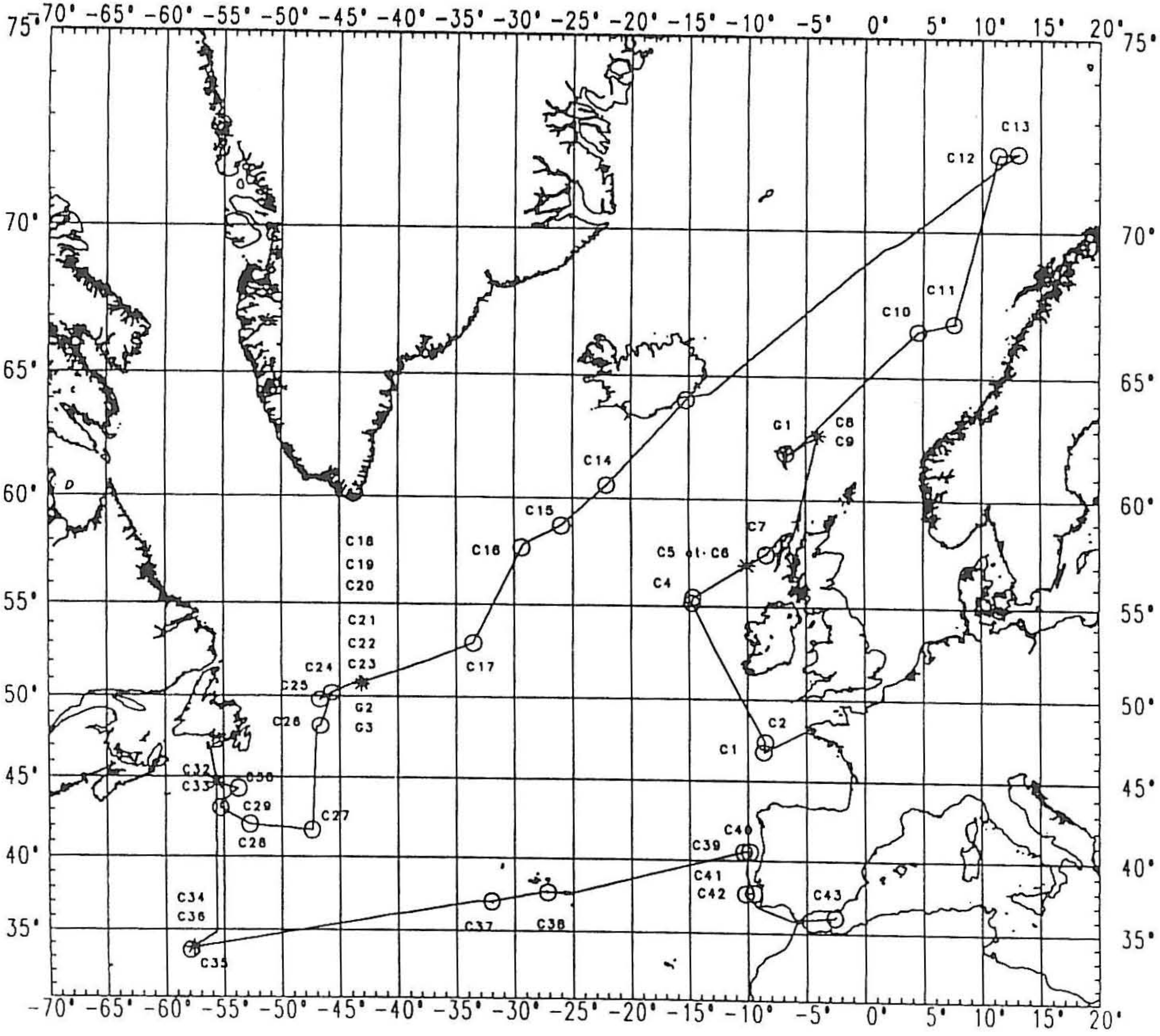
Iron sulfide (FeS) dots and patches concentrated in indistinct layering

distinct-indistinct "Greenish layers"

distinct-indistinct lamination

Le 09/07/95

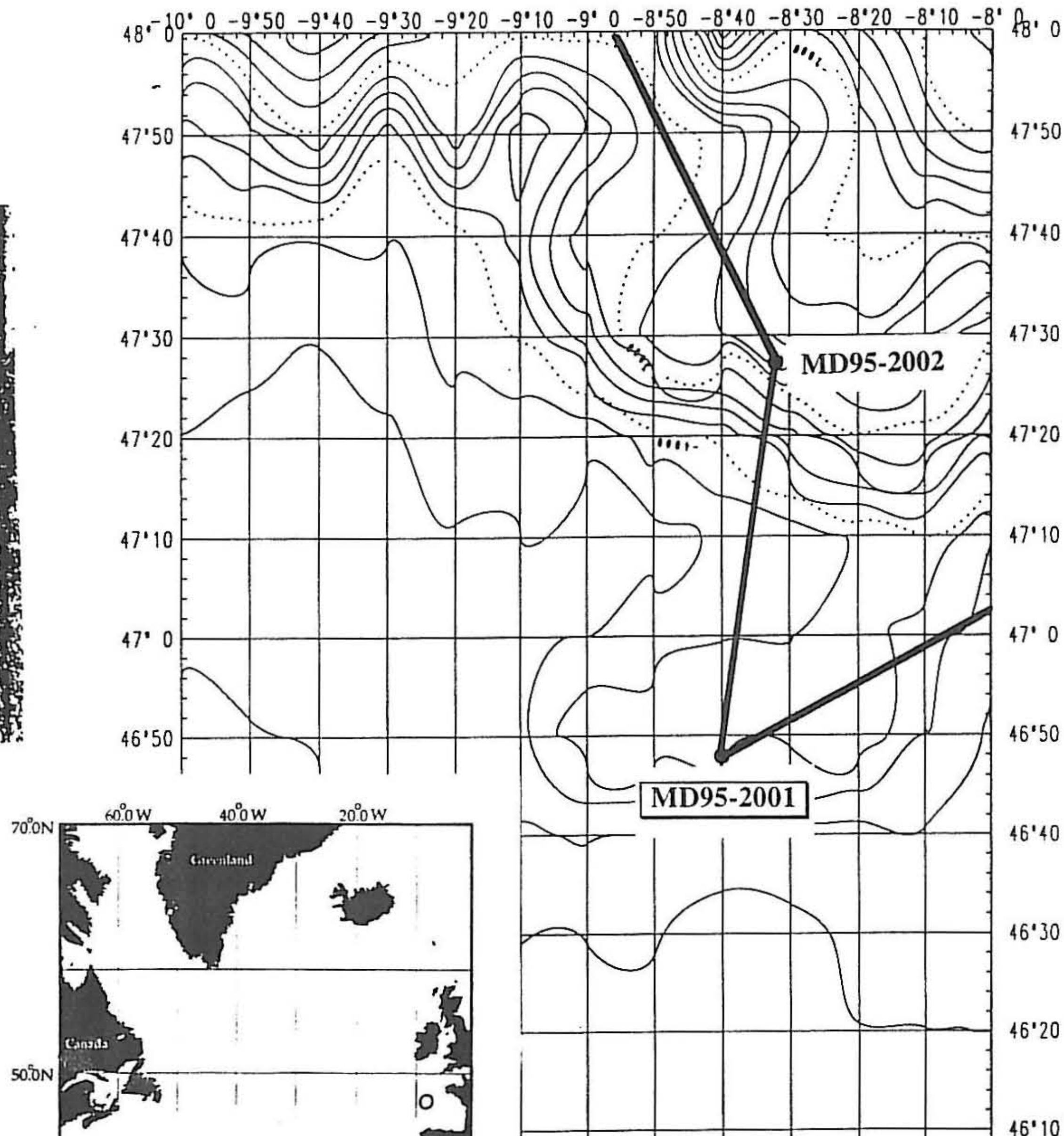
MD101 IMAGES - Mai/Juillet 95

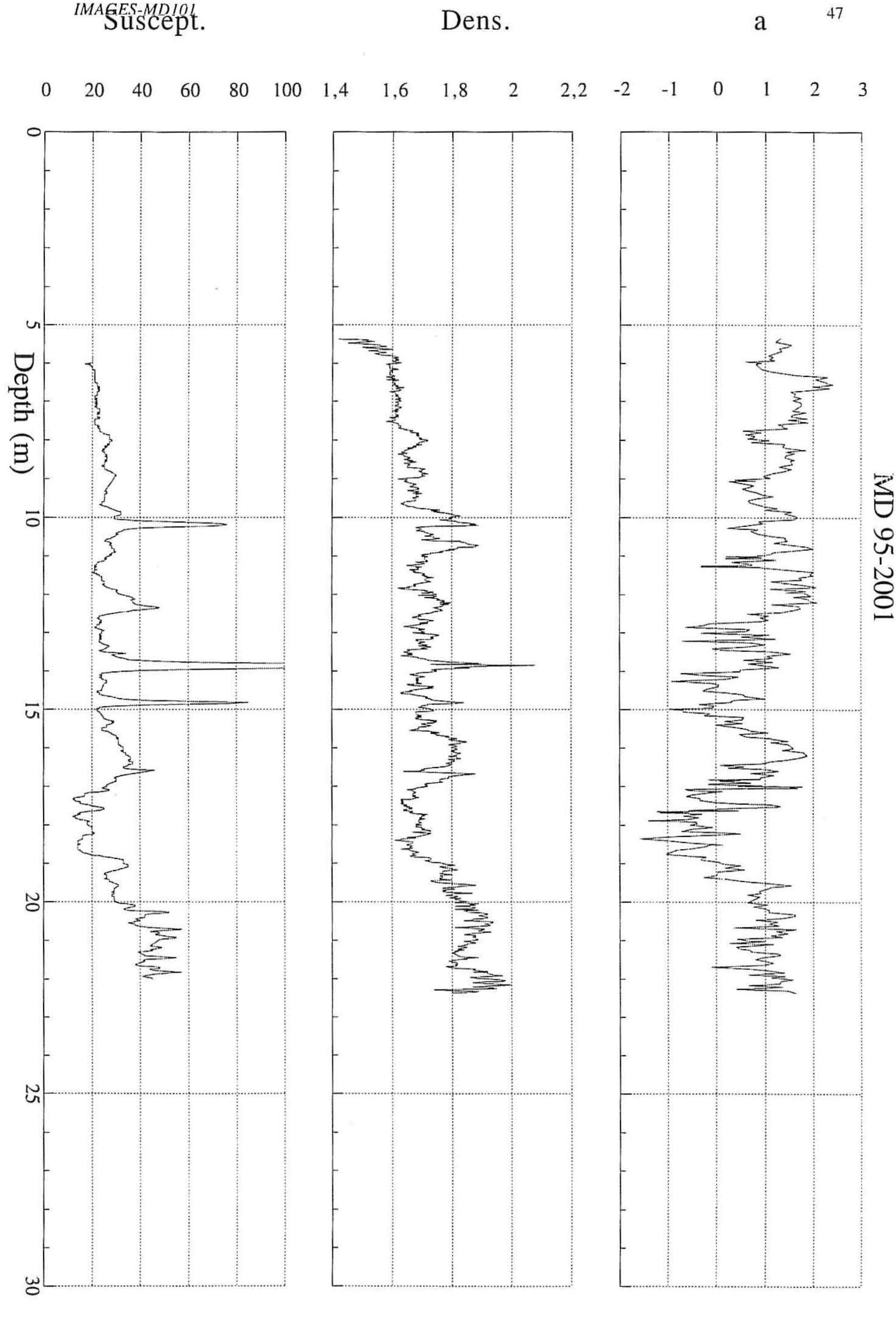


CETIS - EOPGStrasbourg

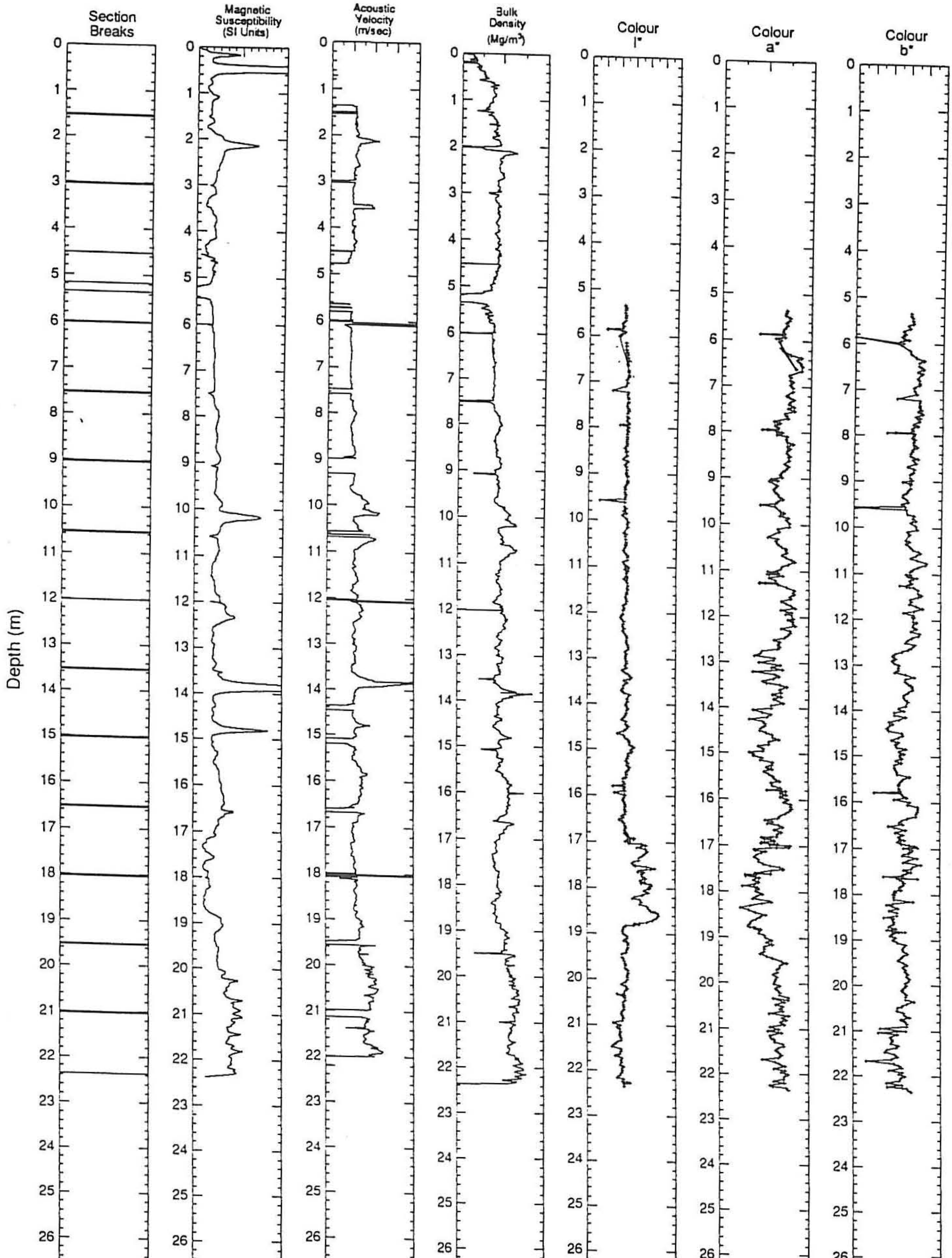
Core MD 95-2001

lat: 46°48.17 N - long: 08°40.28 W
water depth: 3788 m
length: 22.37 m

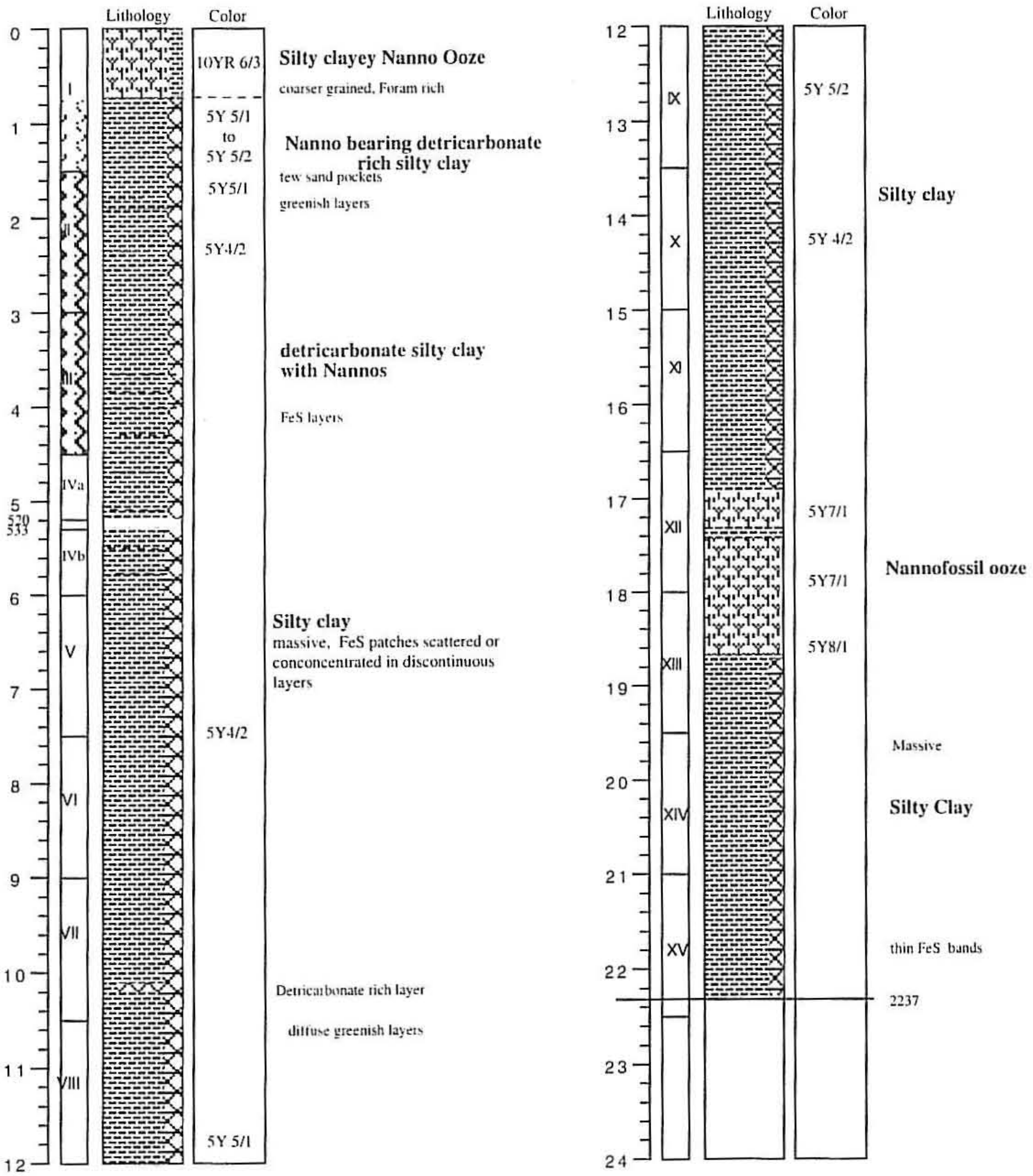



Suscept.
Dens.
a
0 20 40 60 80 100
1,4 1,6 1,8 2 2,2
-2 -1 0 1 2 3
0 5 10 15 20 25 30
Depth (m)
MD 95-2001

MD95-2001


Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0 50 100
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

MD 95-2001

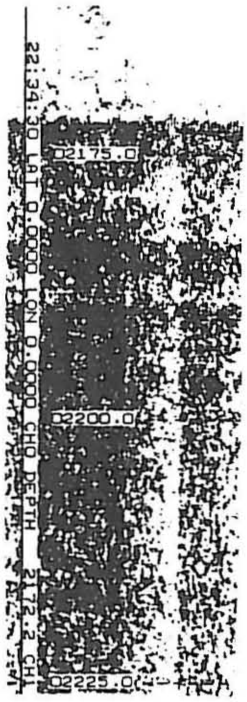

Lithology
Color
10YR 6/3
Silty clayey Nanno Ooze
coarser grained, Foram rich
5Y 5/1
to
5Y 5/2
Nanno bearing detricarbonate rich silty clay
few sand pockets
5Y5/1
greenish layers
5Y4/2
detricarbonate silty clay with Nannos
FeS layers
IVa
520
533
IVb
Silty clay
massive, FeS patches scattered or conconcentrated in discontinuous layers
5Y4/2
Detricarbonate rich layer
diffuse greenish layers
5Y 5/1
I
II
III
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
5Y 5/2
Silty clay
5Y 4/2
5Y7/1
Nannofossil ooze
5Y7/1
5Y8/1
Massive
Silty Clay
thin FeS bands
2237

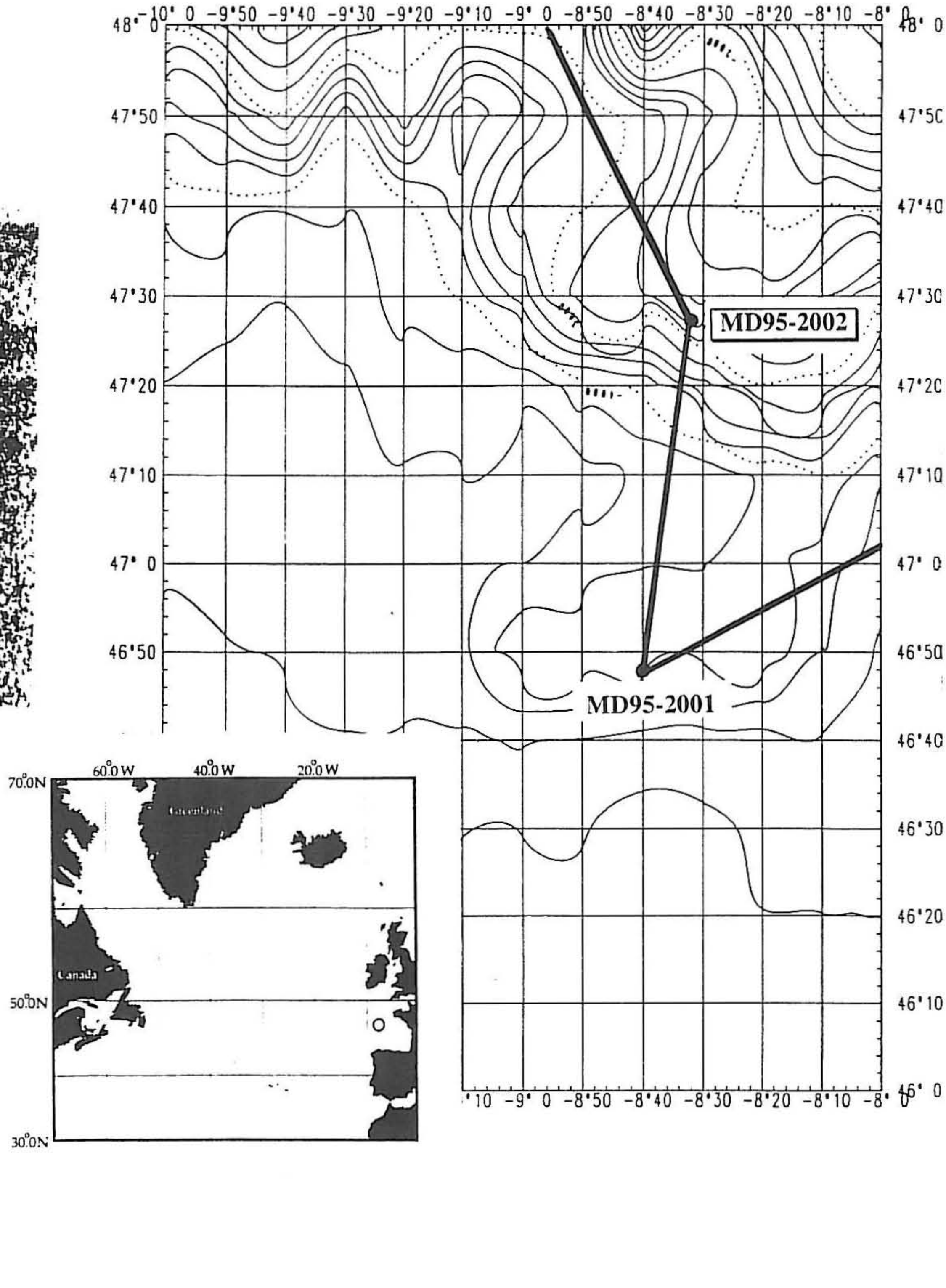
Core MD 95-2002

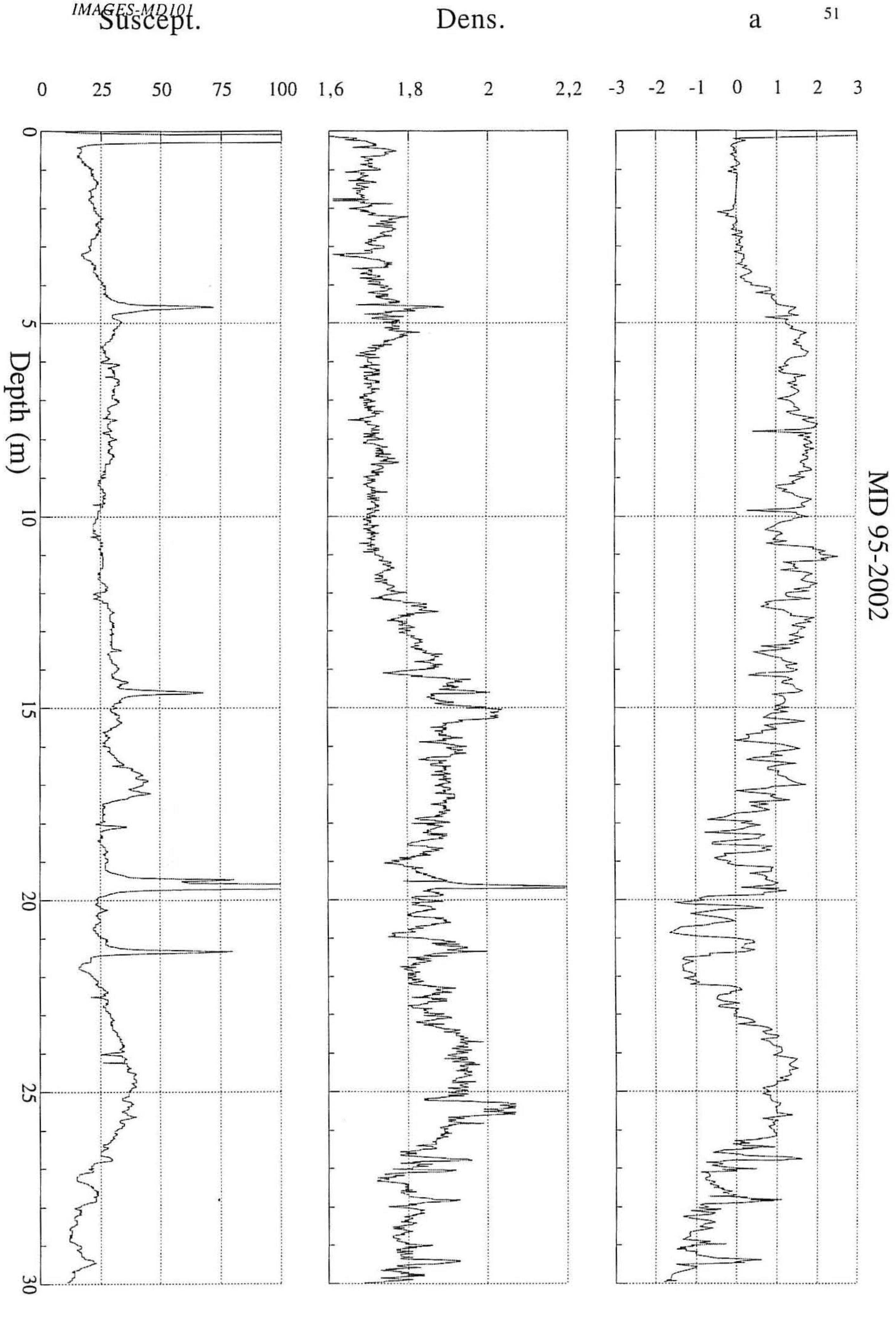
lat: 47°27.12 N - long: 08°32.03 W

water depth: 2174 m

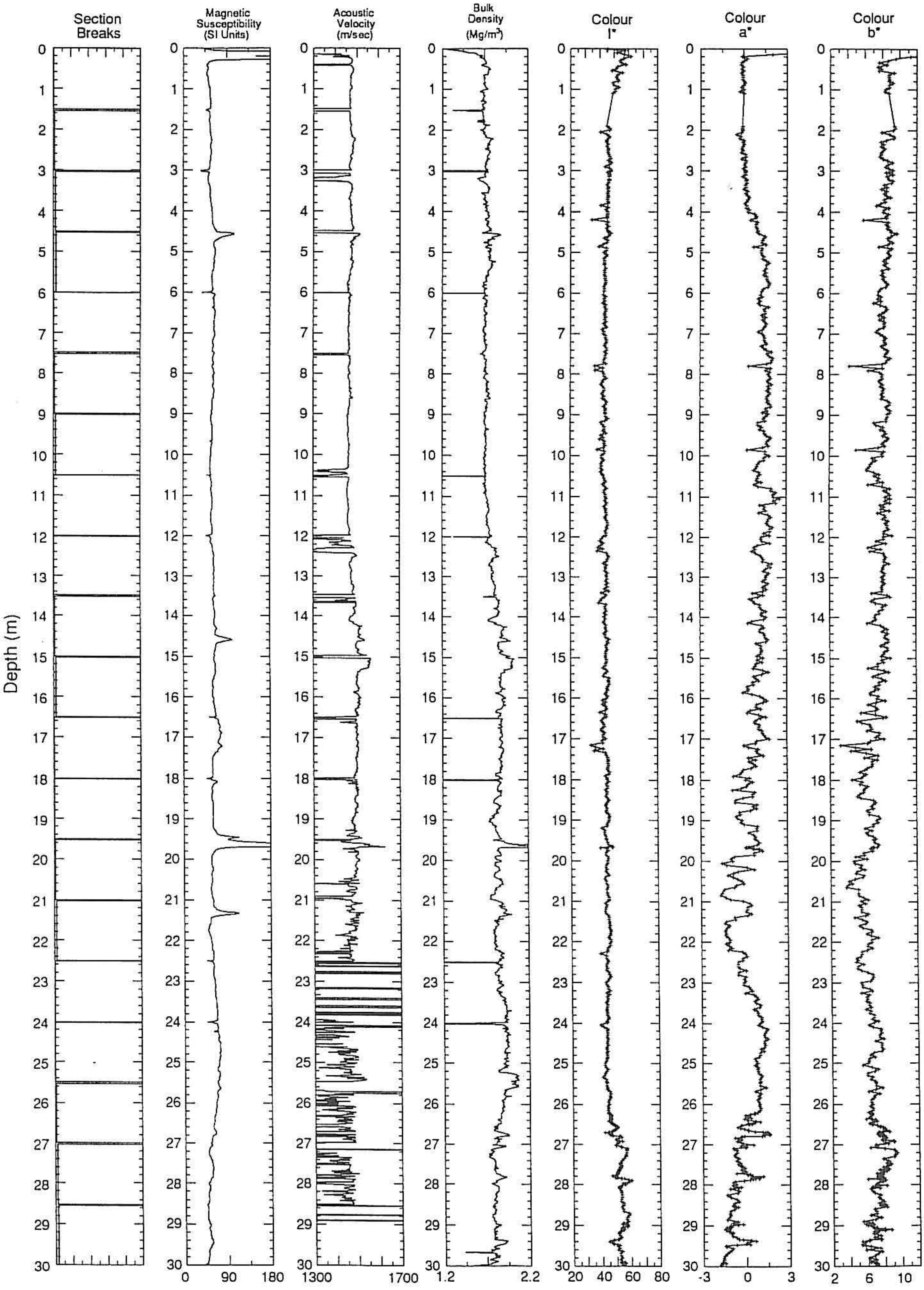
length: 29.99 m



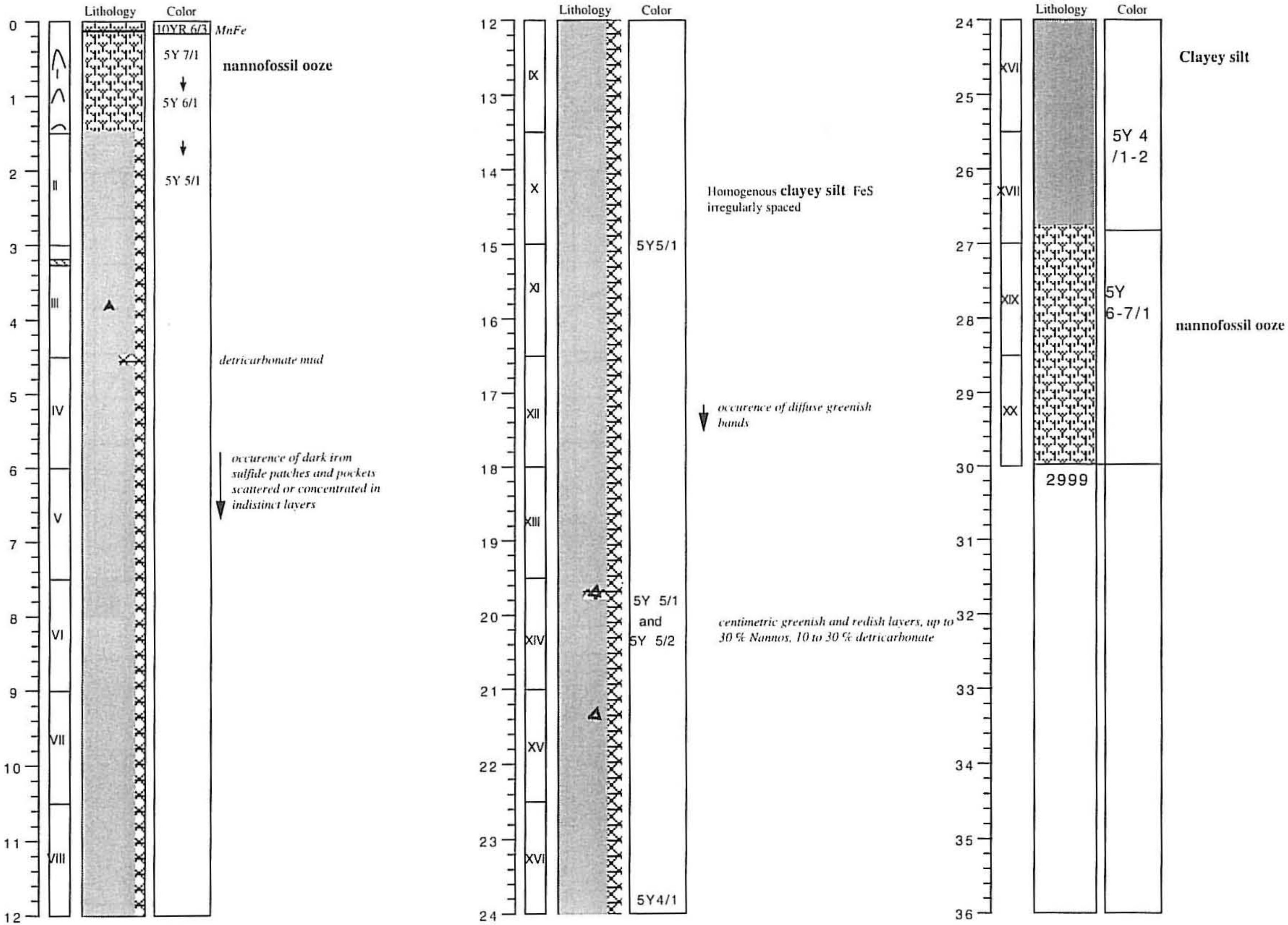



Suscept.
Dens.
a
0 25 50 75 100
1,6 1,8 2 2,2
-3 -2 -1 0 1 2 3
Depth (m)
0 5 10 15 20 25 30
MD 95-2002

MD95-2002

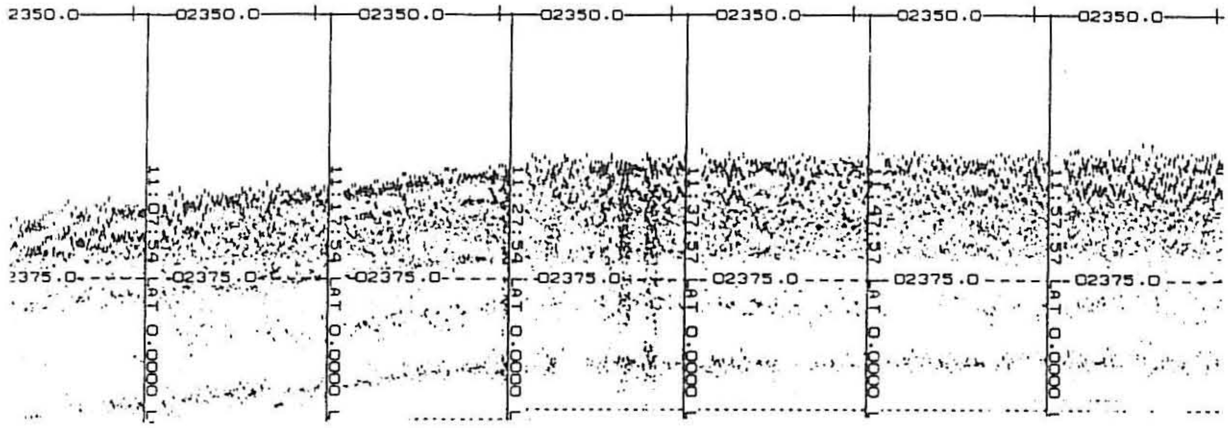

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

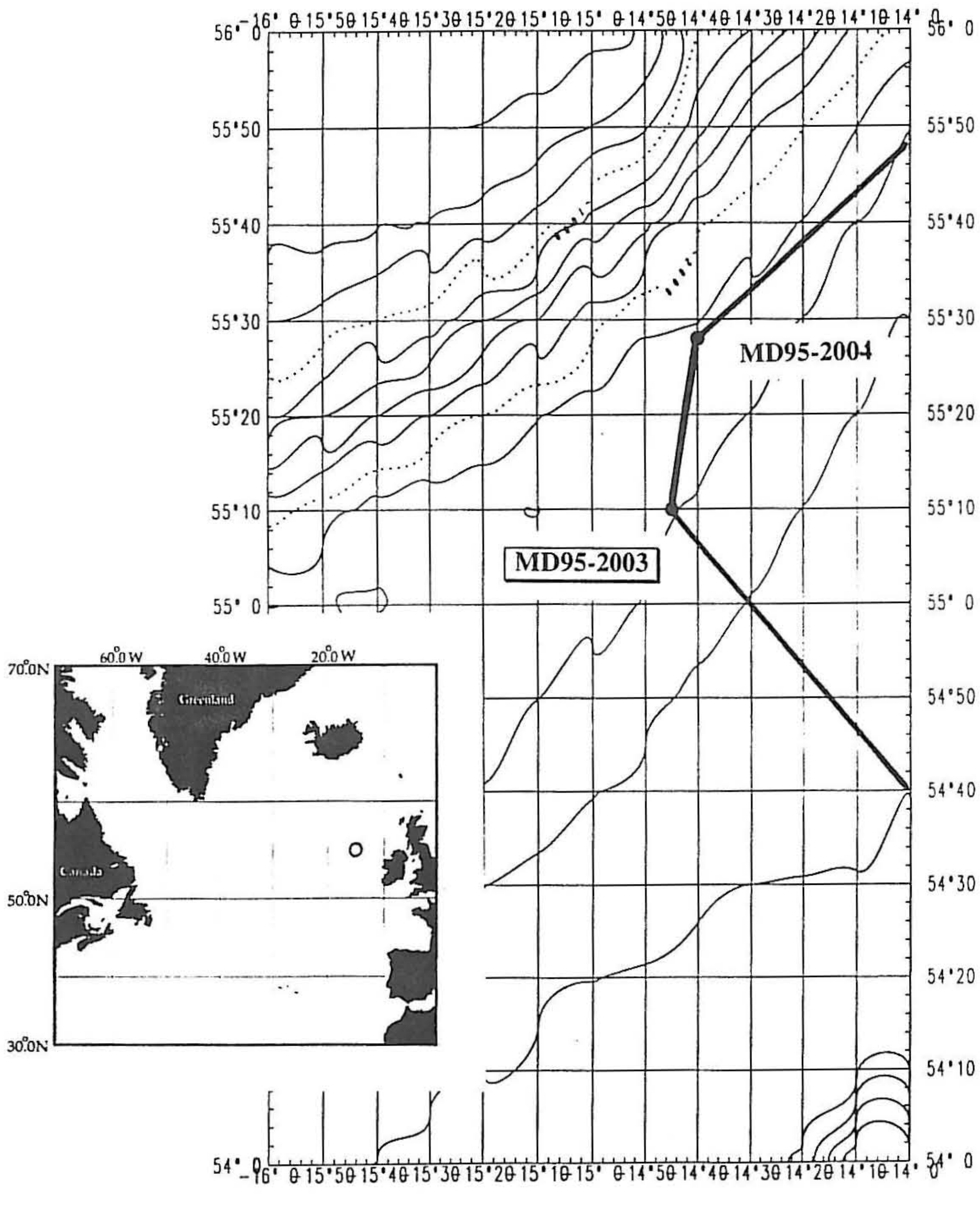
MD 95-2002

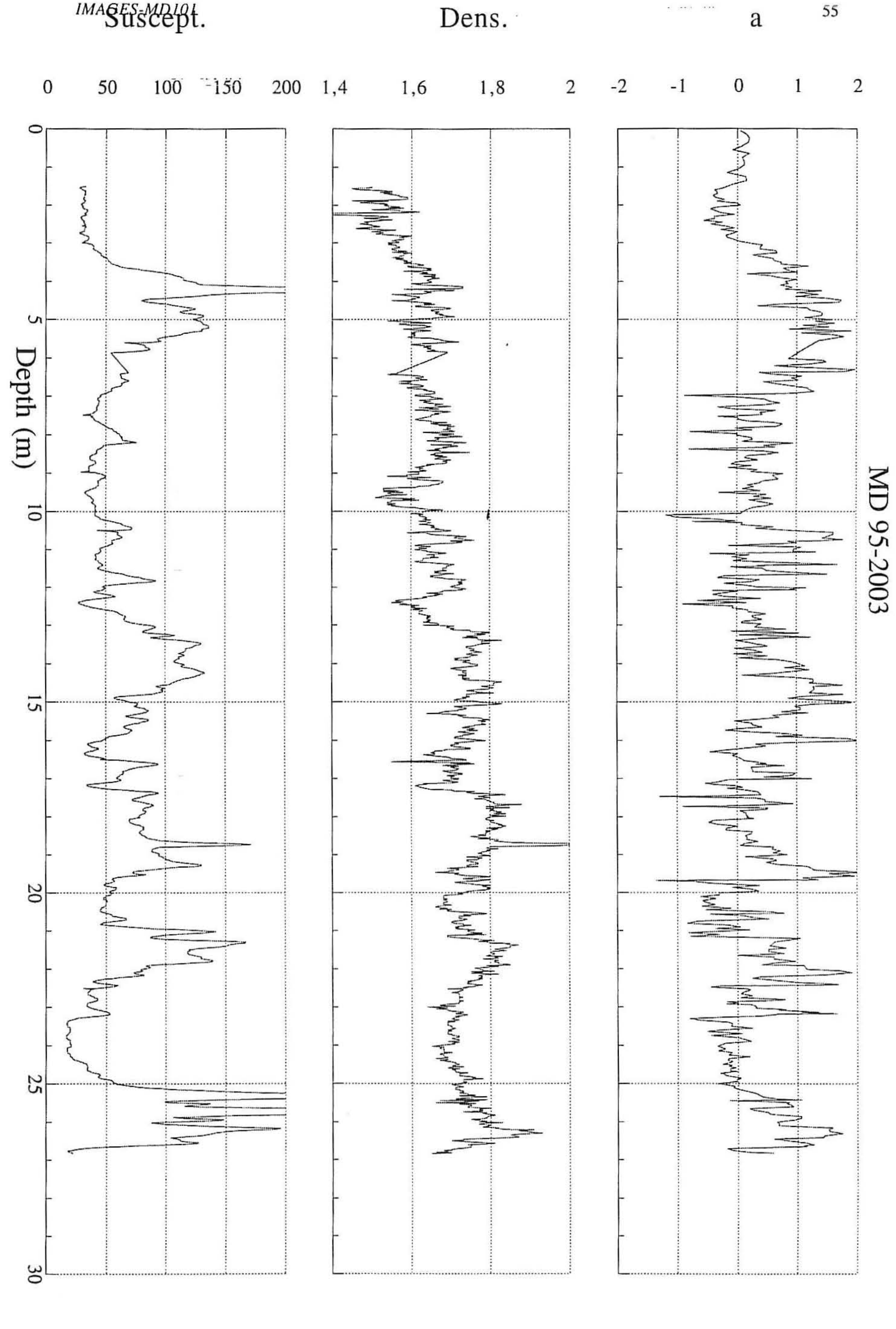

Lithology
Color
10YR 6/3
MnFe
5Y 7/1
5Y 6/1
5Y 5/1
nannofossil ooze
detricarbonate mud
occurence of dark iron sulfide patches and pockets scattered or concentrated in indistinct layers
Homogenous clayey silt FeS irregularly spaced
5Y5/1
occurence of diffuse greenish bands
5Y 5/1 and 5Y 5/2
centimetric greenish and redish layers, up to 30 % Nannos, 10 to 30 % detricarbonate
5Y4/1
Clayey silt
5Y 4 /1-2
5Y 6-7/1
nannofossil ooze
2999

Core MD 95-2003

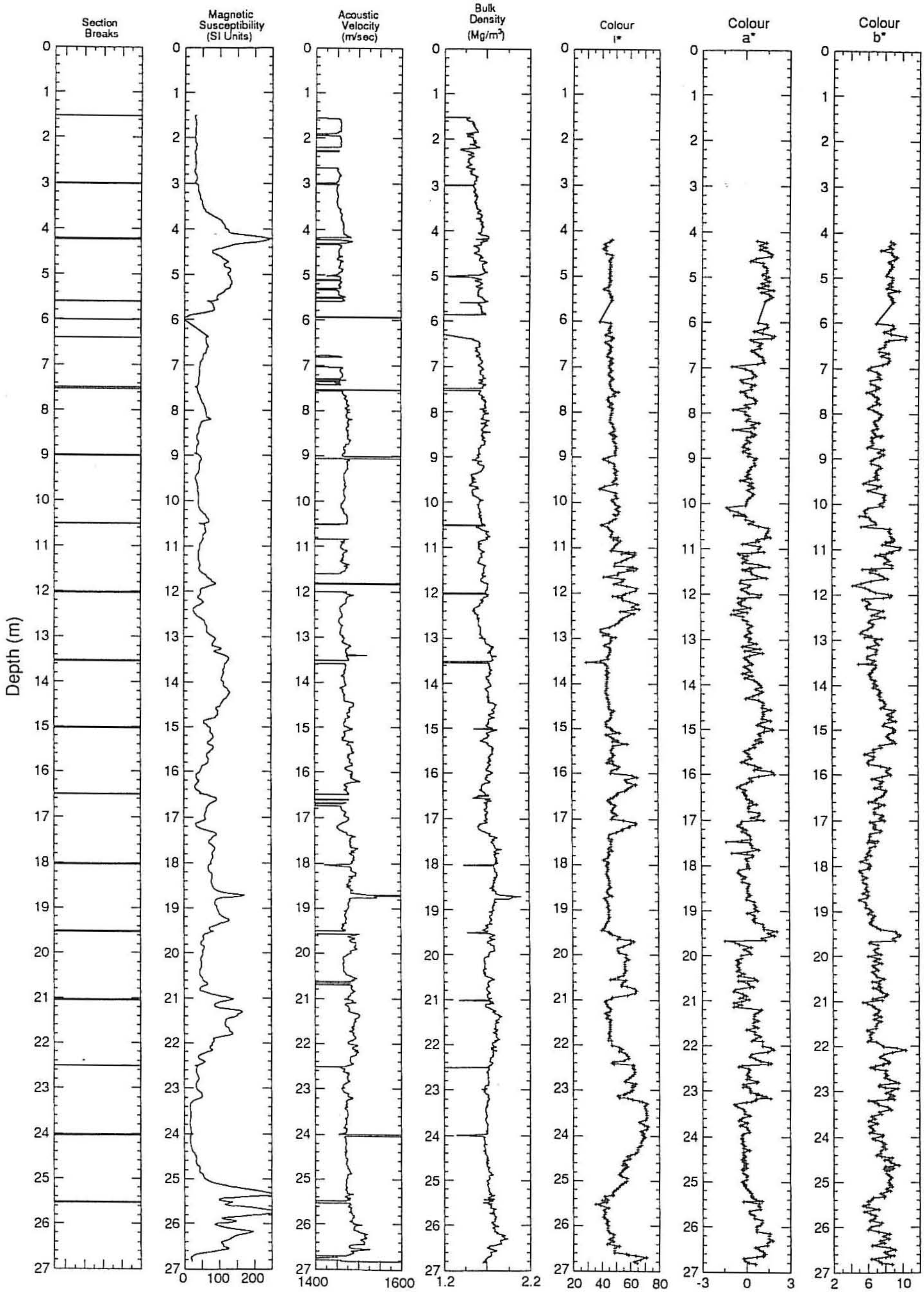
lat: 55°10.61 N - long: 14°45.32 W
water depth: 2365 m
length: 26.93 m



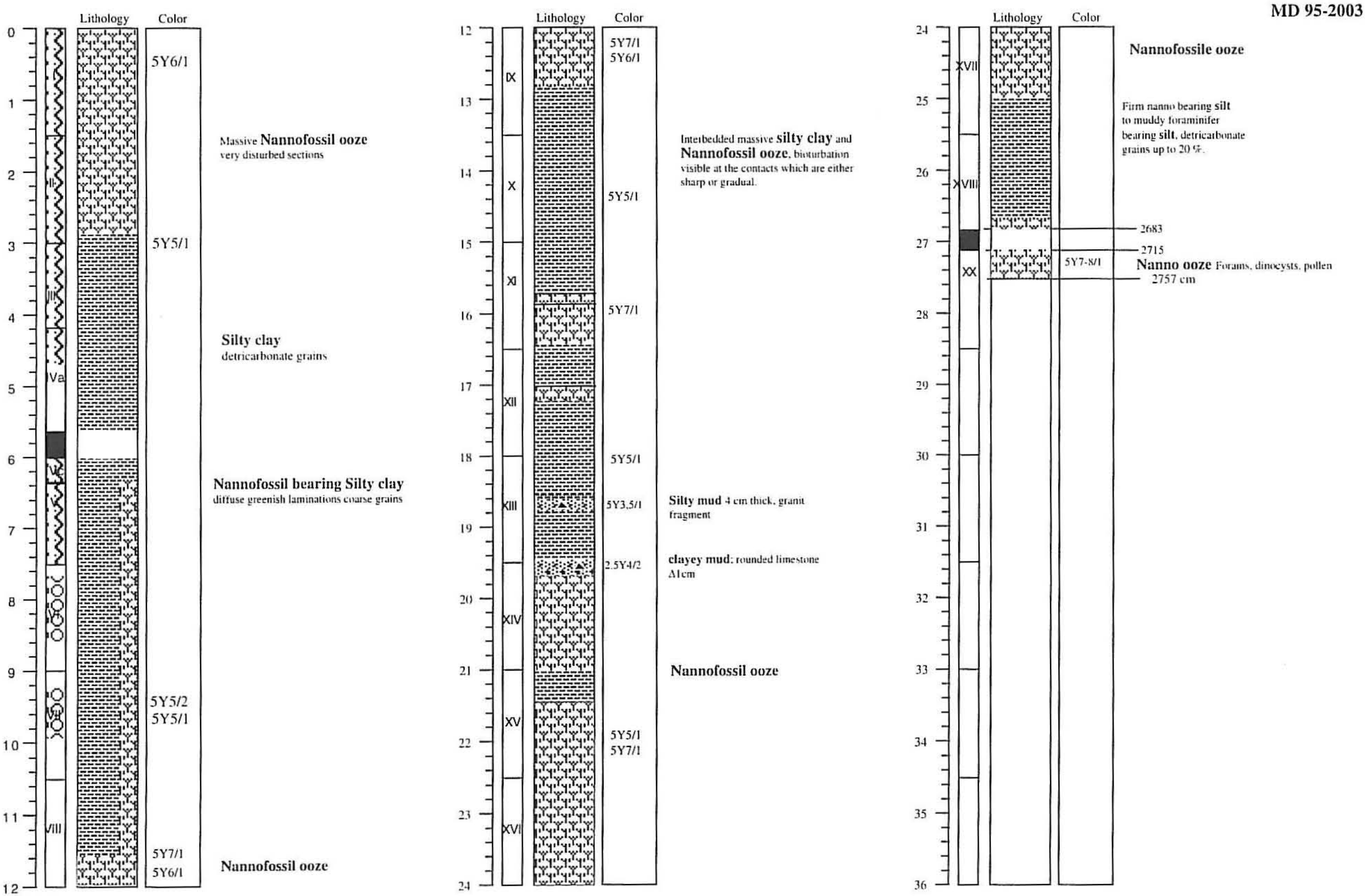



Suscept.
Dens.
a
0 50 100 150 200
1,4 1,6 1,8 2
-2 -1 0 1 2
0 5 10 15 20 25 30
Depth (m)
MD 95-2003

MD95-2003

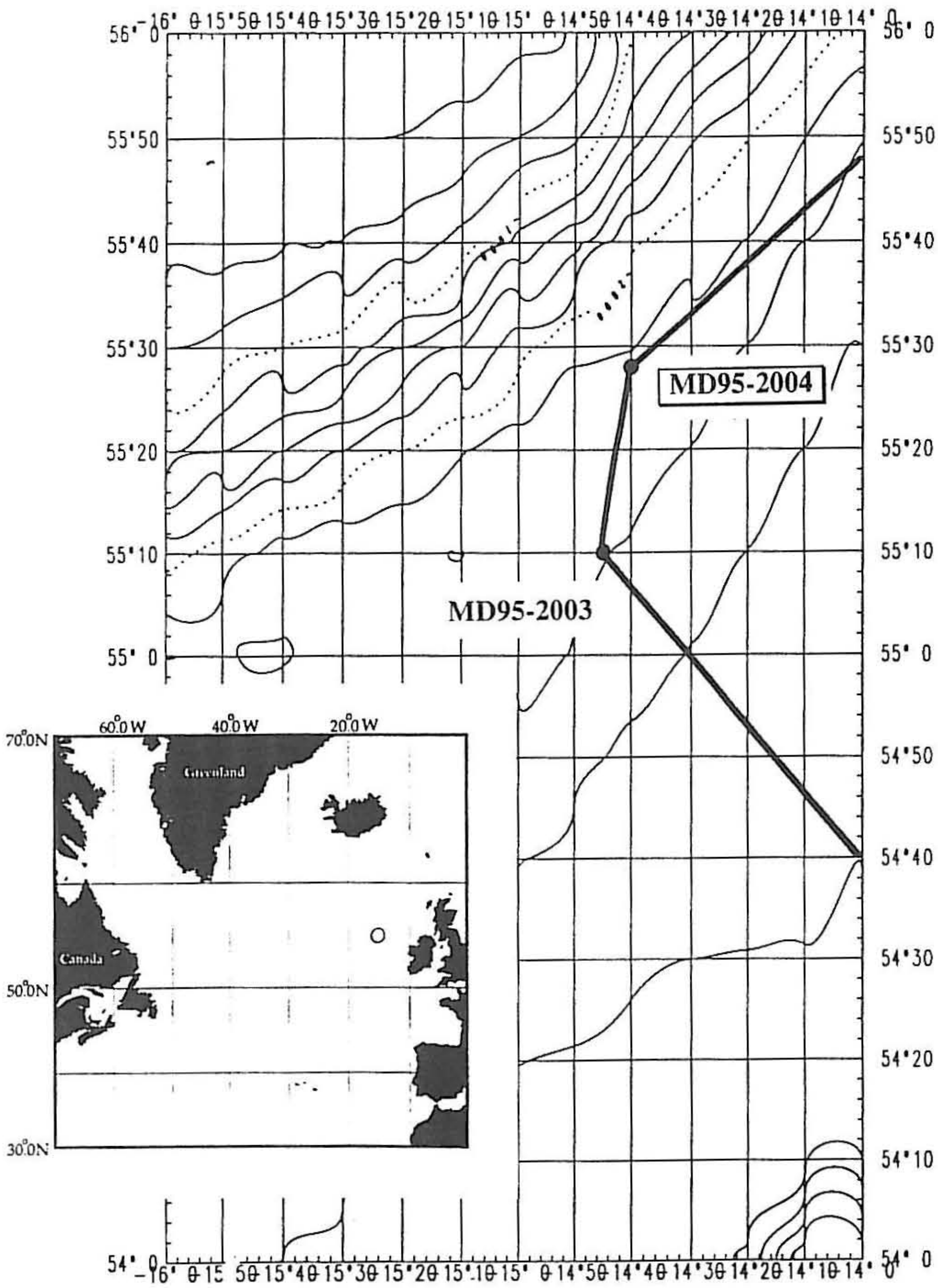


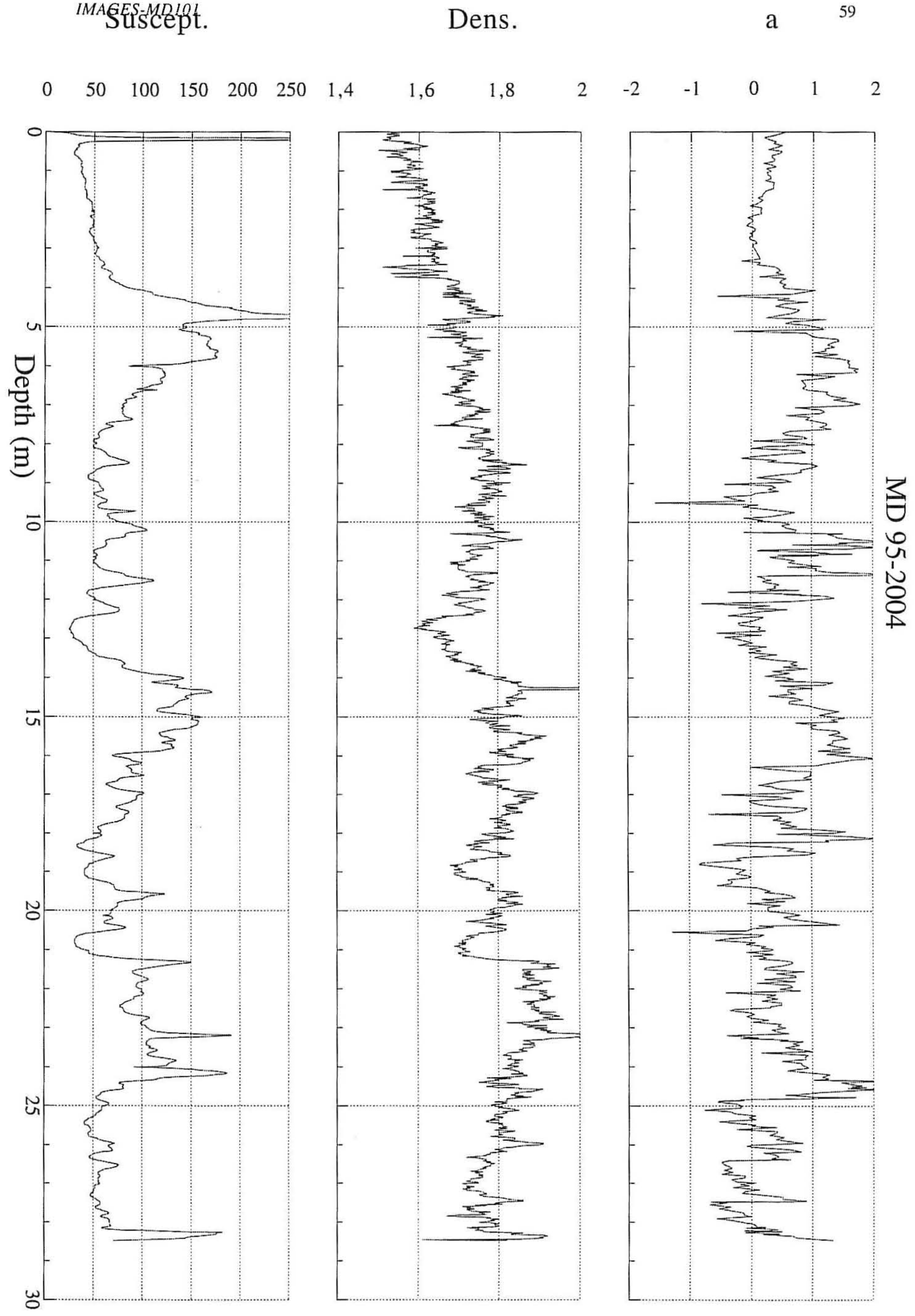
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)


MD 95-2003
Lithology
Color
5Y6/1
5Y5/1
5Y5/2
5Y5/1
5Y7/1
5Y6/1
Massive Nannofossil ooze
very disturbed sections
Silty clay
detricarbonate grains
Nannofossil bearing Silty clay
diffuse greenish laminations coarse grains
Nannofossil ooze
5Y7/1
5Y6/1
5Y5/1
5Y7/1
5Y5/1
5Y3.5/1
2.5Y4/2
5Y5/1
5Y7/1
Interbedded massive silty clay and Nannofossil ooze, bioturbation visible at the contacts which are either sharp or gradual.
Silty mud 4 cm thick, granit fragment
clayey mud: rounded limestone Δ1cm
Nannofossil ooze
Nannofossile ooze
Firm nanno bearing silt to muddy foraminifer bearing silt, detricarbonate grains up to 20 %.
2683
2715
5Y7-8/1
Nanno ooze Forams, dinocysts, pollen
2757 cm

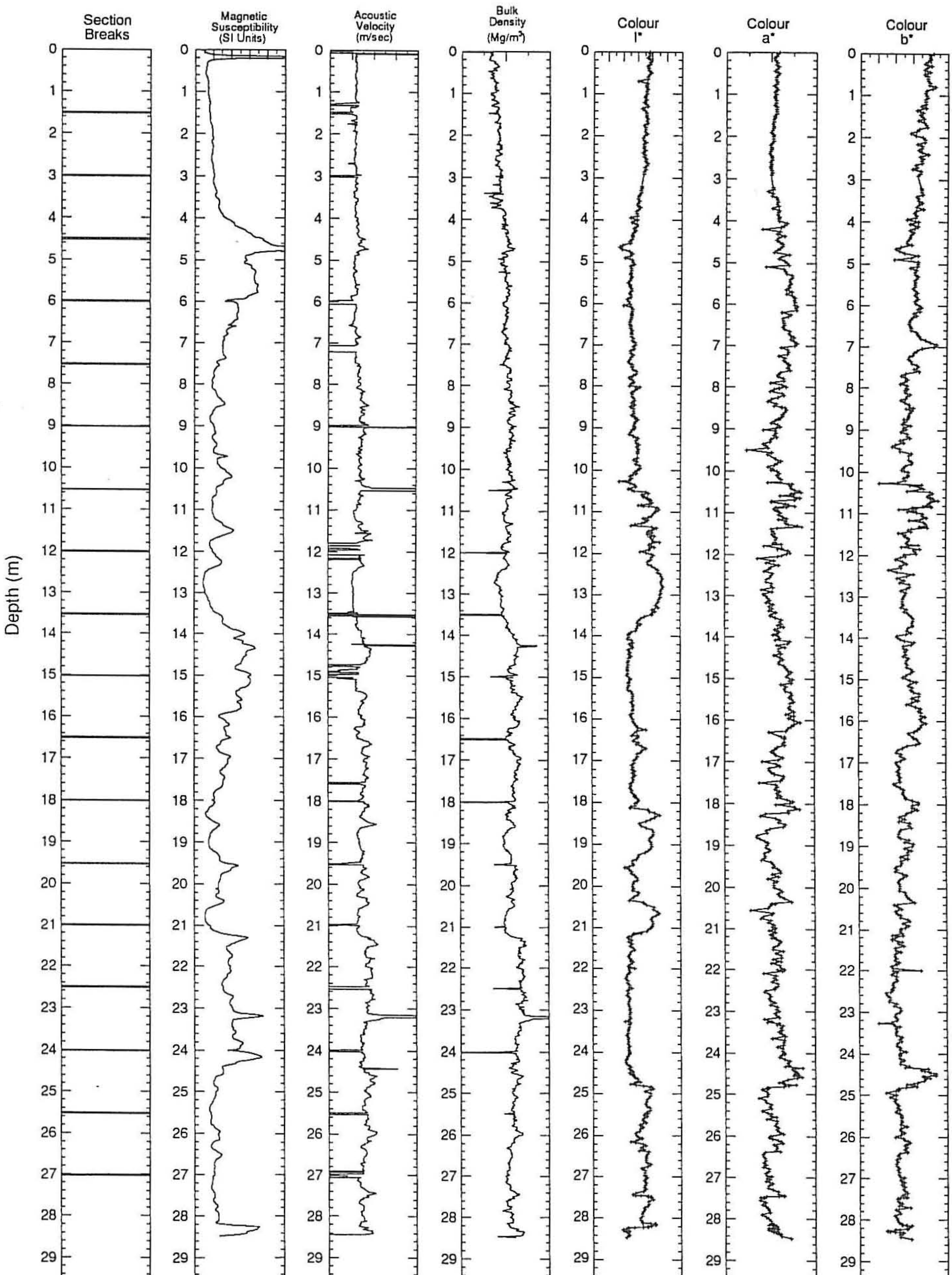
Core MD 95-2004

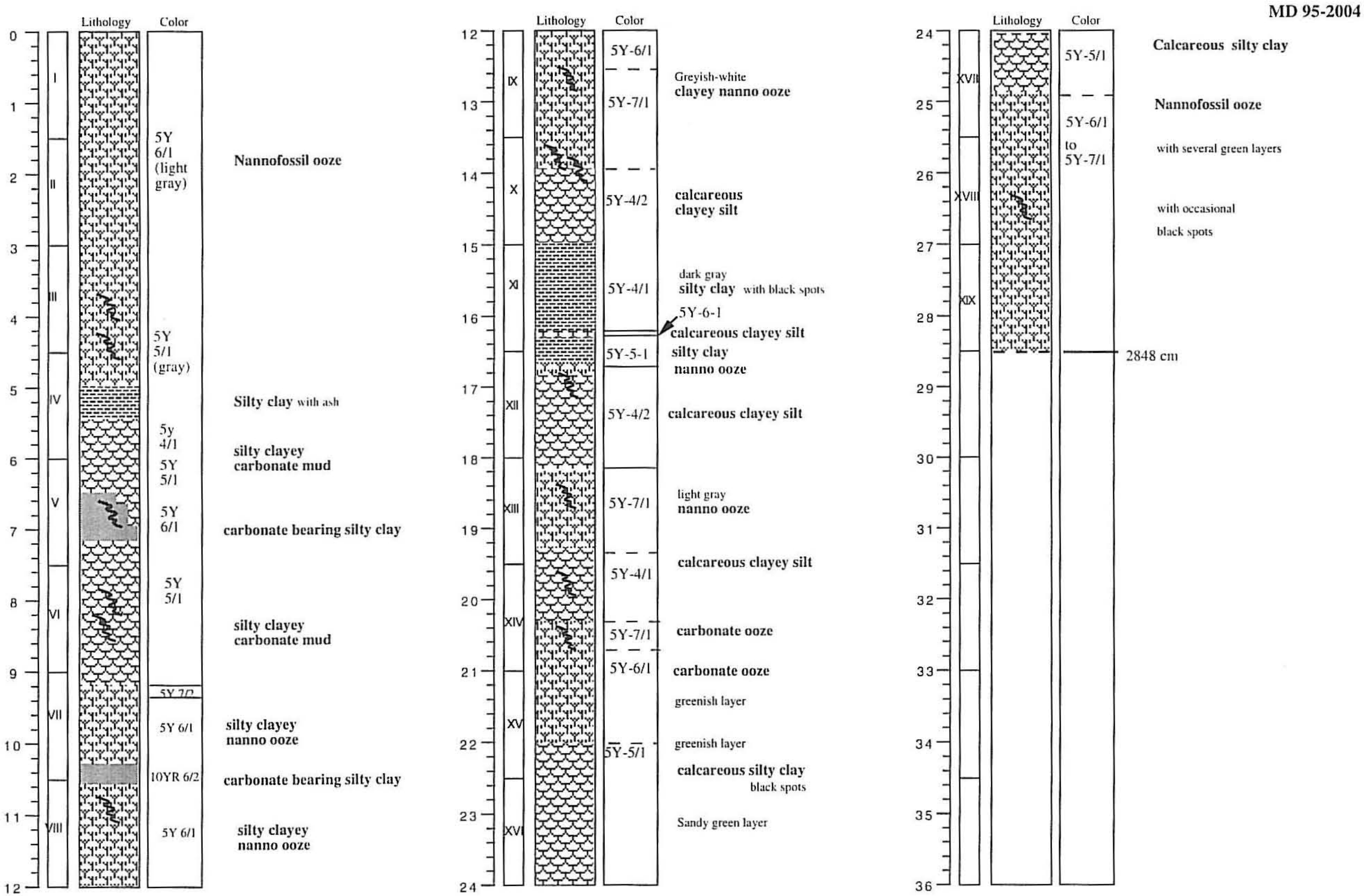
lat: 55°28.07 N - long: 14°40.51 W
water depth: 2177 m
length: 28.485 m




Suscept.
Dens.
a
0 50 100 150 200 250
1,4 1,6 1,8 2
-2 -1 0 1 2
0 5 10 15 20 25 30
Depth (m)
MD 95-2004

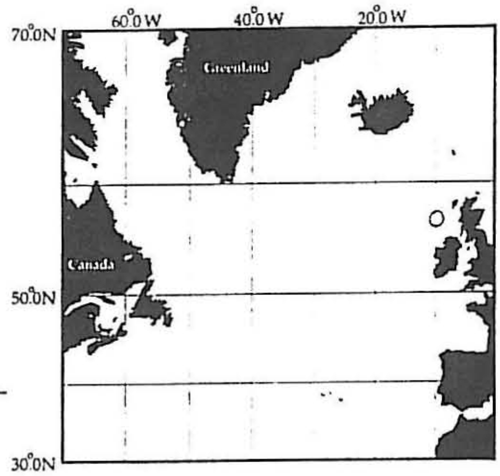
MD95-2004

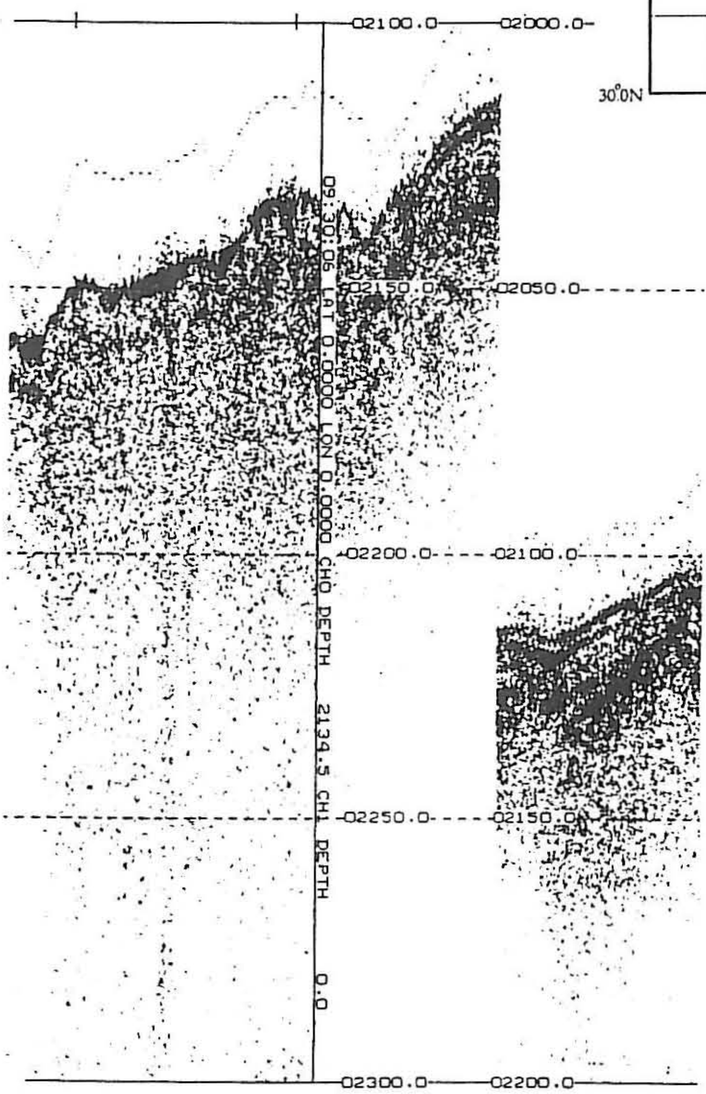

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

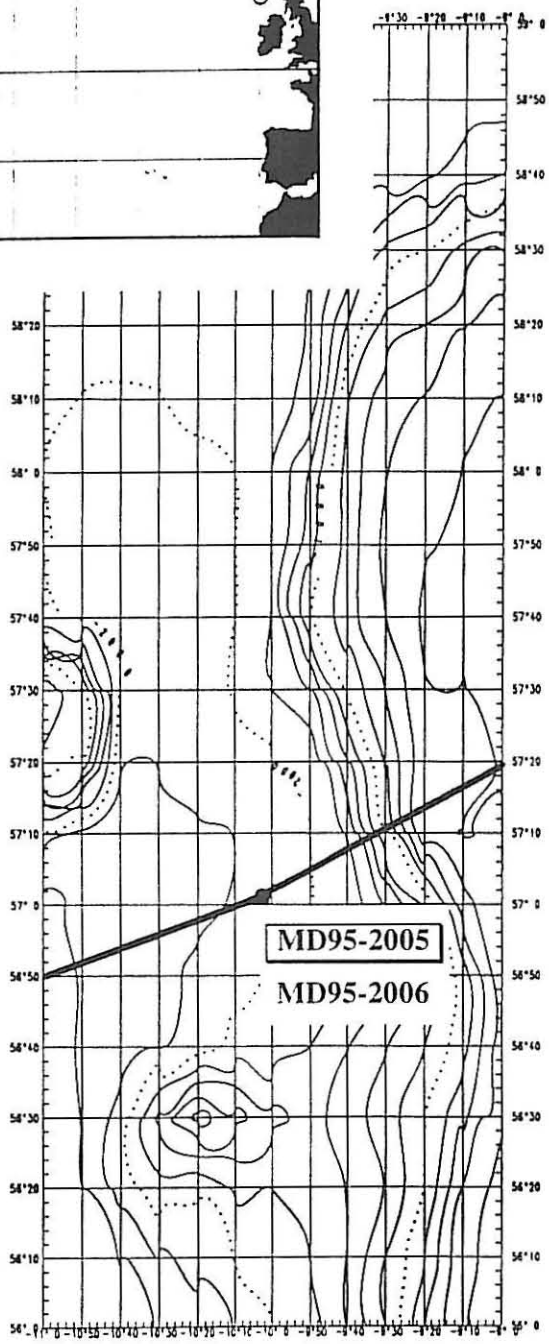

MD 95-2004
Lithology
Color
5Y 6/1 (light gray)
Nannofossil ooze
5Y 5/1 (gray)
Silty clay with ash
5y 4/1
5Y 5/1
silty clayey carbonate mud
5Y 6/1
carbonate bearing silty clay
5Y 5/1
silty clayey carbonate mud
5Y 7/2
5Y 6/1
silty clayey nanno ooze
10YR 6/2
carbonate bearing silty clay
5Y 6/1
silty clayey nanno ooze
5Y-6/1
5Y-7/1
Greyish-white clayey nanno ooze
5Y-4/2
calcareous clayey silt
5Y-4/1
dark gray silty clay with black spots
5Y-6-1
calcareous clayey silt
5Y-5-1
silty clay
nanno ooze
5Y-4/2
calcareous clayey silt
5Y-7/1
light gray nanno ooze
5Y-4/1
calcareous clayey silt
5Y-7/1
carbonate ooze
5Y-6/1
carbonate ooze
greenish layer
5Y-5/1
greenish layer
calcareous silty clay
black spots
Sandy green layer
5Y-5/1
Calcareous silty clay
5Y-6/1 to 5Y-7/1
Nannofossil ooze
with several green layers
with occasional black spots
2848 cm

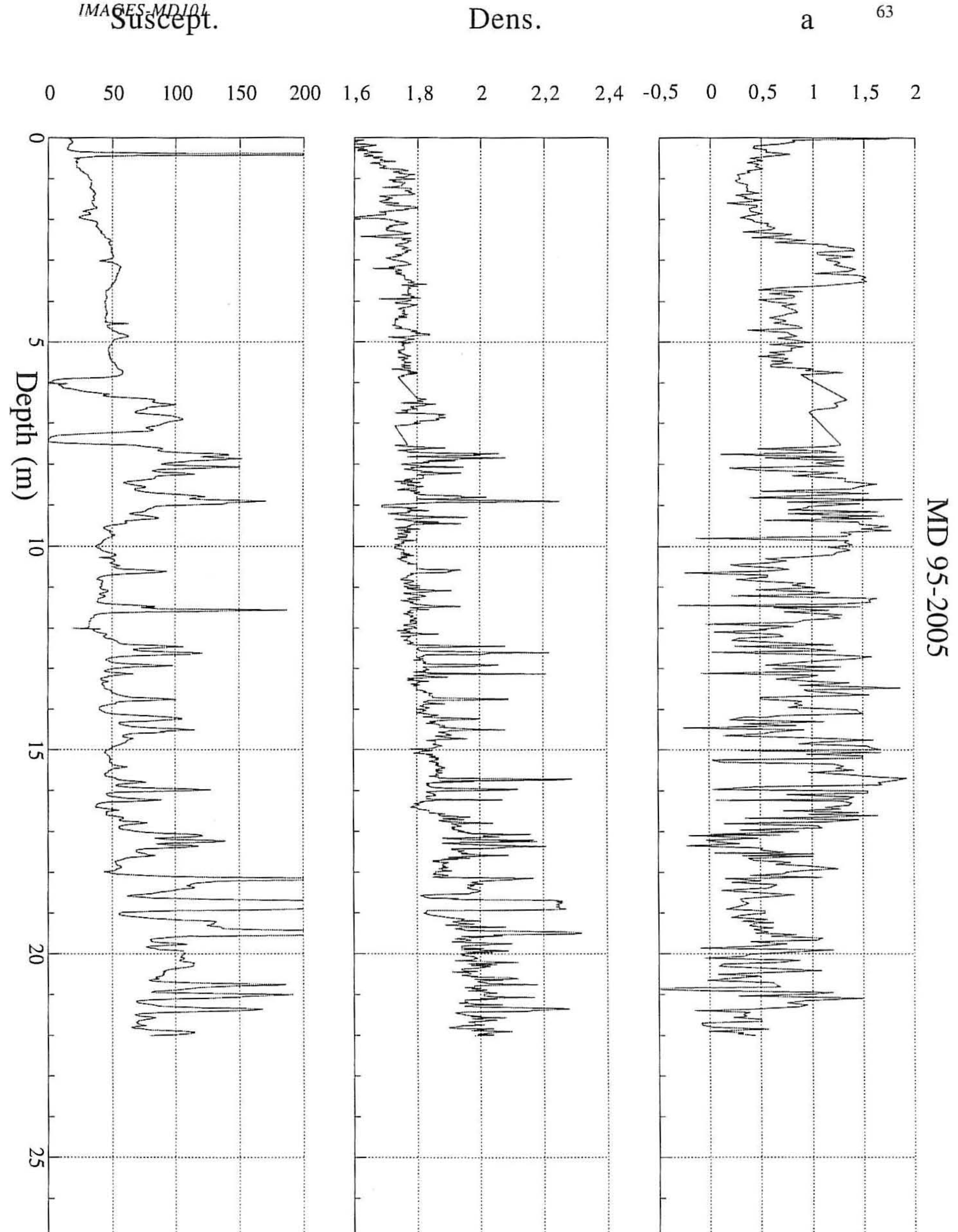
Core MD 95-2005

lat: 57°02 N - long: 10°03.83 W
water depth: 2130 m
length: 22.02 m

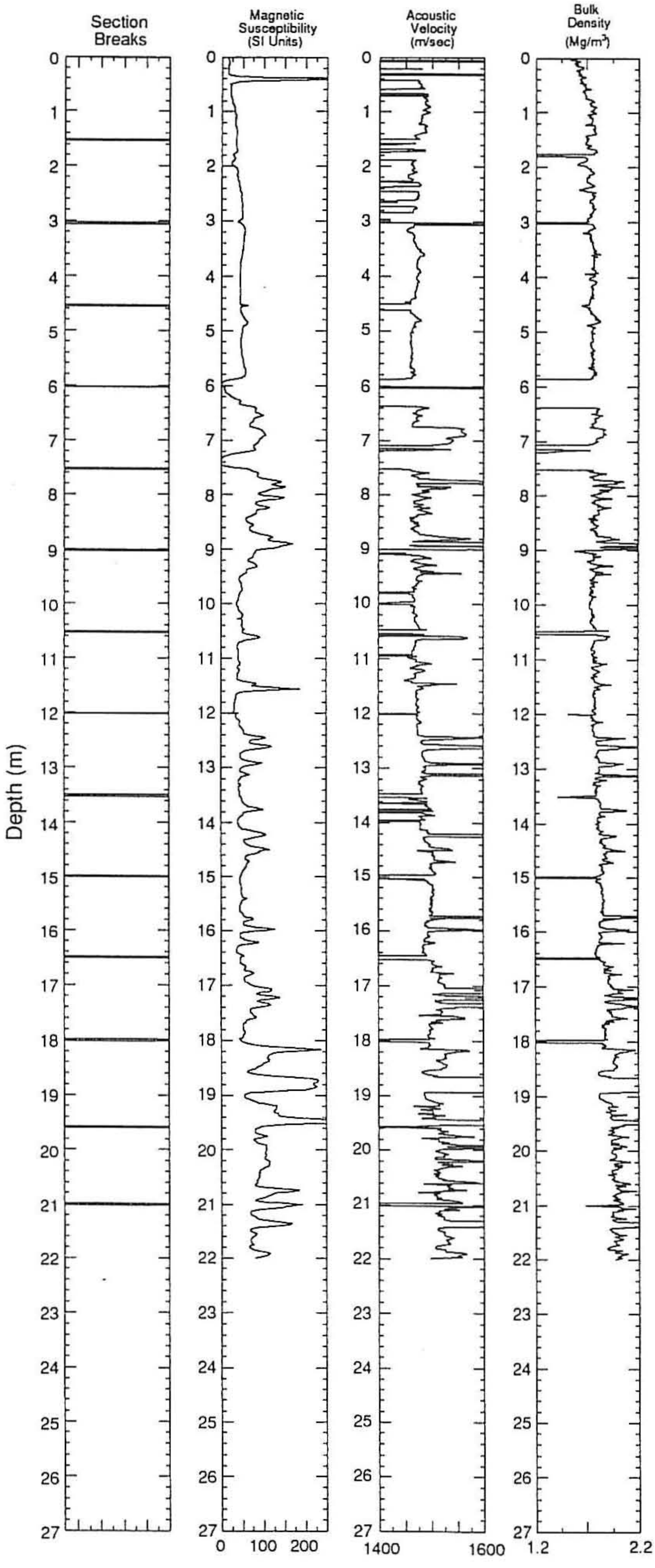




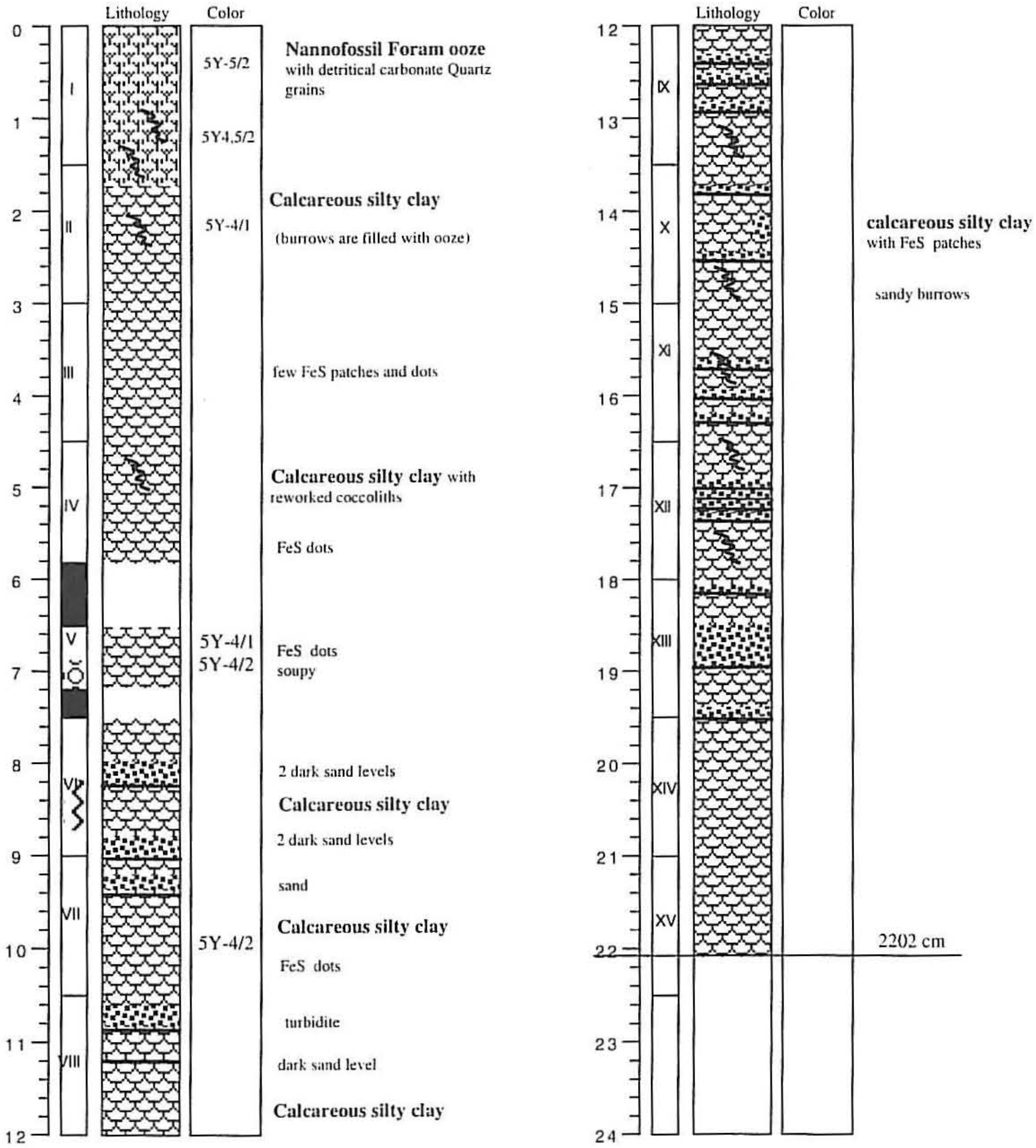



Suscept.
Dens.
a
0 50 100 150 200
1,6 1,8 2 2,2 2,4
-0,5 0 0,5 1 1,5 2
Depth (m)
0 5 10 15 20 25 30
MD 95-2005

MD95-2005

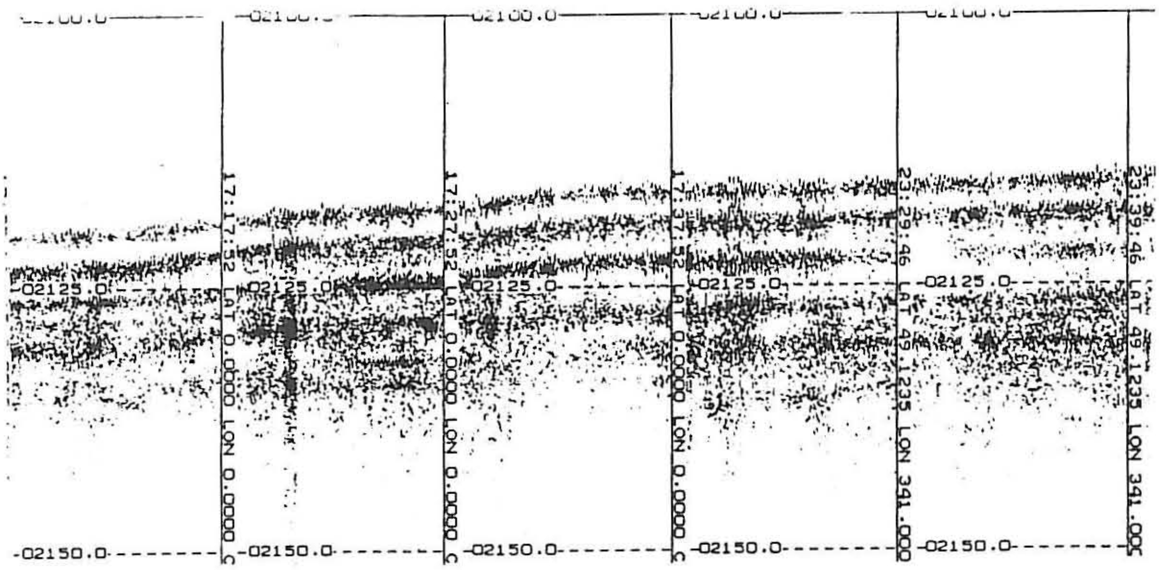

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
0 100 200
1400 1600
1.2 2.2

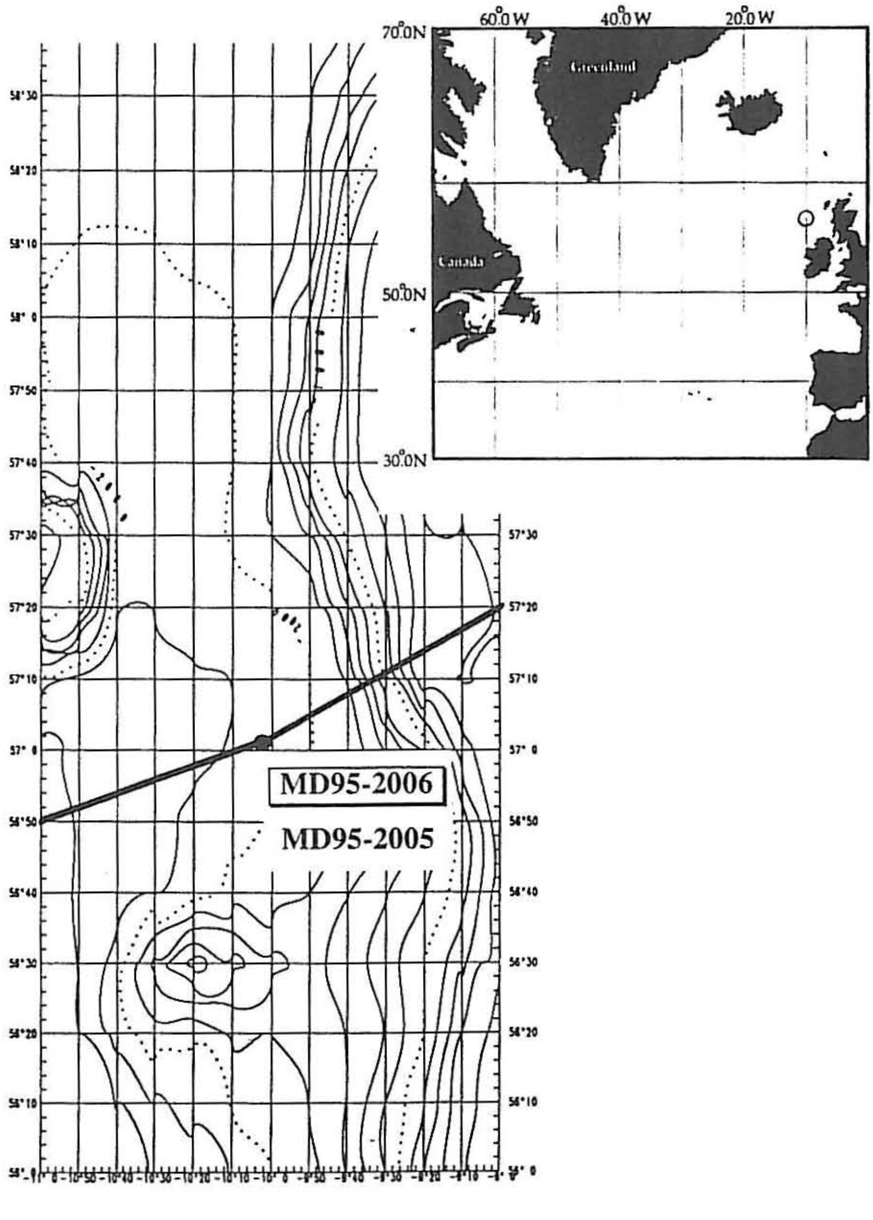
MD 95-2005

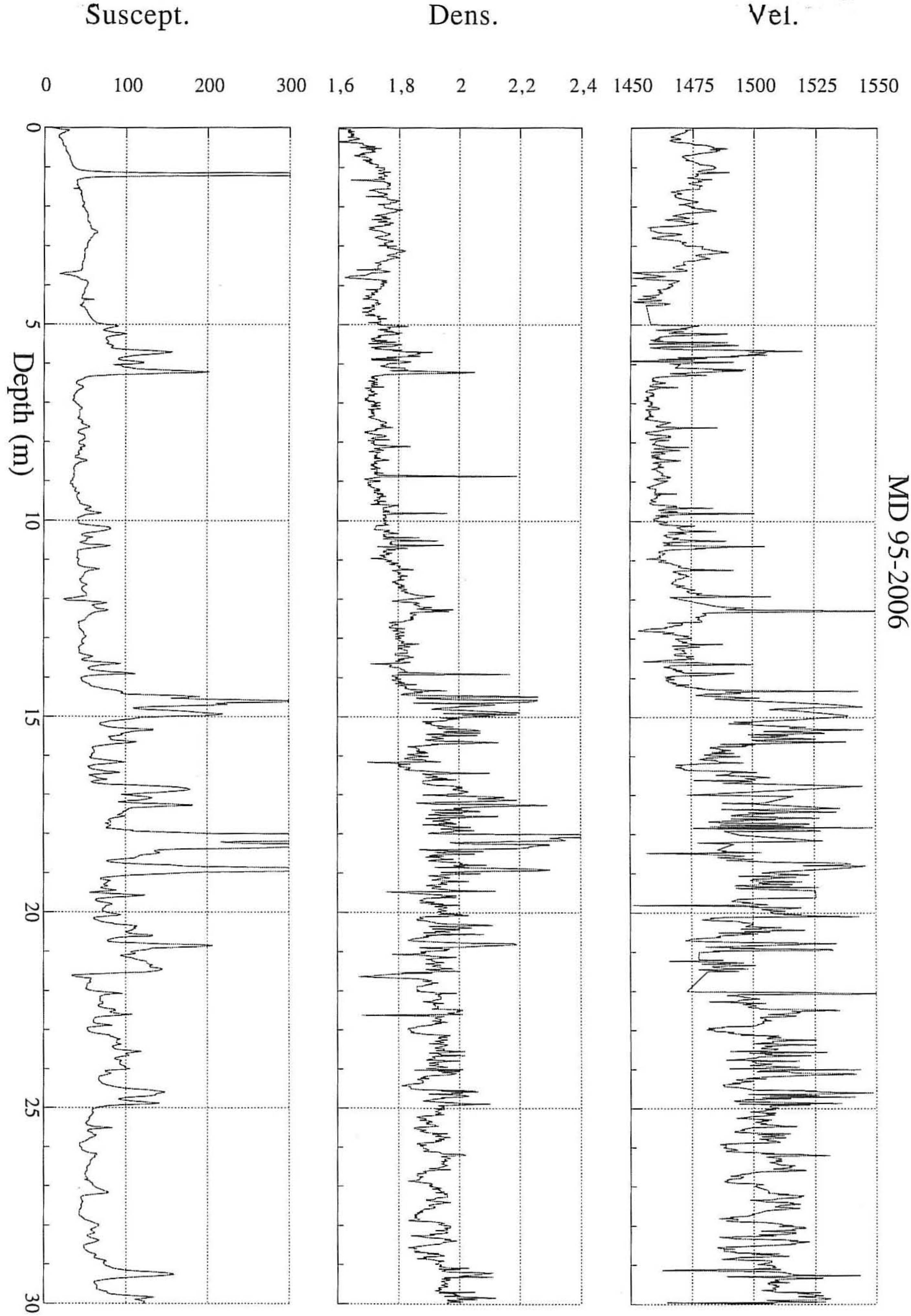

Lithology
Color
5Y-5/2
5Y4.5/2
5Y-4/1
5Y-4/1
5Y-4/2
5Y-4/2
Nannofossil Foram ooze
with detritical carbonate Quartz grains
Calcareous silty clay
(burrows are filled with ooze)
few FeS patches and dots
Calcareous silty clay with reworked coccoliths
FeS dots
FeS dots
soupy
2 dark sand levels
Calcareous silty clay
2 dark sand levels
sand
Calcareous silty clay
FeS dots
turbidite
dark sand level
Calcareous silty clay
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
calcareous silty clay
with FeS patches
sandy burrows
2202 cm

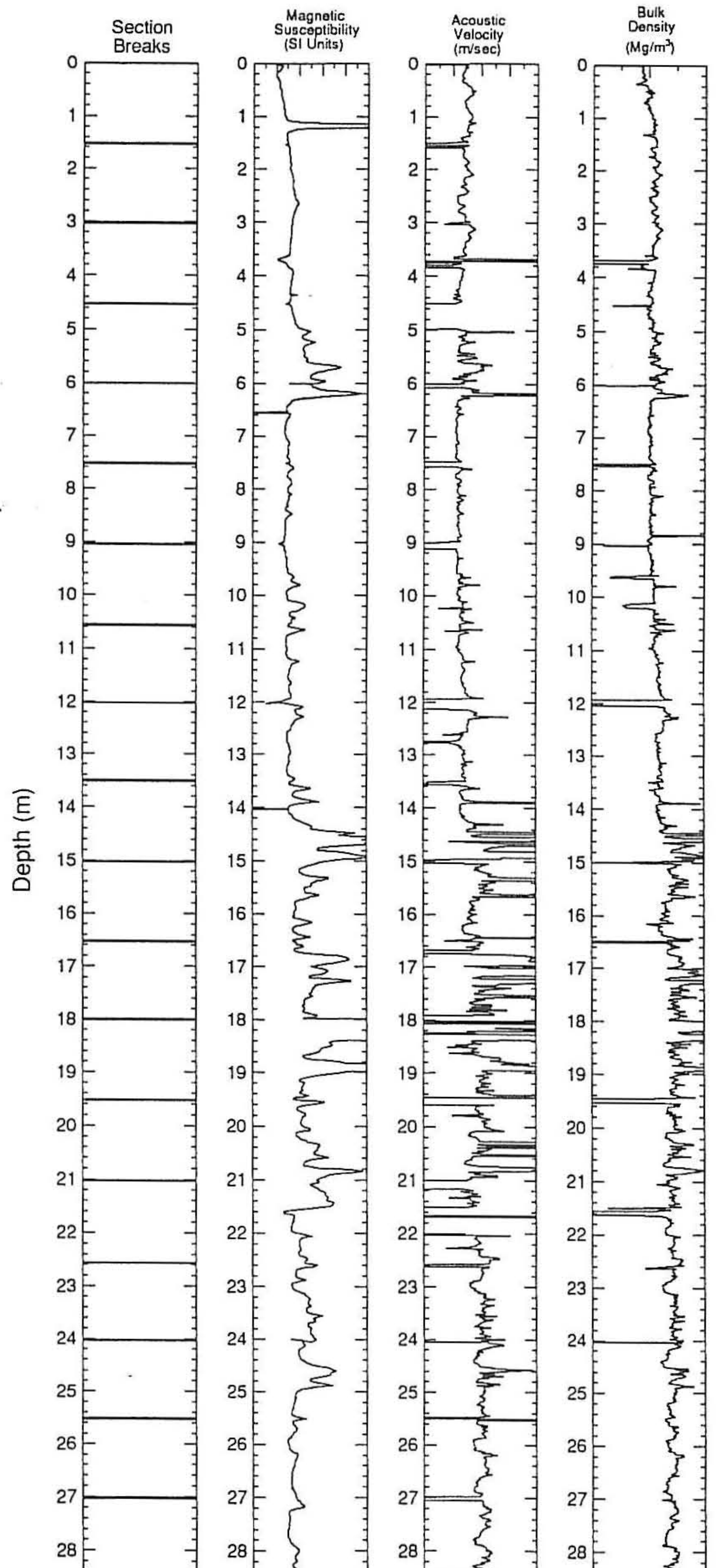
Core MD 95-2006

lat: 57°01.81 N - long: 10°03.48 W
water depth: 2122 m
length: 30.22 m






Suscept.
Dens.
Vel.
0 100 200 300
1,6 1,8 2 2,2 2,4
1450 1475 1500 1525 1550
Depth (m)
0 5 10 15 20 25 30
MD 95-2006

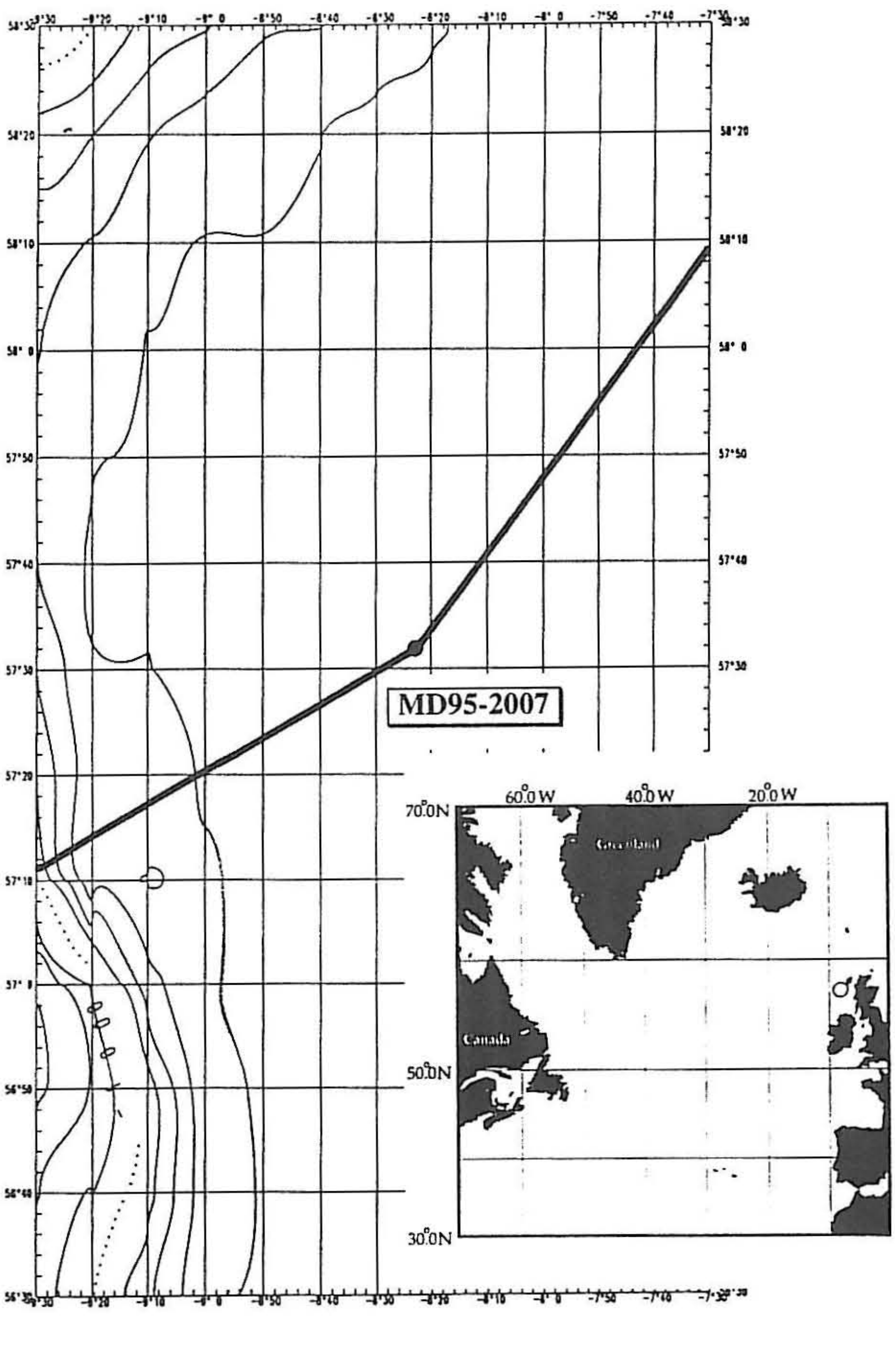

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
100
200
1400
1600
1.2
2.2

Core MD95-2006 not opened on board.

No sediment description.

Core MD95-2007

lat: 57°31.06 N - long: 08°23.17 W
water depth: 158 m
length: 19.35 m



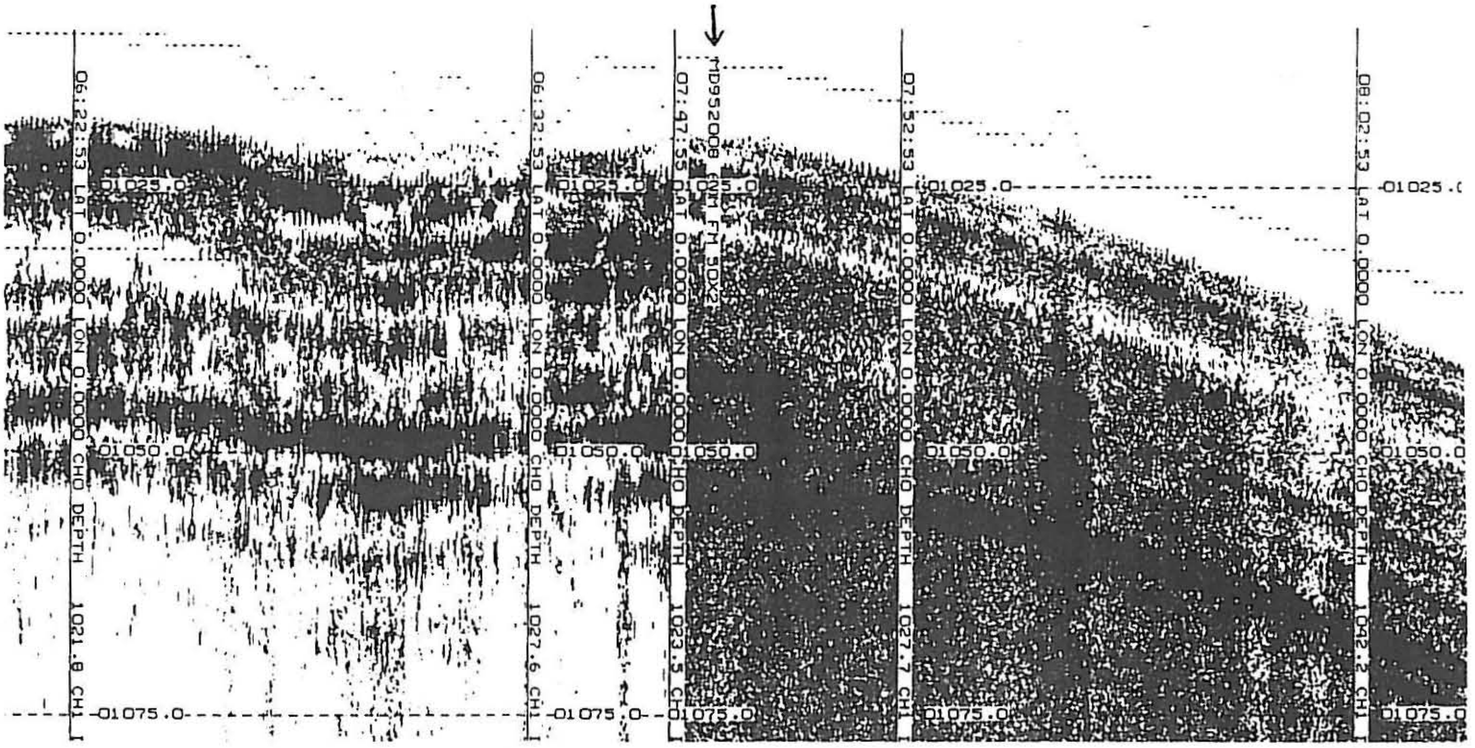
Core MD95-2007 not measured on MST.

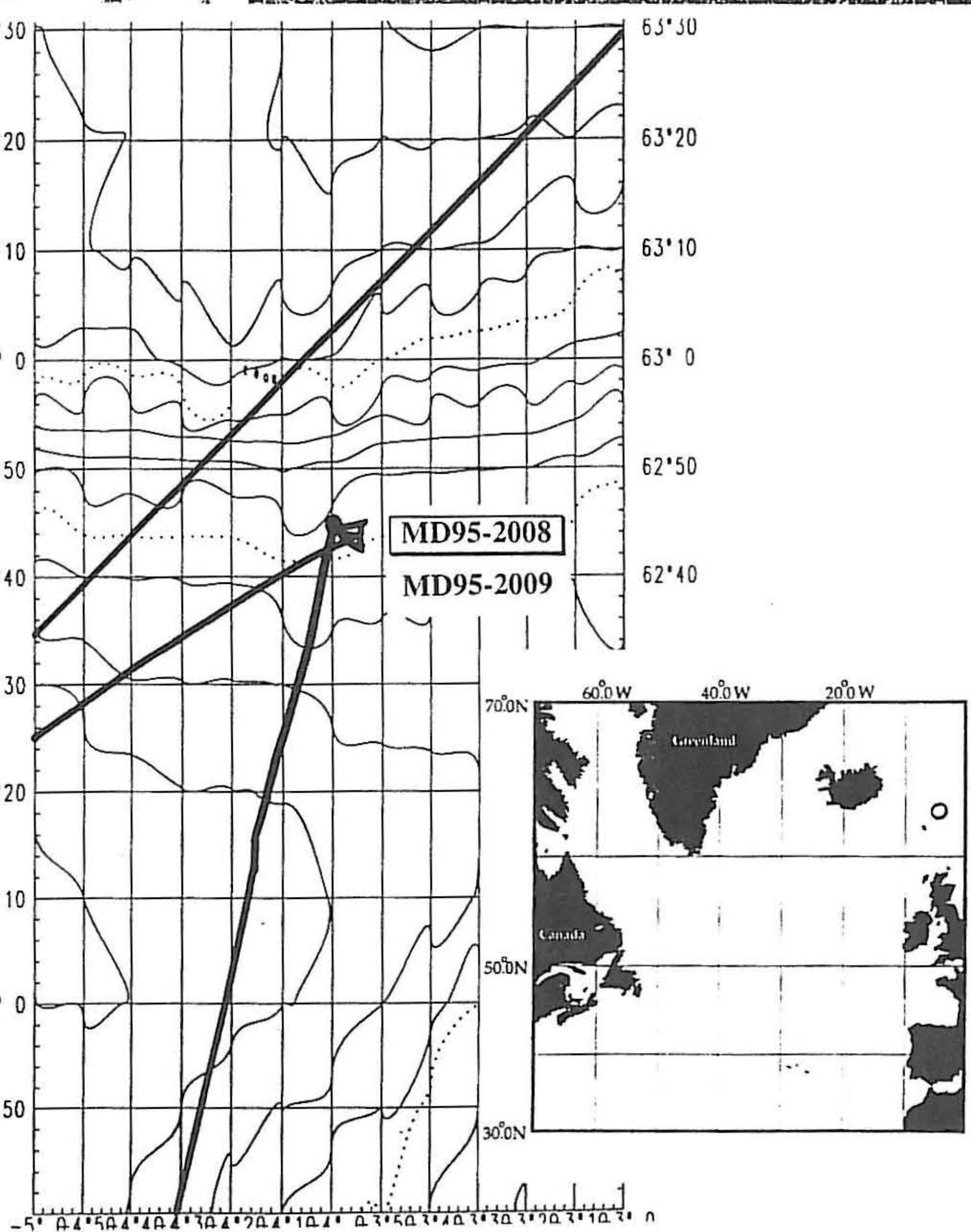
Core MD95-2007 not opened on board.

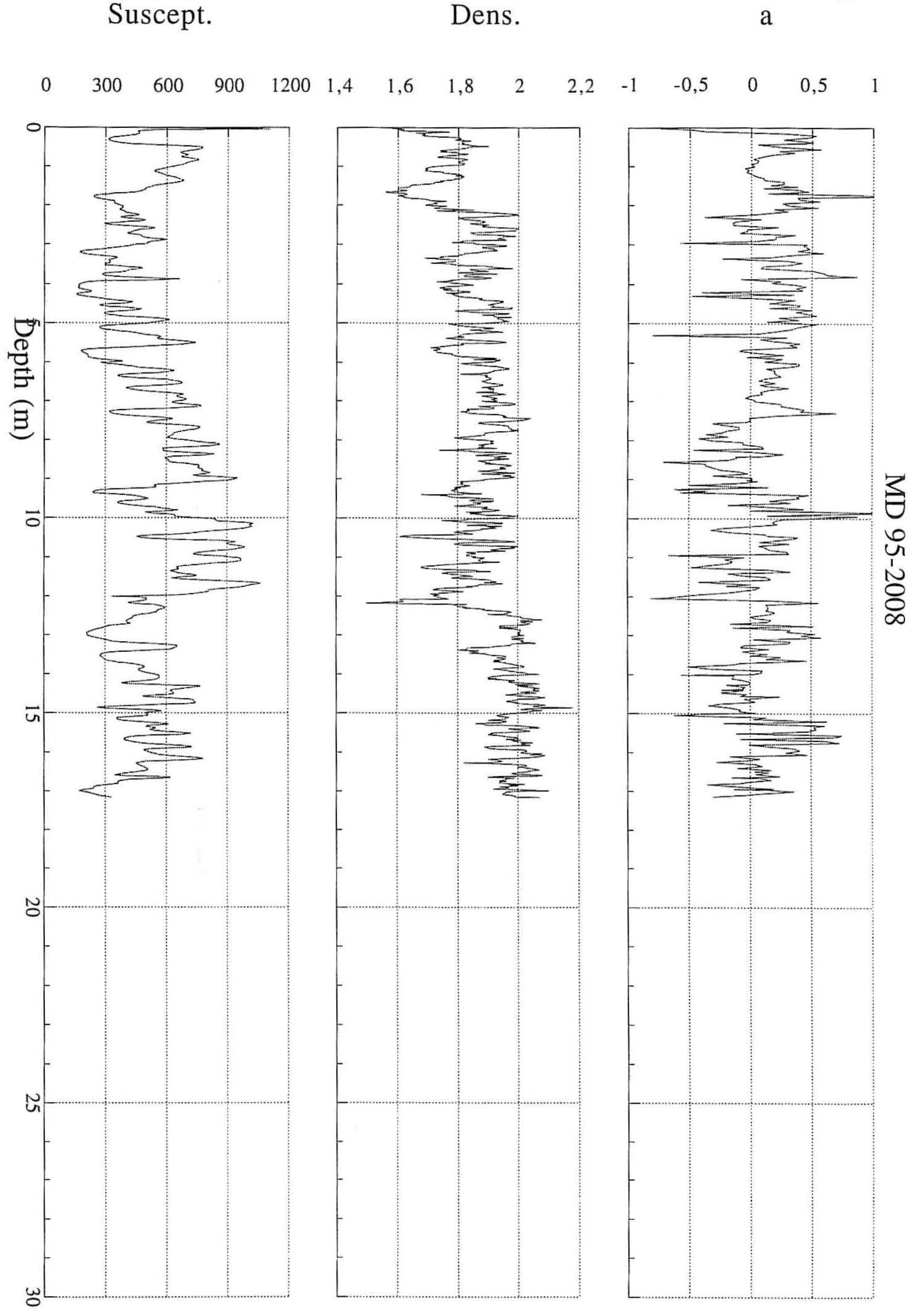
No core description.

Core MD 95-2008

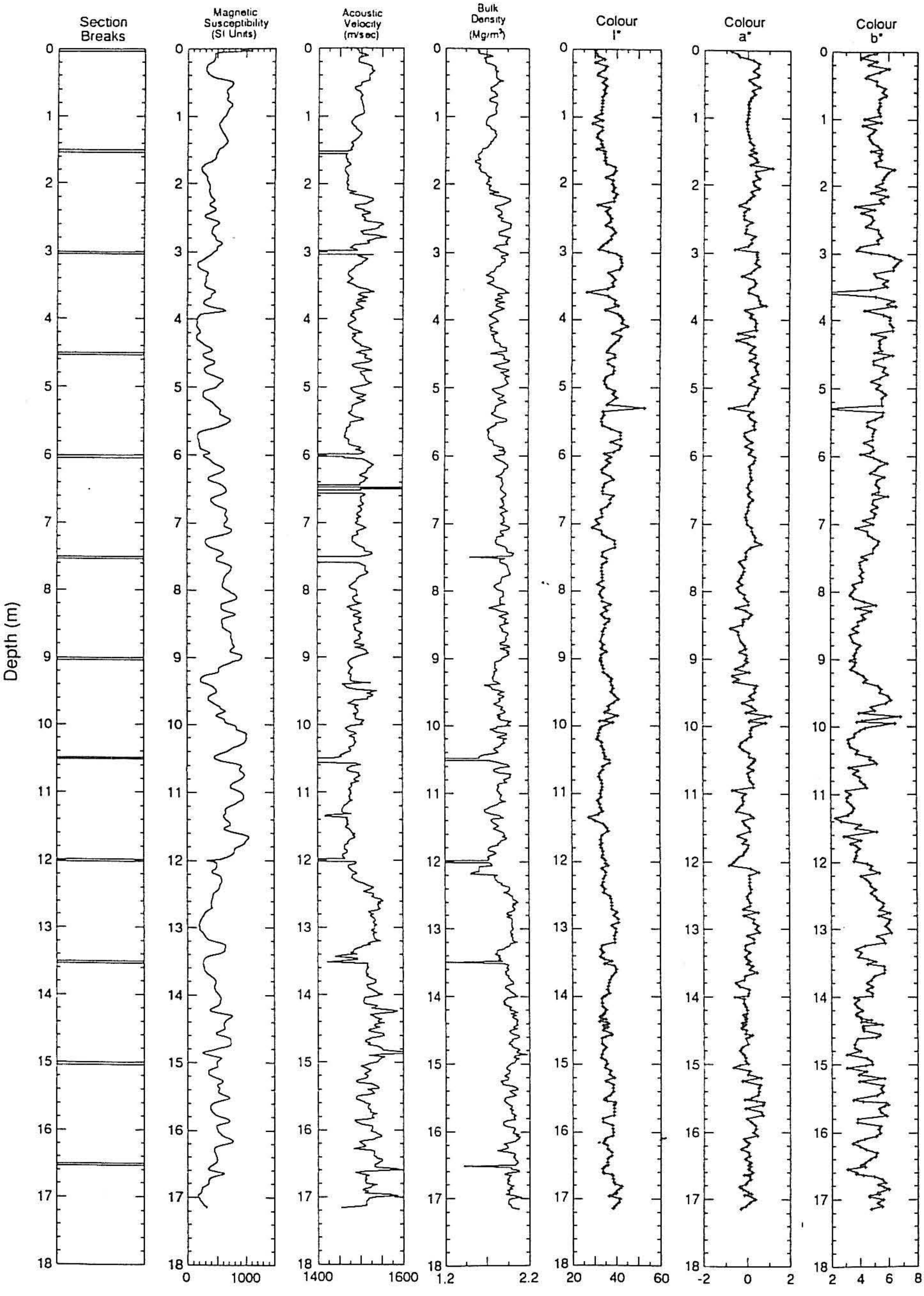
lat: 62°44.35 N - long: 03°59.64 W
water depth: 1016 m
length: 21.5 m



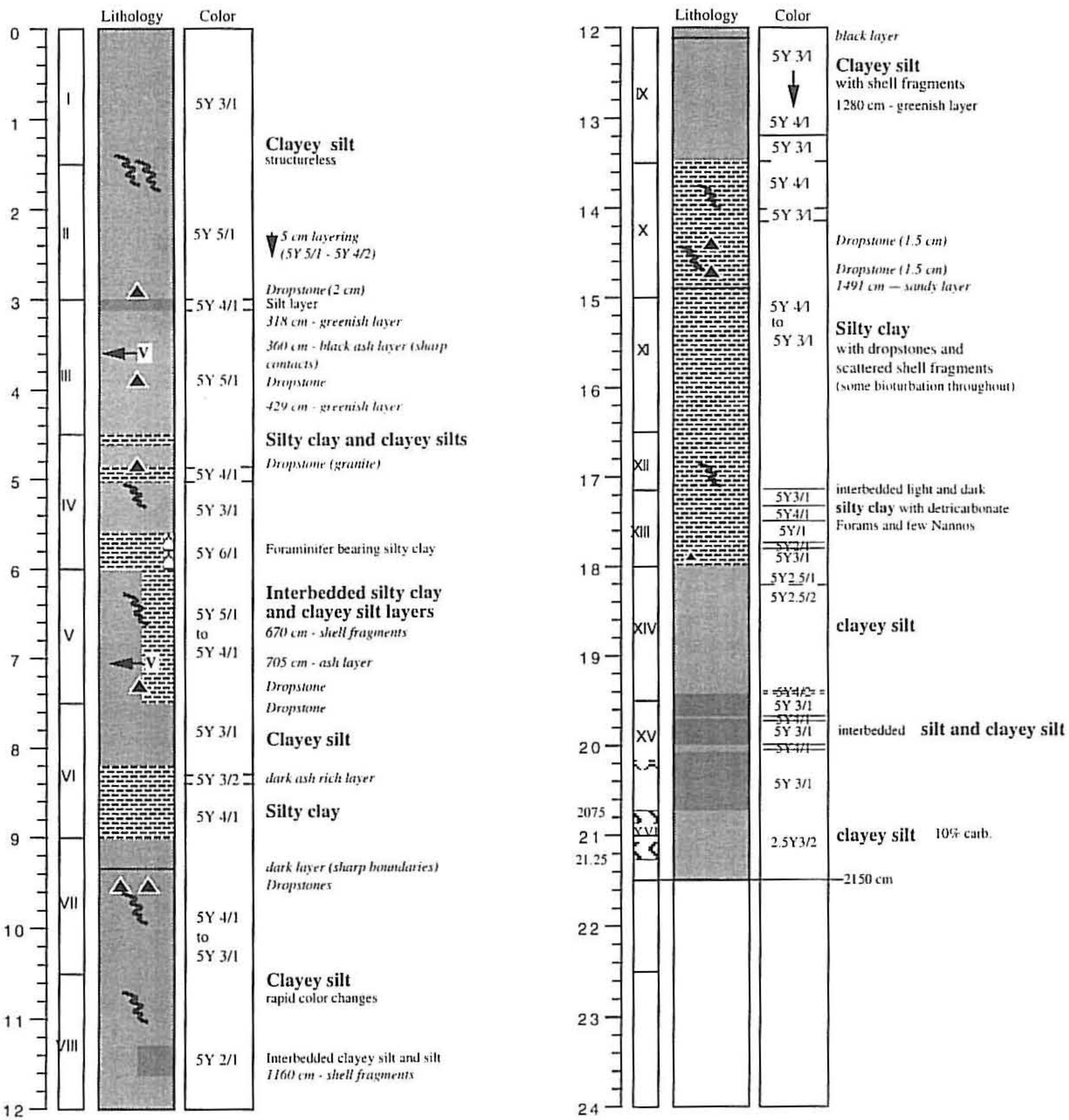



Suscept.
Dens.
a
0 300 600 900 1200
1,4 1,6 1,8 2 2,2
-1 -0,5 0 0,5 1
Depth (m)
0 5 10 15 20 25 30
MD 95-2008

MD95-2008

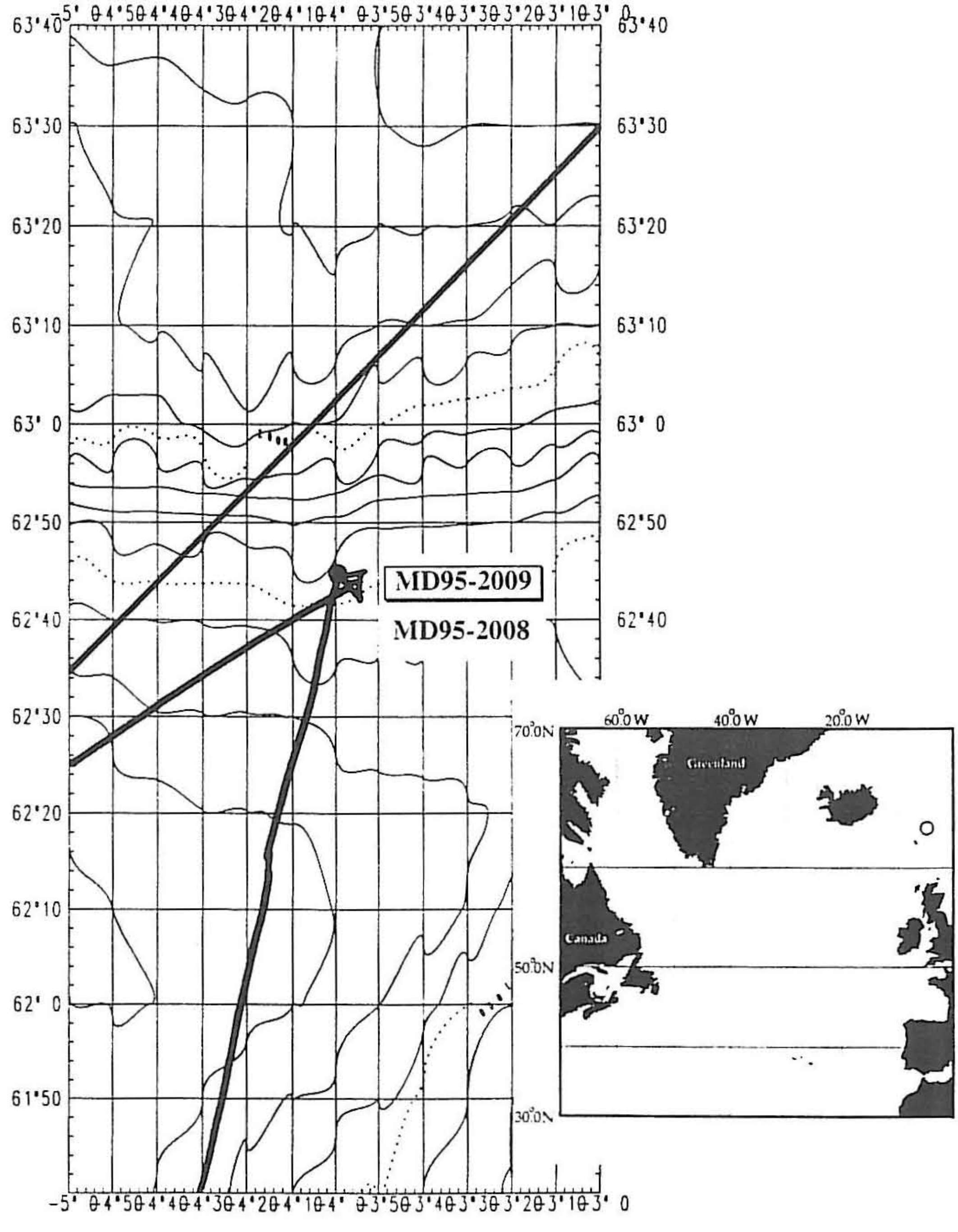

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
0 1000
1400 1600
1.2 2.2
20 40 60
-2 0 2
2 4 6 8

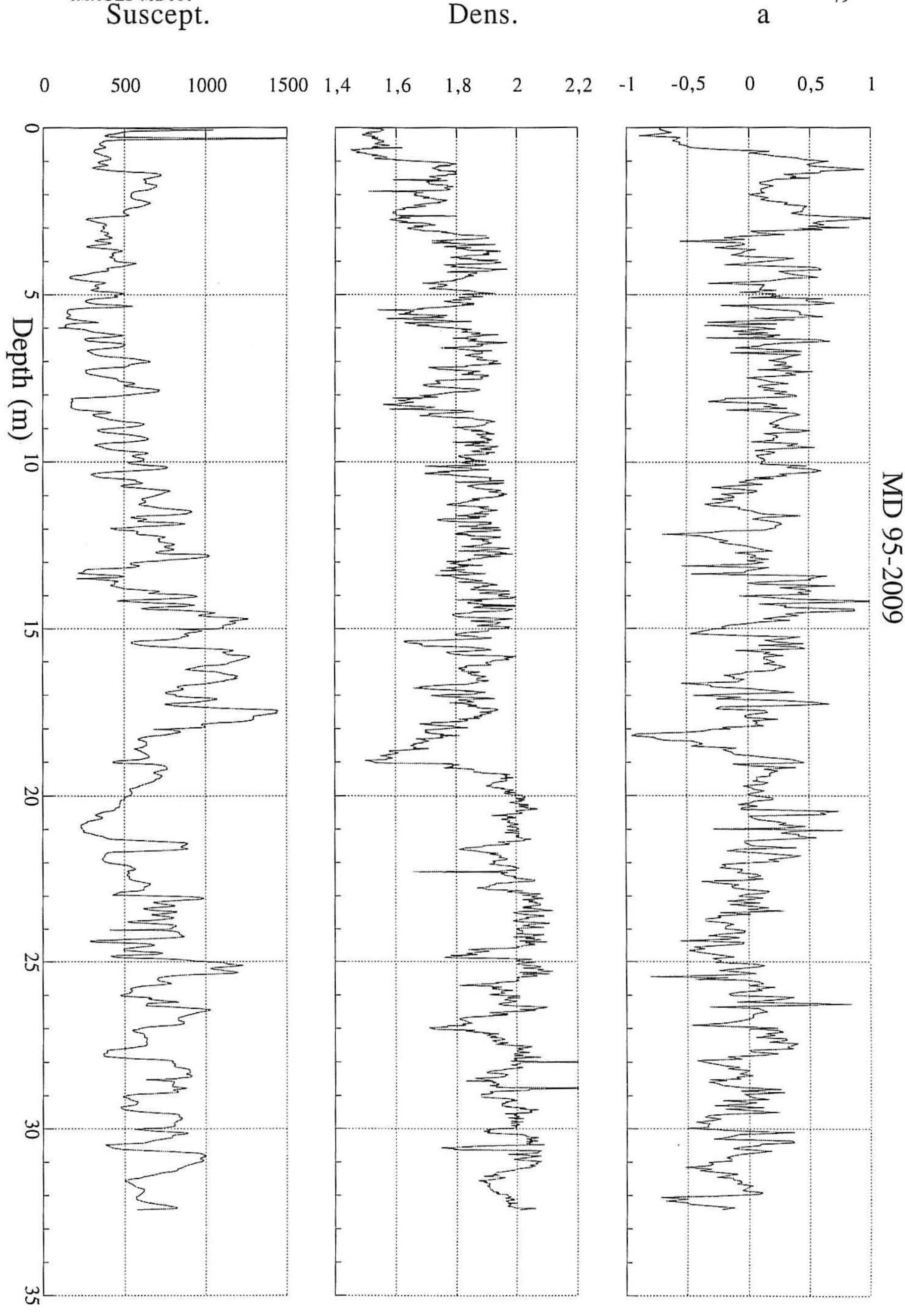
MD 95-2008


Lithology
Color
I
II
III
IV
V
VI
VII
VIII
5Y 3/1
Clayey silt
structureless
5Y 5/1
5 cm layering (5Y 5/1 - 5Y 4/2)
Dropstone (2 cm)
5Y 4/1
Silt layer
318 cm - greenish layer
360 cm - black ash layer (sharp contacts)
5Y 5/1
Dropstone
429 cm - greenish layer
Silty clay and clayey silts
Dropstone (granite)
5Y 4/1
5Y 3/1
5Y 6/1
Foraminifer bearing silty clay
Interbedded silty clay and clayey silt layers
5Y 5/1 to 5Y 4/1
670 cm - shell fragments
705 cm - ash layer
Dropstone
Dropstone
5Y 3/1
Clayey silt
5Y 3/2
dark ash rich layer
5Y 4/1
Silty clay
dark layer (sharp boundaries)
Dropstones
5Y 4/1 to 5Y 3/1
Clayey silt
rapid color changes
5Y 2/1
Interbedded clayey silt and silt
1160 cm - shell fragments
IX
X
XI
XII
XIII
XIV
XV
XVI
black layer
5Y 3/1
5Y 4/1
Clayey silt
with shell fragments
1280 cm - greenish layer
5Y 3/1
5Y 4/1
5Y 3/1
Dropstone (1.5 cm)
Dropstone (1.5 cm)
1491 cm — sandy layer
5Y 4/1 to 5Y 3/1
Silty clay
with dropstones and scattered shell fragments
(some bioturbation throughout)
5Y3/1
5Y4/1
5Y/1
5Y3/1
interbedded light and dark silty clay with detricarbonate Forams and few Nannos
5Y2.5/1
5Y2.5/2
clayey silt
5Y 3/1
5Y 3/1
interbedded silt and clayey silt
5Y 3/1
2.5Y3/2
clayey silt 10% carb.
2075
21.25
2150 cm

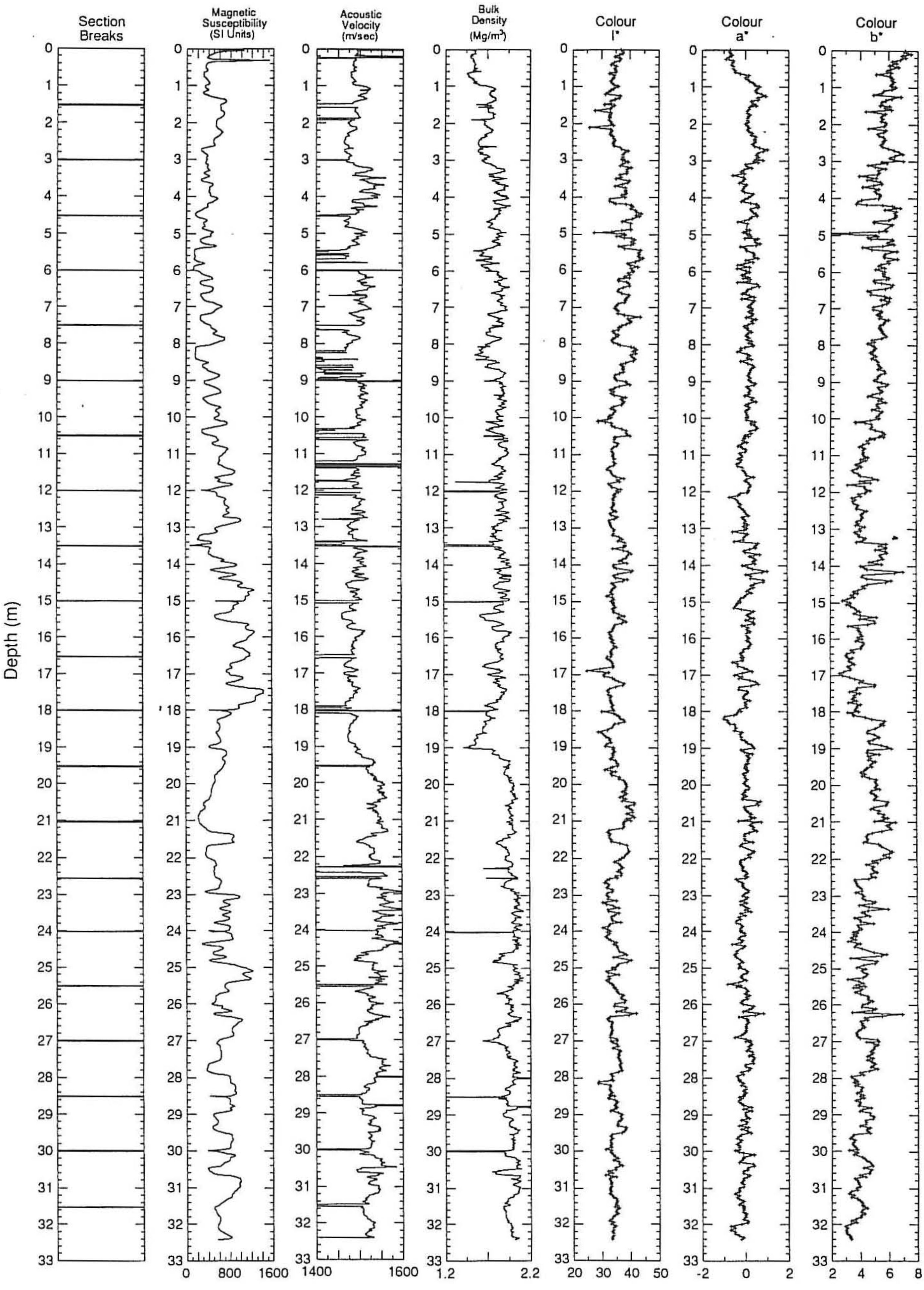
Core MD 95-2009

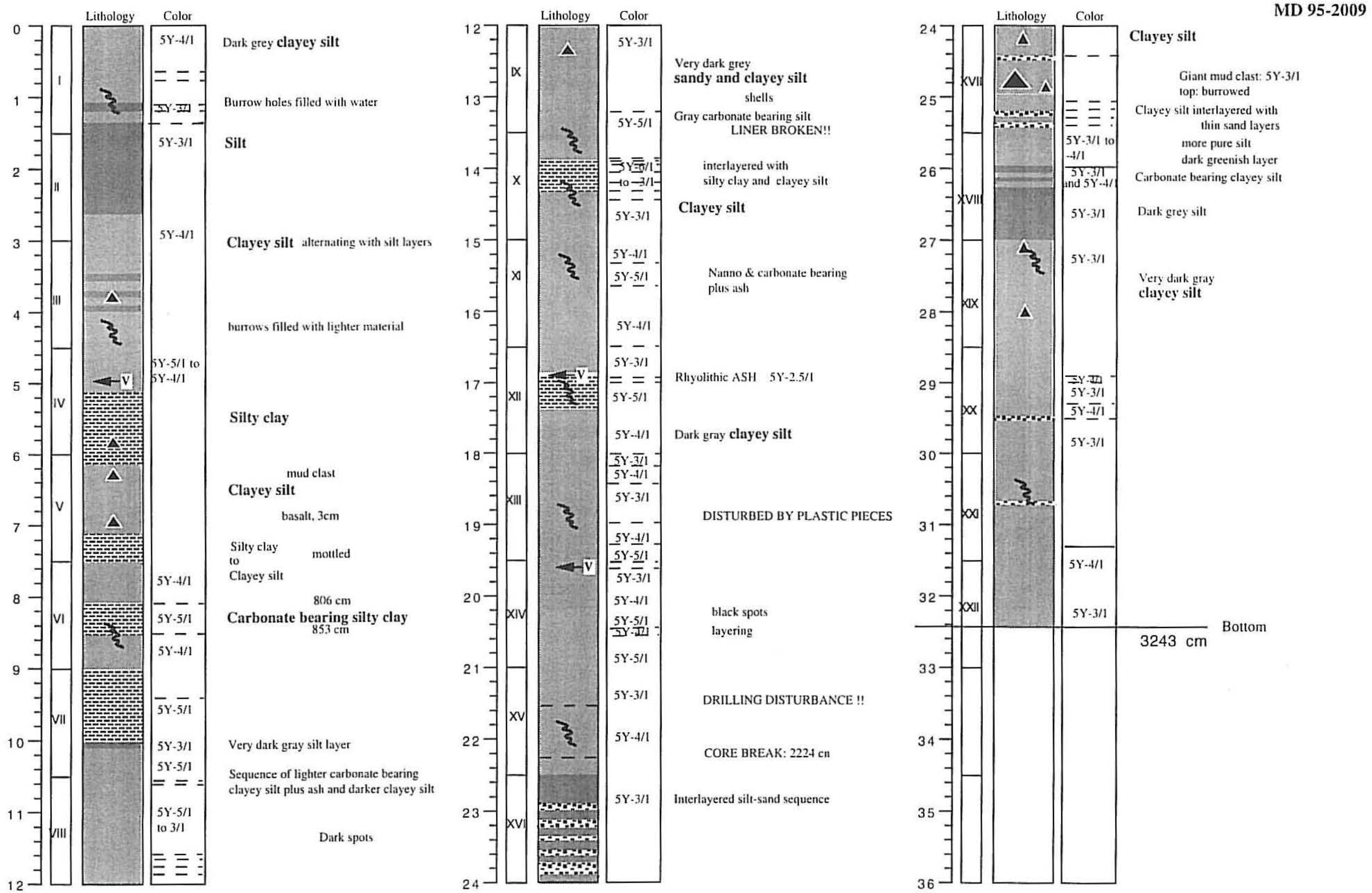
lat: 62°44.25 N - long: 03°59.86 W
water depth: 1027 m
length: 32.43 m




Suscept.
Dens.
a
0 500 1000 1500
1,4 1,6 1,8 2 2,2
-1 -0,5 0 0,5 1
Depth (m)
0 5 10 15 20 25 30 35
MD 95-2009

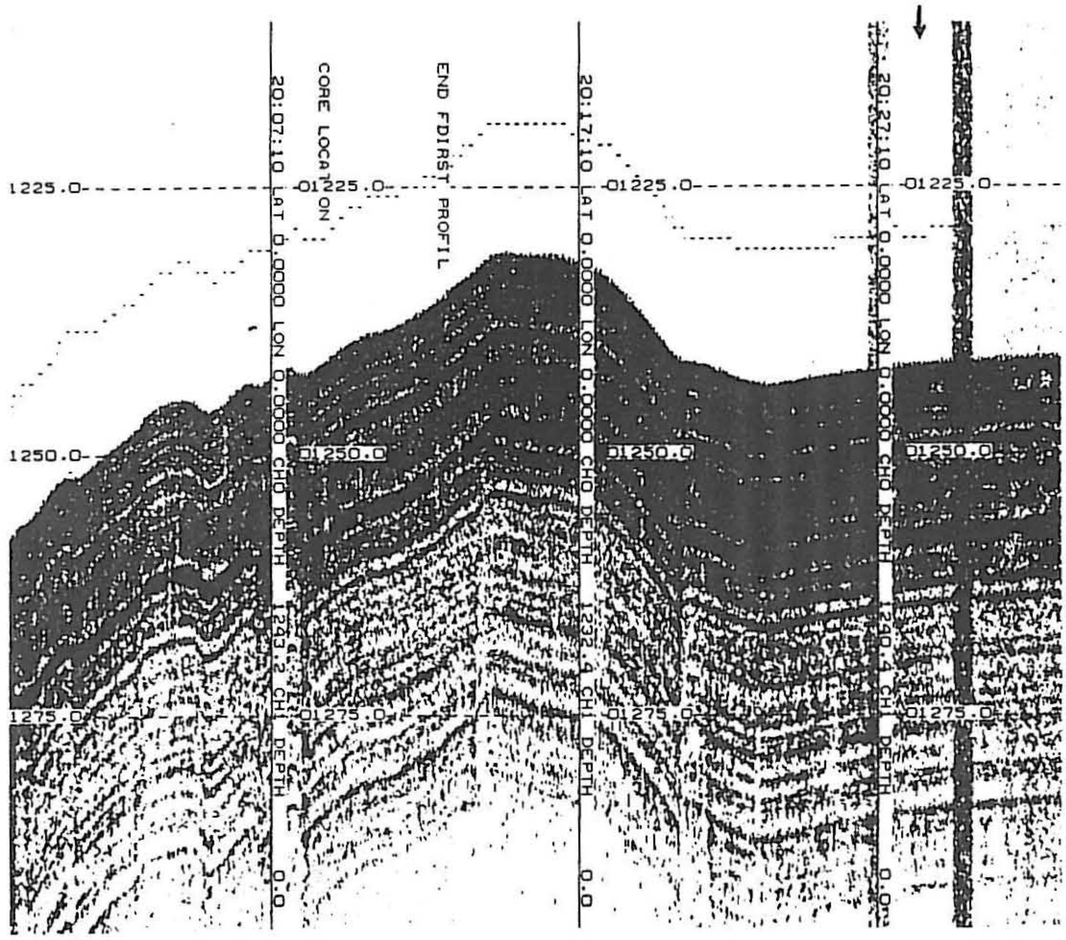
MD95-2009

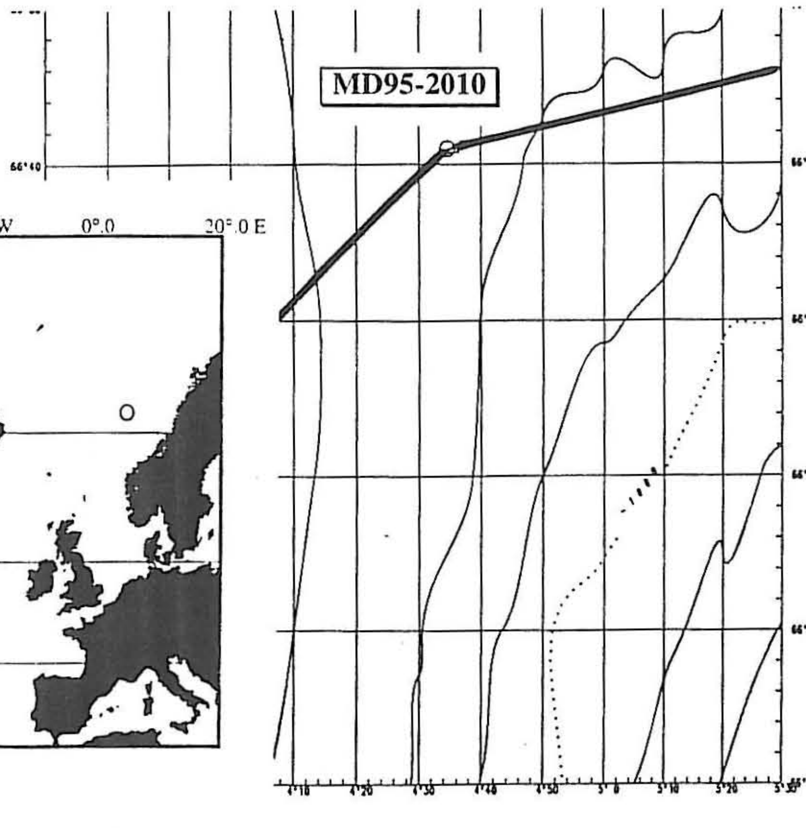

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
800
1600
1400
1600
1.2
2.2
20
30
40
50
-2
0
2
2
4
6
8

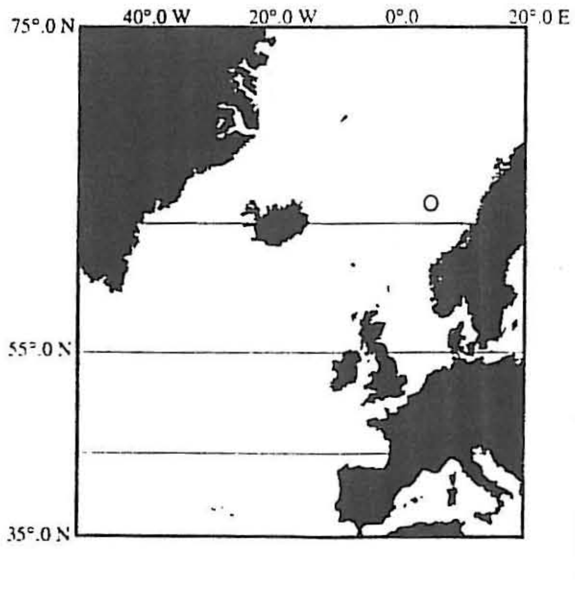

MD 95-2009
Lithology
Color
5Y-4/1
Dark grey clayey silt
Burrow holes filled with water
5Y-3/1
Silt
5Y-4/1
Clayey silt alternating with silt layers
burrows filled with lighter material
5Y-5/1 to 5Y-4/1
Silty clay
mud clast
Clayey silt
basalt, 3cm
Silty clay to Clayey silt
mottled
5Y-4/1
806 cm
5Y-5/1
Carbonate bearing silty clay
853 cm
5Y-4/1
5Y-5/1
5Y-3/1
Very dark gray silt layer
5Y-5/1
Sequence of lighter carbonate bearing clayey silt plus ash and darker clayey silt
5Y-5/1 to 3/1
Dark spots
5Y-3/1
Very dark grey sandy and clayey silt
shells
5Y-5/1
Gray carbonate bearing silt
LINER BROKEN!!
interlayered with silty clay and clayey silt
Clayey silt
5Y-4/1
5Y-5/1
Nanno & carbonate bearing plus ash
5Y-4/1
5Y-3/1
Rhyolithic ASH 5Y-2.5/1
5Y-5/1
5Y-4/1
Dark gray clayey silt
5Y-3/1
5Y-4/1
DISTURBED BY PLASTIC PIECES
5Y-5/1
black spots
layering
DRILLING DISTURBANCE !!
5Y-4/1
CORE BREAK: 2224 cm
Interlayered silt-sand sequence
Clayey silt
Giant mud clast: 5Y-3/1
top: burrowed
Clayey silt interlayered with thin sand layers
more pure silt
dark greenish layer
Carbonate bearing clayey silt
Dark grey silt
Very dark gray clayey silt
Bottom
3243 cm

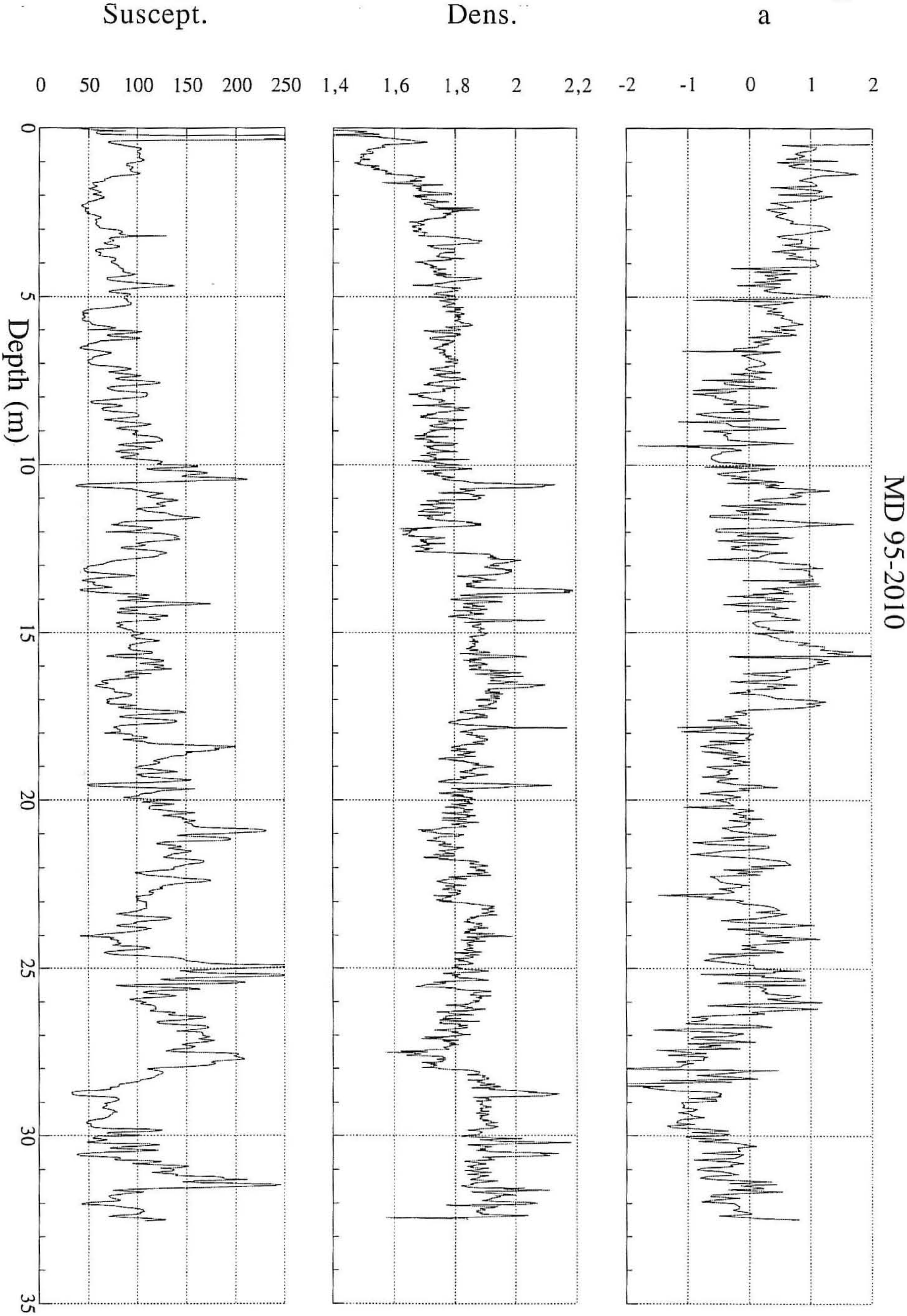
Core MD 95-2010

lat: 66°41.05 N - long: 04°33.97 E
Water depth: 1226 m
length: 32.53 m

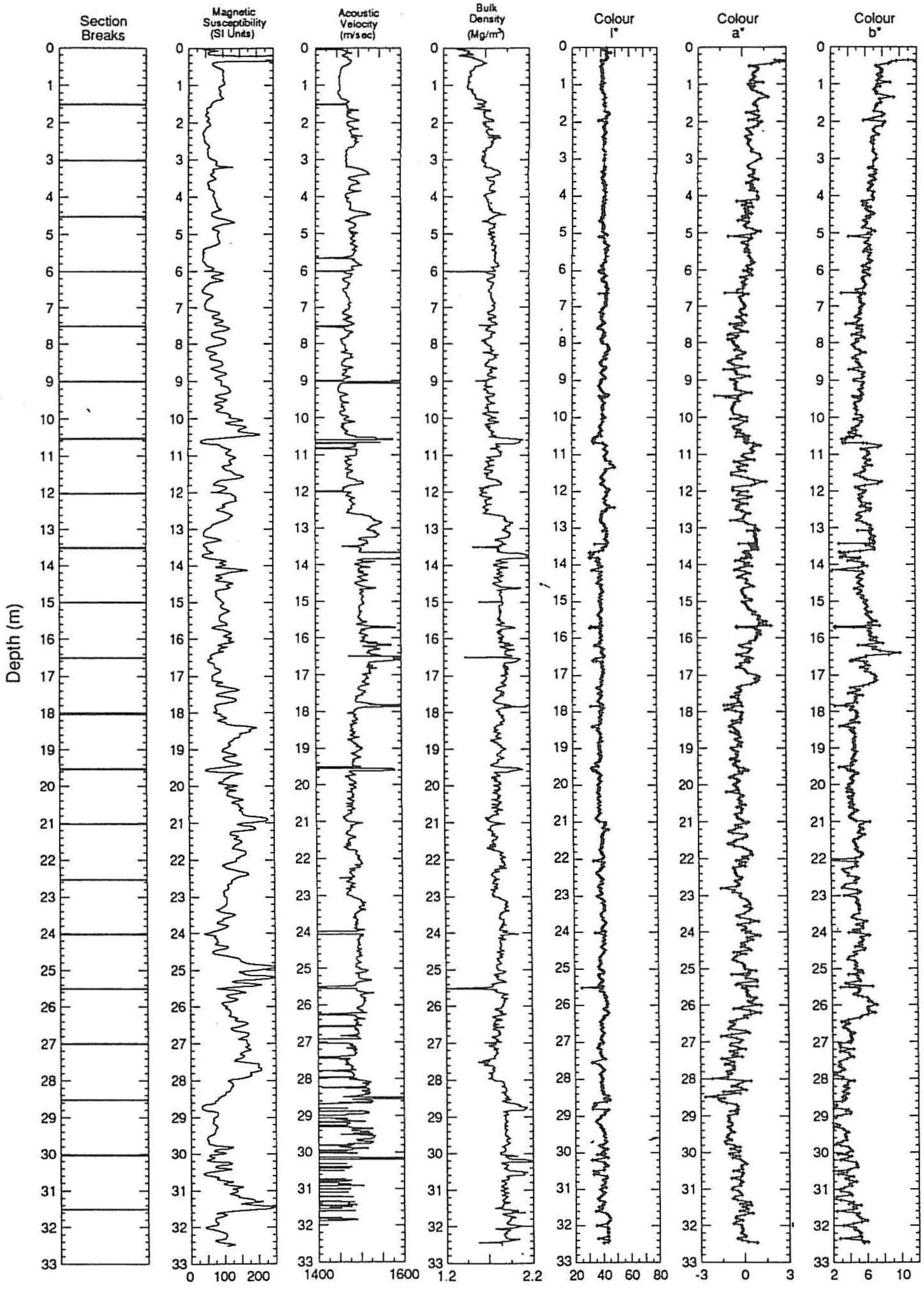




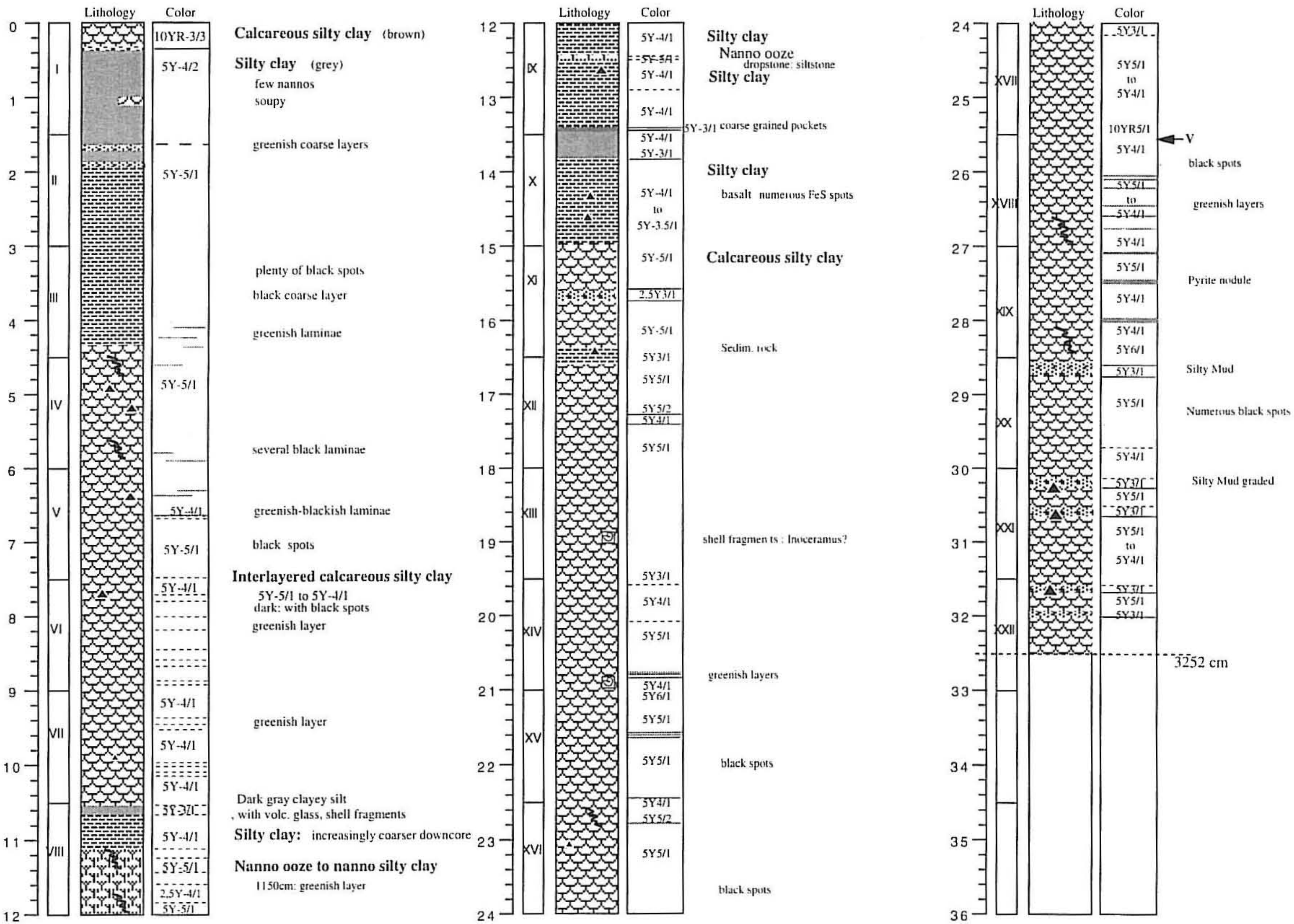



Suscept.
Dens.
a
0 50 100 150 200 250
1,4 1,6 1,8 2 2,2
-2 -1 0 1 2
Depth (m)
0 5 10 15 20 25 30 35
MD 95-2010

MD95-2010

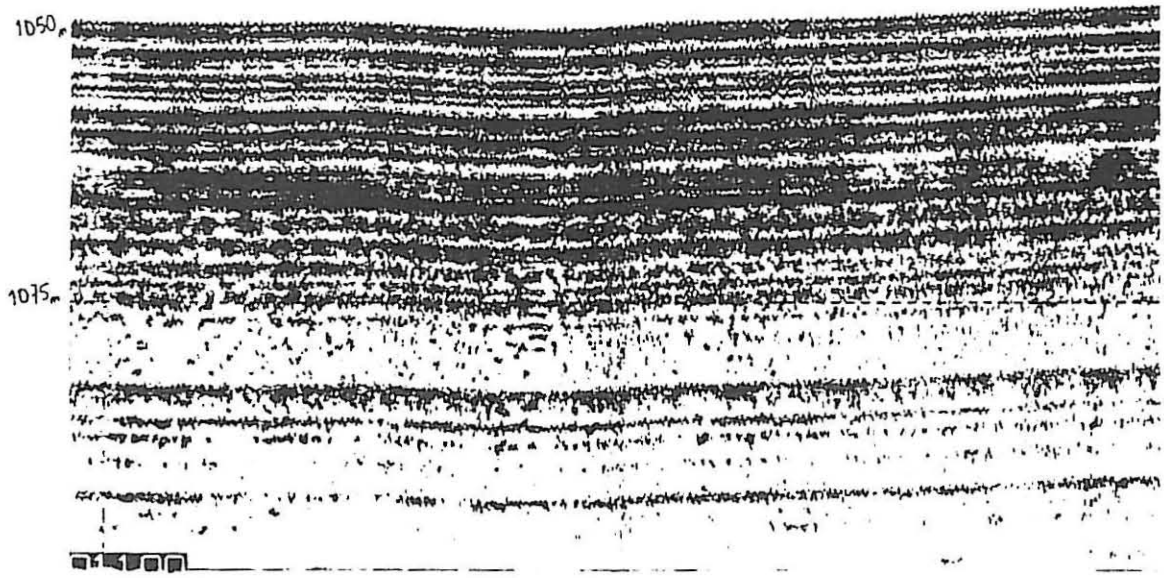

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
0 100 200
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

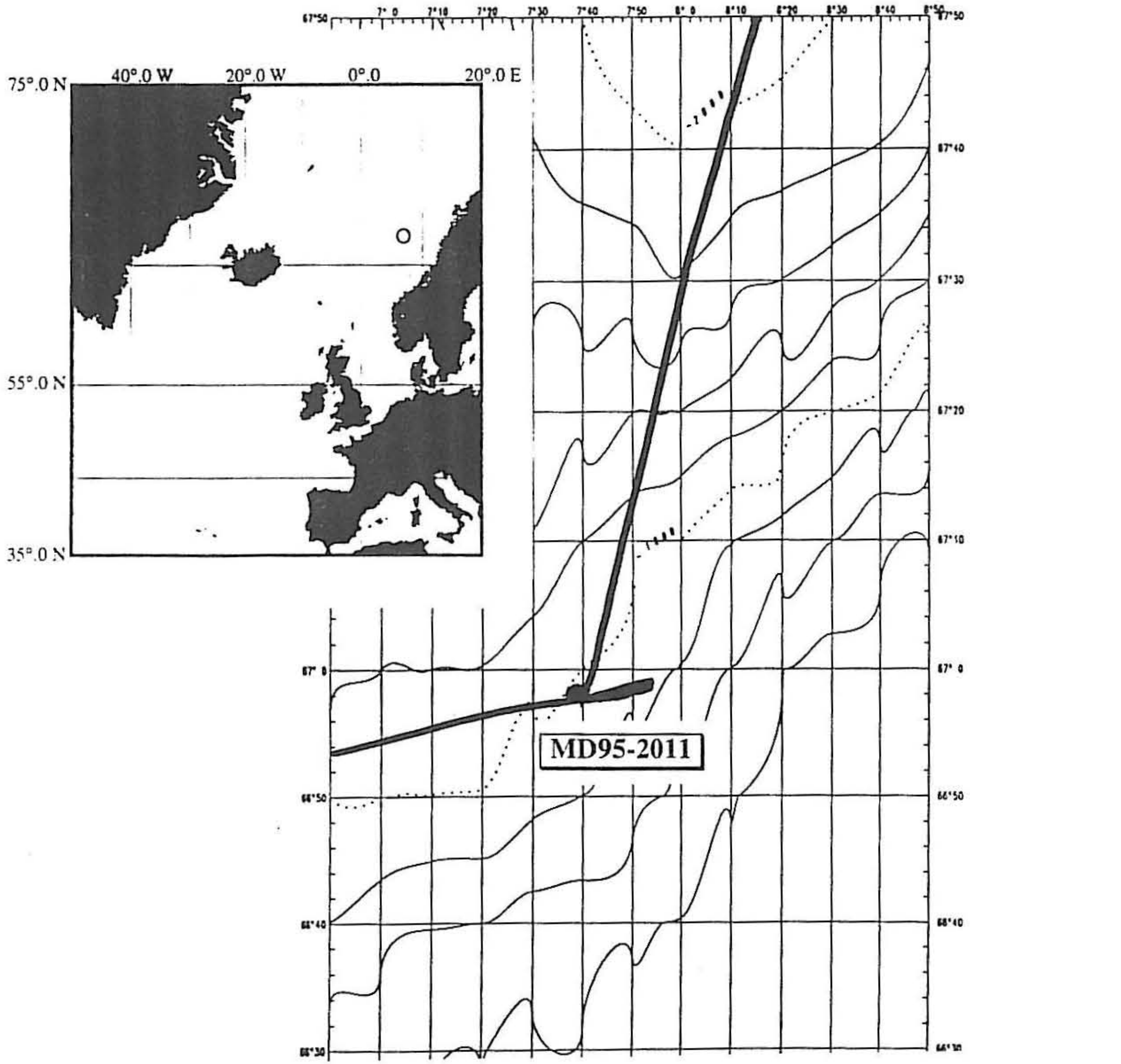
MD 95-2010

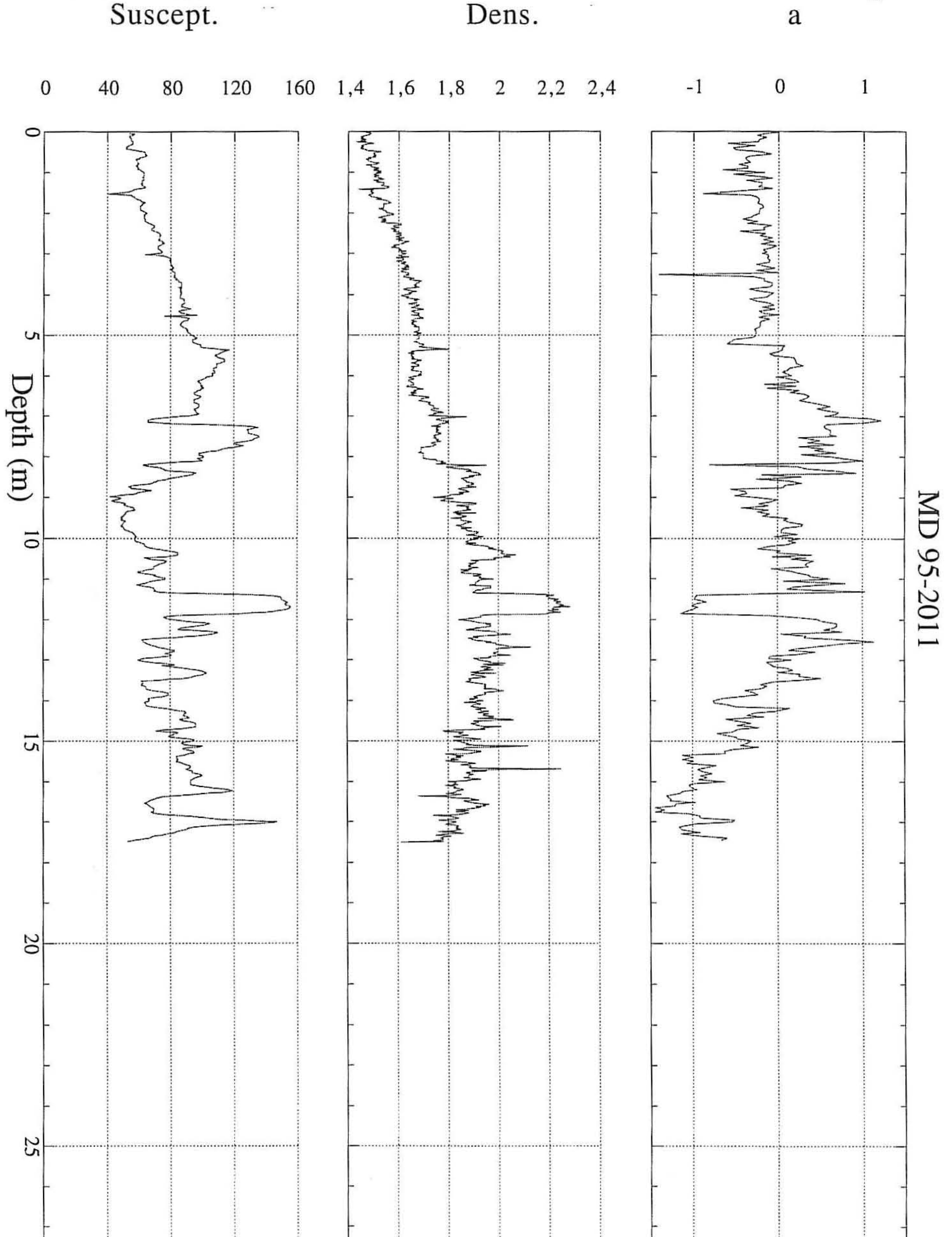

Lithology
Color
10YR-3/3
Calcareous silty clay (brown)
5Y-4/2
Silty clay (grey)
few nannos
soupy
greenish coarse layers
5Y-5/1
plenty of black spots
black coarse layer
greenish laminae
5Y-5/1
several black laminae
5Y-4/1
greenish-blackish laminae
5Y-5/1
black spots
Interlayered calcareous silty clay
5Y-4/1
5Y-5/1 to 5Y-4/1
dark: with black spots
greenish layer
5Y-4/1
greenish layer
5Y-4/1
5Y-4/1
Dark gray clayey silt
, with volc. glass, shell fragments
5Y-4/1
Silty clay: increasingly coarser downcore
5Y-5/1
Nanno ooze to nanno silty clay
1150cm: greenish layer
2.5Y-4/1
5Y-5/1
Silty clay
Nanno ooze
dropstone: siltstone
Silty clay
5Y-4/1
5Y-3/1 coarse grained pockets
5Y-4/1
5Y-3/1
Silty clay
5Y-4/1
to
5Y-3.5/1
basalt numerous FeS spots
5Y-5/1
Calcareous silty clay
2.5Y3/1
5Y-5/1
Sedim. rock
5Y3/1
5Y5/1
5Y5/2
5Y4/1
5Y5/1
shell fragments : Inoceramus?
5Y3/1
5Y4/1
5Y5/1
5Y4/1
5Y6/1
greenish layers
5Y5/1
5Y5/1
black spots
5Y4/1
5Y5/2
5Y5/1
black spots
5Y3/1
5Y5/1
to
5Y4/1
10YR5/1
V
5Y4/1
black spots
5Y5/1
to
5Y4/1
greenish layers
5Y4/1
5Y5/1
Pyrite nodule
5Y4/1
5Y4/1
5Y6/1
5Y3/1
Silty Mud
5Y5/1
Numerous black spots
5Y4/1
5Y3/1
Silty Mud graded
5Y5/1
5Y3/1
5Y5/1
to
5Y4/1
5Y3/1
5Y5/1
5Y3/1
3252 cm
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXII

Core MD 95-2011

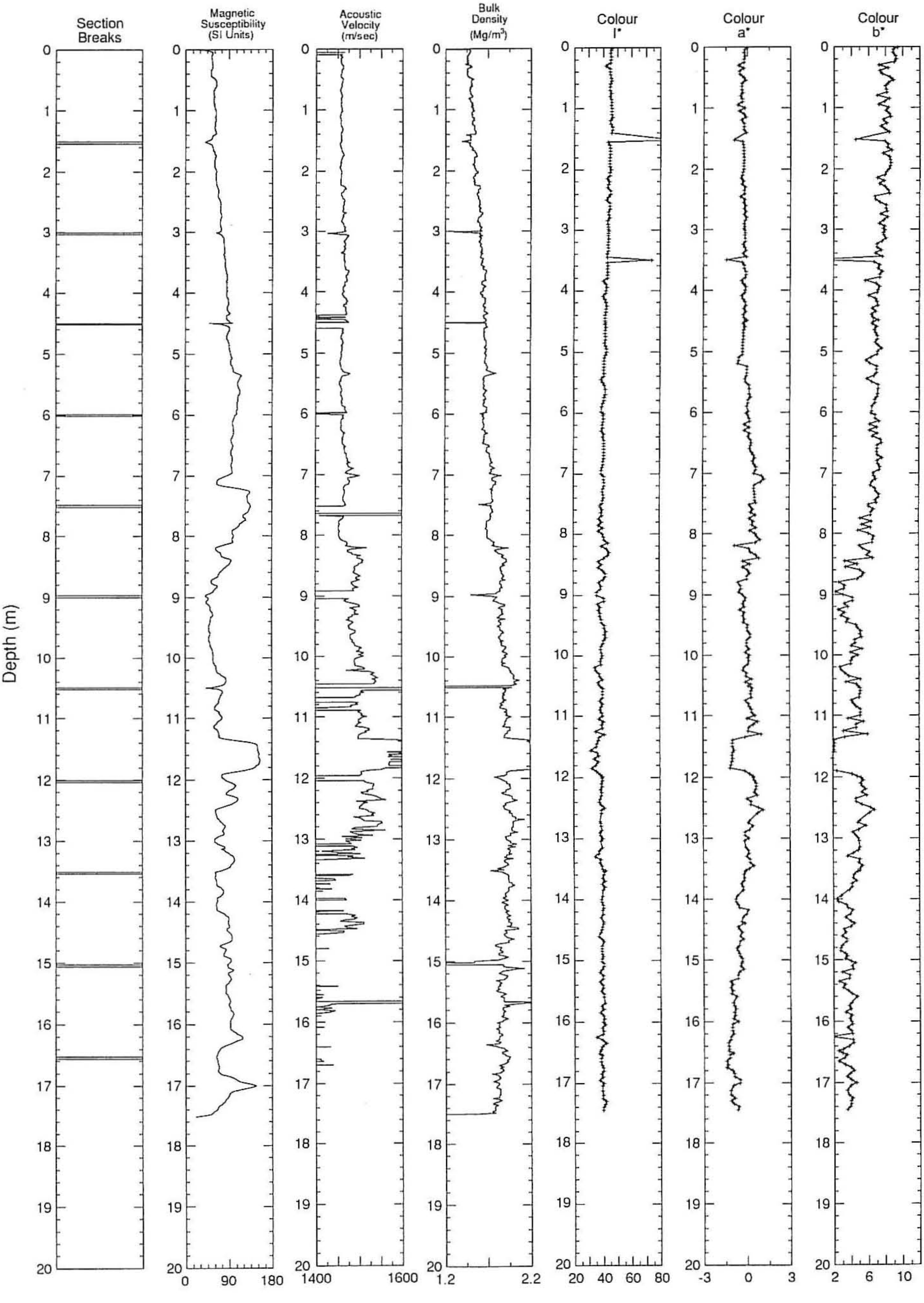
lat: 66°58.18 N - long: 07°38.36 E
water depth: 1048 m
length: 17.49 m





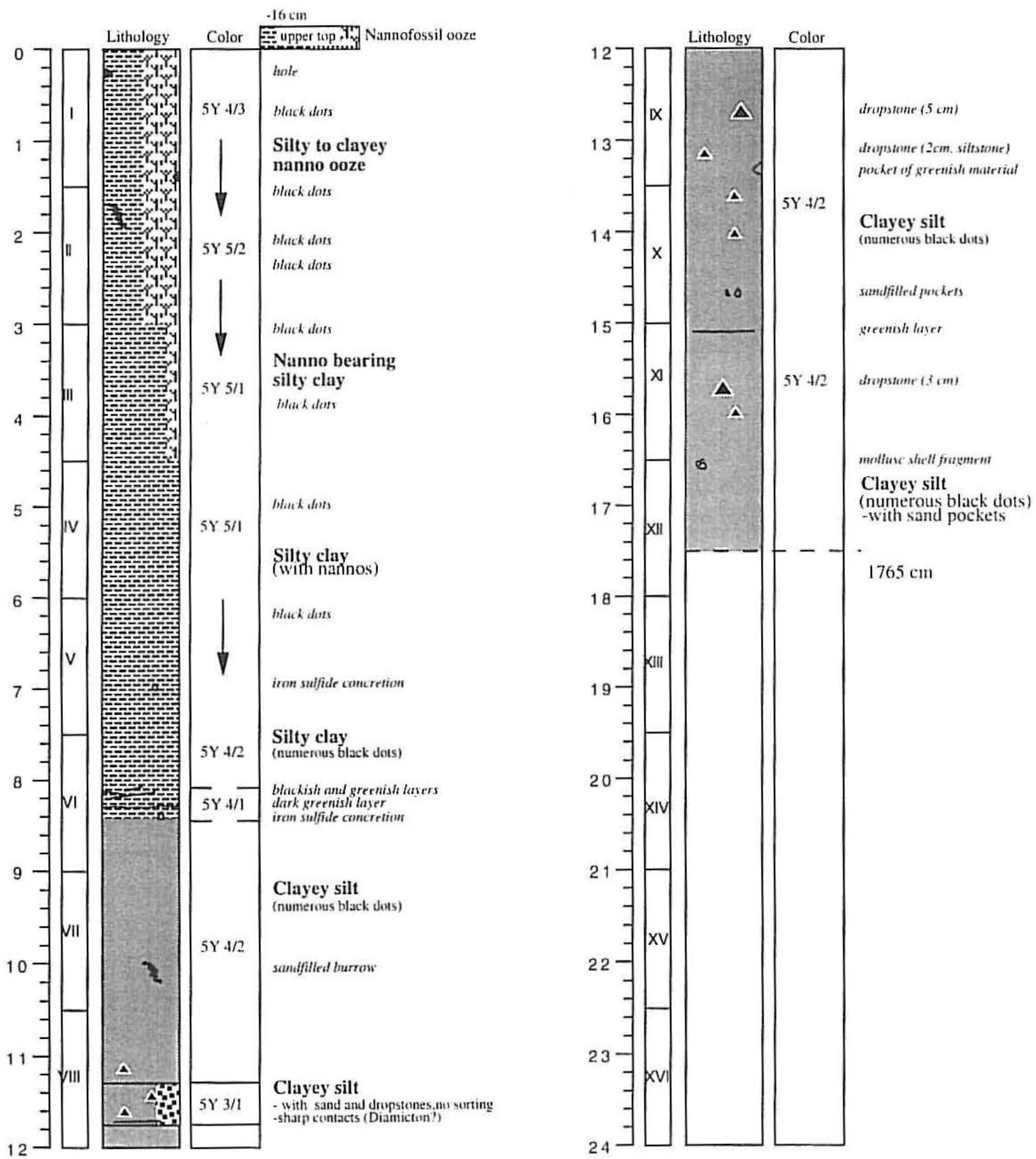

Suscept.
Dens.
a
0 40 80 120 160
1,4 1,6 1,8 2 2,2 2,4
-1 0 1
0 5 10 15 20 25 30
Depth (m)
MD 95-2011

MD95-2011



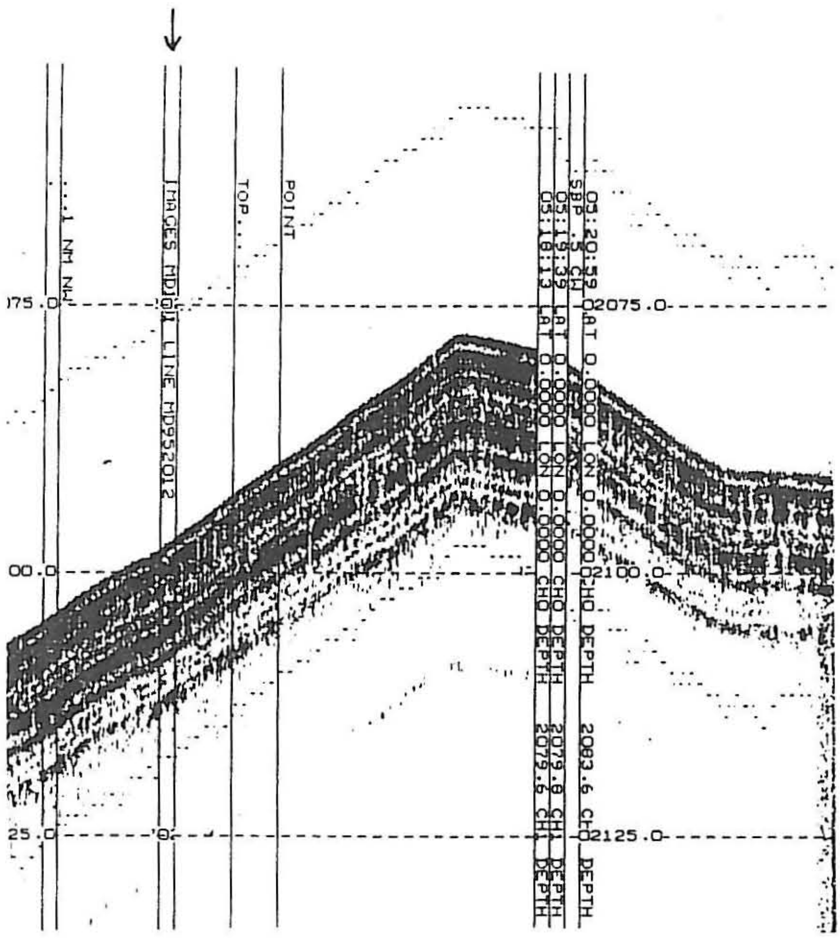
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
90
180
1400
1600
1.2
2.2
20
40
60
80
-3
0
3
2
6
10

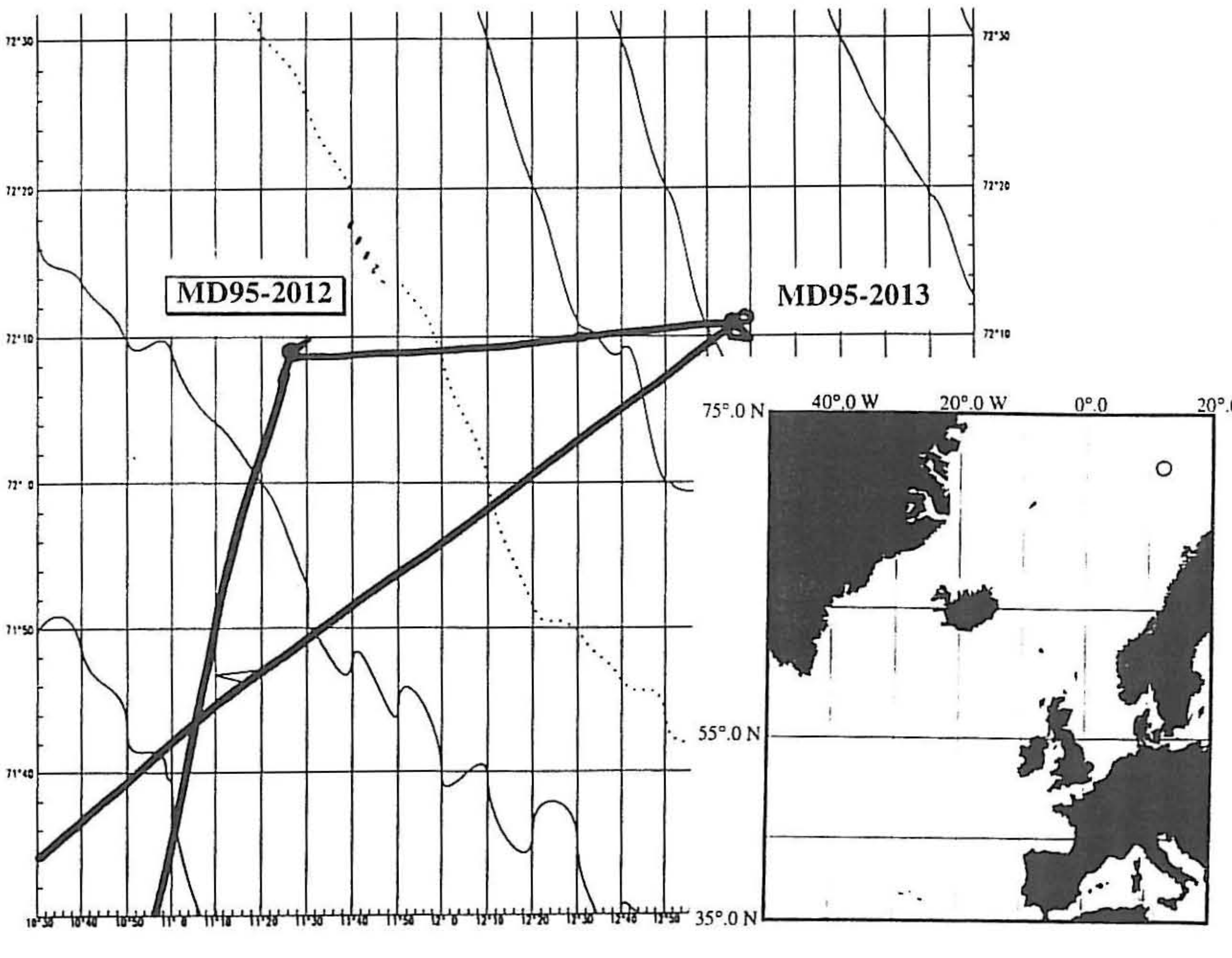
MD 95-2011

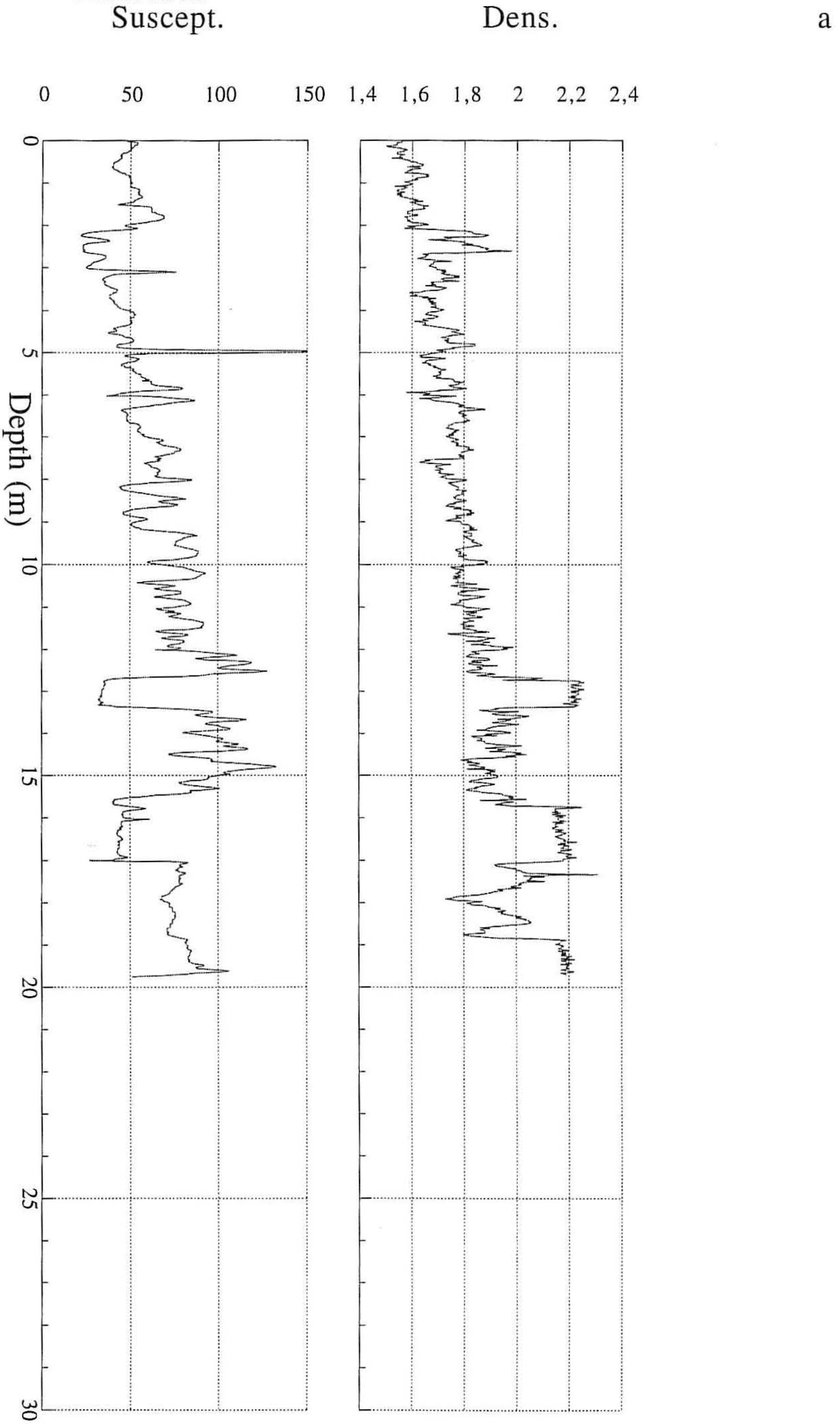

-16 cm
upper top
Nannofossil ooze
Lithology
Color
hole
5Y 4/3
black dots
Silty to clayey nanno ooze
black dots
5Y 5/2
black dots
black dots
black dots
Nanno bearing silty clay
5Y 5/1
black dots
black dots
5Y 5/1
Silty clay (with nannos)
black dots
iron sulfide concretion
Silty clay
5Y 4/2
(numerous black dots)
blackish and greenish layers
5Y 4/1
dark greenish layer
iron sulfide concretion
Clayey silt
(numerous black dots)
5Y 4/2
sandfilled burrow
Clayey silt
5Y 3/1
- with sand and dropstones,no sorting
-sharp contacts (Diamicton?)
dropstone (5 cm)
dropstone (2cm, siltstone)
pocket of greenish material
5Y 4/2
Clayey silt
(numerous black dots)
sandfilled pockets
greenish layer
5Y 4/2
dropstone (3 cm)
mollusc shell fragment
Clayey silt
(numerous black dots)
-with sand pockets
1765 cm

Core MD 95-2012

lat: 72°09.06 N - long: 11°26.06 E
water depth: 2094 m
length: 19.76 m

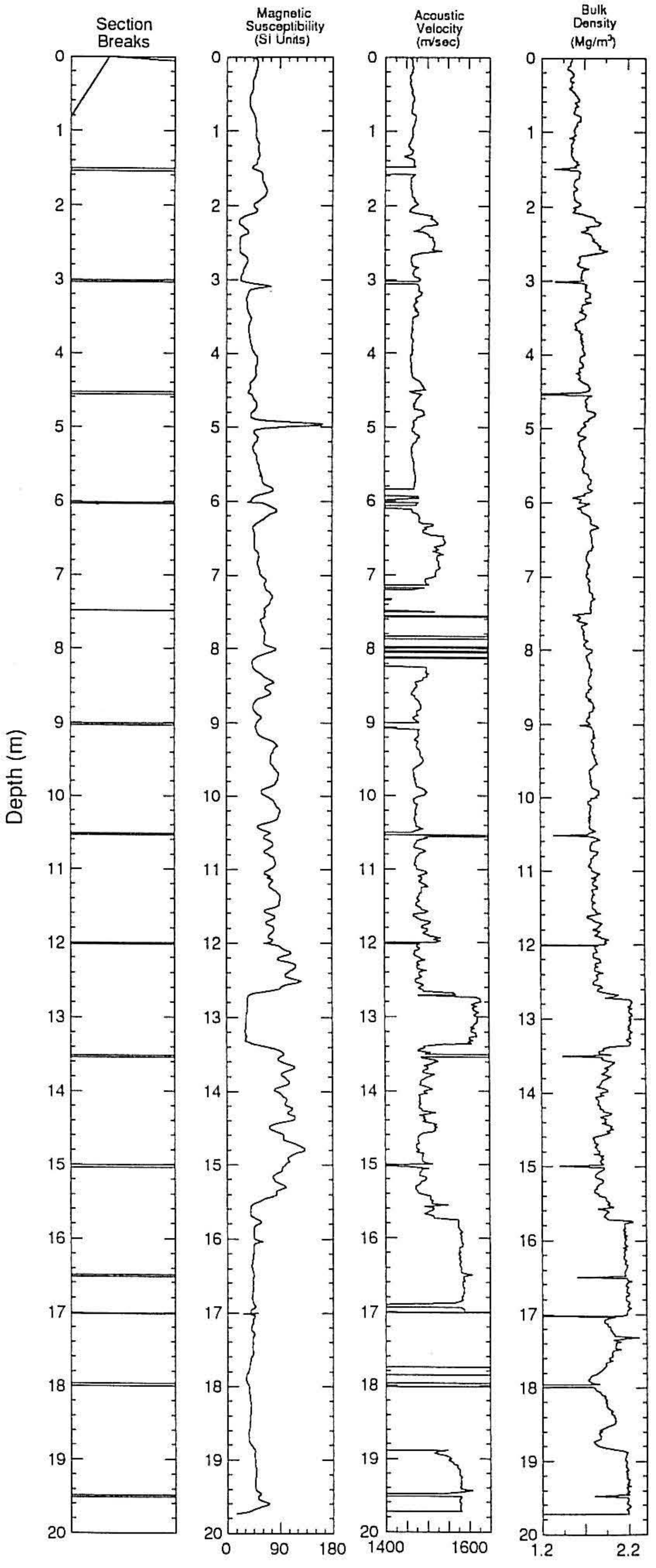





Suscept.
Dens.
a
0 50 100 150
1,4 1,6 1,8 2 2,2 2,4
Depth (m)
0 5 10 15 20 25 30

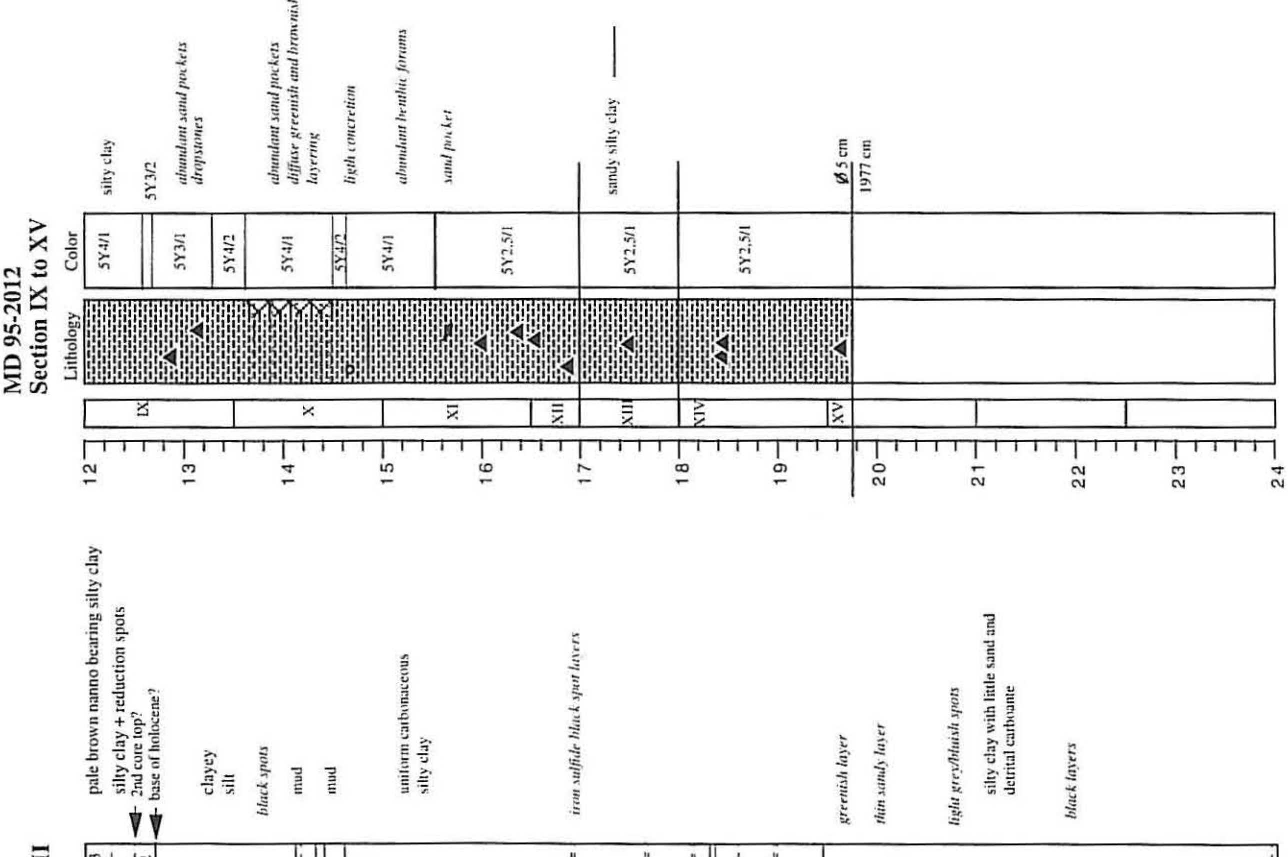
MD 95-2012

MD95-2012



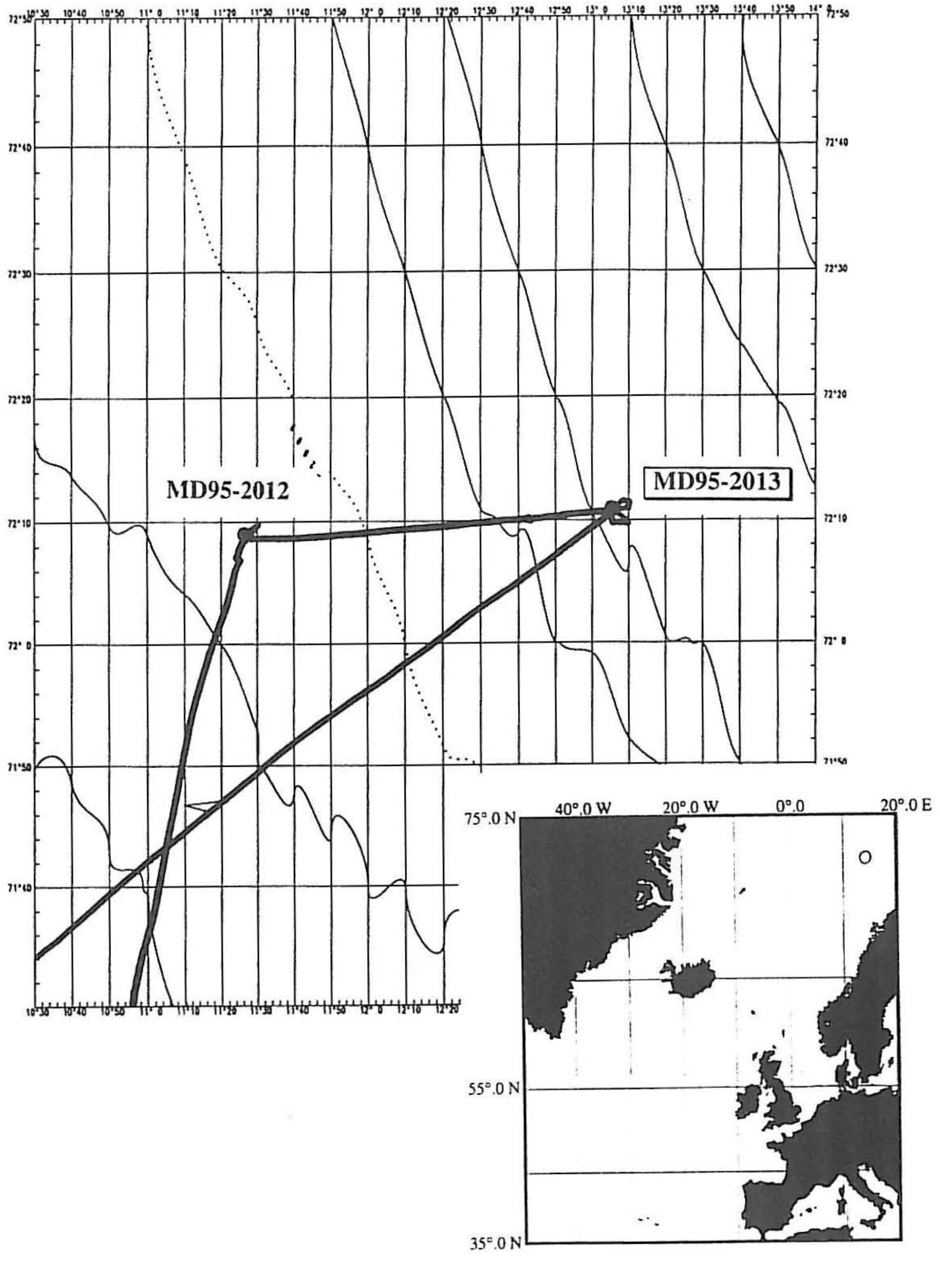
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
90
180
1400
1600
1.2
2.2

MD 95-2012


MD 95-2012
Section I to VIII
Lithology
Color
10YR6/3
+3/3
10YR6/2
5Y
5-6/1
5Y5/1
5Y4/1
5Y5/2
5Y
5/1-
5/2
5Y4/1
5Y5/1
5Y4/1
5Y5/1
pale brown nanno bearing silty clay
silty clay + reduction spots
2nd core top?
base of holocene?
clayey
silt
black spots
mud
mud
uniform carbonaceous
silty clay
iron sulfide black spot layers
greenish layer
thin sandy layer
light grey/bluish spots
silty clay with little sand and
detrital carbonate
black layers
I
II
III
IV
V
VI
VII
VIII
0
1
2
3
4
5
6
7
8
9
10
11
12
MD 95-2012
Section IX to XV
Lithology
Color
5Y4/1
5Y3/1
5Y4/2
5Y4/1
5Y4/2
5Y4/1
5Y2.5/1
5Y2.5/1
5Y2.5/1
silty clay
5Y3/2
abundant sand pockets
dropstones
abundant sand pockets
diffuse greenish and brownish
layering
ligth concretion
abundant benthic forams
sand pocket
sandy silty clay
Ø 5 cm
1977 cm
IX
X
XI
XII
XIII
XIV
XV
12
13
14
15
16
17
18
19
20
21
22
23
24

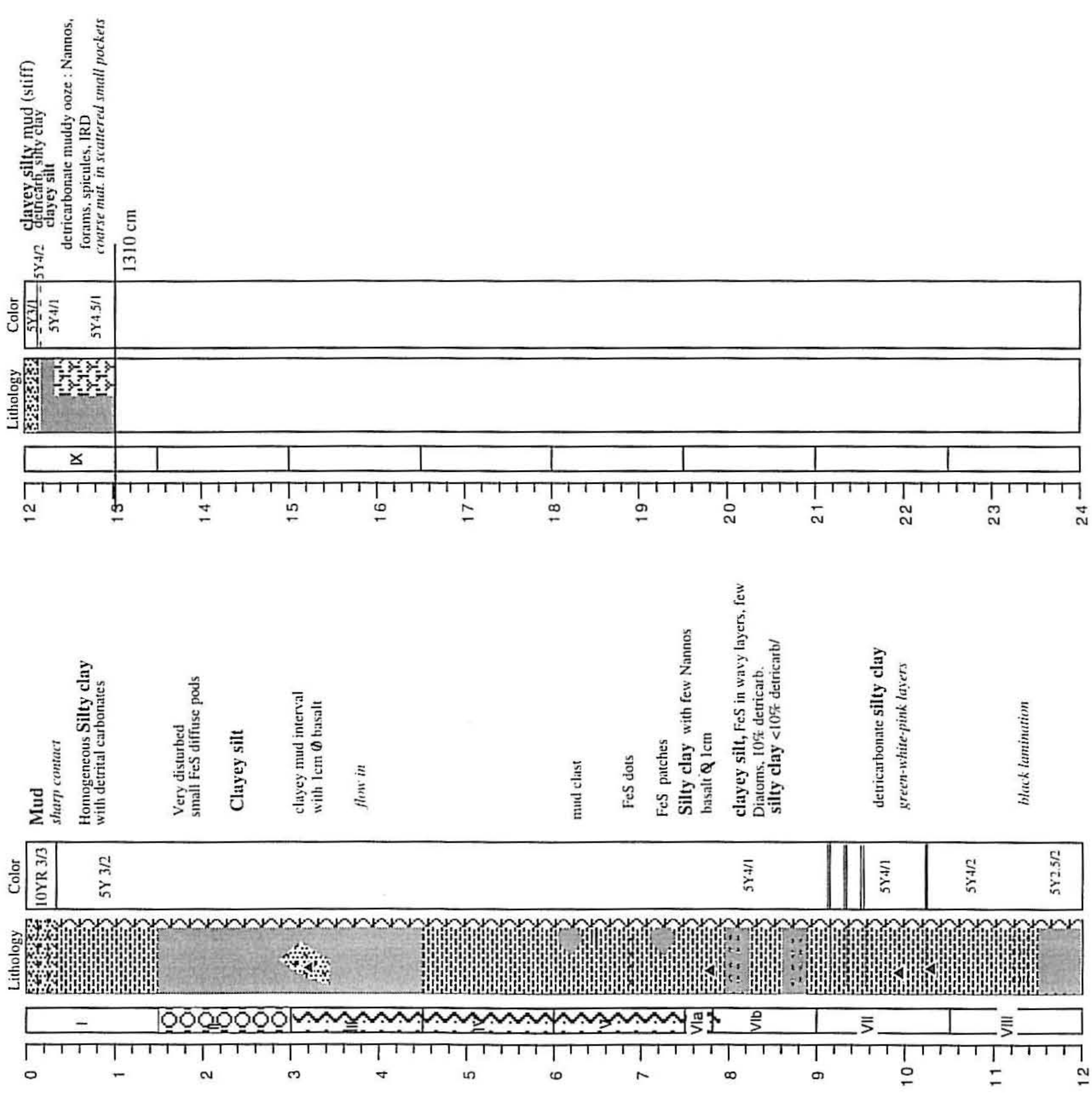
Core MD 95-2013

lat: 72°10.917 N - long: 13°05.632 E
water depth: 1638 m
length: 13.1 m



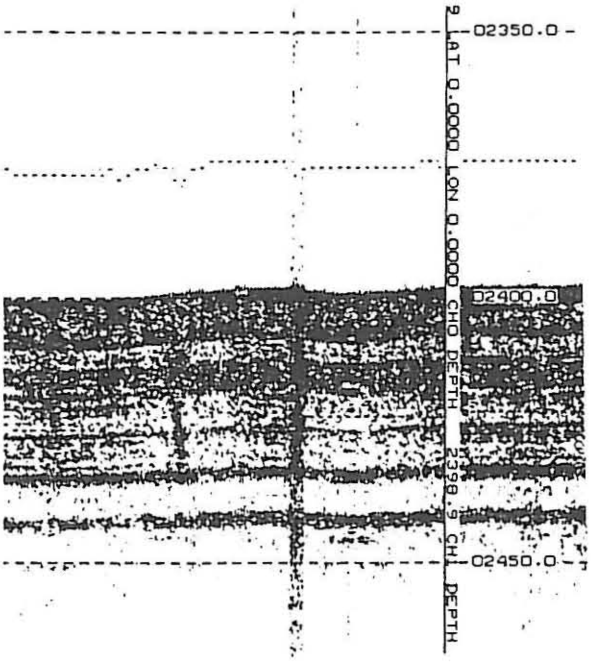
Core MD95-2013 had a badly damaged liner, it was not measured on the MST.

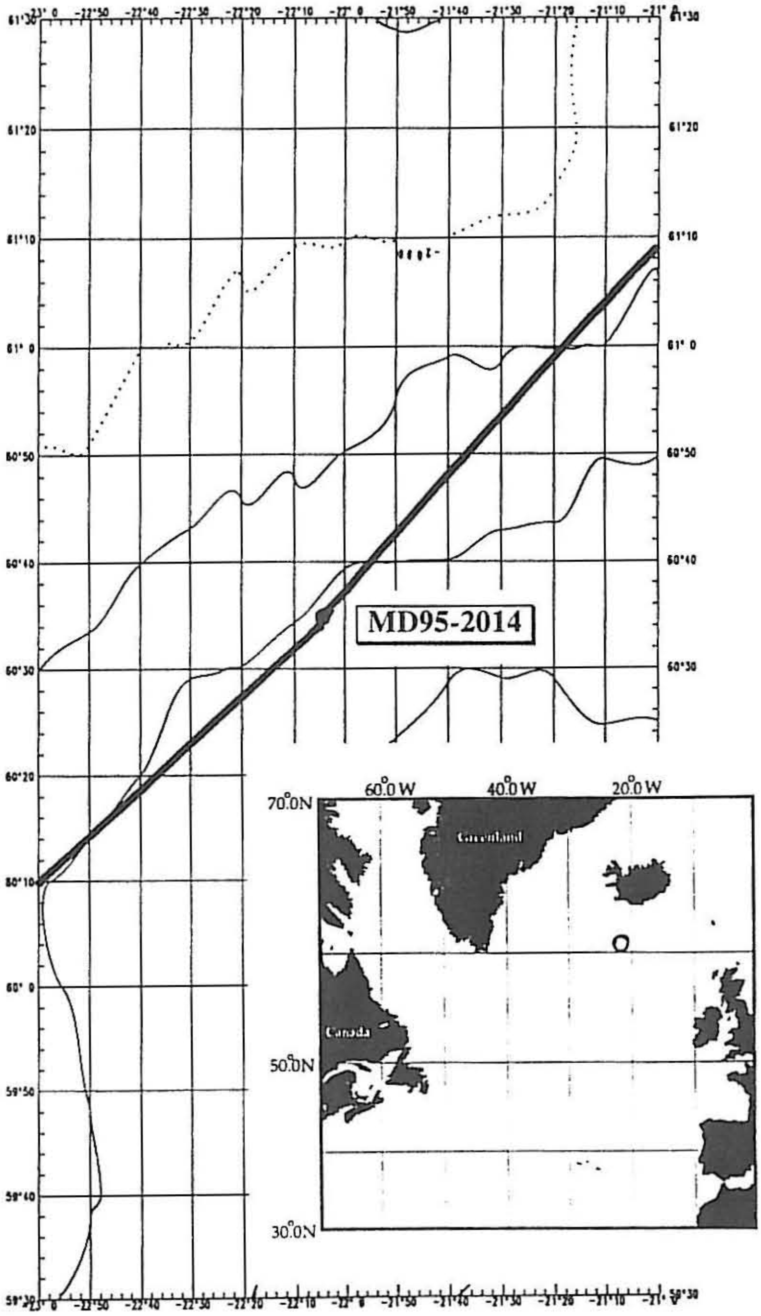
MD 95-2013

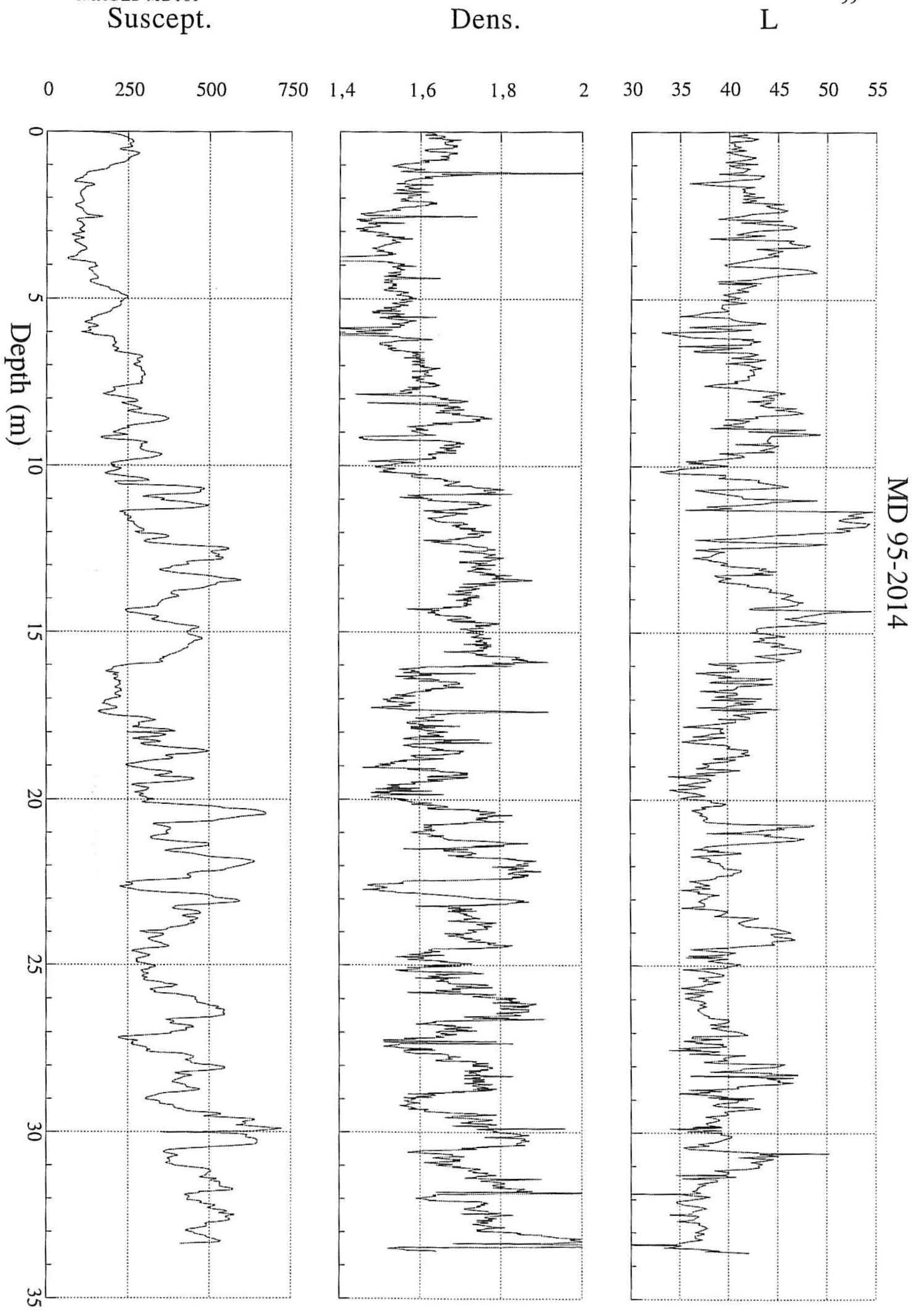

Lithology
Color
10YR 3/3
5Y 3/2
5Y4/1
5Y4/1
5Y4/2
5Y2.5/2
Mud
sharp contact
Homogeneous Silty clay
with detrital carbonates
Very disturbed
small FeS diffuse pods
Clayey silt
clayey mud interval
with 1cm Ø basalt
flow in
mud clast
FeS dots
FeS patches
Silty clay with few Nannos
basalt Ø 1cm
clayey silt, FeS in wavy layers, few
Diatoms, 10% detricarb.
silty clay <10% detricarb/
detricarbonate silty clay
green-white-pink layers
black lamination
I
II
III
IV
V
VIa
VIb
VII
VIII
IX
5Y3/1
5Y4/1
5Y4.5/1
5Y4/2
clayey silty mud (stiff)
detricarb. silty clay
clayey silt
detricarbonate muddy ooze : Nannos,
forams, spicules, IRD
coarse mat. in scattered small pockets
1310 cm
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

Core MD 95-2014

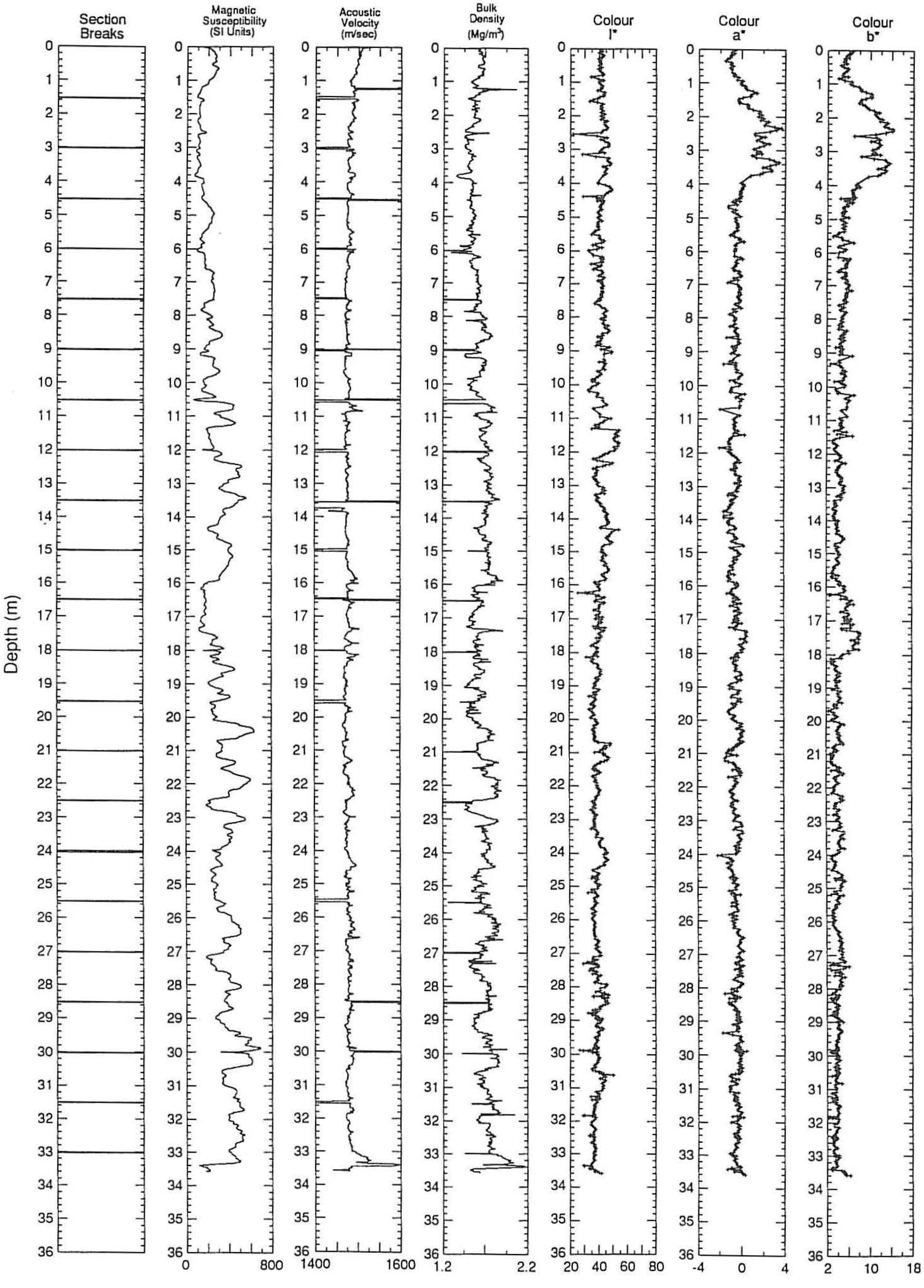
lat: 60°34.93 N - long: 22°04.52 W
water depth: 2397 m
length: 33.61 m



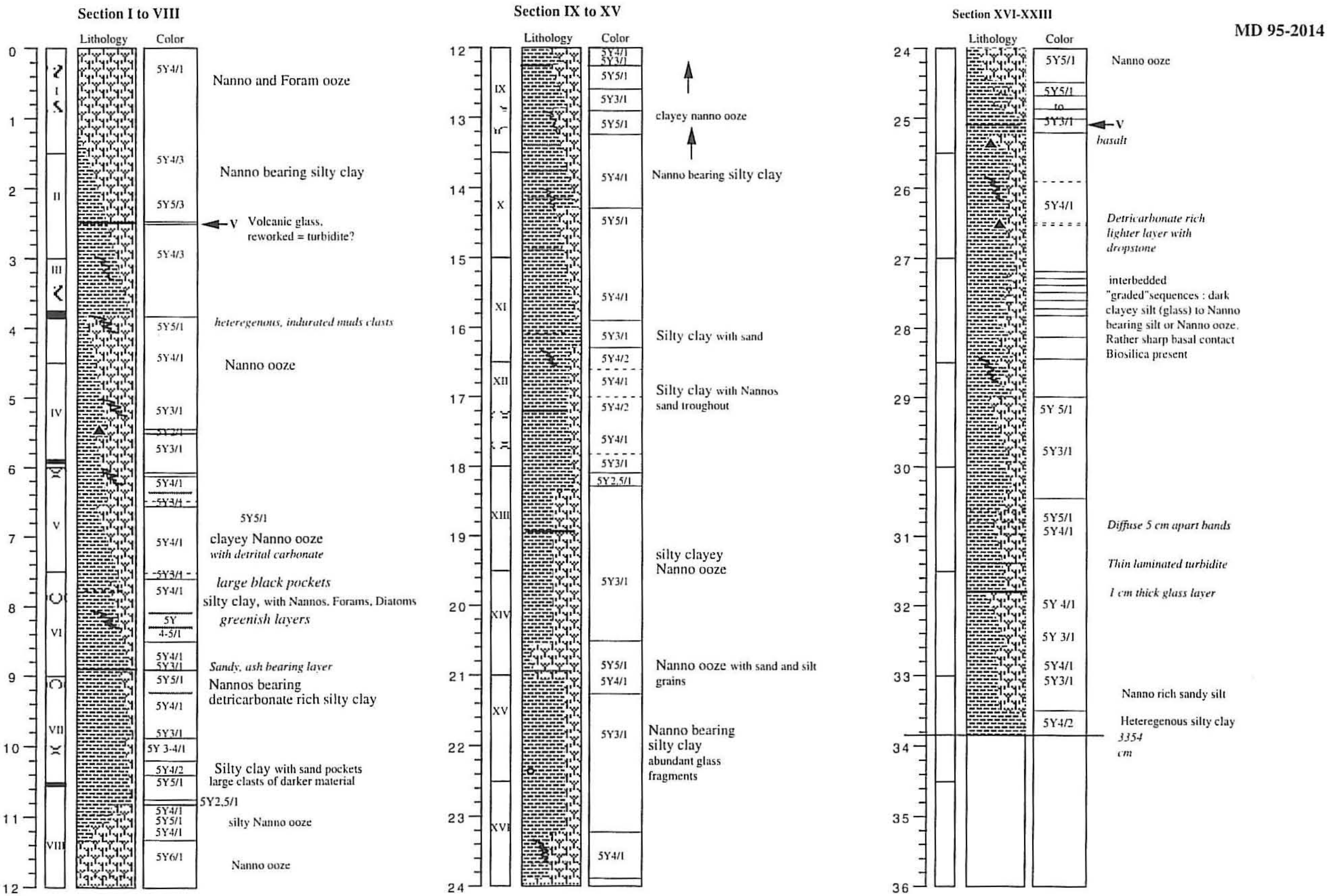



Suscept.
Dens.
L
0
250
500
750
1,4
1,6
1,8
2
30
35
40
45
50
55
Depth (m)
0
5
10
15
20
25
30
35
MD 95-2014

MD95-2014

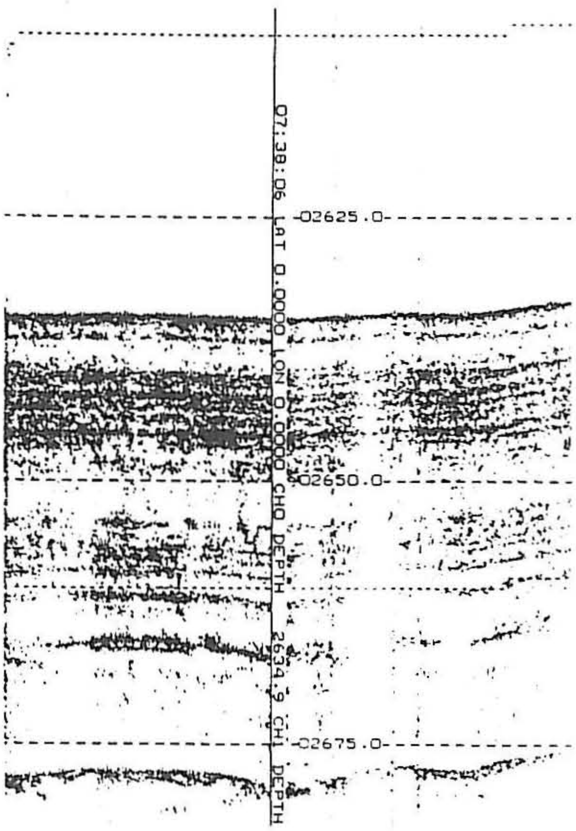


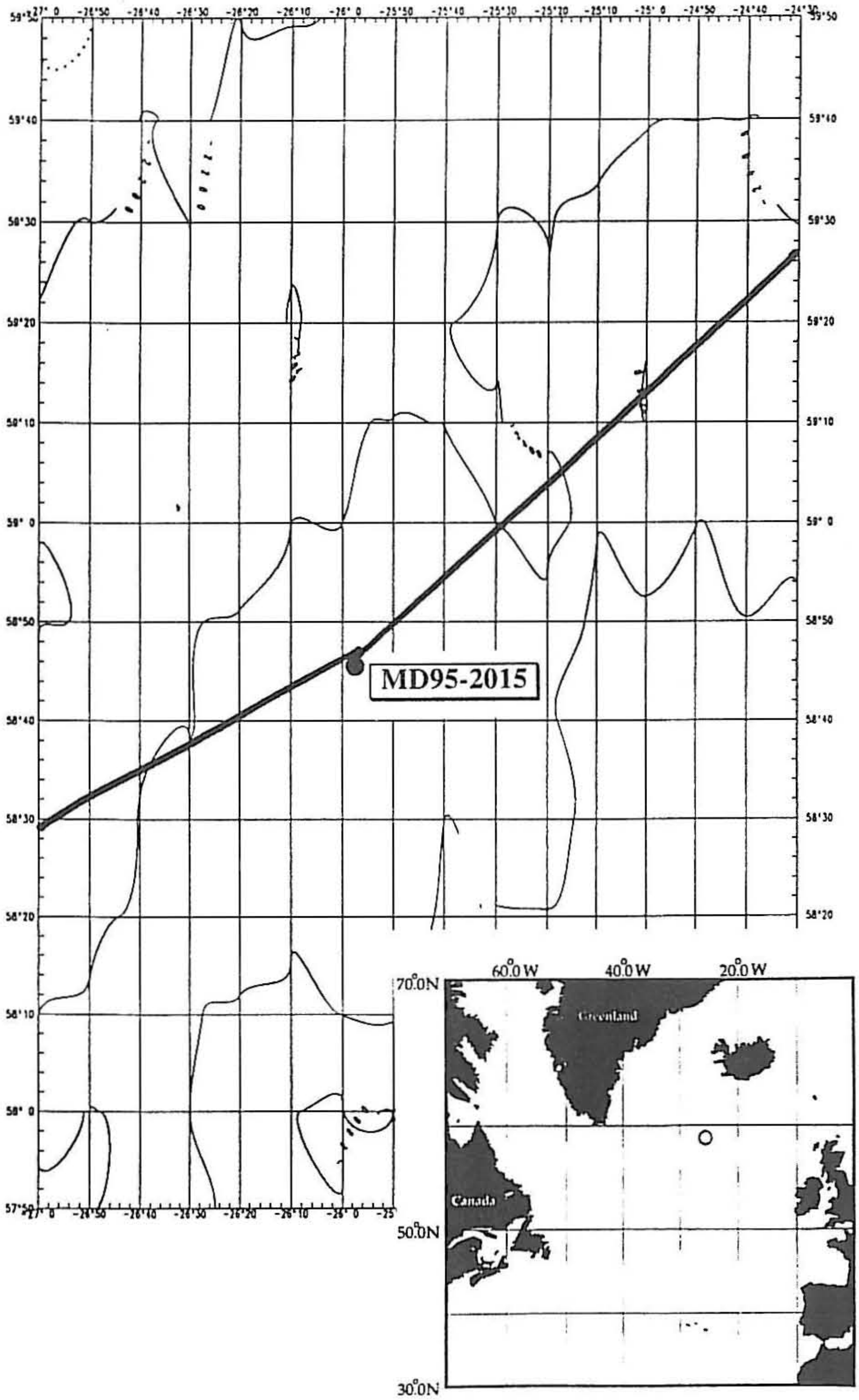
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

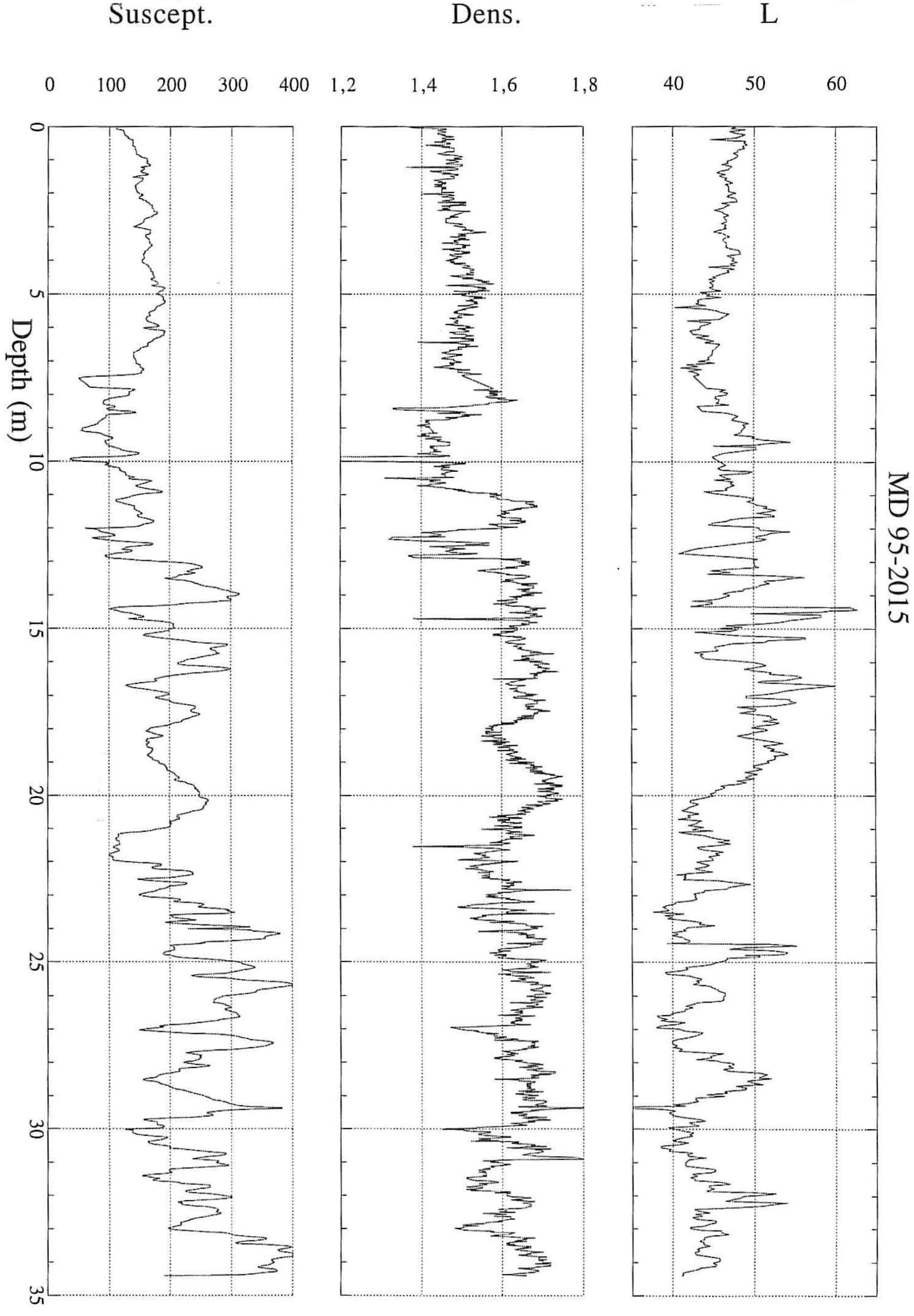

MD 95-2014
Section I to VIII
Lithology
Color
Nanno and Foram ooze
Nanno bearing silty clay
Volcanic glass, reworked = turbidite?
heteregenous, indurated muds clasts
Nanno ooze
clayey Nanno ooze
with detrital carbonate
large black pockets
silty clay, with Nannos, Forams, Diatoms
greenish layers
Sandy, ash bearing layer
Nannos bearing
detricarbonate rich silty clay
Silty clay with sand pockets
large clasts of darker material
silty Nanno ooze
Nanno ooze
Section IX to XV
clayey nanno ooze
Nanno bearing silty clay
Silty clay with sand
Silty clay with Nannos
sand troughout
silty clayey
Nanno ooze
Nanno ooze with sand and silt grains
Nanno bearing
silty clay
abundant glass
fragments
Section XVI-XXIII
Nanno ooze
basalt
Detricarbonate rich
lighter layer with
dropstone
interbedded
"graded"sequences : dark
clayey silt (glass) to Nanno
bearing silt or Nanno ooze.
Rather sharp basal contact
Biosilica present
Diffuse 5 cm apart bands
Thin laminated turbidite
1 cm thick glass layer
Nanno rich sandy silt
Heteregenous silty clay
3354
cm

Core MD 95-2015

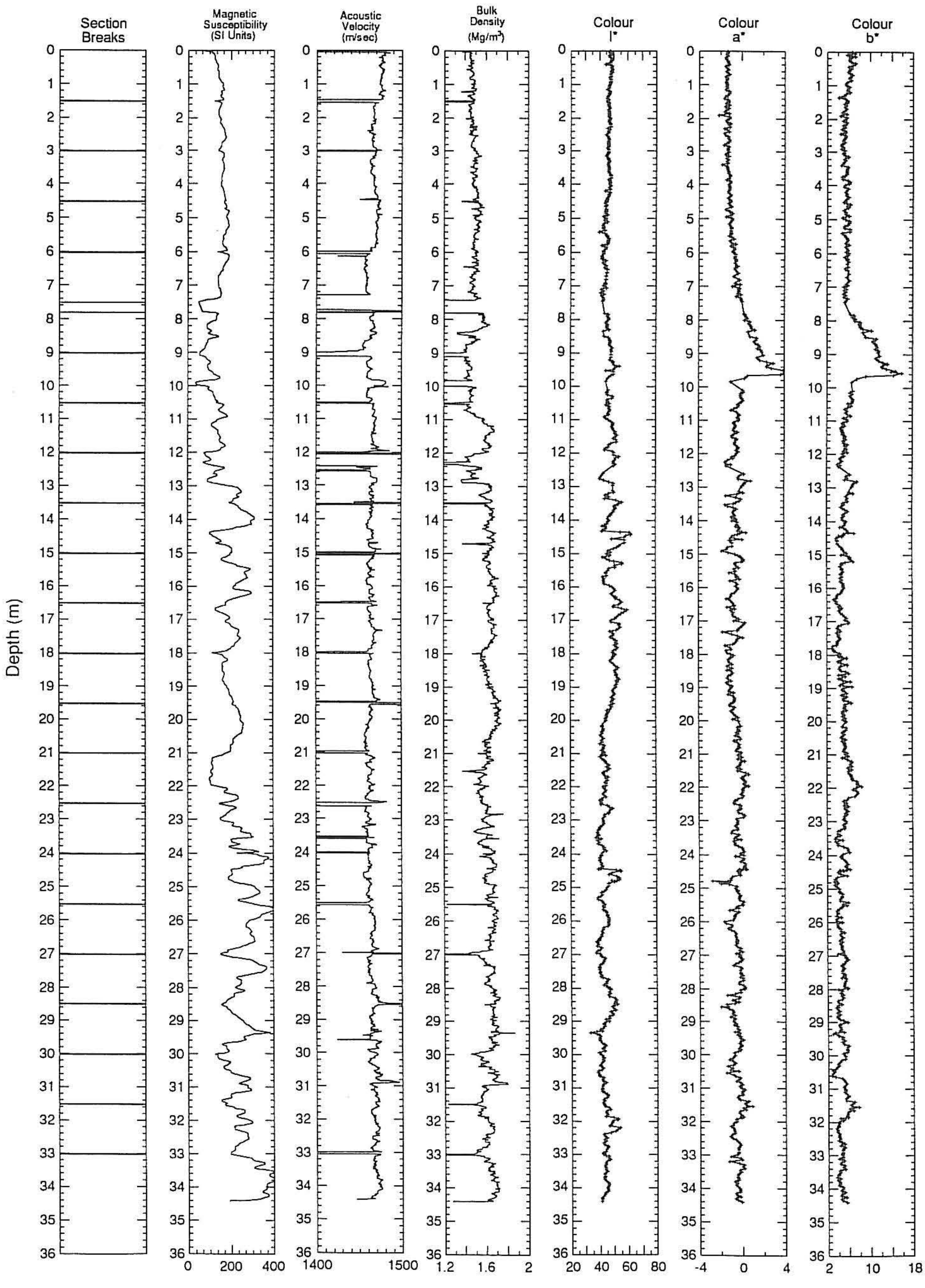
lat: 58°45.74 N - long: 25°57.54 W
water depth: 2630 m
length: 34.42 m





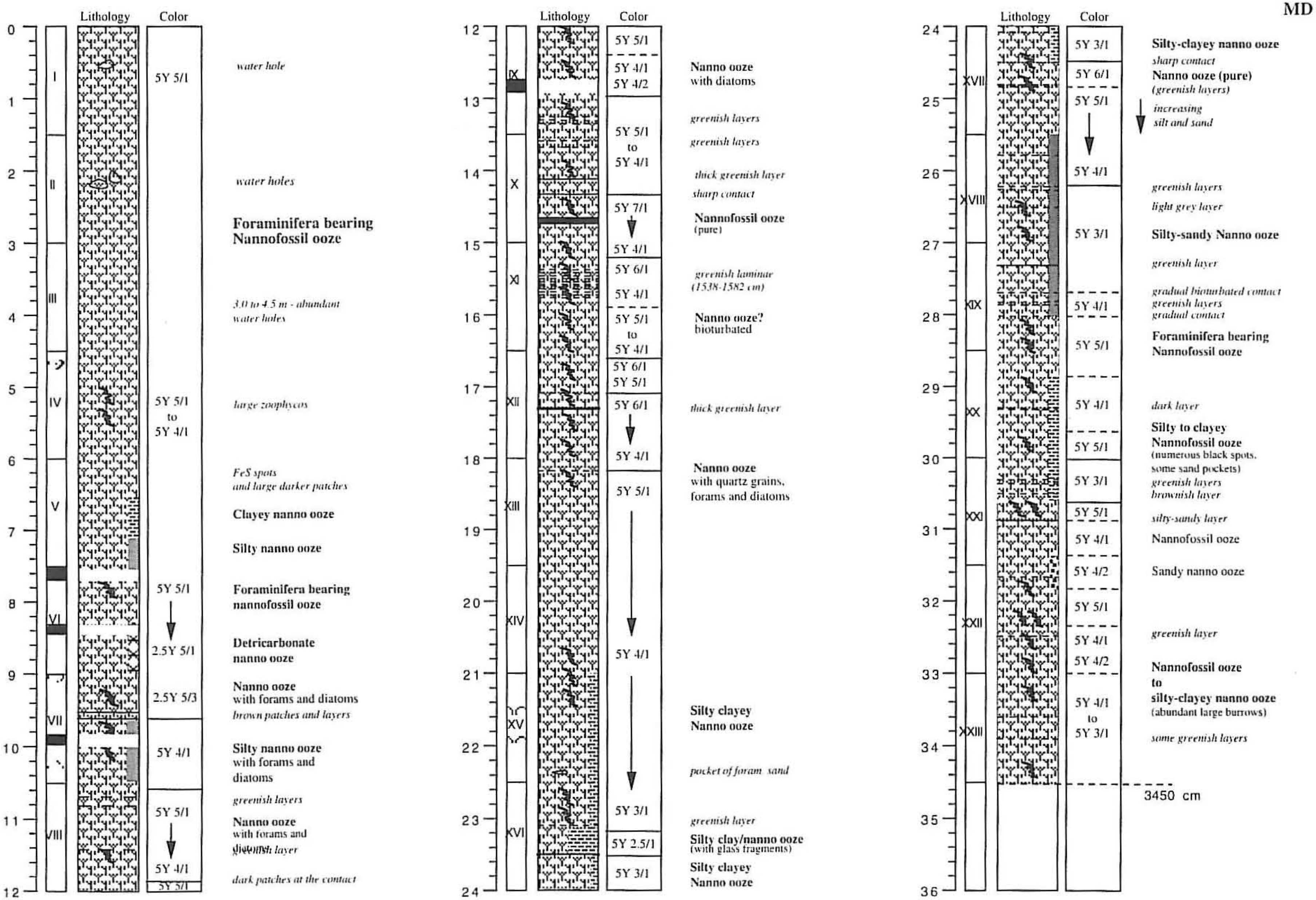

Suscept.
Dens.
L
0 100 200 300 400
1,2 1,4 1,6 1,8
40 50 60
Depth (m)
0 5 10 15 20 25 30 35
MD 95-2015

MD95-2015



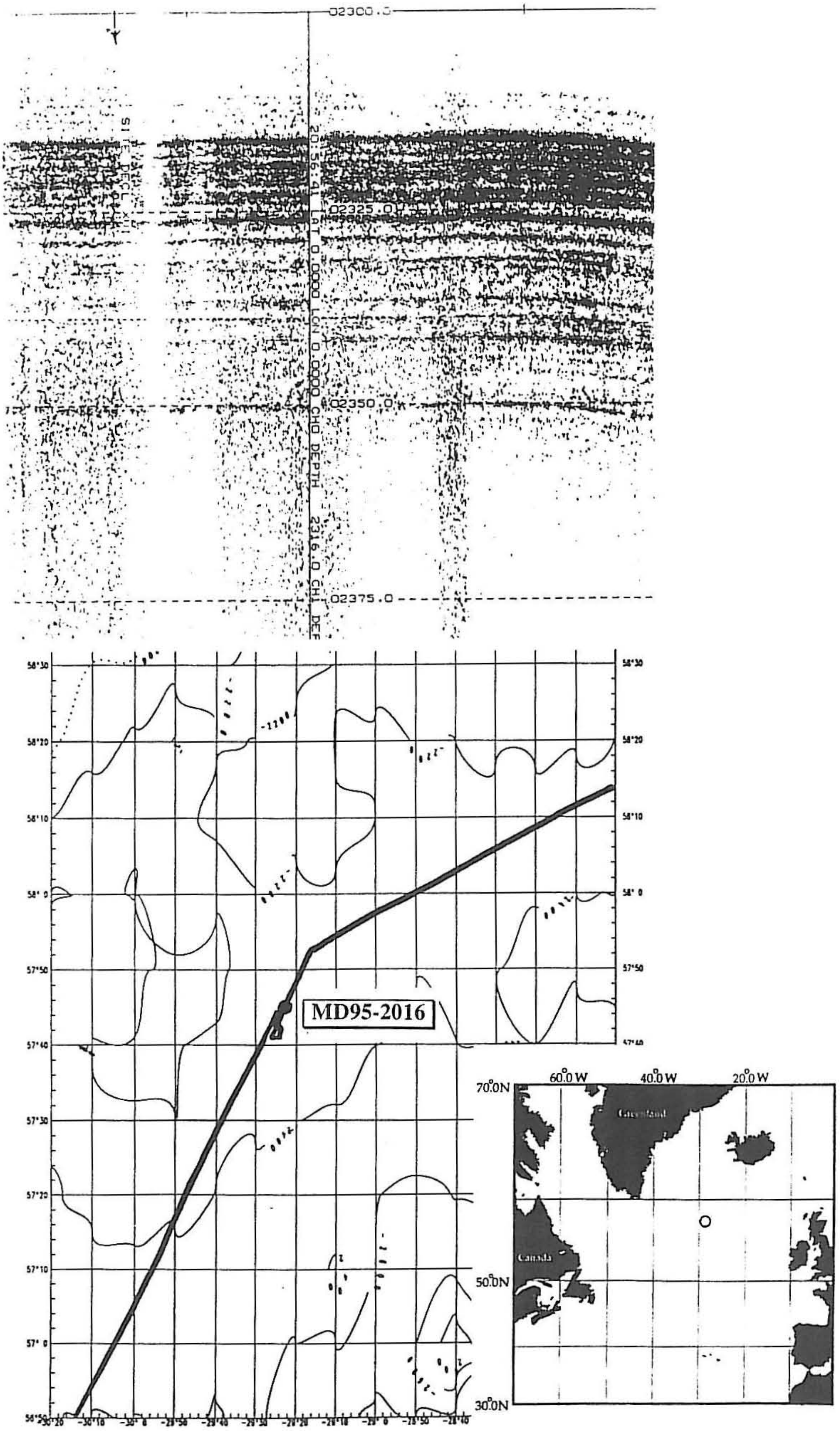
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

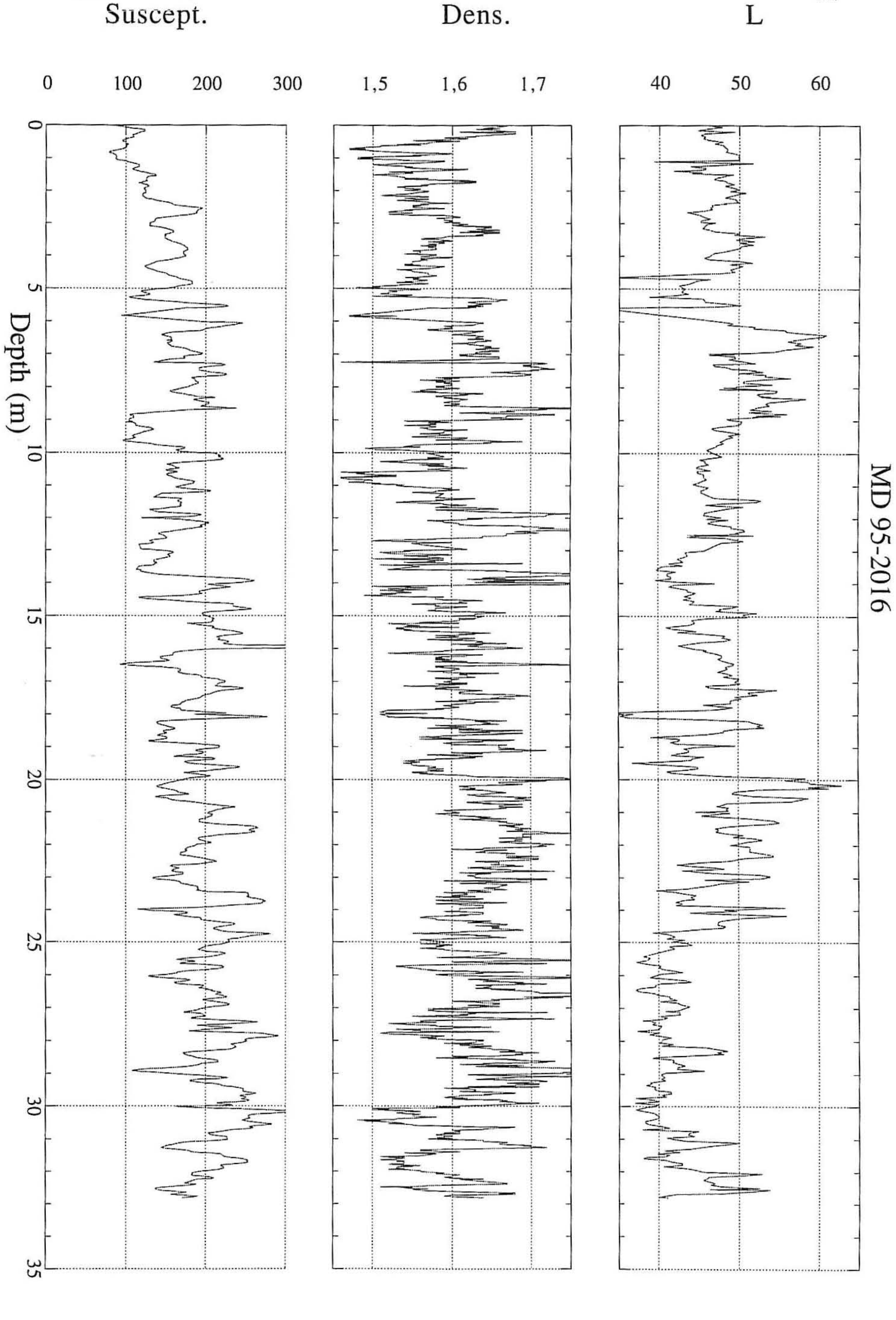
MD 95-2015


Lithology
Color
5Y 5/1
water hole
water holes
Foraminifera bearing Nannofossil ooze
3.0 to 4.5 m - abundant water holes
5Y 5/1 to 5Y 4/1
large zoophycos
FeS spots and large darker patches
Clayey nanno ooze
Silty nanno ooze
5Y 5/1
Foraminifera bearing nannofossil ooze
2.5Y 5/1
Detricarbonate nanno ooze
2.5Y 5/3
Nanno ooze with forams and diatoms
brown patches and layers
5Y 4/1
Silty nanno ooze with forams and diatoms
greenish layers
5Y 5/1
Nanno ooze with forams and diatoms
greenish layer
5Y 4/1
5Y 5/1
dark patches at the contact
5Y 5/1
5Y 4/1
5Y 4/2
Nanno ooze with diatoms
greenish layers
greenish layers
5Y 5/1 to 5Y 4/1
thick greenish layer
sharp contact
5Y 7/1
Nannofossil ooze (pure)
5Y 4/1
5Y 6/1
greenish laminae (1538-1582 cm)
5Y 4/1
5Y 5/1 to 5Y 4/1
Nanno ooze? bioturbated
5Y 6/1
5Y 5/1
5Y 6/1
thick greenish layer
5Y 4/1
5Y 5/1
Nanno ooze with quartz grains, forams and diatoms
5Y 4/1
Silty clayey Nanno ooze
pocket of foram sand
5Y 3/1
greenish layer
5Y 2.5/1
Silty clay/nanno ooze (with glass fragments)
5Y 3/1
Silty clayey Nanno ooze
5Y 3/1
Silty-clayey nanno ooze
sharp contact
5Y 6/1
Nanno ooze (pure) (greenish layers)
5Y 5/1
increasing silt and sand
5Y 4/1
greenish layers
light grey layer
5Y 3/1
Silty-sandy Nanno ooze
greenish layer
gradual bioturbated contact
5Y 4/1
greenish layers
gradual contact
5Y 5/1
Foraminifera bearing Nannofossil ooze
5Y 4/1
dark layer
Silty to clayey Nannofossil ooze (numerous black spots, some sand pockets)
5Y 5/1
5Y 3/1
greenish layers
brownish layer
5Y 5/1
silty-sandy layer
5Y 4/1
Nannofossil ooze
5Y 4/2
Sandy nanno ooze
5Y 5/1
greenish layer
5Y 4/1
5Y 4/2
Nannofossil ooze to silty-clayey nanno ooze (abundant large burrows)
5Y 4/1 to 5Y 3/1
some greenish layers
3450 cm
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXII
XXIII
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

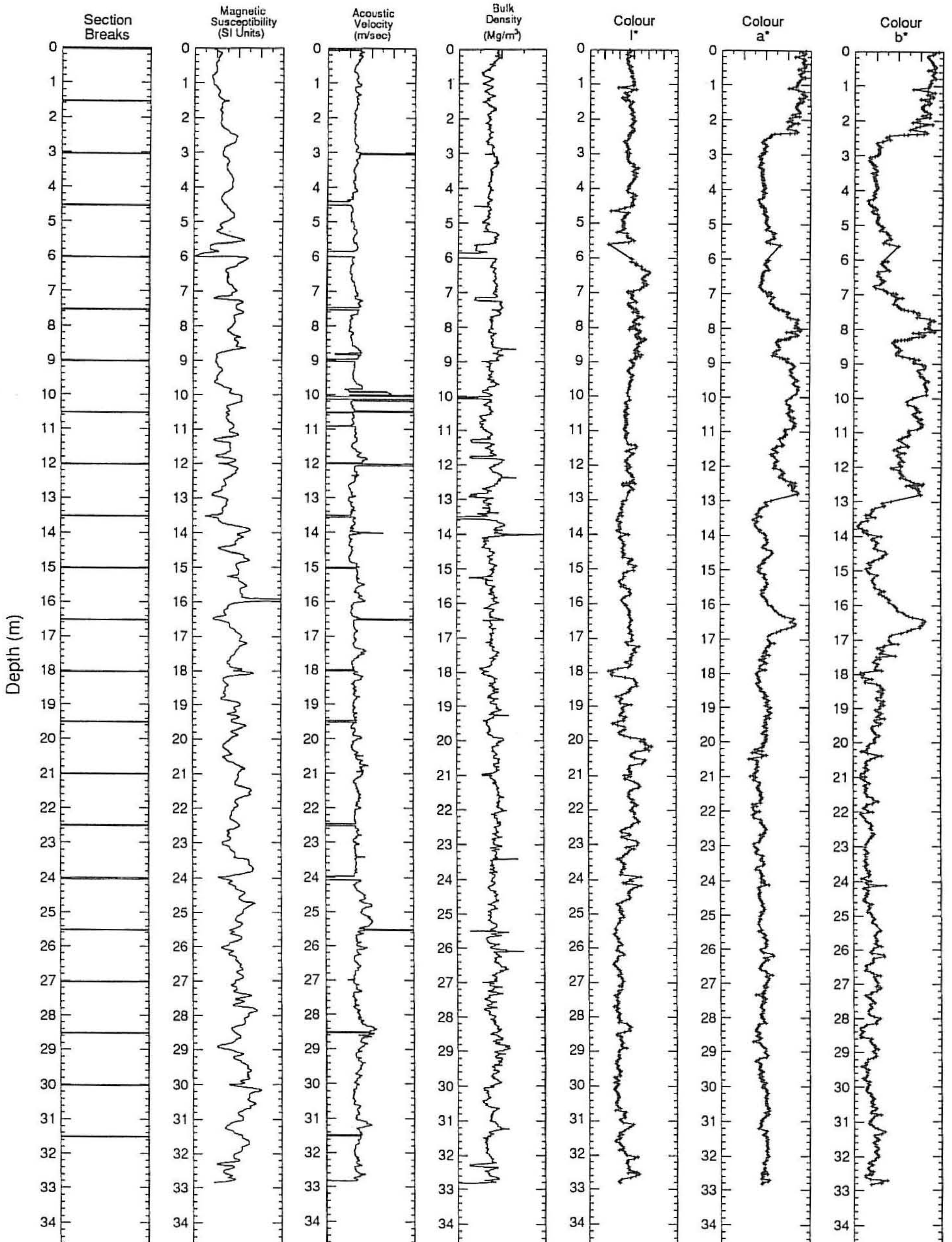
Core MD 95-2016

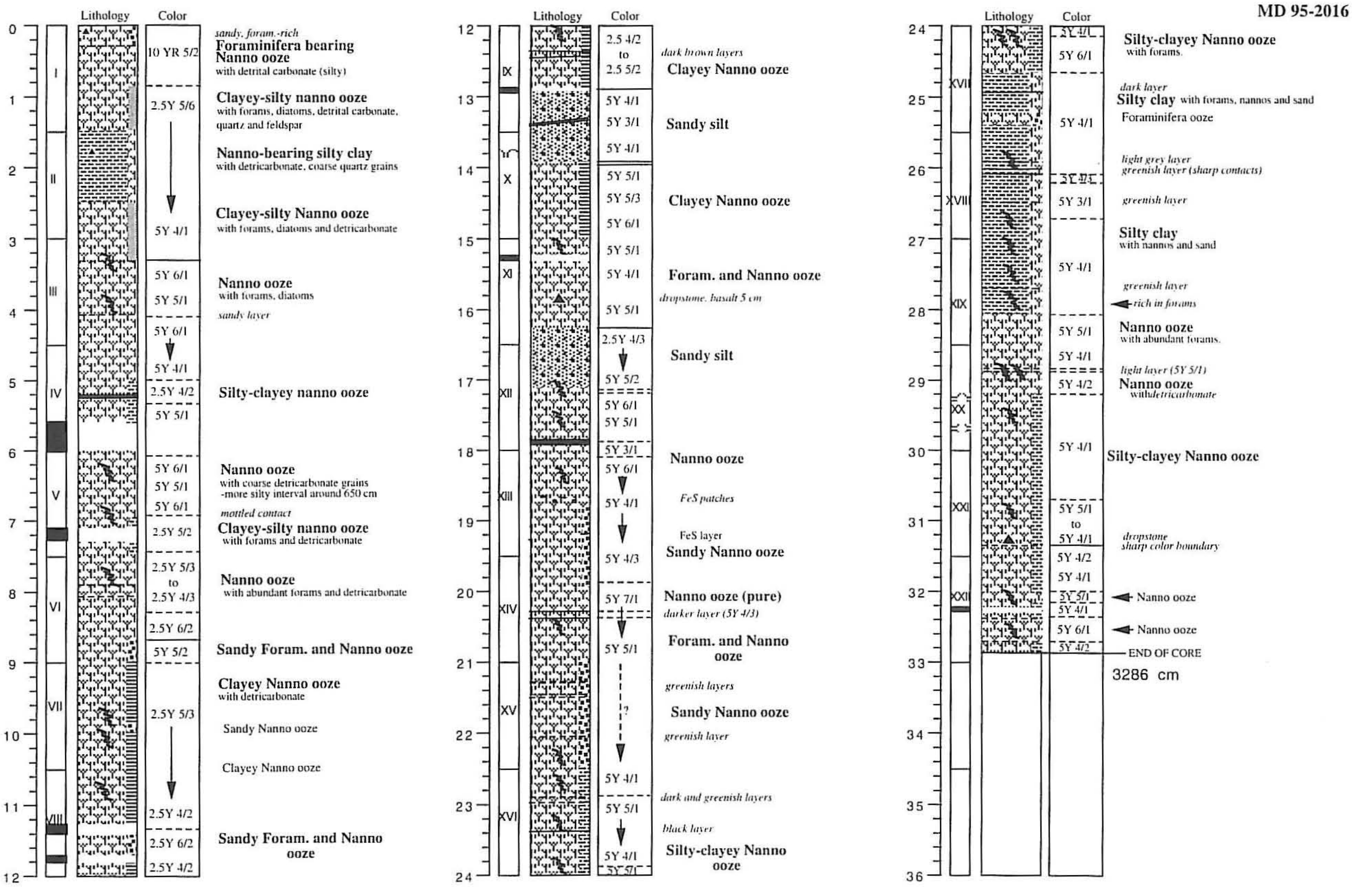
lat: 57°42.46 N - long: 29°25.44 W
water depth: 2318 m
length: 32.83 m




Suscept.
Dens.
L
0 100 200 300
1,5 1,6 1,7
40 50 60
0 5 10 15 20 25 30 35
Depth (m)
MD 95-2016

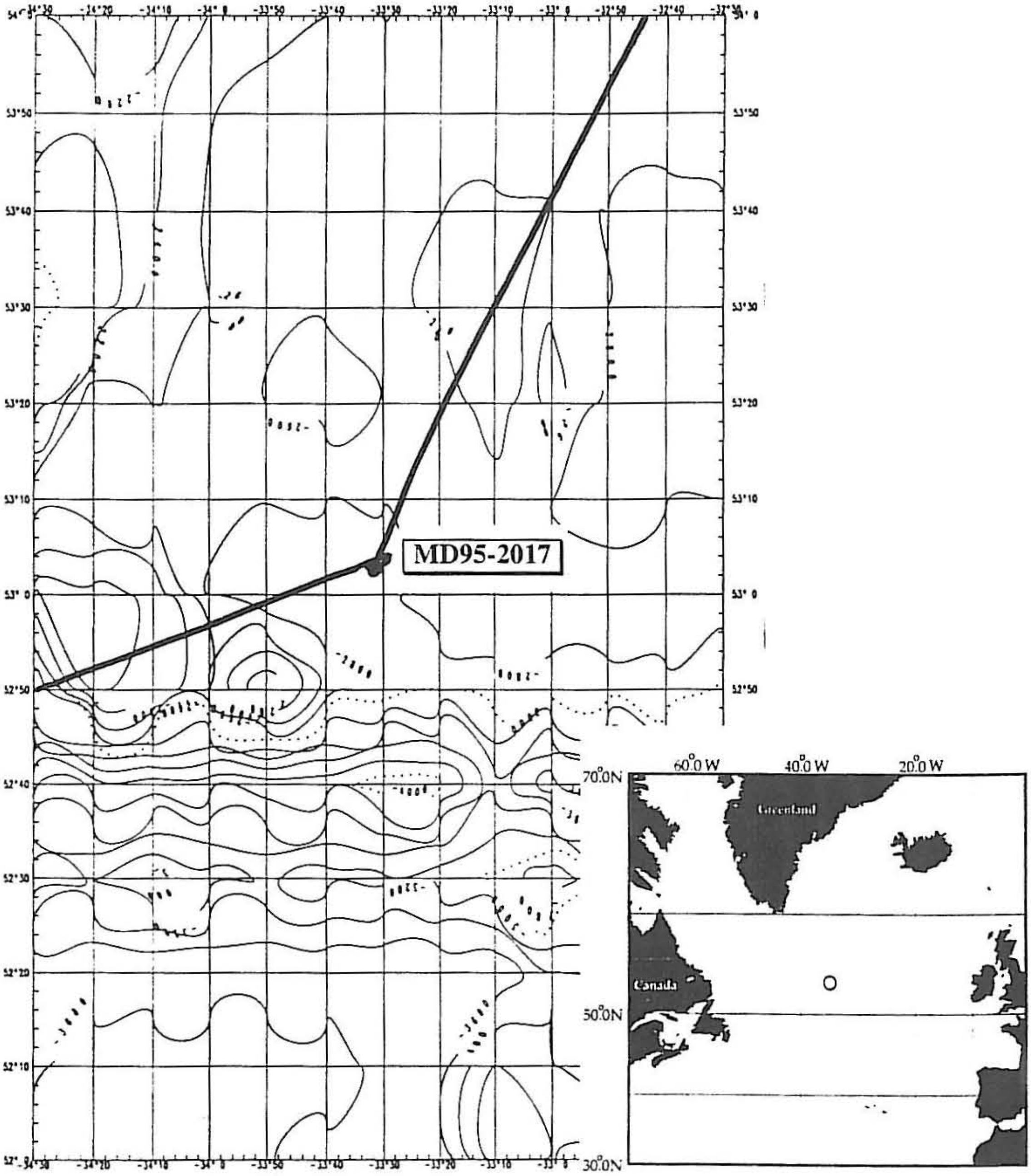
MD95-2016

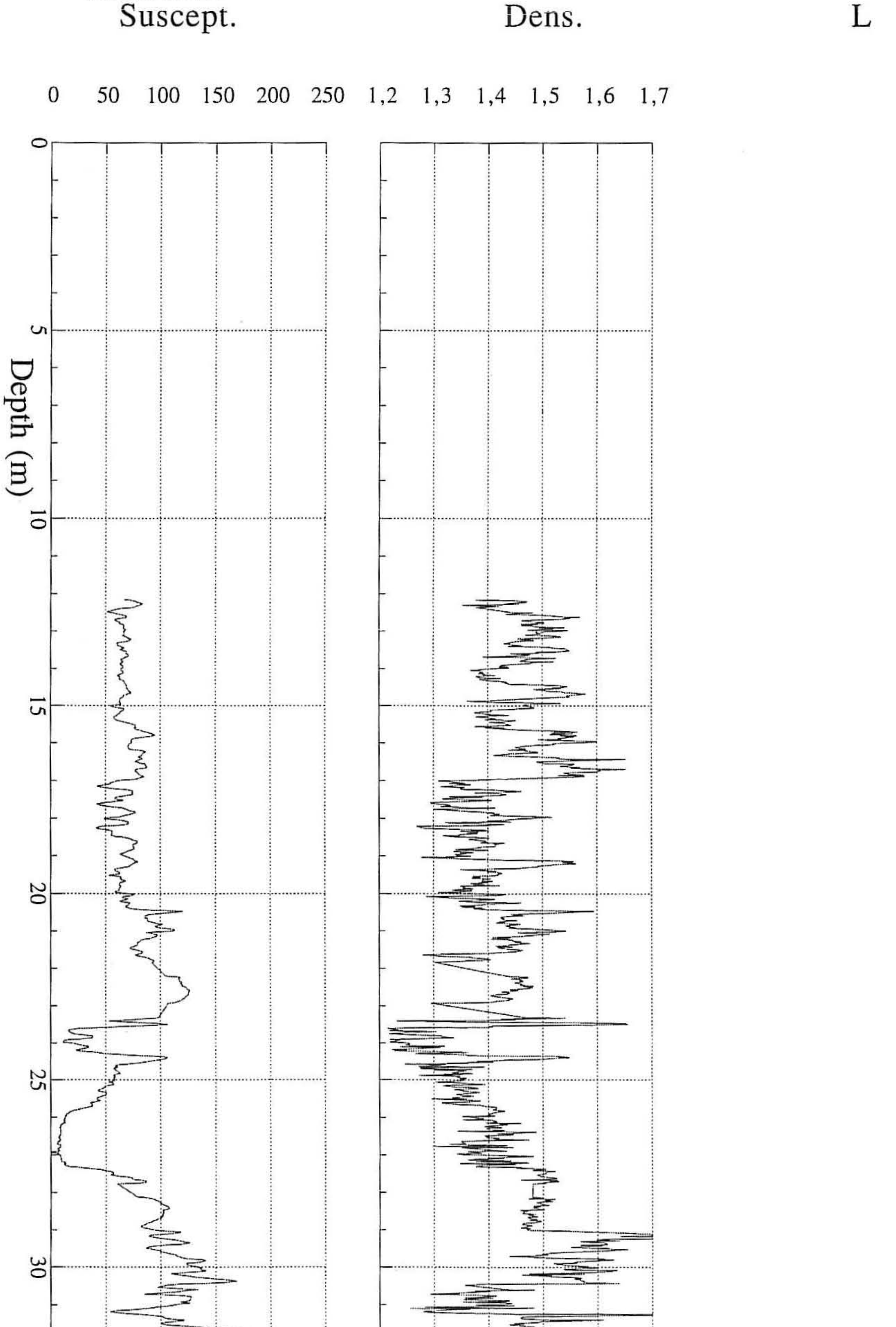

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
400
1400
1600
1.2
2.2
20
40
60
80
-6
0
6
2
10
18


MD 95-2016
Lithology
Color
0
1
2
3
4
5
6
7
8
9
10
11
12
I
II
III
IV
V
VI
VII
VIII
10 YR 5/2
2.5Y 5/6
5Y 4/1
5Y 6/1
5Y 5/1
5Y 6/1
5Y 4/1
2.5Y 4/2
5Y 5/1
5Y 6/1
5Y 5/1
5Y 6/1
2.5Y 5/2
2.5Y 5/3
to
2.5Y 4/3
2.5Y 6/2
5Y 5/2
2.5Y 5/3
2.5Y 4/2
2.5Y 6/2
2.5Y 4/2
sandy, foram.-rich
Foraminifera bearing Nanno ooze
with detrital carbonate (silty)
Clayey-silty nanno ooze
with forams, diatoms, detrital carbonate, quartz and feldspar
Nanno-bearing silty clay
with detricarbonate, coarse quartz grains
Clayey-silty Nanno ooze
with forams, diatoms and detricarbonate
Nanno ooze
with forams, diatoms
sandy layer
Silty-clayey nanno ooze
Nanno ooze
with coarse detricarbonate grains
-more silty interval around 650 cm
mottled contact
Clayey-silty nanno ooze
with forams and detricarbonate
Nanno ooze
with abundant forams and detricarbonate
Sandy Foram. and Nanno ooze
Clayey Nanno ooze
with detricarbonate
Sandy Nanno ooze
Clayey Nanno ooze
Sandy Foram. and Nanno ooze
12
13
14
15
16
17
18
19
20
21
22
23
24
IX
X
XI
XII
XIII
XIV
XV
XVI
2.5 4/2
to
2.5 5/2
5Y 4/1
5Y 3/1
5Y 4/1
5Y 5/1
5Y 5/3
5Y 6/1
5Y 5/1
5Y 4/1
5Y 5/1
2.5Y 4/3
5Y 5/2
5Y 6/1
5Y 5/1
5Y 3/1
5Y 6/1
5Y 4/1
5Y 4/3
5Y 7/1
5Y 5/1
5Y 4/1
5Y 5/1
5Y 4/1
5Y 5/1
dark brown layers
Clayey Nanno ooze
Sandy silt
Clayey Nanno ooze
Foram. and Nanno ooze
dropstone, basalt 5 cm
Sandy silt
Nanno ooze
FeS patches
FeS layer
Sandy Nanno ooze
Nanno ooze (pure)
darker layer (5Y 4/3)
Foram. and Nanno ooze
greenish layers
Sandy Nanno ooze
greenish layer
dark and greenish layers
black layer
Silty-clayey Nanno ooze
24
25
26
27
28
29
30
31
32
33
34
35
36
XVII
XVIII
XIX
XX
XXI
XXII
5Y 4/1
5Y 6/1
5Y 4/1
5Y 3/1
5Y 4/1
5Y 5/1
5Y 4/1
5Y 4/2
5Y 4/1
5Y 5/1
to
5Y 4/1
5Y 4/2
5Y 4/1
5Y 5/1
5Y 4/1
5Y 6/1
5Y 4/2
Silty-clayey Nanno ooze
with forams.
dark layer
Silty clay with forams, nannos and sand
Foraminifera ooze
light grey layer
greenish layer (sharp contacts)
greenish layer
Silty clay
with nannos and sand
greenish layer
rich in forams
Nanno ooze
with abundant forams.
light layer (5Y 5/1)
Nanno ooze
with detricarbonate
Silty-clayey Nanno ooze
dropstone
sharp color boundary
Nanno ooze
Nanno ooze
END OF CORE
3286 cm

Core MD 95-2017

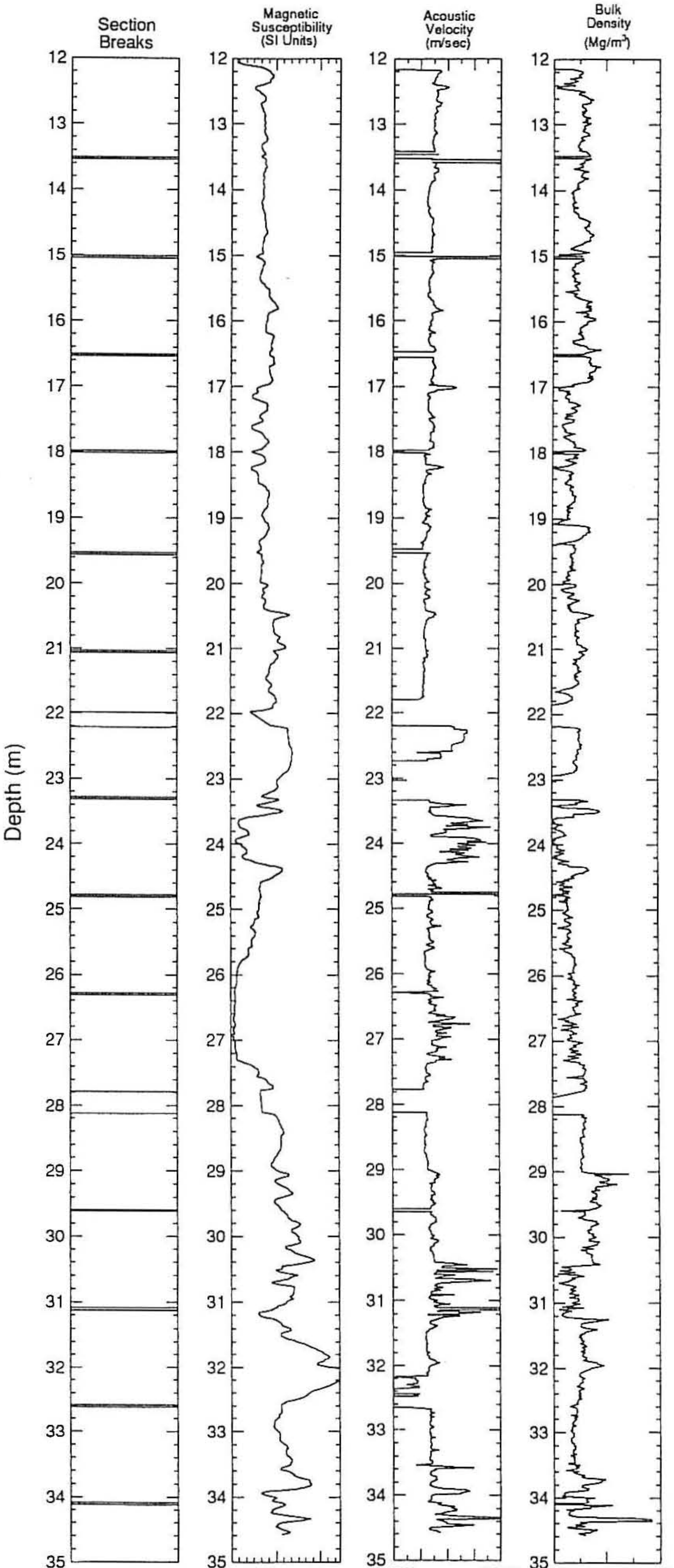
lat: 53°02.56 N - long: 33°31.51 W
water depth: 3100 m
length: 34.59 m




Suscept.
Dens.
L
0 50 100 150 200 250
1,2 1,3 1,4 1,5 1,6 1,7
Depth (m)
0 5 10 15 20 25 30 35

MD 95-2017

MD95-2017

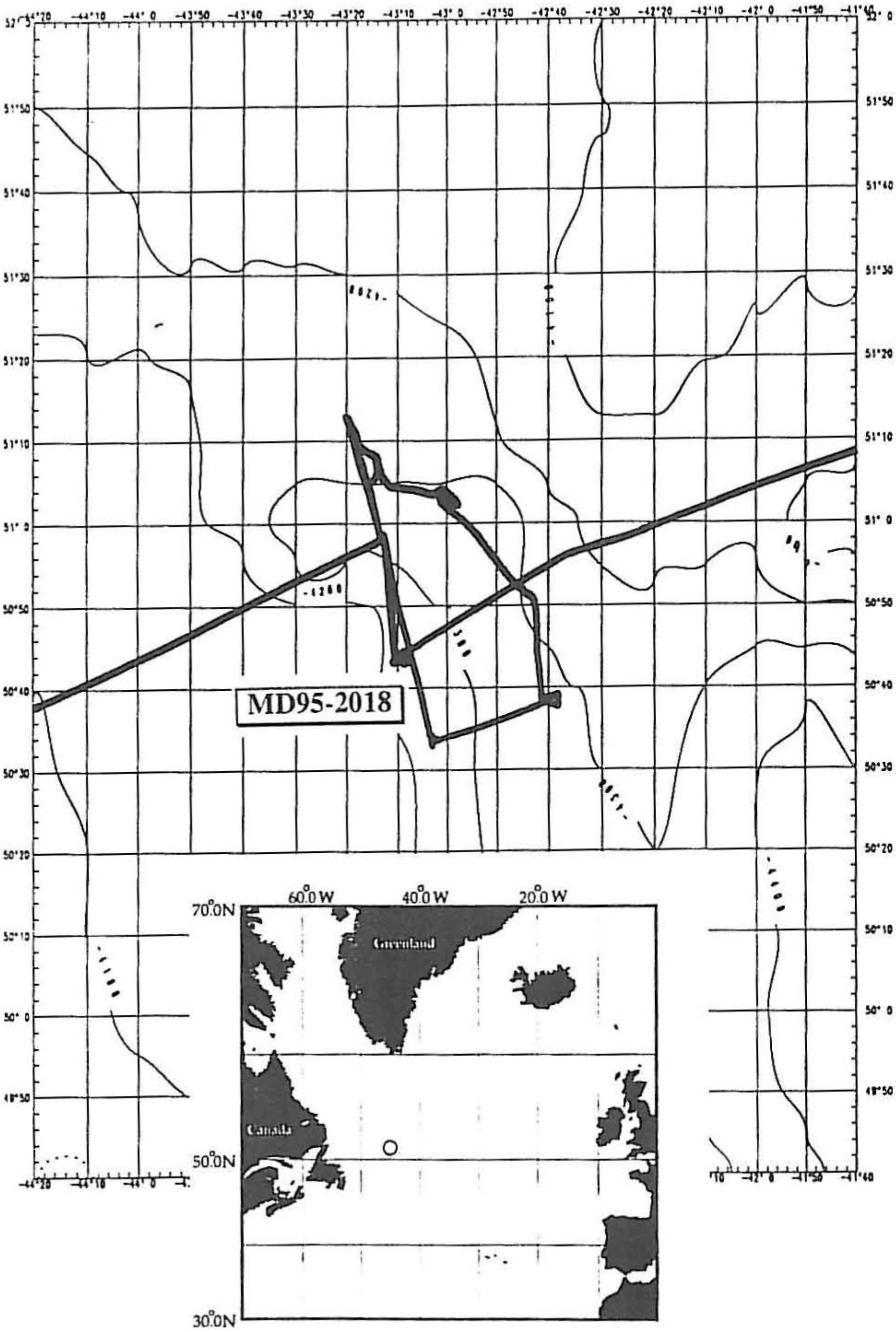

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
0
90
180
1400
1600
1.2
2.2

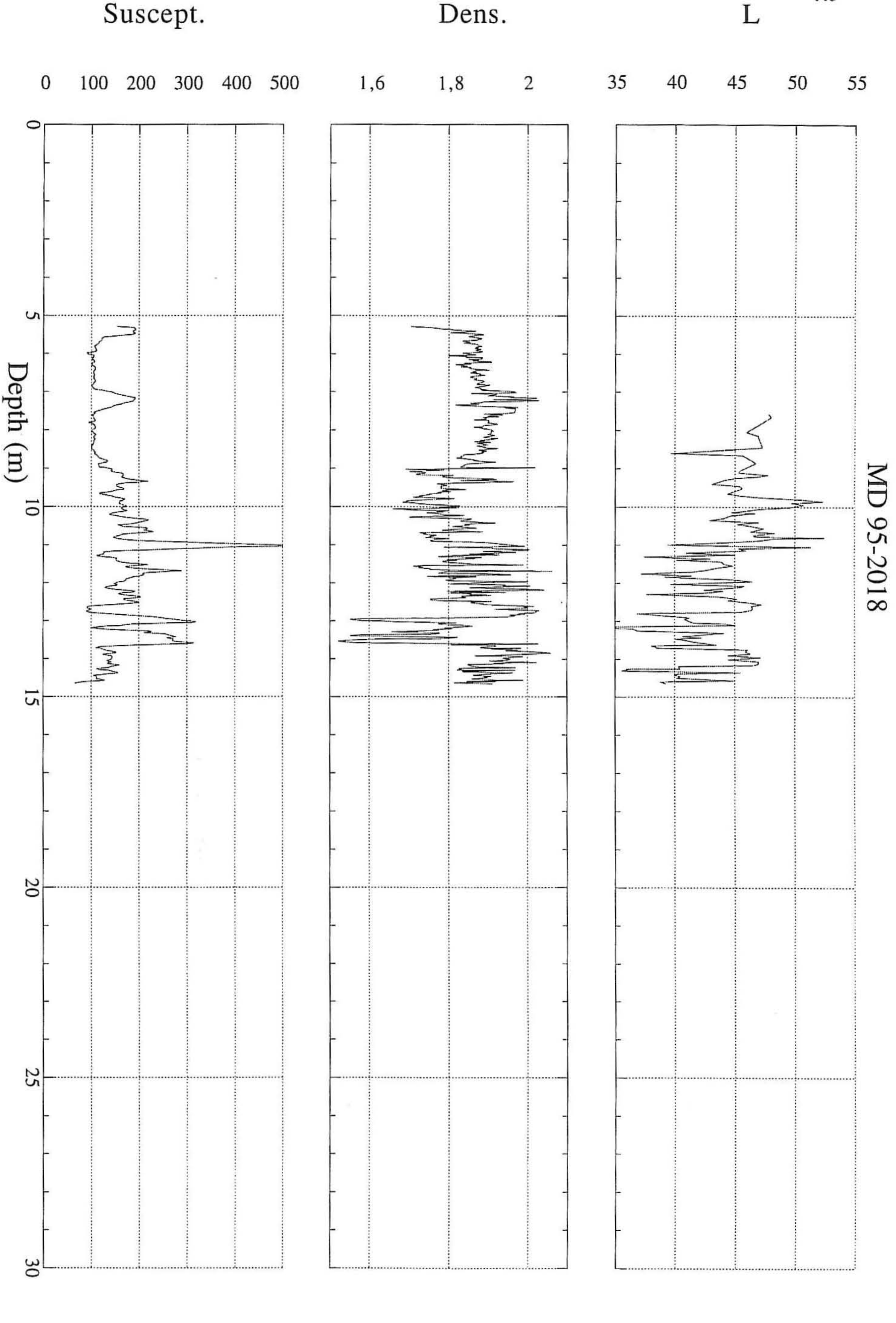
Core MD95-2017 not opened on board.

No sediment description.

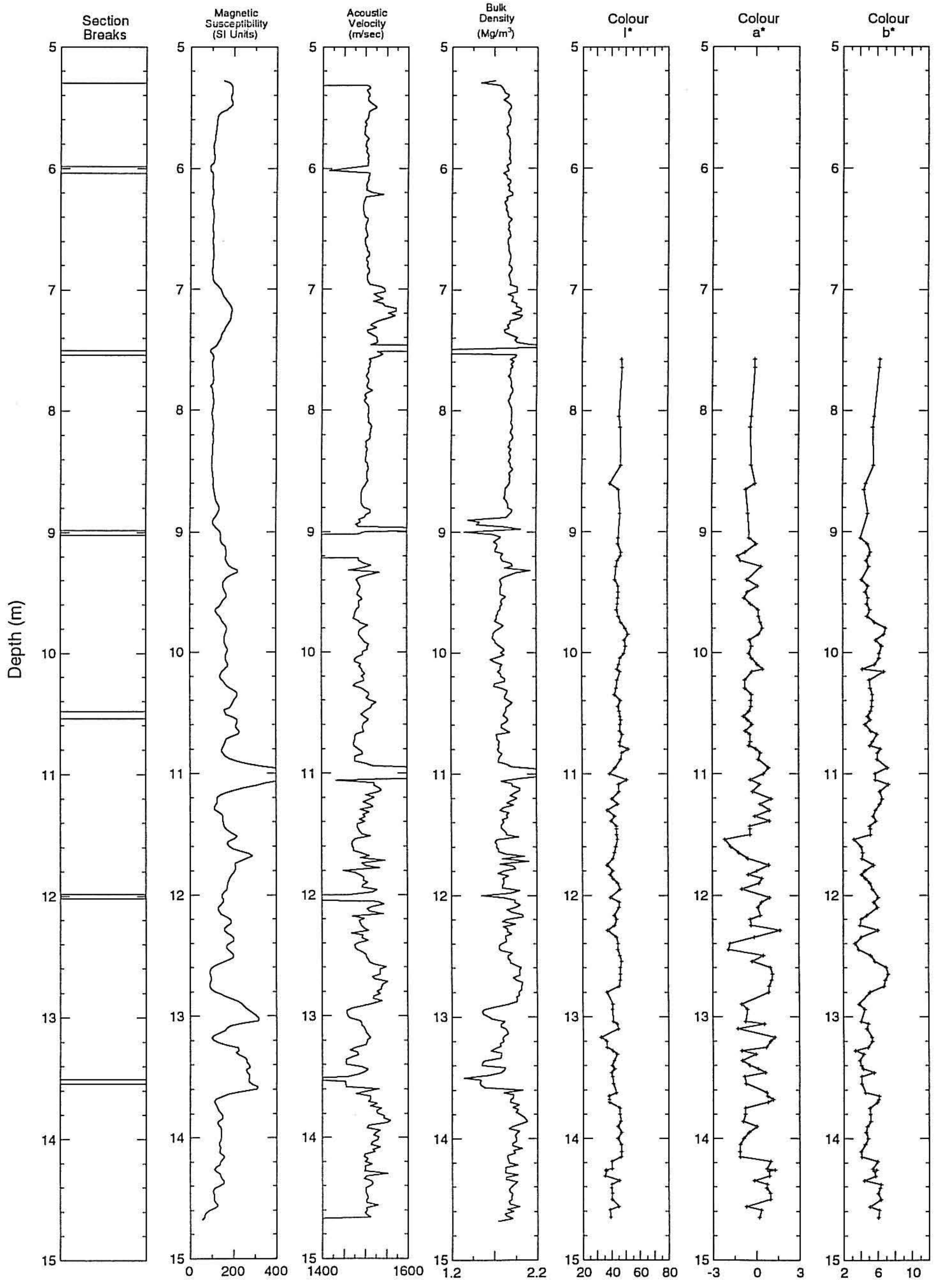
Core MD 95-2018

lat: 50°43.88 N - long: 43°08.54 W
water depth: 4221 m
length: 14.7 m

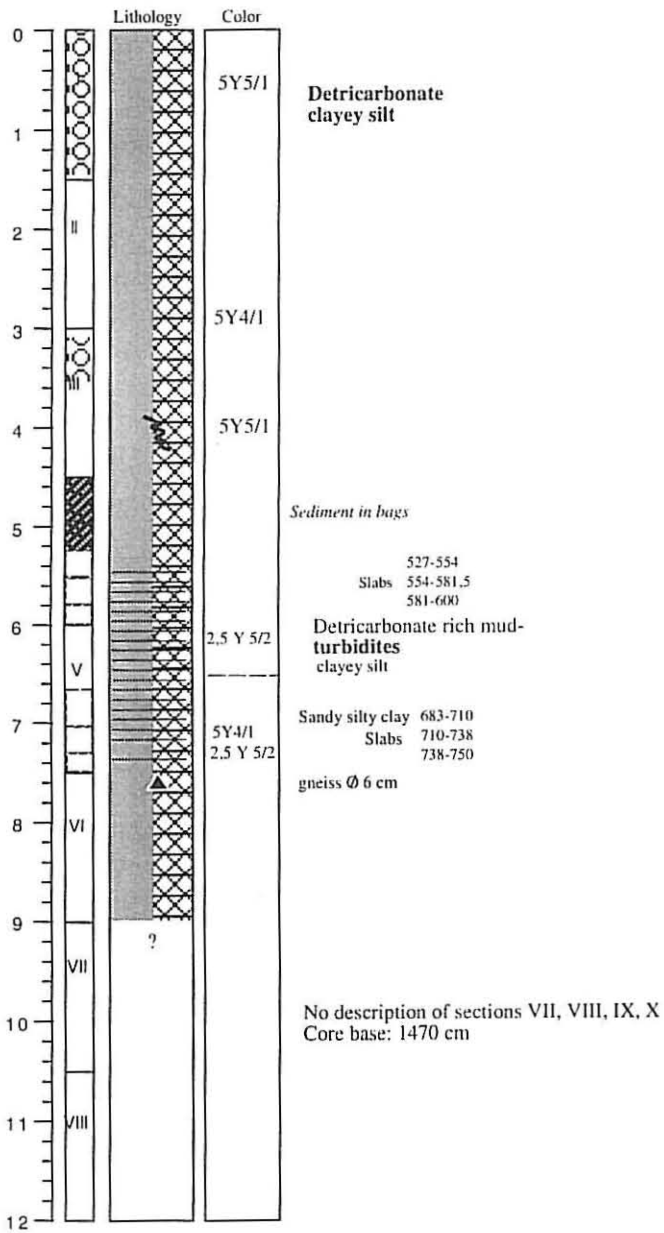



Suscept.
Dens.
L
0 100 200 300 400 500
1,6 1,8 2
35 40 45 50 55
Depth (m)
0 5 10 15 20 25 30
MD 95-2018

MD95-2018

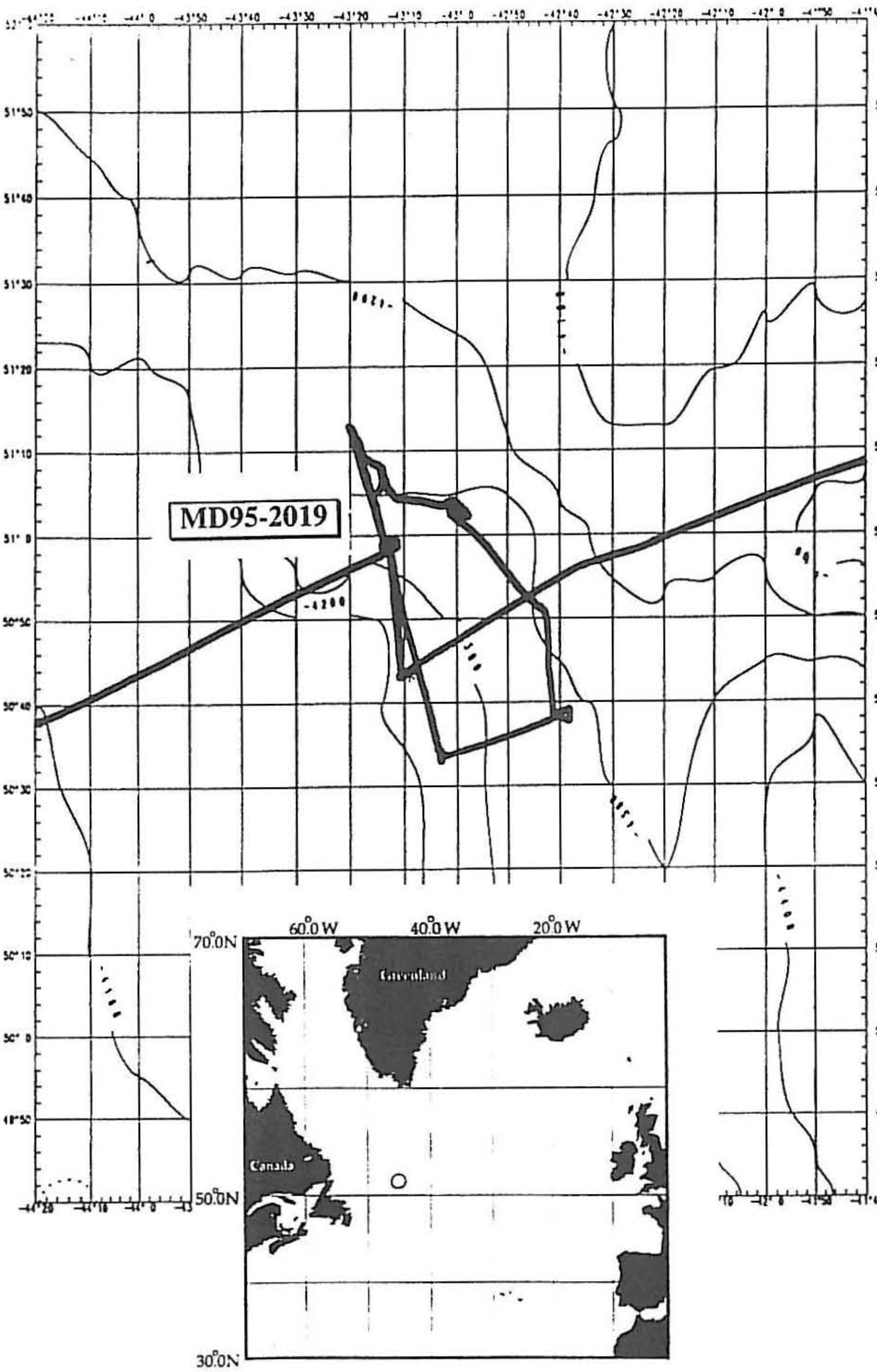

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m3)
Colour l*
Colour a*
Colour b*
Depth (m)
5
6
7
8
9
10
11
12
13
14
15
0
200
400
1400
1600
1.2
2.2
20
40
60
80
-3
0
3
2
6
10

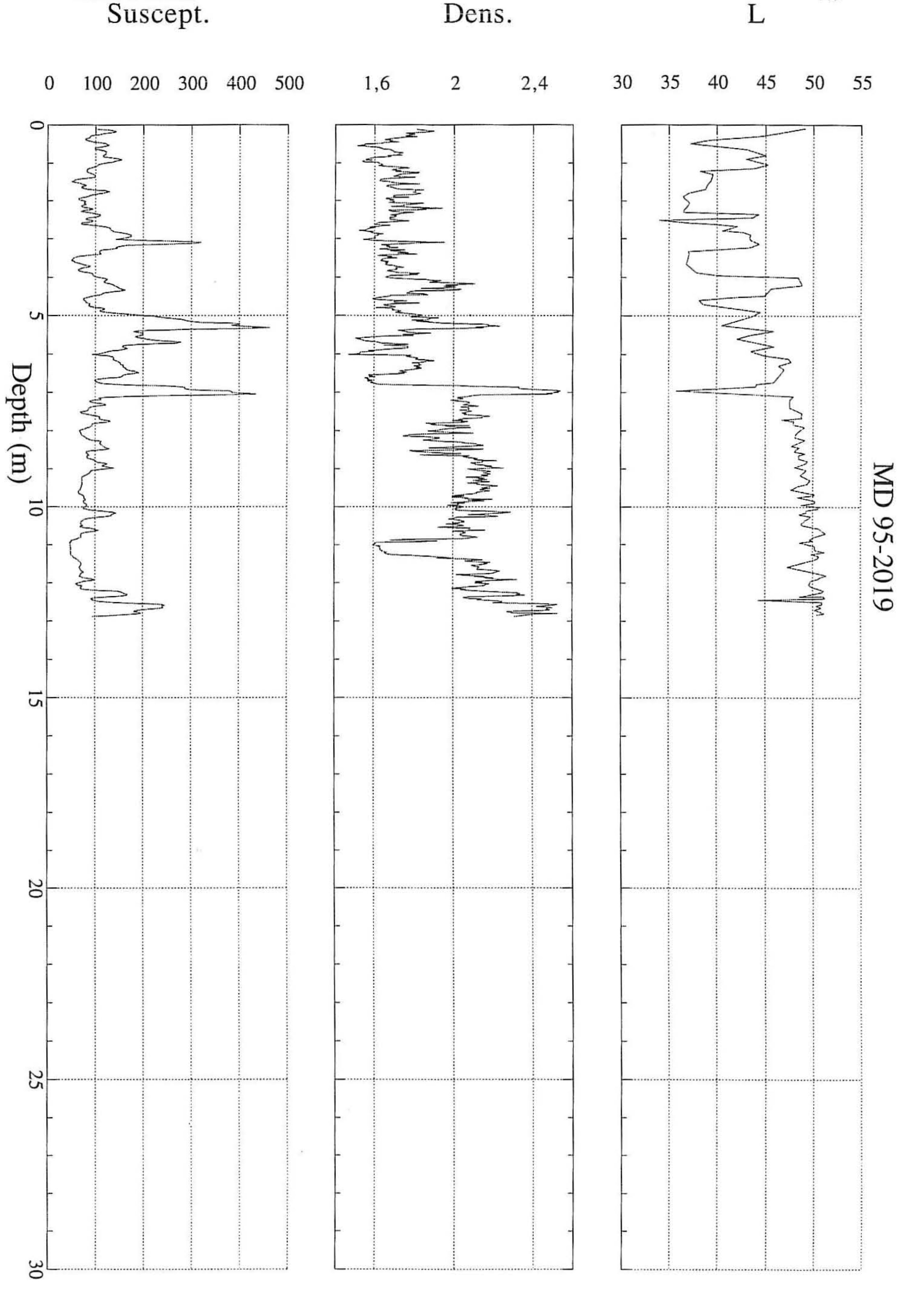
MD 95-2018


Lithology
Color
5Y5/1
Detricarbonate
clayey silt
5Y4/1
5Y5/1
Sediment in bags
527-554
Slabs 554-581,5
581-600
2,5 Y 5/2
Detricarbonate rich mud-
turbidites
clayey silt
Sandy silty clay 683-710
Slabs 710-738
738-750
5Y4/1
2,5 Y 5/2
gneiss Ø 6 cm
?
No description of sections VII, VIII, IX, X
Core base: 1470 cm
II
III
V
VI
VII
VIII
0
1
2
3
4
5
6
7
8
9
10
11
12

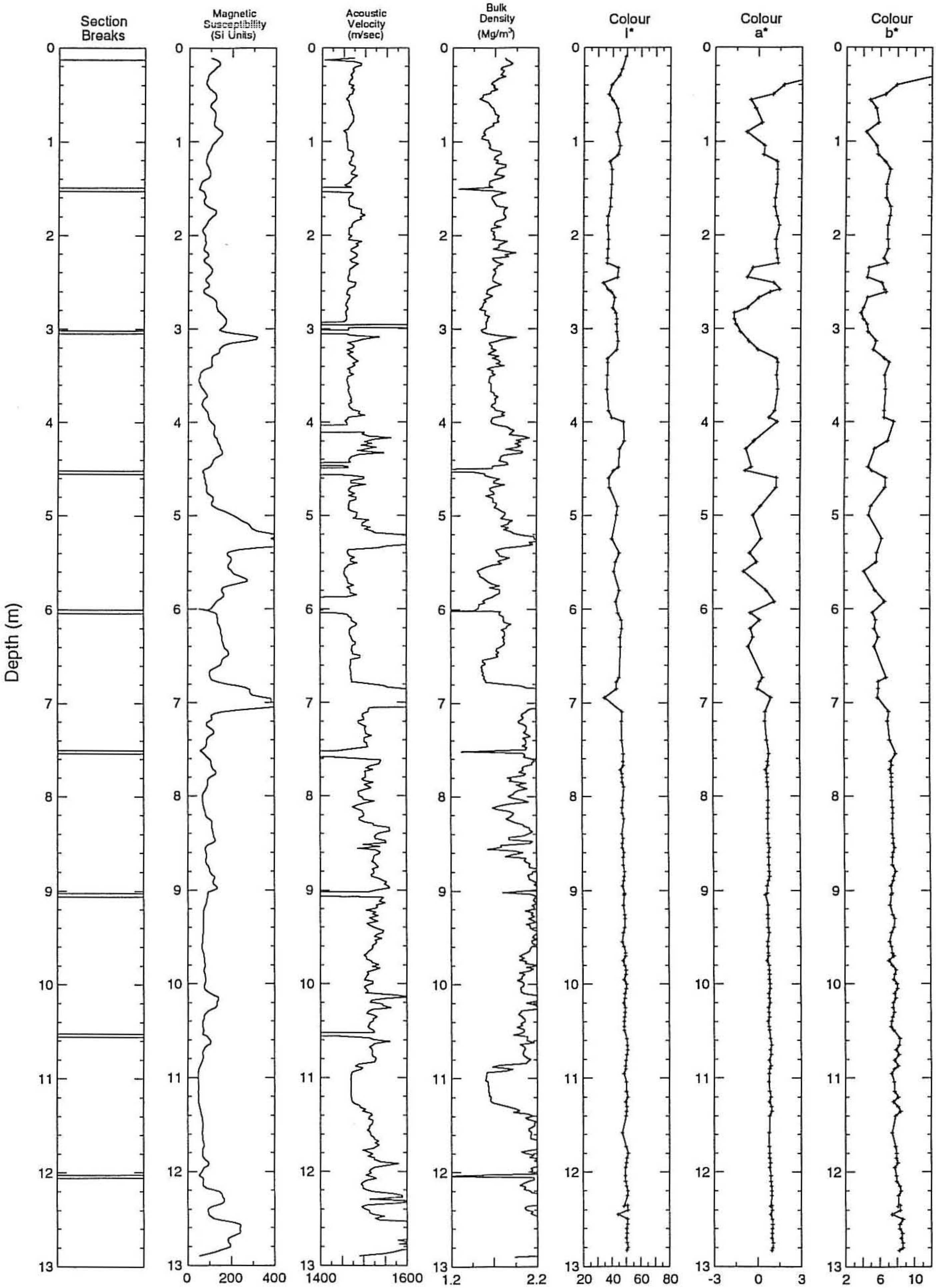
Core MD 95-2019

lat: 51°05.68 N - long: 3°13.27 W
water depth: 4262 m
length: 12.86 m



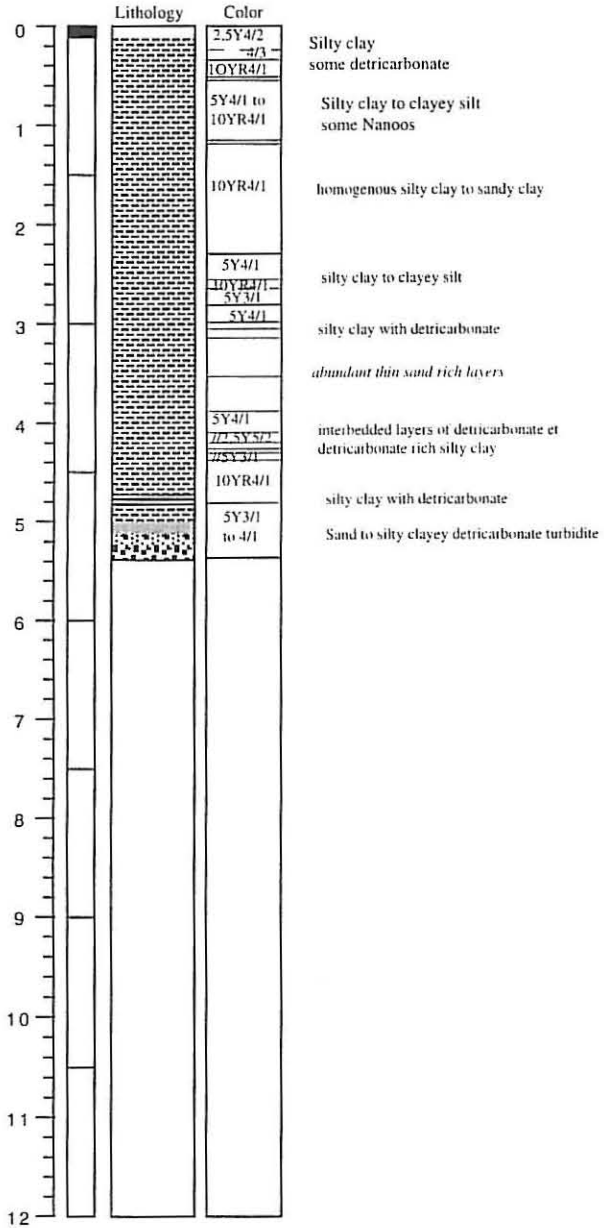

Suscept.
Dens.
L
0 100 200 300 400 500
1,6 2 2,4
30 35 40 45 50 55
Depth (m)
0 5 10 15 20 25 30
MD 95-2019

MD95-2019


Section Breaks
Magnetic Susceptibility (Si Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
0 200 400
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

MD 95-2019

Section I to VIII

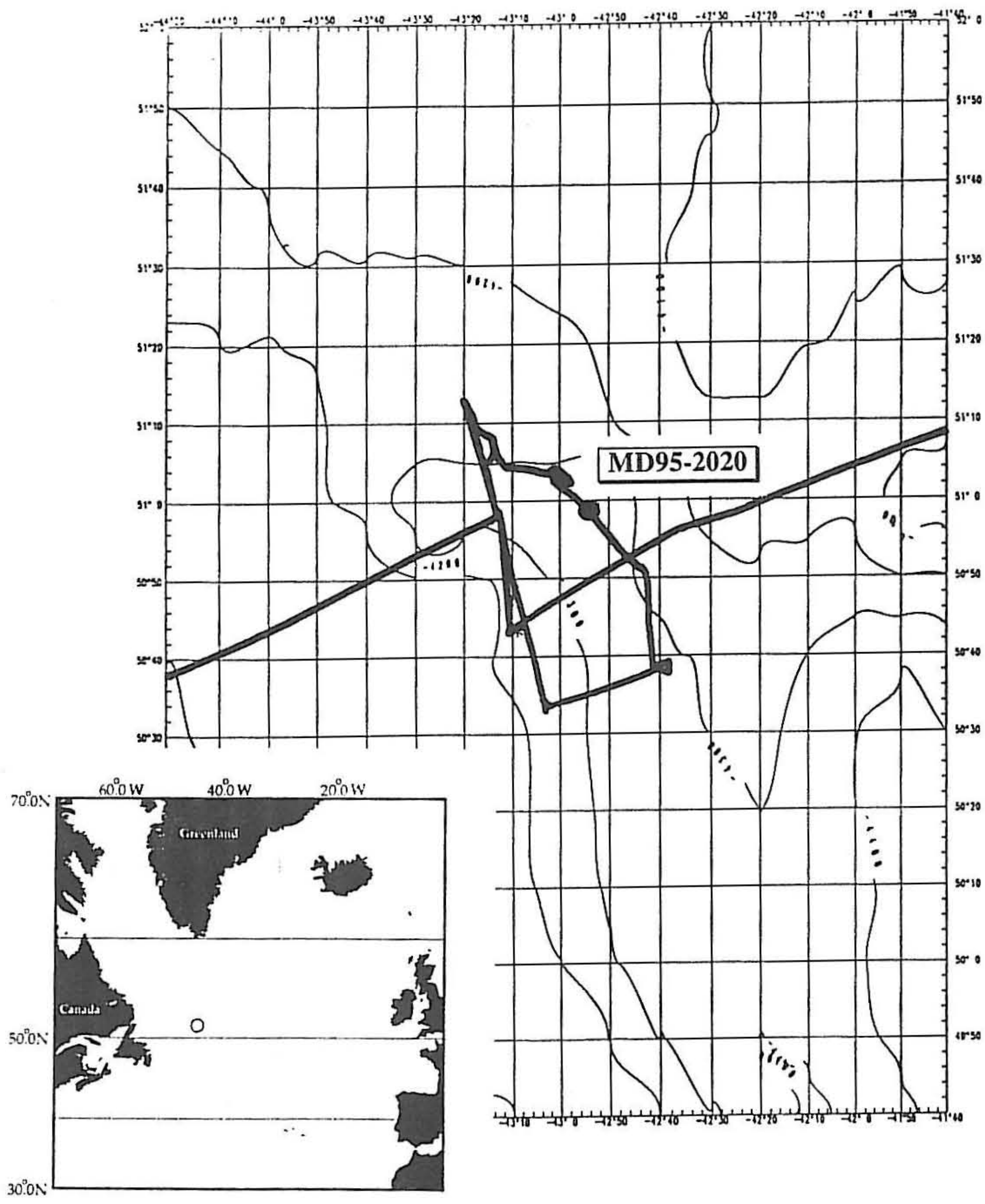


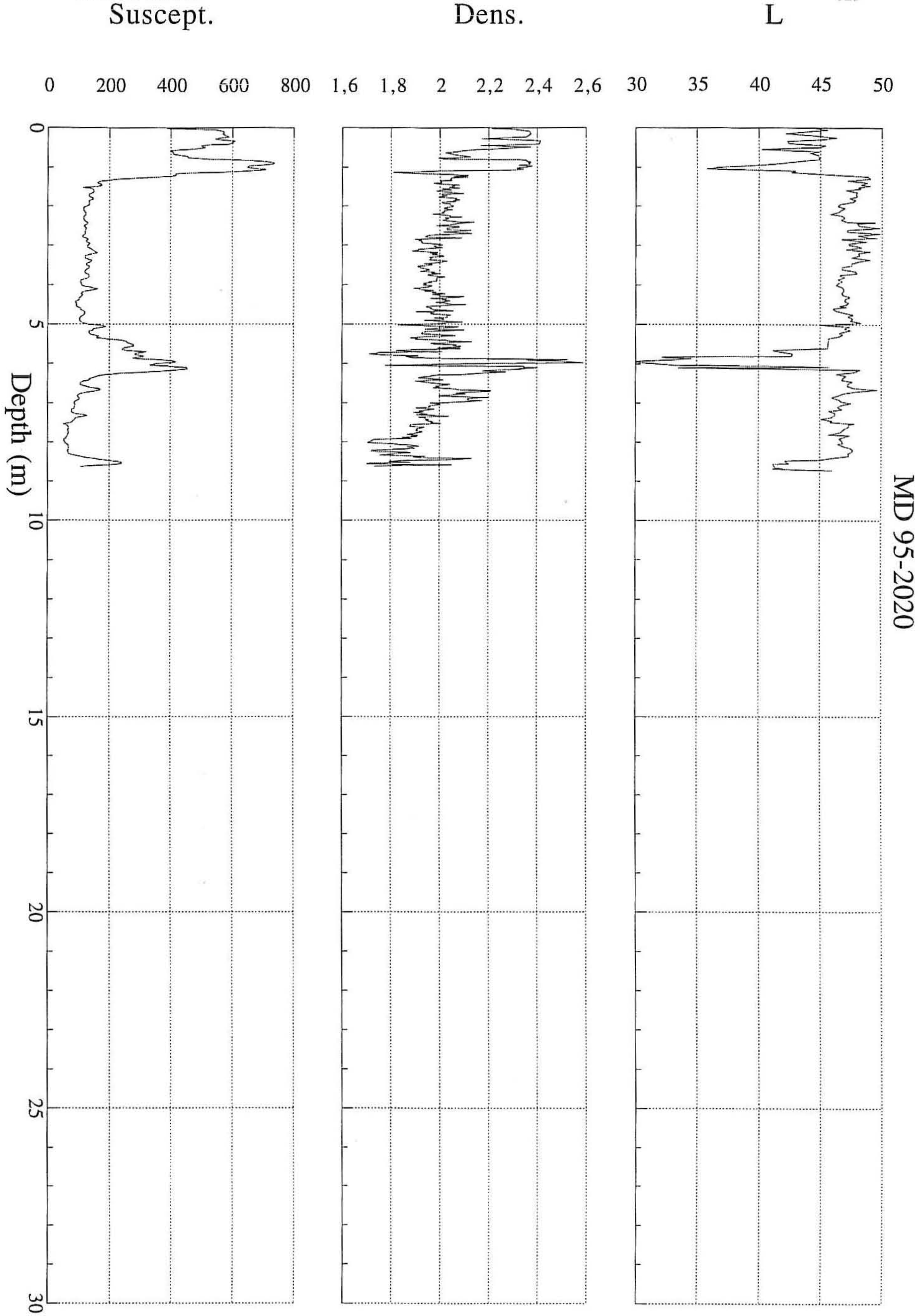
Core MD 95-2020

lat: 51°02.42 N - long: 43°00.62 W

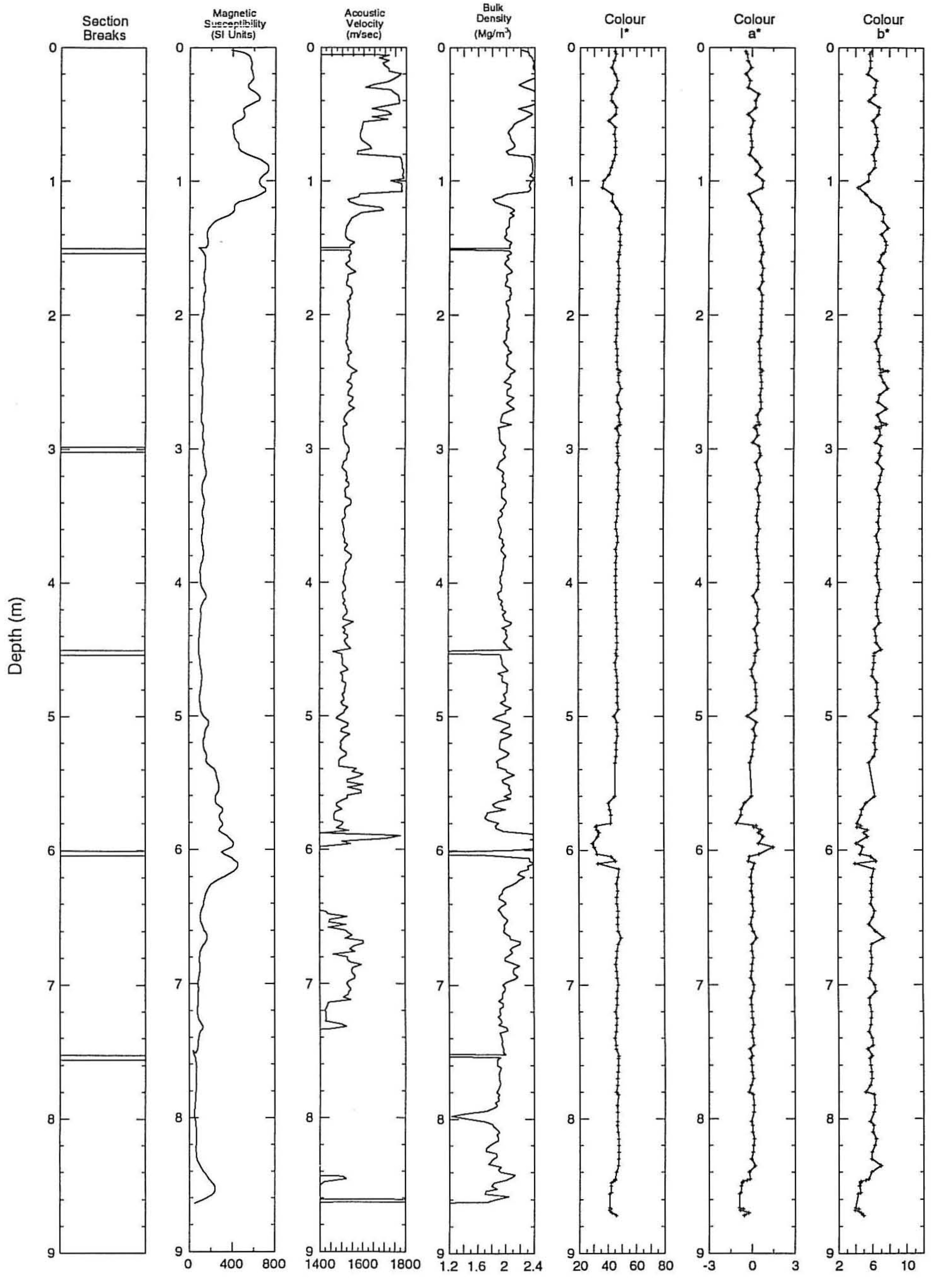
water depth: 4289 m

length: 8.63 m



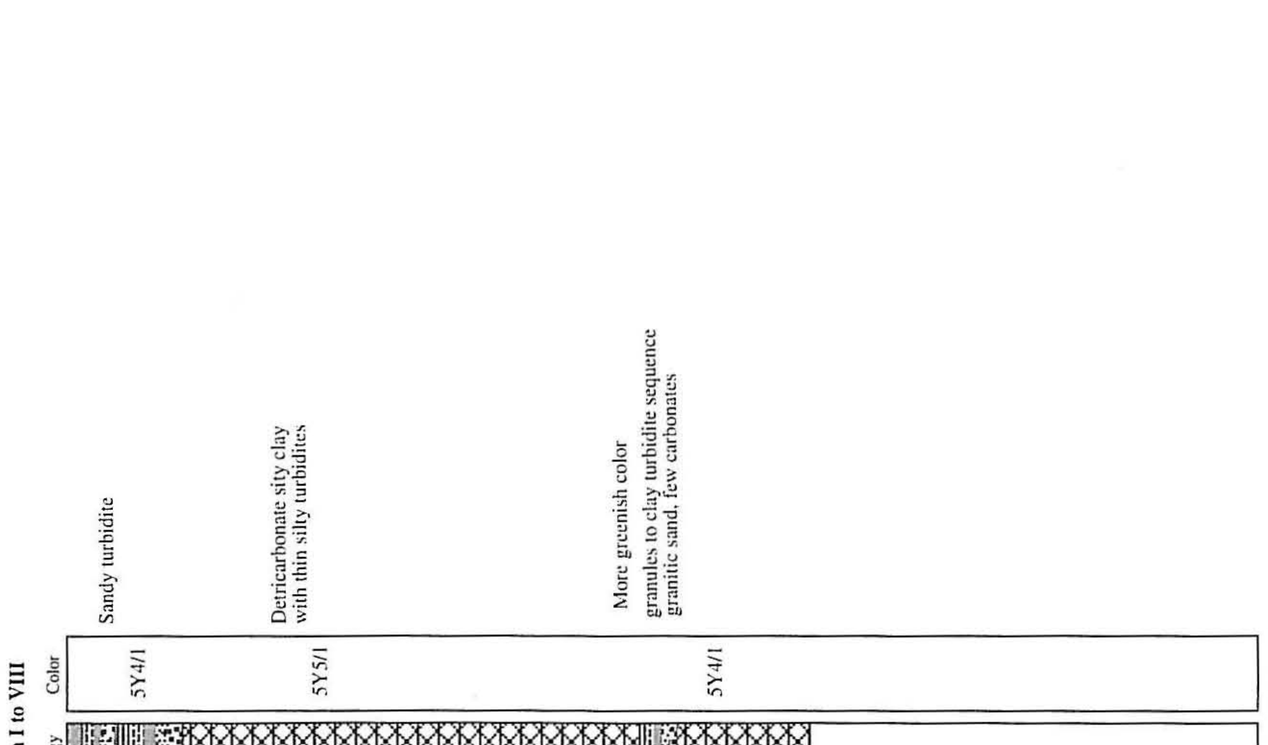

Suscept.
Dens.
L
0 200 400 600 800
1,6 1,8 2 2,2 2,4 2,6
30 35 40 45 50
Depth (m)
0 5 10 15 20 25 30
MD 95-2020

MD95-2020



Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0
1
2
3
4
5
6
7
8
9
0 400 800
1400 1600 1800
1.2 1.6 2 2.4
20 40 60 80
-3 0 3
2 6 10

MD 95-2020

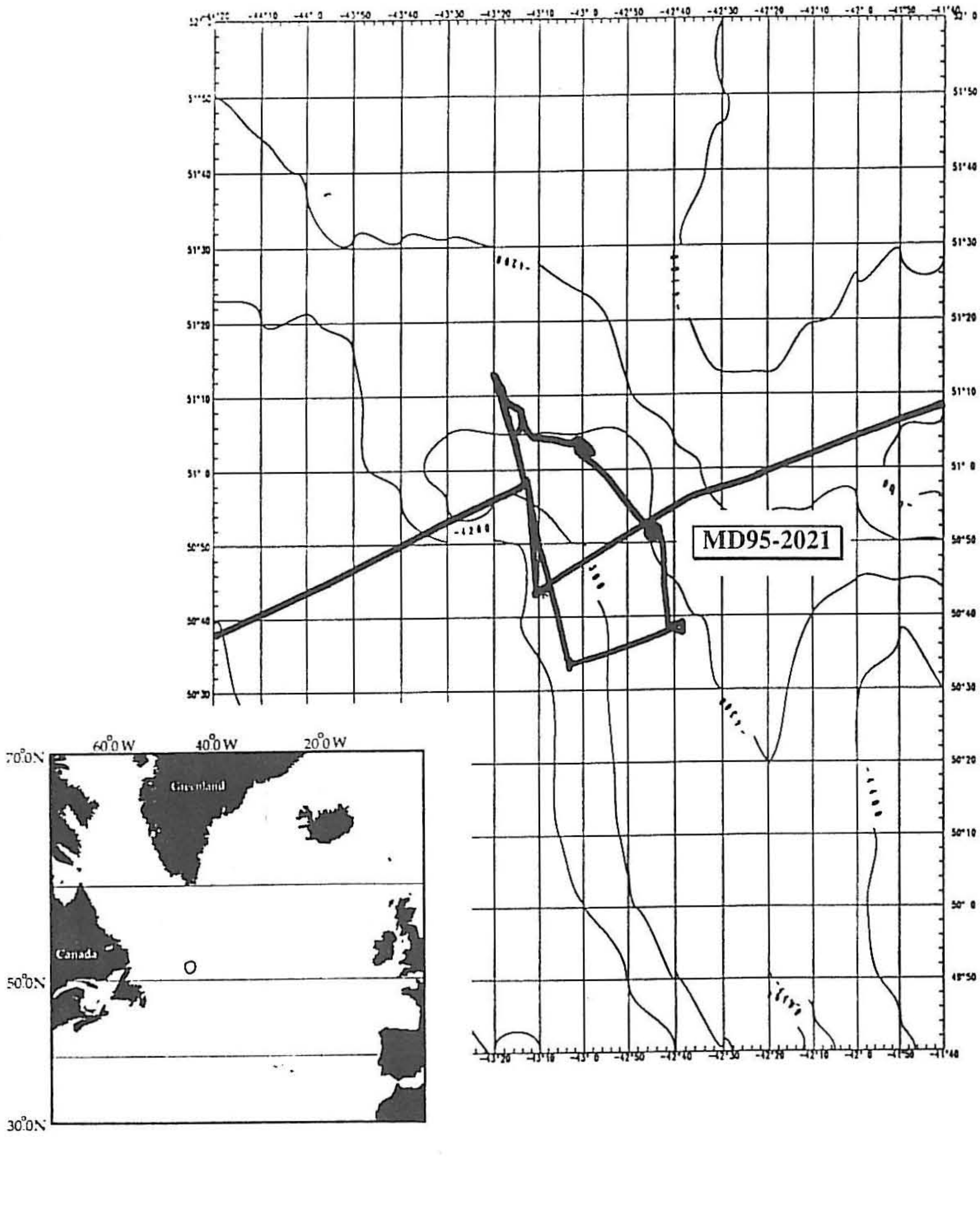

Section I to VIII
Lithology
Color
Sandy turbidite
5Y4/1
Detricarbonate sity clay
with thin silty turbidites
5Y5/1
More greenish color
granules to clay turbidite sequence
granitic sand, few carbonates
5Y4/1
?
0
1
2
3
4
5
6
7
8
9
10
11
12

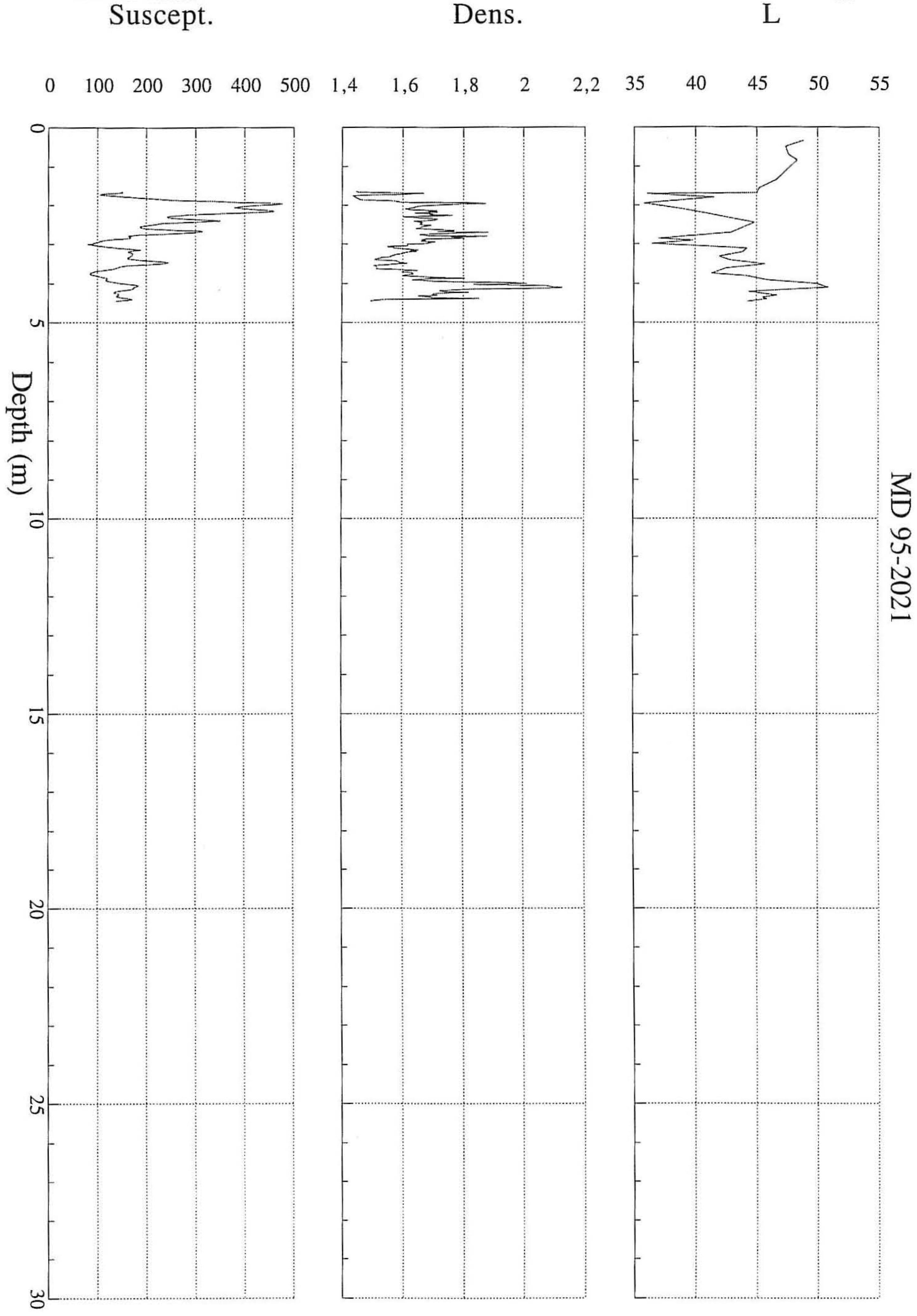
Core MD 95-2021

lat: 50°51.81 N - long: 42°44.49 W

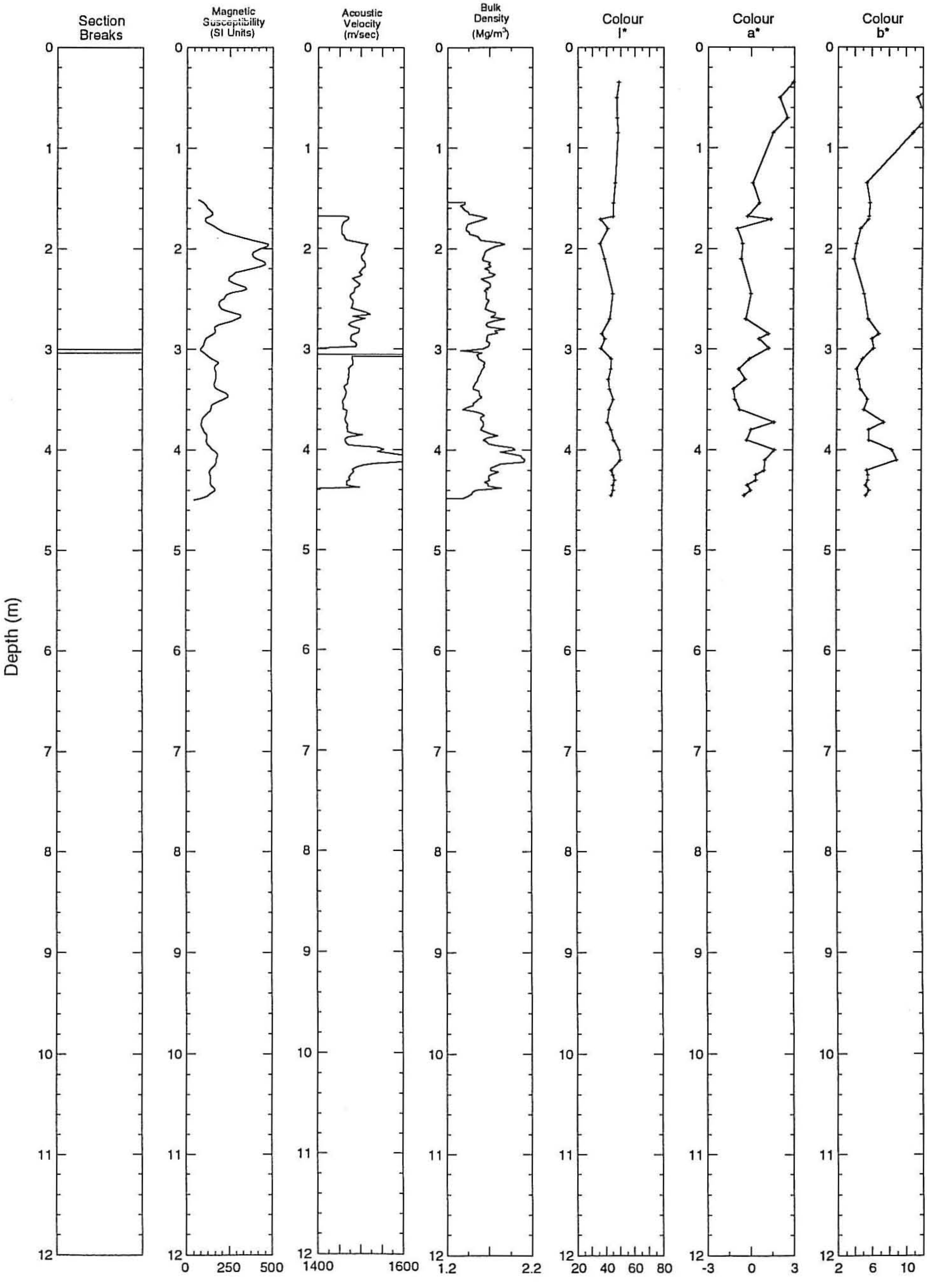
water depth: 4283 m

length: 4.48 m

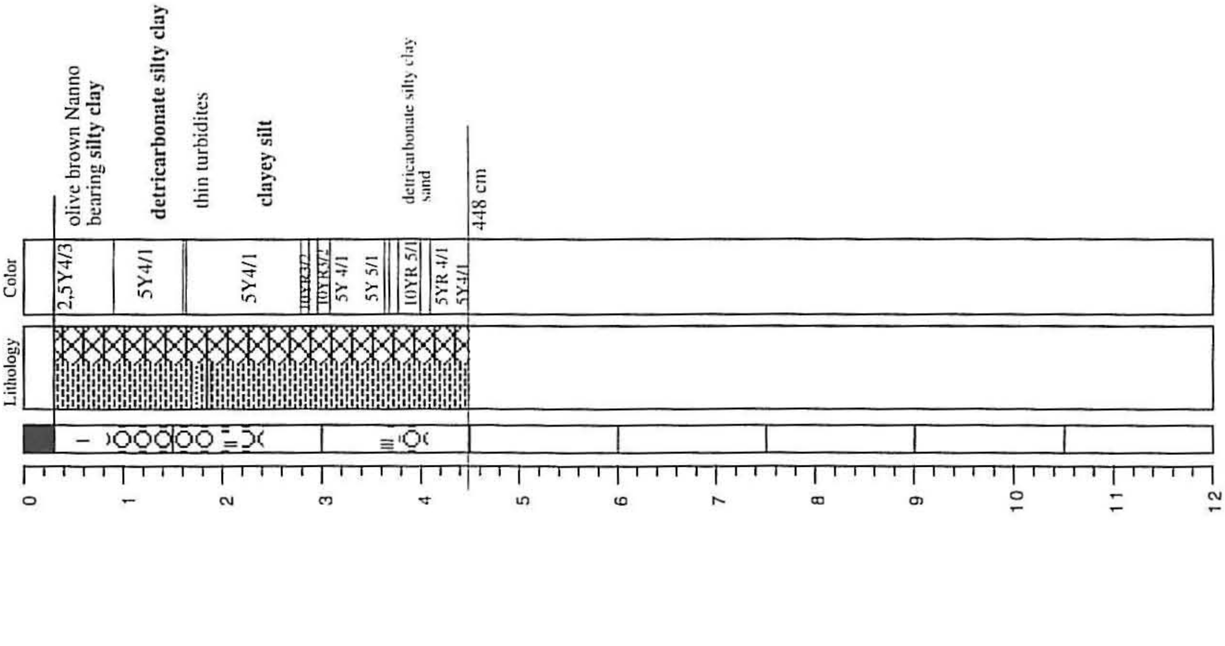



Suscept.
Dens.
L
0 100 200 300 400 500
1,4 1,6 1,8 2 2,2
35 40 45 50 55
0 5 10 15 20 25 30
Depth (m)
MD 95-2021

MD95-2021

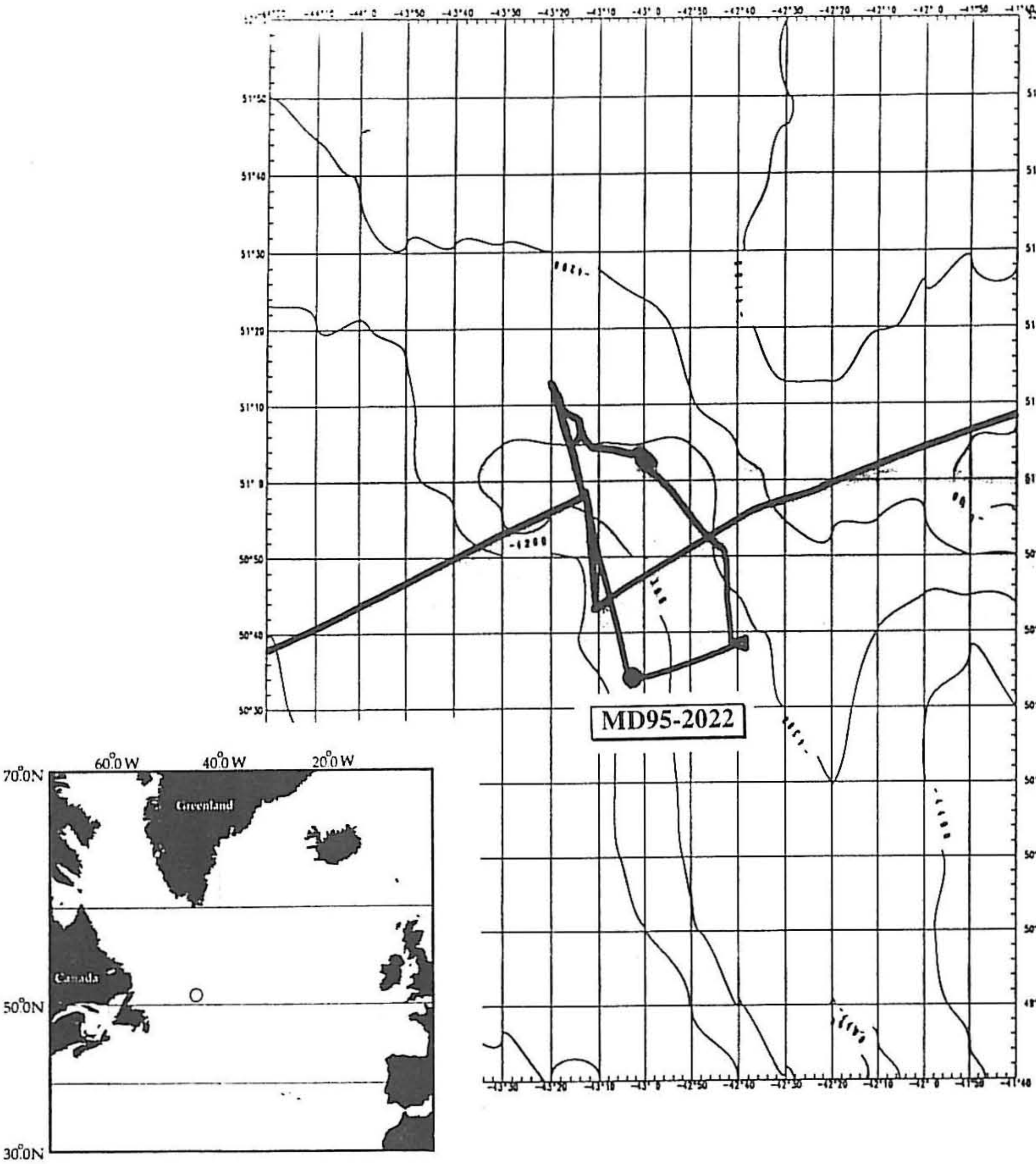

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0 1 2 3 4 5 6 7 8 9 10 11 12
0 250 500
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

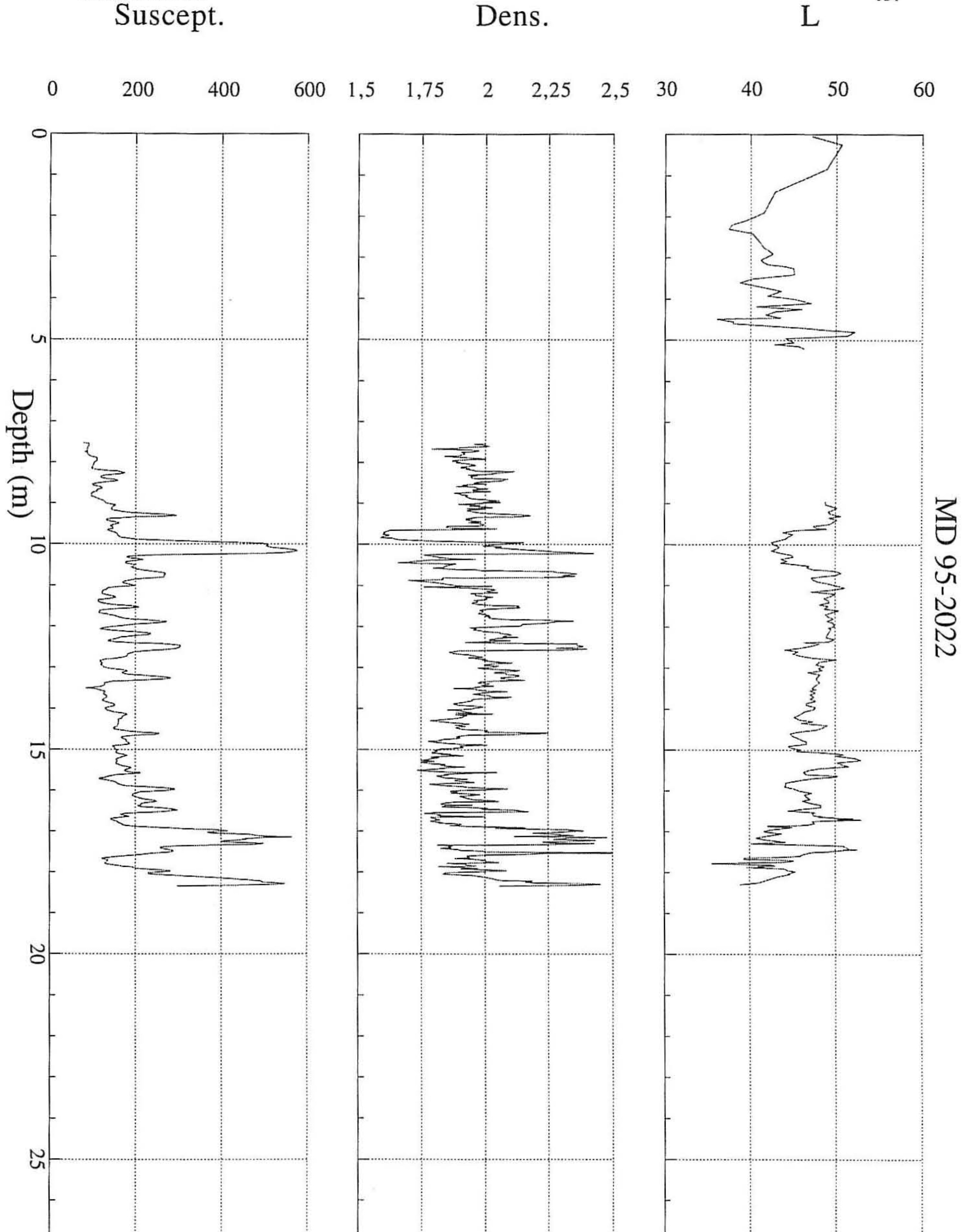
MD 95-2021


olive brown Nanno
bearing silty clay
detricarbonate silty clay
thin turbidites
clayey silt
detricarbonate silty clay
sand
448 cm
Color
Lithology
2,5Y4/3
5Y4/1
5Y4/1
10YR3/2
5Y 4/1
5Y 5/1
10YR 5/1
5YR 4/1
5Y4/1
0
1
2
3
4
5
6
7
8
9
10
11
12

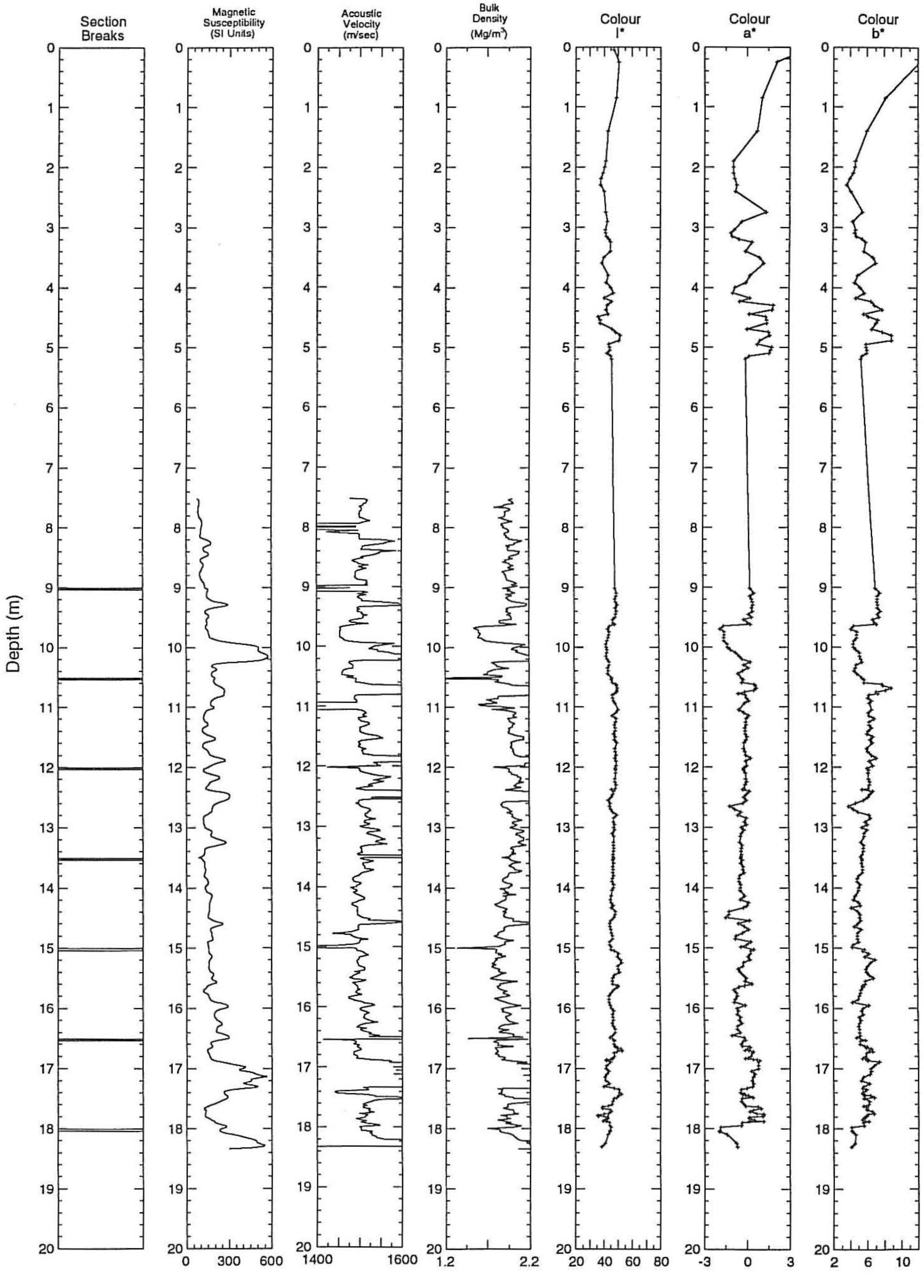
Core MD 95-2022

lat: 50°34.38 N - long: 43°03.51 W
water depth: 4245 m
length: 18.37 m

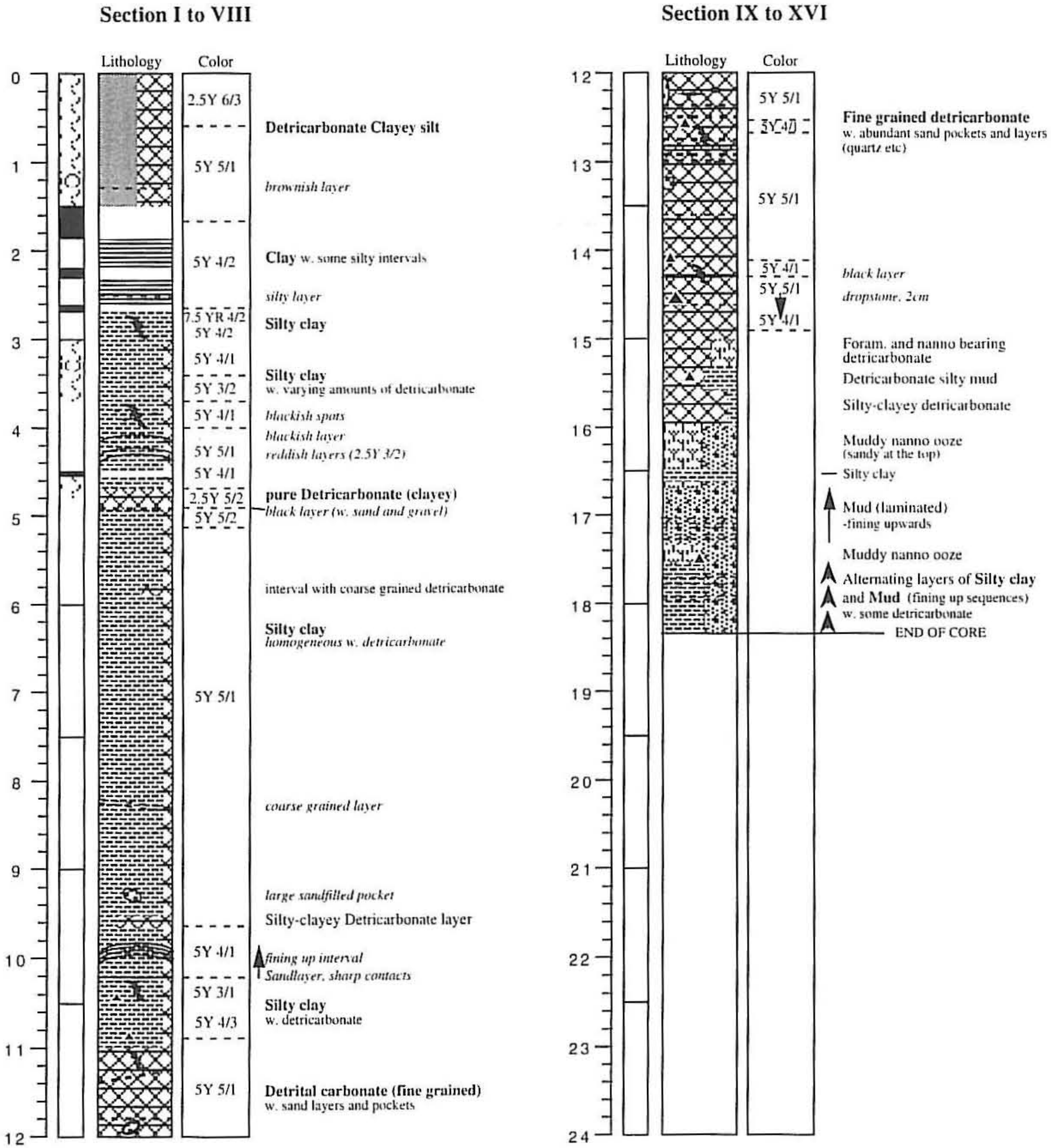



Suscept.
Dens.
L
0 200 400 600
1,5 1,75 2 2,25 2,5
30 40 50 60
0 5 10 15 20 25 30
Depth (m)
MD 95-2022

MD95-2022

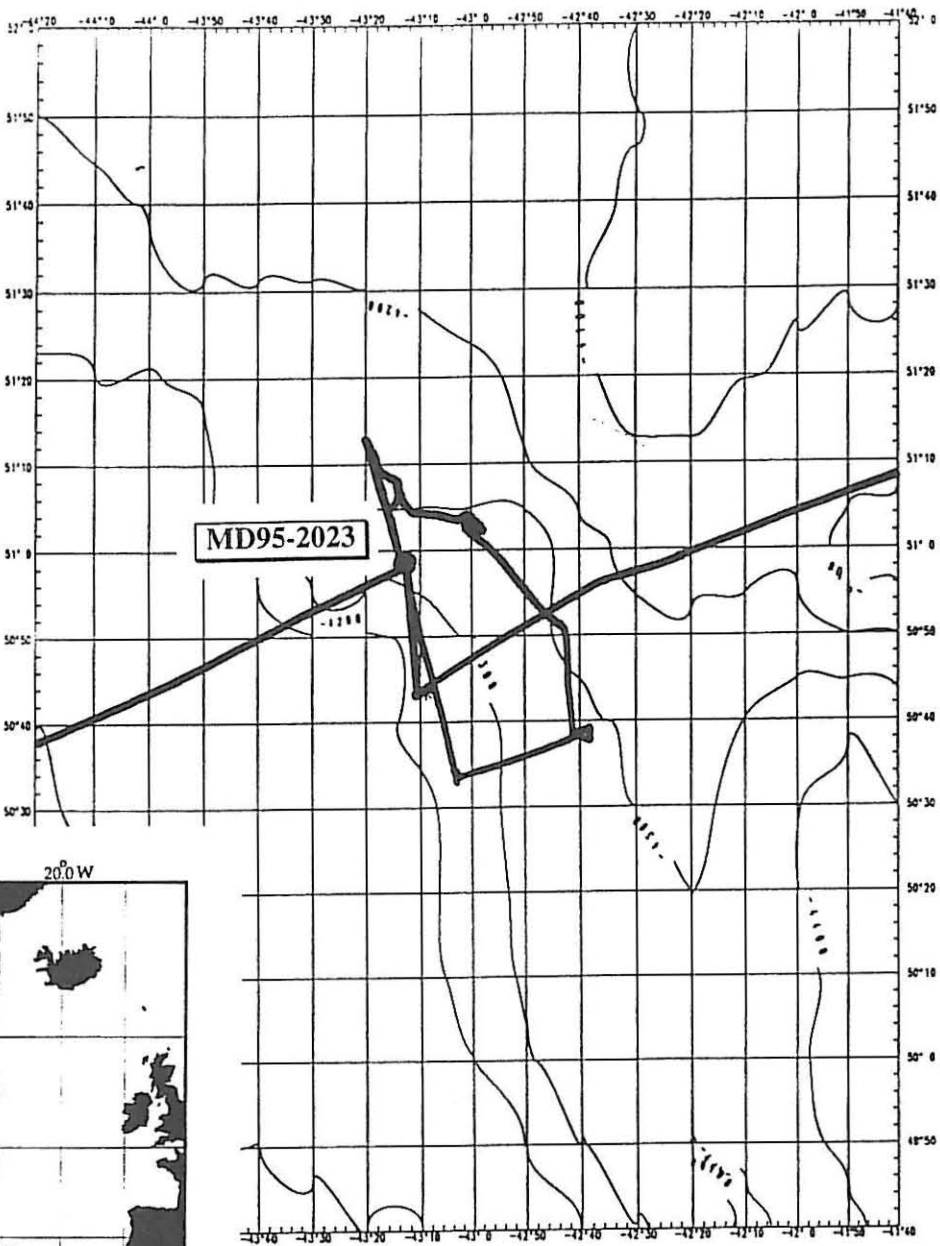

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0 300 600
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

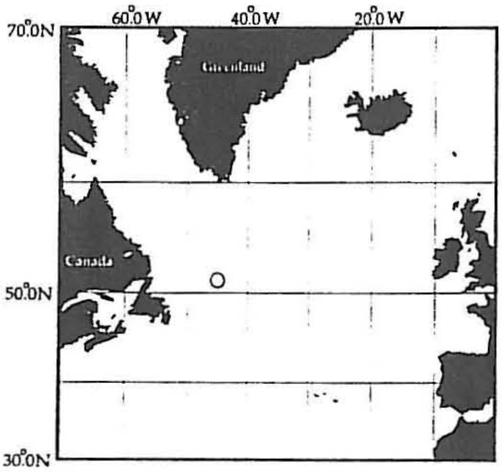
MD 95-2022

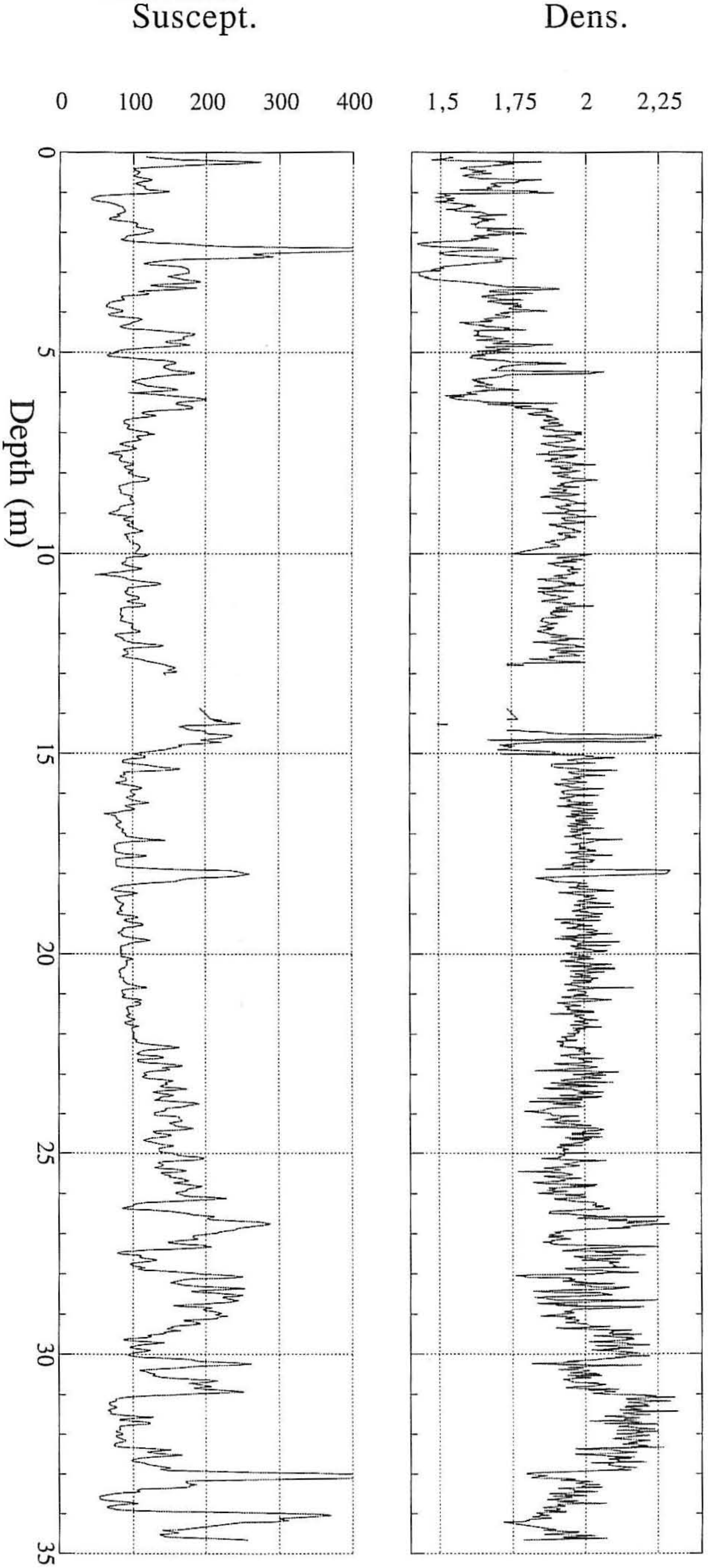

Section I to VIII
Lithology
Color
2.5Y 6/3
Detricarbonate Clayey silt
5Y 5/1
brownish layer
5Y 4/2
Clay w. some silty intervals
silty layer
7.5 YR 4/2
5Y 4/2
Silty clay
5Y 4/1
Silty clay
5Y 3/2
w. varying amounts of detricarbonate
5Y 4/1
blackish spots
blackish layer
5Y 5/1
reddish layers (2.5Y 3/2)
5Y 4/1
pure Detricarbonate (clayey)
2.5Y 5/2
black layer (w. sand and gravel)
5Y 5/2
interval with coarse grained detricarbonate
Silty clay
homogeneous w. detricarbonate
5Y 5/1
coarse grained layer
large sandfilled pocket
Silty-clayey Detricarbonate layer
5Y 4/1
fining up interval
Sandlayer, sharp contacts
5Y 3/1
Silty clay
5Y 4/3
w. detricarbonate
5Y 5/1
Detrital carbonate (fine grained)
w. sand layers and pockets
Section IX to XVI
Lithology
Color
5Y 5/1
Fine grained detricarbonate
5Y 4/1
w. abundant sand pockets and layers
(quartz etc)
5Y 5/1
5Y 4/1
black layer
5Y 5/1
dropstone, 2cm
5Y 4/1
Foram. and nanno bearing detricarbonate
Detricarbonate silty mud
Silty-clayey detricarbonate
Muddy nanno ooze
(sandy at the top)
Silty clay
Mud (laminated)
-fining upwards
Muddy nanno ooze
Alternating layers of Silty clay
and Mud (fining up sequences)
w. some detricarbonate
END OF CORE

Core MD 95-2023

lat: 50°58.32 N - long: 43°13.04 W
water depth: 4198 m
length: 34.68 m

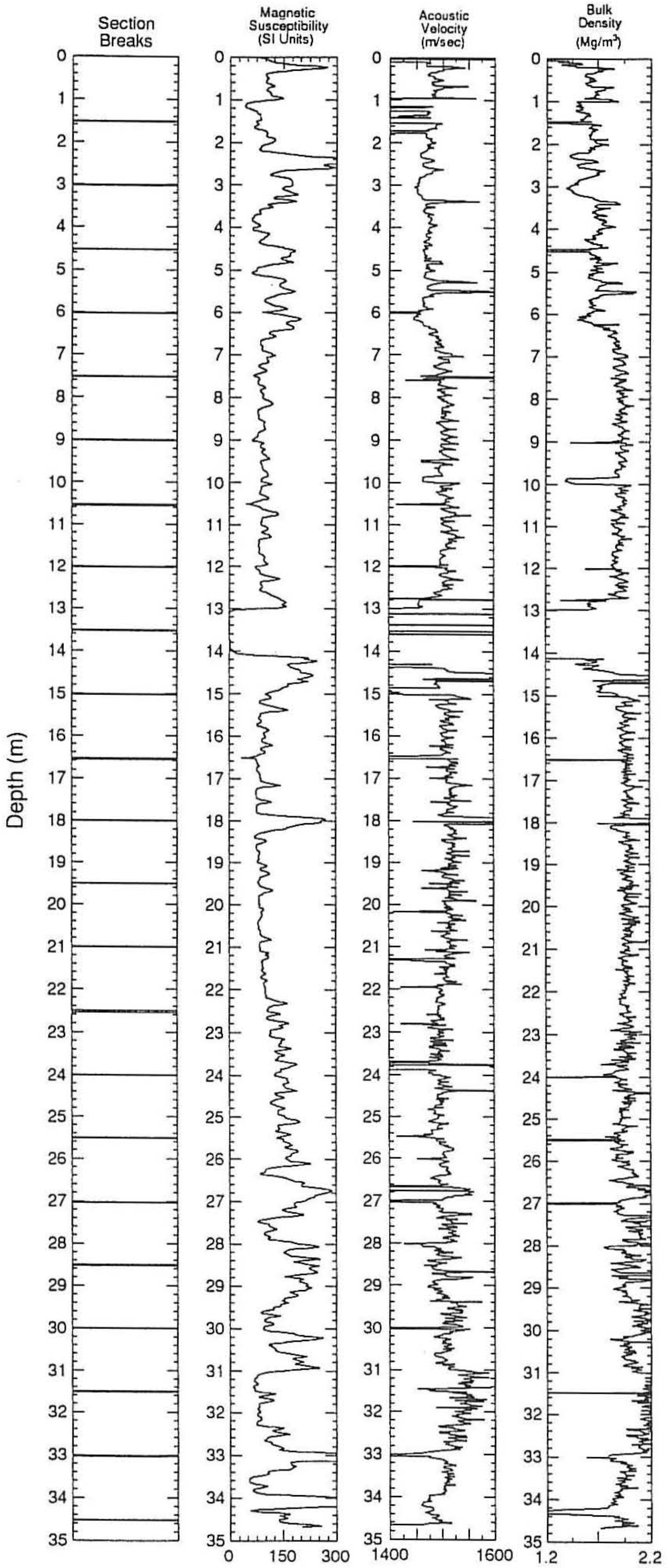




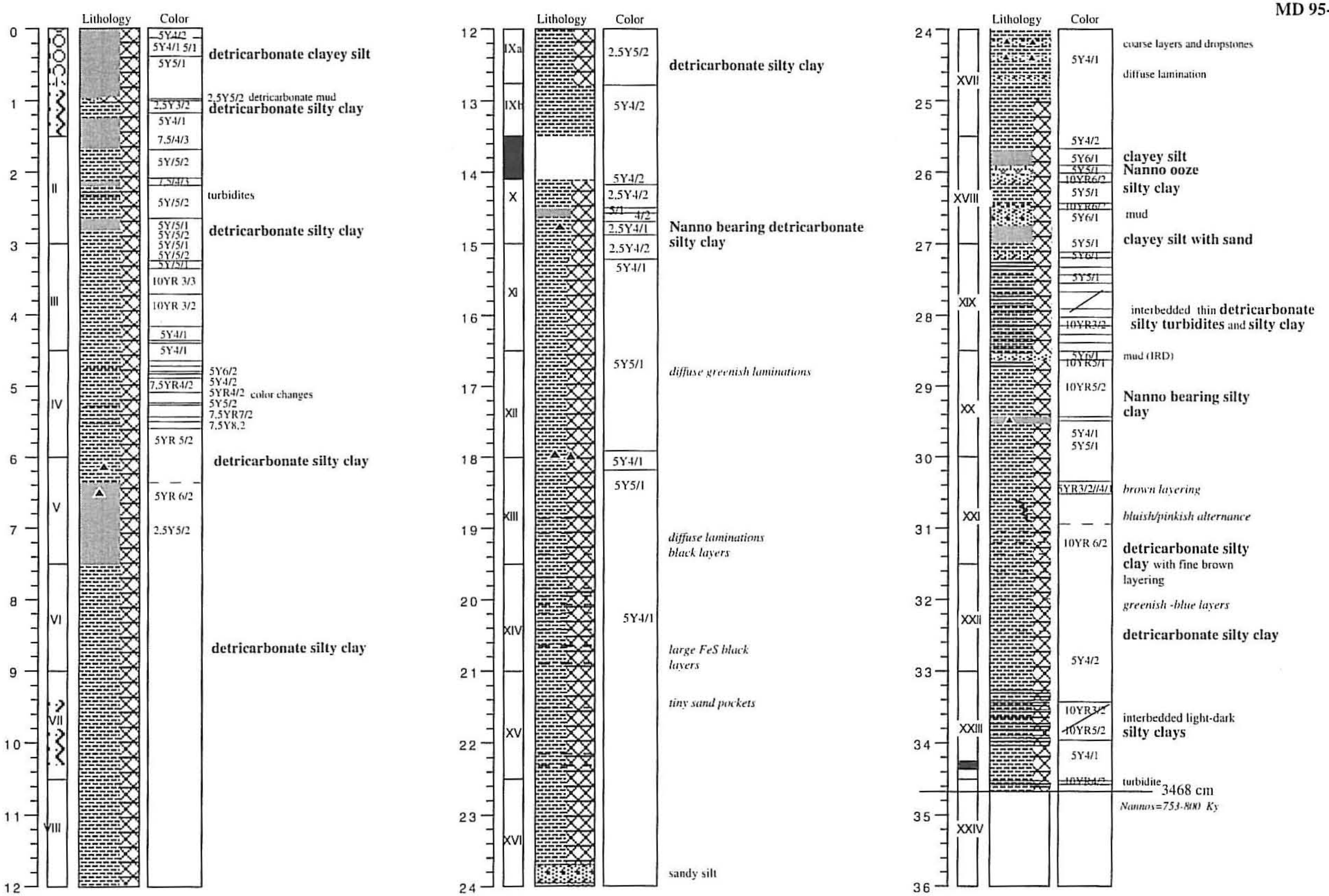

Suscept.
Dens.
L
0
100
200
300
400
1,5
1,75
2
2,25
Depth (m)
0
5
10
15
20
25
30
35

MD 95-2023

MD95-2023


Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
0
150
300
1400
1600
1.2
2.2

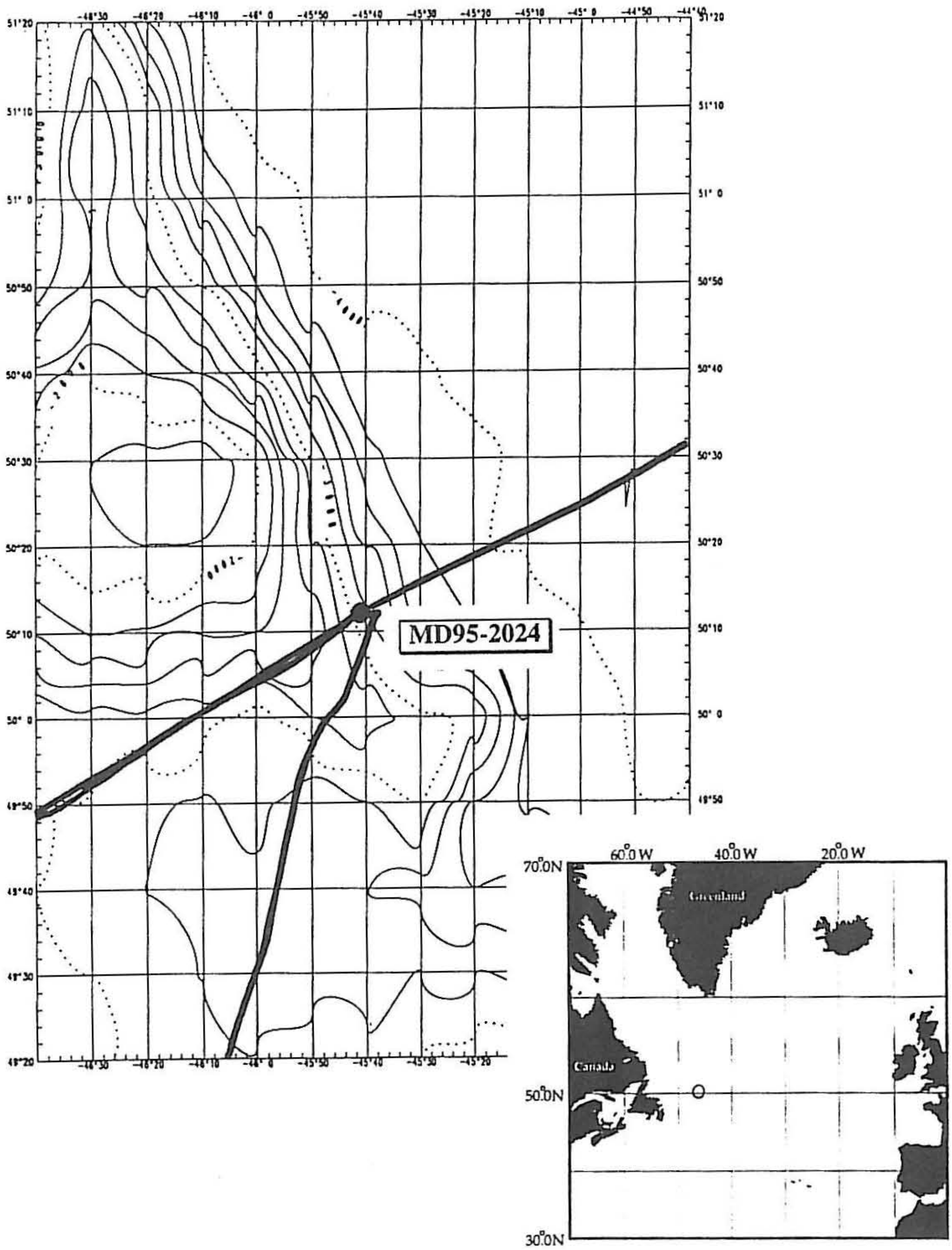
MD 95-2023

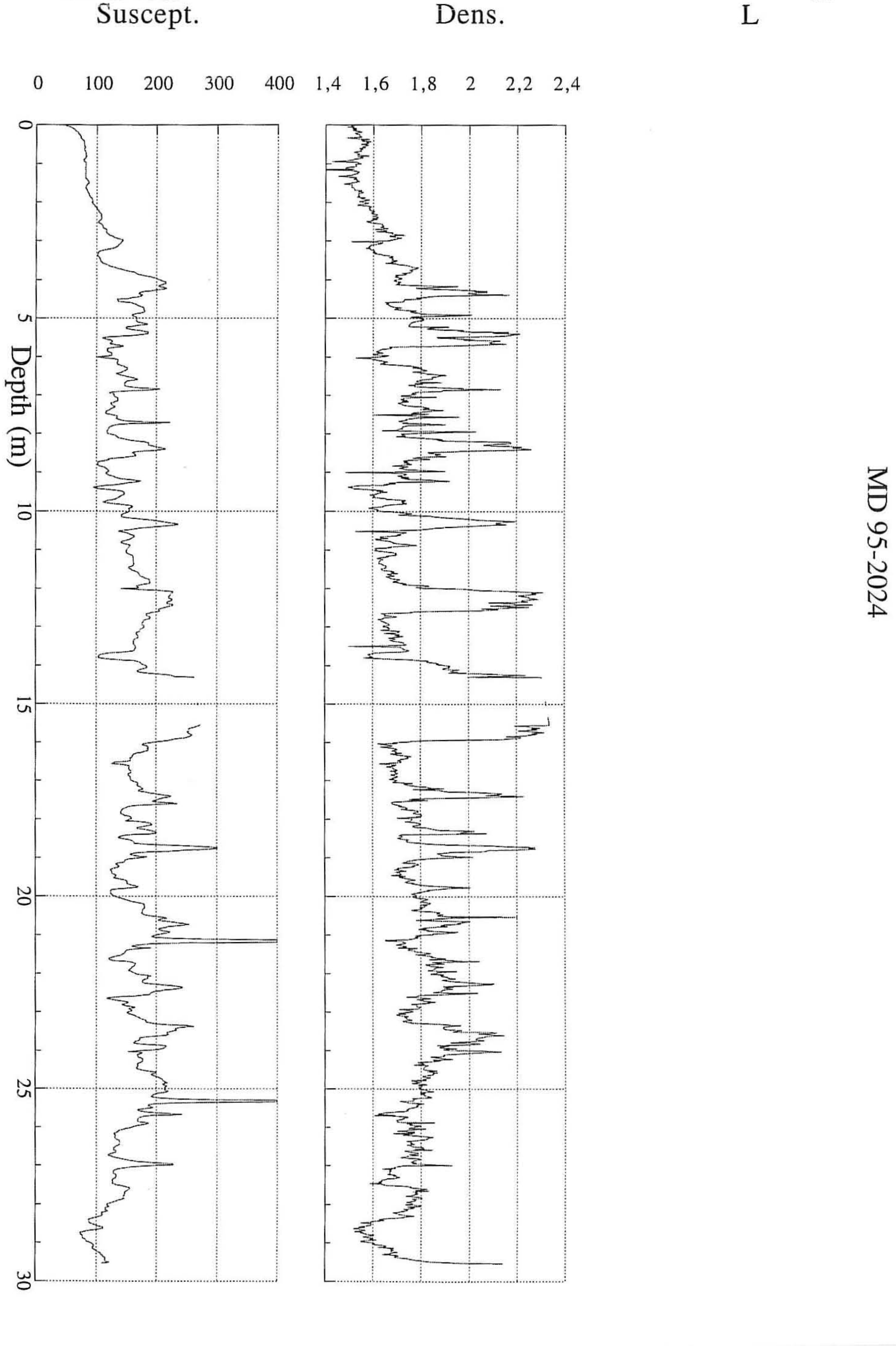


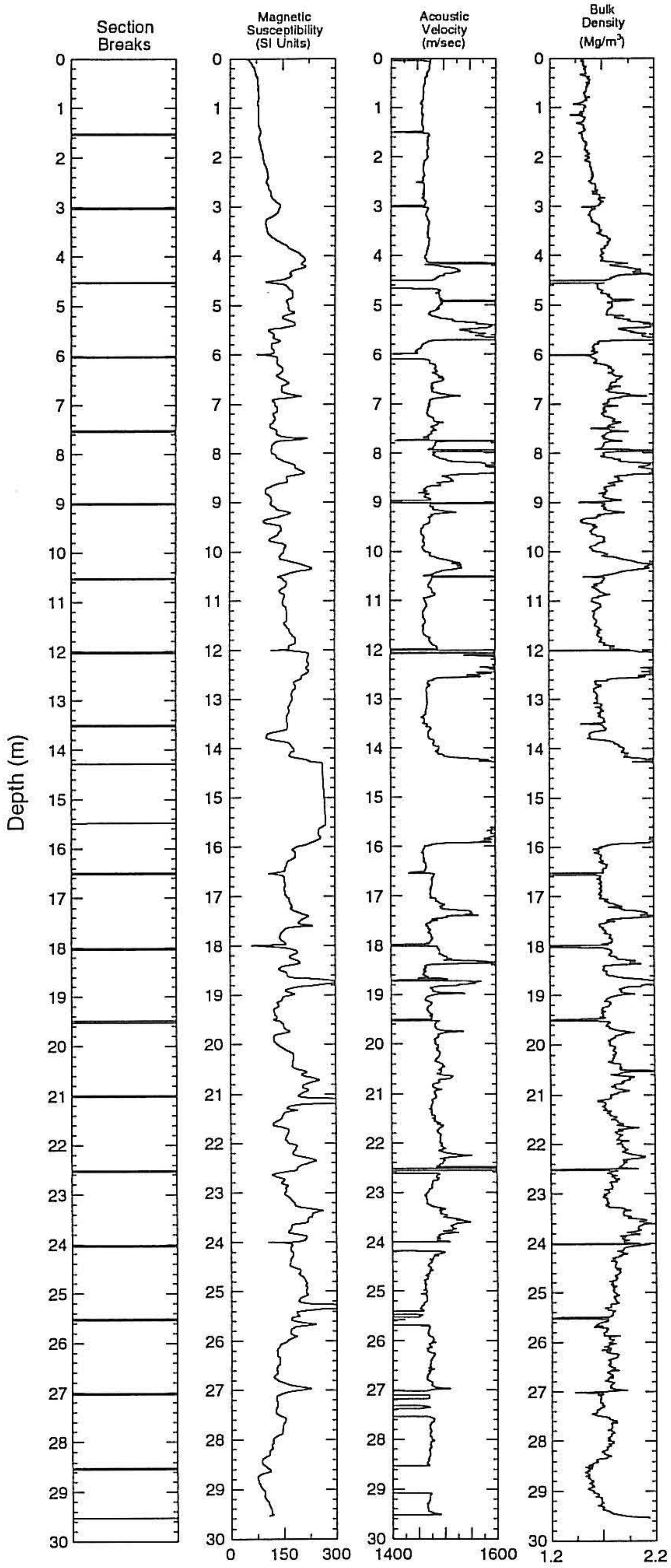
Lithology
Color
detricarbonate clayey silt
2.5Y5/2 detricarbonate mud
detricarbonate silty clay
turbidites
detricarbonate silty clay
color changes
detricarbonate silty clay
detricarbonate silty clay
detricarbonate silty clay
Nanno bearing detricarbonate silty clay
diffuse greenish laminations
diffuse laminations
black layers
large FeS black layers
tiny sand pockets
sandy silt
coarse layers and dropstones
diffuse lamination
clayey silt
Nanno ooze
silty clay
mud
clayey silt with sand
interbedded thin detricarbonate silty turbidites and silty clay
mud (IRD)
Nanno bearing silty clay
brown layering
bluish/pinkish alternance
detricarbonate silty clay with fine brown layering
greenish -blue layers
detricarbonate silty clay
interbedded light-dark silty clays
turbidite
3468 cm
Nannos=753-800 Ky

Core MD 95-2024

lat: 50°12.40 N - long: 45°41.22 W
water depth: 3539 m
length: 29.52 m




Suscept.
Dens.
L
0 100 200 300 400
1,4 1,6 1,8 2 2,2 2,4
Depth (m)
0 5 10 15 20 25 30
MD 95-2024

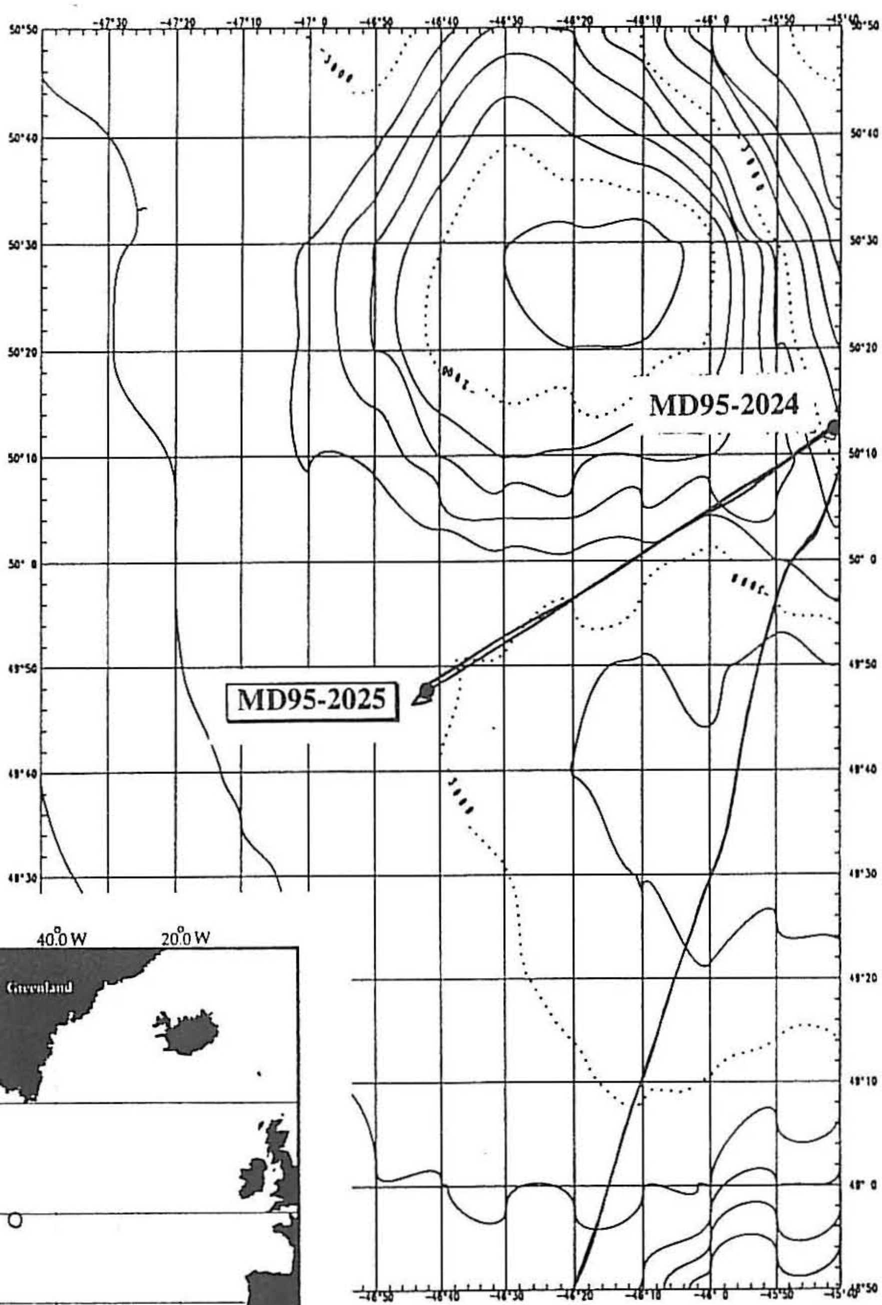

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
0 150 300
1400 1600
1.2 2.2

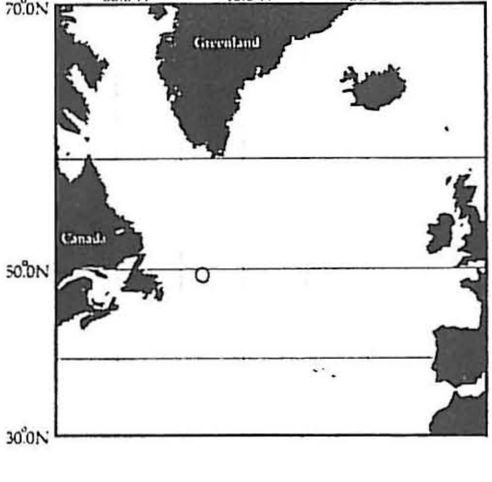
Core MD95-2024 not opened on board.

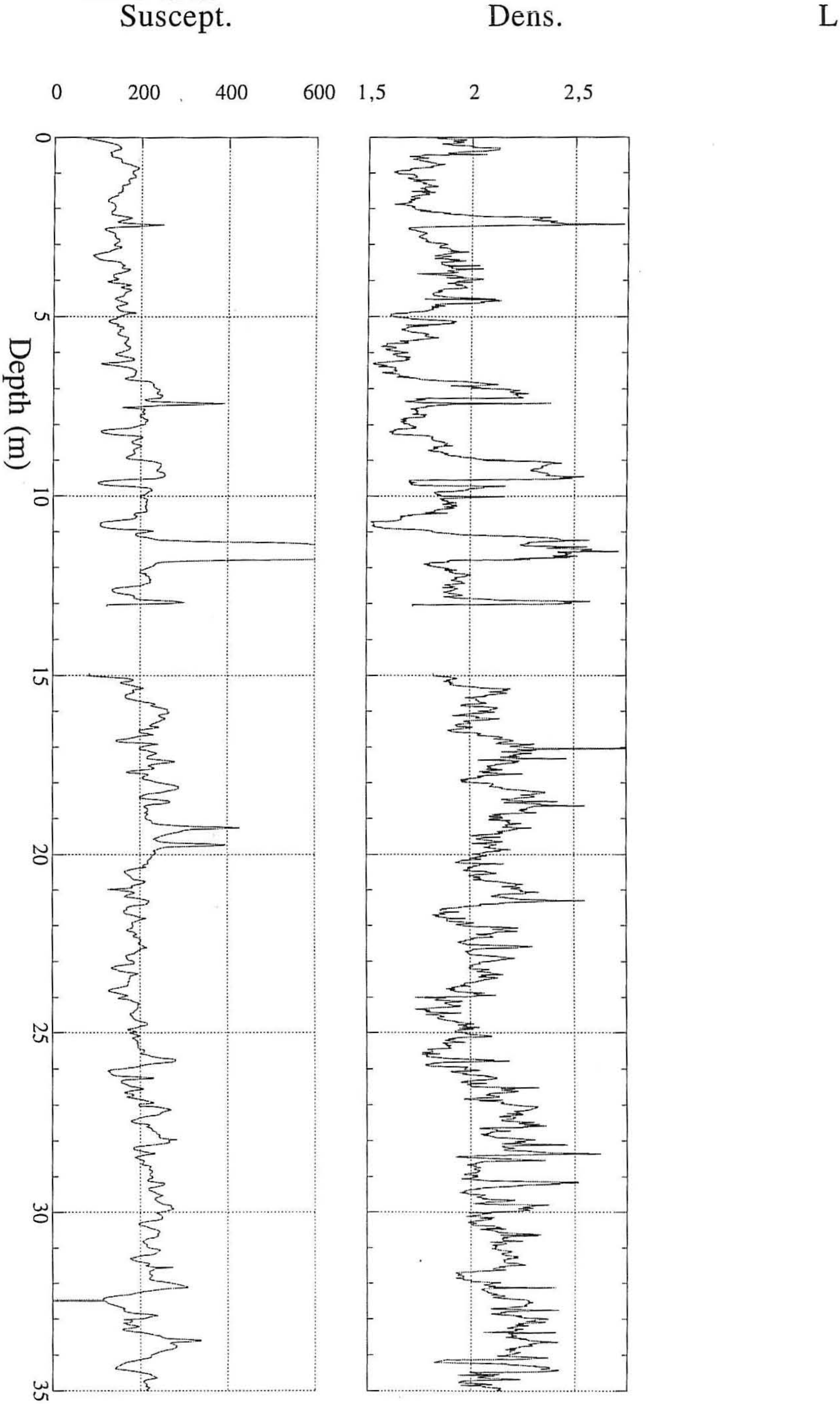
No sediment description.

Core MD 95-2025

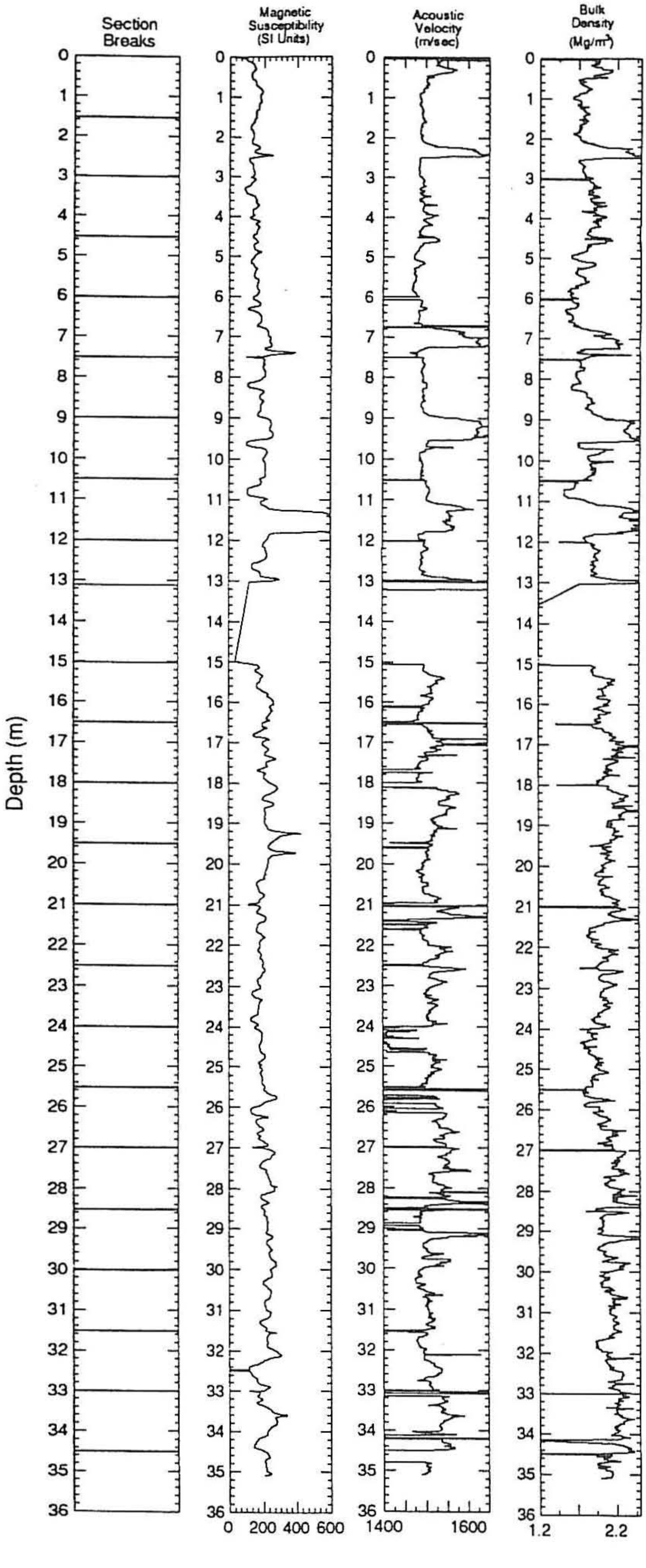
lat: 49°47.65 N - long: 46°41.85 W
water depth: 3009 m
length: 35.12 m







MD 95-2025

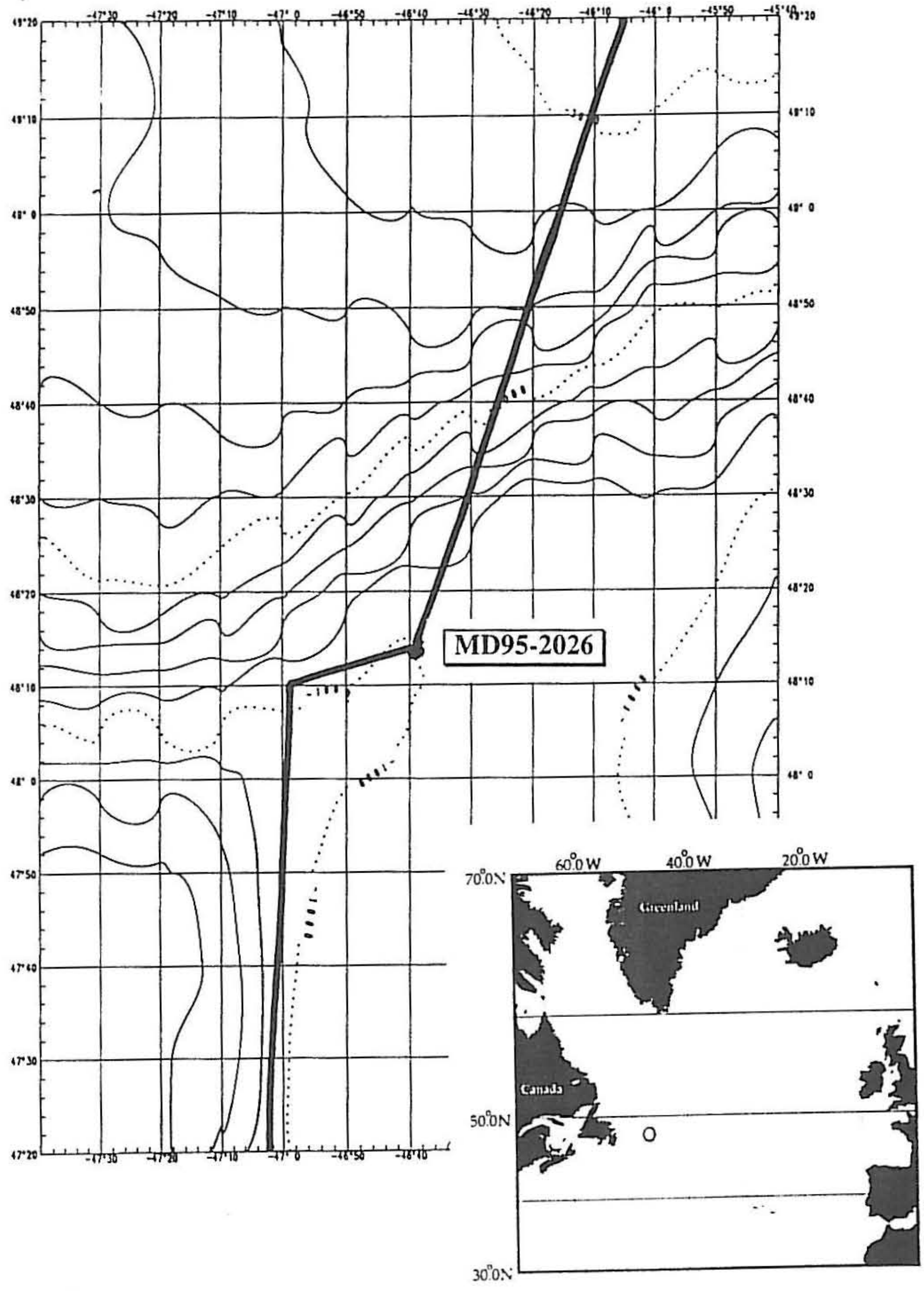

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0 200 400 600
1400 1600
1.2 2.2

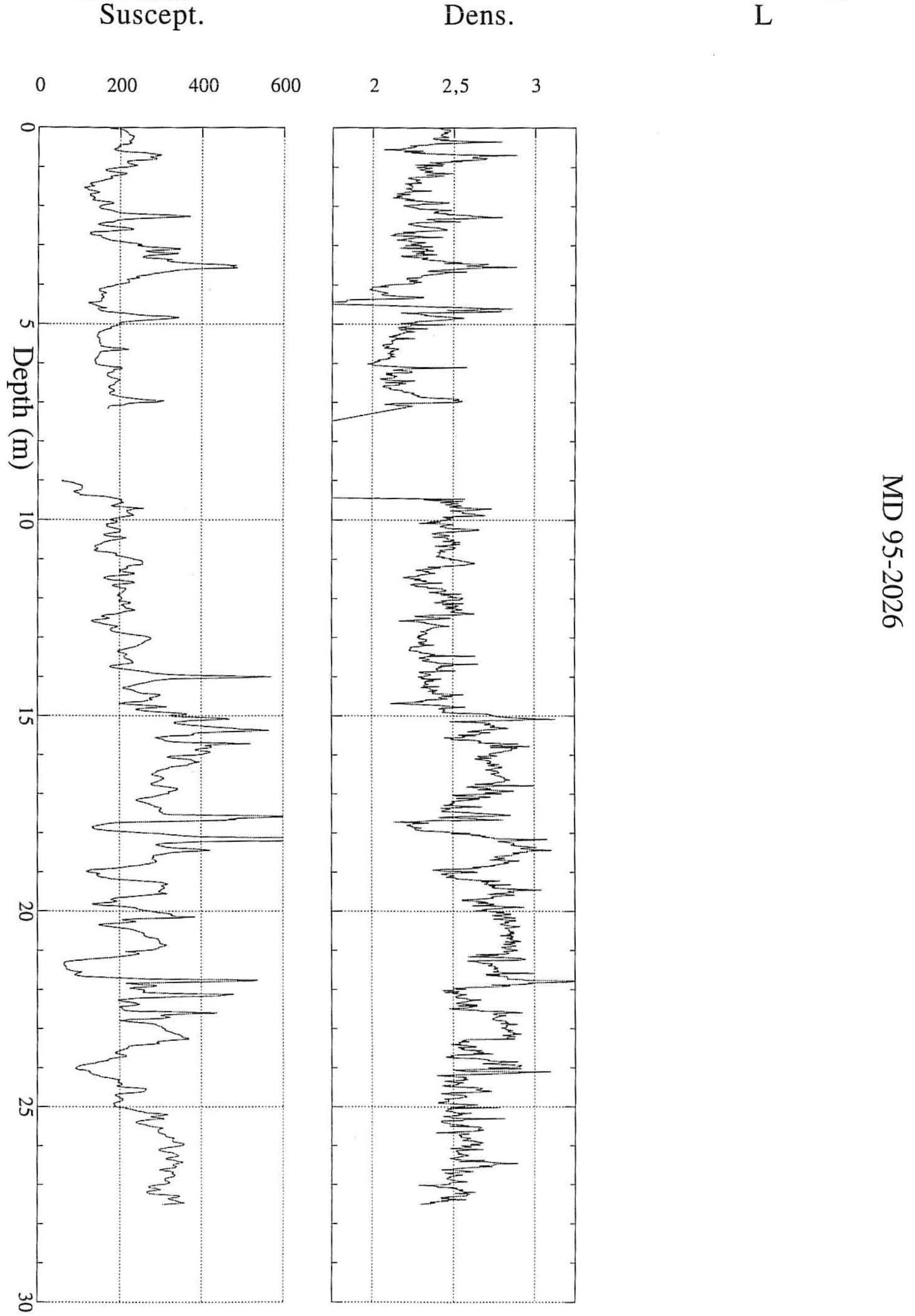
Core MD95-2025 not opened on board.

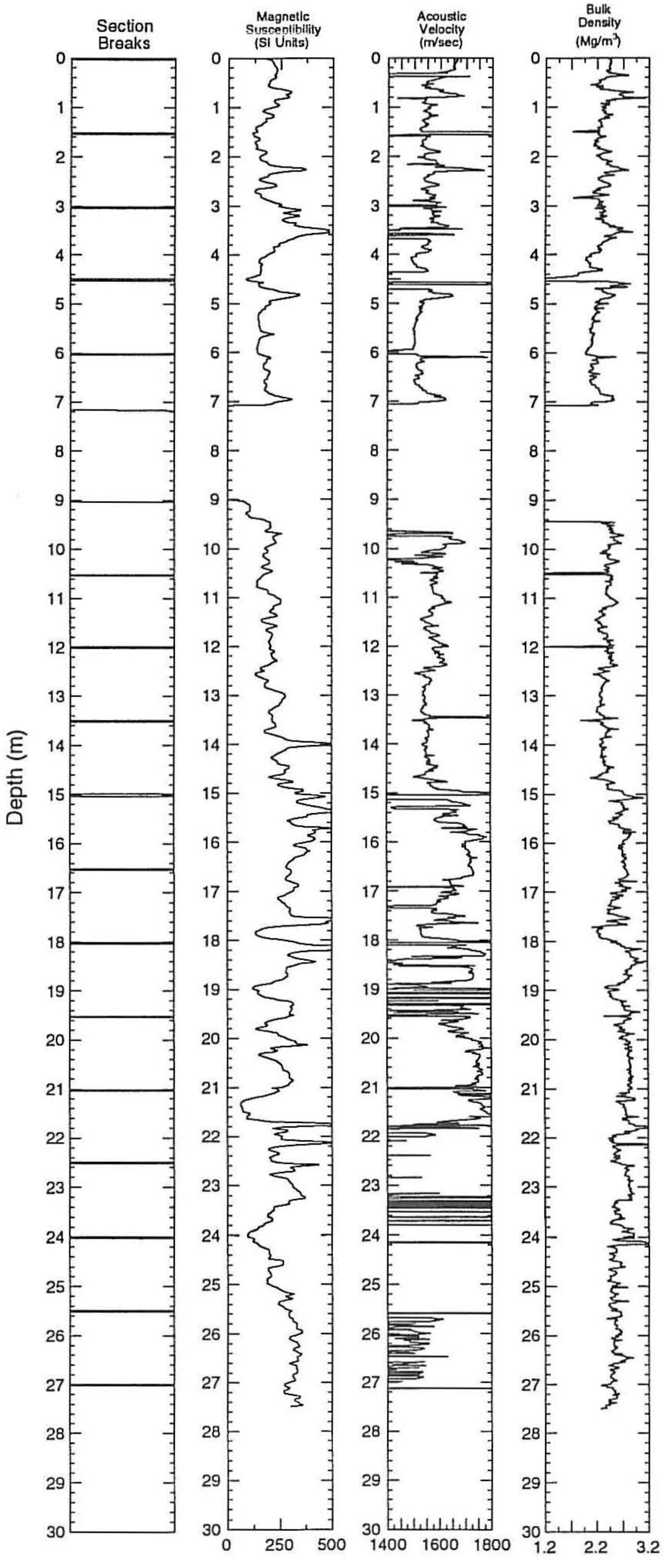
No sediment description.

Core MD 95-2026

lat: 48°13.62 N - long: 46°39.39 W
water depth: 878 m
length: 27.91 m




Suscept.
Dens.
L
0 200 400 600
2 2,5 3
Depth (m)
0 5 10 15 20 25 30
MD 95-2026

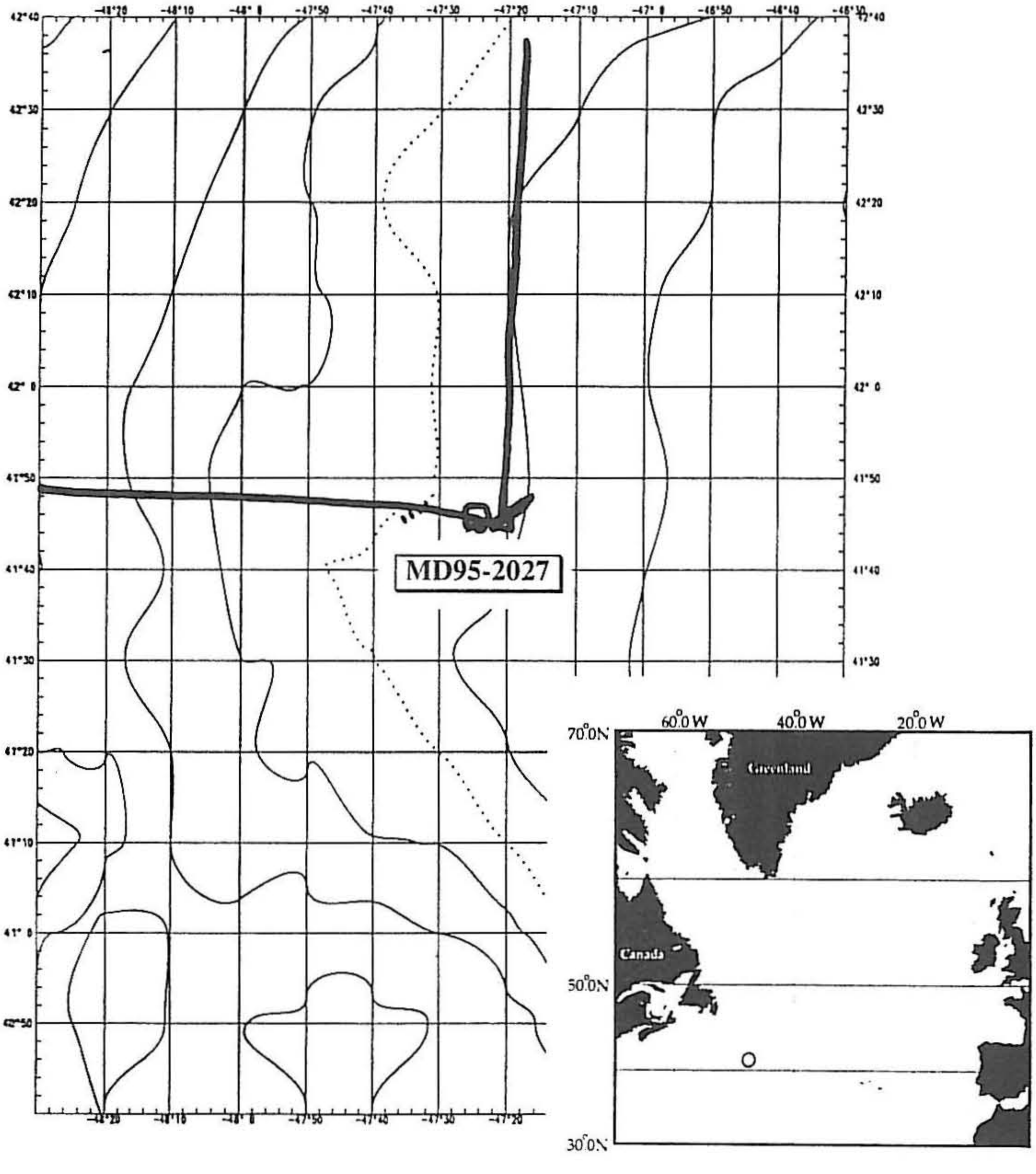

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
0 250 500
1400 1600 1800
1.2 2.2 3.2

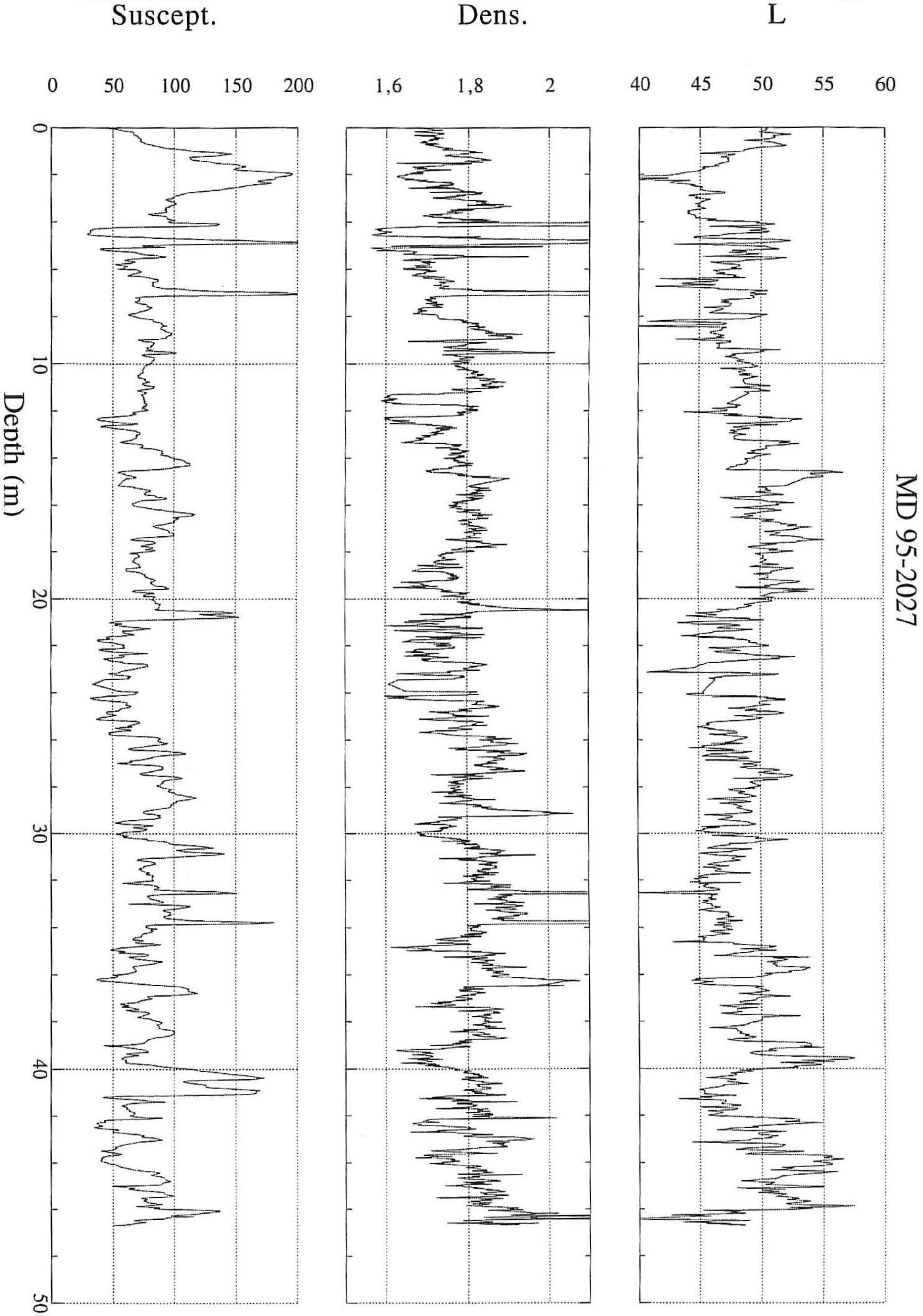
Core MD95-2026 not opened on board.

No sediment description.

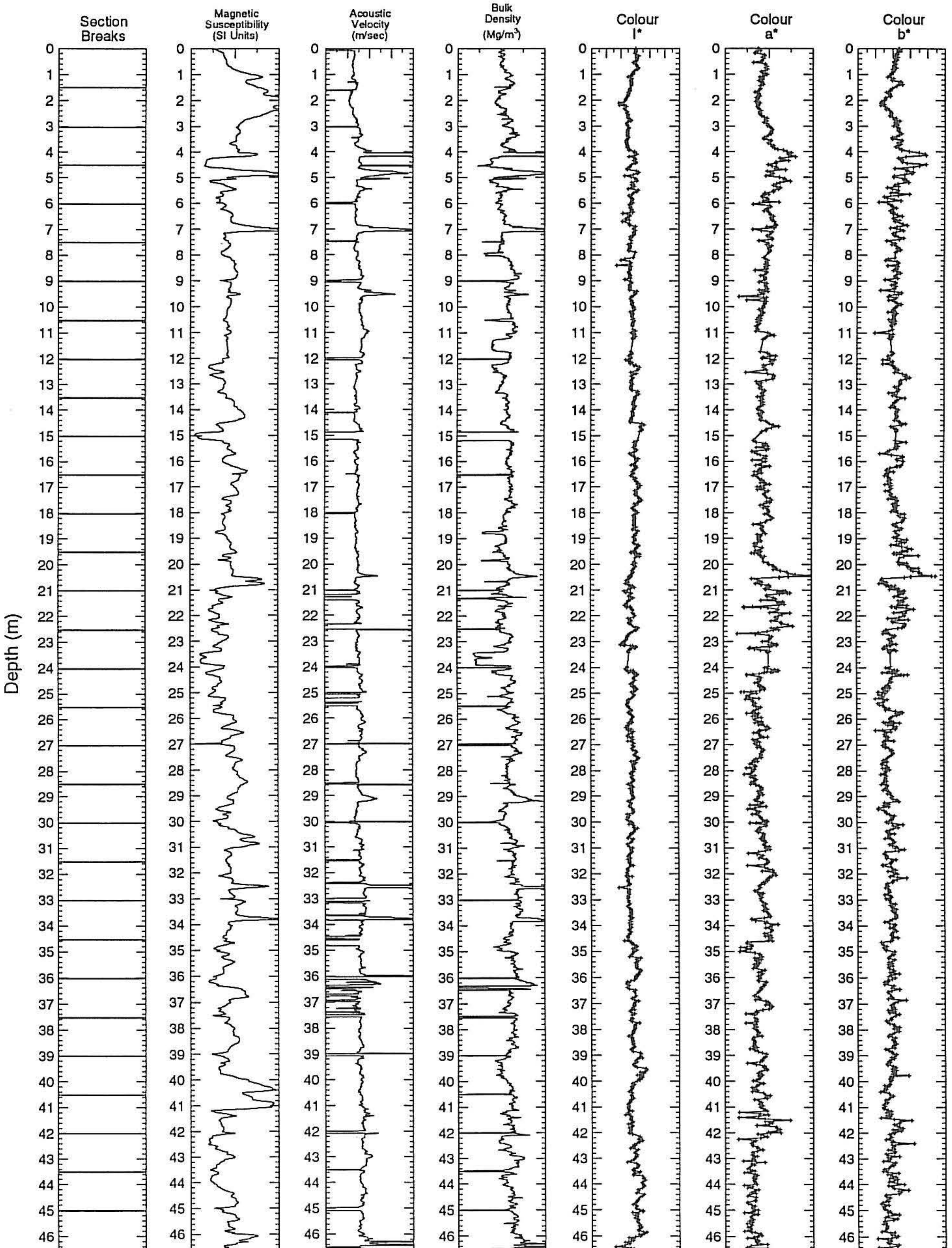
Core MD 95-2027

lat: 41°44.67 N - long: 47°24.79 W
water depth: 4112 m
length: 47.67 m

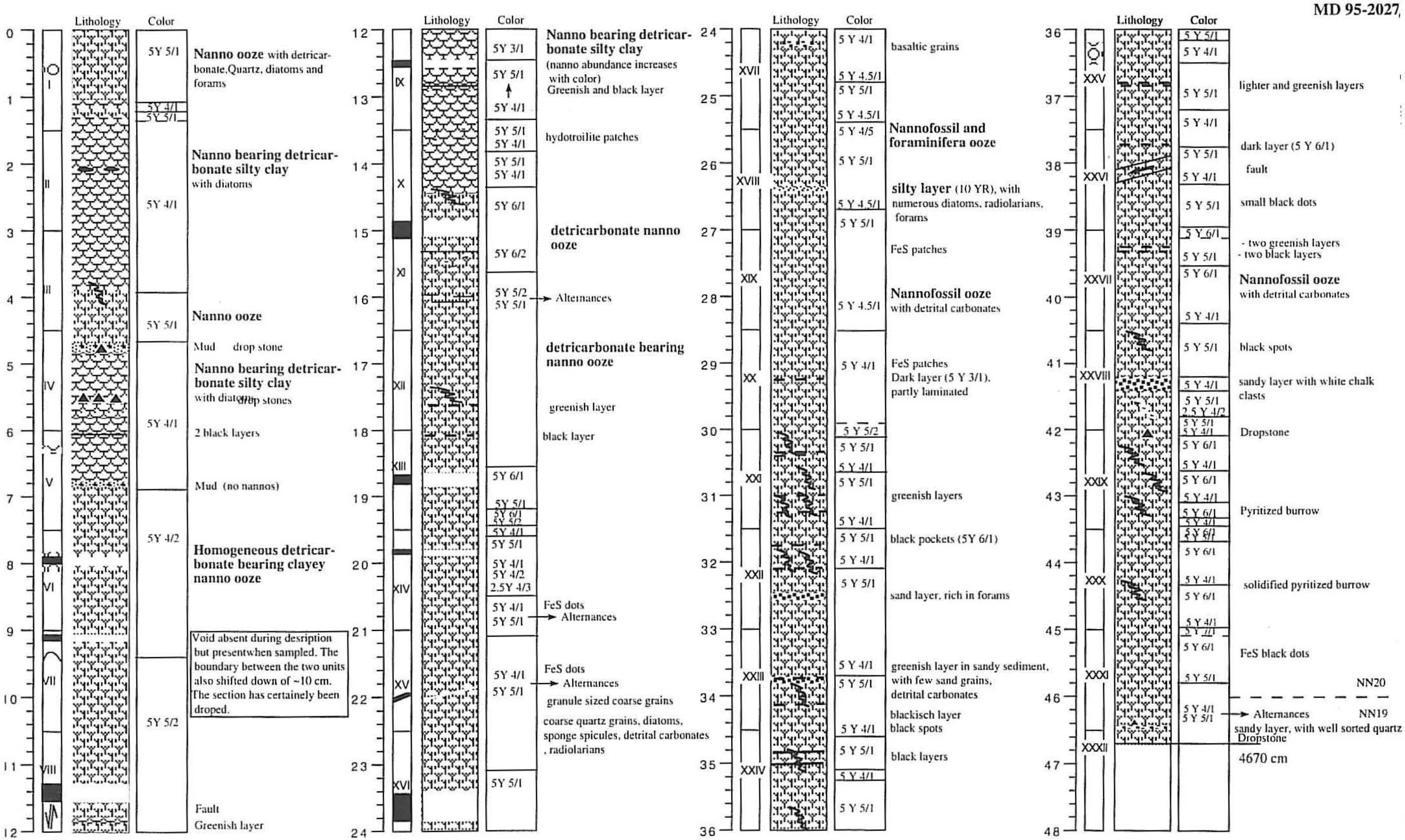



Suscept.
Dens.
L
0 50 100 150 200
1,6 1,8 2
40 45 50 55 60
Depth (m)
0 10 20 30 40 50
MD 95-2027

MD95-2027

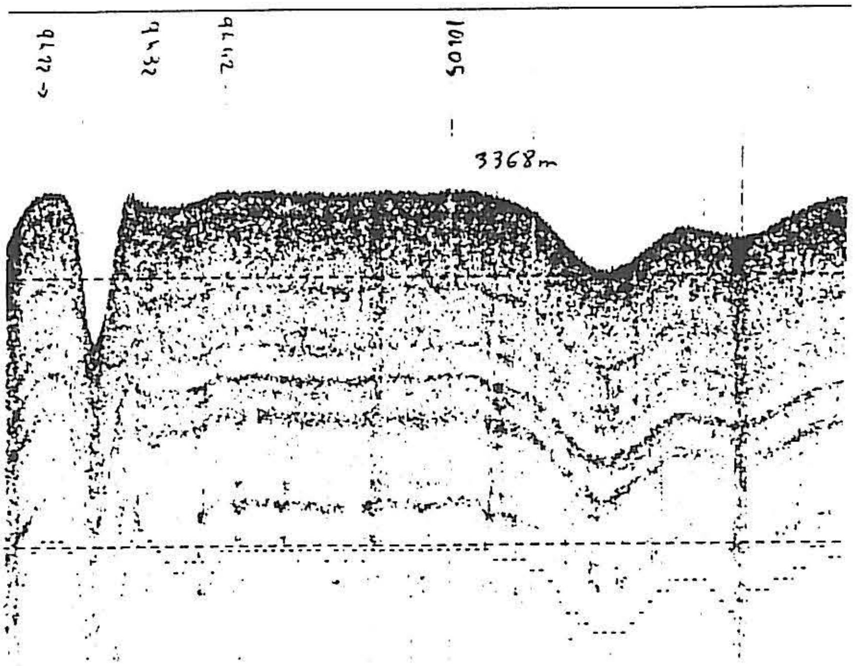


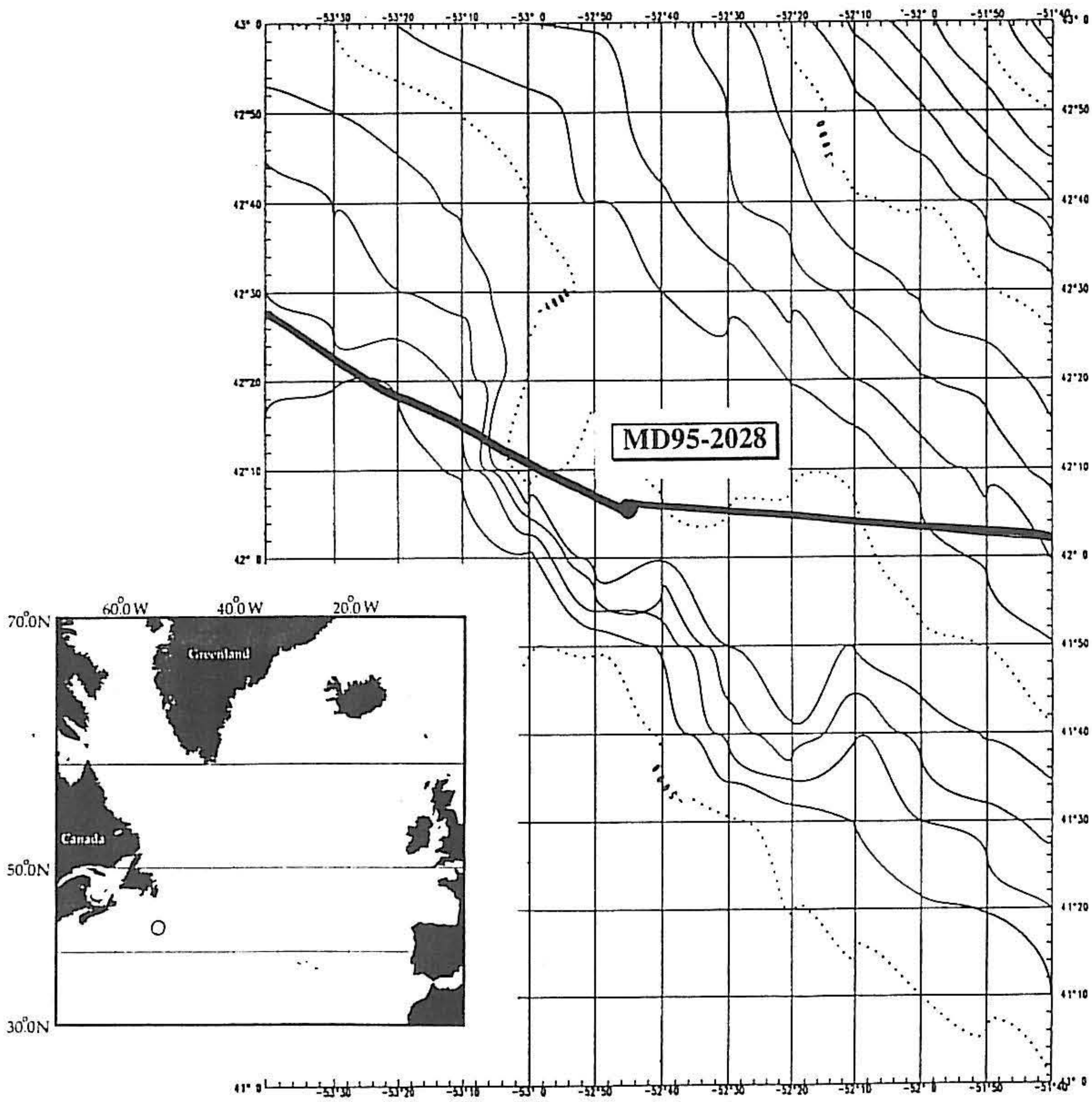
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

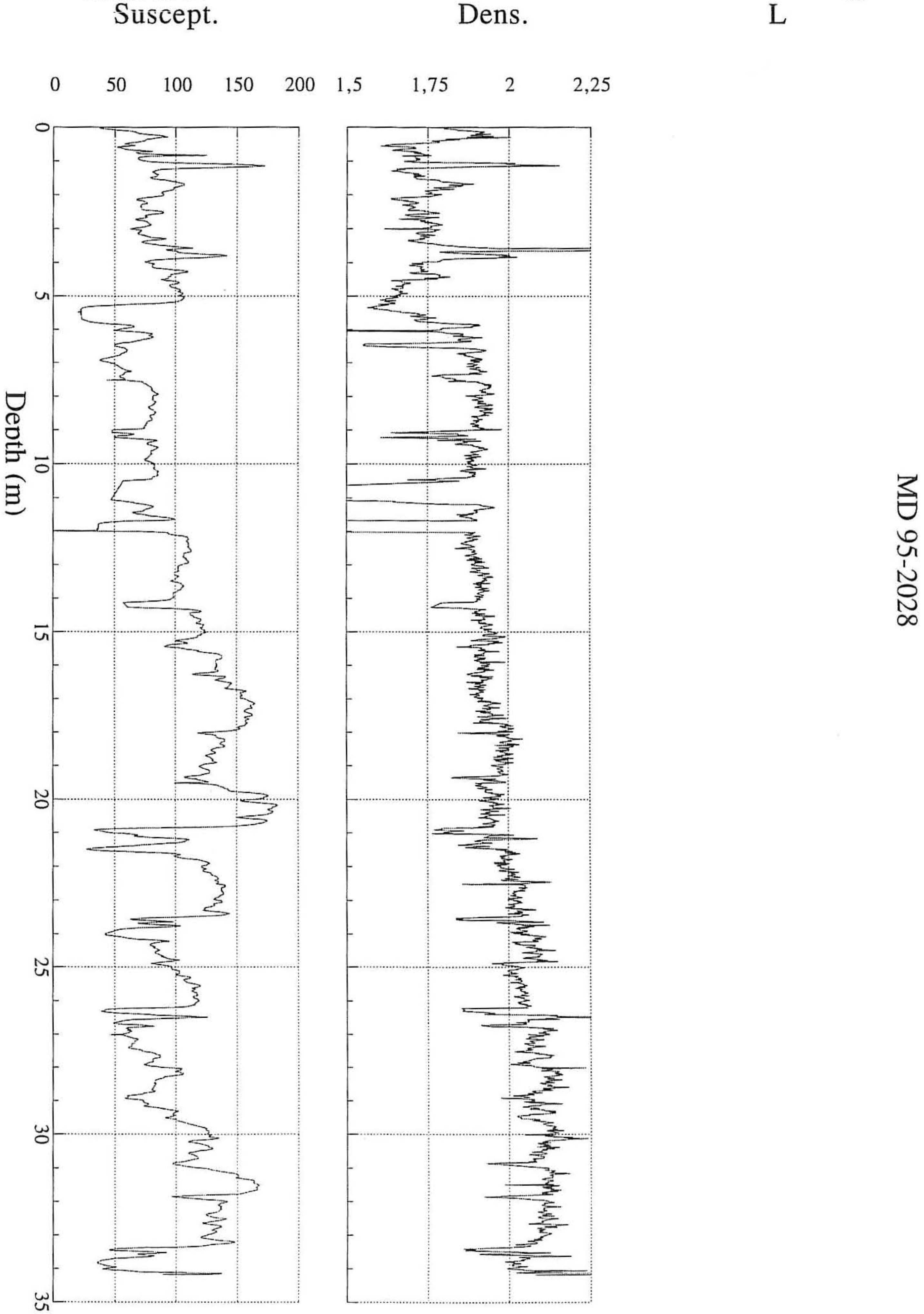

MD 95-2027
Lithology
Color
5Y 5/1
Nanno ooze with detricar-bonate,Quartz, diatoms and forams
5Y 4/1
5Y 5/1
Nanno bearing detricar-bonate silty clay
with diatoms
5Y 4/1
Nanno ooze
5Y 5/1
Mud drop stone
Nanno bearing detricar-bonate silty clay
with diatoms drop stones
5Y 4/1
2 black layers
Mud (no nannos)
5Y 4/2
Homogeneous detricar-bonate bearing clayey nanno ooze
Void absent during desription but presentwhen sampled. The boundary between the two units also shifted down of ~10 cm. The section has certainely been droped.
5Y 5/2
Fault
Greenish layer
Nanno bearing detricar-bonate silty clay
(nanno abundance increases with color)
Greenish and black layer
5Y 3/1
5Y 5/1
5Y 4/1
hydotroilite patches
5Y 6/1
detricarbonate nanno ooze
5Y 6/2
5Y 5/2
5Y 5/1
Alternances
detricarbonate bearing nanno ooze
greenish layer
black layer
5Y 6/1
2.5Y 4/3
FeS dots
Alternances
FeS dots
Alternances
granule sized coarse grains
coarse quartz grains, diatoms, sponge spicules, detrital carbonates , radiolarians
basaltic grains
5 Y 4/1
5 Y 4.5/1
5 Y 5/1
5 Y 4/5
Nannofossil and foraminifera ooze
silty layer (10 YR), with numerous diatoms, radiolarians, forams
FeS patches
Nannofossil ooze
with detrital carbonates
FeS patches
Dark layer (5 Y 3/1), partly laminated
5 Y 5/2
greenish layers
black pockets (5Y 6/1)
sand layer, rich in forams
greenish layer in sandy sediment, with few sand grains, detrital carbonates
blackisch layer
black spots
black layers
lighter and greenish layers
dark layer (5 Y 6/1)
fault
small black dots
- two greenish layers
- two black layers
Nannofossil ooze
with detrital carbonates
black spots
sandy layer with white chalk clasts
2.5 Y 4/2
Dropstone
Pyritized burrow
solidified pyritized burrow
FeS black dots
NN20
Alternances
NN19
sandy layer, with well sorted quartz
Dropstone
4670 cm

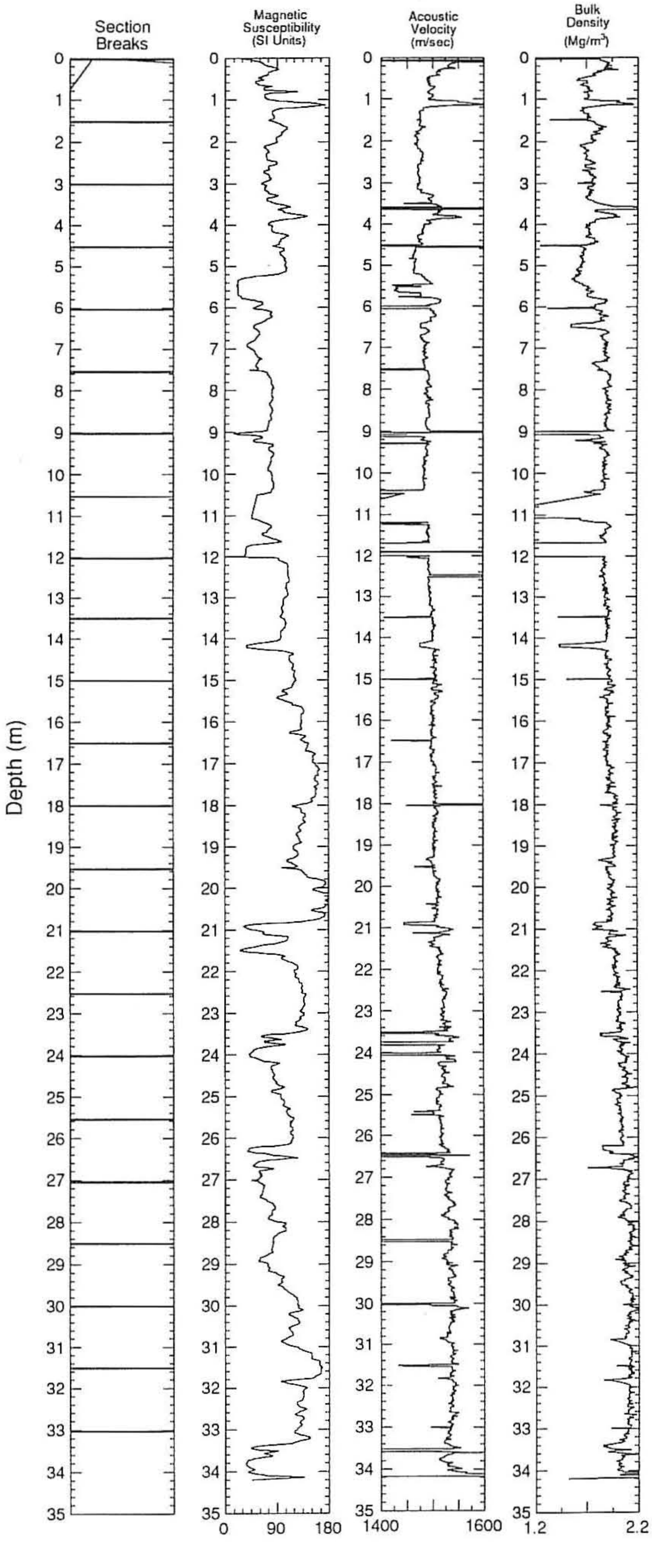
Core MD 95-2028

lat: 42°05.99 N - long: 52°44.85 W
water depth: 3368 m
length: 34.2 m






Suscept.
Dens.
L
0 50 100 150 200
1,5 1,75 2 2,25
0 5 10 15 20 25 30 35
Depth (m)
MD 95-2028

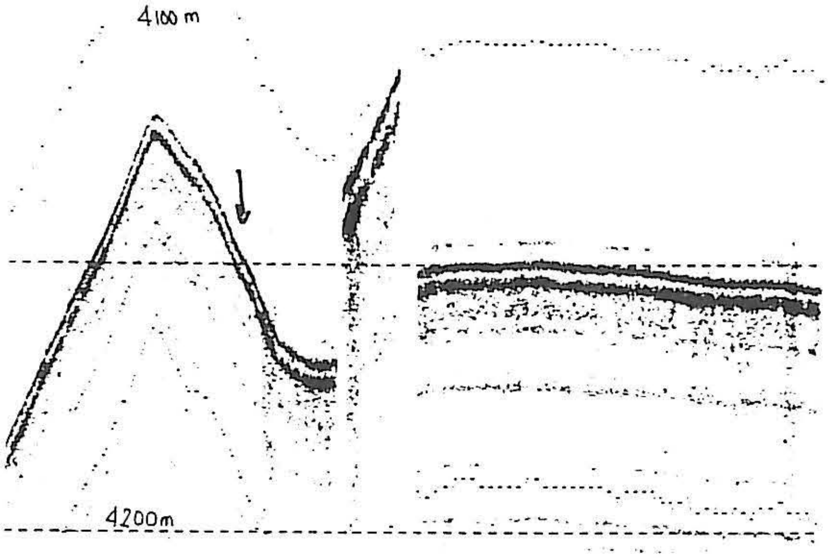

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
90
180
1400
1600
1.2
2.2

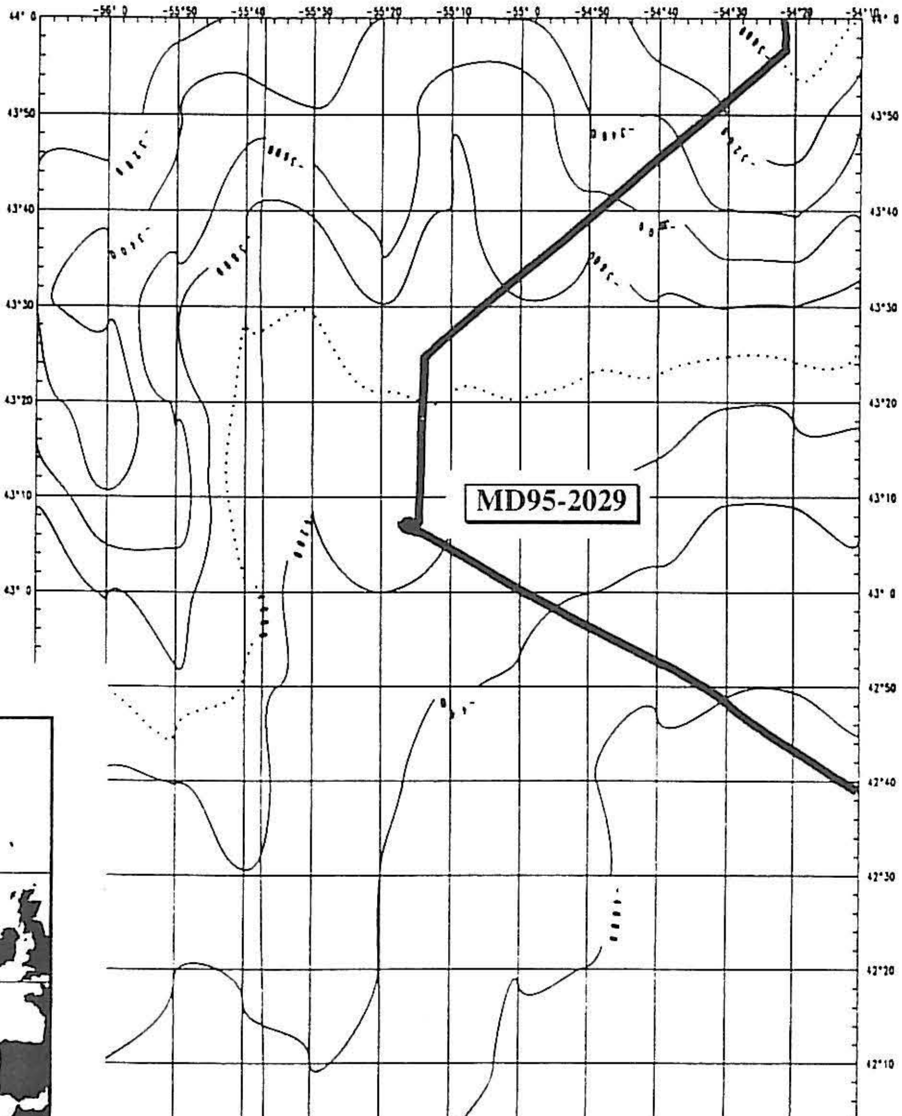
Core MD95-2028 not opened on board.

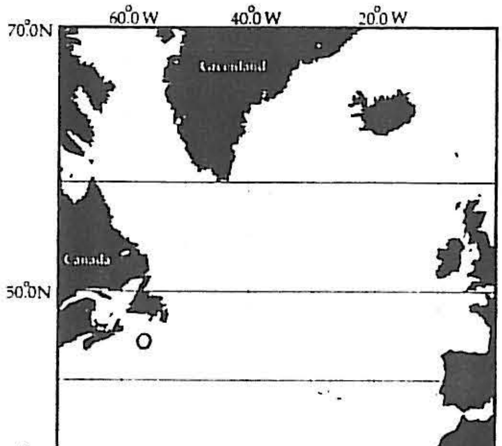
No sediment description.

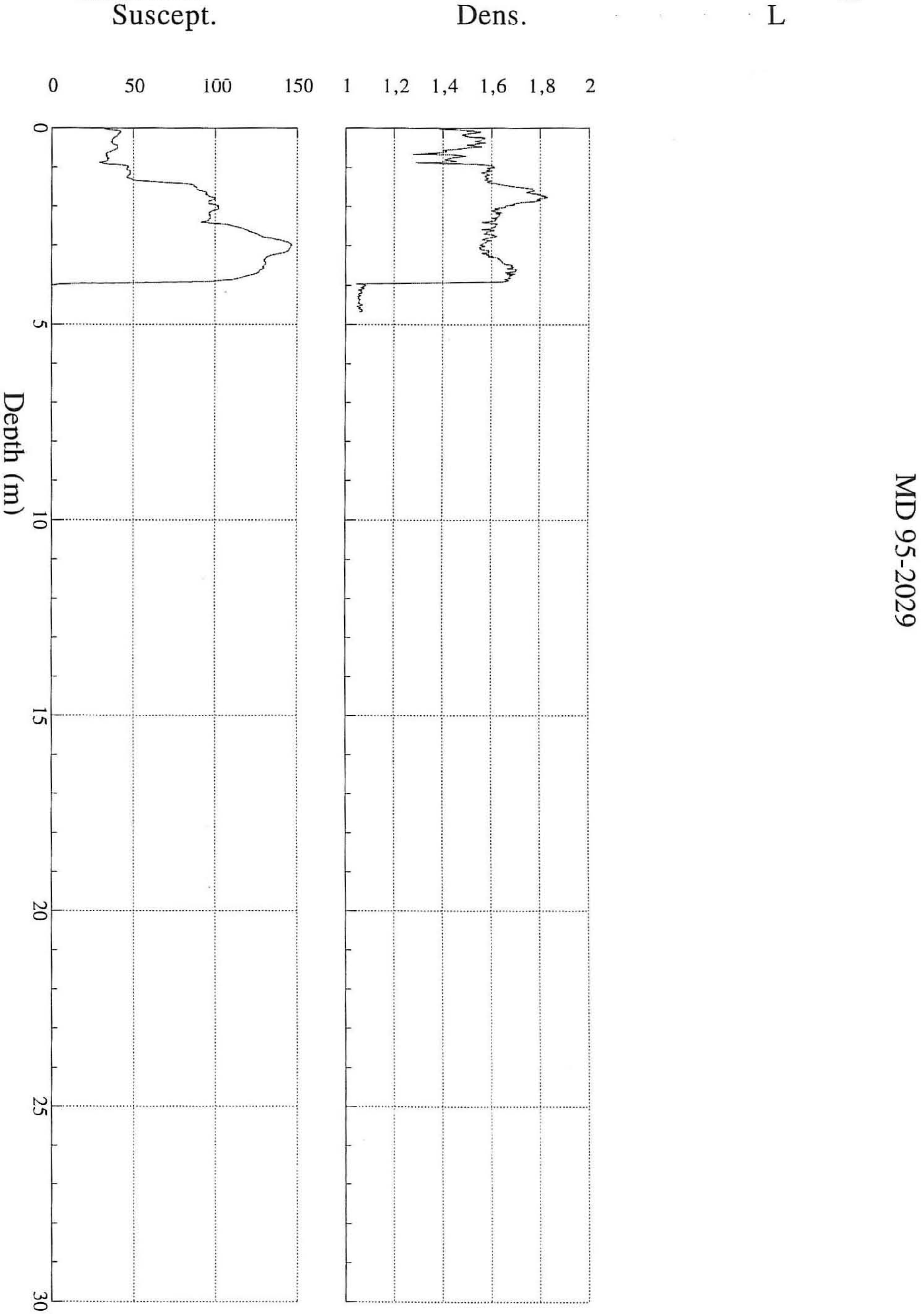
Core MD 95-2029

lat: 43°06.78 N - long: 55°15.96 W
water depth: 4156 m
length: 35.1 m








Suscept.
Dens.
L
0
50
100
150
1
1,2
1,4
1,6
1,8
2
0
5
10
15
20
25
30
Depth (m)
MD 95-2029

Core MD95-2029 not opened on board.

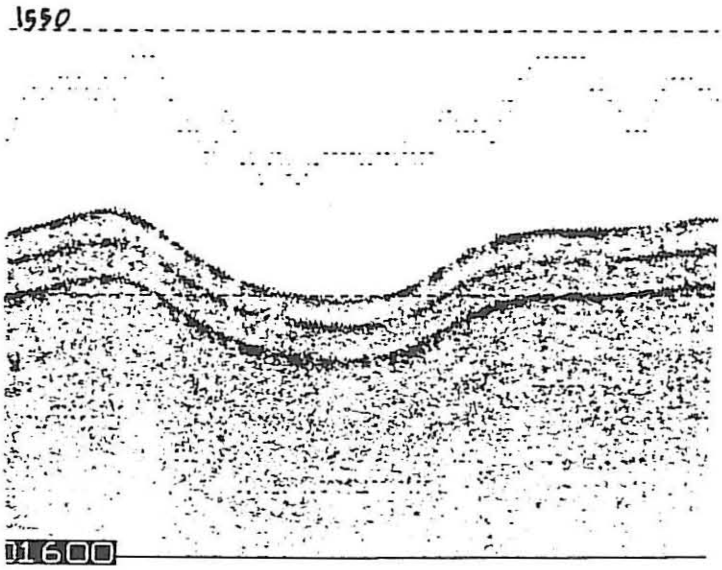
No sediment description.

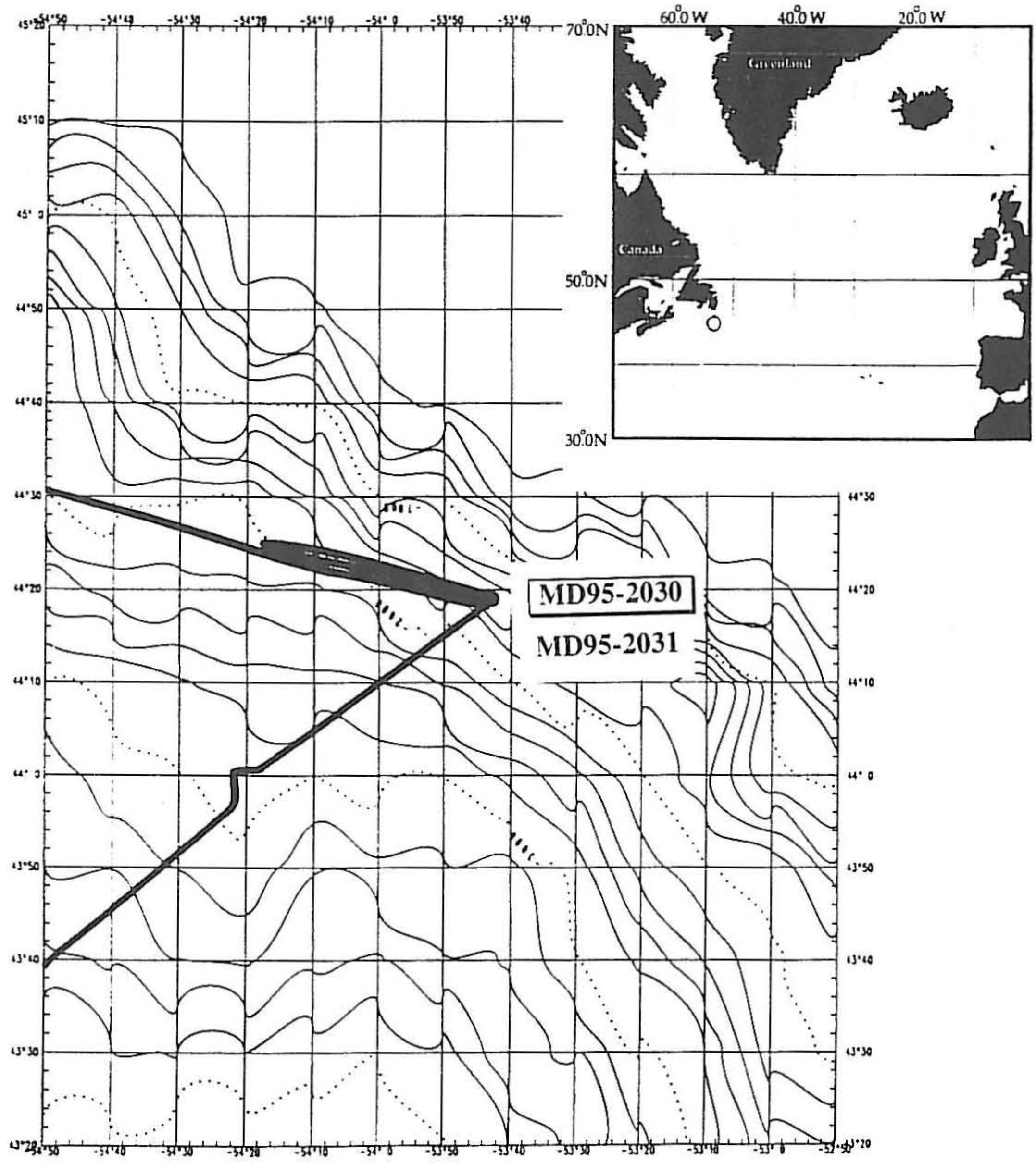
Core MD 95-2030

lat: 44°19.14 N - long: 53°43.44 W

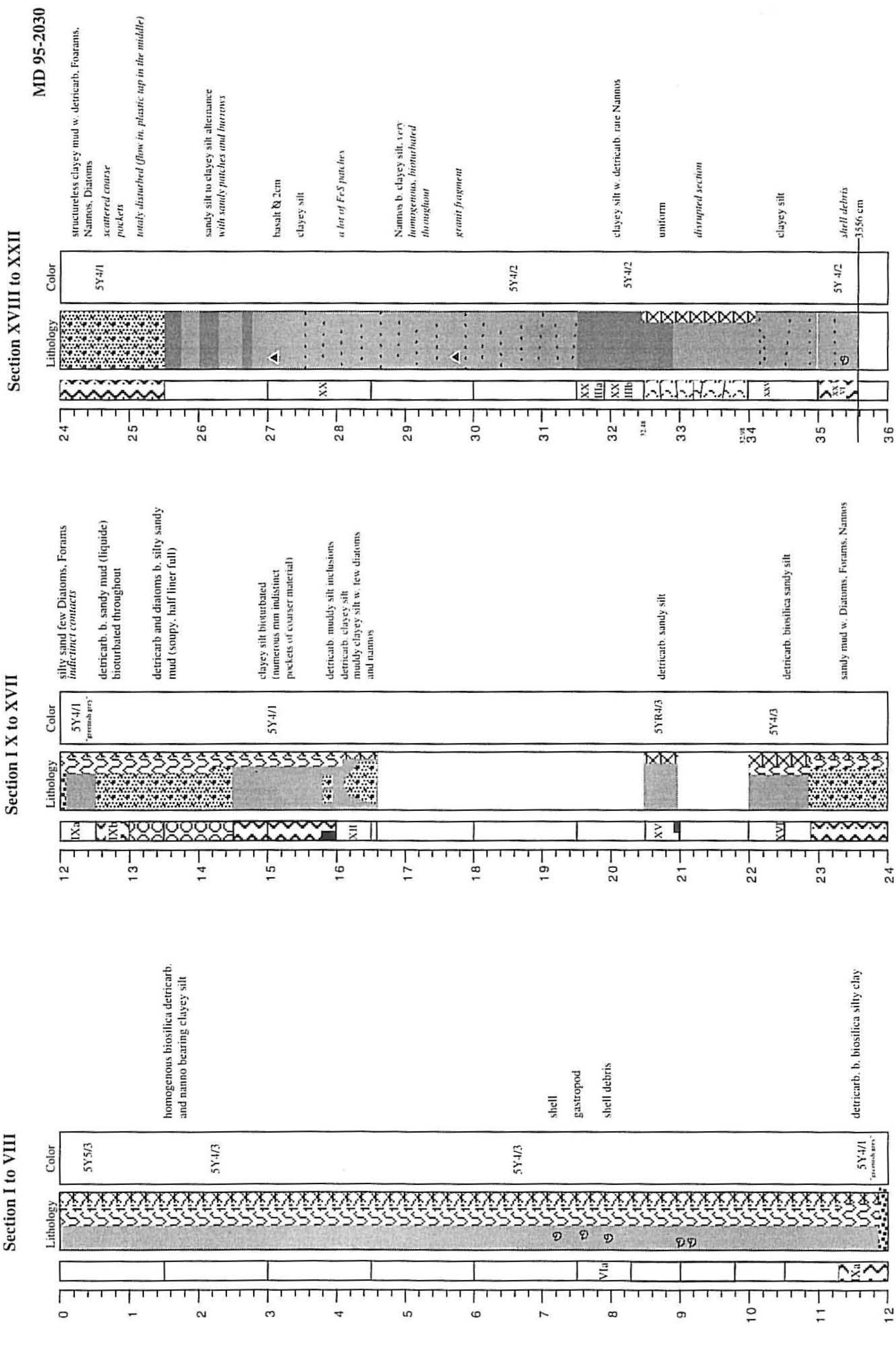
water depth: 1573 m

length: 35.59 m



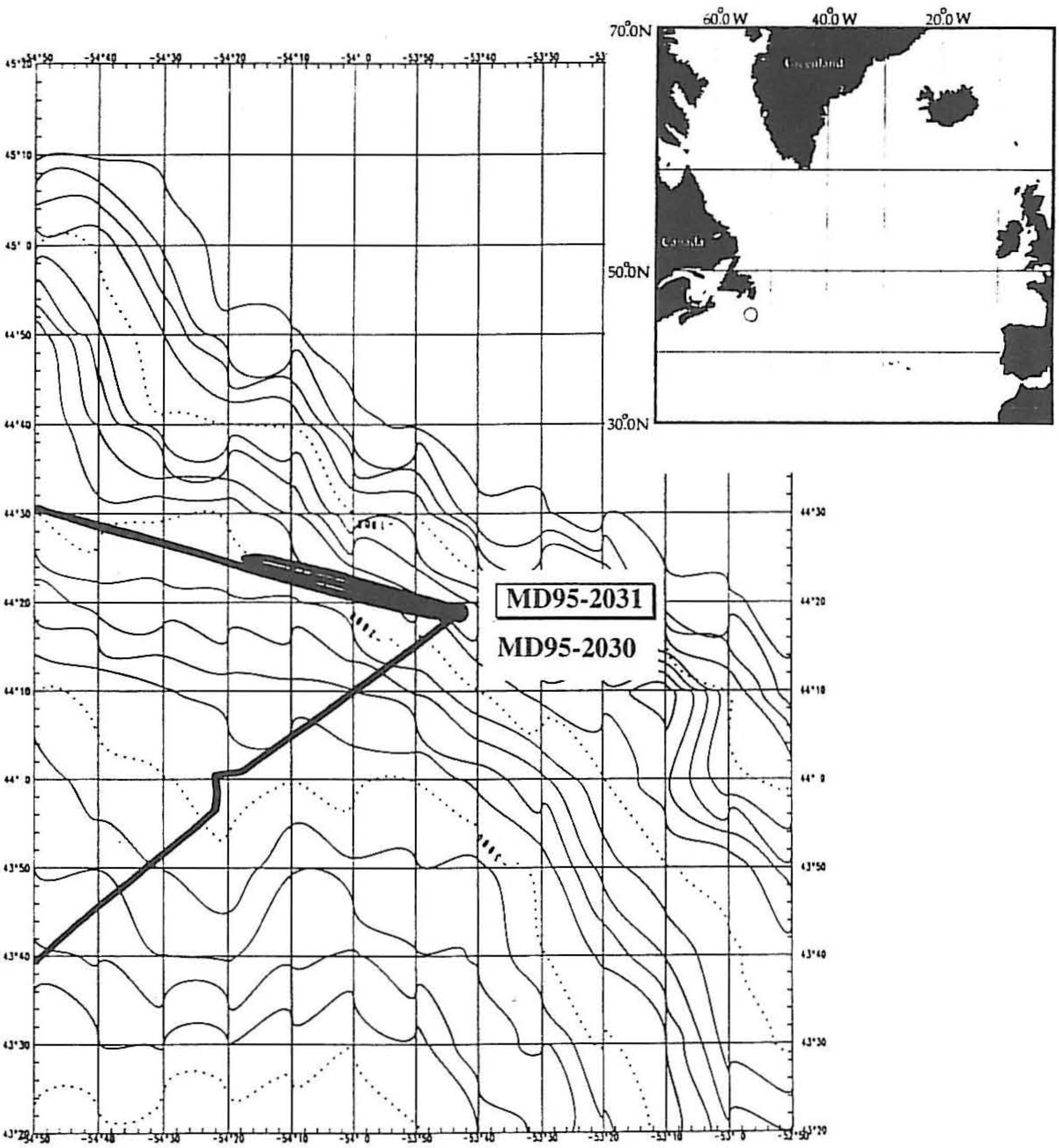


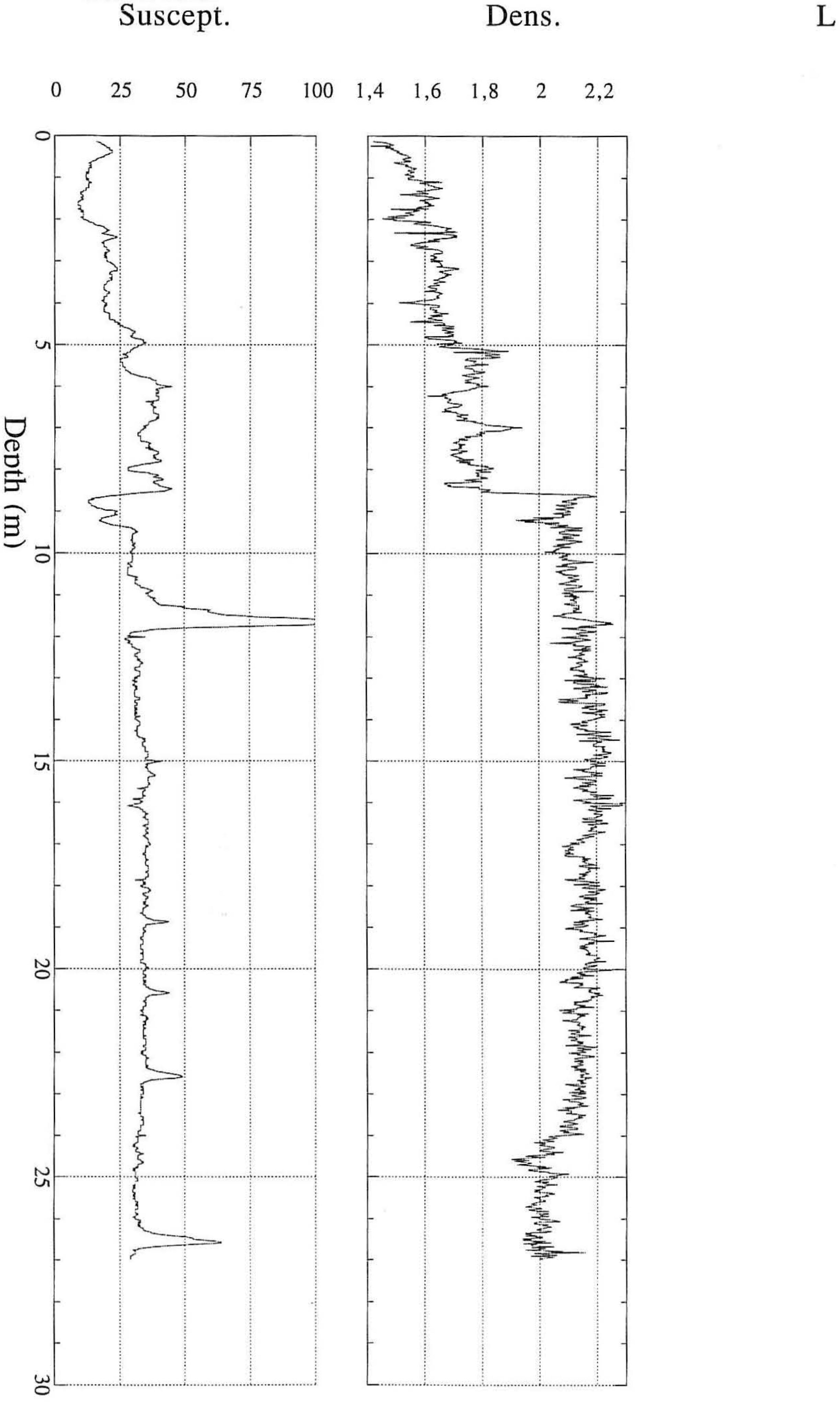
Core MD95-2030 not measured on the MST.


MD 95-2030
Section I to VIII
Section I X to XVII
Section XVIII to XXII
Lithology
Color
5Y5/3
5Y4/3
5Y4/3
5Y4/1
homogenous biosilica detricarb. and nanno bearing clayey silt
shell
gastropod
shell debris
detricarb. b. biosilica silty clay
5Y4/1
5Y4/1
5YR4/3
5Y4/3
silty sand few Diatoms, Forams
indistinct contacts
detricarb. b. sandy mud (liquide) bioturbated throughout
detricarb and diatoms b. silty sandy mud (soupy, half liner full)
clayey silt bioturbated (numerous mm indistinct pockets of courser material)
detricarb. muddy silt inclusions
detricarb. clayey silt
muddy clayey silt w. few diatoms and nannos
detricarb. sandy silt
detricarb. biosilica sandy silt
sandy mud w. Diatoms, Forams, Nannos
5Y4/1
5Y4/2
5Y4/2
5Y 4/2
structureless clayey mud w. detricarb. Forams, Nannos, Diatoms
scattered coarse pockets
totaly disturbed (flow in, plastic tap in the middle)
sandy silt to clayey silt alternance with sandy patches and burrows
basalt Ø 2cm
clayey silt
a lot of FeS patches
Nannos b. clayey silt, very homogenous, bioturbated throughout
granit fragment
clayey silt w. detricarb. rare Nannos
uniform
disrupted section
clayey silt
shell debris
3556 cm

Core MD 95-2031

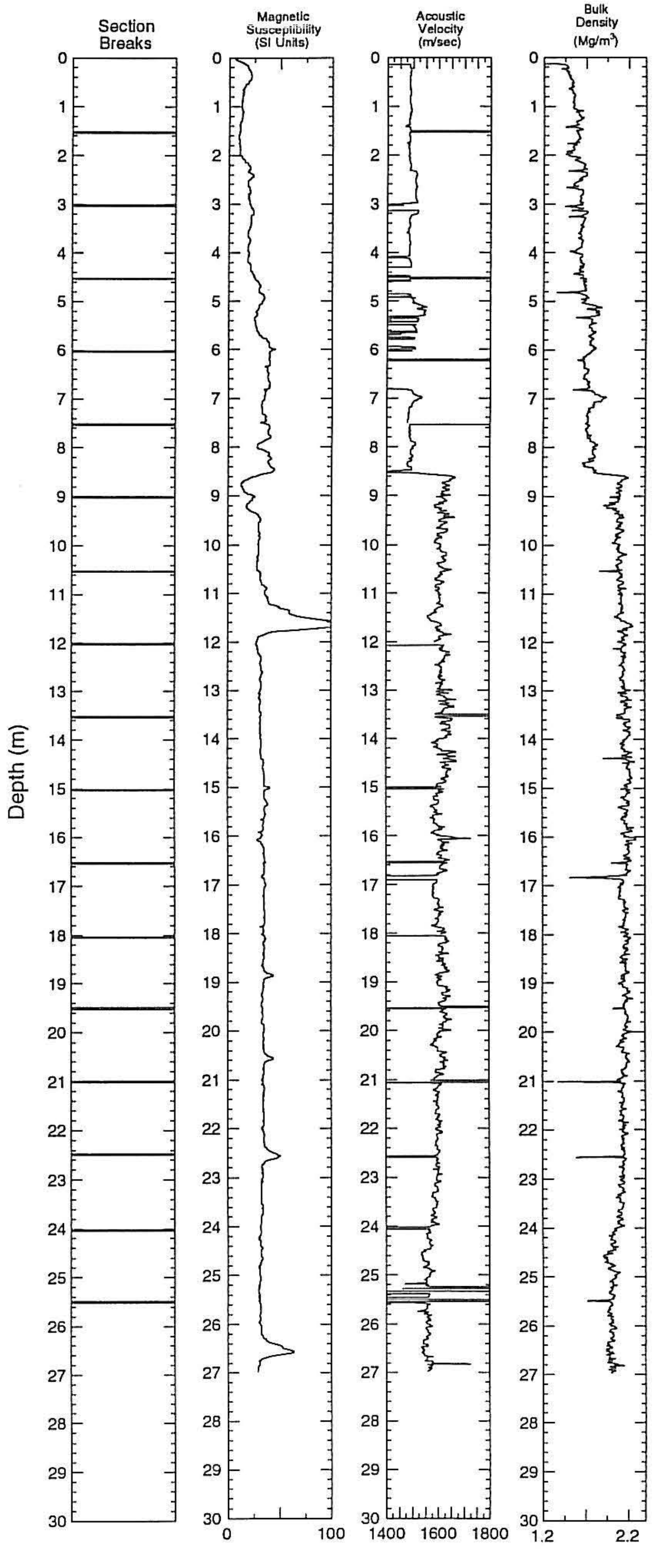
lat: 44°18.45 N - long: 53°44.14 W
water depth: 1570 m
length: 27.72 m





MD 95-2031

MD95-2031

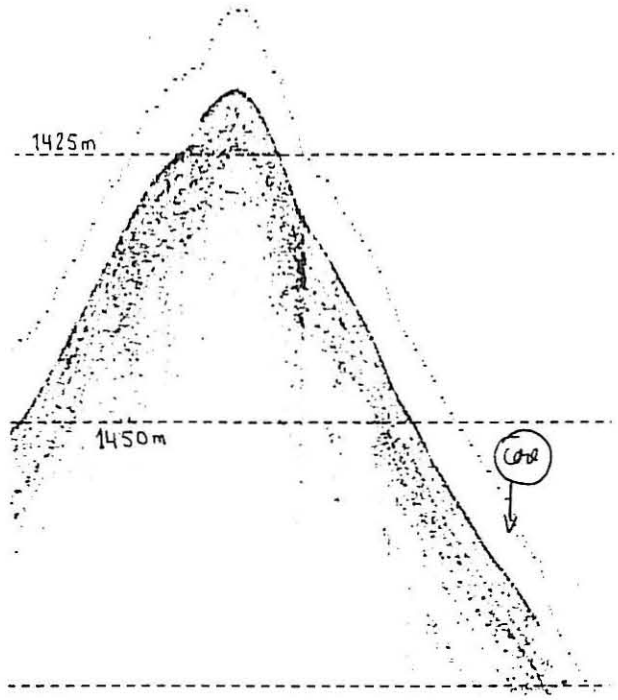

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
100
1400
1600
1800
1.2
2.2

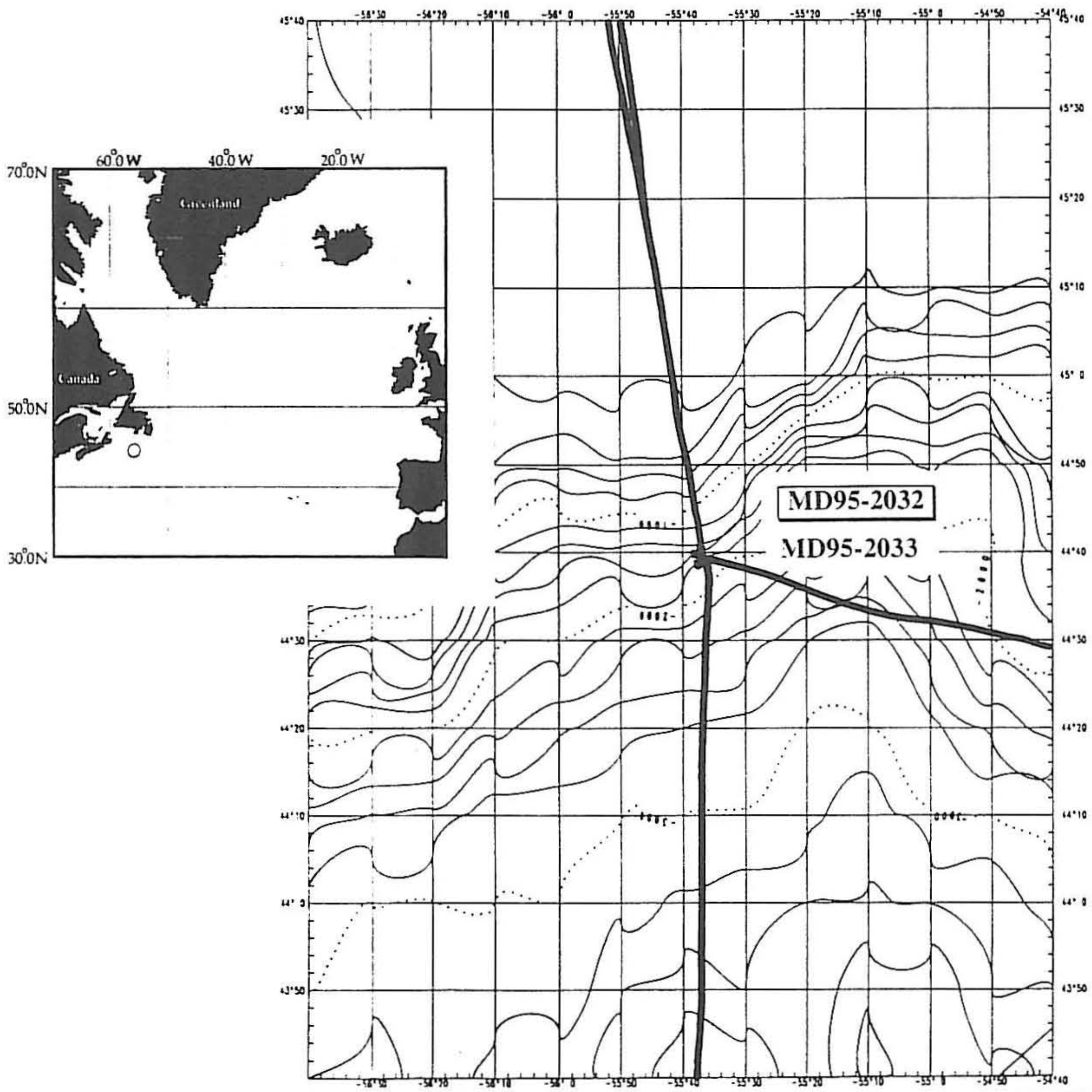
Core MD95-2031 not opened on board.

No sediment description.

Core MD 95-2032

lat: 44°39.46 N - long: 55°37.14 W
water depth: 1433 m
length: 28.54 m





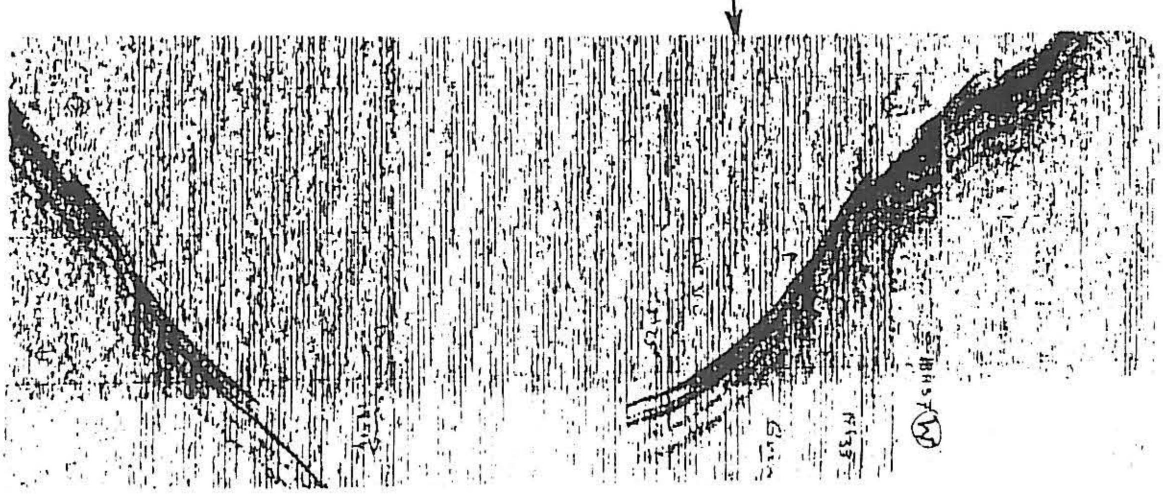
Core MD95-2032 not measured on MST.

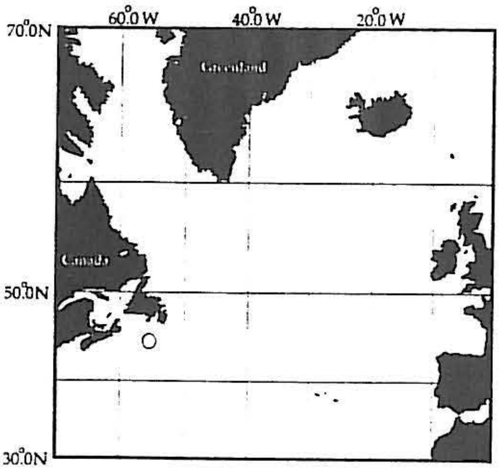
Core MD95-2032 not opened on board.

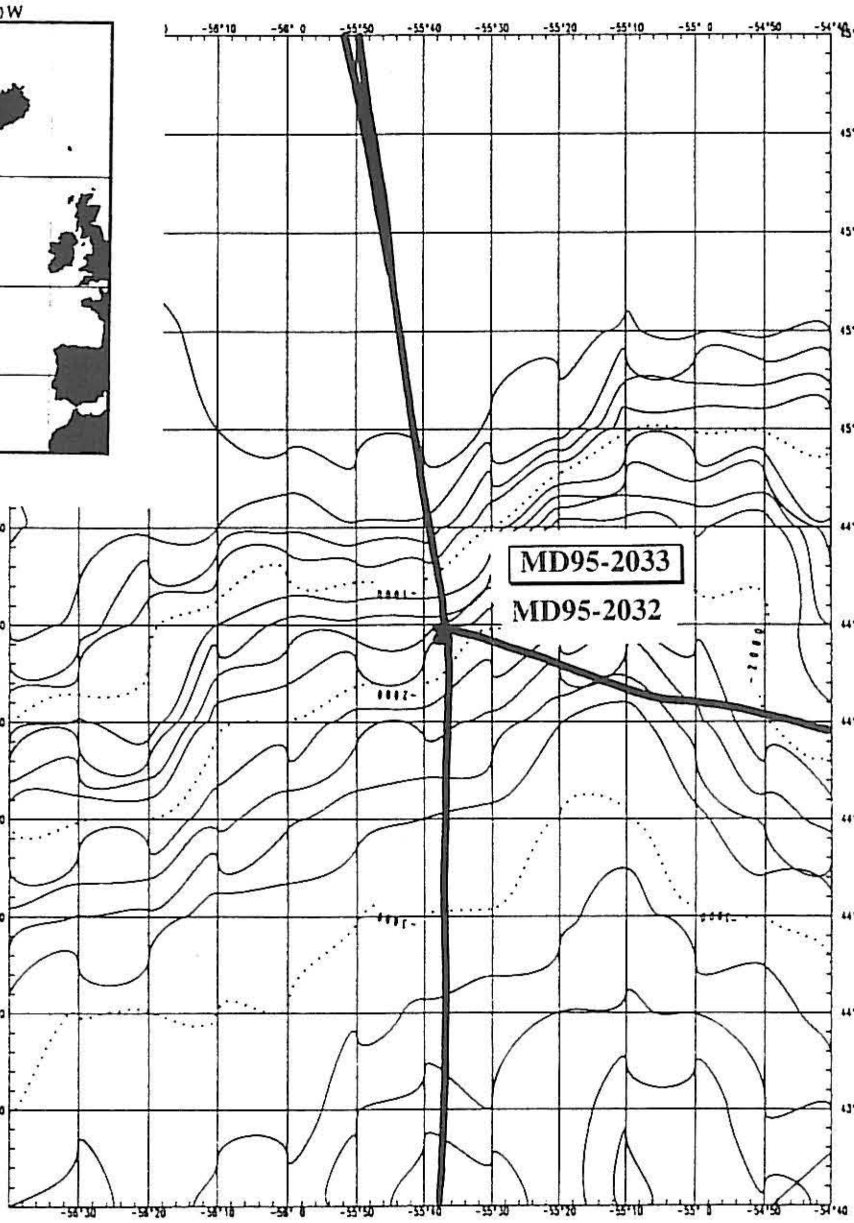
No sediment description.

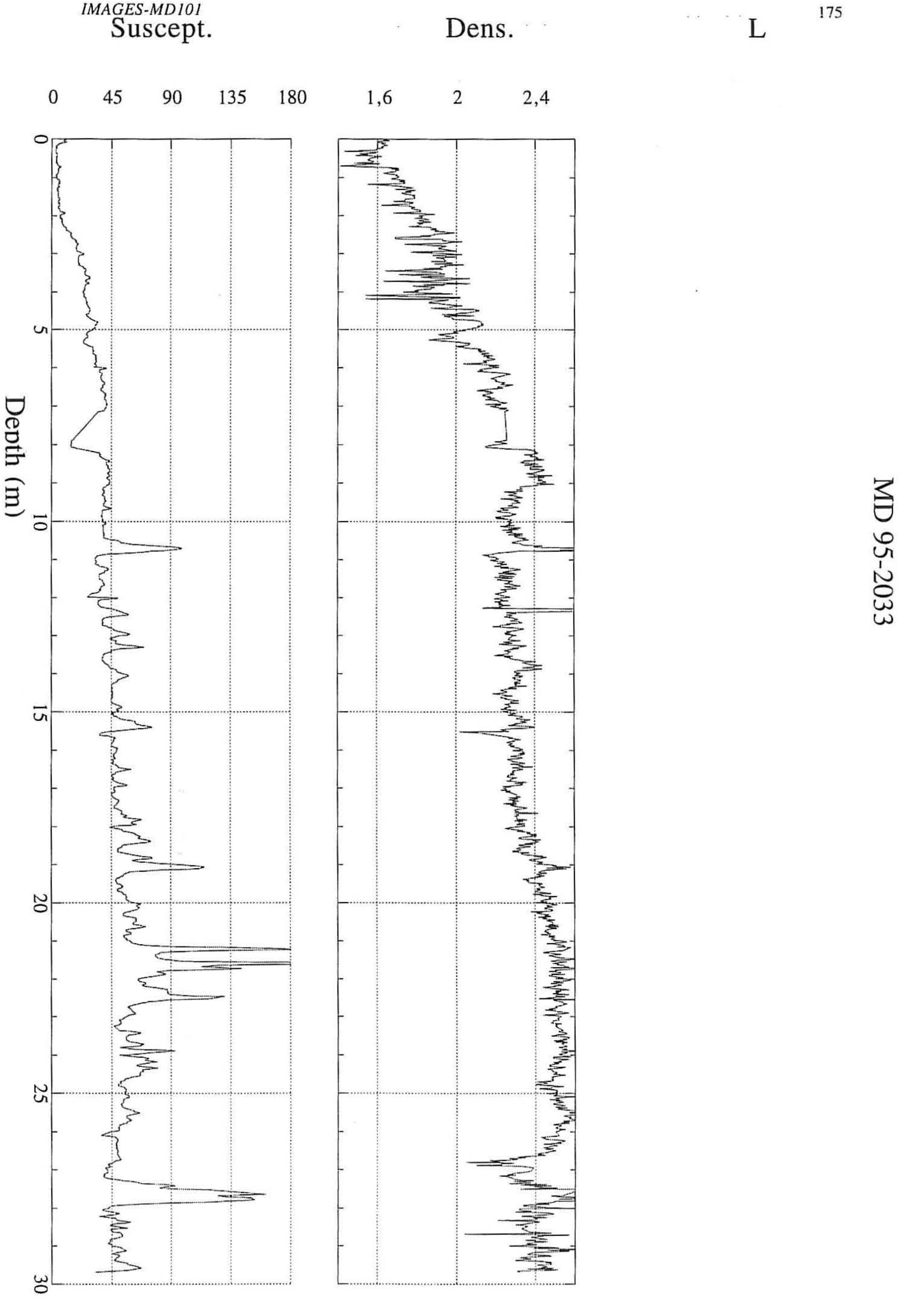
Core MD 95-2033

lat: 44°39.87 N - long: 55°37.21 W
water depth: 1412 m
length: 29.68 m

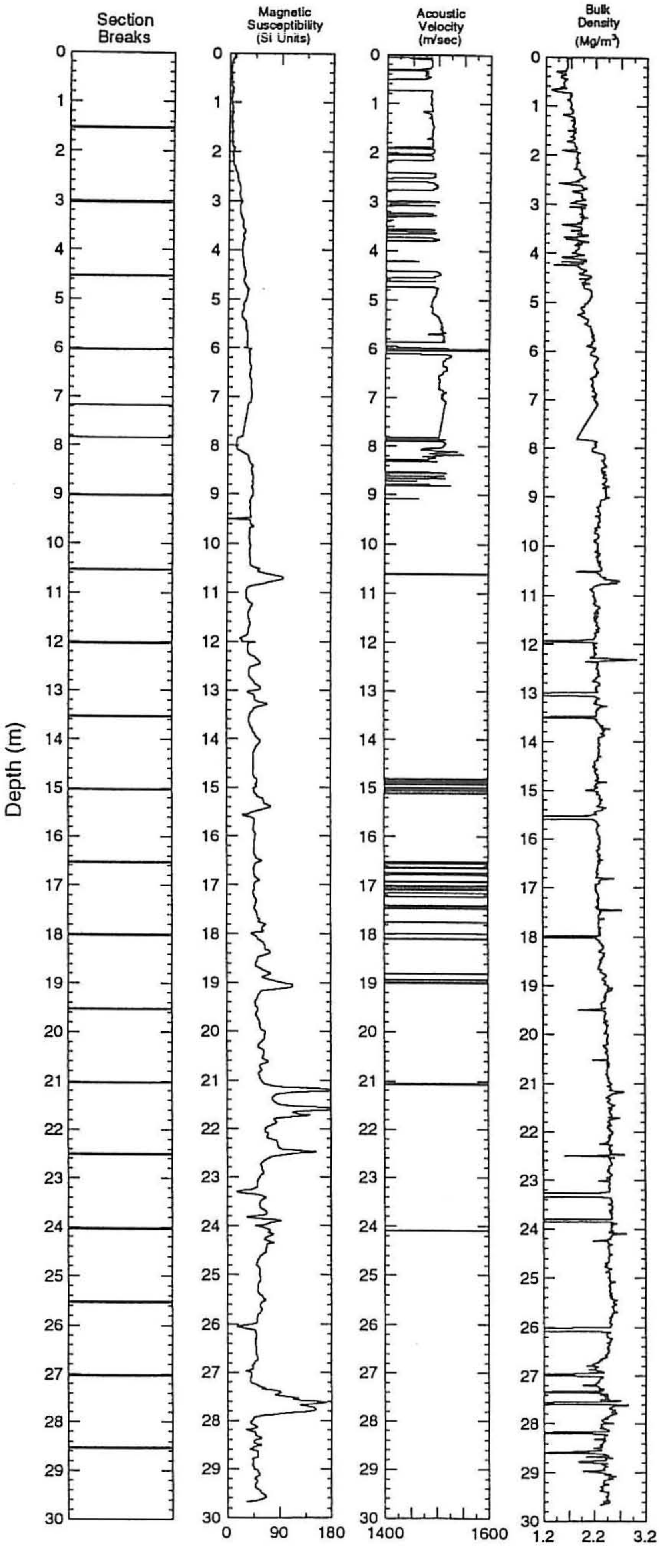







Suscept.
Dens.
L
0 45 90 135 180
1,6 2 2,4
Depth (m)
0 5 10 15 20 25 30
MD 95-2033

MD95-2033

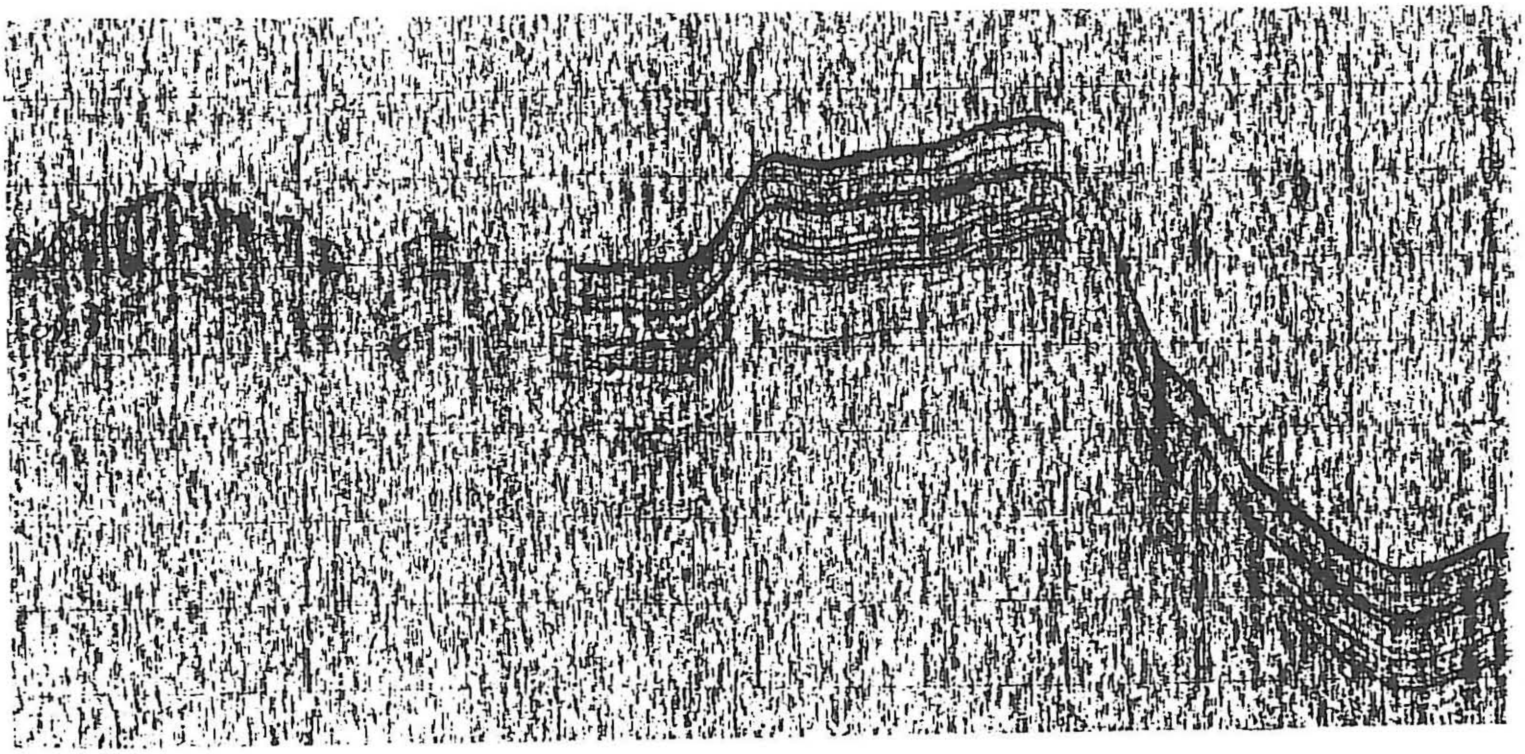

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0 90 180
1400 1600
1.2 2.2 3.2

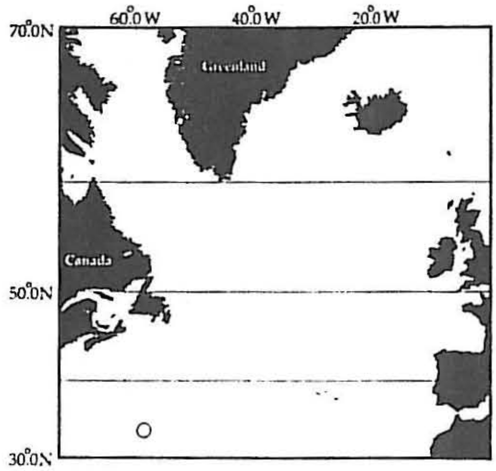
Core MD95-2033 not opened on board.

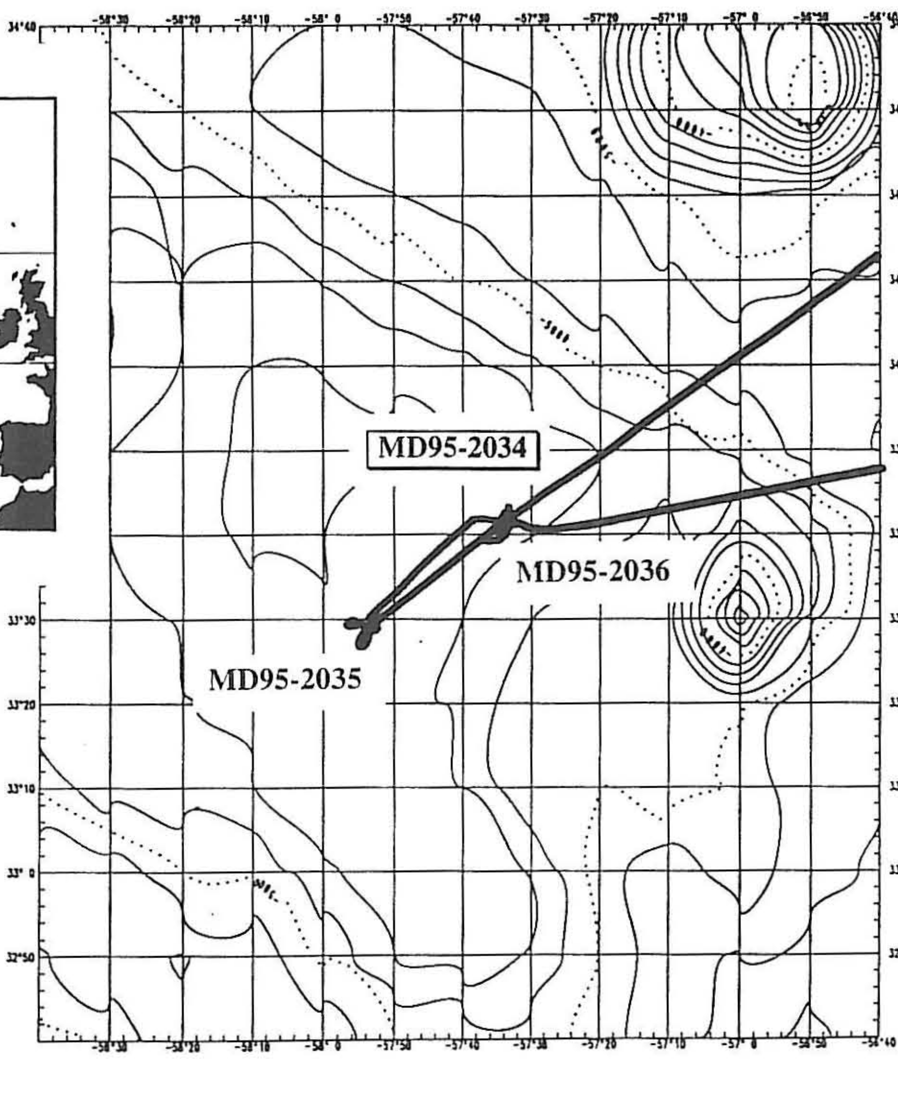
No sediment description.

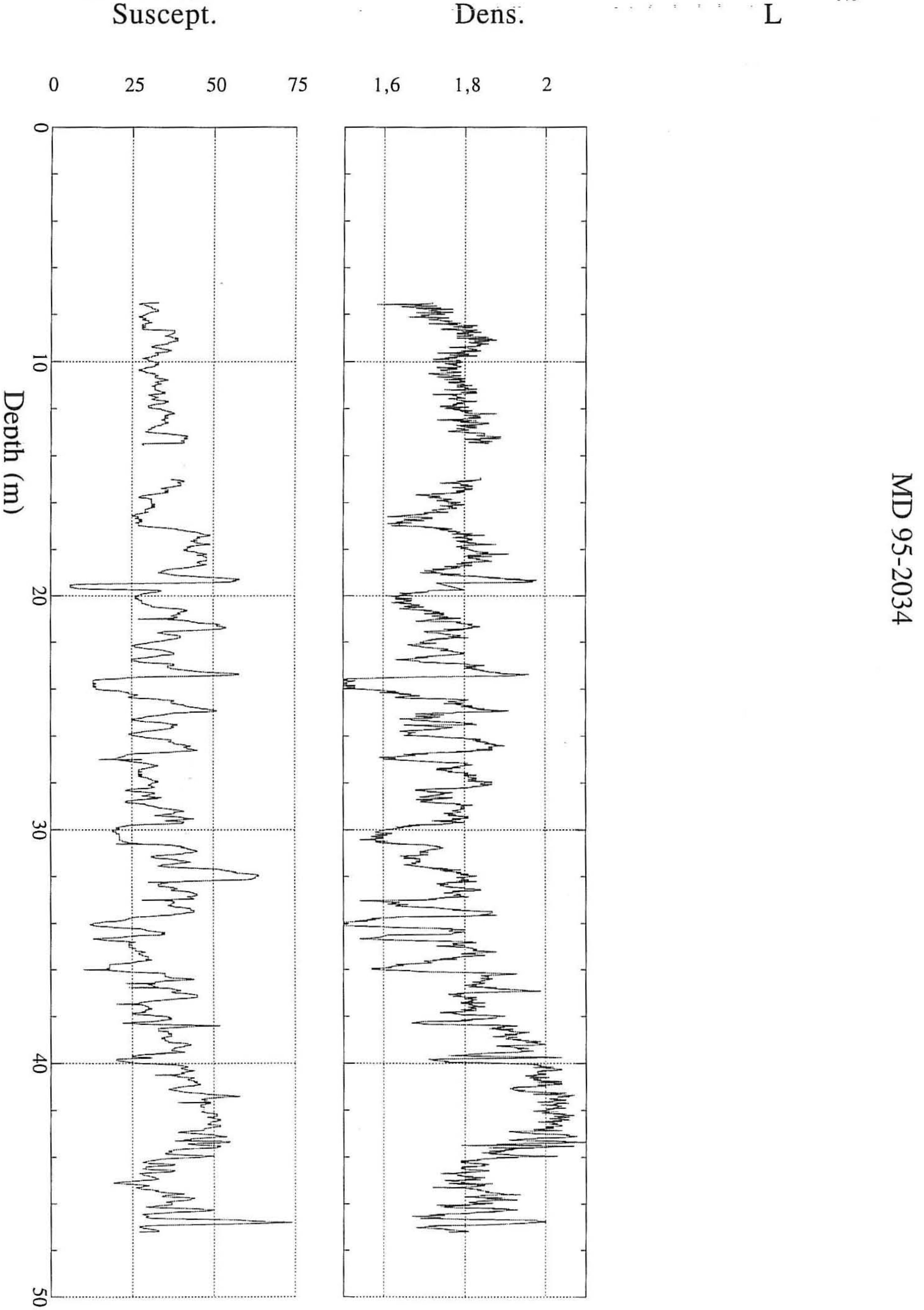
Core MD 95-2034

lat: 33°41.46 N - long: 57°34.55 W
water depth: 4461.5 m
length: 47.16 m

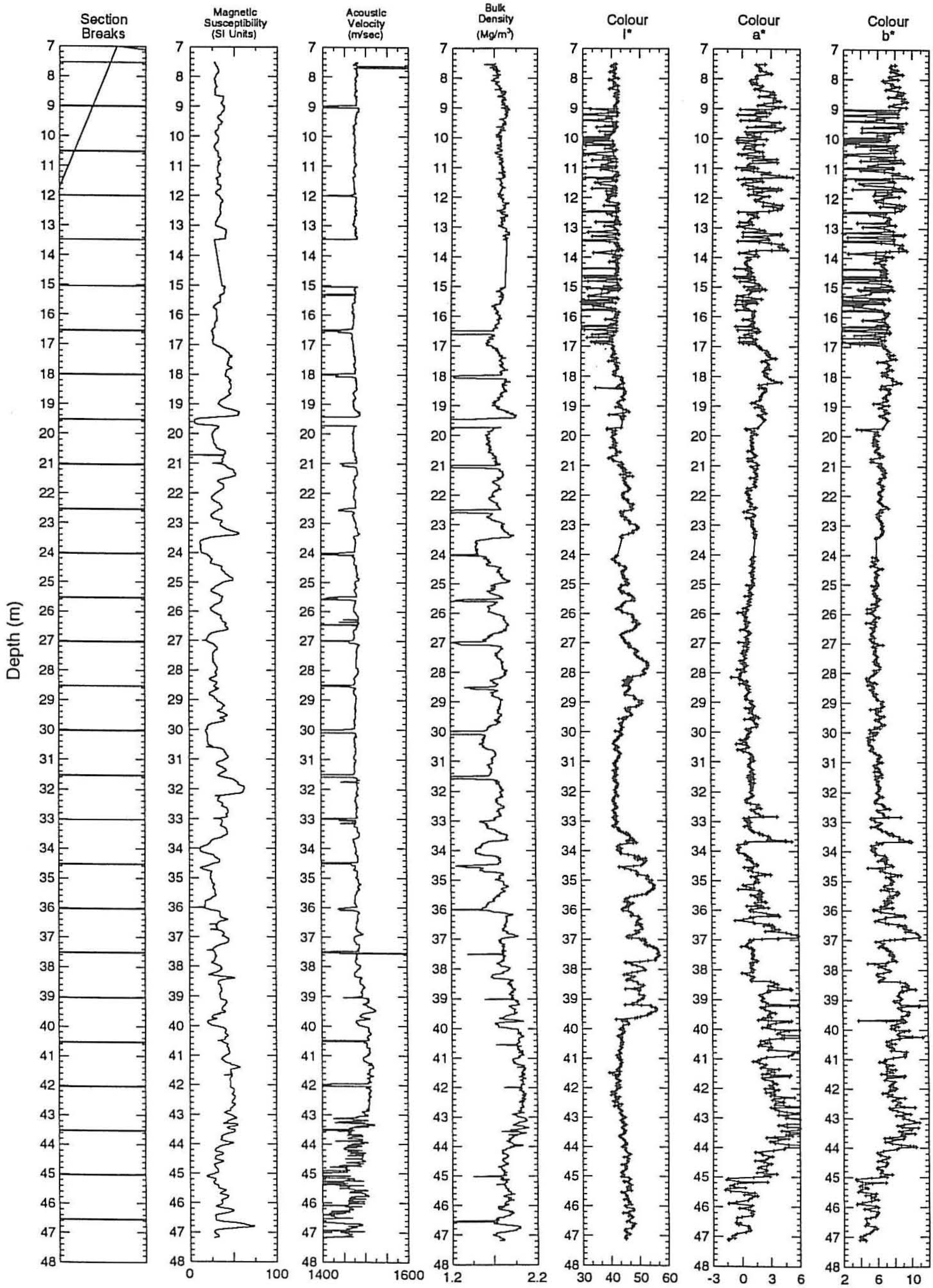




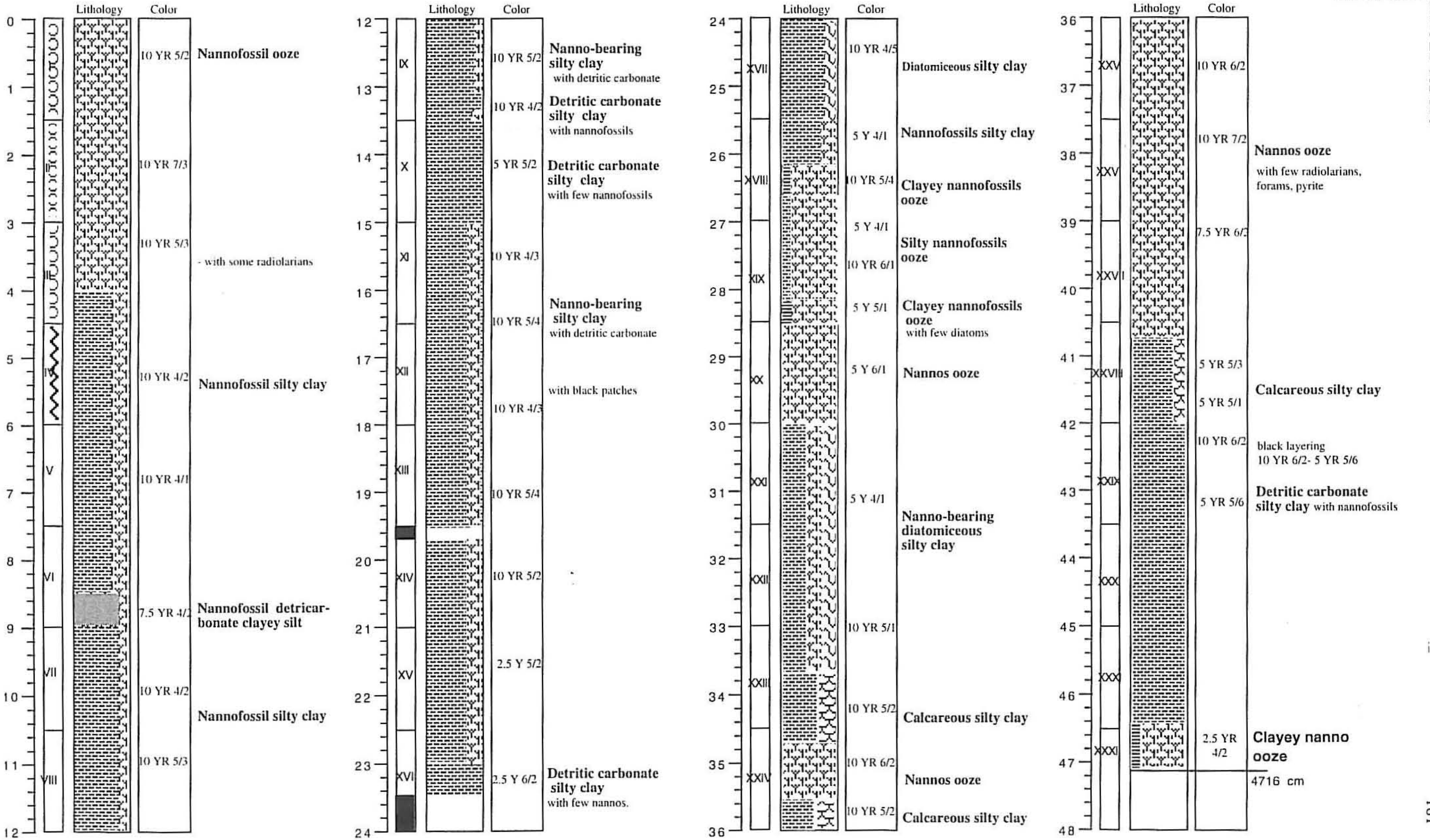



Suscept.
Dens.
L
0
25
50
75
1,6
1,8
2
0
10
20
30
40
50
Depth (m)
MD 95-2034

MD95-2034

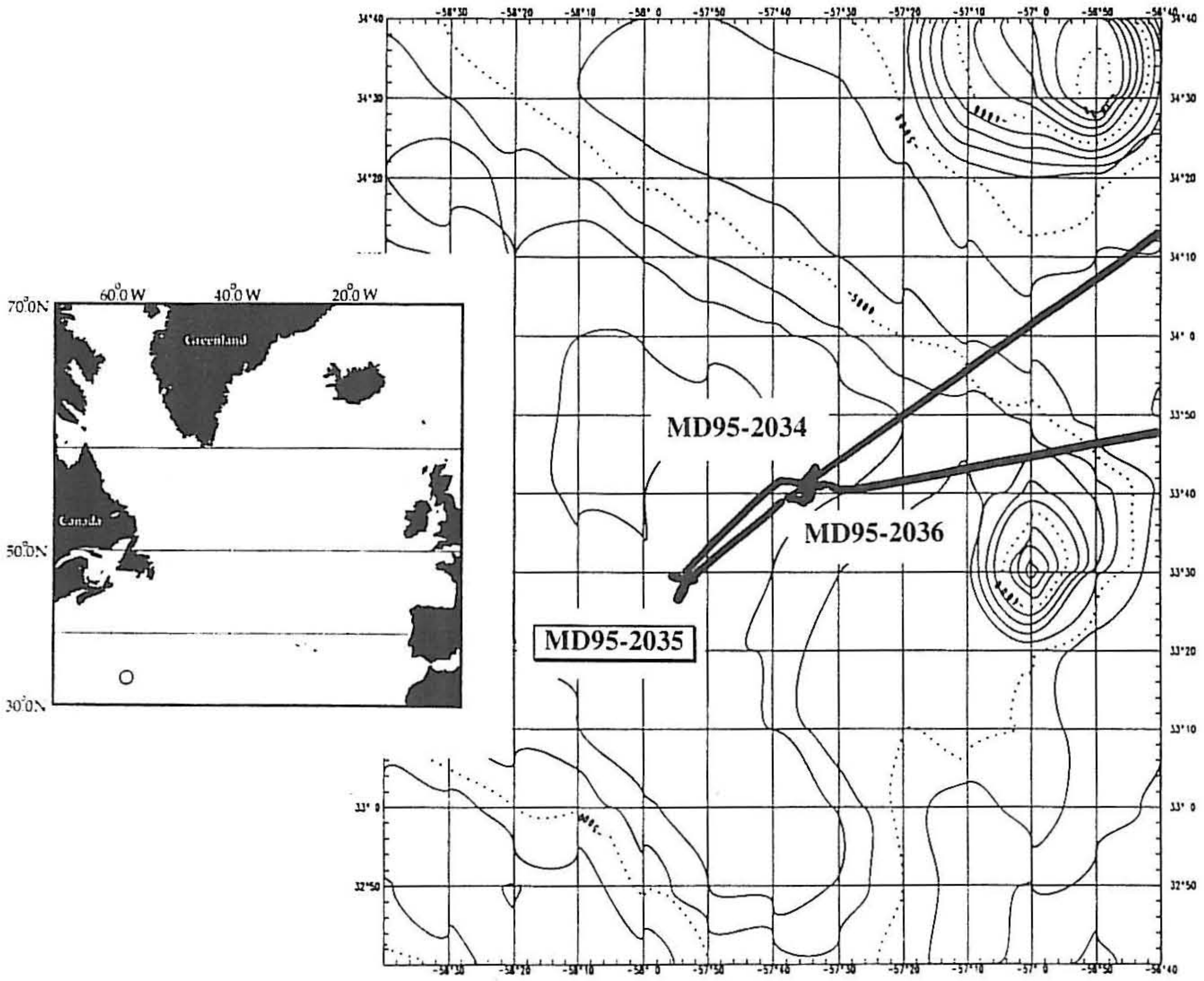

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

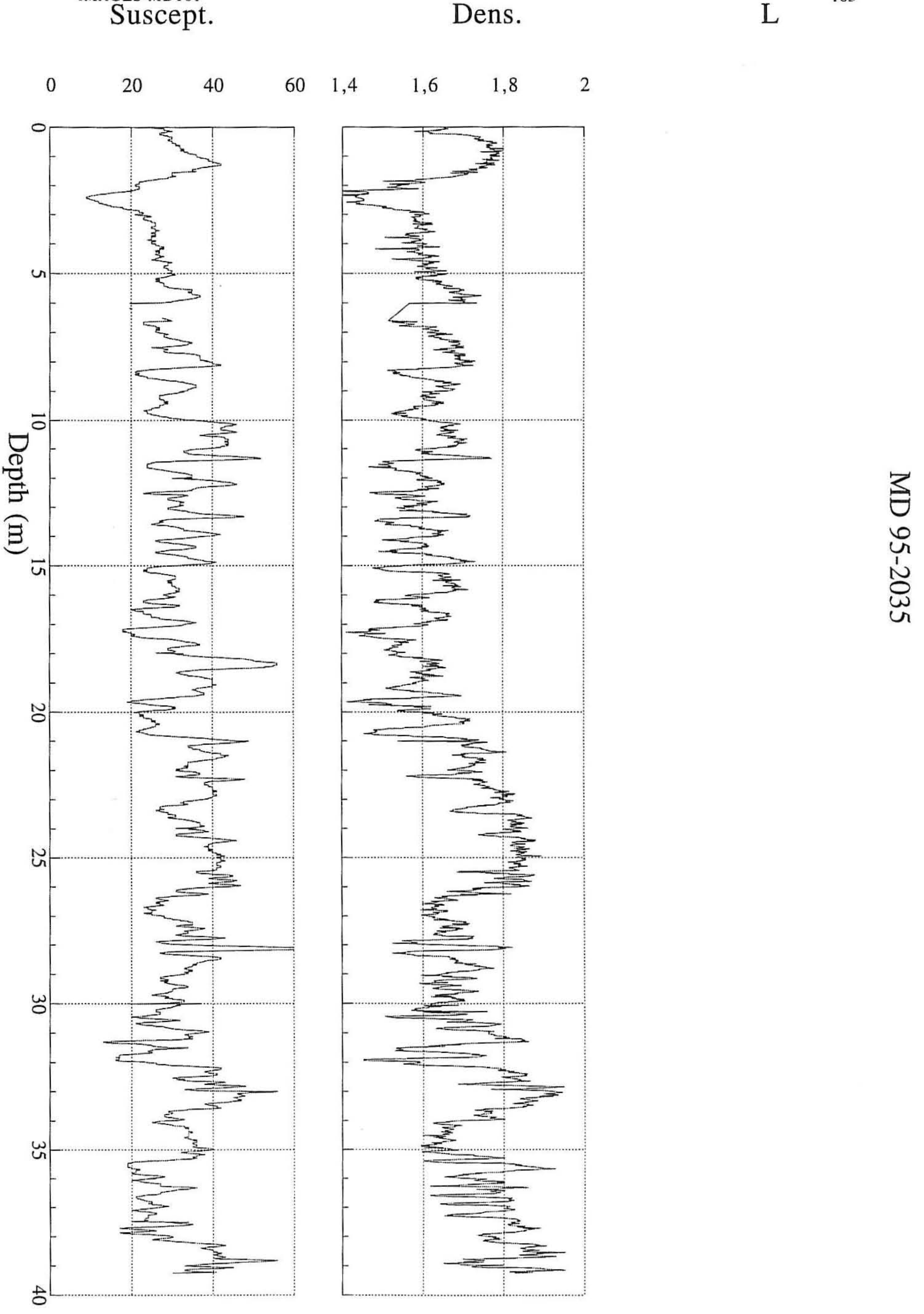
MD 95-2034


Lithology
Color
10 YR 5/2 Nannofossil ooze
10 YR 7/3
10 YR 5/3
- with some radiolarians
10 YR 4/2 Nannofossil silty clay
10 YR 4/1
7.5 YR 4/2 Nannofossil detricar-bonate clayey silt
10 YR 4/2 Nannofossil silty clay
10 YR 5/3
10 YR 5/2 Nanno-bearing silty clay with detritic carbonate
10 YR 4/2 Detritic carbonate silty clay with nannofossils
5 YR 5/2 Detritic carbonate silty clay with few nannofossils
10 YR 4/3
10 YR 5/4 Nanno-bearing silty clay with detritic carbonate
with black patches
10 YR 4/3
10 YR 5/4
10 YR 5/2
2.5 Y 5/2
2.5 Y 6/2 Detritic carbonate silty clay with few nannos.
10 YR 4/5 Diatomiceous silty clay
5 Y 4/1 Nannofossils silty clay
10 YR 5/4 Clayey nannofossils ooze
5 Y 4/1 Silty nannofossils ooze
10 YR 6/1
5 Y 5/1 Clayey nannofossils ooze with few diatoms
5 Y 6/1 Nannos ooze
5 Y 4/1 Nanno-bearing diatomiceous silty clay
10 YR 5/1
10 YR 5/2 Calcareous silty clay
10 YR 6/2 Nannos ooze
10 YR 5/2 Calcareous silty clay
10 YR 6/2
10 YR 7/2 Nannos ooze with few radiolarians, forams, pyrite
7.5 YR 6/2
5 YR 5/3 Calcareous silty clay
5 YR 5/1
10 YR 6/2 black layering 10 YR 6/2- 5 YR 5/6
5 YR 5/6 Detritic carbonate silty clay with nannofossils
2.5 YR 4/2 Clayey nanno ooze
4716 cm

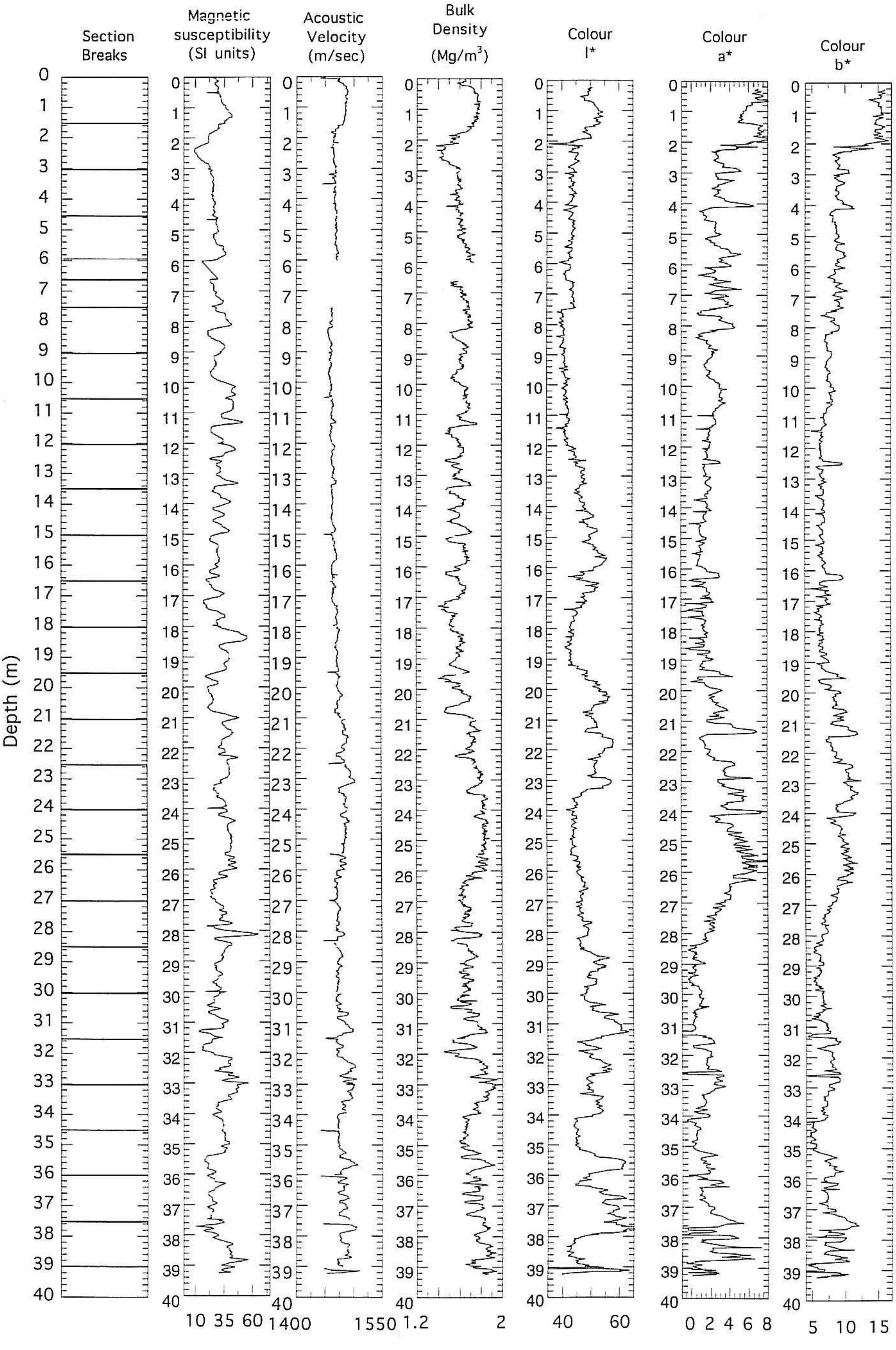
Core MD 95-2035

lat: 33°29.20 N - long: 57°53.16 W
water depth: 4286 m
length: 39.25 m

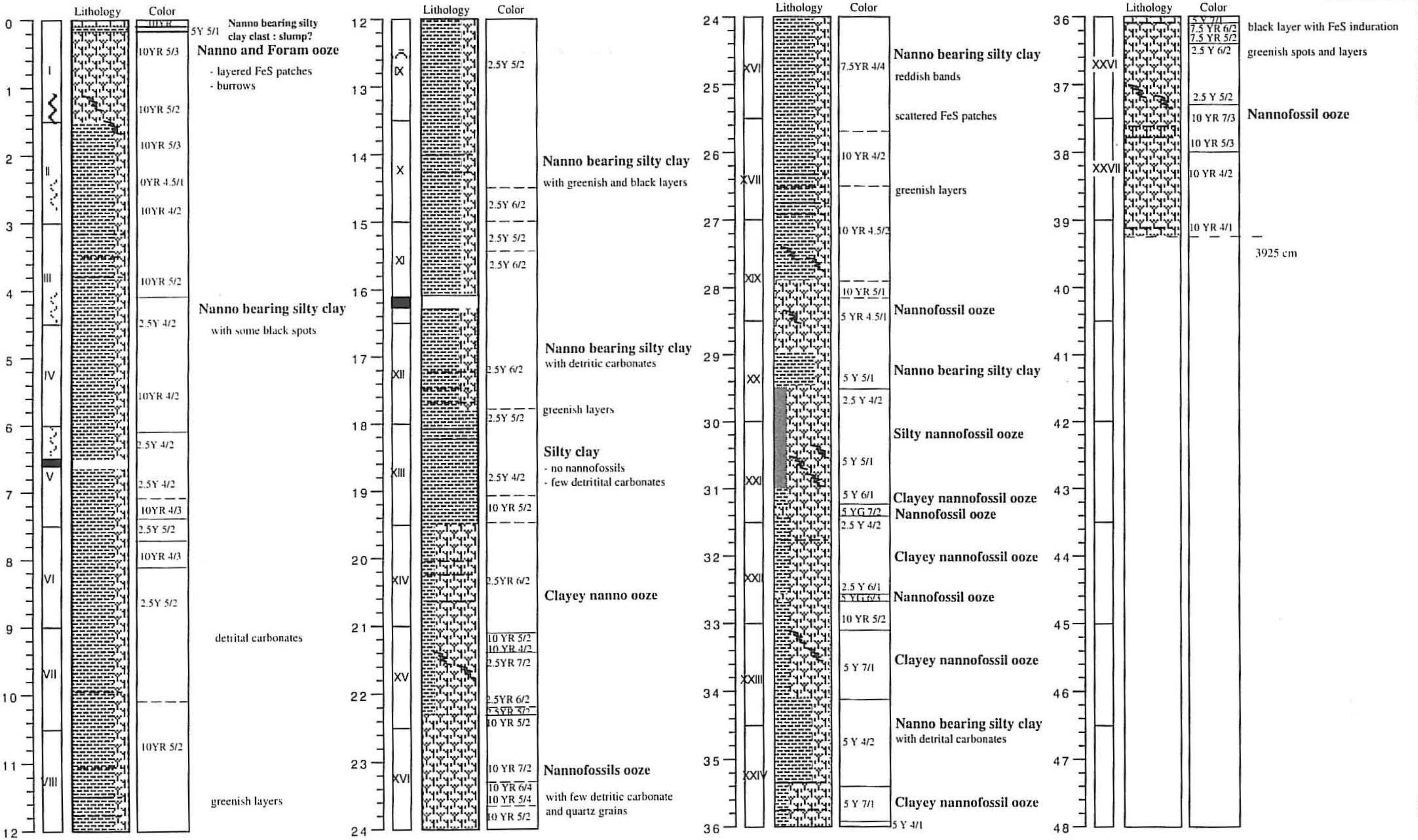



Suscept.
Dens.
L
0
20
40
60
1,4
1,6
1,8
2
0
5
10
15
20
25
30
35
40
Depth (m)
MD 95-2035

MD95-2035

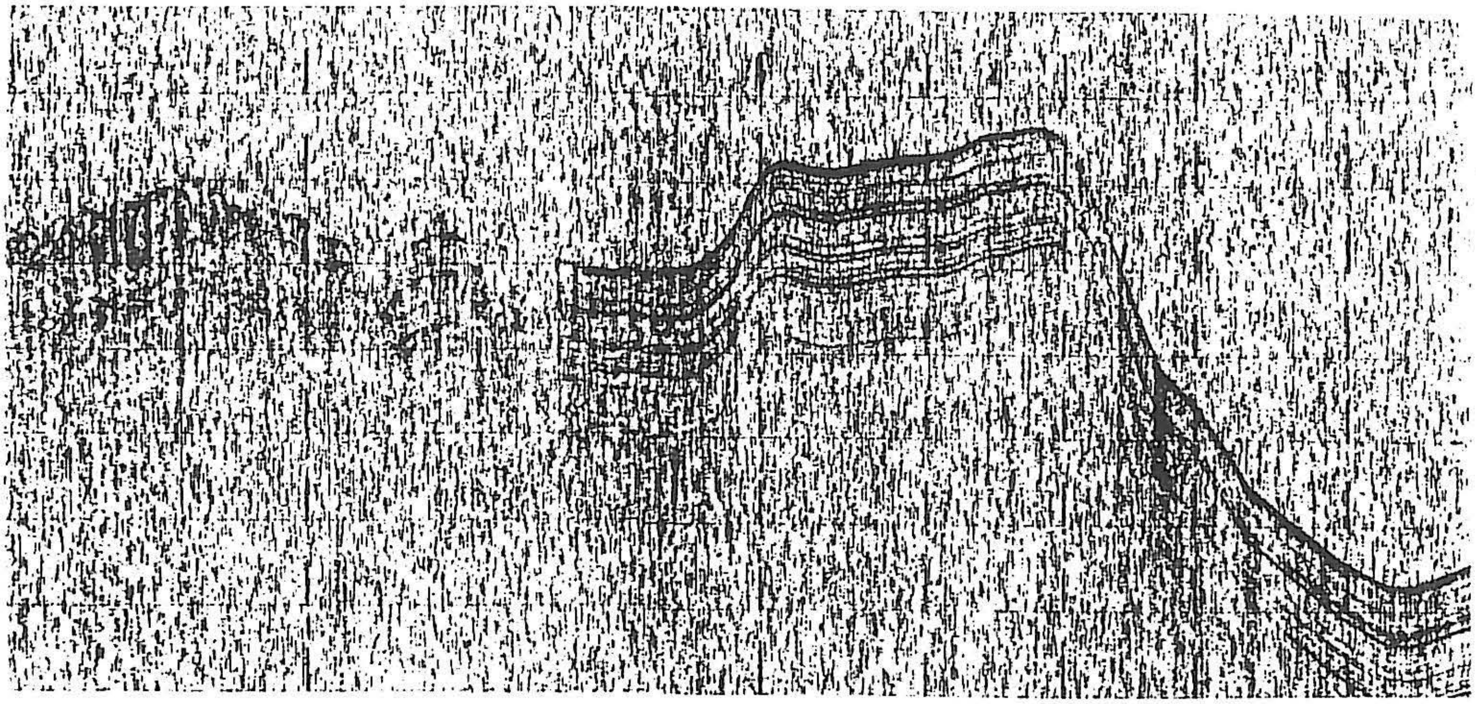

Section Breaks
Magnetic susceptibility (SI units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m3)
Colour l*
Colour a*
Colour b*
Depth (m)
10 35 60
1400 1550
1.2 2
40 60
0 2 4 6 8
5 10 15

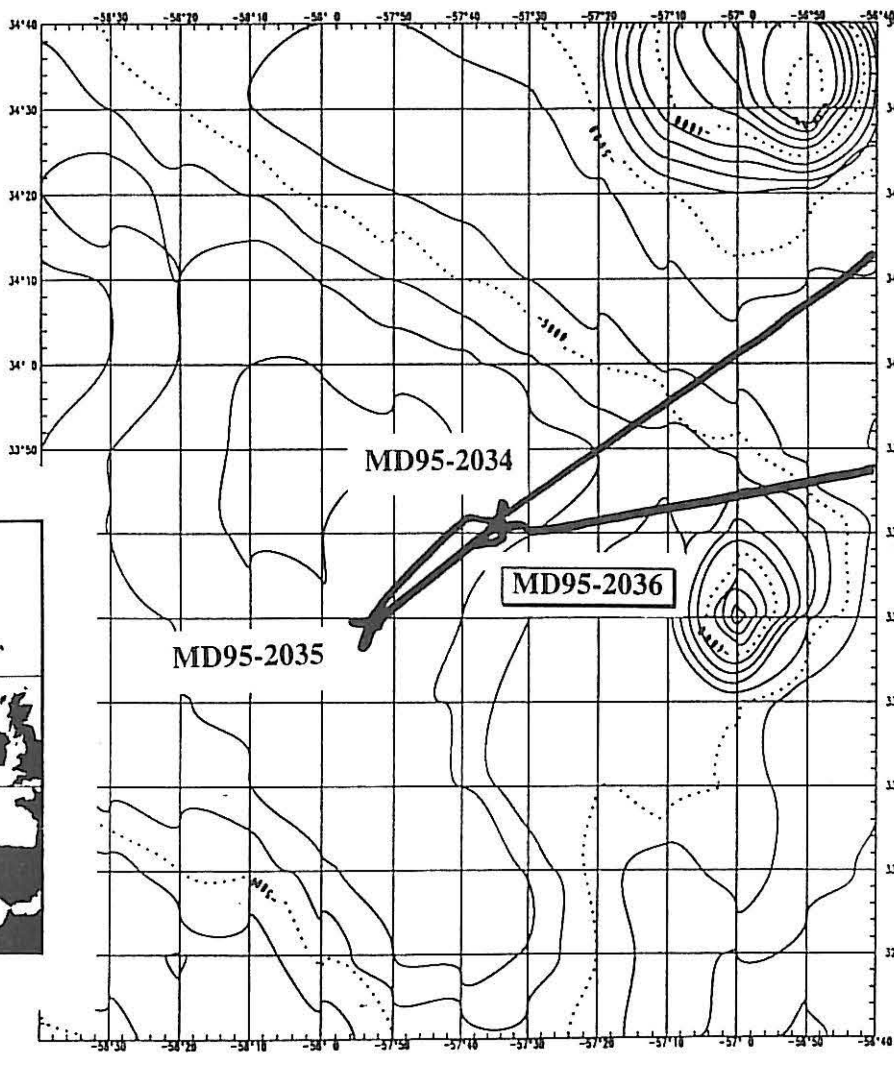
MD 95-2035

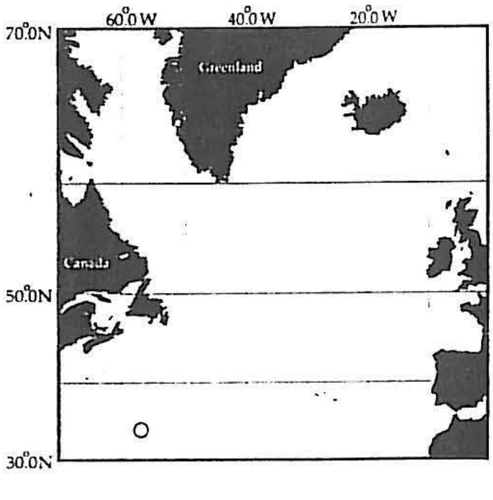

Lithology
Color
5Y 5/1
Nanno bearing silty clay clast : slump?
10YR 5/3
Nanno and Foram ooze
- layered FeS patches
- burrows
10YR 5/2
10YR 5/3
10YR 4.5/1
10YR 4/2
10YR 5/2
Nanno bearing silty clay
with some black spots
2.5Y 4/2
10YR 4/2
2.5Y 4/2
2.5Y 4/2
10YR 4/3
2.5Y 5/2
10YR 4/3
2.5Y 5/2
detrital carbonates
10YR 5/2
greenish layers
2.5Y 5/2
Nanno bearing silty clay
with greenish and black layers
2.5Y 6/2
2.5Y 5/2
2.5Y 6/2
Nanno bearing silty clay
with detritic carbonates
2.5Y 6/2
greenish layers
2.5Y 5/2
Silty clay
- no nannofossils
- few detritital carbonates
2.5Y 4/2
10 YR 5/2
2.5YR 6/2
Clayey nanno ooze
10 YR 5/2
10 YR 4/2
2.5YR 7/2
2.5YR 6/2
10 YR 5/2
10 YR 7/2
Nannofossils ooze
10 YR 6/4
10 YR 5/4
10 YR 5/2
with few detritic carbonate and quartz grains
Nanno bearing silty clay
7.5YR 4/4
reddish bands
scattered FeS patches
10 YR 4/2
greenish layers
10 YR 4.5/2
10 YR 5/1
5 YR 4.5/1
Nannofossil ooze
5 Y 5/1
Nanno bearing silty clay
2.5 Y 4/2
Silty nannofossil ooze
5 Y 5/1
5 Y 6/1
Clayey nannofossil ooze
5 YG 7/2
Nannofossil ooze
2.5 Y 4/2
Clayey nannofossil ooze
2.5 Y 6/1
Nannofossil ooze
10 YR 5/2
5 Y 7/1
Clayey nannofossil ooze
5 Y 4/2
Nanno bearing silty clay
with detrital carbonates
5 Y 7/1
Clayey nannofossil ooze
5 Y 4/1
7.5 YR 6/2
7.5 YR 5/2
black layer with FeS induration
2.5 Y 6/2
greenish spots and layers
2.5 Y 5/2
10 YR 7/3
Nannofossil ooze
10 YR 5/3
10 YR 4/2
10 YR 4/1
3925 cm
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XIX
XX
XXI
XXII
XXIII
XXIV
XXVI
XXVII

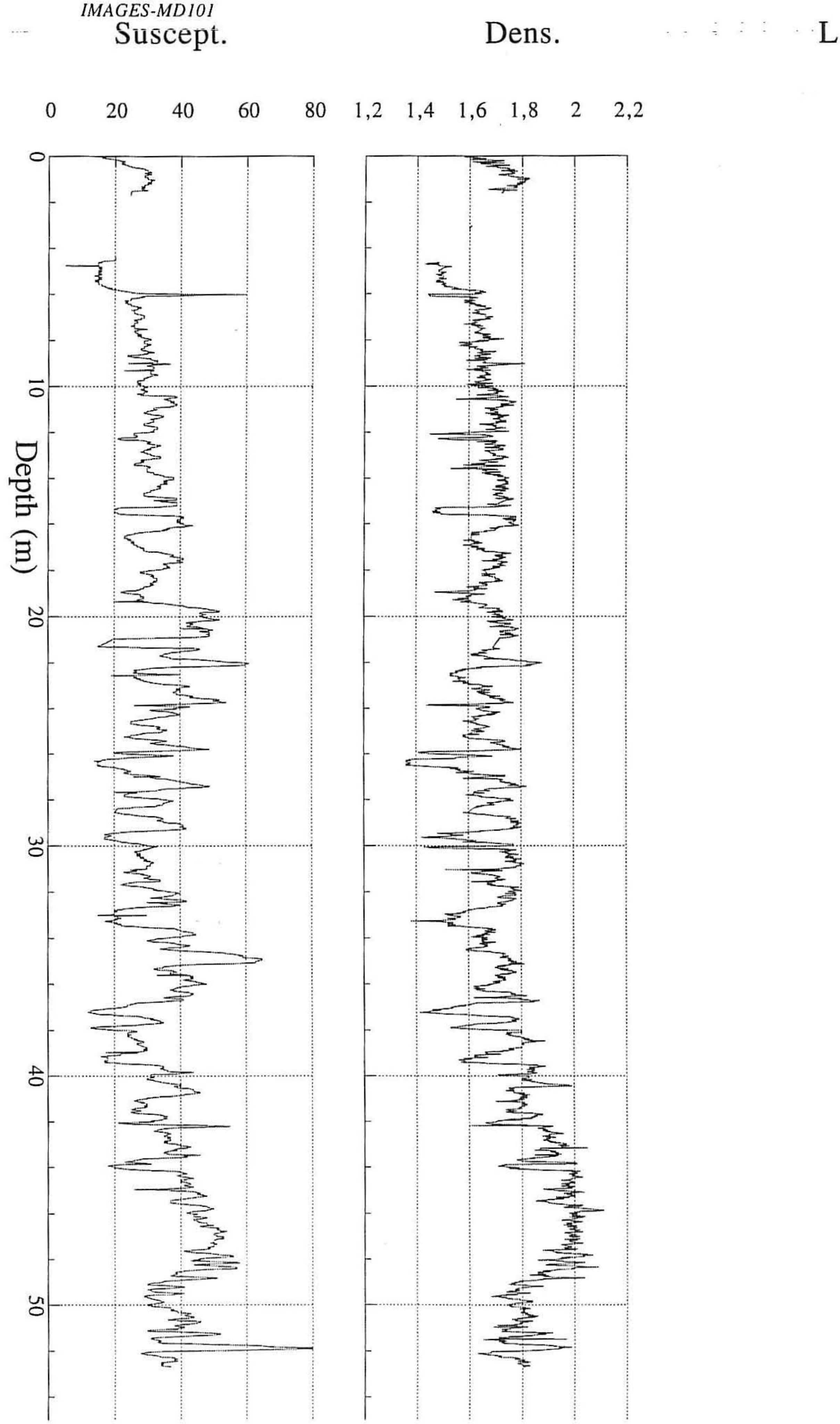
Core MD 95-2036

lat: 33°41.44 N - long: 57°34.55 W
water depth: 4461.5 m
length: 52.64 m



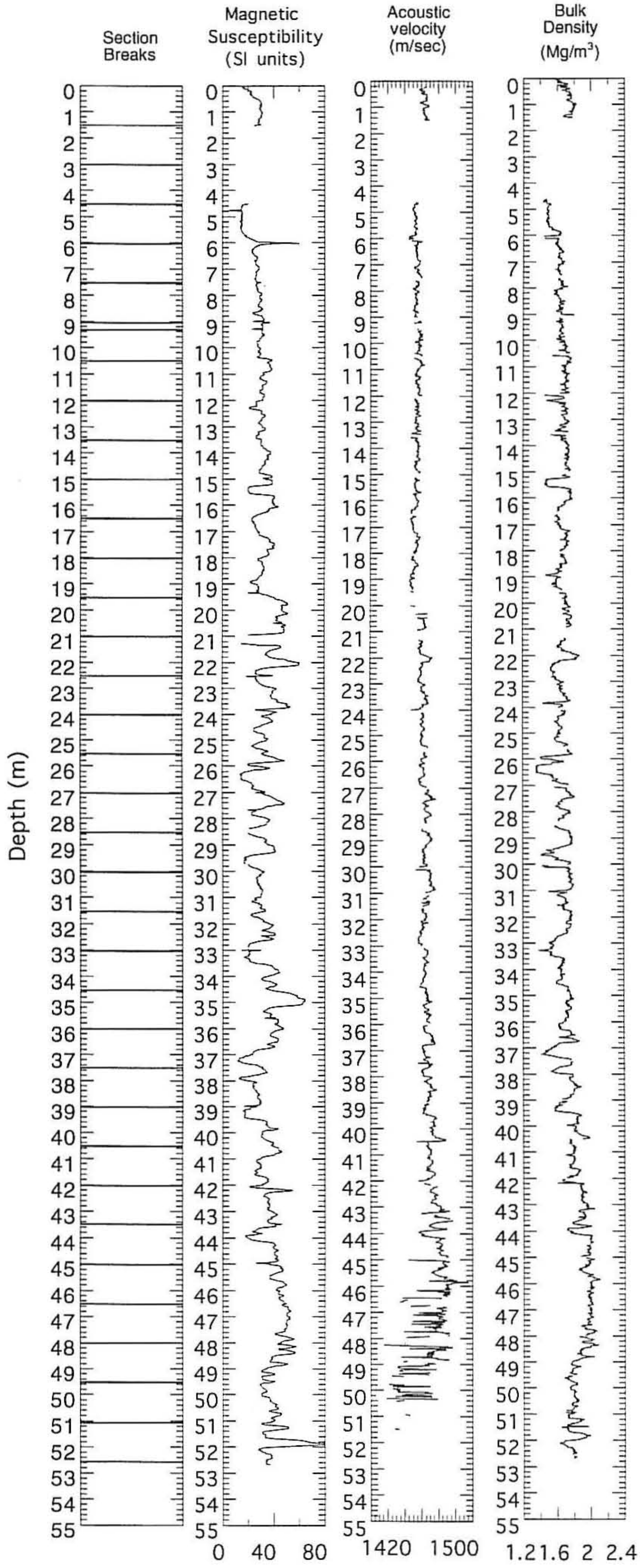






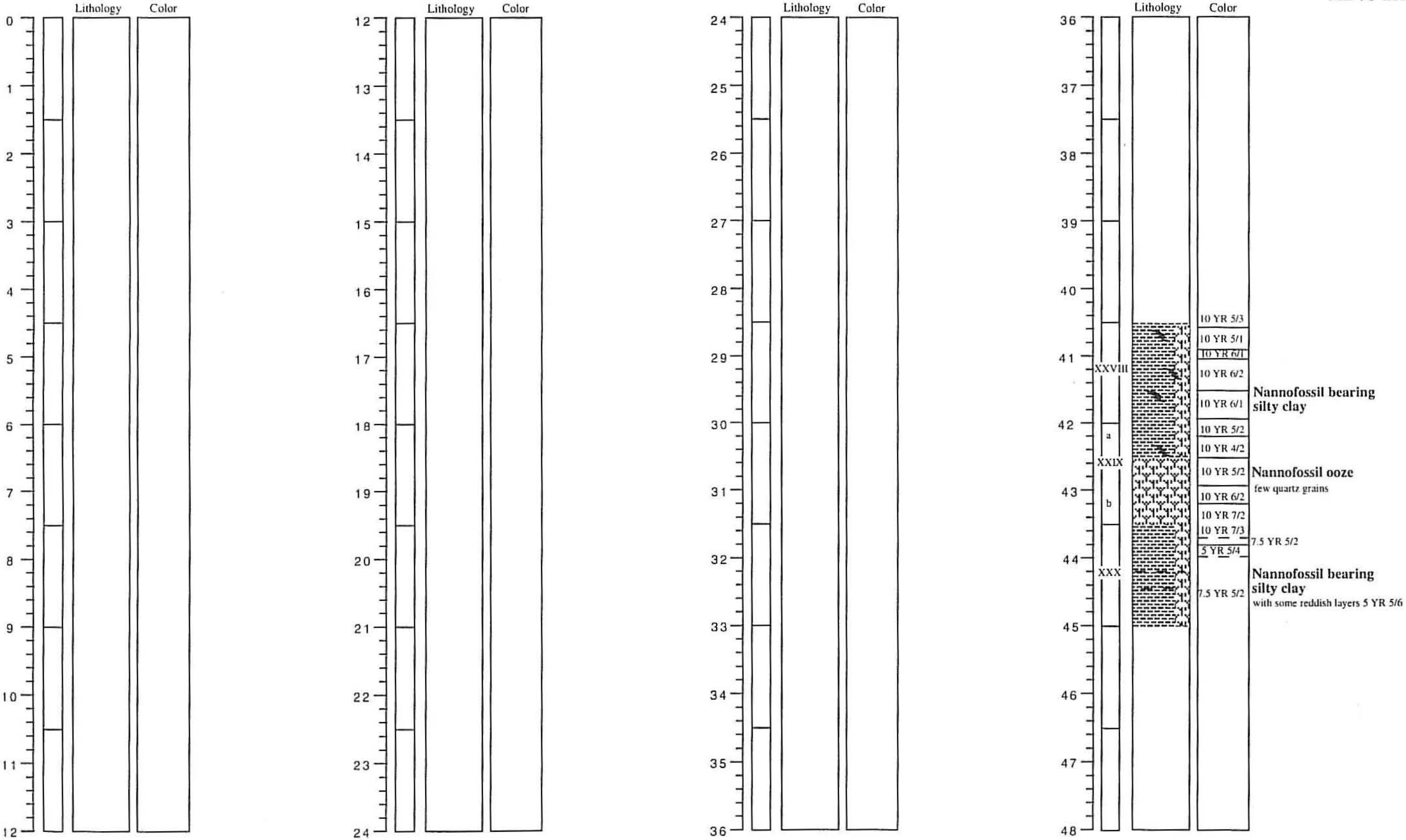
MD 95-2036

MD95-2036


Section Breaks
Magnetic Susceptibility (SI units)
Acoustic velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0 40 80
1420 1500
1.2 1.6 2 2.4

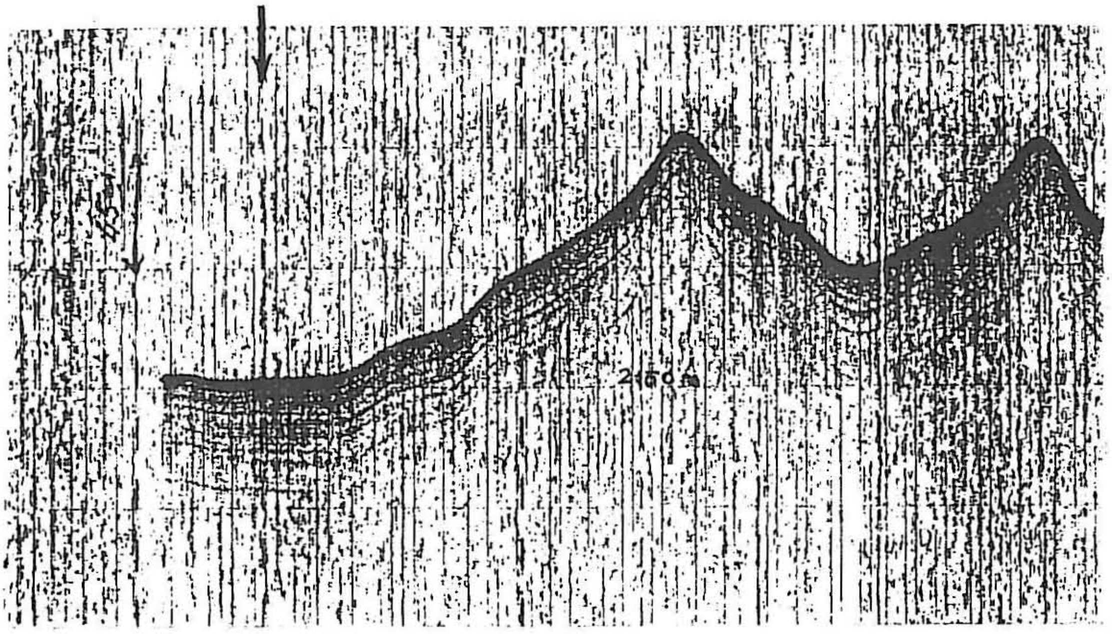
Unopened sections I to XXVI: 0-4050 cm
and XXXI to XXXVI: 4500-5264 cm

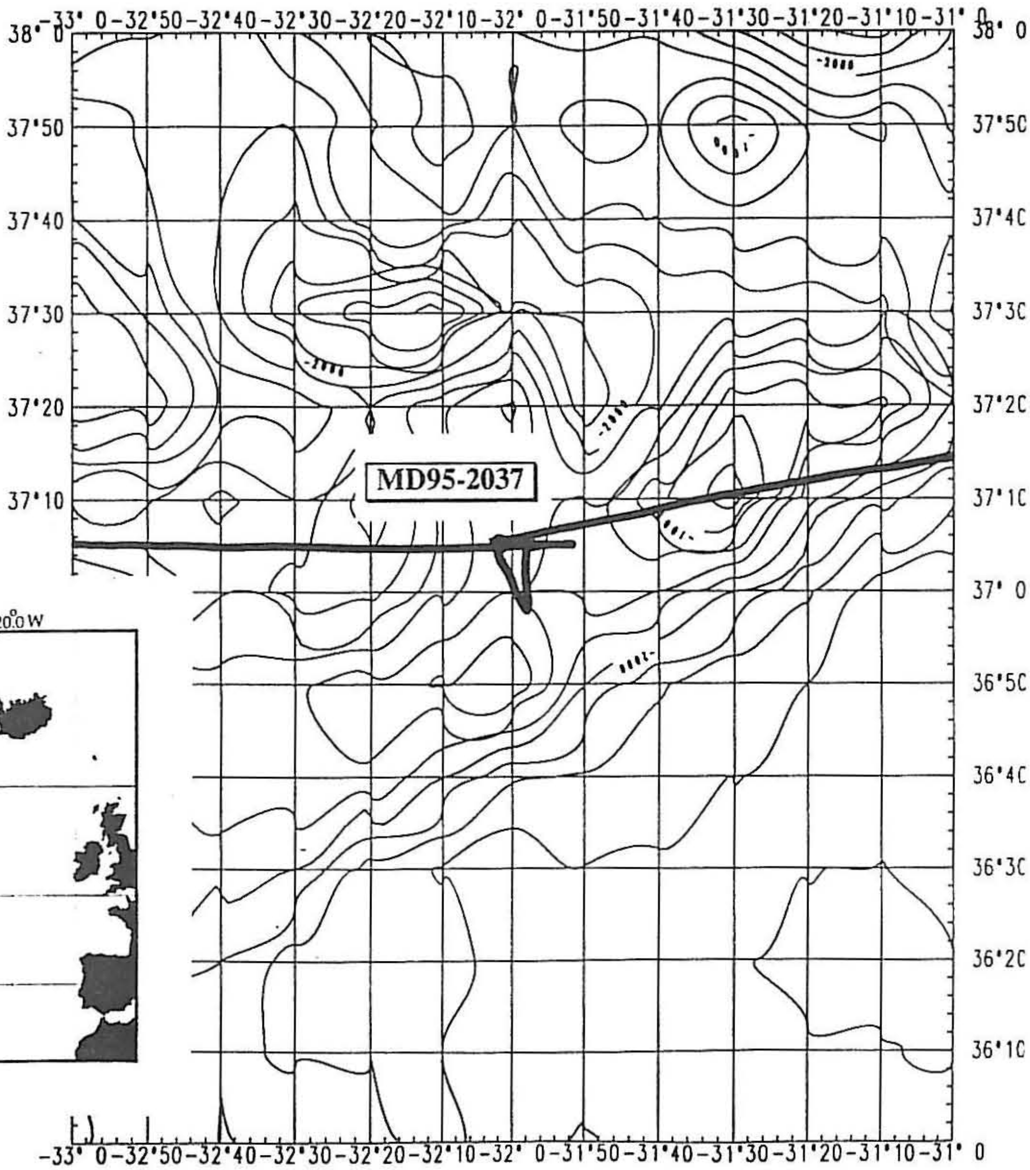
MD 95-2036

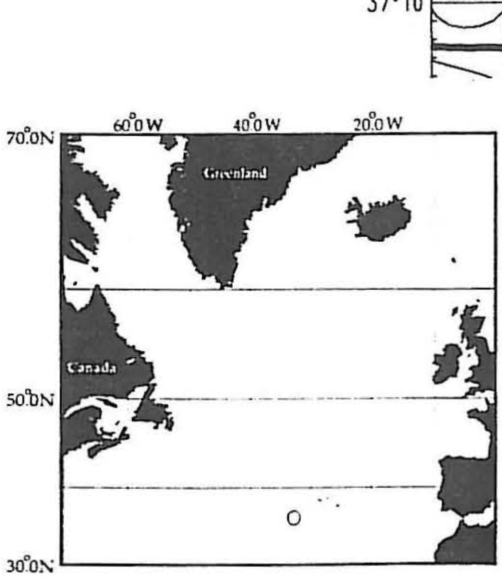


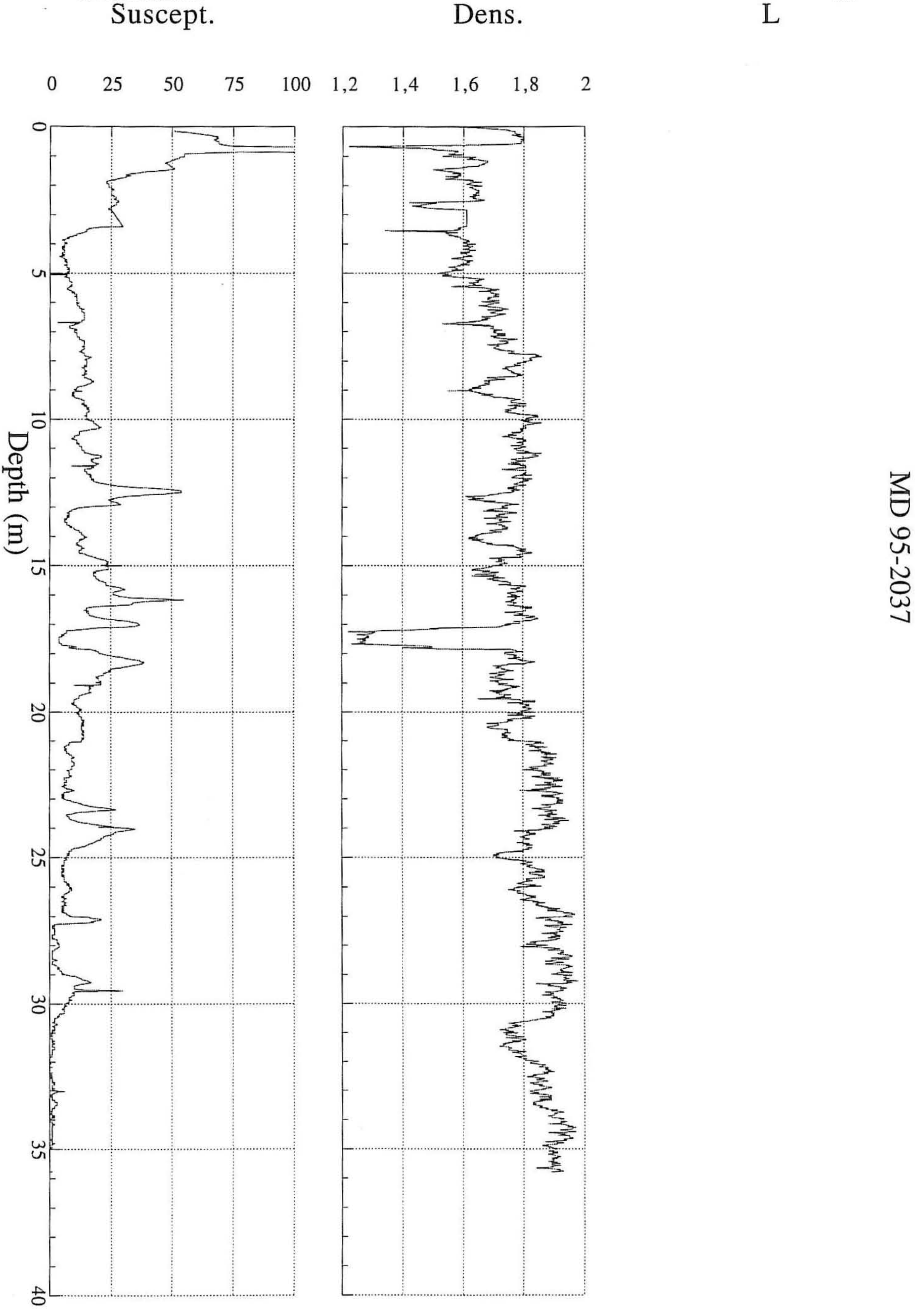
Core MD 95-2037

lat: 37°05.23 N - long: 32°01.87 W
water depth: 2159 m
length: 35.81 m

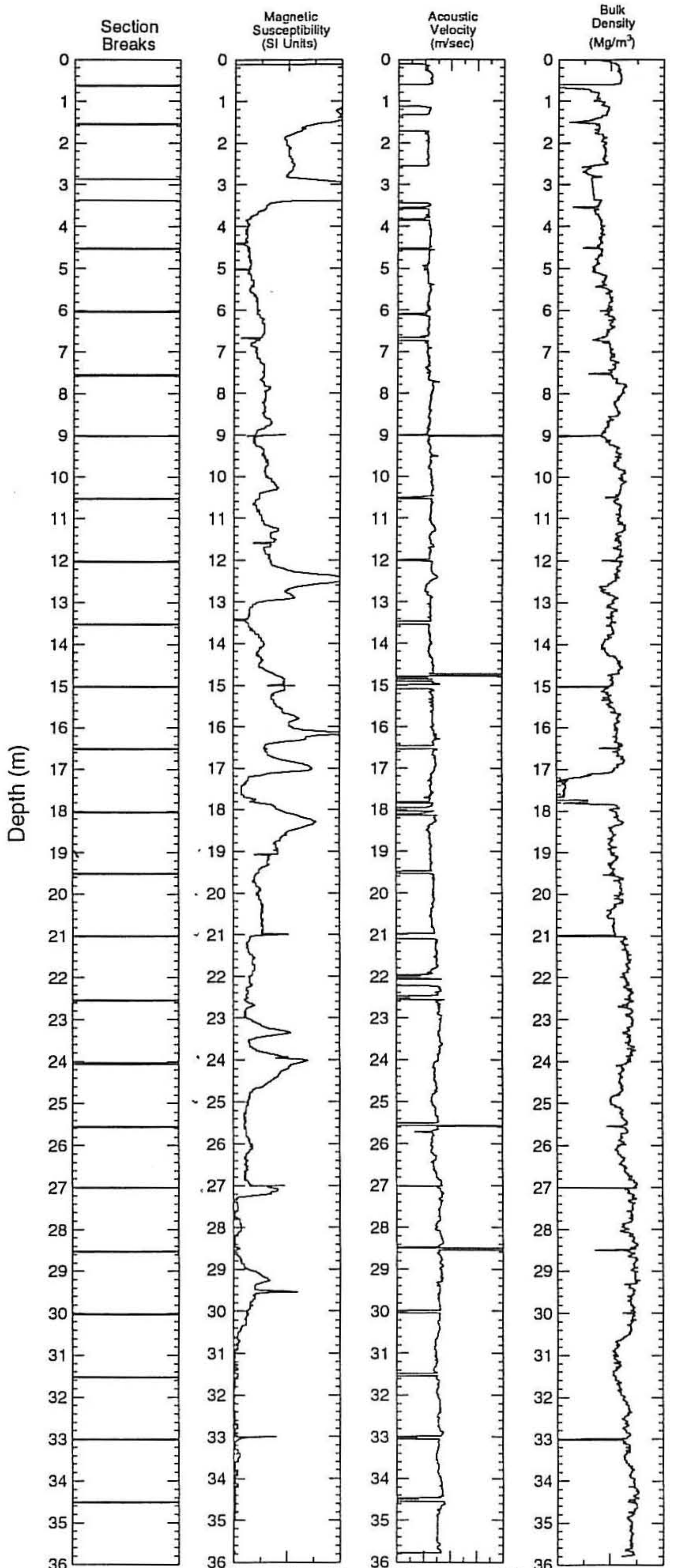




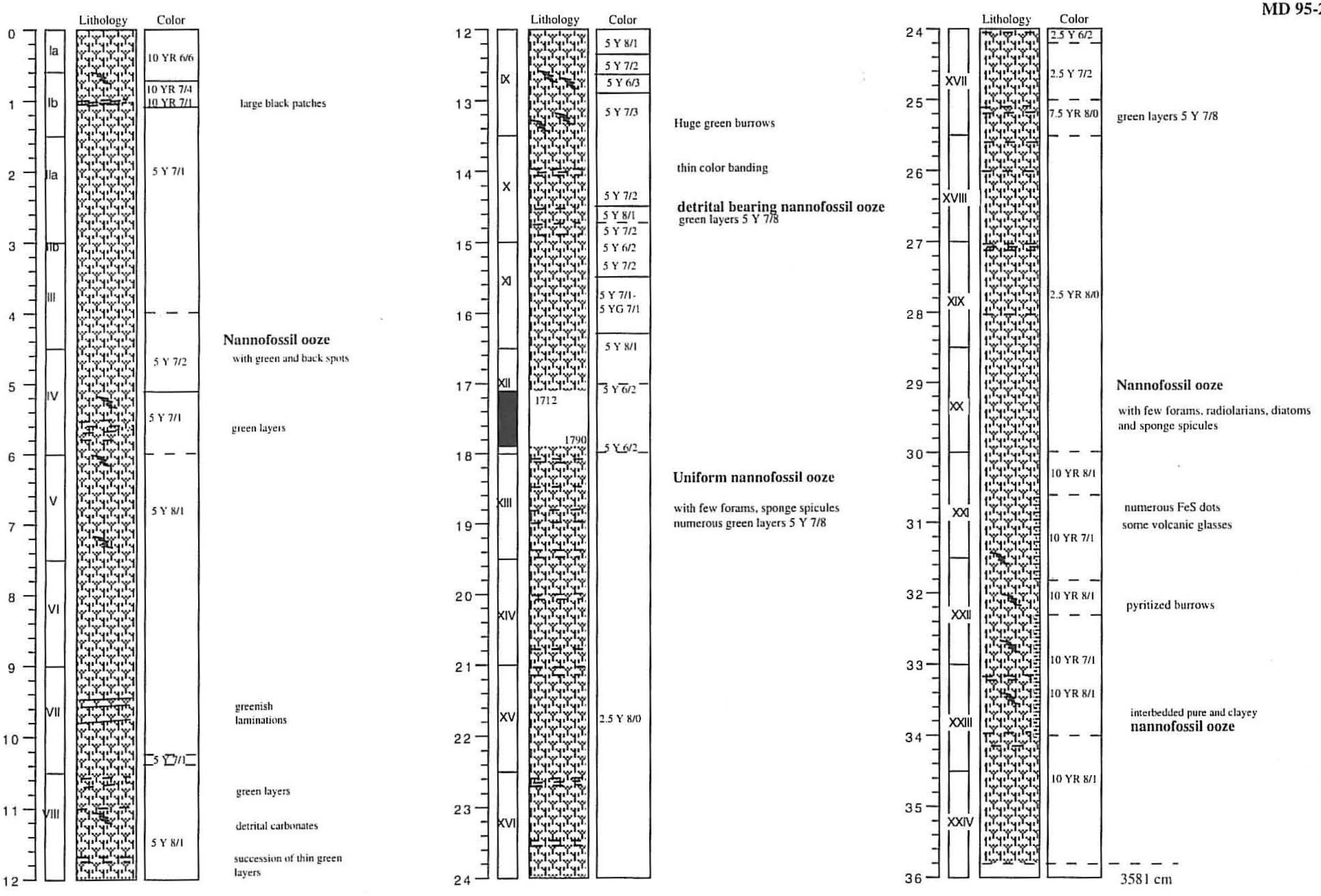



Suscept.
Dens.
L
0 25 50 75 100
1,2 1,4 1,6 1,8 2
0 5 10 15 20 25 30 35 40
Depth (m)
MD 95-2037

MD95-2037

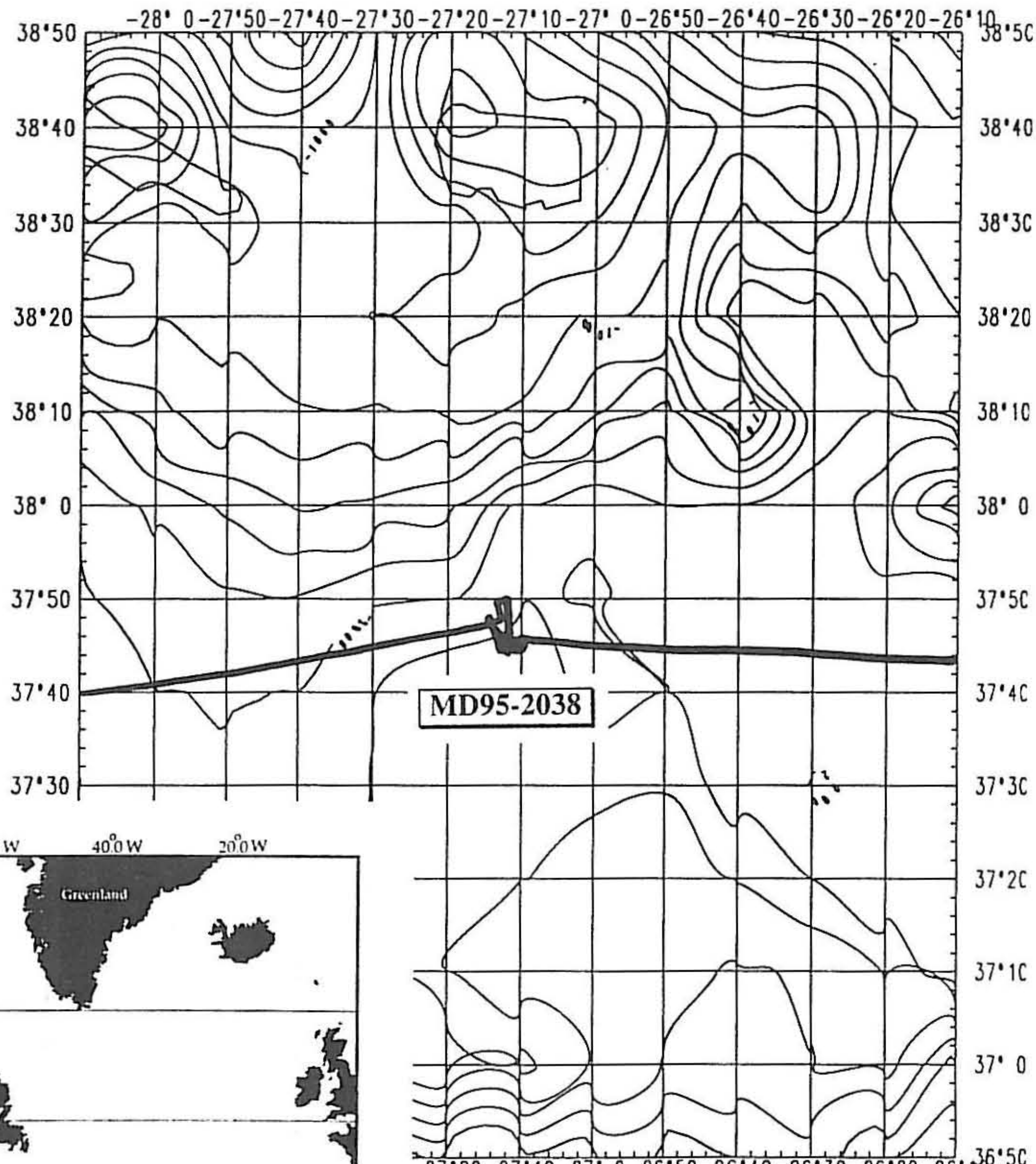

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0
25
50
1400
1600
1.2
2.2

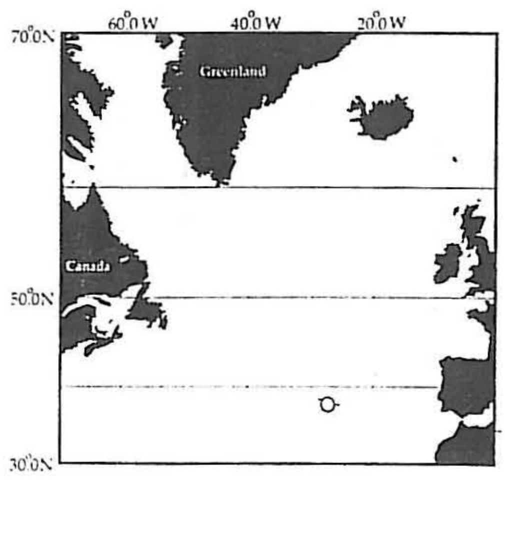
MD 95-2037

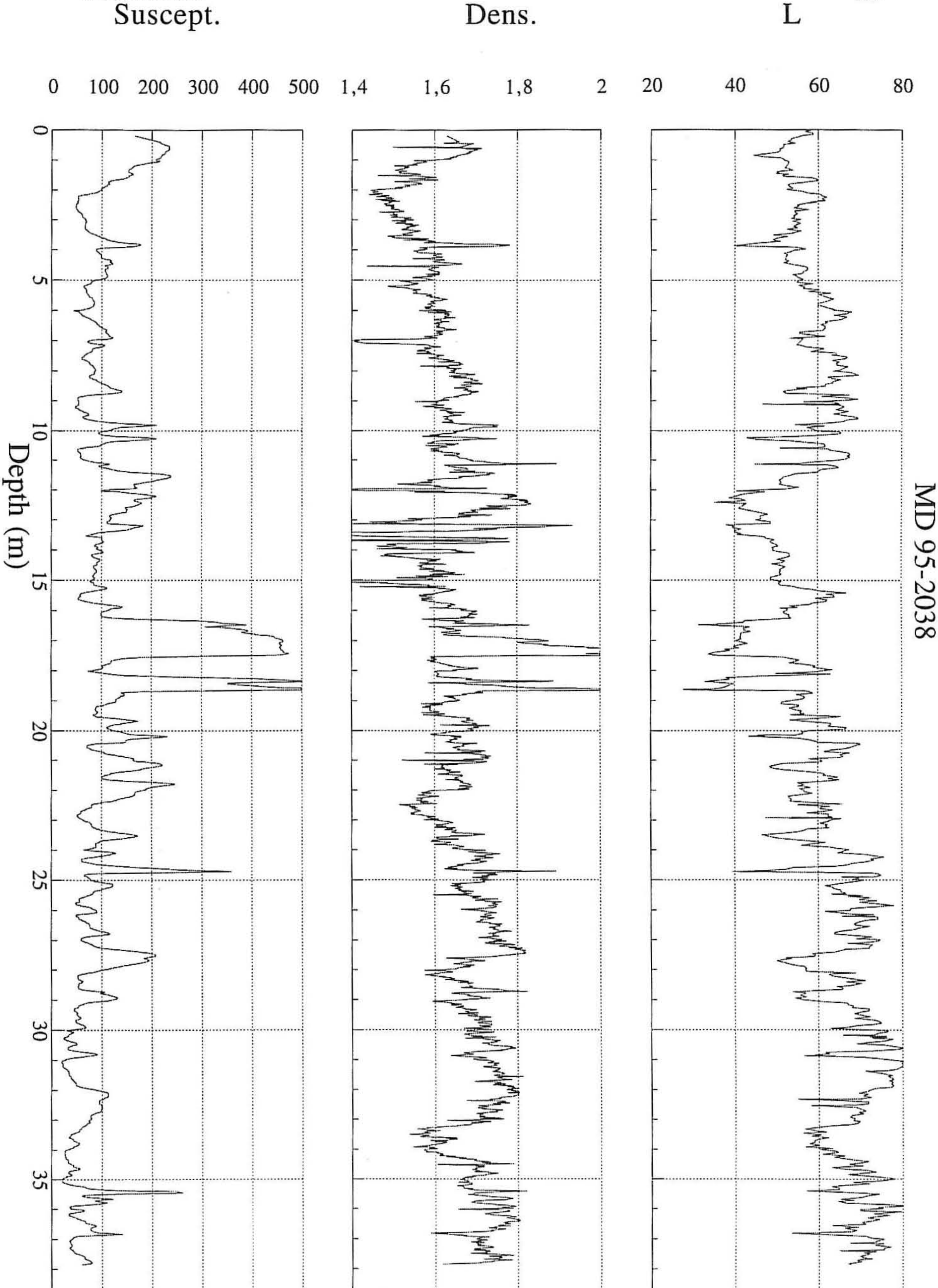

Lithology
Color
10 YR 6/6
10 YR 7/4
10 YR 7/1
large black patches
5 Y 7/1
Nannofossil ooze
with green and back spots
5 Y 7/2
5 Y 7/1
green layers
5 Y 8/1
greenish
laminations
5 Y 7/1
green layers
detrital carbonates
5 Y 8/1
succession of thin green
layers
5 Y 8/1
5 Y 7/2
5 Y 6/3
5 Y 7/3
Huge green burrows
thin color banding
5 Y 7/2
detrital bearing nannofossil ooze
green layers 5 Y 7/8
5 Y 8/1
5 Y 7/2
5 Y 6/2
5 Y 7/2
5 Y 7/1-
5 YG 7/1
5 Y 8/1
5 Y 6/2
1712
1790
5 Y 6/2
Uniform nannofossil ooze
with few forams, sponge spicules
numerous green layers 5 Y 7/8
2.5 Y 8/0
2.5 Y 6/2
2.5 Y 7/2
7.5 YR 8/0
green layers 5 Y 7/8
2.5 YR 8/0
Nannofossil ooze
with few forams, radiolarians, diatoms
and sponge spicules
10 YR 8/1
numerous FeS dots
some volcanic glasses
10 YR 7/1
10 YR 8/1
pyritized burrows
10 YR 7/1
10 YR 8/1
interbedded pure and clayey
nannofossil ooze
10 YR 8/1
3581 cm

Core MD 95-2038

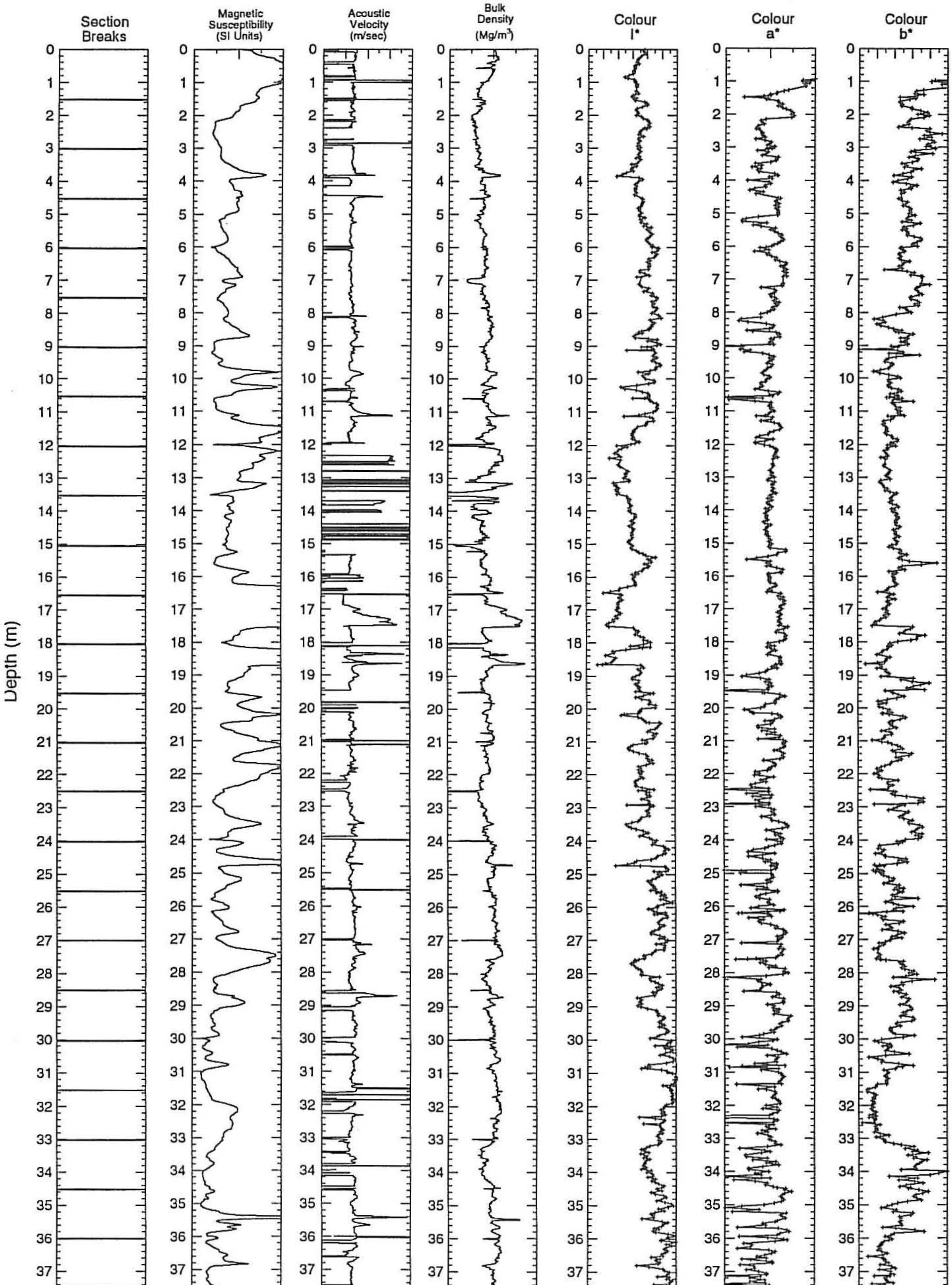
lat: 37°45.15 N - long: 27°11.21 W
water depth: 2310 m
length: 37.85 m

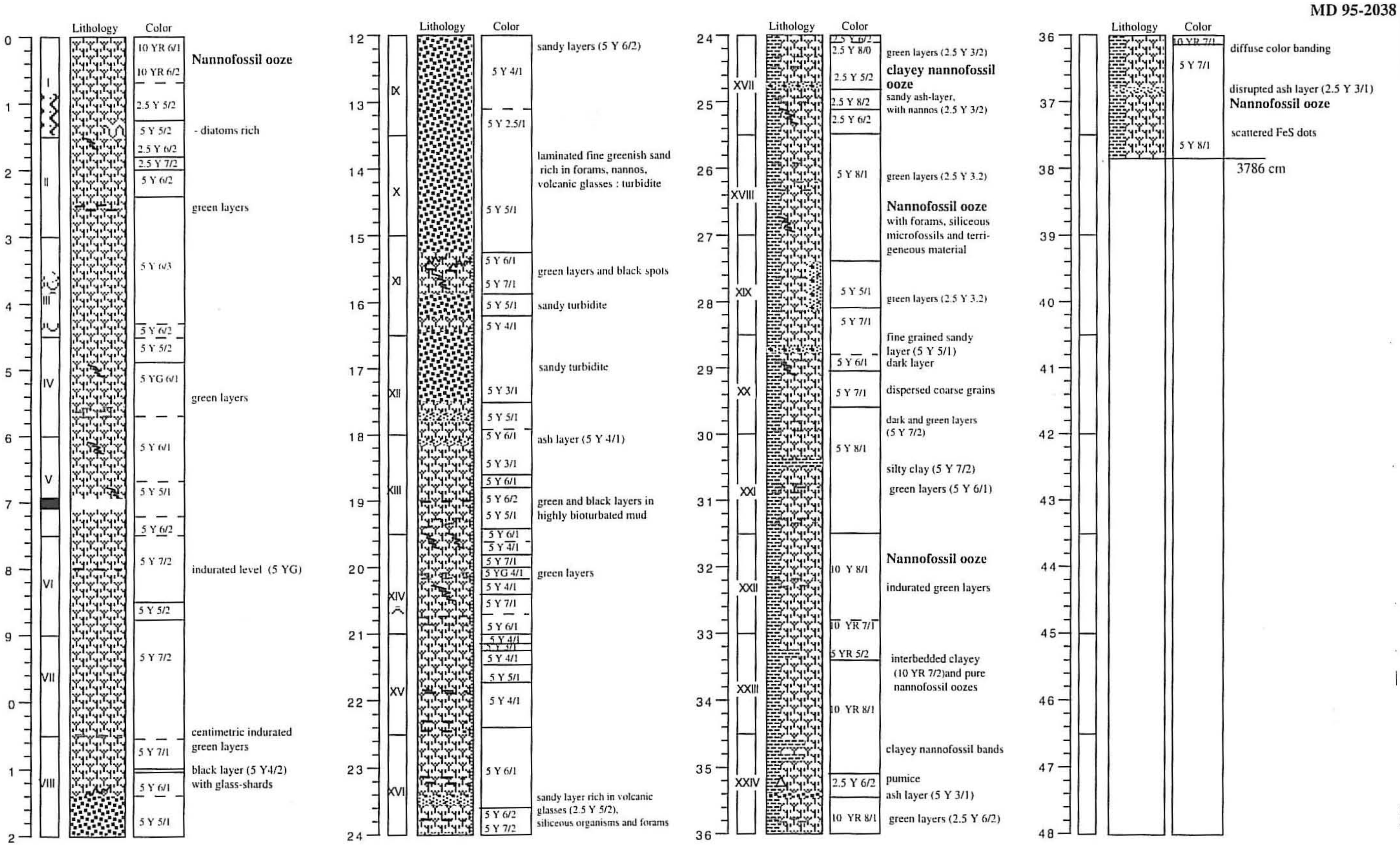





Suscept.
Dens.
L
0 100 200 300 400 500
1,4 1,6 1,8 2
20 40 60 80
0 5 10 15 20 25 30 35 40
Depth (m)
MD 95-2038

MD95-2038


Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)
0 110 220
1400 1600
1.2 2.2
20 40 60 80
-3 0 3
2 6 10

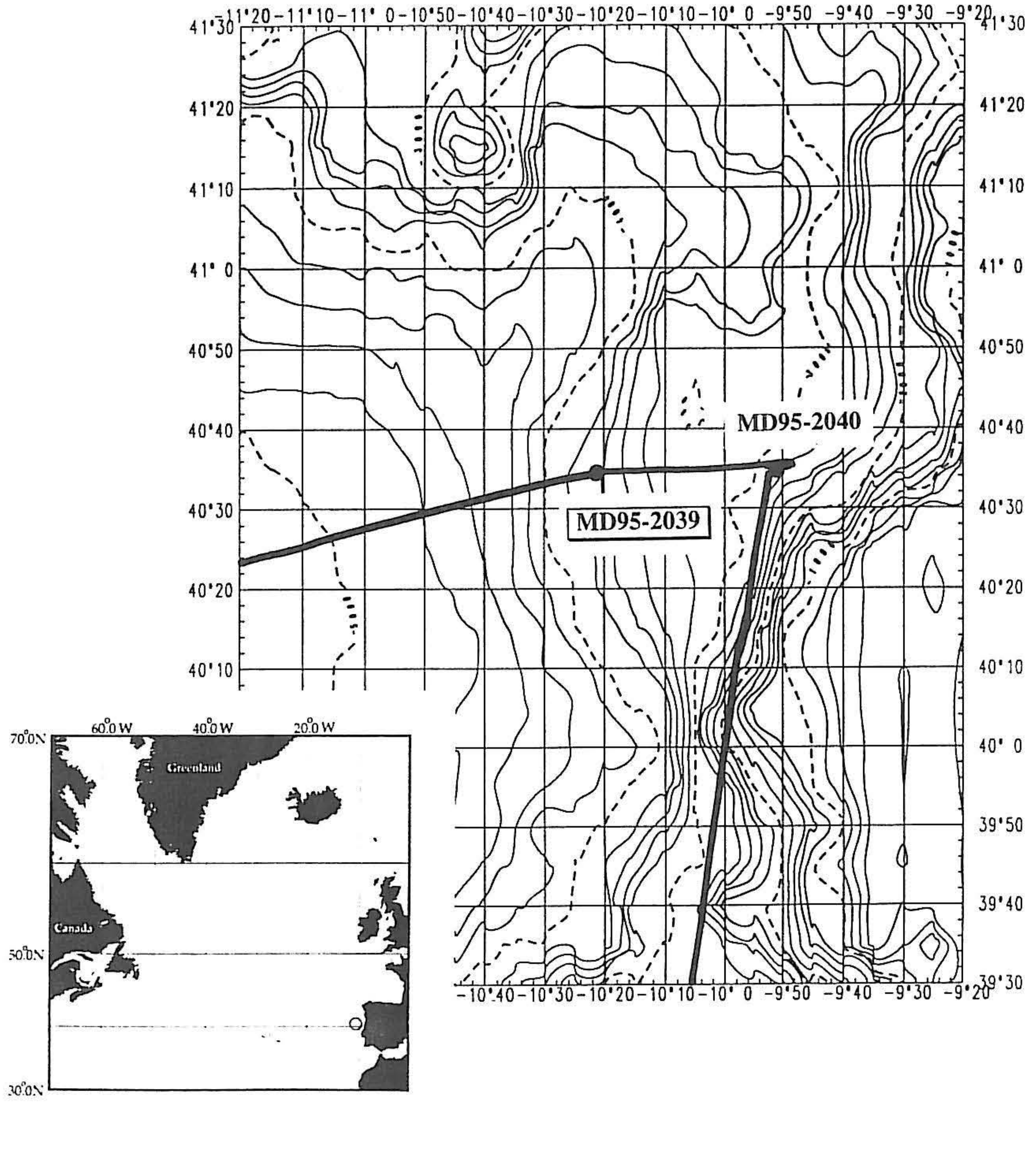

MD 95-2038
Lithology
Color
Nannofossil ooze
- diatoms rich
green layers
green layers
indurated level (5 YG)
centimetric indurated green layers
black layer (5 Y4/2) with glass-shards
sandy layers (5 Y 6/2)
laminated fine greenish sand rich in forams, nannos, volcanic glasses : turbidite
green layers and black spots
sandy turbidite
sandy turbidite
ash layer (5 Y 4/1)
green and black layers in highly bioturbated mud
green layers
sandy layer rich in volcanic glasses (2.5 Y 5/2), siliceous organisms and forams
green layers (2.5 Y 3/2)
clayey nannofossil ooze
sandy ash-layer, with nannos (2.5 Y 3/2)
green layers (2.5 Y 3.2)
Nannofossil ooze
with forams, siliceous microfossils and terrigeneous material
green layers (2.5 Y 3.2)
fine grained sandy layer (5 Y 5/1)
dark layer
dispersed coarse grains
dark and green layers (5 Y 7/2)
silty clay (5 Y 7/2)
green layers (5 Y 6/1)
Nannofossil ooze
indurated green layers
interbedded clayey (10 YR 7/2)and pure nannofossil oozes
clayey nannofossil bands
pumice
ash layer (5 Y 3/1)
green layers (2.5 Y 6/2)
diffuse color banding
disrupted ash layer (2.5 Y 3/1)
Nannofossil ooze
scattered FeS dots
3786 cm

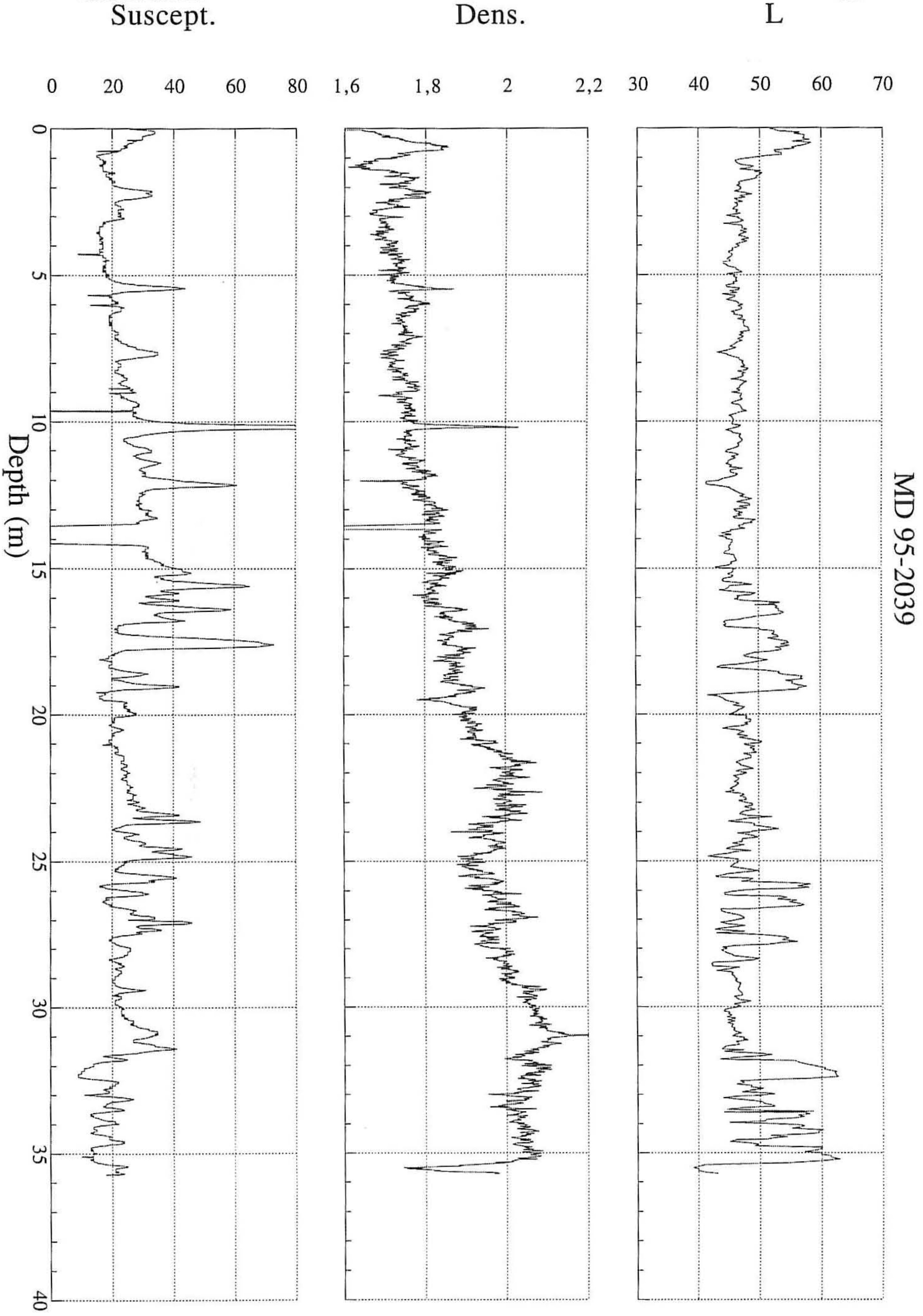
Core MD 95-2039

lat: 40°34.71 N - long: 10°20.91 W

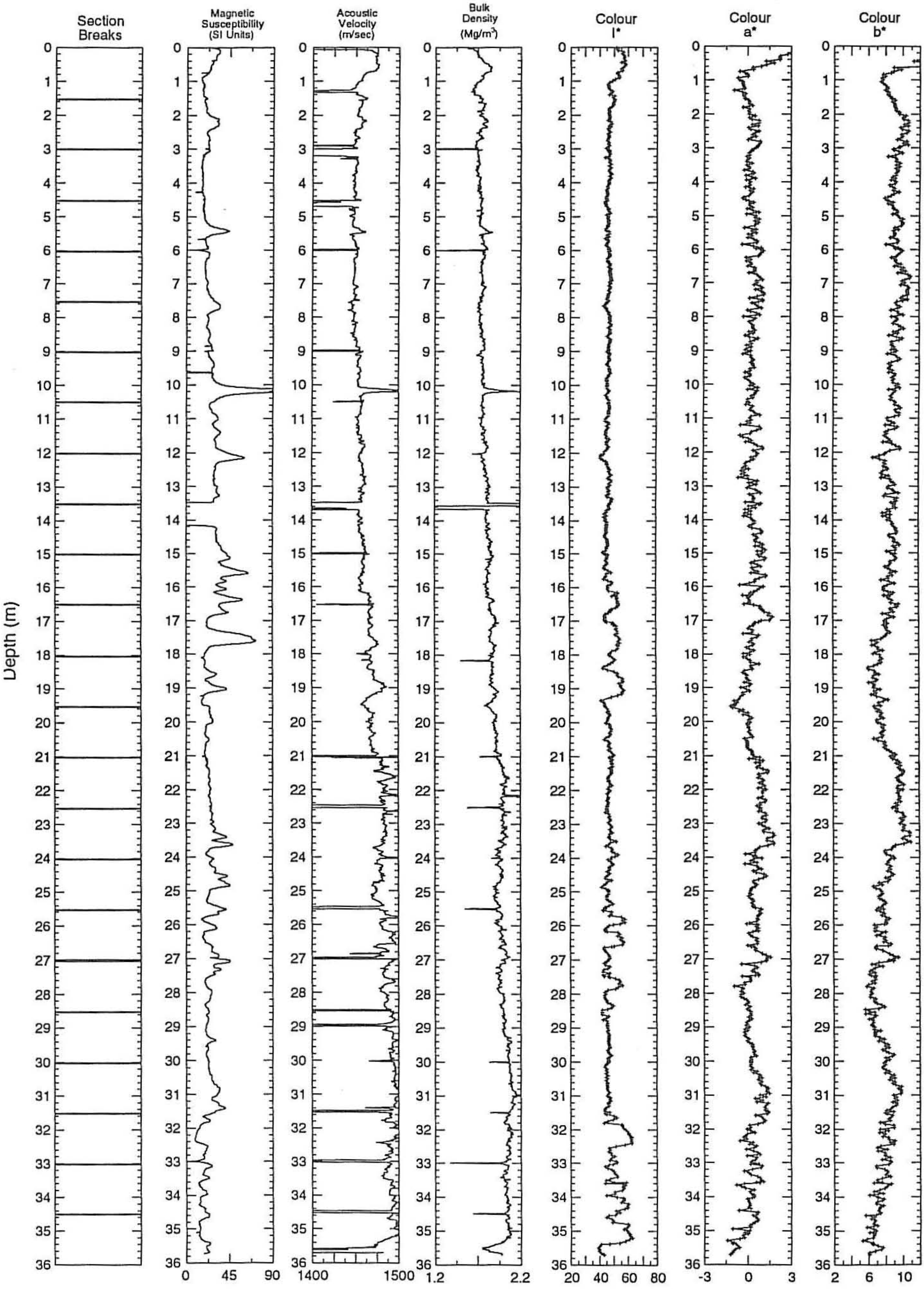
water depth: 3381 m

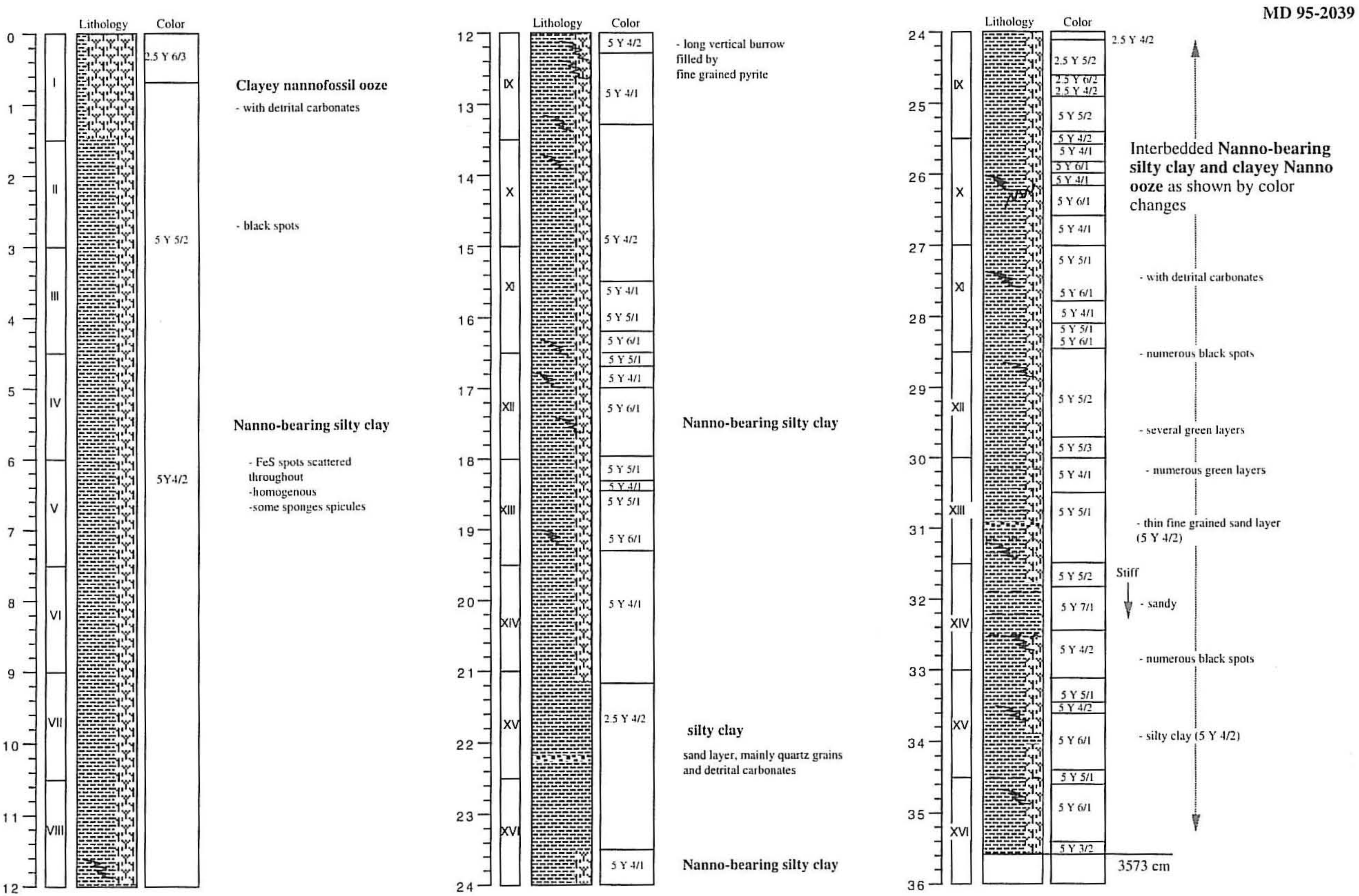
length: 35.71 m




Suscept.
Dens.
L
0 20 40 60 80
1,6 1,8 2 2,2
30 40 50 60 70
0 5 10 15 20 25 30 35 40
Depth (m)
MD 95-2039

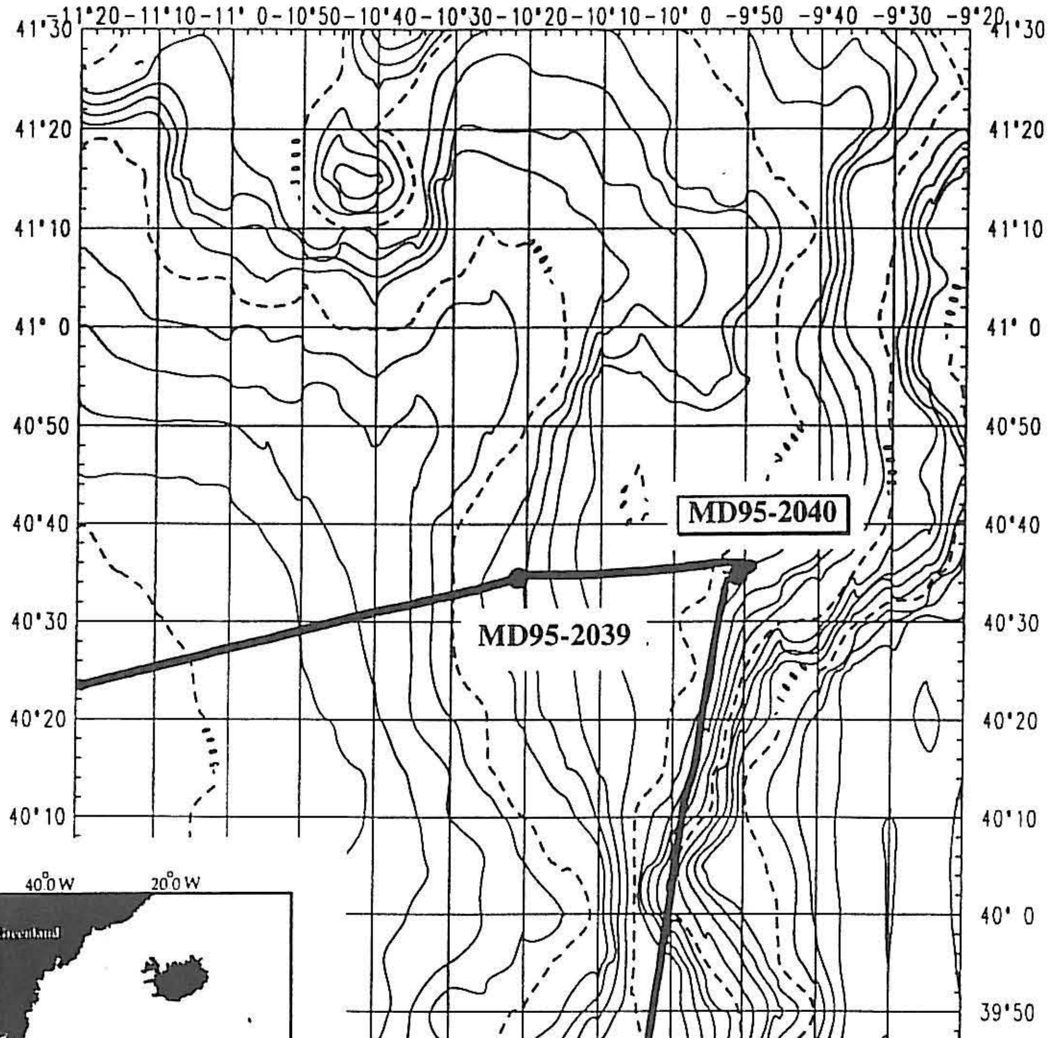
MD95-2039

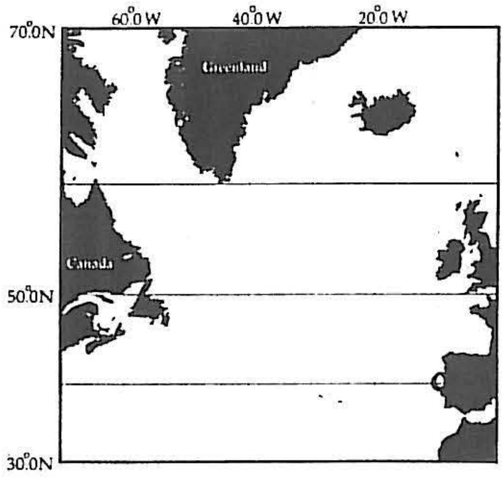

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m3)
Colour l*
Colour a*
Colour b*
Depth (m)

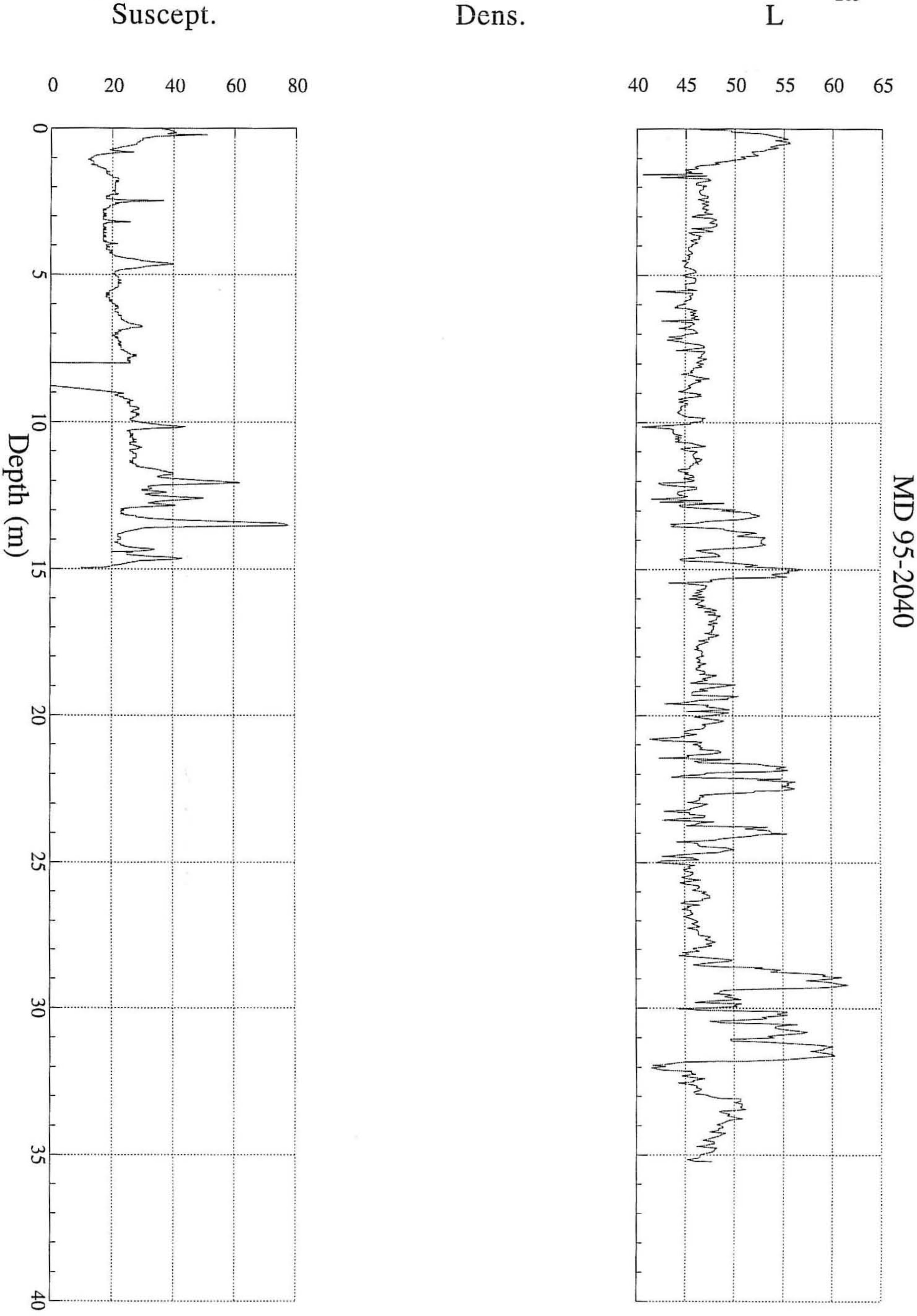

MD 95-2039
Lithology
Color
2.5 Y 6/3
5 Y 5/2
5Y4/2
Clayey nannofossil ooze
- with detrital carbonates
- black spots
Nanno-bearing silty clay
- FeS spots scattered throughout
-homogenous
-some sponges spicules
5 Y 4/2
5 Y 4/1
5 Y 5/1
5 Y 6/1
2.5 Y 4/2
- long vertical burrow filled by fine grained pyrite
Nanno-bearing silty clay
silty clay
sand layer, mainly quartz grains and detrital carbonates
Nanno-bearing silty clay
2.5 Y 5/2
5 Y 5/3
5 Y 7/1
5 Y 3/2
Interbedded Nanno-bearing silty clay and clayey Nanno ooze as shown by color changes
- with detrital carbonates
- numerous black spots
- several green layers
- numerous green layers
- thin fine grained sand layer (5 Y 4/2)
Stiff
- sandy
- numerous black spots
- silty clay (5 Y 4/2)
3573 cm

Core MD 95-2040

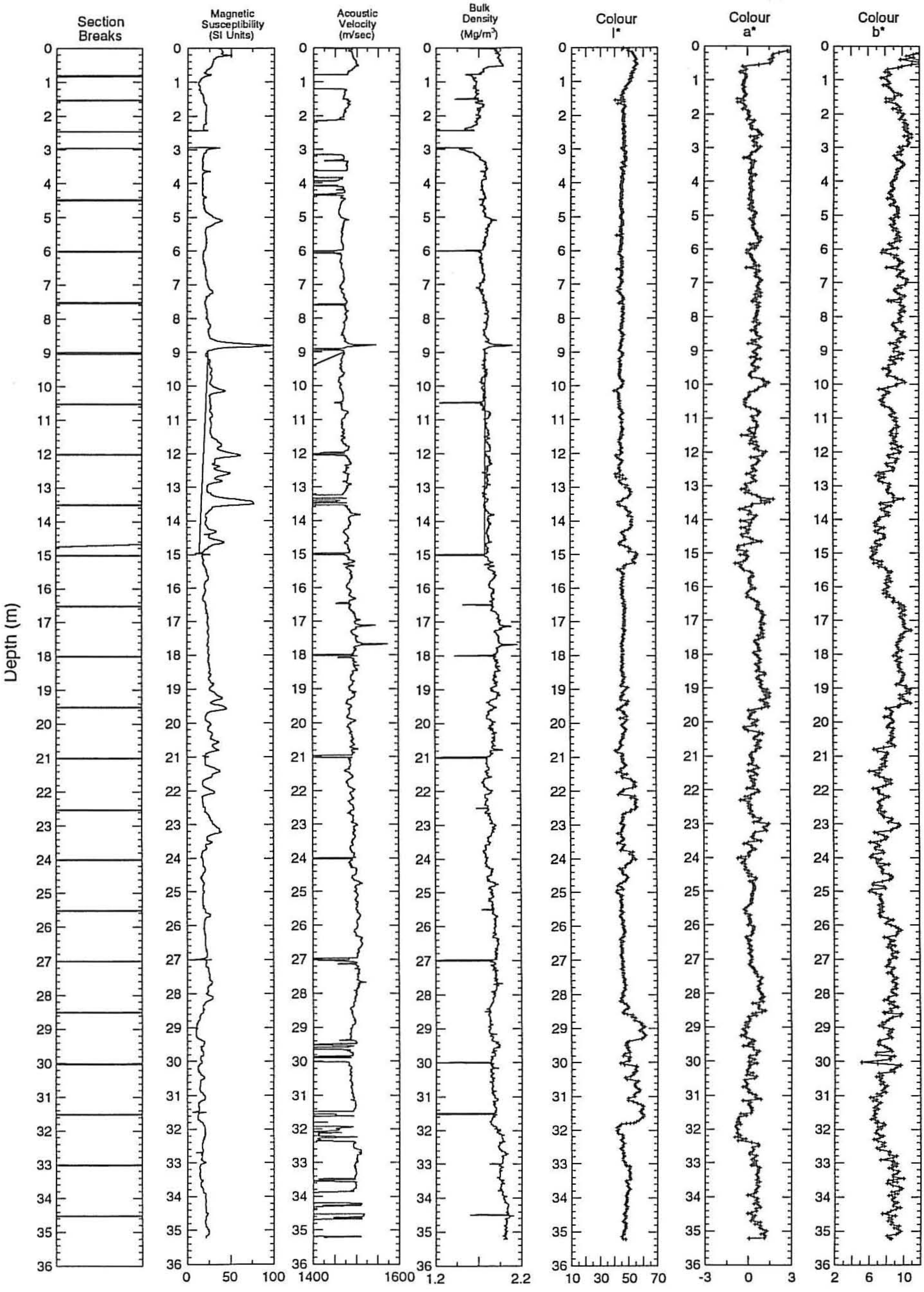
lat: 40°34.91 N - long: 09°51.67 W
water depth: 2465 m
length: 35.24 m





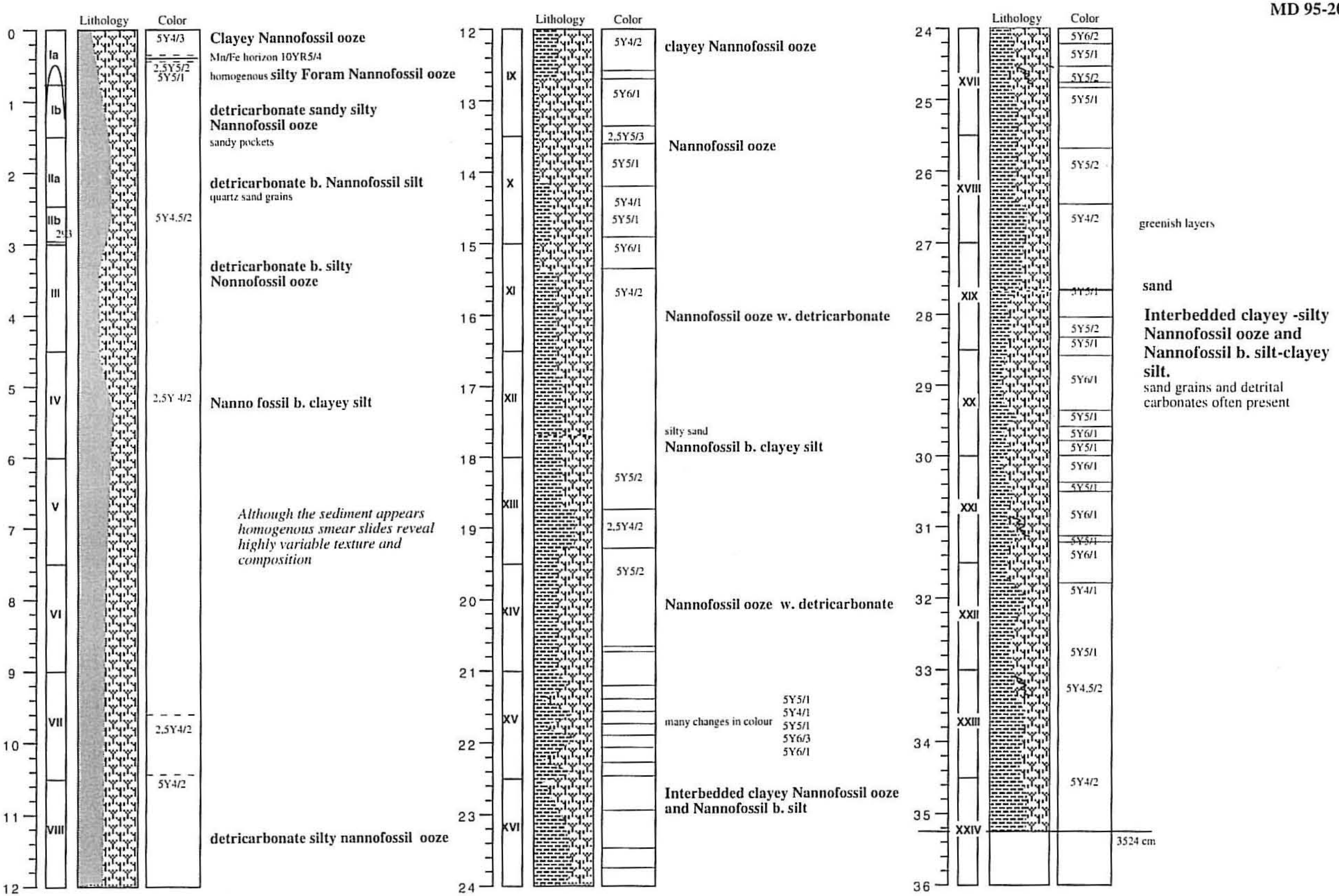

Suscept.
Dens.
L
0 20 40 60 80
40 45 50 55 60 65
0 5 10 15 20 25 30 35 40
Depth (m)
MD 95-2040

MD95-2040



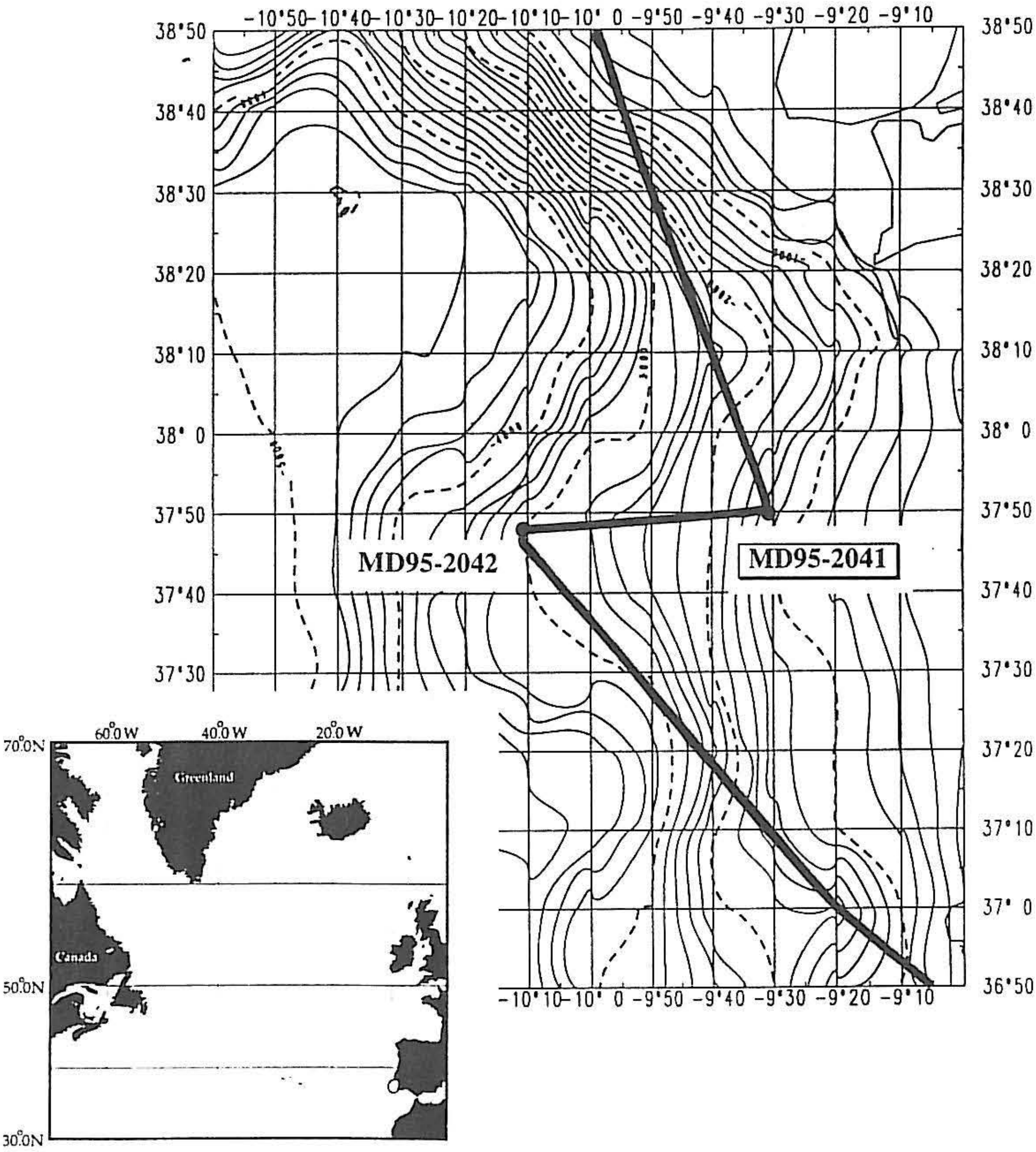
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Colour l*
Colour a*
Colour b*
Depth (m)

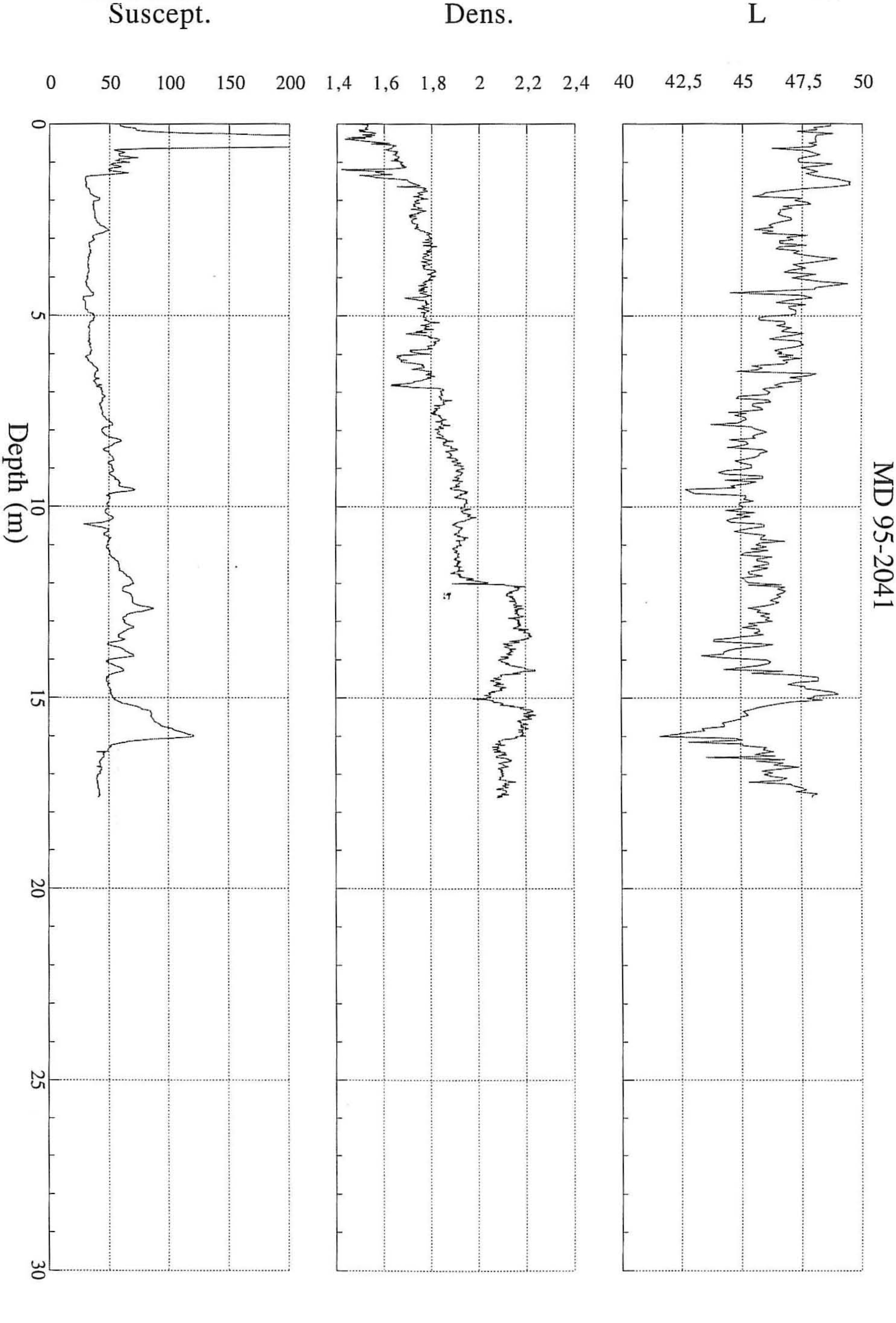
MD 95-2040


Lithology
Color
Clayey Nannofossil ooze
Mn/Fe horizon 10YR5/4
homogenous silty Foram Nannofossil ooze
detricarbonate sandy silty Nannofossil ooze
sandy pockets
detricarbonate b. Nannofossil silt
quartz sand grains
detricarbonate b. silty Nonnofossil ooze
Nanno fossil b. clayey silt
Although the sediment appears homogenous smear slides reveal highly variable texture and composition
detricarbonate silty nannofossil ooze
5Y4/3
2.5Y5/2
5Y5/1
5Y4.5/2
2.5Y 4/2
2.5Y4/2
5Y4/2
Ia
Ib
IIa
IIb
III
IV
V
VI
VII
VIII
clayey Nannofossil ooze
Nannofossil ooze
Nannofossil ooze w. detricarbonate
silty sand
Nannofossil b. clayey silt
Nannofossil ooze w. detricarbonate
many changes in colour
5Y5/1
5Y4/1
5Y5/1
5Y6/3
5Y6/1
Interbedded clayey Nannofossil ooze and Nannofossil b. silt
5Y4/2
5Y6/1
2.5Y5/3
5Y5/1
5Y4/1
5Y5/1
5Y6/1
5Y4/2
5Y5/2
2.5Y4/2
5Y5/2
IX
X
XI
XII
XIII
XIV
XV
XVI
greenish layers
sand
Interbedded clayey -silty Nannofossil ooze and Nannofossil b. silt-clayey silt.
sand grains and detrital carbonates often present
5Y6/2
5Y5/1
5Y5/2
5Y5/1
5Y5/2
5Y4/2
5Y5/2
5Y5/1
5Y6/1
5Y5/1
5Y6/1
5Y5/1
5Y6/1
5Y6/1
5Y6/1
5Y4/1
5Y5/1
5Y4.5/2
5Y4/2
XVII
XVIII
XIX
XX
XXI
XXII
XXIII
XXIV
3524 cm

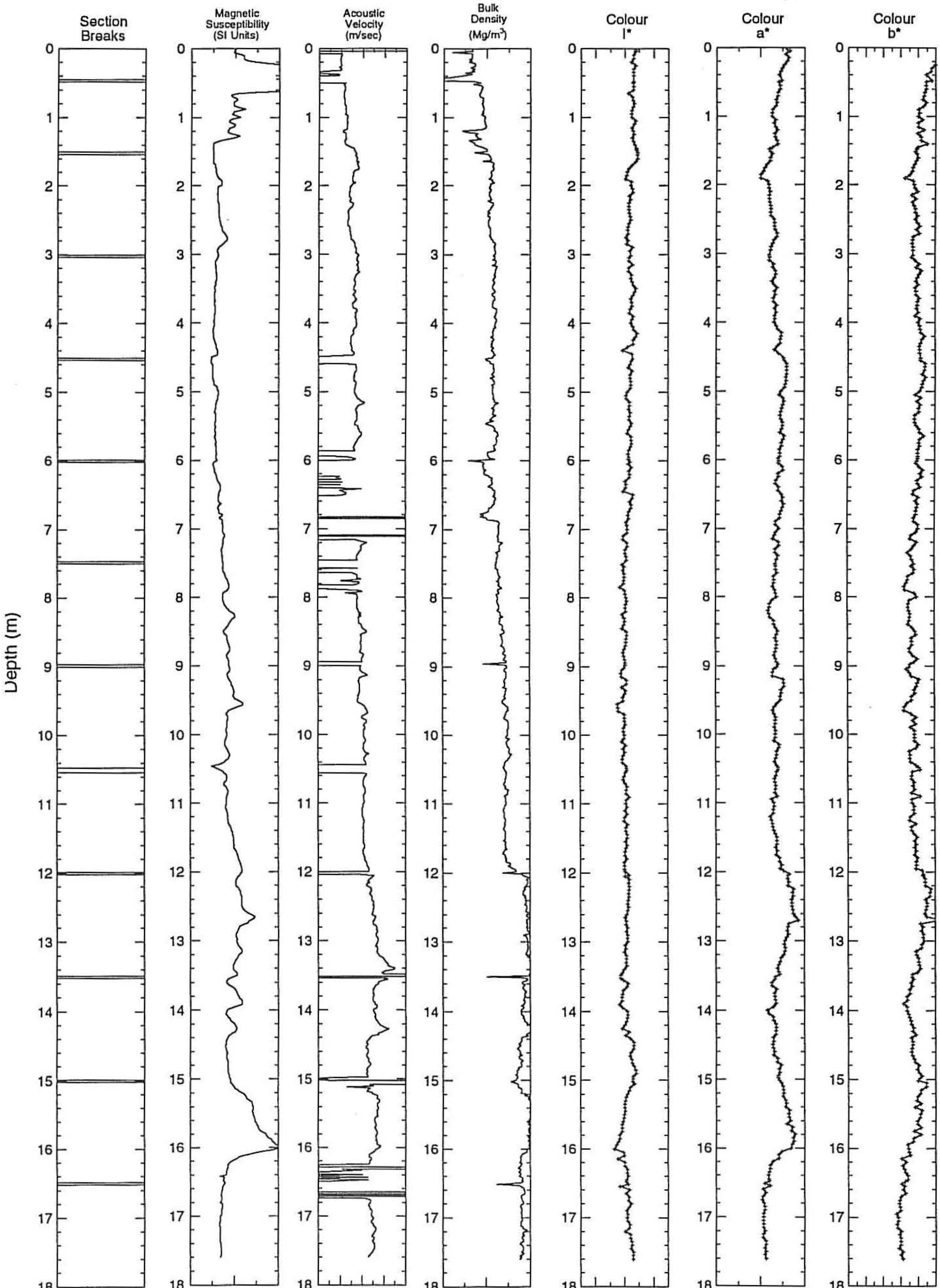
Core MD 95-2041

lat: 37°50 N - long: 09°30.64 W
water depth: 1123 m
length: 17.62 m

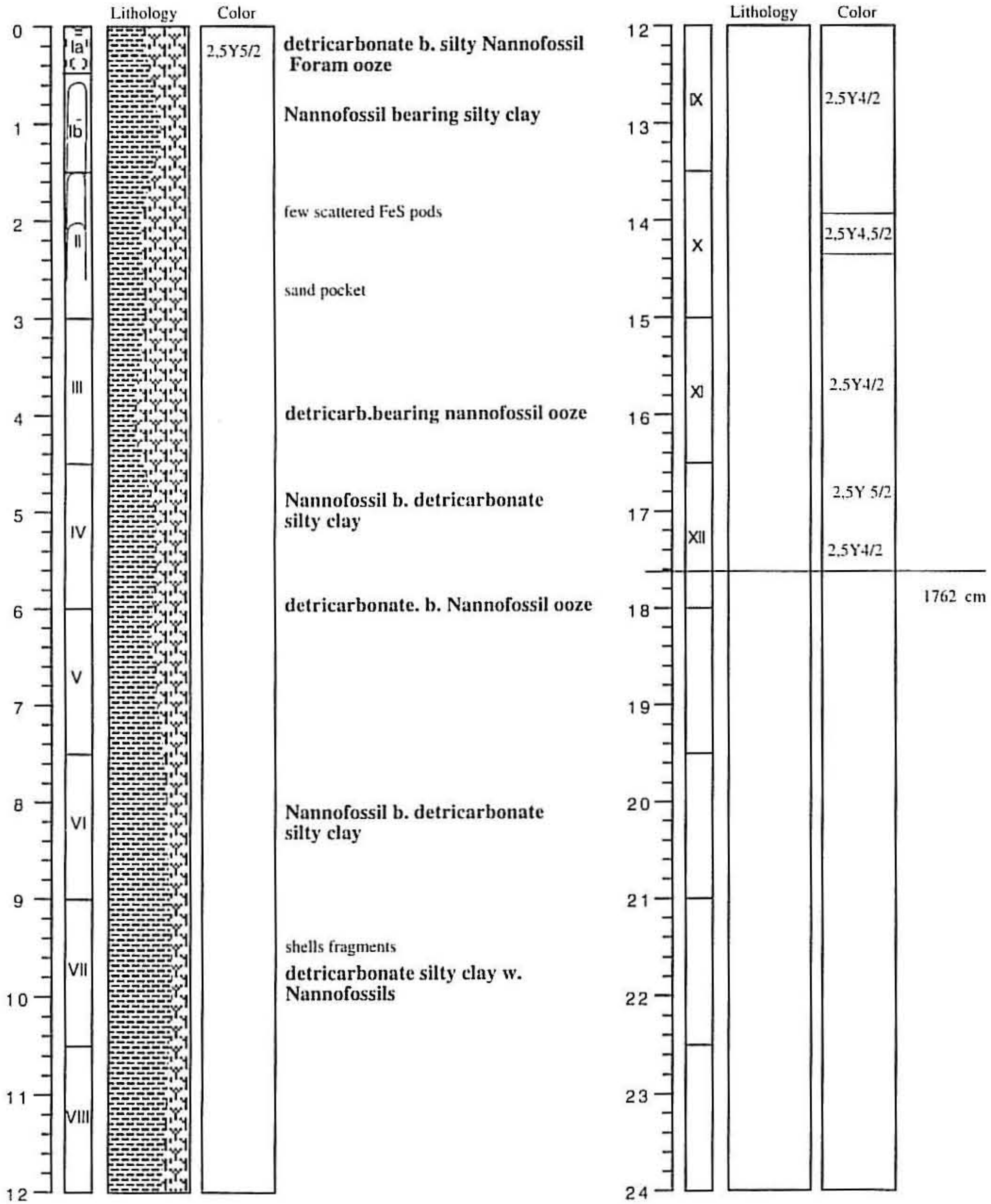



Suscept.
Dens.
L
0 50 100 150 200
1,4 1,6 1,8 2 2,2 2,4
40 42,5 45 47,5 50
0 5 10 15 20 25 30
Depth (m)
MD 95-2041

MD95-2041

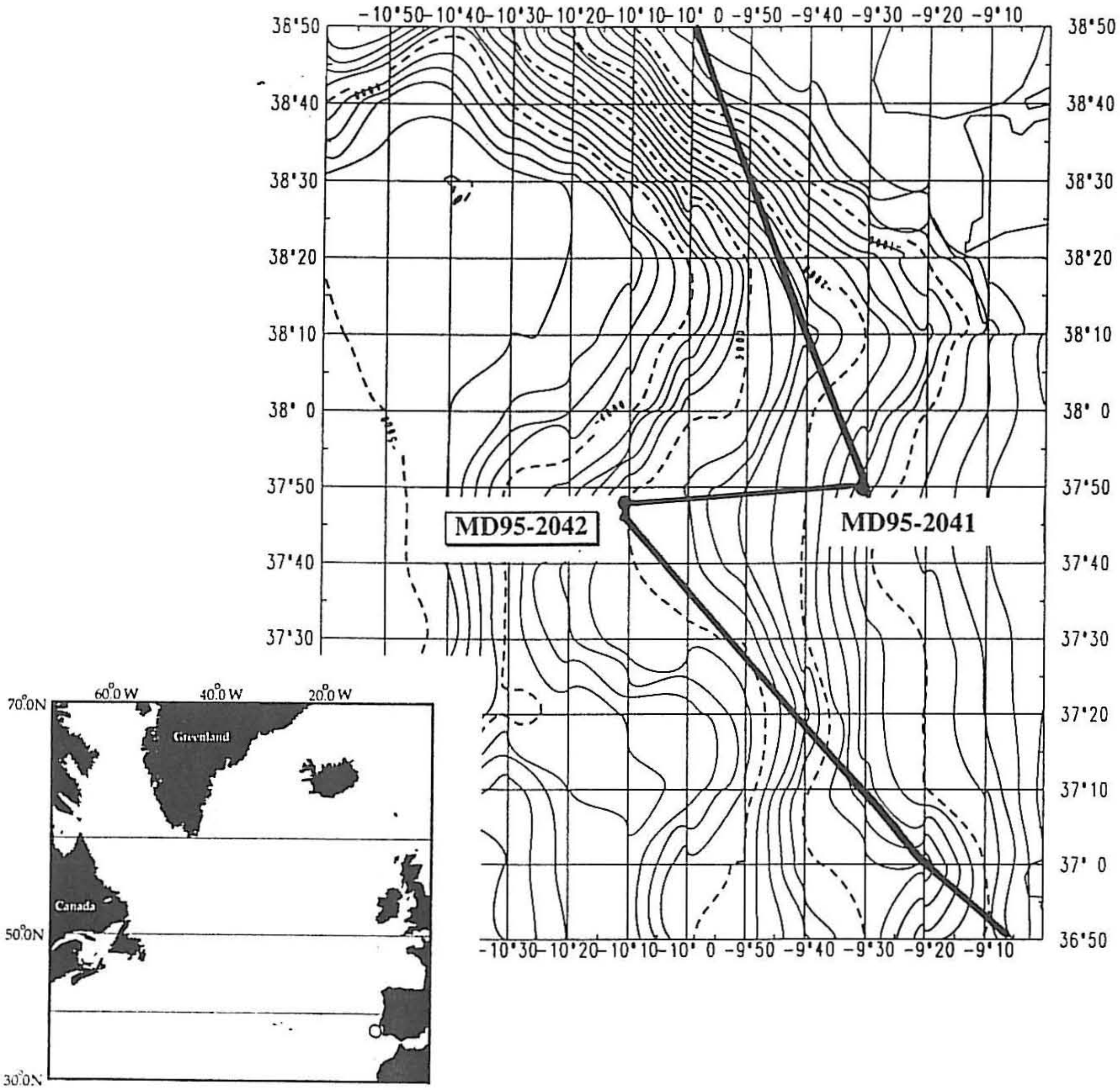

Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m^3)
Colour l*
Colour a*
Colour b*
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
0 60 120
1400 1600
1.2 2.2
35 55
-3 0 3
2 6 10

MD 95-2041

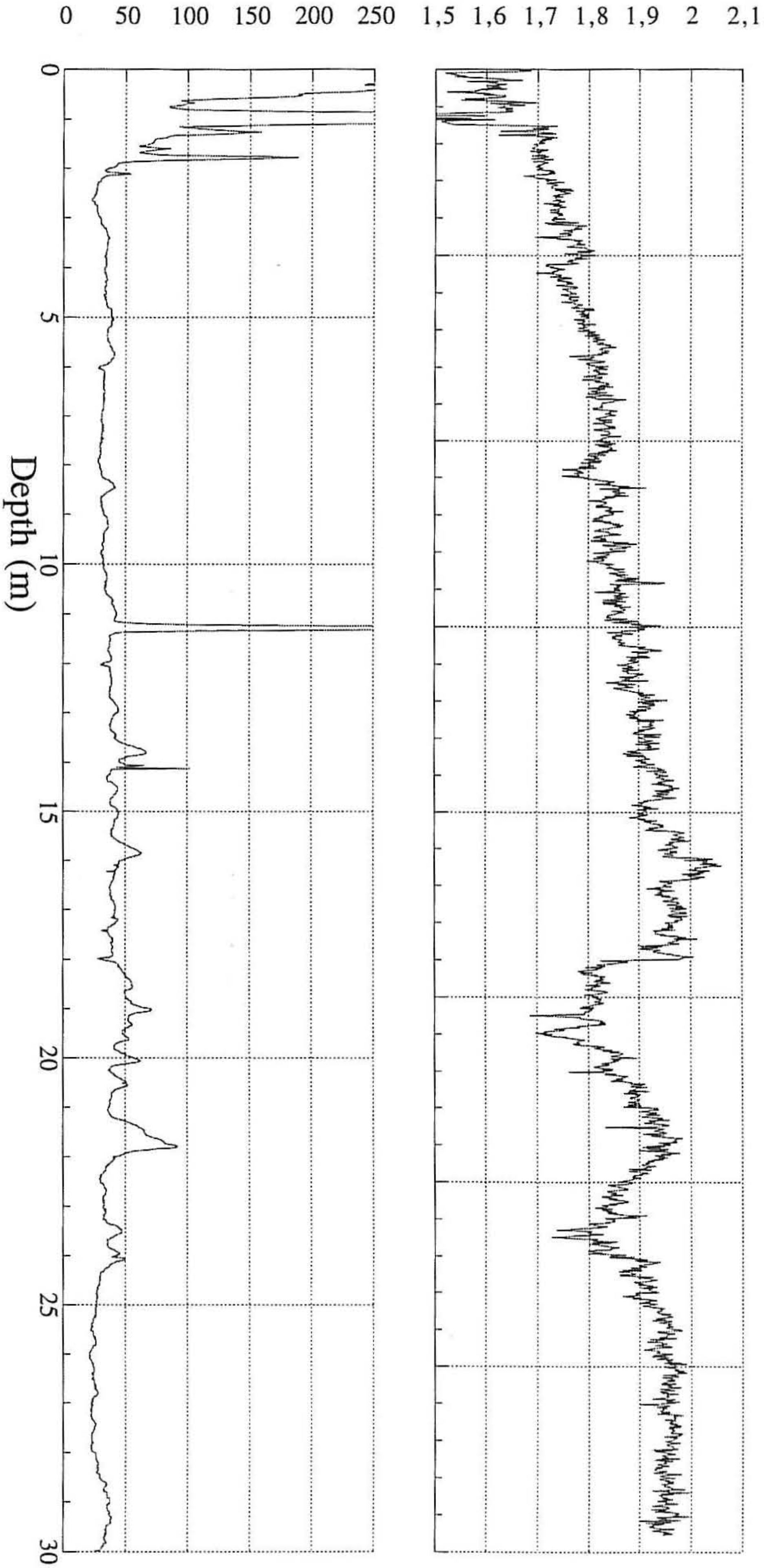

Lithology
Color
2,5Y5/2
detricarbonate b. silty Nannofossil Foram ooze
Nannofossil bearing silty clay
few scattered FeS pods
sand pocket
detricarb.bearing nannofossil ooze
Nannofossil b. detricarbonate silty clay
detricarbonate. b. Nannofossil ooze
Nannofossil b. detricarbonate silty clay
shells fragments
detricarbonate silty clay w. Nannofossils
Ia
Ib
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
2,5Y4/2
2,5Y4,5/2
2,5Y4/2
2,5Y 5/2
2,5Y4/2
1762 cm

Core MD 95-2042

lat: 37°47.99 N - long: 10°09.99 W
water depth: 3146 m
length: 39.56 m

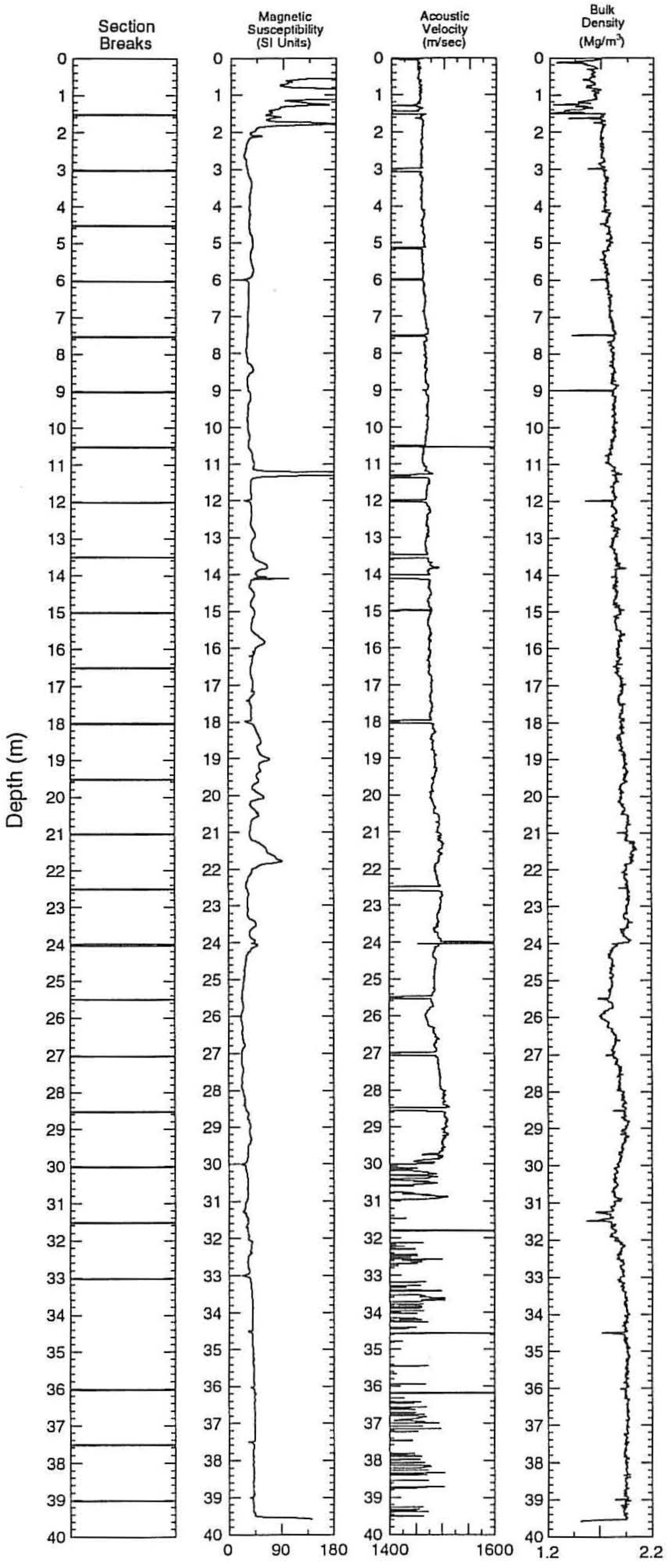


Suscept. Dens. L



MD 95-2042

MD95-2042



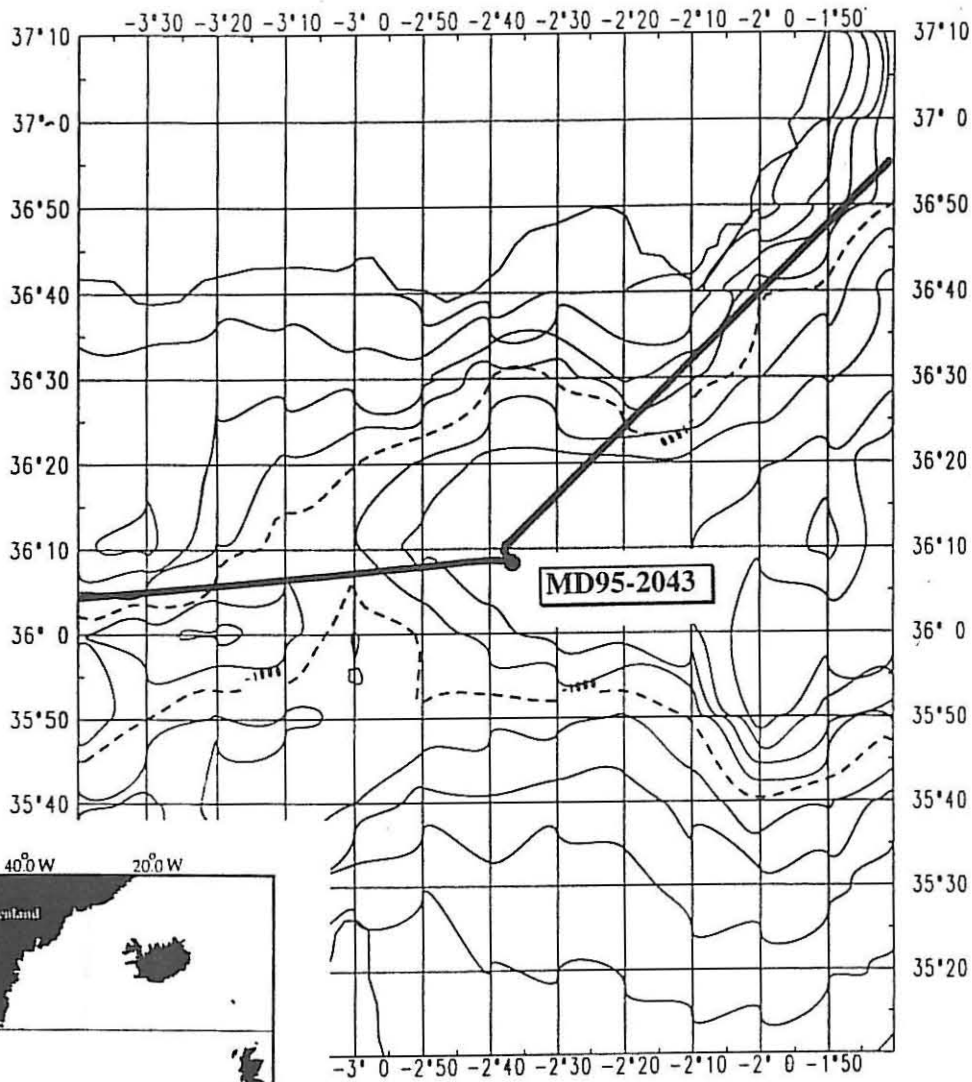
Section Breaks
Magnetic Susceptibility (SI Units)
Acoustic Velocity (m/sec)
Bulk Density (Mg/m³)
Depth (m)
0 90 180
1400 1600
1.2 2.2

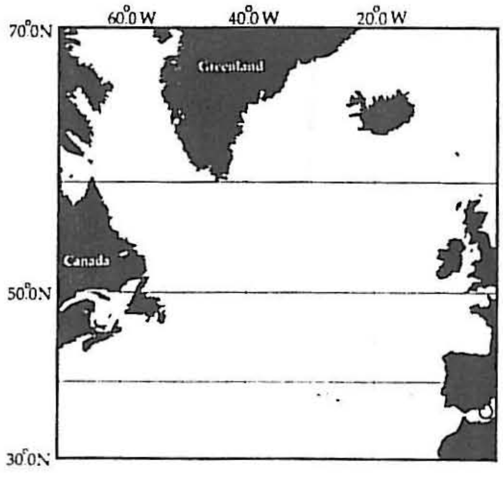
Core MD95-2042 not opened on board

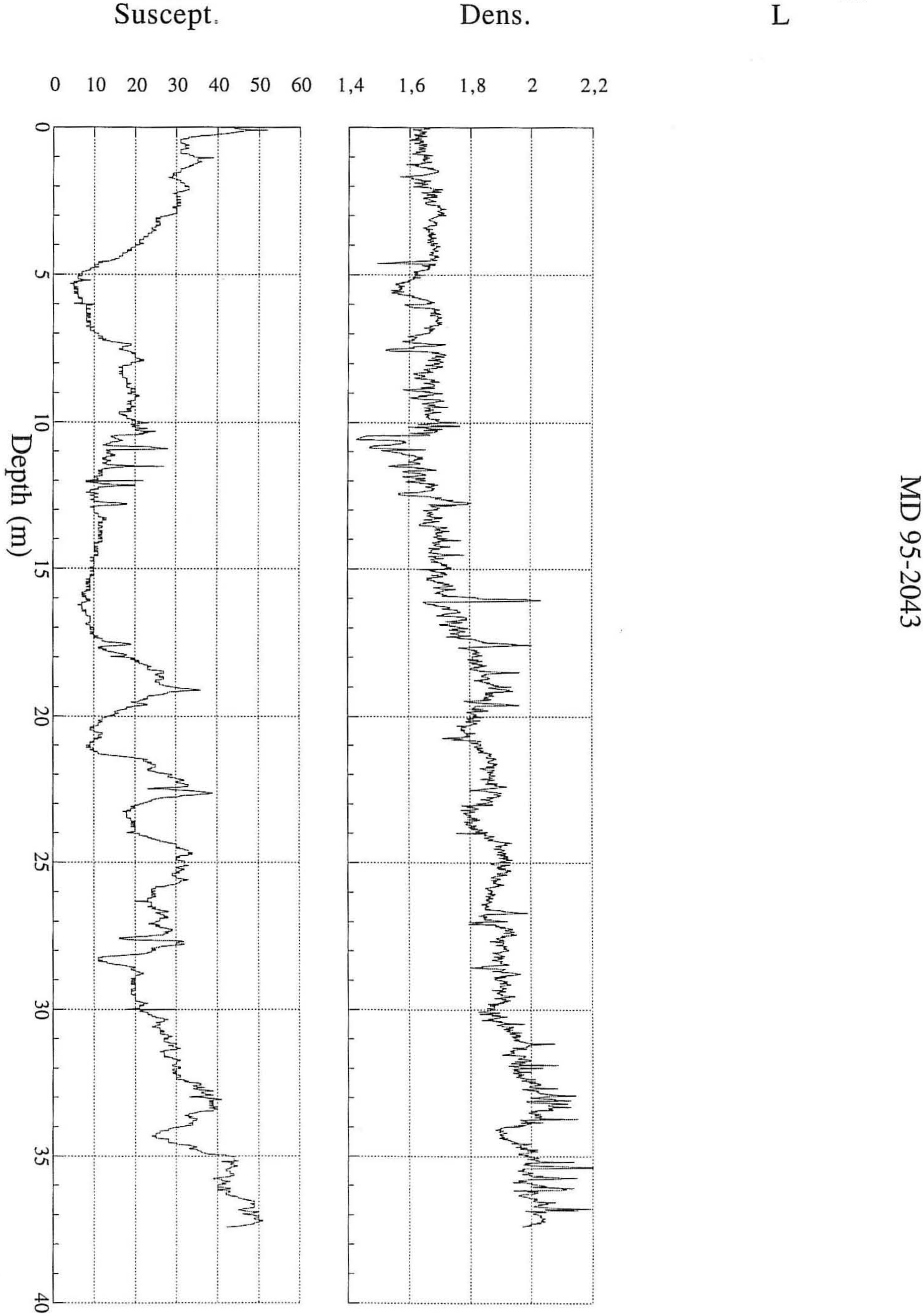
No sediment description.

Core MD 95-2043

lat: 36°08.60 N - long: 02°37.27 W
water depth: 1841 m
length: 37.46 m






Suscept.
Dens.
L
0 10 20 30 40 50 60
1,4 1,6 1,8 2 2,2
0 5 10 15 20 25 30 35 40
Depth (m)
MD 95-2043

Core MD95-2043 not opened on board.

No sediment description.

DÉPOT LÉGAL : 4ème trimestre 1996
ISSN : 1246-7375
ISBN : 2-910180-12-3