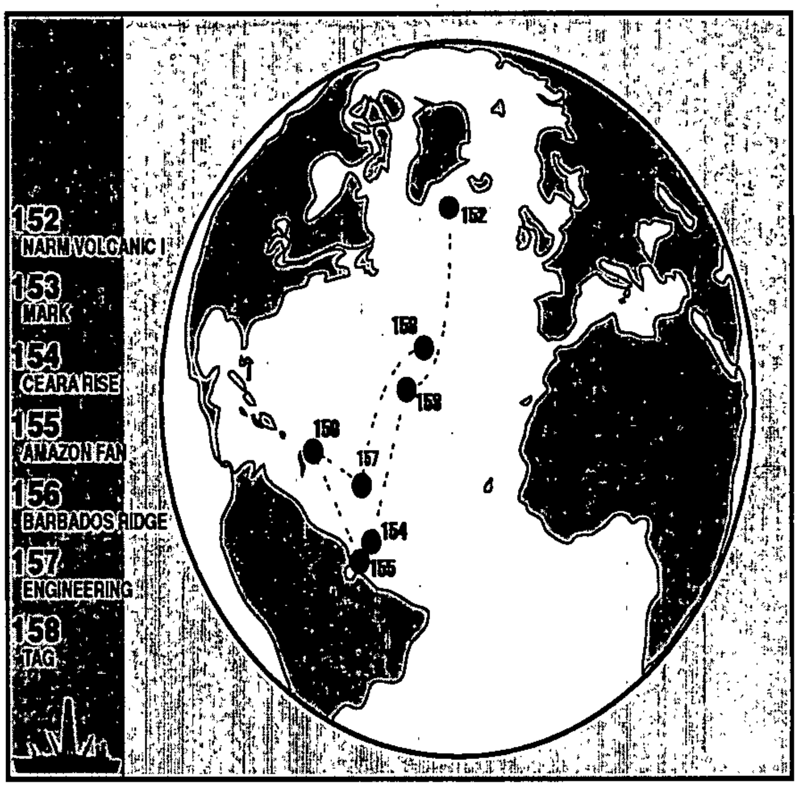
# JOIDES Journal

Joint Oceanographic Institutions for Deep Earth Sampling
Volume 19, Number 1, February 1993





## ODP 1994 Science Plan



**Cover:** Planned drilling legs for the 1994 ODP Science Plan established at the December Planning Committee meeting in Bermuda.

Comments, suggestions and contributions for the content of the *JOIDES Journal* should be directed to the editorial staff:

c/o JOIDES Planning Office
University of Washington, HA-30
Seattle, WA 98195
Tel: (206) 543-2203
Fax: (206) 685-7652
Internet: joides@ocean.washington.edu

Changes of address, requests for additional copies of the current issue and available back issues should be requested from:

Joint Oceanographic Institutions Inc
1755 Massachusetts Ave., NW Suite 800
Washington, D.C. 20036-2102
Tel: (202) 232-3900
Fax: (202) 232-8203
Internet: joi@iris.edu

# JOIDES Journal

## Table of Contents

# FOCUS

*Brian Lewis, Planning Committee Chair*

At the time of writing, the renewal of the Ocean Drilling Program beyond 1993 is not yet done, although the outlook is optimistic. We must continue to remind ourselves and others of the incredible scientific tool we have worked so hard together to be able to use. Without the *JOIDES Resolution*, our ability to test models of climate history, lithosphere formation, tectonics, sedimentary and geochemical processes would be severely curtailed; an equivalent loss to the scientific community would be the opportunity to interact and work with colleagues from around the world.

With the impending renewal of support for the program beyond October 1993 will come some exciting changes:

- The JOIDES Office will rotate to the United Kingdom after Seattle (in October 1994). This represents another step toward getting the international partners more actively involved in the day-to-day operations of JOIDES and ODP.
- A start has been made toward acquiring an upgraded computer and database system that will be installed on the ship and at Texas A & M University. Information Handling Panel and Shipboard Measurements Panel have spearheaded this activity, formulating plans to completely overhaul the shipboard data input functions. This new system will also allow data to be accessible over Internet by ODP users and, together with user-friendly access programs, has the potential to revolutionize the way ODP data are stored and used.
- In 1993 we will see land testing of the Diamond Coring System, specifically testing a much-modified heave compensation system; Technology & Engineering Development Committee has been actively involved in providing advice on all these matters. If these land tests are successful, a field test will take place on Leg 157. On this leg, in addition to the diamond coring bit and the secondary heave compensation system, a retractable drill bit may also be tested. The technology of retractable bits opens up the potential to change bits without pulling the drill string and this could greatly increase the core recovery per leg.
- Responses to an RFP for a new wireline logging services contractor are now being evaluated; Downhole Measurements Panel has been actively involved in the specifications of this RFP. The recently-published DMP/ODP brochure *Downhole Measurements in the Ocean Drilling Program — A Scientific Legacy* shows the important relationships between ODP scientific objectives and the downhole measurement program.

The first and most important of the advisory structure tasks has been the preparation of the 1994 Science Plan, which was finalized in December at Bermuda (see the 1994 Science Plan in this issue, p. 3). The quality of the Science Plan is due, in large part, to the efforts and expertise of the thematic panels and their excellent scientific leadership.

This spring Planning Committee and the thematic panels will be working to upgrade the 4 year plan, which encompasses 1993, 94, 95 and 96. This plan will provide JOIDES's best estimate of the long range drilling plans based on review of proposals in the system. It is important to note that this leaves only 1997 and 1998 unplanned. Looking ahead to these last two years of the new phase is our chance to focus on solving some key thematic problems. It will be ODP's approach to these critical themes which will be important for program reviews in 1995/96 and program renewal beyond 1998. Creative ideas and proposal formulation at the investigator level is crucial, so keep those proposals coming!

This is the first of six *JOIDES Journals* that will be prepared by the JOIDES Office at the University of Washington. The transition from the office at Univ. of Texas-Austin was very smooth, in large part due to the help of Jamie, Peter, Craig and Kathy. We have acquired a Macintosh computer system that allowed all the UT software and records to be moved seamlessly. We are now pretty familiar with the substantial data bases we inherited and I should also note that getting the new office up and running has been a full time job for Karen, Bill, Sam and myself.

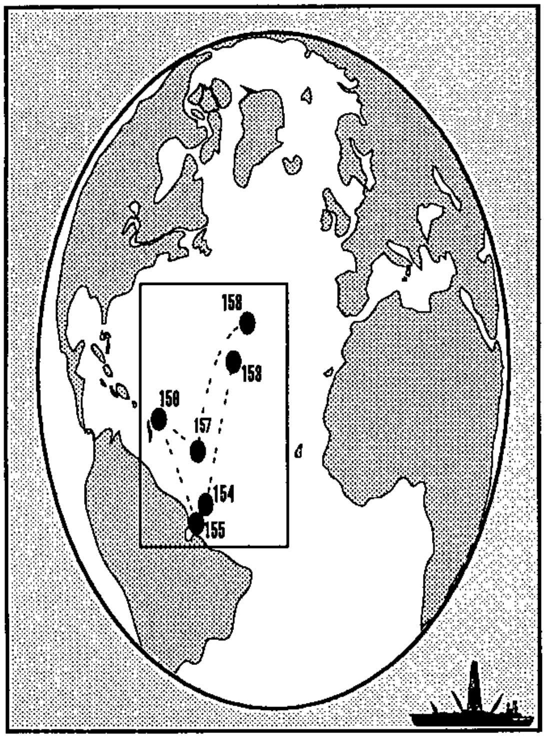
As a final note, I would like to add that usage of the Internet system has been growing exponentially since it came into use in about 1986. At the JOIDES office we use Internet extensively for e-mail and file transfer of minutes and other documents. This has increased our efficiency several fold and also reduced expenses. We are actively encouraging all JOIDES and ODP persons to utilize Internet, its e-mail and file transfer functions.

## PLANNING COMMITTEE (PCOM)

**BERMUDA BIOLOGICAL STATION**
**DECEMBER 2 - 4, 1992**

## ODP SETS SIGHTS ON 1994 SCIENCE PLAN

At the December Planning Committee meeting the science and engineering objectives for FY 1994 and the first leg of FY 95 drilling were established. The program of drilling includes the first volcanic target of the NARM Program off East Greenland, which was approved as part of the 1993 science plan. Ocean history and sedimentary and geochemical processes will be investigated at the Amazon Fan and Ceara Rise off NE South America. Lithospheric objectives include the study of the generation of ocean crust at the MARK site and processes at the TAG hydrothermal mound. Both the MARK and TAG sites are on the mid-Atlantic ridge. The dynamics of fluids in accretionary prisms will be studied by drilling and instrumenting boreholes on the Northern Barbados Ridge. An engineering leg is planned for the Vema Fracture Zone where, amongst other things, a test of ODP's new diamond coring system will take place.




**153** MARK

The purpose of this leg is to sample lower crust and upper mantle created at a slow spreading ridge. Specific drilling targets include an exposed gabbro massif and a residual mantle section along strike to the south of the Gabbro.

**154** CEARA RISE

The purpose of this leg is to study the Cenozoic history of Atlantic deep water circulation and southern-source deep water in an area where the two water masses converge. The study of carbonate dissolution along a bathymetric transect will provide information on the mixing of these water masses. The mixing influences the initial chemical and physical characteristics of the deep water that flows into the Indian and Pacific Oceans.

**155** AMAZON FAN

The purpose of this drilling is to determine the lithology, facies and age of several acoustic units comprising the Amazon Fan and their relationship to sea level change. The data will provide information on the terrestrial paleoclimate, western equatorial Atlantic paleocurrents, and regional tectonic influences, such as Andean uplift, on fan sedimentation.

**156** BARBADOS RIDGE

The primary objective of this program is to drill five holes along a transect and to log and case these holes in order to measure fluid flow along the decollement using a borehole seal. This will yield information on the dynamics of deep sourced fluids, tectonic features, and geochemical signatures in the decollement zone.

**157** ENGINEERING

The prime purpose of this engineering leg is to test the diamond coring system and in particular the secondary heave compensation system. The test will take place on the Vema Fracture Zone. Drilling is expected to take place on the median ridge, starting in the limestone cap.

**158** TAG

The drilling objective is to characterize the fluid flow, geochemical fluxes and associated alteration and mineralization, and to investigate the subsurface nature of an active hydrothermal system at a slow spreading ridge. The data should provide an analogy for modern land based mineral deposits of similar sea floor origin.

PCOM met for their annual meeting at the Bermuda Biological Station; Jamie Austin was the host. The PCOM meeting was preceded by a meeting of the Panel Chairs (PANCH). A field trip to view the local geology of Bermuda was also held prior to the PCOM meeting. The following report is a brief summary of the important motions and actions taken by PCOM at the December meeting. Complete minutes of the PCOM meeting, as well as all of the JOIDES Advisory Structure Panels, are available from the JOIDES Office.

### 1994 Science Plan

The most important task for PCOM at this meeting was to determine the 1994 Science Plan. After much discussion and presentation of thematic panel rankings by the panel chairs, PCOM voted to adopt the above schedule.

PCOM passed a motion that Legs 152 through 158 include: NARM Volcanic I (East Greenland), 369-Rev2 MARK, 388-Add Ceara Rise, 405-Rev Amazon Fan, 414-Rev North Barbados Ridge, 361-Rev2 TAG Hydrothermal. There will also be an Engineering Leg (Leg 157) to test the DCS if TAMU and TEDCOM so advise. This leg will be at Vema (Site VE3) unless a more suitable test site can be located.

### Other Issues and Actions

*Shallow Water Drilling Working Group — PCOM Motion*

In response to the safety issues raised by the recent PPSP review of the Leg 150 shallow water drilling sites, PCOM passed the following motion:

> **PCOM recognizes the thematic importance of the study of the history of relative sea level fluctuations (including amplitude, timing and stratigraphic response), and the central role that passive margin drilling transects plays in addressing that objective.**
>
> **In order to document safe approaches for ODP drilling across continental shelves in support of the aforementioned sea level and other important passive/active margin objectives, PCOM establishes a Working Group, to consist of the PCOM, PPSP and SSP Chairs, representatives designated by the Science Operator, and necessary additional expertise. This Working Group will determine equipment, dimensions and costs of hazards surveys required by government and/or ODP regulations to rule out likelihood of hydrocarbon risks to target depths at sites on shallow shelves. This Working Group will report to PCOM at its April 1993 meeting.**

*Deep Drilling RFQ — PCOM Motion*

PCOM endorsed TEDCOM's recommendation that an RFQ for deep drilling be issued by the Science Operator. The Science Operator and TEDCOM will review the responses and will report to PCOM in April before any financial commitments are made.

*Working Groups — PCOM Motion*

PCOM thanked and disbanded both of the Sea Level and Offset Drilling Working Groups and mandates that implementing the substance of their recommendations be transferred to the thematic panels.

*Long Range Budget and Science Planning*

PCOM consensus was for a message to be taken to BCOM that real-time navigation goes back to the top of the equipment list for the *JOIDES Resolution*.

After much discussion on the upcoming scientific and technological development programs, the PCOM Chair agreed to prepare a report for the April meeting on long range planning of the major budgetary items PCOM is going to be facing the next few years, with particular attention to implementing a phased budgeting approach for expensive items in the face of a diminishing budget.

## TECTONICS PANEL (TECP)

**GRANADA, SPAIN, SEPTEMBER 22 - 27, 1992**

TECP's meeting in Granada was preceded by a field trip to the Betic Cordillera. The following is a condensed version of the Executive Summary of the TECP minutes.

### TECP Business Items

- Structural Data Sheet. TECP noted, with considerable approval, the recent progress in devising a structural data sheet for onboard use. TECP wanted to see this in use as soon as possible, and looked forward to further progress in transferring to a database package with spreadsheet and graphic capabilities.
- Pressure Core Sampler (PCS). TECP was concerned about the reliability of the PCS system in use on-board the *JOIDES Resolution*. Because of the importance of the PCS to TECP objectives, TECP recommended that appropriate engineering efforts be made to reduce the complexity of the design and to enhance the reliability of use. Alternatively, adequate training of ODP marine technicians in the use of the PCS could improve results from its deployment.
- Liaisons. TECP consensus was that the panel's liaisons with other large projects should be part of the watchdog responsibilities.
- Core Repositories. TECP recognizes the need to internationalize the sample collections, but cautions that the number of repositories should be kept at a minimum. Perhaps the US repositories could be consolidated into one, too which ODP might add one in Europe and one in Japan-Australia.
- Offset Drilling Working Group. TECP viewed the final report of the Offset Drilling Working Group as a good summary of the major issues, which was beneficial in focusing attention on new and exciting themes of ocean drilling. TECP looked forward to reviewing proposals for drilling that would shed light on the tectonic igneous and metamorphic processes associated with the creation of oceanic lithosphere and major exposures of deep crustal and upper mantle rocks.
- High-Temperature Tools. TECP consensus was that the testing requirements for high-temperature borehole instrumentation should not be waived. Many on-land testing possibilities exist, such as at Los Alamos, Cajon Pass, or KTB. The matter should be referred back to DMP.
- Sea Level Working Group. TECP views the Report of the Sea Level Working Group as a comprehensive report with a clearly defined statement of the importance of the subject. However, TECP felt that the report was weak on the integral relationship between epirogenic movements, eustatic sea level changes, mantle dynamics, and Earth axis instabilities.

### NARM DPG

- NARM Non-Volcanic. TECP recommended that, in view of the prospect that the three priority sites on the Iberian Abyssal Plain will not be completed in 1993, the second leg of NARM non-volcanic drilling in 1994 or later continue with the Iberian priorities, to include Galicia, if possible (As per the NARM DPG).

- NARM Volcanic. As for the second leg of NARM volcanic drilling, TECP wished to see the 63° N transect of sites completed before beginning other transects.

### FY94 Rankings

Rankings of the proposals in the FY94 Atlantic/E. Pacific Prospectus were as follows:

| Rank | Program | Score |
|---|---|---|
| 1. | 323 Rev 2 Alboran Sea | 8.41 |
| 2. | 330 Rev Mediterranean Ridge Phase 1 | 7.45 |
| 3. | 369 Rev 2 MARK | 6.64 |
| 4. | 376 Rev 3 Ivory Coast-Ghana transform | 6.50 |
| 5. | NARM Non-volcanic leg 2 | 6.42 |
| 6. | NARM Volcanic leg 2 | 6.33 |
| 7. | 376 Rev 2 Vema Transform | 4.58 |
| 8. | 334 Rev 2 Galicia margin S reflector | 3.42 |
| 9. | NARM Non-volcanic leg 3: Newfoundland | 3.33 |
| 10. | 414 Rev N. Barbados Accretionary prism | 2.91 |

## SEDIMENTARY AND GEOCHEMICAL PROCESSES PANEL

**KIEL, GERMANY, SEPTEMBER 26 - 28, 1992**

The following is a condensed version of the Executive Summary of the Sedimentary and Geochemical Processes Panel (SGPP) minutes.

### Ranking of Prospectus Proposals

SGPP reviewed and gave the following rankings to the proposals in the Atlantic/E. Pacific Prospectus:

| Rank | Program | Score |
|---|---|---|
| 1. | 405 Rev Amazon Fan | 9.09 |
| 2. | 414 Rev North Barbados Ridge | 8.00 |
| 3. | 391 Rev Mediterranean Sapropels | 7.67 |
| 4. | 380 Rev 3/059 Rev 3 VICAP/MAP | 6.50 |
| 5. | 361 Rev 2 TAG Hydrothermal | 6.16 |
| 6. | 388/388 Add Ceara Rise | 5.66 |
| 7. | 369 Rev 2 MARK Lithosphere | 3.58 |
| 8. | 323 Rev 2 Alboran Basin | 3.33 |
| 9. | 346 Rev 3 E. Eq. Atl. Transform | 2.21 |
| 10. | NARM DPG N. Atlantic Rifted Margins | 1.42 |

### Working Group Reports

SGPP liaisons to the offset Drilling and Sea Level Working Groups summarized the final documents prepared by the Working Groups (WGs). SGPP congratulated the WGs for their excellent contributions, which outlined the drilling strategy that should be taken to tackle these themes. SGPP recommended the acceptance of both WG reports and the disbanding of the WGs.

SGPP acknowledges that the sea-level theme figures high within its mandate and proposes to follow closely the multileg sea-level program proposed by the Sea Level Working Group. SGPP will name watch-dogs as appropriate to follow and evaluate particular sea-level proposals. SGPP will submit an annual written report to PCOM on the progress of the sea-level program and take a proactive position in judging the performance and the possible needs for program changes at the scale from drilling leg priority to detailed siting, as requested by PCOM.

### Technical Development

SGPP continued to support the development of the Vibra-Percussive Corer and requests that the device be tested and ready for deployment during Leg 150 (New Jersey Transect) where extensive unconsolidated sands are anticipated.

Although SGPP was encouraged by the possibility for the development of high-temperature downhole fluid sampling devices, SGPP continued to support the development of *in situ* fluid sampler with the additional capabilities to measure *in situ* pressure, as outlined in the RFP submitted by the Steering Group for *In Situ* Pore Fluid Sampling. SGPP wishes to emphasize that passive borehole sampling is not a substitute for the *in situ* sampling of formation fluids in lithified strata.

The development of high-temperature borehole instrumentation (HTBI) is welcomed, but SGPP advised that strict care be taken not to endanger the hole during deployment. HTBI development should remain under the guidance of DMP.

SGPP expressed extreme concern about the current progress and anticipated development costs of the Diamond Coring System (DCS). Therefore, SGPP requested that an ODP/TAMU engineer attend the Spring meeting in 1993 to report on progress.

### Core Repositories

SGPP supported the internationalization of the core repositories but, at the same time, recommended that the number of repositories be kept at a minimum. SGPP recommended that refrigeration of the current core collections be continued and that refrigeration should be maintained during transport. In order to protect core quality, the cores should remain in the repositories where they are currently housed.

### Global Geoscience Initiatives

SGPP felt that ties with global geoscience initiatives should be strengthened. SGPP recommended that the panels receive reports on the activities of the various programs with particular emphasis on themes related to the mandate of individual panels. SGPP requested that one of its members report at the Spring meeting on the Inter-RIDGE program and its relevance to the TAG and Juan de Fuca hydrothermal drilling programs.

## OCEAN HISTORY PANEL (OHP)

**MARSEILLE, FRANCE, SEPTEMBER 30-OCTOBER 2, 1992**

OHP met at the DNRS Training Center at Marseilles-Luminy, the following is a condensed version of the Executive Summary of the OHP minutes.

### N. Atlantic-Arctic Gateways Leg I

OHP reiterated its view that decisions about icebreaker use for the high-priority Leg 151 be made primarily on the basis of the scientific objectives and opportunities of the leg. OHP encouraged continued contact between the Co-chief scientists and ODP/TAMU in achieving this balance.

### Leg 145 Drilling Strategy

OHP noted that the achievements of Leg 145 North Pacific Transect were made possible by the flexibility in pursuing drilling operations by Ron Grout, drilling superintendent, in cooperation with the chief scientists.

His use of an aggressive coring strategy with the APC, using it to deeper depths than conventional wisdom would suggest, with larger pullouts and the washover technique when necessary, ensured the outstanding scientific achievements of this leg. In addition, this aggressive APC strategy opens all high-latitude oceans dominated by siliceous sediments to detailed paleoceanographic investigation.

### Biostratigraphy Software

The currently-available biostratigraphic range chart software on the *JOIDES Resolution* is outdated and cumbersome. Shipboard biostratigraphers must spend an inordinate amount of time filling out paper forms and transcribing data; as a result, there have been some near disasters in production of range charts. OHP members strongly supported the development and installation of software for range chart production. We recommend that the software has the following capabilities: (1) that it be Macintosh-based in light of the large proportion of such computing equipment on the ship and in the paleontology lab, and (2) that it can interface with UNIX-based software in view of anticipated future developments in the shipboard computing environment.

### Ranking of Prospectus Proposals

OHP gave the following rankings to the FY94 Atlantic/E. Pacific Prospectus proposals:

| Rank | Program | Score |
|---|---|---|
| 1. | 388/388 Add Ceara Rise | 1.00 |
| 2. | 391 Rev Mediterranean Sapropels | .57 |
| 3. | 405 Rev Amazon Fan | .53 |
| 4. | 323 Rev 3 Alboran Sea evolution | .49 |
| 5. | 380 Rev 3 MAP leg | .41 |
| 6. | NARM-DPG Non-Volcanic Leg II | .39 |
| 7. | 380 Rev 3 VICAP leg | .11 |

The remaining proposals in the Prospectus were not within OHP interests and were not ranked.

### Reviews/Responses/Evaluations

- ODP Publicity. OHP discussed program visibility from three perspectives: (1) links to other global geoscience initiatives, (2) visibility within the scientific community, and (3) visibility to the general public.
- Core repositories. (1) *Should core be refrigerated?* OHP consensus was clear that the core collection should continue to be refrigerated.

  (2) *Should cores be moved?* OHP concluded that cores should most definitely not be moved.

  (3) *Should additional repositories be established?* The view of the panel majority was that the ideal arrangement would be one central facility, and that the three existing repositories represented as great a compromise from the ideal as was acceptable. In particular, it was emphasized that the existing core repositories have a consistent philosophy for core handling, with long experience and a demonstrated successful track record. Others on the panel felt that although a small number of repositories was obviously ideal, three was not a magic number; why not four or five? Other more indirect, scientific benefits might accrue as well.
- High-Temperature Borehole Instrumentation (HTSI). Although not within OHP mandate, it seems reasonable that the existing guidelines should be followed
- Sea level Working Group Report. By panel consensus, OHP recommended that the SLWG report be accepted and that the SLWG be disbanded. There was no support for a separate Sea Level Program, whose details are not entirely clear, in the advisory structure. There was also concern about the report's specification of a requirement of one leg/year for sea level objectives, specifically when evaluation of existing and soon-to-be-drilled legs with sea level objectives is needed, or in the absence of highly ranked proposals, and given the other objectives of thematic interest. Acceptance of the report should not be taken as endorsement of, or commitment to, this level of drilling effort. While the efforts of the

working group to identify watchdogs and proponents for specific targets are well-received, wider solicitation to the scientific community for proponents and proposals should be made, most appropriately by the JOIDES Office. This target list of scientists should not be viewed as an exhaustive or an exclusive one by virtue of the report's acceptance. Consistent with PCOM's request, three panel members were named to serve as watchdogs for sea level objectives of OHP interest.

### Items of Concern

*Proposals*

Several points about proposals arose: (1) addenda and revisions should be required to have a section which summarizes what was changed and how these changes respond to the points raised in earlier reviews, and (2) the ideal format for a proposal should be for it to approach drilling prospectus format as it approaches maturity, and proponents should be encouraged to consider the best of these as models.

*Diamond Coring Ssystem*

By panel consensus, OHP strongly urges a land-based test of the DCS system in realistic lithologies representing those of interest to OHP (e.g., alternating hard and soft lithologies, vuggy limestones). Such a test under ideal conditions will be critical to evaluating the potential of DCS for shipboard recoveries of such material, and thus critical for obtaining continued OHP support for DCS development.

## LITHOSPHERE PANEL (LITHP)

**PARIS, FRANCE, OCTOBER 14 - 16, 1992**

The Lithosphere Panel met in October in Paris, France. The most important result of LITHP deliberations on the scientific and engineering issues that have arisen in the last year was the decision to revise the LITHP White Paper written in May 1987. The following report was condensed from the Executive Summary of the LITHP minutes.

### Revision of the White Paper

In revising the White Paper, LITHP wanted to get input from the scientific community to avoid the perception that the plans were being made by a small group of individuals. Consequently, LITHP endorsed a timetable of activities that will result in a final product to be presented to PCOM at the December 1993 meeting; the timetable includes an open meeting for community input.

LITHP assigned the task of writing sections to panel members. A draft will be discussed at the spring meeting. LITHP requested that the JOIDES Office assist the Panel in identifying potential funding sources for the Open Meeting proposed in the above timetable. It was considered important that international representation be possible at this meeting.

### Offset Drilling Working Group

LITHP thanked the Offset Drilling Working Group for their report, it was viewed as an important contribution to the future directions of ODP lithosphere drilling. The recommendations of the OD-WG would be reflected in the revision of the LITHP White Paper now in preparation. LITHP suggests that the document be accepted and the current Working Group be disbanded.

A number of proposals that use the offset drilling strategy have been submitted and LITHP views these as the seeds of a program of offset drilling. However, given the maturity of some of the drilling proposals, and the Panel's desire to begin to address basement structure during the Atlantic drilling, LITHP did not want to request a DPG at this time. Through a sub-committee LITHP will actively seek and track proposals that address the high priority objectives recommended by the OD-WG.

### Planning for Upcoming Legs

*Leg 148 - Return to Hole 504B*

LITHP recommended that, if the high-temperature borehole instrument (HTBI) meets the guidelines established by DMP for third-party tools by successfully passing a land test, the tool be carried on board the *JOIDES Resolution* during Leg 148 for use at the discretion of the Chief Scientists. On the broader issue of using Hole 504B for testing new downhole instrumentation, LITHP recommended that testing in this hole be limited to those tools that may provide scientifically useful information from that site.

LITHP also discussed contingencies for Leg 148 if the hole had to be abandoned for any reason. LITHP recommended two contingencies for time remaining on Leg 148 if Hole 504B has to be abandoned:

i) return to Hess Deep and continue if drilling is successful on Leg 147

ii) drill a second hole ~500m from Hole 504B to begin to investigate crustal heterogeneity.

The choice between these alternatives should be left to the discretion of the Chief Scientists.

### Engineering Developments

*High Temperature Downhole Fluid Sampler*

LITHP supported the development of a system for collection of borehole fluids at high temperatures. However, the Panel agreed with SGPP that this was not a replacement of formation fluid sampling, which should remain a long-term goal. LITHP continued to support the development of an *in situ* fluid sampler as outlined in the RFP submitted to PCOM by the *In Situ* Fluid Sampling Working Group.

### Proposal Reviews

There are now a number of proposals to drill in the Caribbean Sea that address both the K-T boundary and the nature of the basement rocks. In view of the existence of proposals addressing objectives that require drilling in the Caribbean, LITHP recommended forming a Caribbean Detailed Planning Group.

The mandate for this DPG should include designing a drilling program to address:

a) the consequences of the K-T bolide impact

b) the origin of Caribbean basement and the character of deep seismic reflectors

c) the character of the flood basalts and the implications for testing the hot spot model

The DPG should also consider whether this is the best area to study a large igneous province (LIP). LITHP also requested that the other thematic panels add to this mandate in order to meet their high priority objectives.

### FY'94 Prospectus Rankings

Rankings of proposals for the FY-94 drilling schedule are:

| Rank | Proposal | Avg. Vote |
|---|---|---|
| 1 | MARK | 7.53 |
| 2 | TAG | 7.07 |
| 3 | NARM Volcanic Leg 2 | 6.00 |
| 4 | Vema Site VE-3 | 5.07 |
| 5 | VICAP/MAP | 4.50 |
| 6 | N. Barbados Ridge | 4.33 |
| 7 | Equatorial Atlantic Transform | 2.73 |
| 8 | Alboran Sea | 1.73 |

Other notes related to this ranking:

1) TAG: LITHP strongly supports instrumentation of TAG drill holes, but did not wish to see drilling delayed. LITHP hopes that interested groups could be informed as soon as possible if TAG was scheduled so that experiments can be planned to utilize the drilling.
2) CORK at Hole 395A: LITHP views this project as sufficiently important to include it in drilling plans for the near future. There are two possibilities:
   a) if there are problems with Leg 150, Hole 395A could be CORKed with the remaining time
   b) make either TAG or MARK a 58-day leg to include 60 hours of logging and deployment of CORK at Hole 395A.

LITHP is willing to give up one day of drilling at either site (needed to keep the leg to 58 days) in order to complete this project.

3) NARM Volcanic Leg 2: If EG63 Sites 1 and 2 have been completed, this leg should drill on the Voring Margin. If EG63 Sites 1 and 2 are not finished, this Leg should complete them and then, if time, EG63-3 and -4 should be drilled.

### FY'94 Engineering Leg

LITHP considers that drilling and recovery of significant percentages of zero-age crust to be a high priority objective for lithospheric drilling. However, it recognized that, in order for development of the DCS to be continued, it was absolutely critical that the next test be "successful" (defined as recovering core). LITHP therefore suggested that VE-3 be considered as the next Engineering Test Site as it provides a shallow, less hostile environment to test the system. In addition, high-priority LITHP scientific objectives can be met by drilling at this site on the Vema transverse ridge.

### Global Geoscience Initiatives

LITHP reviewed the level of representation of other initiatives through its members. LITHP acknowledged the importance of good liaisons with other global geoscience initiatives, and felt that there was excellent representation of such programs among the current LITHP members. However, in recognition of the fact that more attention needs to be paid to cooperative efforts, LITHP will include reports from other initiatives as an agenda item at one meeting/year (most likely the spring meeting).

Another issue that is related to this is the use of ODP drillholes for post-drilling science; the drillholes are likely to become important scientific assets that will be in demand in the next few years. It appears that there are currently about 20 holes that might be appropriate for such use. EXCOM has published guidelines for the use of already existing drillholes, which are currently in effect. Given the importance of maintaining the integrity of holes that are potentially of scientific importance for deepening (for example Hole 504B), LITHP recommended to PCOM that the review process for the use of open drillholes be expanded to include the appropriate thematic panels.

### ODP Core Repository

LITHP recognized the need to internationalize ODP, as well as the requirement for additional storage of cores in the very near future. However, LITHP did not support transporting cores that were currently in storage to a new facility. LITHP recommended that the number of repositories be kept to a minimum (as dictated by all the considerations of ODP) and that geographic coherence be maintained in all the collections.

## SITE SURVEY PANEL (SSP)

#### LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, AUGUST 4 - 6, 1992

The charge for the August 1992 SSP meeting was to provide PCOM with survey package assessments of 22 proposals that had been highly ranked and considered "drillable" by Thematic Panels and were on the FY94 general ship track defined by PCOM in Spring 1992. SSP was to update its assessments following an August 1st deadline set by PCOM for data submission. PCOM required the updates to aid in selecting around 10 proposals from the 22 for FY94 Prospectus.

Response by proponents to the August 1st deadline varied from poor to impressive but **no** data package was considered completely deposited in the Data Bank by the time of the August meeting. On the other hand, for 11 of the proposals under consideration the required data either existed or would be collected within a few months.

SSP assessments categorized 2 proposals (*Costa Rica Accretionary Wedge* and *Madeira Abyssal Plan*) as "in the Data Bank but minor items still to be deposited"; a major group of 7 proposals (*Alboran Basin, East Equatorial Atlantic Transform, TAG Hydrothermal System, MARK Lithosphere, Mediterranean Sapropels, North Barbados Ridge* and *Newfoundland Basin (non-Volcanic Rifted Margins)*) as "required data exists but major items of existing data still to be deposited in the Data Bank:; and 2 proposals (*Ceara Rise* and *Amazon Fan*) as "dependent on a cruise in August/Sept. 1992 for completion of packages."

SSP concluded that the eleven proposals mentioned above could complete their data packages in 1992 for scheduling in the FY94 program. Other proposals under consideration were dependent on further survey work and processing that would not be possible to assess until the end of 1993 and should not be considered for the FY94 program.

# POLLUTION PREVENTION AND SAFETY PANEL (PPSP)

## LONDON, UK, OCTOBER 22 - 23, 1992

PPSP met at the offices of British Petroleum in London, England in October to review the drilling sites for Legs 149 and 150. The following report was summarized from the PPSP minutes.

### Leg 149

Co-Chief Scientists for Leg 149 (R. Whitmarsh and D. Sawyer) reviewed the scientific objectives of Leg 148 and described the proposed drilling locations on a site-by-site basis. Sites IAP - 2, IAP - 3c, IAP - 4, IAP - 5, and GAL - 1 were approved for drilling.

### Leg 150

Co-Chief Scientists for Leg 150 (K. Miller and G. Mountain), reviewed the scientific objectives of Leg 150 and presented the site-by-site descriptions of their proposed program. Sites MAT - 12, MAT - 11, MAT - 10, MAT - 8A, and MAT - 9 were approved. After discussion on the safety of the remaining shallow water sites, further consideration of proposed shallow water Leg 150 drilling locations was suspended.

As a result of the discussions on the safety of drilling in shallow water with the *JOIDES Resolution*, PPSP proposed the establishment of a sub-committee to determine the current procedures and requirements for high-resolution drill site surveys and recommended that PCOM take up the issue at its December meeting.

### Santa Barbara Channel

PPSP member H. Wories presented the site-by-site discussion of the three proposed sites for the Santa Barbara Channel that were due to be drilled at the end of Leg 146; Site SB-1A was approved.

# INFORMATION HANDLING PANEL (IHP)

## MARSEILLES, FRANCE, SEPTEMBER 9 - 11, 1992

The following is a condensed version of the Executive Summary of the IHP minutes.

### Shipboard Computing

IHP noted that in September 1991, they recommended to PCOM that urgent action was required to upgrade the ODP shipboard computing/database environment. The report of the Data Handling Working Group (DHWG) and a detailed set of proposals from the Operator had made the JOIDES community were more sensitive to the issue but PCOM was unwilling to divert scarce resources to rectifying the situation.

After discussion, the Panel decided to continue to urge PCOM to press ahead with plans to implement changes to the shipboard and shore-based computing and database environments as set out in the report of the DHWG Report of March 1992.

### ODP Data Base Group

TAMU noted that database requests for copies of particular datasets were declining, perhaps because of the increasing availability of some ODP digital data on CD-ROM. Progress on the VCD, Core-log, and age-profile datasets was reported.

In discussion, IHP noted with concern that the VCD data capture package was still under development and sedimentary core description data was not being added to the formal database. The panel also urged the immediate evaluation of the *BugWare* software package as the standard paleontology data acquisition package on the *JOIDES Resolution*.

TAMU agreed that at present little data was being added to the formal IHP-mandated datasets that constitute the heart of the ODP database structure. Such information exists, but is being kept as an unstructured set of separate datasets at TAMU/ODP. The panel regarded this as an unsatisfactory state of affairs and noted that significant improvement would only come with the renewal of ODP shipboard computing/database environment.

### ODP Publications

The panel commended ODP/TAMU for its work in the preparation of the *Proceedings* volumes. The timely production of volumes continued, with maintenance of a quality product. IHP considers this progress to be very satisfactory. IHP urged PCOM not to make changes in the publication policy at this time. The present volumes are being well produced in an effective manner and appear to be serving the community well.

### ODP Computer Services

Since the last report the changeover to UNIX has begun at TAMU. It was emphasized that the main operational objective of the Computer Services Group was to present users with a friendly, robust system that they would actually want to use. IHP noted that this was not being achieved; parts of the data-acquisition software were perceived as being unfriendly and out of date. Again significant improvement would only come with the renewal of ODP shipboard computing and database environment.

### Paleontological Matters

The panel reviewed the present status of the Micropaleontological Reference Centers and strongly supported their work and the plan to hold a meeting in Basel in mid-1993 for the curators and users.

IHP suggested that to improve stratigraphic coverage on legs, more specific advice needed to be given to future Co-

Chiefs prior to Leg staffing and agreed to liase with the operator on this matter.

### Review of ODP Volumes

Reviews of the *Initial Report* and *Scientific Results* volumes for ODP Legs 119 - 125 were made by IHP panel members. Overall the reviews were complimentary and some of the concerns expressed have already been addressed by ODP as a result of in-house assessments.

The panel noted that although some *Scientific Results* volumes do contain contributed chapters that are either second class or simply data reports, these often contribute by maintaining a balanced account of the achievements of specific legs.

### Co-Chiefs Report

W. Sager, Co-chief, Leg 143, and Jorg Erzinger, Co-chief, Leg 140, both commented that the shipboard database/data-acquisition computer system, although outdated, was not stressed during these legs because relatively little core was recovered. The panel noted that high-recovery, paleoceanographic legs were a different matter.

## SHIPBOARD MEASUREMENTS PANEL (SMP)

**VICTORIA, CANADA, SEPTEMBER 21 - 23, 1992**

At the fall SMP meeting, in addition to the normal review of individual laboratories, the SMP reviewed the requirements for the new ODP computing system; reviewed core processing requirements for Santa Barbara Basin; updated the equipment priority lists; in the add-on meeting of physical property specialists, reviewed the specific problem areas in this laboratory; and jointly met with DMP to review core-log data integration. The following is a condensed version of the Executive Summary of the SMP minutes.

### Computing System Priorities

The proposed new computing has three major components: the data acquisition modules; the database; and the data retrieval modules. The largest cost of the new computer system will be for the data acquisition modules. The level of effort for the data acquisition modules development may be as much as 80% of the total resources. Given the potentially restricted budget, SMP reviewed the data acquisition requirements and ranked them in priority order. The result of this review was a listing (in priority order) of data acquisition modules which would require new software.

### Laboratory Recommendations

- Paleomagnetic Lab. The IHP recommendation to allow higher de-magnetizing fields was supported by SMP. SMP recommended specific procedures for shipboard AF demagnetization to ODP/TAMU.
- Paleontology. SMP agreed that any further delay on paleontological data acquisition software development would seriously impact the success of future legs, particularly legs with paleoceanographic objectives. The panel agreed that this software development has the highest priority and the RFP should go out immediately. SMP recommended that ODP-TAMU complete the paleontological software package prior to Leg 150, New Jersey Sea Level.
- Theft. The panel is concerned that items such as reprints, books, microscope parts and other accessories are frequently permanently borrowed by the members of the science party. These long term loans (or thefts, to be blunt) not only cost the program money, but affects the ability of subsequent scientists to complete their research tasks. SMP recommended that ODP-TAMU include the following statement in the initial information package sent out to all scientists before joining a leg:

> ***A message to all shipboard scientists from the Shipboard Measurements Panel***
>
> It has come to our attention that reference papers, books, DSDP reports and occasionally items of a more attractive nature, such as microscope objectives, are "lost" or "go missing". More often than not this is a kind way of saying they have been stolen. Microscope objectives are expensive to replace, but of equal, if not more importance, reference literature is being denied to scientists on subsequent Legs. Please leave everything as you would hope to find it yourself when joining a Leg.
>
> Thank you,
>
> JOIDES Shipboard Measurements Panel

- Video Core Description. SMP recommended specific requirements that the second generation video core description (VCD) program should fulfill.
- Anoxic Sediment Procedures. SMP recommended specific storage procedures for split and whole cores of anoxic sediment.
- Color Data. SMP recommended that the new Minolta spectrophotometer be routinely used to measure Munsell color and should replace visual assessment of color. For legs with paleoceanographic objectives, color spectral data should routinely be measured and recorded at an appropriate depth interval.
- Navigation. SMP was seriously concerned with the delay in adequate navigation software/hardware; the delay was considered totally unacceptable. Real time navigation on the *JOIDES Resolution* is not possible and SMP agreed that this must be changed immediately.

### Santa Barbara Basin Cores

SMP was concerned that Santa Barbara Basin cores might not be properly handled and processed so recommended that the cores be processed in the same manner as all other ODP cores.

### Core-Log Data Integration

SMP recommended that ODP/TAMU purchase the new version of *CORPAC* for evaluation and for specifying any special modifications required for shipboard use. A version of *CORPAC* should be available for Leg 150.

DMP and SMP were concerned that core-log integration had not been included as an integral part of the new computing system upgrade. The panels jointly agreed on the following recommendation: DMP/SMP re-emphasize the scientific requirements of core-log data integration during the upgrading of the shipboard computer system. In order to incorporate a new core-log data integration shipboard facility, a scientific staff member at ODP/TAMU should be identified to lead and coordinate this development. The core-log integration software development should draw upon existing capabilities within the JOIDES community where appropriate.

## DOWNHOLE MEASUREMENTS PANEL (DMP)

**VICTORIA, CANADA, SEPTEMBER 23 - 25, 1992**

DMP met in Victoria during the port call of the *JOIDES Resolution*. This was the last meeting as Chair for Paul Worthington, he stepped down as chair at the end of 1992. Peter Lysne took over as Chair as of Jan. 1, 1993. Key thrusts of the meeting were the evaluation of the booklet on ODP downhole measurements, third-party tool guidelines, technology reviews of topical subjects, a joint session with the JOIDES SMP on the shipboard integration of core and log data, and a tour of the *JOIDES Resolution*.

### Downhole Measurement Booklet

The education and promotional booklet *Downhole Measurements in the Ocean Drilling Program — A Scientific Legacy* had been printed and was ready for distribution. The authors were Paul Worthington, Andy Fisher (ODP-TAMU) and Xenia Golovchenko (ODP-LDEO). The DMP view was that the booklet would achieve the stated goal of educating the scientific community and acknowledged the contribution of the Editor, Karen Riedel (ODP-TAMU), to the production of the booklet. It surpassed DMP's expectations and the extremely high quality of the booklet would increase its impact on the scientific community.

### Third-Party Tools

The guidelines for third-party tools (see *JOIDES Journal* Oct. 1992) will soon to be printed in an informational brochure that will be available from ODP/TAMU. These are the first stage of the communication process, technical specifications would be the second. DMP felt a need for close monitoring of tool development and that the monitoring of third-party tool developments was a fundamental part of the ODP contractual function: it is not optional. In addition, DMP recommended that the staff of the ODP logging operator should include a person designated as the permanent point of contact for the development of third-party wireline logging tools.

### CORK

DMP expanded on its earlier recommendations to the Principal Investigators of the instrumented borehole seal (CORK) program. DMP wanted them to investigate the oil industry thermistor/pressure observatories in order to establish what was available as off-the-shelf technology.

## *New Booklets from DMP*

**Downhole Measurements in the Ocean Drilling Program: *A Scientific Legacy***

*For additional copies and further information:*

Dr. Philip D. Rabinowitz, Director
Ocean Drilling Program
Texas A & M University
1000 Discovery Drive
College Station, TX 77845 USA
Phone: 409/845-2673 Fax: 409/365-3182

**Guide to Third-Party Tools: The Ocean Drilling Program**

**For inquiries about wireline tools contact:**

Manager of Technical Operations
Borehole Research Group
Lamont-Doherty Earth Observ.
Palisades, NY 10956 USA
Phone: 914-365-8734
Fax: 914-365-3182

**For inquiries about all other downhole tools contact:**

Dr. Philip D. Rabinowitz, Director
Ocean Drilling Program
Texas A & M University
1000 Discovery Drive
College Station, TX 77845 USA
Phone: 409/845-2673 Fax: 409/365-3182

# TECHNOLOGY & ENGINEERING DEVELOPMENT COMMITTEE (TEDCOM)

## CAMBRIDGE, UK, OCTOBER 7 - 9, 1992

TEDCOM met in October in Cambridge to discuss:

- DCS development
- Finalization of the Deep Drilling RFQ
- Possible application of Russian technology to ODP.

The first two items were discussed in depth on the first day by two working groups. TEDCOM expressed great satisfaction at the way their recommendations on DCS had been followed up since their May 1992 meeting.

The meeting was summarized by the following sixteen points condensed from the Executive Summary of the TEDCOM minutes.

### Diamond Coring System

*DCS Field Tests*

1. TEDCOM approved the principle of the Amoco field test of the DCS (in Tunisia), which would allow DCS downhole tools to be tested and also provide drilling/coring experience. It would **not** test the secondary compensator however.
2. Complementary land testing **must** take place to test the control system with the secondary compensator. The Amoco test was not considered an alternative. The planned land tests will not simulate the ASPI string.
3. Further land testing of the DCS with API string simulation, including simulation of slip-stick friction, may be necessary, depending on results of initial land tests and simulation tests.

*DCS Development*

4. The possibility of controlling the DCS W.O.B. using a bumper sub should be examined by TAMU.
5. The possibility of determining residual heave of the DCS hit when off bottom, using a sensor lowered down the string, should be examined by TAMU.
6. Studies of the application of retractable mining bit technology to the DCS should be continued. Such technology could lead to enormous time savings in the deployment of the DCS Phase II and could eliminate the requirement for DCS Phase III.
7. TAMU should assess the possibility of adapting Russian retractable mining bits to the DCS.
8. The application of rollercone retractable bits technology to DI-BHA systems should be studied. A specification of requirements should be sent by TAMU to M. Gelfgat (VNIIBT), who should be invited to return an estimate for a detailed study.

*DCS Simulation Studies.*

9. Local TEDCOM members should review the draft final reports of the simulation studies before acceptance.

*DCS Seatest*

10. Given recent progress on DCS development, the next seatest of the system should be planned for FY94, especially since funding has been found for land tests in FY93. TEDCOM will confirm this recommendation following results of simulation tests and land tests.
11. The next seatest location should be chosen, if possible, in an easier area than EPR, with access to land for possible assistance.

*Deep Drilling RFQ*

12. The objectives of the RFQ have been narrowed. Well plans for the LITHP and TECP holes have been defined. The drill plan includes the use of a slimline riser to improve stability/circulation.
13. The RFQ now includes principally:
    - the application of a 9 5/8" or a 10 3/4" slimline riser to the 471,
    - ways of extending the drillstring
    - ways of side-hanging the riser while running casing strings
14. The RFQ is to be rewritten by TAMU and rediscussed with local TEDCOM members, late October 1992. The revised version will be presented to PCOM in December 1992.
15. The TEDCOM supports PCOM's motion of December 1991 that deep drilling studies should be launched urgently.

**JOIDES Resolution** - ***Spare Parts.***

16. A review of the inventory of spare parts carried by the *JOIDES Resolution* should be done by TAMU.

# NORTHWEST PACIFIC ATOLLS AND GUYOTS

**Dr. Janet A. Haggerty** Co-Chief Scientist
**Dr. Isabella Premoli-Silva** Co-Chief Scientist
**Dr. Frank Rack** Staff Scientist

*Reports presented in the Joides Journal are summaries. Complete Reports are available from ODP, Texas A & M University, 1000 Discovery Drive, College Station, TX 77845-9547*

## ABSTRACT

Five guyots were drilled in the Western Pacific Ocean during ODP Leg 144 (including 20 holes drilled at 10 sites) to investigate the formation of these volcanic edifices, the evolutionary development and demise of carbonate platforms on these features, and the subsequent accumulation of pelagic sediments overlying the drowned platforms. In addition, Hole 801C (drilled during ODP Leg 129) was reentered and logged during Leg 144 and a downhole packer experiment was conducted.

The drilling results of Leg 144 indicate that the formation of carbonate platforms on these guyots, and specifically their termination, is not a simple matter of a mid-Cretaceous drowning event. At least three major episodes of carbonate platform drowning were observed from the guyots drilled; specifically: Albian, late Maastrichtian, and middle Eocene. Most of the carbonate platforms contain paleoecologic assemblages and sedimentary facies that indicate multiple relative sealevel fluctuations during their growth. The Cretaceous and Eocene carbonate systems, in contrast to modern atolls having a coral-algal reef framework surrounding a lagoon, may have produced vast quantities of loose carbonate sediment in large shoal deposits with rudist-algal-coral boundstones forming relatively thin bioherms on the exterior ridges near the margins of the guyot.

*In summary, drilling of guyots during ODP Leg 144 revealed that the development and termination of these former carbonate platforms is a complex function of sealevel fluctuations and environmental change, and that modern Pacific atoll reef systems are an inadequate analog for the Cretaceous and lower Tertiary carbonate platforms of the ancient Pacific.*

## SCIENTIFIC OBJECTIVES OF LEG 144

Over wide areas of the Pacific Basin, drowned atolls now lie at depths between 1 and 2 km. The normally rapid upward growth rate of reefs, coupled with relatively slow subsidence rates and sea level changes, led Schlager (1981) to propose that reef drowning is a paradox. Because many of the drowned reefs north of the Marshall Islands apparently drowned in mid-Cretaceous time (see Winterer et al., submitted; Matthews et al., 1974) it was recently proposed that these Cretaceous reefs were drowned as a result of a global oceanic anoxic event in Aptian-Albian or Cenomanian-Turonian time (Schlanger and Jenkyns, 1976), or by a series of paleolatitudinal changes (Winterer et al., submitted).

Leg 144 is the second of two legs (Legs 143 and 144) organized to core carbonate-platform-bearing guyots of the Western Pacific. The objective of these legs is to understand Western Pacific tectonics, global sea-level history, carbonate-platform drowning, and the nature of the parent mantle material that produced these volcanic seamounts (Fig. 1).

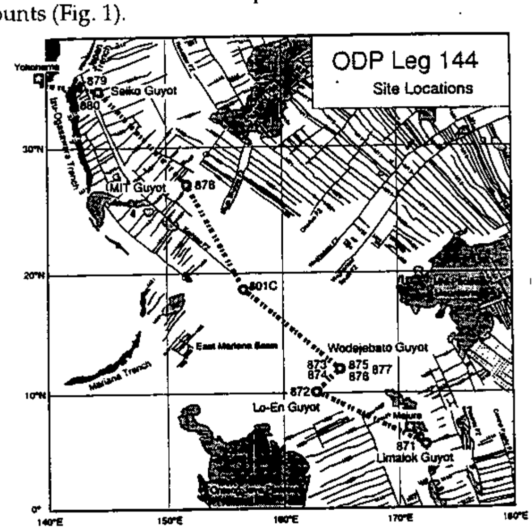



Figure 1. Location of ODP Leg 144 sites. Also shown are the position of Mesozoic magnetic anomaly lineations, fracture zones, and major topographic features.

## DRILLING OBJECTIVES

Drilling on Leg 144 had the following objectives:

- To recover pelagic sediments for high-resolution stratigraphy and for reconstructing paleoceanography in this sector of the Pacific;
- To relate the acoustic stratigraphy of the pelagic cap to its depositional history and correlate seismic reflectors with those seen in other guyots;
- To date the interface between the pelagic cap and the underlying platform, and infer the age and cause of platform drowning;
- To establish the stratigraphy, and examine the faunas, floras, and growth of the carbonate platform ;
- To reconstruct migration routes of benthic organisms (rudists and benthic foraminifers) and paleoceanographic implications;
- To examine the diagenesis of the shallow-water limestones and compare the diagenesis of the older guyots with the younger guyots drilled in the Marshall Islands;
- To investigate the nature and variability of the perimeter ridges on Wodejebato Guyot, and Takuyo-Daisan Guyot;
- To determine the age and causes of platform drowning, possible emergence, and subsidence history of the platform limestone relative to sea level;
- To determine the genesis of the rough surface topography of MIT Guyot and Takuyo-Daisan Guyot in relation to the hypothesis of emergence and karsting of the shallow-water limestone cap before the final drowning;
- To establish the age and paleolatitude of the volcanic edifices, and subsequent paleolatitudinal changes;
- To obtain geochemical data from the volcanic edifices for comparison with other sites and the DUPAL/SOPITA anomaly; and finally
- To compare the geological history of drilled guyots with that of other Western Pacific guyots drilled during Legs 143 and 144.

## RESULTS

### Site 871

Site 871 (proposed site Har-2) is located at 5°33.43'N, 172° 20.66'E, in 1255 m water depth, in the south central portion of Limalok (Harrie) Guyot in the southern Marshall Islands (Fig. 1). Three holes were drilled at Site 871; Hole 871B is located 10 m east of Hole 871A, while Hole 871C is located 10 m to the west of Hole 871A. Holes 871A and 871B were APC (advanced hydraulic piston corer) cored to 139.5 and 133.2 mbsf, respectively, where refusal occurred at the boundary between lower Miocene and middle Eocene sediments. These holes were continued by XCB coring to 151.9 mbsf with a total of 83% recovery (Hole 871A), and 152.4 mbsf with a total of 68.2% recovery (Hole 871B).

#### Lithostratigraphy

Four lithologic units were identified at Site 871 (Fig. 2):

**Unit 1:** (0-133.7 mbsf) Nannofossil foraminifer ooze and foraminifer ooze of Pleistocene to early Miocene age. The unit contains a hiatus which spans the late middle to latest Miocene.

**Unit II:** (133.7-422.9 mbsf) Sequence of white to very pale brown platform carbonates of middle Eocene to early late Paleocene age. The contact between the pelagic cap and the underlying platform limestone is marked by an iron-manganese oxide and phosphatic hardground. Borings in the hardground are infilled with pelagic sediment of late early Oligocene age.

**Unit III:** (422.9-451.6 mbsf) Variegated clay of indeterminate age with large variations in the texture and content of lithoclasts. Basalt pebbles occur in the lower part of the unit.

Unit IV: (451.5-500 mbsf TD) Interbedded volcanogenic sandstones with basaltic breccias and nepheline-bearing basalt flows.

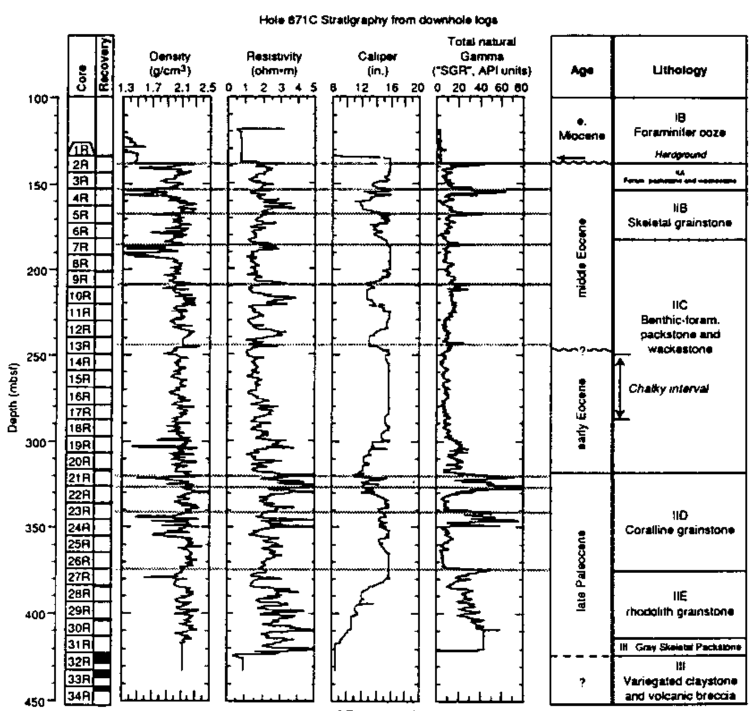



Figure 2. Stratigraphy of Hole 871C with geophysical logs compared to cored intervals, biostratigraphic ages, and lithologies within Hole 871C. Peaks in natural gamma are marked by shaded lines; these events are associated with hiatuses in sedimentation or exposure surfaces.

#### Interpretation

Initial interpretations indicate that the upper portion of the igneous basement of Limalok Guyot was formed by a series of eruptions of highly alkalic basalts, basanites, and nephelinites. These are probably related to the constructional phase of the volcano rather than a short-lived post-erosional phase. Paleomagnetically, the basalt has a normal polarity magnetization acquired at a low southern paleolatitude of approximately 10°S.

The flow-top volcanic breccias are capped by a thick sequence of dense, variegated clay that record a period of subaerial weathering and erosion. Flooding of the island occurred during the early late Paleocene when a gray clay was deposited in a low-energy environment that was influenced by seawater and contains calcareous nannofossils of early late Paleocene age.

The overlying carbonate sequence records the development and demise of a Paleocene to Eocene carbonate platform. The lowermost limestones have a well-sorted packstone texture, with coarse, sand-sized grains. These characteristics suggest a well-oxygenated, shallow-marine depositional environment existed during the early late Paleocene.

The late Paleocene packstones and grainstones contain a normal marine biota and rhodoliths, denoting deposition on an open shelf or steep ramp. These packstones give way to grainstones, rudstones, and some boundstones, which contain abundant miliolids, scleractinian corals, red and green algae, echinoids, and larger foraminifers (*Nummulites, Discocyclinidae*). The facies signify the presence of a nearby reef and they represent deposition in a back-reef environment during the late Paleocene.

A period of deposition in a protected lagoon that may have undergone periods of slight restriction during the early Eocene is represented by lower Eocene wackestones. The overlying lower and middle Eocene burrowed skeletal wackestones and packstones contain *Alveolina* and miliolids; these low-energy facies indicate continued deposition in a protected, shallow-lagoon setting during early to middle Eocene time. The presence of middle Eocene grainstones signifies the return of higher energy, beach or sand-bar, conditions. The uppermost limestones are middle Eocene packstone and wackestone containing *Nummulites* and miliolids that were deposited in a protected, shallow lagoon.

The platform limestones on Limalok Guyot represent a shallowing-upward sequence, with changes in depositional environment from open subtidal to a shallow-lagoonal depositional setting. A peak in faunal diversity, coupled with the presence of planktonic foraminifers, marks at least one period of higher sea level during the early middle Eocene. Benthic foraminifers and rare diatoms in the uppermost part of the sequence are indicative of a central lagoonal environment just prior to platform drowning.

The carbonate platform, Unit II, is overlain by an iron-manganese oxide and phosphatic crust containing middle Eocene calcareous plankton. This planktonic assemblage tightly constrains the date of the platform drowning and indicates that oceanic, poorly oxygenated waters covered the relict platform immediately after its demise. Manganese oxide encrustation and phosphatization possibly continued through some part of the late Eocene and early Oligocene.

The carbonate platform subsided into the pelagic realm by the early Oligocene as demonstrated by the presence of planktonic foraminifers and nannofossils that infill borings in the marine hardground. The accumulation of pelagic sediments did not commence until the early Miocene. Lower and middle Miocene sediments were strongly winnowed by subsurface currents, although sediment preservation was relatively continuous with accumulation rates of 5-20 m/m.y.

A prominent disconformity, spanning the late middle Miocene through most of the late Miocene (approximately 6 m.y.), resulted in appreciable reworking of calcareous microplankton of Oligocene and early/middle Miocene age. Sediment accumulation during the latest Miocene and Pliocene was slow (2-3 m/m.y.) and discontinuous. The relatively complete, albeit thin, uppermost Pliocene and Pleistocene sequence suggests a change in oceanographic conditions. This change was accompanied by higher sediment-accumulation rates (11-12 m/m.y.) and a decrease in sediment winnowing.

## Site 872

Site 872 is located at 10°05.85'N, 162°51.96'E, at 1084 m water depth, on the central part of Lo-En Guyot (Fig. 1). The guyots in the Marshall Islands region have pelagic caps that range in thickness from 0 to 150 m. The thickness of an individual pelagic cap appears to be strongly correlated with both the depth of the guyot (related to length of the depositional history) and the size of the guyot (less erosion near the perimeter of the summit). The position of Site 872 is in the thickest part of the pelagic cap on Lo-En Guyot; three holes were drilled at Site 872.

### Lithostratigraphy

Four lithologic units were recognized at Site 872 (Fig. 3):

Unit I (0-143.6 mbsf, 872A; 0-141.7 mbsf, 872C). White to pale brown nannofossil foraminifer ooze intercalated with foraminifer ooze of Pleistocene to late Oligocene age. Within the lower Miocene, a disconformity representing a hiatus of approximately 5 m.y., was observed in at about 100 mbsf in both holes. The sedimentary succession across the Oligocene/Miocene boundary appears to be complete.

Unit II (143.6-143.7 mbsf, 872A; 135.2-135.36 mbsf, 872B) includes: (1) phosphatized middle Eocene chalk containing pebbles of basalt, conglomerates, and volcaniclastics, (2) phosphatized volcaniclastic sandstone of indeterminate age, and (3) conglomerate—coated by a shiny dark brown to black veneer and containing phosphatized lithoclasts. The phosphatized lithoclasts contain volcaniclastic debris set in a pelagic limestone matrix of latest Santonian to early Campanian age. The lithoclasts are redeposited in pelagic sediment of late Paleocene age.

Unit III (135.36-135.41 mbsf, 872B). Subangular basalt clasts, 0.5 to 4 cm in size, in a pelagic limestone matrix of late early Santonian age in contact with slightly altered basalt.

Unit IV (143.7-144.0 mbsf, 872A; 135.41-192.5 mbsf, 872B; 146.0-148.0 mbsf, 872C). Differentiated alkali olivine basalt as massive flows and flow-top breccias. The uppermost 71 cm of Unit IV in Hole 872B has a few fractures infilled with pelagic sediments of early Santonian age. These pelagic sediments are increasingly phosphatized with depth, and contain some reworked planktonic foraminifers of late Turonian age. An olivine-phyric basalt characterizes the uppermost flow in both Holes 872A and 872B; in Hole 872C, the upper volcanic flow is a different, highly altered olivine basalt flow.

### Interpretation

Initial interpretation of the cores obtained at Site 872 indicates that a series of subaerial eruptions of differentiated alkali olivine basalt, possibly hawaiites and mugearite, form the upper part of the igneous basement at

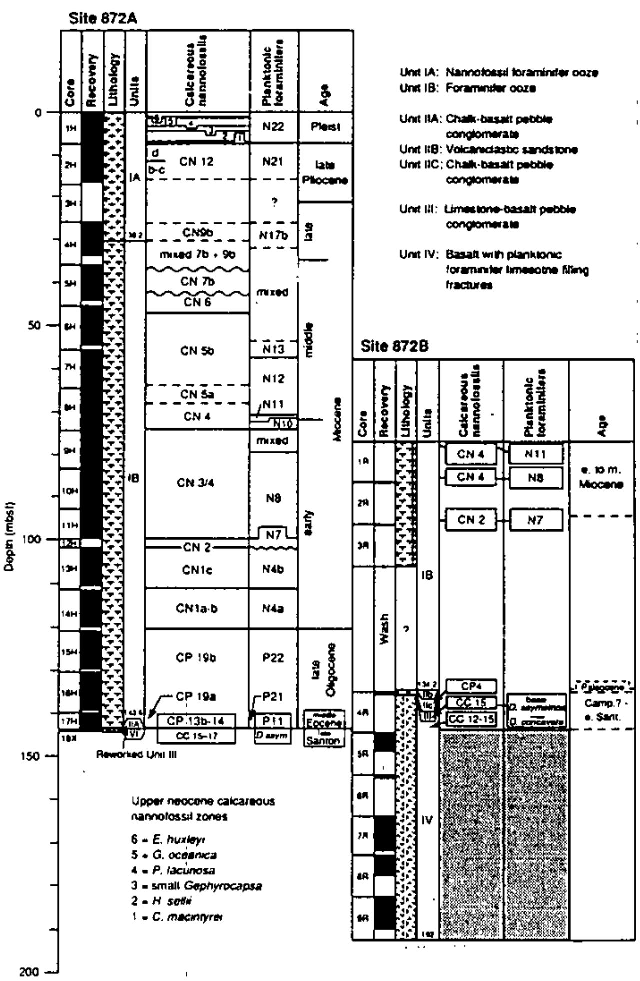



Figure 3. Summary of lithologic units and calcareous-plankton biostratigraphy of Site 872.

Lo-En Guyot. They appear to represent the very latest shield stage or the alkalic-cap stage of hotspot volcanism. Magnetic measurements demonstrate that the basalt is normally magnetized, with magnetization acquired at a paleolatitude of about 30°S.

Planktonic foraminifers of late Turonian age are reworked into lower Santonian sediments filling the fractures in the basalt—indicating volcanism occurred prior to the late Turonian. The hypothesis that the Lo-En volcanic edifice existed and was submerged prior to late Turonian time is further supported by the occurrence of nearshore marine organisms of early Albian age recovered in dredges along the southern slope of this guyot.

The overall paucity of pelagic sediments, and the occurrence of highly phosphatized, manganese oxide encrusted lithoclasts of different origin and age (late Santonian, early Campanian, and late Paleocene) above the basalt in Holes 872A and 872B, suggest that for several millions of years the guyot experienced prevailing nondepositional conditions in an active current regime.

The middle Eocene sediment is overlain by a 140-m-thick sequence of upper Oligocene and Neogene pelagic carbonates. The hiatus associated with this middle Eocene—late Oligocene disconformity suggests that the seafloor may have been exposed for as long as 15 m.y. Calcareous microplankton stratigraphy indicates that sedimentation was relatively continuous from the late Oligocene through the Pleistocene.

## Site 873

Site 873 (proposed site Syl-2A) is situated on the south-central summit of Wodejebato (Sylvania) Guyot, in the northern Marshall Islands. Two holes were drilled at Site 873; Hole 873B was located 100 m northeast of Hole 873A.

### Lithostratigraphy

Six lithologic units were recognized at Site 873 (Fig. 4):

**Unit I**: (0-54.3 mbsf). Nannofossil Foraminifer ooze and Foraminifer ooze of Pleistocene to early Miocene age. Minor disconformities occur within the remainder of the middle Miocene and in the early Miocene.

**Unit II**: (54.3-54.9 mbsf). Manganese oxide encrusted, phosphatized limestone conglomerate of middle Eocene to late Paleocene age.

**Unit III**: (54.9-155.9 mbsf). A sequence of very pale brown to gray platform carbonates of mainly Maastrichtian to possibly late Campanian age.

**Unit IV**: (155.9-175.1 mbsf). Dark red ferruginous clay to olive claystone of indeterminate age.

**Unit V**: (175.1-204.3 mbsf). Altered basalt of indeterminate age. Differentiated, olivine-poor alkali basalt and hawaiite in at least eight flow units.

**Unit VI**: (204.3-232.3 mbsf). Olive gray volcanic breccia of indeterminate age.

### Interpretation

Site 873 records two volcanic events associated with the late-stage development of Wodejebato Guyot. Hyaloclastites were formed during phreatomagmatic, nearshore or submarine basaltic eruption; these subsequently underwent deep oxidative weathering. The second event recorded at Site 873 was the eruption of differentiated alkali basalt and hawaiite flows. After volcanism ceased, a second deep oxidative weathering profile developed.

In the late Campanian, a transgression of the sea occurred and a shallow-water platform with open-marine circulation developed. Progressive and periodic floodings are documented as alternating phases of open-marine to more restricted conditions within a shallow lagoon. Planktonic foraminifers are present in the middle of the lower carbonate platform subunit and record the period of maximum flooding. The sequence ends under normal-marine conditions with algal rudstone as the only evidence of bioherm proximity recovered at Site 873.

The carbonate platform subsided into the pelagic realm before the late Paleocene, as indicated by the presence of upper Paleocene pelagic limestone and lithoclasts of Maastrichtian neritic limestone which are reworked into the hardground. From the late Paleocene to middle Eocene, a manganese oxide encrusted and phosphatized hardground continued to develop. The accumulation of pelagic sediments did not commence until the early Miocene.

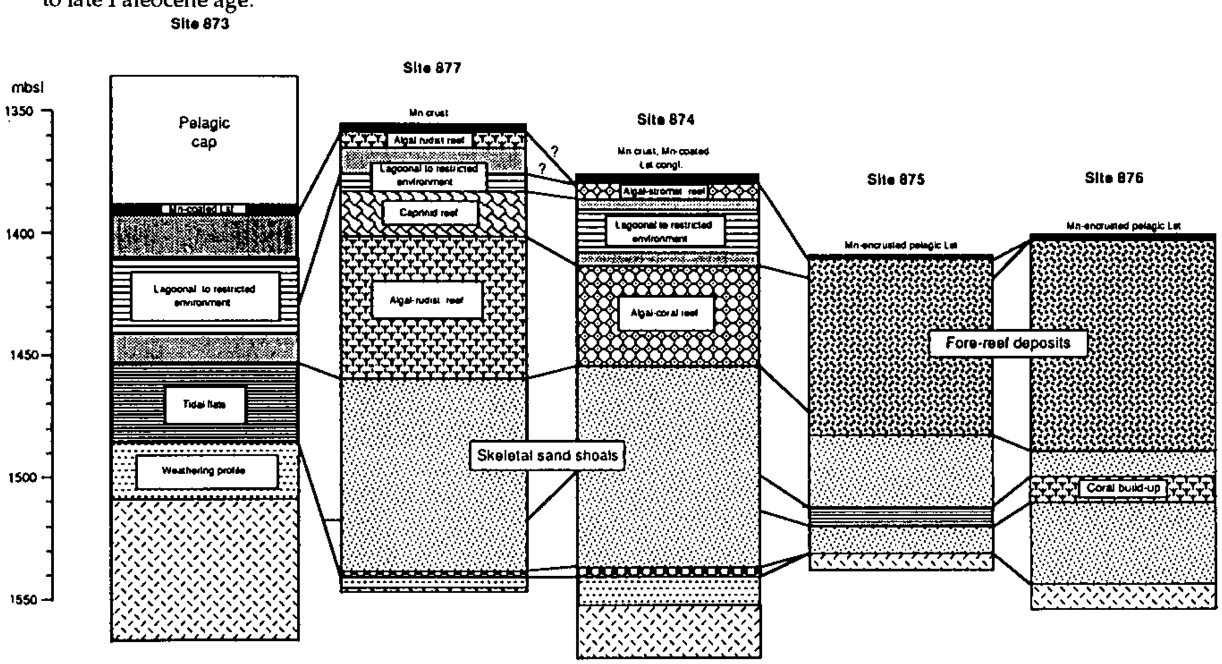



Figure 4. Comparison of the geological history of Sites 873, 874, 875, 876, and 877 as interpreted from the lithostratigraphy.

## Site 874

Site 874 was located on the inner perimeter ridge of Wodejebato Guyot

### Lithostratigraphy

Core and log data were combined, and four lithologic units were recognized at Site 874 (Fig. 4):

**Unit I:** (0.0-0.11 mbsf). Manganese oxide encrusted and phosphatized limestone conglomerate of late middle Eocene age. Clasts of Maastrichtian foraminifer rudist grainstone are embedded in the crust.

**Unit II:** (0.11-162.82 mbsf). A sequence of white to light brown bioherms and associated facies of Maastrichtian to late Campanian age. Lithologies are predominantly grainstone, but boundstone, packstone, rudstone, and wackestone were also recovered.

**Unit III:** (162.82-177.7 mbsf). Ferruginous clay and claystone of Campanian age and older.

**Unit IV:** (177.7-193.5 mbsf). A single flow of altered ankaramitic basalt. The groundmass is alkali olivine basalt similar to those recovered at the other sites on Wodejebato Guyot.

### Interpretation

A single basaltic lava flow is overlain by a claystone weathering profile. The first marine influx is recorded by the black clay, which yielded marine organisms of Campanian age, and abundant woody material from vegetation on the exposed edifice. The carbonate succession started with grainstone and packstone, rich in larger foraminifers, rudists, corals, red algae (including rhodoliths), indicative of a shallow-marine environment with open-marine circulation and moderate to high energy. A bioherm grew at this time as boundstone with encrusting red algae, tabular coral colonies, and a few clusters of radiolitids. This short episode of "reef" growth was followed by deposition in a shallow lagoon. A return to a more agitated shallow-marine environment is associated with the second and last episode of bioherm development.

The first pelagic sediments recorded at Site 874 are Maastrichtian in age and infill cavities within the upper part of the shallow-carbonate sequence. Site 874 drowned before the end of the Cretaceous. The lack of pelagic ooze, and the presence of manganese-encrusted phosphatized lithoclasts overlying the cavities containing pelagic infilling, suggest that Site 874 was and is still a site of prevailing nondeposition.

## Sites 875 and 876

Sites 875 and 876 are located on the northeastern rim of Wodejebato Guyot. Three holes were drilled at Site 875, and one hole was drilled at Site 876.

### Lithostratigraphy

Three lithologic units were recognized at Sites 875 and 876 (Fig. 4):

**Unit I:** (0-0.14 mbsf, Hole 875C; 0-0.08 mbsf, Hole 876A). Manganese oxide dendrites penetrating an upper middle Eocene foraminifer limestone encrusting phosphatized Maastrichtian skeletal packstone.

**Unit II:** (0-0.36 mbsf, Hole 875A; 0-30.83 mbsf, Hole 875B; 0.14-126 mbsf, Hole 875C; 0.08-145.5 mbsf, Hole 876A). Skeletal grainstone and packstone of middle to late Maastrichtian age. A few small basalt fragments are incorporated at the bottom of Unit II. A cavity at least 30 cm in length extends into the upper surface of Unit II at Site 876. The cavity is lined by manganese oxide and infilled with pelagic sediment of middle Eocene age.

**Unit III:** (126-133 mbsf, Hole 875C; 145.5-154.0 mbsf, Hole 876A). Highly vesicular basalt, possibly alkali olivine basalt, with 1%-2% pyrite in the uppermost part of the unit in Hole 875C.

### Interpretation

Holes 875C and 876A both terminated in alkalic basalt flows. All the lavas recovered at both sites, including a flow-top breccia, share the dominant mineralogical characteristic of all the Wodejebato flows. The mineralogy of the flows is consistent with a slight to moderate degree of undersaturation, similar to the alkalic cap stage of Hawaiian volcanism. They most likely represent a subaerial sequence, although both outer perimeter ridge sites do not record significant weathering intervals prior to the onset of marine conditions.

In the Maastrichtian, a transgression of the sea occurred over the basalt flow. The pile of sand encountered at Sites 875 and 876 contains abundant fragments of Late Cretaceous organisms with larger foraminifers as a dominant constituent. Planktonic foraminifers occur throughout, except near the top of the sequence. The reworking of the sands in conjunction with the persistent occurrence of planktonic foraminifers suggests that the depositional setting for these units was a forereef apron, seaward of the reef tract located along the inner perimeter ridge that were drilled at Sites 874 and 877.

A shoaling episode interrupted this sedimentation pattern and is represented by cemented skeletal packstone with lenses of muddier wackestone interbedded in the poorly cemented grainstone, and a layer of mudstone. This assemblage indicates a restricted environment. The absence of planktonic foraminifers in the uppermost part of the grainstone sequence possibly indicates a shallow-water environment until the end of sand deposition.

Exposure of this shoal may have been extensive, as indicated by the occurrence of cavities at least 30 cm deep and by infiltration of pelagic ooze into the sands to become the matrix of the grainstone at least 70 cm deep in the section. Relief of about a meter on unconnected depressions in the manganese-encrusted surface of the limestone was seen during the VIT survey at these outer perimeter ridge sites. This suggests formation of a microkarstic surface between middle to late (?) Maastrichtian and late Paleocene, before submergence into the pelagic realm.

## Site 877

Site 877 is located on the northeastern rim of Wodejebato Guyot, 0.7 km north of Site 874; both sites are located on the inner bathymetric ridge. A single hole was drilled at Site 877.

### Lithostratigraphy

Four lithologic units were recognized at Site 877 (Fig. 4):

**Unit I:** (0-0.03 mbsf). Manganese oxide encrusted and phosphatized limestone of middle Eocene age. The host substrate is composed of Maastrichtian shallow-water packstone with cavities infilled with partially phosphatized pelagic sediments of late middle Eocene, early Eocene, and late Paleocene age.

**Unit II:** (0.03-182.9 mbsf). White to light brown and pinkish white Maastrichtian grainstones are predominate. The basal part of Site 877 correlates with that of Site 874. Unit II is thicker at Site 877 than at Site 874; more reef development is present at Site 877.

**Unit III:** (182.9-190.2 mbsf). Black clay, argillaceous limestone, peat, reddish-brown clay, and claystone breccia of indeterminate age. A clast of basalt is present in the lower part of the unit.

**Unit IV:** (190.2-190.5 mbsf). Basaltic breccia with clasts of vesicular, plagioclase-clinopyroxene basalt.

### Interpretation

At Site 877, a volcanic breccia was recovered below a thick subaerial, in-situ, weathering profile. The presence of root molds, plant remains, and pyrite indicates that the transition from subaerial to marine conditions took place in a low-energy, sulfate-reducing, marine environment. The occurrence of calcareous nannofossils, restricted to the Cenomanian and reworked in the argillaceous limestone, indicates that only the most recent part of the geological history of Wodejebato Guyot was recovered at Sites 873-877.

Sedimentation history at Site 877 mirrors that described from Site 874, the twin site farther to the southeast on the inner perimeter ridge. The difference between these two sites is a function of the limestone sequence being 20 m thicker at Site 877 than at Site 874.

At Site 877, the lower, or older, bioherm began with a rudist assemblage dominated by small erect radiolitids. The rudist framework developed from a scattered community of individuals and evolved into clusters of a few individuals. Radiolitids, in life position, are locally encrusted by red algae. Up-section, the rudists become more abundant and form the bulk of the organic framework, while red algae diminishes in abundance. The assemblage becomes dominated by loosely-packed large caprinids, which were typically recumbent and barely acquired a gregarious habit. These caprinids formed an open framework that may easily have been smothered by increased sedimentation. This development differs from that recorded at Site 874, where in addition to rudists, algae and coral form boundstone. The differences between the assemblages at Sites 874 and 877 suggest a lateral zonation of the frameworks as a response to their slightly different positions along the axis of the ridge. The second, more recent episode of bioherm construction resulted in a strong similarity between the two sites. In both locations the boundstone is composed of stromatoporoids, coral, and caprinid rudists that are heavily encrusted by red algae without any lateral zonation.

## Site 801

Hole 801C, already cored and cased into middle Jurassic oceanic crust on Leg 129, was re-entered to conduct downhole measurements of the basement section, since they were not accomplished during Leg 129.

## Site 878

Site 878 is located at 27°19.143'N, 151°53.028'E in 1323 m water depth, on the northeastern part of MIT Guyot near its southern edge (Fig. 5). Three holes were drilled at Site 878.

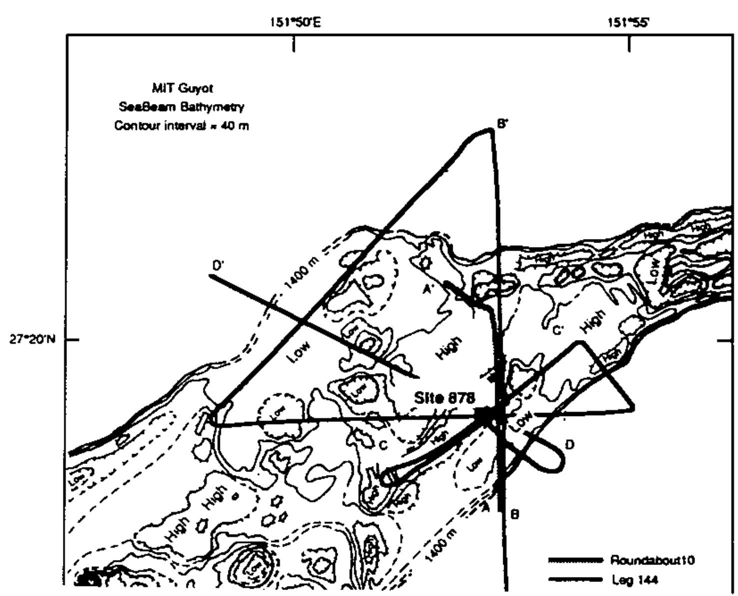



Figure 5. Contoured SeaBeam bathymetry over MIT Guyot, showing the location of Site 878 . Contour interval is 40 m. The ship tracks in this figure represent the seismic coverage across this guyot.

### Lithostratigraphy

Six lithologic units were recognized at Site 878:

**Unit I**: (0-3.2 mbsf) Yellowish brown foraminifer nannofossil ooze and nannofossil ooze with manganese nodules of early Pleistocene to late Miocene age. The lowermost portion of this unit contained an abundance of manganese nodules and crusts that contain phosphatized pelagic limestone fragments of latest Albian, Santonian-Campanian, late Paleocene, and early Eocene age. A disconformity spanning the early Pliocene was detected.

**Unit II**: (3.2-236 mbsf) White micritized, gastropod-rich wackestone, packstone, and mudstone; peloidal packstone with fenestral fabric; peloid-algal wackestone; and minor grainstone and rudstone of Albian to Aptian(?) age.

**Unit III**: (236-399.7 mbsf) Primarily consists of very pale brown grainstone of fine to medium grain size, wackestone, and mudstone of late Aptian age.

**Unit IV**: (399.7-604.3 mbsf) Primarily consists of polymictic breccia with both basalt and shallow-water limestone clasts in a white to grayish-green matrix of late to possibly early Aptian age. Volcanic clasts, with the exception of the large basalt ones, are replaced by clay minerals but retain relict igneous textures. There are three major types of basalt clasts: (1) scoriaceous basalt; (2) much less vesicular, microcrystalline basalt, or some olivine microphyric basalt; and (3) non-vesicular basalt.

**Unit V**: (604.3-722.5 mbsf) Very pale brown skeletal grainstone, packstone, and wackestone with minor rudstone, rich in nerineids, oysters, and corals of early Aptian age.

**Unit VI**: (722.5-908.7 mbsf) Alkalic basalt flows and flow-top breccias of older than early Aptian age. Thirty-four igneous units were recognized, including 24 distinct lava flows, 3 volcaniclastic units, and 2 weathering horizons.

### Interpretation

Initial interpretation of the cores obtained at Site 878 indicates that the upper part of the igneous basement of MIT Guyot was formed by numerous lava flows of alkalic affinity, more likely associated with the constructional phase of volcanism rather than with a later rejuvenated phase. The presence of well-defined vesicular and/or brecciated flow tops suggests they are probably subaerial in origin, although indications of significant weathering are missing. Some of the tuffs appear to have been subaqueously deposited.

The overlying sequence records the development of a carbonate platform in the early Aptian. The contact between the carbonate platform and the basement rocks was not recovered; however, a few fragments of highly altered basalt are present within the lowermost coarse-grained skeletal grainstone. The combination of the basalt fragments and the fossil evidence suggests that marine deposition was initiated in a fully-oxygenated, high-energy environment, such as an open-marine shoal. This was followed by at least one episode of pelagic influence, and then by a period of slightly less oxygenated, marine conditions. Sedimentation evolved toward coarsening-upward cycles as the environment fluctuated from open-marine to more restricted lagoonal conditions.

The development of the carbonate platform was abruptly interrupted during the late early Aptian, by a volcanic eruption through the carbonate platform, which resulted in a 200-m-thick sequence of polymictic breccia. The breccia contains clasts of shallow-water platform deposits whose origins are still uncertain and whose ages are poorly constrained. There is no apparent depositional trend related to the carbonate lithoclasts. The rare fragments of woody plant material in the breccia are of sub-bituminous rank, implying the presence of a nearby island at some point in the development of the ancient carbonate platform. The maturity level of the organic matter cannot be explained from burial depth alone.

Two distinct cycles are observed within the volcaniclastic succession. Each of these cycles most likely represents a short-lived eruptive episode from a single vent. It is suggested that, at the beginning of each cycle, the eruptive products were dominated by lithoclasts from pre-existing volcanic flows and the carbonate platform. As the vent became established, progressively more material derived from new lava was incorporated into the eruptive products. The breccias, recovered at Site 878, may represent the evidence for short-lived, very late-stage, phreatomagmatic eruptions through a carbonate platform. The resulting mixed basalt/limestone debris was likely redeposited by slumping and gravity flows down the flank of the platform. The perimeter of the platform may have been constructional or down-faulted along the margin. This difference may be resolvable if the relative ages of the limestones above, below, and within the breccia sequence can be established.

Carbonate-platform deposition resumed by late Aptian in a low-energy, restricted and poorly oxygenated lagoonal environment. The lagoonal environment rapidly changed to an oxygenated and open-marine environment with pelagic influence at the beginning of this open-marine well-oxygenated phase. Later in the late Aptian, this open-marine platform gave way to the growth of one or more bioherms near Site 878 and terminated by another flooding event inferred from planktonic foraminifers.

A significant change occurred in the late Aptian, with the onset of alternating poorly oxygenated marine and restricted environmental conditions. These alternating conditions evolved into a low-energy, fully restricted environment that was occasionally interrupted by storm deposits possibly during the Albian. The recovery at Site 878 indicates that the platform was dominantly a restricted environment prior to its demise. Iron oxide staining associated with some vugs may indicate that the top of the platform was very briefly subaerially exposed before drowning. It is uncertain if any of the uppermost carbonate-platform sequence was removed by erosion or dissolution.

Manganese nodules within and below the ooze sequence contain nuclei that record several episodes of calcareous pelagic sedimentation. The oldest material consists of phosphatized pelagic limestone with planktonic foraminifers of latest Albian age. This assemblage establishes a minimum age for the drowning of the underlying carbonate platform. Other intervals represented in the manganese nodules are late Santonian to early Campanian, latest Paleocene, and middle early Eocene age, based on calcareous microplankton. The age distribution of these microfossils suggests that, for several millions of years, the guyot experienced prevailing nondepositional conditions in an active current regime.

A thin (3 m) manganese-bearing nannofossil ooze of latest Miocene, late Pliocene, and early Pleistocene age was recorded at the upper surface of Site 878. The upper Miocene ooze contains well-preserved nannofossils but severely dissolved planktonic foraminifers. In addition, it contains manganese nodules and micronodules, echinoderm fragments, fish otoliths, and benthic foraminifers including common *Uvigerina*. This indicates deposition in a low-oxygen environment at, or near, the late Miocene oxygen minimum. The Pliocene-Pleistocene ooze contains well-preserved diatoms, radiolarians, and dinoflagellates in addition to calcareous microplankton, implying a relatively high local productivity during its deposition.

## Site 879

Site 879 is located at 34°10.46'N, 144°18.56'E in 1501 m water depth atop the southern ridge of the Takuyo-Daisan guyot the easternmost guyot of the Seiko cluster of seamounts. One hole was drilled at Site 879.

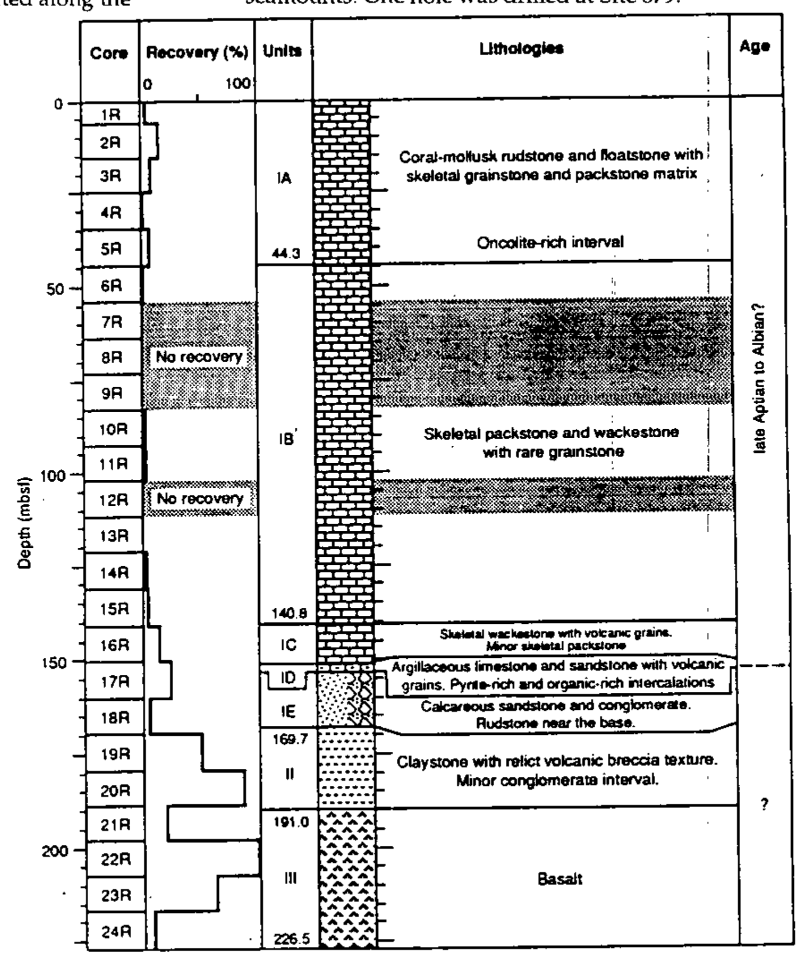



Figure 6. Lithostratigraphic summary of Site 879.

### Lithostratigraphy

A preliminary evaluation of the recovered material at Site 879 yielded three lithologic units (Fig. 6):

**Unit I**: (0-169.7 mbsf) White, pale brown to brown, sometimes stained, carbonate-platform sequence of Albian(?) to late Aptian age.

**Unit II**: (169.7-191.0 mbsf) Consists of clay, claystone with relict volcanic-breccia texture, and a minor conglomerate interval of late Aptian or older in age. Clasts in the breccia are (1) pale yellow, highly vesicular basalt with vesicles filled by zeolite, and (2) dusky red to dark gray basalt with <10% vesicles.

**Unit III**: (191.0-226.5 mbsf) Consists of 19.5 m of plagioclase phyric basalt intercalated in a complex fashion with volcanic breccia of indeterminate age. This complex intermixture can best be described as a peperite, formed by the intrusion of the basaltic lava into soft, wet sediment. This breccia is very similar in texture to the polymictic breccia of Hole 878A, although it lacks the included limestone clasts.

### Interpretation

A very preliminary interpretation of the cores obtained at Site 879 suggests that the upper part of the volcanic edifice shows evidence of basaltic intrusion into wet sediments as documented by the peperite. This is overlain by a thin layer of yellowish volcanic breccia that appears to have undergone intense weathering. A high-energy, beach and/or stream environment eroded and rounded the pebbles of the basalt to form the conglomerate.

By the late Aptian, flooding of the weathered volcanic edifice by marine waters is documented by the calcareous nature and the presence of biotic contents in the rudstone, calcareous sandstone, and argillaceous limestone. Progressive and periodic floodings of this former island are documented by lagoonal deposits with nerineids to more open-marine deposits containing planktonic organisms. The presence of coal and wood associated with beginning of the shallow-water marine deposition as well as the basaltic lithoclasts attests to the terrestrial influence at this site. This implies that a vegetated, exposed volcanic edifice was close to Site 879. Moreover, the presence of coal contained within the sandstone, as well as well-rounded basalt pebbles and molds of mollusks in the matrix of the volcanic conglomerate, is consistent with deposition in a nearshore marine environment. A low-energy, shallow-marine environment followed as shown by the presence of lime mud in the packstone and wackestone, with rare grainstone intervals, as well as on the basis of the biotic contents of oysters, and nerineids. This low-energy environment gradually evolved into a more open-marine, higher energy setting documented by an oncolite-rich interval and then the presence of coral-mollusk rudstone and floatstone. The carbonate platform subsided into the pelagic realm after Albian(?) to late Aptian time.

## Site 880

Site 880 is located at 34°12.53'N, 144°18.74'E at 1525 m water depth, on the center of Takuyo-Daisan Guyot, about 2 nmi north of Site 879.

### Lithostratigraphy

A preliminary evaluation of the recovered material at Site 880 yielded one lithologic unit:

**Unit 1** (0-18.4 mbsf). Consists of a sequence of interlayered volcaniclastic sand and foraminifer sand with nannofossil foraminifer ooze and volcanic ash of late Pleistocene to late Pliocene age.

### Interpretation

A preliminary evaluation of the cores obtained at Site 880 indicates that the recovered sediment sequence displays variations of two end members, volcaniclastic sand and nannofossil foraminifer ooze. These pelagic sediments were deposited under the varying influence of volcanic eruptions from the nearby convergent-margin setting. The recovered sequence contains a condensed but apparently complete section spanning the entire Pleistocene and the Pleistocene/Pliocene boundary.

## REFERENCES

Matthews, J.L., Heezen, B.C., Catalano, R., et al., 1974. Cretaceous drowning of reefs on Mid-Pacific and Japanese guyots. Science, 184:462-463.

Schlager, W., 1981. The paradox of drowned reefs and carbonate platforms. Geol. Soc. Amer. Bull., 92:197-211.

Schlanger, S.O., and Jenkyns, H.C., 1976. Cretaceous oceanic anoxic events: causes and consequences. Geol. en Mijnbouw, 55:179-184.

Winterer, E.L., Duncan, R.A., McNutt, M.K., Natland, J.H., Premoli Silva, I., Sager, W.W., van Waasbergen, R.J., and Wolfe, C.J., submitted. Cretaceous guyots in the northwest Pacific: an overview of their geology and geophysics. In Pringle, M., Sager, W.W., Sliter, W.V., and Stein, S. (Eds.), The Mesozoic Pacific: Washington (Am. Geophys. Union).

## SHIPBOARD PARTY

The following scientists were aboard *JOIDES Resolution* for Leg 144 of the Ocean Drilling Program:

Janet A. Haggerty, Co-Chief Scientist (Univ. Tulsa, Oklahoma)

Isabella Premoli Silva, Co-Chief Scientist (Universiti di Milano, Italy)

Frank R. Rack, ODP Staff Scientist (Texas A&M Univ.)

Annie Arnaud-Vanneau (Institut Dolomieu, France)

Douglas D. Bergersen (University of Hawaii,)

Yuri Bogdanov (Russia Academy of Science, Russia)

Horst W. Bohrmann (GEOMAR, Germany)

Björn Buchardt (Univ. Copenhagen, Denmark)

Gilbert Camoin (CNRS, France)

David M. Christie (Oregon State University,)

Julie J. Dieu (Scripps Institution of Oceanography)

Paul Enos (University of Kansas)

Elisabetta Erba (Universiti di Milano, Italy)

Juliane Fenner (BGR, Germany)

Jeffrey S. Gee (Lamont-Doherty Geological Observatory)

Martin J. Head (University of Toronto, Canada)

Peter R.N. Hobbs (British Geological Survey, UK)

Hisao Ito (Geological Survey of Japan)

Lubomir Jansa (Bedford Inst. Oceanography, Canada)

John W. Ladd (Lamont-Doherty Geological Obs.)

Roger L. Larson (University of Rhode Island)

Jonathan M. Lincoln (Montclair St. College New Jersey)

Masao Nakanishi (University of Tokyo, Japan)

James G. Ogg (Purdue University, Indiana)

Bradley N. Opdyke (University of Michigan)

Paul N. Pearson (University of Cambridge, UK)

Terrence M. Quinn (University of South Florida)

David K. Watkins (University of Nebraska)

Paul A. Wilson (University of Cambridge, UK)

# NORTH PACIFIC TRANSECT

DR. DAVID K. REA CO-CHIEF SCIENTIST
DR. IVAN A. BASOV CO-CHIEF SCIENTIST
DR. THOMAS JANECEK STAFF SCIENTIST

## ABSTRACT

Scientific drilling in the high-latitude North Pacific during ODP Leg 145 has resulted in a new insight into the paleoceanographic and paleoclimatic record of this important region. One important change occurred at 2.6 Ma, the time of the onset of major Northern Hemisphere glaciation. Dropstones appear in abundance at 2.6 Ma and reflect sources in both Siberia and Alaska. The input of continentally derived, fine-grained clastics into the deep sea increases several fold at this time, and in the northwestern Pacific abyssal reworking of bottom sediments also begins at about 2.6 Ma and continues to the present. Finally, volcanic ash layers suddenly become abundant in sediments younger than 2.6 Ma all across the North Pacific, a volcanic event that dwarfs anything found earlier in the Cenozoic record. At about 12 Ma, we were able to document that opal fluxes began to increase, with a pronounced maximum between about 6 and 3 Ma. Also starting in the early portion of the middle Miocene, the calcite compensation depth becomes 1.5 km shallower — in marked contrast to a deepening of the CCD at this time observed everywhere else in the world. The middle and upper Eocene sediments at Detroit Seamount are characterized by episodes of downslope transport, reworking and slumping, the timing of which matches that of similar events in the central Pacific Basin. Several Eocene ash horizons occur, adding further definition to the poorly-known Eocene volcanism history. Leg 145 was able to show that the Meiji sediment tongue is an Atlantic-type drift deposit that has been forming continuously since the early Oligocene. Many paleoceanographic implications follow this important discovery, the most important of which is the continual presence of a southward thermohaline flow from the Bering Sea to the North Pacific for the past 35 million years.

## SCIENTIFIC OBJECTIVES

The scientific objectives of Leg 145 were to determine:

- the high- resolution variations of surface and deep-water circulation and chemistry during the Neogene,
- the Late Cretaceous and Cenozoic history of atmospheric circulation, ocean chemistry, and climate; and
- the age and nature of the seafloor.

*During Leg 145* JOIDES Resolution *completed 25 holes at seven sites at four locations (Fig. 1). Logging operations were conducted at four of the drill sites, and included the first ODP deployment of the French magnetometer and susceptibility tools.*

*Overall sediment and rock recovery totaled 4321 m, 87% of the cored section, placing Leg 145 among only five cruises in the history of the Ocean Drilling Program and its predecessor, the Deep Sea Drilling Project, to recover more than 4 km of material.*

## DRILLING OBJECTIVES

The drilling objectives of Leg 145 were:

- To sample the high-resolution Miocene and younger sedimentary record at intervals as short as 1- to 2 k.y. (the mixing time of the ocean) to determine the history of oceanic and climatic change in the high-latitude North Pacific Ocean.
- To recover high-latitude Paleogene and Cretaceous carbonate- bearing sediments to aid in deciphering the oceanographic record of the old Northern Pacific.
- To collect sediments along a depth transect down the flank of Detroit Seamount in an attempt to reveal oceanic behavior at different depths and times and between different water masses.
- To investigate the middle Miocene silica shift phenomena; and
- To seek evidence of a coherent bottom-current system in the North Pacific responsible for the production of the Meiji Tongue, proposed to represent a North- Atlantic type drift deposit.

| Site | Latitude Longitude | Water Depth (m) |
|---|---|---|
| 881 | 47°06.1' N 161°29.5' E | 5531 |
| 882 | 50°21.8' N 167°36.0' E | 3244 |
| 883 | 51°11.9' N 167°46.1' E | 2385 |
| 884 | 51°27.0' N 168°20.2' E | 3826 |
| 885 | 44°41.3' N 168°16.0' W | 5711 |
| 886 | 44°41.3' N 168°14.3' W | 5173 |
| 887 | 54°21.9' N 148°26.8' W | 3631 |

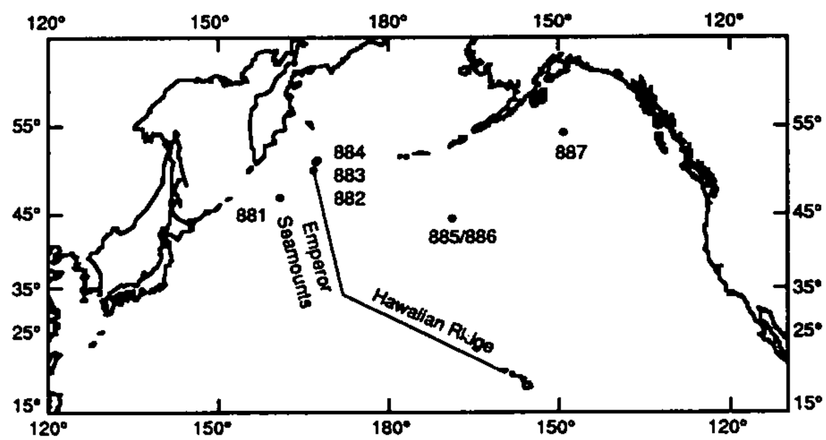



Figure 1. Location of Leg 145 sites.

## RESULTS

### Site 881

A total of 465.2 m of upper Miocene through Pleistocene diatom ooze was recovered at Site 881, in four holes.

#### Lithology

Unit IA, 0-164 mbsf, is a clayey diatom ooze that contains ash layers, dropstones, and rhodochrosite/dolomite concretions. Volcanic ash occurs as unaltered glass and as altered ash layers.

Unit IB, 164-363.8 mbsf, is dominated by diatom ooze and has accessory clay and radiolarians. Dropstones occur rarely; the oldest one occurs 243.5 mbsf in lower Pliocene sediment about 4.7 m.y. old.

#### Age

Throughout this section siliceous microfossils are moderately well preserved. Foraminifers are entirely absent except for a few samples, and nannofossils are rare. Good magnetostratigraphic data back to the Gauss/Gilbert boundary may allow modification of zonal boundaries for the subarctic siliceous organisms.

#### Accumulation Rate

Two important changes of the mass-accumulation rate of the major sediment components are apparent (Fig. 2). The first occurs at the Pliocene/Miocene boundary, 5.4 Ma (Cande and Kent, 1992). At that time there was a threefold increase in the mass-accumulation rate of diatoms. Opal flux in the form of diatoms remained high throughout the entire Pliocene and Pleistocene. Values for organic carbon also appear to increase at the Pliocene/Miocene boundary and remained within a factor of 2 or 3 throughout the Pliocene and Pleistocene.

The fluxes of volcanogenic and terrigenous materials increased in the middle of the late Pliocene, at the time of the Matuyama/Gauss reversal boundary, approximately 2.6 Ma. Clay fluxes increased by an order of magnitude. Quartz flux may have increased by even greater amounts between the mid-Pliocene and the Pliocene—Pleistocene. The input of volcanic ash also increased ten- to twentyfold at this time.

#### Paleoceanography and Paleoclimatology

Dating the transition between the sediments of Units IA and IB establishes that the beginning of relatively strong bottom-current activity in the North Pacific coincided with the onset of Northern Hemisphere glaciation at 2.6 Ma.

This determination is the major new paleoceanographic discovery of Site 881; surficial effects of bottom-current activity have been mapped in the region from seismic profiles (Damuth et al., 1983), but the geologic history of this activity had been unknown previously.

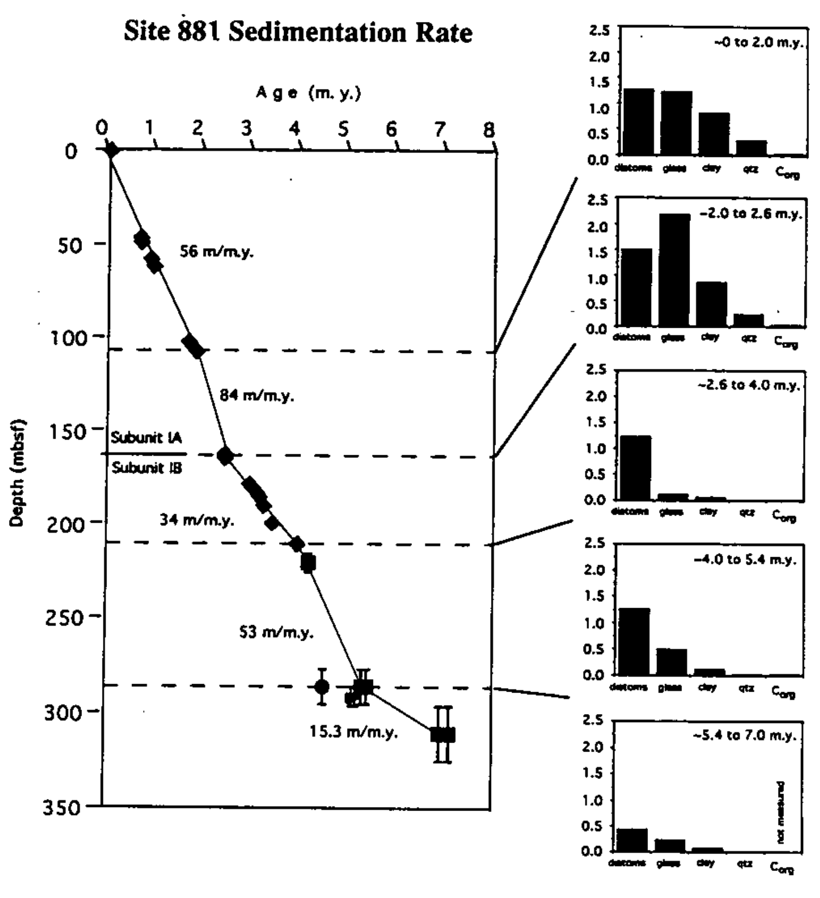



Figure 2. Composite sedimentation rate plot for Holes 881A to 881C of Site 881 using magnetostratigraphy above ~210 mbsf and biostratigraphy below 210 mbsf. Dashed lines mark significant changes in the linear rate of sedimentation. On the right, histograms show the average flux (mass-accumulation rate, in g/cm$^2$·k.y.) of sedimentary components for each of the five time- stratigraphic intervals delimited by the dashed lines. It is evident that the lithological break at this site (~164 mbsf) resulted from an increase in the flux of glass, clay, and quartz, beginning 2.6 m.y. ago.

Other significant changes occurred at 2.6 Ma. The deposition of volcanogenic material increased by more than an order of magnitude. The sudden increase in dropstone abundance that occurs at 2.6 Ma and is a clear demonstration of large-scale glacial activity around the North Pacific region.

In summary, Site 881 provides a well-dated paleoceanographic record of the past 7.2 m.y.. Opal fluxes increased suddenly at the Miocene-Pliocene boundary and remained high ever since. Important changes occurred in conjunction with the late Pliocene onset of Northern Hemisphere glaciation; dropstones became common and the mass-accumulation rate of the clay and quartz components of the sediments rose sharply, indicating increased terrigenous input to the deep sea. Bottom current mediation of the depositional process became dominant at 2.6 Ma, implying vigorous circulation of Pacific Deep Water. Coincident with these changes, volcanism in the Kuril-Kamchatka arc began a period of heightened activity.

## Site 882

Sediments recovered at Site 882 comprise 398.3 m of diatom ooze of late Miocene through Quaternary age.

### Lithology

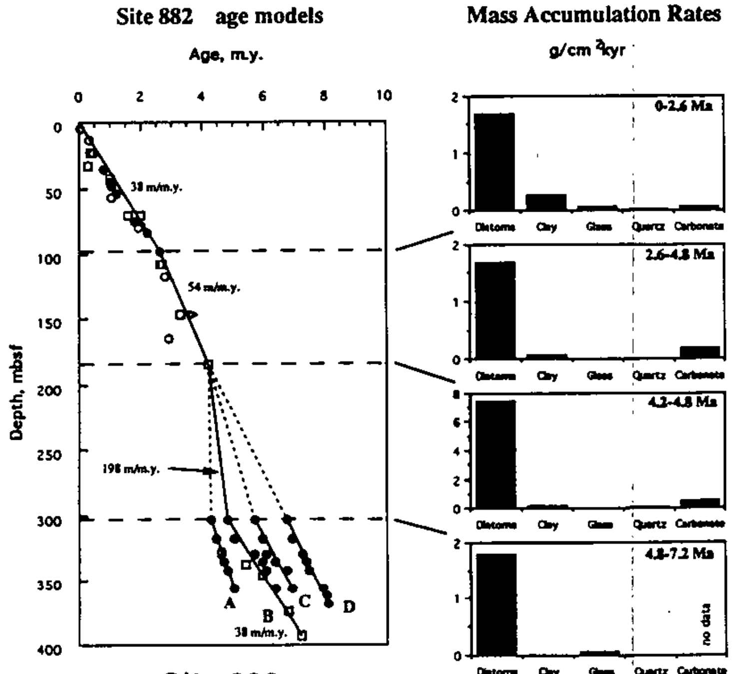
Unit IA, 0-105 mbsf, is clayey diatom ooze and diatom ooze with clay. Ash layers and dropstones are much more abundant in Unit IA than farther downcore. Unit IA is devoid of calcium carbonate, and organic carbon concentrations are low, averaging 0.2 to 0.3% in this unit.

Unit IB, 105-398.3 mbsf, is a bioturbated diatom ooze. Calcium carbonate (nannofossils and micrite particles) is an important minor component. Organic carbon concentrations are about 0.2%.

### Age

Biostratigraphic zonations are based on siliceous microfossils, with nannofossils providing some stratigraphic information in lower Pliocene sediments. Magnetic-reversal stratigraphy is clear in the upper, more clayey, portion of the core. Reversals related to the Brunhes/Matuyama boundary; to the Jaramillo, Olduvai, and Reunion events; and to the Matuyama/Gauss boundary are clear. The Matuyama/Gauss reversal boundary occurs at the same position in the core as the boundary between lithologic Units IA and IB.

Figure 3. A sedimentation rate plot for Hole 882A using magnetostratigraphy and biostratigraphy. Below 300 mbsf four alternative age models (A-D) were considered. Models B and C are thought to be the most reasonable and the former is chosen for determinations of flux (mass-accumulation rate; histograms on right). The most significant change at this site is the dramatically increased diatom flux between 4.2 and 4.8 Ma (note scale change for that interval).




### Accumulation Rate

Sedimentation rates based on the biostratigraphic zonations and magnetic-reversal stratigraphy are 40 to 50 m/m.y. in sediments younger than 4.2 Ma, perhaps 200 m/m.y. in sediments between 4.2 and 4.8 Ma, and 38 m/m.y. in lower Pliocene and upper Miocene sediments (Fig. 3). Fluxes of the individual sedimentary components reflect the influx of terrigenous material in Unit IA and the extreme diatom flux in the upper portion of Unit IB.

### Paleoceanography and Paleoclimatology

The late Miocene of the northwestern Pacific at Site 882 was characterized by deposition of diatom ooze. The oldest paleoceanographic event recorded at Site 882 was the rapid deposition of diatoms that occurred during the early Pliocene warm interval, at linear sedimentation rates of 200 m/m.y.. These unusual conditions of extreme silica productivity continued for only 0.5 or 0.6 m.y. Calcium carbonate and organic carbon fluxes also reached their maxima during this time, probably as a result of the unusual productivity conditions and rapid burial that retarded both the dissolution of calcite and the breakdown of organic carbon. Fluxes returned to more "normal" values at 4.2 Ma. At 2.6 Ma, the fluxes of terrigenous materials, clays, and quartz increased several fold, although the overall sedimentation rates changed very little. The deposition of volcanogenic material also increased by about an order of magnitude at 2.6 Ma.

The oldest ice rafting at Site 882 occurred in the latest Miocene, seen as a pebble in sediments of approximately 6 Ma. This compares to the age of the oldest pebble at Site 881 of about 4.3 Ma. Site 882, now at a depth of 3255 m, has been at or below the calcite compensation depth (CCD) for most of the time since the late Miocene. The exception is the time of very high sedimentation rates between 4.2 and 4.8 Ma. when the combination of extreme productivity and rapid burial resulted in the preservation of calcite.

## Site 883

Drilling at Site 883 penetrated about 830 m of uppermost Cretaceous and Cenozoic sediment atop Detroit Seamount and 37.5 m into the underlying basalts.

### Lithology

Unit I, 0-86.9 mbsf, is a Quaternary to upper Pliocene clay with quartz and diatoms. Vitric ash layers are common, and dropstones are more rare as accessory lithologies. Unit I corresponds in age with the Brunhes and Matuyama chrons.

Unit II, 86.9-458 mbsf, is an upper Pliocene to upper Miocene diatom ooze. Ash layers are present but in much lower abundance than in Unit I.

Unit III, 458-655 mbsf, is a biogenic ooze that can be subdivided into an upper more siliceous portion and a lower, more calcareous portion. Subunit IIIA, 458-597 mbsf, is an upper Miocene to middle Miocene calcareous diatom ooze. Subunit IIIB, 597-655 mbsf, is a middle Miocene to lower Miocene diatomaceous chalk.

Unit IV, 655-818 mbsf is a Paleogene chalk. Subunit IVA, 655-740 mbsf, is an upper Oligocene to middle Eocene nannofossil chalk, Subunit IVB, 740-818 mbsf, is a middle to lower Eocene or Paleocene nannofossil chalk with ash. In both Hole 883B and Hole 883E, Subunit IVB displays evidence for downslope displacement of sedimentary material; debris flows are common, and carbonate turbidites occur.

Unit V, 818-830 mbsf in Hole 883B but much thinner in Holes 883E and 883F, consists of Paleocene to Campanian (?) altered ashes.

Unit VI, 819-856.5 mbsf in Hole 883E and 823-849.4 mbsf in Hole 883F, consists of a series of pillow basalts. The bulk chemistry of the basalts puts them in the ocean-island-basalt category.

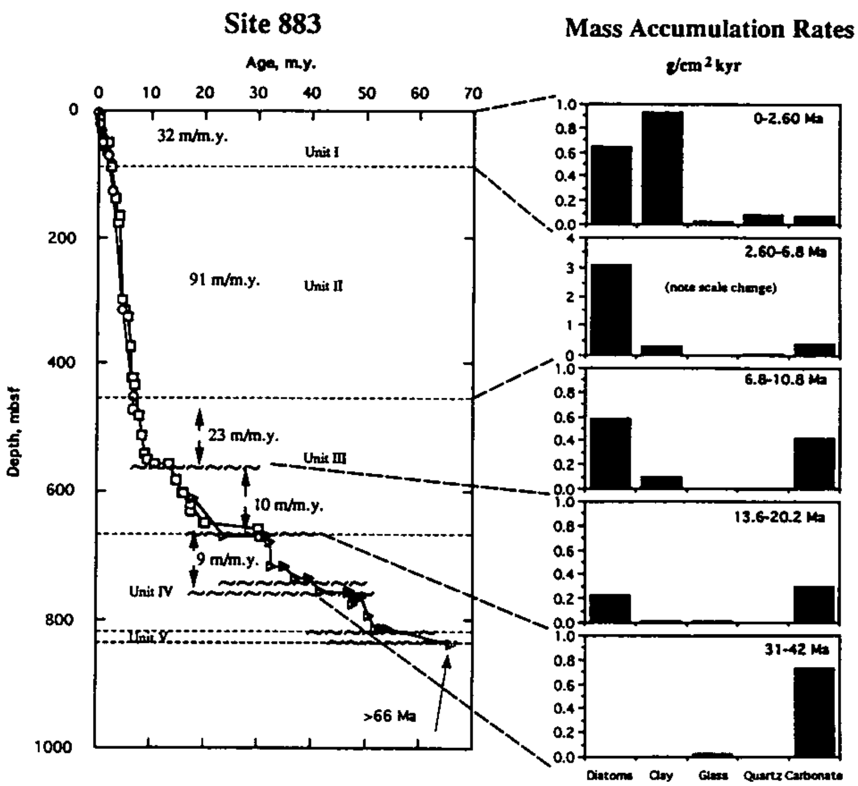



Figure 4. A sedimentation rate plot for Hole 883B using magnetostratigraphy and biostratigraphy. For flux calculations the section is divided into five intervals where rates of sedimentation are relatively constant. These intervals are identified by dashed lines tying the stratigraphic column to the flux results, and their boundaries coincide with lithological boundaries (dashed lines) or condensed intervals/hiatuses (wavy horizontal lines). The flux results quantify the change from Paleogene carbonate sedimentation to Neogene siliceous sedimentation and the onset of terrigenous sedimentation associated with glaciation.

### Age

Biostratigraphic control was provided by siliceous microfossils in Units I, II, and III, with assistance from nannofossils in Quaternary sediments. Nannofossil zonation provides the age control in the Paleogene sediments of Units IV and V.

Magnetic-reversal stratigraphy is well constrained in the upper clay-rich portion of the core. Reversals related to the Brunhes/Matuyama boundary; to the Jaramillo, Olduvai, and Reunion events; and to the Matuyama/Gauss boundary are clear. The Matuyama/Gauss reversal boundary occurs at essentially the same position in the core as the boundary between lithologic Units I and II.

### Accumulation Rates

Overall, sedimentation rates for the various lithologic units show moderate deposition rates for Unit I (approximately 47 m/m.y. for the past 1 m.y.) and lower rates (23 m/m.y.) for the interval between about 1.0 and 2.6 Ma (Fig. 4). The enhanced sedimentation rates during the past 1 m.y. is seen in all four of the Leg 145 northwest Pacific drill sites. Unit II accumulated the most rapidly, with an overall rate in excess of 90 m/m.y. Rates are slower deeper in the section, 23 m/m.y. in Subunit IIIA, 10 m/m.y. in Subunit IIIB, and about the same down through Subunit IVA.

### Paleoceanography and Paleoclimatology

The basalts of Detroit Seamount were erupted in latest Cretaceous; the seafloor at the location of Site 883 apparently never reached sea level — suggested by the complete lack of shallow water or reefal materials in the lowest portion of the sedimentary section. Carbonate and ash deposits on the slopes of Detroit Seamount during the lower Eocene and Paleocene were unstable and moved downslope as turbidites, slumps, and debris flows. During the Eocene the influx of ash declined, and was followed by deposition of nannofossil chalk of middle Eocene to early Oligocene age in Subunit IV

Above the late Oligocene to early Miocene hiatus, the siliceous component of the sediment becomes important. The diatom ooze of Unit II defines the time of extreme silica deposition in the northwestern Pacific Ocean between 2.6 and 6.8 Ma, it may have been much higher than that during the early Pliocene. This latest Miocene and early Pliocene episode of silica deposition represents a short period of extreme productivity in high latitudes associated with the warm interval of the same age.

At 2.6 Ma, the flux of terrigenous clays and quartz to the sediments at Site 883 more than tripled and the flux of opal returned to its pre-latest Miocene levels. Enhanced flux of hemipelagic materials at the time of onset of significant continental glaciation is recorded elsewhere in the North Atlantic and North Pacific. Taken together, the Leg 145 drill sites and the Leg 86 drill sites define the source of the northwest Pacific dropstones to be the Sea of Okhotsk, or possibly the Kamchatka Peninsula (Krissek et al., 1985; Heath, Burckle, et al., 1985). In addition, the deposition of volcanogenic material increased by more than an order of magnitude at 2.6 Ma. The occurrence of Eocene ash layers provides the first evidence of a period of Eocene volcanism suggested by other data from scattered locations such as Hess Rise (Vallier et al., 1983) and the central Pacific basins (Rea and Thiede, 1981).

## Site 884

Drilling at Site 884 penetrated 854 m of Cenozoic sediment on the lower flank of Detroit Seamount, including the Meiji Drift, and 87 m into the underlying basalt.

### Lithology

Unit I, 0-604.8 mbsf, is a Quaternary to middle—lower Miocene clay and diatom ooze.

Unit II, 604.8-854 mbsf, is lower Miocene to lower Eocene unit dominated by chalk and claystone that displays evidence of minor to total downslope redeposition.

Unit III, 854-941 mbsf, is 13 units of basalt. Ten units are flows, and three are pillow lavas. Flows are thick (up to 30 m), and have chilled margins, no glassy margins were recovered and the basalt is only slightly altered.

## Age

A complete sequence of all North Pacific diatom zones ranging in age from late Quaternary to late Oligocene occurs at Site 884. The rapidly accumulating clay-rich sediments also permitted the development of a magnetic-reversal stratigraphy that is coherent back into the middle Miocene at about 13.5 Ma. **This stratigraphy is a singular achievement and, for the first time, allows the direct correlation of the North Pacific diatom zonations to the magnetic-reversal time scale in sediments older than latest Miocene.** Initial paleomagnetic results from the basalts of the lower flank of Detroit Seamount indicate that those rocks are reversely magnetized and were erupted at a paleolatitude of approximately 33°N. Nannofossil biostratigraphy allows definition of the Miocene/Oligocene boundary at 640 mbsf, and the Oligocene/Eocene boundary between 680 and 693 mbsf.

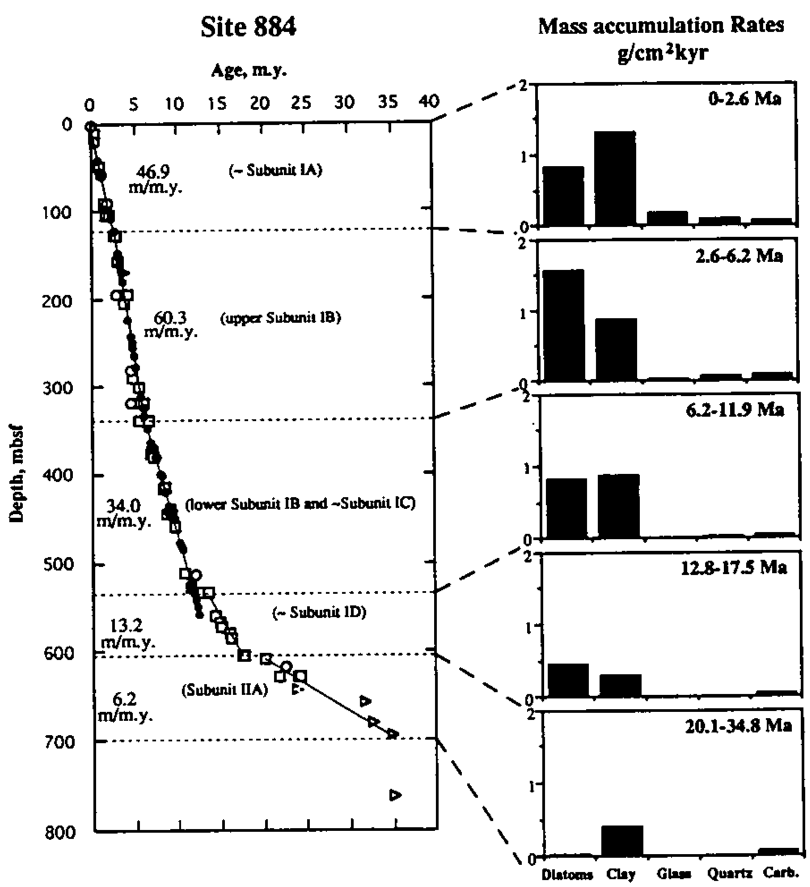



Figure 5. A sedimentation rate plot for Site 884 using magnetostratigraphy from Holes 884A and 884B (solid symbols) and biostratigraphy from Hole 884B. The flux results quantify the origin of late Paleogene Meiji Drift sedimentation, Neogene siliceous and hemipelagic sedimentation, and late Neogene and Quaternary terrigenous sedimentation associated with glaciation.

## Accumulation Rates

Rates of deposition at Site 884 were high since 2.6 Ma, during the late Pliocene and Pleistocene (Fig. 5). The linear sedimentation rate (LSR) for that interval was about 47 m/m.y. In the remainder of the Pliocene and latest Miocene, 2.6 to 6.2 Ma, the LSR averaged 60 m/m.y.. In the remainder of the late Miocene and in the latter part of the middle Miocene, between 6.2 and 11.9 Ma, the LSR was 34 m/m.y.. Between 13.5 and 17.5 Ma, LSR values were much reduced, averaging only 13 m/m.y. For the Oligocene and lower Miocene portion of the section representing the period between 20.1 and 34.8 Ma, LSR values are rather low, only 6 m/m.y. Diatoms are not a volumetrically important component of the sediment in this unit, and clay-plus-quartz fluxes were moderate. Site 884 has not been above the CCD since the end of the Eocene.

## Paleoceanography and Paleoclimatology

The basalts of Detroit Seamount were erupted in latest Cretaceous time. If the estimate for the age of basement is correct, then as much as 20 m.y. passed before there was any sediment accumulation at Site 884. None of the downslope-transported material of lithologic Unit II shows any indication of transported shallow-water or reefal material. We conclude that Detroit Seamount never built up to sea level.

Ash and calcium carbonate were deposited on the slopes of Detroit Seamount during early Tertiary time. During the Eocene, important amounts of sediment reworking and downslope redeposition occurred, resulting in soft-sediment deformation, intra-formational conglomerates and turbidites. By the end of Eocene time, the early Tertiary ash influx had ended, reworking had essentially ceased, carbonate deposition was reduced to a minor portion of the whole, and the deposition of continentally derived hemipelagic clays and quartz became important.

The flux of the hemipelagic continental component of the Detroit Seamount sediments has increased ever since first becoming important at the time of the Eocene/Oligocene boundary. Rates increased during the middle Miocene at about 12 Ma, and again at 2.6 Ma, the time of the onset of Northern Hemisphere glaciation. Diatoms became an important contributor to the sediments above the condensed interval in the lower Miocene. During the late middle Miocene the diatom flux increased and then doubled again in the latest Miocene at 6.2 Ma. Evidence of this period of maximum diatom flux in the latest Miocene and early and middle portions of the Pliocene has been seen at all the Leg 145 drill sites and indicates a relatively warm period in the northwest Pacific. During the late Pliocene and Quaternary, diatom fluxes returned to their previously moderate level.

At Site 884 dropstones occur in Unit I in amounts similar to those at Site 883, in lower abundance than encountered at Site 882 and Site 881, defining a northward decline in ice-rafted debris. Dropstones appeared in the section at the time of the Matuyama/Gauss reversal boundary at 2.6 Ma, reflecting the onset of major glaciation in the Northern Hemisphere (Rea and Schrader, 1985). Also at 2.6 Ma, the deposition of volcanogenic material increased by more than an order of magnitude. The occurrence of Eocene ash layers at Site 884 provides additional evidence for a period of Eocene volcanism.

### The Meiji Drift

The Meiji Drift is a deposit on the northeast side of the northern Emperor Seamount chain, the drift is over 800 km long and about 350 km wide. The deposit is 1800 m thick at its northwestern end at the Kamchatka Strait and thins to the southeast. Scholl *et al*. (1977) conclude that the Kamchatka current flows south through the deep Kamchatka Strait and transports Siberian terrigenous materials to the northwest Pacific, forming the Meiji Drift.

Site 884 was positioned on the Meiji Drift at a location where the deposit was expected to be thin enough so that it could be completely penetrated. Leg 145 was able to penetrate the Meiji sediment body, it contains siliceous pelagic-biogenic materials and hemipelagic land-derived clays and quartz. Deposition of this feature has continued since Eocene/Oligocene boundary time. Northern-source diatoms occur throughout the deposit, suggesting a constant depositional process supplied by sediment from a northern or northwesterly source region.

## Sites 885/886

Sites 885 and 886, located 2.2 km apart, penetrated 70 m of sediments overlying basalt. The sedimentary sequence is similar at both sites but differs in thickness; 52 m thick at Site 885 and 71.9 m thick at Site 886.

### Lithology

Unit I, 0-17.3 mbsf, is Quaternary to late Pliocene in age and consists of pelagic clay in concentrations typically ranging from 65% to 95%. Diatoms and sponge spicules constitute the minor lithologies of this unit.

Unit II, 17.3-50.3 mbsf, is of late Pliocene to late Miocene age and consists of diatom ooze with diatom concentrations ranging from 54% to 95% and averaging 81%.

Unit III, 50.3-71.9 mbsf, is late Miocene in age in the uppermost part and undated down throughout the most of the sequence, being barren of any fossils except for fish teeth in the deeper portion. This unit is composed predominantly of pelagic clay, grading down to hematitic clay at the base of the unit.

Unit IV, 52.1-58.8 mbsf (but poorly recovered) in Hole 885A and 68.5-68.9 mbsf in Hole 886B, consists of angular fragments of aphyric basalt. The basalts are highly altered and have surficial coatings of alteration products. Due to poor recovery and the extent of alteration, the nature, sill or basement, of these basalts remains unknown.

### Age

Units I and II contain abundant diatoms providing continuous zonation ranging from the Miocene *Thalassionema schraderi* Zone through the late Pleistocene *Neodenticula seminae* Zone. Radiolarians are present throughout these units, but zonation is possible only for the Pleistocene interval. Ichthyoliths are the only fossils present in the pelagic "red" clays of Unit III.

Despite the relatively slow sedimentation rates, good paleomagnetic reversal stratigraphy down to Anomaly 3 was obtained both at Sites 885 and 886, providing reliable age control for biostratigraphic zonations. The Matuyama/Gauss reversal boundary is close to the boundary between lithostratigraphic Units I and II.

### Accumulation Rates

LSRs within the stratigraphically well-constrained portion of the sequence (Units I and II) averaged 5.7 m/m.y. and did not vary significantly from the late Miocene through the Quaternary (Fig. 6).

### Paleoceanography and Paleoclimatology

Basalt was recovered at both Sites 885 and 886 (52 and 71 mbsf) at much shallower depths than expected, the nature and age of these basalts remain unknown. The oldest reliably dated sediments at both sites are late Miocene in age, before that time pelagic clay deposition dominated the region. Since the late Miocene, pelagic clays and biogenic silica have accumulated in the region. Diatoms appeared in sediments of Sites 885 and 886 at approximately 9.5 Ma and greatly increased in abundance at about 7.5 Ma, distinctly marking the boundary between pre-upper Miocene clays and upper Miocene-upper Pliocene diatom ooze. Sedimentation rates increased to average values of 5.7 m/m.y., lower here as compared to the more northerly drill sites.

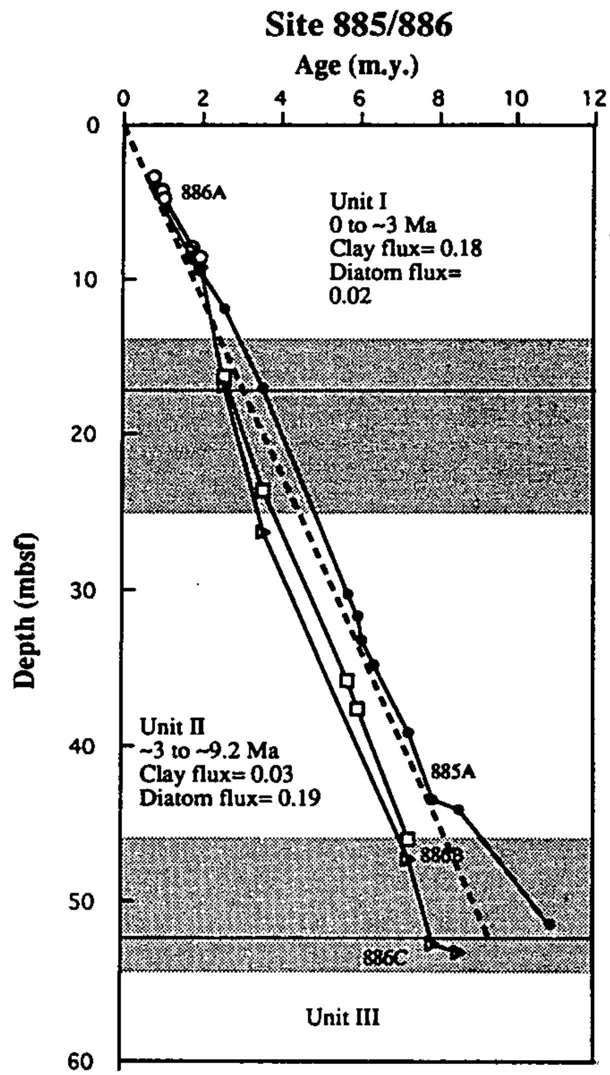



Figure 6. Sedimentation rate plot for Site 885/886 using magnetostratigraphy. Dashed line shows model sedimentation rate used for flux calculations, shaded pattern shows range of unit boundary locations among these sites, and average unit boundaries are assumed to occur at ~17 and ~52 mbsf (solid lines). Average rates and fluxes (in $g/cm^2.k.y.$) are calculated for the upper two lithological units, but there is no chronostratigraphic information below Unit II. The major flux change at this site occurs at the lithologic Unit I-Unit II boundary, with a change from dominantly diatomaceous sediments to dominantly clayey sediments. That level in these cores probably marks the onset of Northern Hemisphere glaciation at ~2.6 Ma.

## Site 887

### Lithology

Three sedimentary units, early Miocene to Quaternary in age, with a total thickness of 289 m and basalt were recovered at ODP Site 887 in the Gulf of Alaska.

Unit I, 0-90 mbsf, consists of two subunits: Subunit IA, 0-45 mbsf, is a siliceous silty clay of Pleistocene age, Subunit IB, 45-90 mbsf, is a Pleistocene to upper Pliocene clay with diatomaceous layers.

Unit II, 90-270 mbsf, can be divided into three subunits: Subunit IIA, 90-174 mbsf, is an upper Pliocene to upper Miocene homogeneous diatom ooze, Subunit IIB, 174-235 mbsf, is an upper to middle Miocene calcareous diatom ooze, Subunit IIC, 235-270 mbsf, is a middle to lower Miocene clayey siliceous ooze dominated by poorly preserved diatoms and radiolarians.

Unit III, 270-289 mbsf, is a lower Miocene clay that occurs just above the basalt in Hole 887D. In Hole 887A several meters of basaltic pea gravel in a clay slurry was encountered at the bottom of the hole, resting on basalt, a testimony to the local variability of basement cover on this seamount platform.

Unit IV, 289-376.3 mbsf, is represented by the 16.3 m of basalt recovered from drilling 87.3 m into basement. The basalts range from highly clinopyroxene-plagioclase phyric basalt in the upper portion to moderately plagioclase phyric basalt to sparsely plagioclase phyric basalt near the bottom of the hole.

### Age

Calcareous fossils are present in the Miocene and lower Pliocene parts of the section; most of the Pleistocene is barren. Diatoms are abundant and provide the basic biostratigraphic zonations. Radiolarians are common throughout the section. Reworked middle Miocene forms of these fossils occur in the upper Miocene and lower Pliocene sediments. A magnetic reversal stratigraphy complete to 18 Ma has been constructed for essentially the entire section of APC Hole 887C, 0-270 mbsf.

### Accumulation Rate

Subunit IA has a linear sedimentation rate of about 61 m/m.y. from 0 to 0.74 Ma (Fig. 7). Sedimentation rates decline continuously downcore, and were about 25 m/m.y. for the Pliocene and lower Pleistocene portion of the section, 0.74 to 5.8 m.y. in age, and 10 m/m.y. for the middle and upper Miocene. The lower Miocene clays have a linear sedimentation rate of 2 m/m.y.

Terrigenous materials increased in flux by nearly an order of magnitude at the time of the onset of Northern Hemisphere glaciation in the Miocene and lower and middle Pliocene. The greatest flux of terrigenous materials occurred in the youngest portion of the section, in materials younger than 0.74 Ma. Diatoms, the other major sedimentary component, reached flux maxima in the lower and middle Pliocene portion of the section, in the time interval between 2.6 and 5.7 Ma. The lower Pliocene period of greatly enhanced diatom deposition, observed throughout the North Pacific, is also present in the Gulf of Alaska.

### Paleoceanography and Paleoclimatology

The Patton-Murray Seamount edifice was extruded in the latest Oligocene onto seafloor that was 10 to 12 m.y. old.; volcanic activity continued for at least 1 or 2 m.y.. Seamount peaks stand as high as 3000 m above the platform level, which is in turn 1500 m above the seafloor. Those peaks must have stood above sea level, the well-rounded pea gravel in the bottom core of Hole 887A implies shallow-water processes prior to downslope emplacement. Sediment deposition was initially slow and with little carbonate. Calcite becomes a noticeable contributor to the sediments only within Subunit IIB, which is of late Miocene age. Clearly the CCD was not becoming deeper through the past 10 to 15 m.y. at Patton-Murray, as it does elsewhere in the Pacific (Berger, 1973; van Andel *et al.*, 1975; Rea and Leinen, 1985). Diatom fluxes reached a maximum in the latest Miocene and early Pliocene.

The onset of Northern Hemisphere glaciation had a strong effect on sedimentation in the Gulf of Alaska. Site 887 core demonstrates that ice-rafted debris became significant exactly at the 2.6 Ma magnetic reversal that marks the onset of glaciation. The flux of opal was greatly reduced, and the sediments became dominated by terrigenous grains of clay and quartz. Dropstones are far more abundant in the Gulf of Alaska than in the northwest Pacific and of quite different lithology, confirming the pronounced Alaskan source of ice-rafted debris suggested by Rea and Schrader (1985). The pan-Pacific dropstone record will allow us to compare timing and pulses of glaciation in Siberia and North America.

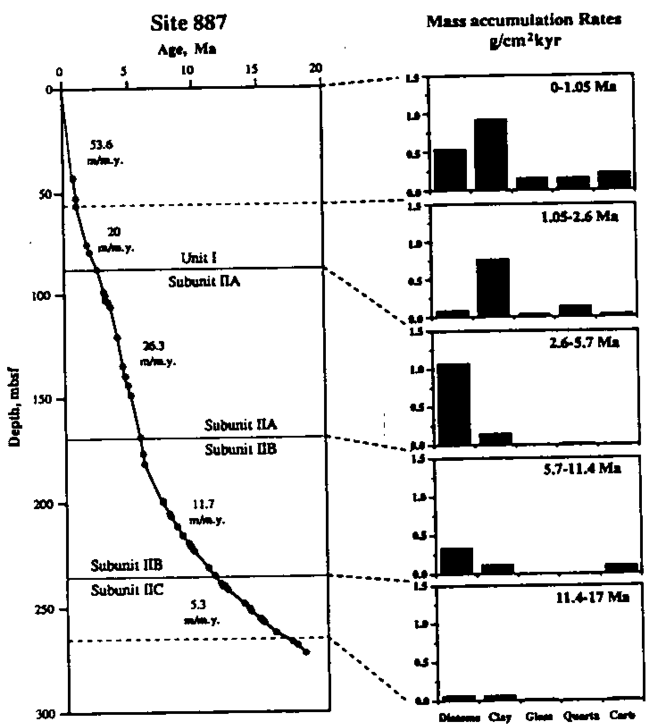



Figure 7. An age-depth plot for Site 887 using magnetostratigraphy from Hole 887C. For flux calculations the section is divided into five intervals where rates of sedimentation, dry bulk density, and sediment composition are relatively constant. These intervals are identified by dashed lines tying the stratigraphic column to the flux results (histograms to right). Solid horizontal lines mark lithostratigraphic unit boundaries. Flux results quantify the late Neogene and Quaternary influence of terrigenous sedimentation associated with glaciation and the latest Miocene-early Pliocene pulse of diatom sedimentation.

## REFERENCES

Berger, W. H., 1973. Cenozoic sedimentation in the eastern tropical Pacific. Geol. Soc. Am. Bull. 84:1941-1954.

Cande, S. C., and Kent, D.V., 1992. A new geomagnetic polarity timescale for the Late Cretaceous and Cenozoic, J. Geophys. Res., 97:13, 917-13,951.

Damuth, J. E., Jacobi, R. D., and Hayes, D. E., 1983. Sedimentation processes in the northwest Pacific Basin revealed by the echo-character mapping studies. Geol. Soc. Am. Bull., 94:381- 395.

Heath, G. R., Burckle, L. H., et al., 1985. Init. Repts. DSDP, 86: Washington (U.S. Govt. Printing Office).

Heath, G. R., Rea, D. H., Levi, S., 1985. Paleomagnetism and accumulation rates of sediments at Sites 576 and 578, Deep Sea Drilling Project Leg 86, western North Pacific. In Heath, G. R., Burckle, L. H., *et al.*, Init. Repts. DSDP, 86: Washington (U.S. Govt. Printing Office), 459-502.

Janecek, T. R., 1985. Eolian sedimentation in the northwest Pacific Ocean: A preliminary examination from Deep Sea Drilling Project Sites 576 and 578. In Heath, G. R., Burckle, L. H., *et al.*, Init. Repts. DSDP, 86: Washington (U.S. Govt. Printing Office), 589- 603.

Krissek, L. A., Morley, J. J., and Lofland, D. K., 1985. The occurrence, abundance, and composition of ice-rafted debris in sediments from Deep Sea Drilling Project Sites 579 and 580, Northwest Pacific. In Heath, G. R., Burckle, L. H., et al., Init. Repts. DSDP, 86: Washington (U.S. Govt. Printing Office), 647- 655.

Rea, D. K., and Leinen, M., 1985. Neogene history of the calcite compensation depth and lysocline in the South Pacific Ocean. Nature, 316:805-807.

Rea, D. K., and Schrader, H., 1985. Late Pliocene onset of glaciation: Ice-rafting and diatom stratigraphy of North Pacific DSDP cores. Palaeogeogr., Palaeoclimatol., Palaeoecol., 49:313- 325.

Rea, D. K., and Thiede, J., 1981. Mesozoic and Cenozoic mass accumulation rates of the major sediment components in the Nauru Basin, Western Equatorial Pacific.In Larson, R. L., Schlanger, S. O., *et al.*, Init. Repts. DSDP, 61: Washington (U.S. Govt. Printing Office), 549-555.

Scholl, D. V., Hein, J. R., Marlow, M., Buffington, E. C., 1977. Meiji sediment tongue: North Pacific evidence for limited movement between the Pacific and North American plates. Geol. Soc. Am. Bull., 88:1567-1576.

Vallier, T. L., Dean, W. E., Rea, D. K., and Thiede, J., 1983. Geologic evolution of Hess Rise, central North Pacific Ocean. Geol. Soc. Am. Bull., 94:1289-1307.

van Andel, T. H., Heath, G. R., and Moore, T. C., Jr., 1975. Cenozoic History and Paleoceanography of the Central Equatorial Pacific Ocean. Geol. Soc. Am. Mem., 143, 134 pp.

## SHIPBOARD PARTY

David K. Rea, Co-Chief Scientist (Univ. Michigan,)
Ivan A. Basov, Co-Chief Scientist (Inst. Lithosphere, Russia)
Thomas Janecek, ODP Staff Scientist (Texas A&M Univ.)
Eve Arnold (University of Rhode Island)
John A. Barron (U.S. Geological Survey, Menlo Park)
Luc Beaufort (CNRS, France)
James F. Bristow, (University of Leicester, UK)
Peter deMenocal (Lamont-Doherty Geological Obs.)
Gilles J. Dubuisson (Ecole Normale Supé rieure, France)
Andrey Y. Gladenokov (Inst. Lithosphere, Russia)
Tark Hamilton (Geol. Surv. Canada)
Bonnye Lynn Ingram (University of California, Berkeley)
Lloyd D. Keigwin, Jr. (Woods Hole Oceanographic Inst.)
Randall A. Keller (Oregon StateUniversity)
Aarno Kotilainen (Geological Survey of Finland)
Lawrence Krissek (Ohio StateUniversity)
Barrie McKelvey (University of New England, Australia)
Joseph Morley (Westwood, New Jersey)
Makoto Okada (University of Tokyo, Japan)
Gunnar Olafsson, (Marine Research Institute, Iceland)
Robert Owen (University of Michigan)
Dorothy Pak (Lamont-Doherty Geological Observatory)
Tom Pedersen (University of British Columbia, Canada)
John A. Roberts (University of Wales, UK)
Anne K. Rutledge (Texas A&M University)
Valery V. Shilov (Inst. Geol. & Min. Res., Russia)
Hilde Snoeckx (University of Michigan)
Rainer Stax (Alfred-Wegener-Institut, Germany)
Ralf Tiedemann (Geol.-Pal. Institut, Germany)
Robin Weeks (University of California, Santa Barbara)

# Wireline Logging on the North Pacific Transect

Peter deMenocal LDEO Logging Scientist

Leg 145 drilled a total of seven sites in a west-east transect across the North Pacific. The primary scientific objectives of this leg were to understand the late Neogene paleoceanographic and paleoclimatic evolution of the North Pacific. More than two decades had elapsed since this region was visited by a drillship, and these sediments present the first new opportunity to study long, complete, and high-resolution climate change records in this poorly understood, yet critical region. Significant basalt sections were recovered at five of the seven sites; these will help constrain the age and chemistry of North Pacific crust.

Four of the seven sites drilled during Leg 145 were logged with the standard suite of Schlumberger tools (Sites 881, 883, 884, and 887). Sites 883, 884, and 887 all have excellent natural gamma, sonic velocity, density, resistivity, and Formation Microscanner (FMS) logs, and many logs were recorded with several passes. Additionally, two new logging tools, French-built total field magnetometer and a magnetic susceptibility tools, were deployed at Site 883 and 884 to test the resolution and sensitivity of these tools in an ODP borehole environment. We experienced some logging difficulties during Leg 145: bottom hole temperatures at all sites were too low (old, cold North Pacific crust) to allow the geochemical tool to stabilize and calibrate. The loss of reliable geochemical log data was particularly acute for those sites where ocean crust could have been logged.

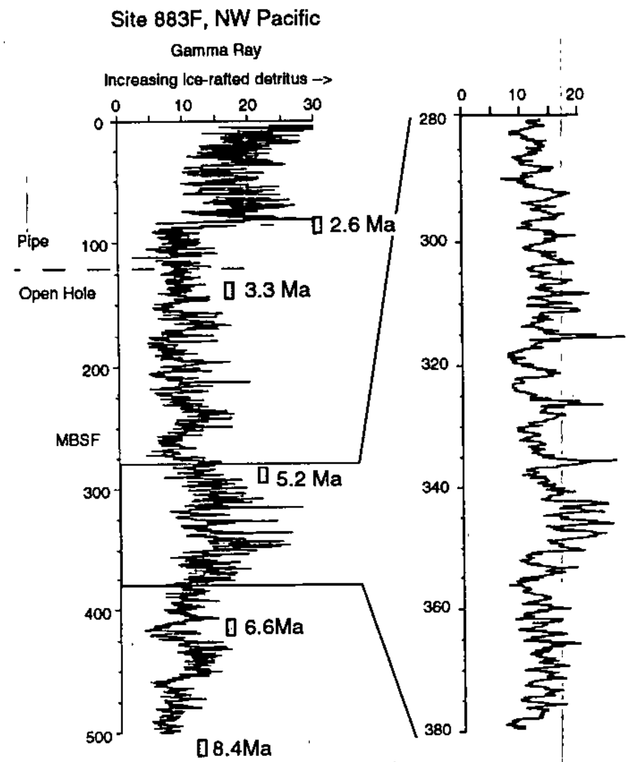



Figure 1: Plot of the spectral gamma ray log from Detroit Seamount Site 883. Age control points are shown based on bio- and magnetostratigraphic data. Increases in the log reflect increases in K and Th abundances associated with increased terrigenous sediment. Smear slide and mineralogical data indicate that ice-rafted detritus (IRD) comprises much of the terrigenous fraction. Note IRD increases between 6-5 Ma and after 2.6 Ma.

In addition to routine log interpretations, log data collected during Leg 145 are being used to reconstruct quantitative biogenic ($CaCO_3$ and opal) and terrigenous (ice-rafted detritus) component percentage and accumulation rate records at selected sites. The objective is to employ core-log data integration techniques to establish relationships between core analytical data and the log responses, and then to use these results to predict component data from the log data. These efforts will help to define how logs can be used as effective and quantitative paleoclimate tools. Logs may contribute significantly toward defining regional changes in biogenic and terrigenous deposition, such as the mid-Miocene "silica shift" event when the locus of silica deposition shifted from Atlantic to Pacific sediments.

Three sites were drilled along a depth transect down the Detroit Seamount in the Northwest Pacific. Neogene sediments are comprised primarily of opal (diatom valves) and terrigenous (ice-rafted) material; carbonate contents were generally low and variable. Log data recorded at Site 883 on the Detroit Seamount summarize the pattern of sedimentation over the past ~8 Ma. Figure 1 shows the spectral gamma-ray log (SCR) from Hole 883F from 0-500 mbsf. The gamma-ray response is largely attributable to natural gamma radiation from K and Th decay in clays and other terrigenous minerals. Smear slide and mineralogical analyses of these sediments indicated that ice-rafted detritus (IRD) comprised a significant component of the terrigenous fraction. The gamma ray log indicates large increases in terrigenous sedimentation (IRD) between ca. 6-5 Ma and after 2.6 Ma. The earlier increase between 6-5 Ma coincides with the late Miocene expansion of Antarctic ice, whereas the increase after 2.6 Ma reflects increased IRD supply associated with the development of Northern Hemisphere glaciations. Detail of the SGR log within the earlier 6-5 Ma interval demonstrates a clearly periodic mode of variability (Figure 1), consistent with other studies of late Miocene-early Pliocene climate fluctuations in the North Atlantic Ocean. The Site 883 log data, and log data from other sites, may be useful for identifying pattern of covariance between North Pacific, North Atlantic, and Antarctic paleoclimate records.

The French (LETI/CEA/TOTAL) total field magnetometer and magnetic susceptibility tools were deployed at Sites 883 and 884 on the Detroit Seamount. These tools have extremely high sensitivities and data from both tools are used to calculate the remanent magnetic field component attributable to detrital or thermal remanent magnetizations. In short, these tools provide a means to acquire magnetic polarity chronostratigraphic information as a continuous logging measurement. Site 884 was an ideal location for test these tools since a stable and continuous magnetic polarity stratigraphy was established to ca. 13 Ma based on pass-through cryogenic core measurements. Although the log results are not yet available, the strong remances and stable directions of the sediments at this site provided an ideal opportunity to test the sensitivity of the tools and develop a log-based paleomagnetic polarity stratigraphy.

# Ocean-Continent Transition in the Iberia Abyssal Plain

Dr. Dale S. Sawyer — Co-Chief Scientist
Dr. Robert B. Whitmarsh — Co-Chief Scientist
Dr. Andy Fisher — ODP Staff Scientist

## Abstract

Leg 149 is scheduled to core a transect of holes across the ocean - continent transition (OCT) off western Iberia to determine the changes in the physical and petrological nature of the acoustic basement. Four sites that span the OCT (IAP-2, IAP-3C, IAP-4, and IAP-5) have been chosen on basement highs to enable penetration of basement at each site. We anticipate drilling three of these sites during Leg 149. Leg 149 will test our conceptual model of the crust and upper mantle within the OCT. Secondary objectives of Leg 149 include examining the depth of the ooze/chalk transition, the history of sediment deformation in the Cenozoic, the post-rift subsidence history of the margin, and the late Cenozoic turbidite succession.

**Leg 149 represents the first part of the program planned by the North Atlantic Rifted Margins Detailed Planning Group for the study of nonvolcanic margins.**

## Scientific Objectives and Methodology

### Ocean-Continent Transition

The principal objective of Leg 149 is to sample the crust within the OCT of the Iberia Abyssal Plain to establish the nature of the upper crust and test some of the predictions based on geophysical observations. In order to achieve significant progress within a single leg, four sites (IAP-2, 3C, 4, and 5) have been chosen at critical points within the OCT (Fig. 1). We expect to drill three of these sites during Leg 149. Our aim is to penetrate several hundred meters into the acoustic basement and to use cores and downhole logs to determine basement origin and history.

### Sedimentary History

A secondary objective is to discover the history of turbidite sedimentation in the Iberia Abyssal Plain. We expect to determine the extent to which the age and frequency of turbidites relates to past climatic changes. Another objective will be to date the deformation of the sediments and to relate these events to periods of deformation in Europe. An additional objective is to test estimates of the depth of the ooze/chalk transition.

### Heat Flow

Thermal gradient will be determined by making in-situ temperature measurements in relatively shallow sediments (the upper 300-500 mbsf) at various depths with the APC tool and WSTP. Temperatures in open holes will be measured as part of most logging runs.

### Late Post-Rift Subsidence

We expect to acquire data to estimate the late post- rift subsidence history of the Iberia Abyssal Plain. We will document the depth, age, environment of deposition, and physical properties of sedimentary units.

### S Reflector

On Leg 149 we may address the S reflector problem by sampling the "enigmatic terrane" rocks that overly the S' reflector. We will use petrologic, chemical, and structural descriptions of the rocks to determine if they could be the intact hanging-wall block of a crustal detachment. If so, it may be possible and useful to core the S' reflector, a possible detachment fault, on a future leg.

## Proposed Drill Sites

### Site IAP-2

This site is situated over a basement high thought to be part of the most oceanward continental-rift block on this margin. About 850 m of sediment, estimated to be as old as Santonian, overlies basement. Studies of the reflection profiles, and analogy with Site 398, suggest that the lithologies are ooze/chalk with turbidites overlying chalk, mudstone, and claystone. The post-Eocene unconformity lies at about 510 mbsf.

### Site IAP-3C

This site is situated over a shallow basement high, which magnetic modeling and seismic refraction results indicate is part of the thin oceanic crust associated with the OCT. About 830 m of sediment, estimated to be as old as late Paleocene, overlies basement. Studies of reflection profiles and Site 398, suggest that the lithologies are ooze/chalk with turbidites over chalk and mudstone. The post-Eocene unconformity lies at about 510 mbsf. The basement material is expected to be upper oceanic crust.

### Site IAP-4

This site centers on a basement high which may be continuous with the peridotite ridge drilled at Site 637 off Galicia Bank during Leg 103. The IAP-4 basement high occupies a critical location in our conceptual model of the OCT, lying at the boundary between the intermediate crust and the thin oceanic crust generated by seafloor spreading. About 680 m of sediment, estimated to be as old as Maastrichtian, overlies basement. Studies of reflection profiles and Site 398, suggest that the lithologies are ooze/chalk with turbidites overlying chalk, mudstone, and claystone. The post-Eocene unconformity lies at about 360 mbsf.

### Site IAP-5

This site is situated east of site IAP-2, and is an alternate for site IAP-3C. About 980 m of sediment, estimated to be as old as early Paleocene, overlies basement. Studies of reflection profiles and Site 398, suggest that the lithologies are ooze/chalk with turbidites overlying chalk, mudstone, and claystone. The post-Eocene unconformity lies at about 560 mbsf. The basement at this site is expected to be continental in character with little or no igneous intrusive material.

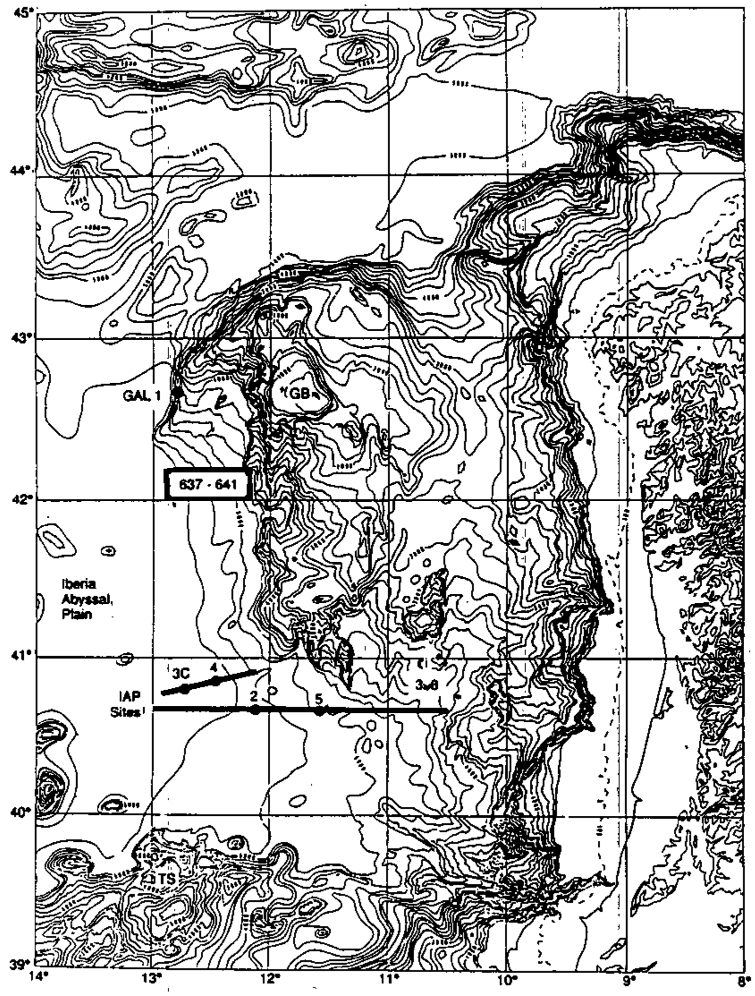



Figure 1. Location of Leg 149 proposed drill sites. Sites 398 (DSDP Leg 47) and 637 to 641 (ODP Leg 103) are also shown. G. B. = Galicia Bank; T. S. = Tore Seamount

# Policy Update for Wireline Re-entry of DSDP and ODP Boreholes

*At their January 1993 meeting, EXCOM amended their 1987 policy for wireline re-entry of DSDP and ODP boreholes to the following (changes shown in bold):*

The JOIDES Executive Committee actively encourages the use of the Deep Sea Drilling Project and Ocean Drilling Program boreholes for scientific purposes by both the D/V *JOIDES Resolution* and independent vessels through wireline re-entry. The drilling program has historically sought to maintain a catalog of hole conditions for those sites with installed re-entry equipment in order to facilitate scientific planning. in order to maintain such a list and to protect JOIDES interests in future use of these holes, the JOIDES Executive Committee requests that parties desiring to use any of these holes seek endorsement of the **Planning Committee, through the JOIDES Office,** prior to their use. In addition, a written report to the Science Operator on the state of the holes used is requested following the conduct of these experiments. We trust that all member institutions and governments will adhere to this agreement and will ensure that those announcements and reports are made in a timely fashion.

Preliminary Prospectus Leg 157

# DCS Update: Engineering Leg — Vema Fracture Zone

## Engineering / Operations Plan

### INTRODUCTION

The Vema FZ has been proposed as the next engineering test site for the Diamond Coring System (DCS), scheduled for Leg 157 in July-August-September 1994. Leg 157 will mark the fourth deployment of the DCS. The system was first tested in 1989 on Leg 124E.

*The primary goal of Leg 157 efforts will be to maximize coring and recovery time with the DCS at the VEMA FZ. Secondary goals will include testing additional new hardware, such as the DRB and 6-3/4 inch DI-BHA (if required).*

Changes made to the DCS during 1992-1993 will be tested at sea for the first time during Leg 157. The most significant of these are changes made to the secondary heave compensation system. A much more robust compensation controller has been designed, and it will be built and tested extensively on land during 1993.

Formations expected at the Vema FZ are characterized by relatively thin sediments overlying limestone formations, deposited on upthrust blocks of crust. The limestone is anticipated to be quite thick in some areas, on the order of 400m. Water depths range from a few hundred meters to over 2,000 meters.

### OPERATIONS SEQUENCE

Upon arrival at Vema FZ, a bottom TV survey will be conducted in order to locate possible areas for Hard Rock Base (HRB) emplacement. Since some limited sediment cover is expected, it is likely a test hole will be drilled to assess near-surface lithology and to help determine setting depths for the Drill-In-BHA (DI-BHA).

The ideal location for the HRB would have less than 1 m sediment cover. A HRB will be assembled and run to bottom once a suitable location is chosen. The 10-3/4 inch DI-BHA will then be deployed in order to set the stage for coring with the DCS. The DCS will then be picked up and coring will proceed.

### NEW EQUIPMENT

As mentioned previously, significant changes will have been made to the secondary heave compensation system. Specifically, a completely new compensation system controller will be tested and tuned at the initiation of DCS coring. New bit designs will also be tested when the 10-3/4 inch DI-BHA is drilled in. Two different diamond bit/center bit designs will be available. These are expected to be much more efficient in the limestone formation than the 12-1/2 inch roller cone bits used on Leg 142 at the East Pacific Rise (EPR). New bits for the 6-3/4 inch DI-BHA system may also be tested if hole conditions dictate that a second string of casing be set. The 6-3/4 inch DI-BHA hardware has also been modified to include a loss of pressure indicator for when back-off occurs.

If initial coring is successful with conventional diamond bits, a segmented DCS retractable bit (DRB) system may be tested. The DRB allows the 3.96 inch diamond core bit to be changed without tripping the DCS tubing out of the hole. This retractable bit hardware will ride on the inner core barrel and can be viewed after each core run. Successful deployment of this hardware will potentially save a significant amount of time that would have been used for tripping the DCS tubing in place of coring.

The primary goal of Leg 157 efforts will be to maximize coring and recovery time with the DCS at the VEMA FZ. Secondary goals will include testing additional new hardware, such as the DRB and 6-3/4 inch DI-BHA (if required).

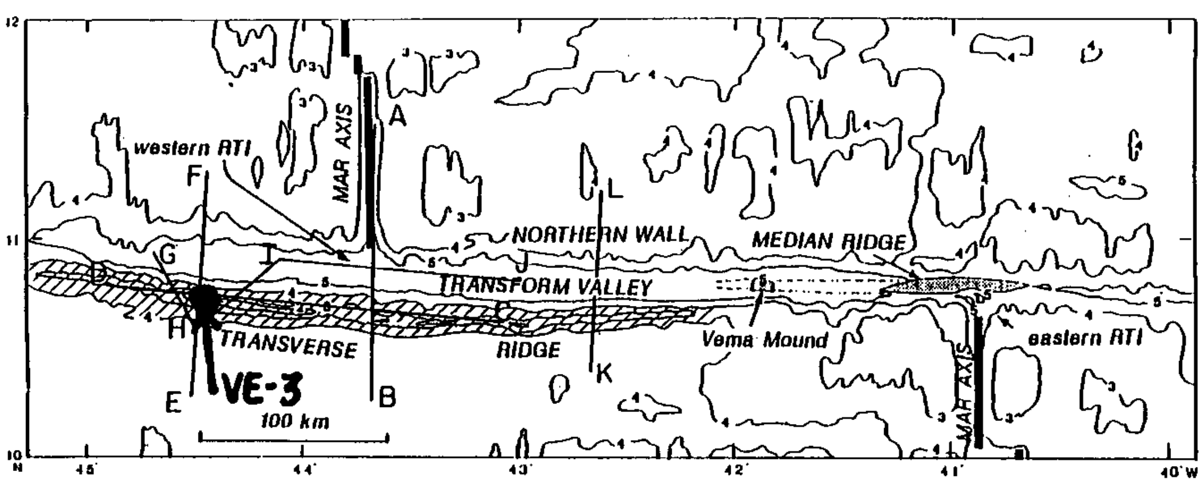



Figure 1. Tracks of seismic profiles carried out in August 1992 at the Vema Fracture Zone (from the proposal 376 - Rev. 2)

# International News

International News is a new section in the Journal where we hope to highlight activities and issues concerning all JOIDES members. We look to the international community to help keep us informed of ODP events in their countries.

## JOIDES Office to go International

In June 1992 EXCOM issued a request for proposals from non-US JOIDES Members to host the JOIDES Office following it's term at the University of Washington. At the most recent meeting of EXCOM it was announced that the bid from Britain's Natural Environment Research Council was successful. This means that the office should move to the Department of Geology, University of Wales, Cardiff in October of 1994. Dr. Rob Kidd will be chairman of the Planning Committee and Dr. Jim Briden will be Executive Committee chairman.

## ODP Canada Reorganizes

In late January the Government of Canada decided to withdraw ODP funding to Energy, Mines and Resources and Industry, Science and Technology Canada. This effectively leaves Canada and the Can/Aus consortium 1 million Canadian dollars short of an ODP subscription when renewal time comes around in October. In order to place the Canadian scientific community in the best position to address the funding shortfall, the Canadian Council for the Ocean Drilling Program has appointed Dr. John Malpas as its chairman. Dr. Malpas has already convened a strategy meeting of interested scientists and is very actively looking for funding to continue Canada's ODP commitment.

## *Drilling Towards the 21st Century*

In May 1992 scientists from the European Consortium for Ocean Drilling staged a workshop with the Theme "Drilling towards the 21st century: ODP in the Atlantic". The chief purpose of the workshop was to formulate ideas for thematically defined drilling activities, aimed primarily at Atlantic drilling in the mid- and late 1990's. The workshop report is now available and is comprised of working group reports focused along the lines of JOIDES thematic panels, namely, lithosphere, ocean history, sedimentary and geochemical processes, and tectonics. Copies may be obtained by writing to the ESCO Secretariat, Geological Survey of Denmark, Thoravej 8, DK-2400 Copenhagen NV, Denmark.

## *Western Pacific Active Margins and Marginal Basins*

Over 70 scientists gathered in Monterey California January 18-21 to participate in this JOI/USSAC sponsored workshop. Just under half of the participants were non-US based scientists. The workshop focused on the science related to drilling on active margins and marginal basins. The sessions included summations of the results from Western Pacific drilling with a view to future drilling. It is expected that a number of new drilling proposals will be produced as a result of the meeting.

## German ODP Meeting

Look in the next edition of the JOIDES Journal for a report on the German ODP Meeting to be held
**March 10 - 12 in Freiberg / Saxony.**

# Proposal News

## ACTIVE PROPOSALS IN THE ODP SYSTEM

*Proponents of JOIDES drilling proposals are reminded that the statute of limitations for proposals (PCOM motion, August 1991) renders proposals inactive after a certain period. Inactive proposals are not considered for planning. To keep a proposal active, or to reactivate a proposal, a revised version or an addendum must be submitted to the JOIDES Office.*

**All proposals not updated since 1 Jan 1990 have become "inactive".**

| DATE | BRIEF TITLE | NUMBER | CONTACT |
|---|---|---|---|
| 01/18/90 | Plume volcanism and rift/drift, Grand Banks-Iberia | 363— | Tucholke, B.E. |
| 01/22/90 | Accretionary prism in collisional context, Med. Ridge | 330-Add | Cita-Sironi, M.B. |
| 01/22/90 | Thrust units of cont. basement, Sardinian-African Strait | 364— | Torelli, L. |
| 02/07/90 | Cool water carbonate margin, southern Australia | 367— | James, N.P. |
| 02/12/90 | Jurassic Pacific crust: A return to Hole 801C | 368— | Larson, R.L. |
| 02/22/90 | Magmatic processes and natural tracers, MAR | 370— | Dick, H.J.B. |
| 02/26/90 | Cenozoic circulation and chem. gradients, N Atlantic | 372— | Zahn, R. |
| 03/01/90 | Stress, hydrol. circ. and heat flow, Site 505 revisited | 373— | Zoback, M.D. |
| 03/06/90 | Mantle heterogeneity, Oceanographer FZ | 374— | Dick, H.J.B. |
| 03/12/90 | Growth and fluids evol., Barbados accretionary wedge | 378-Rev | Westbrook, G.K. |
| 03/12/90 | Scientific drilling in the Mediterranean Sea | 379— | Mascle, J. |
| 03/19/90 | Drilling on continental shelf and slope, Argentina | 381— | Huber, B.T. |
| 05/01/90 | VICAP, Gran Canaria | 380-Rev | Schmincke, H.U. |
| 05/03/90 | Upper mantle - lower crustal uplifted section, Vema FZ | 382— | Bonatti, E. |
| 05/22/90 | Extension and continent-continent collision, Aegean Sea | 383— | Kastens, K.A. |
| 06/04/90 | Addendum to Woodlark Basin proposal | 265-Add | Scott, S.D. |
| 07/18/90 | Pacific-Atlantic connection, Venezuela basin, Aruba Gap | 384-Rev | Mauffret, A. |
| 08/10/90 | Paleoceanography and deformation, California margin | 386-Rev | Lyle, M. |
| 08/30/90 | Formation of a gas hydrate | 355-Rev2 | Von Huene, R. |
| 09/07/90 | Bering Sea history (Pacific Prospectus) | Bering | CEPAC |
| 10/05/90 | Addenda to West Florida margin sea level and paleo. | 345-Add | Joyce, J.E. |
| 10/29/90 | Cretaceous traverse, Western South Atlantic | 389— | Malmgren, B.A. |
| 11/12/90 | Drilling in the Shirshov ridge region | 390— | Milanovsky, V.E. |
| 12/27/90 | S reflector and ultramafic basement, Galicia margin | 334-Rev | Boillot, G. |
| 01/02/91 | Formation of sapropels, eastern Mediterranean | 391— | Zahn, R. |
| 01/15/91 | Cont. margin sed. instability, drilling adjacent turbidites | 059-Add | Weaver, P.P.E. |
| 01/29/91 | Mantle plume origin, North Atlantic volcanic margins | 392— | Larsen, H.C. |
| 01/29/91 | Continent-ocean transition, Greenland volcanic margin | 393— | Larsen, H.C. |
| 02/04/91 | Pre/syn-volcanic extensinal basins on passive margins | 394— | Kiørboe, L.V. |
| 02/11/91 | Alboran basin and Atlantic-Mediterranean gateway | 323-Rev | Comas, M.C. |
| 02/11/91 | Compressional tectonics on a passive volcanic margin | 395— | Boldreel, L.O. |
| 02/18/91 | Paleoceanographic record at sites NR1, NR2, and NR3 | 363-Add | Tucholke, B.E. |
| 02/20/91 | Mantle plume and multiple rifting, North Atlantic | 397— | Gudlaugsson, S.T. |
| 02/22/91 | Quat. paleoceanography, Grand Banks, Newfoundland | 398— | Piper, D.J.W. |
| 03/25/91 | Data status, equatorial Atlantic transform margin | 346-Add | Mascle, J. |
| 05/01/91 | Oceanogr./climatic changes, North Greenland Sea | 356-Rev | Smolka, P.P. |
| 05/03/91 | Tectonic evolution of the Alboran Sea | 399— | Watts, A.B. |
| 06/19/91 | Deposition of organic carbon-rich strata, ancestral Pacific | 253-Rev | Sliter, W.V. |
| 08/14/91 | Ivory Coast - Ghana transform margin | 346-Rev2 | Mascle, J. |
| 09/03/91 | Mass balance/def. mech., Middle Am. Trench/Costa Rica | 400— | Silver, E.A. |
| 09/05/91 | Evolution of a Jurassic Seaway, SE Gulf of Mexico | 401— | Buffler, R.T. |
| 09/09/91 | Geochemical anomaly in MAR basalts between 12°-18°N | 402— | Sobolev, A.V. |
| 09/09/91 | KT boundary, Gulf of Mexico | 403— | Alvarez, W. |
| 09/10/91 | Accretionary prism in collisional context, Med. Ridge | 330-Add2 | Cita-Sironi, M.B. |
| 09/11/91 | Neogene paleo. from W North Atlantic sediment drifts | 404— | Keigwin, L.D. |
| 09/12/91 | VICAP, Gran Canaria | 380-Rev2 | Bednarz, U. |
| 09/12/91 | Formation of sapropels, eastern Mediterranean | 391-Add | Zahn, R. |
| 09/16/91 | North Atlantic climatic variability | 406— | Oppo, D. |
| 09/16/91 | North Atlantic shallow mantle at geochemical anomaly | 407— | Dick, H.J.B. |
| 09/16/91 | Testing two new interpretations, N Nicaragua Rise | 408— | Droxler, A.W. |
| 12/09/91 | The Caribbean Basalt Province - an oceanic basalt plateau | 411— | Donnelly, T.W. |
| 01/28/92 | Bahamas transect: Neogene/Quat. sea level and fluid flow | 412— | Eberli, G.P. |
| 01/30/92 | Cont. margin sed. instability: sea level & basinal analysis | 059-Rev3 | Weaver, P.P.E. |

| | | | |
|---|---|---|---|
| 01/30/92 | Benguela Current and Angola/Namibia upwelling | 354-Rev | Wefer, G. |
| 02/03/92 | KT boundary, Gulf of Mexico | 403-Rev | Alvarez, W. |
| 02/03/92 | Magmatic/tectonic evol. of oceanic crust: Reykjanes Ridge | 413— | Murton, B.J. |
| 02/03/92 | Cretaceous-Tertiary boundary in the Caribbean Sea | 415— | Sigurdsson, H. |
| 02/04/92 | Florida Escarpment drilling transect | 332-Rev3 | Paull, C.K. |
| 02/04/92 | Update to Cayman Trough transect | 333-Add | Mann, P. |
| 02/10/92 | California margin drilling | 386-Rev2 | Lyle, M. |
| 03/11/92 | Glacial history, Svalbard margin | 416— | Solheim, A. |
| 06/30/92 | Gas hydrate in vicinity of gas plume, Okhotsk Sea | 417— | Soloviev, V. |
| 07/13/92 | Sea-level fluct., Marion carbonate plateau, NE Australia | 338-Add | Pigram, C.J. |
| 07/20/92 | NSF proposal: fluid paths in Costa Rica Acc. wedge | 400-Add | Silver, E.A. |
| 07/21/92 | Pacific-Atlantic connection, Venezuela basin, Aruba Gap | 384-Rev2 | Mauffret, A. |
| 07/27/92 | Drilling in the Red Sea | 086-Rev2 | Bonatti, E. |
| 07/27/92 | Galicia margin S reflector | 334-Rev2 | Boillot, G. |
| 07/27/92 | Miocene biomagnetostrat. reference section, Menorca Rise | 418— | Cita-Sironi, M.B. |
| 07/28/92 | KT Boundary Drilling in the Gulf of Mexico | 403-Rev2 | Alvarez, W. |
| 07/28/92 | Convergence at Azores-Gibraltar plate boundary | 419— | Zitellini, N. |
| 07/30/92 | L. Cenozoic paleoceanography, south-equatorial Atlantic | 347-Add | Wefer, G. |
| 07/30/92 | Benguela Current and Angola/Namibia upwelling | 354-Add | Wefer, G. |
| 07/30/92 | Clastic apron, Gran Canaria, and Madeira Abyssal Plain | 380-Rev3 | Schmincke, H.U. |
| 07/30/92 | The evolution of oceanic crust | 420— | Purdy, G.M. |
| 07/30/92 | Alkali-acidic rocks of the Volcano Trench | 421— | Vasiliev, B.I. |
| 07/31/92 | Tethys and the birth of the Indian Ocean | 079-Rev | Coffin, M.F. |
| 07/31/92 | Tectonic evolution of the Alboran Sea | 323-Rev2 | Comas, M.C. |
| 07/31/92 | Mediterranean Ridge accretionary complex (Phase 1) | 330-Rev | Camerlenghi, A. |
| 07/31/92 | Ivory Coast - Ghana transform margin | 346-Rev3 | Mascle, J. |
| 07/31/92 | Caribbean ocean history and KT-boundary | 415-Rev | Sigurdsson, H. |
| 07/31/92 | Santa Monica Basin | 422— | Stott, L.D. |
| 07/31/92 | Gas hydrate sampling, Blake Ridge and Carolina Rise | 423— | Paull, C.K. |
| 07/31/92 | To "cork" Hole 395A | 424— | Becker, K. |
| 07/31/92 | MAR at 15°37'N: crust generation at magma-poor MOR | 425— | Cannat, M. |
| 08/01/92 | Return to Site 735: very slow-spread. lower ocean crust | 300-Rev | Dick, H.J.B. |
| 08/01/92 | Formation of sapropels in the Mediterranean | 391-Rev | Zahn, R. |
| 08/20/92 | Mantle reservoirs/migration, Australia-Antarctic rifting | 426— | Christie, D. |
| 10/05/92 | Cool water carbonate margin, southern Australia | 367-Add | James, N.P. |
| 12/15/92 | Cenozoic circulation and chem. gradients, N Atlantic | 372-Add | Zahn, R. |
| 12/21/92 | Tests of the Exxon Sea Level Curve, New Zealand | 337-Add | Carter, R. |
| 12/24/92 | Late Cenozoic Paleoceanography, South-equatorial Atlantic | 347-Rev | Wefer, G. |
| 12/24/92 | Bahamas transect: Neogene/Quat. sea level and fluid flow | 412-Add | Eberli, G.P. |
| 12/28/92 | Tyrrhenian Seafloor and Hydrothermal Sulfide Deposits | 428— | Savelli, C. |
| 12/28/92 | Testing two new interpretations, N Nicaragua Rise | 408-Rev | Droxler, A.W. |
| 12/28/92 | Deposition of organic carbon-rich strata, ancestral Pacific | 253-Add | Sliter, W.V. |
| 12/31/92 | Evolution of pull-apart basin, Cayman Trough | 333-Rev | Mercier de Lepinay, B. |
| 12/31/92 | Santa Monica Basin | 422-Rev | Stott, L.D. |
| 12/31/92 | Gas hydrate sampling, Blake Ridge and Carolina Rise | 423-Rev | Paull, C.K. |
| 12/31/92 | To "Cork" Hole 395A | 424-Rev | Becker, K. |
| 12/31/92 | Convergence at Azores-Gibraltar plate boundary | 419-Rev | Zitellini, N. |
| 12/31/92 | South Florida Margin Sea-Level | 427— | Hine, A.C. |
| 12/31/92 | Sed. Ridges II | SR-Rev | Zierenberg, R.A. |
| 12/31/92 | Atlantic-Mediterranean Gateway | 429— | Nelson, C.H. |
| 12/31/92 | Tectonic, climatic, oceano. change, N Australian margin | 340-Rev | Symonds, P. |
| 12/31/92 | Subantarctic Southeast Atlantic Transect | 430— | Hodell, D.A. |
| 12/31/92 | Western Pacific Seismic Network | 431— | Suyehiro, K. |

# DEADLINES FOR PROPOSAL SUBMISSION

**1 July 1993 & 1 January 1994**

Thematic panels will review new and revised proposals received at the JOIDES Office not later than 1 July 1993 during their fall meetings and rank those proposals within their mandate and interest. Highly-ranked proposals will be reviewed by the Site Survey Panel at its April 1994 meeting and monitored from then on.

**Proposals must be submitted to the JOIDES Office. Proposals submitted directly to thematic panels <u>are not reviewed</u>.**

# Bulletin Board

## JOI/USSAC Ocean Drilling Fellowships

JOI/U.S. Science Advisory Committee is seeking doctoral candidates of unusual promise and ability who are enrolled in U.S. institutions to conduct research compatible with that of the Ocean Drilling Program. Both one-year and two-year fellowships are available. The award is $20,000 per year to be used for stipend, tuition, benefits, research costs and incidental travel, if any. Applicants are encouraged to propose innovative and imaginative projects. Research may be directed toward the objectives of a specific leg or to broader themes.

**Applications should be submitted according to the following schedule:**

| | |
|---|---|
| **Shipboard Research (Legs 153-158)** | **5/1/93** |
| **Shorebased Research (regardless of leg)** | **12/1/93** |

For an application and descriptions of the upcoming legs contact:

JOI/USSAC Ocean Drilling Fellowship Program
Joint Oceanographic Institutions, Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102

***For additional information, call Andrea Leader (Tel: 202-232-3900).***

## Funding for Site Survey Augmentation

JOI/U.S. Science Support Program has Site Survey Augmentation funds available to supplement drilling site data sets that are in all phases of planning. This program element includes support for:

- acquiring and/or processing data for sites being considered by JOIDES;
- mini-workshops that would bring together scientists to coordinate site-specific data for integration into a mature drilling proposal;
- "augmentation" surveys on ships of opportunity that would significantly enrich drilling-related science and/or acquire needed site survey data;
- U.S. scientists to participate in non-U.S. site surveys.

Site Survey Augmentation proposals may be submitted at any time. Priority will be given to augmentation of sites and/or themes that are high priority within JOIDES. As with all JOI/USSSP activities, it is important to clearly state how the work would contribute to U.S. plans or goals related to the Ocean Drilling Program. Note that the Site Survey Augmentation funds cannot be used to supplement NSF/ODP funded work.

Contact Ellen Kappel, JOI office, for further information and proposal guidelines: (202) 232-3900, ekappel@iris.edu.

## ODP Long Range Plan

The ODP Long Range Plan portfolio is available from the JOI office. If you would like to receive a copy, contact:
Jenny Ramarui, JOI, Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102
Phone: 202-232-3900, Fax: 202-232-8203

## Now Available!

The JOI/USSAC Workshop Report, ***Paleogene Paleoceanography*** and the Conference Report ***The Role of Antarctica in Global Climatic Change*** are now available from JOI, Inc.

For a free copy, contact Johanna Adams
Joint Oceanographic Institutions, Inc.
1755 Massachusetts Ave., NW, Suite 800,
Washington, DC 20036-2102

# ODP Promotional Material

Available from: Karen Riedel, ODP, Public Relations, Texas A&M University, 1000 Discovery Drive, College Station, TX 77840.

## Coring Poster

ODP has a poster: "Scientific Coring Beneath the Sea," available for distribution. The poster features individual coring systems developed for scientific ocean drilling, including the rotary core bit, advanced piston coring and extended core barrel. Eric Schulte of Engineering and Drilling Operations designed and produced the poster.

## Brochures

Updated ODP brochures in English, French, Spanish and German are now available. A brochure featuring engineering developments is also available.

## Reprints

Reprints of the 1990 Offshore Technology Conference paper, *"The Ocean Drilling Program: After five years of field operations,"* is available from Karen Riedel. The paper, written by P.D. Rabinowitz, L.E. Garrison, et al., features the significant results of Legs 100-124. The paper also describes in detail Legs 124E-135. An ODP Operations Summary outlines the data from each cruise, including number of sites, number of holes and percent recovery.

# *Report on National Workshop on Gas Hydrates*

Workshop held in April 1991, organized by: US Navy, Naval Research Laboratory; USGS; US Dept. of Energy, Morgantown Energy Technology Center.

Report available from: National Technical Information Service, US Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

# ODP Open Discussion Bulletin Board via Bitnet

The ODP BITNET LISTSERVER is an open discussion service to which individuals subscribe *via* Bitnet. It permits exchange of information among all subscribers. Currently, the list administrator sends a report of the previous week's shipboard scientific and operations activities to all subscribers. Site summaries are distributed as soon as they are received at ODP from the ship, usually the day after a site is completed. Periodically, an updated cruise schedule and brief descriptions of upcoming cruises are sent out. Any subscriber may send files to the list for distribution. A file sent *via* Bitnet to the list address (ODP-L@TAMVM1) will be distributed automatically to all subscribers.

Anyone with a Bitnet computer link can subscribe. At present there are subscribers in the U.S., Canada, Europe, Australia and Japan. There is no charge for subscribing to the listserver.

To subscribe, send a brief Bitnet command to LISTSERV@TAMVM1 consisting of the words "SUBSCRIBE ODP-L YOUR_NAME" (where YOUR_NAME really is your first and last names). For example, people on VAX/VMS systems using the JNET networking software will send a command that looks like this: $SEND LISTSERV@TAMVM1 "SUBSCRIBE ODP-L YOUR_NAME" but it may be different according to the command language your computer system uses. If you have any questions, your own friendly local system manager should be able to help. As a last resort, you may send a message to Joan Perry (PERRY@TAMODP or perry@odpvax.tamu.edu) requesting that you be added to the ODP-L subscription list.

# CENOZOIC GLACIATION: THE MARINE RECORD ESTABLISHED BY OCEAN DRILLING

### *A SUPPLEMENT TO UNDERGRADUATE CURRICULA*

Eugene Domack and Cynthia Domack, Hamilton College

A new course supplement, *Cenozoic Glaciation: The Marine Record Established by Ocean Drilling,* will be available for use in the fall 1991 semester. The booklet, sponsored by JOI/USSAC, covers the results of five ODP high-latitude legs: two in the northern hemisphere (legs 104 and 105) and three in the southern hemisphere (legs 113, 119 and 120). Cenozoic Glaciation is intended for use as a supplement to regular class materials in courses such as oceanography, glacial geology, marine geology and sedimentology, and is designed specifically for undergraduates. A coordinated color poster illustrating the core intervals described in the text is included.

*Copies of the booklet and poster are available from JOI.*

If you would like a sample copy, contact Mary Reagan, Joint Oceanographic Institutions, Inc., 1755 Massachusetts Ave., NW, Suite 800, Washington, DC 20036-2102; (202) 232-3900.

# Micropaleontological Reference Centers

## Micropaleontological Reference Centers (MRC)

Located at eight sites on four continents, provide scientists around the world an opportunity to examine, describe and photograph microfossils of various geological ages and provenance. The collections contain specimens from four fossil groups—foraminifers, calcareous nannofossils, radiolarians and diatoms—selected from sediment samples obtained from the Deep Sea Drilling Project (DSDP). Processing of samples from DSDP legs 1 through 82 has been overseen by John Saunders, Supervisor of the Western Europe Center, and William Riedel, Supervisor of the facility on the US West Coast. These samples have been prepared, divided into eight identical splits, and distributed to each MRC. Future plans include addition of samples from later legs of DSDP and from the Ocean Drilling Program (ODP) as well.

All fossil material maintained by MRCs remains the property of the US National Science Foundation and is held by the MRCs on semipermanent loan.

Establishment of identical paleontological reference collections around the world will help researchers to unify studies on pelagic biostratigraphy and paleoenvironments, and to stabilize taxonomy of planktonic microfossils.

Researchers visiting these centers may observe quality of preservation and richness of a large number of microfossils, enabling them to plan their own requests for either ODP or DSDP deep-sea samples more carefully. Visitors to MRCs also may compare actual, prepared faunas and floras (equivalent to type material) with figures and descriptions published in DSDP *Initial Reports* or ODP *Proceedings* volumes.

## Facilities at MRCs

All MRCs maintain complete, identical collections of microfossil specimens.

In addition, the following materials and equipment are available for visitor use:

- secure storage and display areas
- binocular microscope and work space
- reference set of DSDP *Initial Reports* and ODP *Proceedings* volumes
- lithologic smear slides accompanying each fossil sample
- microfiche listings of samples available.

For more infΔormation about MRCs, or to schedule a visit, contact the supervisor on site.

## Locations of MRCs

### US East Coast

Lamont-Doherty Geological Observatory
Palisades, NY 10964
Supervisor: Ms. Rusty Lotti
Phone: (914) 359-2900
Telex: 7105762653 LAMONTGEO

### US National Museum

US National Museum of Natural History
Dept. of Paleobiology
Smithsonian Institution
Washington, D.C. 20560
Supervisor: Dr. Brian Huber
Phone: (202) 786-2658
Telex: 264729
Fax: (202) 786-2832

### US Gulf Coast

Texas A&M University
Dept. of Oceanography
College Station, TX 77843
Supervisor: Dr. Stefan Gartner
Phone: (409) 845-8479

### US West Coast

Scripps Inst. Oceanography
La Jolla, CA 92093
Supervisor: Dr. William Riedel
Phone: (619) 534-4386
Telex: 910337127 IUC WWD SIOSDG

### New Zealand

DSIR Geology & Geophysics
PO Box 30 368
Lower Hutt, New Zealand
Supervisor: Dr. C.P. Strong
Phone: (04) 569-9059
Fax: (04) 569-5016

### Russia

Institute of the Lithosphere
Staromonet 22
Moscow 109180, Russia
Supervisor: Dr. Ivan Basov
Phone: 231-48-36

### Japan

National Science Museum
3-23-1 Hyakunin-cho
Shinjuku-ku
Tokyo, 160, Japan
Supervisor: Dr. Y. Tanimura
Phone: 03-364-2311
Telemail: 03-364-2316

### Western Europe

Natural History Museum
CH-4001 Basel
Switzerland
Supervisor: Mr. John Saunders
Phone: 061-29-55-64

# JOI/USSAC Workshop Reports and Other ODP-Related Reports

*available from* Joint Oceanographic Institutions, Inc.
1755 Massachusetts Ave. NW, Suite 800, Washington, D.C. 20036-2102, Tel (202) 232-3900

*Scientific Seamount Drilling*, A.B. Watts and R. Batiza, conveners.
*Vertical Seismic Profiling (VSP) and the Ocean Drilling Program (ODP)*, J. Mutter and A. Balch, conveners.
*Dating Young MORB?*, R. Batiza, R. Duncan and D. Janecky, conveners.
*Downhole Seismometers in the Deep Ocean*, G.M. Purdy and A. Dziewonski, conveners.
*Science Opportunities Created By Wireline Reentry of Deep-Sea Boreholes*, M.G. Langseth and F.N. Spiess, conveners.
*Wellbore Sampling*, R.K. Traeger and B.W. Harding, conveners
*South Atlantic and Adjacent Southern Ocean Drilling*, J.A. Austin, Jr., convener.
*Measurements of Physical Properties and Mechanical State in the Ocean Drilling Program*, D.K. Karig and M.H. Salisbury, conveners.
*Paleomagnetic Objectives for the Ocean Drilling Program*, K.L. Verosub, M. Steiner and N. Opdyke, conveners.
*Cretaceous Black Shales*, M.A. Arthur and P.A. Meyers, conveners.
*Caribbean Geological Evolution*, R.C. Speed, convener.
*Drilling the Oceanic Lower Crust and Mantle*, H.J.B. Dick, convener.
*Role of ODP Drilling in the Investigation of Global Changes in Sea Level*, J.S. Watkins and G.S. Mountain, conveners.
*Ocean Drilling and Tectonic Frames of Reference*, R. Carlson, W. Sager and D. Jurdy, conveners.
*Drilling of the Gulf of California*, B. Simoneit and J.P. Dauphin, Conveners.
*East Pacific Rise Petrology Data Base (Vols. I-III)*, C. Langmuir, compiler.
*Report on the Conference on Scientific Ocean Drilling (COSOD I)*, JOIDES, sponsor.
*Report of the Second Conference on Scientific Ocean Drilling (COSOD II)*, JOIDES, sponsor.
*Geochemistry Progress and Opportunities*, M. Kastner and G. Brass, Conveners.
*Proceedings of a Workshop on the Physical Properties of Volcanic Seafloor*, G.M. Purdy and G.J. Fryer, Conveners.
*Data Synthesis on Rejuvenescent Mid-Plate Volcanism in the Pacific Basin*, compiled by S.O. Schlanger, R.G. Gordon, E. Okal, and R. Batiza (available in flat ASCII format on Mac or IBM disks, or Sun tapes[150MB 1/4 in. cartridge or 9-track TAR])..
*Large Igneous Provinces*, M. Coffin, convener.
*Cretaceous Resources, Events and Rhythms*, M.A. Arthur, convener.
*Paleogene Paleoceanography*, L. Stott, convener.
*Antarctica in Global Climatic Change*, J. Kennett and J. Barron, conveners.

## ECOD Workshop Report

***The ESCO Secretariat Announces the Publication of the Report of the 4th ECOD Workshop***

## DRILLING TOWARDS THE 21ST CENTURY: ODP IN THE ATLANTIC

**held at Rungstedgaard, Denmark**
**May 6 - 8, 1992**

A limited number of copies are available upon request to:
Birgit Jorgensen or Naja Mikkelsen
ESCO Secretariat, Geological Survey of Denmark
Thoravej 8, DK-2400
Copenhagen NV, Denmark

L

# ODP Science Operator

Texas A&M University, 1000 Discovery Drive, College Station, Texas 77845-9547

and Databases

## Cumulative Index to 96 DSDP Volumes Now Available

A cumulative index to all 96 volumes of the Initial Reports of the Deep Sea Drilling Project is now available from ODP/TAMU. The index is presented in two formats: an electronic version on CD-ROM, and a printed version. Both are packaged together in a sturdy slipcase.

The index is in three parts: (1) a subject index, (2) a paleontological index, and (3) a site index. The three parts reflect the interwoven nature of the marine geoscience subdisciplines.

The electronic version of the index is the more complete of the two, containing up to eight hierarchies of entries. The 1072-page printed index volume contains three hierarchies of entries and was condensed from the electronic version. Both versions of the index were prepared by Wm. J. Richardson Associates, Inc.

The CD-ROM containing the electronic index was manufactured under the auspices of the Marine Geology and Geophysics Division of the National Geophysical Data Center, National Oceanic and Atmospheric Administration, and U.S. Department of Commerce. In addition to the three-part index, the CD-ROM contains (1) a bibliography of authors and titles, (2) citations to DSDP exclusive of the Initial Reports, (3) proposals to DSDP, (4) site-summary information, (5) an inventory of DSDP underway geophysical data, (6) an inventory of downhole-logging data, and (7) data-documentation files.

Many persons contributed to the indexing project, including those at Scripps Institution of Oceanography and Texas A&M University. The U.S. National Science Foundation funded preparation and publication.

*Index sets* (US$50), *Proceedings* (US$45 each, plus postage); *Prospectuses, Preliminary Reports* and *Technical notes* (free) can be obtained from:

Publications Distribution Center
Ocean Drilling Program
1000 Discovery Drive
College Station, Texas 77845
U.S.A.

Phone, (409) 845-2016;

## Proceedings of the Ocean Drilling Program, Initial Reports & Scientific Results

| | Init. Reports | | Sci. Results | |
|---|---|---|---|---|
| | Vol. | Pub. | Vol. | Pub. |
| Leg 101 | 101/102 | Dec 86 | 101/102 | Dec 88 |
| Leg 102 | 101/102 | Dec 86 | 101/102 | Dec 88 |
| Leg 103 | 103 | Apr 87 | 103 | Dec 88 |
| Leg 104 | 104 | July 87 | 104 | Oct 89 |
| Leg 105 | 105 | Aug 87 | 105 | Oct 89 |
| Leg 106 | 106/109/111 | Feb 88 | 106/109 | Jan 90 |
| Leg 107 | 107 | Oct 87 | 107 | Feb 90 |
| Leg 108 | 108 | Jan 88 | 108 | Dec 89 |
| Leg 109 | 106/109/111 | Feb 88 | 106/109 | Jan 90 |
| Leg 110 | 110 | Apr 88 | 110 | May 90 |
| Leg 111 | 106/109/111 | Feb 88 | 111 | Dec 89 |
| Leg 112 | 112 | Aug 88 | 112 | May 90 |
| Leg 113 | 113 | Sept 88 | 113 | Aug 90 |
| Leg 114 | 114 | Nov 88 | 114 | Feb 91 |
| Leg 115 | 115 | Nov 88 | 115 | Sept 90 |
| Leg 116 | 116 | Jan 89 | 116 | Sept 90 |
| Leg 117 | 117 | June 89 | 117 | Feb 91 |
| Leg 118 | 118 | May 89 | 118 | July 91 |
| Leg 119 | 119 | Sept 89 | 119 | Sept 91 |
| Leg 120 | 120 | Nov 89 | 120 | May 92 |
| Leg 121 | 121 | Nov 89 | 121 | Nov 91 |
| Leg 122 | 122 | Jan 90 | 122 | Dec 91 |
| Leg 123 | 123 | June 90 | 123 | May 92 |
| Leg 124 | 124 | June 90 | 124 | Sept 91 |
| Leg 125 | 125 | Aug 90 | 125 | Apr 92 |
| Leg 126 | 126 | Aug 90 | 126 | Aug 92 |
| Leg 127 | 127 | Sept 90 | 127/128 | Sept 92 |
| Leg 128 | 128 | Sept 90 | 127/128 | Sept 92 |
| Leg 129 | 129 | Dec 90 | 129 | Dec 92 |
| Leg 130 | 130 | Mar 91 | | |
| Leg 131 | 131/132 | June 91 | | |
| Leg 132 | 131/132 | June 91 | | |
| Leg 133 | 133 | Sept 91 | | |
| Leg 134 | 134 | Mar 92 | | |
| Leg 135 | 135 | May 92 | | |
| Legs 136/137 | 136/137 | Jan 92 | | |
| Leg 138 | 138 | Sept 92 | | |
| Leg 139 | 139 | Aug. 92 | | |
| Leg 140 | 140 | Sept. 92 | | |
| Leg 141 | 141 | Dec. 92 | | |

## Scientific Prospectuses and Preliminary Reports

| | Prospectuses | | Prelimin. Rpts. | |
|---|---|---|---|---|
| | Vol. | Pub. | Vol. | Pub. |
| Legs 143/144 | 43/44 | Jan 92 | 43 | Sept 92 |
| Leg 145 | 45 | Apr 92 | 44 | Oct. 92 |
| Leg 146 | 46 | July 92 | 45 | Nov. 92 |
| Leg 147 | 47 | Sept 92 | | |
| Leg 148 | 48 | Oct 92 | | |
| Leg 149 | 49 | Nov 92 | | |

## Engineering Prospectuses and Preliminary Reports

| | Prospectuses | | Prelimin. Rpts. | |
|---|---|---|---|---|
| | Vol. | Pub. | Vol. | Pub. |
| Leg 142 | 3 | Nov 91 | 3 | June 92 |

## Technical Notes

No. 1: Preliminary time estimates for coring operations (Revised Dec 86)

No. 3: Shipboard Scientist's Handbook (Revised 1990)

No. 6: Organic Geochemistry aboard JOIDES Resolution- An Assay (Sept 86)

No. 7: Shipboard Organic Geochemistry on JOIDES Resolution (Sept 86)

No. 8: Handbook for Shipboard Sedimentologists (Aug 88)

No. 9: Deep Sea Drilling Project data file documents (Jan 88)

No. 10: A Guide to ODP Tools for Downhole Measurement (June 88)

No. 11: Introduction to the Ocean Drilling Program (Dec 88)

No. 12: Handbook for Shipboard Paleontologists (June 89)

No. 14: A Guide to Formation Testing using ODP Drillstring Packers (1990)

No. 15: Chemical Methods for Interstitial Water Analysis on JOIDES Resolution

No. 16: Hydrogen Sulfide-High Temperature Drilling Contingency Plan (1991)

## Sample Distribution

The materials from Legs 140 and 141 are now available for sampling by the general scientific community. This means that the twelve-month moratorium on cruise-related sample distribution is complete for Ocean Drilling Program legs 101- 141. Scientists who request samples from these cruises are no longer required to contribute to *ODP Proceedings* volumes, but must publish in the open literature.

All requests received at ODP are entered in the Sample Investigations Database. Anyone may request a search. Some common types of searches include: on-going research from particular holes or legs, current research in a specified field of interest, or publications resulting from DSDP or ODP samples.

*For details contact: Assistant Curator, Chris Mato*
*Phone: (409) 845-4819, Fax: (409) 845-4857*
*Bitnet: CHRIS@TAMODP*
*The Assistant Curator takes an average of 1.5—2 weeks to review each request.*

## Other Items Available

- Brochure: The Data Base Collection of the ODP - Database Information
- Ocean Drilling Program brochure (English, French, Spanish, German or Japanese)
- ODP Sample Distribution Policy
- Micropaleontology Reference Center brochure
- Instructions for Contributors to ODP *Proceedings* (Revised Oct 90)
- ODP Engineering and Drilling Operations (New)
- Multilingual brochure with a synopsis of ODP (English, French, Spanish, German and Japanese)
- ODP Posters (Ship and coring systems posters)
- ODP After Five Years of Field Operations (Reprinted from the 1990 Offshore Technology Conference proceedings)
- Brochure: On Board *JOIDES Resolution*
- Brochure: *Downhole Measurements in the Ocean Drilling Program—A Scientific Legacy*

*Contact: Karen Riedel*
*ODP Public Information Office,*
*Phone: (409) 845-9322; Fax: (409) 845-0876*
*Bitnet: KAREN@TAMODP*

## Data Available from ODP

ODP data currently available include all DSDP data files (Legs 1-96), geological and geophysical data from ODP Legs 101-137, and all DSDP/ODP core photos (Legs 1-137). More data are available as paper and microfilm copies of original data collected aboard the *JOIDES Resolution*. Underway geophysical data are on 35 mm microfilm; all other data are on 16 mm microfilm.

All DSDP data and most ODP data are contained in a computerized database. Data can be searched on almost any specified criteria. Files can be cross-referenced so a data request can include information from multiple files.

Computerized data are currently available on Macintosh- or PC-formatted disks, magnetic tape, hard-copy printouts, or through BITNET or Internet.

Photos of ODP/DSDP cores and seismic lines are available. Seismic lines, whole core and close-up core photos are available in black and white 8x10 prints. Whole core color 35-mm slides are available.

The following are also available: (1) ODP Data Announcements containing information on the database; (2) Data File Documents containing information on specific ODP data files; (3) ODP Technical Note No. 9, "Deep Sea Drilling Project Data File Documents," which includes all DSDP data file documents.

Small requests can be answered quickly, free of charge. If a charge is made, an invoice will be sent and must be paid before the request is processed.

*Contact: Data Librarian Phone: (409) 845-8495, Fax: (409) 845-0876*
*BITNET: DATABASE@TAMODP Internet: database@nelson.tamu.edu*

## Data Available from the National Geophysical Data Center (NGDC)

Computerized data from the DSDP are now available through NGDC in compact-disc read-only-memory (CD-ROM) format. The DSDP CD-ROM data set consists of two CD-ROMs and custom, menu-driven, access software developed by NGDC with support from JOI/USSSP. 500 complimentary copies are being offered to U.S. researchers courtesy of JOI/USSSP.

Volume I of the set contains all sediment/hardrock files, the Cumulative Index, bibliographic information, age and fossil codes dictionaries, an index of DSDP microfilm, sediment chemistry reference tables, and documentation.

Volume II contains all digital logging data from the DSDP. All data are in the Schlumberger Log Information Standard (LIS) format. All DSDP underway and geophysical data are on disc 2, including bathymetry, magnetics, and navigation in the MGD77 format (no data for Legs 1-3; navigation only for Legs 4, 5, 10, 11; SEG-Y single channel seismic data not included). Volume II also contains the DSDP Core Sample Inventory and color/monochrome shaded relief images from several ocean views.

DSDP data files can be provided on magnetic tape according to user specifications (see table ). NGDC can also provide marine geological and geophysical data from other sources. NGDC will provide a complimentary inventory of data available on request; searches are tailored to users' needs.

Information from DSDP Site Summary files and digital DSDP geophysical data are fully searchable and available. In addition, NGDC can provide analog geological and geophysical information from DSDP on microfilm. Two summary publications are available: (1) Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of Deep Sea Drilling Project Vols. 1-44: An Overview, Rept. MGG-1; (2) Lithologic Data from Pacific Ocean Deep Sea Drilling Project Cores, Rept. MGG-4.

Costs are: $90/2-disc CD-ROM data set, $90/magnetic tape, $30/floppy diskette, $20/microfilm reel, $12.80/copy of Rept. MGG-1, $10/copy of Rept. MGG-4. Prepayment is required by check or money order (drawn of a U.S. bank), or by charge to VISA, Mastercard, or American Express. A $10 handling fee is added to all shipments ($20 for foreign shipments), and a $15 fee is added to all rush orders. Data Inventory searches of correlative (non-DSDP) geological/geophysical data available from NGDC are available at no charge.

***For details on available NGDC data contact:***
*Marine Geology and Geophysics Division,*
*NOAA/NGDC, E/GC3, Dept. 334, 325 Broadway, Boulder, CO 80303*
*Tel (303) 497-6339; Fax 303-497-6513) Internet cjm@ngdc1.colorado.edu.*

## Partial Listing of Data Available From NGDC

| Data Available | Data Source | Description | Comments |
|---|---|---|---|
| **1. Physical Properties** | | | |
| G.R.A.P.E. (gamma ray attenuation porosityevaluator) | Shipboard data | Continuous whole-core density measurements. | |
| Grain Size | Shore laboratory | Sand-silt-clay content of a sample. | Legs 1-79 only |
| Index properties: bulk and grain density, water content, and porosity | Shipboard data | Gravimetric and volumetric measurements from a known volume of sediment | |
| Liquid and plastic limits | Shipboard data | Atterberg limits of sediment samples. | |
| Shear-strength measurements | Shipboard data | Sediment shear-strength measurements using motorized and Torvane instruments. | |
| Thermal conductivity | Shipboard data | Thermal conductivity measurements of sediments using a thermal probe. | |
| Velocity measurements | Shipboard data | Compressional and shear-wave velocity measurements. | |
| Downhole measurements | | | |
| Heatflow | Shipboard data | In-situ formation temperature measurements. | |
| Pressure | Shipboard data | In-situ formation and hydrostatic pressure. | |
| **2. Lithologic and Stratigraphic Data** | | | |
| Visual Core Descriptions<br>Sediment/sedimentary rock | Shipboard data | Information about core solor, sedimentary structures disturbance, large minerals and fossils, etc. | |
| Igneous/metamorphic rock | Shipboard data | Information about lithology, texture, structure, mineralogy, alteration, etc. | |
| Smear slide descriptions | Shipboard data | Nature and abundance of sedimentary components. | |
| Thin section descriptions | Shipboard data | Petrographic descriptions of igneous and metamorphic rock. Includes information on mineralogy, texture, alteration, vesicles, etc. | |
| Paleontology | Initial Reports, Proceedings | Abundance, preservation and location for 26 fossil groups. The "dictionary" consists of more than 12,000 fossil names. | |
| Screen | Processed data | Computer-generated lithologic classifications. Basic composition data, average density, and age of layer. | |
| **3. Sediment Chemical Analyses** | | | |
| Carbon-carbonate | Shipboard data, shore laboratory | Percent by weight of the total carbon, organic carbon, and carbonate content of a sample. | Hydrogen percents for Legs 101, 103, 104, 106-108; nitrogen percents for Legs 101, 103, 104, 107, 108. |
| Interstitial water chemistry | Shipboard data, shore laboratory | Quantitative ion, pH, salinity, and alkalinity analyses of interstitial water. | |
| Gas chromatography | Shipboard data | Hydrocarbon levels in core gases. | |
| Rock evaluation | Shipboard data | Hydrocarbon content of a sample. | |
| **4. Igneous and Metamorphic Chemical Analyses** | | | |
| Major element analyses | Shipboard data, shore laboratory | Major element chemical analyses of igneous, metamorphic, and some sedimentary rocks composed of volcanic material. | |
| Minor element analyses | Shipboard data, shore laboratory | Minor element chemical analyses of igneous, metamorphic, and some sedimentary rocks composed of volcanic material. | |
| **5. X-Ray Mineralogy** | | | |
| X-ray mineralogy | Shore laboratory | X-ray diffraction | Legs 1-37 only |
| **6. Paleomagnetics** | | | |
| Paleomagnetics | Shipboard data, shore laboratory | Declination, inclination, and intensity of magnetization for discrete samples and continuous whole core. Includes NRM and alternating field demagnetization. | |
| Susceptibility | Shipboard data | Discrete sample and continuous whole-core measurements. | |
| **7. Underway Geophysics** | | | |
| Bathymetry | Shipboard data | Analog records of water-depth profile | Available on 35-mm continuous microfilm |
| Magnetics | Shipboard data | Analog records and digital data. | Available on 35-mm continuous microfilm |
| Navigation | Shipboard data | Satellite fixes and course and speed changes that have been run through a navigation smoothing program, edited on the basis of reasonable ship and drift velocities, and later merged with the depth and magnetic data. | Available in MGD77 exchange format |
| Seismics | Shipboard data | Analog records of sub-bottom profiles and unprocessed signal on magnetic tape | Available on 35-mm continuous microfilm |
| **8. Special Reference Files** | | | |
| Leg, site, hole summaries | Shipboard data, initial core descriptions | Information on general leg, site, and hole characteristics (i.e. cruise objectives, location, water depth, sediment nature, drilling statistics). | |
| DSDP Guide to Core Material | Initial Reports, prime data files | Summary data for each core: depth of core, general paleontology, sediment type and structures, carbonate, grain size, x-ray, etc. | Legs 1-85 only |
| AGEPROFILE | Initial Reports, hole summaries | Definition of age layers downhole. | |
| COREDEPTH | Shipboard summaries | Depth of each core. Allows determination of precise depth (in m) of a particular sample. | |
| **9. Aids to Research** | | | |
| ODASI | A file of ODP-affiliated scientists and institutions. Can be cross-referenced and is searchable. | | |
| Keyword Index | A computer-searchable bibliography of DSDP- and ODP-related papers and studies in progress. | | |
| Sample Records | Inventory of all shipboard samples taken. | | |
| Site Location Map | DSDP and ODP site positions on a world map of ocean topography. | | |
| Thin Section Inventory | Inventory of all shipboard thin sections taken. | | |

# ODP Editorial Review Boards (ERB)

For each ODP cruise, an editorial board is established to handle review of the manuscripts intended for publication in the "Scientific Results" volume of the *Proceedings of the Ocean Drilling Program.* These boards consist of the Co-Chief Scientists (*) and the ODP Staff Scientist (**) for that cruise, one outside scientist (***) selected by the Manager of ODP Science Operations in consultation with the cruise Co-Chief Scientists, and an ODP Editor. These boards are responsible for obtaining reviews and for making decisions concerning the acceptance or rejection of papers. A chairman for each ERB, usually a Co-Chief Scientist, has been elected since Leg 120. The names of scientists serving on ERBs for Legs 130 through 147 are listed below.

**Leg 130:**
Dr. L. Kroenke* (Univ. Hawaii)
Dr. W. Berger* (Scripps., UCSD)
Dr. T. Janecek** (ODP-TAMU)
Dr. W. Sliter*** (USGS, CA)

**Leg 131:**
Dr. A. Taira* (Univ. Tokyo, Japan)
Dr. I. Hill* (Univ. of Leicester, U.K.), chair
Dr. J. Firth** (ODP-TAMU)
Dr. P. Vrolijk*** (Exxon, Houston, TX)

**Leg 132 (Engineering II):**
Dr. J. Natland* (Univ. Miami)
Dr. F. Rack** (ODP-TAMU)

**Leg 133:**
Dr. P. Davies* (Univ. Sydney, Australia)
Dr. J. McKenzie* (ETH, Zurich, Switzerland)
Dr. A. Palmer-Julson** (ODP-TAMU)
Dr. R. Sarg*** (Midland, TX)

**Leg 134:**
Dr. G. Greene* (USGS, CA)
Dr. J. Collot* (Lab. Geod.,Villefranche, France)
Dr. L. Stokking** (ODP-TAMU)
Dr. T. Crawford*** (U. Tasmania, Australia)

**Leg 135:**
Dr. L. Parson* (Inst. Oceanog. Sci., UK)
Dr. J. Hawkins* (Scripps, UCSD), chair
Dr. J. Allan** (ODP-TAMU)
Dr. P. Weaver*** Sediment. (Inst. Oceanog. Sciences, UK)
Dr. J. Resig*** Paleontology (Univ. Hawaii)

**Leg 136:**
Dr. R. Wilkens* (Univ. Hawaii)
Dr. A. Dziewonski* (Harvard Univ.)
Dr. J. Firth** (ODP-TAMU)
Dr. J. Bender*** (Univ. N. Carolina)

**Leg 137/140:**
Dr. K. Becker* (Univ. Miami)
Dr. J. Erzinger* (Univ. Giessen, Germany), chair
Dr. H. Dick* (WHOI)
Dr. L. Stokking (ODP-TAMU)

**Leg 138:**
Dr. L. Mayer* (Univ. New Brunswick, Canada)
Dr. N. Pisias* (Oregon State Univ.), chair
Dr. T. Janecek** (ODP-TAMU)
Dr. T. van Andel*** (Univ. Cambridge, UK)

**Leg 139:**
Dr. E. Davis* (Pac. Geo. Centre, BC, Canada)
Dr. M. Mottl* (Univ. Hawaii)
Dr. A. Fisher** (ODP-TAMU)
Dr. J. Slack*** (USGS, Reston, VA)

**Leg 140:**
(See Leg 137/140)

**Leg 141:**
Dr. S. Lewis* (USGS, Menlo Park, CA)
Dr. J. Behrmann* (Univ. Giessen, Germany)
Dr. R. Musgrave** (ODP-TAMU)

**Leg 142:**
Dr. M. Storms* (ODP-TAMU)
Dr. R. Batiza* (Univ. Hawaii)
Dr. J. Allen ** (ODP-TAMU)

**Leg 143:**
Dr. W. Sager* (TAMU)
Dr. E. Winterer* (Scripps, UCSD)
Dr. J. Firth** (ODP-TAMU)
Dr. J. Sinton*** (Univ. Hawaii)

**Leg 144:**
Dr. J. Haggerty* (Univ. Tulsa)
Dr. I. Premoli-Silva* (Univ. Milan)
Dr. F. Rack** (ODP-TAMU)

**Leg 145:**
Dr. I. Basov* (Russian Acad. Sci.)
Dr. D. Rea* (Univ. Michigan)
Dr. J. Baldauf** (ODP-TAMU)

**Leg 146:**
Dr. B. Carson* (Lehigh Univ.)
Dr. G. Westbrook* (Univ. Birmingham)
Dr. B. Musgrave** (ODP-TAMU)

**Leg 147:**
Dr. K. Gillis* (WHOI)
Dr. C. Mevél* (Univ. Pierre et Marie Curie)
Dr. J. Allen** (ODP-TAMU)

# ODP Site Survey Databank

Lamont-Doherty Earth Observatory, Palisades, NY 10964

The JOIDES/ODP Data Bank received the following data between August 1, 1992, and November 30, 1992. For additional information on the ODP Data Bank, please contact Dr. Greg Mountain at Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, Internet: Mountain@lamontldeo.columbia.edu

-From G. Moore (U. of Hawaii): MCS line and navigation chart in support of N. Barbados Ridge drilling.

-From A. Camerlenghi (Triest, Italy): Single channel and multichannel seismic reflection profiles, heat flow data and various geophysical maps in support of Mediterranean Ridge drilling.

-From R. Whitmarsh (IOS, UK): Additional *Sonne* and *Lusigal* seismic profiles in support of Iberia Abyssal Plain drill sites.

-From P. Buhl (LDEO): *Conrad* 2911 MCS lines 823 through 828, in the Alboran Sea area.

-From A. Watts (Oxford, UK): Seismic profiles with corresponding navigation, bathymetry, gravity, and GLORIA data in support of Alboran Sea drilling.

-From L. Dorman (U.C., San Diego): SeaBeam map compiled from *Thomas Washington* ENCORE cruise in the Hess Deep area.

-From K. Hinz (Bundesanstalt fur Geowiss. u. Rohstoffe, Germany): *Sonne* MCS profiles SO 75-16, -17, and -19 in support of proposed Iberian Abyssal Plain drilling.

-From G. Moore (U. of Hawaii): Migrated Oregon MCS lines OR-24 and 26.

-From M. Comas (U. of Granada, Spain): MCS and SCS profiles with navigation charts for sites AL-3, -3B, -4, and -4A; and stacking velocity data plus depth-to-basement map in the vicinity of site AL-3, all documenting proposed Alboran Sea Drilling.

-From S. Lallemant (Ecole Normale Superieure, France): Mosaic of the ENSBAR deep-tow, side-scan sonar images; SeaBeam; 3.5 kHz echo sounder profiles; structural sketch map; and temperature data in the proposed Barbados drilling area.

-From H.C. Larsen (The Geological Survey of Greenland, Denmark): MCS data and navigation chart, documenting proposed East Greenland Margin sites.

-From J. Mascle (Universite P.& M. Curie, France): MSC line MT-18, and re-processed lines MT-1, 2, 3, 5, and 7; navigation; SeaBeam; and gravity maps documenting proposed Equatorial Transform Margin sites.

-From G. Boillot (Universite P.& M. Curie, France): MCS line GP 03 and track chart in the area of the Iberian Abyssal Plain drill sites.

-From C. Mevel (Universite P.& M. Curie, France): Video tapes of the Nautile dive in the vicinity of site MK-2 in the MARK area.

-From G. Thompson and S. Humphris (WHOI): A summary video, bottom photographs of the proposed drill site, TOBI image and contours in the TAG area.

-From K. Gillis (WHOI): Gravity profiles, interpreted seismic profiles, SeaBeam, bathymetry and navigation maps from the Hess Deep area.

-From J. Casey (U. of Houston): Magnetics and gravity data maps, ALVIN and Angus track charts, side-scan sonar, ALVIN sampling data and selected photographs in the MK-1 area, and two reprints containing MCS profiles and information on structural relationships in the proposed site locations of the MARK area.

-From D. Kempler (The Hebrew University of Jerusalem, Israel): High-resolution SCS profiles and navigation chart, a section of MCS line MS-54, swath bathymetry, and logs of piston cores from the flanks of the Eratosthenes Seamount, all documenting proposed Mediterranean Ridge drilling.

-From B Vedova (Universita Degli Studi Di Trieste, Italy): Single channel seismic line SS-13 and corresponding track chart documenting proposed Mediterranean Ridge site ESM-4.

-From K. Kastens (LDEO): Location maps and core logs for piston and gravity cores in the vicinity of proposed Mediterranean Ridge sites.

-From John Woodside (Geomarine Centre, The Netherlands): Side scan data across proposed Mediterranean Sapropel site MS-1A, and *R/V Tyro* SCS line 21 and track chart in the vicinity of proposed site MS-7.

-From A. Argnani (Istituto Di Geologia Marina, Italy): Two MCS lines and navigation chart in the vicinity of the proposed Mediterranean Sapropel site MS-4.

-From K Emeis (Geologisch-Palaontologisches Institut Und Museum Der Universitat Kiel, Germany): MCS, SCS, track charts, core logs, and various reprints, all documenting proposed Mediterranean Sapropel drilling.

-From S. Srivastava (AGC, Canada): MCS, 3.5 kHz, and site survey report from *Hudson* 92-022 cruise in support of the Newfoundland Basin drilling. A floppy disk containing navigational, bathymetry, gravity, and magnetic data was also sent.

-From B. Tucholke (WHOI): 3.5 kHz profiles and Sea Beam data documenting proposed NARM Newfoundland Basin drilling.

-From M. Tivey (WHOI): ALVIN dive trackline, bathymetry, magnetic field, and crustal magnetization maps documenting proposed TAG drilling.

-From K. Kastens (LDEO): A report on the preliminary analysis of MCS data from the summit of the Southern Transverse Ridge in support of proposed Vema Fracture Zone drilling.

-From T. Shipley (UT, Austin): *R/V Ewing* MCS lines 204-206, and OBS shot point location charts, in support of proposed Barbados drilling.

-From P. Weaver (Institute of Oceanographic Sciences, UK): 3.5 kHz profiles documenting proposed VICAP MAP drilling.

-From H. Hirschleber (Universitat Hamburg, Germany): Processed *R/V Meteor* MCS lines documenting MAP VICAP proposed drilling.

-From J. Mutter (LDEO): MCS lines and navigation chart documenting proposed MARK drilling.

-From P. Buhl (LDEO): Stacking velocity data in support of Alboran Sea drilling.

-From R. Flood (SUNY, Stoneybrook): and C. Pirmez (LDEO): Single channel seismic profiles with corresponding navigation, SeaBeam bathymetry, GLORIA images and core descriptions in the Amazon Fan area.

-From G. Mountain (LDEO): Hydrosweep, 3.5 kHz record, and navigation chart; gravity, magnetics, and sonobuoy data; core descriptions; all documenting proposed Ceara Rise drilling.

# ODP Wireline and Logging Services

Lamont-Doherty Earth Observatory, Palisades, NY 10964.

## Wireline Log Data Requests and Communications via Electronic Mail

The Borehole Research Group can receive data requests and querieselectronically by two paths.

The first path is through our mailbox on **Omnet**. The address of thie mailbox is **'borehole'**. It is checked every day.

The second path is over the **Internet**. Lamont-Doherty has a T3 class connection to the Internet so data file transfer over the net is a practical option in addition to handling electronic mail. Data transfer via ftp or anonymous ftp can be arranged (this has already been done in several instances). The primary contact points for outsiders are the following:

1. **borehole@lamont.ldeo.columbia.edu** (general purpose account, forwarded to hobart@lamont.ldeo.columbia.edu)
2. **hobart@lamont.ldeo.columbia.edu** (account for the LDEO-BRG computer systems manager, for computer related questions)
3. **chris@lamont.ldeo.columbia.edu** (account for Cristina Broglia, database manager, for database and log analysis-related questions)
4. **filice@lamont.ldeo.columbia.edu** (Frank Filice, for questions related to logging tools, 3rd party tools, and CD-ROM developement/status)

*Note Name Change!*

**Lamont-Dohertry Geological Observatory is now Lamont-Doherty Earth Observatory**

**Wireline Logging Manual (New Edition, Sept 1990).**

To obtain a copy, contact Dave Roach
(Tel: (914) 365-8672 Fax: (914) 365-3182)
Internet: borehole@lamont.ldeo.columbia.edu

# ODP/JOIDES Directory

## Committees

Member (Chair) Alternate Liaison to:

### Executive Committee (EXCOM)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Beiersdorf, H. | | |
| Bogdanov, N. (inactive) | | |
| Briden, J.C. | Summerhayes, C.P. | |
| Caldwell, D.R. | Small, L. | |
| Dorman, C.E. | Gagosian, R.B. | |
| Duce, R.A. | | |
| Eaton, G.P. | Hayes, D.E. | |
| Falvey, D.A. | Riddihough, R. | |
| Frieman, E.A. | Moss, M. | |
| Helsley, C.E. | Taylor, B. | |
| Lancelot, Y. | | |
| Leinen, M. | Schilling, J.G. | |
| Maxwell, A.E. | Davies, T.A. | |
| Nowell, A. | Heath, G.R. | |
| Rosendahl, B.R. | Harrison, C.G.A. | |
| Sartori, R. | Backman, J. | |
| Taira, A. | | |

### Planning Committee (PCOM)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Austin, J.A., Jr. | | TEDCOM |
| Becker, K. | Swart, P.K. | DMP |
| Berger, W.H. | Kastner, M. | SGPP |
| Dick, H.J.B. | Curry, W.B. | SSP |
| Fox, P.J. | | SMP |
| Kidd, R.B. | Pearce, J. A. | SGPP, SSP |
| Larsen, H.C. | McKenzie, J. | TECP |
| Lewis, B. | | EXCOM, PPSP |
| Malpas, J. | Arculus, R. | LITHP |
| Mevel, C. | | LITH |
| Mix, A.C. | | OHP |
| Mutter, J. | Langseth, M. | LITHP |
| Sager, W.W. | | IHP |
| Suyehiro, K. | | DMP |
| Taylor, B. | Moberly, R. | TECP |
| Von Rad, U. | Beiersdorf, H. | SGPP |

### Technology & Engineering Development Committee (TEDCOM)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Fujimoto, H. | Kasahara, J. | |
| Gelfgat, M.Y | Nikolaev, A.V. | |
| Marsh, G.L. | | |
| Marx, C. | Deutsch, U. | |
| Millheim, K. | | |
| Rischmuller, H. | | |
| Schuh, F.J. | | |
| Shanks, F.E. | | |
| Shatto, H.L. | | |
| Skinner, A.C. | Beswick, J. | |
| Sparks, C. | | |
| Summerour, A. | | |
| Svendsen, W.W. | | |
| Texier, M. | Collin, R. | |
| Thorhallsson, S. | | |
| Williams, A. | Christ, R. | |

## Thematic Panels

Member (Chair) Alternate Liaison to:

### Lithosphere Panel (LITHP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Bender, J.F. | | InterRIDGE |
| Bloomer, S.H. | | |
| Cannat, M. | | TECP |
| Caress, D. | | |
| Coffin, M.F. | | |
| Herzig, P.M. | | |
| Humphris, S.E. | | |
| Kempton, P. | Baker, P.E. | |
| Kristoffersen, Y. | Banda, E. | TEDCOM |
| Ludden, J. | | |
| Moos, D. | | DMP |
| Tarduno, J. | | OHP |
| Tatsumi, Y. | | |
| Wilson, D.S. | | |
| Zierenberg, R.A. | | SGPP |

### Ocean History Panel (OHP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Backman, J. | Weissert, H. | |
| Barron, J.A. | | |
| Blake, G.H. | | |
| Carter, R.M. | Pedersen, T.F. | |
| Channell, J.E.T. | | |
| Delaney, M.L. | | |
| Herbert, T.D. | | |
| Hine, A.C. | | |
| Karpoff, A. M. | Leckie, R.M. | |
| Okada, H. | Saito, T. | |
| Pratt, L.M. | | |
| Raymo, M.E. | | |
| Weaver, P.P.E. | Kemp, A.E.S. | |
| Wefer, G. | Gersonde, R. | |
| Zachos, J.C. | | SGPP |

### Sedimentary & Geochemical Processes Panel (SGPP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Alt, J.C. | | LITHP,TEDCOM |
| Bahr, J.M. | | DMP |
| Boulegue, J. | | |
| Elderfield, H. | | |
| Emeis, K.C. | | |
| Farrimond, P. | | |
| Garrison, R. | | |
| Greenlee, S.M. | | |
| Hiscott, R.N. | Chivas, A. | |
| McKenzie, J.A. | Buchardt, B. | |
| Paull, C.K. | | |
| Sayles, F.L. | | |
| Soh, W. | Yagishita, K. | TECP |
| Surlyk, F. | | |
| Swart, P.K. | | OHP |
| Underwood, M.B. | | |

## Tectonics Panel (TECP)

| | | |
|---|---|---|
| Agar, S.M. | | |
| Bourgois, J. | | |
| Cande, S.C. | | |
| Doglioni, C. | Skogseid, J. | |
| Karson, J.A. | | LITHP |
| Lagabrielle, Y. | | |
| Moore, G.F. | | |
| Moores, E.M. | | |
| Ogawa, Y. | Tamaki, K. | |
| Robertson, A.H.F. | Parson, L.M. | SGPP |
| Steckler, M. | | |
| Symonds, P. | | |
| Ten Brink, U. | | |
| Von Huene, R. | | |
| Zoback, M.D. | | |

# Service Panels

Member (Chair) Alternate Liaison to:

## Downhole Measurements Panel (DMP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Desbrandes, R. | | |
| Draxler, J.K. | Villinger, H. | |
| Dubuisson, G. | Pascal, G. | |
| Fryer, G.J. | | |
| Gieskes, J.M. | | SMP |
| Hickman, S.H. | | |
| Hutchinson, M.W. | | |
| Lysne, P. | | |
| Morin, R.H. | | |
| Pedersen, L.B. | Woodside, J. | |
| Salisch, H. | | |
| Von Damm, K. | | |
| Williams, D.M. | | |
| Lovell, M.A. | Worthington, P. | TEDCOM |
| Yamano, M. | Kinoshita, H. | |

## Information Handling Panel (IHP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Fryer, P. | | |
| Gibson, I.L. | Jenkins, C. | |
| Huber, B.T. | | OHP |
| Loughridge, M.S. | | |
| Maillard, C. | | |
| Richards, A. | Mikkelsen, N. | |
| Riedel, W.R. | | |
| Saito, T. | | |
| Spall, H. | | |
| Spiess, V. | Bruckmann, W. | |
| Wadge, G. | Kay, R.L.F. | |
| Watney, L. | | |
| Wilkens, R. | | |

## Site Survey Panel (SSP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Camerlenghi, A. | Lykke-Andersen, H. | |
| Farre, J.A. | | |
| Hinz, K. | Weigel, W. | |
| Hirata, N. | | |
| Kastens, K.A. | | |
| Mountain, G. | | |
| Scrutton, R | | |
| Sibuet, J - C. | Renard, V. | |
| Srivastava, S.P. | | |
| Trehu, A.M. | | |
| Von Herzen, R.P. | | |

## Pollution Prevention and Safety Panel (PPSP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Aoki, Y. | | |
| Ball, M.M. | | SSP |
| Claypool, G.E. | | |
| Delas, C. | | |
| Fortier, M. | Powell, T. | |
| Gamsakhurdia, G.R. | | |
| Garrison, L. | | |
| Green, A.R. | | |
| Horn, D. | | |
| Hovland, M. | Doyle, C. | |
| Katz, B. | | |
| MacKenzie, D.B. | | |
| Purdy, E.G. | | |

## Shipboard Measurements Panel (SMP)

| Member (Chair) | Alternate | Liaison to: |
|---|---|---|
| Brereton, N.R. | | |
| Chaney, R.C. | | |
| King, J.W. | | |
| Moran, K. | Stagg, H. | SSP, OHP |
| Mottl, M.J. | | |
| Rhodes, J.M. | | |
| Thomas, E. | | |
| Tokuyama, H. | | |
| Valet, J.-P. | | |
| Weis, D. | Egeberg, P.K. | |

# Working Groups

Member (Chair)

## Shallow Water Drilling Working Group (SWDWG)

- Ball, M.
- Francis, T. J.
- Garrison, L.
- Kastens, K.
- Leach, C.
- Lewis, B.

# ODP Subcontractors

Member Liaison to:

## Science Operator

| Member | Liaison to: |
|---|---|
| Allan, J. | SMP |
| Baldauf, J. | |
| Blum, P. | SSP |
| Clift, P. | LITHP |
| Coyne, J. | IHP |
| Firth, J. | OHP |
| Fisher, A. | DMP |
| Francis, T.J.G. | PCOM, PPSP |
| Grout, R. | |
| Klaus, A. | DMP |
| Mefferd, M. | |
| Merrill, R.B. | IHP |
| Mills, B. | SMP |
| Musgrave, R. | TECP |
| Rabinowitz, Ph. | EXCOM |
| Reudelheuber, D. | |
| Stokking, L. | SGPP |
| Storms, M. | TEDCOM |

## Wireline Logging Services

| | |
|---|---|
| Goldberg, D. | EXCOM, PCOM |
| Hobart, M. | IHP |

## Site Survey Data Bank (SSDB)

| | |
|---|---|
| Brenner, C. | SSP, PPSP |
| Mountain, G. | SSP, PPSP |

## JOIDES Office

| | |
|---|---|
| Clark, R.S. | |
| Collins, W. | SSP |
| Lewis, B. | PCOM Chair |
| Schmitt, K. | TECP |

# Other Representatives

| Member (Chair) | Liaison to: |
|---|---|

## Budget Committee (BCOM)

Austin, J.A., Jr.
Briden, J.C.
Lancelot, Y.
Lewis, B.
Rosendahl, B.

## ODP Council (ODPC)

| | |
|---|---|
| Asai, T., | Japan |
| Babcock, K. | Can/Aus |
| Bjornsson, A. | Iceland |
| *Bogdanov, N.,* | *Russia (inactive)* |
| Brandt, B. | Sweden |
| Madelain, F. | France |
| Egelund, S. | Denmark |
| Fratta, M. | ESF |
| Heinrichs, D. | US |
| Hertogen, J. | Belgium |
| Ignatius, H. | Finland |
| Knill, J.L. | UK |
| Lalechos, N., | Greece |
| Maronde, D., | Germany |
| Pak, N.K., | Turkey |
| Perez-Estaun, A., | Spain |
| Rutland, R., | Can/Aus |
| Sartori, R., | Italy |
| Stel, J.H., | Netherlands |
| Weber, J.-B., | Switzerland |
| Westgaard, L., | Norway |

## National Science Foundation (NSF)

| | |
|---|---|
| Ambos, E. | |
| Dauphin, P. | PCOM |
| Heinrichs, D. | EXCOM |
| Malfait, B. | PCOM, SSP |

## Joint Oceanographic Institutions, Inc. (JOI)

| | |
|---|---|
| Baker, D.J. | EXCOM |
| Burns, A. | |
| Kappel, E. | |
| Pyle, T. | PCOM, SSP |

# Member Country Administrative Offices

## European Consortium for Ocean Drilling (ECOD)

### ESCO Secretariat

Dr. Hans-Christian Larsen, Chairman

ECOD is the acronym for the European Consortium for Ocean Drilling. It consists of twelve small European Countries (Belgium, Denmark, Finland, Greece, Holland, Iceland, Italy, Norway, Spain, Sweden, Switzerland, Turkey) and has been constituted under the umbrella of the European Science Foundation (ESF).

The Scientific Office of ECOD is called the ESCO Secretariat, ESCO is the acronym for the ESF Scientific Committee for the ODP.

Address: Geological Survey of Denmark (DGU)
Thoravej 8
DK-2400 Copenhagen NV
Denmark

Telephone: 45-31-10 66 00
Fax: 45-31-19 66 68
Telex: 19999 DANGEO DK

Administrative Officer: Dr. Naja Mikkelsen, Science Coordinator

### ESF

Dr. Michele Fratta, EMCO Secretary

Address: European Science Foundation
1 Quai Lezay-Marnesia
F-67080 Strasbourg Cedex

Telephone: 33 88 76 71 14
Fax: 33 88 37 05 32

Administrative Officer: Ms. M.-Aimee. Comte

## Japan

### ODP Japan Office

Dr. Asahiko Taira, Director

Address: Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakanoku
Tokyo,164, Japan

Telephone: 81-3-3376-1251, ex. 388
Fax: 81-3-3375-6716
Telex: 25607/ORIUT J
E-Mail: taira@tansei.cc.u-tokyo.ac.jp (Internet)

Administrative Officer: Ms. Chizuru Kinoshita

The primary task of the ODP Japan Office is to distribute and handle information, to coordinate domestic ODP activities, to arrange traveling and to support public relations. The office publishes the *Japan ODP Newsletter* several times a year and hosts several workshops an symposiums a year.

## Germany

### German ODP Office

Address: Bundesanstalt f. Geoswiss. und Rohstoffe
Stilleweg 2, Postfach 510153
D-3000 Hannover 51
Germany

Telephone: 49 (0511) 643-2795
Fax: 49 (0511) 643-2304
E-Mail: vonrad@gate1.bgr.dbp.de (Internet)

Administrative Officer: Dr. Ursula Roehl

| JOIDES Panel | Member |
|---|---|
| EXCOM | Lancelot, Y. |
| PCOM | Mevel, C. |
| TECP | Lagabrielle, Y. |
| LITHP | Cannat, M. |
| SGPP | Boulegue, J. |
| OHP | Karpoff, A. |
| DMP | Dubuisson, G. |
| SSP | Sibuet, J. |
| IHP | Maillard, C. |
| SMP | Valet, J. |

## Canada/Australia Consortium

### Canadian ODP Secretariat

Dr. John Malpas, Director

Address: Memorial University
Centre for Earth Resources Research
St. John's, Newfoundland A1B 3X5
Canada

Telephone: 1 (709) 737-4708
Fax: 1 (709) 737-4702
E-Mail: ODP@kean@ucs.mun.ca (Internet)
E-Mail J. Malpas (Omnet)

Administrative Officer: Mr. Stuart Deveau

### Australian ODP Secretariat

Dr. Richard Arculus, Director

Address: Department of Geology and Geophysics
University of New England
Armidale, NSW 2351
Australia

Telephone: (067) 73 2860, international (61 67) 73 2860
Fax: (067) 71 2898, international (61 67) 71 2898
E-Mail: rarculus@metz.une.edu.au

Administrative Officer: Dr. Ian Metcalfe

## France

### IFREMER

Dr. Francois Madelain, Director

Address: Technopolis 40
155 Rue Jean-Jacques Rousseau
92138 Issy-les-Moulineaux Cedix
France

Telephone: (1) 46 48 21 00
Telex: 631 912
Fax: (1) 46 48 22 24 (DRO)
E-Mail: IFREMER.ODP (Omnet)
E-Mail: bernadette.metayer@ifremer.fr (Internet).

Administrative Officer: Ms. Bernadette Metayer

## United Kingdom

### UK ODP Office, Directorate Secretariat, Natural Environment Research Council

Dr. James Briden, Director

Address: Polaris House
North Star Avenue
Swindon SN2 IEU
United Kingdom
Telephone Swindon (0793) 411500
Telex 444293 ENVRE G
Fax: (0793) 411584 GTN 1434
E-Mail: RLFK@mail.nsw.ac.uk (Internet)
NERC.Science.HQ (Omnet)

Administrative Officer: Dr. Lin Kay

The UK ODP Office manages the national UK ODP Science Programme (ODPSP) and coordinates information exchange between the international elements of ODP (JOI, JOIDES) and the UK community.

| JOIDES Panel | Member | Alternate |
|---|---|---|
| EXCOM | Briden, J. | Summerhayes, C. |
| PCOM | Kidd, R. B. | Pearce, J. A. |
| LITHP | Kempton, P. D. | Baker, P. E. |
| OHP | Weaver, P. P. E. | Kemp, A. E. S. |
| SGPP | Farrimond, P. A. | Elderfield, H. |
| TECP | Robertson, A. H. F. | Parson, L. M. |
| TEDCOM | Skinner, A. C. | Beswick, J. |
| SSP | Scrutton, R. A. | |
| DMP | Lovell, M. A. | Worthington, P. |
| SMP | Brereton, N. R. | |
| SSPS | Purdy, E. | |
| IHP | Wadge, G. | Kay, R. L. F. |

JOIDES panel members and the following constitute the UK ODP Science Committee:

| | |
|---|---|
| ODPSPSteering Committee Chair | Hamilton, N. |
| Council Independent | Liss, P. S. |
| ESC member | Curtis, C. D. |

***UK ODP Newsletter***

Produced and distributed by Natural Environment Research Council. For copies, or to be placed on the distribution list contact:

Ms. L. Brewerton
Earth Sciences Directorate, NERC
Polaris House
North Star Avenue
Swindon SN2 1EU

# Alphabetical Directory

Country Codes used in this directory:

| | |
|---|---|
| AUS | Australia |
| B | Belgium |
| CAN | Canada |
| CH | Switzerland |
| DK | Denmark |
| E | Spain |
| F | France |
| G | Germany |
| GR | Greece |
| I | Italy |
| IS | Iceland |
| J | Japan |
| N | Norway |
| NL | Netherlands |
| R | Russia |
| S | Sweden |
| SF | Finland |
| TR | Turkey |
| UK | United Kingdom |
| US | United States of America |

Note that all the ODP/JOIDES mail to Russian members should go to the Office of N. A. Bogdanov.

**Agar, Susan M.**
Dept. of Geological Sciences
Northwestern University
Evanston, IL 60201 (US)
Tel: 1 (708) 491-3238
Fax: 1 (708) 491-8060
Internet: postmaster@earth.nwu.edu

**Allan, Jamie**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-0506
Fax: 1 (409) 845-0876

**Alt, Jeffrey C.**
Department of Geological Sciences
University of Michigan
1006 C.C. Little Building
Ann Arbor, MI 48109-1063 (US)
Tel: 1 (313) 764-8380
Fax: 1 (313) 763-4690

**Aoki, Yutaka**
Akasaka Twin Tower Bldg., East 3F
JAPEX Geoscience Institute, Inc.
2-17-22 Akasaka, Minato-ku
Tokyo 107 (J)
Tel: 81 (3) 3584-0511
Fax: 81 (3) 3584-0563
Omnet: ORI.Tokyo

**Arculus, Richard J.**
Department of Geology and Geophysics
University of New England
Armidale, NSW 2351 (AUS)
Tel: 61 (67) 732-860
Fax: 61 (67) 712-898
Internet: rarculus@metz.une.edu.au

**Asai, Tomio**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251 X201
Fax: 81 (3) 3375-6716
Omnet: ORI.Tokyo

**Austin, James A.**
Institute for Geophysics
University of Texas at Austin
8701 N Mopac Expressway
Austin, TX 78759-8397 (US)
Tel: 1 (512) 471-0450
Fax: 1 (512) 471-0999
Internet: jamie@utig.ig.utexas.edu

**Babcock, Ken**
Energy, Mines & Resources
Geological Survey of Canada
580 Booth Street, 20th Floor
Ottawa, Ontario K1A 0E4 (CAN)
Tel: 1 (613) 992-5910
Fax: 1 (613) 995-3082

**Backman, J.**
Deep Sea Geology Division
Stockholm University
S-10691 Stockholm (S)
Tel: 46 (8) 164-720
Fax: 46 (8) 345-808
Internet: backman@geologi.su.se

**Bahr, Jean M.**
Department of Geology and Geophysics
University of Wisconsin-Madison
Weeks Hall, 1215 W Dayton St.
Madison, Wisconsin 53706 (US)
Tel: 1 (608) 262-5513
Fax: 1 (608) 262-0693
Internet: geodept@geology.wisc.edu

**Baker, D. James**
Joint Oceanographic Institutions Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102 (US)
Tel: 1 (202) 232-3900
Fax: 1 (202) 232-8203
Internet: joi@iris.edu

**Baldauf, Jack**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-9297
Fax: 1 (409) 845-0876
Internet: Baldauf@NELSON.TAMU.EDU

**Ball, Mahlon M.**
Petroleum Geology Branch
U.S. Geological Survey
Box 25046, MS-940, Denver Fedl. C.
Denver, CO 80225 (US)
Tel: 1 (303) 236-5784
Fax: 1 (303) 236-8822

**Banda, Enrique**
Consejo Superior de Invest. Cientificas
Instutut de Geologia-Jauma Almera
Marti i Franquez s/n
E-08028 Barcelona (E)
Tel: 34 (3) 330-2716
Fax: 34 (3) 411-0012

**Barron, John A.**
U.S. Geological Survey
345 Middlefield Road, MS-915
Menlo Park, CA 94025 (US)
Tel: 1 (415) 329-4971
Fax: 1 (415) 329-5110
Internet: jbarron@isdmnl.wr.usgs.gov

**Becker, Keir**
Rosenstiel School of Marine & Atm. Sci.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 1 (305) 361-4661
Fax: 1 (305) 361-4632
Omnet: K.Becker

**Beiersdorf, Helmut**
Bundesanstalt fur Geowiss. u. Rohstoffe
Stilleweg 2, Postfach 510153
D-3000 Hannover 51 (G)
Tel: 49 (511) 643-2412
Fax: 49 (511) 643-2304
Internet: Beiersdorf@gate1.bgr.dbp.de

**Bender, John F.**
Dept. of Geography and Earth Sciences
University of North Carolina, Charlotte
Charlotte, NC 28223 (US)
Tel: 1 (704) 597-2293
Fax: 1 (704) 547-2767

**Berger, Wolfgang H.**
Scripps Institution of Oceanography
Univ. of California, San Diego, A-008
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-2750
Fax: 1 (619) 534-0784

**Beswick, John**
Kenting Drilling plc
Castle Donnington
Derby DE7 2NP (UK)
Tel: 44 (332) 850-060
Fax: 44 (332) 850-553

**Bjornsson, Axel**
Icelandic Council of Science
Barugata 3
101 Reykjavik (IS)
Tel: 354-1-10233
Fax: 354-1-21331

**Blake, Gregg H.**
Unocal
P.O. Box 4551
Houston, TX 77210-4551 (US)

**Blanchard, James**
Enterprise Oil Plc.
Grand Building, Trafalgar Square
London WC2N 5AE (UK)
Tel: 44 (71) 930-1212
Fax: 44 (71) 930-0321

**Bloomer, S.H.**
Department of Geology
Boston University
675 Commonwealth Avenue
Boston, Massachusetts 02215 (US)
Tel: 1 (617) 353-2532
Fax: 1 (617) 353-3290

**Blum, Peter**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-0506
Fax: 1 (409) 845-0876
Internet: Blum@NELSON.TAMU.EDU

**Bogdanov, Nikita (Inactive)**
Institute of Lithosphere
Staromonetny per., 22
Moscow 109180 (Russia)
Tel: 7 (095) 233-5588/230-7771
Fax: 7 (095) 233-5590

**Boulegue, Jacques**
Geochimie et Metallogenie
Universite Pierre et Marie Curie
4 Place Jussieu, Bo te 124
F-75252 Paris Cedex 05 (F)
Tel: 33 (1) 4427-5006
Fax: 33 (1) 4427-5141

**Brandt, Björn**
Swedish Natural Science Res. Council
P.O. Box 6711
S-11385 Stockholm (S)
Tel: 46 (8) 610-0700
Fax: 46 (8) 610-0740

**Brenner, Carl**
JOIDES/ODP Site Survey Data Bank
Lamont-Doherty Geological Observatory
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x542
Fax: 1 (914) 365-2312
Internet: odp@lamont.ldgo.columbia.edu

**Brereton, Robin**
Regional Geophysics Group
British Geological Survey
Kingsley Dunham Centre, Keyworth
Nottingham NG12 5GG (UK)
Tel: 44 (602) 363-351
Fax: 44 (602) 363-145

**Briden, James C.**
Director, Earth Sciences
Natural Environment Research Council
Polaris House, North Star Ave.
Swindon SN2 1EU (UK)
Tel: 44 (793) 411-730
Fax: 44 (793) 411-584
Omnet: NERC.Science.HQ

**Brückmann, Warner**
GEOMAR
Research Center for Marine Geoscience
Wischhofstrasse 1-3, Geb. 4
D-2300 Kiel 14 (G)
Tel: 49 (0431) 720-2148
Fax: 49 (0431) 725-650

**Bryan, Wilfred B.**
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
McLean Laboratory
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2587
Fax: 1 (508) 457-2187

**Buchardt, Bjørn**
Department of Geology
University of Copenhagen
Oster Voldagde 10
DK-1350 Copenhagen NV (DK)
Tel: 45 (33) 112-232
Fax: 45 (33) 114-637

**Burns, Allison**
Joint Oceanographic Institutions Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102 (US)
Tel: 1 (202) 232-3900
Fax: 1 (202) 232-8203
Internet: joi@iris.edu

**Caillau, Etienne**
Technopolis 40
IFREMER
155 rue Jean-Jacques Rousseau
F-92138 Issy-les-Moulineaux Cedex (F)
Tel: 33 (1) 4648-2100
Fax: 33 (1) 4648-2224
Internet: bernadette.metayer@ifremer.fr

**Caldwell, Douglas R.**
College of Oceanography
Oregon State University
Corvallis, OR 97331 (US)
Tel: 1 (503) 737-3504
Fax: 1 (503) 737-2400
Omnet: D.Caldwell

**Camerlenghi, Angelo**
Osservatorio Geofisico Sperimentale
P.O.Box 2011 (Opicina)
I-34016 Trieste (I)
Tel: 39 (40) 214-0255
Fax: 39 (40) 327-307
Bitnet: acam@its.ogs.bitnet

**Cande, Steven C.**
Geol. Res. Dev. A-0215
Scripps Inst. Oceanography
Univ. of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093-0215 (US)
Tel. 1 (619) 534-1552
Fax: 1 (619) 534-0784

**Cannat, Mathilde**
Laboratoire de Petrologie
Universite P. et M. Curie, URA 736
4 place Jussieu, tour 26, 3eme
F-75252 Paris cedex 05 (F)
Tel: 33 (1) 44-27-51-92
Fax: 33 (1) 44-27-39-11
Internet: MAC@ccr.jussieu.fr

**Caress, Dave**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914)359-2900
Fax: 1 (914)365-3181

**Carter, Robert M.**
Department of Geology
James Cook University
Townsville, QLD 4811 (AUS)
Tel: 61 (77) 814-536
Fax: 61 (77) 251-501
Internet: glkgh@marlin.jcu.edu.au

**Chaney, Ronald C.**
Dept. of Environmental Resources Eng.
Humboldt State University
Arcata, CA 95521 (US)
Tel: (707) 826-3619
Fax: (707) 826-3616

**Channell, James E.T.**
Department of Geology
University of Florida
1112 Turlington Hall
Gainesville, FL 32611 (US)
Tel: 1 (904) 392-3658
Fax: 1 (904) 392-9294

**Chayes, Dale**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900
Fax: 1 (914) 359-2931

**Cheminée, Martine**
Universite Pierre et Marie Curie
Tour 26, 4eme etage
Bo te 118
4 place Jussieu
75252 Paris Cedex 05
Tel: 33 (1) 44 27 51 55
Fax: 33 (1) 44 27 38 93

**Chivas, Allan**
Research School of Earth Sciences
The Australian National University
GPO Box 4
Canberra, ACT 2601 (AUS)
Tel: 61 (6) 249-3406
Fax: 61 (6) 249-0738

**Clark, R. Samuel**
JOIDES Planning Office
University of Washington (HA-30)
3731 University Way N.E.
Seattle, WA 98195 (US)
Tel: 1 (206) 543-2203
Fax: 1 (206) 685-7652
Internet: joides@ocean.washington.edu

**Claypool, George E.**
Mobil E&P Services Inc.
P.O. Box 650232
Dallas, TX 75265-0232 (US)
Tel: 1 (214) 951-2837
Fax: 1 (214) 951-2265

**Coffin, Millard F.**
Institute for Geophysics
University of Texas at Austin
8701 N Mopac Expressway
Austin, TX 78759-8397 (US)
Tel: 1 (512) 471-0429
Fax: 1 (512) 471-8844
Internet: coffin@ig.utexas.edu

**Collin, Robert**
Elf-Aquitaine (Production)
Tour Elf, Cedex 45
92078 Paris La Defense (F)
Tel: 33 (1) 4744-4546

**Collins, William**
JOIDES Planning Office
University of Washington (HA-30)
3731 University Way N.E.
Seattle, WA 98195 (US)
Tel: 1 (206) 543-2203
Fax: 1 (206) 685-7652
Internet: joides@ocean.washington.edu

**Comte, Marie-Aimée**
European Consortium for Ocean Drilling
European Science Foundation
1 quai Lezay-Marnesia
F-67080 Strasbourg Cedex (F)
Tel: 33 (88) 76-71-14
Fax: 33 (88) 37-05-32

**Courtney, Bob**
Dept. of Oceanography
Dalhousie University
Halifax, NS B3H 4J1 (CAN)
Tel: (902) 494-3557
Fax: (902) 494-3877

**Coyne, John**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-1927
Fax: 1 (409) 845-0876
Internet: John_Coyne@NELSON.TAMU.EDU

**Curry, William B.**
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2591
Fax: 1 (508) 457-2187
Internet: w.curry@whoi.edu

**Dauphin, Paul**
National Science Foundation
1800 G Street, NW, Room 609
Washington, DC 20550 (US)
Tel: 1 (202) 357-9849
Fax: 1 (202) 357-7621
Internet: jdauphin.nsf.gov

**Davies, Thomas A.**
Institute for Geophysics
University of Texas
8701 N Mopac Expressway
Austin, TX 78759-8397 (US)
Tel: 1 (512) 471-0409
Fax: 1 (512) 471-8844

**Delaney, Margaret L.**
Institute of Marine Sciences
University of California, Santa Cruz
Santa Cruz, CA 95064 (US)
Tel: 1 (408) 459-4736
Fax: 1 (408) 459-4882
Internet: Delaney@cats.ucsc.edu

**Delas, Claude**
Total/CFP
Cedex 47
92069 Paris La Defense (F)
Tel: 33 (1) 4291-3704
Fax: 33 (1) 4291-4052

**Desbrandes, Robert**
Dept. of Petroleum Engineering
Louisiana State University
Baton Rouge, LA 70803-6417 (US)
Tel: (504) 388-5215
Fax: (504) 388-5990

**Deutsch, Ulrich**
Inst. Tiefbohrkunde u. Erdolgewinnung
TU Clausthal
Agricolastrasse 10
D-3392 Clausthal-Zellerfeld (G)
Tel: 49 (5323) 722-450

**Deveau, Stuart**
Canadian ODP Secretariat
Memorial University
Centre for Earth Resources Research
St. John's, Newfoundland A1B 3X5 (CAN)
Tel: 1 (709) 737-4708
Fax: 1 (709) 737-4702
Internet: ODP@kean.ucs.mun.ca

**Dick, Henry J.B.**
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000
Fax: 1 (508) 457-2187
Omnet: WHOI.Geol.Geoph

**Doglioni, Carlo**
Dipartimento Geologia
Campus Universitario
V. Orabona, 4
70100 Bari (I)
Tel: 39 80 242 627
Fax: 39 80 242 625

**Dorman, Craig E.**
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2500
Fax: 1 (508) 457-2190
Omnet: C.Dorman.WHOI

**Doyle, Claire**
Maersk Olie og Gas A/S
Esplanaden 50
DK-1263 Copenhagen (DK)
Tel: 45 (33) 11-46-76
Fax: 45 (33) 32-23-25

**Draxler, Johann K.**
Niedersachs. Landesamt f. Bodenforschung
Postfach 510153
D-3000 Hannover 51 (G)
Tel: 49 (511) 643-2673
Fax: 49 (511) 643-2304

**Dubuisson, Gilles**
Departement de Geologie
Ecole Normale Superieure
24, rue Lhomond
75231 Paris Cedex 05 (F)
Tel: 33 1 44 32 22 94
Fax: 33 1 44 32 20 00

**Duce, Robert A.**
Coll. Geosciences & Maritime Studies
Texas A&M University
College Station, TX 77843 (US)
Tel: 1 (409) 845-3651
Fax: 1 (409) 845-0056

**Eaton, Gordon P.**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900
Fax: 1 (914) 359-2931

**Eberli, Gregor P.**
Rosenstiel School of Marine & Atm. Sci.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 1 (305) 361-4678
Fax: 1 (305) 361-4632

**Egeberg, P.K.**
Agder Distriktshoyskole
P.O. Box 607
N-4601 Kristiansand (N)
Tel: 47 (42) 79500
Fax: 47 (42) 79501

**Egelund, Susanne**
Department of Research
Natural Science Research Council
H.C. Andersons Boulevard 40
DK-1553 Copenhagen V (DK)
Tel: 45 (33) 114-300
Fax: 45 (33) 323-501

**Elderfield, Harry**
Earth Sciences Department
Cambridge University, Bullard Laboratories
Madingley Road
Cambridge CB3 0EZ (UK)
Tel: 44 (223) 333-406
Fax: 44 (223) 333-450
Omnet: H.Elderfield

**Emeis, Kay-Christian**
Geologisch-Palaontolog. Inst. und Museum
Olshausenstr. 40
D-2300 Kiel (G)
Tel: 49 (431) 880-2085
Fax: 49 (431) 880-4376

**Falvey, David A.**
Associate Director
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601 (AUS)
Tel: 61 (6) 249-9111
Fax: 61 (6) 257-4614

**Farre, John A.**
EXXON Production and Research
P.O. BOX 2189
Houston, TX 77252-2189 (US)
Tel: 1 (713) 966-6149
Fax: 1 (713) 966-3174

**Farrimond, Paul**
Organic Geochem., Dept. of Geology
University of Newcastle Upon Tyne
Drummond Building
Newcastle Upon Tyne NE1 7RU (UK)
Tel: 44 (431) 720-0249
Fax: 44 (431) 725-391

**Firth, John**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845 (US)
Tel: (409) 845-0507
Fax: (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Fisher, Andrew**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-2197
Fax: 1 (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Fortier, Mimi**
Dept. of Indian and Northern Affairs
Northern Oil and Gas Directorate
10 Wellington Street, 6th Floor
Ottawa, Ontario K1A 0H4 (CAN)
Tel: 1 (819) 953-8722
Fax: 1 (819) 953-5828

**Foster, Jack**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-9323
Fax: 1 (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Fox, P. Jeff**
School of Oceanography
University of Rhode Island
Kingston, RI 02881 (US)
Tel: 1 (401) 792-6222
Fax: 1 (401) 792-6160
Internet: jfox@gsosunl.gso.uri.edu

**Francis, Tim J.G.**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-8480
Fax: 1 (409) 845-1026
Internet: francis@nelson.tamu.edu

**Fratta, Michele**
European Science Foundation
1 Quai Lezay-Marnesia
F-67080 Strasbourg (F)
Tel: 33 (88) 76-71-14
Fax: 33 (88) 37-05-32

**Fricker, Peter**
Swiss National Science Foundation
Postfach 2338
CH-3001 Bern (CH)
Tel: 41 (31) 27-22-22
Fax: 41 (31) 23-30-09

**Frieman, Edward A.**
SIO, Director's Office, 0210
Univ. of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093-0210 (US)
Tel: 1 (619) 524-2826
Fax: 1 (619) 453-0167
Omnet: E.Frieman

**Fryer, Gerard J.**
School of Ocean & Earth Sci. & Tech.
University of Hawaii
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-7875
Fax: 1 (808) 956-2538
Internet: g.fryer@soest.hawaii.edu

**Fryer, Patricia**
Department of Geology and Geophysics
University of Hawaii at Manoa
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-3146
Fax: 1 (808) 956-6322

**Fujimoto, Hiromi**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251
Fax: 81 (3) 3375-6716
Omnet: ORI.Tokyo

**Gagosian, Robert B.**
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000
Fax: 1 (508) 548-1400 X6013

**Garrison, Lou**
8503 Amethyst Court
College Station, TX 77845 (US)
Tel: 1 (409) 764-7473 or 845-4
Omnet: Ocean.Drilling.TAMU

**Garrison, Robert**
Earth Sciences Board
University of California at Santa Cruz
Santa Cruz, CA 95064 (US)
Tel: 1 (408) 459-2114
Fax: 1 (408) 459-3074

**Gersonde, Rainer**
Alfred-Wegener-Institut fur
Polar- und Meeresforschung
Postfach 120161
D-2850 Bremerhaven (G)
Tel: 49 (471) 483-1203

**Gibson, Ian L.**
Department of Earth Sciences
University of Waterloo
Waterloo, Ontario N2L 3G1 (CAN)
Tel: 1 (519) 885-1211 x2054
Fax: 1 (519) 746-7484
Internet: guelph2@watdcs.uwaterloo.ca

**Gieskes, Joris M.**
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-4257
Fax: 1 (619) 534-0784

**Goldberg, David**
Lamont-Doherty Geological Observatory
Director, Borehole Research Group
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900
Fax: 1 (914) 365-3182
Internet: goldberg@lamont.ldeo.columbia.

**Golovchenko, Xenia**
Borehole Research Group
Lamont-Doherty Geological Observatory
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x336
Fax: 1 (914) 365-3182
Internet: brg-users@lamont.ldeo.columbia.edu

**Gordon, Richard**
Department of Geological Sciences
Northwestern University
Evanston, IL 60201 (US)

**Graham, Dennis**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-8482
Fax: 1 (409) 845-4857
Omnet: Ocean.Drilling.TAMU

**Green, Arthur R.**
Exxon Exploration Company
P.O. Box 4788
Houston, TX 77210-4778 (US)
Tel: 1 (713) 775-7529
Fax: 1 (713) 775-7780

**Green, David**
Geology Department
University of Tasmania
GPO Box 252C
Hobart, Tasmania 7001 (AUS)
Tel: 61 (002) 202-476
Fax: 61 (002) 232-547

**Grout, Ron**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-2144
Fax: 1 (409) 845-2308

**Hall, Jeremy**
Centre for Earth Resources Research
Memorial University of Newfoundland
St. John's, Newfoundland A1B 3X5 (CAN)
Tel: 1 (709) 737-4519
Fax: 1 (709) 737-2589
Internet: jeremy@kean.ucs.mun.ca

**Harding, Barry**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-8481
Fax: 1 (409) 845-4857
Omnet: Ocean.Drilling.TAMU

**Harrison, Christopher G.A.**
Rosenstiel School of Marine & Atm. Sci.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 1 (305) 361-4610
Fax: 1 (305) 361-4711

**Hayes, Dennis E.**
Lamont-Doherty Geol. Observatory
Columbia University
Department of Geological Sciences
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 X470
Fax: 1 (914) 365-0718
Internet: deph@lamont.ldeo.columbia.edu

**Heath, G. Ross**
College of Ocean & Fishery Sciences
University of Washington, HN-15
Seattle, WA 98195 (US)
Tel: 1 (206) 543-6605
Fax: 1 (206) 543-6393
Omnet: R.Heath

**Heinrichs, Donald**
National Science Foundation, OCE
1800 G Street, NW, Room 609
Washington, DC 20550 (US)
Tel: 1 (202) 357-9639
Fax: 1 (202) 357-7621
Internet: dheinrichs@nsf.gov

**Helsley, Charles E.**
School of Ocean and Earth Sci. & Techn.
University of Hawaii at Manoa
1000 Pope Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-3188
Fax: 1 (808) 956-2538
Internet: Chuck@soest.hawaii.edu

**Herbert, Timothy D.**
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-4199
Fax 1 (619) 534-0784

**Hertogen, Jan**
Fysico-Chemische Geologie
Universiteit Leuven
Celestijnenlaan 200 C
B-3030 Leuven (B)
Tel: 32 (16) 20-10-15
Fax: 32 (16) 20-13-68

**Herzig, Peter Michael**
Institut fur Mineralogie und
Lagerstattenlehre der RWTH
Wullnerstr. 2
D-5100 Aachen 1 (G)
Tel: 49 (241) 805-773
Fax: 49 (241) 804-413

**Hickman, Stephen H.**
Branch of Tectonophysics
U.S. Geological Survey
345 Middlefield Road, MS 977
Menlo Park, CA 94025 (US)
Tel: 1 (415) 329-4807
Fax: 1 (415) 329-5163

**Hine, Albert C.**
Department of Marine Science
University of South Florida
140 7th Ave. South
St. Petersburg, FL 33701 (US)

Tel: 1 (813) 893-9161
Fax: 1 (813) 893-9189

**Hinz, Karl**
Bundesanstalt fur Geowiss. u. Rohstoffe
Stilleweg 2, Postfach 510153
D-3000 Hannover 51 (G)
Tel: 49 (511) 643-3244
Fax: 49 (511) 643-2304
Internet: odp.ssp@gate1.bgr.dbp.de

**Hirata, Naoshi**
Department of Earth Sciences
Chiba University
1-33 Yayoi-cho
Chiba 260 (J)
Tel: 81 (472) 511-111
Fax: 81 (472) 565-793
Internet: NHirata@science.s.chiba-u.ac.j

**Hiscott, Richard N.**
Department of Earth Sciences
Memorial University
St. John's, Newfoundland A1B 3X5 (CAN)
Tel: 1 (709) 737-8394/4708
Fax: 1 (709) 737-2589
Omnet: J.Malpas
Internet: rhiscott@kean.ucs.mun.ca

**Hobart, Mike**
Lamont-Doherty Earth Observatory
Columbia University
Borehole Research Group
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900
Fax: 1 (914) 365-3182
Internet: hobar@lamont.ldeo.columbia.edu

**Horn, Dietrich**
DEMINEX
Dorotheenstrasse 1
4300 Essen (G)
Tel: 49 (201) 726-3905
Fax: 49 (201) 726-2942

**Hovland, Martin**
STATOIL
P.O. Box 300
N-4001 Stavanger
Tel: 47 (4) 807-130
Fax: 47 (4) 806-065

**Huber, Brian T.**
National Museum of Natural History Bld., NHB-121
Smithsonian Institution, Dept, Paleobiology
Washington, DC 20560 (US)
Tel: (202) 786-2658
Bitnet: MNHB007@SIVM.bitnet

**Humphris, Susan E.**
Ridge Office, Dept. Geology & Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2587
Fax: 1 (508) 457-2150
Bitnet: ridge@copper.whoi.edu

**Hutchinson, Mark W.**
Eastman Teleco
15355 Vantage Parkway West
Houston, TX 77032 (US)
Tel: 1 (713) 985-3840
Fax: 1 (713) 985-3842

**Ignatius, Heikki**
Geological Survey of Finland (GTK)
Kivimiehentie 1
SF-02150 Espoo 15 (SF)
Tel: 358 (0) 469-31

**Jackson, Peter D.**
Kingsley Dunham Centre
British Geological Survey
Keyworth
Nottingham NG12 5GG (UK)
Tel: 44 (602) 363-379
Fax: 44 (602) 363-145

**Jenkins, Chris**
Ocean Science Institute
University of Sydney
Sydney, NSW 2006 (AUS)
Tel: 61 (2) 692-4068
Fax: 61 (2) 692-4202

**Johnson, David**
Department of Geology
James Cook University, N. Queensland
Townsville, QLD 4811 (AUS)
Tel: 61 (77) 814-536
Fax: 61 (77) 251-501
Internet: glkgh@marlin.jcu.edu.au

**Julson, Brad**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-5716
Fax: 1 (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Kappel, Ellen**
Joint Oceanographic Institutions Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102 (US)
Tel: 1 (202) 232-3900
Fax: 1 (202) 232-8203
Internet: ekappel@iris.edu

**Karpoff, Anne-Marie**
Centre de Geochimie de la Surface
Universite Louis Pasteur
1, rud Blessig
67084 Strasbourg Cedex (F)
Tel: 33 1 88 35 85 65
Fax: 33 1 88 36 72 35

**Karson, Jeffrey A.**
Geology Department
Duke University
206 Old Chemistry Building
Durham, NC 27706 (US)
Tel: 1 (919) 684-5847
Fax: 1 (919) 684-5833

**Kasahara, Junzo**
Earthquake Research Institute
University of Tokyo
1-1-1 Yayoi, Bunkyo-ku
Tokyo 113 (J)
Tel: 81 (3) 3812-2111 X5713
Fax: 81 (3) 3812-6979

**Kastens, Kim A.**
Lamont-Doherty Earth Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x236
Fax: 1 (914) 365-0718
Internet: Kastens@lamont.ldeo.coumbia.ed

**Kastner, Miriam**
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-2065
Fax: 1 (619) 534-0784
Omnet: M.Kastner

**Katz, Barry**
TEXACO EPTD
P.O. Box 770070
Houston, TX 77215-0070 (US)
Tel: 1 (713) 954-6093
Fax: 1 (713) 954-6113

**Kay, Lin**
Earth Sciences Directorate
Natural Environment Res. Council
Polaris House, North Star Ave.
Swindon, SN2 1EU (UK)
Tel: 44 (793) 411-521
Fax: 44 (793) 411-584
Internet: rlfk@mail.nsw.ac.uk

**Kemp, Alan**
Department of Oceanography
University of Southampton
Southampton S09 5NH (UK)
Tel: 44 (703) 592-788
Fax: 44 (703) 593-059

**Kempton, Pamela**
Kingsley Dunham Centre
British Geological Survey
Keyworth
Nottingham NG12 5GG (UK)
Tel: 44 (602) 363-100
Fax: 44 (602) 363-200

**Kidd, Robert B.**
Department of Geology
University of Wales, Cardiff
P.O. Box 914, Cathays Park
Cardiff CF1 3YE (UK)
Tel: 44 (222) 874-830
Fax: 44 (222) 874-326
Internet: KiddR@geology.cardiff.ac.uk

**King, John W.**
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882-1197 (US)
Tel: 1 (401) 792-6594
Fax: 1 (401) 792-6160
Omnet: J.King

**Kinoshita, Chizuru**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251 x256
Fax: 81 (3) 3375-6716
Internet: taira@tansei.cc.u-tokyo.ac.jp

**Kinoshita, Hajimu**
Earthquake Research Institute
University of Tokyo
Bunkyo-ku
Tokyo 113 (J)
Tel: 81 (3) 3812-9417
Fax: 81 (3) 3816-1159

**Knill, John L.**
Natural Environment Research Council
Polaris House, North Star Avenue
Swindon SN2 1EU (UK)
Tel: 44 (793) 411-653
Fax: 44 (793) 411-691
Omnet: NERC.Science.HQ

29275 Bre**rsen, Yngve**
Tel: of Solid Earth Physics
Fax: y of Bergen
**Lalechon** 41
Public PBergen (N)
199 Kifi 47 (5) 213-420
GR-15' 47 (5) 320-009
Tel:
Fax: **rielle, Yves**
rsite de Bretagne Occidentale
**Lance**Sciences et Techniques
c/o D452
IFR85 Brest Cedex (F)
155 33 (1) 98 31 61 86
921: 33 (1) 98 31 66 20
Fa **achos, N.**
Om iblic Petroleum Corporation of Greece
**La** 99 Kifissias Ave.
GR-15124 Maroussi/Athens (GR)
Tel: 30 (1) 806-9301-9
Fax: 30 (1) 806-9317

**ancelot, Yves**
c/o Direction des Recherches Oceaniques
IFREMER
155 rue Jean-Jacques Roussequ
92138 Issy-les-Moulineaux Cedex (F)
Fax: 33 (1) 46 48 22 24
Omnet: Y.Lancelot or IFREMER.ODP

**Langseth, Marcus**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x518
Fax: 1 (914) 365-0718
Omnet: M.Langseth

**Larsen, Hans-Christian**
Geological Survey of Greenland
Oster Voldgade 10
DK-1350 Kobenhavn (DK)
Tel: 45 (3) 3118-866
Fax: 45 (3) 3935-352

**Larson, Roger L.**
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882 (US)
Tel: 1 (401) 792-6165
Fax: 1 (401) 792-6160
Omnet: R.Larson

**Leckie, R. Mark**
Dept. of Geology and Geography
University of Massachusetts
Amherst, MA 01003 (US)
Tel: (413) 545-1948
Fax: (413) 545-1200

**Leinen, Margaret**
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882-1197 (US)
Tel: 1 (401) 792-6268
Fax: 1 (401) 792-6160
Omnet: M.Leinen

**Levi, Shaul**
College of Oceanography
Oregon State University
Corvallis, OR 97331 (US)
Tel: 1 (503) 737-2296
Fax: 1 (503) 737-2400

**Lewis, Brian**
JOIDES Planning Office
University of Washington (HA-30)
3731 University Way N.E.
Seattle, WA 98195 (US)
Tel: 1 (206) 543-2203
Fax: 1 (206) 685-7652
Internet: joides@ocean.washington.edu

**Loughbridge, Michael S.**
Marine Geology and Geophysics Div.
Natl. Geophys. Data Center, E/GC3, NOAA
325 Broadway
Boulder, CO 80303 (US)
Tel: 1 (303) 497-6487
Fax: 1 (303) 497-6513

**Lovell, Mike**
Department of Geology
University of Leicester
Leicester (UK)
Tel: 44 (533) 522-522
Fax: 44 (533) 522-200

**Ludden, John**
Department de Geologie
Universite de Montreal
C.P. 6128, Succursale "A"
Montreal, Quebec (CAN)
Tel: (514) 343-7389
Fax: (514) 343-5782
Internet: luddenj@ere.umontreal.ca

**Lykke-Andersen, Holger**
Geophysical Institute
University of Aarhus
Finlandsgade 8
DK-8200 Aarhus (DK)
Tel: 45 (86) 16-16-66
Fax: 45 (86) 10-10-03

**Lysne, Peter**
Department 6111
Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185 (US)
Tel: 1 (505) 844-8885
Fax: 1 (505) 844-3952

**MacKenzie, David B.**
1000 Ridge Road
Littleton, CO 80120 (US)
Tel: 1 (303) 794-4750

**Magnusson, Magnus**
Icelandic Council of Science
Barugotu 3
IS-101 Reykjavik (IS)
Tel: 354 (1) 102-33/102-34
Fax: 354 (1) 253-93

**Maillard, Catherine**
Centre de Brest
IFREMER/SISMER
BP 70
29280 Plouzane Cedex
Tel: 33 98 22 42 79
Fax: 33 98 22 45 46
Internet: catherine.maillard@ifremer.fr

**Malfait, Bruce**
National Science Foundation
1800 G Street, NW, RM 609
Washington, DC 20550 (US)
Tel: 1 (202) 357-9849
Fax: 1 (202) 357-7621
Internet: bmalfait@nsf.gov

Canadian ...
Memorial University
Centre for Earth Resources Research
St. John's, Newfoundland A1B 3X5 (CAN)
Tel: 1 (709) 737-4708
Fax: 1 (709) 737-4702
Internet: odp@kean.ucs.lmun.ca

**Maronde, Dietrich**
Deutsche Forschungsgemeinschaft
Kennedy-Allee 40
5300 Bonn 2 (G)
Tel: 49 (228) 885-2328
Fax: 49 (228) 885-2221

**Marsh, Gary L.**
Shell Oil Company
One Shell Plaza, P.O. Box 2463
Houston, Texas 77252 (US)

**Marx, Claus**
Inst. Tiefbohrkunde u. Erdolgewinnung
TU Clausthal
Agricolastrasse 10
D-3392 Clausthal-Zellerfeld (G)
Tel: 49 (5323) 722-239

**Maxwell, Arthur E.**
Institute for Geophysics
University of Texas at Austin
8701 N Mopac Expressway
Austin, TX 78759-8397 (US)
Tel: 1 (512) 471-0411
Fax: 1 (512) 471-8844
Internet: art@utig.ig.utexas.edu

**McCann, Clive**
PRIS
University of Reading
P.O. Box 227, Whiteknights
Reading RG6 2AH (UK)
Tel: 44 (734) 318-940
Fax: 44 (734) 310-279

**McKenzie, Judith A.**
Geologisches Institut
ETH-Zentrum
Sonneggstrasse 5
CH-8092 Zurich (CH)
Tel: 41 (1) 256-3666
Fax: 41 (1) 252-0819
Bitnet: sediment@czheth5a.bitnet

**Mefferd, Matthew**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-8948
Fax: 1 (409) 845-0876
Internet: Matt_Mefferd$odp
NoBullets%MAILER
@NELSON.TAMU.EDU

**Merrill, Russell**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-2016
Fax: 1 (409) 845-4857
Internet: merrill@nelson.tamu.edu

**Métayer, Bernadette**
Direction des Recherches Oceaniques
IFREMER

155 rue Jean-Jacques Roussequ
92138 Issy-les-Moulineaux Cedex
Tel: 33 (1) 46 48 22 17
Fax: 33 (1) 46 48 22 24
Internet: b.metayer@ifremer.fr

**Metcalfe, Ian**
Department of Geology and Geophysics
University of New England
Armidale, NSW 2351 (AUS)
Tel: 61 (67) 73-2860
Fax: 61 (67) 71-2898
Internet: rarculus@metz.une.edu.au

**Mével, Catherine**
Petrologie Metamorphique
Universite Pierre et Marie Curie
4 Place Jussieu, Tour 26, E3e
F-75252 Paris Cedex 05 (F)
Tel: 33 (1) 44-27-51-93
Fax: 33 (1) 44-27-39-11
Internet: cam@ccr.jussieu.fr

**Mikkelsen, Naja**
Geological Survey of Denmark
Thoravej 8
DK-2400 Copenhagen NV (DK)
Tel: 45 (31) 10-66-00
Fax: 45 (31) 19-68-68

**Miller, Kenneth G.**
Department of Geological Sciences
Rutgers, The State University
New Brunswick, NJ 08903 (US)
Tel: 1 (908) 932-3622
Fax: 1 (908) 932-3374

**Millheim, Keith**
AMOCO Production Co.
P.O. Box 3385
Tulsa, OK 74102 (US)
Tel: 1 (918) 660-3381
Fax: 1 (918) 660-3310

**Mills, Bill**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-2478
Fax: 1 (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Mix, Alan C.**
College of Oceanography
Oregon State University
Oceanography Admin. Bldg. 104
Corvallis, OR 97331-5503 (US)
Tel: 1 (503) 737-2296
Fax: 1 (503) 737-2400
Internet: mix@oce.orst.edu

**Moberly, Ralph**
School of Ocean and Earth Sci. & Techn.
University of Hawaii at Manoa
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-8765
Fax: 1 (808) 956-2538
Omnet: R.Moberly

**Moore, Gregory F.**
Department of Geology and Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-6854
Fax: 1 (808) 956-2538
Internet: moore@kalani.soest.hawaii.edu

**Moore, Ted C.**
Cent. for Great Lakes & Aquatic Sci.
University of Michigan
2200 Bonisteel Blvd.
Ann Arbor, MI 48109-2099 (US)
Tel: 1 (313) 747-2742
Fax: 1 (313) 747-2748
Internet: Ted.Moore@um.cc.umich.edu

**Moores, Eldridge M.**
Geology Department
University of California, Davis
Davis, CA 95616 (US)
Tel: 1 (916) 752-0352
Fax: 1 (916) 752-0951
Internet: moores@garnet.ucdavis.edu

**Moos, Daniel**
Department of Geophysics
Stanford University
Stanford, CA 94305 (US)
Tel: 1 (415) 723-3464
Fax: 1 (415) 725-7344
Internet: moos@pangea.stanford.edu

**Moran, Kate**
Atlantic Geoscience Centre
Bedford Institute of Oceanography
Box 1006
Dartmouth, NS B2Y 4A2 (CAN)
Tel: 1 (902) 426-8159/5596
Fax: 1 (902) 426-4104
Internet: kmoran@agcrr.bio.ns.ca

**Morin, Roger H.**
U.S. Geological Survey
MS 403, Denver Federal Center
Denver, CO 80225 (US)
Tel: 1 (303) 236-5913
Fax: 1 (303) 236-5959

**Moss, Marvin**
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-2836
Fax: 1 (619) 453-0167

**Mottl, Michael J.**
School of Ocean and Earth Sci. & Techn.
University of Hawaii at Manoa
1000 Pope Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-7006
Fax: 1 (808) 956-2538

**Mountain, Gregory**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x541
Fax: 1 (914) 365-2312
Internet: Mountain@lamont.ldeo.columbia.

**Musgrave, Robert**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845 (US)
Tel: (409) 845-2522
Fax: (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Mutter, John**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900 x525
Fax: 1 (914) 365-3181
Internet: jcm@lamont.lgdo.columbia.edu

**Mwenifumbo, Jonathan**
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8 (CAN)
Tel: 1 (613) 992-6520
Fax: 1 (613) 996-9295
Internet: jarako@gsc.emr.ca

**Nobes, David C.**
Department of Geology
University of Canterbury
Christchurch 1 (NZ)
Tel: 64 (3) 667-001
Fax: 64 (3) 642-769

**Nowell, Arthur**
College of Ocean & Fishery Sciences
University of Washington (HA-40)
Seattle, WA 98195 (US)
Tel: 1 (206) 543-6605
Fax: 1 (206) 543-6073
Internet: nowell@ocean.washington.edu

**O'Reilly, Suzanne**
Discipline of Physical Earth Science
Macquarie Universoty
North Ryde, NSW (AUS)
Tel: 61 (2) 805-8418
Fax: 61 (2) 805-8428

**Ogawa, Yujiro**
Institute of Geoscience
University of Tsukuba
Tsukuba, Ibaraki 305 (J)
Tel: 81 (298) 534-307
Fax: 81 (298) 519-764

**Orcutt, John**
Scripps Institution of Oceanography
Dept. IGPP (0225)
La Jolla, CA 92093-2015 (US)
Tel: 1 (619) 534-2887
Fax: 1 (619) 534-5332
Internet: orcutt@bull.ucsd.edu

**Okada, Hisatake**
Department of Earth Sciences
Yamagata University
Kojirakawa-cho
Yamagata 990 (J)
Tel: 81 (236) 31-1421 x2588
Fax: 81 (236) 32-8384

**Ozawa, Kazuhito**
Dept. of Geology & Geophysics
Woods Hole Oceanographic Inst.
Woods Hole, MA 02543 (J)
Tel: 1 (508) 457-2000
Fax: 1 (508) 457-2187
Omnet: WHOI.Geol.Geoph

**Pak, Namil Kemal**
TUBITAK
Scientific and Technical Research Council
Ataturk Bulvari 221, Kavaklidere
TR-0611 Ankara (TR)
Tel: 90 (4) 147-74-83
Fax: 90 (4) 147-74-83

**Parson, Lindsay M.**
Institute of Oceanographic Scis.
Deacon Laboratory
Book Road, Wormley, Godalming
Surrey GU8 5UB (UK)
Tel: 44 (428) 794-141
Fax: 44 (428) 793-066

**Pascal, Georges**
Laboratoire de Geophysique Marine
Univ. de Brest, Fac. des Sci. et Tech.
6 Avenue le Gorgeu
F-29283 Brest Cedex (F)
Tel: 33 (98) 462-521
Fax: 33 (98) 040-573

**Paull, Charles K.**
Department of Geology
University of North Carolina
213 Mitchell Hall
Chapel Hill, NC 27599-3315 (US)
Tel: 1 (919) 966-4516
Fax: 1 (919) 966-4519

**Pautot, Guy**
Centre de Brest
IFREMER
B.P. 70
F-29280 Plouzane Cedex
Tel: 33 (98) 224-040
Fax: 33 (98) 224-549
Internet: GPautot@ifremer.fr

**Pearce, Julian A.**
Department of Geological Sciences
University of Durham
South Road
Durham, DH1 3LE (UK)
Tel: 44 (91) 374-2528
Fax: 44 (91) 374-3741

**Pedersen, Laust B.**
Department of Geophysics
Uppsala University
Box 556
S-751 22 Uppsala (S)
Tel: 46 (18) 182-385
Fax: 46 (18) 501-110
Internet: ldp@geofys.uu.se

**Pedersen, Torstein**
Norges Allmenvitenkapelige Forskningsrad
NAVF
Sandakerveien 99
N-0483 Oslo (N)
Tel: 47 (2) 15-70-12
Fax: 47 (2) 22-55-71

**Pedersen, Tom F.**
Department of Oceanography
University of British Columbia
6270 University Boulevard
Vancouver, B.C. V6T 1W5 (CAN)
Tel: (604) 822-5984
Fax: (604)822-6091
Internet: tfp@unixg.ubc.ca

**Pérez-Estaún, Andrés**
Departamento de Geologia
Universidad de Oviedo
Jes s Arias de Velasco s/n
E-33005 Oviedo (E)
Tel: 34 (8) 510-3110
Fax: 34 (8) 523-3911

**Pospichal, James J.**
Department of Geology
Florida State University
Tallahassee, FL 32306-3026 (US)
Internet: pospichal@geomag.gly.fsu.edu

**Powell, Trevor**
Division of Continental Geology
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601 (AUS)
Tel: 61 (6) 249-9111
Fax: 61 (6) 257-4614

**Pratt, Lisa M.**
Department of Geology
Indiana University
Bloomington, IN 47405 (US)
Tel: 1 (812) 855-9203
Fax: 1 (812) 855-7899

**Purdy, Ed**
PetroQuest International, Inc.
93/99 Upper Richmond Road
London SW15 2T9 (UK)
Tel: 44 (81) 780-1067
Fax: 44 (81) 788-1812

**Pyle, Thomas**
Joint Oceanographic Institutions Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102 (US)
Tel: 1 (202) 232-3900
Fax: 1 (202) 232-8203
Internet: pyle@iris.edu

**Rabinowitz, Philip**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: 1 (409) 845-8480
Fax: 1 (409) 845-1026
Omnet: Ocean.Drilling.TAMU

**Raymo, Maureen E.**
Dept. of Earth Atmospheric and Plan. Sci.
Massachusetts Inst. of Technology
Cambridge, MA 02139
Tel: 1 (617) 253-3388
Fax: 1 (617) 253-8630

**Renard, Vincent**
IFREMER
Centre de Brest, B.P. 70
F-29263 Plouzane Cedex (F)
Tel: 33 (98) 224-226

**Rhodes, J. Mike**
Department of Geology and Geography
University of Massachusetts
Amherst, MA 01003 (US)
Tel: 1 (413) 545-2841
Fax: 1 (413) 545-1200

**Richards, Adrian**
Adrian Richards Company
Viterweg 309
NL-1431 AJ Aalsmeer (NL)
Tel: 31 (29) 774-0012
Fax: 31 (29) 774-0723

**Riddihough, Robin**
Energy, Mines and Resources
Geological Survey of Canada
601 Booth Street, Rm 240
Ottawa, Ontario K1A 0E8 (CAN)
Tel: 1 (613) 995-4482
Fax: 1 (613) 996-8059

**Riedel, William R.**
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-0220 (US)
Tel: 1 (619) 534-4386
Fax: 1 (619) 534-0784
Internet: wriedel@sdsioa.ucsd.edu

**Rischmuller, Heinrich**
Niedersachs. Landesamt f. Bodenforschung
Postfach 510153
D-3000 Hannover 51 (G)
Fax: 1 (508) 457-4673
Omnet: F.Sayles

**Robertson, Alastair H. F.**
Grant Institute of Geology
Univ. Edinburgh
West Mains Rd.
Edinburgh EH9 3JW (UK)
Tel: 44 (31) 667-1081 x3569
Fax: 44 (31) 668-3184

**Röhl, Ursula**
Bundesanstalt f. Geowiss. und Rohstoffe
Stilleweg 2, Postfach 510153
D-3000 Hannover 51 (G)
Tel: 49 (0511) 643-2785
Fax: 49 (0511) 643-2304

**Rosendahl, Bruce R.**
Rosenstiel School of Marine & Atm. Sci
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 1 (305) 361-4000
Fax: 1 (305) 361-4711
Omnet: RSMAS.Dean

**Rowe, Gilbert T.**
Dept. of Oceanography
Texas A & M University
College Station, TX 77843 (US)
Tel: 1 (409) 845-7211
Fax: 1 (409) 845-6331

**Rutland, Roye**
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601 (AUS)
TEL: 61 (62) 499-111
Fax: 61 (62) 488-178

**Sager, William**
Dept. of Oceanography
Texas A & M University
College Station, TX 77843-3146
Tel: 1 (409) 845-9828
Fax: 1 (409) 845-6331
Internet: sager@triton.tamu.edu

**Saito, Tsunemasa**
Inst. of Geology and Paleontology
Tohoku Univeristy, Faculty of Science
Sendai, 980 (J)
Tel: 81 (22) 222-1800 x 3419
Fax: 81 (22) 262-6609

**Salisch, Henry**
Centre for Petroleum Engineering
University of New South Wales
P. O. Box 1
Kensington, NSW 2033 (AUS)
Tel: 61 (2) 697-5191
Fax: 61 (2) 662-6640

**Sartori, Renzo**
Instituto Geologia Marina (CNR)
Via Zamboni 65
I-40127 Bologna (I)
Tel: 39 (51) 225-444
Fax: 39 (51) 229-704

**Sayles, Frederick L.**
Department of Chemistry
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2561
Fax: 1 (508) 457-4673
Omnet: F.Sayles

**Schilling, Jean-Guy**
School of Oceanography
University of Rhode Island
Kingston, RI 02881 (US)
Tel: 1 (401) 792-6222
Fax: 1 (401) 792-6160

**Schmitt, Karen**
JOIDES Planning Office
University of Washington (HA-30)
3731 University Way N.E.
Seattle, WA 98195 (US)
Tel: 1 (206) 543-2203
Fax: 1 (206) 685-7652
Internet: joides@ocean.washington.edu

**Schuh, Frank J.**
Drilling Technology Inc.
5808 Wavertree, Suite 1000
Plano, TX 75075 (US)
Tel: 1 (214) 380-0203

**Scrutton, Roger**
Grant Institute of Geology
University of Edinburgh
West Mains Road
Edinburgh EH9 3JW (UK)
Tel: 44 (31) 667-1081
Fax: 44 (31) 668-3184

**Shanks, F. Earl**
Drilling Technology
Mobil Exploration and Prod. Serv. Inc.
P.O. Box 650232
Dallas, TX 75265-0232 (US)
Tel: 1 (214) 951-3271
Fax: 1 (214) 951-2512

**Shatto, Howard L.**
444 Knipp Oaks 1
Houston, TX 77024-5055 (US)
Tel: 1 (713) 467-8616
Fax: 1 (713) 465-1716 (call first)

**Sibuet, Jean-Claude**
Centre de Brest
IFREMER
BP 70
29280 Plouzane Cedex (F)
Tel: 33 98 22 42 33
Fax: 33 98 22 45 49
Internet: jcsibuet@ifremer.fr

**Sinha, Martin**
Department of Earth Sciences
Cambridge University, Bullard Labs.
Madingley Road
Cambridge CB3 0EZ (UK)
Tel: 44 (223) 333-406
Fax: 44 (223) 333-450

**Skinner, Allster C.**
Marine Geophys. & Offshore Serv. Progr.
British Geological Survey
Murchison House, West Mains Road
Edinburgh EH9 3LA (UK)
Tel: 44 (31) 667-1000
Fax: 44 (31) 668-2683

**Skogseid, Jacob**
Department of Geology
University of Oslo
P.B. 1047, Blindern
N-0316 Oslo 3 (N)
Tel: 47 (2) 856-663
Fax: 47 (2) 854-215

**Small, Lawrence F.**
College of Oceanography
Oregon State University
Corvallis, OR 97331-5503 (US)
Tel: 1 (503) 737-5195
Fax: 1 (503) 737-2064

**Soh, Wonn**
Institute of Geosciences
Shizuoka University
Oya
Shizuoka, 422 (J)
Tel: 81 (54) 237-1111 ex.5818
Fax: 81 (54) 238-0491

**Spall, Henry**
Office of Scientific Publications
U.S.G.S., National Center, MS-904
12201 Sunrise Valley Drive
Reston, VA 22092 (US)
Tel: 1 (703) 648-6078
Fax: 1 (703) 648-6138
Bitnet: HSpall.ISDRES

**Sparks, Charles**
Institut Francais du Petrole
1 et 4, avenue de Bois-Preau, B.P. 311
F-92506 Rueil-Malmaison Cedex (F)
Tel: 33 (1) 4752-6395
Fax: 33 (1) 475-27002

**Spiess, Volkhard**
Fachbereich Geowissenschaften
Universitat Bremen
Postfach 330440
D-2800 Bremen 33 (G)
Tel: 49 (421) 218-3387
Fax: 49 (421) 218-3116

**Srivastava, Shiri**
Atlantic Geoscience Centre
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, N.S. B2Y 4A2 (CAN)
Tel: 1 (902) 426-3148
Fax: 1 (902) 426-6152
Omnet: Bedford.Inst

**Staerker, Scott**
1004 San Jacinto, #418
Irving, TX 75063 (US)

**Stagg, Howard**
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601 (AUS)
Tel: 61 (6) 249-9111
Fax: 61 (6) 257-4614

**Steckler, Michael**
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964 (US)
Tel: 1 (914) 359-2900
Fax: 1 (914) 359-2931

**Stel, Jan H.**
Netherlands Marine Res. Foundation (SOZ)
Laan van Nieuw Oost Indie 131
NL-2593 BM The Hague (NL)
Tel: 31 (70) 344-0041
Fax: 31 (70) 383-2173

**Stokking, Laura**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77840 (US)
Tel: 1 (409) 845-5218
Fax: 1 (409) 845-0876
Omnet: Ocean.Drilling.TAMU

**Storms, Michael**
ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845 (US)
Tel: 1 (409) 845-2101
Fax: 1 (409) 845-4857
Omnet: Ocean.Drilling.TAMU

**Summerhayes, C.P.**
Deacon Laboratory
Institute of Oceanographic Sciences
Brook Road, Wormley, Godalming
Surrey GU8 5UB (UK)
Tel: 44 (42) 879-4141
Fax: 44 (42) 879-3066
Omnet: IOS.Wormley

**Summercor, A.**
Drilling Technology Center
Chevron Services Co.
2202 Oil Center Court, PO Box 4450
Houston, TX 77073 (US)
Tel: 1 (713) 230-2793
Fax: 1 (713) 230-2669

**Surlyk, Finn**
Department of Geology
University of Copenhagen
Oxter Voldgade 10
DK-1350 Copenhagen K (DK)
Tel: 45 35 32 26 26
Fax: 45 35 32 24 99

**Suyehiro, Kiyoshi**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251
Fax: 81 (3) 3375-6716
Internet: taira@tansei.cc.u-tokyo.ac.jp

**Svendsen, Walter W.**
1276 Highview Drive
New Brighton, MN 55112 (US)

**Swart, Peter K.**
Rosenstiel School of Marine & Atm. Sci.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 1 (305) 361-4103
Fax: 1 (305) 361-4632

**Symonds, Phillip**
Division of Marine Geoscience
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601 (AUS)
Tel: 61 (6) 249-9490
Fax: 61 (6) 249-9986

**Taira, Asahiko**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251 x256
Fax: 81 (3) 3375-6716
Internet: taira@tansei.cc.u-tokyo.ac.jp

**Tamaki, Kensaku**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251
Fax: 81 (3) 3375-6716
Omnet: ORI.Tokyo

**Tarduno, John**
Scripps Institute of Oceanography
University of California, San Diego
A-008
La Jolla, CA 92093 (US)
Tel: 1 (619) 534-3205
Fax: 1 (619) 534-0784

**Tatsumi, Yoshiyuki**
Department of Geology and Mineralogy
Kyoto University
Oiwake-cho, Sakyo-ku
Kyoto, 606 (J)
Tel: 81 (75) 753-4163
Fax: 81 (75) 753-4189

**Taylor, Brian**
School of Ocean & Earth Sci. & Tech.
University of Hawaii
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-6649
Fax: 1 (808) 956-2538
Omnet: B.Taylor
Internet: taylor@elepaio.soest.hawaii.edu

**Ten Brink, Uri**
Branch of Atlantic Marine Geology
U.S. Geological Survey
Quissett Campus
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2396
Fax: 1 (508) 457-2310

**Texier, Michel**
Research and Technology
Elf Exploration Inc.
1000 Louisiana, Suite 3800
Houston, TX 77002 (US)
Tel: 1 (713) 739-2166
Fax: 1 (713) 650-1789

**Thomas, Ellen**
Department of Geology and Geophysics
Yale University
Whitney Avenue
New Haven, CT 06511 (US)
Tel: 1 (203) 432-3169
Fax: 1 (203) 342-3134
Bitnet: ethomas@wesleyan.bitnet

**Thorhallsson, Sverrir**
Orkustofnun
Grens svegur 9
IS-103 Reykjavik (IS)
Tel: 354 (1) 813-600
Fax: 354 (1) 688-896
Internet: s@os.is

**Tokuyama, Hidekazu**
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai, Nakano-ku
Tokyo 164 (J)
Tel: 81 (3) 3376-1251
Fax: 81 (3) 3375-6716
Omnet: ORI.Tokyo

**Tréhu, Anne M.**
College of Oceanography
Oregon State University
Oceanography Admin. Bldg. 104
Corvallis, OR 97331-5503 (US)
Tel: 1 (503) 737-3504
Fax: 1 (503) 737-2064
Internet: TrehuA@jacobs.cs.orst.edu

**Underwood, Michael B.**
Department of Geologic Sciences
University of Missouri
Columbia, MO 65211 (US)

**Valet, Jean-Pierre**
Inst. de Physique du Globe
Universite Pierre et Marie Curie
4, Place Jussieu, Tour 24-25
F-75252 Paris Cedex 05 (F)
Tel: 33 (1) 4427-3566
Fax: 33 (1) 4427-3373

**Van Hinte, Jan E.**
Instituut voor Aardwetenschappen
Vrije Universiteit
Postboks 7161
NL-1007 MC Amsterdam (NL)
Tel: 31 (20) 548-3511
Fax: 31 (20) 646-2457

**Villinger, Heinrich**
Alfred-Wegener Institut
Columbusstrasse, Postfach 120161
D-2850 Bremerhaven 12 (G)
Tel: 49 (0471) 483-1215
Fax: 49 (0471) 483-1149
Omnet: Alfred.Wegener

**Von Damm, Karen L.**
Department of Earth Sciences
University of New Hampshire
Durham, New Hampshire (US)
Tel: (603)862-0124

**Von der Borch, Chris**
School of Earth Sciences
Flinders University
Bedford Park
South Australia 5042 (AUS)
Tel: 61 (8) 275-2212
Fax: 61 (8) 275-2676

**Von Herzen, Richard P.**
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)
Tel: 1 (508) 457-2000 x2465
Fax: 1 (508) 457-2187
Internet: RvonH@red.whoi.edu

**Von Huene, Roland**
GEOMAR
Research Center for Marine Geoscience
Wischhofstrasse 1-3, Geb. 4
D-2300 Kiel 14 (G)
Tel: 49 (431) 720-2272
Fax: 49 (431) 720-2293

**Von Rad, Ulrich**
Bundesanstalt fur Geowiss. u. Rohstoffe
Stilleweg 2, Postfach 510153
D-3000 Hannover 51 (G)
Tel: 49 (0511) 643-2785
Fax: 49 (0511) 643-2304
Internet: vonrad@gate1.bgr.dbp.de

**Vrellis, Gregory**
Drilling Department
Public Petroleum Co., (DEP-EKY-S.A)
199 Kiffissias Avenue
GR-15124 Maroussi, Athens
Tel: 30 (1) 806-9314

**Wadge, Geoff**
NUTIS
University of Reading
P.O. Box 227, Whiteknights
Reading RH6 2AH (UK)
Tel: 44 (734) 318-741
Fax: 44 (734) 755-865

**Watney, Lynn**
Kansas Geological Survey
1930 Constant Avenue
Lawrence, KS 66047 (US)
Tel: 1 (913) 864-3965
Fax: 1 (913) 864-5053
Internet: watney@kuhub.cc.ukans.edu

**Watts, Tony B.**
Department of Earth Sciences
University of Oxford
Parks Road
Oxford, OX1 3PR (UK)
Tel: 44 (865) 272-032
Fax: 44 (865) 272-072

**Weaver, Philip P.E.**
Institute of Oceanographic Sciences
Deacon Laboratory
Brook Rd., Wormley, Godalming
Surrey GU8 5UB (UK)
Tel: 44 (428) 794-141
Fax: 44 (428) 793-066

**Weber, Jean-Bernard**
Swiss National Science Foundation
Postfach 2338
CH-3001 Bern (CH)
Tel: 41 (31) 27-22-22
Fax: 41 (31) 23-30-09

**Wefer, Gerold**
Fachbereich Geowissenschaften
Universitat Bremen
Bibliothekstrasse
D-2800 Bremen 33 (G)
Tel: 49 (421) 218-3389

**Wei, Wuchang**
Scripps Inst. Ocean.
University of California at San Diego
La Jolla, CA 92093

**Weigel, Wilfried**
Institut fur Geophysik
Universitat Hamburg
Bundesstrasse 55
D-2000 Hamburg 13 (G)
Tel: 49 (40) 4123-2981

**Weis, Dominique**
Lab. Ass. Geol., Petrol., Geochron.
Universite Libre de Brusselles
Av. F.D. Roosevelt 50
B-1050 Brusselles (B)
Tel: 32 (2) 642-3748
Fax: 32 (2) 650-3500

**Weissert, Helmut**
Geological Institute
ETH-Zentrum
Sonneggstrasse 5
CH-8092 Zurich (CH)
Tel: 41 (1) 256-3715
Fax: 41 (1) 252-0819

**Westgaard, Leif**
The Research Council of Norway
Meltzers gt 4
N-0257 Oslo 4 (N)
Tel: 47 (2) 15-70-12
Fax: 47 (2) 22-55-71

**Wilkens, Roy**
Hawaii Institute of Geophysics
University of Hawaii at Manoa
2525 Correa Road
Honolulu, HI 96822 (US)
Tel: 1 (808) 956-5228
Fax: 1 (808) 956-5373
Internet: wilkens@elepaio.soest.hawaii.edu

**Williams, Adrian**
Division of Geomechanics
CSIRO
P.O. Box 54
Mount Waverley, VIC 3149 (AUS)
Tel: 61 (3) 881-1355
Fax: 61 (3) 803-2052

Dallas Research Lab
Mobil Research and Development Corp.
P.O. Box 819047
Dallas, TX 75381-9047 (US)
Tel: 1 (214) 851-8589
Fax: 1 (214) 851-8185

**Wilson, Douglas S.**
Department of Geological Sciences
University of California, Santa Barbara
Santa Barbara, CA 93106-9630 (US)
Tel: (805) 893-8033
Fax: (805) 893-2314
Internet: wilson@sbugel.ucsb.edu

**Winterhalter, Boris**
Geological Survey of Finland (GTK)
Kivimiehentie 1
SF-02150 Espoo 15 (SF)
Tel: 359 (0) 469-31

**Wise, Sherwood W.**
Department of Geology, Rm. 221
Florida State Universtiy
Tallahassee, FL 32306-3026 (US)
Tel: 1 (904) 644-6265
Fax: 1 (904) 644-4214
Internet: wise@geomag.gly.fsu.edu

**Woodside, John**
Inst. voor Aardwetenschappen
Vrije Universiteit
De Boelelaan 1085
NL-1081 HV Amsterdam (NL)
Tel: 31 (20) 548-5587
Fax: 31 (20) 646-2457
Bitnet: wooj@geo.vu.nl

**Worthington, Paul**
Charfield House
23 Woodlands Ride, South Ascot
Berkshire SL5 9HP (UK)
Tel: 44 (344) 235-508
Fax: 44 (344) 291-292

**Yagishita, Koji**
Department of Geology
Iwate University
3-18-33 Uyeda
Morioka, 020 (J)
Tel: 81 (196) 235-171 ex.2430
Fax: 81 (196) 544-214

**Yamano, Makoto**
Earthquake Research Institute
University of Tokyo
1-1-1 Yayoi, Bunkyo-ku
Tokyo 113 (J)
Tel: 81 (3) 3812-2111
Fax: 81 (3) 3812-6979

**Yilmaz, Yucel**
Muhendislik Fakultesi
Istanbul Universitesi
Jeoloji Muhendisligi Bolumu
TR-Vezneciler/Istanbul (TR)
Tel: 90 (1) 43-31-00 x652

**Zachos, James C.**
Earth and Marine Sciences
University of California, Santa Cruz
Santa Cruz, CA 95064 (US)
Tel: 1 (408) 459-4644
Fax: 1 (408) 459-3074
Internet: jzachos@rupture.ucsc.edu

**Zierenberg, Robert A.**
Branch of Western Mineral Resources
U.S. Geological Survey
345 Middlefield Road, MS-901
Menlo Park, CA 94025 (US)
Tel: 1 (415) 329-5437
Fax: 1 (415) 329-5490
Internet: robert@mojave.wr.usgs.gov

**Zoback, Mark D.**
Department of Geophysics
Stanford University
Stanford, CA 94305 (US)
Tel: (415) 725-9295
Fax: (415) 725-7344
Internet: zoback@pangea.stanford.edu

# Internet Directory

***Help us build better lines of electronic communication, send your Internet address to the JOIDES Office (joides@ocean.washington.edu). We will update this directory as space allows.***

| | |
|---|---|
| Agar, S.M. | postmaster@earth.nwu.edu |
| Alvarez, A.M. | odp@lamont.ldeo.columbia.edu |
| Ambos, E. | eambos@nsf.gov |
| Arculus, R.J. | rarculus@metz.une.edu.au |
| Austin, J.A., Jr. | jamie@utig.ig.utexas.edu |
| Backman, J. | backman@geologi.su.se |
| Bahr, J.M. | geodept@geology.wisc.edu |
| Baker, D.J. | joi@iris.edu |
| Baldauf, J. | baldauf@nelson.tamu.edu |
| Barron, J.A. | jbarron@isdmnl.wr.usgs.gov |
| Beiersdorf, H. | beiersdorf@gate1.bgr.dbp.de |
| Blum, P. | blum@nelson.tamu.edu |
| Brenner, C. | odp@lamont.ldeo.columbia.edu |
| Briden, J.C. | NERC.Science.HQ@omnet.nasa.gov |
| Brocher, T. | brocher@andreas.menlo.usgs.gov |
| Broglia, C. | chris@lamont.ldeo.columbia.edu |
| Burns, A. | joi@gmuvax.gmu.edu |
| Burns, F. | FABIOLA@TAMODP.bitnet |
| Caldwell, D.R. | D.Caldwell@omnet.nasa.gov |
| Canadian ODP Secretariat | odp@kean.ucs.mun.ca |
| Cannat, M. | MAC@ccr.jussieu.fr |
| Carter, R.M. | glkgh@marlin.jcu.edu.au |
| Christie, D. | dchristie@oce.orst.edu |
| Clark, R.S. | joides@ocean.washington.edu |
| Coffin, M.F. | coffin@ig.utexas.edu |
| Collins, W. | joides@ocean.washington.edu |
| Coyne, J. | coyne@nelson.tamu.edu |
| Crawford, T. | ODPsec@diemen.cc.utas.oz |
| Curry, W.B. | wcurry@whoi.edu |
| Dauphin, P. | jdauphin@nsf.gov |
| Delaney, J | jdelaney@u.washington.edu |
| Delaney, M.L. | Delaney@cats.ucsc.edu |
| Demenocal, P. | pdem@lamont.ldgo.columbia.edu |
| Deveau, S. | ODP@kean.ucs.mun.ca |
| Dorman, C.E. | C.Dorman.WHOI@omnet.nasa.gov |
| Duncan, R. | rduncan@oce.orst.edu |
| Filice, F. | filice@lamont.ldeo.columbia.edu |
| Fox, P.J. | jfox@gsosunl.gso.uri.edu |
| Francis, T.J.G. | francis@nelson.tamu.edu |
| Franklin, J.M. | Jim_Franklin@carleton.ca |
| Fryer, G. | g.fryer@soest.hawaii.edu |
| Gibson, I.L. | guelph2@watdcs.uwaterloo.ca |
| Goldberg, D. | goldberg@lamont.ldeo.columbia.edu |
| Hall, J. | jeremy@kean.ucs.mun.ca |
| Hayes, D.E. | deph@lamont.ldeo.columbia.edu |
| Heath, R. | rheath@u.washington.edu |
| Heinrichs, D. | dheinrichs@nsf.gov |
| Helsley, C. | chuck@soest.hawaii.edu |
| Hinz, K. | odp.ssp@gate1.bgr.dbp.de |
| Hirata, N. | NHirata@science.s.chiba-u.ac.jp |
| Hiscott, R.N. | rhiscott@kean.ucs.mun.ca |
| Hobart, M. | hobart@lamont.ldgo.columbia.edu |
| Huber, B. | MNHB007@SIVM.bitnet |
| Humphris, S. | ridge@copper.whoi.edu |
| James, N. | jamesn@qucdn.queensu.ca |
| Jansen, E. | jansen@uib.no |
| Johnson, D. | glkgh@marlin.jcu.edu.au |
| JOI | joi@iris.edu |
| Kappel, E. | ekappel@iris.edu |
| Kastens, K. | kastens@lamont.ldeo.coumbia.edu |
| Kay, Lin | rlfk@mail.nsw.ac.uk |
| Kendall, C. | kendall@gondwana.geol.scarolina.edu |
| Kidd, R.B. | KiddR@geology.cardiff.ac.uk |
| Lancelot, Y. | y.lancelot@omnet.nasa.gov |
| Larsen, B. | gf055@dgu1.dgu.min.dk |
| Lewis, B. | joides@ocean.washington.edu |
| Lewis, S. | slewis@pmgvax.wr.usgs.gov |
| LISTSERVER | ODP-L@TAMVM1.bitnet |
| Locker, S.D. | slocker@marine.usf.edu |
| Louden, K.E. | Louden@ac.dal.ca |
| Ludden, J. | luddenj@ere.umontreal.ca |
| Lyle, M. | lyle@gozer.ibsu.edu |
| Macko, S.A. | SAM8F@VIRGINIA.bitnet |
| Maillard, C. | catherine.maillard@ifremer.fr |
| Malfait, B. | bmalfait@nsf.gov |
| Malpas, J. | odp@kean.ucs.lmun.ca |
| Mart, Y. | euben@vmsa.technion.ac.il |
| Maxwell, A.E. | art@utig.ig.utexas.edu |
| Mayer, L. | larry@atlantic.cs.unb.ca |
| McKenzie, J. | sediment@czheth5a.bitnet |
| Mercier de Lepinay, B. | Mercier@mimosa.unice.fr |
| Merrill, R. | Merrill@nelson.tamu.edu |
| Metayer, B. | bmetayer@paris.ifremer.fr |
| Mevel, C. | cam@ccr.jussieu.fr |
| Meyer, H. | odp.ssp@gate1.bgr.dbp.de |
| Mix, A. | mix@oce.orst.edu |
| Moore, G.F. | moore@kalani.soest.hawaii.edu |
| Moore, J. C. | casey@java.ucsc.edu |
| Moore, T.C. | Ted_Moore@um.cc.umich.edu |
| Moores, E. | moores@garnet.ucdavis.edu |
| Moos, D. | moos@pangea.stanford.edu |
| Moran, K. | moran@agcrr.bio.ns.ca |
| Mountain, G. | mountain@lamont.ldeo.columbia.edu |
| Mutter, J. | jcm@lamont.lgeo.columbia.edu |
| Mwenifumbo, J. | jarako@gsc.emr.ca |
| Nowell, A. | nowell@ocean.washington.edu |
| Pautot, G. | GPautot@ifremer.fr |
| Pedersen, L.B. | ldp@geofys.uu.se |
| Pedersen, T.F. | tfp@unixg.ubc.ca |
| Pisias, Nick | pisias@oce.orst.edu |
| Pospichal, J.J. | pospichal@geomag.gly.fsu.edu |
| Pyle, Tom | pyle@iris.edu |
| Raramui, J. | joi@iris.edu |
| Raymo, M.E. | mer@maray.berkley.edu |
| Rea, D.K. | David_Rea@um.cc.umich.edu |
| Ridge Office | ridge@copper.whoi.edu |
| Riedel, W.R. | wriedel@ucsd.edu |
| Rodway, K. | rodway@lamont.ldeo.columbia.edu |
| Roehl, U. | vonrad@gate1.bgr.dbp.de |
| Sager, W.W. | Sager@triton.tamu.edu |
| Sandwell, D. | sandwell@radar.ucsd.edu |
| Sawyer, D.S. | dale@rice.edu |
| Schmitt, K. | joides@ocean.washington.edu |
| Scott, S.D. | scottsd@ecf.toronto.edu |
| Shackleton, N.J. | NJS5@phoenix.cambridge.ac.uk |
| Sherin, A. | sherin@agcrr.bio.ns.ca |
| Shipley, T. | tom@utig.ig.utexas.edu |
| Sibuet, J.C. | jcsibuet@ifremer.fr |
| Silver, E.A. | esilver@ucscc.UCSC.edu |
| Simpson, M. | mike@elepaio.soest.hawaii.edu |
| Site Survey Data Bank | mountain@lamont.ldgo.columbia.edu |
| Smith, G.M. | SMITHGM@SLUVCA |
| Smith, R. | joi@gmuvax.gmu.edu |
| Staudigel, H. | hubert @ stopmag.ucsd.edu |
| Stott, L.D. | stott@gamera.usc.edu |
| Taira, A. | taira@tansei.cc.u-tokyo.ac.jp |
| Taylor, B. | taylor@kiawe.soest.hawaii.edu |
| Thiede, J. | JTHIEDE@GEOMAR.UNI-KIEL.DBP.DE |
| Thorhallsson, S. | s@os.is |
| Trehu, A.M. | TrehuA@jacobs.cs.orst.edu |
| Vollbrecht, R. | rvollbr@gwdgv1.dnet.gwdg.de |
| Von Herzen, R.P. | RvonH@red.whoi.edu |
| von Rad, U. | vonrad@gate1.bgr.dbp.de |
| Watney, L. | Watney@KUHUB.CC.UKANS.edu |
| Webb, S. | webb@odpvax.tamu.edu |
| Weissel, J.K. | odp@lamont.ldeo.columbia.edu |
| Whitmarsh, R.B. | rbw@uk.ac.nwo.ia |
| Wilkens, R. | wilkens@elepaio.soest.hawaii.edu |
| Wilson, D.S. | wilson@sbugel.ucsb.edu |
| Winterer, E.L. | jwinterer@ucsd.edu |
| Wise, S.W. | wise@geomag.gly.fsu.edu |
| Zachos, J.C. | jzachos@rupture.ucsc.edu |
| Zierenberg, R.A. | robert@mojave.wr.usgs.gov |

# Acronym Dictionary

## Selected Acronyms and Abbreviations

| | |
|---|---|
| ACOS | Advisory Committee on Ocean Sciences |
| AGU | American Geophysical Union |
| AMC | axial magma chamber |
| ARC | Australian Research Council |
| BGR | Bundesanstalt fur Geowissenschaften und Rohstoffe |
| BGS | British Geological Survey |
| BHA | bottom-hole assembly |
| BHTV | borehole televiewer |
| BIRPS | British Institutions Reflection Profiling Syndicate |
| BMR | Bureau of Mineral Resources |
| BRGM | Bureau de Recherches Geologiques et Minieres |
| BSR | bottom-simulating reflector |
| CSDP | Continental Scientific Drilling Program |
| CSG | Computer Services Group (ODP) |
| CSM | Camborne School of Mines (UK) |
| CY | calendar year |
| DCB | diamond core barrel |
| DCS | diamond coring system |
| DFG | Deutsche Forschungsgemeinschaft |
| DI-BHA | drill-in bottom-hole assembly |
| DOE | Department of Energy |
| DP | dynamic positioning |
| DPG | Detailed Planning Group |
| DRB | DCS retractable bit system |
| ECOD | European (ESF) Consortium for Ocean Drilling |
| ECR | East Coast Repository |
| EEZ | Exclusive Economic Zone |
| EIS | environmental impact statement |
| ETH | Eidgenossiches Technische Hochschule, (Zurich) |
| FDSN | Federation of Digital Seismic Networks |
| FMS | formation microscanner |
| FY | fiscal year |
| GCR | Gulf Coast Repository |
| GSC | Geological Survey of Canada |
| GSGP | Global Sedimentary Geology Program |
| HRB | hard rock guide base |
| HRO | hard rock orientation |
| IDAS | isothermal decompression analysis system |
| IFREMER | Institut Francais de Recherche pour l'Exploitation de la Mer |
| ILP | International Lithosphere Program |
| IMT | Institut Mediterraneen de Technologie |
| InterRIDGE | International Ridge Inter-Disciplinary Global Experiments |
| IOC | Intergovernmental Oceanographic Commission |
| IPR | intellectual property rights |
| IRIS | Incorporated Research Institutions for Seismology |
| JAMSTEC | Japan Marine Science and Technology Center |
| JAPEX | Japan Petroleum Exploration Company |
| JGOFS | Joint Global Ocean Flux Studies |
| JOI-BOG | JOI Board of Governors |
| KTB | Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland |
| LANL | Los Alamos National Laboratory |
| LAST | lateral stress tool |
| LBL | Lawrence Berkeley Laboratory |
| LIPS | large igneous provinces |
| LRP | Long Range Plan |
| mbsf | meters below seafloor |
| MCS | multi-channel seismic |
| MDCB | motor-driven core barrel |
| MMS | Minerals Management Service |
| MOU | memorandum of understanding |
| MOR | mid-ocean ridge |
| MRC | Micropaleontological Reference Center |
| MST | multi-sensor track |
| NADP | Nansen Arctic Drilling Program |
| NAS | National Academy of Sciences |
| NERC | Natural Environment Research Council |
| NGDC | National Geophysical Data Center |
| NRC | National Research Council |
| NSB | National Science Board |
| NSERC | National Science and Engineering Research Council (Canada) |
| OBS | ocean bottom seismometer |
| ODPC | ODP Council |
| OG | organic geochemistry |
| OMDP | Ocean Margin Drilling Program |
| ONR | Office of Naval Research |
| OSN | Ocean Seismic Network |
| PCS | pressure core sampler |
| PDC | poly-crystalline diamond compact (drilling bit) |
| PEC | Performance Evaluation Committee |
| PPI | Producer Price Index |
| RFP | request for proposals |
| RFQ | request for quotes |
| RIDGE | Ridge Inter-Disciplinary Global Experiments (US) |
| ROV | remotely-operated vehicle |
| SCM | sonic core monitor |
| SCOR | Scientific Committee on Ocean Research |
| SCS | single-channel seismic |
| SES | sidewall-entry sub |
| SNL | Sandia National Laboratory |
| SOE | Special Operating Expense |
| SOW | Statement of Work |
| STA | Science and Technology Agency (of Japan) |
| TAMRF | Texas A&M Research Foundation |
| USSAC | US Scientific Advisory Committee |
| USSSP | US Science Support Program |
| VPC | vibra-percussive corer |
| VSP | vertical seismic profile |
| WCR | West Coast Repository |
| WCRP | World Climate Research Program |
| WG | Working Group |
| WOB | weight on bit |
| WOCE | World Ocean Circulation Experiment |

# Publication Statement

The *JOIDES Journal* is edited by JOIDES Office staff. The JOIDES Office is located at the School of Oceanography, HA-30, University of Washington, Seattle, WA 98195.

The *JOIDES Journal* is printed and distributed by the Joint Oceanographic Insitutions (JOI), Inc., Washington, D.C., for the Ocean Drilling Program (ODP) under the sponsorship of the National Science Foundation and participating countries. The material is based upon research supported by the National Science Foundation under Prime Contract OCE 83-17349.

The purpose of the *JOIDES Journal* is to serve as a means of communication among the JOIDES advisory structure, the National Science Foundation, the Ocean Drilling Program, JOI subcontractors thereunder, and interested earth scientists. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

The information contained within the *JOIDES Journal* is preliminary and priviledged and should not be cited or used except within the JOIDES organization or for purposes associated with ODP. This journal should not be used as a basis for other publications.

# Publication History

The *JOIDES Journal* is published in yearly volumes which normally consist of three issues published in February (No. 1), June (No. 2), and October (No. 3). Publication commenced in 1975 with Volume I and has continued since then.

In addition, there are occasional special issues of the *JOIDES Journal* which are listed below:

Special Issue No. 1: Manual on Pollution Prevention and Safety, 1976 (Vol. II)
Special Issue No. 2: Initial Site Prospectus, Supplement One, April 1978 (Vol. III)
Special Issue No. 3: Initial Site Prospectus, Supplement Two, June 1980 (Vol. VI)
Special Issue No. 4: Guide to the Ocean Drilling Program, September 1985 (Vol. XI)
Special Issue No. 4: Guide to the Ocean Drilling Program, Suppl. One, June 1986 (Vol. XII)
Special Issue No. 5: Guidelines for Pollution Prevention and Safety, March 1986 (Vol. XII)
Special Issue No. 6: Guide to the Ocean Drilling Program, December 1988 (Vol. XIV)
Special Issue No. 7: Ocean Drilling Program Guidelines for Pollution Prevention and Safety, Oct., 1992 (Vol. 18)

## JOIDES Office

**Science Planning**

School of Oceanography
Univ. Washington, HA-30
Seattle, WA 98195 (US)
Tel: (206) 543-2203
Fax: (206) 685-7652
Internet: joides@ocean.washington.edu

**Proposal submissions— *JOIDES Journal* editor**

## JOI, Inc.

**Prime Contractor**

Joint Oceanographic Institutions Inc.
1755 Mass. Ave, NW
Suite 800
Washington, DC 20036-2102
Tel: (202) 232-3900
Fax: (202) 232-8203
Internet: joi@iris.edu

**ODP publications— *JOIDES Journal* distribution**

## ODP/TAMU

**Science Operations**

ODP/Texas A&M University
1000 Discovery Drive
College Station, TX 77845-9547 (US)
Tel: (409) 845-2673
Fax: (409) 845-4857
Omnet: Ocean.Drilling.TAMU

**ODP/DSDP sample requests – Leg staffing**

## ODP/LDEO

**Wireline Logging Services**

Borehole Research Group
Lamont-Doherty Earth Observatory
Palisades, NY 10964 (US)
Tel: (914) 365-8672
Fax: (914) 365-3182
Internet: borehole@lamont.ldeo.columbia.edu

**Logging information – Logging Schools**

## *JOIDES Resolution* Operations Schedule

| Leg | Destination | Cruise Dates | In Port † | Total days | Transit | On Site |
|---|---|---|---|---|---|---|
| 148 | Hole 504B | Jan. 26 - March 10, 1993 | Panama, Jan. 22 - 25, 1993 | 43 | 4 | 39 |
| 149A | Transit | March 14 - 27, 1993 | Panama, March 10 -13, 1993 | 13 | 13 | 0 |
| 149B | Iberian Abyssal Plain * | March 28 - April 19, 1993 | Ponta Delgada, March 27, 1993 | 22 | 4 | 18 |
| 149C | Iberian Abyssal Plain * | April 20 - May 25, 1993 | Lisbon, April 19, 1993 | 35 | 2 | 33 |
| 150 | New Jersey Sea Level | May 30 - July 25, 1993 | Lisbon, May 25 - 29, 1993 | 56 | 16 | 40 |
| 151 | Atl. Arctic Gateways | July 30 - Sept. 24, 1993 | St. John's, July 25 - 29, 1993 | 56 | 14 | 42 |
| 152 | E. Greenland Margin | Sept. 29 - Nov. 24, 1993 | Reykjavik, Sept. 24 - 28, 1993 | 56 | 9 | 47 |
| 153 | MARK | Nov. 29 - Jan. 24, 1994 | Lisbon, Nov. 24 - 28, 1993 | 56 | 12 | 44 |
| 154 | Ceara Rise | Jan. 29 - March 26, 1994 | Barbados, Jan. 24 - 28, 1994 | 56 | 8 | 48 |
| 155 | Amazon Fan | March 31 - May 26, 1994 | Recife, March 26 - 30, 1994 | 56 | 8 | 48 |
| 156 | N. Barbados Ridge | May 31 - July 26, 1994 | Barbados, May 26 - 30, 1994 | 56 | 1 | 55 |
| 157 | DCS Engineering | July 31 - Sept. 25, 1994 | Barbados, July 26 - 30, 1994 | 56 | 8 | 48 |
| 158 | TAG | Sept. 30, Nov. 25, 1994 | Barbados, Sept. 25 - 29, 1994 | 56 | | |
| | Drydock | | Lisbon, Nov. 25 - Dec. 9, 1994 | | | |

* Scientific Party on board for 149B & C, Sedco-Forex crew rotates on March 10, April 19, and May 25, 1993
† Although 5 day port calls are generally scheduled, the ship sails when ready

## JOIDES Meeting Schedule

| Date | Place | Panel |
|---|---|---|
| March 22 - 24, 1993 | Davis, California | TECP |
| March 4-6, 1993 | Santa Cruz, California | SGPP |
| March 4-6, 1993 | Santa Cruz, California | OHP |
| March 8 - 10, 1993 | Washington, D. C. | BCOM |
| March 17-19, 1993 | Santa Barbara, Cal. | LITHP |
| March 30 - 31, 1993 | College Station, Texas | TEDCOM |
| April 1 - 2, 1993 | Kiel, Germany | PPSP |
| April 6 - 8, 1993 | Trieste, Italy | SSP |
| April 26-28, 1993 | Palisades, New York | PCOM |
| * May 25-27, 1993 | La Jolla, California | DMP |
| June 22-24, 1993 | College Station, Texas | EXCOM |
| * July 22 -24, 1993 | Halifax, Nova Scotia, Canada | IHP |
| August 10-12, 1993 | Brisbane, Australia | PCOM |
| * September 1993 | Paris, France | SMP |
| * Sept. 29 - 30, 1993 | Reykjavik, Iceland | TEDCOM |
| * mid - Sept. 1993 | Corner Brook, NFLD | SGPP |
| * Sept. - Oct., 1993 | Santa Fe, New Mexico | DMP |
| * October 6-8, 1993 | Bremen, Germany | OHP |
| November 29, 1993 | Miami, Florida | PANCH |
| Nov. 30 - Dec. 3, 1993 | Miami, Florida | PCOM |

* Meeting not yet formally requested and approved