LES RAPPORTS DE CAMPAGNE
A LA MER A BORD DU
MARION-DUFRESNE

CAMPAGNE INTERPOLE
MD99-114/ IMAGES V

ATLANTIQUE NORD

et MERS ACTIQUES

du 11/06/99 au 06/09/99

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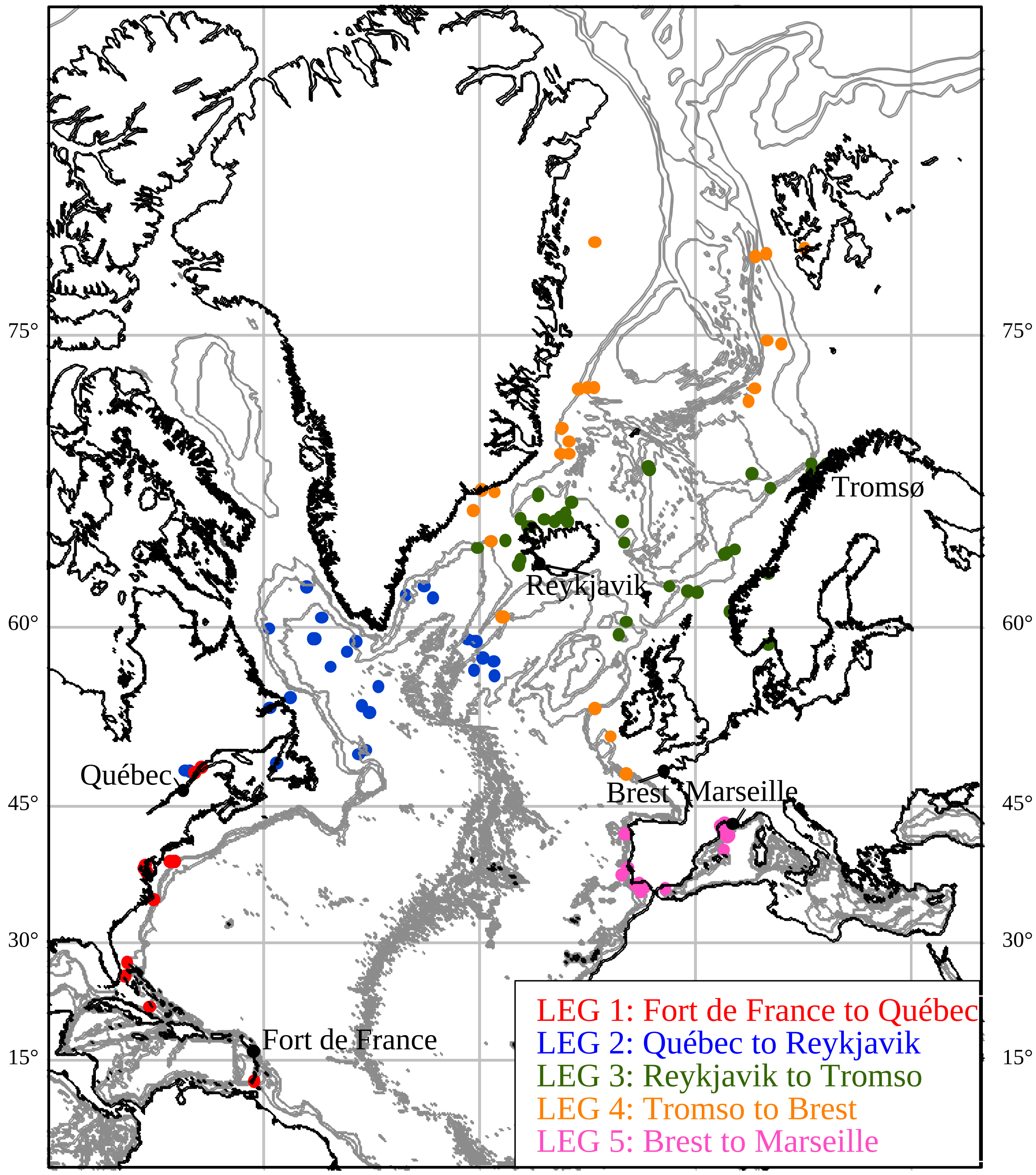

FIGURE 1 : GENERAL MAP OF THE MD99-IMAGES V CRUISE

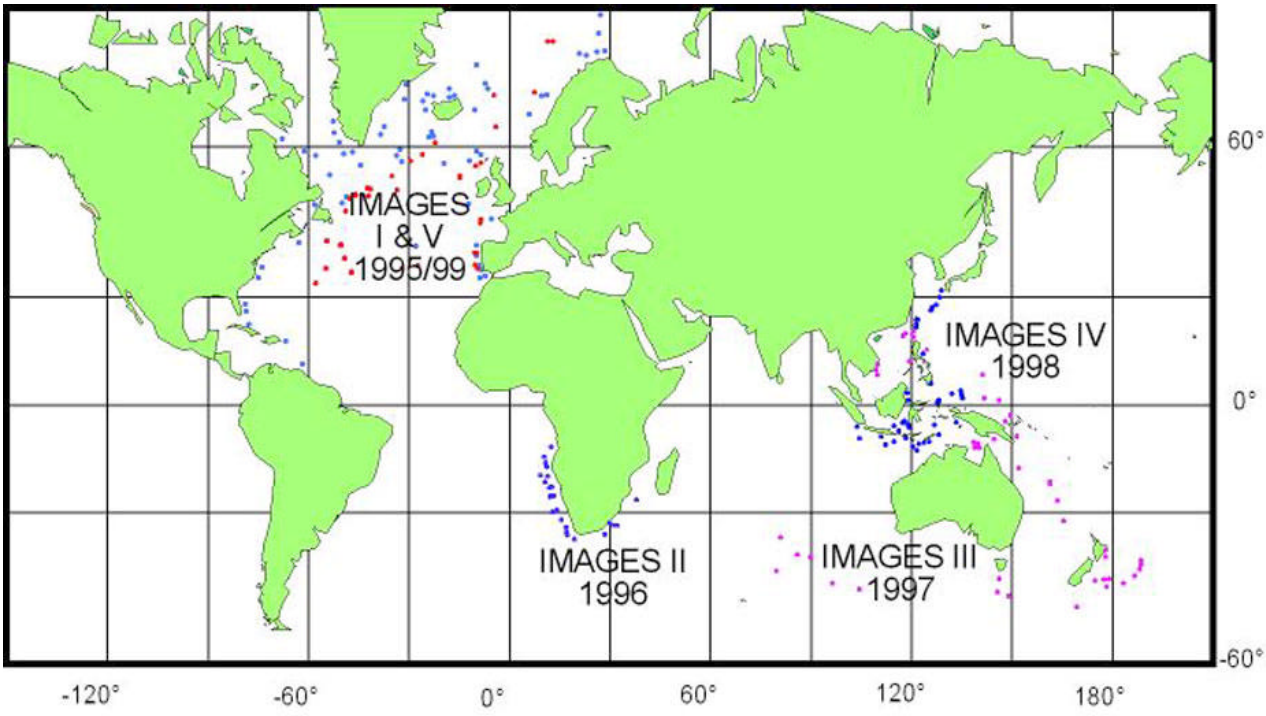

FIGURE 2 : IMAGES CRUISES OVER THE PERIOD 1995-1999

Foreword: images

During summer 1999, the French Institute for Polar Research and Technology (IFRTP) conducted the 5^{th} giant sediment coring cruise for the IMAGES program (International Marine Global Change Study, which is a subprogram of the IGBP (International Global Change Program) PAGES (Past Global Change Program).

How can we distinguish natural climate change from that which is caused by human activities? How will climatic change affect environment and world economy in the next decades end century? Why are climatic changes often rapid and dramatic? What is the role of the ocean in climate change, and how will they be affected in the future? These are pressing questions in the current discussions on climate change and climate politics. The ocean is a key element in these questions, as a possible releaser, amplifier or moderator of climatic changes. Studies on the present variability of the oceanic system are necessary. But the time scales covered by the instrumental records are much too short to sample and understand adequately the changes that may affect the future of the ocean system. Only by studies of the climatic signals embedded in the sediments buried on the ocean floor is it possible to obtain the long records of how oceans and climates have developed over long enough periods, and to understand the causes of changes in ocean circulation and its effects on climate change. This is a prerequisite for placement of changes occurring today or forecasted for the future into a framework of how much and how fast and with what consequences past changes took place. It is also a prerequisite for many attempts to understand why climates change and what effects the increasing greenhouse effect will have on the climate system.

The requirements of this type of research is to provide these records at a temporal scale which approaches that of the instrumental record, which at best only goes 100 years back into the past. Hence we must look for sedimentary archives which can contribute the optimal temporal resolution whilst retaining the ability to use paleoclimatic proxy methods to record and quantify the changes of the past.

The IMAGES program has been initiated to respond to the challenge of understanding the mechanisms and consequences of climatic changes at time scales of decades to millennia using oceanic sedimentary records.

Climatic mechanisms must be studied at global scale using sophisticated models based on high quality data that represent the variability of surface and deep ocean physical and chemical characteristics during key periods of recent earth history. The overriding IMAGES science issue is to quantify climate and chemical variability of the ocean on time scales of oceanic and cryospheric processes; to determine its sensitivity to identified internal and external forcing, and to determine its role in controlling atmospheric CO2. In order to achieve these scientific objectives, IMAGES co-ordinates a global program to collect and study marine sediment records to address three fundamental questions:

* How have changes in surface ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and thereby modified climate?
* How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO2 over the past 300 Ky.?
* How closely has continental climate linked to ocean surface and deep-water properties?

Individual research is no longer sufficient to resolve these problems because the acquisition of the required large number of long sediment cores in high sedimentation rate areas is expensive, and the proper study of such cores demands the use of multiple tools and large numbers of measurements. IMAGES was established to obtain the necessary information from giant sediment cores and develop the required international cooperation and integration of data. It now includes 26 member countries: Australia, Canada, China, Denmark, France, Germany, Iceland, India, Indonesia, Japan, Mexico, Netherlands, New Zealand, Norway, Portugal, Turkey, Russia, South Africa, Spain, Sweden, Switzerland, Taiwan cons, Tunisia, UK, USA. Since 1995, a major IMAGES cruise has been organized each year on the French Research Vessel Marion-Dufresne under responsibility of the IFRTP. Each cruise was supported in a large part by the French Ministère de la Recherche, additional shared funding from the main participating countries, with invited scientists from other member countries of IMAGES.

R/V Marion-Dufresne is the only oceanographic ship in the world able to take the long sediment cores (several tens of meters) which are necessary to reach the IMAGES scientific objectives. The giant corer (named "Calypso") operates much faster and for a smaller cost than drilling ships. Past IMAGES cruises of the Marion-Dufresne have focused on the North Atlantic (1995), South Africa (1996), South Indian Ocean and SouthWestern Pacific (1997), Western Pacific and Indonesia (1998). The results of these campaigns show that ocean sediments do record numerous large amplitude climatic changes, even within the last several hundred years. They are associated with large-scale changes in the surface ocean hydrology and circulation. Since this cruise, other cruises have been realized in the NorthEast Indian Ocean, Indonesia and the North-west Pacific Ocean (WEPAMA 2001). Mona-Page along the North and Central Americas Pacific, Caribbean and Gulf of Mexico coasts should occur in summer 2002. The main focus for these cruises is to better understand the role of low latitudes in climate changes (variability of the warm pools, ITCZ, monsoons and role for the atmospheric transport of water and oceanic transport of salt to high latitudes).

SCIENTIFIC OBJECTIVES OF THE IMAGES V CRUISE

A special motivation and element of the IMAGES cruise V has been to identify and core deposits where high sedimentation rate sediments are available, thereby bringing the Marion Dufresne and its coring system to coastal and offshore areas with excess or focussed sedimentation. A new research priority in the cruise is therefore the emphasis on the highly detailed records of recent climatic changes that are embedded in the coastal sediments of estuaries and fjords. It has been a bold attempt to strive for the ultimate in terms of temporal resolution in sediment basins that have not before been tapped and used for standard paleoceanographic/ paleoclimatic purposes. In this respect this has been a unique effort, which brought a new focus into the IMAGES program.

The main objective has been to understand the changes in the circulation and hydrology of the Gulf Stream, which transports heat from the low latitudes to Europe, and salt to the Northern Atlantic and beyond, in relation to the evolution of the Northern ice sheets and the hydrology of the Arctic seas. Several additional objectives were sought: -changes in surface and deep water ocean hydrology and dynamic, using high accumulation rate sediments from drift deposits along deep contour currents; -study of deep coral deposits along the North European margin; -study of past changes in geostrophic deformation of the thermocline along the Gulf Stream and its links to meridional transport.

The French Institute for Polar Research and Technology (IFRTP) conducted in the summer of 1999 this 5th giant sediment coring cruise for the IMAGES program. The cruise was divided into five legs, with different chief scientists and, in part, specific objectives, covering the whole range of environments from the tropics of the Caribbean to the Arctic regions of Spitsbergen and Greenland. In short it follows the flow of the Gulf Stream waters on their transit from their sources to their destiny in the north.

- Leg 1 (Fort de France to Quebec) had as main focus the study of the climatic changes in the tropics and how these interact with rapid changes in the higher latitudes. Specific targets covered the post-glacial environmental and hydrological changes along the western margin of the North Atlantic and at shallow depth in the Eastern Us-Chesapeake Bay.
- Leg 2, 3 and 4 were aimed at studying the variability of climate and ocean system at high Northern latitudes for both glacial/interglacial time scales and for the last few thousand years, at decadal to centennial time scales. The evolution of the ice sheets surrounding the North Atlantic and Arctic Sea has been studied in parallel, as they may have played a major role in the climatic evolution in the past. Specific targets from Leg 2 (Quebec to Reykjavik) covered several fjords from the St Laurence basin and the Labrador coast, and deeper cores around Greenland. Leg 3 (Reykjavik to Tromso) and Leg 4 (Tromso to Brest) focused on the evolution of the Arctic seas (Greenland and Norwegian seas) and their relationship with the North Atlantic, both at surface and at depth.
- Leg 5 (Brest to Marseilles) focused on the evolution of the sub-polar to subtropical areas of the North Eastern Atlantic, Western Europe and Western Mediterranean Sea, and the exchanges between Atlantic and Mediterranean waters.

The co-chief scientists of IMAGES-V cruise are Professor Laurent Labeyrie (University Paris Sud-Orsay and LSCE), Elsa Cortijo (LSCE) who was responsible for most of the cruise preparation and Professor Eystein Jansen (University of Bergen, Norway). Eight countries shared the cost of the cruise with France: Norway, USA, Canada and Germany as main contributors and United Kingdom, Iceland, Denmark and Spain as smaller contributors. Scientists on board from Portugal, Taiwan, Sweden and Netherlands participate as IMAGES members. France, which contributes to about 2/3 of the coast of the cruise is represented by scientific groups from 7 Universities and Laboratories from the Centre National de la Recherche scientifique (LSCE-Gif/Yvette, CNRS et CEA; DGO Bordeaux (CNRS and Université Bordeaux 1; Laboratoire de Géochimie Université Paris Sud Orsay and CNRS; Laboratoire de Géologie Université de Lille -Marseille et CNRS, Laboratoire de Géologie Université de Chambéry, Laboratoire de Sédimentologie Université Paris VI et CNRS). As a whole, more than 300 scientists participated in the cruise.

INTERPOLE AND THE ADDITIONAL FRENCH PROGRAMS GINS, SIGNATURES ET ISFLUX

In order to add value to the presence of R/V Marion-Dufresne in the northern latitudes, IFRTP has called for complementary proposals to optimize shiptime. Additional sub-programs which are not part of IMAGES are thus included in the 4th leg, from Tromsö, Norway on August 18th to Brest, France, on September 7th 1999. Together, all these programs are associated within the INTERPOLE project of the IFRTP.

GINS and SIGNATURE

The main objective of the hydrological program related to SIGNATURES (under responsibility of Catherine Jeandel from LEGOS-Toulouse) and GINS (under responsibility of J.C. Gascard, LODYC Paris) is to improve our knowledge of the oceanic thermohaline circulation in the North Atlantic subpolar gyre and its variability, based on hydrological and geochemical tracer parameters. This is a key to understand low frequency climate variability over the North Atlantic (North Atlantic oscillation) and ore likely over the Northern Hemisphere (Arctic oscillation). Not only decadal climate variability is at stake, but also longer time scales related to past climate changes recorded in marine sediments.

The North Atlantic sub-polar gyre encompasses five seas: the Labrador, Irminger, Iceland, Greenland and Norwegian seas. Waters in the Labrador and in the Irminger Seas are rapidly renewed by two processes: 1/advection of warm and salty surface waters from the North Atlantic subtropical gyre, and cold and fresh waters from the Arctic Ocean, 2/ local winter deep convection forming Labrador sea deep waters. Bottom waters are also rapidly renewed in these basins

Study the physical and geochemical characteristics of the deep current linked with the return flow of the Gulf Stream, at depth, from Norwegian Sea to the main oceans, from its origin, in Central Norwegian Sea, to the deep North Atlantic. This is part of a major component of the global ocean dynamic, the North Atlantic thermohaline circulation.

The detailed objectives of the hydrological program proposed for INTERPOLE by GINS and SIGNATURES, are to better define :

- the fate of the warm and salty atlantic water masses entering in the Nordic Seas along the norwegian coast and recirculating in the Arctic Ocean, the Greenland and Iceland Seas,
- the fate of the fresh and cold arctic intermediate water masses formed in arctic and subarctic regions,
- the origin and components of the dense waters overflowing above the sills located around Iceland and Faeroes islands and feeding on the North Atlantic deep waters,
- the influence of the surface waters including polar waters and also continental run-off around the north atlantic subpolar gyre on the transformation of atlantic waters, on the formation of arctic intermediate waters and ultimately on the formation of North Atlantic deep waters.
- SIGNATURE'S more specific objectives were to understand how the North Atlantic Deep Water (NADW) acquires its present day neodymium isotopic composition (IC) . It is suspected that dissolved/particulate exchanges at the continental margins modify significantly the water mass ICs. Quantifying these processes will allow to refine our knowledge of the "proxy already used to reconstruct past circulation and transport of material. In the framework of GINS and SIGNATURE, present day Nd ICs will also be used as complementary tracer of sources and fate of the Arctic Water masses.

ISFLUX PROGRAM (under responsibility of Louis Géli, Ifremer)

The domain of influence of hot mantle from the Iceland hot spot , which has been recognized to extend more than 1000 km away from the center of the plume, is particularly visible south of Iceland, on the northern part of the Reykjanes Ridge, resulting in anomalously shallow water depths, the absence of median valley and a crustal composition dominated by plume geochemistry. Since the early seventies, the interaction betwen the Icelandic hot spot and the Mid-Atlantic Ridge has been the subject of numerous studies, theoretically and observationally. The data generally used for these studies include bathymetry, geoid and gravimetry, electromagnetics, refraction and wide angle reflection seismics, and earthquake seismology. Surprinsingly, there has been no attempt so far to measure heat flow to constrain the models of ridge-hot spot interaction.

The objective of the Isflux project is thus to quantify the thermal influence of the Iceland hotspot by measuring variations heat flow along a profile parallel to the Reykjanes Ridge, on a series of sites of comparable environment . For this purpose, it is proposed to use a series of thermistors welded on the tube of the giant corer Calypso on board R/V Marion Dufresne. The heat flow data will be processed at the Marine Geosciences Department of Ifremer. The cores collected simultaneousy with heat flow data will enrich the database of the Images Program.

Bad weather and rough seas limited the feasibility tests. Those have been successfully realized before reaching Brest, on the Celtic margin.

Floating University :

A group of students and University Professors from Brest have participated to the 5th leg for training in oceanograpy and seimentology. In addition ot the lessons, hey have participated to the core handling and associated sedimentology work.

Main results

The cruise has been a complete success concerning IMAGES objectives. **In total, 3272 m of sediments have been collected during the cruise, from 168 cores** located along the coasts of Eastern America and Canada, Greenland, Iceland, Norway, Svalbard and Western Europe. This includes the longest piston core ever obtained to that date (56 m in Saguenay Fjord, Canada). Sedimentary records of exceptional quality have been obtained, with sedimentation rates reaching 1 cm/year along US and European margins. Most of the cores have been described on board for physical and sedimentological properties. These results are presented in this report and as data tables in the IMAGES web site http://www.images-program.org (and linked databases). On-shore laboratory results will be added to them as available.

The main scientific results are communicated at major international conferences. Based on preceding cruises, about 100 PhD theses and about the same number of publications will be issued in the next 3 to 5 years from the material collected during the campaign

COMMUNIQUE DE PRESSE INTERPOLE/IMAGES en fin de Leg 4.

L'Institut Français de recherche et de technologie Polaire (IFRTP) a réalisé cet été sur le navire scientifique Marion Dufresne la première des campagnes océanographiques INTERPOLE (“ de l’Antarctique au Spitsberg ”).
La mission principale de cette campagne correspond au programme IMAGES (International marine Global Change), dirigée par L. Labeyrie (LSCE et Université Paris-Sud-Orsay), E. Jansen (Univ. De Bergen, Norvège) et coordonnée par E. Cortijo (LSCE). Ce programme vise à comprendre les changements passés du climat par l’étude des sédiments océaniques. IMAGES dépend du programme international IGBP (International Biosphere-Geosphere Program), dont le but est d’étudier les changements du climat et de l’environnement, et à en prédire l’évolution future. Il est flux de chaleur depuis les régions chaudes et les interactions entre les différentes composantes du climat (les océans de surface et profond, les continents, les glaces des pôles.), de réaliser des prélèvements dans l’ensemble des grands bassins océaniques, et à toutes les profondeurs. Les carottes de sédiment ne peuvent toutefois être faites que dans des zones où les sédiments s’accumulent très rapidement, pour permettre une finesse suffisante dans l’étude des changements en fonction du temps. On doit donc de très grande longueur (40 à 60 m) Le Marion Dufresne est le seul navire au monde permettant la mise en œuvre du carottier géant Calypso pour des carottes de cette longueur. Ce carottier a été développé par Y. Balut à l’IFRTP, qui dirige les opérations océanographiques des campagnes INTERPOLE. Le programme IMAGES a monté sur le Marion Dufresne une campagne par an depuis 1995, d’abord en Atlantique nord, puis autour de l’Afrique du sud, des Iles s de l’Indonésie à Taiwan. Plus de 10 000 m de sédiment ont ainsi été récoltés.

Ces campagnes ont permis de montrer que la température des océans, et leur circulation, a varié très fortement (plus de 5°C) et rapidement (en quelques décennies) dans le passé, en liaison directe avec des changements climatiques de grande ampleur. La campagne 1999 a pour but principal de progresser dans cette étude en essayant de comprendre les mécanismes affectant l’évolution du Gulf Stream et des flux de chaleur vers le Nor de France (Martinique), elle touche, en 5 étapes successives, le Québec, puis Reykjavik, puis Trömso et le Svalbard (78°N), avant de redescendre vers Brest, pour se terminer à Marseille. Plus de 100 carottes sont prévues, dont plus du tiers par très faible profondeur, en particulier dans des estuaires et des fjords. C'est la première fois que de telles carottes de grande longueur sont tentées dans de telles conditions. Plus de 200 scientifiques de 13 pays différents (France, Allemagne, Canada, USA, Norvège, Islande, Danemark, Suède, Hollande, Espagne, Royaume-Uni, Taiwan, Portugal) sont associés à ces travaux, et se relaieront tout au long des trois mois de campagne. Les responsabilités scientifiques sur chaque section de la campagne sont partagées entre les principaux pays ayant contribués financièrement à la campagne (E. Michel (LSCE-Gif), J.L. Turon (DGO Bordeaux), L. Labeyrie (LSCE-Gif) et N. Thouveny (Univ. Aix-Marseille II) pour la France, R. Zahn (Kiel- Allemagne), C. Hillaire-Marcel (GEOTOP-Canada), E. Jansen (Univ. Bergen, Norvège) et A. Jennings (Univ Boulder USA) pour les autres pays co-participants). Les quatre premières parties de la campagne (entre Fort de France et Brest) se sont déroulées sans problème majeur, et avec des résultats scientifiques exceptionnels

Plusieurs autres programmes sont réalisés au cours de la campagne INTERPOLE.
Les programmes GINS et SIGNATURES visent aussi à étudier les changements de la circulation générale des eaux en liaison avec les changements climatiques, mais pour la période actuelle. Les échanges entre l'Océan Arctique et l'Océan Atlantique Nord jouent en effet un rôle considérable dans le contrôle du climat de l'Europe et dans sa
un important refroidissement des eaux de surface (qui proviennent de l'Atlantique Nord et pénètrent le long des cotes Norvégiennes), qui rendent ainsi de la chaleur à l'atmosphère. Du fait de ce refroidissement, elles deviennent très denses, plongent en profondeur et repartent vers l'Atlantique par des détroits (situés entre Groenland et Islande et entre Islande et Ecosse) d'où elles alimentent une grande partie de la circulation profonde mondiale. Il est donc de première importance de savoir où et comment se forment ces eaux et quel parcours elles suivent. C'est l'objet principal du programme GINS de la campagne Interpol, dont le responsable est JC Gascard (LODYC) en étroite collaboration avec des équipes suédoises; dans le cadre de GINS, la stratégie d'observation repose essentiellement sur des mesures de température et salinité, qui sont les deux paramètres de base pour caractériser les masses d'eau. A ces mesures viendront s'ajouter des analyses de traceurs (Iode 129, SF6, et fréons) qui "suivent" les masses d'eau et jouent le rôle de marqueurs et de chronomètres de la circulation. En outre, Catherine Jeandel (LEGOS, Toulouse) propose d'établir les compositions isotopiques de néodyme de ces masses d'eau "sources" de l'océan mondial dans le cadre du programme "SIGNATURES". Ce paramètre est aussi un traceur des circulations présentes et passées. Contrairement aux précédents il est d'origine naturelle (et non anthropique). Cependant, son comportement lors de la formation des eaux profondes ainsi que la signature de ces eaux ne sont pas encore complètement compris, ce qui est préjudiciable à son application en particulier en paléocéanographie. ces deux programmes sont complémentaires et les échantillonnages se dérouleront pendant les legs 2, 3 et 4 de la campagne IMAGES
Un dernier programme, limité à la zone sud de l'Islande, vise un objectif tout autre. Il s'agit de reconstruire les flux de chaleur des sédiments vers l'océan profond, liés à l'activité de la ride médio-océanique. L. Géli (IFREMER), qui est responsable de ce projet, a développé une nouvelle méthode de mesure rapide de ces flux à partir du carottier géant Calypso. La campagne IMAGES permet de tester la méthode avant de l'appliquer dans des opérations plus

Ces travaux associent les différents organismes français de recherche : Institut Polaire (IFRTP), Institut National des Sciences de l'Univers (CNRS-MESRT), le C.E.A. et IFREMER aux agences scientifiques des autres pays engagés dans la collaboration:

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GRALL	Magali	IUEM	5			
GROUSSET	Francis	Univ. de Bordeaux 1	5	PI	geochemist	DGO/CNRS
GUDMUNDOSTOTTIR	Esther Rut	Univ. Bergen	3		Student	University Bergen
GUIGAND	Jérôme	Univ. P et M Curie	5			
GYLLENCREUTZ	Richard	Stockholm Univ.	3		Student	Stockholm University
HADOUX	Valérie	IFRTP	1+3		Secretary	IFRTP
HAFLIDASON	Haflidi	Univ. Bergen	3	PI	scientist	University Bergen
HALD	Morten	Univ. of Tromso	4	PI	Ass. Professor	
HALKA	Jeffrey	Maryland Geol.Survey	1		Geologist	Maryland Geological Survey
HALL	Ian Robert	Univ. of Cambridge	5		student	
HANNION	Muriel	Facultés d'Orsay	2-4		Student	Facultés d'Orsay
HANSEN	Karen	Universitaet Kiel	3		Student	Universitaet Kiel
HARDARDÓTTIR	Jorunn	Univ. of Iceland	3			University of Iceland
HARMEGNIES	François	IFREMER	4		tech.	Brest
HELGADOTTIR	Gudrun	Marine Research Inst.	3		Géologiste	Marine Research Institute
HERMANN	Benoit	LSCE	4		Student	
HEROUX	Marie-Claude	Dép. de Géologie,Canada	1		Ass. Recherche	Dép. de Géologie

HEWITT	Antony	Univ. of New Brunswick	2		Student	University of New Brunswick
HILBORMAN	Rachael	Univ. of Colorado	3+4		Student	University of Colorado
HILL	James	Maryland Geological Surv.	1		Geochimist	Maryland Geological Survey
HILLAIRE-MARCEL	Claude	GEOTOP	2	co-chief	Professor	GEOTOP
HISCOTT	Richard	Earth Sciences Depart.	2		Professor (séd.)	Earth Sciences Depart.
HOFFMANN	Julien	IFRTP	3-5		Technican	IFRTP
HOUSSAIS	Marie-Noëlle	Univ. Paris 6	4		Oceanographer	LODYC/CNRS
HOVE	Audny Marie	Univ. Bergen	3			University Bergen
HUCHON	Agnès	UBO	5			
HUDERT	Thian	National Resources Canada	2		Student	National Resources Canada
HUITOREL	Benoît	IFRTP	1-2		Technican	IFRTP
HULS	Matthias	GEOMAR	1			GEOMAR
HUREAU-MAZAUDIER	Danielle	Univ. Aix Marseille 3	3		AI	Université Aix Marseille 3
HUSUM	Katrine	Univ. of Tromso	4		Student	
HYACINTHE	Christelle	Univ. de Bordeaux 1	3-4		Student	Université de Bordeaux 1
ISHMAN	Scott	US Geological Surv.	1		forams,	US Geological Survey
JANSEN	Eystein	Univ. Bergen	3	co-chief	professor	University Bergen
JAOUEN	Alain	IFRTP	1+2+5		Engineer	IFRTP
JARRETT	Catherine	Bedford Inst. of Oceanog.	2		Ing. MST	Bedford Institue of Oceanography
JEANDEL	Catherine	CNRS	4	Hydro PI	geochemist	LEGOS/Tolouse
JEANSSON	Ake Emil	Goteburg Univ.	3-4		Student	Goteburg University
JEGOU	Alain	LSCE	2		Engineer	LSCE
JENNINGS	Anne	INSTAAR	4	co-chief	Assistant professor	
JERONIMO	David	Inst. Geologico e Mineiro	5			
JONSDOTTIR	Helga	Univ. of Aarhus	3		Student	University of Aarhus
JONSSON	Kristina	Falcon Bryggenier AB	4		Student	
JOUANNEAU	Jean-Marie	Univ. de Bordeaux 1	5		sédimentolog.	DGO/CNRS
KARTAVTSEFF	Annie	Univ. Paris 6	4		Oceanographer	LODYC/CNRS
KIELIUS	Audrey	IUEM	5			
KING	John	US Geological Surv.	1		magnetics	US Geological Survey
KISSEL	Catherine	LSCE	2			LSCE
KOC	Nalan	Norwegian Polar Inst.	3		scientist	Norwegian Polar Institute
KRISTJÁNSDÓTTIR	Greta Bjork	Univ. of Iceland	3		Student	University of Iceland
LABERG	Jan Sverre	Univ. of Tromso	3	PI	Post Doc	University of Tromso
LABEYRIE	Laurent	LSCE	3-4	Co-chief	Professor	LSCE
LANDURE	Jean-Yves	IFREMER	4		tech.	Brest
LARCHER	Brice	Facultés d'Orsay	3-4		Student	Facultés d'Orsay
LE NAMOURIC	Cyrille	IUEM	5			
LEBREIRO	Susana	Inst. Geologico e Mineiro	5		student	
LEDUC	Julie	GEOTOP	2		Student	GEOTOP
LEE	Shih-Yu	National Taiwan Univ.	2			National Taiwan University
LEFEVRE	Irène	LSCE	1			LSCE
LEGENDRE	Christelle	IUEM	5			
LEGRAND	Laetitia	IUEM	5			
LESEMANN	Jerome	Univ. of Alberta	2		Student	University of Alberta
LEVAC	Elisabeth	Dept of Earth Sciences	1		Student	Department of Earth Sciences
LEVI	Camille	Univ. de Bordeaux 1	3-4		Student	Université de Bordeaux 1
LIE ANDREASSEN	Trond	Univ. of Tromso	4		Student	
LOFI	Johana	IFREMER	5			
LONG	Bernard		1			
MALAIZE	Bruno	Univ. de Bordeaux 1	3-4		Assoc. Prof.	Université de Bordeaux 1
MATTHIESSEN	Jens	Cothringer str.10	3			Cothringer str.10
MAZAUD	Alain	LSCE	3		scientist	Gif/Yvette/CEA
McCAVE	Nick	Univ. Cambridge	5	PI	Professor	
McDONNELL	Sheila	Naval Research Laboratory	1		sed/geophysics	Naval Research Laboratory
McHUGH	Cécilia	Queens College	1		Sedimentol.	Queens College New York

MELKI	Tarak	Univ. de Sfax	5			
MELLET	Martin	IFRTP	1+3+4		Technican	IFRTP
MICHEL	Elisabeth	LSCE	1	Co-chief	paleoceano	CEA/Gif-Yvette
MIL HOMENS	Mario	LGDM, Lisbon	5			
MINASIAN	Diane	USGS	1		geotechnics	United States Geological survey
MORATA	Stéphane	IUEM	5			
MORHANGE	Christophe	CEREGE	5			
MORIN	Xavier	IFRTP	1+2+5		Engineer	IFRTP
MOUNTAIN	Gregory	LDEO	1		Sédimentol.	Columbi Univ.
MUCCI	Alfonso	Mc Gill Univ.	1		Professeur	Mc Gill University
MUDIE	Peta	US Geological Survey	1		Palyno.	US Geological Survey
MULDER	Thierry	Univ. de Bordeaux 1	5		sédimentolog.	DGO/CNRS
NAURET	François	IUEM	5			
NEBOUT-COMBOURIEU	Nathalie	Univ. de Paris 6	3+5		CR	Université de Paris 6
NOLAN	Stephen	IMAGES, LSCE, Gif	5		ing.	
OGGIAN	Georges	Univ. de Bordeaux 1	2-3		Technican	Université de Bordeaux 1
OLLIVIER	Bernard	IFRTP	1+3+5		Engineer	IFRTP
OLSON	Hilary	Univ. of Texas	1		paleoceano	Institute for Geophysics
OLSSON	Karl Anders	Goteborg Univ.	4		professor	
OUAHDI	Rabia	LSCE	2		Student	LSCE
PAGANI	Laurent	Observatoire de Paris 6	4		physicien	CNRS
PAILLEAU	Nicole	IFRTP	5			
PEDEMAY	Philippe	Univ. de Bordeaux 1	2		AI	Université de Bordeaux 1
PEDERSEN	Rikke Ohlenschlaeger	Univ. of Aarhus	3		Student	University of Aarhus
PERENNES	Marc	Thomson Marconi Sonar	1		Ingénieur	THOMSON MARCONI SONAR
PERSSON	Anna Marie	Goteborg Univ.	4		Student	
PETERSCHMITT	Jean-Yves	LSCE	3		Engineer	LSCE
PFUHL	Helen	Univ. of Cambridge,	2		Student	University of Cambridge,
PICHON	Jean-Jacques	Univ. de Bordeaux 1	1		CR 1	Université de Bordeaux 1
PIERRE	Catherine	Univ. Paris 6	5		geochemist	LODYC/CNRS
PINAULT	Claude	IFRTP	4		ing.	
PLACHOT	Jean-Pierre		4			
PLASSEN	Liv	Univ. of Tromso	3			University of Tromso
POHLMAN	John	Naval Research Laboratory	1		Geochimist	Naval Research Laboratory
POULIN	Patrick	GEOTOP	2		Student	GEOTOP
PRINCIPATO	Sarah	Univ. of Colorado	3		Student	University of Colorado
QUEFFURUS	Viviane	Univ. Pierre et Marie Curie	4			
REIJMER	John	GEOMAR	1	PI	Chercheur	GEOMAR
REUNING	Lars	GEOMAR	1			GEOMAR
REVEL	Marie	Institut Dolomien	5			
RHEAULT	Jean Pierre	IUEM	5		Professor	
RICHTER	Thomas	NIOZ	3-4			Texel Netherl.
RISEBROBAKKEN	Bjorg	Univ. Bergen	4		Student	
ROBERGE	Michèle		1		Student avancée (sédimentologie)	
ROCHON	André	Comm. Géol. du Canada	1-2		Postdoc.	Com. Géologique du Canada
RORVIK	Kari Lise	Inst. for geologi	3-4		student	Institutt for geologi
ROUAULT	Catherine	Univ. Paris 6	4		Oceanographer	LODYC/CNRS
ROUBAUD	Fabrice	IFRTP	4		ing.	
ROUDAUT	Elise	(UBO)	5			
ROY BARMAN	Matthieu	LEGOS	2			LEGOS
RUPKE	Lars	UBO	5			
RYTTER	Frank	Univ. of Aarhus	3		Student	University of Aarhus
SAINT ONGE	Guillaume	GEOTOP-UQAM	2		Student	GEOTOP-UQAM
SANGIARDI	Pierre	INSU	4		ing.	
SBAFFI	Laura	Univ. of Cambridge,	2		Student	University of Cambridge,

SCAO	Vincent	LSCE	4		ing.	
SCHOENFELD	Joachim	GEOMAR	5	PI	Professor	
SCHOPKA	Herdis Helga	Univ. of Iceland	3		Student	University of Iceland
SCHUUR	Catherine	Univ. of Texas	1		Sedimentologist	Institute for Geophysics
SEJRUP	Hans Petter	Univ. Bergen	3	PI	Professor	University Bergen
SHACKLETON	Nicholas	Univ. of Cambridge	5	Co-chief	Professor	
SHAW	John		2		Professeur (sédimentologie glaciaire)	
SHEEHAN	Thomas	US Geological Survey	1		Technician	US Geological Survey
SIANI	Guiseppe	LSCE	1		student	
SICRE	Marie-Alexandrine	LSCE	4		geochemist	CNRS-
SMITH	Laryn	Univ. of Colorado	3		Student	University of Colorado
SNAUWAERT	Herlinde	Universitat GENT	4		Student	
STONER	Joseph	Univ. of California	2	PI	Professor	University of California
STURM	Arne	UBO	5			
SZEREMETA	Nadia	LSCE	1			LSCE
TANHUA	Toste	Goteburg Univ.	3		Post doc	Goteburg University
THINON	Isabelle	UBO	5			
THOMAS	Hélène	ENSIETA	5			
THOUVENY	Nicolas	Univ. Aix Marseille 3	5	Co-chief	Professor	
TIRILLY	Ghislaine	Univ. Toulouse le Mirail	1+4		Student	Université Toulouse le Mirail
TURON	Jean-Louis	Univ. de Bordeaux 1	2-3	Co-chief	Palynologist	DGO
VAGNER	Pierre	LSCE	5		student	
VAN ROOIJ	David	UBO	5			
VEIGA PIRES	Cristina	Université d'Algarve, Faro	5			
VILLANUEVA RIBES	Juan	CID - CSIC	1		Chercheur	CID - CSIC
VINCON	Françoise	Univ. de Bordeaux 1	3		Technican	Université de Bordeaux 1
VOELKER	Antje	Universitaet Kiel	3		Student	Universitaet Kiel
VOGT	Peter	Naval Research Laboratory	1		Geophysician	Naval Research Laboratory
WAELBROECK	Claire	LSCE	5		geochemist	CNRS
WAGNER	Robert	US Geological Survey	1		Student	US Geological Survey
WEIMER	Lisa	US Geological Survey	1		Student	US Geological Survey
WEINER	Nancy	Univ. of Colorado	4			
WELLS	Darlene	Maryland Geol. Survey	1		Geologist	
WILLARD	Debra	US Geological Survey	1		Geologist	US Geological Survey
WILLIAMS	Christopher	Maryland Geolo.Survey	1		Geologist	
YU	Ein Fen	National Taiwan Univ.	2			National Taiwan University
ZAHN	Rainer	GEOMAR	1	Co-chief	Ass. Professor	GEOMAR

TABLE OF STATIONS WITH LOCATION AND OPERATIONS

LEG 1 from FORT DE FRANCE to QUEBEC

date	site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
12/06/99		5h00				Departure from F.de F				
12/06/99	1	13h00				arrived on site				
		16h25	12°05.43 N	61°17.48 W	1330	coring	MD99-2197	24.71		Calypso
						departure for next site				
13/06/99	1					arrived on site				
		1h15	12°05.51 N	61°14.01 W	1330	coring	MD99-2198	35.53		Calypso
						departure for next site				
13/06/99	1					arrived on site				
		11h52	12°04.38 N	61°12.99 W	1386	coring	MD99-2199	46.68		Calypso
		13h00				departure for next site				
16/06/99	2	18h00				arrived on site				
		18h45	21°58.58 N	75°47.55 W	1420	coring	MD99-2200	21.24		Calypso
		20h30				departure for next site				
17/06/99	3	21h50				arrived on site				
		22h20	25°53.49 N	79°16.34 W	290	coring	MD99-2201	38.05	CTD	Calypso
		23h15				departure for next site				
18/06/99	4	7h19				arrived on site				
		8h05	27°34.45 N	78°57.93 W	460	coring	MD99-2202	25.95	CTD	Calypso
		9h00				departure for next site				
19/06/99	5	20h30				arrived on site				
		22h04	34°58.38 N	75°12.06 W	618	coring	MD99-2203	38.05	CTD	Calypso
		0h15				departure for next site				
20/06/99	6	20h10				arrived on site				
		21h45	38°03.16 N	76°13.25 W	24	coring	MD99-2204	7.7		Calypso
		22h10				departure for next site				
21/06/99	7	0h50				arrived on site				
		1h31	38°33.95 N	76°26.66 W	14	coring	MD99-2205	6.73		Calypso
		2h05				departure for next site				
21/06/99	7bis	2h20				arrived on site				
		4h14	38°33.95 N	76°26.66 W	13	coring	MD99-2206	7.82		Calypso
		5h00				departure for next site				
21/06/99	8	7h35				arrived on site				
		8h43	38°01.83 N	76°12.88 W	26	coring	MD99-2207	20.7		Calypso
		9h35				departure for next site				
22/06/99	9	9h25				arrived on site				
		10h36	38°32.24 N	76°29.19 W	11.2	coring	MD99-2208	7.82		Calypso
		11h05				departure for next site				
22/06/99	10	13h00				arrived on site				
			38°53.18 N	76°23.48 W	26	coring	MD99-2209	17.2		Calypso
		14h40				departure for next site				
24/06/99	11	23h50				arrived on site				
		0h33	39°13.44 N	72°16.55 W	650	coring	MD99-2210Bx			Box core
		1h15				departure for next site				
23/06/99	11	9h45				arrived on site				
date	site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
		10h22	39°13.70 N	72°16.76 W	630	coring	MD99-2210Gr	1.68		Gravity
						departure for next site				

23/06/99	12	12h25				arrived on site				
		12h58	39°13.92 N	72°15.58 W	641	coring	MD99-2211	30.05		Calypso
		17h00				departure for next site				
23/06/99	12	9h45				arrived on site				
		18h59	39°13.98 N	72°15.46 W	639	coring	MD99-2211Bx	0.84		Box core
						departure for next site				
23/06/99	12					arrived on site				
		20h46	39°13.98 N	72°15.55 W	639	coring	MD99-2212	37.12		Calypso
		20h50				departure for next site				
24/06/99	13	4h30				arrived on site				
		5h42	39°13.39 N	72°17.04 W	640	coring	MD99-2213	29.71		Calypso
		7h00				departure for next site				
24/06/99	14	9h00				arrived on site				
		9h41	39°15.38 N	72°17.76 W	417	coring	MD99-114-04Bx	0.47	CTD	Box core
		10h10				departure for next site				
24/06/99	15	14h00				arrived on site				
		14h33	39°17.08 N	72°25.38 W	157	coring	MD99-2214	1.18		
						departure for next site				
24/06/99	15	12h00				arrived on site				
		12h25	39°17.23 N	72°25.03 W	157	coring	MD99-2214Bx	0.29		
						departure for next site				
24/06/99	15					arrived on site				
		19h36	39°17.07 N	72°25.20 W	157	coring	MD99-2215	1.22		Calypso
		21h00				departure for next site				
24/06/99	16	23h20				arrived on site				
		23h39	39°15.88 N	72°29.68 W	145	coring	MD99-2216	9.41		Calypso
						departure for next site				
25/06/99	17	4h30				arrived on site				
		5h02	39°16.45 N	72°56.27 W	75	coring	MD99-2217	6.35		Calypso
						departure for next site				
25/06/99	18	8h45				arrived on site				
		9h04	39°18.99 N	72°58.08 W	61	coring	MD99-2218	7.47		Calypso
		9h30				departure for next site				
25/06/99	19	11h00				arrived on site				
		12h06	39°19.91N	72°56.27W	75	coring	MD99-2219			
		13h00				departure for next site				
28/06/99	20	21h40				arrived on site				
		22h49	48°38.36 N	68°37.86 W	320	coring	MD99-2220	51.56		
		0h30				departure for next site				
29/06/99	21	4h07				arrived on site				
		5h35	48°10.54 N	69°30.61 W	212	coring	MD99-2221	31.02		
						departure for Québec				

LEG 2 from QUEBEC to REYKJAVIK

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
						departure from Québec				
1/07/99	1	13h18				arrived on site				
		13h48	48°18.28 N	70°15.44 W		coring	MD99-2222	37.72		Calypso
		14h15				departure for next site				
1/07/99	2	17h13				arrived on site				
		17h34	48°20.93 N	70°49.11W	141	coring	MD99-2223	28.63		Calypso
		19h05				departure for next site				
1/07/99	3	22h07				arrived on site				
		22h55	48°18.28 N	70°15.43 W	271	coring	MD99-2224	58.54		Calypso
		0h30				departure for next site				
3/07/99	4	13h29				arrived on site				
		13h50	48°59.88 N	58°05.08 W	104	coring	MD99-2225	37.53		Calypso
		14h55				departure for next site				
3/07/99	5	21h07	50°15,14 N	058°26,11 W	336	Arrived on siteg	empty			Calypso
		22h45				Departure for next site				
5/07/99	6	00h55				Arrived on site				
		01h07	50°02,00 N	052°08,38 W	2716	CTD				
		03h06	50°01,23 N	052°08,70 W	2690	Coring	empty			Calypso
		04h40				Departure for next site				
5/07/99	7	22h18				arrived on site				
		23h46	57°03.71 N	50°37.70 W	3580	coring	MD99-2226	32.14		Calypso
		1h41				departure for next site				
6/07/99	8	10h15				arrived on site				
		11h54	58°12.64 N	48°22.38 W	3460	coring	MD99-2227	42.96		Calypso
		13h06				departure for next site				
7/07/99	9	19h00				arrived on site				
		0h06	58°55.59 N	47°08.45 W	2900	coring	MD99-2228	27.06	CTD	Calypso
		2h30				departure for next site				
7/07/99	10	15h10				arrived on site				
		16h30	59°05.62 N	53°03.38 W	3400	coring	MD99-2229	36.28		Calypso
		20h03				departure for next site				
7/07/99	11	21h25				arrived on site				
		23h25	59°05.35 N	52°48.84 W	3430	coring	MD99-2230	34.76		Calypso
		3h27				departure for next site				
8/07/99	12	11h28				arrived on site				
		13h11	60°34.72 N	51°48.49 W	3190	coring	MD99-2231	34.29		
		14h55				departure for next site				
9/07/99	13	5h06				arrived on site				
		6h15	62°38.99 N	53°53.98 W	2455	coring	MD99-2232	30.32	CTD	Calypso
		8h40				departure for next site				
10/07/99	14	07h00				Arrived on site				
		08h16	59°42,10 N	060°14,28 W	1120	Coring	empty			Calypso
		09h05				Departure for next site				
10/07/99	15	12h57				arrived on site				
		13h55	59°49.46 N	59°09.35 W	2350	coring	MD99-2233	24.62		
		9h05				departure for next site				
10/07/99	16	23h26	58°22,01 N	057°30,54 W	2910	cancelled				
date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
						Departure for next site				
11/07/99	17	23h10				arrived on site				

		23h49	53°50.81 N	59°03.05 W	230	Coring	MD99-2234	39.3		Calypso
						departure for next site				
12/07/99	18					arrived on site				
		3h05	53°50.86 N	59°03.05 W	233	coring	MD99-2235	25.37		Calypso
		4h00				departure for next site				
12/07/99	19	13h33				arrived on site				
		14h05	54°37.00 N	56°10.57 W	520	coring	MD99-2236	21.15		Calypso
		15h05				departure for next site				
13/07/99	20	21h15				arrived on site				
		22h36	50°11.93 N	45°41.03 W	3530	coring	MD99-2237	30.74	CTD	Calypso
		4h55				departure for next site				
14/07/99	21	9h12				arrived on site				
		10h27	49°51.12 N	46°38.20 W	3080	coring	MD99-2238	18.24		Calypso
		12h10				departure for next site				
15/07/99	22	3h25				arrived on site				
		4h47	53°27.03 N	45°15.04 W	3770	coring	MD99-2239	23.77		Calypso
		6h55				departure for next site				
15/07/99	23	13h20				arrived on site				
		14h41	54°00.60 N	46°11.68 W	3525	coring	MD99-2240	25.5		Calypso
		16h25				departure for next site				
16/07/99	24	0h36				arrived on site				
		1h41	55°32.95 N	43°57.88 W	3280	coring	MD99-2241	25.35	CTD	Calypso
		7h05				departure for next site				
16/07/99	25	22h05				arrived on site				
		23h17	58°55.06 N	47°07.49 W	2895	coring	MD99-2242	35.36		Calypso
		6h08				departure for next site				
18/07/99	26	11h25				arrived on site				
		14h37	62°04.51N	40°11.26W	1280	coring	MD99-2243	9.43	CTD	Calypso
		15h50				departure for next site				
18/07/99	27	21h05				Arrived on site				
		21h40	63°03,35 N	039°54,78 W	1408	coring	empty			gravity
		23h27				Departure for next site				
19/07/99	28	4h34				arrived on site				
		8h34	62°41.99 N	37°33.73 W	2110	coring	MD99-2244	24.71	CTD	Calypso
		13h29				departure for next site				
19/07/99	28	10h49				arrived on site				
		12h09	62°41.93 N	37°35.49 W	2125	coring	MD99-2245Bx			Box core
		13h27				departure for next site				
19/07/99	29	18h47				arrived on site				
		22h36	61°54.73 N	36°21.52 W	2750	coring	MD99-2246	35.77	CTD	Calypso
		23h59				departure for next site				
20/07/99	30	17h27				arrived on site				
		18h14	59°04.61 N	31°28.34 W	1690	coring	MD99-2247	24.5		Calypso
		19h00				departure for next site				
21/07/99	31	23h35				arrived on site				
		0h30	58°57.32 N	30°23.33 W	1724	coring	MD99-2248	38.22		Calypso
		5h50				departure for next site				
21/07/99	31					arrived on site				

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
			58°57.44 N	30°23.99 W	1710	coring	MD99-2249 Bx		CTD	Box core
						departure for next site				
21/07/99	32	11h36				arrived on site				
		12h43	57°42.71 N	29°25.27 W	2310	coring	MD99-2250	36.48		Calypso
		14h00				departure for next site				
21/07/99	33	18h45				arrived on site				

		19h49	57°26.87 N	27°54.47 W	2620	coring	MD99-2251	36.58		Calypso
		1h07				departure for next site				
21/07/99	33					arrived on site				
		23h44	57°26.84 N	27°55.83 W	2610	coring	MD99-2252	3.25		Karsten
		1h07				departure for next site				
22/07/99	34	6h50				arrived on site				
		8h02	56°21.78 N	27°48.95 W	2840	coring	MD99-2253	32.75	CTD	Calypso
		12h03				departure for next site				
22/07/99	35	19h10				arrived on site				
		20h11	56°47.78 N	30°39.86 W	2440	coring	MD99-2254	36.21	CTD	Calypso
		22h16				departure for next site				
23/07/99	36	9h10				arrived on site				
		9h56	58°58.41 N	30°39.10 W	1490	coring	MD99-2255	25.03		Calypso
		11h55				departure for Reykjavik				

LEG 3 from REYKJAVIK to TROMSO

date	site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
						Departure from Reykjavik				
26/07/99	1					arrived on site				
		6h39	64°18.19 N	24°12.40 W	246	coring	MD99-2256	29.13		Calypso
						departure for next site				
26/07/99	1	8h01				arrived on site				
		8h42	64°18.15 N	24°12.36 W	246	coring	MD99-2257Gr	2.52		Gravity
						departure for next site				
26/07/99	2	13h55				arrived on site				
		12h36	63°57.83 N	24°26.58 W	385	coring	MD99-2258Bx	0.83		Box core
		14h55				departure for next site				
26/07/99	2	13h55				arrived on site				
		14h26	63°57.79 N	24°28.98 W	385	coring	MD99-2259	20.58		Calypso
		14h55				departure for next site				
27/07/99	3	5h20				arrived on site				
		6h46	65°01.13N	30°14.00 W	1802	coring	MD99-2260	27.53	CTD	Calypso
						departure for next site				
27/07/99	4	22h35				arrived on site				
		22h42	65°25.13 N	28°20.27 W	1050	coring	MD99-2261	7.89		Gravity
		0h02				departure for next site				
28/07/99	5	5h40				arrived on site				
		22h42	65°26.65 N	26°18.94 W	140	coring	MD99-2262	1.5		Calypso
		6h45				departure for next site				
28/07/99	6	13h53				arrived on site				
		21h17	66°40.76 N	24°11.83 W	235	coring	MD99-2263Bx	0.47		Box core
		16h51				departure for next site				
28/07/99	6	15h10				arrived on site				
		15h41	66°40.74 N	24°11.76 W	235	coring	MD99-2264	37.68		Calypso
						departure for next site				
28/07/99	7	21h03				arrived on site				
		21h25	66°16.63 N	22°51.47 W	93	coring	MD99-2265	18		Calypso
						departure for next site				
29/07/99	8	23h58				arrived on site				
		0h10	66°13.77 N	23°15.93 W	106	coring	MD99-2266	38.79		Calypso
		1h25				departure for next site				
29/07/99	9	12h05				arrived on site				
		12h42	67°54.61 N	21°46.30 W	810	coring	MD99-2267	23.37		Calypso
						departure for next site				
29/07/99	10	15h54				arrived on site				
		16h40	67°58.81 N	21°46.68 W	835	coring	MD99-2268	34.99	CTD	Calypso
						departure for next site				
30/07/99	11	1h47				arrived on site				
		3h13	66°37.53N	20°51.16 W	365	coring	MD99-2269	25.44		Calypso
						departure for next site				
30/07/99	11	4h45				arrived on site				
		5h01	66°37.55 N	20°51.10 W	350	coring	MD99-2270Gr	5.61		Gravity
						departure for next site				

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	core
30/07/99	12					arrived on site			
		10h38	66°30.09 N	19°30.34 W	345	coring	MD99-2271	11.18	Calypso

						departure for next site				
30/07/99	13	15h40				arrived on site				
		19h10	66°59.57 N	17°58.49 W	440	coring	MD99-2272	22.6		Calypso
						departure for next site				
30/07/99	14	23h00				arrived on site				
		23h31	66°45.78 N	18°45.02 W	665	coring	MD99-2273	39.56		Calypso
						departure for next site				
31/07/99	15	7h23				arrived on site				
		8h02	67°34.95 N	17°04.41 W	937	coring	MD99-2274	35.43		Calypso
		9h00				departure for next site				
31/07/99	16	14h15				arrived on site				
		14h50	66°33.10 N	17°41.99 W	470	coring	MD99-2275	37.13		Calypso
		16h00				departure for next site				
2/08/99	17	6h00				arrived on site				
		6h59	69°21.94 N	06°32.36 W	2710	coring	MD99-2276	24		Calypso
						departure for next site				
2/08/99	18	10h43				arrived on site				
		12h07	69°15.01 N	06°19.75 W	2800	coring	MD99-2277	33.66		Calypso
						departure for next site				
3/08/99	19	9h41				arrived on site				
		10:49	66°33.16 N	10°06.50 W	1382	coring	MD99-2278	34.34	CTD	Calypso
		12:10				Corer on board				
3/08/99	19b	12h30				arrived on site				
		13h21	66°33.08 N	10°06.05 W	1420	coring	MD99-2279Bx	0.63		Box core
		13:57				departure for next site				
3/08/99	20					arrived on site				
		19h40	65°20.69 N	09°45.11 W	825	coring	MD99-2280	33.76		Calypso
						departure for next site				
3/08/09	21	10h02	62°44,88 N	009°60,40 W	490	Arrived on site			CTD	
		11h05				Departure for next site				
4/08/99	22	22h58				arrived on site				
		23h49	60°20.51 N	09°27.34 W	1197	coring	MD99-2281	29.02		Calypso
		1h28				departure for next site				
5/08/99	23	7h30				arrived on site				
		9h07	59°25.82 N	10°34.17 W	1372	coring	MD99-2282+H82	34.79	hydro	Calypso
		11h20				departure for next site				
6/08/99	24	00h51	60°29,92 N	05°00,23 W	982	Arrived on site			CTD	
		03h15				Departure for next site				
6/10/99	25					arrived on site				
		18h03	62°15.67 N	00°24.84 E	707	coring	MD99-2283	27.51		Calypso
						departure for next site				
7/08/99	26					arrived on site				
		1h25	62°22.48 N	00°58.81 W	1500	coring	MD99-2284	33.15		Calypso
						departure for next site				
7/08/99	27	14h36				arrived on site				

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
7/08/99		15h20	62°41.63 N	03°34.34 W	885	coring	MD99-2285	46.92	CTD	Calypso
						departure for next site			HC85	
9/08/99	28					arrived on site				
		7h40	58°43.77 N	10°12.31 E	225	coring	MD99-2286	32.5		Calypso
						departure for next site				
11/08/99	29					arrived on site				

		5h58	61°01.46 N	04°48.45 E	460	coring	MD99-2287	26.1		Calypso
						departure for next site				
12/08/99	30					arrived on site				
		5h14	64°39.40 N	04°12.58 E	1277	coring	MD99-2288	32.21	CTD	Calypso
						departure for next site				
12/08/99	30					arrived on site				
		8h23	64°39.39 N	04°12.57 E	1262	coring	MD99-2289	23.69		Calypso
						departure for next site				
12/08/99	31	11h45				arrived on site				
		13h20	64°45.03 N	04°31.49 E	860	coring	MD99-2290+alk	31.36	CTD	Calypso
		14:?				departure for next site			HC90	
12/08/99	32					arrived on site				
		19h20	64°56.32 N	05°35.52 E	577	coring	MD99-2291	25.87		Calypso
						departure for next site				
13/08/99	33	11h08				arrived on site				
		11h41	63°28.63 N	10°11.65 E	400	coring	MD99-2292	31.25		Calypso
						departure for next site				
14/08/99	34	17h24				arrived on site				
		18h37	69°01.74 N	07°57.10 E	3071	coring	MD99-2293	16.9	CTD	Calypso
						departure for next site				
15/08/99	35	3h35				arrived on site				
		4h27	68°18.67 N	10°30.45 E	1122	coring	MD99-2294+alk	24.32	CTD	Calypso
		5h40				departure for next site				
15/08/99	36	15h31				arrived on site				
		15h44	69°33.05 N	16°10.79 E	332	coring	MD99-2295Gr	4.6		Gravity
		16h01				departure for next site				
15/08/99	37	19h09				arrived on site				
		19h34	69°08.22 N	16°19.31 E	508	coring	MD99-2296	24.68		Calypso
						departure for next site				
16/08/99	38	2h47				arrived on site				
		3h02	69°27.73 N	18°23.54 E	248	coring	MD99-2297	28.27		Calypso
		3h50				departure for next site				
16/08/99	39	4h51				arrived on site				
		5h12	69°29.72 N	18°23.03 E	171	coring	MD99-2298	36.47		Calypso
						departure for Tromso				

LEG 4 from TROMSO to BREST

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
						departure from Tromso				
19/08/99	40	4h45				arrived on site				
		5h42	72°22.14 N	07°26.62E	2615	coring	MD99-2299	11.32		Calypso
		6h50				departure for next site				
19/08/99	41	10h23				arrived on site				
		11h11	72°53.79 N	08°14.88 E	2412	coring	MD99-2300 Gr	4.45		Gravity
		12h20				departure for next site				
19/08/99	42	21h57				arrived on site				
		23h59	74°45.13 N	10°00.82 E	2518	coring	MD99-2301	11.65		Calypso
		1h05				departure for next site				
20/08/99	43	4h15				arrived on site				
		5h39	74°36.53 N	12°01.28 E	2375	coring	MD99-2302	12.205		Calypso
		6h42				departure for next site				
20/08/99	44	19h01				arrived on site				
		21h58	77°31.18 N	08°23.98 E	2325	coring	MD99-2303	23.915	CTD	Calypso
		23h13				departure for next site				
20/08/99	45	1h27				arrived on site				
		21h58	77°37.26 N	09°56.90 E	1348	coring	MD99-2304	22.885		Calypso
		5h56				departure for next site				
21/08/99	46	7h59	77°32,76 N	010°32,10 E	1075	Arrived on site			CTD	
		8h06				Beginning of CTD				
		9h10				Departure for next site				
21/08/99	47	13h45				arrived on site				
		16h58	77°46.87 N	15°17.81 E	110	coring	MD99-2305	18.075		Calypso
		19h57				departure for next site				
21/08/99	48	22h33				arrived on site				
		23h02	77°37.56 N	09°57.07 E	1305	coring	MD99-2306Gr	6.35		Gravity
		23h51				departure for next site				
22/08/99	48bis		77°00,10 N	7°40,34 W	3315	Beginning of CTD			CTD	
22/08/99	49		76°44,02 N	2°19,88 W	2560	Beginning of CTD			CTD	
22/08/99	50		76°53,31 N	3°01,19 W	1990	Beginning of CTD			CTD	
23/08/99	51	23h13	77°01,90 N	3°45,48 W	1895	Arrived on site				
						Beginning of CTD			CTD	
23/08/99	52		77°11,21 N	4°24,13 W	1575	Beginning of CTD			CTD	
23/08/99	53	19h25	74°59,95 N	10°44,79 W	3000	Arrived on site				
			74°59,95 N	10°40,80 W		Beginning of CTD			CTD	
			74°59,69 N	10°45,87 W		departure for next site				
23-24/08/99	54		75°06,93 N	11°20,17 W	2072	Beginning of CTD			CTD	
24/08/99	55		75°08,96 N	11°40,53 W	1580	Beginning of CTD			CTD	
24/08/99	56		75°10,67 N	11°58,35 W	1015	Beginning of CTD			CTD	
24/08/99	57					arrived on site				
		12h52	73°57.80 N	13°51.27 W	2320	coring	MD99-2307Hy	0.25	CTD	Calypso
						departure for next site				
24/08/99	58		74°00,50 N	14°10,03 W	2000	Beginning of CTD			CTD	
24/08/99	59		74°04,02 N	14°28,87 W	1500	Beginning of CTD			CTD	
24/08/99	60		74°06,60 N	14°42,21 W	985	Beginning of CTD			CTD	

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
25/08/99	61		72°54,93 N	12°59,49 W	2700	Beginning of CTD			CTD	
25/08/99	62	6h49				arrived on site				

		7h46	72°54.75 N	12°58.66 W	2520	coring	MD99-2308Hy	0.21	CTD	Calypso
						departure for next site				
25/08/99	63	10h55				arrived on site				
		11h40	72°55.09 N	14°59.37 W	2320	coring	MD99-2309Hy	0.26	CTD	Calypso
						departure for next site				
25/08/99	64		72°54,86 N	15°50,83 W	2000	Beginning of CTD			CTD	
25/08/99	65	17h20				arrived on site				
		17h59	72°52.41 N	16°10.91 W	1545	coring	MD99-2310Hy	0.24	CTD	Calypso
						departure for next site				
26/08/99	66	4h30				arrived on site				
		5h07	71°11.34 N	18°30.75 W	1584	coring	MD99-2311Gr	6.93	CTD	Gravity
		5h57				departure for next site				
26/08/99	66	6h11				arrived on site				
		5h07	71°11.84 N	18°28.34 W	1602	coring	MD99-2312	17.59		Calypso
		8h24				departure for next site				
26/08/99	67	12h33				arrived on site				
		13h19	70°35.32 N	17°31.09 W	1633	coring	MD99-2313	33.145		Calypso
		14h34				departure for next site				
26/08/99	68		69°59,93	16°29,61 W	1080	Beginning of CTD			CTD	
26/08/99	69		70°00,02 N	17°00,14 W	1280	Beginning of CTD			CTD	
26/08/99	70	23h10				arrived on site				
		23h39	70°00.18 N	17°30.74 W	1618	coring	MD99-2314Hy	0.15	CTD	Calypso
		0h35				departure for next site				
27/08/99	71		70°00,00 N	18°00,04 W	1655	Beginning of CTD			CTD	
27/08/99	72	4h52				arrived on site				
		5h25	69°59.61 N	18°40.40 W	1190	coring	MD99-2315Hy	0.03	CTD	Calypso
		6h15				departure for next site				
27/08/99	73	23h52				arrived on site				
		0h13	68°06.18 N	27°51.69 W	535.8	coring	MD99-2316Gr	8.82		Gravity
		0h38				departure for next site				
27/08/99	73	1h19				arrived on site				
		2h18	68°05.60 N	27°51.13 W	556	coring	MD99-2317	25.065		Calypso
		3h04				departure for next site				
28/08/99	74	6h00				arrived on site				
		9h15	68°12.34 N	29°37.83 W	311	coring	MD99-2318Gr	3.13		Gravity
		9h39				departure for next site				
28/08/99	74	11h23				arrived on site				
		11h38	68°12.09 N	29°37.38 W	456	coring	MD99-2319Gr	4.72		Gravity
						departure for next site				
28/08/99	74					arrived on site				
		13h08	68°12.16 N	29°37.53 W	450	coring	MD99-2320	15.68		
		15h12				departure for next site				
28/08/99	74	16h11				arrived on site			CTD	
		16h35	68°12.09 N	29°37.47 W	456	coring	MD99-2321	7.9		Calypso
		18h00				departure for next site				
29/08/99	75	23h32				arrived on site				
		1h38	67°08.18 N	30°49.67 W	668	coring	MD99-2322	26.355		Calypso
		2h25				departure for next site				

date	n° site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
29/08/99	79	19h18				arrived on site				
		19h52	65°24.93 N	28°19.83 W	1062	coring	MD99-2323	17.86		Calypso
		20h49				departure for next site				
31/08/99	81	9h32	61°59,94 N	023°59,70 W	1500	Arrived on site				
			61°59,97 N	023°59,38 W		Beginning of CTD			CTD	

		14h10				Departure for next site				
1/09/99	82	3h21				arrived on site				
		5h17	60°40.46 N	26°40.22 W	1731	coring	MD99-2324GrT	12.04		Gravity
						departure for next site				
1/09/99	82	8h36				arrived on site				
		7h19	60°40.17 N	26°45.21 W	1674.5	coring	MD99-2325GrT	11.305		Gravity
		10h10				departure for next site				
3/09/99	83	23h16				arrived on site				
		0h42	53°48.13 N	13°53.58 W	689	coring	MD99-2326	24.28	CTD	Calypso
		1h27				departure for next site				
4/09/99	84	12h20				arrived on site				
		13h50	51°23.71 N	11°39.24 W	651	coring	MD99-2327	26.25	CTD	Calypso
		14h58				departure for next site				
5/09/99	85					arrived on site				
		7h31	48°04.62 N	09°30.35 W	942	coring	MD99-2328	23.9	CTD	Calypso
						departure for next site				
5/09/99	85					arrived on site				
		11h03	48°04.62 N	09°30.35 W	942	coring	MD99-2329	20.775		CalypsoT
						departure for next site				
5/09/99	86					arrived on site				
		16h08	48°04.62 N	09°30.30 W	942	coring	MD99-2330	19.81		CalypsoT
						departure for Brest				

Leg 5 from Brest to Marseille

date	site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	core
						departure for next site				
12/09/99	86	04h55	42°08.10N	09°40.90W	2120		MD99-2331	37.20	CTD	Calypso
13/09/99	87	01h51	38°33.56N	09°21.90W	97		MD99-2332	3.20	CTD	gravity
13/09/99	87		38°33.56N	09°21.90W	97		MD99-2333	3.45		gravity
13/09/99	90	21h20				arrived on site	MD99-2334	5.5	CTD	Kasten
		23h18	37°48.44 N	10°10.20 W	3156	Kasten in water				
		00h06	37°48.54 N	10°10.34 W		coring				
		01h30				Departure for next site				
14/09/99	90	03h35	37°47.95 N	10°10.05 W	3156	Arrived on site	MD99-2335	4.03		gravity
		04h32	37°48.07 N	10°10.28 W		coring				
		05h47				Departure for next site				
14/09/99	91	15h14	36°42.70 N	8°15.51 W	680	Arrived on site for ctd			CTD	
		16h02				Arrived on site				Hydro
		16h30	36°43.00 N	8°15.53 W		Coring	MD99-2336	19.56		Calypso
		17h17				Departure for next site				
14/09/99	92	20h55				Arrived on site			CTD	
		22h06				coring	MD99-2337	19.88		
		22h58				Departure for next site				
15/09/99	93	02h26	36°16.59	07°44.45	960	Arrived on site			CTD	
		04h04	36°16.23 N	07°44.39 W		coring	MD99-2338	20.37		Calypso
		04h55				Departure for next site				
15/09/99	94	09h02	35°50 N	07°40 W		Arrived on site				
	A	09h17								
		10h19				coring	MD99-2339	18.54		Calypso
	B	12h55				Arrived on site B				
		13h40	35°52.77 N	7°32.22 W	1182	coring	MD99-2340	25.58		Calypso
		15h00				Departure for next site				
15/09/99	95	17h47	36°21.88 N	07°04.26 W		Beginning of the profil				
		19h56				Arrived on site				
		20h25	36°23.35 N	07°03.94 W		coring	MD99-2341	19.41		
		21h12				Departure for next site				
16/09/99	96	07h09				Arrived on site				
		09h08	36°14.22 N	04°06.83 W	970	coring	MD99-2342	33.20		Calypso
17/09/99	97	19h50				Arrived on site				
		21h38				coring	MD99-2343	32.44		
		23h35				Departure for next site				
18/09/99	98	07h16				Arrived on site				
		08h11	41°59.84 N	04°50.14 E	2306	coring	MD99-2344	10.83		
		09h35				Departure for next site				
19/09/99	99	11h45				Arrived on site				
		12h50	41°45.53 N	4°33.14 E	2501	coring	MD99-2345	6.94		
		15h59				Departure for next site				

date	site	timing	latitude	longitude	depth (m)	Operations	Core number	length (m)	CTD	Core
19/09/99	100	18h45				Arrived on site				
		19h37	42°02.61 N	4°09.04 W	2252	coring	MD99-2346	12.17		Calypso
		21h05				Departure for next site				
20/09/99	101	00h13				Arrived on site				
		01h12	42°41.59 N	03°39.25 W		coring	MD99-2347	15.46		Calypso
		01h55				Departure for next site				
20/09/99	102	04h46				Arrived on site				
		05h11	42°41.58 N	03°50.50 E		coring	MD99-2348	22.77		Calypso
		06h15				Departure for next site				
20/09/99	103	07h20				Arrived on site				
		09h43	42°49.27 N	03°43.43 W	101	coring	MD99-2349	18.62		Calypso
		10h17				Departure for next site				
20/09/99	104a	11h35				Arrived on site				
		13h07	42°54.72 N	03°40.21 E	81	coring	No core			
	104b	14h37				Arrived on site				
		15h25	42°54.64 N	03°40.64 E		coring	MD99-2350	2.,50		Calypso
		15h49				Departure for next site				
20/09/99	105	16h34				Arrived on site				
		17h56	42°57.69 N	03°35.60	86	coring	MD99-2351	3.51		Calypso
		18h15				Departure for next site				
20/09/99	106	20h30				Arrived on site				
		21h 00	43°19.16 N	04°09.65 E	39	coring	MD99-2352	15.56		Calypso
		21h15				Departure				

SEDIMENT CORES LIST

CALYPSO cores

LEG 1 from Fort de France to Québec

Sites	Cores#	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage
1	MD99-2197	1330	12°05.43 N	61°17.48 W	24.71	Rainer Zahn	GM-DE
1	MD99-2198	1330	12°05.51 N	61°14.01 W	35.53	Rainer Zahn	GM-DE
1	MD99-2199	1386	12°04.38 N	61°12.99 W	46.68	Rainer Zahn	GM-DE
2	MD99-2200	1420	21°58.58 N	75°47.55 W	21.24	John Reijner	GM-DE
3	MD99-2201	290	25°53.49 N	79°16.34 W	38.05	John Reijner	GM-DE
4	MD99-2202	460	27°34.45 N	78°57.93 W	25.95	John Reijner	GM-DE
5	MD99-2203	618	34°58.38 N	75°12.06 W	38.05	Laurent Labeyrie	GIF-FR
6	MD99-2204	24	38°03.16 N	76°13.25 W	7.7	Thomas Cronin	USGS-US
7	MD99-2205	14	38°33.95 N	76°26.66 W	6.73	Thomas Cronin	USGS-US
7bis	MD99-2206	13	38°33.95 N	76°26.66 W	7.82	Thomas Cronin	USGS-US
8	MD99-2207	26	38°01.83 N	76°12.88 W	20.7	Thomas Cronin	USGS-US
9	MD99-2208	11.2	38°32.24 N	76°29.19 W	7.82	Thomas Cronin	USGS-US
10	MD99-2209	26	38°53.18 N	76°23.48 W	17.2	Thomas Cronin	USGS-US
12	MD99-2211	641	39°13.92 N	72°15.58 W	30.05	C.Alexander G. Mountain	ODP US
12	MD99-2212	639	39°13.98 N	72°15.55 W	37.12	C.Alexander G. Mountain	ODP US
13	MD99-2213	640	39°13.39 N	72°17.04 W	29.71	C.Alexander G. Mountain	ODP US
15	MD99-2214	157	39°17.08 N	72°25.38 W	1.18	C.Alexander G. Mountain	ODP US
15	MD99-2215	157	39°17.07 N	72°25.20 W	1.22	C.Alexander G. Mountain	ODP US
16	MD99-2216	145	39°15.88 N	72°29.68 W	9.41	C.Alexander G. Mountain	ODP US
17	MD99-2217	75	39°16.45 N	72°56.27 W	6.35	C.Alexander G. Mountain	ODP US
18	MD99-2218	61	39°18.99 N	72°58.08 W	7.47	C.Alexander G. Mountain	ODP US
20	MD99-2220	320	48°38.36 N	68°37.86 W	51.56	B.Long/E. Michel	BI-CA
21	MD99-2221	212	48°10.54 N	69°30.61 W		B. Long/E. Michel	BI-CA

LEG 2 from Québec to Reykjavik

Site	Cores	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage

1	MD99-2222	271	48°18.28 N	70°15.44 W	37.72	C. Hilaire-Marcel	GT-CA
2	MD99-2223	141	48°20.93 N	70°49.11W	28.63	C. Hilaire-Marcel	GT-CA
3	MD99-2224	271	48°18.28 N	70°15.43 W	58.54	C. Hilaire-Marcel	GT-CA
4	MD99-2225	104	48°59.88 N	58°05.08 W	37.53	J. Piper	BI-CA
7	MD99-2226	3580	57°03.71 N	50°37.70 W	32.14	J. Piper	BI-CA
8	MD99-2227	3460	58°12.64 N	48°22.38 W	42.96	C. Hilaire-Marcel	GT-CA / BI-CA
9	MD99-2228	2900	58°55.59 N	47°08.45 W	27.06	C. Hilaire-Marcel	GT-CA / GIF-FR
10	MD99-2229	3400	59°05.62 N	53°03.38 W	36.28	J. Piper	BI-CA
11	MD99-2230	3430	59°05.35 N	52°48.84 W	34.76	J. Piper	BI-CA
12	MD99-2231	3190	60°34.72 N	51°48.49 W	34.29	C. Kissel/L. Labeyrie	GIF-FR
13	MD99-2232	2455	62°38.99 N	53°53.98 W	30.32	C. Kissel/L. Labeyrie	GIF-FR
15	MD99-2233	2350	59°49.46 N	59°09.35 W	24.62	J. Piper	BI-CA
17	MD99-2234	230	53°50.81 N	59°03.05 W	39.3	J. Piper	BI-CA / UCD-US
18	MD99-2235	233	53°50.86 N	59°03.05 W	25.37	J. Piper	BI-CA
19	MD99-2236	520	54°37.00 N	56°10.57 W	21.15	Turon/Hilaire-Marcel	UB-US / BI-CA
20	MD99-2237	3530	50°11.93 N	45°41.03 W	30.74	Turon/Hilaire-Marcel	UB-FR / BI-CA
21	MD99-2238	3080	49°51.12 N	46°38.20 W	18.24	C. Hillaire-Marcel	GT-CA / BI-CA
22	MD99-2239	3770	53°27.03 N	45°15.04 W	23.77	J.L. Turon	UB-FR
23	MD99-2240	3525	54°00.60 N	46°11.68 W	25.5	J.L. Turon	UB-FR
24	MD99-2241	3280	55°32.95 N	43°57.88 W	25.35	C. Kissel/L. Labeyrie	GIF-FR
25	MD99-2242	2895	58°55.06 N	47°07.49 W	35.36	C. Hillaire-Marcel	GT-CA
26	MD99-2243	1280	62°04.51N	40°11.26W	9.43	C. Kissel/L. Labeyrie	GIF-FR
28	MD99-2244	2110	62°41.99 N	37°33.73 W	24.71	C. Kissel/L. Labeyrie	GIF-FR
29	MD99-2246	2750	61°54.73 N	36°21.52 W	35.77	C. Kissel/L. Labeyrie	GIF-FR
30	MD99-2247	1690	59°04.61 N	31°28.34 W	24.5	C. Kissel/L. Labeyrie	GIF-FR
31	MD99-2248	1724	58°57.32 N	30°23.33 W	38.22	C. Kissel/L. Labeyrie	GIF-FR
32	MD99-2250	2310	57°42.71 N	29°25.27 W	36.48	C. Kissel/L. Labeyrie	GIF-FR
33	MD99-2251	2620	57°26.87 N	27°54.47 W	36.58	C. Kissel/L. Labeyrie	GIF-FR
33	MD99-2252	2610	57°26.84 N	27°55.83 W	3.25	N. Shackleton/Maslin	CA-UK
34	MD99-2253	2840	56°21.78 N	27°48.95 W	32.75	C. Kissel/L. Labeyrie	GIF-FR
35	MD99-2254	2440	56°47.78 N	30°39.86 W	36.21	C. Kissel/L. Labeyrie	GIF-FR (W)
36	MD99-2255	1490	58°58.41 N	30°39.10 W	25.03	C. Kissel/L. Labeyrie	GIF-FR

LEG 3 from Reykjavik to Tromso

Site	Cores	Water depth	Latitude	Longitude	Length (m)	Project / PI	Storage A / W

		(m)					
1	MD99-2256	246	64°18.19 N	24°12.40 W	29.13	Anne Jennings	WHOI-US
2	MD99-2259	385	63°57.79 N	24°28.98 W	20.58	Anne Jennings	WHOI-US
3	MD99-2260	1802	65°01.13N	30°14.00 W	27.53	Anne Jennings	WHOI-US
5	MD99-2262	140	65°26.65 N	26°18.94 W	1.5	Anne Jennings	WHOI-US
6	MD99-2264	235	66°40.74 N	24°11.76 W	37.68	Jon Eriksson	UI-IS
7	MD99-2265	93	66°16.63 N	22°51.47 W	18	Jon Eriksson	UI-IS
8	MD99-2266	106	66°13.77 N	23°15.93 W	38.79	Anne Jennings	WHOI-US
9	MD99-2267	810	67°54.61 N	21°46.30 W	23.37	Labeyrie/Sarnthein	**UK-DE**
10	MD99-2268	835	67°58.81 N	21°46.68 W	34.99	M. Sarnthein	UK-DE
11	MD99-2269	365	66°37.53 N	20°51.16 W	25.44	Anne Jennings	WHOI-US
12	MD99-2271	345	66°30.09 N	19°30.34 W	11.18	Jon Eriksson	UI-IS
13	MD99-2272	440	66°59.57 N	17°58.49 W	22.6	Jon Eriksson	UI-IS
14	MD99-2273	665	66°45.78 N	18°45.02 W	39.56	Turon/Labeyrie	GI-FR / UB-FR
15	MD99-2274	937	67°34.95 N	17°04.41 W	35.43	L. Labeyrie/E. Cortijo	GI-FR / UB-FR
16	MD99-2275	470	66°33.10 N	17°41.99 W	37.13	J. Eriksson	**UI-IS / UB-FR**
17	MD99-2276	2710	69°21.94 N	06°32.36 W	24	H. Bauch	GM-DE
18	MD99-2277	2800	69°15.01 N	06°19.75 W	33.66	H. Bauch	GM-DE
19	MD99-2278	1382	66°33.16 N	10°06.50 W	34.34	L. Labeyrie/E. Cortijo	GIF-FR (W)
20	MD99-2280	825	65°20.69 N	09°45.11 W	33.76	L. Labeyrie/E. Cortijo/ E.Jansen	GIF-FR W UB-No arch
22	MD99-2281	1197	60°20.51 N	09°27.34 W	29.02	L. Labeyrie/E. Cortijo	GIF-FR
23	MD99-2282	1372	59°25.82 N	10°34.17 W	34.79	L. Labeyrie/E. Cortijo	GIF-FR
25	MD99-2283	707	62°15.67 N	00°24.84 E	27.51	Haflidason	UB-NO
26	MD99-2284	1500	62°22.48 N	00°58.81 W	33.15	L. Labeyrie/E. Cortijo/ E. Jansen	GIF-FR work UB-NO arch
27	MD99-2285	885	62°41.63 N	03°34.34 W	46.92	L. Labeyrie/E. Cortijo	GIF-FR
28	MD99-2286	225	58°43.77 N	10°12.31 E	32.5	Jan Backman	US-SE
29	MD99-2287	460	61°01.46 N	04°48.45 E	26.1	Haflidason	UB-NO
30	MD99-2288	1277	64°39.40 N	04°12.58 E	32.21	Haflidason	UB-NO
30	MD99-2289	1262	64°39.39 N	04°12.57 E	23.69	Haflidason	GIF-FR
31	MD99-2290	860	64°45.03 N	04°31.49 E	31.36	L. Labeyrie/E. Cortijo	UB-NO
32	MD99-2291	577	64°56.32 N	05°35.52 E	25.87	Haflidason	UB-NO
33	MD99-2292	400	63°28.63 N	10°11.65 E	31.25	L.Labeyrie/E.Cortijo/ E.Jansen	**GIF-FR Work UB-NO (Arch.)**
34	MD99-2293	3071	69°01.74 N	07°57.10 E	16.9	Eystein Jansen	NP-NO
35	MD99-2294	1122	68°18.67 N	10°30.45 E	24.32	Eystein Jansen	NP-NO

37	MD99-2296	508	69°08.22 N	16°19.31 E	24.68	Eystein Jansen	NP-NO
38	MD99-2297	248	69°27.73 N	18°23.54 E	28.27	Morten Hald	NP-NO
39	MD99-2298	171	69°29.72 N	18°23.03 E	36.47	Morten Hald	NP-NO

LEG 4 from Tromso to Brest

Sites	Cores#	Water depth (m)	Latitude	Longitude	Length (m)	Project/PI	Storage
40	MD99-2299	2615	72°22.14 N	07°26.62 E	11.32	L. Labeyrie/E. Cortijo	GIF-FR
42	MD99-2301	2518	74°45.13 N	10°00.82 E	11.65	Laberg	NP-NO
43	MD99-2302	2375	74°36.53 N	12°01.28 E	12.20	Laberg	NP-NO
44	MD99-2303	2325	77°31.18 N	08°23.98 E	23.91	TrØnd Dokken	UB-NO
45	MD99-2304	1348	77°37.26 N	09°56.90 E	22.88	TrØnd Dokken	UB-NO
47	MD99-2305	110	77°46.87 N	15°17.81 E	18.07	TrØnd Dokken	NP-NO
66	MD99-2312	1602	71°11.84 N	18°28.34 W	17.59	Eystein Jansen	UB-NO
67	MD99-2313	1633	70°35.32 N	17°31.09 W	33.14	L. Labeyrie/E. Cortijo	GIF-FR
73	MD99-2317	556	68°05.60 N	27°51.13 W	25.06	Anne Jennings	WHOI-US
74	MD99-2320	450	68°12.16 N	29°37.53 W	15.68	Anne Jennings	WHOI-US
74	MD99-2321	456	68°12.09 N	29°37.47 W	7.9	Anne Jennings	GIF-FR
75	MD99-2322	668	67°08.18 N	30°49.67 W	26.35	Anne Jennings	WHOI-US
79	MD99-2323	1062	65°24.93 N	28°19.83 W	17.86	Anne Jennings	WHOI-US
83	MD99-2326	689	53°48.13 N	13°53.58 W	24.28	L. Labeyrie/E. Cortijo	GIF-FR
84	MD99-2327	651	51°23.71 N	11°39.24 W	26.25	L. Labeyrie/E. Cortijo	GIF-FR
85	MD99-2328	942	48°04.62 N	09°30.35 W	23.9	L. Labeyrie/E.Cortijo/ L.Geli	GIF-FR/IF-FR
85	MD99-2329T	942	48°04.62 N	09°30.35 W	20.77	L. Labeyrie/E.Cortijo/ L.Geli	GIF-FR/IF-FR
85	MD99-2330T	942	48°04.62 N	09°30.30 W	19.81	L. Labeyrie/E.Cortijo/ L.Geli	GIF-FR/IF-FR

T Calypso corer equiped with heat probes (L. Geli/IFREMER)

LEG 5 from Brest to Marseille

Sites	Cores#	Water d. (m)	Latitude	Longitude	Length (m)	Project/PI	Storage
86	MD99-2331	2120	42°08.10 N	09°40.90 W	37.20	F. Grousset, J.L Turon	UB-FR
87A	MD99-2332	97	38°34.00 N	09°22.00 W	3.2	Jean-Louis Turon	UB-FR
87B	MD99-2333	97	38°36.00 N	09°25.00 W	3.45	Jean-Louis Turon	UB-FR
90	MD99-2334	3166	37°48.07 N	10°10.28 W	5.5	N. McCave, N. Thouveny	CE-FR
91	MD99-2336	690	36°43.00 N	08°16.00 W	19.56	Joachim Schoenfeld	GM-DE
92	MD99-2337	598	36°52.00 N	07°43.00 W	19.88	J-C. Faugeres, J. Schoenfeld	UB-FR
93	MD99-2338	960	36°16.23 N	07°44.39 W	20.37	Jean-Claude Faugeres	UB-FR
94 A	MD99-2339	1177	35°52.00 N	07°31.70 W	18.54	Jean-Claude Faugeres	UB-FR
94 B	MD99-2340	1182	35°52.77 N	07°32.22 W	25.58	Jean-Claude Faugeres	UB-FR
95	MD99-2341	582	36°23.35 N	07°03.00 W	19.42	Joachim Schoenfeld	GM-DE
96	MD99-2342	954	36°14.22 N	04°06.83 W	33.20	Nicolas Thouveny	CE-FR
97	MD99-2343	2391	40°29.84 N	04°01.69 E	32.44	Jose Abel Florès	CE-FR
98	MD99-2344	2326	41°59.84 N	04°50.14 E	10.83	Serge Berné	IF-FR
99	MD99-2345	2506	41°45.53 N	04°33.14 E	6,94	Serge Berné	IF-FR
100	MD99-2346	2089	42°02.61 N	04°09.04 E	12.17	S. Berné, N. Thouveny	IF-FR
101	MD99-2347	121	42°41.59 N	03°39.25 E	15.46	S. Berné, N. Thouveny	IF-FR
102	MD99-2348	296	42°41.58 N	03°50.50 E	22.77	Jean Grimlalt, Serge Berné	IF-FR
103	MD99-2349	128	42°49.27 N	03°43.43 E	18.62	S. Berné, N. Thouveny	IF-FR
104B	MD99-2350	98	42°54.64 N	03°40.64 E	2.50	Serge Berné	IF-FR
105	MD99-2351	98	42°57.69 N	03°35.60 E	3.51	Serge Berné	IF-FR
106	MD99-2352	70	43°19.16 N	04°09.65 E	15.56	S. Berné, N. Thouveny	CE-FR

Box-cores

Leg 1

Site	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage
11	MD99-2210Box	650	39°13.44 N	72°16.55 W		C. Alexander	ODP
12	MD99-2211Box	639	39°13.98 N	72°15.46 W	0.84	Greg Mountain	ODP
14	MD99-114-04Box	417	39°15.38 N	72°17.76 W	0.47	Strataform	ODP

Leg 2

Site	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage
28	MD99-2245 box	2125	62°41.93 N	37°35.49 W			GT-CA/BU-FR
31	MD99-2249 box	1710	58°57.44 N	30°23.99 W			GT-CA/BU-FR

Leg 3

Site	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage
2	MD99-2258Box	385	63°57.83 N	24°26.58 W	0.83	Anne Jennings	WHOI-US
6	MD99-2263Box	235	66°40.76 N	24°11.83 W	0.47	Anne Jennings	WHOI-US
19	MD99-2279Box	1420	66°33.08 N	10°06.05 W	0.63	L. Labeyrie	GIF-FR

Interface cores (below CTD)

57	MD99-2307Hy	2320	73°57.80 N	13°51.27 W	0.25	D. Anderson/ L. Labeyrie	GIF-FR
62	MD99-2308Hy	2520	72°54.75 N	12°58.66 W	0.21	D. Anderson/ L. Labeyrie	GIF-FR
63	MD99-2309Hy	2320	72°55.09 N	14°59.37 W	0.26	D. Anderson/ L. Labeyrie	GIF-FR
65	MD99-2310Hy	1545	72°52.41 N	16°10.91 W	0.24	D. Anderson/ L. Labeyrie	GIF-FR
70	MD99-2314Hy	1618	70°00.18 N	17°30.74 W	0.15	D. Anderson/ L. Labeyrie	GIF-FR
72	MD99-2315Hy	1190	69°59.61 N	18°40.40 W	0.03	D. Anderson/ L. Labeyrie	GIF-FR

Gravity-cores

Leg 1

Sites	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage
11	MD99-2210Gr	630	39°13.70 N	72°16.76 W	1.68		ODP

Leg 3

Site	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project / PI	Storage

1	MD99-2257Gr	246	64°18.15 N	24°12.36 W	2.25	Anne Jennings	WHOI-US
4	MD99-2261 Gr	1050	65°25.13 N	28°20.27 W	7.89	Anne Jennings	GIF-FR ?
11	MD99-2270Gr	350	66°37.55 N	20°51.10 W	5.61	Anne Jennings	WHOI-US Wor GIF-FR arch.
36	MD99-2295Gr	332	69°33.05 N	16°10.79 E	4.6	Eystein Jansen	NP-NO

Leg 4

Sites	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project/PI	Storage
41	MD99-2300Gr	2412	72°53.79 N	08°14.88 E	4.45	Labeyrie/Cortijo	GIF-FR
48	MD99-2306Gr	1305	77°37.56 N	09°57.07 E	6.35	Labeyrie/Cortijo	GIF-FR
66	MD99-2311Gr	1584	71°11.34 N	18°30.75 W	6.93	Labeyrie/Cortijo	GIF-FR
73	MD99-2316Gr	535.8	68°06.18 N	27°51.69 W	8.82	Anne Jennings	GIF-FR
74	MD99-2318Gr	311	68°12.34 N	29°37.83 W	3.13	Anne Jennings	GIF-FR
74	MD99-2319Gr	456	68°12.09 N	29°37.38 W	4.72	Anne Jennings	GIF-FR
82	MD99-2324GrT	1731	60°40.46 N	26°40.22 W	12.04	L. Labeyrie/L.Geli	GIF-FR
82	MD99-2325GrT	1674.5	60°40.17 N	26°45.21 W	11.305	L. Labeyrie/L.Geli	GIF-FR

Gr/T : Gravity corer equiped with heat probes

Leg 5

Sites	Core #	Water depth (m)	Latitude	Longitude	Length (m)	Project/PI	Storage
90B	MD99-2335Gr	3166	37°48.07 N	10°10.28 W	4,03	Nicolas Thouveny	CE--FR

List of core storage locations, addresses and IMAGES correspondent:

BI-CA Atlantic Geoscience Center Bedford Institute of Oceanography PO box 1006 Darmouth N.S. Canada B2Y 4A2 (piper@agc.bio.ns.ca)

CE—FR CEREGE Domaine de l'Arbois, Les Milles BP 80 13545 Aix en Provence Cedex 04 France (thouveny@cerege.fr)

CO-US Columbia University Lamont-Doherty Earth Observatory P.O. Box 1000 61 Route 9W Palisades NY 10964-1000 USA (Greg mountain@ldeo.columbia.edu)

GIF-FR LSCE Domaine du CNRS 91198 Gif/Yvette cedex (cortijo@lsce.cnrs-gif.fr)

GM-DE GEOMAR Wischhofstrasse 1-3 D- 24148 Kiel Germany

GT-CA GEOTOP- Université du Québec à Montréal (UQAM) Case Postale 8888 Succursale Centre-Ville H3C 3P8 Montréal (Québec) Canada (C. Hilaire-Marcel, chm@uqam.ca)

IF-FR IFREMER Carothèque nationale BP 70, 29280 PLOUZANE France (Serge Berne <sberne@ifremer.fr>)

NP-NO Norwegian Polar Institute Polarmiljosenteret N-9005 Tromsø Norway (Koç, N. Nalan.Koc@npolar.no)

UB-FR Dept. of Geology, Université Bordeaux 1, 33405 Talence France (Jean-Louis Turon <turon@geocean.u-bordeaux.fr>)

UB-NO University of Bergen Dept. of Geology Allegt. 41 N-5007 Bergen Norway (Jansen, Eystein eystein.jansen@geol.uib.no)

UB-US INSTAAR (Institute of Arctic and Alpine Research) University of Colorado Campus Box 450 Boulder Co 80309-0450 USA (andrewsj@spot.colorado.edu (John T Andrews))

UCD-US Department of Geology 174 Physics /Geology Building University of California One Shields Avenue Davis CA USA 95616-8605 (stoner@geology.ucdavis.edu)

UI-IS University of Iceland Sciences Institute Jordfraedahus Haskolans IS-101 Reykjavik Iceland (Eiriksson, Jon jeir@rhi.hi.is)

UK-DE University of Kiel Institut fuer Geowissenschaften Olshausenstr. 40 D-24103 Kiel Germany (Sarnthein, M. ms@gpi.uni-kiel.de)

USGS-US United States Geological Survey 12201 Sunrise Valley Drive Reston VA 20192 USA (tcronin@usgs.gov)

US-SE University of Stockholm Dept. of Geology and Geochemistry Kungstensgatan 45 S-106 91 Stockholm Sweden (Backman, Jan jan.backman@geo.su.se)

WHOI-US Woods Hole Oceanographic Institution Department of Geology and Geophysics Woods Hole - MA 02543 USA (wcurry@whoi.edu)

Tables of CTD profiles

For CTD from SIGNATURES and GINS programs (SIGN./GINS) , see SIGNATURES and GINS report for results.
For CTD with sampling for alkenones, (Alkenones, Alk.), all the informations are included in the main report.

Leg 1

Sites	CTD#	Water depth (m)	Latitude	Longitude	Program
4	IM5L1-1	460	27°34.45N	78°57.93W	Alkenones
5	IM5L1-2	618	34°58.38N	75°12.06W	Alkenones
14	IM5L1-3	417	39°15.38N	72°17.76W	Alkenones
	IM5L1-4		47°29.92N	59°59.97W	Alkenones

Leg 2

Sites	CTD#	Water depth (m)	Latitude	Longitude	Program
6	IM5001	2716	55°02.00	52°08.38	SIGN./GINS/Alk.
9	IM5002	2901	58°55.26	47°06.96	SIGN./GINS
9	IM5003	2900	58°55.81	47°10.53	SIGN./GINS/Alk.
13	IM5004	2476	62°38.90	53°54.24	SIGN./GINS
13	IM5005	2493	62°39.86	53°54.58	SIGN./GINS/Alk.
20	IM5006	3572	50°11.90	45°40.86	SIGN./GINS
20	IM5007	3540	50°11.55	45°40.68	SIGN./GINS/Alk.
24	IM5008	3280	55°33.13	43°58.00	SIGN./GINS
24	IM5009	3225	55°32.66	43°56.96	SIGN./GINS/Alk.
26	IM5010	1290	62°04.37	40°11.57	SIGN./GINS/Alk.
28	IM5011	2125	62°41.89	37°35.13	SIGN./GINS
29	IM5012	2750	61°54.74	36°21.29	SIGN./GINS/Alk.
31	IM5013	1766	58°57.20	30°23.13	SIGN./GINS/Alk.
34	IM5014	2840	56°22.09	27°49.04	SIGN./GINS
35	IM5015	2716	56°47.87	30°40.00	SIGN./GINS/Alk.

Leg 3

Sites	CTD#	Water depth (m)	Latitude	Longitude	Program
3	IM5016	1875	65°01.17N	30°13.83W	SIGN./GINS

3	IM5017	993	65°19.47N	30°52.89W	SIGN./GINS
3	IM5018	1500	65°10.18N	30°31.24W	SIGN./GINS/Alk.
10	IM5019	861	67°58.95N	21°46.82W	SIGN./GINS/Alk.
16	IM5020	1000	69°04.15N	07°54.66W	SIGN./GINS
16	IM5021	2065	69°07.13N	07°29.75W	SIGN./GINS/Alk.
18	IM5022	2502	69°12.82N	06°50.73W	SIGN./GINS
19	IM5023	1450	66°33.06N	10°06.67W	SIGN./GINS
19	IM5024	1450	66°33.21N	10°06.75W	SIGN./GINS/Alk.
21	IM5025	490	62°44.83N	09°00.40W	SIGN./GINS
23	IM5026	1360	59°26.44N	10°35.51W	SIGN./GINS/Alk.
24	IM5027	1000	60°29.92N	05°00.23W	SIGN./GINS
27	IM5028	1010	62°44,25N	03°59.93W	SIGN./GINS
30	IM5029	1400	64°38.98N	04°11.02E	SIGN./GINS
31	IM5030	900	64°45.06N	04°30.76E	SIGN./GINS/Alk.
34	IM5031	3060	69°01.83N	07°57.22E	SIGN./GINS
35	IM5032	1150	68°19.47N	10°30.34E	SIGN./GINS/Alk.

Leg 4

Sites	CTD#	Water depth (m)	Latitude	Longitude	Program
44	IM5033	2271	77°31.28N	08°23.27E	SIGN./GINS/Alk.
46	IM5034	1075	77°32.95N	10°35.98E	SIGN./GINS/Alk.
48bis	IM5035	3320	77°00.10N	07°40.34E	SIGN./GINS
49	IM5036	2560	76°44.02N	02°19.88W	SIGN./GINS/Alk.
50	IM5037	1990	76°53.31N	03°01.19W	SIGN./GINS/Alk.
51	IM5038	1895	77°01.90N	03°45.48W	SIGN./GINS
52	IM5039	1575	77°11.21N	04°24.13W	SIGN./GINS
53	IM5040	3000	74°59.95N	10°40.80W	SIGN./GINS/Alk.
54	IM5041	2072	75°06.93N	11°20.17W	SIGN./GINS/Alk.
55	IM5042	1580	75°08.96N	11°40.33W	SIGN./GINS
56	IM5043	1015	75°11.67N	11°58.35W	SIGN./GINS
57	IM5044	2321	73°57.90N	13°50.98W	SIGN./GINS
58	IM5045	2000	74°00.50N	14°10.03W	SIGN./GINS
59	IM5046	1500	74°04.02N	14°28.87W	SIGN./GINS
60	IM5047	985	74°06.60N	14°42.21W	SIGN./GINS
61	IM5048	2700	72°54.93N	12°59.49W	SIGN./GINS/Alk.

62	IM5049	2520	72°55.20N	13°59.60W	SIGN./GINS
63	IM5050	2313	72°55.13N	14°59.82W	SIGN./GINS
64	IM5051	2000	72°54.86N	15°50.83W	SIGN./GINS
65	IM5052	1520	72°52.59N	16°11.06W	SIGN./GINS
68	IM5053	1080	69°59.93N	16°29.61W	SIGN./GINS/Alk.
69	IM5054	1280	70°00.02N	17°00.14W	SIGN./GINS
70	IM5055	1618	70°00.07N	17°30.27W	SIGN./GINS
71	IM5056	1655	70°00.00N	18°00.04W	SIGN./GINS
72	IM5057	1190	69°59.77N	18°40.57W	SIGN./GINS
74	IM5058	375	68°12.41N	29°37.68W	SIGN./GINS/Alk.
74	IM5059	450	68°12.07N	29°37.77W	SIGN./GINS
76	IM5060	500	66°09.87N	27°30.27W	SIGN./GINS/Alk.
77	IM5061	625	66°04.92N	27°14.98W	SIGN./GINS
78	IM5062	560	66°00.22N	26°59.33W	SIGN./GINS
79	IM5063	1500	61°59.37N	23°59.38W	SIGN./GINS/Alk.

Leg 5

Sites	CTD#	Water depth (m)	Latitude	Longitude	Program
86	IM5067		42°08.10N	09°40.99W	Alkenones
87	IM5068		38°83.51N	09°21.89W	Alkenones
89	IM5069	325	37°50.07N	09°06.04W	Alkenones
90	IM5070	3156	37°48.54N	10°10.34W	Alkenones
91	IM5071	680	36°43.00N	08°15.53W	Alkenones
93	IM5073	960	36°16.23N	07°44.39W	Alkenones
94	IM5074		35°53.07N	07°31.67W	Alkenones
95	IM5075		36°23.61N	07°03.75W	Alkenones

ANALYSES ON BOARD : METHODOLOGY AND MAIN RESULTS

MULTIBEAM ECHOSOUDER AND SUB-BOTTOM PROFILER

The THOMSON TSM 5265B deep water multibeam echosounder was used intensively during the cruise in water depths between 200 and 4000 m. It operates in two different configurations:

1. Multibeam echosounder configuration.

Centre frequency	12 KHz.
Swath width	120° at 5000 m.
Transmission beam width	1.4° x 140°.
Reception beam width	3.6° x 24°.

2. Sub-bottom profiler configuration.

Centre frequency	3.75 KHz.
Number of reception beams	5
Beamwidth	5° x 5°.

Both systems are fully motion compensated, and navigation is through DGPS (Differential Global Positioning System) .

Multibeam echosounder:

The multibeam system was tested occasionally, but due to problems encountered with the reproduced bathymetry, due to corrections for the cold sea water temperatures, it was not in routine use.

Sub-bottom profiling:

In sub-bottom profiler configuration, the system uses a narrow, high-energy beam, which yields deep penetration and good horizontal resolution. The system uses a chirp source with a central frequency of 3.75 kHz. The return signal is received on 92 channels and combined to form the beam, reduce the relative second side lobes level and improve the signal to noise ratio. Vertical resolution is approximately 0.3 m. 40m penetration was routinely achieved on most coring sites, 60-100m penetration was obtained where sediment thickness and nature of sediment permitted this.

The quality of this system in terms of penetration and resolution clearly surpasses that of analog 3.5 kHz systems routinely in use, and there was a remarkably good correlation between the penetration of the system and the length of the coring system one could apply.

ONBOARD CORE PROCESSING AND STUDIES

Described with the help of G. Bilodeau (GEOTOP, Montréal, Canada), A. Rochon (GSC Dartmouth, Canada) and A. Jegou (LSCE, Gif-sur-Yvette, France)

Core handling description)

As soon as the corer arrives onboard, sediments from the core cutter and catcher are immediately bagged. The core lining is then pulled out of the barrel by the crew and the ends capped. A meter tape is used to measure the length of the core and to mark precisely each 1.5 m section. Using the pre-defined orientation line as a guide, the starboard side of each core is identified as the "Working" half and the port side as the "Archive" half. Each section is identified with the core number, section number (roman) and the depth of the top and bottom in centimeters. The sections are then cut with a section cutter, capped, and transported in the MST container to warm up. When necessary, holes are drilled in the core lining to evacuate excess gases from the sediments. When sediment spills on the deck during section cutting (overpressure), it is placed in an identified bag. After MST measurements, each section is split along its orientation line using two rotating saws mounted on a moving bench (the "Bordeaux" splitter). Both archive and working halves are scrapped and cleaned. The archive is used for description while the working half is sampled when required. After description and sampling, both halves are wrapped in thin plastic and packed in rectangular specially designed boxes to be finally stored in a refrigerated container.

Physical Property Whole Core Measurements by C. Jarrett (GSC Dartmouth, Canada),

High resolution sediment physical property measurements are taken using the Geotek MultiSensor Track (MST) at a downcore resolution of 2 cm. These measurements comprise compressional p-wave velocity, bulk density and magnetic susceptibility. Sediment physical property measurements and sub-samples obtained from the split core included spectral reflectance, penetrometer, discrete bulk density and water content. A summary description of the MST system is given below and a more detailed description of the system and software can be found in the GEOTEK MSCL Manual.

<u>Multi Sensor Track (MST)</u>

The MST consists of a conveyor system, a central unit assembly, a microprocessor and a PC computer. The conveyor system has two track sections, mounted and aligned on either side of the central unit, and a belt driven pusher block which is driven in either direction by a stepper motor and gear box assembly.

The central unit assembly incorporates a compressional wave (p-wave) logger, a gamma ray attenuation logger and a magnetic susceptibility loop. A reference position is located 12 cm to the right of the p-wave logger. The gamma ray attenuation logger and magnetic susceptibility loop are offset to the left of a reference position 26cm and 77cm respectively.

Each 1.5m core section is placed on the right hand track with top located at the reference position and travels incrementally past the p-wave logger, gamma ray attenuation logger and through the magnetic susceptibility coil. After each increment of travel readings from each sensor are taken.

Compressional Wave Velocity

The p-wave logger system consists of two spring loaded compressional wave transducers (PWT) and two rectilinear displacement transducers attached to the PWT mountings. The PWT's are located on either side of the core and are easily moved to accommodate cores of varying diameter. Each PWT comprises a thickness mode 500 kHz piezoelectric crystal mounted in epoxy resin and housed in a stainless steel cylinder. A filled epoxy resin backing is used to shape the transmitted pulse. A short 500 kHz compressional wave pulse is produced at the transmitting transducer at a repetition rate of 1 kHz. This wave pulse travels through the core and is detected by the receiving transducer and the time of flight of the wave pulse is measured. The two rectilinear displacement transducers measure the displacement of the active faces of the PWT transducers from a known standard. Using this measured distance and knowing the thickness of the core liner the diameter of the sediment core can be calculated assuming that the core liner is full of sediment. The p-wave travel time is corrected for the P-wave travel time delay caused by the core liner and the electronics of the system.

Gamma Ray Attenuation

The gamma ray attenuation unit comprises a 10 millicurie Caesium-137 capsule (housed in a 150 mm diameter primary lead shield with both 2.5 and a 5 mm collimators) and a sodium iodide scintillation detector (housed in a 150 mm diameter collimated lead shielding to minimise any background radiation). The source and detector are mounted diametrically across the diameter of the core. A narrow (pencil size) beam of gamma rays with energies principally at 0.662 MeV is emitted from the Cesium -137 source and passes through the diameter of the sediment core. At these energy levels Compton scattering is the primary mechanism for the attenuation of the gamma rays in most sedimentary material. The incident photons are scattered by collision with electrons encountered in the core and there is a partial energy loss. This attenuated gamma beam is measured by the Sodium Iodide detector. The Compton scattering of the photons is directly related to the number of electrons in the path of the gamma ray beam. The bulk density of the core is calculated by comparing the attenuation of gamma rays through the whole core to the attenuation of the gamma rays through aluminium. The calculated bulk density is corrected for the presence of hydrogen in the pore water. (Boyce, 1976).

Magnetic Susceptibility

The magnetic susceptibility Bartington loop sensor (MS2B) is mounted to minimise the effects of magnetic or metallic components of the MST system. A low intensity non-saturating, alternating magnetic field is produced by an oscillator circuit in the sensor loop. Changes in the oscillator frequency caused by material that has a magnetic susceptibility is measured and converted into magnetic susceptibility values (SI units).

The quality of the bulk density and velocity values are dependent on: 1) an accurate measure of sediment thickness; 2) degree of sediment saturation; and 3) the presence of air voids between sediment and plastic core liner. The magnitude of the magnetic susceptibility values are dependent on the type of sediment and the volume of material within the coil. Identical cores of varying diameters will give different magnetic susceptibility values but will show the same downcore profile.

MST Logging Procedure

The 1.5m sections of whole core were brought into the MST container and brought up as close to ambient container temperature as possible to prevent drift of the magnetic susceptibility measurements. After reaching ambient temperature the core section end caps were removed to allow core sections to pass through the magnetic susceptibility coil. Where the top sections of the cores were soupy a temporary plastic end cap was inserted in the end of the liner and taped in place. Where the core was stiff enough a thin piece of plastic was used to separate the core section sediment ends. Metric tape was placed along the length of the section and deck section and measured section length were recorded on the MST Logging sheets (Appendix).

The final MST length measurement procedure was established after processing core MD99-2225. All extruded and bagged sediment as a result of either gas expansion or sediment loss due to cutting on deck was included in the MST metric tape length.

The core section was then placed on the track to the right of the p-wave transducer and the top of the core section was aligned with the reference zero position. A temperature probe was inserted in the core section to record core temperature. To ensure a good acoustic couple for the p-wave velocity measurement the section liner was wiped down with a wet sponge and distilled water was sprayed on the p-wave transducers.

Four sections of core and a distilled water standard were run through the MST at a time as a new core with a filename designation of 2222A, 2222B etc. Core sections were sometimes too heavy or sandy for the pusher system to increment the sections at the 2cm interval. Therefore four sections were run at a time to prevent large errors in measurement depths. The distilled water standard was run at the end of the four sections as a check on the MST system. All relevant notes regarding pusher problems, imploded liner etc. were recorded in the MST logging notes.

MST Data Processing

Due to the problem encountered with the diameter deviation measurement the processed data .out files produced by the software were all incorrect. The .raw datafiles for each series of four sections was imported into an excel workbook and compiled on one sheet. The raw data was then copied to another sheet and an internal diameter of 10.04 mm was assumed for the calculation of uncorrected bulk density and uncorrected p-wave velocity.

Bulk density was calculated as follows:

$$\text{Bulk density} = (\ln \text{counts} - m_o)/(m_1 * D)$$

where:

ln counts = the normalised sample gamma ray attenuation counts

m_o = the calibration intercept

m_1 = the calibration slope

D = the calculated sediment diameter

The p-wave travel time offset caused by the liner and the electronics of the system was measured. P-wave velocity was calculated using the measured travel time, travel time offset and the assumed diameter of the core. This processed data was then copied to another sheet and the bulk density was corrected for the presence of pore water after Boyce (1976) and the p-wave velocity measurements were corrected back to in situ values after Wilson (1960), Wyllie et.al (1956) and Mackenzie (1981).

The MST core depths were edited to account for the temporary plastic end caps and to correct any discrepancies between the measured MST metre tape length and the MST software measured core section lengths.

When running core sections through the MST the temperature probe is taken out of a section before all measurements have been completed for that section and is placed in the next downcore section. Any obvious temperature variations at the end of each section were edited.

This edited processed data was then copied to the final sheet. The final data sheet was saved as an excel 4.0 file and imported into Kaleidagraph 3.08c were data was masked before plotting. Magnetic susceptibility measurements were masked for the top 6 cm and bottom 6 cm for a series of four core sections. P-wave velocity measurements were masked where the amplitude of the signal was less than 80. Density data were masked at section breaks if necessary. Measurements taken on voids in the core were not masked. The section breaks, MST and spectrophotometer data were then plotted on one page.

The distilled water standard data was not edited out and it is recommended these values be used to further correct the data.

MST Problems

The diameter deviation measurement was incorrect for essentially the entire length of the mission. We were unable to solve the problem as it was intermittent and appears to be a software problem. The LCD display of the diameter was always correct and when the Geotek utilities was used to test the diameter deviation measurement it always gave the correct measurement. This resulted in considerable time being spent processing the raw data.

Calibration of the MST gamma attenuation system is done using 8 aluminum plates and a section of core liner. An empty section of core liner is placed between the source and detector. Each aluminum plate is placed in the liner and gamma counts are measured. The density x diameter values are plotted vs. ln gamma counts and the resulting slope and intercept are used to calculate bulk density. These values then have to be corrected for the presence of pore water in the core. It is difficult to hold the aluminum plates perpendicular to the source and detector. An aluminum calibration standard in a water filled core liner would simplify the calibration procedure and eliminate the need for the Boyce correction.

Calibration of the Pwave travel time system is done using a section filled with distilled water. As velocity of distilled water is calculated from the Wilson's velocity-temperature table, the Pwave travel time offset due to the liner can be defined.

The calibration values applied on core 2255 to 2282 came from the calibration done in Reykjavik. Since core 2283, they came from the calibration done on the 7/08/99.

Spectrophotometry

A Minolta CM-2002 handheld spectrophotometer was used to measure properties of the reflected light from sediment cores split on board. It has an 8 mm diameter optical sensor. Spectral reflectance is measured in the frequency band between 400-700 nm, and divided into 31 channels, each 10 nm in length. Reflectance was measured after the core was split, described, and photographed (an elapsed time of about 40 minutes). Measurements were made every 5 cm down the length of the core, where ever possible, and a white calibration was performed at the end of each section. The reflectance measurement also provides and estimate of the sediment colour in the L*a*b colour difference system and in Munsell notation.

Caution should be used in using estimates of the colour since the actual value is an average of a 8 mm diameter section of sediment. In the case of core 2234 for example, in which colour varied markedly on less than 1 cm scales, the Minolta colour does not properly characterise the true colour of the sediment. On the other hand, spectral reflectance in the longer wavelengths is useful in distinguishing layers of detrital carbonate (light colour) that occurred in several other cores.

Digital photography (leg 3 - 5)

Digital core photos were taken of each cores section at 50cm intervals, using a Minolta/Agfa system. For photographing the archive halves of the cores, the programs PHOTOSHOP (2.5.1 for Macintosh) and ACTIONCAM (1.11) were used. For each core section, 3 photos were made which are marked with "a" (top), "b" (middle), and "c" (base) after the section number in the name of the saved photo (see below). Each section photo is approximately 50 cm, with some overlap. In case the working half of a core was photographed a "W" is written after the section number of the saved file (see below). The photos are saved in JPEG format using the highest quality (qualite superieure). The name of a saved photo includes the part of the core number following the MD99..., the section number, and the letter a, b or c (see above).

So for example the photos of section I from core MD992290 would be named like this:
2290-01a
2290-01b
2290-01c
and of section II:
2290-02a
2290-02b
2290-02c

Photographies are available on CD-Rom on request to L. Labeyrie

Constant volume sampling

A stainless steel cylinder of known volume was gently introduced into the core sediment at a constant rate. The cylinder was then carefully removed from the core and trimmed using a wire saw. The sediment was extruded from the cylinder, placed in a 1 oz screw top glass bottle and sealed. The subsample will be weighed, dried at 105 C for 24 hrs and reweighed. Bulk density, dry density and water content will be calculated.
129 constant volume samples were taken at regular intervals from 10 cores during Leg 2 by K. Jarett.

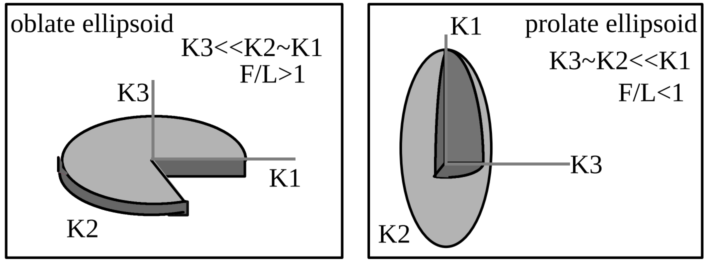
Anisotropy of the low field magnetic susceptibility C. Kissel (LMCE, Gif/Yvette, France)

Principle

The anisotropy of the low-field magnetic susceptibility (AMS) is a powerful method giving access to the preferred orientation of anisotropic magnetic minerals in sediments (« magnetic fabric »). It is represented by a symmetrical second rank tensor and visualized as an ellipsoid defined by the length and the orientation of its three principal axes ($K_1=K_2=K_3$ or $K_{max}=K_{int}=K_{min}$) corresponding to the eigenvectors of the tensor. The intensities of the axes define the shape of the ellipsoid which, in turn, indicates the degree of preferential alignment of the magnetic particles.

In marine cores, a depositional fabric is characterized by a grouping of the minimum axes of susceptibility K_3 perpendicular to the deposition plane, the two other axes being randomly oriented within the deposition plane. The ellipsoid has an oblate shape ($K_1=K_2>>K_3$). Grouping of K_1 axes within the depositional plane may arise from active bottom currents while grouping of K_1 along the core axis indicates coring perturbation. In this case, the ellipsoid has a prolate shape.

The AMS analyses were conducted on board to check the sedimentary origin of the magnetic fabric and to detect possible coring effects. Cubic samples (2 x 2 x 2 cm) have been taken at regular intervals (one to two cubes per section) in some of the cores and measured on board using the



susceptibility bridge KLY-2 (manufactured by AGICO) from the LSCE.

The results are reported in following pages as downcore variations of the inclination of K_1 and K_3 axes and of the F/L ratio where F is the foliation parameter (=K_2/K_3) and L the lineation parameter (=K_1/K_2). F/L > 1 (<1) indicates oblateness (prolateness).

Results

A total of 8 cores was analysed:

- MD99-2227, MD99-2228, MD99-2234, MD99-2242 from the Labrador sea
- MD99-2244, MD99-2246 from the Irminger basin
- MD99-2247, MD99-2251 from the Reykjanes ridge

Two cores (MD99-2234 and MD99-2244) exhibit a perfectly sedimentary fabric (oblate shape and K_3 vertical) all along the sedimentary column.

The other cores have undergone a coring effect at the top (K_1 parallel to the core axis).This effect is clear down to a depth varying between 9 and 11 meters. Then a transitional zone of about 2-3 meters is observed (grey area on plots below). A well defined sedimentary fabric characterises the rest of the cores. The coring effect on the orientation of the elongated magnetic grains seems to be independent from the length of the cores.

Sediment Description

by R. Hiscott[1] and M. Cremer[2] ([1]Memorial Univ., St. John’s, Canada; [2]C.N.R.S., Bordeaux, France)

Split sections were first cleaned to expose fresh sediment. Touching and biting, and smear slides, were used to estimate texture. Textural components are described as clay (<2 µm), silt (2-63 µm), or sand (63-2000 µm). Sediment textural names are *clay* (>80% clay), *silt* (>80% silt), *sand* (>80% sand), *silty clay* (clay>silt; <80% silt or clay; <10% sand), *clayey silt* (silt>clay; <80% silt or clay; <10% sand), *sandy mud* (<80% silt or clay; 10-50% sand) and *muddy sand* (<80% silt or clay or sand; 50-80% sand). Multimodal mixtures span a range of size classes. Both unimodal and multimodal sediment names and associated patterns used on summary columns (§7.2) are summarised in Figure 5.6a. On primary descriptions (open file), the following shorthand is used for textures: clay = c; silt = st; sand = s; silty clay = st-c; clayey silt = c-st; muddy sand = md-s; sandy mud = s-md.

Biogenic or other genetically significant sediment components (e.g., detrital carbonate) are recorded (§7.2) in a separate column with the appropriate symbols (Figure 5.6b), where this component exceeds 10-20%. In such cases, no vertical line separates the terrigenous textural symbol from the biogenic symbol. The implication is that the components are intimately mixed in the sediment. Those sediments with significant biogenic content have names that include the more abundant fossils (e.g., foraminiferal silty clay, diatomaceous sandy mud); if biogenics exceed 50%, the sediment is called an ooze. Carbonate-rich layers are light colored and are readily identified by colour spectrophotometry where the grey-scale reflectance value (L) exceeds 45%.

Interlaminated units with laminations too small to be differentiated are indicated using a split lithologic column with a vertical dividing line. Sedimentary structures, contacts, and grading are indicated using the symbols of Figure 5.6c; some of these symbols are only used on primary description forms (open file). Coring disturbance is also indicated by symbols in Figure 5.6d, and colour is designated using Munsell codes.

Fig. 5.6a Textural names and symbols. Symbols for mixtures offset to right.

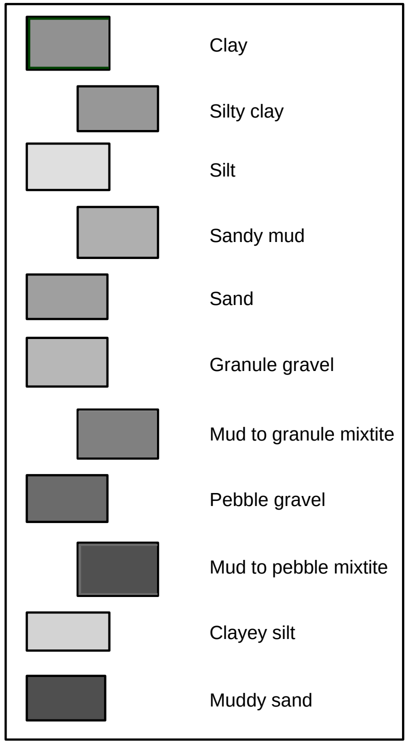


Fig. 5.6c Structure symbols

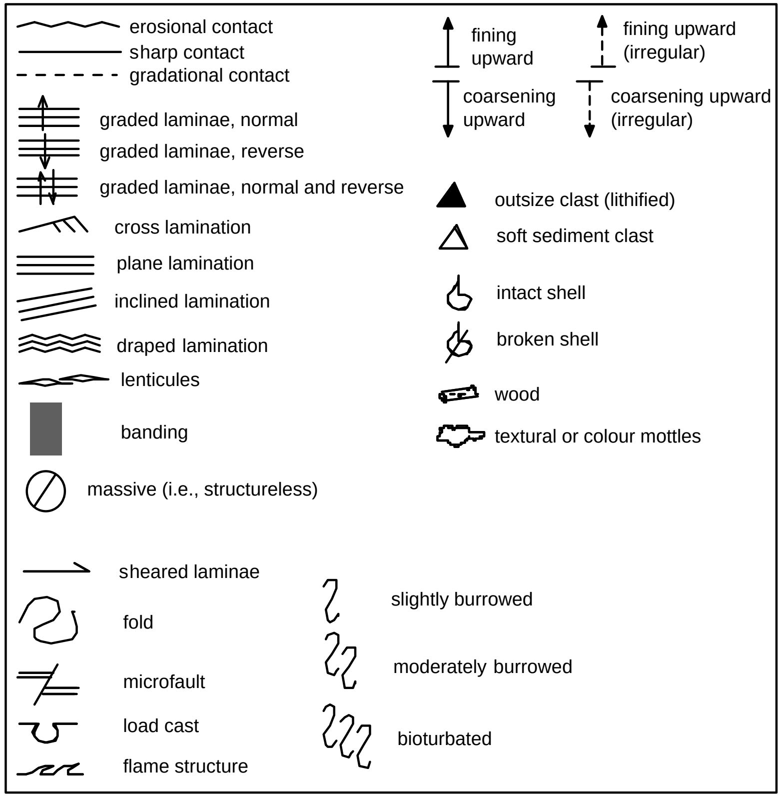


Fig. 5.6b Compositionally distinctive components

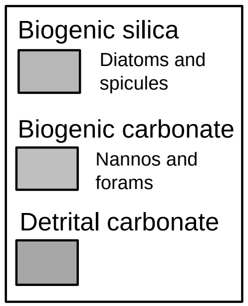
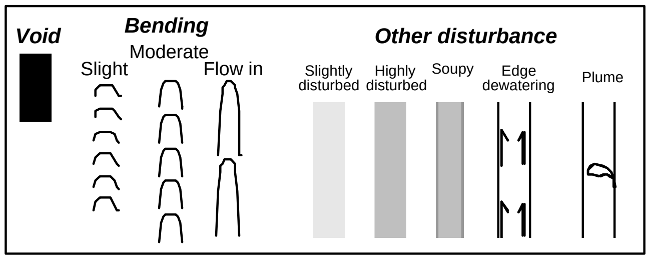


Fig. 5.6d. Coring disturbance



Other studies

.Constant volume sampling

A stainless steel cylinder of known volume was gently introduced into the core sediment at a constant rate. The cylinder was then carefully removed from the core and trimmed using a wire saw. The sediment was extruded from the cylinder, placed in a 1 oz screw top glass bottle and sealed. The sub-sample will be weighed, dried at 105° C for 24 hrs and re-weighed. Bulk density, dry density and water content will be calculated.

129 constant volume samples were taken at regular intervals from 10 cores during Leg 2

HYDROLOGICAL SAMPLES: No measurements on board

Alkenone measurements in sea water

In the frame of IMAGE V cruise, samples were collected from 37 sampling sites. The aim of this work is the reconstruction of paleohydrologic and paleoclimatic events. For this, we are using coccolithophores, which are marine micro-organisms used as biomarkers, with special emphasis on Emiliana euxleyi to reconstruct paleoclimatic conditions based on alkenones. The determination of the alkenones allows us to calculate with a good precision the sea surface water temperature.

Alkenones are insoluble in sea water, and they precipitate with organic and mineral particles, and therefore, they constitute a precious archive for a given period.

In addition to that, we also collected samples for microscopic determination of foraminiferal studies.

Methods and material

Water was sampled at various depths in the water column, between about 4 to 72 meters.

The criteria for the depth selection is the maximum of chlorophyllian development (determined by fluorometry methods) and the water temperature between 4.5 °C and 12.6°C. The equipment used for water sampling is a 12 bottle rosette with 12 litre Niskin bottles . A Seabird CTD, is coupled to the rosette and includes temperature , conductivity, and dissolved oxygen sensors, also a transmissiometer (measuring beam attenuation in a 25 cm centimer path) and a Chelsea fluorometer (for chlorophyll a determination) and other logistic material.

Analysis

Samples will be extracted using organic solvents with an increasing polarity, and subsequently will be analysed by chromatography methods in the laboratory

OTHER PROGRAMS AND SAMPLING

THE SIGNATURE-GINS PROGRAM: TRACING AND EVOLUTION OF WATER CIRCULATION

by C. Bournot-Marec[1] and Matthieu Roy-Barman[2] ([1]IFREMER, Brest, France; LEGOS, Toulouse, France)

Waters from the Labrador sea and from the Irminger sea are rapidly renewed by (1) warm and salty surface waters from the tropical Atlantic, (2) cold and less saline waters from the Arctic as well as by (3) intermediate waters newly formed in the West of the Labrador Sea that invades the Arctic gyre over a few year time scale. Deep and bottom waters are also rapidly renewed in particular by dragging of overlying waters by bottom currents around the straits that separates these basins from the Nordic seas. These waters contribute to the formation of the North Atlantic Deep Water that represents a cornerstone of the conveyor belt.

During Legs 2, 3 and 4 of the IMAGES V cruise, parameter measurements and water sampling were made to study these water circulations with different tracers: Temperature, Salinity, ^{129}I, Nd isotopes and Hf isotopes. Water samples were collected with a 12 bottles rosette equipped with CTD, fluorometer, transmissiometer, and dissolved O_2 sensor. Surface temperature and Salinity were measured continuously along the track of the ship with a thermosalinometer.

Temperature and Salinity: Due to the short residence time of the water masses, the circulation pattern may show strong variability at the decadal time scale in response to changes in atmospheric forcing (North Atlantic Oscillation, Arctic Oscillation). Since 5 years, a systematic survey of these water masses has been started. It includes oceanic cruises, profiling drifters, surface temperature and salinity measurements. The CTD and Thermosalinometer data obtained during the signature program will contribute to complete this database. Seawater was regularly sampled to calibrate salinity data (PI : Gilles Reverdin, LEGOS, Toulouse).

Nd and Hf isotopes

Neodymium isotopic composition (IC)is a tracer of source and mixing of water masses. A good knowledge of the Nd IC of the different water masses in the Labrador and Irminger seas has strong implications for the reconstruction of paleocirculation. The aims of this study are (1) to characterise the Nd IC of the different water masses contributing to the North Atlantic Deep Water and to (2) to get a better understanding of the processes controlling the Nd IC of seawater (with special interest for the interaction between water masses and continents). Ten litre samples were collected along vertical profiles. Nd was extracted from unfiltered and filtered samples on small cartridges loaded with a complexing agent. Small aliquots of selected samples were saved to measure Rare Earth Element concentrations. Hf IC is a potential tracer of water masses. At present, there is no direct measurement of the Hf IC on seawater samples. In order to develop this new tracer , we collected large samples (20 litres) of seawater. Hf extraction and purification will be done in Toulouse (PI : Catherine Jeandel, LEGOS, Toulouse).

Iodine 129

^{129}I is an anisotropic isotope released by the nuclear reprocessing plants of La Hague and Sellafield. It is proposed to use ^{129}I as a transitory tracer of water mass circulation. The samples collected for Nd were sub-sampled for ^{129}I in order to determine ^{129}I concentration in the different water masses. These samples will be analysed by accelerator mass spectrometry in Gif (PI : Yiou and Raisbeck, CSNSM, Orsay).

ISFLUX

The ojective of the ISFLUX program was to study the feasibility of heat flux measurements while taking calypso cores, using autonomous thermic probes fixed along the core barrel, about each meter. Initially, the scientific target was a quantification of the present subwater heat flux associated with the Islandic Hot spot. The corer was lost at the bottom after the first test, using an 18 m corer and 11 mn of thermic equilibration time. The security broke at 24 tons of pull out tension. The following tests have shown that an equilibration time of 4 mn was sufficient, and decreased drastically the resistance to pull out. The method appears reliable for larger scale tests.

Annexes

SCIENCE AGREEMENT

IMAGES international cruise on R/V Marion Dufresne 1999
IMAGES V -GINNA, within the INTERPOLE cruise

1. INTRODUCTION.

IMAGES is the PAGES/IGBP program responsible for quantifying climate and oceanographic variability of the ocean on oceanic and cryospheric timescales. IMAGES is also affiliated to the Scientific Committee on Oceanic Research (SCOR), ICSU. As part of its activities IMAGES coordinates international cruises for obtaining high quality sediment core material and coordinate research teams to work on this material in order to fulfill its scientific objectives.

2. IMAGES V CAMPAIGN

The scientific issues identified by IMAGES require an international effort to design and execute carefully planned paleoceanographic field programs. The new field effort in 1999 (IMAGES V cruise) is planned to take part in June-September as a mutli-leg program in the Caribbean, North Atlantic, Labrador Sea and the Nordic Seas, including coastal regions along the margins of these ocean basins. The cruise is using R/V Marion Dufresne operated by the Institut Français pour la Recherche et la Technologie Polaire (IFTRP). Financial support is provided by research agencies in France, Canada, Denmark, Germany, Iceland, Norway, Spain, Sweden, United Kingdom, and the United States. Iceland, Spain, Denmark, United Kingdom and Sweden form a consortium of smaller contributors which together act as one Principal Partner, while the remaining countries each are identified as Principal Partners.

3. PROGRAM AGREEMENT

Dr. Eystein Jansen, University of Bergen, Norway will be the international chief coordinator for the IMAGES V program, and is acting as responsible for 1999 field activities on behalf of the IMAGES Scientific Steering Committee. Dr. Laurent Labeyrie, LSCE-Gif/Yvette will be co-chief coordinator, in charge of the relationship with IFRTP. Both will share overall responsibility for the scientific sampling program and the archiving of the collected data. To assist in the steering of the cruise program and its individual legs a committee of principal investigators (PIC), representing the contributing countries or consortia is set up:

- Dr. Elsa Cortijo, representing France
- Dr. Claude Hillaire-Marcel, representing Canada

- Dr. Rainer Zahn, representing Germany
- Dr. Hans Petter Sejrup, representing Norway
- Dr. John Andrews, representing the USA (NSF)
- 1 member of the IMAGES SCICOM, to be named, representing the general interest of the IMAGES member nations
- Consortium of the small contributors including:
  - Dr. Jon Eiriksson, representing Iceland/Denmark (leader)
  - Dr. Joan Grimalt representing Spain
  - Dr. Mark Chapman, representing the UK
  - Dr. Jan Backman, representing Sweden
- Consortium of US agencies
  - Dr Thomas Cronin, representing the USA (USGS)
  - Dr. Gregory Mountain, representing the USA (STRATAFORM)

Co-Chief scientists for each leg will be in charge of the operations for that leg, representing the Program co-chief coordinators E. Jansen and L. Labeyrie. Co-Chief scientists for the first leg will be E. Michel (France) and R. Zahn (Germany); for the second leg J.L. Turon (France) and C. Hillaire-Marcel (Canada); for leg 3 L. Labeyrie (France) and E. Jansen (Norway); for Leg 4 J.C. Duplessy (France) and A. Jennings (USA); for leg 5 N. Thouveny (France) and J. A. Flores (Spain). On each leg a group of Principal Investigators (PIG), representing the site proponents for the sites of the leg, will assist the chief scientists, who will consult with the PIG on shipboard operations prioritization of sites during the leg and on-site activities (site approach, coring, CTD).

The cruise plan will include time devoted to conduct the coring program identified in Annex 1.

The field program, paleoceanographic data acquisition, sample and data management, and program coordination will be done in accordance with the policies and standards identified in the IMAGES Science and Implementation Plan, PAGES Workshop Series 94-3 (1994). Cores and core samples will be available and curated consistent with the Sample Management protocol described on pages 31 and 32. The post cruise work will be coordinated as a an international cooperative collaboration in pursuit of the scientific objectives of IMAGES and PAGES/IGBP.

The proponent or a proponent group for a site or suite of sites for a common objective shall coordinate the work in the relevant area in a dialogue with those partners who have a research interest in the same area, who have an interest in coring the same sediment sections and complementary scientific objectives. Those in charge of coordinating the work on each core also have the responsibility to provide information on core storage and sampling to the IMAGES data base manager. The site proponent or proponent group also coordinate the post cruise scientific investigations of the core material from the area, and decide on sample distribution and sharing of material to avoid redundancy and overlapping work, unless another agreements are made prior to or during the cruise.

Final decisions in cases of overlapping interests lie with the international chief coordinator (Dr. Jansen) in consultation with the PIC and the chief scientists for each leg of the program.

A cruise report with core logging data and physical properties data will be published by IFRTP within the first 2 years after the cruise, under chaired responsibility of E. Jansen and L. Labeyrie.There is a 2 year period of exclusive access to the samples taken during the IMAGES V campaign given to PIGs participating in the cruise. Access to samples from any site may be given by the PIG in charge of that site on a case by case basis to shorebased participants who were not part of the shipboard scientific party during the cruise. An additional 3-yr period of privileged access to the IMAGES V materials will be given to scientists within the IMAGES program. All participating partners are obliged to place all their quality controlled data, whether published or not, in a final report of all acquired data. This report is to be published within 5 years post cruise under IMAGES responsibility. In addition to acknowledging national support, all publications originating from the material collected during the cruise have to acknowledge the IMAGES program and the funding agencies for the ship operation: IFRTP, MENRT, CNRS-INSU.

4. FINANCIAL SUPPORT

4.1 The TOTAL COST to operate R/V Marion Dufresne during the cruise is 25 Million FFr. That amount includes direct costs for the ship, sailors, technical crew, replacement supply ship for the Crozet-Kerguelen Islands, transect to and from Reunion Island and added costs for the IMAGES coring cruise.

Financial support to the campaign from each contributing partner is calculated as an approximate share of the total cruise cost proportional to the time of the total cruise track (steaming and coring) required to conduct the coring of those cores which are being studied under the responsibility of that partner.

The IFTRP has decided to support a larger part of the cruise costs than the share strictly proportional to the French scientific interests, taking into account the priority it gives to the IMAGES program and a limited amount of non IMAGES scientific operations (8 days out of the 104 days for the cruise). The planned French contribution is 19.5 Million FFr (75% of the total budget), for a demand corresponding to approximately 45 % of the planned work (France is expected to control the scientific study of 37 cores out of 101).

The number of expected cores coordinated by scientists from the other countries is calcuted proportionally according to their contribution taking into account the mean depth of the cores and how closely they are spaced (Annexe 1).

Germany	200 kUSD (approval expected in May 1999)
Norway	200 kUSD
Canada	200 kUSD

USA		200 kUSD (NSF)
		70 kUSD (USGS)
		35 kUSD (STRATAFORM)
European consortium		
	Iceland	85 kUSD
	UK	32 kUSD
	Spain	40 kUSD
	Denmark	15 kUSD
	Sweden	10 kUSD

The IFRTP and the CGM who is in in charge of operating R/V Marion Dufresne will do their best to achieve the objectives of the program. Each participant accepts the principle of sharing losses, in case of problems or cruise delays. If necessary, a fair partial redistribution of the coring sites and core study will be organized under the responsibility of the chief scientists and PI committee, to preserve as well as possible the major scientific interests of each funding partner.

4.2 The costs for coring, liners and D-tubes for cores, ship-board core logging and description equipment will be born by the IFTRP. Each partner shall bear the costs for shipping the cores from the ship to its repositories, for participants travels to and from the ship and for consumables related to sampling on the ship.