JOIDES Journal

Joint Oceanographic Institutions for Deep Earth Sampling
Volume 19, Number 2, June 1993

APC Core of Distal Turbidites
Leg 146, Hole 893A
Santa Barbara Basin

Cover Photo: Photo taken of core from Hole 893A drilled in the Santa Barbara Basin, the Supplemental Science drill site on Leg 146. This site was located in the basin floor in order to APC-core distal turbidites for high-resolution paleoenvironmental studies. The photo shows the laminations preserved in the core (tick marks on the right side are centimeter markings). The core recovery exceeded 100% at this site because the sediment contained a large amount of biogenic methane gas. The gassy cores caused some handling problems, and the core liners had to be vented before they could be cut to avoid excessive loss of core. Gas bubbles and voids also degraded the quality of the cores for detailed studies; evidence for this can be seen in the photo, particularly the horizontal fractures. A sampling party worked on the core in January at the Ocean Drilling facility at Texas A & M University in College Station. Photo courtesy of ODP-TAMU.

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FOCUS

Brian Lewis
Planning Committee Chair

The spring 1993 round of JOIDES panel meetings are behind us and the deadline for renewal of the program beyond October 1993 is getting closer. It appears likely that all of the international partners, except Russia, will sign the contracts extending their commitments to the Ocean Drilling Program. However, the budget that will emerge from the contract renewal may not be certain for some time. The uncertainty arises from the difficult choices Canada must face because of budgetary constraints. At this time it appears that the Canada-Australia Consortium will remain in ODP, but with a temporary, partial membership. This situation should be clearer after the June ODP Council meeting at Texas A & M University.

In the *Long Range Plan* (LRP), a budget was formulated to cover the period 1989 to 2002. The estimate for 1989 was based on actual costs and the future budget predictions were based on very moderate inflation estimates (6% for payroll, 3% for ship day-rates and other program costs). The estimated budget projections also included important new engineering development costs that would be incurred in 1992-1995 (the Diamond Coring System for example). A comparison of the LRP estimates and the actual budgets is shown on the facing page.

The reduction of the budget below the LRP, which started in 1991, is primarily because of Russia withdrawing its financial contribution. Base budget cuts to all subcontracts, cuts in some engineering development and cuts in computer upgrades were required in 1994 in order to maintain key technology developments. If further cuts in the 1994 budget are required—because of a reduction in funding from the Canada-Australia consortium—there will have to be a difficult and profound redefinition of ODP's scientific and engineering goals. To quote the Budget Committee report ,

> **"It has become evident to BCOM that budgetary projections contained in the LRP have become obsolete under the revenue scenarios which now seem to prevail. Either the LRP should be reformulated or there needs to be radical changes to the overall funding or operation of the drilling program. "**

Discussion at the April Planning Committee meeting revealed just how drastic the revisions could be (see the Planning Committee Report on p. 2 in this issue).

Either the present partners must contribute more to cover the costs, more partners must be found, the program support must be significantly changed, or the program must be pared down in terms of services and objectives so as to fit within a reduced budget. Drilling is a basic tool for marine geology research, our community cannot let this tool disappear by progressive attrition!

Meanwhile, planning for 1994 and beyond continues. Because of proposal pressure, the Planning Committee passed a motion that in 1995, and possibly into 1996, the *JOIDES Resolution* will be operating in the Atlantic oceans, and adjacent seas and oceans. This was liberally interpreted to include: the eastern Pacific Ocean, the western Indian Ocean and the Mediterranean, Red, Labrador, and Caribbean Seas, and other adjacent areas. Proposals that address thematic issues in other parts of the world are in the mill and, if supplemented by additional proposals, could serve to define a non-Atlantic ship track in the years 1996 and beyond.

JOIDES Committee Reports

PLANNING COMMITTEE (PCOM)

PALISADES, NEW YORK, APRIL 26—28, 1993

THE ODP FOUR-YEAR SCIENCE PLAN

At its spring meeting, PCOM discussed the thematic panel's global rankings and worked on formulating a four-year plan that would convey ODP's thematic interests in combination with the ship track.

After discussion of the most highly-ranked proposals in the global rankings (see Thematic Panel Report on p. 7), PCOM concluded that the Atlantic would still be the likely area of operations for FY95. PCOM agreed that it was after FY95, depending on proposals, that the ship track could begin to be headed for other geographic areas. PCOM then passed the following motion on the Four-Year Science Plan:

The ODP Four-Year Science Plan

The Ocean Drilling Program is thematically driven, as generally detailed in the Long-Range Plan and White Papers presented by the program's thematic panels. In order to address some of those themes which are considered of high priority by the advisory panels, and to provide for the development of necessary technology to achieve drilling targets, PCOM sets the direction of the drilling vessel for the next four years as follows:

a) In the remainder of FY93, the ship's track is confirmed as the current program plan.

b) In FY94, the ship's track is confirmed as the program plan approved at the December 1992 PCOM meeting in Bermuda, noting that the precise location of the DCS test leg (157) may change and that, if the DCS testing is eliminated from the FY1994 schedule, drilling at TAG (Leg 158) will occur as Leg 157. This program plan is designed to address aspects of rifted margin evolution, the development of oceanic lithosphere at ocean ridges, Neogene paleoceanography, and the evolution of deep sea fans and accretionary prisms.

c) The further investigation of these and other high priority themes including, but not confined to, sea-level change, high-latitude paleoceanography, fluid circulation in the lithosphere, and carbon cycle will continue to define the track of the drillship. At present, highly ranked and drillable proposals which address such themes exist for the North and South Atlantic Oceans, the Caribbean, the Gulf of Mexico, the Mediterranean, Norwegian, Labrador and the Red Seas, the SW Indian Ocean and the East Pacific. These, at present, confine the likely operational areas of the drillship for FY95 and FY96.

d) PCOM encourages the submission of proposals for any ocean which address those high priority themes appropriately investigated by ocean drilling.

Proposals received before 1 January 1994 that are subsequently highly ranked have the potential to modify the FY1996 and subsequent ship track.

PRIORITIZING BUDGET ITEMS

Brian Lewis, PCOM Chair, raised this issue because he was concerned that major budgetary items critical to the long-range planning process would be severely impacted by the budgetary crisis ODP could face in the next few years—particularly if the Can-Aus Consortium pulls out. If there was a significant shortfall in the budget for next year, PCOM would have to decide on what budget items to cut. Lewis presented two examples of strategies to cut the FY94 ODP budget by $ 3 M—this amount was the potential shortfall if ODP was left with five partners. One option was to cut all special operating expense (SOE) expenditures, this would result in a $ 2 M cut—the remaining $ 1 M would come from across-the-board base budget cuts for the contractors that total $ 1 M. This option would have a large impact on the science program since it would cut out the DCS testing, the planned computing upgrades and all hard rock drilling sites. Focusing on cutting SOEs would essentially made ODP a soft-rock program. A second option Lewis presented was cutting all innovative downhole measurements and using only the basic Schlumberger package to save $ 2.4 M. To bring the cuts up to $ 3 M would also require cutting out the computing upgrade ($ 600 K) or other large SOE/base budget items.

Lewis presented these options not as the only possible ways to cut money, but to show that the program would have to consider major revision of the near-term science program if there were to be a $ 3 M budget shortfall caused by loss of the Can-Aus partner. Lewis pointed out that the $ 3 M cut was the "doomsday scenario" and there were other, perhaps more likely, possibilities for the near-term budget situation. In Lewis' opinion the most likely possibility was that Can-Aus would be allowed to retain a partial membership with the money they had available—about $ 2 M. In this scenario, the ODP budget shortfall for FY94 would be about $ 1 M, Lewis preferred to have a discussion of priorities for cutting this amount from the budget.

Jamie Austin, UT-Austin, noted that the DCS costs were a large budget item that could be deferred by taking it off the FY94 schedule, saving close to $ 1 M. He felt that delaying DCS into FY95 was the cleanest cut—but only if it delayed it and not killed it. PCOM agreed that delaying DCS sea testing would have a relatively low-impact on the FY94 science program but also wanted to know if there were ways that base budgets could be cut more. Tim Francis, ODP-TAMU, pointed out that the LDEO and TAMU base budgets had already been cut by BCOM at a time when the program was asking them to innovate—Francis felt that with these budget cuts they could not be very innovative.

Bruce Malfait, NSF, indicated that PCOM should consider the option of planning for a budget where Can-Aus was granted a full membership for 2/3 of a year to give them time to raise the additional $ 1 M for full membership. PCOM debated the policy of allowing partial memberships and the possible domino effect this might have with other partners if it became a practice. Richard Arculus, Can-Aus, reiterated that the crisis in the Can-Aus consortium was exacerbated by the short amount of lead time they were given to deal with the problem. Can-Aus saw a partial membership as only a temporary measure to allow them more time; Can-Aus remained optimistic that they would, by some means, obtain funding for continued full membership.

Henry Dick, WHOI, asked PCOM to consider what savings might be realized if the publication of *Scientific Results* volumes was cut and publication of results was left to the open scientific literature? PCOM discussed this type of option as an alternative to the cutting of major parts of the drilling operations. Dick wanted PCOM to consider other significant changes to the way ODP did business before they committed to cutting out all hard-rock legs. He suggested an option of completely changing how computing was done on the ship—perhaps ODP should consider no longer providing the computing facilities on the ship and people would provide their own computing platforms when they came on board the ship.

Ulrich von Rad, Germany, asked if there was any possibility that the existing partners could each contribute more money for their membership? PCOM agreed that the economic and political prospects for this option were not good since memberships had just been increased during the last renewal. Lewis asked about alternative sources within each country—such as industry? PCOM did not support trying to get funds from industry, because of past experience with trying to do so. Lewis pointed out that the lesson to be learned from the exercise of trying to cut $ 3 M from the FY94 budget was that, if Can-Aus was lost from the program, the existing partners would be forced to fight for more money in order for ODP to survive.

PCOM discussed getting additional partners from the rest of the world. Some saw potential for a South American consortium, an Asian consortium and possibly a South African consortium. The PCOM consensus was that a more proactive approach needed to be taken in trying to attract new partners, possibly by hiring a professional to do the job.

Lewis brought up the idea of pursuing other funding agencies within member countries, particularly ONR in the US. PCOM's consensus was to pursue new partners over trying to get more money from present member funding agencies. However, PCOM agreed that a search for new members had to be undertaken with the realization that it was not a very promising option given that most of these countries would not have large amounts of money for this type of science.

PCOM concluded the discussion by passing the following motion:

PCOM has considered the impact of financial shortfalls in the period FY 1994 and beyond stemming from reduction or loss of the Can-Aus contribution.

1) **In the event of a one-time shortfall of $ 1 million, PCOM sees no choice but to delay DCS development and engineering Leg 157 into FY 1995.**
2) **If there is to be no contribution from Can-Aus at all, the program will be unable to continue in its present form. Radical reorientation of scientific and technological objectives would be necessary. PCOM discussed potential deleterious consequences to logging and tool development, bare-rock lithospheric and accretionary prism drilling, computer upgrades, publications, and the scale of scientific participation in program planning.**
3) **Since these consequences are unacceptable to large segments of our constituent community, it is imperative that current Can-Aus efforts to find financial support be successful. PCOM stands ready to support those efforts.**
4) **Even if continuing Can-Aus participation in ODP is successful, ODP presently lacks the funds necessary to carry out the program outlined in the Long-Range plan.**
5) **PCOM therefore wishes to assist EXCOM in its efforts to attract a broader international base for scientific ocean drilling.**

Several other business items that related to ODP budget planning were then addressed by PCOM.

Deep Drilling RFQ

PCOM recognized the importance of deep drilling for ODP, particularly for anticipated continuation of operations beyond 1998. However, given severe present fiscal restrictions, PCOM cannot recommend to fund any of the responses to the RFQ recently issued by ODP-TAMU in consultation with TEDCOM. PCOM encourages TEDCOM to pursue the initiative on its own, by augmenting its existing expertise as required.

In Situ Pore Fluid Sampling RFP

PCOM appreciates that sampling of pore fluids in low permeability rocks is of importance to several thematic panels. However, the poor prospects for success and the budgetary constraints, preclude issuing an RFP for evaluation of the feasibility of sampling pore fluids at this time. PCOM recommends that the DMP either use or acquire panel expertise to address this issue or to seek funding from other sources for the RFP.

IHP Publications Recommendations

Initial Reports & *Scientific Results* Sizes

IHP recommended to PCOM that the following changes be made to the publication policy with the objective of: (a) improving the quality of the publications; (b) restraining the progressively rising costs of publications; (c) facilitating the rapid distribution of ODP digital data to the user scientific community:

A. Interpretive material in the Site chapters of the *Initial Reports (IR)* volumes should be kept to a minimum and Co-chiefs asked to restrict interpretations to the Summary sections at the conclusion of each site report.

B. Printed numerical Tables in the *SR* volumes should normally be less than a page in length. Long tables of data should be placed n ASCII format on the *IR*-CD/ROM to be included with each volume. Where possible, shorter tables of data should also be placed on the *IR* CD/ROM. The simultaneous inclusion of printed figures and tables which embody the same numerical data should normally not be permitted.

C. The shipboard party should be encouraged to provide machine-readable copies of shipboard data for inclusion on the *IR*-CD/ROM. This information would be included on a `space available' basis and provided to the Operator at the end of each cruise.

D. Logging Data should be distributed with the *IR* volume on CD-ROM

E. The Editorial Board for each *Scientific Results* (*SR*) volume should limit to twenty printed pages the size of individual contributed papers within the volume (including all associated tables and text, but excluding plates and range charts). The only exceptions to this policy would be the synthesis papers prepared by the Co-chief scientists. The Editorial Board should discourage authors from circumventing this policy by submitting multiple papers on related topics.

F. Authors of *SR* papers should be given the option of placing additional contributed material (numerical tables, appendices, diagrams, images) on a *SR*-CD/ROM.

G. Printed tables of numerical data (excluding range charts) in the *SR* volume should be restricted to one page in length. Any additional information should be placed on a *SR-CD/ROM to be prepared by ODP*-TAMU, and placed at the back of *SR* volumes on a routine basis. Authors should be encouraged to place copies of all the numerical tabular information on the *SR*-CD/ROM.

H. Data reports and `reprints' of externally published papers of results should be placed on the CD-ROM and represented within the volume by only the abstract, and, in the case of externally published papers, by a reference to the original publication.

I. IHP recommended to PCOM that the operator (ODP-TAMU) be encouraged to extend the time frame over which the *SR* volumes are produced from 34 months to 40 months post-cruise. The extra six-months should be used delay the final submission deadline to 22 months post-cruise.

PCOM encouraged publication of data on CD-ROM to reduce printed pages. However, establishing an across-the-board page limit for either *IR* or *SR* was discouraged, to maintain flexibility. After considering the trend for increase in the size of both *Initial Reports* and *Scientific Results* volumes, and a corresponding increase in the costs of publication. PCOM recommended that TAMU negotiate the size of volumes with co-chiefs before each leg, with a review after each leg, when an assessment of scientific output can be made.

PCOM was not in favor of implementing IHP's recommendation for a 40 month submission deadline as policy. PCOM preferred to leave the 36 month post-cruise publication deadline in place.

Data Management

HP recommended to PCOM that TAMU/ODP be asked to devote sufficient resources to capture, curate and organize the current incoming flow of shipboard data into a rational data-structure. At the present time this is NOT being achieved and the large backlog of unassimilated data continues to grow.

PCOM referred the concerns of IHP with regards to the interim capture and curation of data to the Computer RFP Evaluation Committee to review. Brian Lewis, PCOM Chair. will ask the RFP Evaluation Committee to come up with a report containing specific recommendations on how to deal with this problem for the August PCOM meeting.

LONG RANGE PLANNING: POST-1998

In preparation for proposing a renewal of ODP beyond 1998, PCOM identified the following two tasks as being required by 1995.

1. A proposal describing the principal scientific goals of post-1998 drilling.
2. A paper describing platform requirements and options to achieve the science goals.

To accomplish task 1, PCOM assigned a subcommittee consisting of the Brian Lewis, PCOM Chair, and Rob Kidd, next PCOM Chair, to work with PCOM's thematic panel liaisons and Panel Chairs to direct the revisions of thematic panel White Papers. These documents will form the basis for completing task 1.

To accomplish task 2, PCOM assigned a subcommittee consisting of Lewis and Kidd to initiate work on this task.

PCOM expects that in executing these tasks the subcommittees will make maximum use of e-mail and they will present synopses of the revised White Papers at the August 1993 PCOM meeting.

BUDGET COMMITTEE (BCOM)

WASHINGTON, D. C., MARCH 8—10, 1993

BUDGET TARGETS

On directives from NSF, BCOM based its analysis and resulting recommendations on two alternative sets of target budget figures:

Alternative A assumes 6 partners and a budget of $ 44.9 M (i.e. Can-Aus membership continues as is).

Alternative B assumes 5 partners and a budget of $ 41.9M.

It was noted that the NSF budget for FY94 was not yet firm and that the 6 partner scenario was well below the *Long Range Plan* (LRP) target. In the 1992 BCOM report it was stressed that the LRP target figures were realistic if goals were to be met with a program of quality and innovation that the partners would support, and that some erosion of infrastructure would occur at the lower figures. At this meeting this fear was realized.

The FY94-98 Phase and "Internationalization" of ODP

FY94 is the first year of the second phase of ODP and BCOM noted that continuation beyond FY98 is going to depend on scientific successes between now and FY95— 96, when program reviews will begin in earnest. In this renewal phase TAMU will continue as Science Operator, LDEO (with assistance from CRNS in France and U. Leicester in UK) will operate wireline logging services, and the JOIDES Office will be outside the USA for the first time. Vital upgrades in data collection and data bases on the ship and ashore have been put up for international bid, and the East Coast Core Repository is also in the process of international bidding. These welcome modifications to the program were initiated by EXCOM, but they would entail cost increases.

FY94 Science Program

The science program for FY1994 covers a wide range of science and innovative approaches. In particular, the plan includes drilling into an active (unsedimented) hydrothermal system, "CORKing" and instrumentation of holes to measure long-term fluid flow in an accretionary wedge, use of an offset drilling strategy to study fundamental igneous processes, the first sea test of the DCS system with a rigorously designed and land-tested secondary heave compensation system, and use of specialized coring and drilling methods to study objectives relating to ocean history and sedimentary processes. Inevitably, the use of innovative methods to solve scientific problems is expensive. Many of these drilling legs will use costly special equipment requiring transportation and installation, examples being CORKs, bottom-hole assemblies and the DCS system.

BCOM Approach

BCOM noted with concern that with the present budget scenarios, the divergence between program goals and actual funding will deteriorate in future years. Therefore, BCOM recommended a dual strategy:

Short-term strategy

- Maintain cutting edge science and innovation.
- Tighten base budgets as far as possible, using efficiency and performance improvement to effect savings.

Long-term strategy

- Apply concerted effort to find new funds or new structures that will result in new funds.
- Rewrite the science objectives to be more consistent with reality. The *Long Range Plan* has served a purpose, but is no longer a realistic template for science prioritization. Recent emphasis on use of rewritten thematic white papers is encouraged.
- If new funds are not forthcoming, then devise a slimmed-down operation with constrained science goals.

BUDGET PROPOSALS

The draft budgets proposed to BCOM were (with FY93 Program Plan for comparison):

	FY94 Proposed $	FY93 Program Plan $
TAMU	40,709,000	37,016,447
LDEO	5,685,888	4,621,000
JOI/JOIDES	2,001,324	1,560,000
Total	48,396,212	43,197,447

The bids were approximately $ 4.5 M above the target budget for FY94, which itself may not be attained due to uncertainty in the Can-Aus membership. The key contributions to this excess of demand over budget were:

- the enhanced logging and related deliverables proposed by LDEO and its partners in their successful response to RFP 92-2;
- the computing/data base upgrade project;
- technical demands for difficult legs and engineering developments for the future;
- public relations (PR) initiatives ;
- approximately 4% growth in salaries and related costs.

BCOM Recommendations for a $44.9 M Budget

BCOM's budget recommendation is as follows:

	Proposed $	Recommended $
TAMU Base	37,256,164	36,420,000
TAMU Innovation[1]	3,452,836	2,020,000
LDEO Base	5,153,213	4,500,000
LDEO Innovation[1]	532,675	300,000 [2]
JOI/JOIDES Innovation[1]	2,001,324 [3]	1,660,000
TOTALS	48,396,212	44,900,000

[1] In its recommendations, BCOM discontinued the use of the term Special Operating Expenses (SOE) that has been used in recent years in favor of "Innovation", which more accurately portrays the intent. It is recognized that this description has been interpreted elastically!

[2] BCOM was unable to recommend funding of any of LDEO's proposed SOEs but, in making its

recommendation, wished to emphasize the innovation content of LDEO's base proposal.

[3] The JOI proposal contained $ 96K of "innovation" concerning PR which BCOM was unable to recommend supporting due to the severe financial constraint on the operating program.

Implications of a Budget Reduction to $ 41.9 M

Following discussion with subcontractors on scenarios for reaching the upper level target figure of $ 44.9 M provided by NSF, BCOM went on to consider the alternative target of $ 41.9 M, necessitated by potential absence of the Can-Aus contribution from ODP for FY94. BCOM noted that the lower figure represented a shortfall of $ 6.4 M from the budget level projected in the LRP. There are various options, but certain immediate consequences are inevitable, even if this is only a one year cut:

- revision of the Science Plan to more limited objectives;
- reduction or elimination of technical innovation;
- a further cycle of evaluation among PCOM, BCOM and probably EXCOM in a matter of weeks.

One example would include:

- deletion of <u>all</u> ODP-TAMU SOEs for FY94 ($ 2.02 M);
- re-review of the FY94 Program Plan by the JOIDES Advisory Structure, with a view to modifications narrowing the scope of the proposed science, probably focusing on those legs not impacted by SOE deletion (above) - e.g. 154-Ceara Rise, 155-Amazon Fan;
- emphasis on data acquisition throughout all coring and logging aspects of ODP, at the expense of all aspects of processing, interpretation and information dissemination.

BCOM emphasizes the mid- and-longer term deleterious and potentially fatal impact that such a budget reduction would have on ODP.

Long-Term Issues

It was evident to BCOM that budgetary projections contained in the Long-Range Plan have become obsolete under the revenue scenarios which now seem to prevail. Either the Long-Range Plan should be reformulated or there needs to be radical changes made to the overall funding or operation of the drilling program.

There are two main parts to the problem. The first pertains to a growing gap between the needs and expectations of the science that drives ODP and the financial resources that will apparently be available. BCOM unanimously agrees that innovation associated with new science and technology is essential to the health and welfare of ODP, now and into the future. It must be emphasized that the cuts reported here are occurring at a time when scientific and technological innovations should be advancing. In spite of these cuts, BCOM believes that the basic FY94 science plan has been preserved by insisting on base-budget reductions, while retaining as much innovative expenditure as possible. **Such an approach cannot be continued** in subsequent years without detrimental and possibly irreversible consequences to ODP.

The second part of the problem is lack of revenue, which has not kept pace with even the most conservative expectations. The problem has been exacerbated this year by the Can-Aus dilemma, but is a chronic one relating to continued lack of new partners. A renewed, vigorous effort to attract new partners is essential if vitality of the Program is to be maintained. EXCOM members must apply some innovative thinking to this problem and PCOM scientists are urged to assist in the process. The standard approach of simply soliciting new partners either is not working or is not being pursued with enough vigor. It has been assumed that significantly increasing membership dues is not a viable option for increasing the overall budget and could, in fact, have the opposite effect. This assumption should be reviewed.

Data management and networking, both within and between shorebased facilities and the drillship, and between TAMU and LDEO, are long-term issues. There is a consensus that progress must be made in these regards. Sliding toward the backwaters of data management in an age when technology for innovation is advancing rapidly, is not appropriate for a high-visibility, international project such as ODP.

The Diamond Coring System appears to have reached the do-or-die stage, both operationally and financially. The consequence of continuing the DCS program if land and sea tests are successful will be increased budgetary pressure for additional development and deployments. A successful DCS program probably means increased expenditures in the future, and budgets need to anticipate these expenditures.

Another example is the growing budgetary problem in regard to burgeoning publication. The root cause appears to be increased page numbers arising in part from increased scientific productivity. Page limits on manuscripts, and limits on the number of manuscripts, need to be considered by PCOM and other panels before this problem gets out of hand. The use of computer disc technology to replace and/or augment certain aspects of volume presentation also needs to be examined.

If revenues cannot be increased to reduce significantly the gap between science plans and fiscal resources in subsequent years, then consideration will have to be given to reformulating science plans. The key issue is, of course, defining a viable, justifiable, ongoing science program that matches financial resources. It is not the purview of BCOM to specify whether this means focusing on particular objectives in order to achieve "selective excellence". **But it is clear that the future of the Program will be jeopardized if a "business-as-usual" stance is maintained.**

The committee/panel reports in the *JOIDES Journal* are extracted from the minutes of the committee/panel meeting. Complete copies of the PCOM, BCOM and other JOIDES panel minutes are available from the JOIDES Office. You can request them directly or obtain electronic versions via anonymous ftp on moby2.ocean.washington.edu (login: anonymous, password: your username, subdirectory: pub/JOIDES/Minutes).

JOIDES Thematic Panel Global Rankings

The primary task of the spring thematic panel meetings is to make a global ranking of the active ODP proposals—for a list of active proposals see the Proposal News section in the February *JOIDES Journal*, p. 34. The following rankings were extracted from the executive summaries of the panel minutes.

Sedimentary and Geochemical Processes Panel (SGPP) Global Rankings

SGPP met at Santa Cruz, California, March 4—6. SGPP reviewed new proposals and discussed all active proposals before reducing the list to be ranked to a total of 16. The top 6 proposals with their scores and drillablity are as follows:

Ref. No.	Proposal (ODP Number)	Drillable in FY95	Score	Ranking
423	Gas Hydrate Sampling	yes	14.9	1
412, 412Add.	Bahamas Transect	yes	13.1	2
380Rev3./059	VICAP/MAP	yes	12.2	3
391Rev.	Mediterranean Sapropels	yes	11.7	4
400Add.	Middle Am. Trench/Costa Rica	yes	11.2	5
SR-Rev.	Sedimented Ridges II	yes	9.9	6

Because the revised drilling program of Leg 150 New Jersey Transect will not meet the original SGPP thematic objectives for this leg and will not contribute to tests of the sequence stratigraphic model, the majority of the panel decided to make a second ranking of the top 6 ranked proposals, listed above, plus a New Jersey Margin II, derived from proposed sites not drilled on Leg 150. With this second vote, SGPP wished to express its strong support to make every effort to complete the New Jersey Transect, an objective which is essential for achieving the stated sea level objectives, as outlined in the original proposal (SGPP's highest ranked proposal in the FY93 Prospectus) and the Sea Level WG Report. The outcome of this final vote, and the names of the watchdogs assigned to each proposal, are listed below:

Ref. No.	Proposal (ODP Number)	Score	Ranking	Watch Dog
423	Gas Hydrate Sampling	6.7	1	Swart
----	New Jersey Margin II	4.5	2	Paull
412, 412Add.	Bahamas Transect	4.4	3	Sarg
391Rev.	Med. Sapropels	3.6	4	McKenzie
380Rev3./059	VICAP/MAP	3.5	5	Hiscott
400Add.	Middle Am. Trench/Costa Rica	2.8	6	Underwood
SR-Rev.	Sedimented Ridges II	2.2	7	Sayles

Ocean History Panel (OHP) Global Ranking

The Ocean History Panel held its spring 1993 meeting March 4—6 in Santa Cruz, CA. OHP reviewed twenty new proposal submissions and completed the following global ranking of all active proposals:

#	Proposal number and abbreviated title	No. voting	Total points possible	Total points awarded	Fraction awarded/ available points
1	NAAG, Leg II	14	189	178	0.942
2	430 Sub-Antarctic SE Atl. transect	15	202	174	0.861
3	354-Rev/354-Add Benguela Current	14	190	143	0.753
4	415-Rev Caribbean	15	202	142	0.703
5	386-REV2/422-REV California Current	14	189	123	0.651
6	404 Neogene/W. Atl. sed. drifts	15	202	122	0.604
7	427 South Florida margin sea level	14	189	95	0.503
8/9	391-Rev Mediterranean Sapropels	15	202	93	0.460
8/9	079-Rev Mesozoic Somali Basin	14	189	87	0.460
10	337/337-Add EXXON SL test, N Zealand	14	189	69	0.365
11	253-Rev/253-Add Ancestral Pacific	15	202	61	0.302
12	347-Rev Cenozoic s-equat. Atlantic	14	190	56	0.295
13	406 North Atlantic climate	15	189	52	0.275
14	367/367-Add Cool water carbonate	15	202	35	0.173
15	Bering Sea (CEPAC)/390	15	202	34	0.168

Given the high ranking of the NAAG II program in the OHP global ranking, the panel planned to hold a one-day planning session just prior to their Fall 1994 meeting to finalize a drilling plan based on the results of Leg 151, the NAAG-DPG, and other proposals currently in the system. Attendees to be invited include representatives of the OHP panel, the chief scientists of Leg 151, the NAAG-DPG, and the various proponent groups.

LITHOSPHERE PANEL (LITHP) GLOBAL RANKING

LITHP met in Santa Barbara, California on March 17—19. After reviewing new proposals, LITHP completed a global ranking of all active proposals and rated each program's drillability in FY95:

Rank	No.	Proposal	Members Voting	Score (–1σ)	Drill in 1995 ?
1	420	The Evolution of Oceanic Crust	15	11.5 (3.7)	No
2	300-Rev	Return to Hole 735B	15	10.4 (4.6)	(Yes)
3	NARM	NARM Volcanic Leg 2	15	9.9 (4.1)	Yes
4	SR-Rev	Sedimented Ridges II	14	9.8 (4.2)	Yes
4	86-Rev2	Drilling in the Red Sea	15	9.8 (3.3)	No
6	--	LIP Timing (Kerguelen/Ontong-Java)	13	9.5 (3.9)	No
7	--	Forearc/Backarc (W. Pacific)	14	9.1 (3.3)	No
8	426	Mantle reservoirs, AAD	15	8.9 (4.3)	No
9	407/425	MAR at 15°37'N	14	7.9 (4.6)	Yes
10	--	Mass Balance at Subduction Zone	15	7.7 (3.1)	No
11	376/382	Vema FZ - VE-1 and VE-2	15	7.3 (2.7)	Yes
12	368	Return to 801C	15	6.9 (4.1)	Yes
12	--	Caribbean LIP/KT Boundary	15	6.9 (3.3)	No
14	374	Oceanographer FZ	15	4.0 (3.2)	No
15	380-Rev3	VICAP	15	3.3 (3.0	No

The overall result of the rankings is that, based on the standard deviations (±1 σ), there is very little difference in priority among the top ten programs, all of which address very high-priority LITHP objectives. Based on the global rankings, completion of LITHP's high-priority programs for the 1993-1998 time frame will require that the drillship leave the Atlantic, adjacent seas and eastern Pacific after its currently planned stay through April 1996. Programs in the Indian Ocean and the western Pacific are likely to be highly-ranked by LITHP for drilling in 1997-1998.

TECTONICS PANEL (TECP) GLOBAL RANKINGS

TECP met in Davis, California, March 22—24. After reviewing new proposals, TECP completed a global ranking of all active proposals. TECP members also volunteered to serve as "Heroes" to the top four ranked proposed legs, in order to assist proponents in bringing their proposals to a drillable state. Rankings, scores and "heroes" are as follows:

Rank	Score/15	Name	"Hero"
1	11.6	323 Rev Alboran deep hole (AL-1)	Mike Steckler
2	10.85	NARM Non-volcanic Iberian	Phil Symonds
2	10.85	346-Rev 3 African Equatorial Transform	Alastair Robertson
4	10.2	330Rev Mediterranean I (shallow)	Roland Von Huene/Tim Reston
5	7.3	340Rev. N. Australia Margin	
6	7.2	400 Costa Rica/Middle Amer. Trench	
7.	6.6	NARM Volcanic Leg 2	
8.	5.4	265 W. Woodlark Basin	
8	5.4	334 Rev 2 Galicia margin S' reflector	
10	5.1	330 Rev Mediterranean 2 (deep)	
11	4.8	NARM Non-volcanic-Newfoundland	
12	4.7	333-Rev Cayman Trough	
13	4.2	Red Sea Generic	
13	4.2	323 Rev 2 Alboran(the rest)	

TECP noted that many of its highest priority tectonic objectives were being compromised because of the lack of deep drilling capabilities. Four possible deep drilling objectives were included in TECP's 1993 Global Rankings. To assist PCOM in setting priorities for deep drilling, TECP ranked the following deep-drilling targets:

1. Iberian deep hole (IAP 1) — 2550 m
2. Alboran deep hole (AL 1) — 2.5-3 + km.
3. Galicia S' hole (334 Rev 2) — 1.8 km.
4. NARM Newfoundland deep hole (NB4A) — ≈ 2500 m

TECP is committed to seeing that the Iberian drilling is finished. In that it has already been started, IAP 1 is TECP's number one recommendation for ODP to begin its experience with deep drilling targets.

Downhole Measurements Panel (DMP)

College Station, Texas, January 18—21, 1993

New DMP Directions

DMP polled its members to find out how its functions as an advisory panel could be improved. The panel recognized a need for a more critical review of downhole measurement systems, and reasons for such action surfaced repeatedly throughout the meeting. DMP concluded that all scientific drilling programs are suffering from a lack of qualified downhole instrumentation, cooperative development efforts can aid the situation. DMP is in a unique position to further such efforts. However, a challenge exists in that the goals and aspirations of other programs may not parallel those of ODP. DMP will adopt the concept of "watchdogs" to provide points of contact, and to better assess the operational principles, the engineering constraints, and the costs associated with downhole measurements. This action will minimize oversights that lead to false expectations within the ODP community.

DMP instituted a new thrust involving measurements that provide information from the region far-removed from the borehole. Cross-borehole acoustic techniques are used in the hydrocarbon industry to generate velocity and attenuation maps over distances up to several hundred meters. This technology is expensive and, perhaps, immature for use in the oceanic environment, but there is the possibility that cooperative efforts can further the concept. Downhole radar can be used between holes, or from within a single hole. The distance of interrogation is less than that of acoustic experiments, but the technology may be relatively inexpensive.

Shipboard Measurements Panel (SMP)

College Station, Texas, February 23—25, 1993

SMP met on February 23rd and 25th, a joint session was held with IHP on the 24th. SMP Reviewed Physical Properties, Paleontology and XRF laboratories and made the following recommendations.

- ODP-TAMU should modify the existing GRAPE software to incorporate the Boyce correction for pore water.
- ODP-TAMU should initiate a QA/QC procedure for development of any non-commercial software acquisitions.
- ODP-TAMU should proceed immediately with the development of the *4D*-based *Rawhide* paleontological software package. The panel re-states that the ease of data input and production of range charts for shipboard use are of the utmost importance. SMP strongly suggested that TAMU interact with SMP and IHP panel members on this development by utilizing the members for software prototype trials.
- Some computer programmer time should be allocated during the Leg 149 transit to assist the XRF technician in de-bugging the instrument and to assist in the incorporation of internal matrix corrections in the new system software.
- PCOM should provide guidance to the panels and the operator on the appropriate mechanism for large capital equipment replacement. It is likely that many of the large laboratory items will require replacement within a narrow period of time.

Joint Session with IHP

In a joint session with IHP, the two panels reviewed issues of overlapping mandate and IHP/SMP recommend that the operator take the following actions :

- determine if and when the Boyce correction was removed from the software,
- advise the science community about the requirement to correct GRAPE data,
- at the time of the next release of the CD-ROM, replace old, uncorrected data with the Boyce-corrected data,
- immediately change the existing GRAPE software as per SMP recommendation.

IHP/SMP recommended that the co-chief scientist, staff scientist and curator should be allowed to define intervals of limited sampling where all normal sample requests do not apply. The science party would then be required to make requests for samples within this limited sampling interval.

Information Handling Panel (IHP)

College Station, Texas, Feb. 23—25, 1993

Publication Policy

IHP recommended to PCOM that the detailed changes be made to the publication policy ***(for details see PCOM Report, p. 4)*** with the objective of: (a) improving the quality of publications; (b) restraining the progressively rising costs of publications; and (c) facilitating the rapid distribution of ODP digital data to the scientific community.

Prioritization of Activities.

The following is an IHP-prioritized list of activities/developments at ODP-TAMU. IHP considers that action on the majority of these items is essential to ensure the continued health of ODP.

1. TAMU/ODP should devote sufficient resources to capture, curate and organize the current flow of shipboard data into a rational data-structure. At the present time this is NOT being achieved and the backlog of unassimilated data continues to grow.
2. The upgrade of the shipboard computing environment: (a) The replacement of user-hostile data-acquisition modules with new software/hardware to allow the ready acquisition of shipboard data in real-time, (b) The replacement of the present database system with a modern relational

data base, interfaced to the data acquisition units, (c) The provision of software to allow scientists readily to extract information from the shipboard and shore-based data structures.

3. The elimination of the data-entry backlog in the ODP database to allow this information to be accessed by the scientific community. In view of the importance of chronological information to many facets of the project, the 32-leg backlog of paleontological data from the Proceedings volumes should be entered into the ODP Paleontology database. At the present time, the latter is empty of digital information. The 32-leg backlog of shipboard lithologic data should be entered into the presently existing core-description database. The backlog of routine shipboard XRF major and trace-element data should be added to the existing database.

4. As there is presently no formal data-structure for the storage of GRAPE data within the project (i.e. the GRAPE data is not entered into the current ODP database). Attempts should be made to improve the mechanism by which this important data set is curated, to give better access to the information.

5. The growing size and volume of ODP publications, necessitate that ODP consider the generation of a machine-readable cumulative index.

IHP noted that items under (2) on this list are covered by developments proposed under the current "Computing RFP". Item 1 is of the highest priority as it clearly prevents the backlogs noted under items 3 (and other unlisted backlogs in the ODP data base) from getting worse. IHP noted that this was the first time in two years that IHP had been provided by ODP-TAMU with quantitative information on the backlog in the work of incorporating the routine shipboard data into the existing ODP data structure, despite repeated requests for this information.

IHP advised that the significant problems highlighted by the items on this list indicate that PCOM must pay greater attention to this general area of the Program to prevent a serious problem becoming even worse.

Technology & Engineering Development Committee (TEDCOM)

College Station, Texas, March 30—31, 1993

DCS Developments

TEDCOM reviewed recent progress on the DCS and found the development and testing of all items of DCS equipment was proceeding in a well-coordinated fashion as planned in 1992. Great credit was due to the TAMU engineers. TEDCOM formed a sub-committee to assist TAMU on matters related to DCS simulation studies; the sub-committee included: Marx, Millheim, Rischmüller, Skinner and Svendsen. TEDCOM also recommended that laboratory testing of improved seals around the compensator pistons be pursued by TAMU. The benefits of reduced friction would be felt by all drilling/coring systems (not only DCS). The seals should be changed on the *JOIDES Resolution* before Leg 157, if the laboratory test results are satisfactory.

DCS Land and Sea Tests

TEDCOM recommended that the Vema site lithology be simulated as closely as possible during the land tests, planned for June-August 1993. Given the satisfactory progress on all systems, the plans to test the DCS on Leg 157 should be maintained; TEDCOM will review the matter at their next meeting in September, following land test results. Precise sites for drilling at Vema should be chosen following the DCS land tests and the Vema site surveys. TEDCOM recommends most strongly that the HRBs and DBHAs be preset on Vema , before Leg 157. This will give invaluable extra time for DCS testing. Logistically it should be feasible since preceding legs are in nearby areas. Instrumentation should be carried on Leg 157 to allow compensation of the movement of the DCS bottom end (when off bottom) to be verified. This would allow the efficiency of secondary heave compensation to be verified before attempting coring. The computer system on the DCS platform should be air conditioned. TEDCOM recommends most strongly that drillers with experience of drilling the anticipated lithologies be taken on Leg 15 to operate the DCS.

Retractable Bits

TEDCOM recommended pursuing the tests of Russian retractable tricone bits of the DCS DI-BHA. Tests could take place in August 1993 for a cost of $ 30,000. A contract for $ 25,000 has been let to Christensen to build a prototype retractable diamond bit. TEDCOM recommended that this contract be pursued since it is already let. The Longyear, Christensen and three Russian systems should then be evaluated, without making further financial commitments. TEDCOM considers retractable diamond bits to be a high-risk item, which should not be pursued further until after leg 157.

Site Survey Panel (SSP)

Trieste, Italy, April 6 - 8, 1993

The primary goals for this meeting were: (1) to evaluate the status of data for those proposals that had been highly ranked (top 7) by the spring 1993 thematic panel meetings, and (2) to provide feedback to the proponents of those proposals concerning the data required for submission to the ODP Data Bank.

New SSP Evaluation Worksheets

SSP adopted new evaluation worksheets developed for the November 1992 SSP-subgroup meeting. Worksheets evaluate each site against SSP guidelines. Worksheets will be provided to the proponents and included as an appendix in the SSP minutes. Worksheets will be kept on disk for easy updating at subsequent SSP meetings. After discussion, the worksheet format was changed to distinguish explicitly between data that exists somewhere in the world, and data that has been deposited in the ODP Data Bank.

Science Operator Report Leg 146

CASCADIA MARGIN

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DR. GRAHAM WESTBROOK — CO-CHIEF SCIENTIST
DR. ROBERT MUSGRAVE — ODP 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

Leg 146 was directed toward investigation of tectonic dewatering in the accretionary wedge at the Cascadia continental margin. At five sites two principal thematic objectives were pursued: (1) the mechanisms and geological consequences of diffuse flow and channeled flow within the wedge; and (2) the cause of bottom-simulating seismic reflectors (BSRs) and their relationship to the occurrence of gas hydrate and free gas.

Site 888, located in Cascadia Basin near the northern edge of Nitinat Fan, provides a reference section (with particular emphasis on porosity, temperature, and pore-water geochemistry) for the other sites located on the accretionary wedge. Diffuse fluid outflow from the wedge and the nature of a well-defined BSR were investigated at Sites 889 and 890 off Vancouver Island. Flow through fault zones was investigated at Sites 891 and 892 off Oregon. Site 891 examined the frontal thrust fault that connects to the master décollement. Site 892 exhibited a BSR displaced toward the surface along a hydrologically active fault in the Pliocene section of the wedge.

A wide variety of downhole determinations were successfully completed on Leg 146 to characterize the fluid regime on the Cascadia margin and complement detailed laboratory analyses. In addition, the first long-term observatories — instrumented borehole seals (CORKs) — were deployed on a modern accretionary prism at Sites 889 and 892.

INTRODUCTION

Leg 146 of the Ocean Drilling Program was dedicated to the study of the Cascadia convergent continental margin. Drilling was concentrated in two primary areas of the margin, the Vancouver Island and central Oregon Coast regions. Principal topics of investigation included the effects of subduction and accretion on the fluids and sediments at the continental margin, as well as the occurrence of gas hydrates and their relationship to bottom-simulating reflectors present in the area. A final site in California's Santa Barbara Channel was devoted to shallow holes for paleoclimatic studies.

Accretionary complexes evolve through a complex interplay of sedimentation, structural evolution, diagenesis, and fluid flow. These processes are particularly active near the toe of an accretionary wedge, where high porosity sediments overlying oceanic basement are initially deformed. Convergent motion in this region results in sediment compaction, over-pressuring and expulsion of pore fluids, and development of fault zones to structurally accommodate shortening and perhaps to function as aquifers. The movement of fluids to the surface perturbs normally diffusive geochemical systems and may result in localized cementation, formation of gas hydrates, and acceleration of geochemical fluxes to the water column.

Leg 146 was directed toward examining the role and behavior of fluids in these accretionary processes. By necessity, a single drilling leg can investigate only some aspects of the fluid regime; Leg 146 had as its primary foci:

1. The relative importance of dispersed and focused fluid flow and the associated geochemical fluxes from an active accretionary wedge;
2. The nature of gas-hydrate zones and the physical and chemical factors which support them in a convergent-margin setting.

Because the fluids are derived largely from the sedimentary section, investigation of fluid processes required that we measure the fluid chemistry, the temperature and pressure, the physical properties of the sediments involved, determine the nature and history of diagenetic events, and establish the structural evolution associated with accretion and fluid discharge.

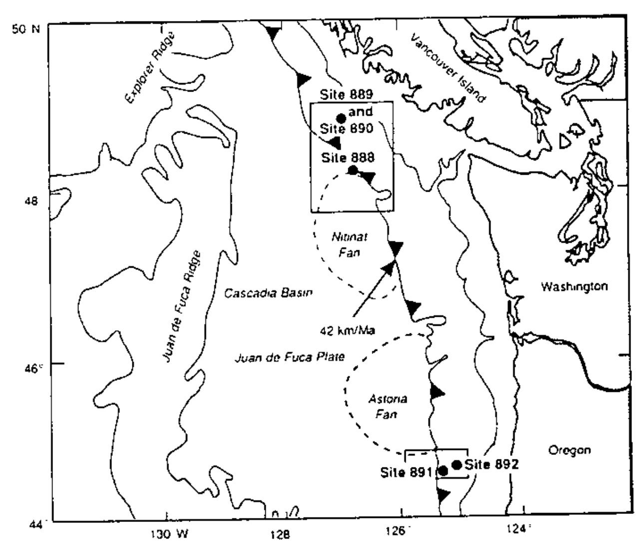

Figure 1. Location map showing position of Cascadia continental margin, convergence of the Juan de Fuca plate relative to the North American plate, and the positions of sites drilled on Leg 146.

The Cascadia margin represents the convergence zone between the Juan de Fuca and North American lithospheric plates (Fig. 1). Simple subduction has persisted here since the Eocene, resulting in westward growth of the continental slope by accretion of Cascadia Basin sediments. The modern convergence rate is approximately 42 km/m.y., directed N69°E (DeMets et al., 1990). Turbidites and hemipelagic deposits in the Cascadia Basin attain thicknesses of 3—4 km at the base of the slope. The décollement between the accretionary wedge and the subducting plate lies at various depths along the margin, so that half to nearly the entire sediment section is accreted at different locations. Compression of this section results in fluid expulsion at the seafloor, and may contribute to formation of well-defined bottom-simulating reflectors (BSRs) across much of the slope.

Drill sites were chosen on the basis of multichannel seismic reflection lines, submersible surveys and samples, sidescan sonar images, and heat-flow data. From these data it has been suggested that the margin off Vancouver Island is characterized by dispersed fluid discharge, while focused flow, evidenced by well-defined fluid vents, is prevalent off Oregon. Leg 146 was planned to investigate each of these areas to evaluate their respective modes of dewatering. Well-defined BSRs are present at one site off Vancouver Island and at one site off Oregon.

Scientific Objectives

Leg 146 was designed to investigate the relationship between fluid flow and tectonics in the accretionary wedge formed at the Cascadia convergent plate boundary. Leg 146 investigated fluid flow from and sediment deformation within the accretionary wedge that forms the continental margins off Oregon and Vancouver Island. This leg was dedicated to advancing our knowledge of the budget, sources, pathways, and ultimate fate of sediment, water, and dissolved chemicals in the wedge, and the relationship between accretionary tectonics and fluid regime. Near Vancouver Island, three sites were drilled to examine the progressive changes in porosity of sediments that are accreted and deformed and the associated fluid flow. Near Oregon, the channeling of the fluid outflow along faults was the focus of investigations at two sites.

Drilling Objectives

Site 888 lies 7 km west of the base of the continental slope in Cascadia Basin, on the northern edge of the Nitinat Fan. The site is little influenced by the tectonic stresses that deform and consolidate sediments within the accretionary wedge and in the proto-deformation zone seaward of the wedge toe, as it lies farther from the deformation front than the spacing of imbricate thrusts in the wedge. Drilling at this site provided a reference section for comparison with sites in the accretionary wedge of the continental margin and information on the types, age, and physical properties of sediment in the sedimentary section that is stripped from the oceanic crust to form the accretionary wedge.

Sites 889 and 890 lie on a 15- to 20-km-wide region of gently undulating seafloor in the mid-slope of the continental margin off Vancouver Island. Beneath Sites 889 and 890, the seismic reflectors within the accretionary-wedge deposits are laterally incoherent (Fig. 2). This incoherence appears to be produced by faulting and by folding over wavelengths shorter than 500 m. Within the incoherent section of the seismic profile, there occurs a strong, seismically continuous Bottom-Simulating Reflector (BSR) at about 276 ms two-way travel time (twt) below the seafloor (Fig. 2). Drilling at Sites 889 and 890 was undertaken to determine the geochemical, thermal, and hydrologic conditions that support formation of the BSR, and the physical properties of the sediments above and below the BSR. These sites were also drilled to define fluid flow and geochemical fluxes at a location believed to be devoid of a major, throughgoing fault zone, i.e., a location characterized by diffuse flow.

Site 891 lies on the westernmost ridge of the Oregon continental margin at 2663 mbsl (Fig. 1). The ridge stands 700 m above the Cascadia Basin, extending approximately 10 km along strike and is an anticlinal thrust sheet formed by movement along the frontal, landward-dipping fault. The fault roots in the décollement beneath the accretionary wedge which forms the outer continental margin. The frontal thrust fault is imaged on seismic reflection profile OR-5 at a depth of about 375 mbsf at Site 891 (Fig. 3). The negative polarity of that reflector suggested that the region beneath it might contain overpressured fluids. Site 891 was drilled to determine if fluids moving along the fault originate from source zones as deep as 3 km within the accretionary complex, or within the underlying, underthrust sedimentary sequence.

Site 892 lies on the western flank of the second ridge on the accretionary wedge that underlies the Oregon continental slope (670 mbsl;). The site is located about 350 m east of a prominent bioherm associated with the surface trace of an out-of-sequence thrust fault. The occurrence of clams, bacterial mats, methane bubbles, and massive diagenetic carbonate deposits at the bioherm indicates active fluid venting from the fault zone. A well-defined BSR lies beneath Site 892. The site was positioned to intersect both the BSR (68 mbsf) and a hydrologically active, landward-dipping fault (105 mbsf). Site 892 was drilled to delineate the hydrogeology and fluid chemistry of a Pliocene portion of the accretionary wedge, to assess the importance of a fault zone as an active aquifer, to determine the history of flow along this fault and its effect on the temperature regime, to analyze the structures developed around active and relict fault zones, and to investigate the effect of focused fluid advection on the occurrence of gas hydrates and the BSR.

Site 893 lies in the Santa Barbara Basin and contains sediments which are ideally suited for ultra-high resolution studies of marine records with regard to climate change and to the global carbon cycle. The existence of both a terrigenous-clastic and marine-biogenic signal allows for detailed reconstruction of climatic fluctuations. Due to the high carbon content of the sediment, the carbon isotopic record of carbonate can be directly compared to the carbon isotopic composition of individual biological markers on a lamina basis. In addition, these sediments will enhance our knowledge about the history of coastal upwelling at interglacial-glacial time scales.

Results

Site 888

Lithostratigraphy

Unit I: (0—175.1 mbsf) Holocene to upper Pleistocene, interbedded clayey silts, and fine to medium-grained sands, with some thin beds containing pebbles, volcaniclastic fragments, and pieces of wood. Between Units I and II is a transition zone, in which there is gradual increase in the proportion of massive sand with depth

Unit II: (175.1—457.0 mbsf) Upper Pleistocene, thick beds (>1 m) of massive fine- to medium-grained sand with interbeds of clayey silt. The unit is predominantly sandy, and core recover from it was low. The sands are poorly sorted

Unit III: (457.0—566.9 mbsf) Upper Pleistocene, clayey silt and silt, finely laminated, with thin interbeds of fine to coarse sand and gravel. The unit may be divided into two subunits IIIA (457.0—496.0 mbsf) predominantly silts, showing incipient lithification; IIIB (496.0—566.9 mbsf) clayey silts with sands.

The three lithostratigraphic units are interpreted as being deposited by normal- and low-density turbidity currents in a submarine fan environment. The turbidites in Unit III are of more distal character than those in Unit I.

The magnetic polarity of the cored interval is normal, except for an interval between 98 and 101 mbsf, which may correspond to the Blake event at about 110,000 yr. The section is therefore younger than 780,000 yr. Biostratigraphic control was poor. Radiolarians of the *Botryostrobus aquilonaris* Zone (less than 450,000 yr) were found to a depth of 170 mbsf.

The geothermal gradient has been established as 68°C/km, from 11 good measurements of temperature down to 315 mbsf. Thermal conductivities measured in the sediment cores increase in value downward through the uppermost 200 m to a mean value of 1.23 W/m°C for the section below that depth. The thermal gradient and conductivities yield a heat flow of about 73 mW/m^2 near the seafloor, which increases through Unit I to reach a value of 84 mW/m^2 through Units II and III. The upward decrease in heat flow is probably a consequence of the absorption of heat by the cool, rapidly deposited sediments.

Measurements of porosity and shear strength indicate that sediments in the cored intervals are under-consolidated. Wireline density and neutron logs show that the minimum porosity of the section lies at 300 mbsf. The general state of undercompaction indicated by the logs and the measurements of physical properties may be attributed to rapid deposition. A good match between the seismic profile and the synthetic seismogram derived from downhole logging enables the profile to be accurately correlated with core and logging data from the site.

The geochemistry of the pore water in the section varies downward in response to bacterial sulfate reduction, carbonate diagenesis, and fluid flow within some intervals. Geochemical analysis of pore fluids and gases revealed several interesting aspects of fluid flow, gas migration, and diagenesis in the section. At 70 mbsf, chloride concentration sharply decreases by 12 mM from 571 mM, to which it had steadily increased from 545 mM at the seafloor. A pronounced minimum in chloride of 18 mM below surrounding values of about 563 mM occurs at 514 mbsf. Flow is required to sustain these anomalies, which would otherwise diminish by diffusion.

Overall, organic carbon in the section is at a low concentration (0.2—0.4 wt%) and is refractory. Concentrations of methane above 200 mbsf are less than 5 ppmv. Ethane, propane, and butane are present only in trace amounts (C_1/C_2 > 1000), indicating that the methane is of bacterial origin. An anomaly of high methane gas content (68,000 ppmv) occurs in a high-porosity sand at 351 mbsf. It is not clear that the methane in this sand was formed in situ, yet fluid migration appears to be excluded as an explanation for its presence by the absence of anomalies in the fluid chemistry. In this instance the gas may have migrated into the sand independently of other fluids.

In summary, investigations at Site 888 revealed that the upper quarter of the sedimentary section on the ocean floor near Vancouver Island comprises a sequence of undercompacted sands and silts that were rapidly deposited in a submarine fan environment. The rate of sedimentation of the upper 100 m of section has been close to 100 cm/1000 yr, and sedimentation rates in the remainder of the cored interval were probably greater. In as many as four intervals of the cored section, there is evidence that fluid flow is occurring as a result of differential compaction of heterogeneous sediments within the fan. The possibility that some of the fluid may also be flowing horizontally from a region of compaction induced by the advancing accretionary wedge, 7 km distant, cannot be excluded.

Sites 889 and 890

Lithostratigraphy—Site 889

Unit I: (0—128 mbsf) This unit includes clayey silts, fine sands, and diagenetic carbonates, and comprises slope and slope basin sediments which are hemipelagites, turbidites, and mass-flow deposits. Age is upper Quaternary.

Unit II: (128—301 mbsf) Unit II consists of highly-fractured abyssal-plain silts and clays that were fractured during accretion. Age is lower Pleistocene to Pliocene.

Unit III: (301—345 mbsf) The sediments in Unit III appear to be abyssal-plain deposits like those in Unit II above, but the abundant authigenic glauconite suggests

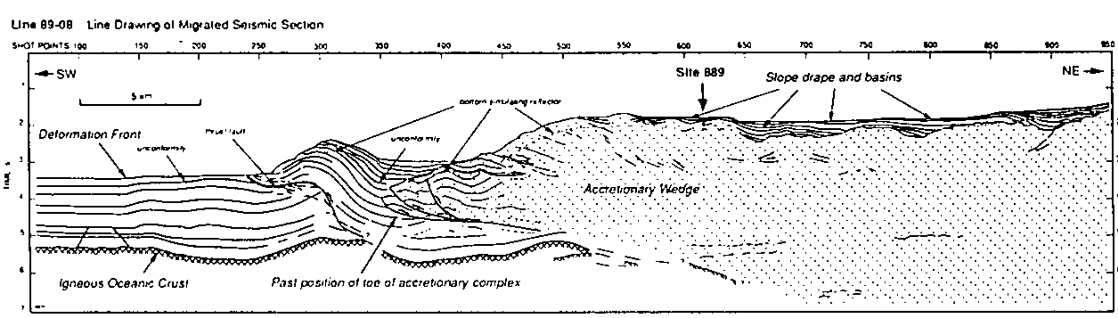

Figure 2. Line drawing of seismic reflection line 89-08, showing position of Site 889 on seismically incoherent accretionary deposits and overlying bedded sediments of the mid-slope, the thrust sheets of the lower slope, and undeformed Cascadia Basin deposits to the west.

deposition under suboxic conditions. Lithostratigraphic Unit III exhibits an apparently anomalous increase in porosity with increasing depth. Age is late Pliocene.

Structural Domains

Domain I (0—104 mbsf) is dominated by subhorizontal bedding, with little apparent deformation of the slope basin sediments.

Domain II (104—127 mbsf) is characterized by less common sand/silt beds that dip 40°—70° to the west.

Domain III (below 127 mbsf) Small-scale fractures are evident and become more common downhole. Below 150 mbsf, fractures are pervasive and produce angular fragments that commonly exhibit an interlocked geometry. The fragment surfaces are sometimes polished and slickensided. The dominant fracture fabric dips 45°—60°. Because fractures are ubiquitous in Domain III, and no clear indicators of fault zones were recovered, we infer that tectonic stress in the accretionary-wedge sediments sampled at this site is accommodated largely by distributed strain.

Holes 889A and 889B were both logged with the geophysical and formation microscanner (FMS) tool strings; a vertical seismic profile (VSP) was run in Hole 889B. Logs show the base of Unit I to have particularly high porosity. This high-porosity zone is associated with geochemical anomalies (Cl, Ca, Mg, S, N, methane, ethane), which implies that it collects fluids evolved from greater depths. Within Unit II, high velocity and resistivity values correlate with low neutron porosity, indicating the presence of carbonate cementation.

The BSR at Sites 889 and 890 is situated 276 ms twt below the seafloor in the migrated seismic section. Time-depth curves derived from the sonic log and VSP indicate that the BSR is located at 225 mbsf in Hole 889B. There is no evidence in either the logs or cores for the accumulation of hydrate in massive form, but a temperature of -1.4° C measured on the core-receiving catwalk in a core recovered from 220 mbsf (about 10°C lower than temperatures measured in other cores from around this sub-bottom depth) could have been produced by the dissociation of hydrate filling 8% or more of the pore space.

Although the sonic log does not exhibit a substantial decrease in velocity across the BSR, the VSP data define a rise in velocity just above the BSR, with a distinct low-velocity zone beneath it (Fig. 3). Velocities are lower than in seawater and suggest the presence of small amounts of free gas. The disparity between the sonic log and VSP results may be attributed to drilling disturbance, which could deplete the gas phase in the immediate vicinity of the borehole; in addition, the sonic log will not record velocities lower than that of the seawater filling the hole.

In summary, the geophysical and geochemical data, taken together, are best explained by the presence of hydrate in the sediment above the BSR at 225 mbsf, and by the presence of a small amount of free gas (no more than 5%) in the 25 m interval beneath the BSR. If this interpretation of the data is correct, then the experimentally derived stability field for hydrate formed from a solution of pure water and pure methane is not appropriate for the natural system investigated at Site 889. The estimated stability field for methane and seawater (Hyndman et al., 1992) gives a closer prediction of the depth of the BSR. The low chlorinity in the interval beneath the BSR might have its origin, at least in part, in dissociation of hydrate accompanying the upward migration of the base of the hydrate stability field, as the upper few hundred meters of the section warmed after the last glacial period.

The pattern of variation at Sites 889 and 890 in the organic and inorganic geochemistry of the pore fluids and in physical properties does not show some of the large discontinuities that are seen at Sites 891 and 892 in association with major faults. With the exception of a narrow interval around 130 mbsf, there is little evidence of significant fluid flow that is confined to conduits or fluid pathways provided by permeable beds or faults. Lithostratigraphic Units II and III are pervasively fractured, and it seems probable that flow through the section will be quite dispersed through this fractured rock. In situ fluid pressure measured with the LAST II tool at a depth of 140 mbsf was indistinguishable from hydrostatic pressure, No direct evidence for large-scale fluid flow through the section was discovered at Site 889, and the linearity of the increase of temperature with depth implies that any flow that is occurring must have a velocity of less than a few millimeters per year.

A borehole seal (CORK) was deployed at Hole 889C and should provide data on temperature, pressure, and pore-water composition after the effects of drilling have been equilibrated. From these data, it should be possible to determine the temperature profile through the hydrate stability zone in more detail, and post-cruise hydrogeologic tests in this sealed hole should define rates of fluid advection in the accretionary wedge through the region of the BSR.

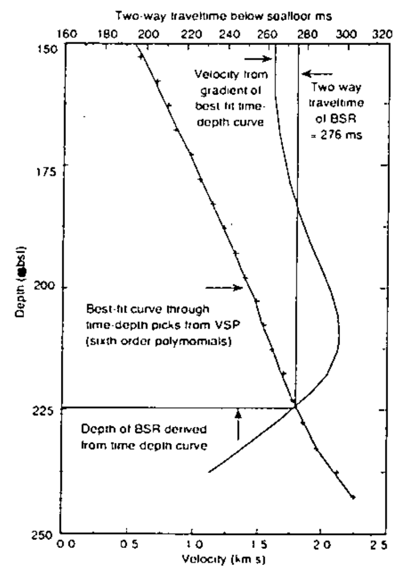

Figure 3. Plot of first arrival times of seismic waves (converted to two-way travel time below seafloor) against depth of the downhole geophone in the VSP at Site 889. From these data, the reflection time of the BSR below seafloor (276 ms) is found to correspond to a depth of 225 mbsf. By fitting a smooth curve through the time-distance points and differentiating it, the broad variation in velocity in the region of the BSR has been derived. Velocity gently increases to a maximum at about 210 mbsf, beneath which it decreases with an increasing steepness to a value of about 1.1 km/s at 238 mbsf. The velocities lower than 1.5 km/s could be caused by the presence of a small quantity of free gas (<5%) in the sediment. The increased velocity above the BSR could be produced by the presence of hydrate.

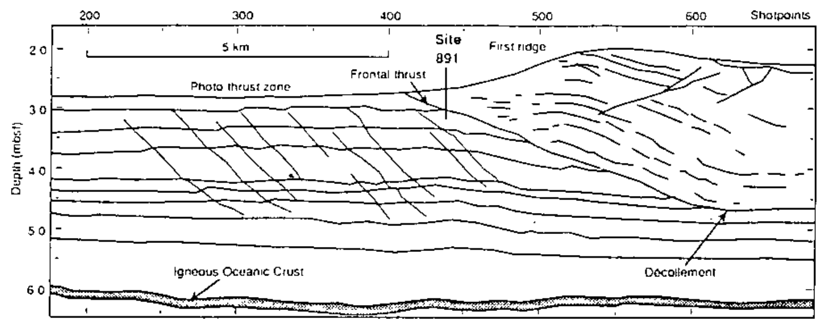

Figure 4. Line drawing of seismic section OR-5, showing the position of Site 891, which penetrates the frontal thrust fault (after R. von Huene, pers. comm.).

Site 891

Lithostratigraphy. Because of the low core recovery and the compositional and textural similarity of all sediments recovered at Site 891, only one lithostratigraphic unit was designated. The lithologies sampled consist primarily of clayey silts and fine to medium sand. Allochthonous pebbles and diagenetic carbonate concretions are distributed randomly throughout the section. Biostratigraphic and paleomagnetic results are consistent with a post-middle Pleistocene age for the entire column. The structural position, age, and composition of the sediments suggest that Site 891 accumulated as proximal deposits on Astoria Fan prior to uplift.

Turbidite beds are steeply inclined (about 60°) above 84 mbsf, overlying variably dipping beds (0°—50°) to 198 mbsf. Shear bands appear sparsely in the interval between 100 and 198 mbsf, but there are no other strain indicators above 198 mbsf. In contrast, numerous discrete fractures are observed from 198 to 278 mbsf and from 321 to 375 mbsf. Two fault zones (263 and 375 mbsf) are recognized within these intervals by the development of shear fabrics and polished and slickensided surfaces. Between the two fractured zones (278—321 mbsf) no shear fractures occur, but development of a bedding-plane fissility suggests a compaction fabric. Below 375 mbsf, few fractures are observed and bedding dips 14°—20°.

Pore-water chemistry and physical properties define three distinct zones in Hole 891B:

Zone 1: (0—200 mbsf) This interval is characterized by (1) porosity which declines regularly from about 50% at the seafloor to about 38% at depth; (2) low concentrations of methane, carbon dioxide, and a virtual absence of higher hydrocarbons; (3) low Cl concentration, the presence of sulfate, low alkalinity, and a stable Mg/Ca ratio. This zone appears to be a region of normal gravitational compaction which is dominated by sulfate reduction.

Zone 2: (200—440 mbsf) This zone differs significantly from Zone 1 and suggests little hydraulic communication between the two. Methane concentration increases markedly in Zone 2, and its sympathetic variation with organic carbon content indicates bacterial methanogenesis. Ethane, higher hydrocarbons, and carbon dioxide appear below 240 mbsf and define maxima at 314, 340, 367, and 410 mbsf. These maxima represent thermogenic (hydrothermal) hydrocarbon incursions that indicate at least localized fluid advection. The presence of the olefin ethene (C_2H_4), which is unstable, suggests that the fluid dispersal system is active. Cl concentrations in Zone 2 are high and relatively constant, SO_4 is absent, and Mg is low. These concentrations indicate that Zone 2 waters belong to a separate hydrologic system from those in Zone 1, and the interface between the two shows little evidence of diffusion between them. Fault zones or intervals of anomalous compaction define several discontinuities (at 260, 308, 375, and 440 mbsf) in the porosity distribution in Zone 2. The two upper zones are apparent in the pore-water (Li, Mg/Ca ratio, and silica) and gas (ΣC_2—C_6) chemistry; the anomalies probably reflect flow along permeable faults or sand beds. The lack of a significant geochemical anomaly at 375 mbsf suggests that the thrust imaged on the seismic reflection profile may be a horizon of little or no active fluid flow.

Zone 3: (440 mbsf—total depth) This zonal boundary is defined primarily on the basis of a pronounced increase in porosity (from 40% to 60%) at 440 mbsf. The porosity inversion and geochemical signature suggest that the active portion of the frontal thrust may have stepped down to near the top of this interval. Zone 3 appears to represent the footwall section beneath the frontal thrust fault.

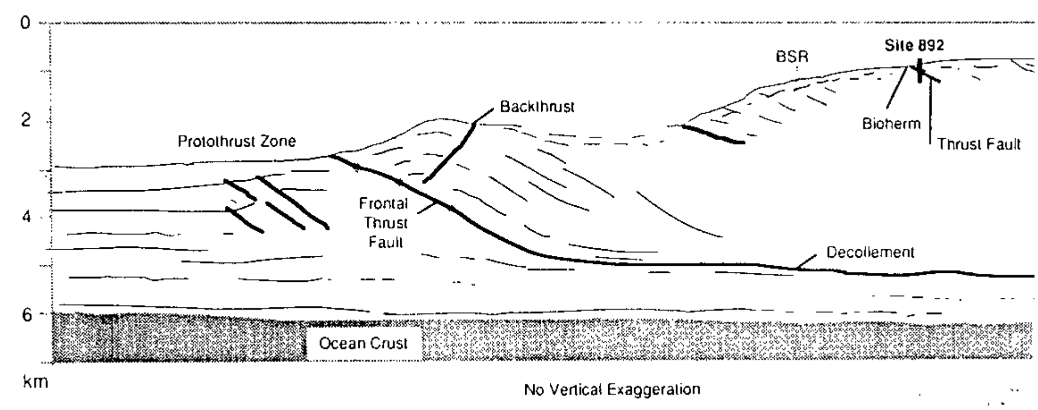

Figure 5. Line drawing of MCS line OR-9 (after MacKay et al., 1992). Site 892 is located at shotpoint 440. Heavy lines indicate positions of inferred faults. Vertical exaggeration is approximately 2:1 at the seafloor.

Site 892

Logging at Site 892 unequivocally indicates that the BSR is caused by the presence of free gas below 71 mbsf. Below this level, sonic velocity drops to a uniform value of 1.5 km/s, indicative of borehole fluid, which implies that velocity in sediment surrounding the borehole is even lower. The low sonic velocities are attributed to free gas in the formation below the BSR and are confirmed by the VSP (_1.4 km/s, 68—91.5 mbsf).

The sediments at Site 892 consist primarily of terrigenous silty clay and clayey silts with scattered sand layers. The sediments at Site 892 appear to be Pliocene abyssal-plain deposits, similar to the lowermost sediments recovered at DSDP Site 174 in Cascadia Basin. A single Lithostratigraphic Unit was defined.

The section cored at Site 892 is divided on the basis of structural characteristics into three domains. Domain I (0—52 mbsf) consists of moderately dipping (<35°) beds of silt and fine sand, with fractured intervals in some of the silts. A fault zone is inferred at 52 mbsf (Domain I/II boundary) from an abrupt reduction in bedding dip to 10°—20°, and by fractures in the FMS log. The presence of shear bands and stratal disruption in the interval 62.5—67 mbsf suggests a fault zone. Fractured intervals, scaly fabric, and veins increase downhole in Domain II (52—106 mbsf) to culminate in a strongly developed fault-zone fabric in Domain III (106—175 mbsf). The interval between 116 and 147 mbsf exhibits a mélange fabric.

Radiolarian-based biostratigraphy of the Pliocene section confirms the positions of the fault zones. Two stratigraphic inversions are apparent in Hole 892A, between 45 and 50 mbsf and between 107 and 117 mbsf. In Hole 892D the lower inversion occurs between 76 and 110 mbsf, and the upper inversion is not recognized. In addition, the biostratigraphy defines a hiatus at 23—30 mbsf in Hole 892A and at 32—43 mbsf in Hole 892B.

Marked downhole discontinuities occur in physical properties at Site 892. Abrupt dislocations in bulk density and porosity occur at 17, 67.8, 116, 144, and 164 mbsf. The discontinuity at 17 mbsf is clearly a function of the gas hydrates observed between 2 and 17 mbsf, the sublimation of which disrupted the near-surface sediment, resulting in a very high porosity (>67%). Beneath the visible hydrates, porosity declines normally to about 55% at 67.8 mbsf (top of lithostratigraphic Subunit IB), and then becomes variable (42%—62%), with little evidence for further general consolidation. Compaction appears to be localized about the faulted intervals where strain hardening has occurred. These same intervals are adjacent to porous, fractured zones which, at 67.8 and 116 mbsf, apparently serve as active fluid-flow zones.

Bacterial methanogenesis occurs at very shallow depths (within the upper 2 mbsf) at Site 892. Although biogenic methane probably persists to the base of the hole, it is mixed with higher hydrocarbon gases below 67.8 mbsf. Thermogenic hydrocarbons (C_2—C_6) were sampled and must be derived from deeper within the prism (1—4 km), as the maturity of the local kerogen is insufficient to produce them. The distribution of higher hydrocarbons suggests movement of fluids through the section at 67.8, 107, and 125 mbsf.

Fluid flow. Temperature is a sensitive indicator of advective flow. In situ temperature measurements at Site 892 define a linear temperature gradient of 51°C/km, which suggests conductive heat transfer. Superimposed on this gradient, however, are two anomalous points at 67.5 and 87.5 mbsf, which have temperatures 1.6°C and 2.5°C higher than predicted by the linear gradient, respectively. These points are attributed to local advection of warm fluids along fault zones delineated by the logs. The limited vertical extent of the anomalies, however, indicates small spatial diffusion of the temperature signal, and requires very recent fluid flow (within the last 10 years).

Active flow at Site 892 is indicated by geochemical anomalies in the pore waters, by a packer test that measured superhydrostatic fluid pressures, and by local higher-temperature excursions from an otherwise linear increase in temperature with depth. Furthermore, the presence of gas hydrates and elevated levels of hydrogen sulfide at 2—17 mbsf may be an indirect consequence of the underlying flow regime. A borehole seal (CORK) was deployed at Hole 892B to provide long-term observation of the thermal, chemical, and hydrogeological conditions at the fault zone.

Gas hydrates occur as macroscopic crystals, pellets, and aggregations distributed in the upper 17 m of sediment, and probably as disseminated deposits to 68 mbsf. The disseminated hydrates have a patchy distribution as indicated by the variable dilution of Cl. Temperature measurements and analysis of the heat budget in the cores with observable hydrate (<17 mbsf) indicate that less than 10% of the pore space is filled with hydrate.

The occurrence of high concentrations of H_2S in near-surface sediments and its presence to 60 mbsf indicate either that H_2S is formed bacterially but its usual removal as monosulfides and/or pyrite is inhibited, or that H_2S is allochthonous to these near-surface sediments and has a hydrothermal source. The close association of H_2S with the gas-hydrate zone suggests that free sulfide may be stored as clathrate in situ.

The temperature distribution constrains the hydrate stability field at Site 892. The temperature gradient predicts the base for the stability field of hydrate formed from pure-methane/pure-water at 120 ± 4 mbsf. The BSR, which is commonly interpreted to indicate the base of the hydrate zone, is situated at 68 mbsf. The disparity between the measured temperature and predicted temperature at the BSR (2.1°C) suggests that the experimentally derived phase boundary for pure-methane/pure-water is not directly applicable to the gas-hydrate system on this margin. Resolution of the apparent disparity between the theoretical gas-hydrate stability field and the position of the base of that field observed at Site 892 must await determination of the gas composition of the hydrates and may require experimental determination of an appropriate gas/seawater hydrate stability field.

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Science Operator Report Leg 147

HESS DEEP RIFT VALLEY

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ABSTRACT

The principal success of Leg 147 was the recovery of continuous sections of crustal gabbroic rocks and shallow mantle harzburgite, dunite, and intercalated gabbroic rocks from the Hess Deep. These cored crustal sections at Site 894 were generated at the fast-spreading East Pacific Rise (EPR), approximately 1 Ma. Hess Deep is the deepest part of a westward-propagating rift valley that is opening up the eastern flank of the equatorial EPR in advance of the propagating Cocos-Nazca spreading center. The exposures cored at Sites 894 and 895 were located on the crest and southern slope of an intra-rift ridge, respectively. At Site 894, 219.9 m was cored in seven holes, recovering 58.5 m of gabbroic rocks, principally gabbronorite with lesser amounts of gabbros, olivine gabbros and gabbronorites, oxide gabbros and gabbronorites, and basaltic dikes. Operations at Site 895 recovered shallow mantle rocks, interpreted as lying close to the petrological Moho, from six holes that penetrated a total of 272.9 m and recovered 64.56 m of rock. The rocks recovered were predominantly dunite and harzburgite, with intercalated, less abundant gabbro, olivine gabbro, and troctolite. This recovery of deep crustal and upper mantle gabbroic rocks and peridotites should prove critical to the characterization of the igneous, metamorphic, and structural evolution of the lower crust and upper mantle generated at a fast-spreading ridge, as well as for understanding variation in physical and magnetic properties of the lower crust and upper mantle. This leg represents the first one of a proposed multi-leg program.

INTRODUCTION

Detailed bathymetric, petrologic, and geophysical surveys along the global mid-ocean-ridge system have greatly modified our view of the stratigraphy of the oceanic crust and upper mantle during the past decade. The simple layer-cake model, which requires a continuous elongate magma chamber along an axis, has evolved to a segmented ridge system with a hierarchy of discontinuities which likely reflect mantle dynamics and magma-melting processes. Recent models suggest that magma chambers are discontinuous features that are fed intermittently from below at regularly spaced points. Most models which attempt to predict how the internal stratigraphy of the oceanic crust is influenced by the rate of magma supply, spreading rate, and magmatic vs. amagmatic extension have been developed on the basis of remote geophysical techniques. To test these models, it is important to study not only the basalts erupted on the seafloor but also plutonic rocks that crystallized within a magma chamber and the upper mantle rocks which are the ultimate magmatic source. Because plutonic and ultramafic rocks may show considerable mineralogical and geochemical heterogeneity at a

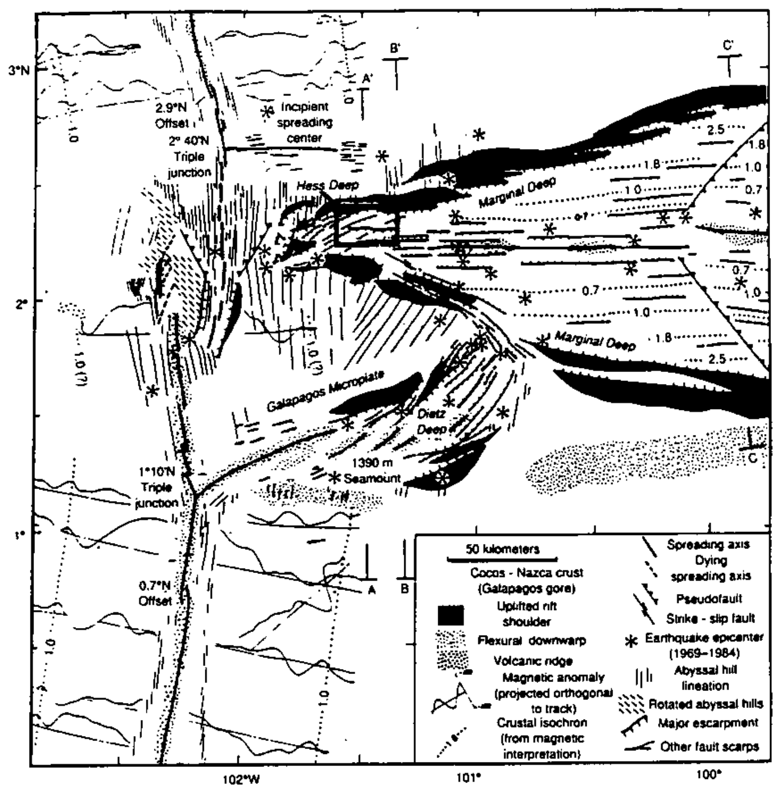

Figure 1. Location of Hess Deep at the western end of the propagating Cocos-Nazca spreading axis (from Lonsdale, 1988, copyright American Geophysical Union).

continuous sections of the lower crust and upper mantle by deep drilling.

The broad elevated topography of axial summit grabens at fast-spreading ridges is thought to reflect a high rate of magma supply which would require fairly steady-state magma chambers (MacDonald, 1987). Until recently, it has been predicted that large, steady-state magma chambers would produce a thick layered sequence in the lower crust similar to the layered sequences in the ophiolites and continental layered intrusions. New geophysical data from the East Pacific Rise (EPR) indicate the presence of a thin lens of magma that is underlain by an extensive crystal mush zone that may extend down to the base of the crust (Detrick, 1991; Kent et al., 1990). Gaps in the axial magma chamber reflector along the EPR axis are interpreted as the boundaries of discrete magma chambers which may account for the chemical diversity seen in the volcanics along axis. The igneous stratigraphy should vary with the relative size and geometry of the chamber and crystal mush zone, and may or may not show evidence for anhydrous ductile deformation. Ductile deformation at fast-spreading ridges should preclude the early penetration of seawater into the solidified lower crust, raising the possibility that high-temperature metamorphism is not a significant process beneath fast-spreading ridges (Mével and Cannat, 1991).

Thus, it is probable that the lower crust in oceanic crust generated at fast-spreading ridges is significantly different than that formed at slow-spreading ridges with a low magma budget. The gabbroic core recovered during Leg 147 will provide important new insights into processes of crustal formation at fast-spreading ridges and will be an important comparison to the gabbroic core recovered at the slow-spreading Southwest Indian Ridge during Leg 118.

Another major issue of lithosphere creation and evolution at mid-oceanic ridges is the understanding of processes occurring in the upper mantle and the crust-mantle transition. In ophiolites, a more or less thick transition zone is composed of alternating dunite and harzburgite tectonites, with the proportion of harzburgite increasing downward. The internal stratigraphy and composition of dunites/harzburgites reflect the processes of melt migration and extraction critical to understanding the evolution of ocean-ridge basalt. The extent to which these processes occur beneath ocean ridges is a key unknown in modeling the generation of ridge basalts.

The nature of the seismically defined Moho beneath ridges is still being debated. Although the Moho is generally viewed as a simple igneous stratigraphic boundary, investigations of ophiolites demonstrate that it may be either a wide transition zone or a tectonic contact. A well-preserved, intact igneous Moho is most likely to occur beneath fast-spreading ridges, as extension accompanying divergence of the plates may be simply accommodated by flow in a crystal mush zone and partially molten mantle. Processes controlling seawater penetration in the mantle are still poorly understood; the chemical effects of serpentinization are of primary importance with respect to the chemical budget of the oceans. Serpentinization decreases the density and velocity of mantle rocks and therefore may play a major role in the seismic and gravity data. Serpentinization is also responsible for the formation of secondary magnetite, which may allow mantle rocks to significantly contribute to the formation of magnetic anomalies.

Geologic and Tectonic Setting

Hess Deep is the deepest part of a westward-propagating oceanic rift valley that is opening up the eastern flank of the equatorial EPR in advance of the

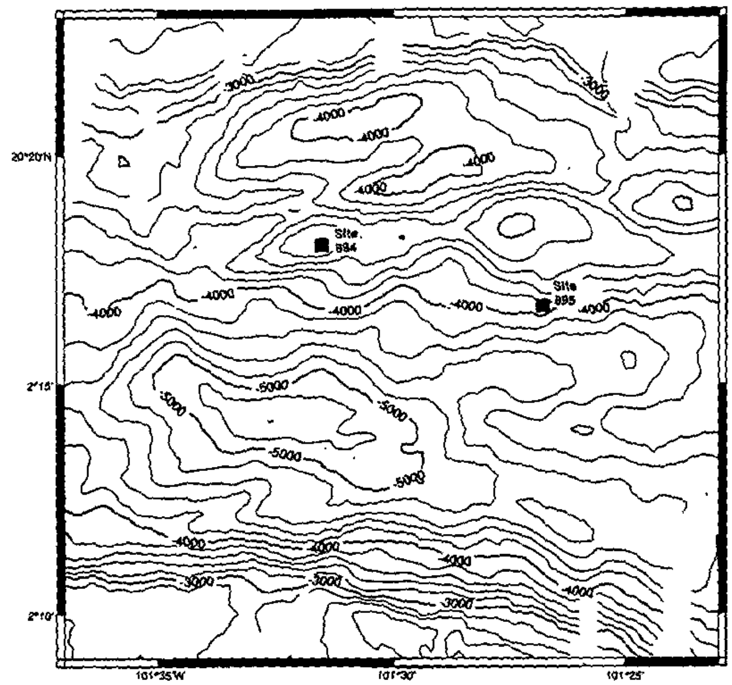

Figure 2. Bathymetric map (in meters) of the Hess Deep intra-rift ridge area, showing locations of Sites 894 and 895. Bathymetry from SeaBeam data collected during Sonne Cruise 60-Galapagos Microplate (courtesy of H. Puchelt, 1992).

westward-propagating Cocos-Nazca spreading center (Lonsdale, 1988; Fig. 1). The western end of the rift valley is 30 km from the EPR axis, where approximately 0.5 Ma EPR crust is broken by two 5-km-wide east-west grabens, which join a few kilometers farther east. As the rift valley extends eastward, it broadens to 20 km and deepens to >5400 m; its uplifted shoulders rise to depths less than 2200 m. Approximately 70 km east of the EPR axis, the Cocos-Nazca spreading center begins to build a volcanic ridge in the rift valley, and the rift escarpments are locally uplifted an additional 500 m at narrow horsts. Farther east, the wedge of newly accreted crust formed by north-south spreading expands to a mature, medium-rate (50 mm/yr total) spreading center, and the rift escarpments become the "rough-smooth boundary" of the Galapagos gore.

The scarps as well as the intra-rift ridge were investigated during a *Nautile* (Francheteau et al., 1990; Francheteau et al., 1992; Hekinian et al., in press) and an *Alvin* (Karson et al., 1992; Lonsdale, unpubl. data) dive programs. The fault scarps that bound the rift valley are seismically active and expose 0.5- to 1.0-Ma crust. Rocks observed on these scarps appear to have been freshly exposed and are not encrusted with manganese oxides. The rift valley is asymmetric, with the Hess Deep ridge axis occurring closer to the southern than the northern wall. The southern wall rises continuously in large steps to a crest of 2200 m depth, approximately 7 km south of the deep. The EPR plateau is fairly flat, and abyssal-hill lineations intersect the scarp. Abyssal-hill lineations within the northern scarp generally extend up to the scarp except in the area of a rift-shoulder horst, where a crustal block has been rotated. A major intra-rift ridge occurs between the Hess Deep and the northern scarp and extends eastward, overlapping the western end of the Cocos-Nazca ridge; Sites 894 and 895 are both located on this ridge (Fig. 2).

A complete, albeit dismembered, crustal section of the EPR, including volcanics, sheeted dikes, gabbros, and peridotites, is exposed on the floor of the Hess Deep rift valley and the intra-rift ridge. This area was investigated with the *Nautile* along two north-south-trending transects that were centered at the western (3040 m) and eastern (2900 m) summits of the intra-rift ridge. The distribution of rock types along the eastern and western transects shows that the structure of Hess Deep is complex. There is no lateral continuity in rock type along the intra-rift ridge such that gabbros crop out at the western end and dolerites and basalts at the eastern; the geology between these two areas is unknown. Similarly, cumulate gabbros occur at greater depths along the western transect than harzburgites along the eastern one. Observations suggest that the western and eastern ends of the intra-rift ridge are comprised of a massive block of gabbros and upper crustal rocks, respectively. Two alternative rifting models have been proposed for the Hess Deep rift valley (Francheteau et al., 1990). One emphasizes the vertical movement of mantle horsts or serpentine diapirs to expose mantle rocks. The other postulates rupture of the lithosphere by low-angle detachment faults similar to those mapped and imaged at rifting sites in continental lithosphere and recently postulated for the regenerating axial rift valleys of slow-spreading ridges. Leg 147 coring results are compatible with an origin of the intra-rift ridge by block faulting; the coring results should prove critical toward understanding the rifting mechanisms of the Hess Deep.

RESULTS

Site 894

Site 894 is located close to the summit of the intra-rift ridge in the Hess Deep. The objective of drilling at Site 894 was to sample a section of oceanic gabbros created at a fast-spreading center, by starting a hole directly on gabbros exposed at the top of the ridge. Seven sites were selected for test drilling to locate appropriate rock types and optimal drilling conditions. Shallow holes were drilled on the flat, slightly sedimented summit of the ridge (Holes 894A, 894D, 894E), and on ledges close to the southern edge of the summit (Holes 894B, 894F). An attempt to start Hole 894C with a guide base failed. A second guide base was successfully deployed to start Hole 894G, close to test Hole 894F. A total of 219.9 m was cored, with a recovery of 58.5 m (26.6%). Hole 894G represents the principal hole and most of the recovery at this site, and its recovered lithology is summarized in Figure 3.

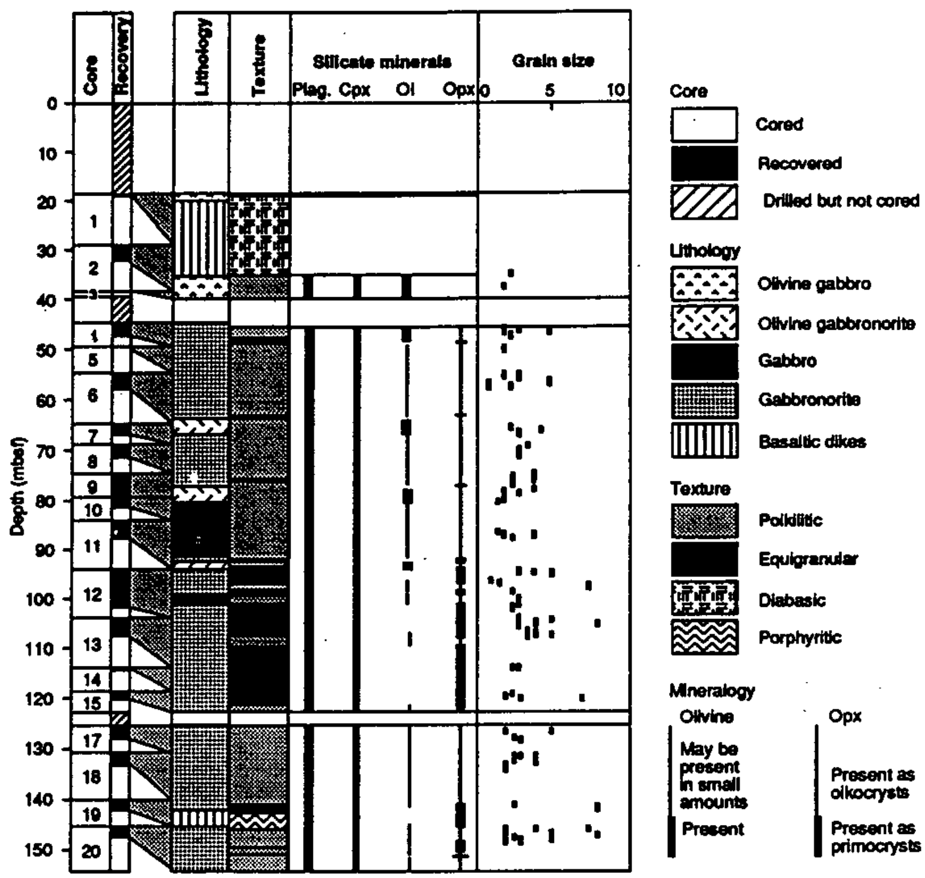

Figure 3. Lithologic summary for Hole 894G. Lithology is expanded, representing a normalization of the curated recovery for each core to that of the advance during coring.

Holes 894A, 894D, and 894E recovered short sections of sediment consisting of foraminiferal ooze, basalt cobbles, basaltic lithic breccias, basaltic sand, and foraminiferal sand. The basaltic and foraminiferal sand are interpreted as turbidites that may have been deposited in a basin prior to the uplift of the intra-rift ridge. In Hole 894A, this formation overlies a monomict igneous breccia consisting of greenschist-facies metabasalts interpreted as being locally derived. Highly metamorphosed gabbro fragments, many of which are cataclastically deformed, were recovered in Holes 894B, 894D, 894E, and 894F.

The stratigraphy of Holes 894F and 894G is considered together, as they are only 18 m apart. The igneous plutonic rocks recovered from Holes 894F and 894G, in order of decreasing abundance, are gabbronorites, gabbros, olivine gabbros and gabbronorites, and oxide gabbros and gabbronorites. The gabbros occur in the upper parts of the section, and gabbronorites first appear at 45 mbsf. These plutonic rocks are non-layered, show textural variations from ophitic to equigranular, and grain-size variations from fine to coarse. Some of the textural variability is related to the presence of patches, pockets, and veins of more coarse-grained gabbronorite hosted in finer grained gabbros and gabbronorites. Zircon and apatite are abundant in many of these coarser grained pockets.

Although there is no apparent layering, magmatic penetrative fabrics are defined by the preferred orientation of euhedral plagioclase in many of the plutonics. A steeply dipping, magmatic foliation is regularly present, and the trend of lineations is subvertical. In fine-grained gabbros, the foliation is oblique to, and cross-cut by, coarser grained gabbronorite, which exhibits an irregularly-distributed, steeply-dipping fabric. Although most medium-grained gabbronorites possess orthopyroxene oikocrysts, these noticeably disappear where a strong magmatic foliation is developed. This feature suggests that the foliation may have formed as a result of deformation of partly crystallized magma, and that deformation locally played a role in expelling evolved interstitial liquid.

Co-precipitation of plagioclase-clinopyroxene-orthopyroxene suggests that the magma indeed became more highly evolved than that which normally erupts along the East Pacific Rise. The zircon and apatite may have crystallized from a volatile-rich magma that segregated and/or percolated through the crystallizing matrix. The lack of layering and textural variability, and the presence of coarse-grained pockets in the recovered rocks, are most similar to gabbroic rocks found in the upper parts of the plutonic sequences of ophiolite complexes.

Several units of olivine-, plagioclase-, spinel-phyric basalts were recovered at Site 894. Two observed contact relations demonstrate that the basalts represent dikes chilled against the plutonic rocks. The dike phenocryst assemblage suggests relatively primitive magmas.

At least 80% of the rocks recovered at Site 894 are moderately altered to greenschist to amphibolite facies mineral assemblages. The extent of alteration increases with increasing grain size and does not correlate with depth below the seafloor. Metamorphic textures consist of pseudomorphic replacement of primary igneous minerals. Amphibolite-facies mineral assemblages define the earliest alteration and include amphibole, hydrothermal clinopyroxene, magnetite, and calcic plagioclase. These minerals are overgrown by transition to the amphibolite and greenschist-facies mineral assemblages dominated by actinolite, minor sodic plagioclase, and rare chlorite. The latest alteration includes zeolite after plagioclase and smectite after clinopyroxene, orthopyroxene, and olivine.

Core from Site 894 is cross-cut by several networks of filled tensile fractures that are devoid of displacement. Cataclastic zones occur primarily in the upper part of the section and are related to steeply dipping normal faults. Three types of macroscopic veins (0.1 mm wide) postdate the early amphibolite-facies mineral assemblages. The earliest veins range from continuous and sharp-sided to discontinuous and wispy and are filled primarily by green amphibole. Some associated minerals include amphibole, chlorite, and sphene. A second set of veins forms a much more regular, abundant, steeply dipping (40°—60°) network associated with strong greenschist-facies wall-rock alteration, and contains chlorite with varying amounts of prehnite, actinolite, and epidote. Reorientation of the veins relative to the stable remanent magnetization direction indicates a consistent west-northwest-east-southeast trend parallel to the Hess Deep rift valley. These veins and associated wall-rock alteration also occur near zones of cataclastic deformation. The youngest veins are filled by assemblages of layer silicates (chlorite to smectite), zeolites, and calcite. Veins of this type exhibit a wide range of dips and are associated with variable wall-rock alteration. The metamorphism and associated vein formation observed in the Site 894 plutonics require the migration of hydrothermal fluids through the gabbros from >500°C to ambient temperatures.

Paleomagnetic measurements show that the average intensity of natural remanent magnetization and magnetic susceptibility of samples from Hole 894G are 2.0 A/m and 0.016 SI units, respectively. The ratio of these two parameters suggests that the in situ magnetization of this crustal section is dominated by remanent magnetization rather than magnetization induced by the Earth's field. The remanent magnetization is observed to be very stable with respect to both alternating-field and thermal demagnetization, and the demagnetization data indicate that nearly pure magnetite is the only significant carrier of remanence. The stable direction of magnetization dips downward at an average of 40° and is significantly different than the value expected for crust formed at this latitude (0°). Therefore, it seems likely that this crustal section experienced substantial tectonic rotation.

Site 895

Site 895 is located along the slope south of the intra-rift ridge crest in an area where ultramafic rocks were recovered during a *Nautile* dive program. The aim of drilling at this site was to recover a section of the shallow mantle. Because of technological problems, it was not possible to drill a long section of mantle. Six holes, Holes 895A to 895F, penetrated a total of 272.9 m and recovered 64.56 m, with an average recovery of 27.5% (Fig. 4).

The igneous rocks recovered consist predominantly of ultramafic rocks (dunite and harzburgite) and less abundant mafic rocks (gabbro, olivine gabbro, and troctolite). Although all rock types are present in both holes, harzburgites predominate in Hole 895D, whereas dunites and gabbroic rocks are more abundant in Hole

894E. Several gradational and sharp contacts were sampled and appear to be largely subparallel and rather steep. Gradational changes from dunite, to sparsely plagioclase-bearing dunite, to interconnected veins of plagioclase and clinopyroxene separated by patches of dunite, occur in continuous sections of core and may suggest that these rocks were formed by melt migration and impregnation.

Despite pervasive serpentinization, harzburgites retain porphyroclastic textures. Spinel-shape fabric in both dunites and harzburgites defines a foliation attributed to high-temperature solid-state flow. In dunite and troctolite, traces of plastic deformation of olivine are observed in thin section. In Holes 895C, 895D, and 895E, the spinel foliation seems to show an increasing amount of dip with depth.

The relatively small amount (less than 2%) of modal clinopyroxene in the ultramafic rocks indicates that they are depleted abyssal peridotites. It is possible that the dunites are the simple residue of melting formed by more melt extraction than from the harzburgites. It is also possible that the dunites are simple cumulate products of melt crystallization. The association of harzburgite-dunite-gabbroic rocks recovered from these holes is similar to the transition zone in ophiolite complexes. The relative abundance of dunite suggests that the drilled sections of Site 895 are close to the mantle/crust boundary as recognized in these complexes, and are likely located just below the petrological Moho.

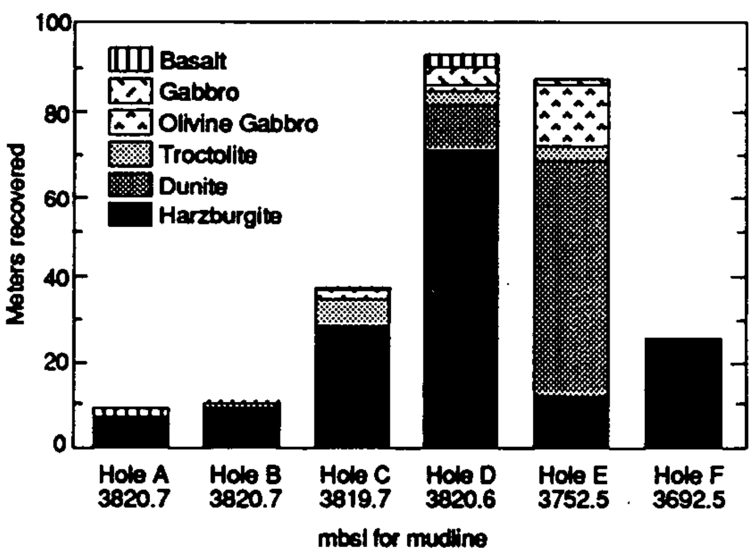

Figure 4. Histogram showing relative expanded recovery of different rock types for the different holes of Site 895.

All ultramafic lithologies are affected by extensive alteration, with 50% to 100% of the primary minerals replaced by secondary phases. Alteration is dominated by serpentine after olivine, with lesser amounts of bastite, talc, magnetite, chlorite, brucite, and trace antigorite. Serpentinization is more intense in dunites than in harzburgites, and in Hole 895E than in Hole 895D. Troctolitic and gabbroic rocks are moderately to pervasively altered and irregularly exhibit a mineral foliation. Secondary minerals commonly include chrysotile, tremolite, magnetite after olivine, and prehnite, chlorite, zeolite, and hydrogrossular after plagioclase.

Multiple generations of discrete fracture-filling veins cross-cut the pervasive background mesh serpentine texture of the peridotites and are filled with tremolite, chlorite, antigorite(?), magnetite, chrysotile, brucite, clays, zeolites, and aragonite. The moderate to pervasive metamorphism and associated vein formation in ultramafic and mafic rocks reflect extensive interaction with seawater-derived fluids during successive hydrothermal pulses. In the absence of mineral assemblages defining distinct metamorphic zones, the temperature of interaction is difficult to estimate. Gabbro assemblages suggest incipient interaction at temperatures close to 500°C with extensive reaction under greenschist-facies conditions. Serpentinization continued at lower temperatures as evidenced by the presence of zeolites, clays, and brucite. The close association of calcium metasomatized gabbroic rocks with the peridotites may reflect migration of calcium-rich fluids under greenschist-facies conditions which were generated during serpentinization of the peridotites (incipient rodingitization).

Paleomagnetic measurements were made on 36 minicores from Holes 895B, 895C, 895D, 895E, and 895F. The magnetization values obtained from 29 peridotite samples range from 0.3 to 25.0 A/m, with an arithmetic mean of 3.8 A/m. This mean is reduced to 3.0 A/m by excluding the highest value of 25.0 A/m, which is anomalous to the sample population. This magnetic intensity suggests that peridotites may be a significant source of marine magnetic anomalies. The average magnetization value for the gabbroic rocks is 0.4 A/m, significantly lower than that of the Hole 894G and Hole 735B gabbros (1—2 A/m). Thermal demagnetization data suggest that relatively pure multidomain magnetites are the dominant magnetic carriers.

Stable magnetic inclination values from Hole 895D samples are widely scattered and suggest that drilling may have penetrated several large blocks of crust which experienced different degrees of tectonic rotation. In contrast, the stable inclinations from Hole 895E fall within a fairly narrow range and have a similar average value (+36°) to that obtained for Hole 894G (+40°). These data suggest that tectonic rotation occurred after the major serpentinization event responsible for the formation of the magnetite that carries the bulk of the rock magnetization. Anisotropies of magnetic susceptibility (AMS) in these rocks are weak. Hole 895E has a consistent north-south-striking magnetic lineation caused by the preferred orientation of long magnetite axes.

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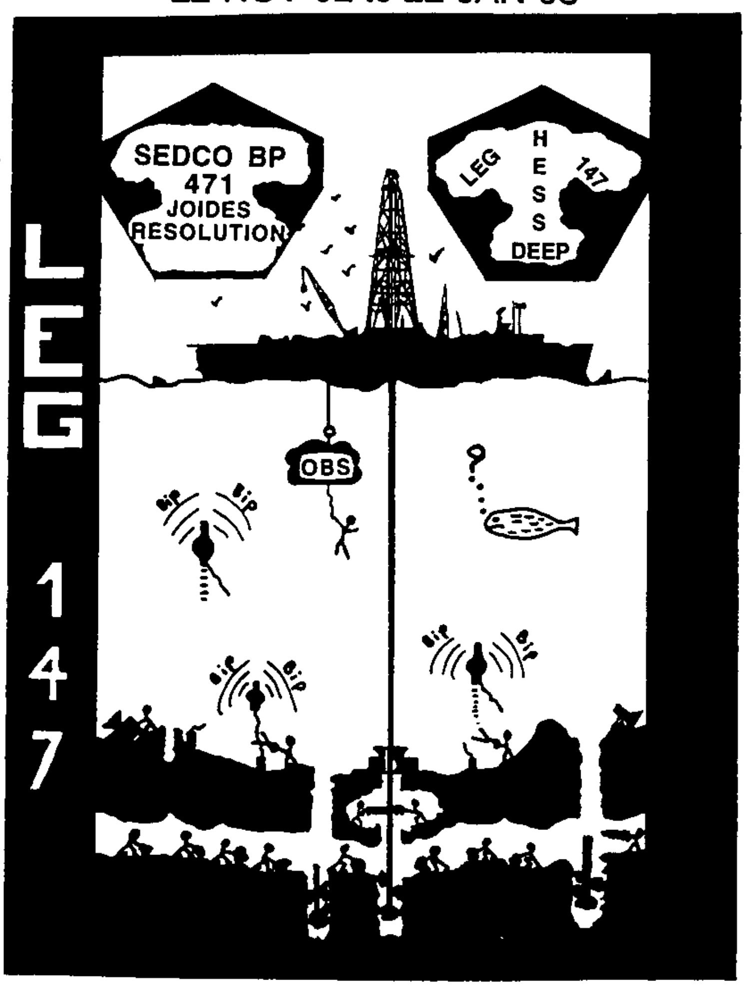

Leg 147 (Hess Deep) Logo designed by Christian Viaud, SEDCO Electrician.

NEW JERSEY SEA-LEVEL MID-ATLANTIC TRANSECT

GREG MOUNTAIN CO-CHIEF SCIENTIST
KENNETH MILLER CO-CHIEF SCIENTIST
PETER BLUM ODP STAFF SCIENTIST

Science Operator Prospectus Leg 150

A complete Prospectus for this leg is available from ODP, Texas A & M University, 1000 Discovery Drive, College Station, TX 77845-9547

ABSTRACT

The "New Jersey sea-level/mid-Atlantic transect" is an integrated set of boreholes to be drilled in the U.S. mid-Atlantic region. The goal is to document the continental-margin record of the Oligocene-Holocene "Icehouse World" by determining the age of major unconformities, acquiring a database needed for modeling the amplitudes and rates of relative sea-level changes, and documenting facies variations associated with oscillations of sea level. Secondary objectives are to determine the ages of major Eocene unconformities and to evaluate the role of sea-level change on continental slope and rise sedimentation. This transect will encompass drilling in four settings with the following objectives:

1. Onshore coastal plain: to date Eocene-Miocene sequences and provide facies information on upper Oligocene-Miocene units landward of their clinoform inflection points. Drilling at Island Beach, Atlantic City, and Cape May, New Jersey, will occur between March and November 1993 in an ODP-related project involving Rutgers University, Lamont-Doherty Earth Observatory, the U.S. Geological Survey, and the New Jersey State Geological Survey.
2. Continental shelf: to recover the most complete record of relatively shallow-water facies deposited during the "Icehouse World." The TAMU safety panel has postponed shelf drilling by the *JOIDES Resolution* until pollution prevention and safety concerns are examined in detail.
3. Continental slope: to sample boundaries of depositional sequences that are imaged on the shelf but which can be dated with greater precision on the slope. Four sites will be drilled and logged during ODP Leg 150 in water depths between 345 and 1298 m; each has been chosen to recover an especially complete and thick part of the Oligocene-Holocene interval.
4. Uppermost continental rise: to compare the age and character of downslope and margin-parallel sediment transport events to the history of eustatic change. During Leg 150 one site at 2760 m will be drilled and logged.

INTRODUCTION

Global Sea Level and the NJ/MAT

The Second Conference on Scientific Ocean Drilling (COSOD II) met in July 1987 to formulate the major scientific problems to be addressed in the next decade of ocean drilling. Improved understanding of the history of global sea-level (eustatic) change was determined to be a primary goal. Subsequent discussions by the JOI/USSAC sea-level workshop (Watkins and Mountain, 1990) and the Sea-Level Working Group (Report of the SLWG, 1992) defined the role of ocean drilling in

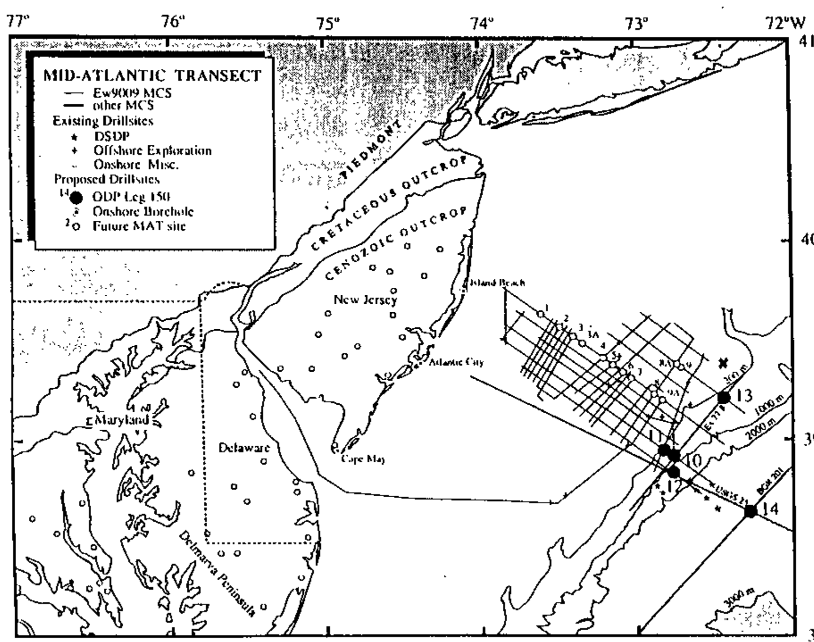

Figure 1. Mid-Atlantic transect (MAT) map, showing proposed Leg 150 drill sites, proposed onshore boreholes, and future MAT sites. Also shown are previously drilled holes and multichannel seismic (MCS) lines.

attaining this goal. The Ocean Drilling Program (ODP) is uniquely qualified to document the timing and magnitude of past eustatic changes because it is the only organization concerned with the collection and integration of data from the deep sea, carbonate platforms and atolls, and continental margins. Analysis of data from these settings provides three independent ways to measure sea-level change:

- Variations in foraminiferal $\delta^{18}O$ in deep-sea sediments provide a proxy for glacio-eustasy;
- Stratigraphic markers (e.g., subaerial exposure surfaces) in carbonate platforms, atolls, and terraces record eustatic variations like oceanic dipsticks;
- Stratigraphic patterns within continental margin and epicontinental sediments preserve the record of changes in sea level relative to the continents.

The continental-margin record of sea-level change can be deciphered in either of two ways: (1) through observations of transgressions/regressions of the shoreline or of changes in water depth inferred from facies successions; or (2) by analyzing regional unconformities either through physical and seismic stratigraphy or through hiatuses associated with them. The chief advantage of the sequence stratigraphic approach is that the formation of stratal discontinuities requires the lowering of depositional base level and is therefore less sensitive to variations in sediment supply than is the position of the shoreline. This approach provides a great deal of information about the timing of relative sea-level changes, but less certain information about their magnitudes. It is essential to assess timing before magnitude to ensure that a given sea-level oscillation is of global rather than local origin.

The SLWG (1992) identified four issues that must be investigated to determine the complete history of eustatic variations: (1) timing; (2) amplitudes and rates; (3) stratigraphic response; and (4) causal mechanisms. A transect of holes across several passive continental margins was proposed as the best strategy for addressing the first three of these issues.

COSOD II, the JOI/USSAC sea-level workshop, and the SLWG identified three time intervals for which sea-level studies would be especially valuable: the Oligocene to Holocene, the middle Cretaceous and the Paleocene-Eocene. The Oligocene to Holocene is an interval in which passive continental-margin records may be directly compared with eustatic estimates obtained from $\delta^{18}O$ studies.

Miller, Mountain, and Christie-Blick designed the "New Jersey sea level/mid-Atlantic transect" (NJ/MAT) to address the continental margin record of the Oligocene to Holocene "Icehouse World—when eustasy was clearly driven by changes in the volume of high-latitude ice sheets. This transect is the first drilling effort intended to examine the evidence of sea-level changes within the paradigm of sequence stratigraphy and the criteria established by COSOD II, the JOI/USSAC workshop, and the SLWG. The NJ/MAT will drill in four physiographic settings:

1. Three boreholes will be drilled on the onshore coastal plain at Island Beach, Atlantic City, and Cape May, New Jersey (Fig. 1). This drilling will take place as an ODP-related project in cooperation with the U.S. Geological Survey and the New Jersey State Geological Survey in March-November, 1993.
2. Eight boreholes have been proposed for future scientific coring of the continental shelf. We proposed to use the *JOIDES Resolution* in water depths where dynamic positioning is feasible (>35 m; Sites MAT-4 and -9) and to use a supplementary platform in water depths shallower than 35 m (Sites MAT-1 and -3).
3. Four boreholes will be drilled during Leg 150 on the continental slope (Sites MAT-10 and -13).
4. One borehole will be drilled on Leg 150 on the uppermost continental rise (Site MAT-14).

Sites in water depth less than 90 m (MAT-1 and -8) were not approved by the Pollution Prevention and Safety Panel (PPSP) in October 1992 because of concerns about drilling in such shallow water with open circulation. Although sites in 90 m of water (MAT-8A and -9) were approved by PPSP, the TAMU safety panel decided that it was not prudent to drill these sites at this time. The remaining slope and rise sites were redesigned and approved by PCOM at its annual meeting in December 1992. The result is 5 sites on Leg 150 and 3 onshore sites that together constitute the end points of a margin-wide transect. Leg 150 drilling will provide the pelagic correlative needed to determine the timing of major stratal surface and sea-level history. It will not address direct stratal indicators of Neogene sea-level change now found beneath the continental shelf; this awaits future shelf drilling. We look forward to the day when the shallow-water portion of the NJ/MAT can be completed.

BACKGROUND

New Jersey Margin

The U.S. middle Atlantic margin (New Jersey-Delaware-Maryland) is a classic passive margin ideally suited for recovering the record of Neogene glacio-eustatic changes. Rifting began in the Late Triassic, and seafloor spreading commenced by the Middle Jurassic(~165 Ma). The subsequent tectonic history has been dominated by simple thermal subsidence, sediment loading, and flexure. The Jurassic section is composed of thick (typically 8-12 km) shallow-water limestones and shales. A barrier-reef complex fringed the margin until the middle Cretaceous. Regional sedimentation rates were generally low during Late Cretaceous to Paleogene siliciclastic and carbonate deposition. Accumulation increased dramatically in the Oligocene to Miocene when siliciclastic sedimentation dominated. The cause of this large increase is not known, although it may reflect tectonics in the hinterland. This period coincides with overall global cooling and the appearance of high-latitude ice caps that continue to characterize the post-Eocene as the Earth's most recent "Icehouse" interval.

The middle Atlantic margin is especially suitable for the study of sea-level changes during the late Oligocene to Holocene "Icehouse World." High sedimentation rates during this period of simple thermal and flexural subsidence led to especially complete upper Oligocene to Holocene shelf sequences. Additional advantages of this section include:

- sediments prograded across the margin throughout the Miocene and accumulated at rates high enough (10's to 100's of m/m.y.) to seismically resolve stratal relationships in unusually great detail;

- the mid-latitude setting ensures good biostratigraphic control, and upper Eocene-Miocene sediments of this region have adequate carbonate to utilize strontium-isotope correlation techniques;
- the eastern United States is an old, stable margin, and throughout the Cenozoic its tectonic subsidence has been along the relatively well-defined, nearly linear part of the thermal subsidence curve;
- there is little seismic or outcrop evidence to suggest faulting, rotation, or other medium-large scale disturbances of the Cenozoic section, although some differential subsidence may have occurred between the Delmarva Peninsula and New Jersey ;
- because of these relatively slow Cenozoic thermal subsidence rates (<10 m/m.y.), eustatic effects on lateral facies changes and coastal onlap are likely to be well expressed; and
- a substantial body of useful data from seismics to wells to outcrops already exists on this margin.

In recognition of many of these features of the New Jersey margin, DSDP Legs 93 and 95 were designed to begin a margin-wide transect that would document the stratigraphic record of eustatic change. However, the shallowest site drilled (612) was on the middle slope in 1400 m water depth where only indirect effects of sea-level change could be monitored. Leg 150 is the next step in the transect effort, and slope drilling will proceed concurrently with drilling the onshore coastal plain of New Jersey. While Leg 150 will not recover direct indicators of sea-level change, proposed slope sites as shallow as 345 m water depth have been placed on seismic lines that trace key marker horizons back onto the shelf. The final step in the transect will be drilling on the continental shelf.

The seismic grid that makes these slope-to-shelf correlations possible was developed in three ways: we obtained regional MCS profiles and log data from Exxon Production Research (EPR); we collected a high-resolution MCS grid of our own (Fig. 1); and we integrated both sets of profiles with well logs, biostratigraphy, and Sr-isotope stratigraphy of boreholes, wells, and outcrops.

The new seismic grid (cruise Ew9009, collected in Nov. 1990) comprises 3700 km of profiles (data archived in ODP data bank). Two-thirds of these data (Fig. 1) are 120-channel, tuned air-gun array profiles across the shelf that complement the Exxon data and tie to their wells; the rest are single-channel water-gun data on the upper continental slope, tying the shelf stratigraphy to a number of boreholes drilled previously and to outcrop samples collected in 1989 by the DSV *Alvin* (K.G. Miller, in prep.). These new profiles represent a clear improvement over older seismic data.

Seismic stratigraphic studies of the New Jersey continental shelf reveal numerous Oligocene-Miocene depositional sequences. We evaluated the ages of six major Miocene sequence boundaries of Greenlee *et al.* (1988; Tuscan to Bice-1) using available industry wells (Greenlee *et al.*, 1992). Biostratigraphic resolution is coarse in these wells, and the age estimates have large uncertainties (-1 m.y. or worse). Ew9009 profiles have better seismic resolution than do those from the Exxon grid, and thus were used to confirm the major sequence boundaries of Greenlee et al. (1988, 1992) and to identify several other surfaces as probable sequence boundaries.

Objectives

The proponents speculate that the major sequence boundaries identified on the seismic grids correlate with oxygen-isotope increases linked to glacio-eustatic lowerings. Furthermore, they propose that these sequence boundaries correlate with hiatuses on the coastal plain (Sugarman et al., in press) and continental slope (K. G. Miller, in prep.; Fig. 2). The primary goal of Leg 150 is to date major Oligocene to Holocene unconformities on the New Jersey margin and to evaluate their correlation with glacio-eustatic age estimates obtained from the $\delta^{18}O$ record. Secondary goals are to determine ages of major Eocene "Doubthouse" unconformities and to evaluate the relative importance of along-slope vs. downslope

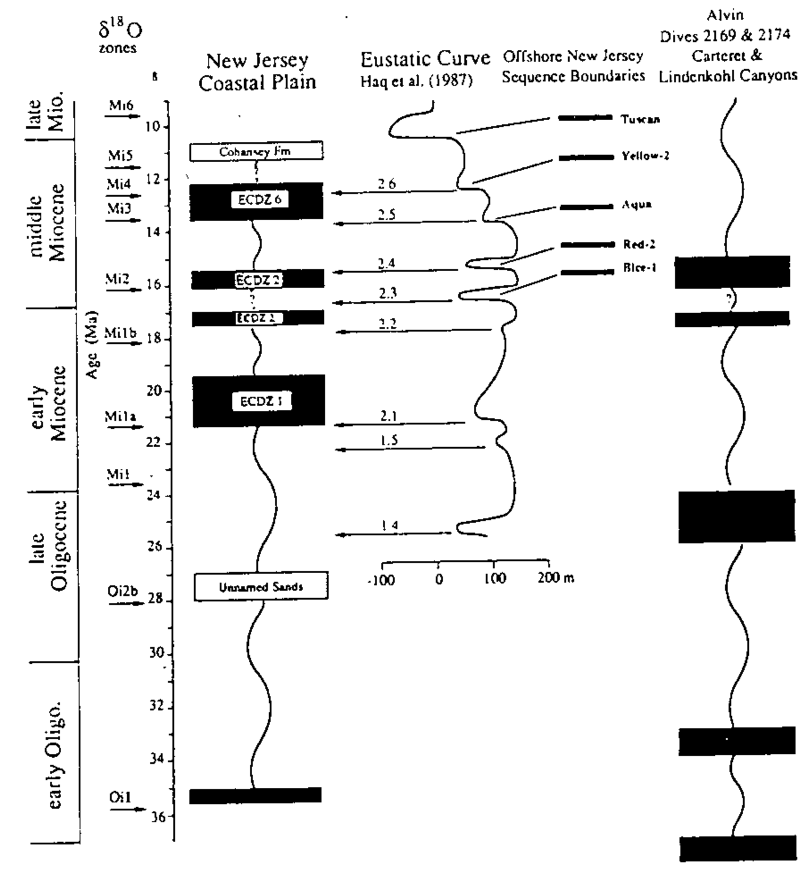

Figure 2. Diagram showing correlation of sequence boundaries with hiatuses on the coastal plain and continental slope.

sediment-transport processes and evaluate their links to eustatic variations. This information will contribute to the final objectives of the entire NJ/MAT that will be completed with shelf drilling. At that time it will be possible to estimate the amplitudes and rates of the sea-level change and assess the stratigraphic response of glacio-eustatic forcing in terms of sequence architecture and facies successions.

Proposed Drill Sites

Leg 150 slope drilling will recover the Oligocene-Holocene "Icehouse" interval on the slope with a composite, stacked section from the four sites MAT-10 through -13. Each borehole will recover different parts of the Oligocene-Holocene section; each has been selected for its optimum thickness, completeness, and clarity of seismic expression. MAT-10 and -12 will bottom in lower Eocene strata at the target reflector Red-3. Greenlee and Moore (1988) have correlated this surface with the 49.5-Ma sequence boundary of Haq et al. (1987). We have traced this reflector from Site 612, where it is associated with the top of a diagenetic front near the lower/middle Eocene boundary, MAT-13 will concentrate on upper Neogene to Holocene stratal surfaces younger than 5.5 Ma.

Leg 150 will also sample the Oligocene-Holocene on the continental rise at Site MAT-14. The scientific objectives at this site differ from those at the slope sites, and we provide a more detailed discussion of this rise location below.

Proposed Site MAT-10

Site MAT-10 (at 806 m water depth on the slope) will penetrate to the top of the lower Eocene. This site is located 2 km north (and slightly upslope) of the Continental Offshore Stratigraphic Test (COST) B-3 well, where the upper Miocene section above Tuscan (post ca. 10.5 Ma) is thicker than at the COST well.

Proposed Site MAT-11

Site MAT-11 (at 430 m water depth on the slope) will penetrate to the top of the lower Eocene. Like MAT-10, this site will recover a thick post-Tuscan interval (680 ms), with some erosion in the upper Neogene (Plio-Pleistocene). This site offers the best opportunity to recover the lower Miocene because it has the thickest Bice-1 to Pink-3 section (~110 ms; ?16 Ma-?top Oligocene.) The lower Miocene section is otherwise thin on the slope. The Eocene to Oligocene section should be comparable to MAT-10.

Proposed Site MAT-12

Site MAT-12 (at 1298 m water depth on the slope) is 2 km north and slightly upslope from DSDP Site 612 (Leg 95). The pre-Oligocene and post-middle Miocene stratigraphy should be identical to Site 612; however, Site 612 was drilled in a buried canyon thalweg and consequently missed the middle Miocene to lowermost Oligocene section into which this canyon is cut. Sampling in Carteret Canyon adjacent to Site MAT-12 has confirmed the presence of these strata missed at Site 612. The middle Miocene to lowermost Oligocene strata thicken away from the canyon outcrop and reach a local maximum at Site MAT-12.

Proposed Site MAT-13

Site MAT-13 (at 340 m on the slope) is 31 km downdip from proposed site MAT-8A (COST B-2) (Fig. 1). The upper Neogene section on the slope above Pink-1 (?5.5 Ma) is uniformly thicker and more clearly imaged seismically in this region than it is at an equivalent water depth 35 km southwest near MAT-10 and -12. MAT-13 will focus on the upper Neogene section above Pink-1. The age and significance of Pink-1 and the numerous unconformities that overlie it are uncertain. The numerous upper Neogene sequence boundaries to be sampled at MAT-13 are much better represented along Line 1002 than elsewhere in the grid of available seismic data. Site MAT-13 will evaluate the feasibility of correlating the numerous uppermost Miocene to Holocene sequences to a glacio-eustatic proxy afforded by the oxygen-isotope record.

Proposed Site MAT-14

Site MAT-14 is the same location as Site NJ-6 from DSDP Leg 95, but because of time constraints it was never drilled. Continental rise Site MAT-14 will provide both the biostratigraphic and lithostratigraphic control for the Miocene sections that will also be sampled on the shelf and slope. MAT-14 will not only address the effects of sea-level change on continental-rise deposition, but will also evaluate the timing and role of deep-water circulation changes in reshaping these deposits. MAT-14 will provide improved geochronology of the three marker horizons Au, Merlin, and Blue, and will allow us to evaluate the causal relationship between deep-water changes, glaciation, and sea-level history.

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Science Operator Prospectus Leg 151

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A complete Prospectus for this leg is available from ODP, Texas A & M University, 1000 Discovery Drive, College Station, TX 77845-9547

Abstract

Leg 151 is scheduled to drill a series of sites in four remote geographic, partly ice-covered locations (the northern gateway region, i.e., Yermak Plateau and Fram Strait, the East Greenland Margin, and the Greenland-Norway Transect, i.e., the Iceland Plateau) with the aim of reconstructing the temporal and spatial variability of the oceanic heat budget and the record of variability in the chemical composition of the ocean. Leg 151 will also undertake a study of circulation patterns in a pre-glacial, relatively warm polar and subpolar ocean, and the mechanisms of climatic change in a predominantly ice-free climatic system. In addition, the proposed drilling includes a collection of sequences containing records of biogenic fluxes ($CaCO_3$, opal, and organic carbon) and stable-isotopic carbon and oxygen records which will address aspects of facies evolution, depositional environments, the carbon cycle and productivity. The drilling approach focuses on rapidly deposited sediment sequences to be used for high-resolution, Milankovitch-scale paleoclimatic analysis and rapid sub-Milankovitch-scale climate changes. Most of the proposed sites are arrayed as either broad north-south and east-west transects to monitor spatial paleoclimatic variability or closely spaced suites of cores across a range of depths to monitor vertical variability. Other approaches include sites chosen for deep drilling that will better constrain the time of opening of Fram Strait, and sites placed to monitor downstream sedimentological effects of deep flow through narrow gateway constrictions.

Introduction

During the last decade it has been realized that much of the natural variance in the Earth's environment on time scales less than 1 million years (m.y.) originates from changes in the geometry of the Earth-Sun orbital system. The sensitivity of the Earth system to orbital forcing has been especially high over the last 1 m.y. Both for understanding how this high sensitivity to external forcing has evolved from periods of less sensitivity and lower amplitude variation, and for understanding the way environmental change is forced both by this and other forcing mechanisms which operate on longer time scales (such as plate reorganizations, orogeny, carbon cycle variations), it is necessary to obtain records that document how the climatically sensitive, high-latitude regions have developed. The Arctic and subarctic deep-sea basins are known to have reacted faster and with a more extreme range of temperature fluctuations during the late Cenozoic climate change than any other part of the world ocean (CLIMAP, 1976): it follows that this focus on high northern latitude paleoenvironmental questions requires deep-sea drilling in the areas (Fig. 1) north of the Greenland-Scotland Ridge.

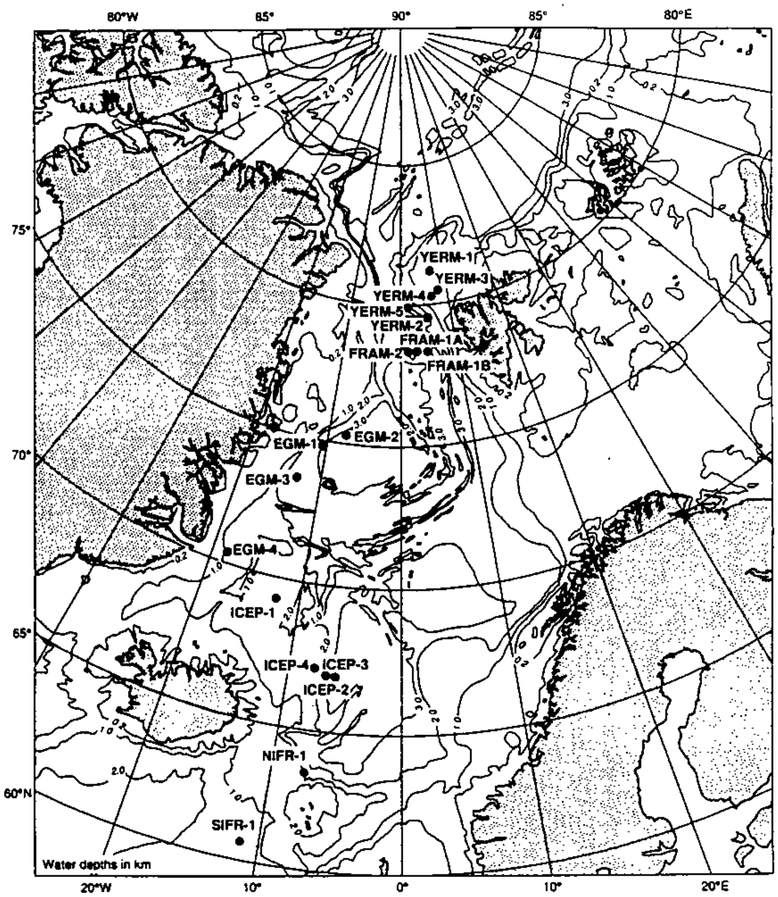


Figure 1. Bathymetric map of the Arctic Ocean and the Greenland-Iceland-Norwegian seas, showing the locations of proposed drill sites. Bathymetry in kilometers.

The deep-water areas of the Nordic Seas were previously drilled during

DSDP Leg 38 which occupied 17 sites spread out over some of the major basins, and ODP Leg 104, which occupied three sites on a transect across the Vöring Plateau in the eastern Norwegian Sea. The quality and continuity of the Leg 38 material is too poor to establish a chronologic resolution and precision which meet the requirements of modern paleoceanography. The Leg 104 sites have good sample quality and document parts of the Neogene fairly well despite a number of hiatuses. The Paleogene intervals of these sites are either missing or seriously altered by diagenesis. Thus, no sequences are available to document the whole Cenozoic history of these oceans, and major parts of the Cenozoic are still unavailable for investigation.

STUDY AREA

The chief components of the surface water systems of the Nordic Seas involve the influx of warm and relatively high-salinity waters via the North Atlantic Current, which continues its northward flow as the Norwegian Current and outflow via the cold and low-salinity East Greenland Current. The Norwegian Current is sufficiently cooled to allow deep water formation within the cyclonic gyre of the Greenland Sea. Another branch of this current continues along the western margin of Svalbard as the West Spitsbergen Current before entering the Arctic Ocean. Within the Arctic this relatively warm water mass mixes with low-salinity surface waters, sinks, and flows as an intermediate water mass counterclockwise before being exported out of the Arctic via the Fram Strait along the Greenland Margin. The surface outflow from the Arctic Ocean sweeps the east margin of Greenland before entering the Irminger Sea of the North Atlantic via the Denmark Strait. The Arctic Ocean is an important contributor of deep waters which flow southward through the Fram Strait and, after mixing with deep waters formed in the Greenland-Iceland seas, pass farther on into the world ocean.

Aagaard et al. (1985) concluded that nearly 50% of the water volume in the Nordic Seas, including the Amerasian Basin, is potentially in communication with the world ocean. The Nordic Seas might hence be characterized as the "lungs" of the present world ocean, implying that it is of fundamental importance to derive a detailed understanding of the timing and history of deep and shallow water exchange between the Nordic Seas and the remainder of the world ocean. The unique topographic constraints provided by a single deep, narrow passageway to the north (the Fram Strait), and a major submarine ridge system to the south (Greenland-Scotland Ridge), make it pertinent to address the question of the Cenozoic paleoceanography of the Nordic Seas as a gateway problem.

The Gateways and Paleoceanography

The tectonic development and the opening of the Fram Strait have determined the history of water-mass exchange between the Arctic Ocean and the Greenland-Norwegian-Iceland seas. Submergence below sea level of the southern gateway (Greenland-Scotland Ridge), or parts of it, has determined the possibilities for water-mass exchange between the Nordic Seas and the Atlantic Ocean, and thus the world ocean.

The Fram Strait, with a present critical sill depth of 2600 m, represents the only deep connection between the Arctic Ocean and the global ocean. The initiation of this connection may have taken place as early as Anomaly 13 time, close to the Eocene/Oligocene boundary. The tectonic history of the Fram Strait area, however, is characterized by complex processes which might include stretching of the Svalbard continental crust and hotspot activity. When taking into account the strongly oblique opening of the Fram Strait and the nearness to surrounding land areas (Greenland and Svalbard), it seems possible that a truly deep Arctic Ocean/Greenland-Norwegian Sea connection became established considerably later than Anomaly 13 time, perhaps as late as Anomaly 6 time. The history of water-mass exchange between the Arctic Ocean and the world ocean via the Greenland-Norwegian-Iceland seas is a key element in any large-scale model of post-Eocene paleoceanography.

Overflow from northern sources occurs in the Faeroe-Shetland Channel, across the Iceland-Faeroe Ridge and in the Denmark Strait. Tracer studies indicate that the overflow waters originate from waters shallower than 1000—1200 m, probably to a large extent formed by deep convection in the Iceland Sea. Reconstructions of the subsidence history of the ridge system suggest that its eastern parts sank beneath sea level probably during middle Eocene times, and during early to middle Miocene times in the Denmark Strait area. The distribution of shallow-water benthic foraminifers, however, indicates that the Nordic Seas were effectively isolated from any "deep" Atlantic influence until middle Miocene times. The overflows have both influenced the Atlantic and global deep-water masses through their contribution to North Atlantic Deep Water (NADW) production and to the formation of North Atlantic sedimentary records. Basic questions as to why and when NADW production was initiated, and how this major water mass has varied, remain unanswered.

SCIENTIFIC OBJECTIVES AND METHODOLOGY

Cenozoic Paleoceanography of the Nordic Seas

1. To study the timing and history of deep and shallow water exchange between the Arctic Ocean and the Norwegian-Greenland Sea via the Fram Strait (northern gateway).
2. To study the timing and history of deep and shallow water inflow and outflow between the Norwegian-Greenland Sea and the North Atlantic across the Greenland-Scotland Ridge.
3. To investigate water mass evolution, particularly addressing the initiation and variability of east-west and north-south oceanic fronts in surface waters, the initiation and variability of northern-source deep-water formation, and the history of vertical physical and chemical gradients.

Cenozoic Evolution of Climate in High Northern Latitudes

1. To investigate the timing and development of polar cooling and the evolution of low to high latitude thermal gradients in the northern hemisphere.
2. To establish the temporal and spatial variation of sea-ice distribution, the glacial history of the circumarctic, Greenland, and Northern Europe, and the history of IRD sedimentation in the Arctic.

3. To investigate variations in climatic zonality and meridionality through time as response to tectonic forcing.
4. To establish the history of the higher frequency components of the climatic and glacial evolution of the Arctic and subarctic areas.
5. To identify ocean-atmosphere interactions associated with northern hemisphere deep-water formation and the interhemispheric couplings and contrasts in climatic evolution.

Sediment Budgets

1. To investigate fluxes of biogenic carbonate, opaline silica, organic matter, and nonbiogenic sediment components through time.
2. To study bathymetric variability through time of the CCD and lysocline.
3. To establish the spatial and temporal history of silica preservation.
4. To investigate Arctic and subarctic oceanic influence on global biogeochemical cycles.

Surface Water-Mass Evolution

The Norwegian-Greenland Sea links the cold Arctic Ocean with the warm-temperate North Atlantic Ocean via northern and southern gateways. Fram Strait in the north is the single passage to the Arctic Ocean through which surface and deep waters are exchanged. Similar exchanges occur farther south at both the Denmark Strait, Faeroe-Shetland Channel, and Iceland-Faeroe Ridge.

The Nordic Seas are characterized by strong oceanographic gradients, not just latitudinally but also meridionally, due to the northward flow of relatively warm Atlantic water in the east and southward flow of cold polar water and ice in the west. Strong seasonal variability also results in rapid migrations of sharply defined fronts. The history of these surface-ocean gradients prior to that of the last few hundred thousand years is almost totally unknown. ODP drilling will provide material from the colder western regions for tracing the spatial evolution of surface-water environments and thus enhance the understanding of climatic change.

Temporal and Spatial Variation of Sea-Ice Distribution

The present Arctic climate is strongly influenced by its sea-ice cover, which greatly increases the regional albedo and reduces heat and gas exchange with the atmosphere. Very little is known about how this ice cover first developed and subsequently varied. Although prevented from drilling within the permanent pack ice in the Central Arctic, *JOIDES Resolution* drilling along the present ice margins will provide better constraints on the history of sea-ice extent just north of a key Arctic gateway and southward into the Nordic Seas.

The Gateway Problem

The gateways in the north (Fram Strait) and south (Greenland-Scotland Ridge) are among the most important submarine topographic constrictions to global oceanic circulation. Opening of Fram Strait and subsidence of the Greenland-Scotland Ridge below critical levels are necessary conditions for deep-water exchange between the Nordic Seas and Atlantic Ocean, although other tectonic changes may also play a role in determining the subsequent long-term evolution of meridional exchanges across these former barriers. The history of these gateways is thus a key component in understanding the long-term evolution of both Northern Hemisphere and global climate.

Leg 151 focuses on two key objectives not addressed in previous drilling: (1) constraining the tectonic history of opening of these barriers, primarily by drilling to obtain basement ages; and (2) defining the subsequent history of surface and deep-water exchange across these barriers, based both on proxy water-mass indicators and on current-sculpted features on the seafloor.

Deep Water-Mass Evolution

At present, deep waters of the subarctic North Atlantic form partly from dense saline waters cooled in the Greenland and Iceland seas, and partly from deep waters flowing out of the Arctic Ocean. Because of their rapid formation and short residence times, these deep waters are rich in O_2 but poor in CO_2 and nutrients. The deep water spills over the Greenland-Scotland Ridge and mixes with warmer North Atlantic waters to form southward-flowing North Atlantic Deep Water (NADW). NADW helps to oxygenate the deep ocean and transfers heat and salt to the Antarctic. Glacial/interglacial changes in deep-water formation in the Nordic Seas are implicated in conceptual models of atmospheric CO_2 variations.

ODP drilling in the Nordic Seas will improve the understanding of deep-water evolution by providing spatial/vertical transects that constrain the development of physical/chemical gradients in deep waters; sites located in regions where vigorous deep-water outflow has altered normal pelagic sedimentation; and evidence of surface ocean climate changes in regions of deep-water formation.

DRILLING PLAN/STRATEGY

Leg 151 comprises a series of proposed sites drilled to form a north-south transect, an east-west transect (linked to the ODP Leg 104 sites in the east), and a bathymetric transect. The north-south transect extends from the Arctic Ocean (the Yermak Plateau) via the Fram Strait, the Greenland and Iceland Seas, into the northwestern North Atlantic. It can thereby tie into existing North Atlantic (DSDP Legs 81, 94) and Labrador Sea (ODP Leg 105) high-resolution stratigraphies. This transect will cover the major ocean basins of the region and provide sites on both sides of the Fram Strait to the north of the Greenland-Scotland Ridge, and it will address the evolution of north-south environmental gradients from the Arctic to the North Atlantic. A second Arctic gateways leg is planned in order to drill those sites that were not drilled by Leg 151 due either to sea-ice limitations or time limitations.

PROPOSED SITES

Yermak Plateau (YERM)

The Yermak Plateau is a topographic marginal high due north of Svalbard. The Morris Jesup and northeastern Yermak rises are a pair of plateaus rising to crestal depths of 0.5 to 1 km, which apparently were formed in Paleocene-Oligocene time by excess Iceland-like volcanism along the southwestern Gakkel Ridge. The southern part of the Yermak Plateau may be thinned continental crust. Thick sediment drapes both reco estern and eastern flanks. Drilling in this area will ava le a study of environmental responses pre- and dating the opening of the deep gateway into the ctic. Another primary objective of drilling this area is at it should provide a continuous upper Neogene ord from the Arctic Ocean of the same quality as is ailable from lower latitude areas.

Proposed site YERM 1 has been proposed to ocument the subsidence history of the Yermak Plateau nd its control on the water-mass exchange through the Arctic gateway, and to determine the age and nature of basement. It will also provide records of surface and deep-water communication between the Arctic and the Norwegian Sea and the IRD-sedimentation history of the Arctic.

Proposed site YERM 2A is an alternate site for YERM 1, this site is designed to study the Neogene glacial history of the Arctic, the history of North Atlantic surface water influx to the Arctic, and to be an intermediate member of a bathymetric transect.

Proposed site YERM 3 is planned as a site to study Neogene variations in climate and oceanography, and will specifically address the Neogene Arctic glacial history and the Neogene variations in Atlantic water influx to the Arctic. It is also the shallow-water member of the bathymetric transect.

Proposed site YERM 4 objectives are the same as for proposed site YERM 3.

Proposed site YERM 5 will be used to document the glacial history of the Arctic Ocean for the Neogene, the history of sea-ice cover, the history of Atlantic water influx, and deep water variations; it will serve as the deep end-member of the bathymetric gradient.

Fram Strait (FRAM)

Proposed site FRAM 1 has two alternate proposed sites, FRAM 1A and 1B; proposed site FRAM 1A is the highest priority. The site is designed to document the timing of the opening of a deep passageway through the Fram Strait and the history of deep and shallow water exchange between the Arctic and the world ocean. It will also provide records of the onset and evolution of Arctic glacial history and the climatic variability of the Arctic region.

Proposed site FRAM 2 is proposed in order to (1) determine the age and lithology of the sedimentary processes immediately postdating the opening of the Fram Strait, and (2) investigate the water-mass exchange in and out of the Arctic Ocean. Drilling at this site potentially should be able to document the earliest post-opening events, whereas proposed site FRAM 1 is better suited to document the Neogene sections.

East Greenland Margin (EGM)

The proposed sites on the East Greenland Margin are to date the onset of the EGC, monitor deep-water formation and surface-water paleoenvironments in the Greenland Sea, determine their influence on the variability of the polar front and on the Northern misphere paleoclimate, decipher the evolution of the Sheet, monitor contour current activity and sediment drift deposition in the Greenland Basin, and study Paleogene paleoceanography.

Proposed site EGM 2 is proposed to document the history of the EGC and of deep-water flow out of the Arctic downstream from Fram Strait. Proposed sites EGM 1 and EGM 3 are alternate sites.

Proposed site EGM 4 intended for high-resolution studies of the late Neogene history of IRD input and evolution of the Greenland Ice Sheet. It is also located where intermediate and deep waters from the Greenland Sea flow toward Denmark Strait.

Iceland Plateau (ICEP)

Proposed site ICEP 1 represents the mid-point in the east-west transect in the southern Nordic Seas, and is proposed to (1) monitor the history of oceanic and climatic fronts moving east and west across the Iceland Plateau, (2) derive an open-ocean record of IRD and carbonate, and (3) determine the history of the formation of northern-source deep waters. As mentioned above, the Leg 104 sites, being located close to the Norwegian continental margin, suggest local influence on the IRD records and possible increased dissolution and dilution of carbonate. It is thus of crucial importance to drill a good, open-ocean site isolated from such influence and where subarctic IRD and environmental changes can be properly assessed.

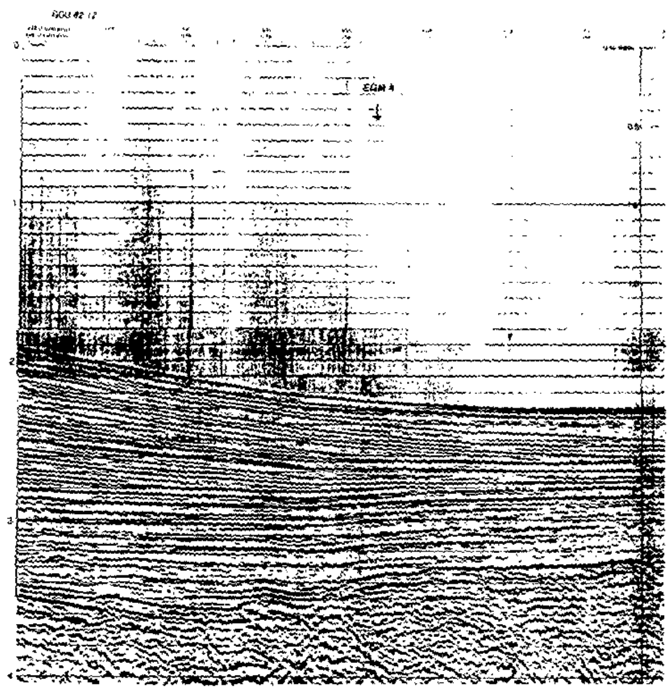


Figure 2. Seismic line GGU 82-12 showing the location of proposed site EGM 4.

Proposed sites ICEP 2, 3, and 4 form a bathymetric transect from the Iceland Plateau down toward the Norway Basin along University of Bergen line ICEP-2 Segment D. As a southern end-member of the north-south transect, these sites will enable a study of the oceanic response to different stages in the opening of the Greenland-Scotland gateway north of the ridge. They will also provide a continuous high-resolution pelagic upper Neogene record. The bathymetric transect enables documentation of CCD and carbonate preservation as well as biogenic silica budgets and their response to changing oceanic and climatic conditions. As a key location for the east-west transect, they will enable a study of variations in surface currents and oceanic fronts. They will also provide a record of pelagic IRD input well away from the ice sheets, thereby avoiding strong continental influence. This will ensure a more complete biogenic record than is available from locations closer to the coasts.

Northern Iceland-Faeroe Ridge (NIFR)

The proposed area for drilling north of the Iceland-Faeroe Ridge holds key information on the early spreading stages of the southern Norwegian Sea and the subsidence history of the Iceland-Faeroe Ridge. Compared with selected sites south of the Iceland-Faeroe Ridge, lithological and biological facies changes may indicate the development of the complex current systems that have crossed the ridge since its initiation in Early to Middle Neogene times. This area provides the unique opportunity of describing the developments of Paleogene environments and determining exactly the early phases of warm surface-water inflow from the North Atlantic, as a key parameter for Northern Hemisphere climate.

Southern Iceland-Faeroe Ridge (SIFR)

The area south of the Iceland-Faeroe Ridge covers the key position for data on the origin and early subsidence history of the Iceland-Faeroe Ridge as the major gateway responsible for Northern Hemisphere climate development. Since the warm North Atlantic Current advected this area also during Early to Middle Neogene times, lithological and biological facies changes from the ridge into the southern Norwegian Sea may help to clarify the onset of surface- and bottom-water exchanges over the ridge. The location of the proposed area provides the opportunity of determining the age and nature of the Iceland-Faeroe Ridge and of the overlying sediments, which will provide crucial information about the early history of the ridge. Drilling in this area can also determine if a stepwise or more sudden exchange of surface and bottom water occurred across the Iceland-Faeroe Ridge during the Early Neogene.

References

Aagaard, K., Swift, J.H., and Carmack, E.C., 1985. Thermohaline circulation in the Arctic Mediterranean Seas. J. Geophys. Res. C3, 90:4833-4846.

CLIMAP, 1976. The surface of the ice-age earth. Science, 191:1131-1137.

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 are not reviewed.

ODP Proposal News

PROPOSAL TRENDS

BILL COLLINS, JOIDES OFFICE

Here at the JOIDES Office we maintain a database of all ODP proposals. We also have a Macintosh-based relational database (4^{th} *Dimension*) of proposal related information. This database sits on a Macintosh and contains a wealth of information very neatly organized by my predecessor, now turned ODP staff scientist, Peter Blum. As a result, information, such as that presented in Table 1, is easily retrieved.

When proposals are first submitted to the JOIDES Office they are given a number such as 999— and classed as a new proposal. We are presently up to number 431—. The discrepancy between this number and the total of new proposals shown in Table 1 is because some proposals were numbered twice when the system of numbering was changed a few years ago. Figure 1 is a plot of the location of those in the "New Proposal" category. When a proposal is revised it maintains its original number but a Rev is attached, e.g. 999-Rev. Similarly, an Add suffix is added to any addendum. The category "Other" refers to such things as DPG reports and the, now defunct, supplemental science proposals. Proposals remain active if they have been updated within the previous three calendar years. There are presently about 100 active proposals in the system.

I extracted the total number of new proposals and corresponding number of proponents. The result is given in Figure 2. In both cases the trend appears to be one of declining numbers. When this information is viewed in the context of an average 4 year lag between proposal, drilling, and published result, the declining numbers do necessarily not correlate to a loss of interest. It is clear that the ODP start-up years saw an abundance of proposals written. In the latter part of 1987 the end of the first circumnavigation of the globe was in sight. The emphasis was changing from regional to thematic thinking. At this time there was a jump in the number of proponents relative to proposals. The results of thematic-based drilling started filtering into the system in 1991. Both 1991 and 1992 show, on average, more proponents submitting fewer (better?) proposals.

CATEGORY		TOTAL
New Proposal		409
Revision	149	
first	108	
second	35	
third	6	
Addendum	59	
Other		12

Table 1. ODP proposal statistics. New proposal refers to the total of original proposals received at the JOIDES Office since 1982. Revision refers to the number of original proposals which have been revised by a first, second or third revision. Addendum refers to addenda to original proposals.

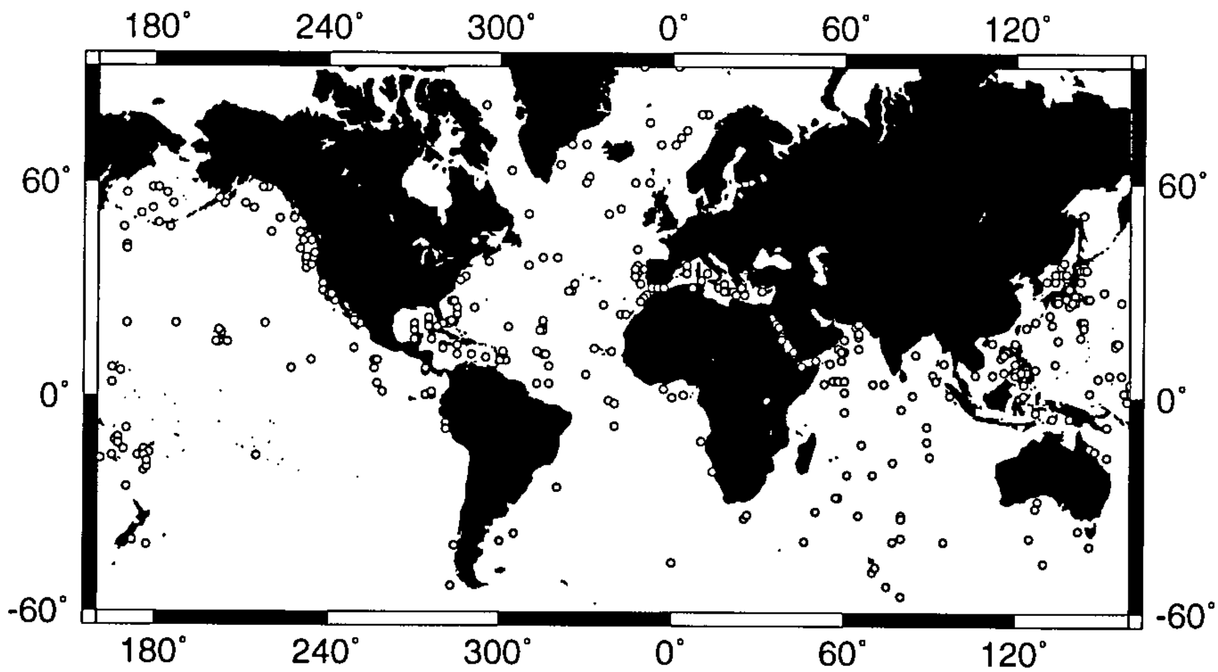


Figure 1. Approximate locations of proposed drilling from proposals received at the JOIDES Office. since 1982. The data points were taken from the original proposals and include those that have been drilled or forwarded to DPG's.

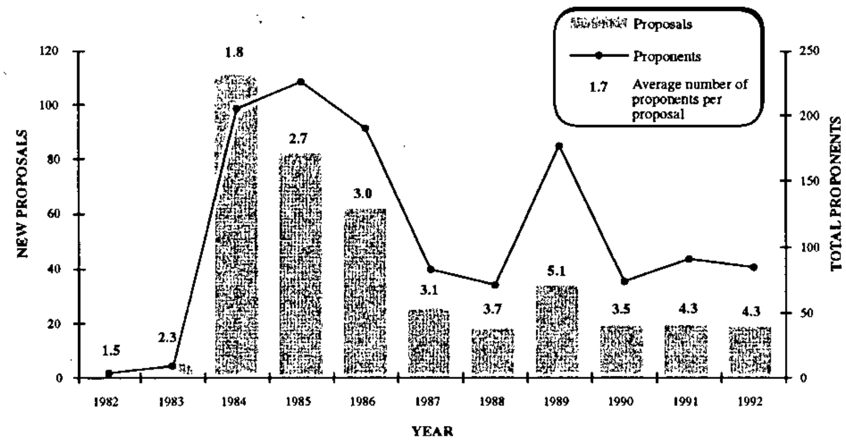


Figure 2. Plot of new proposals and proponents. An individual proponent may be counted more than once if appearing in more than one proposal.

Ocean by Ocean

As we approach the possibility of finishing Atlantic and adjacent seas drilling in 1996, it is interesting to look back at the trend of new proposal submissions on an ocean-by-ocean basis (Fig. 3). Two things jump out from a comparison of new proposal submissions and ship schedule. First, that proposal pressure appears to determine when and where the ship will operate. Second, although the peak of proposals submitted for a given ocean coincided approximately with a decision on the area of operations, the majority of proposals were received subsequent to that decision.

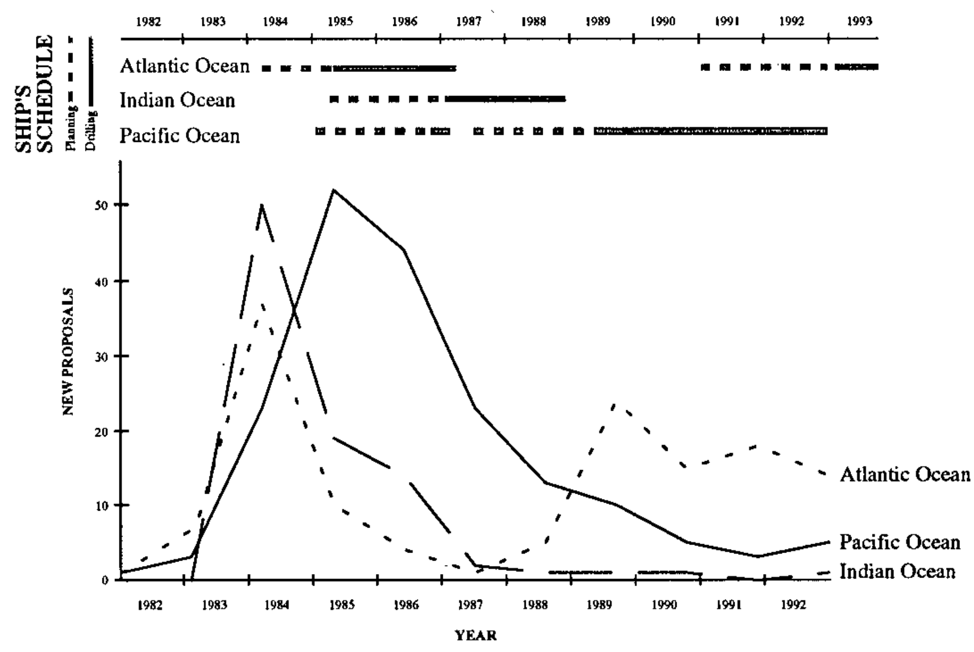


Figure 3. Plot of new proposals in or close to the Atlantic, Pacific, and Indian Ocean drilling. Ship schedule subdivided into planning and drilling phases for Atlantic, Pacific, and Indian Ocean drilling.

The Measure of Success

If a prospective proponent were to ask "All things being equal, what are the chances of my proposal being successful?", the answer would range from 12% to 30%. The 12% success rate of ODP proposals would come from dividing the number of new proposals by the number of legs to date, assuming one proposal per leg. However, if you use the criteria that a proposal has been successful if a portion of the suggested sampling was completed then that number rises to just over 30%. The true success rate probably lies somewhere in between. If you tried to break this success rate down by member country you would see that 54% of proposals are non-US based while 46% are based in the US. These percentages by country are less accurate in recent years as proposals are more multi-national in origin.

Falling Off the Back End

In 1991 the Planning Committee passed a motion whereby all proposals that have not been updated within 3 calendar years would not be considered for ranking and, consequently, drilling. Minimum requirements for an update are: responses to thematic panel comments and an introduction identifying changes. If you are in doubt as to the status of your proposal please contact the JOIDES Office.

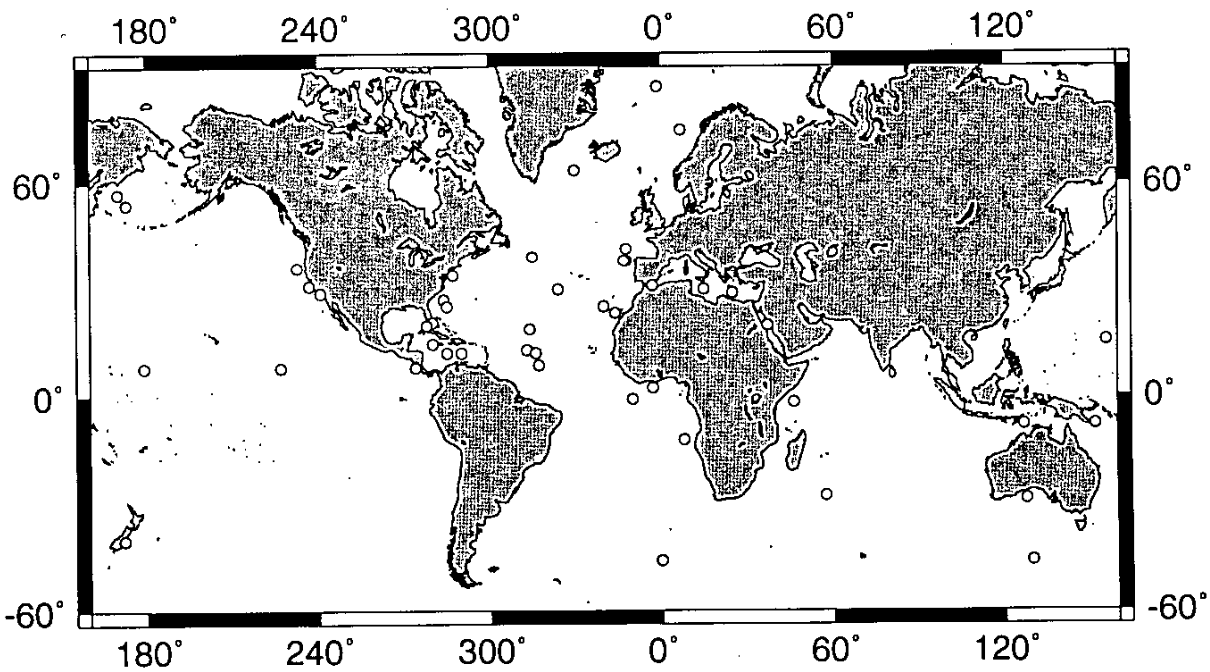
1993 GLOBAL RANKING

Every year around March the JOIDES Thematic Panels prioritize active proposals and generic programs regardless of ocean and state of readiness. PCOM uses this global ranking for medium term (four year) planning. The following are the results of the 1993 global ranking. For titles of proposals see Feb '93 JOIDES Journal.

	LITHP	OHP	SGPP	TECP
1	420— Oceanic crust evol.	NAAG II NA. Arctic Gateways II	423-Rev Gas hydrate sampling	323-Rev2 Alboran Sea (deep hole)
2	300-Rev Return to Site 735	430— Sub-SAT	New Jersey Margin II 348-Add (shallow holes)	TIE} NARM-DPG I N-V Mar. II (Iber. 2)
3	NARM-DPG Volcanic margins II	354-Add Benguela Current	412-Add Bahamas transect	I 346-Rev3 TIE}Equ. Atl. transform
4	TIE} 086-Rev2 I Red Sea	415-Rev Caribbean KT/paleo.	391-Rev Med. sapropels	330-Rev Med. Ridge (Phase 1)
5	I SRII TIE} Sed. Ridges II	386-Rev2/422-Rev California current	380-Rev3 VICAP-MAP	340-Rev N Australian margin
6	* GENERIC Timing of LIPs	404— NW Atl. sed. drifts	400— Costa Rica acc. wedge	400— Costa Rica acc. wedge
7	* GENERIC W. Pac. Forearc/Backarc	427— South Florida sea level	SR-Rev Sedimented Ridges II	NARM-DPG Volcanic Margins II
8	426— Aus.-Antarctic discord.	TIE} 391-Rev I Med. Sapropels	330-Rev Med. Ridge (Phase 1)	TIE{ 265-Rev/Add) I Woodlark Basin
9	407—/425— 15° 20'N/MAR	I 079-Rev TIE} Somali deep hole	422— Santa Monica Basin	I 334-Rev2 TIE} Galacia Margin S
10	* GENERIC Mass Bal. at Sub. Zones	337-Add New Zealand sea level	404— NW Atl. sed. drifts	330—/330-Rev Med. Ridges (deep)
11	376-Rev Vema FZ. VE-1, VE-2	253-Rev/253-Add Pac. black shales	424-Rev Cork Hole 395A	NARM-DPG Non-Volc.II (Nfld)
12	TIE} 368— I Return to 801C	347-Rev South-eq. Atl. paleo.	253-Rev Pac. black shales	333-Rev Cayman Trough
13	I *GENERIC TIE} Caribbean KT/LIP	406—/372-Add Feni Drift/DSDP116	386-Rev2 California margin	* GENERIC Red Sea
14	374— Oceanographer FZ	367-Add S. Australia margin	427— South Florida sea level	323-Rev2 Alboran Sea (non-deep)
15	380-Rev2 VICAP, Gran Canaria	Bering (CEPAC/390) Bering Sea History	407— 15°20'N shallow mantle	
16			368— Hole 801C return	
17			420— Oceanic crust evol.	

*GENERIC PROPOSALS IDENTIFIED IN 1993 GLOBAL RANKINGS

- **LIP Timing:** This program would address the timing of the formation of large igneous provinces, and would most likely be conducted on either the Kerguelen or Ontong Java Plateaus
- **Forearc/Backarc:** A number of high priority objectives exist at convergent margins. It is expected that several proposals will soon be submitted for drilling these environments in the Western Pacific.
- **Mass Balances and Geochemical Fluxes at Subduction Zones:** LITHP has long been interested in addressing this problem. There is currently a proposal in the system (Proposal 400—) that could,with some revision, conduct an appropriate study at the Middle America Trench. However, as presently written, its emphasis is more on fluid flow within the accretionary wedge, than on defining the composition of the down-going slab. Consequently, this topic is included in the rankings as a generic proposal
- **Caribbean LIP/KT Boundary:** The PANCHM recommended that the proponents of the KT boundary proposals and the Caribbean LIP proposals work together to produce a joint program of drilling. A leg of drilling for such a program is included in the rankings
- **Red Sea:** TECP felt that the existing Red Sea proposal (086-Rev2) proposal did not address the needs of the panel and therefore required an extensive rewrite of a new proposal. However, they support the concept of a Red Sea program strong enough to include a generic proposal in the rankings.



LAT	LONG	PROP.
10	227	420
41	233	SR-Rev
36	237	386-Rev2
34	241	422-Rev
18	280	333-Rev
25	280	412-Add
32	284	423-Rev
30	285	404
39	287	348-Add
15	290	411
16	313	425
44	315	406
15	316	407
11	317	376-Rev
35	324	374

LAT	LONG	PROP.
62	330	NARM (EG)
68	7	NARM (VM)
43	348	NARM (IAP+G)
30	340	380-Rev3
28	344	380-Rev2
43	347	334-Rev2
46	348	372
-1	350	347-Rev
36	357	323-Rev2
3	357	346-Rev3
73	359	NAAG II
-15	8	354-Add
15	285	415-Rev
-50	0	430
35	15	391-Rev

LAT	LONG	PROP.
34	25	330-Rev
24	37	086-Rev
-2	46	079-Rev
-33	57	300-Rev
24	82	427
10	86	400
-10	127	340-Rev
-34	128	367-Add
-50	130	426
-10	152	265-Add
19	156	368
58	170	390
-45	172	337-Add
56	173	Bering
10	179	253-Add

Figure 4. Location of the top 15 ranked proposals from each Thematic Panel for 1993. For proposal number refer to approximate latitude and longitude South latitude is given by negative numbers and longitude is given in degrees form 0 to 360 . Plot produced by GMT.

ODP International News

ANNUAL GERMAN ODP MEETING IN FREIBERG

SUBMITTED BY HELMUT BEIERSDORF AND ULRICH VON RAD

150 German scientists working for or interested in ODP related research attended the national ODP colloquium from March 10-12, 1993 in the 800-year old, charming silver-mining town of Freiberg (Saxony). We met in the historical Mineralogisches Institut of the Bergakademie Freiberg (the oldest montane university in the world) named after Abraham Gottlieb Werner (1749-1817), the famous mining counselor who was one of the founders of the science of geology and who worked in Freiberg. We all enjoyed a very rewarding and well organized meeting and were happy to note that tremendous progress has been made towards the integration of East and West German geologists. Also in Germany the interdisciplinary Ocean Drilling Program is one of the most successful geoscience programs.

The attendees were welcomed by the Mayor of Freiberg, Mr. Heinze (a geophysicist himself), and by Professor Oelsner, who acted on behalf of the Rector of the Academy and the Geoscience Department. The attendees heard reports by Dietrich Maronde, representative of the Deutsche Forschungsgemeinschaft (DFG); by Helmut Beiersdorf, the German ODP Coordinator; by the German panel members (PCOM—U. von Rad, LITHP—P. Herzig, TECP—R. von Huene, SGPP—R. Zahn, OHP—G. Wefer), by Hans Dürbaum, the JOIDES Advisory Structure Review Committee Chairman; and by H.-U. Schmincke, from the German Ridge Project (DeRidge).

Dietrich Maronde mentioned, to our great relief, that the DFG is about ready to sign the MOU with NSF for the renewal of the German membership in ODP. In addition to the German ODP Initial Contribution, of which DFG and the Ministry of Research & Technology (BMFT) pay 50% each, DFG supports the ODP related pre-site surveys, ODP-related travel, panel visits, and post-cruise research with approximately 3,75 M DMK (US $ 2.27 M). Another significant million-dollar contribution to ODP-related research within Germany comes from BMFT, mainly going into regional and site-specific survey work.

The meeting included leg reports (145, 146, 147), status reports on completed and planned research projects (ODP Legs 130, 133, 135), and on pre-site surveys (e.g., TAG, South Atlantic, Southern Ocean, Tephra in the Indian Ocean, BSRs off Peru, Galicia Bank, Iberia Abyssal Plain, Norwegian Sea). Altogether 24 selected scientific talks and 28 posters were presented.

Jack Baldauf gave an inspiring slide talk on "News and Views from the Science Operator". This was particularly useful to the numerous "newcomers" from the new Federal States, now just becoming familiar with ODP. In a special session, German panel memberships were discussed and vacancies filled. The attendees then met in one of the most spectacular mineral collections in the world to let the day expire over beer and wine.

We are happy to have acquired new, well-qualified supporters of ODP in Germany. This is the top message from Freiberg after having met scientists from the new States who have been blocked off from our program for so long.

For a copy of the official minutes of the German ODP Colloquium, including abstracts of oral and poster presentations contact: Helmut Beiersdorf or Ulrich von Rad
Bundesanstalt für Geowissenschaften und Rohstoffe, Stilleweg 2, Postfach 510153, D-30631 Hannover 51, Germany

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 Jørgensen or Naja Mikkelsen
ESCO Secretariat, Geological Survey of Denmark
Thoravej 8, DK-2400
Copenhagen NV, Denmark

News from Other Science Groups

Marine aspects of Earth System History (MESH)

SUBMITTED BY ALAN MIX, OREGON STATE UNIVERSITY

The MESH program originated in 1990 as a meeting on earth system history hosted in Washington DC by Dr. Bilal Haq of the NSF Division of Ocean Sciences. The goal: to plan for a marine geological component of global change studies. At that time, an ad hoc advisory panel was formed, and a first statement of initiatives was assembled (edited by G.S. Mountain, 1991, The Advisory Panel Report on Earth System History, available from JOI, Inc.). In February of 1993, a group of about 70 scientists met in Portland Oregon, including representatives from NSF, NOAA, NAD, USGS, ODP-EXCOM, ODP-PCOM, ODP-OHP, and United Kingdom, France, Germany, and Mexico. Eric Barron of Penn State University chaired the gathering, which set scientific priorities and formally elected a new steering committee, now chaired by Nicklas Pisias of Oregon State University. The six MESH themes, in order of priority, are shown in the table at right.

MESH Themes

1. Ocean Biogeochemical Dynamics and Climate Change
2. Episodes of Extreme Warmth
3. Interannual to Millennial Paleoclimate Changes
4. Abrupt Climate Changes
5. Continental-Marine Connections
6. Sea Level

ODP drilling is relevant to all these themes. For example, the first will require recovery and analysis of many high-sedimentation rate sections from the last half-million years, which are often beyond the reach of traditional piston coring technology. The second highlights warm intervals of the Pliocene, which can be sampled well with the ODP Advanced Piston Core. Further opportunities exist for coring varved sediments, such as the recent successful recovery of a sequence from Santa Barbara Basin suitable for study of interannual climate change under different planetary climatic regimes. Study of sea level history is underway on Leg 150.

The Portland meeting developed initial reports on these themes, but much more work needs to be done. The MESH steering committee plans to meet this summer, and small working-group meetings will be held this Fall. Watch for public discussion at the Fall AGU meeting in San Francisco. For more information about MESH activities, contact Dr. Nicklas Pisias, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331 (pisias@oce.orst.edu).

RIDGE and InterRidge

In February a meeting was held to assess the current state of knowledge of the TAG hydrothermal system and to develop a specific plan for measurements to be made before, during, and after drilling (ODP Leg 158) which would maximize the potential scientific gain from drilling in this area. The meeting was organized by the US RIDGE Office on behalf of InterRidge. The meeting included a small group of InterRidge scientists with interests in monitoring ridge crest hydrothermal systems, representatives of the ODP drilling proponents and liaisons from ODP-TAMU and JOIDES advisory panels.

The meeting was divided into four segments:

- assessment of the present state of knowledge of the TAG hydrothermal area and its regional setting;
- presentation of plans for research in the TAG area and the availability of ships, submersibles, and ROVs in 1993 - 1995;
- description of the available instrumentation and experimental approaches to monitoring variability in hydrothermal systems;
- discussion and planning if drilling-related experiments at TAG.

The scientific objectives of a monitoring program at TAG conducted before, during and after drilling will include:

- definition of the temperature variability, fluid flow and porosity within the system from a combination of borehole and sea floor measurements;
- determination of the bulk permeability structure of the mound by documenting the hydrogeologic disturbance by drilling and the covariation of fluid temperature, fluxes and seismicity;
- investigation of the ecological response to a changing hydrothermal system.

The experiments that can be done in the time frame of the scheduled drilling are limited to downhole experiments, seismic experiments, mapping and photography, and measurements of temperature flow rates before, during and after drilling. Continuous monitoring of temperatures and measurements of flow rates in the black smoker chimney complex at TAG are not feasible; however, it should be possible to deploy equipment to measure the variations in flow in the "Kremlin" area and in the region of diffuse flow.

Other newsletters, journals and reports of possible interest:

The Nansen Icebreaker

A newsletter from the Nansen Arctic Drilling Program. It is issued twice a year by JOI Inc. For copies or to subscribe contact JOI Inc. at 1755 Massachusetts Ave., NW, Suite 800, Washington, D.C. 20036-2102. Internet: joi@iris.edu

IRIS Annual Report 1992

Annual report of the Incorporated Research Institutions for Seismology. Available from the IRIS Consortium, 1616, N. Fort Myer Drive, Suite 1050, Arlington, VA 22209

Bulletin Board

Funding for Site Survey Augmentation

JOI/U.S. Science Support Program has Site Survey Augmentation funds available to supplement drilling site data sets during any phase 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 Inc. office, for further information and proposal guidelines: (202) 232-3900, Internet: ekappel@iris.edu.

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:

Shorebased Research (regardless of leg)	**12/1/93**
Shipboard Research (Legs 159 - 164)	**5/1/94**

For an application contact:

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

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

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: Internet: joi@iris.edu
Joint Oceanographic Institutions, Inc. 1755 Massachusetts Ave., NW, Suite 800, Washington, DC 20036-2102

Guide to Third-Party Tools

For inquiries about wireline tools in ODP contact:

Manager of Technical Operations, Borehole Research Group
Lamont-Doherty Earth Observ., Palisades, NY 10956
Phone: 914-365-8734, Fax: 914-365-3182,
Internet: borehole@lamont.ldeo.columbia.edu

For inquiries about all other downhole tools in ODP 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
Internet: moy@nelson.tamu.edu

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.

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

ODP Open Discussion Bulletin Board via Bitnet

The ODP BITNET LISTSERVER is a discussion bulletin board service to which individuals subscribe *via* Bitnet. It permits exchange of information among all subscribers. Currently, the list administrator, Linda Weatherford, 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 reviewed before being distributed.

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 message to Linda Weatherford (Weatherford@tamodp or Weatherford@nelson.tamu.edu) requesting that you be added to the ODP-L subscription list.

WINDOWS TO THE PAST
Discovering Earth's Future

A New Video from the Ocean Drilling Program!

"Windows to the Past: Discovering Earth's Future" introduces you to the Ocean Drilling Program (ODP), the world's largest basic research program in earth and ocean sciences. ODP scientists sail the world's oceans to learn more about Earth's processes locked in the sediment and rocks beneath the seafloor. Join them on this journey; their adventure has just begun. This video was produced by the Biomedical Communications Department, Texas A & M University Health Science Center in conjunction with the Ocean Drilling Program at Texas A & M University.

For copies of this 20 minute video contact:

Agatha Moy, Ocean Drilling Program, Texas A & M University Research Park,
1000 Discovery Drive, College Station, TX 77845-9547
Internet: moy@nelson.tamu.edu

ODP Bibliography & Databases

ODP Science Operator

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

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

	Init. Reports Vol.	Pub.	*Sci. Results* 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	130	Apr 93
Leg 131	131/132	June 91	131	Apr 93
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		
Legs 142/143	142/143	Apr 93		

Scientific Prospectuses and Preliminary Reports

	Prospectuses Vol.	Pub.	*Prelimin. Rpts.* Vol.	Pub.
Leg 146	46	July 92	45	Nov. 92
Leg 147	47	Sept 92	46	Jan 93
Leg 148	48	Oct 92	47	Jan 93
Leg 149	49	Nov 92		
Leg 150	50	Mar 93		
Leg 151	50	Apr 93		

Engineering Prospectuses and Preliminary Reports

	Prospectuses Vol.	Pub.	*Prelimin. Rpts.* 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)

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;
Fax: (409) 845-4857;
Internet: Fabiola@nelson.tamu.edu

Sample Distribution

The materials from Legs 142 and 143 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 *Proceedings of the ODP* (Revised Oct. 92)
- *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
Internet: Riedel@nelson.tamu.edu

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 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.

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ODP Site Survey Databank

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The JOIDES/ODP Data Bank received the following data between December 1, 1992, and April 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 Peter Rona (NOAA): 4 heat flow profiles recorded with the DSV *Alvin* heat flow probe on dive 2189 in 1990 at 4 stations on and adjacent to the active sulfide mound in the TAG hydrothermal field.

-From Robert Whitmarsh (Institute of Oceanographic Sciences, Deacon Laboratory): copies of Sonne 75 lines for IAP co-chief package. Lines 16-21.

-From H. Meyer (B.G.R.): IAP Sonne 75 - MCS lines 22-1 and 22-2, stacked and migrated versions.

-From W.D. Rose (TAMU): Correction to Scientific Results, Volume 129 of Proceedings of ODP (bathymetry map of Pigafetta and East Marianas Basin).

-From M.O. Beslier (Laboratoire de Geodynamique Sous Marine, Villefranche-sur-Mer): two navigation plots of French cruises in Iberia area for co-chief package.

-From T. Shipley (University of Texas at Austin): Barbados 3.5 kHz fromEwing 9207, flip book of 102 seismic lines - FK migrated.

-From Geological Survey of Greenland: Data for Leg 152 safety package.

-From S. Humphris (WHOI): TAG magnetics, gravity and bathymetry.

-From C. Williams (Oxford University): geophysical report of the E. Mediterranean Sea.

-From ODP (TAMU): Legs 139, 140, 141 and 142 microfilm, MGD 77 tape and info. report.

-From A. Camerlenghi (Osservatorio Geofisico Sperimentale): two seismic profiles (monitor of MCS), R.V. *Explora*, for Vema Fracture Zone.

-From ODP Data Bank: two computer plots of Lamont, *Challenger* and *Resolution* data for Medsap.

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 queries electronically 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)

Wireline Logging Manual (New Edition, Sept 1990).

To obtain a copy, contact Dave Roach,
(Tel: (914) 365-8672 Fax: (914) 365-3182)
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Policy Update for Wireline Re-entry of DSDP and ODP Boreholes

At their January 1993 meeting, EXCOM amended their 1987 policy for wirelie 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 all announcements and reports are made in a timely fashion.

M

ODP / JOIDES Directory

Ex

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Dr. Hans-Christian Larsen, Chairman

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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 and symposiums a year.

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Selected Acronyms and Abbreviations

AMC ..... axial magma chamber
BGR ..... Bundesanstalt fur Geowissenschaften und Rohstoffe
BGS ..... *British Geological Survey*
BHA ..... bottom-hole assembly
BHTV ..... *borehole televiewer*
BMR ..... Bureau of Mineral Resources
BRGM . Bureau de Recherches Geologiques et Minieres
BSR ..... bottom-simulating reflector
CSG ..... Computer Services Group (ODP)
DCB ..... diamond core barrel
DCS ..... diamond coring system
DI-BHA ..... drill-in bottom-hole assembly
DP ..... dynamic positioning
DPG ..... Detailed Planning Group
DRB ..... DCS retractable bit system
ECOD.. European (ESF) Consortium for Ocean Drilling
FMS ..... formation microscanner
FY ..... fiscal year
HRB ..... hard rock guide base
HRO ..... hard rock orientation
IFREMER ..... Institut Francais de Recherche pour l'Exploitation de la Mer
InterRidge ..... International Ridge Inter-Disciplinary Global Experiments
IRIS ..... Incorporated Research Institutions for Seismology
JAMSTEC ..... Japan Marine Science and Technology Center
JGOFS ..... Joint Global Ocean Flux Studies
JOI-BOG ..... JOI Board of Governors
KTB ..... Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland
LAST ..... lateral stress tool
LRP ..... Long Range Plan
mbsf ..... meters below seafloor
MDCB ..... motor-driven core barrel
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 (UK)
NGDC ..... National Geophysical Data Center
NSERC ..... National Science and Engineering Research Council (Canada)
OBS ..... ocean bottom seismometer
ODPC ..... ODP Council
OSN ..... Ocean Seismic Network
PCS ..... pressure core sampler
PDC ..... poly-crystalline diamond compact (drilling bit)
PEC ..... Performance Evaluation Committee
RFP ..... request for proposals
RFQ ..... request for quotes
RIDGE ..... Ridge Inter-Disciplinary Global Experiments (US)
ROV ..... remotely-operated vehicle
SCM ..... sonic core monitor
SCS ..... single-channel seismic
SES ..... sidewall-entry sub
SOE ..... Special Operating Expense
SOW ..... Statement of Work
STA ..... Science and Technology Agency (of Japan)
USSAC ..... US Scientific Advisory Committee
USSSP ..... US Science Support Program
VPC ..... vibra-percussive corer
VSP ..... *vertical seismic profile*
WG ..... Working Group
WOB ..... *weight on bit*

FY93 Science Programs:

504B	deepening Hole 504B (Leg 148)
NARM NV-I	North Atlantic Rifted Margins non-volcanic, first leg (Leg 149)
NJ/MAT	New Jersey / Middle Atlantic Transect (Leg 150)
NAAG-I	North Atlantic Arctic Gateways, first leg (Leg 151)

FY94 Science Programs::

NARM V-I	North Atlantic Rifted Margins volcanic, first leg (Leg 152)
MARK	Mid-Atlantic Ridge at Kane fracture zone (Leg 153)
Ceara Rise	Leg 154
Amazon Fan	Leg 155
N. Barbadoes Ridge	Leg 156
DCS-VE3	Diamond Coring System engineering leg at the Vema fracture zone (Leg 157)
TAG	Trans-Atlantic Geotraverse Hydrothermal Field (leg 158)

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 general purpose directory as space allows and will also include non-panel/committee members (Note: the ODP Directory on p. 45 has complete address information only for the panels/committees/ODP-TAMU/ODP-LDEO/ODPC/NSF/JOI/International offices)

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New JOIDES Office FTP Site on moby2.ocean.washington.edu

The following information is now available from the JOIDES Office via anonymous FTP on moby2.ocean.washington.edu; FTP (File Transfer Protocol) is the primary method of transferring files over Internet, it is often the name of the program that implements the protocol. File transferring normally requires a user to have an id on the system they are transferring files to/from. However, with an anonymous FTP site, the JOIDES Office can make files publicaly available to anyone with FTP capabilities without the necessity for user ids. Editor's Note: If you want to find out more about FTP or the Internet, I would recommend *The Whole Internet* by Ed Krol (1992)

Acess via: FTP moby2.ocean.washington.edu
Login: anonymous
Password: your userid

Subdirectory	File Name	File Type	Contents
/pub/JOIDES/Directory		(MS Word is v. 5.1 for Macintosh)	
	e-mail_dir.txt	ascii	Internet Directory
	JJ_Directory.txt	ascii	copy of *JOIDES Journal* Directory addresses
	JOIDES_Directory.txt	ascii	copy of the entire JOIDES address data base
	liaisons.bin	binary - MS Word	JOIDES Panel liaisons listing
/pub/JOIDES/Meetings			
	Meeting_Schedule.bin	binary - MS Word	JOIDES Panel/Committee meeting schedule
	Meetings_(text).txt	ascii	JOIDES Panel/Committee meeting schedule
/pub/JOIDES/Minutes			
/pub/JOIDES/Minutes/BCOM	BCOMMar_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/EXCOM	EXCOMJan_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/IHP	IHPMar_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/LITHP	LITHPMar_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/OHP	OHPMar_93bin	binary - MS Word	
/pub/JOIDES/Minutes/PCOM	PCOMDec_92.bin	binary - MS Word	
	PCOMApr_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/SGPP	SGPPMar_93.bin	binary - MS Word	
/pub/JOIDES/Minutes/TECP	TECPMar_93.bin	binary - MS Word	
/pub/JOIDES/Proposals			
	ssform.bin	binary - MS Word	site summary forms
	guidelines.bin	binary - MS Word	proposal submission guidelines
/pub/JOIDES/Reports			
	ASRC-final-report.txt	ascii	Advisory Structure Review Com.Final Report

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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)

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Logging Information – Logging Schools

JOIDES Resolution Operations Schedule

Leg	Destination	Cruise Dates	In Port †	Total days	Transit	On Site
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	6	50
153	MARK	Nov. 29 - Jan. 24, 1994	St. John's, Nov. 24 - 28, 1993	56	10	46
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			

† Although 5 day port calls are generally scheduled, the ship sails when ready

JOIDES Meeting Schedule

Date	Place	Panel
June 22 - 24, 1993	College Station, Texas	EXCOM
July 21 - 23, 1993	Halifax, Nova Scotia, Canada	IHP
* July 28 - 30, 1993	Palisades, New York	SSP
August 10 - 12, 1993	Brisbane, Australia	PCOM
* Sept. 18 - 21, 1993	Corner Brook, Newfoundland	TECP / SGPP
* Sept. 24 - 28, 1993	Reykjavik, Iceland	TEDCOM
* Sept. 27 - 28, 1993	Marseilles, France	SMP
* October 6 - 8, 1993	Bremen, Germany	OHP
* October 12 - 14, 1993	Santa Fe, New Mexico	LITHP / DMP
November 29, 1993	Miami, Florida	PANCH
Nov. 30 - Dec. 3, 1993	Miami, Florida	PCOM
* January 25 - 27, 1994	Belairs Research Lab., Barbados	SMP
* March 29 - 31, 1994	Amherst, Massachusetts	OHP

* Meeting not yet formally requested and approved