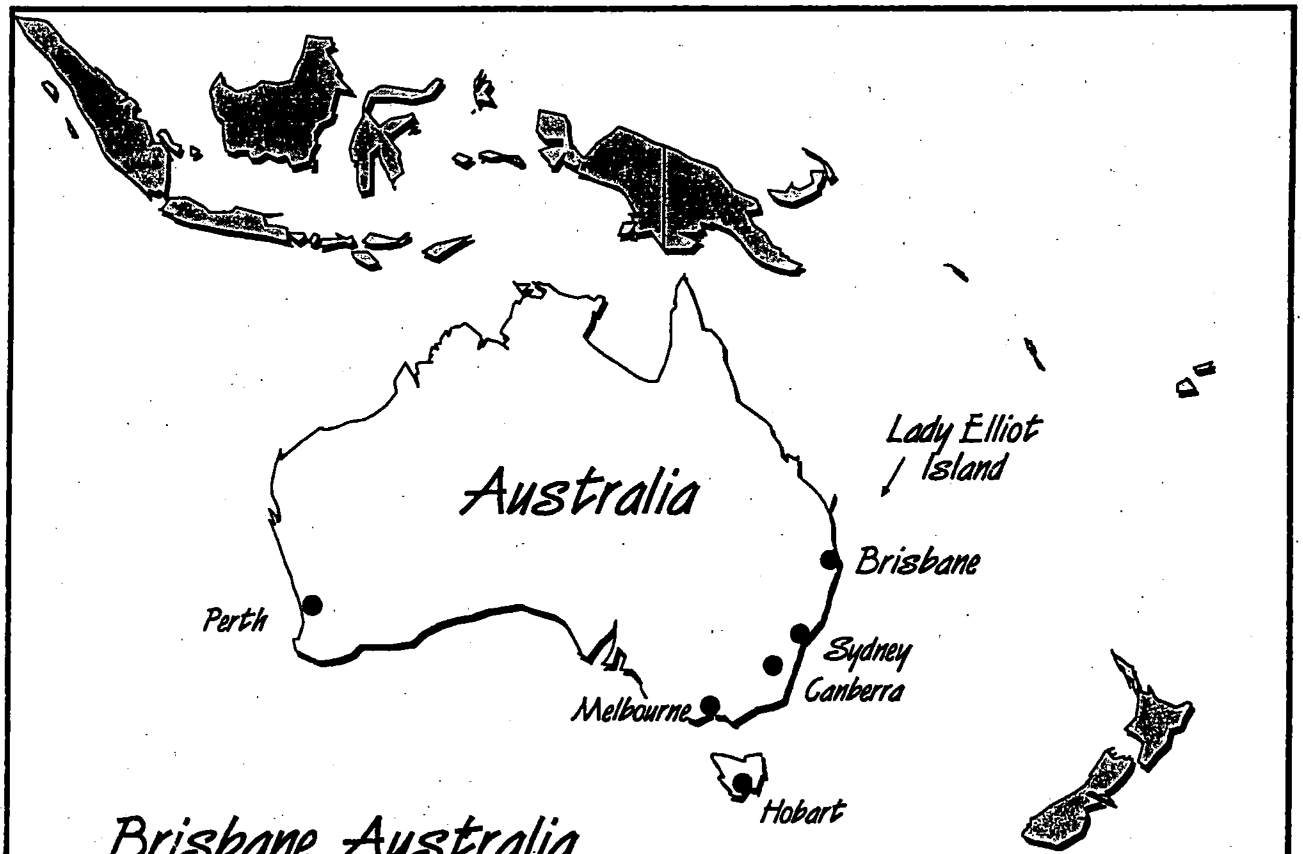
JOIDES PCOM



Brisbane, Australia
August 10 - 13, 1993

AGENDA BOOK

Joint Oceanographic Institutions for Deep Earth Sampling

•University of California, San Diego, Scripps Institution of Oceanography •Canada-Australia Consortium •Columbia University, Lamont-Doherty Earth Observatory •European Science Foundation: Belgium, Denmark, Finland, Greece, Iceland, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, and Turkey •France: Institut Francais de Recherche pour l'Exploitation de la Mer •Germany: Bundesanstalt für Geowissenschaften und Rohstoffe •University of Hawaii, School of Ocean and Earth Science and Technology •Japan: Ocean Research Institute, University of Tokyo •University of Miami, Rosenstiel School of Marine and Atmospheric Science •Oregon State University, College of Oceanic and Atmospheric Sciences •University of Rhode Island, Graduate School of Oceanography •Russian Academy of Sciences, Institute of Lithosphere (inactive) •Texas A&M University, College of Geosciences and Maritime Studies •University of Texas at Austin, Institute for Geophysics •United Kingdom: Natural Environment Research Council •University of Washington, College of Ocean and Fishery Sciences •Woods Hole Oceanographic Institution •

PCOM AGENDA BOOK TABLE OF CONTENTS

PARTICIPANT LIST

Planning Committee - PCOM

R. Arculus	University of New England (Canada - Australia Consortium)
J. Austin	University of Texas at Austin, Institute for Geophysics
W. Berger	University of California, San Diego, Scripps Institution of Oceanography
H. Dick	Woods Hole Oceanographic Institution
J. Fox	University of Rhode Island, Graduate School of Oceanography
R. Kidd	Dept. of Geology, University of Wales, Cardiff
B. Lewis	University of Washington, College of Ocean and Fishery Sciences
J. McKenzie	Geologisches Institut, ETH-Zentrum, Zürich
C. Mével	Laboratoire de Géologie du Quaternaire, Marseilles (France)
A. Mix	Oregon State University, College of Oceanography
J. Mutter	Columbia University, Lamont-Doherty Geological Observatory
J. Natland	University of Miami, Rosenstiel School of Marine and Atmospheric Science
W. Sager	Texas A&M University, College of Geosciences
K. Suyehiro	Ocean Research Institute (Japan)
B. Taylor	University of Hawaii, School of Ocean and Earth Science and Technology
U. von Rad	Bundesanstalt für Geowissenschaften und Rohstoffe (Germany)

Liaisons

T. Francis	Science Operator (ODP-TAMU)
D. Goldberg	Wireline Logging Services (ODP-LDGO)
B.Malfait	National Science Foundation
T. Pyle	Joint Oceanographic Institutions, Inc.

Guests and Observers

R. Whitmarsh	Leg 149 Co-Chief
L. Kay	NERC

JOIDES Office

B. Collins	Executive Assistant and Non-US Liaison
K. Schmitt	Science Coordinator

JOIDES 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

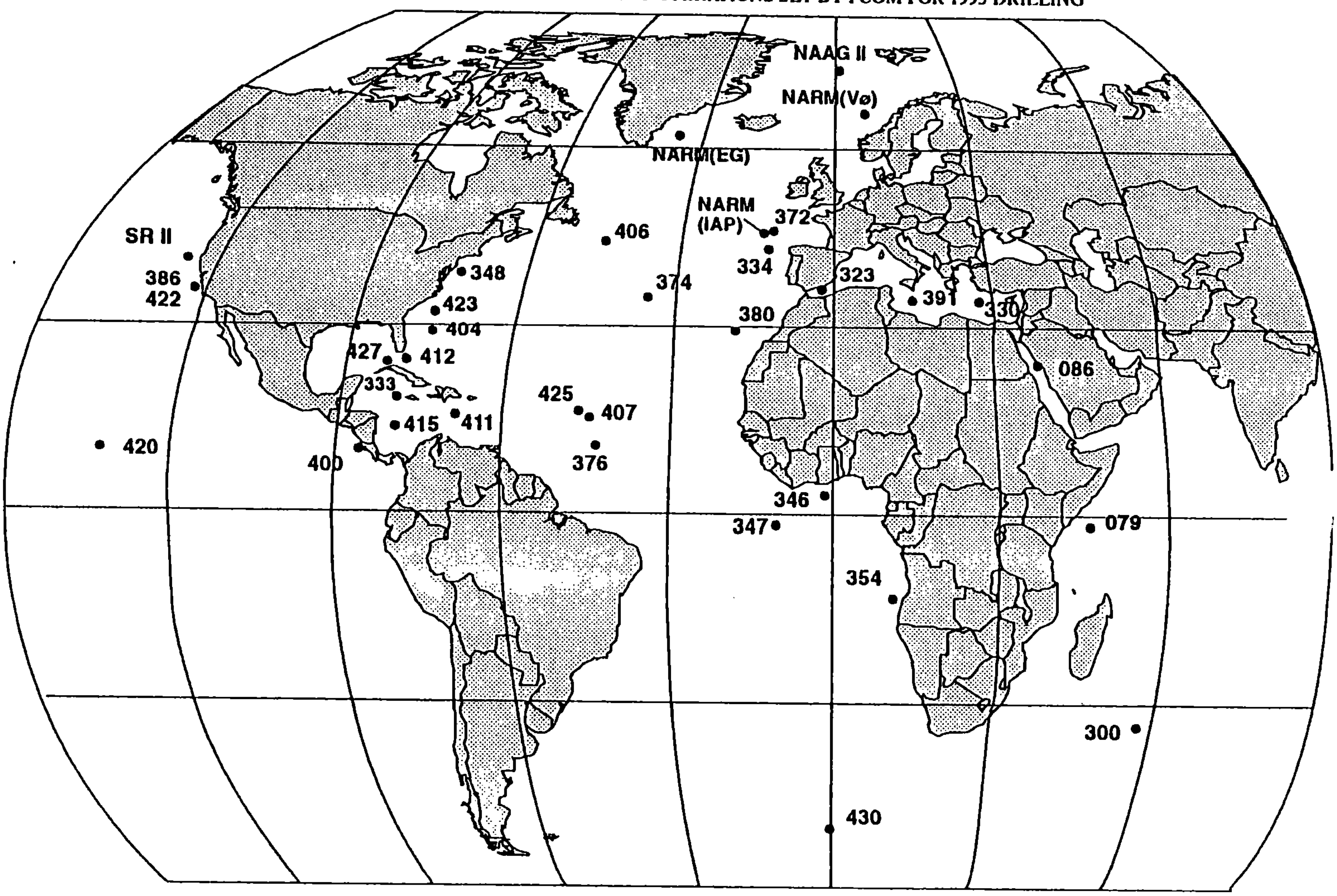
JOIDES Meeting Schedule

Date	Place	Panel
August 10 - 12, 1993	Brisbane, Australia	PCOM
Sept. 18 - 21, 1993	Corner Brook, Newfoundland	TECP / SGPP *
Sept. 23 - 26, 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
Jan. 31 - Feb. 2, 1994	Kyoto, Japan	EXCOM
* March 29 - 31, 1994	Amherst, Massachusetts	OHP
April 18 - 21, 1994	Cardiff, Wales	PCOM
June 27 - 30, 1994	Washington, D.C.	EXCOM

* Meeting not yet formally requested and approved

Top Ranked Proposals 1993

FALLING WITHIN AREA OF OPERATIONS SET BY PCOM FOR 1995 DRILLING



JOIDES THEMATIC PANEL GLOBAL RANKINGS

	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.

PLANNING COMMITTEE MEETING SCHEDULE

August 7 - 9 .... Field Trip to Lady Elliot Island

August 10 .... 9:00 am

A. Welcome and Introduction (Arculus and Lewis)
   1. Introduction of PCOM members, liaisons and guests
   2. Logistics of the meeting (Arculus)
   3. Approval of the agenda (Lewis)
   4. Approval of the minutes of the April 26 -28, 1993 PCOM meeting at LDEO, Palisades, New York
   5. Review of Action Items from the December PCOM Meeting (Lewis)

B. Reports of Liaisons (20 minutes each)
   1. NSF (Malfait)
   2. JOI (Pyle)
   3. ODP-TAMU (Francis)
   4. ODP-LDEO (Goldberg)
   5. JOIDES Office (Lewis, Collins, Schmitt)

Coffee break .... *10:30 - 10:50*

C. JOIDES Panel Reports (20 minutes each)
   1. EXCOM (Lewis)
   2. BCOM (Lewis)
   3. SSP (Dick)
   4. JHP (Sager)
   5. DMP (Natland)

Lunch break .... *12:30 - 1:30*

D. Leg Report (1 hour)
   1. Leg 149 (Whitmarsh)

E. Science Group Liaison Reports (20 minutes each)
   1. FDSN/OSN (Suyehiro)
   2. Margins (Mutter)

Coffee break .... *3:10 - 3:30*

   3. RIDGE (Fox)
   4. MESH (Mix)
   5. InterRIDGE (written submission)
   6. IGBP/GSGP (written submission)

F. Panel Membership Actions (Executive Session)
   1. JOIDES Panel Membership
   2. PCOM Membership and Liaisons

End of session 4:30

August 11 .... 9:00 am

G. FY95 Prospectus
   1. 1993 Global Rankings (Thematic Panel Liaisons) — *break from 10:30 - 10:50*
   2. FY95 Prospectus (Lewis and Collins)
   3. PCOM Watchdog Assignment

Lunch break .... *12:30 - 1:30*

H. Budget Planning
   1. FY94 Program Plan Budget (Lewis and Pyle) — *break from 3:10 - 3:30*
   2. FY95 and Beyond—A Focused Planning Strategy (Lewis)

End of session 4:30

August 12 .... **9:00 am**

I. Long-Range Planning (Lewis)

1. White Papers — *break from 10:30 - 10:50*
2. Platforms

Lunch break .... *12:30 - 1:30*

J. ASRC Report (Lewis)

1. Motions for EXCOM — *break from 3:10 - 3:30*
2. PCOM Subcommittee Recommendations

End of session 4:30

August 13 .... **9:00 am**

K. Old Business

1. Shallow Water Drilling Working Group Report (Francis)
2. IHP Data Management Recommendations (Lewis)

Coffee break .... *10:30 - 10:50*

3. Core Repository (Lewis)
4. In Situ Pore Fluid Sampling
5. Russian Membership

Lunch break .... *12:30 - 1:30*

L. New Business

1. Ethics Question (Leg 146)
2. Logging
3. Future PCOM Meetings

M. Other Business

1.
2.
3.

N. Review of Motions and Action Items

Adjournment 3:30

PLANNING COMMITTEE AGENDA NOTES

August 10	9:00 am

A. Welcome and Introduction (Arculus and Lewis)

1. **Introduction of PCOM members, liaisons and guests**
2. **Logistics of the meeting (Arculus)**
3. **Approval of the agenda (Lewis)**

Motion

4. **Approval of the minutes of the April 26 -28, 1993 PCOM meeting at LDEO, Palisades, New York**
   - The Revised Draft Minutes, Agenda Book p. 26, contain all revisions received in the JOIDES Office as of July 15, 1993.
5. **Review of Action Items from the December PCOM Meeting (Lewis)**
   - Items from the last PCOM meeting that will be addressed at this meeting:

a) PCOM Consensus 1993A-2: Long Range Planning (beyond 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.

☞ These subcommittees will report under agenda item I.

To accomplish task 1, PCOM assigns a subcommittee, consisting of the PCOM Chair (Lewis) and next PCOM Chair (Kidd) to work with the thematic panel liaisons to direct the writing of White Papers by the thematic panels that can form the basis for task 1.

To accomplish task 2, PCOM assigns a subcommittee consisting of PCOM Chair (Lewis) and next PCOM Chair (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 these papers at the August 1993 PCOM meeting.

b) PCOM Motion 1993A-3: Leg 157

☞ An update will be given under agenda item H - 1 - b - 2.

PCOM, in light of recent Hess Deep experience, recognizes the importance of photo coverage in the vicinity of any site scheduled for deployment of a HRGB. PCOM, in order to prepare properly for Leg 157, endorses a plan of action to attempt to acquire this coverage during an upcoming survey of the Vema FZ transverse ridge. **The JOIDES Office will help the PI of the program with that effort.**

c) PCOM Consensus 1993A-5: Advisory Structure Review Committee Report

☞ PCOM's action on the final ASRC Report will be discussed in detail under agenda item J.

PCOM has received the #3 draft of the ASRC report. PCOM finds within the report many beneficial recommendations, but also some recommendations that it wants to examine in greater detail.

PCOM requests after the report is formally received by EXCOM, that it be referred to PCOM for detailed comment.

PCOM set up a subcommittee consisting of Von Rad, Austin, Kidd, Taylor and Lewis to coordinate PCOM responses.

d) PCOM Motion 1993A-6: FY94 Budget Shortfall

☞ Status of the FY94 budget will be discussed under agenda items C - 2 and H - 1.

PCOM 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.

e) PCOM Motion 1993A-9: BCOM / DMP Request for Review of RFP Specification and Review Procedures

☞ This item was endorsed by EXCOM and will be updated under agenda item C - 1.

To ensure that the interests of the JOIDES advisory structure are fully represented in all contracts let by JOI Inc. or it subcontractors that involve important new directions, the PCOM Chair should be directly involved with JOI Inc. in the specification of RFPs and nomination of reviewers.

f) PCOM Consensus 1993A-12: LITHP White Paper Revision

☞ White Paper revision will be discussed under agenda item I - 1.

PCOM fully endorses the approach and schedule taken by LITHP in their White Paper. **The PCOM Chair will contact the LITHP Chair to ensure that the objectives of the White Paper are consistent with the PCOM discussion.**

g) PCOM Action 1993A-13: IHP Data Management Recommendation

☞ These recommendations will be presented under agenda item K - 2.

PCOM referred the concerns of IHP with regards to the interim capture and curation of data to the Computer RFP Evaluation Committee to review. **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.**

☞ ODP-TAMU will give an update on this issue under agenda item B - 3.

h) PCOM Motion 1993A-14: IHP Publications Recommendation - IR & SR Size

Considering the trend for increase in the size of both Initial Results and Scientific Results volumes, and a corresponding increase in the costs of publication. PCOM recommends 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 encourages publication of data on CD-ROM to reduce printed pages. Establishing an across-the-board page limit for either IR or SR is discouraged, to maintain flexibility.

☞ Leg 157 planning will be discussed under agenda item H - 1.

i) PCOM Action 1993A-16: TEDCOM DCS Leg 157 Planning Recommendation

PCOM will reconsider in August the issue raised by TEDCOM concerning DCS hardware placement prior to Leg 157.

☞ This will be discussed under agenda item E - 1.

j) PCOM Chair Action - Proposal Review Inquiry

PCOM Chair to consult with an FDSN representative (Dziewonski/Purdy) about the proposal for the emplacement of a borehole seismometer (proposal # 431).

☞ See page 176.

k) JOIDES Office Action - Science Program Publicity

JOIDES Office will submit the FY94 schedule and Four Year Plan for Publication in *EOS*.

☞ This item will be discussed under agenda item K - 5.

l) C. Mével Action - Russian Request for ODP Speakers and Information From Leg 147 & 148

Catherine Mével (Leg 147) will investigate the possibility that she and another scientist from Leg 148 can travel to Russia to give presentations on results of those legs.

B. Reports of Liaisons (20 minutes each)

1. NSF (Malfait)

2. JOI (Pyle)

3. ODP-TAMU (Francis)

4. ODP-LDEO (Goldberg)

a) Logging Programs on Legs 150 - 155

- DMP reviewed the logging plans presented by the Wireline Logging Service Operator for Legs 150-155. The DMP noted that the proposed plans were an extension of past activities that were successful. Thus, the DMP formulated the following recommendation:

The DMP recommends that PCOM approve the proposed logging activities for Legs 150-155 as put forth by the Wireline Logging Service Operator with the understanding that the Operator initiate discussions with the appropriate Co-Chiefs so that the logging program can be incorporated into the science plans.

5. JOIDES Office (Lewis, Collins, Schmitt)

☞ See the new proposal logsheets and abstracts on p. 385.

a) Proposal News

b) *JOIDES Journal* Special Issue - June 1994

c) Recent Publications - *GSA Today* and *EOS* *(see p. 176)*

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

- Minutes, reports, proposal guidelines, meetings schedules and directory 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. 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 available to anyone with FTP capabilities without the necessity for user-ids. For an index to what is available on moby2 see the June *JOIDES Journal*, p. 62. Let us know if you have any suggestions about additional items to be made available on moby2.

FTP Access via:	moby2.ocean.washington.edu
Login:	anonymous
Password:	your user-id

➪ *Coffee Break* .... *10:30 - 10:50 am*

C. JOIDES Panel Reports

1. EXCOM (Lewis)

- The June meeting of EXCOM was held June 23, 1993 at the Ocean Drilling Program facility on the campus of Texas A & M University, College Station, Texas. The following is a brief summary of the relevant items of business covered at the meeting.

a) EXCOM Approvals

1) Advisory Structure Review Committee Final Report

EXCOM passed a motion to accept the Report of the Advisory Structure Review Committee (ASRC) and thanked the committee members and its Chair, Hans Dürbaum, for a most thorough and focused report.

- Regarding the implementation of the ASRC, the following statements were adopted by consensus:

EXCOM requested that PCOM examine each of the 12 subjects identified in the report and, where desirable, to implement immediately the recommendations.

EXCOM recognized the need for discussion on some of the issues and, in those cases where PCOM had significant concern about specific ASRC recommendations,

EXCOM requested PCOM review and evaluate those recommendations and prepare specific alternative motions for EXCOM's consideration at the January meeting .

EXCOM requests the Chair of EXCOM to review these motions with the ASRC Chair and to present a summary at the next EXCOM meeting.

It was the wish of EXCOM to take final action on the recommendations of the ASRC and on PCOM's alternatives at its January meeting.

2) FY94 Program Plan

EXCOM endorsed the FY94 Program Plan with a motion, but noted that the DCS test scheduled for FY94 may need to be postponed to 1995 for budgetary reasons.

b) EXCOM Policy Updates

1) Procedures for Contract Development, Specification and Review

- At the request of the PCOM Chair to endorse the PCOM Motion 1993A 9, EXCOM passed the following motion:

All ODP contracts let by JOI Inc. and its subcontractors should fully reflect the advice of the JOIDES Advisory Structure, particularly those that involve important new ODP program directions. To ensure that the interests of the JOIDES Advisory Structure are fully represented, the PCOM Chair, and as appropriate the EXCOM Chair, should be directly involved with JOI Inc. in the development of contracts that are determined (by JOI Inc.) to require Advisory Structure input. In those cases where RFPs are issued, PCOM Chair (and as appropriate the EXCOM Chair) should advise JOI Inc. on the specification of the RFP, on the proposal review process and the nomination of proposal reviewers.

c) EXCOM Items of Business

1) Core Repository

☞ Core repository movement will be discussed under agenda item K - 3.

EXCOM passed a motion requesting JOI advise TAMU to:

1. Definitize procedures for moving cores, with advice from PCOM and the panels.
2. Visit and enter negotiations with Universität Bremen regarding technical and financial aspects of establishing the ODP Atlantic repository in Bremen.
3. If technical and fiscal aspects of an ODP repository at Bremen are satisfactory, to contract for such services with Universität Bremen and conclude plans for core movement.
4. If discussions with Bremen did not conclude satisfactorily, accept the offer of LDEO.

2) FY94 Budget Contingencies

☞ Budget contingencies will be discussed under agenda item H - 1.

Part 1
To accommodate a $ 4 M shortfall, EXCOM passed a motion recommending that JOI calculate the savings that would accrue from:

- DCS termination and related reduction in engineering staff and operations.
- Cessation of in-house publication.
- Cutting back logging to routine operations only.
- Other actions that JOI may identify, while attempting to keep disruption of the FY94 program to a minimum (in particular by not laying up the ship or withdrawing invitations to shipboard scientists).
- Administrative savings throughout the Program. JOI is to inform PCOM, at its August 1993 meeting, of its conclusions, and should take PCOM's response into account if implementation becomes necessary.

☞ DCS scheduling will be discussed under agenda item H - 1 - a - 2.

Part 2
Turning to the possibility of a $ 1 M shortfall, EXCOM endorsed the following resolution:

> PCOM should be encouraged at its August meeting to defer Leg 157 and associated DCS expenditure ($ 740 K) into FY95.

Part 3
EXCOM recommended that, if major redesign of the Program was called for, innovation and productivity should be preserved as much as possible. Elimination of units or functions that would have a pervasive negative effect on the Program should be avoided.

d) Long-Range Planning

☞ PCOM will discuss long-range planning and platform requirements under agenda item I.

1) PCOM's Long-Range Planning Efforts

EXCOM endorsed, with a motion, the PCOM consensus (PCOM 1993A-2) regarding long range planning and requested that PCOM present EXCOM with a status report on science planning and platform requirements at EXCOM's January 1994 meeting.

2) Japanese Proposal for the "New Era of Ocean Drilling"

☞ The proposal is included in the agenda book, p. 327.

In the second part of the long-range planning motion, EXCOM

A. recognized the importance of the "New Era of Ocean Drilling" concept for the future of scientific ocean drilling,

B. recognized the need for close exchange/cooperation,

C. proposed to hold a workshop jointly with STA/JAMSTEC immediately following the next EXCOM meeting to investigate future modes of scientific ocean drilling with emphasis on cooperation. It was suggested that, in addition to EXCOM, representatives from the JOIDES advisory structure, TAMU and LDEO be invited to attend this workshop.

2. BCOM (Lewis)

☞ The report from the June 21 BCOM meeting is included in the agenda book p. 85.

- BCOM met at ODP, Texas A & M University on June 21, 1993. The meeting was convened to address the budgeting consequence of any shortfall in membership subscriptions for FY94 onwards. At the time of the meeting French Participation could not be confirmed, and only $2M of the Can-Aus subscription appeared to be secure, though that was awaiting final confirmation . BCOM addressed two hypothetical scenarios: $4M and $1M shortfalls in FY94 below the Target Figure of $44.9M that had been assumed at the March 1993 meeting. See the BCOM Report in the Agenda Book, p, .

3. SSP (Dick)

4. IHP (Sager)

☞ The minutes from the May DMP meeting is included in the agenda book p. 87.

5. DMP (Natland)

Lunch Break .... *12:30 - 1:30 pm*

D. Leg Report

1. Leg 149 (Whitmarsh)

E. Science Group Liaison Reports (20 Minutes)

- The JOIDES Office was unable to get a written report from JGOFS in time for the Agenda Book mailing. If we do receive a report from JGOFS it will be distributed at the meeting.
- Gary Brass will give be giving a report from NAD in December at the Miami PCOM meeting to coincide with the Leg 151 NAAG report.

1. FDSN/OSN (Suyehiro)

2. Margins (Mutter)

Coffee Break .... *3:10 - 3:30 pm*

3. RIDGE (Fox)

4. MESH (Mix)

5. InterRIDGE (written submission, see p. 170 of the Agenda Book)

6. IGBP/GSGP (written submission see p. 171 of the Agenda Book)

F. Panel Membership Actions (Executive Session)

1. JOIDES Panel Membership

a) IHP

- Ian Gibson has submitted his resignation as Chair of IHP (p. 349). IHP will present nominations to PCOM for a new Panel Chair.

b) DMP

- DMP will present nominations for the replacement member for Joris Geiskes.

c) TECP

- Alistair Robertson has accepted the position of TECP Chair, he will take over as TECP Chair beginning in the spring of 1994. (*no action required*)

d) PANCH Chair

- PCOM needs to select a Chair for the PANCH meeting on November 29, 1993 from the following panel Chairpersons:

Ball, Mahlon	(PPSP)
Bloomer, Sherman	(LITHP)
Delaney, Peggy	(OHP)
Kastens, Kim	(SSP)
Lysne, Peter	(DMP)
McKenzie, Judith	(SGPP)
Moores, Eldridge	(TECP)
Moran, Kate	(SMP)
Sparks, Charles	(TEDCOM)
to be named	(IHP)

c) Other membership changes

1)

2)

2. PCOM Membership and Liaisons

a) Tom Shipley will replace Jamie Austin on PCOM effective January 1, 1994. This is the normal rotation of UTIG's member of PCOM.

b) Liaisons

- Please review the following PCOM liaison assignments for addition or correction.

	EXCOM	LITHP	OHP	SGPP	TECP	DMP	IHP	PPSP	SMP	SSP	TEDCOM
J. Austin											X
K. Becker						X					
W. Berger				X							
H. Dick										X	
J. Fox									X		
R. Kidd				X						X	
H.C. Larsen					X						
B. Lewis	X							X			
J. Malpas											
C. Mével		X									
A. Mix			X								
J. Mutter		X									
W. Sager							X				
K. Suyehiro						X					
B. Taylor					X						
U. von Rad				X							

Motion

- A motion will be required at this time for PCOM to adopt the approved membership changes.

❖ *End of Day 1* .... *4:30 pm*

August 11	9:00 am

G. FY95 Prospectus

1. 1993 Global Rankings

Coffee Break .... *10:30 - 10:50 am*

Motion

2. FY95 Prospectus (Lewis and Collins)

- As the schedule currently stands, with Leg 158 already scheduled in FY95, unscheduled ship-time in FY95 extends from December 10, 1994 (the conclusion of the drydock period in Lisbon) to September 30, 1995—approximately 5 legs. PCOM's Four-Year Plan Motion, passed at the last meeting, defines the likely operational areas of the drillship for FY95 in part c:

PCOM Motion 1993A-1: Four Year 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, confirmed as the current program plan (PCOM winter 91).

b) In FY94, 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, 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.

- Based upon global rankings conducted by thematic panels at their spring 1992 meetings (for rankings and a map of locations see p. 5), the JOIDES Office plans to put approximately 10—12 programs into the FY95 Prospectus for consideration and re-ranking by the JOIDES thematic panels in fall 1993.
- Final selection of prospectus programs will be made by PCOM at this meeting, following a final assessment of "drillability" to be made by SSP at their July 28 - 30 meeting at LDEO. The FY95 Prospectus will be mailed to PCOM, SSP, thematic panels, other panel Chairs, all subcontractors and relevant liaisons by late August.

3. PCOM Watchdogs

- Once the content of the FY95 Prospectus is determined, PCOM may wish to assign watchdogs for those highly-ranked programs under consideration for drilling in FY95, particularly those that do not yet have one.

a) Candidates for inclusion that have watchdogs, assigned last year, are:

323-Rev2	Alboran Basin Evolution	Larsen
346-Rev3	Eastern equatorial Atlantic transform	Fox
380 Rev3	VICAP/MAP (only MAP ready)	Arculus
NARM-DPG	Non-volcanic margins - II	von Rad

Lunch Break .... 12:30 - 1:20 pm

H. Budget Planning

1. FY94 Program Plan Budget

a) Contingency Planning (Pyle)

- Pyle will present PCOM with a report on budget cutting options in response to Part 1 of the EXCOM motion on FY94 Budget Contingencies:

> **EXCOM Motion**
> **Part 1**
> To accommodate a $ 4 M shortfall, EXCOM passed a motion recommending that JOI calculate the savings that would accrue from:
> - DCS termination and related reduction in engineering staff and operations.
> - Cessation of in-house publication.
> - Cutting back logging to routine operations only.
> - Other actions that JOI may identify, while attempting to keep disruption of the FY94 program to a minimum (in particular by not laying up the ship or withdrawing invitations to shipboard scientists).
> - Administrative savings throughout the Program. JOI is to inform PCOM, at its August 1993 meeting, of its conclusions, and should take PCOM's response into account if implementation becomes necessary.

2) DCS

- DCS scheduling was also addressed in the EXCOM motion on FY94 Budget Contingencies—Part 2:

> **EXCOM Motion Part 2**
> Turning to the possibility of a $ 1 M shortfall, EXCOM endorsed the following resolution:
> PCOM should be encouraged at its August meeting to defer Leg 157 and associated DCS expenditure ($ 740 K) into FY95.

Motion

- PCOM should also familiarize themselves with the budget issues raised below for Legs 153 and 158. Please be prepared to discuss the issue of moving the DCS leg into FY95 and to decide what, if any, action needs to be taken at this time.

b) Science Operations (Lewis)

1) Leg 153 - MARK

Motion

- Jeff Karson, Leg 153 Co-Chief, requested that the issue of the cost of hard-rock drilling be brought to PCOM's attention at this meeting. Please read the correspondence from Jeff Karson and Sherm Bloomer on p. 350 - 353 regarding the issues of concern for Leg 153. ODP-TAMU will be asked to give us an update us on the plans for this leg and then PCOM will discuss what action, if any, needs to be taken on this issue at this time.

2) Leg 157 - DCS testing

- Lewis will give an update on Kim Kastens' efforts to acquire photo coverage during her upcoming survey of the Vema FZ transverse ridge.
- Enrico Bonatti has submitted a letter to the JOIDES Office (p. 354) suggesting the Romanche FZ as an alternative site where the scientific and engineering objectives of Leg 157 could also be met.

Motion

- PCOM needs to reconsider the issue raised by TEDCOM, tabled from the April PCOM meeting, concerning DCS hardware placement prior to Leg 157.

3) Leg 158 - TAG; DMP Recommendation 93 - 2

- According to the DMP minutes, DMP noted that the DCS effort, presently Leg 157, may be dropped from the schedule thus moving the TAG program forward and causing a very short time frame for high-temperature tool development. The DMP further noted that none of the tools proposed by the WLSO for the TAG operations are operational, let alone having passed any third-party-tool requirements. Finally, the DMP noted that budgetary resources are scarce, yet TAG represents a very important forward step for the ODP. Thus the DMP made the following recommendation:

The DMP recommends to PCOM that the TAG Downhole Measurements Program be given the highest priority by the Wireline Logging Service Operator, that the resources necessary for the success of this effort be drawn from those presently available to the Operator, and that the Operator present a plan for downhole measurements at TAG to the DMP and the LITHP during their joint meeting next October. This plan should include input from the TAG proponents, as well as a statement as to how the Third-Party Tool Requirements will be satisfied.

Motion

PCOM should read the DMP minutes (p. 87) and be prepared to discuss endorsing this recommendation.

Coffee Break .... *3:10 - 3:30*

2. FY95 and Beyond—A Focused Planning Strategy (Lewis)

End of Day 2 .... *4:30 pm*

August 12	9:00 am

I. Long-Range Planning

1. White Papers (Lewis)

- The present White Papers, as well as the new ones (where applicable), are included in the Agenda Book, p. 177 - 287. Subcommittee correspondence on the White Paper revisions is also included on p. 288 - 326.

a) At the last EXCOM meeting PCOM was given the green light to proceed with our long range planning and asked to present a progress report at the January 1994 meeting of EXCOM.

As a reminder the purpose of this planning is:

1. to define a plan for 1993-1998 that fits within the budget constraints that we will possibly know by the end of this year. The present LRP is based on the assumption of 7 partners and this is not a likely scenario.
2. to define a plan for post-1998 that can be used as a proposal for renewal beyond 1998. This renewal activity will become serious in 1995-1996, in terms of negotiating MOUs with partners, and a science plan and platform options will be needed before then.

b) Since it is usually easier to start with an idea of what the output should look like let me (Lewis) propose that our desired output should be 2 items.

Item 1. A document with a table of contents as follows:

- Executive summary
- Introduction
- Thematic accomplishments of ODP drilling up to 1993
- Thematic foci for 1993-1998
- Technology objectives 1993-1998
- Science objectives post 1998
- Platform options post 1998

Appendices

- Thematic panel white papers

Item 2. Videos

- A video on drilling methods
- A video on core analysis methods, logging, and core-log integration
- 1 to 4 videos on thematic objectives

In my (Lewis') opinion, videos could be a very useful tool for selling the program internationally and, if done correctly, could be used in teaching. I know of no videos at present that are intellectually of a standard useful for teaching.

c) Thematic panel liaisons presentations

PCOM liaisons to each of the thematic panels will make a ≈ 1/2 hour presentation. The presentation should cover:

- the content of the White Papers as they currently exist,
- how they view their panel addressing the issue of "focusing" in the next several years,
- how they view their panel setting priorities for the post-1998 period,
- opinions and comments on the attached outline,
- an opinion as to whether the present thematic panels are appropriate.

1) OHP (White Papers, p. 177 - 195) .... A. Mix
2) LITHP (White Papers, original and revised draft, p. 196 - 251) .... C. Mével
3) SGPP (White Papers, p. 252 - 267) .... R. Kidd
4) TECP (White Papers, 268 - 287) .... B. Taylor

Motion

- After the presentations PCOM should discuss the overall report, the specific content of the report, timing and publication. It should then finalize instructions for the thematic panels and, if necessary, the service panels.

Coffee Break .... 10:30 - 10:50 am

2. Platforms

a) Japanese Proposal for the "New Era of Ocean Drilling"

- Copies of the Japanese proposal for the "New Era of Ocean Drilling" are included in the Agenda Book (p. 327). EXCOM actions relative to this are contained in the EXCOM minutes (p. 70).

b) PCOM's Platform Paper Based on Updated LRP

- PCOM established a subcommittee of Kidd and Lewis to start thinking about platform issues. The subcommittee will present a progress report to PCOM and recommendations for future actions.

Lunch Break .... 12:30 - 1:30 pm

J. ASRC Report

1. Motions for EXCOM

The final draft of the ASRC report is included on p. 153.

a) EXCOM passed a consensus regarding the ASRC report which reads:

"**EXCOM requests PCOM to examine each of the 12 subjects identified in the report and, where desirable, to implement immediately the recommendations.**

EXCOM recognizes the need for discussion on some of the issues and in those cases where PCOM has significant concern about an ASRC recommendation **EXCOM requests PCOM to review and evaluate the recommendation and bring for EXCOM consideration at its next meeting (Jan 94) specific alternative motions.**

EXCOM requests the Chair of EXCOM to review these motions with the ASRC Chair and to present a summary at the next EXCOM meeting.

It is the wish of EXCOM to take final action on the recommendation of the ASRC and PCOM's alternatives at its January meeting."

2. PCOM Subcommittee Recommendations

- At the April 1993 PCOM meeting a subcommittee of PCOM was established to coordinate and draft responses regarding the ASRC report. The subcommittee consists of, Lewis, Austin, Taylor, Kidd, von Rad.

a) The subcommittee recommends to PCOM that it should accept and implement proposals 1, 2, 3, 6, 9, and 11.

Motion

The following motion is suggested to accomplish this:

" PCOM endorses the proposals numbered 1, 2, 3, 6, 9 and 11 in the ASRC report and recommends that EXCOM adopt these proposals."

b) The remainder of the proposals are not acceptable and we need to construct motions for EXCOM to consider that will represent PCOM's viewpoint.

Motion

- Each of the unacceptable proposals will be addressed by a subcommittee member who will present the arguments for and against the proposal. Following discussion by PCOM, a motion to EXCOM that represents the PCOM position will be presented by the subcommittee member.

1) Proposal 4. Handling of proposals ....Taylor

2) Proposal 5. SSP and PPSP ....Kidd

Coffee Break .... *3:10 - 3:30*

3) Proposal 7. Selection of JOIDES office .... Lewis

4) Proposal 8. Operation of PCOM ....Von Rad

5) Proposal 10. TEDCOM .... Austin

6) Proposal 12. JOIDES office ....Lewis

End of Day 3 .... *4:30 pm*

August 13	9:00 am

K. Old Business

1. Shallow Water Drilling Working Group Report (Francis)

- In December, PCOM passed the following motion:

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

- At the April meeting Francis reported that a draft of the final report of the SWDWG would be produced by the end of June to be reviewed by PPSP at their October meeting and that the final report will be presented to PCOM in December. Francis, the ODP-TAMU liaison to the SWDWG, will provide PCOM with the draft report and give an update on the SWDWG's progress.

2. IHP Data Management Recommendations

- At the April meeting PCOM referred IHP's concerns regarding the interim capture and curation of data to the Computer RFP Evaluation Committee for review. Lewis will report on the RFP Evaluation Committee's specific recommendations on how to deal with this problem.

Coffee Break .... 10:30 - 10:50 am

3. Core Repository (Lewis)

a) Status Report

- At its January meeting, EXCOM passed the following motion:

> EXCOM requests JOI advise TAMU to:
>
> 1. Definitize procedures for moving cores, with advice from PCOM and the panels.
> 2. Visit and enter negotiations with Universität Bremen regarding technical and financial aspects of establishing the ODP Atlantic repository in Bremen.
> 3. If technical and fiscal aspects of an ODP repository at Bremen are satisfactory, to contract for such services with Universität Bremen and conclude plans for core movement.
> 4. If discussions with Bremen did not conclude satisfactorily, accept the offer of LDEO.

- Francis will give a brief update on the status of ODP-TAMU's visits and negotiations with Bremen.

b) Procedures for Moving Cores

- Part 1 of the EXCOM motion asks for PCOM and the panels to advise ODP-TAMU on "definitizing" the procedures for moving cores in anticipation of moving the cores to Bremen. Lewis has been in communication with Russ Merrill at TAMU regarding their plans and procedures for moving cores.
- The JOIDES Office has not yet received TAMU's complete plan, when the plan is received it will be sent via e-mail to PCOM and panel Chairs for review and comments—possibly before the PCOM meeting. Lewis will give a report on the status of the definitization of procedures.

4. In Situ Pore Fluid Sampling

a) DMP Recommendation 93-1 for a Development Group

- In response to the following motion, passed at the April PCOM meeting:

> 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.

DMP formulated the following recommendation (Recommendation 93-3):

The DMP recommends to PCOM that;
(1) a group of self-supported experts pertinent to the pore-fluid-sampling RFP be drawn from the ODP community,
(2) that Joris Gieskes be responsible for the institution and coordination of this group, and
(3) that this group provide documentation as to the feasibility and costs associated with the development and deployment of a fluid-sampling system. The DMP further recommends that PCOM help promulgate the thrust throughout the ODP.

Motion

- PCOM should read the DMP minutes and be prepared to discuss endorsing this recommendation.

5. Russian Membership

a) NSF has informed JOI that *Proceedings* of ODP will no longer be sent to Russia after publication of results from the last leg Russian scientists sailed on (see letter on p. 358). In addition, all references to Russia (inactive partner) cease October 1, 1993.

b) Mével was unable to find funds to travel to Russia to give presentations on results of Legs 147 and 148. Any PCOM member with funds or interest in continuing this effort should contact the JOIDES Office (p. 359).

Lunch Break .... 12:30 - 1:30 pm

L. New Business

1. Ethics Question (Leg 146)

Motion

- Miriam Kastner would like to bring a new ethical problem to PCOM's attention. Please read Kastner's letter, Agenda Book p. 361, and be prepared to discuss what action, if any, should be taken by PCOM on this issue.

2. Logging

Motion

a) Geophysical Properties Probe (Geoprops)

- Bobb Carson and Dan Karig have asked that PCOM and DMP consider allocating time aboard the JOIDES Resolution for continued testing of the Geoprops Probe. Please read the Carson/Karig letter (p. 364), the 1992 bench test report and the sea trial & development summary report from Leg 146. For a brief description of what the Geoprops tool does see p. 374. PCOM should be prepared to discuss the future of this tool in ODP and to decide what action, if any, should be taken by PCOM at this time.

3. Future PCOM Meetings

a) Addition of International ODP Reports

- Brian Taylor has suggested that PCOM consider whether or not either the spring or fall PCOM meetings should include a report from the international partners and USSAC on the ODP activities/plans/problems of each member country. Should PCOM include this as a topic in future meetings?

b) Dates

- December ....Miami ....November 30 - December 3, 1993
- April ....Cardiff .... April 18 - 21, 1994
- August ....Iceland ....(dates pending)
- December..........TAMU ....(dates pending)

M. Other Business

1.

2.

3.

N. Review of Motions and Action Items

- PCOM will review the motions passed during the meeting and the tasks assigned to various members/liaisons for action.
- PCOM members who compose motions are asked to give a legible copy of the motion to Karen Schmitt or Bill Collins as soon as possible after the motion has been passed to facilitate production of the motion summary report. Thanks!

❖ *Adjournment*...*4:30 pm*

JOIDES PANEL REQUESTS AND RECOMMENDATIONS TO PCOM

DMP

1. Logging activities for Legs 150-155

The DMP reviewed the logging plans presented by the Wireline Logging Service Operator for Legs 150-155. The DMP noted that the proposed plans were an extension of past activities that were successful. Thus, the DMP formulated the following recommendation:

RECOMMENDATION 93-1.

The DMP recommends that PCOM approve the proposed logging activities for Legs 150-155 as put forth by the Wireline Logging Service Operator with the understanding that the Operator initiate discussions with the appropriate Co-Chiefs so that the logging program can be incorporated into the science plans. (Minutes, Items 5.e. and Appendix)

The DMP is very cognizant of the strong support for the pore-fluid-sampling initiative coming from SGPP, LITHP, and TECP. Furthermore, the DMP recognizes the reality of the budgetary situation that caused PCOM to withhold monetary support for the initiative, but the DMP is concerned that momentum will be lost unless forward steps are made in the very near future. Thus, the DMP formulated the following recommendation:

2. TAG - Leg 158

In view of the potential benefit of using measurement-while-drilling technology at Barbados, a team drawn from the ranks of the Wireline Logging Service Operator, the Science Operator, the Barbados Co-Chiefs, and interested scientific personnel was formed to generate an appropriate position statement for consideration by the DMP. Since contractual interactions with Schlumberger play an essential role in this activity, the Wireline Operator will take the lead in generating the statement which will be presented to the DMP at its next meeting. (Minutes, Items 7-10.)

The DMP notes that the DCS effort, presently Leg 157, may be dropped from the schedule thus moving the TAG program forward and causing a very short time frame for high-temperature tool development. The DMP further notes that none of the tools proposed by the Wireline Logging Service Operator for the TAG operations are operational, let alone having passed any third-party-tool requirements. Finally, the DMP notes that budgetary resources are scarce, yet TAG represents a very important forward step for the ODP. **Thus the DMP makes the following recommendation:**

RECOMMENDATION 93-2.

The DMP recommends to PCOM that the TAG Downhole Measurements Program be given the highest priority by the Wireline Logging Service Operator, that the resources necessary for the success of this effort be drawn from those presently available to the Operator, and that the Operator present a plan for downhole measurements at TAG to the DMP and the LITHP during their joint meeting next October. This plan should include input from the TAG proponents, as well as a statement as to how the Third-Party Tool Requirements will be satisfied. (Minutes, Items 11.a.-11.c)

3. Pore fluid sampling

RECOMMENDATION 93-3

The DMP recommends to PCOM that;

(1) a group of self-supported experts pertinent to the pore-fluid-sampling RFP be drawn from the ODP community,

(2) that Joris Gieskes be responsible for the institution and coordination of this group, and

(3) that this group provide documentation as to the feasibility and costs associated with the development and deployment of a fluid-sampling system. The DMP further recommends that PCOM help promulgate the thrust throughout the ODP.

Revised Draft Minutes

JOIDES Planning Committee Spring Meeting

April 26 - 28, 1993 — Palisades, New York

The Revised Draft Minutes contain all additions and corrections to the Draft Minutes received at the JOIDES Office as of July 15, 1993.

Revisions are shown in italics.

LIST OF PARTICIPANTS

Planning Committee - PCOM

R. Arculus	University of New England (Canada-Australia Consortium)
J. Austin	University of Texas at Austin, Institute for Geophysics
W. Berger	University of California, San Diego, Scripps Institution of Oceanography
H. Dick	Woods Hole Oceanographic Institution
J. Fox	University of Rhode Island, Graduate School of Oceanography
R. Kidd	Dept. of Geology, University of Wales, Cardiff, United Kingdom
H. C. Larsen	Geological Survey of Greenland, Copenhagen (ESF Consortium)
B. Lewis	University of Washington, College of Ocean and Fishery Sciences
C. Mével	Laboratoire de Géologie du Quaternaire, Marseilles (France)
A. Mix	Oregon State University, College of Oceanography
G. Moore	University of Hawaii, School of Ocean and Earth Science and Technology
J. Mutter	Columbia University, Lamont-Doherty Geological Observatory
J. Natland	University of Miami, Rosenstiel School of Marine and Atmospheric Science
W. Sager	Texas A&M University, College of Geosciences
K. Suyehiro	Ocean Research Institute (Japan)
U. von Rad	Bundesanstalt für Geowissenschaften und Rohstoffe (Germany)

Liaisons

T. Francis	Science Operator (ODP-TAMU)
D. Goldberg	Wireline Logging Services (ODP-LDGO)
B. Malfait	National Science Foundation
T. Pyle	Joint Oceanographic Institutions, Inc.

JOIDES Office

W. Collins	Executive Assistant and non-US Liaison
K. Schmitt	Science Coordinator

Guests

J. Alt	Co-Chief, Leg 148, University of Michigan
J. Malpas	Memorial University (Canada - Australia Consortium)

EXECUTIVE SUMMARY

JOIDES PLANNING COMMITTEE SPRING MEETING

Lamont-Doherty Earth Observatory, Palisades, New York
April 26 - 28, 1993

LONG RANGE PLANNING

PCOM Motion 1993A-1: Four Year 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, confirmed as the current program plan (PCOM winter 91).

b) In FY94, 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, 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.

PCOM Consensus 1993A-2: Long Range Planning (beyond 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 assigns a subcommittee, consisting of the PCOM Chair (Lewis) and next PCOM Chair (Kidd) to work with the thematic panel liaisons to direct the writing of White Papers by the thematic panels that can form the basis for task 1.

To accomplish task 2, PCOM assigns a subcommittee consisting of PCOM Chair (Lewis) and next PCOM Chair (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 these papers at the August 1993 PCOM meeting.

FY94 Science Program Plan Actions

PCOM Motion 1993A-3: Leg 157

PCOM, in light of recent Hess Deep experience, recognizes the importance of photo coverage in the vicinity of any site scheduled for deployment of a HRGB. PCOM, in order to prepare properly for Leg 157, endorses a plan of action to attempt to acquire this coverage during an upcoming survey of the Vema FZ transverse ridge. The JOIDES Office will help the PI of the program with that effort.

PCOM Consensus 1993A-4: Leg 158

PCOM consensus was not to use the TAG leg to CORK hole 395A.

Advisory Structure Review Committee Report

PCOM Consensus1993A-5: Advisory Structure Review Committee Report

PCOM has received the #3 draft of the ASRC report. PCOM finds within the report many beneficial recommendations, but also some recommendations that it wants to examine in greater detail.

PCOM requests after the report is formally received by EXCOM, that it be referred to PCOM for detailed comment.

PCOM set up a subcommittee consisting of Von Rad, Austin, Kidd, Taylor and Lewis to coordinate PCOM responses.

Actions Taken in Regards to the FY94 Budget and Pending RFPs and RFQs

PCOM Motion 1993A-6: FY94 Budget Shortfall

PCOM 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.

PCOM Motion 1993A-7: Deep Drilling RFQ

PCOM recognizes 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.

PCOM Motion 1993A-8: *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.

PCOM Actions Taken on JOIDES Advisory Panel Recommendations

PCOM Motion 1993A-9: BCOM / DMP Request for Review of RFP Specification and Review Procedures

To ensure that the interests of the JOIDES advisory structure are fully represented in all contracts let by JOI Inc. or it subcontractors that involve important new directions, the PCOM Chair should be directly involved with JOI Inc. in the specification of RFPs and nomination of reviewers.

PCOM Action 1993A-10: TECP Core Orientation Recommendation

PCOM referred the TECP core orientation recommendation to both DMP and SMP for their opinions on what to do and how to implement this recommendation. DMP/SMP recommendations in regards to core orientation are to be presented to PCOM at the December annual meeting..

JOIDES Office Action: SGPP / LITHP Proposal Updating Recommendation

The JOIDES Office will make an effort to improve the process of updating proposals for non-revised proposals nearing the three year age limit by working with proponents of these proposals to meet the JOIDES thematic panels recommendations.

PCOM Motion 1993A-11: SGPP PCS Recommendation

PCOM recognized the critical importance of the Pressure Core Sampler (PCS) for studies of in situ sediment conditions, including but not limited to capture of clathrates. However, PCOM remains concerned about the sporadic success of the instrument to date, and the complete lack of information concerning progress on design and construction of a lab chamber for transfer of pressurized core into an environment more amenable to analysis. PCOM requests SGPP to investigate the latter, for a report back to PCOM at its 1993 annual meeting.

A. Mix Action - OHP Recommendation - Carbonate Autosampler

Alan Mix will investigate the OHP recommendation on the carbonate autosampler, he will talk to Peggy Delaney and report back on this issue to PCOM at the August meeting.

PCOM Consensus 1993A-12: LITHP White Paper Revision

PCOM fully endorses the approach and schedule taken by LITHP in their White Paper. The PCOM Chair will contact the LITHP Chair to ensure that the objectives of the White Paper are consistent with the PCOM discussion.

PCOM Action 1993A-13: IHP Data Management Recommendation

PCOM referred the concerns of IHP with regards to the interim capture and curation of data to the Computer RFP Evaluation Committee to review. 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.

PCOM Motion 1993A-14: IHP Publications Recommendation - *IR* & *SR* Size

Considering the trend for increase in the size of both *Initial Results* and *Scientific Results* volumes, and a corresponding increase in the costs of publication. PCOM recommends 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 encourages publication of data on CD-ROM to reduce printed pages. Establishing an across-the-board page limit for either *IR* or *SR* is discouraged, to maintain flexibility.

PCOM Consensus 1993A-15: IHP Publications Recommendations - *SR* Submission Deadline

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.

PCOM Action 1993A-16: TEDCOM DCS Leg 157 Planning Recommendation

PCOM will reconsider in August the issue raised by TEDCOM concerning DCS hardware placement prior to Leg 157.

JOIDES COMMITTEE/PANEL MEMBERSHIP CHANGES

PCOM Motion 1993A-17: Personnel Changes

PCOM endorsed all personnel changes in panel membership, panel chairs and PCOM liaisons presented at the April 1993 PCOM meeting.

SGPP
- R. Sarg to replace N. Christie-Blick

TECP
- J. Stock to replace T. Atwater
- A. Robertson to replace E. Moores as Chair.

LITHP
- A. Sheehan to replace T. Brocher
- A. Fisher to replace D. Moos
- K. Gillis to replace S. Humphris

SMP
- J. Gieskes to replace K. Moran as Chair
- J. Parizo to replace J. King
- J. Whelan to replace M. Mottl

SSP
- D. Toomey to replace G. Moore

PCOM Consensus 1993A-18: ODP-LDEO Liaison to the Computer RFP Evaluation Committee

PCOM endorsed, by consensus, the designation of Dave Goldberg as a liaison to the Computer RFP Evaluation Committee to foster interaction (except that he will be excluded from situations involving conflict of interest.).

PCOM Consensus 1993A-19: Canadian Co-Chief

PCOM endorsed, by consensus, the nomination of Dave Piper (Canada) as Co-Chief Scientist for Leg 155 (Amazon Fan).

PCOM Consensus 1993A-20: Susan Humphris Retiring from LITHP Chair

On behalf of the JOIDES advisory structure, PCOM expresses its considerable appreciation for the excellent job that Susan Humphris performed as chair of the Lithosphere Panel and wishes her well in her position at the RIDGE office and co-chief designate of Leg 158.

PCOM Consensus 1993A-21: John Malpas Retiring from PCOM

On behalf of the JOIDES advisory structure and the entire ODP community, PCOM expresses its deep appreciation to John Malpas for the time and energy he has put into PCOM, the Long Range Plan, and the numerous committee and panels he has attended over the years. PCOM recognizes that his 10 year commitment to the program has contributed immeasurably to its success.

OTHER MISCELLANEOUS ACTION ITEMS

PCOM Chair Action - Proposal Review Inquiry

PCOM Chair to consult with an FDSN representative (Dziewonski/Purdy) about the proposal for the emplacement of a borehole seismometer (proposal # 431).

JOIDES Office Action - Science Program Publicity

JOIDES Office will submit the FY94 schedule and Four Year Plan for Publication in *EOS*.

JOIDES Office Action - August 1994 Meeting

The JOIDES Office will poll PCOM for interest in having the August 1994 meeting in Iceland, possibly to include a field trip to Greenland.

PCOM Chair Action - PCOM Liaison Duties

PCOM Chair to notify Brian Taylor he should plan to attend the fall TECP meeting as PCOM liaison - Hans Christian Larsen will be unable to attend.

C. Mével Action - Russian Request for ODP Speakers and Information From Leg 147 & 148

Catherine Mével (Leg 147) will investigate the possibility that she and another scientist from Leg 148 can travel to Russia to give presentations on results of those legs.

DRAFT MINUTES

JOIDES PLANNING COMMITTEE MEETING
PALISADES, NEW YORK
APRIL 26 - 28, 1993

Monday, April 26, 1993 .... 9:00 AM

Item 987. Initial Business

1. Introduction of PCOM members, liaisons and guests

The meeting was called to order by Lewis and introductions were made. Lewis thanked Roy Schlische from Rutgers University for leading a field trip to the Newark Basin on Sunday, everyone who attended agreed that the trip was a great success.

2. Approval of the Agenda for the April PCOM Meeting

Lewis reviewed the agenda for the meeting and outlined the major items to be addressed at the meeting. Lewis intended to have a review and vote on all motions on Wednesday afternoon. PCOM agreed that voting on motions should be moved up to Wednesday morning in recognition of the fact that many PCOM members would be leaving early on Wednesday.

PCOM approved the revised agenda for the April meeting.

Fox proposed, Natland seconded; vote: 16 yes.

3. Approval of Minutes from the December PCOM Meeting

1. Kidd requested a change on p. 44: change "the" to "sufficient ".
2. Sager requested a change on p.49: change the sense of an ambiguous sentence to specify that "it" the RFP and not the working group.
3. Francis requested a change on p. 56: delete the sentence "It was the first time a hole............"
4. Berger requested a change on p. 39: delete the second sentence of the SGPP report.

PCOM approved the revised minutes of the December 2 - 4, 1993 meeting in Bermuda.

Natland proposed, von Rad seconded; vote: 16 yes.

Item 988. ODP Liaison Reports

1. NSF

Budget Issues

Malfait began his report by reviewing the NSF budget situation (Appendix 1.0). He was sorry to report Clinton's economic stimulus package, which included $ 241 M for NSF, would have brought NSF's budget to the requested FY94 level. Unfortunately, the Clinton package failed to pass through Congress; the final FY94 budget was still in Congress.

Status of Renewal Activities - MOUs

Malfait reported that MOU renewal activities were moving along (Appendix 1.1); the UK had signed, Germany was in the process of signing, Japan should be prepared to sign in May, and the ESF signing date would be known soon, Can/Aus status was unknown and France's signing date had not yet been set. Mével clarified that IFREMER had been waiting the French elections to be completed—to see if their budget would be there; the budget was now in place and France would sign in early June.

Contracts

Malfait reported that JOI and NSF were negotiating a new contract. NSF had completed "administrative" review of the 1994 Program Plan, the plan was submitted with a $ 44.9 M budget—this was a six partner scenario. Malfait stressed that this budget was unlikely to stand without the sixth (Can/Aus) partner. In his opinion, the budget uncertainty would probably not be resolved until June.

Other Items

Malfait concluded his report by summarizing other items of NSF business that related to ODP (Appendix 1.2). These included: (1) the USSAC program being reviewed this summer, (2) 1994 field programs, (3) drilling of holes onshore New Jersey as part of the Leg 150 transect program, (4) Beth Ambos would be departing NSF in July—NSF was looking for a replacement, (5) NSF would be moving to northern Virginia in the fall of 1993.

Canadian Funding Situation

At this time Malpas asked to report on Canada's funding situation. He briefly reviewed the history of events that had occurred since November leading up to the present Canadian situation. Malpas explained the ODP funding structure in Canada and detailed efforts in the Canadian ODP community to restore funding after the decision to cut ODP funding in Canada was announced in December.

Malpas had recently been elected Chair of the Canadian ODP Council. The Council had been working hard to get the money to continue Canadian membership from Canadian government sources. There had been efforts made to solicit funds from an internal Canadian partner—i.e. from provincial governments such as Nova Scotia, New Brunswick or Newfoundland. Petroleum companies had also been approached. Another alternative for funding was finding a third partner for Can/Aus. This option had been postponed until all Canadian sources of funding were exhausted; this, Malpas explained, was in order to be able to negotiate fairly with potential partners.

Malpas concluded by saying that it was unlikely that Canada would have anything definite to report about money by June. The Canadian Council would be meeting after the PCOM meeting and would discuss the third-partner option. Malpas was hopeful that there would be good news by the August PCOM.

2. JOI Inc.

Updates

Pyle reviewed the ODP-related activities at JOI since the last PCOM meeting (Appendix 2.0). Two RFPs had been completed, one for the JOIDES Office to the UK in FY95 and one for the logging subcontract to LDEO. Pyle reported that the Advisory Structure Review Committee (ASRC) had met with TEDCOM in March and issued a revised draft report after that meeting. JOI had completed the draft of the FY94 Program Plan according to BCOM's recommendations; NSF's comments on the document were under review. Pyle noted that the Program Evaluation Committee (PEC) was postponed from FY94 to FY95. Contract renewal negotiations continue between JOI and NSF. There would also be negotiations between JOI and its subcontractors, the meeting dates for those negotiations were to be announced. Pyle announced that JOI had received a grant, through NERC, from the Royal Society to support Russian scientists. The JOI/NERC grant was one-time money in Pounds and it was intended to support sea-going Russian scientists.

Budget

Pyle showed last year's budget and the projected FY94 budget for ODP (Appendix 2.1). He pointed out the shortfalls from the LRP budget projections. Pyle then reviewed the FY94 SOEs that were funded by BCOM (Appendix 2.2), the list included: hard rock guidebases, DCS, DCS shipping, computer/database upgrade and a real-time shipboard navigation system. There was also the possibility, depending on the outcome of the Can/Aus situation, that another $ 3 M would need to be cut from the budget. If these cuts needed to be made there would be another meeting of BCOM in June.

Keck Report

Pyle read excerpts (Appendix 2.3) concerning ODP from the National Academy of Science's Solid Earth Sciences and Society Report ("Keck Report"). These comments were very positive about ODP's contribution to earth sciences. Copies of the report were available from the National Academy Press.

Oceanus

JOI was organizing publication of a special issue of *Oceanus* devoted to the 25th anniversary of ODP, publication was planned for January 1994. Pyle outlined the content of the issue (Appendix 2.4) and requested suggestions and volunteers to help with this undertaking. Austin asked about the cost of this activity? Pyle replied that JOI was negotiating costs and he went on to explain that he saw this as a minimum-cost remnant of JOI's PR program—something that EXCOM had wanted JOI to do but had been cut by BCOM. PCOM discussed the cost, circulation and content of material presented in *Oceanus*.

3. Science Operator

Leg 147

Francis gave an overview of Leg 147 drilling at Hess Deep and explained the drilling operations that occurred on the leg, including problems with lost and damaged hardware (Appendices 3.0 - 3.2). Francis reported that the offset drilling strategy had been expensive due to lost hardware (Appendix 3.3). However, 122 m of core was recovered out of 545 m penetrated—a very good ratio for this type of leg—so the expense may pay off scientifically. Mével countered that she did not think it was the offset drilling strategy that lead to equipment loss but rather the environment of drilling.

PCOM then discussed the causes of equipment loss on this leg and implications for future legs and budgets. There was concern about site survey deficiencies and the discussion examined if existing guidelines were sufficient to prevent similar problems from happening in the future. Kidd assured PCOM that SSP would have a full post-cruise review of site survey problems on the leg at its next meeting.

Leg 148

Francis reported on the drilling progress on Hole 504B during Leg 148 (Appendices 3.4 - 3.5), the coring operations deepened the hole by 111 m before the drill string became stuck. After a day and a half of fishing, drilling was abandoned until additional jars arrived—they had to be emergency-shipped to the *JOIDES Resolution*. In the meantime, a new hole (896A) was started. After the jars arrived, the BHA was recovered and a .5 m fish was left in the hole with 15 m of rubble above it.

Austin wanted to know why the proper jars were not on board, TAMU had been directed to have an extensive inventory of fishing tools on board for this leg. Francis said that the fishing tool inventory on board had been a cost issue.

Leg 149

Francis reviewed the status of Leg 149 drilling, the cruise was still in progress (Appendix 3.6). He was sorry to report that there had been several problems at site IAP-4 with both drilling and logging; equipment had been lost and none of the holes at IAP-4 were logged. The worst news was that on April 24th, at IAP-2, 123 stands of pipe were lost in rough weather (est. value $500,000). Francis explained that 6180 m of pipe were still left on board but this was not quite long enough to achieve basement objectives at IAP-2. As a result, proposed site IAP-6 was selected as the alternate site where basement could be achieved with the remaining pipe and a new re-entry hole had been established at this site. The last proposed site for Leg 149 would be IAP 3-C, there should be enough pipe for completing this hole.

PCOM discussed what alternatives there would be for the leg if any more pipe was lost and what the impact of this problem was on the objectives of NARM. Of particular concern was the budgetary impact of recent equipment losses on future drilling programs.

Leg 150 & Leg 151

Francis discussed the New Jersey Leg 150 and NAAG Leg 151 proposed site locations (Appendix 3.7 - 3.9). The staffing for these legs was reviewed.

Ice Boat

Francis presented a listing of bidders who responded to the RFP for an ice support vessel on Leg 151 (Appendices 3.10 - 3.12). He announced that the *Fennica* had won the bid, the cost would be about $ 900 K depending on fuel costs which could be quite variable depending upon actual ice conditions.

Leg 152

Francis identified the Leg 152 proposed sites (Appendix 3.13) and reported that the Leg 152 Prospectus would be coming out soon. A scheduling change had been made to save transit days, the end of Leg 152 would be in St. John's, NFLD, instead of Lisbon (Appendix 3.14).

Staffing Leg 153 - Leg 155

Francis reviewed the status of staffing for Leg 153 - Leg 155 (Appendices 3.15 - 3.17), he noted there would be several new staff scientists joining the program in the next year.

Francis asked PCOM for direction on the purchase of equipment for Leg 153. TAMU would soon need to commit funds for necessary equipment but realized that there might be some changes to the science plan pending upcoming budget cuts. Francis wanted to make PCOM aware that if funds were committed to equipment at this point, any future budget cutting would probably have to be in other budgets. PCOM discussed the budget issue and concluded that TAMU should go ahead with planned equipment purchases.

Equipment Status Report

Francis reported on the status and priority of equipment for the ship (Appendix 3.18); the first priority was core-log integration.

Publications

Francis gave a summary of progress *ODP Proceedings* volume publications (Appendix 3.19). He noted that the costs of publications were rising steadily, in part because the volumes were getting larger.

Coffee Break...11:15 AM

4. Wireline Logging

Operations

Goldberg discussed the details of recent logging operations on Leg 147, 148 and 149 (Appendices 4.0 - 4.1). To help remedy some of the recent problems encountered in FMS logging operations, LDEO would create a more comprehensive logging manual to cover operation of this tool in more detail.

Developments

Goldberg reported on the status of downhole systems development for the following (Appendix 4.2): (1) High-T temperature tool (BGRM), (2) High-T cable (BGRM), (3) High-T resistivity tool (CSMA), (4) Directional shear wave sonic tool (LDEO), (5) Third-party tool guidelines (TAMU/LDEO).

Lewis asked how the technical report on third-party tool guidelines fits in with the brochure already published by TAMU? Goldberg explained that this report was to be the second phase of DMP's program for third-party tools; this report would be a more technical production than what was published previously.

Future Logging Operations

Goldberg presented the future logging operations for Leg 149 through Leg 152 (Appendix 4.3). Goldberg pointed out that LDEO planned to have a working BHTV on Leg 152. He explained that it was the digital BHTV that had not been working and that the tool had been diagnosed as having a hardware problem. Since the tool was leased, LDEO was actively working with the German manufacturer/subcontractor (DMT) to fix the problem with the tool. In the case that the digital instrument was not functional, the plan was that the analog BHTV would be used on Leg 152 as a back-up. However, Goldberg acknowledged that the analog BHTV was not on board the ship at that moment and would need to be shipped out in order for this to happen; use of the analog tool would also require that someone receive an extensive amount of training in order to be able to use the tool successfully.

PCOM discussed LITHP's statement of frustration regarding the recent failures of the BHTV. Austin brought up the point that BCOM had specified, at the recommendation of LDEO, that the BHTV subcontract be terminated in FY94 due to the high cost and unreliability of the tool. In addition, Austin reported that BCOM had decided that the BHTV should only be used in specialty situations and only if it was being supported externally. PCOM discussed with Goldberg the recent performance history of this tool and the specialty status that BCOM had intended for the future operation of this tool.

Lewis questioned why LDEO was planning to continue to work with the BHTV subcontractor when BCOM had mandated the subcontract be terminated? Goldberg clarified that BCOM's mandate was for FY94 and the subcontract was still valid through FY93—through Leg 152. He went on to say that there were two separate subcontracts for the two different televiewers and since there was a strong need expressed by LITHP for the general use of a BHTV and a specific need on Legs 152 and 153 the best approach was to get the digital BHTV working in the time still left in the contract. Goldberg wanted to make sure that the subcontractor fixed the unit so that it was available for operations in the remainder of FY93.

PCOM debated the scientific value of the digital BHTV tool and the possibility of reconsidering funding for it in the future if the reliability problems were remedied. The likelihood, practicality and budgetary implications of substituting the analog BHTV were discussed in terms of personnel and training required.

Other Operational Developments

Goldberg described recent operational developments at LDEO in the area of CD-ROM production for logging data on Legs 143 - 146 and gave updates on the ODP field tape backup project, logging schools and staffing (Appendix 4.4).

Lewis returned to the issue of BCOM cutting funds for borehole tool development from the LDEO contract. Given DMP's interest in tool development, Lewis asked Goldberg how he thought this would impact the program? Goldberg was concerned about the situation, he felt that third-party tool development was especially problematical because the line between new tool development and third-party support was hard to define. What BCOM cut was new tool development, Goldberg interpreted this to mean tools not already in the program as an existing or third-party tool.

PCOM discussed the implications of the tight budget situation on tools, it was clear that budget cuts meant that no new innovation would be possible and continued funding of existing or third-party tools would need to be prioritized. Lewis pointed out that some of the problems with tool development were exacerbated by the fact that panels were not careful to route their recommendations about tools through PCOM for approval, this had lead to some confusion between LDEO and BCOM about priorities.

Item 989. Reports by PCOM Liaisons

1. EXCOM

Lewis summarized the major business items that were addressed at the EXCOM meeting in January. Two items of interest to PCOM were: (1) panel chairs and national membership, and (2) core repository facilities. EXCOM decided that if a countries' national representative became a panel chair, it did not entitle a country to add another representative to the panel. However, if scientific expertise required it, there was no objection to having an additional member from that country on the panel. The core repository internationalization issue was revisited by EXCOM and they asked that TAMU reopen their search with a new request for proposals. In response to EXCOM's mandate, TAMU issued a letter asking for proposals to operate the facility; the responses were due at the end of April and they would be reviewed by three members of EXCOM for recommendation to TAMU in June.

2. BCOM

Austin reported that at the March BCOM meeting the large discrepancy between the LRP budget and the present budget made it clear that the LRP budget goals would not be met. Due to the budget situation, the term SOE was replaced simply with "innovation".

Strategy - Short Term & Long Term

Austin explained that BCOM had taken a short term and long term strategy in preparing the FY94 budget. The short-term strategy included goals of: (1) maintaining cutting edge science and innovation, and (2) tightening base budgets by using efficiency and performance improvements to affect savings. For the long term, BCOM felt that it should: (a) apply concerted effort to find new funds, (b) rewrite ODP's science objectives to reflect fiscal realities, and (c) if there were no new funds, devise a slimmed-down operation with science to match.

Draft Budget

Austin reviewed aspects of the draft budget (Appendix 5.1). He wanted to make it clear that BCOM had prioritized funds in order to make it possible to complete the FY94 Science Program as it was planned. Austin explained the budget funding levels and the required budget cuts for TAMU, LDEO and JOI/JOIDES. BCOM was concerned that further budget reduction would have serious implications for the program. Specifically, BCOM felt that further reduction would require ODP to revise its science plan to limit scientific objectives and to reduce/eliminate technical innovation. BCOM had concluded that such a budget reduction would have a mid- to longer-term deleterious—and potentially fatal—impact on ODP.

3. TECP

Moore reported the results of TECP's global ranking (Appendix 6.0). Atlantic/E. Pacific proposals still remained at the top of TECP's list but some new proposals in different geographic areas were moving up in the global rankings. As requested by PCOM in December, Moore presented TECP's prioritized list of deep holes and stressed TECP's continuing support for development of deep-drilling capabilities. The Iberian Deep hole (IAP-1) was TECP's top deep-hole priority because TECP felt that this hole was critical to completion of the NARM Non-Volcanic science objectives.

TECP was in the process of revising its White Paper, drafts of revised sections were due to the Chair, Eldridge Moores by July 15, 1993. Moores would edit a revised version of their White Paper to be reviewed at the fall TECP meeting. TECP wanted to produce a short, publishable version of the White Paper as well as a longer, more meaty version for proponents. Unlike LITHP, the TECP revision scenario did not include a public meeting. This was because of the large TECP mandate and the panel's feeling that a public review would only tend to broaden their document. TECP preferred to use its own expertise to focus the White Paper on the best tectonic problems that can be addressed by ODP drilling.

Dick was not in support of such a closed-shop approach, he felt that LITHP had previously suffered from this kind of approach and wanted to see TECP adopt the open meeting, public review approach that LITHP was taking in revising its White Paper. Moore emphasized that TECP members were not planning to do their revision work in a vacuum and panel members would seek input from colleagues in their field when revising their assigned section of the White Paper.

Arculus questioned if TECP had been able to address PCOM's concern in Bermuda (December 1992) that important TECP programs were not getting drilled because the concepts of how drilling could solve tectonic problems were not being communicated by proponents? Moore felt that TECP had started to solve that problem by assigning TECP watchdogs to highly-ranked or promising tectonics proposals. The watchdogs were to work with proponents to get the proposals ready for this type of scrutiny.

Moore summarized TECP's discussions on the content of the ASRC Draft Report.

Lunch Break..*1:00 - 2:00 PM*

<u>Panel Recommendations</u>

Moore explained TECP's concern that collection of core orientation data was not being done in a systematic manner on the *JOIDES Resolution*. As a result, TECP endorsed the recommendation by Staff Scientist Bob Musgrave, the ODP-TAMU liaison to TECP, that core orientation become a routine operation by the shipboard paleomagneticist.

PCOM discussed how this recommendation should be handled. As SMP liaison, Fox felt that SMP should get this item and that they would like to review the specifics of the recommendation. After discussion, PCOM came to the following consensus:

PCOM consensus was to refer the TECP core orientation recommendation to both DMP and SMP for their opinions on what to do and how to implement this recommendation. DMP/SMP recommendations in regards to core orientation are to be presented at the December PCOM meeting.

4. SGPP

Berger presented the results of SGPP's global ranking. SGPP was not happy that the shelf drilling for Leg 150 would not be accomplished and felt that the sea-level goals were not being properly addressed by the revised transect. To emphasize this, SGPP did a second ranking that included the undrilled Leg 150 shelf sites—they ranked second overall among SGPP's globally-ranked proposals.

<u>Panel Recommendations</u>

SGPP was concerned about the procedure for keeping a proposal active within the ODP system and recommended that there should be a requirement that a complete revision must be submitted to keep a proposal active, not just a letter. PCOM discussed the current requirements to keep a proposal active and the issue of corporate memory on panels. The JOIDES Office would make an effort to improve the process of updating proposals for non-revised proposals nearing the three year age limit by working with proponents of these proposals to meet the JOIDES thematic panels recommendations. PCOM also recognized that an uncomfortable situation often arose when new members were asked to rank proposals that they were not familiar with. For the future, the JOIDES Office would compile a compendium of abstracts of all active proposals to be made available to panel members to help them in their preparation for global ranking.

Berger reported that the other major item of concern for SGPP was the status of the PCS. SGPP had recommended that there be continued field testing of this system, specifically on Leg 150. SGPP felt that the PCS would be critical to the success of any future gas hydrate leg. Arculus argued that PCS was a working tool and that the problems with it were in transferring samples for preservation. Francis agreed, explaining that the PCS was operational but that, while it was good at acquiring pressurized core, it was not particularly good at coring—it had also become a back-burner item after the recent engineering budget cuts. Austin noted that there had been an independent proposal to create a pressurized transfer/storage container to work with the PCS. PCOM discussed what the best course of action would be and passed the following motion:

PCOM recognizes the critical importance of the Pressure Core Sampler (PCS) for studies of *in situ* sediment conditions, including but not limited to capture of clathrates. However, PCOM remains concerned about the sporadic success of the instrument to date, and the complete lack of information concerning progress on design and construction of a lab chamber for transfer of pressurized core into an environment more amenable to analysis. PCOM requests SGPP to investigate the latter, for a report back to PCOM at its 1993 annual meeting.

Austin moved, Natland seconded; vote: 14 yes, 1 abstention, 1 absent.

Dick wanted the record to indicate that the SGPP minutes were not accurate with regards to the results of Leg 147 (Agenda Book p. 143). He was particularly disturbed by the description of the leg as not having achieved its operational goals. He wanted to say that scientists on the leg strongly disagree with that and regard it as an uninformed and unsubstantiated opinion. As to the statement in the SGPP minutes concluding that some of the problems on the leg could have been prevented by more detailed site survey (Agenda Book p. 144), Dick wanted to state for the record that the Co-Chief Scientists and the proponents did not agree with that assessment. He was upset that SGPP, in that their official minutes, were misleading readers with respect to the scientific achievements of Leg 147—a leg that was a major scientific success for the program. Several other members of PCOM who were also on Leg 147 agreed that the minutes were not accurate in these regards.

5. OHP

Sager summarized the OHP meeting (Appendix 7.0) and the results of OHP's global ranking (Appendix 7.1). Coring issues were an important item of discussion, specifically the need to improve the handling/curation procedures of gassy sediment cores. OHP also felt that it was important to figure out the cause of and a cure for the depth mismatches between mbsf and composite stratigraphic depth. OHP voted the NAAG leg II its highest priority in the global ranking and, in order to better prepare for it, planned to hold a one-day meeting after Leg 151.

OHP's discussion of the ASRC Draft Report had brought up the issue of program publicity; OHP wanted to see increased visibility for ODP science. PCOM discussed at length whether or not the ODP Science Plan schedule was being disseminated fully. Some members of PCOM questioned whether or not this was a real problem and what the origin of OHP's perception was. Further discussion followed over what PCOM could do to fix the problem, there was general agreement that the constituency for publicity efforts should be larger than just the ODP community—the use of *EOS* was preferred by many as a vehicle to do this. PCOM debated the use of *EOS* as a way to inform a broader-based earth science community about ODP activities. Different opinions were expressed about what mechanism would work better in *EOS*—an ad or an article. PCOM discussed the merits of different strategies for publicizing the program in regularly published media (journals and magazines). PCOM agreed that more efforts to publicize the science plan and schedule could be made. The JOIDES Office would pursue the issue further by working on putting an article and/or an ad in *EOS* in the near future about the FY94 schedule and the Four Year Plan.

Panel Recommendations

Sager noted that the only item of major concern that OHP had raised was that of equipment, specifically the carbonate autosampler. This item had not been included in SMP's prioritized equipment list because it was not available from the manufacturer. OHP wanted to make it known that when it became available it would be OHP's highest priority item. PCOM referred the item to the OHP liaison (Mix) for further investigation. If necessary, Mix will report on the item in August for further PCOM consideration.

6. LITHP

Mutter reported that, aside from the global ranking, a large part of the LITHP meeting was taken up with rewriting the LITHP White Paper. LITHP was in favor of having an open meeting to facilitate White Paper revision and were encouraged that the ASRC Draft Report had endorsed this approach. Mutter said that the main problem that LITHP had was in finding funding sources for the meeting and LITHP requested a clear statement of support from PCOM endorsing this approach to White Paper revision. LITHP felt that it would facilitate getting funds to support an open meeting.

Panel Recommendations

Mutter summarized LITHP's other recommendations: (a) LITHP was concerned about the engineering requirements for the FY94 hard-rock drilling legs and requested an engineer be assigned to address them, (b) LITHP wanted a reliable BHTV system and operator on board, (c) LITHP wanted to add the deployment of a CORK to hole 395A to Leg 158, (d) LITHP supported the development of in situ fluid sampling capabilities and wanted to see the RFP or RFQ approach be undertaken as soon as possible, and (e) LITHP recommended the JOIDES Office compile abstracts of all active proposals.

Lewis noted that the JOIDES Office would address the last item and that the main issue that PCOM had to act on was to decide if CORKing hole 395A should be added to the 1994 schedule—this item would be taken up later in the agenda.

7. SSP

Kidd reported that SSP evaluated the status of data for the top seven globally-ranked proposals from each of the thematic panel rankings (Appendix 8.0 - 8.3). He reviewed SSP's comments to proponents of the highly ranked-proposals regarding data requirements that must be met for the site survey data package to be considered complete. SSP also flagged three proposals, Eastern Equatorial Atlantic, Costa Rica and Gas Hydrates, as having potential safety problems and in need of a pre-review by PPSP.

Post-mortems were done on recent legs in an attempt to evaluate if the site survey data was adequate for the leg. Of particular concern were the Santa Barbara sites with the gas problems that were encountered, SSP's consensus was that the data package for this site was rushed through the SSP and PPSP review process. SSP concluded that a more deliberate approach would have been beneficial to the results of the leg. Kidd noted that site survey data for Leg 147 (Hess Deep) would be carefully re-evaluated at the next SSP meeting.

Of the currently scheduled proposals, Kidd reported that the most significant problem SSP had identified was with the Vema site survey data. SSP was concerned that there was no carbonate cap at the 1500 m water depth. Kim Kastens asked to clarify the issue and explained that there was not enough data available to determine if there was carbonate cap in the desired water depth. Kastens felt that, based on the data that existed, it appeared that the cap did not extend into the area of 1500 m water depth. She felt that it was possible that limestone cap existed at another site but there was no data to make that determination. Austin said that, based on what he had heard at the TEDCOM meeting, the water depth issue was still up in the air and the engineers may not need to have the 1500 m water depths; more information on this depth requirement would be available after the DCS land tests in the summer.

Kidd concluded by relating SSP's discussions and opinions regarding the ASRC Draft Report.

Coffee Break... 4:00 PM

Item 990. Scientific Reports of Recent Drilling

1. Leg 147

Catherine Mével, Leg 147 Co-Chief Scientist, began by outlining the primary objectives of Leg 147 (Appendix 9.0). The program was the first leg designed to drill the lower crust and mantle using the offset drilling strategy. The drilling targets were within a tectonic window in oceanic lithosphere generated at the fast-spreading EPR. Two sites were successfully drilled, 894 in gabbros and 895 in peridotites.

Site 894

Mével gave a complete description of the preliminary scientific results, operational procedures and problems that were encountered in drilling at Site 894 (Appendices 9.1 - 9.14). The hole conditions encountered at this site made it difficult to log, the FMS was not successful in the lower part due to irregularities of the hole size. Drilling encountered mainly gabbros cross-cut by a few basaltic dikes, six holes were drilled with an average recovery of 22.5 % overall. Mével then presented detailed descriptions of the petrology, lithostratigraphy, foliations and cross-cutting relationships between ductile and brittle structures observed in the cores.

Mével outlined the principle results to-date from Hole 894G: (a) the gabbroic section crystallized from the roof of the magma chamber, (b) the strong subvertical magmatic foliation was oriented N-S—parallel to the EPR axis, (c) no high temperature deformation was observed as had been in slow-spreading ridges (735B), (d) the brittle fracture network was most likely related to the opening of the Hess Deep rift.

Site 895

Mével reported on the preliminary scientific results, the operational procedures and problems that were encountered in drilling at Site 895 (Appendices 9.15 - 9.23). At this site there had been numerous unexpected difficulties encountered during the drilling of the peridotites. Six holes were drilled at this site; harzburgites, dunites and gabbroic rocks were recovered with an average recovery of 23.4 % overall. Mével presented a detailed description of the petrology, lithostratigraphy and structural fabrics of cores recovered from the site.

The major conclusions reached to-date about the rocks recovered at site 895 were: (a) the rocks recovered at site 895 correspond to plastically-deformed upper mantle that was impregnated and cross-cut by magmatic liquids—similar to the *transition zone* in ophiolites, (b) the origin of the dunites was both the result of a reaction between the harzburgite and magma and as a cumulate, and (c) the variability between the different holes at the site suggested that melt percolation may be focused within conduits.

Mével compared aspects of holes from Sites 894 and 895 (Appendix 9.25) and discussed her conclusion that what had been drilled on this leg was the upper part of the fast-spreading ridge magma chamber (Appendix 9.25). Mével explained that one of the goals of this leg was to determine what effect the opening of Hess Deep had on EPR rocks (Appendix 9. 26), in Mével's opinion, it was still not possible to distinguish between the two tectonic models hypothesized for the Hess Deep area. However, she strongly supported the offset drilling strategy for this type of investigation.

2. Leg 148

504B

Jeff Alt, Leg 148 Co-Chief Scientist, gave a complete description of the preliminary scientific results, the operational procedures and some of the problems that were encountered in deepening Hole 504B by 111 m—to a total depth of 2111 mbsf (Appendices 10.0 - 10.8). He explained that, prior to Leg 148, there was speculation that the hole was nearing the depth of the observed velocity contrast between layer 2 and layer 3. The objective of the leg was to penetrate into layer 3. Unfortunately, several problems were encountered during drilling operations at 504B and eventually the drill became inextricably stuck in the hole. Fishing was attempted but was unsuccessful, jars that were not on board were needed so were sent for. While waiting for the equipment to arrive, the ship moved to a new, nearby site (896) to continue drilling—356 m were drilled prior to the jars arrival. After the jars arrived, operations moved back to 504B to remove the drillstring stuck in the hole. Alt explained the complex problems that were encountered in trying to remove all of the stuck equipment from the hole and in trying to make the hole drillable again. Four days were spent fishing and when all of the fishing equipment sent out to the ship was used up it was decided that it was not worth trying to clean out the hole to continue to drill any further. After abandoning drilling, logging was completed at 504B and the ship moved back to 896A to continue operations with the time remaining.

Alt described in detail the lithologies of rocks recovered from 504B and passed out samples of rock chips that were characteristic of all of the cores on Leg 148. Alt felt that the chips were a feature of an interval with pervasive microfaults, this zone of microfaulting had not been previously encountered in the hole. The drilling rate went up dramatically near the depth where the drill became stuck, both these events were attributed to penetration of a major fault zone. The sonic velocity tool had worked well in logging 504B and Alt pointed out that near the bottom of the hole the velocities appeared to approach the layer 3 level. Alt observed that fault zones similar to that inferred at the bottom of 504B have been observed in ophiolites separating the sheeted dikes from the gabbros and suggested that the analogy may be additional evidence to support the hypothesis that the hole was nearing layer 3.

Site 896

Alt described the siting and operational procedures used to drill Hole 896A to a total depth of 469 m (Appendices 10.9 - 10.12). One of the objectives of drilling this hole was to drill on a local heat flow high indicated by the site survey heat flow data. The site was located on a different fault block than 504B making it possible to test the local variability of the basement but still close enough to 504B so that future cross-hole experiments would be possible. The lithologies that were recovered were described and Alt noted that there was a high degree of alteration and numerous carbonate veins in the recovered core which were attributed to hydrothermal activity. Alt described the logging program carried out at 896A, comparing 896A results with 504B data (Appendix 10.13). An initial interpretation of the comparison of the logging results was that the crust was more tightly sealed at 896A than at 504B, possibly as a result of the inferred hydrothermal activity at 896A.

Prognosis Report for 504B

Francis asked to report on TAMU's engineering prognosis for continued drilling at 504B. TAMU engineers had concluded that a final determination of the feasibility of deepening 504B could not be made unless a two-part leg was scheduled to: (1) clean out the hole—estimated to take 3 weeks, (2) determine if the unstable zone could be drilled at all—TAMU would prefer drilling with a downhole motor instead of a rotating drill string, and (3) run packer tests to see if the hole could be cemented and, if so, then case the hole. TAMU felt that there was a great deal of open hole at 504B and to continue drilling would require casing the hole—a step that would be very expensive Francis warned. After casing, the next step would be to continue drilling but it was unknown how effective the drill bits that exist would be.

Dick brought up for discussion the option of starting over and drilling a new deep hole that would start out with a proper casing and drilling program. PCOM discussed this strategy and why casing had not been done previously at 504B. Natland brought up that several years ago TEDCOM had recommended developing a complete drilling program—from start to finish—to achieve deep holes. Natland felt that ODP had reached the point where a such a deep drilling program needed to be developed, particularly for a post-98 time frame.

Item 991. Non-JOIDES Liaison Report

1. MESH (Marine aspects of Earth System History)

Mix explained the development of the Marine aspects of Earth System History (MESH) group and the plans/timetable for development of their programs (Appendices 11.0 - 11.1). He noted that MESH had representation from many other groups (NSF, NOAA, NAD, USGS were examples) and countries. The MESH Steering Committee had been elected and money would be coming available at NSF for MESH programs. Mix reviewed the MESH working groups and goals and wanted to point out to PCOM that large part of the MESH program could become involved with ODP. PCOM discussed the internationalization of the MESH program in terms of funding. Mix felt that the initial intent was for MESH to get US money and NSF would be the source for funds.

Item 989. Reports by PCOM Liaisons - continued

8. IHP

Database Problems

Sager reported that IHP had identified several high-priority problems with data base management, specifically the influx of new data and the backlog of data that were not being captured and curated(Appendix 12.0). IHP was also concerned about the problem of data that was collected in individual labs and not submitted to TAMU; IHP hoped that CD-ROMs might help address all of these problems. Sager summarized IHP's recommendation for prioritizing tasks for TAMU to address the database problems (Appendix 12.0). PCOM discussed IHP's recommendations debated the best way to solve the problems IHP had identified.

Sager clarified the discussion by asking PCOM to consider two separate issues—one issue was dealing with raw data management and the second was updating refined data. Arculus brought up the possibility for solving both types of problems by an integrated use Internet throughout the program. PCOM debated this option and other possible alternatives but could not identify with certainty what they could or should do given the pending computer and database upgrade project. Sager stressed that IHP realized that the computer upgrade would take place in the near future but felt strongly that, in the meantime, there needed to be something done to capture data being produced at present.

Lewis ended the discussion on this issue by giving PCOM the choice of going back to IHP with a request for more specific recommendations on how to solve the database problems or, instead, to request from TAMU a proposal to address the database problems. Lewis favored having the Computer RFP Evaluation Committee review the recommendation. Francis urged PCOM to wait until the computer RFP came back before any decision was made on this issue. PCOM recognized the need to get something done in the time frame that IHP urged (immediate) and the realities of changes that were shortly pending; CD-ROM was viewed as the most promising scenario. After further discussion, PCOM reached the following consensus:

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

Other Issues

On other issues (Appendix 12.1), IHP was not happy with what they perceived as a short-circuit of the advisory system in regards to development of the HARVI - HRTHIN software. IHP noted that work at Micropaleontology Reference Centers was slowing due to funding problems. In regards to core repositories, IHP was not in favor of breaking up collections, transporting curated cores or using non-refrigerated storage space.

IHP/SMP held a joint session during the meeting and had discussed the concept of "limited sampling interval". This designation would be used to help co-chief's reduce over-sampling of cores with low recovery. IHP favored a three-tier approach: (1) the "critical interval" would be the most restrictive for sampling, (2) the "limited sampling interval" with fewer restrictions, and (3) normal sampling intervals. The importance of critical intervals and problems of equitable sampling were discussed in light of problems that arose on Leg 147. PCOM was sympathetic to the need for a clear statement of rules but felt that the existing rules for shipboard participants were very clear in stating that co-chiefs have the final authority in sampling decisions.

Publications - *Initial Results (IR)*

Sager reviewed IHP's recommendations regarding cost reduction for publications (Appendix 12.2). The first recommendation was that TAMU should shorten the *IR* by encouraging brevity, this should be done by giving specific directives to co-chiefs. IHP felt this could be accomplished if interpretations were put elsewhere in the publication process and tables should be put on CD-ROMs. IHP specifically recommended that a 20-page limit be instituted on papers and specified the editorial guidelines for implementing the limit in practice.

PCOM debated the merits of cutting down the size of volumes and speculated on what other changes were implicit in IHP's recommended guidelines. Several PCOM members felt that the overall cost of publications in the program was small relative to the impact and scientific legacy it provided; their feeling was that limiting publication sizes was a bad idea given the importance of the data. Further discussion addressed the question of whether or not PCOM should mandate a capping of publication sizes, and therefore costs. PCOM's consensus was that, given the high degree of variability between core type and recovery on different legs, the co-chiefs should be self-limiting, with suggested guidelines provided by TAMU. PCOM discussed and passed the following motion:

Considering the trend for increase in the size of both *Initial Results* and *Scientific Results* volumes, and a corresponding increase in the costs of publication. PCOM recommends 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 encourages publication of data on CD-ROM to reduce printed pages. Establishing an across-the-board page limit for either *IR* or *SR* is discouraged, to maintain flexibility.

Berger proposed, von Rad seconded; vote 14 in favor, 1 abstention, 1 absent (voted on Wednesday).

Publications - *Scientific Results (SR)*

For *SR* volume publications, IHP recommended the *SR* submission deadlines be changed to 40 months post-cruise. IHP's reason was that the publication time had been decreasing steadily with time and IHP was concerned that the shortening of preparation time had been detrimental to the quality of papers submitted.

Von Rad reminded PCOM that in the past PCOM had fought very hard to get the shorter lead time for the *SR* and he felt strongly that going backward to a 40 month deadline would be bad. PCOM discussed the potential benefits and drawbacks of implementing IHP's suggestion. Sager emphasized that the reason IHP requested the time extension was strictly a quality issue, not a financial one. PCOM felt that there was not enough evidence to show that the time deadlines were the fundamental problem in quality control so they preferred to leave the 36 month post-cruise publication deadline in place. PCOM reached the following consensus:

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.

9. SMP

Fox reported that at the SMP meeting, the first issue of particular concern was the recently-identified systematic error in the GRAPE numbers. Scientists from Leg 138 discovered that a software change was the source of a systematic error in the calculation of density. SMP was satisfied that the error had been correctly identified and remedied in the software but wanted to make sure that the correction was applied to all past data. To ensure this, SMP formulated specific recommendations on how to do the correction and replace old GRAPE data. Fox explained that for SMP, the GRAPE problem illustrated the necessity for quality control for all software on board. SMP wanted to see TAMU implement a quality control program on board to ensure that proper documentation for all computer programs was on board—especially for non-commercial software acquisitions.

Another important issue the SMP discussed was the need for capital equipment replacement. SMP felt that it was likely that many large laboratory items would be in need of replacement soon; a plan for the phased acquisition of major pieces of equipment needed to be formulated by TAMU.

Fox reiterated the point that IHP had made about hardware/software prioritization. SMP felt that their efforts were being undermined by individuals who went around the SMP software prioritization system—i.e. HARVI & HRTHIN. Fox emphasized that it was the process that needed to be addressed, not the specifics of the most recent example.

End of day 1.. 8:00 PM

Tuesday, April 27, 1993.. 9:00 AM

10. DMP

Lewis reported that DMP was beginning to assign watchdogs to monitor operations, development and costs of downhole tools (Appendices 13.0 -13.1). DMP instituted a new thrust involving measurements that provide information from the regions far-removed from the borehole—i.e. cross-borehole acoustic techniques and downhole radar. DMP continued to monitor the development of third-party logging tools and felt that progress was good. The German magnetometer tool was the first third-party tool to enter the ODP certification process. The French sediment magnetometer had been accepted for commercialization by Schlumberger and would be provided at no cost to ODP during the engineering checkout phase; this tool may be ready for Leg 150.

Panel Recommendations

DMP was distressed about not having more involvement in the wireline services contractor review; they recommended that PCOM review the situation. Pyle objected to DMP's statement because JOI did involve DMP members in the process. Lewis elaborated on DMP's specific concerns on the issue and explained that he had recently contacted Peter Lysne, the DMP Chair, and had resolved the confusion over this issue. Lewis would return to the issue of JOIDES input to RFP review later in the agenda. Austin pointed out that DMP had become somewhat separated from the service panel advisory structure—they met three times a year instead of two and were not providing direct input to PCOM on logging issues. Austin asked that PCOM review this panel's schedule and activities. Lewis agreed but tabled the issue until discussion of the ASRC Draft Report since the issue would come up again there.

11. TEDCOM

Austin reported that one of the main objectives of the meeting had been to discuss the responses to the RFQ on deep drilling (Appendix 14.0). However, due to conflict of interest of some TEDCOM members, the TAMU engineers could not bring the bids to TEDCOM for review. In order to be able to have TEDCOM evaluate the responses, a subcommittee of uninvolved members was created to review the responses. Austin did not know when the subcommittee review was going to occur, PCOM would receive a report by August.

TEDCOM was updated on the DCS Phase IIB by TAMU engineers, a complete review of all aspects of DCS was presented. A DCS land test was planned for the summer, in Texas, to see if the secondary heave compensation was operational. TEDCOM then had a detailed discussion of the DCS sea test scheduled for Leg 157.

Panel Recommendations

After discussing the DCS testing on Leg 157 and reviewing the operations on the previous DCS test on Leg 142, TEDCOM recommended setting seafloor hardware at the DCS test drill site ahead of time. This recommendation was made to increase the chances of success for the DCS test itself. Austin felt that this was a reasonable recommendation and recommended that PCOM consider it since implementing it would be possible given the present schedule.

PCOM discussed the issue of presetting hardware. Of particular concern was the water depth requirement for the DCS test, and the fact that TAMU wanted to see the land test results before making a definitive water depth determination for the test site. Because the issue of placing equipment ahead of time was tied to site selection, PCOM felt that it had to defer a decision on this recommendation until August, after the land test of DCS. PCOM discussed the sites at Vema and the specifics of the site survey by Kastens that would be done this summer. PCOM's consensus was:

PCOM will reconsider in August the issue raised by TEDCOM concerning DCS hardware placement prior to Leg 157.

Another issue that TEDCOM discussed was retractable bit technology. TEDCOM recommended that TAMU engineers should go to Russia to investigate this technology further because it offered the potential for a dramatic increase in drilling efficiency for ODP.

12. PPSP

Lewis reported that PPSP had reviewed and approved drilling sites for Leg 150, Leg 151, Leg 152, MARK and TAG (Appendix 15.0). Safety pre-reviews were done on Leg 156 (Barbados) and on Proposal 323-Rev2 (Alboran Sea) (Appendix 15.1). The Leg 156 Barbados sites located on top of a bright spot along the décollement were approved after a thorough analysis of amplitudes and velocity on a 3-D cube. The Alboran Sites Al-1, Al-3 and Al-4 could be approved if slightly relocated (shallow holes) but the Al-1 (deep hole) could not be approved because of the potential for overpressuring. In order to get PPSP approval the proposed Al-1 site required more data or analysis proving that overpressuring was not present in the section. Lewis added that an additional problem with the site was that it was located on-structure and would have to be relocated to be approved. Alboran proponents could either do a velocity study or devise a new drilling strategy to accomplish their scientific objectives. Lewis noted that if proponents chose to revise the proposal it would be in review at the time the FY95 Prospectus would be assembled. PCOM discussed the Alboran data and whether or not it would be possible to answer the overpressuring question.

The results of the meeting of the Shallow Water Drilling Working Group (SWDWG) were presented to PPSP meeting. PPSP discussed and approved of the working group's preliminary recommendations and would review the SWDWG final report at their fall meeting.

Item 992. Shallow Water Drilling Working Group Report

Francis reported on the meeting of the SWDWG held at TAMU and chaired by PPSP Chair Mahlon Ball (Appendix 16.0). Members of the group included people from industry, academia and several other JOIDES panels. Written contributions were submitted by WG members unable to participate in the meeting. A final report would be produced by the end of June, reviewed by PPSP in October and presented to PCOM in December.

The SWDWG confirmed that riserless drilling from a floating rig was the safest way to drill in shallow water but stressed that gas must be avoided (Appendix 16.1). After discussing methods for detecting shallow gas, SWDWG concluded that drilling in shallow water could be conducted provided that very tightly-specified hazard surveys were carried out for each site and the data was properly processed and interpreted. Francis outlined the specific recommendations that were made for hazard surveys regarding: seismic source, hydrophone streamer, sampling rate, line spacing and orientation, and data processing. The SWDWG recommended that these types of hazard surveys be obligatory for all ODP drilling in water depths of less than 200 m on sedimented continental margins. Francis explained that this type of survey would cost about $ 250 K. He felt that, if the money was available, the surveys could be done by academic workers but might require leasing some oil industry equipment—i.e. seismic sources.

Drilling guidelines proposed by the SWDWG were that penetration be restricted to 1000 mbsf and that any deeper penetration in the sedimentary margins should not be attempted without blow-out protectors and well control (Appendix 16.2). The SWDWG also recommended some engineering and operational procedures to be considered by ODP. The first was to have the ability to drop the drill string, the second was to monitor the water column at the seabed for gas bubbles, and the third was to have an emergency contingency plan.

Francis pointed out that TAMU had added the requirement that hazard surveys be conducted, processed and interpreted by people who were not proponents of drilling. PCOM discussed this last requirement at length, specifically the idea of who was qualified to evaluate a hazard survey and the rights of proponents to be involved. PCOM agreed that the requirement should be for an independent review of the data, not a completely separate, non-proponent, acquisition. Francis felt that TAMU would not want to back down on the issue of having non-proponents do hazard studies. Austin asserted that there would never be funding for academic people to conduct these hazard studies because there would not be any scientific merit to proposals submitted for this work. Instead, Austin was in favor of establishing a separate fund for money to do these types of hazard surveys, specifically for surveys that were not scientifically required.

After more discussion, Francis was willing to back off on the TAMU requirement for independent acquisition but stressed that the requirement for an independent review of the hazard survey by experienced non-proponents was crucial for safety. PCOM agreed that having an independent third-party evaluate the data was appropriate; options to implement such a policy were then discussed. Lewis concluded the discussion by asking PCOM to think about these issues for further discussion when the final SWDWG Final Report was presented to PCOM in December.

Item 993. Computer RFP Evaluation Committee Report

Francis listed the respondents to the RFP for computer and data management (Appendix 17.0). The RFP Evaluation Committee had met at TAMU in February and selected three bidders to write a proposal: (1) EG&G Washington Analytical Services Center, Inc. (LDEO/GEOMAR), (2) the Meyer Group, (3) TRACOR Applied Sciences, Inc.. Representatives of these bidders went on the recent transit leg from Panama with Kate Moran on board to facilitate the tour. The bidders' responses were to be submitted to TAMU by May 31, 1993. Responses would be evaluated by John Coyne at TAMU and then by the Computer RFP Evaluation Committee in July.

Coffee Break.. *9:40 AM*

Item 994. Four Year Plan FY93 1996

1. Thematic Panel Global Rankings

Lewis began discussion on the Four Year Plan by reading the PCOM motion from last year. Panel liaisons (Moore, Berger, Sager, Mutter) were then asked to review their panel's global rankings (Appendix 18.0). PCOM discussed the status of the various top-ranked programs with respect to site survey data, potential safety problems, and overall proposal maturity.

2. Setting the Arena of Ship Operations for FY95 — 1996

Lewis started the discussion by presenting a draft motion for the Four Year Plan. PCOM discussed what to present in the Four Year Plan motion given that budget cuts could potentially affect the near-term program plans. PCOM agreed that it was important to maintain an upbeat message for the Four Year Plan but recognized that budgets needed to be factored into the picture.

Natland proposed formulating a science plan with a longer-range view and having PCOM make a bold statement on the long-term ideas PCOM wanted to implement. He presented a map illustrating several options for long-term ship tracks (FY95 - 98). He discussed the geographic distribution of the past ODP legs and, using highly-ranked proposals, suggested several ship tracks that would allow the *JOIDES Resolution* to get out of the North Atlantic. Using additional proposals already in the review system, Natland then presented a five-year ship track and schedule as an example of the approach he was suggesting. PCOM discussed the scientific and political aspects of Natland's scheduling approach.

PCOM agreed that Natland's suggestion was an interesting idea but most PCOM members felt strongly that there were proposals soon to be submitted that would make this long-term scheduling approach unwise. PCOM felt that it was clear that the system was intended to be proposal-driven and that within the next few years there would proposals submitted that would begin to direct the ship's schedule into new areas. Announcing a ship's schedule through the end of the program using only proposals in the system at present was not considered a viable option. Natland clarified that his proposed schedule was only for PCOM's use in thinking about how best to accomplish effective long-range planning, not necessarily as a specific proposal for the schedule.

PCOM continued the discussion of how to present an effective announcement for future operations. There was general PCOM agreement that themes should drive the science and that it was just as important to publicize the thematic interests of ODP as the geographic area of operations. Mutter felt the problem of setting an area of operations and then getting a large number proposals for that area would always occur. To counter this type of proponent reaction and guide PCOM in its planning process, Malpas felt it was important to stress the thematic objectives that ODP wanted to be addressed. Natland felt that the only critical geographical issue was deciding on the general area of geographic interest that proposals for the prospectus would come from. Fox felt that any statement coming from PCOM should be worded to emphasize the thematic priorities. Arculus agreed and wanted PCOM to insure itself enough flexibility to accommodate new proposals that would be submitted this year.

Larsen asked for clarification on why it was necessary for PCOM to formulate a greater-than-two-year plan for the ship's track. Austin explained the four year plan allowed for fiscal planning and kept the technological development on track; Austin stressed that PCOM's Four Year Plan motion needed to include technological priorities. Malfait added that the Four Year Plan assisted proponents in developing drilling proposals and in site survey data collection.

PCOM discussed the globally-ranked proposals and how to convey ODP's thematic interests in combination with the ship track. Austin wanted PCOM to state explicitly what themes ODP would pursue in the future, he felt that there had been criticism of ODP for its lack of specificity that could be addressed if the high-priority themes were stated clearly. Dick agreed, he felt that ODP needed to actually accomplish some of its significant thematic objectives in order to be successful post-1998. Dick did not feel that the present system of setting a ship track and then getting proposals for that area was an effective strategy for accomplishing the themes that were crucial to ODP's future success—the ship needed to go where it could be used to solve thematic problems. Malpas was in favor of PCOM presenting its planning in terms of themes that would be addressed in the near-term schedule while also announcing what themes PCOM would like to be addressed in the near-future.

After discussion of the most highly-ranked proposals in the global rankings, Lewis drew the discussion to a close by summarizing that for FY95 the Atlantic would still be the likely area of operations. Lewis felt that it was after FY95, depending on proposals, that the ship track could begin to be headed for other geographic areas. A subcommittee of Mutter, Mix, Kidd and Austin prepared a thematically-focused Four Year Plan Motion. After presentation by the subcommittee, PCOM discussed and passed the following motion on the Four Year 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, confirmed as the current program plan (PCOM winter 91).

b) In FY94, 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 <u>rifted margin evolution, the development of oceanic lithosphere at ocean ridges, Neogene paleoceanography, and the evolution of deep sea fans and accretionary prisms</u>.

c) The further investigation of these and other high priority themes including, but not confined to, <u>sea-level change, high-latitude paleoceanography, fluid circulation in the lithosphere, carbon cycle</u> 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.

Austin proposed, Kidd seconded; vote: 15 yes, 0 no, 1 absent.

Item 995. Advisory Structure Review Committee (ASRC) Draft Report

Lewis had distributed Revised ASRC Draft Report (#3) to all members of PCOM prior to the meeting and wanted to have a general discussion on the report so he could take PCOM's views, in the form of a motion, to EXCOM in June. Lewis suggested that PCOM request that EXCOM pass the report back to PCOM for detailed comments after the final report was presented to EXCOM in June. PCOM discussed the subjects of the Revised ASRC Draft Report individually.

<u>Proposal 1: Workshops / COSODs / White Papers</u>

PCOM agreed that the ASRC recommendation for open workshops to improve White Papers was a good idea for long-range planning. However, the specific details of how these workshops would be implemented needed to be worked out. Also of concern was what PCOM's charge to the panels for their revisions should be. PCOM wanted the revisions to include a section focusing on post-1998 plans.

In addition to post-1998 planning, Fox stressed that the White Papers should be used to identify important themes that need to be drilled using a multi-leg program in order to completely address the thematic objectives. He saw this approach as having an important impact on how resources were allocated by PCOM from the present to the end of the program and beyond; less themes were needed if these themes needed large amounts of resources to accomplish their goals. Fox urged the panels not to be afraid to develop themes that may require more than a leg to accomplish.

Lewis felt that PCOM should ask LITHP to postpone their White Paper meeting until PCOM could come up with detailed instructions on what to incorporate into their White Paper. Lewis explained that he wanted PCOM to have time to carefully develop their charge to the thematic panels regarding post-98 and multiple-platform planning—both issues the PCOM itself was only beginning to address at this meeting. PCOM was reluctant to postpone the LITHP meeting at this stage of development. After more discussion, PCOM agreed to support LITHP's approach and work with them during the revision process to help refine the LITHP objectives. At the conclusion of the discussion, PCOM adopted the following consensus:

PCOM fully endorsed the approach and schedule taken by LITHP in their White Paper. The PCOM Chair will contact the LITHP Chair to ensure that the objectives of the White Paper are consistent with the PCOM discussion.

Proposal 2: Role of thematic panels

PCOM endorsed this ASRC proposal and it was generally felt that the present structure had already adopted this type of role in the planning process.

Proposal 3: Overlapping of themes, liaisons and international groups

PCOM agreed that this ASRC proposal was already in practice within the system.

Proposal 4: Handling of drilling proposals

PCOM agreed that the central idea of the first part of this proposal was using a DPG for planning the ship's schedule. PCOM's consensus was that a DPG was not necessary but PCOM was in favor of the use of a pre-planning subcommittee with representatives from the science operator, SSP and PPSP be employed to prepare scheduling options for the PCOM annual meeting.

PCOM then discussed the ASRC idea of having panels rank proposals on the basis of scientific merit and interest, thematic relevance, and scientific feasibility. PCOM agreed that thematic panels were not currently giving enough scrutiny to the details of the proposed drilling sites or the issue of whether or not the proposed sites would accomplish the objectives of the proposal. PCOM was in favor of panels using additional criteria for evaluating proposals to help identify and develop immature proposals in the thematic review process.

Proposal 5: SSP, PPSP

After a general discussion of the ASRC proposal, Kidd assured PCOM that the site survey guidelines were always under review by SSP and that SSP was very flexible on a case-by-case basis. In addition, SSP always updated PCOM on changes in any of the site survey guidelines. Kidd felt that SSP did spend a lot of time on the issues in the ASRC proposal and the ASRC had not recognized the SSP procedures that were already in place. PCOM discussed the SSP and PPSP review schedules and was satisfied that recent changes to procedures for proposal review—safety pre-review and drilling time estimates from the operator—were good improvements. PCOM was against the ASRC recommendations to: (a) make SSP a smaller group, (b) to have the JOIDES Office be tasked with site survey augmentation—SSP already did this, and (c) to use abstracts/extended abstracts in place of a complete proposal.

Proposal 6: Panel and Shipboard Party membership

1. PCOM agreed that a rotational policy for most non-US panel members had already been implemented.

2. PCOM agreed that it already does informally consider several candidates for new panel members in consultation with the national PCOM representative.

3. PCOM agreed that this item was not necessary because there were no barriers to former panel members being reappointed to a panel.

4. PCOM agreed that in the present system co-chiefs were already chosen largely as ASRC described.

5. PCOM discussed the issue of non-US nominations for leg participants. Dick felt that this was a useful suggestion that allowed co-chiefs to choose the best crew. Kidd wanted to clarify that such a slate of candidates had to be from actual applicants for the leg. Malpas added that the MOUs insure that the ultimate decision on who goes on a leg was up to the countries themselves, changing that policy would require a change in the MOUs.

<u>Proposal 7: Selection of new JOIDES Office</u>

Lewis felt that the main point of this proposal was the issue of having a non-JOIDES institution lead the program. PCOM discussed the further implications for the program if this proposal was implemented. PCOM consensus was that this was an internal US problem and it was not appropriate to address the problem as part of the advisory structure review.

<u>Proposal 8: PCOM</u>

1. PCOM had a variety of opinions on giving the thematic panels more work in the planning process, most were against adding to panel chair workloads. There was support for more subcommittee work by PCOM to handle business issues and save time for more long-range planning during meetings.

2. PCOM agreed that subcommittees were an appropriate way to deal with the majority of the panel recommendations prior to PCOM meetings. There was support for having longer PCOM meetings to allow more time for effective handling of long-range planning.

3. PCOM agreed that TEDCOM viewed itself as somewhat autonomous and had tried to distance itself from the advisory process. The consensus was that PCOM probably did not get enough direct technical advice from TEDCOM.

4. PCOM discussed the proposal to have thematic panel chairs or their representatives attend all PCOM meetings. There was general agreement that PCOM did not want to see work taken away from PCOM liaisons and added to the panel chairs' responsibilities. However, several PCOM members wanted to have thematic panel representation at all PCOM meetings to give direct input on proposals and science planning. PCOM debated the necessity of having thematic panel chairs attend both the April and the August meetings. To conclude the discussion, a straw vote was taken on having thematic panel chairs attend all of the PCOM meetings, the results were: 5 in favor, 11 against.

5. PCOM was not in favor of implementing this proposal for the Four Year Plan because it was viewed as a geographic, and not a thematic, approach to ship scheduling.

Lunch Break .... *1:00 - 2:00 PM*

<u>Proposal 9: Scientific Syntheses</u>

PCOM agreed with the proposal to ask thematic panels to encourage syntheses of ODP science.

<u>Proposal 10: TEDCOM</u>

PCOM discussed the ASRC proposals regarding TEDCOM and supported many of the suggestions. PCOM debated what the mandate of TEDCOM should be in the advisory structure. The recent role of TEDCOM in PCOM's decision-making process was evaluated and ideas were generated on what could be done to improve PCOM's interactions with this panel. There was general agreement that, as presently constructed, TEDCOM was not as responsive to PCOM's need for technical advice as it could be. TEDCOM's technical advice was considered very valuable but PCOM wanted to see greater willingness to give input directly to PCOM. It was suggested that more engineers from academia be added to the panel to address the complaint that people from industry were not able to put in sufficient time to the panel because they were not being paid for it. There was discussion about having the TEDCOM chair, or a representative, come to all of PCOM's 's meetings.

<u>Proposal 11: New technologies for downhole measurements</u>

PCOM agreed that DMP was already doing a good job at this.

<u>Proposal 12: Mode of operations of panels and JOIDES Office</u>

PCOM was in favor of using more committees and subcommittees to delegate work but there was agreement that generating additional meetings should be avoided. PCOM was in favor of increasing the staff for the JOIDES Office but saw that it was going to be impossible with the current budget situation.

Kidd wanted to see the JOIDES Office take on some of the work of the panel chairs to help cut their workload. PCOM was not in favor of increasing the workload of the JOIDES Office without adding more staff.

PCOM agreed that it may need to pay attention to those proposals of high scientific merit that were slipping through the cracks of the ODP review process. PCOM tried to identify some active proposals that were of high quality but were not being highly ranked by panels because they did not fit exactly into any of the ODP thematic categories.

PCOM concluded discussion of the Revised ASRC Draft Report by adopting the following consensus statement:

PCOM has received the #3 draft of the ASRC report. PCOM finds within the report many beneficial recommendations, but also some recommendations that it wants to examine in greater detail.

PCOM requests after the report is formally received by EXCOM, that it be referred to PCOM for detailed comment.

PCOM set up a subcommittee consisting of Von Rad, Austin, Kidd, Taylor and Lewis to coordinate PCOM responses.

Item 996. Long Range Planning

1. Prioritizing Budget Items

Lewis 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 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 was the potential shortfall if ODP was left with five partners (Appendix 19.0). One option was to cut all 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. This type of budget cutting, focusing on 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.

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. Francis 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.

Malfait 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. Arculus reiterated that the crisis in the

Can/Aus consortium was exacerbated by the short amount of lead time they had 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.

Dick 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 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.

Von Rad 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 felt 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, 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 did not have money for this type of science.

PCOM concluded the discussion by passing the following motion:

PCOM 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.

Natland proposed, seconded; vote: 15 yes, 0 opposed, 1 absent.

The In Situ Pore Fluid Sampler RFP

Lewis explained that this RFP was for a feasibility study to find out if it was technically possible to make a an in situ pore fluid sampling tool. Austin recommended that, given the current budget situation, PCOM not fund this RFP and that DMP identify additional expertise for their panel to find out for themselves if this instrument could ever be successfully designed. After discussion, PCOM agreed not to commit money to do a feasibility study for a tool that might not yet be technologically possible to develop.

Lewis noted that several of the thematic panels were in support of developing a way to do this type of sampling and had requested that the RFP be issued. Francis suggested that a tool may not be the answer, casing and perforation was a way to accomplish the in situ pore fluid sampling—it was the way that the oil companies do such sampling. However, he did not feel that the long time periods required for this type of testing was feasible for ODP.

PCOM concluded the discussion by passing the following motion:

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.

Natland proposed, Kidd seconded; vote: 13 yes, 2 abstentions, 1 absent.

Deep-Drilling RFQ

PCOM discussed the scope of the deep-drilling RFQ issued by TAMU. Francis explained that the RFQ was for a feasibility study for deep drilling on the *JOIDES Resolution* but was to include specifications for an alternate drilling vessel/platform if the required changes would exceed the capability of the *JOIDES Resolution*. Francis reviewed the names of the respondents to the RFQ. TEDCOM wanted time to evaluate the responses to the RFQ but could not complete this task at their March meeting due to conflict of interest problems with some TEDCOM members. A subcommittee of TEDCOM would be reviewing the responses soon so, until then, there would be no decision by TAMU on the winner.

PCOM debated what action to take on this issue given the current budget situation. Austin felt that the process needed to be stopped because there was no money for it and it was not clear that it was ODP's business to conduct this study. Lewis felt strongly that resolving the issue of deep drilling on the *JOIDES Resolution* was critical for a post-1998 planning and that some type of feasibility study needed to be done ahead of the renewal review of the program.

Francis explained that PCOM's only options were to: (1) table the issue pending TEDCOM review until the August PCOM meeting—waiting until this date would violate the terms of the RFQ, or (2) to not fund the RFQ. PCOM discussed the two options. The PCOM consensus was that deep drilling was essential for long-range, post-1998 planning and needed to be investigated prior to 1998. Unfortunately there was no money for it in the current budget so PCOM agreed that TAMU should not fund the RFQ. PCOM agreed to revisit the issue in the future and suggested that TEDCOM progress the issue on its own.

PCOM concluded the discussion by passing the following motion:

PCOM recognizes 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.

Austin proposed, Moore seconded; vote: 14 yes, 1 no, 1 absent.

Item 997. Old Business

1. Von Herzon proposal request update

Lewis reported that at the December PCOM, Richard Von Herzen had requested an opportunity to deploy temperature measuring devices on Legs 150 and 152. Von Herzen was currently planning to take measurements at the two shallow slope sites on Leg 150, the co-chiefs supported the activity. Von Herzen planned to evaluate the data from Leg 150 before deciding whether or not to continue with the program on later legs.

Wednesday, April 28, 1993...9:00 AM

2. Update on the 1994 Schedule

Vema Engineering update, Leg 157

Lewis summarized the status of the site selection for the DCS leg. Austin noted that in order to have site survey done for placing a hardrock guidebase, Kastens would need to write another proposal to add camera surveys to her cruise. Austin felt that PCOM should not miss the opportunity to get data needed to make Leg 157 a success. PCOM discussed the necessity of getting the photos for hardrock guidebase emplacement and what the possibility of actually getting this data on the Kastens cruise was. At the conclusion of the discussion, PCOM passed the following motion:

PCOM, in light of recent Hess Deep experience, recognizes the importance of photo coverage in the vicinity of any site scheduled for deployment of a HRGB. PCOM, in order to prepare properly for Leg 157, endorses a plan of action to attempt to acquire this coverage during an upcoming survey of the Vema FZ transverse ridge. The JOIDES Office will help the PI of the program with that effort.

Austin proposed, Natland seconded; 15 yes, 1 abstention.

TAG monitoring program update

Fox reported that RIDGE held a workshop on the instrumentation of the TAG site in February 1993. Lewis brought up that LITHP requested that the TAG leg (Leg 158) be used to CORK 395A but that SGPP had recommended not to CORK the hole on Leg 158. Francis wanted to make it clear that the TAMU budget did not include a CORK for the 395A site. PCOM discussed the panel recommendations, operational feasibility and budget constraints for this operation and came to the following consensus:

PCOM consensus is not to use Leg 158 to CORK 395A.

Coffee Break..10:30 AM

Item 998. New Business

1. 1993 Meeting schedule

PCOM Meetings

1) Summer Meeting in Brisbane, Australia, August 10 - 12, 1993
2) Annual Meeting at Miami, November 30 - December 3, 1993
3) Spring Meeting 1994 at Cardiff, Wales, date undetermined
4) Summer 1994 possibly an ESF-hosted meeting in Iceland, or in Barbados at the Leg 157 port call
5) Annual meeting, December 1994 in College Station, Texas
3) Spring Meeting 1995, possibly meeting in Japan

2. Membership Actions

PCOM adjourned to Executive Session to discuss membership actions

Panels and Panel Chairs

SGPP:	R. Sarg to replace N. Christie-Blick
TECP:	J. Stock to replace T. Atwater
	A. Robertson to replace E. Moores as Panel Chair after the fall LITHP meeting
LITHP:	A. Sheehan to replace T. Brocher
	A. Fisher to replace D. Moos

K. Gillis to replace S. Humphris

In recognition of Humphris' service, PCOM adopted the following consensus statement:

On behalf of the JOIDES advisory structure, PCOM expresses its considerable appreciation for the excellent job that Susan Humphris performed as chair of the Lithosphere Panel and wishes her well in her position at the RIDGE office and co-chief designate of Leg 158.

SMP: J. Gieskes to replace K. Moran as Panel Chair after the fall SMP meeting
J. Parizo to replace J. King
J. Whelan to replace M. Mottl

SSP: D. Toomey to replace Greg Moore

PCOM Membership and Liaisons

PCOM Membership

Malpas would officially be replaced by Arculus for Can/Aus on PCOM as of September 30, 1993. However, this was Malpas' last PCOM meeting. In recognition of Malpas' years of service, PCOM adopted the following consensus statement:

On behalf of the JOIDES advisory structure and the entire ODP community, PCOM expresses its deep appreciation to John Malpas for the time and energy he has put into PCOM, the Long Range Plan, and the numerous committee and panels he has attended over the years. PCOM recognizes that his 10 year commitment to the program has contributed immeasurably to its success.

PCOM Liaison Assignments

	EXCOM	LITHP	OHP	SGPP	TECP	DMP	IHP	PPSP	SMP	SSP	TEDCOM
J. Austin											X
K. Becker						X					
W. Berger				X							
H. Dick										X	
J. Fox									X		
R. Kidd				X						X	
H. C.. Larsen					X						
B. Lewis	X							X			
R. Arculus			X								
C. Mével		X									
A. Mix			X								
J. Mutter		X									
W. Sager							X				
K. Suyehiro						X					
B. Taylor					X						
U. von Rad				X							

Co-Chief Scientists

PCOM endorsed, by consensus, the nomination of Dave Piper (Canada) as Co-Chief Scientist for Leg 155 (Amazon Fan).

Computer RFP Evaluation Committee

PCOM endorsed, by consensus, the designation of Dave Goldberg as a liaison to the Computer RFP Evaluation Committee to foster interaction (except that he will be excluded from situations involving conflict of interest.).

At the conclusion of the Executive Session, PCOM passed the following motion:

PCOM endorsed all personnel changes in panel membership, panel chairs and PCOM liaisons presented at the April 1993 PCOM meeting.

Natland proposed, von Rad seconded; vote: 16 yes.

3. Review of RFPs

Lewis explained that DMP felt there had not been sufficient input by the JOIDES advisory structure in the recent wireline logging RFP review process. Lewis' purpose of raising this issue here was an attempt to clarify the RFP reviewer selection process for PCOM. Lewis suggested that the handling and review process of the recent computer upgrade RFP might serve as a better model for future RFP reviews and that if the JOIDES advisory structure was involved in the process at an earlier stage, reviews might go smoother.

Malfait saw no problem with more input from the JOIDES advisory structure but cautioned that conflicts of interest may exist. He explained that individuals representing themselves on an RFP review committee may or may not have a conflict, but individuals representing JOIDES would be seen as a having a conflict. After discussion, PCOM passed the following motion:

To ensure that the interests of the JOIDES advisory structure are fully represented in all contracts let by JOI Inc. or it subcontractors that involve important new directions, the PCOM Chair should be directly involved with JOI Inc. in the specification of RFPs and nomination of reviewers.

Austin moved, Moore seconded; vote: 15 yes, 1 absent

4. Russian Request for ODP Representatives to Visit Russia

Lewis brought up for discussion a recent request from Nikita Bogdanov for ODP scientists to go to Russia to give presentations on the results of Legs 147 and 148. PCOM discussed the general problems of interactions with the Russian science community. There was general sympathy to keep Russian scientists involved in ODP through such informal interactions because there was a large scientific population in Russia who were interested in ODP. Austin felt that the impact of lectures was limited, he felt insuring Russian access to ODP publications was a better investment. Fox agreed and related that there was a severe lack of written journals and materials in Russia. PCOM discussed ideas that would help ODP to better distribute literature in the Russian system.

PCOM discussed the specific request that had been made. Since the Russian request was specifically for more information on Legs 147 and 148, Mével volunteered her efforts to try go to Russia to talk about Leg 147 and would look for someone from Leg 148 to go with her. She felt that she could get funds from France to undertake this activity.

5. Western Pacific Seismic Network Proposal

Suyehiro asked PCOM to discuss the Western Pacific Seismic Network proposal (ODP proposal # 431—Suyehiro identified himself as a proponent) and he questioned whether or not it had received a fair review during the spring global rankings; he noted that LITHP had not included it in their global ranking. Austin felt that the proposal should not be ranked because it needed to be placed into context of the global OSN network program plan priorities, PCOM had made that clear in the past for these types of proposals. Suyehiro said that the proposal was not submitted as part of OSN and even so, it had been placed within the most recent prioritized OSN listing. He understood LITHP's need for proof of the technical feasibility of the program but questioned if the review/ranking process had been fair.

After discussion, PCOM's consensus was that in order for a proposal for drilling special-purpose holes to be ranked highly, the proposal needed to be fit into a global network plan. Lewis disagreed that a proposal should be forced to fit itself into a global network if it was designed as a single, geographically-isolated experiment. Lewis pointed to this proposal as an example of a proposal not within the mandates of any of the thematic panels and might be best handled as the ASRC Draft Report suggested—by having PCOM review and rank the proposal itself. Pyle suggested having a liaison from FDSN come to the August PCOM meeting and address this issue. PCOM agreed this would be a good option because the August meeting traditionally included guests from ODP liaison groups—which included FDSN. Lewis agreed to consult with an FDSN representative (Dziewanski/Purdy) about the proposal for the emplacement of a borehole seismometer (# 431).

PCOM continued to discuss how a proposal like # 431 should be handled. Since it was not a proposal that fit well into any panel mandates there was some support for having the proposal reviewed externally and letting PCOM consider it independently of the thematic panel review process. PCOM debated the scientific objectives of proposal # 431 and how it fit into the LRP objectives. Most felt that PCOM needed to know what the OSN priorities were in order to put a proposal like this into context with it. Austin's opinion was that PCOM's only commitment to these types of proposals was to view them in the global context and stressed that it would be bad a precedent for PCOM to contradict or go around the panel reviews. Mutter clarified that the reason LITHP did not rank proposal # 431 highly was that they did not feel it would be a good experiment for technical reasons.

Item 999. Review of Action Items and Voting on Motions Outstanding

PCOM reviewed a list of all of the motions, action items and consensus statements that had been presented during the meeting. Motions that had been discussed earlier but not officially voted on were presented for final consideration and voting.
[*Editor's note: The results of the vote are reported with each motion in the minutes where it was discussed*].

Lunch .... *12:45 - 1:30*

Ken Miller gave a presentation during lunch on the progress at land-based NJ/MAT drilling at Island Beach, New Jersey.

Item 1000. Long-Range Planning for Post - 1998

In order to begin planning for ODP in post-1998 time, Lewis asked PCOM to think about three principal questions: (1) What will be the main focus of the science in the program—deep drilling, ocean history sites, shelf drilling, or a selection of each? (2) What platforms will be required to achieve these science objectives—special purpose or general purpose vessel(s) ? (3) What level of funding will be required to support this type of program? Lewis felt that these were the issues critical to the continuation of ODP post-1998 and strategies that PCOM developed now would be important for the continued success of the program.

Austin questioned how PCOM could deal with long-term planning when the budget planning process was very short-term? PCOM discussed the budgetary situation for the near future and agreed that if the "doomsday scenario" of budget cuts occurred it would be very difficult to plan for a long-term future. However, PCOM agreed that it must begin to address post-1998 planning now, even if only for the static—and admittedly optimistic—case of level funding through 1998. Lewis pointed out that trying to maintain and increase money in the program would also have to be part of a long-range plan.

Natland wanted to see ODP become more program-oriented and pursue integrated drilling strategies instead of concentrating on individual projects. Austin thought that the program should restructure itself to focus on more effectively addressing specific thematic goals, he saw a need for two vessels in the program, one a long-term drilling project ship (6 months to a year), the other a moveable, multi-purpose vessel to drill legs like ODP did now. Larsen thought that there should be some vision applied to the program in order to get more money from partners, ODP should not expect to get more money for performing the same service. Mével agreed, changes in the program could open up possibilities for increases in the funding levels and she cited multiple platforms as a possible example. Von Rad saw a need for the program to have both shallow- and deep-drilling programs with multiple platforms, but he recognized that there would need to be a much more money in the program to do both of these types of drilling well.

PCOM discussed the assets it already had in the *JOIDES Resolution* and the efficiency of a single, multi-purpose platform with laboratory facilities, equipment and storage. It was recognized that these features would not be available to the program if several types of specialized vessels were contracted on short-term charter to do various types of drilling. PCOM agreed that adding another platform to the program would require doubling the budget and that in order to properly support multiple platforms the program needed to have strong international support and an increase in funding.

Mutter questioned why PCOM did not discuss the science planning and funding first, instead of platform planning? He felt that ODP needed to sell the program on the science not on a platform and suggested that global change was an area that ODP could make some headway into in terms of increased funding. PCOM debated whether or not ODP should try to sell itself through global change aspects. Further discussion covered the philosophical concept of "selling the science" and how justification angles applied to what ODP did in its science program.

Berger changed the subject of the discussion back to the decisions that were made earlier in the meeting regarding the potential budget cuts and proposed the following motion:

> Considering the importance of retaining the thrust of technological innovation during times of budgeting difficulties, PCOM asks TAMU and LDEO to make a list of program services not directly impinging on drilling activities that can be cut in times of future budget shortfall.

The motion was seconded by Mével and opened up for discussion. Berger explained that he did not want to see PCOM set a pattern of cutting out all aspects of technology development and innovation from the program when budgets got tight. He proposed this motion because he wanted other options to be available, options that he did not feel had been fully explored at this meeting, if this type of situation happened again.

Austin argued that PCOM, or a subcommittee of it, should do the list making for budget cuts and not leave it up to the subcontractors. Pyle countered that it was JOI's responsibility to make the list but added that he did not approve of the list making approach to budget cutting as a general practice. Fox questioned how any cuts could be made without having prioritized the near- and long-term science and technology goals to guide those cuts? Kidd wanted to make it clear that the innovation and technology, which were the main product of this international collaboration, were critical to the continued funding and participation of the international partners.

Having already passed a motion regarding budget priorities, PCOM discussed what purpose passing the motion would serve. PCOM felt that the earlier motion incorporated enough language to deal with the perceived problem. Berger withdrew the motion noting that his point had been made.

Lewis proposed that in order to prepare for post-1998 renewal PCOM should undertake a two-part strategy: (1) write a proposal describing the principal scientific goals of post-1998 drilling, and (2) write a paper describing the platform requirements and options to achieve these science goals. After discussion it was decided that a subcommittee of PCOM consisting Lewis and Kidd (next PCOM Chair) should work with PCOM's thematic panel liaisons to direct the revision of the White Papers—this would form the basis for completion of task 1. Task 2 would be investigated by Lewis and Kidd as the requirements of the first task became clearer. Lewis expected that synopses of these papers could be ready by the August PCOM meeting.

PCOM discussed Lewis' proposal and the most efficient way of accomplishing the planning tasks. There was concern over the timeframe that Lewis outlined given that the thematic panels would not be meeting prior to August. PCOM agreed that in order to get the information prior to the August PCOM meeting, it would be most effective to have the PCOM liaisons contact and work with the panel chairs. While they worked on this project, Lewis asked the liaisons to consider if they envisaged that the present thematic panel organization should be maintained or changed in the post-1998 advisory structure—were there better options for thematic panel organization.

Austin wanted to have the issue of post-1998 planning discussed by the panels at their fall meetings, the results could be presented to PCOM for further discussion at the annual meeting in December. Lewis wanted to complete this first task by August so that the panel chairs could be given specific direction from PCOM to take to their fall panel meetings in regards to White Paper revisions and the White Paper revisions could be kept on a timely track. PCOM agreed that the panels should add an aspect of long-range, post-1998 planning in their White Papers.

PCOM discussed the wording of a post-1998 planning statement. It was agreed that the approach would be to first define the science goals and then identify what type of platform(s) would be required to accomplish this science. After theses issues were addressed, PCOM would begin the process of identifying suitable platforms that would be available in a post-1998 timeframe. PCOM concluded the discussion and the meeting by adopting the following consensus statement:

In preparation for proposing a renewal of ODP beyond 1998, PCOM identifies 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 assigns a subcommittee, consisting of the PCOM Chair (Lewis) and next PCOM Chair (Kidd) to work with the thematic panel liaisons to direct the writing of White Papers by the thematic panels that can form the basis for task 1.

To accomplish task 2, PCOM assigns a subcommittee consisting of PCOM Chair (Lewis) and next PCOM Chair (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 these papers at the August 1993 PCOM meeting.

Meeting adjourned.. 3:30 PM

ACRONYM DICTIONARY

ACOS	Advisory Committee on Ocean Sciences
ABW	Antarctic Bottom Water
AGU	American Geophysical Union
AMC	axial magma chamber
APC	Advanced Piston Corer
ARC	Australian Research Council
ARCSS	Arctic System Science
ASRC	Advisory Structure Review Committee
ASTC	Association of Science and Technology Centers
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe
BGS	British Geological Survey
BHA	bottom-hole assembly
BHTV	borehole televiewer
BIRPS	British Institutions Reflection Profiling Syndicate
BMFT	Bundeministerium für Forschung und Technologie
BMR	Bureau of Mineral Resources
BRGM	Bureau de Recherches Géologiques et Minières
BSR	bottom-simulating reflector
CGC	Canadian Geoscience Council
CHT	cross-hole tomography
CORK	
CSDP	Continental Scientific Drilling Program
CSG	Computer Services Group (ODP)
CSM	Camborne School of Mines (UK)
CY	calendar year
DCB	diamond core barrel
DCS	diamond coring system
DEA	Drilling Engineering Association
DFG	Deutsche Forschungsgemeinschaft
DI-BHA	Drill-in bottom-hole assembly
DOE	Department of Energy
DP	dynamic positioning
DPG	Detailed Planning Group
DRB	diamond coring system retractable bit system
ECB	extended Core Barrel
ECOD	ESF Consortium for Ocean Drilling
ECR	East Coast Repository
EEZ	Exclusive Economic Zone
EMCO	ESF Management Committee for ODP
EIS	environmental impact statement
EMR	Department of Energy, Mines & Resources
ENSO	El Niño Southern Oscillation
EPR	East Pacific Rise
ESCO	ESF Scientific Committee for ODP
ESF	European Science Foundation
ETH	Eidgenössiches Technische Hochschule, (Zürich)
FARA	French-American Ridge Atlantic
FCCSET	Federal Coordinating Committee on Science Engineering & Technology
FDSN	Federation of Digital Seismic Networks
FMS	formation microscanner
FY	fiscal year
GCR	Gulf Coast Repository
GEOSECS	Geochemical Ocean Sections Study
GLOBEC	Global Ocean Ecosystem Dynamics
GOOS	Global Ocean Observing System
GSC	Geological Survey of Canada
GSGP	Global Sedimentary Geology Program
HRB	hard-rock guide base
HRO	hard-rock orientation
IDAS	isothermal decompression analysis system
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
ILP	International Lithosphere Program
IMT	Institut Méditerranéen de Technologie
INSU	Institut de Sciences de l'Univers
InterRIDGE	International Ridge Inter-Disciplinary Global Experiments
IOC	Intergovernmental OceanographicCommission
IPOD	International Phase of Ocean Drilling
IPR	intellectual property rights
IRIS	Incorporated Research Institutions for Seismology
JAMSTEC	Japan Marine Science and Technology Center
JAPEX	Japan Petroleum Exploration Company
JGOFS	Joint Global Ocean Flux Studies
JOIBOG	JOI Board of Governors
KTB	Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland
LANL	Los Alamos National Laboratory
LAST	lateral stress tool
LBL	Lawrence Berkeley Laboratory
LDEO	Lamont-Doherty Earth Observatory
LIPS	large igneous provinces
LRP	Long Range Plan
mbsf	meters below seafloor
MCS	multi-channel seismic
MDCB	motor-driven core barrel
MMS	Minerals Management Service
MOU	memorandum of understanding
MOR	mid-ocean ridge
MRC	Micropaleontological Reference Center
MST	multi-sensor track
NAD	North Atlantic Deepwater
NADP	Nansen Arctic Drilling Program
NAS	National Academy of Sciences
NATRE	NorthA Atlantic Tracer Release Experiment
NERC	Natural Environment Research Council
NGDC	National Geophysical Data Center
NOAA	National Oceanic & Atmospheric Administration
NRC	National Research Council
NSB	National Science Board
NSF	National Science Foundation
NSERC	National Science and Engineering Research Council (Canada)
OBS	ocean bottom seismometer
ODIN	Ocean Drilling Information Network

ODPC	Ocean Drilling Program Council
OG	organic geochemistry
OMDP	Ocean Margin Drilling Program
ONR	Office of Naval Research
ORI	Ocean Research Institute of Univ. of Tokyo
OSN	Ocean Seismic Network
PCS	pressure core sampler
PDC	poly-crystalline diamond compact (drilling bit)
PEC	Performance Evaluation Committee
PPI	Producer Price Index
RFP	request for proposals
RFQ	request for quotes
RIDGE,	Ridge Inter-Disciplinary Global Experiments (US)
ROV	remotely-operated vehicle
SCM	sonic core monitor
SCOR	Scientific Committee on Ocean Research
SCS	single-channel seismic
SES	sidewall-entry sub
SNL	Sandia National Laboratory
SOE	Special Operating Expense
SOW	Statement of Work
STA	Science and Technology Agency (of Japan)
SUSCOS	Subcommittee on U.S. Coastal Ocean Science
TAMU	Texas A & M University
TAMRF	Texas A&M Research Foundation
TOGA COARE	Tropical Ocean Global Experiment Coupled Ocean-Atmosphere Response Experiment
TTO	Transient Tracers in the Ocean program
UDI	Underseas Drilling, Incorporated
USSAC	US Scientific Advisory Committee
USSSP	US Science Support Program
VPC	vibra-percussive corer
VSP	vertical seismic profile
WCR	West Coast Repository
WCRP	World Climate Research Program
WG	Working Group
WHOI	Woods Hole Oceanographic Institution
WOB	weight on bit
WOCE	World Ocean Circulation Experiment
WSTP	water sampler, temperature, pressure (downhole tool)

JOIDES Committees and Panels:

BCOM	Budget Committee
DMP	Downhole Measurements Panel
EXCOM	Executive Committee
IHP	Information Handling Panel
LITHP	Lithosphere Panel
OHP	Ocean History Panel
OPCOM	Opportunity Committee (disbanded)
PANCHM	Panel Chairs Meeting
PCOM	Planning Committee
PPSP	Pollution Prevention and Safety Panel
SGPP	Sedimentary and Geochemical Processes Panel
SMP	Shipboard Mearurements Panel
SSP	Site Survey Panel
STRATCOM	Strategy Committee (disbanded)
TECP	Tectonics Panel
TEDCOM	Technology and Engineering Development Committee

Detailed Planning Groups (DPG) and Working Groups (WG):

DH-WG	Data-Handling WG
NAAG-DPG	North Atlantic-Arctic Gateways DPG (disbanded)
NARM-DPG	North Atlantic Rifted Margins DPG (disbanded)
OD-WG	Offset Drilling WG (disbanded)
SL-WG	Sea-Level WG (disbanded)
SWD-WG	Shallow Water Drilling Working Group

FY93 Programs:

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

FY94 Programs:

NARM Volcanic-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 Engineering	Diamond Coring System engineering leg (Leg 157)
TAG	Trans-Atlantic Geotraverse Hydrothermal Field (leg 158)

LIST OF APPENDICES

Draft Minutes
JOIDES Executive Committee / ODP Council Meeting
June 22 - 23, 1993 — College Station, Texas

Table of Contents

SUMMARY OF EXCOM ACTIONS

The June meeting of EXCOM was held June 23, 1993 at the Ocean Drilling Program facility on the campus of Texas A & M University, College Station, Texas. The following is a brief summary of the main items of business covered at the meeting.

APPROVALS

1. **Advisory Structure Review Committee Final Report**

   EXCOM passed a motion to accept the Report of the Advisory Structure Review Committee (ASRC) and thanked the committee members and its Chair, Hans Dürbaum, for a most thorough and focused report.

   Regarding the implementation of the ASRC, the following statements were adopted *by consensus*:

   EXCOM requested that PCOM examine each of the 12 subjects identified in the report and, where desirable, to implement immediately the recommendations.

   EXCOM recognized the need for discussion on some of the issues and, in those cases where PCOM had significant concern about specific ASRC recommendations,

   EXCOM requested PCOM review and evaluate those recommendations and prepare specific alternative motions for EXCOM's consideration at the January meeting .

   EXCOM requests the Chair of EXCOM to review these motions with the ASRC Chair and to present a summary at the next EXCOM meeting.

   It was the wish of EXCOM to take final action on the recommendations of the ASRC and on PCOM's alternatives at its January meeting.

2. **FY94 Program Plan**

   EXCOM endorsed the FY94 Program Plan with a motion, but noted that the DCS test scheduled for FY94 may need to be postponed to 1995 for budgetary reasons.

POLICY UPDATES

1. **Changes to the ODP Policy Manual**

   EXCOM passed a motion adopting all of the proposed wording changes, as presented at the meeting, to the ODP Policy Manual. These minor changes were required as a result of the internationalization of the JOIDES Office..

2. **Procedures for Contract Development, Specification and Review**

   EXCOM passed a motion stating that all ODP contracts let by JOI Inc. and its subcontractors should fully reflect the advice of the JOIDES Advisory Structure, particularly those that involve important new ODP program directions. To ensure that the interests of the JOIDES Advisory Structure are fully represented, the PCOM Chair, and as appropriate the EXCOM Chair, should be directly involved with JOI Inc. in the development of contracts that are determined (by JOI Inc.) to require Advisory Structure input. In those cases where RFPs are issued, PCOM Chair (and as appropriate the EXCOM Chair) should advise JOI Inc. on the specification of the RFP, on the proposal review process and the nomination of proposal reviewers.

ITEMS OF BUSINESS

1. **Core Repository**

   EXCOM passed a motion requesting JOI advise TAMU to:

   1. Definitize procedures for moving cores, with advice from PCOM and the panels.
   2. Visit and enter negotiations with Universität Bremen regarding technical and financial aspects of establishing the ODP Atlantic repository in Bremen.
   3. If technical and fiscal aspects of an ODP repository at Bremen are satisfactory, to contract for such services with Universität Bremen and conclude plans for core movement.
   4. If discussions with Bremen did not conclude satisfactorily, accept the offer of LDEO.

2. **FY94 Budget Contingencies**

Part 1

To accommodate a $ 4 M shortfall, EXCOM passed a motion recommending that JOI calculate the savings that would accrue from:

- DCS termination and related reduction in engineering staff and operations.
- Cessation of in-house publication.
- Cutting back logging to routine operations only.
- Other actions that JOI may identify, while attempting to keep disruption of the FY94 program to a minimum (in particular by not laying up the ship or withdrawing invitations to shipboard scientists).
- Administrative savings throughout the Program.

JOI is to inform PCOM, at its August 1993 meeting, of its conclusions, and should take PCOM's response into account if implementation becomes necessary.

Part 2

Turning to the possibility of a $ 1 M shortfall, EXCOM endorsed the following resolution:

PCOM should be encouraged at its August meeting to defer Leg 157 and associated DCS expenditure ($ 740 K) into FY95.

Part 3

EXCOM recommended that, if major redesign of the Program was called for, innovation and productivity should be preserved as much as possible. Elimination of units or functions that would have a pervasive negative effect on the Program should be avoided. 17

LONG-RANGE PLANNING

1. **PCOM's Long-Range Planning Efforts**
   EXCOM endorsed, with a motion, the PCOM consensus (PCOM 1993A-2) regarding long range planning and requested that PCOM present EXCOM with a status report on science planning and platform requirements at EXCOM's January 1994 meeting.
2. **Japanese Proposal for the "New Era of Ocean Drilling"**
   In the second part of the long-range planning motion, EXCOM:
   A. recognized the importance of the "New Era of Ocean Drilling" concept for the future of scientific ocean drilling,
   B. recognized the need for close exchange/cooperation,
   C. proposed to hold a workshop jointly with STA/JAMSTEC immediately following the next EXCOM meeting to investigate future modes of scientific ocean drilling with emphasis on cooperation. It was suggested that, in addition to EXCOM, representatives from the JOIDES advisory structure, TAMU and LDEO be invited to attend this workshop.

MEMBERSHIP CHANGES

Art Maxwell was elected, by acclamation, to replace Jim Briden on BCOM.
Bruce Rosendahl was elected, by acclamation, to be Chair of BCOM, also replacing Briden.

FUTURE EXCOM MEETINGS

Winter 1994:	January 31 - February 2, 1994, in Kyoto, Japan
Summer 1994:	June 27 - 30, 1994, in Washington, D. C.
Winter 1995:	to be held in the US , meeting place and dates yet to be determined
Summer 1995:	to be held in the UK, dates and place yet to be determined

RETIREMENTS

EXCOM recognized Craig Dorman, Doug Caldwell (absent) and Dave Falvey for their service to EXCOM and contributions to ODP; this was their last EXCOM meeting.

List of Participants

EXCOM

Helmut Beiersdorf - Bundesanstalt für Geowissenschaften und Rohstoffe (Germany)
James Briden - Natural Environment Research Council (United Kingdom)
Craig Dorman * - Woods Hole Oceanographic Institution
Robert Duce * - Texas A&M University, College of Geosciences and Maritime Studies
David Falvey - Bureau of Mineral Resources (Canada-Australia Consortium)
Charles Helsley - University of Hawaii, School of Ocean and Earth Science and Technology
Dennis Kent * - Columbia University, Lamont-Doherty Earth Observatory
Yves Lancelot - Laboratoire de Géologie du Quaternaire (France)
Arthur Maxwell * - University of Texas at Austin, Institute for Geophysics
Arthur Nowell (Chair) - University of Washington, College of Ocean and Fishery Sciences
John Orcutt * - University of California, San Diego, Scripps Institution of Oceanography
Bruce Rosendahl * - University of Miami, Rosenstiel School of Marine and Atmospheric Science
Renzo Sartori - European Science Foundation (Consortium for Ocean Drilling)
Nick Pisias * - Oregon State University, College of Oceanic and Atmospheric Sciences
Asahiko Taira ** - Ocean Research Institute, University of Tokyo (Japan)

Liaisons

David Goldberg - Wireline Logging Services (ODP-LDGO)
Brian Lewis - PCOM Chair, University of Washington, College of Ocean and Fishery Sciences
Bruce Malfait - US National Science Foundation
Thomas Pyle - Joint Oceanographic Institutions, Inc.
Philip Rabinowitz - Science Operator (ODP-TAMU)

ODP Council

Donald Heinrichs - National Science Foundation (United States)
Michele Fratta - European Science Foundation (Consortium for Ocean Drilling)
John Knill - Natural Environment Research Council (United Kingdom)
Francois Madelain - IFREMER (France)
Dietrich Maronde - Deutsche Forschungsgemeinschaft (Germany)
Robin Riddihough - Geological Survey of Canada

JOIDES Office, University of Washington

Bill Collins - Executive Assistant and non-US Liaison
Karen Schmitt - Science Coordinator

Guests and Observers

Elizabeth Ambos - US National Science Foundation
Paul Dauphin - US National Science Foundation
Hans Dürbaum (ASRC Chair) - Bundesanstalt für Geowissenschaften und Rohstoffe (Germany)
Lou Garrison - Texas A&M University
Grant Gross - US National Science Foundation
G. Ross Heath * - College of Ocean and Fishery Sciences, University of Washington
Eiichi Kikawa - Ocean Development Division, Science and Technology Agency (Japan)
Marcia McNutt - Dept. of Earth, Atmosphere & Planetary Sciences, MIT
Jiro Naka - Deep Sea Research Department, JAMSTEC (Japan)
Katsuyoshi Omori - Planning Department of JAMSTEC (Japan)
Shuji Unno - Ocean Development Division, Science and Technology Agency (Japan)

* - JOI Board of Governors
** - ODP Council

DRAFT MINUTES OF THE JOIDES EXCOM / ODP COUNCIL MEETING

Tuesday, June 22, 1993 9:00 am

JOINT SESSION OF EXCOM AND ODP COUNCIL

ITEM 456. INITIAL BUSINESS

Nowell and Heinrichs, meeting Co-Chairs, welcomed everyone in attendance; Madelain and Taira were recognized as the new ODPC members for France and Japan respectively, Taira would also serve as the EXCOM member for Japan. Nowell reviewed changes in the agenda for the meeting and the revised agenda was adopted by acclamation.

ITEM 457. ADVISORY STRUCTURE REVIEW COMMITTEE REPORT

Dürbaum reviewed the history, membership and terms of reference of the Advisory Structure Review Committee (ASRC). The ASRC had held two meetings, one in December 1992, in conjunction with the PCOM and PANCH meeting in Bermuda and the second in March 1993, in conjunction with a TEDCOM meeting at ODP-TAMU. The first draft of the ASRC report was circulated to PCOM and all Panel Chairs in February 1993. Comments from PCOM and the panels were solicited by the ASRC and used to revise the report. The second draft of the report was completed in April and reviewed by PCOM at their April meeting. The final ASRC Report was completed in May 1993 for presentation to EXCOM at this meeting.

Dürbaum explained that the intent of the ASRC Report was to help ODP identify areas where the advisory structure could be improved. The major proposal in the ASRC Report concerned: (1) long-range planning and focus, (2) proposals, and (3) Technology Development and TEDCOM.

1. Long-Range Planning

Dürbaum presented the ASRC's recommendations for increasing the long-range planning within the advisory structure and for focusing ODP in the period 1993 - 1998 (Appendix 1.0). In regards to long-range planning, the ASRC recommended that ODP should,

- evaluate the technological feasibility of long-term drilling targets,
- realistically examine what has been achieved, why failures have occurred, and what achievements are likely given present constraints on time and money,
- reduce the time PCOM spends short-term drilling plans.

In reference to the last recommendation, Dürbaum explained that an important theme in the ASRC Report was their conclusion that PCOM should take a greater lead in the task of long-term planning. The ASRC recognized that in order for PCOM to do this, the thematic panels needed to be strengthened to take on some of PCOM's short-term planning tasks. The ASRC cited the recent PCOM four-year plan motion as an example of how not to do long-term planning —the ASRC felt that the themes identified in the motion reflected the biases of the PCOM subcommittee that wrote the motion and was not a thoughtful presentation of the long-term goals of ODP. Instead, the ASRC concluded that PCOM should put more work into the long-range planning process and that the thematic panels should set the thematic objectives for the program.

With respect to focusing the program in the period 1993 - 1998 in order to achieve major drilling objectives, the ASRC Report contained specific proposals for:

- strengthening the thematic panels and TEDCOM
- focusing the thematic panel White Papers
- shorten and streamline the proposal review process
- develop better communications between and among PCOM and TEDCOM/service panels

2. Proposal Review Process

McNutt presented the ASRC Report findings concerning the proposal review process (Appendix 1.1). The ASRC recommended that the advisory structure:

- shorten the amount of time from proposal submission to acceptance but lengthen the amount of time it takes to prepare for actual drilling
- give relevant information at an early stage to service panels/TEDCOM (via proposal abstracts)
- ensure that objectives can be met with the drilling plan (via a DPG)
- continue to provide the outside community of scientists and funding agencies input and guidance on the broad areas of future ODP drilling operations.

Regarding the first point, McNutt explained that the first half of the recommendation was put forth in recognition of the small percentage of success—roughly 10%— for proposals in the ODP system. The

ASRC had concluded that shortening the proposal-to-leg time frame would decrease the workload for panels and proponents. The second part of the recommendation was based on input the ASRC had received from the science operator; ODP-TAMU wanted more time added to preparation for actual drilling. The third point, adding a DPG to formulate a drilling plan, was recommended by the ASRC as a quality control check within the ODP system to ensure that it was feasible to achieve the scientific goals of a proposal through drilling.

McNutt outlined the specifics of the ASRC proposal for implementing a shortened timetable for proposal review (Appendix 1.2). McNutt explained that the "abstract", as envisioned by the ASRC, was a detailed, organized document submitted in place of a full proposal that would give the ODP all the necessary information to examine the drilling idea, including special technological requirements, scientific objectives and logistics. After the annual DPG process, the ASRC recommended that the thematic panels send a definite message to the proponents of proposals not chosen about whether or not they should resubmit their proposals or if it had any real chance of ever being drilled.

The ASRC recommended that PCOM give more guidance to the earth science community on where the ship would be going in the future. The ASRC felt that the proposal-driven nature of the ship's track was not effective because of the perception by proponents that it was difficult to get a proposal scheduled in this system due to long lead-times. The ASRC concluded that if a longer-term ship track was set, it would encourage submission of proposals for areas that might not be attracting proposals at the moment.

The ASRC proposed that the advisory structure adopt new review criteria for proposals to be used by the thematic panels, site survey panel, TEDCOM and DMP (Appendix 1.3). McNutt reviewed the criteria and explained how they would provide PCOM with a more accurate review of a proposal's scientific and technical feasibility.

3. Technology Development and TEDCOM

Garrison reported that the ASRC viewed the process of technology development as an area critical to long-range planning but found it in need of reform (Appendix 1.4). In order for ODP to go beyond the current level of technology, the ASRC recommended that TEDCOM and ODP-TAMU become more involved in long-term planning. In addition, the ASRC recommended that an outside evaluation of technology development be instituted by EXCOM and that:

1. the evaluation be instituted as soon as possible and be conducted by an outside group of technical experts in drilling who have experience with high-tech engineering,
2. the reviewers should work with ODP-TAMU to review cost-effectiveness of ongoing efforts, the adequacy of assigned manpower, and the probability of success of projects underway,
3. the review group should carefully examine TEDCOM's philosophy, procedures and membership with the idea of improving their interactions with both ODP-TAMU and PCOM.

Nowell thanked the ASRC members for their reports and opened up the floor for questions and discussion. Dorman asked what PCOM's opinion was on the ASRC's recommended proposal review procedures. Lewis answered that PCOM agreed with some of the ideas and noted that several of the suggestions had been already instituted. Lewis asked what the ASRC's opinion was regarding the advisory panels making recommendations to bodies other than PCOM—to ODP-TAMU for example. McNutt answered that the issue was addressed in the ASRC Report under the section dealing with the service panels; the ASRC recommended that a subcommittee of PCOM be established to deal with service panel recommendations. It was the ASRC's conclusion that the reason panels had bypassed PCOM with their advice and/or recommendations in the past was that there was too much time delay in the process.

Pisias reviewed some of the reasons that the science panels had been changed from regionally-based to thematically-based and recounted that the change had been conditional on the thematic panels becoming involved in the detailed planning previously done by the regional panels. He felt the failure of the system was that the thematic panels were not doing the detailed planning that they should to ensure that their ranked list of proposals also reflected drilling feasibility. McNutt explained that what the ASRC objected to, and had written this proposal for, was the lack of detailed planning during the final stages of scheduling—such as they had observed at the PCOM meeting in Bermuda last December. The ASRC agreed that the regional panels had provided more appropriate levels of scrutiny and planning in the past. Pisias preferred to see the thematic panels do their homework and provide PCOM with more detailed reviews of the proposals for both science and drilling feasibility. McNutt agreed that the thematic panels needed to better package drillable legs but she was not sure that there was sufficient expertise on the thematic panels to accomplish the necessary evaluation and planning needed for actually scheduling legs of drilling.

Helsley questioned if prioritizing "where the ship will be" over "where the best science is" was a good idea for a proposal-driven program? McNutt countered that the best-science strategy was a good one for explored areas but not for unexplored areas. The ASRC's opinion was that PCOM needed to be more proactive in this regard since they should know where the high-priority themes would be best addressed. Therefore, by announcing a firm direction for the ship track, PCOM could also encourage production of proposals to address high-priority themes.

Orcutt asked what the ASRC's opinion was on the use of ODP as a service to provide holes to other programs—OSN for example? Dürbaum replied that the ASRC had addressed the requirements for these types of special-use holes, even though the need for some types of special-use drill holes had not yet been fully proven, in the ASRC discussion on the need for circumnavigation. McNutt added that the White Papers should incorporate ideas for special-use holes as well as for broader uses of the ship for projects with multi-thematic objectives.

Nowell concluded the discussion of the ASRC Report and deferred any action on the report until Wednesday's EXCOM session.

Coffee and tea break .... *10:15 - 10:30 AM*

ITEM 458. JAPANESE DEEP-DRILLING VESSEL

Unno presented a proposal from STA /JAMSTEC to ODP for an international cooperative effort for a "New Era of Ocean Drilling" (Appendices 2.0 - 2.3). As envisioned by STA/JAMSTEC, the "New Era of Ocean Drilling" would be an international cooperative program—construction and operation costs will be shared by participating countries. Japan intended to make an active contribution to the program, specifically in program formulation, drilling ship construction, and in program operations. STA/JAMSTEC wanted to enter into active international discussions with interested countries to clarify details of "New Era of Ocean Drilling" and wished to include a close liaison with ODP/JOIDES. The primary issues that such discussions would need to address were: (1) scientific strategy and requirements, (2) technical requirements, (3) management requirements, (4) legal and financial aspects.

An Action Program was presented by Unno that included the following timetable for the "New Era of Ocean Drilling" (Appendices 2.4 - 2.6):

Action Program	Schedule
1. Study the three broad categories of:	1993 to early 1995
(a) scientific discussion	
(b) technical discussion	
(c) policy discussion	
2. Reach agreement on each country's commitment	by mid-1995
3. Start design and construction of a new deep-sea drilling ship	1996 - 2000
4. Science operations in the "New Era of Ocean Drilling"	2001 -

Unno proposed that STA/JAMSTEC and ODP/JOIDES take advantage of the EXCOM meeting in Japan during January 1994 to have a workshop that would focus on the scientific strategy and technical requirements for the "New Era of Ocean Drilling". The workshop would include ODP/JOIDES participants and invite other key overseas scientists.

1. Scientific Aspects & Objectives of the New Era for Ocean Drilling

Naka reviewed the past scientific achievements of DSDP and ODP, praising these programs as a highly successful examples of the combined application of science and engineering. He then gave a brief overview of the scientific objectives of the ODP Long Range Plan and presented the proposed scientific objectives of the "New Era of Ocean Drilling" (Appendices 2.7 - 2.21). Naka explained that the scientific objectives of the "New Era of Ocean Drilling" would try to build upon the results of the second phase of ODP, particularly those results that had a direct societal impact—such as global change or earthquake prediction. Possible objectives included:

1. Super deep drilling—to penetrate the oceanic crust and ultimately the upper mantle.
2. Detailed reconstruction of global environmental changes.
3. Long-term observation systems (seismometers & geophysical/geochemical equipment).

Scientific objectives were still being discussed and there was a strong desire in Japan to develop a close liaison with ODP to make the "New Era of Ocean Drilling" science program successful. Naka stressed that the science objectives could be modified by input of an international planning committee.

Taira related some background information on why this proposal was being presented at this time. He explained that the Japanese STA was a government agency equivalent to NOAA and NASA combined; JAMSTEC was a part of STA. The university community, such as ORI, was part of the

Monbusho educational funding system—similar to NSF. Taira explained that, at present, the Japanese government required that new technology development by STA be internationalized. So, in order for STA/JAMSTEC to begin a program for deep drilling, they need to create an internationalized development program. Taira urged ODP to take advantage of this proposal and saw it as a great opportunity. However, action needed to be taken within the next year-and-a-half in order to maintain funding for this project in Japan. STA/JAMSTEC needed a clear statement from JOIDES about how ODP could work with them in this endeavor.

Beiersdorf wanted to know if Japan was planning to provide the ship for free or would it expect to split the costs, both of construction and operations? Omori answered that at this moment STA's position was that both construction and operation costs would be shared with partners at some level but that Japan would make a "major" contribution. Briden did not think that the costs should be considered at this point and welcomed the effort of a JOIDES member in taking a substantial lead in this type of long-range planning and development. Briden considered it more important to talk about the concept of the "New Era in Ocean Drilling" and pointed out that the Japanese proposal envisaged an immense program—ODP's challenge was to see if it could commit itself to embark on such an endeavor.

Heinrichs related the history of the ODPC's relationship with STA during the development of this proposal. He felt the STA proposal was in line with the discussions that the MOU renewals had brought up regarding future ships for the program, these discussions had also included Russian and French vessels. Heinrichs suggested that one objective of this week's meeting should be to investigate how the JOIDES advisory system could build a close liaison with the STA/JAMSTEC program—both politically and scientifically.

Nowell concluded the discussion by asking EXCOM to consider the Japanese proposal for the "New Era in Ocean Drilling" and to prepare for further discussion on the issue at Wednesday's EXCOM session.

ITEM 459. ODP COUNCIL

Heinrichs reported that the focus of ODPC for the last year had been the signing of the renewal MOUs and issues related to renewal. There had been a polling of members to see if a Russian membership could be supported via member country contributions; unfortunately the answer was no. Heinrichs then outlined the main topics for the upcoming ODPC meeting this year: (a) uncertainty of membership for FY94, specifically problems with Can-Aus and French memberships, (b) a membership audit of contributions, (c) the Japanese proposal—political/management considerations, (d) aspects of program management, specifically the structural roles between the prime contractor and subcontractors.

ITEM 460. PROGRAM MANAGEMENT REPORTS

1. NSF

a) Budgets—FY93 & FY94

Malfait reported on FY93 operations funding (Appendix 3.0); the US contribution to the Program Plan budget ($ 43,197,000) was 58% and the six international members provided 42%. For FY94, JOI was given preliminary target budget of $ 44.9 M in early January; this budget assumed six partners. NSF completed its administrative review of the FY94 Program Plan in April and a final target figure should be available in late June. Malfait stressed that since the number of international partners was still uncertain, a procedure for reducing the FY94 budget should be identified.

b) MOUs / Contracts

MOUs with the UK and Germany had been signed (Appendix 3.1). NSF had signed and sent out for signature the MOUs for Japan and the ESF. The date for the signing of the MOU with France was still uncertain, as was the Can-Aus situation. In addition to the MOUs, Malfait reported that a new contract was being negotiated between NSF and JOI. JOI was also negotiating its subcontracts to ODP-LDEO and ODP-TAMU.

2. JOI Inc.

Pyle reviewed JOI's program management activities in FY93 (Appendix 4.0), noting a particularly favorable review of ODP in the Solid Earth Sciences and Society Report ("Keck Report"—Appendix 4.1).

Dorman returned to the subject of the Japanese proposal and asked Unno if there was a detailed set of plans or a technical description available for their planned vessel? Dorman thought it would be desirable for EXCOM/ODPC to have copies of all available information because the nature of the design would influence the costs of construction and operation as well as the science that could be done on board—would DCS be compatible with the vessel for example. Dorman also questioned the present level of flexibility in the design of the vessel and asked if changes could still be made or if STA/JAMSTEC would seek ODP input on the design? Omori indicated that JAMSTEC had been working on the ship's design for a few years already and that they would try to provide EXCOM/ODPC with some information on the conceptual and technical designing efforts. Taira agreed that there was still a lot of flexibility in design of the ship and that the program was at the stage where input from the scientific community was needed to guide further design development. Taira stressed that design priorities needed to be set, particularly with the phased development program that was planned, and that the development of liaisons with ODP was critical to this process.

Lancelot asked if the US had any plans for the future replacement of the *JOIDES Resolution* or if there were any other US efforts going on that EXCOM/ODPC needed to be aware of ? Heinrichs said that NSF had committed to using the *JOIDES Resolution* until 1998, with the option of going to 2003. NSF had also promised its partners a review of the program in the 1995-96 time frame that would consider other vessel developments. If, at that time, there were other vessels under development that would meet US requirements for drilling Heinrichs said that the US would try to work into those programs. If there were no other drilling vessels under development, the US would continue with the *JOIDES Resolution* program. Other than Japan, France and Russia, Heinrichs knew of no other programs developing this type of drilling vessel capability. He assured EXCOM/ODPC that the US would not drop out of scientific ocean drilling in the near future, it was still very much a part of US national science goals.

Lancelot pointed out that ODP had received several overtures from national programs developing initiatives for new drilling ships, but ODP had never sent back a strong indication that they would be receptive to the incorporation of new vessels into the program. Lancelot stressed that 1996 may be too late to begin looking for new vessels, particularly given the fact that there was a Japanese proposal on the table now. Lancelot wanted EXCOM to make a more definite statement to guide these national efforts—either to encourage them or discourage them. Helsley agreed and asserted that if ODP wanted to continue to operate post-1998 a decision regarding alternate platforms needed to be made soon to allow time for such a platforms to come on line. Briden thought that the hesitance of ODP to make positive statements about future program plans was the perceived straight jacket of level funding. Briden suggested that the solution to this problem would require major reorganization of the funding structures and perhaps a greater effort at conveyance of the societal impact of ODP's work to funding agencies and the public.

Lunch break .... *12:00 - 1:00 PM*

3. Science Operator Report, ODP-TAMU

Rabinowitz introduced the ODP-TAMU staff members who would present the Science Operator Report (Appendix 5.0).

a) Leg 147 (Carl Richter, Staff Scientist)

Richter summarized the scientific objectives, drilling operations and preliminary results of Leg 147 at the Hess Deep rift valley (Appendices 5.1 - 5.6).

b) Leg 148 (Laura Stokking, Staff Scientist)

Stokking summarized the scientific objectives, drilling operations and preliminary results of Leg 148 at Hole 504B (Appendices 5.7 - 5.11).

c) Leg 149 (Adam Klaus, Staff Scientist)

Klaus summarized the scientific objectives, drilling operations and preliminary results of Leg 149 on the Iberian Abyssal Plain (Appendices 5.12 - 5.15).

d) Publications & Science Services (Russ Merrill, Science Services Manager)

Merrill presented the publications schedule of ODP volumes (Appendices 5.16 - 5.17) and noted problems with the growth of volumes, particularly the *Proceedings*. Merrill assured EXCOM that actions were being taken to shorten the volumes. He then reviewed the annual distribution of ODP samples from all repositories and the ship for the period 1984 to 1993 (Appendix 5.18) and included a breakdown of the geographic distribution of total sample requests for DSDP and ODP cores (Appendix 5.19).

e) Information Services (John Coyne, Database Group Manager)

Coyne outlined the philosophy behind the past, present and future development of information services at ODP-TAMU (Appendices 5.20 - 5.21). Coyne then explained the Computer RFP process that was underway and how it would affect the development of information services on the ship and at ODP-TAMU.

f) Engineering and Drilling Operations (Barry Harding)

Harding outlined the primary development engineering projects at ODP-TAMU and gave an update on the status of each (Appendix 5.22).

4. Wireline Logging Services Report, ODP-LDEO

Goldberg reviewed recent logging operations on Legs 148-149 (Appendices 6.0 - 6.4) and showed slides of the MAXIS 500 unit installation at the Panama port call (Appendix 6.5). Logging results from Leg 149, Hole 899B, were presented(Appendices 6.6 - 6.7) and future logging operations on Legs 150 through 153 were outlined (Appendix 6.8). Goldberg updated EXCOM on ODP-LDEO's new initiatives (Appendix 6.9) and clarified the current ODP-LDEO subcontracting structure, emphasizing the planning advantages that the new structure will provide to ODP logging operations.

5. PCOM Report

a) Four-Year Plan

Lewis presented a location map of active proposals and reviewed the 1993 Global Ranking (Appendices 7.1 - 7.3). PCOM used the Global Ranking to arrive at a Four-Year Plan which was adopted at the April PCOM meeting. The Four-Year Plan: (a) affirms the FY94 science program (Appendix 7.4), (b) outlines ODP's FY95 and FY96 objectives in terms of thematic goals, and (c) specifies a general ship's track. The Four-Year Plan will be published in *EOS* in June along with a solicitation for proposals (Appendix 7.6).

b) Long-Range Planning (post-1998)

Lewis reported on PCOM's long-range planning activities (Appendix 7.7 - 7.8). At the April meeting, PCOM tasked itself to: (1) describe long-range science goals, and (2) derive the drilling platform requirement and options necessary to achieve these scientific goals. A PCOM subcommittee was working on part 1 by helping the thematic panels revise their respective White Papers. The revisions will be directed toward reviewing scientific accomplishments achieved by drilling and focusing of the scientific goals achievable by drilling. Action on part 2 of the motion was just beginning. Lewis stressed that communications with the Japanese would be an important aspect of this activity.

c) Budgets

At its April meeting PCOM considered what budget options ODP had if there was a one-time $ 1 M shortfall. After much discussion, PCOM passed a motion recommending delaying the DCS leg from FY94 into FY95 (Appendix 7.9). PCOM also considered a $ 3 M shortfall, but concluded that a major review and revision of the direction of the program would have to be made if such a large shortfall were to occur and did not consider the issue in detail.

Lewis reviewed ODP's overall budget problems—unrelated to the potential Can-Aus shortfall. Lewis explained that increased funding for engineering and technology development had been included in the LRP budgets for FY94 and FY95 (Appendices 7.10 - 7.11); this was done in recognition of the increased costs of DCS and other technological developments expected to be coming on-line at this time. Lewis pointed out that since FY91 there had been significant shortfalls between the actual budgets and the projected LRP budgets. He explained that the origin of the current budget crunch was due to the fact that the present budget was inadequate to support both the science operations and the technological developments—such as DCS—foreseen in the LRP. Lewis warned that, with budgets below the LRP, there would have to be significant cuts into science operations in order to accommodate continuing technological development of equipment like DCS (Appendix 7.12). In addition to cuts in science operations, another negative consequence of the budget situation was the termination of the Deep Drilling RFQ (Appendix 7.13), a technology initiative developed by ODP-TAMU in conjunction with TEDCOM. The loss of this initiative meant that ODP would not receive a timely and realistic evaluation of the possibilities, problems and costs of using the *JOIDES Resolution* with a riser for deep drilling—an issue critical to long-range planning.

d) Review of RFP Specification and Review Procedures

In response to recommendations by BCOM and DMP, PCOM passed a motion at its April meeting regarding the process of development, specification and review of RFPs (Appendix 7.14). Lewis asked EXCOM to endorse the PCOM motion.

Orcutt asked if opportunities for alternate scientific uses of the *JOIDES Resolution* would be incorporated into the revised White Papers? Pisias also urged PCOM to make sure that the long-term commitments JOIDES made to other science programs were honored and that these programs had access to ODP. Lewis was confident that these issues would be adequately addressed in the revised White Papers. Lewis also endorsed the ASRC proposal to have PCOM directly review proposals that do not fit within the panel mandates.

Coffee and tea break .... *3:00 - 3:15 PM*

ITEM 461. EXCOM AD HOC REPORT

1. Long-Range Strategy Report

Helsley presented two handouts on long-range planning, one with Helsley's views (Appendix 8.0 - 8.1) and the other, as requested at the last EXCOM meeting, submitted by Barry Raleigh (Appendix 8.2 - 8.3). Helsley explained that his report was an attempt to focus EXCOM on some action items that could be implemented at this meeting. He stressed that renewal would depend on the impression that the earth science community had of ODP at the time the renewal review took place. Therefore, Helsley concluded that it would be critical to have a strong program in the period 1995 -1996 in order to ensure post-98 renewal. Helsley recommended the following actions to EXCOM:

1. instruct PCOM to review the current LRP and revise it to be consistent with the currently available budget levels,
2. ask PCOM to attempt to identify several major targets and or objectives to be incorporated into the program in late 1995 or early 1996 that would have significant chances for success and that would contribute to an "up beat" attitude toward the program during the period of intensive review that will occur in 1996,
3. discuss, and hopefully reach consensus on, hosting an international workshop—but not another COSOD meeting—to address the technology and platform requirements that will be needed to meet the full COSOD objectives in the post-98 time frame;
4. pursue new partners internationally,
5. pursue alliances with other programs that are out there, i.e. the continental drilling program, the RIDGE community and the global change community.

Helsley concluded by emphasizing that for the post-98 program it would be necessary to strike a balance between the three competing components of the current program—deep drilling (long times on one site), shallow APC drilling (high-precision sampling), and intermediate drilling (the majority of the current program). Helsley's opinion was that, unless a multi-platform program became financially feasible, these three types of drilling would be best supported from a platform like the *JOIDES Resolution* ; he felt that ODP's challenge was to provide a balanced program that would continue to enjoy the support of the entire earth science community.

EXCOM/ODPC discussed the common themes between Helsley's report, the ASRC Report and PCOM's recent long-range planning activities. Briden was disappointed with the conclusion of Helsley's report, he preferred that ODP move toward a position of selective excellence rather than trying to maintain a completely balanced science program. Helsley clarified that his final point was made in order to stress that both sediment and hard-rock drilling had to be addressed by ODP to keep their present constituency, he wanted these end-members kept in the program in order to maintain ODP's broad-based scientific perspective.

ITEM 462. 1994 PROGRAM PLAN BUDGET REPORTS

1. BCOM Report

Briden outlined the budget shortfalls for FY94 that BCOM had addressed at their March meeting, the proposed budgets presented to BCOM were $ 3.5 M over available funds. To address the FY94 budget shortfalls BCOM had set out some principles, both short- and long-term, to guide their budget cutting while trying to maintain cutting-edge science. In order to preserve money for special features and operations, BCOM had to cut base budgets at TAMU, LDEO, JOI. BCOM considered the consequences of further reductions due to partner shortfalls and Briden reviewed the conclusions that BCOM had reached regarding the potential consequences of either a $ 1 M or a $ 3 M budget shortfall.

BCOM reconvened on June 21st to further address possibilities for budget shortfalls of either: (a) $ 4 M, or (b) $ 1 M—scenarios that could arise from: (a) the combination of the French not signing their MOU and Can-Aus not finding a third partner, and (b) lack of a Can-Aus third partner (Appendix 9). After considering a $ 4 M shortfall scenario, BCOM presented JOI with a list of budgetary items and recommended that JOI inform PCOM of the estimated savings that could be realized by cutbacks in these areas. BCOM also recommended that PCOM prioritize these budget cutting options at their August meeting. Therefore, if radical budget cuts became necessary, JOI would have direction from PCOM to guide them. BCOM also reviewed the $ 1 M budget shortfall scenario and endorsed PCOM's motion to move the DCS testing leg back into FY95 if it became necessary to cut an additional $ 1 M in FY94.

Briden returned to the statements BCOM had made in the minutes of its March meeting and explained that BCOM was very concerned about the funding predicament ODP was in. He summarized BCOM's suggestions to ameliorate the situation in the short term—revision of the Science Plan, reduction or elimination of technical innovation, and further base budget cuts—but he emphasized that BCOM saw this approach as having a mid- to longer-term deleterious, and potentially fatal, impact on ODP. In the long term, BCOM recommended that the LRP be reformulated to reflect fiscal realities or else a there would be a need for a radical change in the funding and/or operation of ODP.

Pisias asked if BCOM saw revising the LRP as simply cutting out engineering development or if they had they identified ways of adjusting the operations so that innovation could be sustained at present funding levels? Pisias suggested that there were other cut-back options to be considered—for example, were there ways of using existing technology to gather and distribute data rather than buying a completely new computer systems upgrade. Pisias asserted that ODP should not reduce its capacity for technology development and innovation, there must be other ways to reduce base budgets that had not yet been identified. Briden agreed and explained that BCOM was only pointing out the issues that needed to be addressed by the advisory system.

Dorman asked how many of the globally-ranked proposals required DCS; he wondered what the impact would be on pending proposals if the DCS development was terminated? Lewis explained that, at present, not very many proposals required the use of the DCS. However, Lewis clarified that this was a result of the past unreliability of the system and the uncertain timetable for DCS development; proponents were reluctant to say that their drilling program required DCS until they were certain that it would be available. Pisias asked if postponing DCS testing into FY95 would just delay the current budget problem or if budgets would be able to accommodate it at this later time. Lewis felt that it would be accommodated in FY95; he acknowledged that, as a result of moving DCS testing, there would not be much budget flexibility left in FY95.

2. 1994 NSF Budget Planning

Heinrichs reviewed the actual budgets from FY91 - FY92, the estimated FY93 budget and the projected FY94 budget in a six partner scenario (Appendix 10.0). The six-partner FY94 budget was still uncertain but Heinrichs was reasonably confident that Can-Aus would get a third partner and renew their membership with the program.

Heinrichs reported that uncertainty had recently arisen with the French membership. France had indicated to NSF that its commitment to ODP remained strong and they would sign the MOU, however, they would not be able to sign until mid-August. Heinrichs was concerned that the French signing could not be assured and he recommended that ODP develop a contingency plan in the event of a non-signing by France (Appendix 10.1). He then reviewed the best-case ($ 44.9 M) and worst-case ($ 40.9 M) scenarios for the ODP budget, emphasizing that ODP needed to have a plan for the worst-case budget shortfall scenario.

3. 1994 ODP Budget and Science Planning

a) FY94 Program Plan

Pyle reviewed the FY94 Program Plan budget at the $ 44.9 M level, noting that JOI's public relations plan had been eliminated by BCOM, the PEC-4 was postponed to FY95 and SOE's were funded at a level of $ 3,020 K (Appendix 11.0). Pyle addressed the possibility of a FY94 budget shortfall and outlined PCOM's and BCOM's action plans for various budget scenarios.

Pyle brought up the issue of meeting costs, specifically post-cruise and JOIDES panel meetings (Appendix 11.1). He pointed out that post-cruise meetings were significantly more expensive when not held at ODP-TAMU and he felt that the advantage of having the post-cruise meetings in different countries was mostly an image thing. In order to bring down meeting costs Pyle recommended that mail, fax and e-mail be used more extensively for the review process so as to cut down panel meetings to one per year. Secondly, JOI calculated that it would be less expensive if meetings were required to be held in hosted sites—places where a person and an institution could be designated to provide the necessary arrangements and logistical support for the meeting. Pyle asked ODP to seriously consider reducing the costs of meetings, despite the images they might convey, in this time of science operations cuts.

b) Oceanus Issue

Pyle gave an overview of progress on the *Oceanus* Special Issue that JOI was planning to celebrate the 25th Anniversary of Scientific Ocean Drilling (Appendix 11.2 - 11.3).

c) Publications

Pyle reminded that the issue of cutting ODP publications was brought up to EXCOM several years ago. Pyle wanted to raise this issue again and indicated that he would like to reinvestigate several publication options, specifically the possibility of publishing results through AGU. Briden agreed that it had been a recurring issue but saw the problem in two contexts; one context was a reaction to the current crisis mode of budget cutting, the other was as an overall policy change that would save money. EXCOM discussed their previous decision against implementing an external publications policy and concluded that a thorough, in-depth analysis of any potential change of publications policy should be done before a final decision was made.

4. 1994 PCOM Science Planning

Lewis reported that the only pending change to the FY94 Science Plan was moving Leg 157 (DCS testing) into FY95—if there was a $ 1 M budget shortfall. This would be accomplished by moving Leg 158 forward into the Leg 157 slot and having the DCS test become Leg 158—as scheduled, Leg 158 was in FY95 (September 30 - November 25, 1994).

❖ *End of Day 1* .... *4:25 PM*

Wednesday, June 23, 1993 9:00 AM

ITEM 463. MEMBERSHIP REPORTS

1. Can-Aus

Falvey reported that the Can-Aus Consortium was confident that they had funds to sustain two-thirds of a full membership and were actively pursuing a third party to provide the funds for the remaining one-third. Can-Aus was meeting with a potential partner this week in Ottawa. Falvey noted that the EXCOM and PCOM positions would be switching to Canadian (John Malpas) and Australian (Richard Arculus) representatives as of October 1, 1993. Falvey would become the ODP Council member for Can-Aus. The Australian Secretariat would remain at the University of New England and it also becomes the official Can-Aus Office as of October 1.

Riddihough reviewed the history of events since his report last year, specifically with regard to the Canadian funding situation. He announced that the Canadian Council had been reorganized, Riddihough had stepped down as Chair and was replaced by Malpas. The Canadian Council had been actively looking for funds since the funding crisis began, in April it was decided that Canada would have to look for a new partner. Riddihough explained that funding for science in Canada was in trouble due to recent governmental downsizing.

Falvey explained that Can-Aus would propose to ODPC that they accept a Can-Aus two-thirds partial membership for a year in order to allow Can-Aus more time to secure an additional partner. Falvey suggested that, for the future, ODP consider mechanisms to incorporate partial memberships for accommodating smaller countries within ODP.

2. ECOD

Sartori reported that ECOD had finalized their financial commitments, ESF would sign the MOU with NSF next week. Ten countries were committed financially, ECOD was hoping that all 12 countries of the first phase would eventually join in for the second phase. Sartori indicated that it was possible that countries in the consortium could change in the future. ECOD was still looking for better coordination of its ODP-related science and were successfully using workshops to accomplish this. There were efforts being made to coordinate ship schedules to help improve the site survey capabilities of the consortia.

Fratta wanted to emphasize that the financial commitment of ESF was in place and the MOU would be signed next week. There was still the opportunity for additional countries to join the consortium. However, if this occurred the committed partners would reduce their contributions and funding would be maintained at the same level.

3. France

Lancelot began his report with reassurances that the French renewal was not a problem, he stressed that France did not intend to withdraw from ODP. France intended to sign for 5 years, with a review in 1996. Lancelot explained that recent elections and budget reductions had created the delay in signing of the MOU. The budget cuts were not a surprise but had delayed setting of final budgets. IFREMER's budget was now finalized and they would be ready to sign the MOU around the first or second week of August. Lancelot hoped that it would be possible to have the MOU signed before the PCOM meeting in August but he was not sure it would be possible.

Lancelot felt that France now recognized that the thematic emphasis of ODP was beginning to come into its own; CNRS had recently reorganized so that ODP themes were a large part of its science program. In addition, the French Geological Society meeting in December would showcase ODP. France had put major efforts into promoting ODP science within their country and Lancelot felt that they had been successful in attract new French participants to the program. Beiersdorf pointed out the German-French undersea research initiative as an example of international collaboration on ODP-related science.

Heinrichs brought up the issue of whether or not EXCOM felt it needed to address the budget issues that would arise if France left the program. Lancelot objected to the need for this exercise, he reiterated that France would sign their MOU in August; he understood that it would be a relatively late signing, but there was no doubt that they would sign.

4. Germany

Maronde reported that the German MOU was signed on May 3, 1993. The issue of intellectual property rights was still contentious but was being addressed, the clause under question had been be deleted from the MOU so that the signing could be done in May. Maronde explained that, even though science budgets in Germany were not good, funds for Priority Programs for ODP had been increased (Appendix 12.0). Maronde compared the German Priority Program funding for international travel to other national ODP programs (Appendix 12.1). Maronde noted that continental drilling initiatives were making progress in Germany; he encouraged ODP participation in the upcoming Potsdam Conference.

Beiersdorf elaborated on the status of German science budgets and spending levels for ODP-related science support and travel. Beiersdorf reported that the German high-temperature magnetometer had performed successfully in recent operations at Hole 504B on Leg 148. The German ODP Conference in Frieberg was very successful, Beiersdorf reported on the talks, activities and highlights of the meeting. The next German ODP Conference was scheduled for March 2 - 4, 1994 in Cologne.

5. Japan

Taira reported that the Japanese had received their MOU and were close to signing, some minor problems remained with several new clauses in the MOU. Negotiations were still being held with NSF over these details but Taira was confident that the signing would be in the very near future. Taira presented two new publications that had been produced in the last year by a Japanese review committee, one report had been published in the Japanese ODP Journal and the other in a Japanese results volume. Budgets for the ODP support program in Japan had been cut this year as a result of competition with other science programs. Taira outlined recent site survey activities in Japan and announced that several workshops were scheduled in Japan next year to identify priorities for science and site survey.

6. United Kingdom

Briden reported that the UK, partly as a result of last year's ODPC discussions, had established a "Russia" fund with some UK eastern European aid money. The fund was a one-time sum of 60,000 British Pounds ($ 90 K US) that would be used to enable Russian scientists to continue to work on ODP-related science in their labs, for travel to other labs and to maintain a training program for marine scientists. The fund would be administered through JOI and the UK was working with JOI to advertise the fund appropriately and to develop guidelines for its use.

Briden then reviewed recent site-survey activities, science activities, research initiatives, technological developments and equipment upgrades in the UK. Knill reported that construction on the new Southampton oceanographic facility construction had begun, it was due to be finished in February 1995.

7. United States

Malfait reviewed the FY92, FY93 and requested FY94 NSF and Geosciences Directorate budgets (Appendix 13.0). He then outlined the NSF ODP budget for FY92 and FY93 (Appendix 13.2). In FY93, NSF awarded $ 5.5 M for unsolicited science projects, down $ 1 M from last year (Appendix 13.2). In other items; Malfait reported that Ambos would be leaving NSF, USSAC would be reviewed during the summer/fall, and NSF would be moving to northern Virginia beginning n August (Appendix 13.3).

Pyle reported on the activities and support that JOI/USSAC provided for workshops, site survey augmentation studies, the Distinguished Lecturer Series, Ocean Drilling graduate fellowships, and the summer research program for undergraduates (Appendices 13.4 - 13.6). Pisias noted that USSAC was still considering the LITHP proposal for a meeting to help in the revision of their White Papers. Pisias indicated that, due to high costs, USSAC may ask JOIDES to provide some of the necessary funds.

Coffee and tea break .... *10:30 - 10:45 AM*

ITEM 464. CORE REPOSITORY

Nowell noted that copies of all four of the core repository letters of intent had been made available for review to everyone present. He explained that Leinen had not been able to serve on the original Core Repository Review Subcommittee (Dorman, Taira, Leinen) and that Maxwell had been asked to serve as a replacement.

Dorman reported that the Core Repository Review Subcommittee had reviewed the letters of intent to provide core repository facilities for ODP. He recounted the history of the process that had led to this point, beginning with the Briden Report, which originally suggested that the core repositories could be internationalized. At the January 1993 meeting, EXCOM decided to ask for letters of intent from parties interested in providing core repository facilities. As a result, letters of intent were received from: Universität Bremen, Canada, GEOMAR and LDEO. Dorman described the review procedure the subcommittee used, LDEO was used as a baseline for comparison of others facilities. The subcommittee also considered the issue of moving the existing core to a new facility and had concluded that, in order to justify moving the existing core collection, there had to be significant cost advantages to doing so.

After analysis of the letters, the Core Repository Review Subcommittee had concluded that the letter of intent from Universität Bremen had significant cost advantages and further enhanced internationalization of theprogram. As a result of their analysis, the subcommittee recommended to EXCOM that action be taken to: (1) definitize procedures for moving cores, with advice from PCOM and the panels, (2) visit and enter negotiations with Universität Bremen regarding technical and financial aspects of establishing the ODP Atlantic repository in Bremen, (3) if technical and fiscal aspects of an ODP repository at Bremen are satisfactory, to contract for such services with Universität Bremen and conclude plans for core movement, and (4) if discussions with Bremen do not conclude satisfactorily, accept the offer of LDEO.

Pisias asked if any consideration had been given to the question of what would happen when ODP was no longer around and what the disposition of the cores would be? Dorman agreed that this issue had not yet been adequately addressed, NSF and the international partners needed to discuss this issue.

END OF JOINT EXCOM/ODPC SESSION

Joint Session Adjourned .... *10:45 AM*

EXCOM SESSION

ITEM 465. OLD EXCOM BUSINESS

1. Adoption of the Minutes of the January 26 - 28, 1993 EXCOM Meeting

Motion

> EXCOM approves the revised minutes of the EXCOM meeting of Jan. 26 - 28, 1993.

Dorman proposed, Maxwell seconded. Vote: 15 yes, 1 absent

2. ASRC Final Report

After a review of Tuesday's discussion on the ASRC Report, the following motion was proposed:

Motion

> EXCOM accepts the Report of the Advisory Structure Review Committee (ASRC) and thanks the committee members and its Chair, Hans Dürbaum, for a most thorough and focused report.

Helsley proposed, Rosendahl seconded. Vote: 15 yes, 1 absent

The following statements concerning the ASRC Report were then adopted by **consensus:**

Consensus

> EXCOM requests PCOM to examine each of the 12 subjects identified in the report and, where desirable, to implement immediately the recommendations.
>
> EXCOM recognizes the need for discussion on some of the issues and in those cases where PCOM has significant concern about an ASRC recommendation EXCOM requests PCOM to review and evaluate the recommendation and bring for EXCOM consideration at its next meeting (January 94) specific alternative motions.
>
> EXCOM requests the Chair of EXCOM to review these motions with the ASRC Chair and to present a summary at the next EXCOM meeting.
>
> It is the wish of EXCOM to take final action on the recommendation of the ASRC and PCOM's alternatives at its January meeting.

Briden questioned if PCOM would be able to take this task up in August? Lewis assured EXCOM that it would be addressed in detail, a PCOM subcommittee was already working on it. Helsley thought it was important to note that the ASRC recommended that PCOM spend more time on long-range planning and revise the membership of TEDCOM; he wanted EXCOM to send a message to PCOM that those ideas needed to be addressed. Nowell agreed but was confident that the point had been made to the PCOM Chair and that the message would be carried to PCOM.

Lancelot was hesitant to endorse the procedure of letting a body like PCOM reform itself based on the ASRC Report, he wanted EXCOM to review the reform process more closely. Nowell agreed but wanted EXCOM to first have a formal report from PCOM on what they were planning to do in response to the report before mandating any changes. Orcutt pointed out that some of the suggestions applied to EXCOM—location of the JOIDES Office for example—and he thought that EXCOM should be sure to examine these issues in more detail.

EXCOM debated whether or not they wanted to take a position on contentious proposals in the ASRC Report and then send a message about implementation of these proposals to PCOM. The alternative was the possibility of having to overrule changes that PCOM might implement but that EXCOM disagreed with. Helsley cautioned that full implementation of the program would increase the workload of the advisory structure and some of the ASRC proposals implied cost increases to the program, he stressed that the element of added cost needed to be addressed by PCOM's report to EXCOM. Lancelot asserted that guidance was needed for PCOM and should be provided in a brief, formal summary of EXCOM's opinion on each proposal.

Beiersdorf thought that shortening the proposal life span, by using the proposed ASRC annual DPG process and timetable, was a good idea and that PCOM should try to implement this proposal. Taira countered that PCOM still had to look at the drilling plans in detail and that by delegating the process out to a DPG, ODP would lose the guidance a strong PCOM provided. Instead of a DPG, Taira preferred that PCOM seek more balance between its long-range planning and the annual planning duties. Pisias agreed that the system was not broken and did not see why it should be fixed; he pointed out that some of these ASRC ideas had been tried before and that, as a result of trial and error, there were good reasons that the system was as it was. Pisias thought that the most visible aspect of the program was leg-by-leg planning and that what PCOM needed was balance, not just long-range planning duties. Helsley shared Pisias' concerns about implementing changes to the system, cautioning that there may be a reasons for why the current system was configured as it was.

Nowell concluded the discussion by tasking Lewis to report the EXCOM discussion on the ASRC Report to PCOM and to have PCOM prepare a report on the ASRC proposals. EXCOM would review PCOM's recommendations and make final decisions on the proposals at that time. Nowell also asked that PCOM's report include discussions on alternatives to ASRC proposals and, if PCOM chose not to implement an ASRC proposal, the reasons PCOM did not want to change the present system.

3. Core Repository

At this point, the representatives of the institutions and countries that had submitted letters of intent were asked to leave the room.

Based on the Core Repository Review Subcommittee's report, the following motion was proposed:

Motion

> EXCOM requests JOI advise TAMU to:
> 1. Definitize procedures for moving cores, with advice from PCOM and the panels.
> 2. Visit and enter negotiations with Universitat Bremen regarding technical and financial aspects of establishing the ODP Atlantic repository in Bremen.
> 3. If technical and fiscal aspects of an ODP repository at Bremen are satisfactory, to contract for such services with Universitat Bremen and conclude plans for core movement.
> 4. If discussions with Bremen do not conclude satisfactorily, accept the offer of LDEO.

Dorman proposed, Duce seconded. Vote: 12 yes, 1 absent.
3 members not voting due to conflicts of interest.

EXCOM discussed the contents of the letters of intent, the management of core curation and the movement of existing cores. NSF's position was that there were no policy prohibitions to having a repository in a member country and that opening a new repository overseas was basically a management issue. EXCOM discussed the implications of moving the entire core collection to a repository in Europe if Bremen were to pay for the move. The annual cost savings that would be realized by accepting the Bremen proposal were reviewed. The conclusion was that this motion would initiate a positive step toward cost savings—approximately $ 200 K/yr— and internationalization for the program. The vote was taken at the conclusion of the discussion.

Lunch break .... *12:00 - 1:15 PM*

4. JOIDES Policy Changes

a) Changes to Operational Procedures

Nowell explained that, as a result of the internationalization of the JOIDES Office, there would need to be some minor wording changes to ODP's Operational Procedures. Nowell presented the specific wording changes that would be required as a result of the JOIDES Office moving overseas to an international partner country (Appendix 14.0 - 14.3). The meaning and intent of the specific wording changes were reviewed. The discussion concluded with the following motion:

Motion

> EXCOM adopts the proposed wording changes, as presented, to the ODP Policy Manual.

Helsley moved, Duce seconded. Vote: 15 in favor, 1 absent.

ITEM 466. NEW EXCOM BUSINESS

1. Follow-up on 1994 Budget Issues and BCOM Schedule

EXCOM discussed the following three-part motion presented as a follow-up to the BCOM report:

Motion

> **Part 1**
>
> To accommodate a $ 4 M shortfall, EXCOM recommends that JOI should calculate the savings that would accrue from:
>
> * DCS termination and related reduction in engineering staff and operations.
> * Cessation of in-house publication.
> * Cutting back logging to routine operations only.
> * Other actions that JOI may identify, while attempting to keep disruption of the FY94 program to a minimum (in particular by not laying up the ship or withdrawing invitations to shipboard scientists).
> * Administrative savings throughout the Program.
>
> JOI should inform PCOM, at its August 1993 meeting, of its conclusions, and should take PCOM response into account if implementation becomes necessary.
>
> **Part 2**
>
> Turning to the possibility of a $ 1 M shortfall, EXCOM endorses the following resolution:
>
> PCOM should be encouraged at its August meeting to defer Leg 157 and associated DCS expenditure ($ 740 K) into FY95.
>
> **Part 3**
>
> EXCOM recommends that, if major redesign of the program is called for, innovation and productivity should be preserved as much as possible. Elimination of units or functions that would have a pervasive negative effect on the Program should be avoided.

Briden proposed, Dorman seconded Vote: 15 in favor, 1 absent.

Helsley questioned if a specific motion was needed, noting that the contingency addressed in this motion was in the BCOM minutes, or if the BCOM minutes should be endorsed instead. Nowell advocated that EXCOM make an explicit statement on these budget scenarios. Heinrichs warned that the planning needed to happen early so there would be time to get ready for any of these contingencies. Helsley did not see the need for these budget statements to be made so strongly since France had indicated that they would sign their MOU—the drastic $ 4 M shortfall stated in the motion implied the lack of French commitment. Briden thought that this motion was part of contingency planning, and the tone of the motion reflected a belief that the worst-case scenario was not a likelihood. After discussion, EXCOM amended Part 1 of the motion to incorporate the same wording as the BCOM report. Duce pointed out that the three sections of the motion were different, the first was just affirmation of the BCOM report and not an approval for any budget cutting; the bottom two were giving EXCOM approval for budget cutting scenarios. He was concerned that in the case budget cuts were required, EXCOM would not have approved any prioritization of the budget cutting options listed in Part 1.

2. Ocean Drilling Program FY94 Program Plan Approval

EXCOM discussed the following motion and its provision for moving the DCS testing into FY95. There was concern over whether or not there would be any real budget savings by this move and if the budget for DCS testing could be accommodated in FY95. Helsley also questioned whether or not the FY94 Program Plan was realistic with the given budget constraints. Lewis indicated that the Program Plan was realistic and that the necessity for taking action on the provision to move DCS into FY95 would be necessary only in the event of a $ 1 M shortfall caused by the Can-Aus membership situation. Discussion concluded with the following motion:

Motion

> EXCOM endorses the FY94 Program Plan, while noting that the DCS test scheduled for FY94 may need to be postponed to 1995 for budgetary reasons.

Nowell proposed, Maxwell seconded. Vote: 15 in favor, 1 absent.

3. Actions Required from the Joint ODP Council - EXCOM Meeting

a) Procedures for Contract Development

In response to the request from Lewis for EXCOM to endorse the PCOM motion regarding procedures for contract development, EXCOM discussed the following motion:

Motion

> All ODP contracts let by JOI Inc. and its subcontractors should fully reflect the advice of the JOIDES Advisory Structure, particularly those that involve important new ODP program directions. To ensure that the interests of the JOIDES Advisory Structure are fully represented, the PCOM Chair, and as appropriate the EXCOM Chair, should be directly involved with JOI Inc. in the development of contracts that are determined (by JOI Inc.) to require Advisory Structure input. In those cases where RFPs are issued, PCOM Chair (and as appropriate the EXCOM Chair) should advise JOI Inc. on the specification of the RFP, on the proposal review process and the nomination of proposal reviewers.

Pisias moved, Beiersdorf seconded. Vote: 14 in favor, 1 abstention, 1 absent.

EXCOM debated the necessity for a motion like this, specifically the question of what contract situations EXCOM and/or PCOM would want to be involved in. Lewis cited the Computer RFP as an example where this type of process had been productive for ODP. Helsley thought that this motion was too specific, he felt that the process should work as it was supposed to and EXCOM should not need to pass a motion that simply told JOI to follow advisory structure advice.

4. Long Range Planning

EXCOM discussed the following two-part motion to formalize actions EXCOM wanted to take regarding long-range planning:

Motion

> **Part 1**
>
> EXCOM endorses the PCOM consensus (1993A-2) regarding long range planning and requests that PCOM present EXCOM with a status report on science planning and platform requirements at it s January 1994 meeting.
>
> **Part 2**
>
> EXCOM:
>
> A. recognizes the importance of "New Era of Ocean Drilling" concept for the future of scientific ocean drilling.
>
> B. recognizes the needs for close exchange/cooperation.
>
> C. proposes to hold a workshop jointly with STA/JAMSTEC immediately following the next EXCOM meeting to investigate future modes of scientific ocean EXCOM, representatives from the JOIDES advisory structure, TAMU and LDEO be invited to attend this workshop.

Duce proposed, Taira seconded. Vote: 13 in favor, 3 absent.

Dorman questioned if the STA/JAMSTEC proposal for the Japanese drill ship was a project or a concept? Taira felt it was somewhere in between, a bit more of a concept at this stage. Briden asked STA/JAMSTEC to provide EXCOM a more detailed draft of the Japanese proposal that would more accurately reflect the status of the project.

Helsley brought up the issue of his suggested LRP revision, he asked EXCOM to include in this motion a definite statement that the LRP is no longer viable. Lewis explained that the current revision of the White Papers would, in effect, be the LRP revision. Helsley disagreed, since the LRP was no longer viable, he felt that it should not be allowed to exist. Pisias countered that the LRP was intended to be a living document and to undergo progressive change in response to changes in the program and funding—it should be changed, not thrown out. Heinrichs said he didn't think the LRP should concern the program, it was viewed as ambitious at the time it was compiled. Helsley worried that it would be used as the planning document that the program would be judged against.

EXCOM discussed how the LRP was being used to direct the program and if there had been enough analysis of where the plan would take the program given the yearly budget shortfalls that were being experienced. Kent pointed out that the program may not be well served by White Paper revisions if the four themes could not be supported financially by the system—this question would not be answered by simple white paper revision. Lewis explained that revising the White Papers was a way to refocus the expectations and goals of the program. When PCOM put together the revised White Paper package, PCOM planned to incorporate a section on what ODP could reasonably expect to accomplish in the next few years given the funds available. Kent wanted PCOM to consider narrowing the breadth of the program in order to sharpen the accomplishments of particular themes; to do this it might be necessary to cut out some types of thematic science. Kent pointed out that present budget problems were only compounding the loss of the seventh member—Russia. Lewis agreed and urged EXCOM to increase their efforts to raise more funds for the program.

ITEM 467. FUTURE EXCOM BUSINESS

1. Future EXCOM meetings

- a) **Winter 1994:** **January 31 - February 2, 1994, in Kyoto, Japan (workshop on Feb. 3)**
- b) **Summer 1994:** **June 27 - 30, 1994, in Washington, D. C.**
- c) **Winter 1995:** **to be held in the US , meeting place and dates yet to be determined**
- d) **Summer 1995:** **to be held in the UK, dates and place yet to be determined**

ITEM 468. OTHER EXCOM BUSINESS

1. New International Partners

EXCOM discussed progress in trying to obtain new international partners for ODP. Helsley questioned if any attempts had been made to form a Latin America consortia? Heinrichs said that there had not. The ad hoc committee (Leinen, Falvey, Sartori and the JOI liaison—Nowell) had not yet taken any action, but Nowell said JOI would soon be convening the subcommittee—the new JOI President would be taking a lead role in this effort.

Rosendahl indicated that Miami has been in contact with Uruguay and Argentina, he related his experience with the scientific interests in these countries. Rosendahl stressed that NSF and JOI should take the lead in developing these potential leads for new partners. Lewis agreed and indicated that PCOM was also interested in the process and would help if needed, but JOI and NSF that needed to point the way.

Maronde asked about the state of communication with the Russian ODP contacts? Heinrichs indicated that there had been no recent or in depth communications with Bogdanov.

Sartori asked for Fratta to be his alternate on the ad hoc committee in order for him to help with these efforts. Sartori also indicated that some contacts had been made with Israel and Portugal but their possible commitments would be small.

2. Membership of BCOM

Briden was stepping down as Chair of BCOM, EXCOM needed to appoint another member to BCOM. However, with the addition of Kidd to BCOM in 1994, as next PCOM Chair, a US EXCOM member needed to be appointed for March 1994. Maxwell was added to BCOM by acclamation.

3. Co-Chief Scientist Designations and Budget Shortfalls

Dorman raised the question of what would happen to the membership of shipboard parties if the French pulled out? EXCOM discussed the necessity for a contingency plan for this possibility but decided that it was TAMU's job to deal with shipboard party membership and the likelihood of a crisis was low given the French position that they would sign in August.

4. New Chair for BCOM

Rosendahl was selected by acclamation to be the new Chair of BCOM, replacing Briden.

5. EXCOM Service Recognition

EXCOM thanked Dorman for his service to EXCOM and contributions to ODP, specifically the Dorman Report which has had an important impact on the program, Dorman would be leaving Woods Hole in the fall.

EXCOM thanked Caldwell for his service to EXCOM and contributions to ODP, Caldwell would be stepping down from EXCOM this fall.

EXCOM thanked Falvey for his service to EXCOM and contributions to ODP, this was his last meeting as an EXCOM member. He becomes the Can-Aus ODPC member after this meeting.

ADJOURNMENT

❖ *End of Day 2*.. *3:45 PM*

LIST OF APPENDICES

SELECTED ACRONYMS

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
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
LRP	Long Range Plan
mbsf	meters below seafloor
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)
SCS	single-channel seismic
SOE	Special Operating Expense
STA	Science and Technology Agency (of Japan)
USSAC	US Scientific Advisory Committee
USSSP	US Science Support Program
WG	Working Group

BUDGET COMMITTEE REPORT
21 June 1993, College Station, TX

1. The Budget Committee met at ODP, Texas A&M University on 21 June. Members present were James Briden (Chair), Yves Lancelot and Brian Lewis. Apologies were received from James Austin and Bruce Rosendahl. Tom Pyle (JOI), Donald Heinrichs (NSF), Phil Rabinowitz and Tim Francis (TAMU) and David Goldberg (LDEO) attended.

2. The meeting was convened to address the budgeting consequence of any shortfall in membership subscriptions for FY94 onwards. At the time of the meeting French participation could not be confirmed, and only $2M of the CAN-AUS subscription appeared to be secure, though that was awaiting final confirmation. BCOM therefore addressed two hypothetical scenarios: $4M and $1M shortfall in FY94 below the Target Figure ($44.9M) that had been assumed at the March 1993 meeting.

3. To accommodate a $4M shortfall, BCOM recommends that JOI should calculate the savings that would accrue in FY94 from:

- DCS termination and related reduction in engineering staff and operations.
- Cessation of in-house publication.
- Cutting back logging to routine operations only.
- Other actions that JOI may identify, while attempting to keep disruption of the FY94 program to a minimum (in particular by not laying up the ship or withdrawing invitations to shipboard scientists).
- Administrative savings throughout the Program.

Note: BCOM advised against preemptive moves to achieve immediate savings in late FY93 and early FY94 that would have involved withdrawal from contractual commitments.

JOI should inform PCOM, at its August 1993 meeting, of its conclusions, and should take PCOM response into account if implementation becomes necessary.

4. Turning to the possibility of a $1M shortfall, PCOM should be encouraged at its August meeting to defer Leg 157 and associated DCS expenditure ($740k) into FY95. The further $260k of needed economies will be agreed by BCOM in July at the latest, based on advice of JOI.

It was noted that the rescheduling of the DCS development and test leg could be deferred until the longer term membership and income position becomes known.

5. BCOM considered other funding scenarios in passing. It concluded that if the shortfall in FY94 were $3M and not $4M, that could be tackled by moderating the scenario in section 3 above.

In subsequent years, with level funding from USA and five full international partners, there would be an ongoing shortfall of $3M per year.

At this time it seems probable that both membership uncertainties should be clear in time for the normal planning cycle to operate for FY95. BCOM advises that, if major redesign of the Program is called for, innovation and productivity should be preserved as much as possible. Elimination of units or functions that would have a pervasive negative effect on the Program should be avoided.

BCOM did not discuss the loss of two members, which would clearly be a matter for ODP Council.

College Station, TX
22 June 1993

Sandia National Laboratories
Albuquerque, New Mexico 87185

June 28, 1993

Dear Colleague,

Enclosed you will find the Draft Minutes of the JOIDES Downhole Measurements Panel that assembled at the Scripps Institution of Oceanography last May. In my judgment, the meeting was an outstanding success in that it established directions for the difficult logging exercises at Barbados, it set the stage for the fall meeting with the Lithospheres Panel that will feature operations at the TAG hydrothermal system, and the Panel got a start on the prioritization process that is force upon us by the budgetary situation. Furthermore, an e-mail system was established to expedite DMP business. It will be activated in July.

Please have a good summer.

Respectfully yours,

Peter Lysne
Chairman, JOIDES DMP

MEETING OF THE JOIDES DOWNHOLE MEASUREMENTS PANEL

SCRIPPS INSTITUTION OF OCEANOGRAPHY
LA JOLLA, CALIFORNIA
MAY 25-27, 1993

EXECUTIVE SUMMARY

The DMP has instituted a policy of focusing its attention on legs that present difficult drilling and downhole measurement scenarios. Past work at accretionary prisms indicates that the Barbados exercise (Leg 156) falls into this category. Accordingly, Barbados was featured at the present meeting. The next DMP Meeting will feature the TAG Hydrothermal System (Leg 158).

In view of the potential benefit of using measurement-while-drilling technology at Barbados, a team drawn from the ranks of the Wireline Logging Service Operator, the Science Operator, the Barbados Co-Chiefs, and interested scientific personnel was formed to generate an appropriate position statement for consideration by the DMP. Since contractual interactions with Schlumberger play an essential role in this activity, the Wireline Operator will take the lead in generating the statement which will be presented to the DMP at its next meeting. (Minutes, Items 7-10.)

The DMP notes that the DCS effort, presently Leg 157, may be dropped from the schedule thus moving the TAG program forward and causing a very short time frame for high-temperature tool development. The DMP further notes that none of the tools proposed by the Wireline Logging Service Operator for the TAG operations are operational, let alone having passed any third-party-tool requirements. Finally, the DMP notes that budgetary resources are scarce, yet TAG represents a very important forward step for the ODP. Thus the DMP makes the following recommendation:

RECOMMENDATION 93-2.

The DMP recommends to PCOM that the TAG Downhole Measurements Program be given the highest priority by the Wireline Logging Service Operator, that the resources necessary for the success of this effort be drawn from those presently available to the Operator, and that the Operator present a plan for downhole measurements at TAG to the DMP and the LITHP during their joint meeting next October. This plan should include input from the TAG proponents, as well as a statement as to how the Third-Party Tool Requirements will be satisfied. (Minutes, Items 11.a.-11.c)

The DMP reviewed the logging plans presented by the Wireline Logging Service Operator for Legs 150-155. The DMP noted that the proposed plans were an extension of past activities that were successful. Thus, the DMP formulated the following recommendation:

RECOMMENDATION 93-1.

The DMP recommends that PCOM approve the proposed logging activities for Legs 150-155 as put forth by the Wireline Logging Service Operator with the understanding that the Operator initiate discussions with the appropriate Co-Chiefs so that the logging program can be incorporated into the science plans. (Minutes, Items 5.e. and Appendix)

The DMP is very cognizant of the strong support for the pore-fluid-sampling initiative coming from SGPP, LITHP, and TECP. Furthermore, the DMP recognizes the reality of the budgetary situation that caused PCOM to withhold monetary support for the initiative, but the DMP is concerned that momentum will be lost unless forward steps are made in the very near future. Thus, the DMP formulated the following recommendation:

RECOMMENDATION 93-3

The DMP recommends to PCOM that; (1) a group of self-supported experts pertinent to the pore-fluid-sampling RFP be drawn from the ODP community, (2) that Joris Gieskes be responsible for the institution and coordination of this group; and (3) that this group provide documentation as to the feasibility and costs associated with the development and deployment of a fluid-sampling system. The DMP further recommends that PCOM help promulgate the thrust throughout the ODP. (Minutes, Item 18.)

The DMP and the Wireline Logging Service Operator both noted that there is a litany of downhole measurement tools and interpretation techniques that are not achieving fruition due to a lack of attention. Included in this list are essential tools such as the BHTV, and newer tools that result from very real needs of the community. The source of this difficulty a general lack of resources, and the situation is not likely to improve.

To address the difficulties caused by a general lack of resources, the DMP asks that the Wireline Operator develop a draft plan for the prioritization of its overall efforts including those associated with technology development, that this plan contain a metric for judging the support of its efforts by the ODP community, and that the Operator present this plan to the DMP at the Santa Fe meeting. (Minutes, Items 4.a.-4.d., 5.b.-5.e., 6.a.i., 6.a.v., 8.-11.)

In view of the budgetary situation, the PCOM Chair had requested the DMP to reduce its number of meetings to two per year. To make this system work, communication between DMP Members and Liaisons will have to be improved so that discussions can continue outside of the meeting format.

To improve communications, the DMP has instituted an e-mail service. The address for DMP business is: DMP@SANDIA.GOV. Access to the address is open; anyone can bring issues to the attention of the entire DMP through it. However, mail is forwarded only to DMP Members; to PCOM, Thematic, and Service Panels Liaisons (or Panel Chairs if there is no DMP Liaison); and to the contract operators. (Minutes, Items 3., 4.a., 21.e.)

Next Meeting.

The next meeting of the JOIDES Downhole Measurements Panel will be in Santa Fe, NM, October 12-14, 1993. A joint session with LITHP will take place on October 12.

Farewell.

Last December, Paul Worthington stepped down from his position as Chairman, DMP, and he is now the Alternate Representative from the United Kingdom. It is important that the ODP recognize the contributions that Paul made in his tenure. In years past, logging operations were not an integral part of the scientific endeavors. Almost single-handedly this situation was changed by Paul's expertise, foresight, perseverance, and enthusiasm. Furthermore, Paul, through his leadership of the DMP, set the stage for systematic advances in third-party instrumentation. This instrumentation will influence future directions in all earth science programs.

MEETING OF THE JOIDES DOWNHOLE MEASUREMENTS PANEL

SCRIPPS INSTITUTION OF OCEANOGRAPHY
LA JOLLA, CALIFORNIA
MAY 25-27, 1993

DRAFT MINUTES

Present

Chairman:	Peter Lysne	US
Panel Members:	Robert Desbrandes	US
	Johann K. Draxler	Germany
	Gilles Dubuisson	France
	Gerard J. Fryer	US
	Joris Gieskes	US
	Stephen H. Hickman	US
	Mark W. Hutchinson	US
	Roger H. Morin	US
	Laust Pedersen	ESF
	Henry A. Salisch	Australia-Canada
	Makoto Yamano	Japan
	Michael D. Williams	US
	Paul F. Worthington	UK
Liaisons:	Susan Agar	TECP
	Elizabeth Ambos	NSF
	Frank Felice	ODP-LDEO
	David Goldberg	ODP-LDEO
	Dan Moos	LITHP
	Tom Pettigrew	ODP-TAMU
	Laura Stokking	ODP-TAMU
	Peter Swart	SGPP
Guests:	Tony Boegeman	SIO
	Leroy Dorman	SIO
	Jean-Paul Foucher	France
	Casey Moore	UCSC
	Thomas Shipley	Univ. Texas at Austin

Apologies

	Karen Von Damm	US

DRAFT MINUTES

MEETING OF THE JOIDES DOWNHOLE MEASUREMENTS PANEL SCRIPPS INSTITUTION OF OCEANOGRAPHY

1. WELCOME AND INTRODUCTIONS

The second meeting of the JOIDES Downhole Measurements Panel for 1993 was called to order at 0910 hours on Tuesday, May 25, 1993, in the Summer House Inn, La Jolla, CA. This location was a temporary change of venue due to a thesis defense occurring in the customary meeting room at Scripps Institution of Oceanography (SIO). The meeting was moved to SIO after the noon break.

A welcome was extended to Gilles Dubuisson, the new DMP representative from France; to Peter Swart, the Alternate Liaison from the Sedimentary and Geochemical Processes Panel (SGPP); to Laura Stokking, an ODP Staff Scientist and a representative of the ODP Science Operator; and to Frank Felice, a new representative of the Wireline Logging Service Operator (WLSO). Welcomes were extended to the following Members, Liaisons and Guests of the panel when they arrived later in the session: Paul Worthington, the Alternate UK Panel Member; Elizabeth Ambos, of the US National Science Foundation; Keir Becker, the Planning Committee (PCOM) Liaison; Leroy Dorman and Tony Boegeman, Invited Speakers from SIO; Casey Moore, an Invited Speaker; Thomas Shipley, an Invited Speaker and a Co-Chief for Barbados; and Jean-Paul Foucher, the previous DMP representative from France. Panel Member Karen Von Damm was at sea and could not attend the meeting.

The Chair noted that Panel Liaisons were especially important to the success of the meeting, and encouraged them to be very active participants. It was agreed that technical terms and jargon would be explained as required to improve communications between individuals with different backgrounds.

Edward Frieman, the Director of SIO, welcomed the Panel, its Liaisons, and Guests to the Institution. He noted the ODP is regarded as a model for international scientific cooperation in addition to its reputation for excellence in research. He pointed out that vigorous thrusts must be instituted to maintain the budgetary momentum necessary for a successful program.

Joris Gieskes, the host for the meeting, was thanked for his efforts and those of his wife, Barbara. The Chair noted that the present meeting was Joris' last as a member of the DMP, and that he would go on to be Chairman of the Shipboard Measurements Panel (SMP). The SMP and the DMP will benefit from Joris' future endeavors, and the DMP is looking forward to continued interactions with the SMP.

The DMP Chair reminded the Panel that in the future it would focus on legs presenting difficult logging situations, and that the current meeting would feature Leg 156 (Barbados). To this end, scientists and engineers familiar with previous drilling operations in accretionary prisms had been invited to the meeting.

The following modifications to the Draft Agenda were proposed;

1. Portions of the Executive Summary for the PCOM April meeting would be presented by the DMP Chair due to the temporary absence of the PCOM Liaison

(Draft Agenda Item, 4.a). This action was necessary due to the importance of PCOM input to the DMP.

2. A discussion of the proposed San Andreas Drilling Program would be presented by Steve Hickman as a new Agenda Item, 4.f.

3. Draft Agenda Item 20, Downhole Measurements on Future Legs, would be rescheduled as Agenda Item 5.e. for the convenience of the WLSO team.

4. A new Agenda Item, 5.f., would be inserted into the WLSO's report to deal with Data Base Systems.

5. Joris Gieskes would present the *In-Situ* Fluid Sampling Report due to the absence of Karen Von Damm.

6. A new Agenda Item 21.e. dealing with a DMP e-mail system would be presented by the DMP Chair.

7. A new Agenda Item 6.a.i. dealing with the GEOPROPS tool was inserted on the second day of the meeting due to a request from the PCOM Chair.

With the above modifications, the Draft Agenda was adopted as the working document for the meeting.

2. MINUTES OF THE MEETING, COLLEGE STATION, TX, JANUARY 18-21, 1993

The following changes were made to the Draft Minutes of the College Station Meeting:

page 6, paragraph 4: "Panel interactions with other *global programs with interests in drilling,* e.g. InterRidge..."

page 7, paragraph 7: "Susan Humphris reported progress on the re-write of the LITHP White Paper, a five to ten-year view of *issues of importance to the LITHP."*

page 7, paragraph 8: "SGPP asked that the DMP review logging activities *at* 504B..."

page 9, paragraph 3: "A *mud resistivity* log indicated a zone of saline water..."

page 10, paragraph 1: "The sampling problem was first visited *during* a 1987..."

page 15, paragraph 6: "Goldberg reported that logging operations on Leg 145 (North Pacific Transit) were *successful* in that..."

With the above changes, the Draft Minutes of the College Station Meeting were approved as a fair representation of the proceedings.

3. IMPLEMENTATION OF WATCHDOGS INTO THE DMP

The DMP Chair noted that the concept of Watchdogs is used by the thematic panels to enable a better evaluation of proposals submitted to the ODP. Thematic Watchdogs are advocates for assigned proposals (perhaps two or three per individual), and they nurture and promote the proposals as they move through the review process.

At the Texas A&M meeting, the Watchdog concept was introduced into the DMP with the intent to provide points of contact for various thrusts of the downhole measurement program. The intent is that Watchdogs can devote a concentrated effort on the scientific gains, the engineering and physical constraints, the interpretative techniques, and the costs associated with downhole measurements. An important responsibility of the Watchdogs is to minimize oversights that lead to false expectations within the ODP community. Finally, Watchdogs will insure a smooth passage of third-party tools through the certification process.

It was noted that the JOIDES Advisory Structure Review Committee (Drubaum Committee) recommended that the DMP adopt the Watchdog concept in its Draft Report of April 15, 1993.

The following DMP Members and Liaisons have accepted Watchdog responsibilities:

Keir Becker	CORK Experiments
Johann Draxler	Third-Party Tool Certification Process
Robert Desbrandes	Magnetometer Tools
Joris Gieskes	Water Sampler, Temperature, Pressure Tool (WSTP)
Steve Hickman	Lateral Stress Tool (LAST) Tool
Mark Hutchinson	Measurement While Drilling (MWD)
Peter Lysne	High-Temperature Tools, Memory Tools
Karen Von Damm	Fluid-Sampling Tools, WSTP
Mike Williams	Land-Based Tool Test Facilities

The ODP community is encouraged to contact the above individuals for further information regarding specific areas of importance. Other areas of importance will receive Watchdogs as the program unfolds.

4. LIAISON REPORTS

a. Planning Committee (PCOM)

The PCOM Liaison was unable to attend the first day of the DMP meeting. In view of the important issues raised at the April PCOM Meeting, the DMP Chair reviewed pertinent portions of the Executive Summary of the PCOM Draft Minutes, and summarized a communication with Brian Lewis, the Chairman of PCOM. Issues are:

1. PCOM appreciated that sampling of pore fluids in low permeability rocks is of importance to several thematic panels. However, the poor prospects for success and budgetary constraints preclude issuing a Request for Proposals (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 seek funding from other sources for the RFP.

2. PCOM has asked the DMP and the SMP to investigated the prospects for the core orientation tool, and to present the results of this investigation to the PCOM at its December meeting. This issue will be discussed at the Santa Fe Meeting of the DMP.

3. If the budgetary situation becomes severe, the test of the Diamond Coring System (DCS) will be eliminated from the 1994 drilling schedule. Currently the

DCS is scheduled as Leg 157. An elimination of the DCS Leg would mean that the TAG Hydrothermal drilling will become Leg 157, and it will be immediately preceded by Barbados, Leg 156. Thus, the two legs identified by the DMP as being challenging, and requiring CORKs, will be consecutive. This point was noted to Lewis in an e-mail communication from Lysne; it will be revisited when the budgetary situation is better understood.

The DMP Chair noted that the Deep-Drilling RFP put forth by the Technology and Engineering Development Committee (TEDCOM) suffered a fate similar to that of the fluid-sampling RFP. The Chair also noted that the prospects for funding any RFP through the JOIDES structure are small due to severe budgetary constraints. At best, the ODP budget is flat. This fact means that the Long Range Plan, which allowed for limited technology development, cannot be followed. At worst a disintegration of the Canada-Australia consortium means that cut-backs in the logging program may be necessary.

In view of the budgetary situation, Lewis had asked the DMP Chair to reduce the number of DMP meetings to two per year. The DMP Chair noted that such an action may mean that important issues are not resolved expeditiously. However, in the interest of the overall program, the DMP will try the two-meeting schedule. To make this system work, communication between DMP Members and Liaisons will have to be improved so that discussions can continue outside of the meeting format. Thus, a DMP e-mail system will be implemented.

The Chair noted that budgetary constraints will become a part of DMP deliberations, and that all Panel Members must become cognizant of their ramifications. Prioritization of downhole measurement activities will be an issue before the DMP at the present and at future meetings. The prioritization process must combine the knowledge of the DMP and the feelings of the ODP community.

b. Lithosphere Panel (LITHP)

Dan Moos presented the report from LITHP, and the following points were noted:

1. LITHP reiterates its strong support for the fluid-sampler system. To be compatible with drilling in hydrothermal systems, components should be of a "slim-hole" design and operable to 350 ^{o}C.

2. The Borehole Televiewer (BHTV) is essential for *in-situ* stress determinations, and the present system that does not function consistently is unacceptable.

3. The LITHP supports the Ocean Seismic Network (OSN) thrust to establish ocean-floor seismic stations provided these stations yield the same quality of data as those obtained from down-hole stations.

4. Subjects for the joint DMP/LITHP meeting in Santa Fe include formation characterization in regions removed from a borehole, the LITHP White Paper, a review of technological issues, and progress on high-temperature instrumentation.

5. LITHP wished to know if CORKs were compatible with the DCS.

Pettigrew commented that CORKs are compatible with the DCS.

Lysne reported that the OSN through JOI, Inc., and the US Department of Energy (DOE) were investigating areas of mutual interest including an assessment of seismometer-deployment options. The DOE is responsible for seismic treaty-verification programs associated with nuclear weapon proliferation issues, and oceanic systems under consideration would cover areas of the world that not served by present systems.

Moos commented that many scientists do not understand logging tools. Goldberg noted the existence of the ODP Logging Manual, and stated that two logging schools will be scheduled for later in the year. The ODP Logging Manual may be obtained from Larry Sullivan: SULLIVAN@LDEO.COLUMBIA.EDU, or (914) 365-8805 [TALK], or (914) 365-3182 [FAX].
The DMP and LITHP Chairs have been discussing the Agenda for the Santa Fe Meeting, and Panel Members and Liaisons are encouraged to review the Draft Agenda as soon as it is published in August so that the meeting can move expeditiously.

c. Sedimentary and Geochemical Processes Panel (SGPP)

Peter Swart reported that the following issues of interest to the DMP were discussed at the March 4-6 meeting of the SGPP:

1. The SGPP strongly supports the pore-water sampling proposal of the DMP.

2. The SGPP expresses concern regarding the slow progress in developing the Pressure Core Sampling (PCS) tool, and urges continued testing and development.

3. The SGPP notes that there should be no question of funding CORKs for Barbados, Leg 156.

4. The SGPP reminds the Co-Chiefs of Barbados to ensure that correct casing screens are used in the CORK experiments.

Swart noted that geochemists do not use data from the Schlumberger geochemical tool since the assumptions and corrections that go into the Schlumberger data reduction package are unknown. Thus, the data from this tool must be questioned unless they are used only for gross geochemical information. He further noted that the Schlumberger neutron tool, sometimes called the porosity tool, should not be dropped from the logging suite merely because its interpretation is in question.

In regard to the WSTP tool, the SGPP had noted that this tool does not provide unique information in that it works only in sediments of a consistency that are compatible with uphole fluid extraction methods. When properly deployed, the WSTP is capable of producing gas samples, but they have been rarely collected and used. Swart noted that the WSTP did produce useful borehole-temperature information.

d. Tectonics Panel (TECP)

Susan Agar reported that a consensus on downhole measurement issues is still in evolution within TECP. In specific regard to tools, the highest priorities are: (1) fix the problems with the Schlumberger Formation Microscanner (FMS), (2) move forward with the LAST, (3) develop high-temperature tools, and (4) develop magnetometers systems. The BHTV has a low priority due to its bad showing in the past. The general priorities for short-term efforts are: (1) pore-fluid sampling, (2) deep drilling, and (3) the DCS, and (4) an upgrade of the computing system. Long-term, high-cost initiatives such as the development of seismometers and downhole radar tools are strongly supported.

Agar noted that there is a change in emphasis within the TECP; the question is now "What do we do when we get to a site?" A straightforward document discussing the merits and difficulties associated with a logging tool, or of a suite of tools, would be beneficial to discussions within the TECP. The Chair noted that the development of such documentation would be a meaningful endeavor of the DMP.

e. The KTB and the upcoming "Potsdam Meeting"

Hans Draxler reported that as of May 18, the KTB project was drilling ahead at 7,390 m in altered amphibolite with layers of gneiss. Major fault zones with a high number of shear planes, slickensides, and fractures were noted. A new lithology, indicated by strongly magnetized cuttings and an increased presence of calcite, was noted beginning at 7,336 m.

Fault zones were responsible for an enlargement of the hole and a consequential loss of support for the vertical drilling tools. The deviation was such that the hole had to be plugged back to 7100 m, and sidetracked.

A setback occurred when the drill string was being withdrawn from the hole after drilling to 7,220 m. The pipes parted about 600 m below the surface, and dropped 40 m to the bottom of the hole. The first fishing attempt was successful, the pipes were badly bent, and the recovered material indicated that the box-portion of a tool joint had split on a new section of a special, high-strength drill pipe. The special pipe was taken out of service, and drilling continues using rented pipe.

Difficulties also occurred with a loss of lost viscosity in the drilling mud, perhaps due to high temperatures downhole, or to an influx of formation fluids. A suite of logs was run at 7,190 m.

The financial situation in the KTB operation is extremely tight. Consequently, it is possible that the deeper portions of the hole will not be logged due to a lack of commercial tools suitable for operation above 260 °C, and the inability of the KTB to fund the development of a suitable suite.

The International Conference on Scientific Continental Drilling will be held in Potsdam, from August 30 to September 1, 1993. This conference is patterned after the ODP COSODs, and its goal is to create an organization for international continental scientific drilling. The thematic topics of the conference are:

- Earth History, Climate, and Extent of the Biosphere
- Meteorite Impacts and Large-scale Extinction of Life
- Crustal Fluids and Transport Processes
- Origin of Mineral Deposits
- Volcanic Systems
- Calibration of Crustal Geophysics
- Basin Evolution and Origin of Hydrocarbons
- Dynamics of the Lithosphere
- Earthquake Mechanics
- Drilling, Coring, Sampling, and Logging Technologies

Further information regarding the Potsdam Meeting may be obtained from Kevin Burke, President of the International Lithosphere Program, or from Mark Zoback, a meeting organizer (and a member of TECP).

f. The Proposed San Andreas Drilling Program

The proposed San Andreas Drilling Program was discussed by Steve Hickman who is one of the proponents of the program; the others are Mark Zoback and Lee Younker (Lawrence Livermore National Laboratory). This initiative is of potential importance to the ODP due to its strong emphasis on technology development.

The thrust of the effort is to answer questions concerning fault behavior, fault structure and composition, fault zone properties and physical parameters, and the nature of fault-zone fluids. Investigations would be accomplished by drilling a series of holes through the San Andreas Fault at depths of approximately 1, 3, 6, and 10 km; access would be obtained by using slant or deviated drilling techniques. Long-term observation stations would be placed in the holes. Temperatures may exceed 300 ^{o}C. A consortium of US Department of Energy/Office of Basic Energy Sciences and industry sponsors is being sought to fund and develop the necessary technology. The present status of the program involves the in-depth examination of four candidate sites; proposals are being submitted to the NSF to further this effort. A final site will be selected when this work is completed.

5. WIRELINE LOGGING SERVICE CONTRACTOR'S REPORT

a. Management Structure of the WLSO

David Goldberg reported that the management structure of the WLSO located at Lamont-Doherty Earth Observatory (LDEO) underwent an extensive revision after the new logging service contract was signed with JOI, Inc. Goldberg is the program Director, and three Chief Scientists report to Goldberg; one from LDEO, one from Leicester, and one from Marseilles. The Leicester operations will center on the Schlumberger Geochemical Tool, while the Marseilles operations will be concerned with the Schlumberger FMS tool. The three Chief Scientists will steer the logging program through a semi-annual meeting process. Operationally, Goldberg envisioned that the DMP and PCOM, as well as a new Interface Working Group, would provide direct input to the WLSO.

The DMP Chair noted that the DMP reported to PCOM, and that formal DMP/PCOM input to the WLSO would come through JOI. Furthermore, he questioned the need for the Interface Working Group. Goldberg noted that the group has not been formed.

Swart requested that a geochemist be incorporated into the Leicester operations to insure that tool data were vetted.

Several thematic panels had requested that the WLSO provide liaisons so that the nuances of the logging programs could be more fully appreciated. Goldberg noted that this effort could not be instituted due to insufficient funds, and reiterated that two logging schools would be held in the near future. Goldberg stated that single-sheet documentation would be prepared on tools of importance. The Panel suggested that the WLSO institute a series of monographs on important tools, and that these volumes delineate the principals of tool operation, the assumptions that go into tool interpretation, and the applicability of the tools to scientific endeavors.

b. Review of Recent Legs, Tool Reliability

Frank Felice reported on the logging operations at holes 894, 504B, and 896. In general, the operations were successful, and the data are in the interpretation phase. However, it is notable that the Woods Hole Oceanographic Institute three-component vertical seismic profile tool failed on three separate occasions, and the digital televiewer has performed poorly.

Goldberg noted that the digital televiewer system has never performed consistently, and Draxler reported similar difficulties with this tool at the KTB operation. The difficulty lies in the data transmission package that is incompatible with long-length cables. Goldberg noted that attempts are being made to fix the tool. If this action is not successful, other options include renting a televiewer service from Schlumberger or re-deploying the analog televiewer system. In any event, Goldberg noted that incremental funds were needed it a televiewer is to be deployed in the future. Goldberg noted that US $100K/year had been put into the digital system for the past several years, and that success was minimal.

The DMP Chair stated that LITHP and TECP are counting on the successful operation of the BHTV, and he sought assurances that the WLSO was doing everything possible to see that the BHTV program was a success. Goldberg could not give such assurances due to a lack of funds.

The DMP Chair stated that the BHTV problem will be revisited in Santa Fe in the joint session with LITHP.

c. New Schlumberger Tools

Felice reported that the Schlumberger MAXIS System, an updated computer package used in tool deployment, was operational, and that it allowed use of the Schlumberger Dipole Sonic Imager tool.

Mike Williams noted that Mobil Research and Development Corporation had tested the Dipole Sonic Imager, and found that its data were difficult to interpret. Thus Mobil had discontinued use of the service.

The Chair stated that services that did not provide a useful input to ODP science could not be part of the Downhole Measurements Program. The status of the Dipole Sonic Imager tool will be revisited.

d. Status of the Digital Televiewer

This subject was covered in topic 5.b., above.

e. Downhole Measurements on Future Legs

Felice presented a plan for logging operations on Legs 150-158; this plan is detailed in Appendix to these minutes. Goldberg put forth a set of requests for augmentation of the WLSO effort. Many of these items required incremental funding support, and a few had support from the scientific community. After a considerable discussion, the following action items were agreed upon:

1. The deletion of the "porosity" tool from the Schlumberger logging suite is not warranted at the present time even though the interpretation of the tool data

are in question. The WLSO agreed to maintain the "porosity" tool as part of the tool suite; the issue of calibration will receive attention in the future.

(Note that the term "porosity" tool is somewhat of a misnomer. The tool monitors the decrease in energy of high-energy neutrons as they move through formation material. If the pore space is filled with water, this moderation is due largely to the presence of hydrogen, and the response can be related to porosity. Perturbations are caused by tool off-set from the borehole wall and by elements that are strong absorbers of thermal neutrons.)

2. The DMP noted that the proposed logging plans for Legs 150-155 were an extension of past, successful activities. Thus, the DMP formulated the following recommendation:

RECOMMENDATION 93-1.

The DMP recommends that PCOM approve the proposed logging activities for Legs 150-155 as put forth by the Wireline Logging Service Operator with the understanding that the Operator initiate discussions with the appropriate Co-Chiefs so that the logging program can be incorporated into the science plans. (Minutes, Items 5.e. and Appendix)

3. A discussion of logging operations for Barbados, Leg 156, was tabled until Agenda Items 7-10 had received attention.

4. A discussion of logging operations for TAG, Leg 158, was tabled until Agenda Item 11 had received attention.

5. The DMP cannot recommend the expansion of the WLSO operations into areas that do not have strong support from the scientific community. Such support is defined as being similar to that associated with the fluid-sampler thrust and the BHTV program. However, some efforts proposed by the WLSO team such as the participation of WLSO Liaisons in the workings of the thematic panels are meritorious and deserving of support even in times of a stressed budget. Therefore, the DMP asks the WLSO to develop a draft plan for the prioritization of its overall efforts, that this plan contain a metric for judging the support of its efforts by the ODP community, and that the WLSO present this plan to the DMP at the Santa Fe meeting.

f. Data Base Systems

Goldberg reported that the Leg 143 CD-ROM was published, and that Legs 144-146 were in preparation.

6. SCIENCE OPERATOR'S REPORT

a. Update on TAMU Tools

i. GEOPROPS

While in session, the DMP received a communication from Brian Lewis requesting its opinion on a proposed re-deployment of the GEOPROPS tool. This initiative was originated by Dan Karig and Bobb Carson, two principal investigators with previous

GEOPROPS experience. The request to the DMP was secondhand; a formal transmittal did not occur.

The DMP Chair noted that the deployment of GEOPROPS involves first coring out the bottom of the primary hole with the Motorized Core Barrel (MCB). The MCB is then removed, and the GEOPROPS inserted into the MCB-cored portion of the hole. In some past deployments, the MCB-cored hole had filled with slough, and the insertion of GEOPROPS was uncertain.

GEOPROPS received attention at the College Station Meeting where Tom Pettigrew noted that the tool was a "real nightmare to work on and deploy." Furthermore, if progress is to be made, the project must be resuscitated from the ground up, and development will be costly. Pettigrew was asked if this was still his opinion, and he answered affirmatively. Pettigrew has completed his report on the GEOPROPS tool.
Pettigrew indicated that 60-80 hours of ship time would be needed to test the MCB/GEOPROPS deployment system, and that this time would be spread out over several legs. The panel did not feel that it had enough information to justify such an expenditure of time, and it urged the tool proponents to provide more detail on their plans.

ii. Hard Rock Guide Base

Pettigrew provided the following information on engineering activities undertaken by the Science Operator. Two Hard Rock Guide Bases used on Leg 147 were being refurbished for use on Leg 153, and will be compatible with the new ODP hanger system

iii. DCS Platform/Mast and Hydraulics

The DCS is currently being refurbished for Leg 157. The bent feed cylinder which caused most of the secondary heave compensation problems has been replaced, and the secondary heave compensator hardware and software are being redesigned. Land tests are planned for late June or July.

iv. Vibra-Percussive Core System

The original Novatek tool has been abandoned, and a new tool, a Rossfelder Vibro-Bail, is being investigated. The Vibro-Bail is in the prototype stage, but has undergone initial testing with good results in tightly-packed sand.

v. Pressure Core Sampler

The Pressure Coring Sampler was modified during Leg 146. The modification resulted in full hydrostatic pressure being maintained during the last three deployments. The internal flow path and core catchers have been redesigned to reduce core-washing problems. Two new cutting shoe designs are being pursued in an attempt to increase core recovery.

vi. Hard Rock Core Orientation/Sonic Core Monitor

The Hard Rock Core Orientation tool and the Sonic Core Monitor were deployed on Legs 148 and 149 with partial success. Problems are thought to be associated with vibrations encountered while coring hard rock.

vii. Tensor Tool

The Tensor tool is an electronic core orientation probe; it is operational.

viii. CORKs

The CORK design is being changed to be compatible with the new ODP hanger system. New, higher pressure hydraulic connectors are being considered for future use. When the redesign is complete, four systems will be available for Barbados, but it is unlikely that all will be used. At the present time, no CORKs are being constructed for TAG; Corks not used at Barbados will be available.

Bobb Carson is scheduled to visit the existing CORK installations with the ALVIN in July/August, 1993.

ix. Information Handling Proposal

The following information was provided by Laura Stokking. The proposal for the information handling system went out on December 15, 1992. Thirteen letters of intent were received, and of these, three were awarded US $50K each to develop a full proposal. The winners in this first exercise are:

1. A consortium of EG&G, Inc., LDEO, and Geomar
2. Tracos, Inc.
3. The Meyers Group

Proposals are due in June 15, after which the Information Services Group at ODP will conduct an internal review. Then the JOIDES Evaluation Committee will meet at TAMU to continue the review, and additional reviews will be provided by the Budget Committee (BCOM) and PCOM. A final decision is expected this summer.

x. Holes 504B and 896A

Drilling in hole 504B was terminated at 2,111 mbsf after the pipe became stuck, probably in a fault zone. After some difficulties , the hole was left with 20 m of fill, and some junk at the bottom. Hole 896A was drilled about 1 km southeast of 504B on a basement high in an area of high heat flow. Downhole logging included temperature, sonic and resistivity logs, the geochemical tool, the BGR magnetometer, the FMS, and a packer experiment. The hole appears to be slightly more sealed than 504B.

7. BACKGROUND FOR BARBADOS, LEG 156

Thomas Shipley reported that the principal temporal and spatial objectives of the Barbados effort involved (1) determining the fluid pressure in the vicinity of the decollement, (2) determining *in-situ* permeability estimates of the prism host rock and in fault zones, (3) defining the nature of fluids along the decollement, and (4) investigating the nature of "bright" fault plane reflectors. Some of these investigations will require long-term monitoring of such quantities as pressure, temperature, and fluid composition. CORKs are proposed at the three first-priority sites. Casing is required to maintain hole stability and to isolate zones of interest.

8. PREVIOUS DRILLING IN THIXOTROPIC FORMATIONS

Casey Moore reported on previous logging exercises at Barbados, Leg 110, and Cascadia, Leg 146. Logging exercises were attempted at three of six sites on Leg 110. In each case, bridging, probably due to formation swelling, prevented significant downhole measurement activities. Potassium chloride-inhibited mud or saltwater mud was used at these sites, so freshwater mud was not the cause of the difficulties. A side-entry-sub was not used. No holes were drilled specifically for the logging program. In some cases, packer experiments were attempted prior to logging; this action may have been detrimental to the logging exercises. The logged intervals are: Site 671 (691 m total depth), 23 m logged; Site 672 (494 m total depth), 26 m logged; and Site 676 (310 m total depth), 36 m logged.

The Cascadia program was very successful in obtaining downhole measurements, but was costly in time and equipment. At the four significant drill sites, four suites of logs were collected and three bottom-hole-assemblies were lost. Downhole measurements were conducted in dedicated holes. The logging program not only included standard logging runs, but also vertical seismic profiles and FMS logs. Various mud sweeps were made during drilling and before logging, but the holes never contained mud during logging exercises. Downhole measurements were most successful in holes that were open only for a short period of time. Packer measurements were attempted at two sites, and succeed at one. Leg 146 provided the first *in-situ* permeability measurements in an accretionary prism. Two CORKs were installed. Side-entry-subs were used occasionally.

9. APPLICABILITY OF SCHLUMBERGER MWD TO BARBADOS

The DMP Chair introduced Jim Aivalis of Schlumberger to the DMP, and the Chair noted that Aivalis and Mark Hutchinson worked for competing measurement-while-drilling companies.

Aivalis reported that the Schlumberger Measurement While Drilling (MWD) capabilities included passive gamma, active gamma, neutron, and electrical logs that are similar to logs commonly used in the ODP. Two types of service are available. The first uses memory devices to store data downhole. These data are retrieved only at bit changes. Consequently, this service is less expensive that a second system that transmits data to the surface by encoding pressure pulses on the mud system. The memory system would require one additional Schlumberger technician on board the JOIDES Resolution; the mud-pulse system would require two. Aivalis chose not to discuss the costs of MWD deployment at the DMP meeting since it is a private issue between Schlumberger and the WLSO.

10. LOGGING PLANS FOR BARBADOS

The Panel reviewed the options for Barbados, and the following points were noted:

1. The probability of loosing downhole assemblies at Barbados is comparable to that experienced at Cascadia.

2. A sonic log is not included in the Schlumberger MWD suite. However, resistivity logs can be inverted to give rudimentary sonic information.

3. It is possible to shuttle logging equipment and personnel to the ship at Barbados. Thus, stand-by costs may be low.

4. It would be advantageous for the ODP to gain experience with MWD technology.

5. Dedicated holes would be necessary for MWD logging since MWD is incompatible with coring operations.

In view of the potential benefit of using MWD at Barbados, a team drawn from the ranks of the WLSO, Science Operator, the Barbados Co-Chiefs, and interested scientific personnel was formed to generate an appropriate position statement for consideration by the DMP. The WLSO will take the lead in generating this statement since contractual issues with Schlumberger need to be discussed. The statement will be presented to the DMP in Santa Fe. A recommendation to PCOM is likely to come from this action.

11. STATUS OF HIGH-TEMPERATURE TOOLS

a. Tool Development in France and the United Kingdom

Felice reported on the French Temperature Tool and the Resistivity Tool being developed at Camborne School of Mines Associates. The French tool has not progressed significantly since it was visited by the DMP at the College Station Meeting. The probe itself is comprised of sections that screw together, and even thought the segments are carefully machined, the joints provide paths for fluid entry. The cable for this tool suffered corrosion problems when used in the Larderello Geothermal Field (Italy). Karen Von Damm (reporting by e-mail) tested WLSO-provided fluid specimens for compatibility with the cable. She doubted that these fluids were representative of the fluids that "ate" the cable, though if they were, the cable would not hold up in the seafloor environment. Goldberg reported that the WLSO is not funded to continue work on the French tool.

The Camborne tool still suffers from a failure of ceramic components used in the resistivity array. Even if this tool is successful, the cable available for deployment is usable only to 260 ^{o}C (Note that downhole temperatures at TAG may exceed 350 ^{o}C).

Becker commented that the downflow of cold fluids into the TAG hydrothermal system may cool the holes sufficiently to allow conventional logging to be successful. Lysne noted that such a downflow could compromise the TAG efforts, and might be controlled if the holes were drilled slowly. Input from the TAG proponents is needed to resolve these issues. It will be sought at the joint DMP/LITHP Meeting.

The Chair noted that if above tools are to be used at TAG, they will require at least a DMP certification as Development Tools. This certification process must begin immediately if the tools are to be ready within the year.

b. US Department of Energy Tools

Lysne reported that the Precision Temperature-Pressure Tool under development at Sandia should see first deployment this summer. Furthermore, a spectral gamma tool was undergoing calibration tests, but it definitely was a prototype tool that needed further engineering assistance. Development of the fluid-sampling tool will start as soon as the pressure-temperature tool is fielded. It was noted that the Department of Energy cannot supply funds enabling its tools to pass through the ODP's Third Party Certification process, but that joint work with the ODP on subjects of common interest could further both programs.

c. Preparation for TAG and the Joint Meeting with LITHP

The DMP notes that the DCS effort, presently Leg 157, may be dropped from the schedule thus moving the TAG program forward and causing a very short time frame for high-temperature tool development. The DMP further notes that none of the tools proposed by the WLSO for the TAG operations are operational, let alone having passed any third-party-tool requirements. Finally, the DMP notes that budgetary resources are scarce, yet TAG represents a very important forward step for the ODP. Thus the DMP makes the following recommendation:

RECOMMENDATION 93-2.

The DMP recommends to PCOM that the TAG Downhole Measurements Program be given the highest priority by the Wireline Logging Service Operator, that the resources necessary for the success of this effort be drawn from those presently available to the Operator, and that the Operator present a plan for downhole measurements at TAG to the DMP and the LITHP during their joint meeting next October. This plan should include input from the TAG proponents, as well as a statement as to how the Third-Party Tool Requirements will be satisfied.

Finally, Lysne, acting in his Watchdog role, must report to the Co-Chiefs of TAG that the ODP high-temperature tool development program is not going well. If the PCOM Chair concurs, Susan Humphris, a Co-Chief of TAG, will be invited to the Santa Fe DMP Meeting.

12. OVERVIEW OF MAGNETIC MEASUREMENTS

Magnetic measurements are becoming more prevalent in the ODP. The last several years have seen the development of the French system which has been incorporated into the Schlumberger logging suite, and the German system, which is seeking Third-Party Certification within the ODP. A Japanese system is also under development.

Robert Desbrandes gave an overview of the general field of magnetic geophysical investigations. Topics included: Principles of Nuclear Magnetism Resonance, Free Precession Logging, Spin Echo Logging, Determined Parameters, Commercial Examples, and Log Examples. A detailed set of notes was presented, and it may be obtained from Desbrandes (RND@R3.PETE.LSU.EDU).

Lysne suggested that the concept of magnetic logging was new to the ODP, that the subject was difficult, and that it would be appropriate for the DMP to generate a monograph on the technique that put forth the basic principles in an easy-to-understand format. Worthington commented that other techniques would benefit as well if further monographs were written. This issue will be a subject of further study by the DMP.

13. THIRD-PARTY CERTIFICATION FOR THE GERMAN MAGNETOMETER

At the College Station Meeting, Draxler reported that the German tool had satisfied all of the ODP/DMP requirements for a Third-Party Development Tool, and that an application for the status of a Certified Tool was submitted to the WLSO. This application was dated June, 1992, and contained waivers of certain costs as the tool progressed through the certification process. No response had been obtained from the WLSO team.

In College Station, the DMP Chair had noted that it was the responsibility of the WLSO team to move forward expeditiously on such matters. Draxler has accepted the responsibility of Watchdog for all third-party tools.

A Certified Tool is deemed to satisfy all the criteria for scientific deployment within the ODP, and these criteria are defined in the Guide to Third-Party Tools. In general, the German tool has (1) satisfied the requirements for an ODP Development Tool, (2) been satisfactorily tested on ODP legs, and (3) a Request for Certification has been forwarded to the WLSO. However, documentation supporting this work, and other requirements delineated under items (4)-(6) of the Guide to Third-Party Tools, have not been formally presented to the DMP. Thus, the DMP cannot move forward on the certification process for the German magentometer tool.

Worthington noted that the certification process was necessary due to past, negative experiences with third-party tools. He further noted that a dilution of the process at this early stage of its development would be detrimental, and would certainly lead to difficulties in the future. The DMP Chair agrees with this philosophy, and the certification process will proceed strictly in accord with the Guide to Third-Party Tools.

14. OTHER MAGENTOMETER TOOLS.

Gilles Dubuisson noted that the French magnetometer tool has been taken over by Schlumberger, and that it will see action on future ODP legs. He presented a report on the scientific successes of this tool.

Makoto Yamano had received no word concerning recent progress on the Japanese tool.

15. TECHNOLOGY REVIEW--WIRELINE REENTRY

At the College Station Meeting, the DMP received a report on cross-borehole acoustic measurements that strongly suggested that this technology was ripe for use in the ODP. However, simultaneous access to two or more holes is a requirement that cannot be met from the JOIDES Resolution. Wireline reentry from a service vessel is a candidate solution, and Tony Boegeman of SIO was invited to present an overview of this technology.

The Scripps Wireline-Reentry System utilizes downcable thrusters to maneuver the reentry package into a borehole. Real-time television pictures are transmitted to the surface to allow the final placement of the package. These pictures can give some information as to the condition of a borehole. A logging suite could be attached to the reentry cable, however ships heave could compromise the data. Clamped seismic sensors present no difficulty. Data can be transmitted to the surface at 32 K baud.

The Scripps system has been used to place ocean-bottom seismic arrays with individual positioning accurate to within a few meters. The cost of the Scripps system is low since some work can be assigned to system development.

The Scripps system overcomes the difficulty of emplacement of sensors in multiple holes for cross-borehole acoustic experimentation, and thus cross-borehole-acoustic experimentation is an option for ODP investigators. However, a great deal of work is required to bring it into fruition, and the cost in ship's time would be high. A viable experiment may require a dedicated leg.

Lysne noted that wireline reentry was necessary for the deployment of the OSN seismic system, and that he would report favorably to the DOE on the progress of the SIO wireline reentry team.

16. TECHNOLOGY REVIEW--SEA FLOOR SEISMIC EXPERIMENTS

Leroy Dorman of SIO presented a very detailed discussion of the technology used to extract information from seismic data. Anyone wishing information on such data processing should contact Leroy directly.

17. HISTORY OF THE WSTP TOOL

Joris Gieskes has been involved with the WSTP tool since is conception. He has written a report on the evolution of the tool, and a summary was presented.

The WSTP has produced samples from several temperature-pressure environments. The agreement with shipboard measurements from squeezings is good for major constituents. A larger data base is needed for minor constituents which can be sensitive to artifacts resulting from temperature/pressure differences, e.g., silica and boron. Gas sampling has been less successful, although only a few attempts have been made for their analysis. Gas sampling technology can be improved, but there is a need for enthusiasm from the community.

The WSTP provides a means to determine borehole temperatures that may be used to back calculate formation temperatures. The temperature measurements also provide a quality check on the fluid samples.

The success rate for fluid sampling is about 43% and that for temperature measurements is about 50%. These rates are influenced by the nature of the formation and sea conditions.

The Chair suggested that the WSTP document receive a more general distribution than is intended. Gieskes will consider this suggestion.

18. *IN-SITU* PORE FLUID SAMPLING

The DMP is very cognizant of the strong support for the fluid-sampling initiative coming from SGPP, LITHP, and TECP. Furthermore, the DMP recognizes the reality of the budgetary situation that caused PCOM to withhold monetary support for the initiative, but is concerned that momentum will be lost unless forward steps are made in the very near future.

Joris Gieskes proposed that he put together a team of ODP scientists and engineers to address the issues noted in the Pore-Fluid-Sampling RFP, and that these individuals find external support for their services. The DMP endorses this altruistic thrust, and, consequently, makes the following recommendation to PCOM:

RECOMMENDATION 93-3

The DMP recommends to PCOM that; (1) a group of self-supported experts pertinent to the pore-fluid-sampling RFP be drawn from the ODP community, (2) that Joris Gieskes be responsible for the institution and coordination of this group, and (3) that this group provide documentation as to the feasibility and costs associated with the development and deployment *of a fluid-sampling system. The DMP further recommends that PCOM help promulgate the thrust throughout the ODP.*

19. TECHNOLOGY REVIEW--DOWNHOLE MEASUREMENTS IN THE OCEAN DRILLING PROGRAM

In February, Paul Worthington presented a talk to the Geological Survey of Greenland entitled "Downhole Measurements in the Ocean Drilling Program- A Scientific Legacy." This talk was based on the DMP Brochure of the same title, and was very well received. Paul suggested that DMP Members give the same presentation to their consistencies at opportune times. Such action would publicize the ODP in general, and downhole measurements in particular. In view of these benefits, Paul was invited to repeat his presentation.

Paul presentation set the standards for professionalism. The talk was videotaped, and slides used in the presentation will be distributed to DMP Members.

The DMP Chair took the opportunity to acknowledge the tremendous service that Paul Worthington had made to the ODP. In years past, logging operations were not an integral part of the scientific endeavors. Almost single-handedly this situation was changed by Paul's expertise, foresight, perseverance, and enthusiasm. Furthermore, Paul, through his leadership of the DMP, set the stage for systematic advances in third-party instrumentation. This instrumentation will influence future directions in all earth science programs.

21. HOUSEKEEPING ISSUES

a. Panel Membership

The Panel was reminded that Joris Gieskes would be retiring from the DMP at the end of the current meeting, and that candidates for his seat were being sought by the Chair. The Chair noted that personnel from non-Schlumberger logging companies are permissible candidates.

In keeping with policy, discussions concerning membership issues are not minuted by the DMP.

b. Duration and Timing of Meetings

Due to the institution of a semiannual meeting format, the timing and duration of DMP Meetings is in a state of flux. This issue will be revisited in Santa Fe.

c. Suggestions to the Chair

Several Panel Members noted a possible conflict of interest presented by a proposed non-US panel member and his institution of employment. The DMP Chair will pursue this issue with the PCOM Chair.

d. E-mail

The Chair noted that the change from three meetings per year to two comes an inopportune time for the DMP due to the workload put on the Panel by extraordinary legs such as Barbados and TAG, and due to a change in the JOI contract to the WLSO. However, in the interests of the overall program, the DMP is behooved to make the most of the situation. With this issue in mind, the DMP will institute an e-mail system.

The e-mail address for DMP business is: DMP@SANDIA.GOV. Access to the address is open; anyone can bring issues to the attention of the entire DMP through it. However, mail is forwarded only to DMP Members; to PCOM, Thematic, and Service Panels Liaisons or Panel Chairs; and to the contract operators.

Watchdogs will play an important role in conducting business by e-mail, but everyone should comment on issues raised on the network. As usual, DMP business on issues requiring input to other panels will be conducted through the DMP Chair. In other words, the e-mail system will serve as a continuation of DMP Meetings.

Obviously, the e-mail system can work only if all Panel Members have access to INTERNET. It is understood that representation will be complete in the near future.

22. FUTURE MEETINGS

Jeanette and Peter Lysne will host the next meeting of the JOIDES DMP, Santa Fe, New Mexico, October 12-14, 1993. The session on October 12 will be joint with LITHP.

Non-US locations will receive the highest consideration for a DMP meeting to be held in the spring of 1994.

23. ADJOURN

The DMP Chair thanked Barbara and Joris Gieskes for the hospitality that they had extended to Members, Liaisons and Guests of the DMP. The Chair also noted that Joris' contributions to the DMP over the past years had been considerable, and that the DMP was looking forward to working with Joris in his new roles as Chairman of the Shipboard Measurements Panel, and Coordinator of the Fluid Sampling Effort.

The proceedings of the JOIDES Downhole Measurements Panel were concluded at 1200 hours, May 27, 1993.

Respectfully submitted,

Peter Lysne
June 28, 1993

1993-94 LOGGING PLAN

1993 - 94 (Straw Man) Logging Plan

	TOOL	LEG 150	LEG 151	LEG 152	LEG 153	LEG 154	LEG 155	LEG 156	LEG 157	LEG 158
		N J MARGIN	ARCTIC GATEWAY	NARM	MARK	CEARA	AMAZON	BARBADOS	DCS	TAG
		May-July	July-Sept	Sept-Nov	Nov-Jan	Jan-Mar	March-May	May-July	July-Sept	Sept-Nov
1	sonic (DSST= XX)	XX	XX	XX	X	X	X	XX		
2	resistivity	X	X	X	X	X	X	X		
3	density	X	X	X	X	X	X	X		
4	porosity									
5	geochemical	X	X	X	X	X	X	X		
6	gamma ray	X	X	X	X	X	X	X		
7	caliper	X	X	X	X	X	X	X		
8	televiewer			X	X			X		
9	VSP				X			X		
10	FMS			X	X		X	X		
11	temperture tool	X	X	X	X	X	X	X		X
12	drillstring packer				X			X		
13	flowmeter				X			X		?
14	MAG/suspectibility		X	X		X	X			
15	Hi-T Resistivity									X
16	Hi-T BHTV									X

Lamont-Doherty Earth Observatory of Columbia University

Palisades, NY 10964 U.S.A.

phone: 914-365-8836
fax: 914-365-0718

Internet: kastens@lamont.ldeo.columbia.edu

June 7, 1993

TO: ODP Panel chairs
FROM: Kim Kastens
RE: April 93 minutes

Please find enclosed the more or less final minutes from the April 1993 SSP meeting in Trieste. In addition to the discussions covering programs of particular thematic interest to your panel, you may care about:

• agenda item 9B: revision to SSP guidelines for barerock drilling.

• agenda item 9E: SSP's intent to not discuss at the July SSP meeting those programs which have zero data package in the data bank following the July 1st data deadline. Such programs will simply be lumped into a category of "no data package submitted" in the advice we provide to PCOM. In other words, we will not try to second guess whether it might have been possible to assemble a decent data package on the basis of our own knowledge of the field area and/or the tidbits of data in the proposal.

• consensus 34: recommendation that bare rock legs select alternate site(s) in sediment pockets which could be spuddd-in with conventional technology in the event of technical failure at the barerock site(s).

• Appendix 4: contains "worksheets" or "matrices" showing the status of particular data types compared to the SSP guidelines for the type of drilling target. These worksheets are intended to provide more detailed, less ambiguous guidance to proponents than the text of the minutes by itself. Not all programs have worksheets; in some cases the proposal was too immature, or the data too poorly documented, or the watchdog too overworked at the Trieste meeting to produce worksheets.

FINAL
(June 2, 1993)

JOIDES SITE SURVEY PANEL MINUTES

APRIL 6-8, 1993
OGS, Trieste, Italy

Members: Kastens, Kim (L-DEO, Palisades, NY, USA) Chair
Camerlenghi, Angelo (OGS, Trieste, Italy)
Farre, John (EXXON, Houston, TX, USA)
Hinz, Karl (Bundesanstalt fur Geowiss u. Rohstoffe, Germany)
Moore, Greg (SOEST, Honolulu, HI, USA)
Mountain, Greg (L-DEO, Palisades, NY, USA)
Shinohara, M. (alternate for N. Hirata, Japan)
Scrutton, Roger (U. of Edinburgh, Edinburgh, UK)
Sibuet, Jean-Claude (IFREMER, Brest, France)
Srivastava (Atlantic Geoscience Center, Dartmouth, NS, Canada)

Liaisons: Blum, Peter (TAMU)
Collins, Bill (JOIDES Office)
Kidd, Rob (PCOM)

Observers: Maria Cita (U. of Milan, Milan, Italy)
Rainer Zahn (Geomar, Kiel, Italy)

Apologies: Trehu, Ann (OSU, Corvallis, USA)
von Herzen, Dick (WHOI, Woods Hole, USA)

Inactive: Zverev, Sergey (IEP, Moscow, Russia)

AGENDA

JOIDES Site Survey Panel
April 6-8, 1993
OGS, Trieste, Italy

1. PRELIMINARY MATTERS
   - A. Introductions (Kastens)
   - B. Logistics (Camerlenghi)
   - C. August 1992 Lamont meeting:
     - Changes to minutes (Kidd)
     - Action Items (Kastens)
   - D. Charge for this meeting (Kastens)
   - E. Status of latest Thematic Panel ratings (Collins)
   - F. New watchdog assignments (Kastens)
   - G. New SSP evaluation worksheets (Kastens)
2. REPORTS
   - A. Nov. '92 SSP-subgroup meeting (Kastens/Kidd)
   - B. PCOM/PANCH (Kidd)
   - C. JOIDES (Collins)
   - D. Data Bank (Mountain)
   - E. PPSP (Mountain)
   - F. Shallow Water Drilling Workshop (Kastens)
3. POST-MORTEM ON RECENTLY DRILLED LEGS
   - A. Leg 145: North Pacific Transect (Blum)
   - B. Leg 146: Cascadia Margin (Camerlenghi)
4. UPDATES ON SCHEDULED LEGS
   - A. Leg 149: Iberia Abyssal Plain Deep Hole: NARM-NV1 (Mountain)
   - B. Leg 150: New Jersey Margin (Kastens)
   - C. Leg 151: North Atlantic Arctic Gateway (Mountain)
   - D. Leg 152: East Greenland Margin (Mountain)
   - E. Leg 153: MARK (Shirohara)
   - F. Leg 154: Ceara Rise (Kidd)
   - G. Leg 155: Amazon Fan (Kidd)
   - H. Leg 156: North Barbados Ridge (Camerlenghi)
   - I. Leg 157: DCS test at Vema Fracture Zone (Kastens)
   - J. Leg 158: TAG Hydrothermal System (Moore)
5. POTENTIAL FUTURE DRILLING TARGETS: TECP
   - A. Alboran Basin (323-rev2) (Kastens)
   - B. NARM non-volcanic II (Iberia II) (Mountain)
   - C. Eastern Equatorial Atlantic Transforms (346-rev3) (Camerlenghi)
   - D. Mediterranean Ridges, shallow (330-rev) (Farre)

E. North Australian Margin (340-rev) (Scrutton) NEW
F. Costa Rica Accretionary Wedge (400, 400rev) (Moore)

6. POTENTIAL FUTURE DRILLING: SGPP
A. Gas Hydrate, Blake Ridge & Carolina Rise (423-rev) (Mountain) NEW
B. New Jersey Margin II (Kastens)
C. Bahamas Transect (412-rev) (Sibuet) NEW
D. Mediterranean Sapropels (391-rev) (Kidd)
E. VICAP/MAP (380-rev3) (Farre)

7. POTENTIAL FUTURE DRILLING: LITHP
A. Evolution of Oceanic Crust (420) (Shrivastava) NEW
B. Return to 735B, Atlantis II FZ (300-rev) (Shrivastava) NEW
C. NARM volcanic II (NARM) (Scrutton)
D. Red Sea (086-rev) (Scrutton) NEW
E. Sedimented Ridges II (SR-DPG) (Hinz)

8. POTENTIAL FUTURE DRILLING: OHP
A. North Atlantic Arctic Gateways II (Hinz)
B. Sub-Antarctic SE Atlantic Transect (430) (Camerlenghi) NEW
C. Benguela Current (354rev, 354add) (Farre)
D. Caribbean K/T boundary (415rev) (Mountain)
E. California Margin (386-Rev2/422-Rev) (Kidd)
F. Bermuda Rise/Blake Bahama Outer Ridge (404) (Mountain)
G. South Florida Margin (427) (Farre) NEW

9. OTHER BUSINESS
A. Response to draft report on JOIDES Advisory Structure
B. SSP Guidelines
C. Feedback to proponents
D. Panel membership
E. Next meeting

Executive Summary

JOIDES Site Survey Panel Meeting

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 '93 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. Following are the consensus and action items resulting from this meeting.

SSP CONSENSUS 1: For the 1993 round of assessments SSP will flag proposals at its April meeting that potentially could have **safety considerations**. By discussion with PPSP Chair, SSP may invite proponents on these proposals to present data at SSP's July meeting. After this, or in lieu of this, these proposals may be recommended for PPSP pre-review at PPSP's Fall meeting.

SSP CONSENSUS 2: SSP notes that the presence of gas in the sediments at the **Santa Barbara Basin** site drilled on Leg 146 is obvious in 3.5kHz and SCS profiles in the data package. Although the gas was CO_2, and thus did not pose a safety problem, the stratigraphic objectives may have been somewhat compromised by pervasive gas-induced disturbance of the sediment laminae. SSP wonders if a less rushed approach to the compilation and evaluation of regional seismic data might have found a site where gas-disturbance of sediments would have been less of a problem.

SSP CONSENSUS 3: All data required for Leg 149, **Iberia Abyssal Plain** NARM-V I, have been deposited with the Data Bank.

SSP CONSENSUS 4: Two vital seismic lines (Ex77-8 and BGR 201), in support of the new **New Jersey margin** sites MAT 13 and MAT 14, need to be submitted to the data bank immediately. In addition, 3.5kHz data is said to exist across the two new sites, but is not in the data bank. Finally, every effort should be made to submit "desirable" data types: GLORIA, Hydrosweep bathymetry, and logs of cores in the vicinity.

SSP CONSENSUS 5: **North Atlantic Arctic Gateway** proponents must submit full data packages for sites ICEP-2, ICEP-3, ICEP-4, NIFR-1 and SIFR-1. These sites were approved by PPSP at their April meeting, but have never been seen or evaluated by SSP, and no data in support of these sites exists in the Data Bank.

SSP CONSENSUS 6: For Leg 152, **East Greenland Margin**, the Data Bank lacks copies of the new high-res seismic data collected in the summer of '92, 12kHz records, a summary of surficial grab samples, and information related to bottom currents and surficial ice conditions.

SSP CONSENSUS 7: The data package for the primary targets at **MARK** (Leg 153) is nearly complete. We still await (a) locations for the photographs near site MK1, (b) additional data from the MPL/SIO Deep Tow cruise, and (c) existing refraction data. SSP feels that it would be prudent for barerock drilling legs to plan backup sites in sediment ponds in case of technical failure on barerock sites; 3.5kHz and/or SCS and/or coring information should be submitted to document drillable sediment pockets in the vicinity of the primary sites.

SSP CONSENSUS 8: The **Ceara Rise** data package is complete except for 4 piston core descriptions still to be filed at the Data Bank.

SSP CONSENSUS 9: The **Amazon Fan** site survey data package is complete in the Data Bank.

SSP CONSENSUS 10: The **North Barbados Ridge** has a strong data package. All "vital" data types are in the Data Bank. Several existing "desirable" data types are not yet submitted, including improved seismic velocities, and the results of the 3-D seismic processing.

SSP CONSENSUS 11: SSP cannot at the present time endorse drilling at 1500m water depth on the crest of the **Vema Fracture Zone** transverse ridge, in the absence of any observational evidence that lithologies of interest for scientific or engineering purposes will be recovered at that water depth. It is possible that a suitable target can be found at ~1500m waterdepth by SCS/dredging/Hydrosweep operations aboard the Ewing this summer. Data packages for originally-proposed sites VE-1, VE-2 and VE-3 are expected to be completed after the August 1993 Ewing cruise.

SSP CONSENSUS 12: All "vital" data types for the proposed sites at the **TAG Hydrothermal System** (361-Rev2) are in the Data Bank. Newly-collected heatflow data should be submitted in time for Safety review. SSP feels that it would be prudent for barerock drilling legs to plan backup sites in sediment ponds in case of technical failure on barerock sites; 3.5kHz and/or SCS and/or coring information should be submitted to document drillable sediment pockets in the vicinity of the primary targets.

SSP CONSENSUS 13: From a scientific perspective, sufficient data now exist in the data bank to schedule an **Alboran** drilling leg. Heatflow measurements are still desirable for safety panel consideration, and a core is still required near the re-entry sites; these will be collected on an April/May 1993 Hesperides cruise. If new sites are selected in response to safety pre-review, proponents must ensure that the documentation for these new sites is in the Data Bank.

SSP CONSENSUS 14: All "vital" data types for **Eastern Equatorial Atlantic Transforms** are in the Data Bank except for the MCS crossing of IG5. Several "desirable" data types exist, but have not yet been deposited. The program is ready for PPSP pre-review.

SSP CONSENSUS 15: The data package for drilling the **Mediterranean Ridge** remains incomplete. There is a general lack of high-resolution SCS data across the sites. On the complex areas of the Mediterranean Ridge, SSP is requiring crossing high-resolution SCS profiles and swath bathymetry over the sites in addition to the usual requirements for Target Type "A". Based on SSP's understanding of several site surveys planned for summer '93, it is possible that a complete data package for one leg worth of drilling will be submitted by November 1, '93.

SSP CONSENSUS 16: In considering data types that will be needed in support of **North Australian Margin** drilling, SSP points out (a) the need for a grid of intersecting seismic lines plus swathmapping data in this structurally complex setting, (b) the need for heat flow data if the fluid flow objective is pursued, and (c) the need for core data if reentry holes are proposed.

SSP CONSENSUS 17: The **Costa Rica Accretionary Wedge** (400/400-Add) data set is satisfactory for the current structural objectives and would be drillable in 1995.

A detailed heat flow and Alvin dive program have been funded and should provide required data for fluid objectives for 1995 drilling.

SSP CONSENSUS 18: No data for **Gas Hydrates** (423-rev) is in the Data Bank, although the proposal suggests that significant relevant data exist. In addition to the usual data types required for paleoenvironment sites, SSP will want to see velocity determinations so that the position of drilled samples relative to the BSR can be accurately known. Also, SSP will want to see heat flow measurements so that the observed clathrate distribution in the drillhole can be compared with the distribution predicted for the theoretical temperature/pressure stability field.

SSP CONSENSUS 19: In support of the sealevel objectives of the **Bahamas Transect**, a grid of seismic lines, rather than a single crossing, will be required to get a three dimensional view of the prograding sequences. In support of the fluid flow objectives, SSP will want to see observational evidence that the hypothesized discharge and recharge zones exist (relevant data could include detailed heatflow measurements, near-bottom towed side-looking sonar and 3.5/4.5kz, and visual observations).

SSP CONSENSUS 20: No data has been submitted to the Data Bank since the packages that arrived in support of the **Mediterranean Sapropels** proposal in November '92. Apart from the proposed re-occupation of Tyrrhenian Sea ODP site 652, none of the Medsap sites can be considered fully documented in terms of site survey data. Based on SSP's understanding of several site surveys planned for summer '93, it is possible that a complete data package could be submitted by November 1, '93.

SSP CONSENSUS 21: The data package for **MAP**is complete, and from SSP's perspective, the program is ready to drill. Since the August '92 SSP meeting, a minor quantity of additional data has been deposited in the data bank in support of **VICAP**; however, this data package remains far from complete. SSP is aware of planned cruises that will address many or all of the deficiencies in the VICAP data package.

SSP CONSENSUS 22: SSP generally endorses the planned survey data collection strategy outlined in the "**Evolution of Oceanic Crust**" drilling proposal. Because the experimental design of the drilling leg depends critically on penetrating a hypothesized normal fault, SSP urges the proponents to make every effort to image or otherwise document the existence, attitude, and depth of this fault, rather than relying on inference from surface morphology alone.

SSP CONSENSUS 23: The proposal to **return to site 735B** on the Atlantic II Fracture Zone is an ambitious project which will be more successful if the geological and geophysical setting of the sites are better understood through additional survey/sampling work before drilling begins.

SSP CONSENSUS 24: If the East Greenland transect EG63 is not completed on Leg 152, very little additional data would be needed to plan a **second NARM volcanic margin leg** using already-approved EG63 sites. If, however, Leg 152 does complete the EG63 objectives, and a second NARM volcanic leg wishes to focus on the Voring Margin, substantial improvement to that data package will be needed.

SSP CONSENSUS 25: Only a small amount of a very large **Red Sea** data set is presented in the proposal. Existing data sets have not yet been fully exploited in support of this program, and it is unclear at this time whether additional data collection would be necessary before the Red Sea could be scheduled for drilling.

SSP CONSENSUS 26: Much of the data needed for **Sedimented Ridges II** drilling remains in the Data Bank in the package prepared for Leg 39. ROV and side-looking sonar data acquisition scheduled for 1993 will strengthen the data package.

SSP CONSENSUS 27: The existing Data Bank data package prepared for NAAG I (now scheduled as Leg 151) will need to be supplemented to provide enough fully-documented sites for a **second leg of NAAG** drilling.

SSP CONSENSUS 28: New data must be acquired to prepare an adequate site survey data package for the **Sub-Antarctic SE Atlantic Transect,** and proponents plan to request funding to acquire such data. SSP does not anticipate that the data package for this leg will be ready in time for FY95 scheduling.

SSP CONSENSUS 29: No data has yet been deposited in the data bank in support of **Benguela Margin** drilling, but a site survey cruise is scheduled for April/May 1993. Because of the likelihood of encountering stratigraphy affected by mass wasting, SSP is requiring crossing high-resolution SCS at all sites, and swath bathymetry across areas of rugged topography, in addition to the core data and 3.5kHz/Parasound that are always considered "vital" for paleoceanographic sites.

SSP CONSENSUS 30: NSF has recently declined a proposal to survey the region of the **Caribbean K/T boundary** drilling targets; and no effort has yet been made to compile a data package from existing data. In addition to the normal data types for Target Type "D," SSP will want to see (1) regional data (e.g. magnetic anomalies, seismic ties to existing drillholes) documenting that the basement age is not younger than Late Cretaceous, and (2) piston cores in support of the paleoceanography objectives.

SSP CONSENSUS 31: No original data has yet been submitted in support of **California Margin** proposal 386-Rev2 but it is now to be merged by OHP with California Borderland proposal 422-Rev. SSP urges the proponents of these two offshore California proposals to finalize site locations and prepare their data packages to meet Target A requirements for the 1 July '93 deadline.

CONSENSUS 32: Although no data has yet been submitted to the Data Bank in support of **NW Atlantic Sediment Drifts,** SSP anticipates that the proponents will be able to assemble a strong data package from abundant existing data, and from a funded upcoming (1993) cruise.

SSP CONSENSUS 33: No data package has yet been submitted in support of **South Florida Margin** drilling. SSP generally endorses the proposed site survey plan outlined in the proposal. Because of proposed shallow-water drilling and the desired use of the DCS, this proposal will need special attention from the ODP advisory system.

SSP CONSENSUS 34: SSP considers that it would be prudent for **barerock drilling legs** to have alternate site(s) in sediment pockets, which could be spudded-in with conventional technology in the event of technical failure at the barerock site(s). Consequently, the data package for barerock legs should include 3.5kHz data, and/or SCS data, and/or coring data sufficient to document the location of drillable sediment pockets in the vicinity of the primary targets.

****

ACTION ITEM 1: Kastens to convey the sense of SSP's discussion of **shallow water hazards** surveys to PPSP Chair Mahlen Ball for incorporation into the guidelines under preparation. SSP to review the draft guidelines for shallow water drilling when they become available.

ACTION ITEM 2: Kastens to alert PPSP Chairman Ball to the possible need for a safety pre-review for **Eastern Equatorial Atlantic Transforms.**

ACTION ITEM 3: Kastens to alert PPSP Chair Ball to the possible need for a Safety Prereview for the **Costa Rica Accretionary Wedge** program, if the program is put in the prospectus for FY95.

ACTION ITEM 4: Kastens to alert PPSP Chairman Ball to the possible need for a safety pre-review for **Gas Hydrates.**

ACTION ITEM 5: PCOM liaison Kidd to present the sense of SSP's discussion on **Dürbaum report** to PCOM.

ACTION ITEM 6: Each **watchdog** will write a letter to the lead proponent of each proposal discussed in Trieste, enclosing the relevant section of the SSP minutes, plus copies of the completed SSP worksheets (if applicable). A copy of these letters will be sent to the ODP Data Bank.

ACTION ITEM 7: Kastens to contact **three candidate members** to see if they are willing to join SSP. Kastens to forward names of candidate members to PCOM chair.

ACTION ITEM 8: Kastens to request permission for **SSP meeting** at Lamont the last week of July from PCOM Chair.

MINUTES

JOIDES Site Survey Panel

April 6-8, 1993

OGS, Trieste, Italy

1. PRELIMINARY MATTERS

A. *Introductions (Kastens)*

Kastens welcomed new members Jean-Claude Sibuet (France), Roger Scrutton (Great Britain), and Shiri Srivastava (Canada), and new JOIDES Office liaison Bill Collins. Rob Kidd has changed status from SSP member to PCOM liaison. Peter Blum has changed status from JOIDES Office liaison to TAMU liaison.

B. *Logistics (Camerlenghi)*

C. *August 1992 Lamont meeting:*

Changes to minutes (Kidd): There were no changes to the minutes.

Action Items (Kastens): Kastens reported that she had not submitted guidelines for survey requirements for Offset Drilling (Tectonic Windows) for publication in the JOIDES Journal because of uncertainty over whether near-bottom towed side-looking sonar should be "required" or "recommended." We decided to reconsider this question when we discuss Leg 147 (Hess Deep) at our next meeting.

D. *Charge for this meeting (Kastens)*

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 '93 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.

E. *Status of latest Thematic Panel ratings (Collins)*

Collins summarized the rankings from the Spring '93 thematic panel meetings and briefly described the goal of each of the new proposals.

F. *New watchdog assignments (Kastens)*

Watchdogs were selected for new proposals. The new watchdog assignments are reflected in the agenda at the beginning of these minutes. All of the watchdog assignments in the minutes are permanent, with the following exceptions: Mountain is the temporary watchdog for Leg 152 (East Greenland Margin), pending return of the regular watchdog Trehu. Kastens is the temporary watchdog for the Vema Fracture Zone, pending return of the regular watchdog Hirata. Shinohara is the temporary watchdog for Leg 153 (MARK), pending return of the regular watchdog Hirata. Camerlenghi is the temporary watchdog for Leg 156 (Barbados) pending return of the regular watchdog Trehu. Scrutton is the temporary watchdog for NARM volcanic margin II, pending return of the regular watchdog Trehu. Sibuet replaces Camerlenghi as the permanent watchdog for Eastern Equatorial Atlantic Transforms because of a newly-developed conflict of interest.

G. *New SSP evaluation worksheets (Kastens)*

Kastens described new evaluation worksheets developed for November '92 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. Collins asked whether to include SSP worksheets in the digital database on proposal status maintained by the JOIDES office; we decided not to do so until we have more experience using these worksheets internally within SSP. 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 Databank.

2. REPORTS

A. Nov. '92 SSP-subgroup meeting (Kastens/Kidd)

By the end of the August 1992 SSP meeting, it was obvious that no program was 100% ready for drilling from the perspective of site-survey readiness. Every program had at least minor items missing from the package in the Data Bank. After PCOM compiled the FY'94 Prospectus at their August 1992 meeting, proponents of prospectus proposals were given a new deadline of 1 Nov 1992 to complete their data packages.

A subgroup of SSP (Kastens, Kidd, Mountain plus Jamie Austin representing PCOM) met at Lamont in early November to evaluate the new data submitted in response to the November 1 deadline. Alboran Sea, Ceara Rise, Amazon Fan, N. Barbados Ridge, E. Equatorial Atlantic Transform, and NARM-Newfoundland Basin were considered to be ready for drilling from a scientific perspective. MARK and TAG had outstanding deficiencies, but it was thought that they could be made ready for PPSP review by April 1993. Within the Vema FZ proposal, only Site VE-3 could be made ready for FY'94 drilling; and within VICAP-MAP, only MAP was ready. The Mediterranean Ridge and Mediterranean Sapropels proponents had deposited a large amount of data in the Data Bank, but even so the data packages were incomplete at the time of the November sub-group meeting. Appendix 1 (prepared by Rob Kidd for PCOM) summarizes the detailed status of each proposal at the time of the November meeting.

B. PCOM/PANCH (Kidd)

Kidd had earlier circulated a report to SSP members summarizing his report to PCOM/PANCH on SSP issues. Among his recommendations: (1) SSP should flag potential safety problem proposals in April, (2) SSP should meet 3 times per year, (3) SSP and PPSP should be involved in any working group on shallow water drilling surveys. Recommendation (3) came to pass; see agenda item 2F below.

Discussion of the increased emphasis of the role of SSP in early identification of proposals that might have safety connotations resulted in agreement that SSP should flag such proposals at its April meeting. The PPSP Chair should decide in consultation with SSP whether the proponents should be asked to present data at the summer SSP meeting. After this, or in lieu of this, SSP and PPSP Chairs could recommend a pre-review at the fall PPSP meeting, ie prior to PCOM consideration for scheduling. Since PPSP Chair Mahlon Ball was unable to attend the April 1993 SSP meeting, it was agreed that SSP would adopt this procedure for the 1993 round by flagging the relevant proposals for Ball to make his decision for July SSP based on his reading of the proposal.

In clarification of the recommendation that SSP should meet three times per year, the ODP annual proposal cycle was reviewed for the benefit of new panel members: The April SSP meeting evaluates all proposals that were highly ranked at the Spring Thematic Panel meetings, and provides feedback to proponents on how to collect and compile data in support of their programs. The summer SSP meeting evaluates the site-survey readiness on a site-by-site, datatype-by-datataype basis, of those highly-ranked proposals for which a data package has been submitted to the ODP Data Bank. The results of the summer meeting guide PCOM in deciding which programs to put into the prospectus. Last year, a November subgroup meeting was necessary to complete a second round of evaluations of the site-survey readiness, on a site-by-site, datatype-by-datatype basis, of the proposals in the prospectus. The results of the November meeting results guided PCOM in their final scheduling for FY'94. Discussion ensued on the optimum configuration of SSP meetings, i.e. number of meetings and their timing, and several viable alternatives were considered. A decision on the necessity of a November meeting will be made when we see how many data deficiencies remain in top-ranked proposals (i.e. lead candidates for FY95 scheduling) at the end of the July SSP meeting.

SSP CONSENSUS 1: For the 1993 round of assessments SSP will flag proposals at its April meeting that potentially could have safety considerations. By discussion with PPSP Chair, SSP may invite proponents of these proposals to present data at SSP's July meeting. After this, or in lieu of this, these proposals may be recommended for PPSP pre-review at PPSP's Fall meeting.

C. JOIDES (Collins)

Collins summarized recent issues being addressed by the JOIDES office: (a) response to the draft Dürbaum report; (b) the Budget Committee report; and (c) the status of the Can/Aus consortium.

D. Data Bank (Mountain)

Acting ODP Data Bank manager Greg Mountain circulated a list of data received at the Data Bank since our August meeting.

E. PPSP (Mountain)

Acting ODP Data Bank Manager Greg Mountain reviewed the outcomes of the April 1993 PPSP meeting. All sites proposed for New Jersey continental slope and rise (revised Leg 150), North Atlantic Arctic Gateways (Leg 151), and East Greenland margin (Leg 152) were approved, in some cases with minor modifications. Safety pre-review of Barbados Ridge (Leg 156) revealed no potential safety issues. Safety pre-review of the Alboran Sea proposal revealed several concerns about deep drilling into overpressured units, and about certain sites located in potentially hydrocarbon-prone structural settings. PPSP members gave Alboran proponent Watts detailed advice about data processing and display strategies that can help improve the ability of PPSP to evaluate these risks accurately. The Alboran safety pre-review had been recommended by SSP, and we were pleased to see that it had been effective at uncovering both potential safety problems and potential solutions to those problems.

F. Shallow Water Drilling Workshop (Kastens)

In response to the safety problems of Leg 150, New Jersey margin, a meeting was convened to consider new strategies that might make it possible for ODP to drill safely and productively in shallow (<200m) water depths. The meeting was chaired by PPSP Chair Ball and attended by SSP Chair Kastens. Two kinds of strategies were discussed: improved high-resolution site surveys to identify and avoid gas pockets in the drilled section, and techniques to safeguard the ship while drilling. Hazard survey techniques used in industry, and hazard survey requirements of various governments were reviewed. The usual approach is an MCS grid survey. The line spacing is denser (50-100m), the source is higher frequency, and the shotpoint spacing is tighter, than are used for academic scientific MCS surveys. By the end of the meeting, the sense was that ODP can indeed find sites suitable for drilling on the continental shelf, provided that additional dedicated hazard surveys are conducted at each candidate site. A draft set of requirements for shallow water hazard surveys and shallow water drillship procedures is being written under the direction of Mahlen Ball. SSP will have an opportunity to review and comment on the survey requirements as soon as they are written.

Some SSP members expressed dismay over the impression conveyed by some PPSP members that academic investigators were incapable of carrying out adequate hazard surveys. These SSP members felt that their own expertise was transferrable to this new type of survey, provided that the guidelines were clear and explicit. There was some discussion of the potential for biased interpretation of hazards survey data: a commercial interpreter might maximize stated hazards to minimize his company's liability; whereas an academic investigator might minimize stated hazards to maximize the chances of getting interesting sites drilled. Finally, some SSP members expressed concerned about how such potentially expensive surveys could ever get funded in the academic system, and queried whether as extensive a survey as is used in industry is really needed in the ODP context.

ACTION ITEM 1: Kastens to convey the sense of SSP's discussion of shallow water hazards surveys to PPSP Chair Mahlen Ball for incorporation into the guidelines under preparation. SSP to review the draft guidelines for shallow water drilling when they become available.

3. POSTMORTEM ON RECENTLY DRILLED LEGS

A. Leg 145: North Pacific Transect (Blum)

SSP had requested that the Co-Chief Scientists of Leg 145 carry out a pre-drilling seismic survey at several sites where the seismic lines in the data package were of marginal quality. These surveys were carried out as requested, and the subsequent drilling did not encounter any problems that might have been avoided with better pre-cruise data.

B. Leg 146: Cascadia Margin/Santa Barbara Basin (Camerlenghi)

The Cascadia margin proponents had prepared an excellent data package, which was approved by SSP well in advance of the drilling leg. Drilling did not reveal any problems related to the background data set.

One site in the Santa Barbara Basin was added to the Leg 146 program only a short time before the drilling leg. The data package for this site was approved after mail review by the Chairmen of SSP and PPSP, but the full data package was not methodically reviewed by SSP in our normal fashion. Drilling in the Santa Barbara Basin recovered very gassy sediments. The gas was mostly carbon dioxide, and thus did not present a safety hazard. However, most of the cores were heavily disturbed by gas expansion fractures, and by sediment extension at the end of the sections and through the holes punched in the liners to allow gas pressure to dissipate. The gas-induced sediment disturbance is particularly critical for the detailed paleoceanographic objectives dependent on the recovery of intact sections of laminated deposits. In looking back at the seismic data around the Santa Barbara Basin site, SSP notes that gas is extremely evident on the SCS and 3.5kHz profiles contained in the data package. Below about 30m subbottom, gas appears to be pervasive and no seismic reflectors are detectable. Gas is also present at the surface and a gas expulsion mound is present on line Farnella 92-4, line 6. Drilling in the Santa Barbara Basin reached 200m subbottom, well below the zone of obviously disturbed sediments on the SCS profiles. SSP wonders whether a more methodical, deliberate approach to the compilation and examination of seismic and 3.5kHz data from the Santa Barbara Basin might have found a site where gas-disturbance of sediments would have been less of a problem.

SSP CONSENSUS 2: SSP notes that the presence of gas in the sediments at the Santa Barbara Basin site drilled on Leg 146 is obvious in 3.5kHz and SCS profiles in the data package. Although the gas was CO_2, and thus did not pose a safety problem, the stratigraphic objectives may have been somewhat compromised by pervasive gas-induced disturbance of the sediment laminae. SSP wonders if a less rushed approach to the compilation and evaluation of regional seismic data might have found a site where gas-disturbance of sediments would have been less of a problem.

4. UPDATES ON SCHEDULED LEGS

A. Leg 149: Iberia Abyssal Plain: NARM-NV1 (Mountain)

[SSP members Sibuet, Srivastava, and Hinz are proponents for NARM]

All data required for Leg 149 have been deposited with the Data Bank. SSP commends the several proponents and their respective institutions for the cooperation shown in preparing these data. We note, however, the benefit that could have derived from all participants submitting digital navigation; this would have enabled the Data Bank to display all relevant ship tracks at a common scale.

SSP CONSENSUS 3: All data required for Leg 149, Iberia Abyssal Plain NARM-V I, have been deposited with the Data Bank.

B. Leg 150: New Jersey Margin (Kastens)

[SSP member Greg Mountain is a proponent for New Jersey margin.]

At our August 1992 meeting, SSP considered that the New Jersey shelf and slope sites were ready to drill from a scientific perspective, but noted that the possibility of shallow gas was still an unresolved safety hazard. At the October Safety Panel meeting, sites MAT 1 through MAT 9, i.e all of the shelf sites, were disallowed. The present plan includes sites MAT 10, 11 and 12, which were approved by SSP in Aug 1992 and by PPSP in October 1992. In addition, two new primary sites, never before considered by SSP, have been proposed. MAT 13 & 14, plus alternate sites 15, 16 & 17, were approved by PPSP at its April 1993 meeting.

MAT 13 is on the slope (345m water depth), along strike to the NE from the cluster of other planned sites, in a region where the upper Neogene (5.5Ma) to recent units are particularly well developed. Total proposed depth is 833m (predicted age 13.5Ma). The site is almost but not quite on a crossing of MCS lines: site is on dip line Ew9009, 0.5km upslope of a crossing with line Ex77-8. The Ewing line is in the data bank; the Exxon line is available, but not yet deposited. The Ewing SCS grid does not reach this far northeast. According to the proponents, 3.5kHz data (vital), Hydrosweep (desirable), GLORIA (desirable), and cores (desirable) exist but are not yet deposited in the data bank.

MAT 14 is on the continental rise (2761m water depth), downslope from the main cluster of drillsites. The site is at the intersection of MCS lines USGS line 25 and BGR line 201. The USGS line is in the data bank, but BGR line is not. According to the proponents, 3.5kHz data (vital), Hydrosweep (desirable), GLORIA (desirable), and cores (desirable) exist but are not yet deposited in the data bank.

Worksheets evaluating sites MAT-13 and -14 against the SSP guidelines for Target Type B: Passive Margin are included in the Appendix.

SSP CONSENSUS 4: Two vital seismic lines (Ex77-8 and BGR 201), in support of the new New Jersey margin sites MAT 13 and MAT 14, need to be submitted to the data bank immediately. In addition, 3.5kHz data is said to exist across the two new sites, but is not in the data bank. Finally, every effort should be made to submit "desirable" data types: GLORIA, Hydrosweep bathymetry, and logs of cores in the vicinity.

C. Leg 151: North Atlantic Arctic Gateway (Mountain)

[no SSP members are proponents for NAAG]

Sites ICEP-2, -3 and -4 plus NIFR-1 and SIFR-1 were developed as potential targets since the last meeting of SSP and have thus not been examined for survey data adequacy. These sites as well as the sites seen previously by SSP were approved by PPSP at their April '93 meeting. Sites not drilled on Leg 151 may be attempted on a future

NAAG leg. Proponents should submit all data relevant to these "unseen" sites at the soonest possible date, but in any case not later than the July 1 data deadline. This will ensure that: (a) SSP can evaluate survey data adequacy for NAAG II for potential 1995 drilling, and (b) the Data Bank can prepare data packages to send to TAMU and to the Resolution in time for Leg 151.

> **SSP CONSENSUS 5: North Atlantic Arctic Gateway proponents must submit full data packages for sites ICEP-2, ICEP-3, ICEP-4, NIFR-1 and SIFR-1. These sites were approved by PPSP at their April meeting, but have never been seen or evaluated by SSP, and no data in support of these sites exists in the Data Bank.**

D. Leg 152: East Greenland Margin: NARM-V I (Mountain)

[SSP members Srivastava, and Hinz are proponents for NARM]

High-resolution seismic data of excellent quality were collected in the summer of '92 across each of the four proposed EG63 sites; SSP encourages the proponents to submit reproducible copies of these profiles to the Data Bank at their earliest convenience. Additional data useful to the drilling operations that await deposit include 12 kHz records and a summary of surficial grab samples (both of which SSP believes were collected last summer). Similarly, information relating to bottom currents and surficial ice conditions (as described in the Leg 152 Safety package presented to PPSP in Kiel) should be sent to the Data Bank and TAMU/ODP operators alike.

> **SSP CONSENSUS 6: For Leg 152, East Greenland Margin, the Data Bank lacks copies of the new high-res seismic data collected in the summer of '92, 12kHz records, a summary of surficial grab samples, and information related to bottom currents and surficial ice conditions.**

E. Leg 153: MARK (Shinohara)

[no SSP members are proponents for MARK]

Since SSP's August meeting, several datasets have been submitted to the Data Bank. These are: (1) representative Alvin photographs near MK1 site (but not located on track), a map showing ALVIN and Angus dive tracks with drill holes and seismic surveys, ALVIN dive track profiles and sample locations with description of samples, and a reprint containing ALVIN and Angus results; (2) 96-ch MCS data with a track chart, and a reprint of MCS survey and results; (3) track lines from recent MPL/SIO deep-tow side looking sonar cruise plus two page-size "preliminary" side-looking sonar images; (4) Videos of Nautile dives in the vicinity of MK2 site; (5) annotated map of gravity data showing sites MK1 and MK2.

A note from the proponents says that ALVIN video data cannot be provided for MK1 site, because video systems did not work during dive in the region of MK1. Original films of still camera photos are archived at WHOI. The representative photographs near site MK1 will be more useful when location information is submitted to the Data Bank. More extensive data from the MPL/SIO Deep Tow cruise has been promised by Jeff Karson. The Data Bank has a location map for refraction data but no data are in the Data Bank; refraction data are "recommended" in support of tectonic window sites, and so this data should be submitted to the Data Bank.

There is no 3.5 kHz or SCS in the Data Bank. SSP feels that it would be prudent for all bare rock legs to go to sea ready with alternative sites in sediment pockets in case of technical failure with bare rock procedures (see below under Site Survey Guides, agenda item 9B). If this advice is taken, the proponents should submit 3.5kHz, SCS and or coring data to document the sediment distribution in the vicinity of the primary targets.

Worksheets evaluating the status of the MARK data package against the draft SSP guidelines for Tectonic Window drill sites are included in the Appendix.

SSP CONSENSUS 7: The data package for the primary targets at MARK(Leg 153) is nearly complete. We still await (a) locations for the photographs near site MK1, (b) additional data from the MPL/SIO Deep Tow cruise, and (c) existing refraction data. SSP feels that it would be prudent for barerock drilling legs to plan backup sites in sediment ponds in case of technical failure on barerock sites; 3.5kHz and/or SCS and/or coring information should be submitted to document drillable sediment pockets in the vicinity of the primary sites.

F. Leg 154: Ceara Rise (Kidd)

[SSP member Mountain is a proponent for Ceara Rise]

The Ceara Rise data set was judged complete during the November '92 SSP assessment, except for core log descriptions that still were to be submitted for as-yet unsplit cores taken at 4 of the 7 proposed sites. Subsequently PCOM scheduled a Ceara Rise leg at its December '92 meeting and PPSP has deferred its assessment to its summer meeting. The remaining core descriptions are still to be filed with the Data Bank.

SSP CONSENSUS 8: The Ceara Rise data package is complete except for 4 piston core descriptions still to be filed at the Data Bank.

G. Leg 155: Amazon Fan (Kidd)

[no SSP members are proponents for Amazon Fan]

The Amazon Fan data package was judged complete at the November SSP sub-group meeting.

SSP CONSENSUS 9: The Amazon Fan site survey data package is complete in the Data Bank.

H. Leg 156: North Barbados Ridge (Camerlenghi)

[SSP member Moore is a proponent for Barbados Ridge]

Since the August SSP meeting, a large amount of good quality data has been added to the North Barbados Ridge data package. The North Barbados Ridge program was pre-reviewed without problems during the April meeting of PPSP.

The sites are very well documented seismically by a 3-D MCS survey. Example processed lines at large scale are in the data base, and small scale plots of all of the 2-D migrated lines belonging to the 3-D survey (103 lines, 50m spacing) have been submitted to the Data Base. Previous MCS stacking velocities used for Leg 110 drilling are available in the Data Base. Other MCS stacking velocities from various cruises are available, but they are not in the Data Base. Refraction velocities from OBS recordings are being worked on, and are not yet submitted to the Data Bese.

French 3.5 kHz deep-tow subbottom profiles, and heat flow measurements in the vicinity of site NBR-4 have been submitted. A French multibeam map at 10 m contour interval, and a French SAR near-bottom towed side-looking sonar image, cover all of the proposed sites.

Track charts for 1992 Nautile dives around ODP site 676 are in the Data Base, but visual data have not been submitted. A letter from S. Lallement says that no signs of fluid expulsion were noted on the submersible dives. Because these dives were not at a proposed site, and because the dive records apparently do not contain visual information that might relate directly to the fluid flow objectives of the drilling proposal, and because the submersible data are newly collected and not yet published and considered still proprietary by the acquirer, SSP will not press to have visual data from the Nautile dives deposited in the Data Bank.

Even though these are re-entry sites, SSP does not require coring data because the lithology of the sediments to be drilled is well know from previous DSDP and ODP drilling in the area.

Worksheets evaluating the North Barbados Ridge data package against the SSP guidelines for Target Type "C: active margin" are included in the Appendix.

SSP CONSENSUS 10: The North Barbados Ridge has a strong data package. All "vital" data types are in the Data Bank. Several existing "desirable" data types are not yet submitted, including improved seismic velocities, and the results of the 3-D seismic processing.

I. Leg 157: DCS test at Vema Fracture Zone (Kastens)

[no SSP members are proponents for Vema; however SSP member Kastens is involved with site survey work in this area]

The status of sites VE-1 and VE-2, the lower crust/upper mantle targets, has not changed since they were declared unready for drilling at our August meeting. Deep-towed SLS scheduled to be collected on the Ewing this summer should complete these data packages.

Site VE-3 was proposed for conventional drilling in 600m water depth on the crest of the Vema southern transverse ridge, where a cap of shallow water limestone is present. Prior to the November 1992 subgroup meeting, the Data Bank received a cruise report containing a section of MCS data across site VE-3. In Trieste, we received monitor records for additional crossings of the limestone cap from the same R/V Explora data set. The Explora data is of good quality, and shows quite a bit of detail within the 400m-thick limestone cap. The seismic coverage of the limestone cap will be supplemented by additional high resolution SCS coverage on the Ewing this summer.

At our November 1992 subgroup meeting, we considered VE-3 to be ready for potential drilling in 1994. Then, at the December PCOM meeting, leg 157 was tentatively scheduled as a test of the diamond coring system, at a site identified as VE-3. The perceived advantages of site VE-3 were that the DCS could be tested in both reefal carbonates and igneous basement, and that the single hole, if successful, could address scientifically-interesting questions about vertical tectonics. However, in spite of the fact that VE-3 was proposed in 600m water depth, the DCS test was directed to take place at a water depth of 1500m to maximize the chance of success of the secondary heave compensator, the Achilles's heel of the DCS.

The distribution of limestone on the Vema transverse ridge is controlled by the amount of subsidence below the photic zone. The existing seismic data show that the base of the limestone cap is fairly uniform at ~1000m below sealevel. The deepest known carbonate-covered point on the relatively-flat crest (as opposed to the steep flanks) of the transverse ridge is at 957m water depth; however, the carbonate cap is <50m thick here and cannot be expected to yield a good subsidence history. It is true, as stated at the December PCOM meeting, that the water depth of the crest of the transverse ridge deepens progressively eastward to near-normal oceanic depths; however, no limestone cap is known to exist at longitudes where the crestal water depth exceeds ~1000m. There remains a slight possibility that reefal limestones may cap the transverse ridge at deeper water depths beyond the westward limit of the Explora data set. This possibility can be explored with the Hydrosweep/SCS/ dredging work this summer aboard the Ewing.

The present Vema Fracture Zone data set includes no site-specific data about potential sites around 1500m water depth. Sites VE-2 and VE-3, the gabbro and peridotite targets, are in ~3500m and ~4200m water depth respectively. If one selected a hypothetical site at the longitude where the crest of the transverse ridge intersects the 1500m bathymetric contour, such a site would be located at ~43°30'W, ~90 km east of proposed site VE-3, and ~85 km west of proposed sites VE-1 and VE-2. We have no empirically-based knowledge of what might be found at such a site. The most likely recovery would be basalt, based on analogy with the section exposed along the Nautile dive transect at 42°40'W. There is no particular reason to think that such a site would address scientific goals posed in the Vema Fracture Zone proposal or in the Offset Drilling Group Whitepaper. The Ewing cruise this summer could explore this hypothetical 1500m site with Hydrosweep, dredging, 3.5kHz and gravity coring. The Ewing will not be equipped to collect photo or video, so no information will be available about the microtopography for guidebase emplacement.

Note added to final version of minutes (Kastens): At the March 30-31 TEDCOM meeting, the issue of optimal water depth for the DCS test site was discussed at length, and the 1500m water depth was no longer felt to be important; in fact some participants thought that 600m water depth, as at the originally proposed site VE-3, would be preferable. At the April 26-28 meeting of PCOM, a resolution was passed encouraging the collection of photographic or video data at potential DCS test sites during the August/Sept 1993 Ewing cruise at the Vema Fracture Zone. The PI's for the Ewing cruise are endeavoring to find funding, equipment and personnel available on short notice to comply with this request.

SSP CONSENSUS 11: SSP cannot at the present time endorse drilling at 1500m water depth on the crest of the Vema Fracture Zone transverse ridge, in the absence of any observational evidence that lithologies of interest for scientific or engineering purposes will be recovered at that water depth. It is possible that a suitable target can be found at ~1500m waterdepth by SCS/dredging/Hydrosweep operations aboard the Ewing this summer. Data packages for originally-proposed sites VE-1, VE-2 and VE-3 are expected to be completed after the August 1993 Ewing cruise.

J. Leg 158: TAG Hydrothermal System (Moore)

[SSP member von Herzen is a proponent for TAG]

Much new data has been submitted to the Data Bank since August, including an Alvin video, bottom photos of proposed drill sites, a TOBI image, bathymetric contours of the TAG area, various kinds of magnetics data, a Bouguer gravity anomaly map and several heat flow profiles. All "vital" data types for the proposed sites are in the Data Bank.

There is no 3.5 kHz or SCS or coring data in the Data Bank, although some data of these types do exist in the area. SSP feels that it would be prudent for all bare rock legs to go to sea ready with alternative sites in sediment pockets in case of technical failure with bare rock procedures (see below under Site Survey Guides, agenda item 9B). If this advice is taken, then proponents should submit 3.5kHz, SCS and or coring data to document the sediment distribution in the vicinity of the primary targets.

Additional resistivity, heat flow, photos, and dredge samples are to be collected during an April-May 1993 cruise. The heatflow data should be deposited in the Data Bank in time to be included in the Safety review package, and the other data should be submitted in time to be included in the data packages sent to the Co-Chiefs and to TAMU for the drilling leg.

Worksheets evaluating the TAG sites against the SSP guidelines for Target Type "F: Barerock Drilling" are included in the Appendix.

SSP CONSENSUS 12: All "vital" data types for the proposed sites at the TAG Hydrothermal System (361-Rev2) are in the Data Bank. Newly-collected heatflow data should be submitted in time for Safety review. SSP feels that it would be prudent for barerock drilling legs to plan backup sites in sediment ponds in case of technical failure on barerock sites; 3.5kHz and/or SCS and/or coring information should be submitted to document drillable sediment pockets in the vicinity of the primary targets.

5. POTENTIAL FUTURE DRILLING TARGETS: TECP

A. Alboran Basin (323-rev2) (Kastens)

[SSP liaison Kidd is a proponent for Alboran Basin.]

At our August 1992 meeting SSP was generally pleased with the quality and quantity of the Alboran data set, but noted the following specific deficiencies: (a) sites AL-3 and Al-4 were apparently not on crossing MCS lines, (b) seismic velocities had not been provided for sites AL-3 and AL-4, (c) the likelihood of encountering Messinian evaporites had not been addressed for sites AL-3 and AL-4, (d) the proposed re-entry site AL-1 needed data on geotechnical properties of the surficial sediments from a nearby core. In addition, an SSP member inquired whether there were any analyses of dredged samples from outcrops on nearby bathymetric highs.

By the time of our November 1992 SSP mini-meeting, crossing lines had been provided for sites AL-3 and AL-4. These are SCS rather than MCS lines; however basement is reached, so SSP will not insist on the MCS lines usually required for passive margin sites. A map of Messinian evaporites distribution was provided by proponent Comas to watchdog Kastens, showing the western edge of the evaporite-bearing basin to be east of all of the proposed Alboran drilling sites. Seismic velocities for sites 3, 4 and 4A, based on R/V Conrad MCS data were received a few days after the November meeting. According to a letter from proponent Comas to watchdog Kastens, the core for geotechnical properties, as well as heatflow data, are being collected on an April/May 1993 cruise.

Alboran sites 1, 2, 3 and 4 had a safety pre-review at the April 1993 PPSP meeting, and multiple problems were noted. The 2700-deep hole AL-1 is proposed to enter a unit which is overpressured in a commercial well on the continental shelf. Al-3 is at a pinchout on the dipline and a rollover on the strike line. Al-4 needs to be moved away from a structural closure.

Worksheets evaluating the data package for the Alboran sites against the SSP guidelines for Target Type "B: Passive Margin" are included in the Appendix.

SSP CONSENSUS 13: From a scientific perspective, sufficient data now exist in the data bank to schedule an Alboran drilling leg. Heatflow measurements are still desirable for safety panel consideration, and a core is still required near the re-entry sites; these will be collected on an April/May 1993 Hesperides cruise. If new sites are selected in response to safety pre-review, proponents must ensure that the documentation for these new sites is in the Data Bank.

B. NARM non-volcanic II (Iberia II) (Mountain)

[SSP members Sibuet, Srivastava, and Hinz are proponents for NARM]

Survey data pertaining to sites IAP-1, -2, -3, -3B, -4 and -5 have been determined adequate by SSP and PPSP. Not all six of these sites can be drilled on Leg 149; those left over may be proposed for a return to the Iberian margin. SSP reminds the proponents that any sites other than these six, even if located on data already in the Data Bank, will have to be reviewed by SSP and PPSP.

C. Eastern Equatorial Atlantic Transforms (346-rev3) (Camerlenghi)

[no SSP members are proponents for Eastern Equatorial Atlantic]

All "vital" data requested from the proponents before November 1, 1992 has been sent to the Data Bank including all processed MCS lines except line MT17 (site IG5 crossing) which is not in the DB. It must be provided as soon as possible.

Some "desirable" data types are known to exist but have not yet been deposited in the data bank: (1) OBS refraction velocity results should be deposited. (2) Some pertinent photographs and information about samples from the submersible cruise EQUANAUTE should be provided to the DB along with their locations on a map. (3) A magnetic anomaly map of the area should be provided to the DB.

Heat flow data are not required by SSP but may be required by PPS Panel. These data have not been acquired by proponents.

Worksheets evaluating the Eastern Equatorial Atlantic Transform sites against the SSP guidelines for Target Type "B: Passive Margin" are included in the Appendix.

SSP CONSENSUS 14: All "vital" data types for Eastern Equatorial Atlantic Transforms are in the Data Bank except for the MCS crossing of IG5. Several "desirable" data types exist, but have not yet been deposited. The program is ready for PPSP pre-review.

ACTIOM ITEM 2: Kastens to alert PPSP Chairman Ball to the possible need for a safety pre-review for Eastern Equatorial Atlantic Transforms.

D. Mediterranean Ridges, shallow (330-rev) (Farre)

[SSP members Camerlenghi and Kastens are proponents for Med Ridge]

This proposal addresses the first of a two-phase strategy to study fundamental processes associated with incipient continental collision on a salt-bearing accretionary prism. Five transects across the deformation front of the Mediterranean Ridge (MR) are proposed (3-4 sites each), with one additional site on the Napoli mud volcano.

At the instruction of the proponents and PCOM, the November 1992 SSP subgroup meeting considered a possible hybrid leg combining objectives from the Mediterranean Ridge proposal with Mediterranean sapropel objectives. SSP has been informed that the proponents no longer wish to pursue this hybrid plan, and SSP is now evaluating proposal 330-Rev as submitted.

Although some additional data were submitted to the data bank prior to the November '92 deadline, the data package for MR remains insufficient to meet SSP guidelines for paleoenvironmental sites (Target A). The MR program involves drilling of both smooth abyssal plain and highly complex areas above the deformation front. In addition to the data types normally considered vital for paleoenvironmental sites, SSP will require sites above the deformation front to include crossing high-resolution SCS profiles and swath bathymetry in order to finalize site location and allow drilling results to placed in context. In these complex terranes, deep-towed sidescan sonar/subbottom profile data are highly-desirable for the same reasons.

For sites MR 1-3 (Ionian transect) and MR 7-9 (Katia transect), the data bank lacks high-resolution single channel seismic and 3.5/12 kHz profiles and core data. For MR 2-3 and MR 8-9, the more extensive data coverage described above for complex areas is required.

Sites MR 4-6 (Sirte Transect) are best covered by available site survey data. However, the data bank lacks 3.5/12 kHz data across the sites. MR 6 also lacks crossing high-resolution SCS lines around the complex geology of the target area.

For sites MR 10-12 (Herodotus Transect), the data package in the data bank is far from complete. Proponent A. Carmerlenghi has informed SSP that these sites will be dropped from the drilling program. If these sites are not omitted, then additional data collection will be necessary.

For site MV-1 on the Napoli mud volcano, only required 3.5/12 kHz profiles are missing from the data bank. Additional site survey data collection, planned for summer '93, will only improve the understanding of this complex area.

For sites ESM 1-4 (Erastosthenes Transect), crossing high-resolution SCS and 3.5/12 kHz profiles and core data are needed. At ESM-4 (above the deformation front), the morphology is less complex than on the Mediterranean Ridge, so multibeam swath bathymetry will not be required in view of the expected availability of deeptowed side-looking sonar and subbottom profiles from an upcoming Russian cruise.

Based on SSP's understanding of several site surveys planned for summer '93 (table, Appendix 2), it is possible that a complete data package (with the exception of sites MR 10-12) will be submitted by November 1, '93.

Worksheets evaluating the data status for some of the Mediterranean Ridges sites against the guidelines for Target Type "A: Paleoenvironment" are included in the Appendix.

SSP CONSENSUS 15: The data package for drilling the MR remains incomplete. There is a general lack of high-resolution SCS data across the sites. On the complex areas of the Mediterranean Ridge, SSP is requiring crossing high-resolution SCS profiles and swath bathymetry over the sites in addition to the usual requirements for Target Type "A". Based on SSP's understanding of several site surveys planned for summer '93, it is possible that a complete data package for one leg worth of drilling will be submitted by November 1, '93.

E. North Australian Margin (340-rev) (Scrutton) NEW

[no SSP members are proponents for North Australia margin]

This proposal on Neogene/Quaternary collisional tectonism and foreland basin development across the northern Australian Margin is a tectonically focussed proposal. An earlier climate/oceanographic component has been dropped. However, the proposal remains preliminary because the sites are only indicative of the types of problems and locations that could be investigated in the region. Following the acquisition of new seismic data in 1993 clearly-defined and well-documented site locations will be proposed, probably towards the west in the Australia - Timor region.

There are three objectives: along-strike variability of the collisional tectonics in this oblique collision system; testing of conflicting models of tectonism and fluid flow in foreland basins; and the nature and timing of the reactivation of old passive margin structures. A fair to good regional data set, chiefly MCS lines, exists on which the objectives and indicative sites are based. A large number of oil exploration wells exist on the continental shelf immediately adjacent to the south. Some normal and high-resolution seismic reflection data, cores and hydrocarbon sniffer data exist in parts of the region. Five indicative sites are put forward, all in 2000m-3000m of water and with about 1000m penetration. However, if the sites are reorganized into transects as suggested by TECP, the targets may well change. Although the collection of new MCS in 1993 by "Rig Seismic" is described, there is no mention of other data sets that will be required for site survey and the best use of the drilling results.

With only site indications and no specific locations at this stage, SSP simply draws the proponents' attention to the Guidelines for the preparation of site documentation for Target Type "C: Active Margin" sites. In this structurally complex setting, a good network of intersecting seismic lines and either swath bathymetry or side-looking sonar, will be needed to understand the three-dimensional tectonic secting of the sites. If the fluid flow object is pursued, heatflow data will be needed. If re-entry sites are planned, a core will be needed.

SSP CONSENSUS 16: In considering data types that will be needed in support of North Australian Margin drilling, SSP points out (a) the need for a grid of intersecting seismic lines plus swathmapping data in this structurally complex setting, (b) the need for heat flow data if the fluid flow objective is pursued, and (c) the need for core data if reentry holes are proposed.

F. Costa Rica Accretionary Wedge (400, 400rev) (Moore)

[no SSP members are proponents for Costa Rica]

A nearly complete data package for drilling of structural objectives (including 3-D seismic data and swath bathymetry) has been submitted to the Data Bank. Data from existing cores at proposed re-entry sites should be deposited in the Data Bank. SSP anticipates that a revised proposal adding fluid objectives will be submitted. We reiterate our August, 1992 statement that, "if fluid objectives are included, a detailed heat flow survey will be required." We note that the proponents have been funded for heat flow and Alvin surveys in 1994. We therefore anticipate that all necessary data should be in hand by the end of 1994.

SSP CONSENSUS 17: The Costa Rica Accretionary Wedge (400/400-Add) data set is satisfactory for the current structural objectives and would be drillable in 1995. A detailed heat flow and Alvin dive program have been funded and should provide required data for fluid objectives for 1995 drilling.

ACTION ITEM 3: Kastens to alert PPSP Chair Ball to the possible need for a Safety Prereview for the Costa Rica Accretionary Wedge program, if the program is put in the prospectus for FY95.

6. POTENTIAL FUTURE DRILLING: SGPP

A. Gas Hydrate, Blake Ridge & Carolina Rise (423-rev) (Mountain) NEW

[no SSP members are proponents for Gas Hydrates]

This proposal seeks to examine several aspects of clathrate-rich sediments along the margin of the SE United States. Knowledge of the distribution of clathrates is important for understanding: 1) the global carbon budget; 2) sediment stability; 3) pore fluid chemistry and circulation; and 4) sources of greenhouse gases. The proponents seek to: 1) estimate the source and amount of gas trapped as clathrates; and 2) establish the physical properties of clathrate-rich sediments, and (3) evaluate how these physical properties influence pore fluid circulation, by examining fabric and lateral variability.

Three drilling transects totalling 9 holes are proposed. One transect is on the NE flank of the Blake Ridge; two are along the adjacent continental rise offshore S. Carolina. Of the latter, one is along an open, undisturbed stretch of the rise; the other is in a slump scar associated with a diapiric structure cored by either mud or salt. Recognizing the risks in drilling through the base of clathrates and into a zone of potentially highly pressured, gas-prone sediments, the proponents offer a more conservative strategy of stopping short of any clearly expressed BSR. Should a safety pre-review relax the proponents' concerns that penetrating a BSR is to be avoided in most cases posed by their proposal, then they will modify their plans accordingly.

Abundant data contributing to a complete survey data set exists in this region, although none has yet been deposited in the Data Bank. The proponents will be collecting Deep-Tow data in Sept., 1993. SSP points out to the proponents that their drilling plans call for survey data of category "A", i.e. paleoenvironment. The proponents describe access to data that is relevant to this category. SSP urges that existing data be deposited with the Data Bank before July 1, 1993 because only in this instance can the proposal be eligible for review at the July SSP meeting. A liaison from PPSP will be at that meeting, and the possible need for a safety pre-review will be determined at that time. Furthermore, discussion at that meeting could provide the proponents with useful guidance in track lay-out and general cruise design. SSP notes that even if no sites are intended to penetrate the BSR, velocity information will be critical for calculating true depth to the base of the clathrate zone. In addition, heat flow data will be highly desirable for comparing observed clathrate distribution with the distribution predicted for the theoretical temperature/pressure stability field. Finally, SSP urges that the proponents contact proponents Keigwin and Boyle of proposal 404 (Paleoceanography from W N Atlantic Sediment Drifts) and consider combining their efforts in assembling regional data for both of their respective survey cruises and potential drilling.

SSP CONSENSUS 18: No data for Gas Hydrates (423-rev) is in the Data Bank, although the proposal suggests that significant relevant data exist. In addition to the usual data types required for paleoenvironment sites, SSP will want to see velocity determinations so that the position of drilled samples relative to the BSR can be accurately known. Also, SSP will want to see heat flow measurements so that the observed clathrate distribution in the drillhole can be compared with the distribution predicted for the theoretical temperature/pressure stability field.

ACTION ITEM 4: Kastens to alert PPSP Chairman Ball to the possible need for a safety pre-review for Gas Hydrates.

B. New Jersey Margin II

[SSP member Mountain is a proponent for New Jersey II]

The continental shelf sites of the New Jersey margin transect already have SSP approval for drilling from a scientific perspective. They are not on the schedule for New Jersey I (Leg 150) because of safety hazards in shallow water. Proponents should be aware that special guidelines are being developed for hazard surveys in support of drilling in water depths less than 200m. Eventually, proponents will need to submit data conforming to these shallow-water guidelines before these sites can be scheduled for drilling.

C. Bahamas Transect (412-rev) (Sibuet) NEW

[no SSP member is a proponent for Bahamas Transect]

A transect of four holes is proposed on the slope of the Bahamas, offshore from two existing holes drilled by the Bahamas Drilling Project. The scientific objectives pertain to (1) sealevel history, and (2) fluid flow.

A detailed grid of high resolution single channel seismics across the proposed drill sites has been proposed for funding; in Trieste we had no knowledge of whether this project was funded. No data has been deposited in the Data Bank for this project. The proponents are reminded of the July 1 data deadline; programs which have no data in the Data Bank following this deadline will not be discussed at the July SSP meeting.

The Bahamas Transect data package will be evaluated against the guidelines for Target Type "A: paleoenvironment." In support of the sealevel objectives, a grid of seismic lines, rather than a single crossing, will be required to get a three dimensional view of the prograding sequences.

The fluid flow objective depends critically on siting holes accurately with respect to zones of discharge and recharge. In addition to the usual data types for Target Type A, SSP will want to see observational evidence that these hypothesized discharge and recharge zones exist and have been located. Such data might include detailed heatflow surveys, high resolution side-looking sonar and nearbottom-towed 3.5kHz images (to identify the potential diagenetic surficial sediments associated with fluid discharge), and visual images (to document possible vent-associated benthic life).

SSP CONSENSUS 19: In support of the sealevel objectives of the Bahamas Transect, a grid of seismic lines, rather than a single crossing, will be required to get a three dimensional view of the prograding sequences. In support of the fluid flow objectives, SSP will want to see observational evidence that the hypothesized discharge and recharge zones exist (relevant data could include detailed heatflow measurements, near-bottom towed side-looking sonar and 3.5/4.5kz, and visual observations).

D. Mediterranean Sapropels (391-rev) (Kidd)

[SSP member Camerlenghi is a proponent for Med Sap]

At the instruction of the proponents and PCOM, the November 1992 SSP subgroup meeting considered a possible hybrid leg combining objectives from the Mediterranean Ridge proposal with Mediterranean sapropel objectives. SSP has been informed that the proponents no longer wish to pursue this hybrid plan, and SSP is now evaluating proposal 391-Rev as submitted.

A number of packages of data were received in the Data Bank in support of the Medsap sites for the November '92 SSP sub-group meeting. Apart from the proposed re-occupation of Tyrrhenian Sea ODP site 652, none of the Medsap sites could be considered fully documented in terms of site survey data. No new data has been received in the Data Bank since November but a number of cruises (see Appendix 2) are expected to fill remaining survey needs this year. SSP has been told that a revised Medsap proposal is known to be in preparation, which may document new sites. As with the Mediterranean Ridge sites, some survey data will almost certainly not be available from this series of cruises in time for assessment at the July SSP meeting. Proponents are nevertheless urged to submit to the Data Bank all the relevant data that they can gather for July 1 so that PCOM can consider the proposal's inclusion in the 1995 prospectus.

Worksheets evaluating the data status for Med Sap sites against the guidelines for Target Type "A: Paleoenvironment" are included in the Appendix.

SSP CONSENSUS 20: No data has been submitted to the Data Bank since the packages that arrived in support of the Mediterranean Sapropels proposal in November '92. Apart from the proposed re-occupation of Tyrrhenian Sea ODP site 652, none of the Medsap sites can be considered fully documented in terms of site survey data. Based on SSP's understanding of several site surveys planned for summer '93, it is possible that a complete data package could be submitted by November 1, '93.

E. VICAP/MAP (380-rev3) (Farre)

[SSP liaison Kidd is a proponent for MAP]

This proposal combines the Volcanic Island Apron Project (VICAP, 380) and Madiera Abyssal Plain (MAP, 059) proposals into a single effort aimed at studying the development of the Canary Basin in terms of: the history of volcanic activity at the Canary Hotspot; the evolution of large volcanic islands; and the filling of the Madeira Abyssal Plain.

For VICAP, a few newly-processed MCS profiles were deposited in the data bank since the August '92 SSP meeting. However, numerous deficiencies in the existing site survey data package remain. SSP is evaluating the VICAP drilling targets against the guidelines for Target Type "G: topographically elevated features." Due to the need to understand the basement architecture and the probability of encountering gaps in the stratigraphic record due to mass wasting, SSP is requiring: crossing MCS lines; high-resolution SCS and Parasound or 3.5kHz profiles; careful velocity analysis of the MCS data for adequate estimation of drill depths; either sidescan sonar or swath bathymetry for choosing sites in areas of rough topography; and gravity data for addressing the tectonic objectives. Core data is also needed near each site requiring placement of a re-entry cone.

SSP is aware of planned cruises that will address many or all of the deficiencies in the VICAP data package. We recommend that the proponents submit a comprehensive data package of existing data and a detailed plan for upcoming data collection to the Data Bank prior to the July 1 '93 data deadline, to maximize their changes for inclusion in the FY '95 drilling prospectus.

For MAP, the site survey data package is complete, and from SSP's perspective, the program is ready to drill.

> **SSP CONSENSUS 21: The data package for MAP is complete, and from SSP's perspective, the program is ready to drill. Since the August '92 SSP meeting, a minor quantity of additional data has been deposited in the data bank in support of VICAP; however, this data package remains far from complete. SSP is aware of planned cruises that will address many or all of the deficiencies in the VICAP data package.**

7. POTENTIAL FUTURE DRILLING: LITHP

A. Evolution of Oceanic Crust (420) (Srivastava) NEW

[no SSP members are proponents for Evol. Oc. Cr.]

This is an ambitious project addressing fundamental processes that control the evolution of the structure of the uppermost oceanic crust. To do this, the proponents are proposing to drill a set of holes on the western flank of the East Pacific Rise. The program is divided into two legs. Each leg would drill a pair of holes separated by a km or so. One hole of each pair would be located on the crest of an abyssal hill, and the paired hole would be located at the base of the same hill, positioned so as to penetrate the bounding normal fault at a few hundred meters subsurface. The first pair of holes would be on 20m.y. crust; the second pair on 60m.y. old crust.

SSP realizes that the exact positions of these holes have not been decided yet and that ambitious plans are underway to carry out regional and detailed surveys for this purpose. We agree in general with the plans for these surveys and would appreciate being kept informed of progress. The proponents are reminded of the requirement for a core at re-entry sites. Because the experimental design of this drilling leg depends critically on penetrating a hypothesized normal fault, SSP urges the proponents to make every effort to image or otherwise document the existence, attitude, and depth of this fault, rather than relying on inference from surface morphology alone.

SSP CONSENSUS 22: SSP generally endorses the planned survey data collection strategy outlined in the "Evolution of Oceanic Crust" drilling proposal. Because the experimental design of the drilling leg depends critically on penetrating a hypothesized normal fault, SSP urges the proponents to make every effort to image or otherwise document the existence, attitude, and depth of this fault, rather than relying on inference from surface morphology alone.

B. Return to 735B, Atlantis II FZ (300-rev) (Srivastava) NEW

[SSP member von Herzen and SSP liaison Dick are proponents of return to 735B]

It is proposed to drill a set of holes along the crest of a 5km high ridge constituting the eastern wall of the Atlantis II transform valley along the Southwest Indian Ridge. The transect involves drilling four holes 500m deep, in addition to deepening hole 735B to a maximum depth of 2 km. The motivation for deepening 735B is to obtain a complete picture of the lower crust which was so successfully drilled at this site. The reason for drilling additional holes nearby is to obtain a representative section of the lower oceanic crust in order to decipher its temporal and spatial variability. Between two and three legs of drilling are proposed.

SSP appreciates the opportunity to build on the success of hole 735B, but feels that a better understanding of the geological and geophysical setting of the site can and should be obtained before multiple additional drilling legs are devoted to this area. For example, SSP would like to see observational evidence about the lateral variability of the lithologies and structures exposed on the top of the ridge penetrated by 735B; this will be an essential constraint when it comes time to site ODP holes in a manner that will neither oversample nor undersample for spatial and temporal variability. Similarly, SSP would like to see observational evidence that the structures depicted in the interpretive sketch in the proposal exist and can be mapped or imaged, and thus targeted for drilling. SSP recommends that the proponents of Return to 735B refer to the draft guidelines for tectonic windows sites ("offset drilling sites"), and remain in frequent contact with SSP through the SSP watchdog, as they formulate their data acquisition plans.

SSP CONSENSUS 23: The proposal to return to site 735B on the Atlantic II Fracture Zone is an ambitious project which will be more successful if the geological and geophysical setting of the sites are better understood through additional survey/sampling work before drilling begins.

C. NARM volcanic II (NARM) (Scrutton)

[SSP members Srivastava, and Hinz are proponents for NARM]

No new data has been received since August 1992. At their March 1993 meeting, LITHP recommended that NARM volcanic-II should proceed to the Voring margin if EG63-1 and EG63-II are completed on Leg 152; otherwise the EG63 Greenland Margin transect should be completed. SSP reiterates the need for 3.5kHz data at the EG66 transect sites, and the need to prepare a comprehensive data package for the Voring Margin. Voring Margin data would need to deposited by the 1 July 1993 data deadline for evaluation at SSP's July meeting, in order for these sites to be in a strong position for FY95 scheduling.

SSP CONSENSUS 24: If the East Greenland transect EG63 is not completed on Leg 152, very little additional data would be needed to plan a second NARM volcanic margin leg using already-approved EG63 sites. If, however, Leg 152 does complete the EG63

objectives, and a second NARM volcanic leg wishes to focus on the Voring Margin, substantial improvement to that data package will be needed.

D. Red Sea (086-rev) (Scrutton) NEW

[no SSP members are proponents for Red Sea]

Now that the political situation in the Red Sea area is stable, it is proposed that some fundamental geotectonic and petrological questions related to the transition from continental to oceanic rifting should be addressed there. The Red Sea is a natural laboratory in which to study the initiation of seafloor spreading and the formation of passive margins as they take place. Stratigraphic and paleoceanographic problems may also be tackled by drilling in the Red Sea, but are not the subject of this proposal. A number of stages of continental splitting are identified from continental stretching in the north to fully-developed spreading in the south. Sites are proposed to sample different stages. All sites have basement objectives, although basement is not deep at the proposed sites (less than 400mbsf).

There is a wealth of background data of many types in the Red Sea, but some of it is quite old. Specific locations are proposed for sites, but supporting data in the proposal consists of only one poor quality seismic profile in each case. No data has been submitted to the Data Bank. Based on the proposal, the following data exist: Site 1A, intended to sample A2' oceanic basement in the southern axial trough, is documented by GLORIA coverage and a recent deep-tow profile. Site 1B, intended to sample 1-2Ma crust in the Nereus Trough central deep where spreading is just starting, is supported by SeaBeam, Deep Tow, and good SCS. Site 1C, intended to sample intrusive material in the Bannock Deep, has SCS. Sites 2 and 3, near to Zabargad Island (where mantle peridotites are exposed), appear to have little supporting data in hand.

Sites 1A, 1B and 1C are tentatively designated as Target Type "E: Oceanic Crust with less than 400m sediment." However, the proposal mentions possible bare-rock drilling at Site 1B, in which case that site would be evaluated against the guidelines for Target Type F: Barerock Drilling. Sites 2 and 3 are designated as Target Type "B: passive margin." Hydrothermal circulation and mineralization are mentioned as potential objectives. The proponents are reminded that additional background data may be required for drilling in hot environments (data types labelled "H" in the SSP guidelines).

A cruise is proposed for 1993 on which SCS, SeaBeam and magnetics would be collected. There are probably older data sets that have not been fully assessed or fully exploited yet, e.g. heatflow and coring.

SSP CONSENSUS 25: Only a small amount of a very large Red Sea data set is presented in the proposal. Existing data sets have not yet been fully exploited in support of this program, and it is unclear at this time whether additional data collection would be necessary before the Red Sea could be scheduled for drilling.

E. Sedimented Ridges II (SR-DPG) (Hinz)

[no SSP members are proponents for Sed Ridges II]

Based on the results of Leg 139, the Sedimented Ridges Working Group developed a drilling strategy for Leg II for the area of Middle Valley on the northern Juan de Fuca Ridge and the Escabana Trough on the southern Gorda Ridge. Several holes for the Middle Valley area have been proposed to drill through and adjacent to the Bent Hill massive sulfide deposit and in the area of the Dead Dog vent field. A suite of holes have been proposed in the NESCA area of the Escabana Trough.

Besides the site survey data for Leg 139, additional data, including data from the CORKed boreholes, have been acquired by both submersible and ROV. Additional cruises with the ROV are planned in 1993 in the proposed Middle Valley drilling area. A USGS cruise in the proposed NESCA drilling area is planned for 1993 to collect detailed side looking sonar data. SSP did not have sufficient data in Trieste to evaluate the Sedimented Ridges II proposal on a site-by-site, datatype-by-datatype basis; however we anticipate that much of the required data will be in the Data Bank in the package prepared for Leg 139.

SSP CONSENSUS 26: Much of the data needed for Sedimented Ridges II drilling remains in the Data Bank in the package prepared for Leg 39. ROV and side-looking sonar data acquisition scheduled for 1993 will strengthen the data package.

8. POTENTIAL FUTURE DRILLING: OHP

A. North Atlantic Arctic Gateways II (Hinz)

[no SSP members are proponents for NAAG]

A large number of well-documented sites were prepared in planning for NAAG I (now scheduled as Leg 151). However, the existing data package prepared for NAAG I will need to be supplemented to provide enough fully-documented sites for a second leg of NAAG drilling. In particular, as noted in the writeup of Leg 151 above, sites ICEP-2, -3, and -4, plus SIFR and NIFR have no data package in the Data Bank at present. It is expected that NAAG II would drill sites left undrilled by Leg 151, presumably the southern sites that don't require an icebreaker.

We understand that the Ocean History Panel plans to hold a planning day at their fall meeting to finalize the design of NAAG II based on the results of Leg 151. At that time, they might also incorporate some sites from other proposals into the NAAG II plan. Even though that planning meeting will not yet have occurred, we strongly encourage the proponents to submit additional data (at least for sites ICEP-2, -3, and -4, plus SIFR and NIFR) before the July 1 data deadline, so that SSP can evaluate the site survey readiness of NAAG II before the FY95 prospectus is assembled at the August PCOM meeting.

SSP CONSENSUS 27: The existing Data Bank data package prepared for NAAG I (now scheduled as Leg 151) will need to be supplemented to provide enough fully-documented sites for a second leg of NAAG drilling.

B. Sub-Antarctic SE Atlantic Transect (430) (Camerlenghi) NEW

[no SSP members are proponents for sub-SAT]

The sub-SAT proposal in its present status does not include a site survey data package. Sites are tentatively located on existing seismic lines of rather poor quality. SSP acknowledges the statement of the proponents that "it is fully recognized that additional site survey data will be necessary in order to develop this proposal into a viable expedition by ODP. If the proposal is favorably reviewed by the thematic panels, we will seek funding to collect the necessary site survey data to produce a fully mature drilling proposal." SSP requests that the proponents prepare their site survey plans and data package according to the guidelines for Target Type A (Paleoenvironment) rather than D/E (Open Oceanic Crust), as they had indicated on their site summary forms.

SSP CONSENSUS 28: New data must be acquired to prepare an adequate site survey data package for the Sub-Antarctic SE Atlantic Transect, and proponents plan to request funding to acquire such data. SSP does not anticipate that the data package for this leg will be ready in time for FY95 scheduling.

C. Benguela Current (354rev, 354add) (Farre)

[no SSP members are proponents for Benguela Current]

Neogene history of the Benguela Current and coastal upwelling off Angola-Namibia West Africa are the subjects of this proposal. Eleven sites in 6 transects with an average penetration of 500 m are proposed.

All sites are being judged as paleoenvironmental (Target Type A) by SSP. No data has yet been deposited in the data bank. Because of the likelihood of encountering stratigraphy affected by mass wasting, crossing high-resolution SCS lines will be required at each site. Also, to aid site selection, swath bathymetry will be required in areas of rough topography. This is in addition to the core data and 3.5kHz or equivalent that are always considered "vital" for paleoceanographic sites.

SSP is aware of a site survey scheduled for April/May '93. It is possible that an acceptable data package will be deposited in the data bank by the July 1, '93 deadline. The proponents are urged to submit a data package of existing and/or newly-collected data by the deadline, as proposals with no data package will not be considered by SSP at its July meeting.

SSP CONSENSUS 29: No data has yet been deposited in the data bank, but a site survey cruise is scheduled for April/May 1993. Because of the likelihood of encountering stratigraphy affected by mass wasting, SSP is requiring crossing high-resolution SCS at all sites, and swath bathymetry across areas of rugged topography, in addition to the core data and 3.5kHz/Parasound that are always considered "vital" for paleoceanographic sites.

D. Caribbean K/T boundary (415rev) (Mountain)

[no SSP members are proponents for K/T boundary]

There has been no change in the status of this proposal or data package since our August '92 meeting. A second request for funds to collect survey data that would pinpoint the drilling targets proposed in this proposal has been declined by NSF. However, an unrelated MCS cruise aboard the R/V Ewing has been funded to investigate basement fabric and history in the Caribbean. The proponents for ODP proposal 415 are encouraged to contact the principal investigators of the funded cruise (Diebold and Driscoll, L-DEO) to see whether some data useful in support of proposal 415 will be or could be collected. SSP does not have a good sense as to whether or not an adequate data package could be compiled from existing data.

In thinking about what kind of data would be needed in support of proposal 415, the proponents have correctly identified the survey guidelines as Target Type "D". SSP considers it very important that the proponents provide some kind of data (e.g. magnetic anomaly data, seismic ties to existing drillholes) documenting that the basement age at each site is not younger than Late Cretaceous, to ensure that recovering the K/T boundary event is possible. The proponents are advised that piston cores will be important for evaluating their paleoceanographic objectives. If the drilling plans evolve to include more extensive plans for drilling into basement in support of LIP objectives, the proponents are advised to consider the need for survey data types beyond those of type "D".

SSP CONSENSUS 30: NSF has recently declined a proposal to survey the region of the Caribbean K/T boundary drilling targets; and no effort has yet been made to compile a data package from existing data. In addition to the normal data types for Target Type "D," SSP will want to see (1) regional data (e.g. magnetic anomalies, seismic ties to existing drillholes) documenting that the basement age

is not younger than Late Cretaceous, and (2) piston cores is support of the paleoceanography objectives.

E. California Margin (386-Rev2/422-Rev) (Kidd)

[no SSP members are proponents for Calif marg.]

The OHP has advised construction of a one-leg program based on a synthesis of the 13 site Lyle et al California Margin proposal (386-Rev) and the 5 site Stott/ Thunnell California Borderland proposal (422- Rev).

At its August 1992 meeting, SSP considered the Lyle proposal incomplete: the USGS EEZSCAN Atlas was referred to as the main source of data in support of the proposal and although a copy of the Atlas resides in the Data Bank, no original data was submitted for the August 1 deadline. In addition an upcoming survey cruise (as yet unfunded) was referred to by the proponents as pending. SSP characterized the proposal as awaiting a survey cruise and not ready for scheduling for 1994 and thus it was not included by PCOM in its 1994 Prospectus. In August 1992, SSP confined itself to advising these proponents on data that they should attempt to collect on their cruise, which we subsequently learned was not funded. Specific items under Target A (all sites <500m penetration) were the desirability of SCS crossings over the EEZSCAN lines where the cores were located, since a number of the sites were in somewhat complicated terrain. Some of the sites anticipate penetration of basement under a thin sediment cover. Two of the sites, CA-6 and CA-14 were re-locations of old DSDP sites and, as such, were not considered as needing further survey data under Target A. SSP now considers that, even in the absence of further cruise data, the proponents could possibly satisfy Target A requirements (vital = high res. SCS, 3.5kHz and a core) for many of the sites by submission of original EEZSCAN data and core logs for the 1 July '93 deadline.

The Stott/Thunnell sites must also satisfy Target A guidelines with sediment penetrations of up to 500m. Each site is located in a different Borderland basin and, although the proponents show maps of extensive seismic coverage of seismic tracklines, some of the xerox copies of the example basin crossings suggest poor records. None of the proposed sites are yet located on seismic lines. The impression is that sites can be chosen in this data network to satisfy Target A needs but SSP will await the merger of the two proposals before doing a detailed site by site assessment.

SSP Consensus 31: No original data has yet been submitted in support of California Margin proposal 386-Rev2 but it is now to be merged by OHP with California Borderland proposal 422-Rev. SSP urges the proponents of these two offshore California proposals to finalize site locations and prepare their data packages to meet Target A requirements for the 1 July '93 deadline.

F. NW Atlantic Sediment Drifts: Bermuda Rise/Blake Bahama Outer Ridge (404) (Mountain)

[no SSP members are proponents for NW Atlantic Sed Drifts]

Since our last review, the proponents have been funded to collect survey data along the Blake Outer Ridge in 1993. Drilling plans on the northern Bermuda Rise will be based on existing data. SSP reiterates its previous statement that a considerable amount of data exists in this region. This existing data should be assembled and submitted to the Data Bank before the July 1 data deadline; proposals that have no data in the Data Bank following that deadline will not be evaluated at SSP's July meeting.

SSP notes some common interests between proposal 404 and proposal 423-rev (Gas Hydrates, Paull et al). The proponents for these two programs are urged to consider combining their efforts in assembling regional data for both of their respective survey cruises.

CONSENSUS 32: Although no data has yet been submitted to the Data Bank in support of NW Atlantic Sediment Drifts, SSP anticipates that the proponents will be able to assemble a strong data package from abundant existing data, and from a funded upcoming (1993) cruise.

G. South Florida Margin (427) (Farre) NEW

[no SSP members are proponents for S. Florida margin]

The purpose of this program is to test the concept and application of seismic sequence stratigraphy, determine the magnitude and rates of late Quaternary sea level fluctuations, understand the growth pattern of a carbonate margin, and determine the influence and importance of current activity on the stratigraphic record.

The proponents recognize the need to collect additional site survey data for these paleoenvironmental sites (Target A). SSP agrees with the proponents' plan to collect a grid of high-resolution SCS profiles, side-scan sonar imagery, multi-beam bathymetry, and piston coring/bottom sampling (at each drill site). SSP urges the proponents to ensure that 3.5 kHz (or equivalent) data are collected. Because of the likelihood of significant bottom currents, SSP will require documentation of their magnitude and variability.

As 14 of the 17 proposed sites lie in water depths shallower than 200 meters, this proposal will have to satisfy new guidelines for shallow-water drilling being developed by PPSP. Also, SSP notes that use of the Diamond Coring System is desired for the 9 shallowest sites. SSP urges the proponents to submit a data package as soon as possible, even if it is incomplete, as this will allow safety issues to be addressed as early as possible. Proponents are advised that to be considered at the July '93 SSP meeting, a data package must be submitted to the data bank by the July 1, '93 data deadline.

SSP CONSENSUS 33: No data package has been submitted. SSP generally endorses the proposed site survey plan outlined in the proposal. Because of proposed shallow-water drilling and the desired use of the DCS, this proposal will need special attention from the ODP advisory system.

9. OTHER BUSINESS

A. Response to draft report on JOIDES Advisory Structure

The draft report submitted by the committee on the Joides Advisory Structure (Dürbaum report) was discussed. There was general agreement with the letter submitted by Kastens (Appendix 3), which incorporated feedback from other SSP members. In particular, the idea of loading SSP's existing or enlarged workload onto a smaller number of people in a Site Survey "Group" was felt to be impractical. The goal of incorporating site survey expertise into an end-of-the-year planning meeting could be achieved by inviting the SSP watchdogs for the relevant programs to that meeting, rather than by scaling down SSP.

In addition, several non-U.S. members emphasized the importance of having some meetings overseas (the draft report recommended that all SSP meetings be at the ODP Data Bank), to demonstrate the presence of ODP in their countries. We agreed that the data-intensive summer and fall SSP meetings should be held at the Data Bank to avoid shipping or carrying data around the world. However the April meeting, which focuses on proposals newly ranked by the Thematic Panels, typically involves viewing less data. We feel that the April meeting can and should be held outside the U.S.

ACTION ITEM 5: PCOM liaison Kidd to present the sense of SSP's discussion on Dürbaum report to PCOM.

B. SSP Guidelines

The SSP guidelines for Target Type F "Bare rock drilling" were re-evaluated. We decided to downgrade the guideline for high-res SCS, 3.5kHz, and core from "X vital" to "(X)* desirable but may be required in some cases." The rationale for requiring these data types on a bare rock drilling leg is so that alternate sites can be selected in sediment pockets as backups in case of technical failure with the bare rock drilling procedure. We felt that 3.5kHz data and/or SCS and/or core information should be included in the data package to document the location of such sediment ponds. We noted that MARK and TAG, on the schedule for FY'94 bare rock drilling, do not have any backup non-barerock sites.

SSP CONSENSUS 34: SSP considers that it would be prudent for barerock drilling legs to have alternate site(s) in sediment pockets, which could be spudded-in with conventional technology in the event of technical failure at the barerock site(s). Consequently, the data package for barerock legs should include 3.5kHz data, and/or SCS data, and/or coring data sufficient to document the location of drillable sediment pockets in the vicinity of the primary targets.

C. Feedback to proponents

For all highly-ranked but unscheduled proposals, watchdogs should inform the proponents about the outcome of the SSP meeting. Feedback from the watchdogs to the proponents should include: (a) the name and contact information of the watchdog, (b) the target types within the SSP guidelines against which each site will be evaluated, (c) for each data type classified as "desirable but may be required in some cases (X)*", an indication of whether SSP will or will not require this particular data type for these particular sites, (d) a reminder of the July 1 data deadline, and (e) a copy of the section of the minutes dealing with the proposal.

In addition, in some cases the feedback may include: (a) an indication of potential safety issues, (b) an indication of shallow water drilling problems, (c) an indication of additional data types that SSP might require in support of secondary or non-standard drilling objective in circumstances not well covered by SSP guidelines, (d) advice on other investigators who may have relevant data in the region, (e) advice on survey ships that may be able to visit the area, (f) copies of the SSP worksheets, if the data package is sufficiently mature to enable the watchdog to fill out worksheets.

For scheduled legs where new data was received, or data is still missing, or new sites have been discussed, the watchdog should also write to the lead proponent and inform him/her of the sense of the SSP discussion. For scheduled legs where there was no change in data status and no missing data and no substantive issues raised in Trieste, it is not necessary to contact proponents.

ACTION ITEM 6: Each watchdog will write a letter to the lead proponent of each proposal discussed in Trieste, enclosing the relevant section of the SSP minutes, plus copies of the completed SSP worksheets (if applicable). A copy of these letters will be sent to the ODP Data Bank.

D. Panel membership

Greg Moore is leaving SSP to join TECP after this meeting. Dick von Herzen will complete his four year term on SSP after the July meeting. We discussed the pros and cons of possible new members with expertise in shallow water hazards surveys, seismic data analysis, near-bottom-towed geophysical surveys, and crustal petrology. We narrowed our list of replacement candidates for Greg Moore to three candidates with expertise in seismic data analysis and/or deep-towed geophysical surveys.

ACTION ITEM 7: Kastens to contact three candidate members to see if they are willing to join SSP. Kastens to forward names of candidate members to PCOM chair.

E. Next meeting

We propose to hold the next SSP meeting at Lamont the last week of July, 1993. The primary goal of the July meeting is to provide advice to PCOM on the site survey readiness of proposals that they may wish to consider for inclusion in the prospectus for FY'95 drilling. After discussion, we decided that proposals that have absolutely NO data in the ODP Data Bank by the July 1 data deadline will be declared to be unready and will not be further discussed at our July meeting.

ACTION ITEM 8: Kastens to request permission for SSP meeting at Lamont the last week of July from PCOM Chair.

FINAL
(June 3, 1993)

JOIDES SITE SURVEY PANEL

APPENDICES & WORKSHEETS

APRIL 6-8, 1993
OGS, Trieste, Italy

SSP AD-HOC GROUP MEETING, LDGO, 5-7 NOVEMBER'92

ASSESSMENT OF POTENTIAL 1994 DRILLING PROPOSAL DATA SUBMISSIONS AFTER NOV 1 DEADLINE

AMAZON FAN - DATA PACKAGE COMPLETE

1. Curry-Mountain cruise has provided high quality seismic data (SCS & 3.5kHz) to give required crossings of sites AF-18, -10, -9, -11, -19, -8 and -5. All in DB.
2. Not all cores are exactly at sites but proponents have now tabulated core locations and logs by seismic facies to show which cores are representative of sediments at sites. All in DB.
3. We noted that Sites AF-14, -15 and -20 are offset from crossings of seismic lines. Proponents have targetting reasons for this but are prepared to move to crossings if required by PPSP.
4. Package ready for PPSP review in April.

CEARA RISE - DATA PACKAGE COMPLETE; EXCEPT FOR SOME CORE LOGS

1. Curry-Mountain cruise has provided all of the data required by SSP.
2. Processing to improve high resolution seismic records is on-going post-cruise and can be complete by PPSP in April.
3. New piston cores were taken at all 7 sites; copies of corelogs for the 3 cores that are split are in the DB, remainder to follow; further 99 previous cores with logs available.
4. Package can be ready for PPSP review in April.

ALBORAN SEA - DATA PACKAGE COMPLETE EXCEPT FOR CORE AT RE-ENTRY SITE

(Question for PPSP on heat flow data)

1. Although all prime sites are at MCS crossings, some alternates have only MCS/SCS crossings (but SCS reaches basement)
2. Requested seismic velocity data now in DB.
3. Question of distribution of Messinian salts resolved by distribution mapping.
4. Core for geotechnics at re-entry site can be collected on scheduled April cruise.
5. Package can be ready for PPSP review in April but will require information from PPSP before that on whether site specific heat flow data is required by them. It can be collected on the April cruise.

MARK - DATA PACKAGE INCOMPLETE ON NOV 1

1. MCS data near MK-1 and -2 known to exist but not submitted for survey package. (Proposal is model dependent and SSP requested these data - submitted later, in 3rd week Nov.)
2. Photo and video data seen as vital for data package: 80 Alvin photos exist from near MK-1: only 4 representative photos submitted, not located or orientated. Video data submitted but for MK-2 only (Nautile dive this November).
3. Existing SLS data need to be submitted

2. For SIRTE transect: MR4 & 5 data is complete except for 3.5 kHz line which exists but is not in DB: for MR6 no SCS data has been provided across the site but it could be moved to a nearby crossing, again existing 3.5 kHz data not in DB.

3. For KATIA transect little data was in the DB on Nov 1.

4. For MV1 to investigate mud diapirism all of the required data is in the DB except for 3.5 kHz data which exists (question here for PPSP).

5. For Eratosthenes Seamount: all sites require crossing seismic lines because of complex structure and there is insufficient seismic data. Each site lacks 3.5 kHz and core data near drill sites.

NORTH BARBADOS RIDGE - DATA PACKAGE COMPLETE EXCEPT FOR AVAILABLE 3.5 kHz AND CORE DATA.

1. Sites NBR1 & 2 are re-occupations of ODP Leg 110 sites. Additional new 3D MCS survey data and heat flow results have been submitted to DB.
2. Sites NBR 3 to 5 have complete survey packages but existing 3.5 kHz and core data have not yet been submitted.
3. Examples of OBS data have been submitted to the DB: remainder still in processing.
4. Data package can be ready for PPSP Review in April.

NARM NON-VOLCANIC - NEWFOUNDLAND - DATA PACKAGE COMPLETE (Question for PPSP on heat flow)

1. Data package complete and sufficient for PPSP Review in April.
2. Final site selection is expected to be within a tight Hudson 92-022 MCS grid. Processing of MCS and OBS continues.
3. No cores are available at current re-entry site locations, but further cores can be collected from Hudson in 1993.
4. Heat flow may be required by PPSP. None available at site. Measurements at 2 LDGO core sites within 100 nm: data not yet in DB.

MAP / VICAP - FINAL SUBMISSION OF REQUESTED DATA TO COMPLETE MAP COMPONENT NOW IN DB: NO NEW DATA FOR VICAP

VEMA - DATA PACKAGE INCOMPLETE - VEMA SITE 3 CAN BE CONSIDERED READY

1. MCS data on summit of Southern Transverse Ridge with limestone cap submitted to DB along with velocity data.
2. Sites VE-1 & 2 are still dependent on critical sidescan data.
3. Only VE-3 can be considered ready for PPSP Review.

EAST GREENLAND AND VORING PLATEAU - NO NEW DATA SUBMISSIONS WERE CONSIDERED FOR VOLCANIC MARGINS II

SITE SURVEY DATA ACQUISITION RELEVANT TO PROPOSALS 330 Rev (MED. RIDGE) AND 391 Rev (MED. SAPROPELS) FUNDED AND SCHEDULED IN 1993

Ship/schedule Coordinator	Areas/proposed sites	Techniques
R/V ... Feb 23-Mar 23/93 J. Mascle	SIRTE TRANSECT (MR 4-6)	MCS Survey KATIA TRANSECT (MR 7-9)
R/V TYRO Mar 8-28/93 G. de Lange (Utrecht, NL)	GELA BANK-SICILY STRAIT (MEDSAP-4) MENORCA RIDGE (MEDSAP-6)	Subbottom profiling HR seismic profiling Piston coring
R/V GELENDZHIC Jun 30-Jul 17/93 J. Woodside (Amsterdam, NL)	OLIMPI MUD DIAPIR FIELD Subbottom profiling (ESM-1, -2, -3, -4)	HR Side Scan Sonar (MV-1; MEDSAP 2B)HR SCS MCS profiling ERATHOSTENES SEAMOUNT Magnetometry Gravimetry ROV+Camera+TV Coring
R/V METEOR Jul 20-Aug 20/93 W. Hieke H. Hirschleber R. von Huene (Munich, Hamburg Kiel, FRG)	OLIMPI MUD DIAPIR FIELD Parasound SIRTE TRANSECT (MR-4, -5, -6) IONIAN TRANSECT (MR-1, -2, -3) KATIA TRANSECT (MR-7, -8, -9)	Hydrosweep (MV-1; MEDSAP 2B) Side Scan Sonar Camera+TV Piston coring Magnetometry Gravity
R/V URANIA Sep 3-29/93 M.B.Cita A.Camerlenghi (Milano, Trieste Italy)	KATIA TRANSECT (MR-7, -8, -9) GELA BANK-SICILY STRAIT PISANO PL. (CAL. RIDGE) (MEDSP-3)	HR seismic profiling Subbottom profiling Side Scan Sonar Piston and gravity (MEDSAP-4) coring

25 March 1993

Dear Dr. Duerbaum,

Following are some thoughts on how the changes and suggestions in the draft JOIDES Advisory Structure Review Committee report would impact the Site Survey Panel. These are primarily my personal opinions, but incorporate feedback from other panel members as well. We appreciate the thought and effort that you and your fellow committee members have put into this effort.

Report Subject 4: SSP, PPSP

"Problem: ..... There is also the impression that certain statements can and should be made independent of specific drilling proposals. These concern such matters as the safety of drilling through clathrates, drilling in shallow waters, or the requirement of site survey data."

I don't understand why this is described as a problem. In the past, both SSP and PPSP have issued such statements independent of specific drilling proposals, and these statements seem to have been well-received by the community. A fairly detailed statement about site survey requirements (independent of specific drilling proposals) has been published in the Joides Journal. SSP, PPSP and TAMU/ODP are now in the process of assembling such a statement concerning drilling in shallow waters.

"Ranking of proposals should also depend on the timely availability of the necessary site data."

In principal, I agree whole-heartedly with this statement. However, it's not clear to me whether "ranking" in this statement refers to (a) global ranking by the Thematic Panels (i.e. spring-meeting rankings), (b) inclusion in or exclusion from the prospectus by PCOM (summer-meeting), or (c) intra-prospectus ranking by Thematic Panels (fall-meeting rankings). In the present system, SSP provides a formal evaluation to PCOM and to the Thematic Panels of site-survey readiness for programs that have reached steps (b) and (c) in the proposal-flow. I think that this part of the advisory process works reasonably well.

At step (a), however, programs now come to the Thematic Panels without any official advice from SSP (unless, of course, the program reached step (b) or (c) in a previous year). I don't think that increasing the weight placed on site-survey-readiness at step (a) is necessary or desirable. In the present system, it has often been possible for an investigator group to use the existence of a inadequately-surveyed, but highly-ranked field area as leverage to obtain shiptime and funding to conduct new surveys. In fact, SSP actively solicits surveys of inadequately-surveyed but highly-ranked field areas. If a good survey were prerequisite to a high Thematic ranking, such an area would never get to be highly-ranked. But without the high Thematic ranking, the area might never get to be surveyed; and if it never got surveyed, it never would become drillable. Highly-ranked, poorly-surveyed programs may clutter up the system in the short run, but over the course of several years, the best of such programs evolve into highly-ranked, well-surveyed, highly-drillable field areas.

And then there is the practical matter of exactly who would decide whether or not the site-survey data of a program at step (a) is good enough. If SSP were to undertake this task, SSP's field of view would have to be enlarged to include all proposals at the time they are submitted. As I will note below, I don't think this increase in SSP's workload is realistic. It could be possible to encourage the Thematic Panels themselves to consider site-survey readiness more heavily in preparing their global rankings (spring-meeting rankings). However, I don't think they could or would do a very good job of evaluating site-survey readiness. First, they would have to make their evaluation based on the information in the proposal alone, which SSP members have generally found is insufficient to make an accurate evaluation of site-survey readiness. Secondly, many Thematic Panel members are not familiar with the Site Survey Guidelines, and may therefore not know what is an adequate or inadequate site survey package. Finally, there is an inherent conflict of interest between choosing the best proposals from a scientific, thematic perspective and choosing the sites most ready to drill. I think that introducing site-survey readiness as a major factor in the Thematic Panel Global Ranking discussion would just confuse their discussions and interfere with their ability to carry out their primary mission.

"PCOM should review the necessity of site survey data, especially differentiating which data are required in any case and which data could be dispensed with."

It's not clear whether this statement means that PCOM should review the necessity of site survey data in the general case, or on a proposal by proposal basis. If you mean reviewing the necessity of site survey data on a proposal by proposal basis, this is a huge job, and not an appropriate use of PCOM's time, in my opinion. If you mean review the necessity of site survey data types in the general case, PCOM has reviewed the Site Survey Guidelines as published in the JOIDES Journal. The Site Survey Guidelines spell out in detail which data types are required for specific target types, and which data could be dispensed with. Are you suggesting that this review should be repeated? Or something more profound?

"SSP should become a smaller group (SSG) meeting more frequently than during the last years."

Although your report did not spell out the rationale for this change, I can think of some advantages of a smaller Site Survey group. Less cumbersome communications, closer liaison between SSG members and the ODP Data Bank, more uniform proposal evaluation standards, and more coherent communications with proponents, come to mind.

However, several international members of SSP expressed concern that shrinking the group would require omitting some countries' representatives, which they didn't like.

Also, it was felt that decreasing the number of people involved would increase the probability of arbitrary and unfair applications of guidelines. When we tried to work with a smaller subset of SSP (3 SSP members plus a visitor from PCOM) in November, 1992, we found that our knowhow, quality, and coverage of specialties were more than adequate to evaluate programs under discussion. However, the small number of people did produce potential problems with conflicts of interest. We were all proponents of one or more proposals, and with so few voices at the table, it could be argued that the proponent's voice carried an inappropriate weight in evaluating the site-survey-readiness of specific proposals.

Finally, I would like to point out that the present workload of an SSP member--attending two to three meetings a year and "watchdogging" two to four programs--strains the maximum amount of work that can be expected from volunteers on a not-terribly-prestigious committee. If the same workload (or even a larger workload, see below) were shared out among a smaller number of individuals, the workload per person would exceed what most volunteers would be willing to do. Somebody would have to be paid a salary to do some of the work. The smaller number of members on an SSG could be paid a stipend. Alternatively, another person could be added to the ODP Data Bank staff; I envision a Master's degree level person who would, among other things, prepare the SSP matrix-worksheets for each site of each proposal.

"They [SSP] should meet at the ODP data bank which plays a very important service function."

I personally agree that SSP should meet at the ODP Data Bank. Schlepping data around the world to SSP meetings is an unnecessary burden on the Data Bank staff and places the data at risk of loss or damage. Furthermore, it is impossible to anticipate every tidbit of data that might be needed at an SSP meeting. For example in our August consideration of the MARK area, the MARK watchdog was able to dig up some relevant data from the Leg 106/109 files; had that meeting not been at Lamont, that data would not have been available.

I should, however, note that non-American members of the ODP community have pointed out that having SSP meetings on various continents permits proponents from all countries to make presentations of their data to SSP without incurring unmanageable travel costs. I am somewhat uncomfortable with the whole idea of proponents making presentations to SSP, because this procedure gives an unfair advantage to proponents who have the resources to support their own travel to an SSP meeting. If we phase out this procedure, then it doesn't really matter whether the meetings occur on multiple continents.

"SSG should be involved in very early stages of proposals as it might take much time to get additional data which are missing."

SSP does not have the person-power to consider every proposal submitted to JOI. I realize that every Thematic Panel considers every proposal, but in many cases a quick glance is enough to check-off "not within our mandate." For SSP to consider a proposal means that somebody has to do a time-consuming, labor-intensive, site-by-site, data-type-by-data-type comparison of the existing data against the site survey guidelines.

One thing that we could do, would be to prepare a form letter, to be sent out by the JOIDES office to the lead proponent of all newly-submitted proposals, spelling out the SSP procedures and including a photocopy of the Site Survey Guidelines.

"If the rules on the site survey data requirements are revised and agreed upon so that the impression of unfairness cannot come up...."

Those members of SSP who responded to my request for comments on the draft report universally characterized this phrase as naive, unrealistic, or inconsistent with human nature. The impression of unfairness does not arise because the Site Survey Guidelines are presented in an ambiguous or unfair way. Problems arise because there are infinite shades of grey between a clearly-acceptable site survey package and a clearly-unacceptable package. Does a 1970's vintage fuzzy analog single channel seismic line satisfy the guideline which requires "high-resolution SCS data" for paleoceanographic sites? Perhaps the proponent thinks it does, but SSP may feel that it does not. Does a page size photocopy of a fragment of a SeaBeam map at reduced scale and 100m contour interval satisfy the requirement for swath-bathmetry at an offset drilling site? Perhaps the proponent thinks it does, but SSP may feel that it does not. We do our best to keep in mind the bottom-line questions--are the data good enough to select the most informative sites? are the data good enough to extrapolate from the cored section to answer the key scientific questions? But there are alot of judgement calls involved in this process.

Another problem with this vision of an agreed-upon, "fair" set of site survey requirements is that the guidelines have changed through time in response to new scientific objectives, new drilling technologies, and new survey techniques. This evolutionary process shows no sign of slowing down. SSP is currently in the final stages of working up a new set of guidelines for site surveys of tectonic windows ("Offset drilling"), and simultaneously in the early stages of preparing guidelines for site surveys for shallow water drilling. Preparation of guidelines for new types of drilling targets is an interactive process, requiring broad-ranging and thoughtful discussion, among people with widely-varying perspective and experience.

".... there will not be a problem of national representation in the Site Survey Group (SSG) but rather of knowhow, quality and coverage of specialties."

I agree that knowhow, quality and coverage of specialties are the most important criteria in constituting an effective Site Survey Group. However, the value of broad international representation should not be underestimated. Such representation brings access to a greater range of regional and technical expertise, survey tools, and ships suitable for conducting surveys. In many countries, marine scientists do not have the tradition or the obligation to place data into a public archive after a reasonable period of proprietary use. In such cases, the only way to obtain survey data for ODP use is likely to be through personal contact with a colleague, most likely a colleague from the same country.

Subject 8: Handling of Proposals

"Some proposals are found deficient in site survey or safety after they are scheduled and co-chiefs have been selected."

I am not aware of a case where a proposal has been found deficient in site survey after it has been scheduled. There have been legs which have been found deficient in site survey after they were placed in the Prospectus. And there have been leg(s) which were scheduled despite known deficiencies in site survey data.

"March 199x: Panels review proposals (all); this includes the service panels (including the SSG) which get only a well prepared summary and the data they need to give early comments to proponents and the other panels."

Who is going to prepare the "well-prepared summary" for every proposal? Sounds like a lot of work.

SSP currently tracks about 30 programs at a time, including recently completed legs, upcoming scheduled legs, and legs which are highly ranked by the Thematic Panels. For recently completed legs, we consider whether, in retrospect, the site survey data was in fact adequate to site the holes optimally and to place the drilling data in context regionally and thematically. For upcoming scheduled legs, we follow the assembling of the last bits of survey data, and we track any last-minute changes in drilling objectives, site locations, etc. For highly-ranked unscheduled proposals, we work with the proponents and the data bank personnel to pull together a complete data package, and we continually evaluate and re-evaluate the data package as the bits of data trickle in, often over the course of years. When the system is working well, the SSP watchdog develops a rapport with the proponent and an intimate knowledge of the details of the program; he or she shepherds the data package from the time the program first claws its way onto the bottom of the Thematic Panels rankings, through the post-drilling retrospective evaluation of the site-survey adequacy.

We can't handle twice to three-times as many programs, as would be required if we reviewed all proposals. Even if the Data Bank staff were increased to handle more of the routine work for us, we can't conscientiously keep track of the detailed evolution of that many different data packages in that many different field areas. I think the community is well served by the level of detail with which we focus on each of the limited number of programs that we do follow. I think the community would be poorly served if we paid more superficial attention to a larger number of programs.

"Sept. 199x: The Thematic Panels rank proposals/revised proposals taking into account the comments of the service panels."

It appears from this phrase that SSP/G would no longer advise PCOM directly, that our major input to the planning process would be via the Thematic Panels. This seems to us to be a mistake. It is in the best interest of a Thematic Panel to downplay any data deficiencies that may exist in a program which is scientifically exciting to them, so that their favored program will look more viable than a program brought forward by a competing thematic panel. We think there is a need at PCOM for independent advice with respect to site surveys and drillability, to give a dose of realism to the exciting but sometimes immature ideas that come out of the thematic panels.

"Oct 199x: A Detailed Planning Group (DPG) meets....... The DPG meets for 1 week together with the PPSP. ...... The DPG is constituted in part at the Spring PCOM meeting and supplemented at the August PCOM. The then SSG is a subgroup of the DPG."

It's unclear from this wording whether SSG would also be constituted at the Spring PCOM meeting and supplemented at the August PCOM. If that's what you meant, I would be opposed to such rapid turnover of the SSP membership. The long-term corporate memory of SSP is important, the ability to keep track of the evolution of a drilling plan and a data package over the course of years.

I'm not sure how many times you want to hear this, but here we go again: with respect to SSG member attendance at an October detailed planning group meeting, YOU CANNOT INCREASE THE WORKLOAD OF SSP, WHILE DECREASING THE NUMBER OF MEMBERS, IF YOU EXPECT THE WORK TO BE DONE BY UNPAID VOLUNTEERS.

Thank you for the opportunity to comment on your draft. We will be discussing your report at our April 6-8 SSP meeting, and I may forward you some more comments after that meeting.

Regards,
Kim Kastens

12-MAY-1993 08:44:45.76

Subj: Final Report of Dr. Durbaum

To: Chairman of JOIDES EXCOM
JOIDES Office, Seattle
JOI Inc., Washington D.C.

Accompanying I submit the final version of the report of the Advisory Structure Review Committee to you. Marcia McNutt, Lou Garrison and I will present our recommendations to EXCOM at the June EXCOM/ODP Council meeting. Please inform me how much time you will allow us for the presentation so that we can prepare ourselves for it.

Sincerely, Hans-J. Durbaum

Copy to members of the Advisory Structure Review Committee by e-mail/fax

Final Version

May 10, 1993

Report of the JOIDES Advisory Structure Review Committee

Executive Summary

The Advisory Structure Review Committee was established by the JOIDES Executive Committee in 1992 in order to review the effectiveness of ODP's advisory structure. We undertook this task with the goal of maximizing the scientific return from the program in the next 5 years prior to a decision on the second half of ODP's second decade. Our principal recommendations can be summarized as follows:

The Advisory Structure Review Committee considered the overall JOIDES advisory structure, and reviewed the mandates of the committees, panels, and other components of the advisory system. We concluded that in general the advisory system works well and that there should be no major changes in organization. However, we did note two areas that we believe can be significantly improved:

- processing of proposals for drilling and
- long-range planning.

The advisory system unintentionally encourages development of proposals that have little prospect of actually being drilled. The system has a long lead time between the identification of scientific problems that can best be solved by drilling and the actual field program of drilling, recovery of cores, and analysis of samples. The advisory system does not adequately address long-range planning. This is partly because of the lack of a comprehensive structure for long range planning and partly because of a lack of information on ongoing and required engineering development.

Under specific subjects that follow we propose changes that should streamline the processing of proposals and shorten the time until drilling, and we suggest modifications to panel and committee mandates that should facilitate the advisory process. Under subject 12 we recommend changes in the mode of operation of the planning groups that should produce economies of time and facilitate their deliberations.

The work load on some of the panel chairs has expanded beyond the limit of what can be borne by a volunteer. Additional staff should be provided at the JOIDES office and at the LDEO site survey data bank to support the panel chairs. In addition, more use should be made of committee vice-chairs to distribute the work load.

Another COSOD is not required at this time or during the next five years; the COSOD II themes are still relevant but too broad. The thematic panels should organize small workshops to update and partly rewrite the "white papers" describing their highest priority themes for ocean drilling.

PCOM spends too much time in detailed planning of drill legs and not enough time in long-term planning. At the August meeting PCOM should discuss thoroughly the scientific worth of the thematic panels' high-ranked proposals and select those considered top-ranked and ready to be drilled. An annual DPG should then be established to work out detailed drilling plans for the top-ranked proposals, refine the operations plans for legs in the context of optimum portcalls, transit times and the best estimates of drilling and logging times. The plan would only need minor input and approval from PCOM at the December meeting.

TEDCOM needs to become more pro-active in providing more advice and guidance for TAMU in high-priority engineering developments and in helping PCOM set priorities for those developments.

Thematic panels should take the initiative to find members of the scientific community with the required expertise and enthusiasm to organize syntheses volumes (and associated workshops, if necessary) to better publicize the achievements of the drilling program.

Introduction

In 1987 at the Annual Planning Committee meeting, the PCOM expressed a desire to change the program's driving mechanism from a geographic orientation to a thematically-driven process. The PCOM formulated a revised panel structure with new Terms of Reference that was implemented in January 1989. After three years of this system, EXCOM in June 1992 directed that an Advisory Structure Review Committee be established to examine the structure and evaluate the effectiveness of each of the existing advisory bodies.

In addition, there were comments on the advisory structure in the reports of the PEC III and two EXCOM ad hoc committees which EXCOM asked this committee to consider. These comments refer mainly to PCOM and TEDCOM.

EXCOM passed the following terms of reference:

1. The committee will review and evaluate the current science and technology advisory structure of the Ocean Drilling Program. It will review the terms of reference and assess the effectiveness of the overall structure and the value of each of the existing bodies. Attention will be given to PCOM and its panels, committees, Detailed Planning Groups and Working Groups, and to the overall COSOD process.
2. The committee may recommend changes, not limited to the strengthening or deletion of groups, but will provide justification for any recommended changes.
3. The committee is requested to take into account the discussions and suggestions of recent review groups, including the EXCOM ad hoc Committee on Long-Term Organization and Management of ODP, the Performance Evaluation Committee III, and the EXCOM ad hoc Subcontracting Committee. Input from JOIDES EXCOM members should be solicited.
4. The committee will focus on the potential effectiveness of the science and technology advisory structures for the time period 1993-1998.
5. The committee membership will be eight, four from the U.S. and four from non-U.S. partner countries. Members will be experts in the fields of science, technology and/or management. A liaison with the JOIDES Office will be appointed to the committee. The committee will be appointed by the President of JOI, Inc., in consultation with the Chair of EXCOM and the Chair of PCOM.
6. The committee will carry out its work during 1992 and early 1993 and will report its findings and recommendations to EXCOM in June 1993.

EXCOM decided that Hans J. Durbaum should chair the committee. After consultation the President of JOI Inc. appointed the following additional members of the advisory structure review committee:

Bernard Biju-Duval, France

Dieter Eickelberg, Germany

Lou Garrison, USA

William W. Hay, USA

Richard D. Jarrard, USA

Marcia McNutt, USA

Matthew Salsbury, Canada

Hay attended the SGPP meeting at Kiel in September 92, Eickelberg attended the TEDCOM meeting at Cambridge in October 92. Also in October 92 Durbaum paid a visit to IFREMER to have a discussion with the French represen- tatives in PCOM, EXCOM and the ODP Council. Durbaum also informed Charles Sparks, Chairman of TEDCOM, on the task of the advisory structure committee, especially concerning TEDCOM.

The committee met first on 30 November 92, one day ahead of the Panel Chairs meeting, attended the Panchm and important parts of the PCOM meeting, and adjourned on Saturday 5 December at noon. During the week the committee had several meetings discussing the subjects and interviewing all panel and committee chairpersons assembled in Bermuda, including the outgoing and the incoming PCOM Chairmen.

We listed the subjects to be discussed under six main groups

1. Tasks of thematic panels (proactive role), workshops, COSODs
2. Membership of panels and shipboard parties
3. Liaison with groups outside ODP
4. PCOM's role
5. TEDCOM and other service panels
6. JOIDES office, site surveys, handling of proposals, syntheses.

The second version of our report - with JOI Inc.'s consent - was distributed to the PCOM members and to the panel chairs to get comments from them for the committee's continuing work. In addition Hay attended meetings of the OHP and SGPP in mid-March.

The committee met for the second time from March 29 to April 1 at ODP/TAMU. On March 30, the committee met jointly with TEDCOM discussing TEDCOM's relationships in advising ODP and JOIDES on the engineering development projects.

The final work of the committee has been done by e-mail or fax. The mid-April version of the committee report has been sent to the JOIDES office for distribution to PCOM members to discuss at the end of April PCOM meeting. The final version of the advisory structure review committee report will be presented to EXCOM at its meeting in June 1993.

Subject 1 Workshops / COSODs / White Papers

Problem: The COSOD II Report, which was written in 1987 and covered the period 1993-2003, does not fill ODP's need for an up-to-date statement of priorities for the next 5 years. The thematic white papers similarly need either an update or a pre - 98 focus, or both. The question has been brought up if there should be held another COSOD. In our opinion, the long range plan is not focussed enough and leaves the themes of objectives too diffuse, so that the danger exists that inadequate progress may be made on major themes by 1998. LITHP has proposed to work on an updated thematic white paper, then to hold an open meeting (about 50 people) for community discussion of the white paper. After that discussion, the panel would work on a revised version, send this to PCOM and with PCOM's consent publish the result in the JOIDES Journal.

Proposal: Our committee proposes that the LITHP proposal should be accepted and be applied to all thematic panels:

- draft updated thematic white papers
- hold meetings of about 50 people for intense discussion and revision of the updated papers; the updated versions should outline the few themes on which ODP drilling should be focussed during the years 93 - 98 using mainly the present drilling technology, as well as other themes that should be taken up then during the period 1998 - 2003, assuming that new technologies will be available.
- publish the revised versions of the white papers in the JOIDES Journal and summaries elsewhere (e.g., in EOS) to give a more focussed guidance for proponents.

Discussion: The primary purpose of these 4 small scale meetings to be organized under the guidance of the thematic panels is to focus the ODP objectives for the period 93 - 98, and with less resolving power those of 1998 - 2003. An additional purpose is to guide long-term technological developments within the context of scientific objectives for that second half-decade. These meetings and associated "white papers" would replace a full-scale COSOD, which is not deemed necessary at this time.

Funding should come from national funds, not comingled funds, as the latter would be a major financial load for ODP. We believe that this approach is the fastest way to provide thematic focus to ODP without fueling arguments complaints of insider control. In our opinion ODP proponents need more guidance for 93 - 98. Focus would be set by themes, not by oceans. ODP would avoid the danger appearing in the public as just a tool. The technological developments has to be more focussed, and the timetable for their availability worked out in a better way.

Updated and focussed white papers would be a compromise between tightly focussed themes and the concept of the drillship as a tool.

This focussing will reduce the long-term workload on the panels. There is the danger that this procedure might exclude some exciting and valuable drilling proposals, but ODP cannot do everything and focussing need not eliminate flexibility.

Subject 2: Role of thematic panels

Problem: If JOIDES builds its program only from unsolicited proposals it may - and it does - happen that important subjects are not covered by the incoming proposals.

Proposal: When major themes are not addressed by unsolicited proposals, JOIDES should solicit drilling proposals. Some thematic panels already are doing this. The members of the thematic panels know who or which research group is working on high ranking objectives on which JOIDES wants to focus. They can contact them and soon find out who is willing to support ODP by a proposal and the necessary data. The thematic panels thus should be encouraged to play this proactive role.

Discussion: Unsolicited proposals should remain as the basis of most of ODP's operation. There may be objectives which are not adequately covered by unsolicited proposals despite asking for such in the updated and focussed white papers. It is important then that JOIDES does not depend exclusively on unsolicited proposals.

One purpose of this proposal is to ensure that ODP remains thematically-driven rather than geographically-driven in response to announcements concerning the JOIDES ship schedule.

Organizations like RIDGE might be involved in such solicited proposals, but there should always be an individual responsible for the quality of the proposal and the submission of the necessary site survey data.

Subject 3: Overlapping of themes, liaisons with international groups

Problems: Sometimes there is considerable overlap between the scientific interests of JOIDES and those of other international and national groups, as e.g. InterRIDGE, IRIS, the Nansen Arctic Project etc.

There is also overlap between important tasks of panels within JOIDES. E.g. the theme of sealevel changes is of concern to both OHP and SGPP which have different points of view and different expertise. Overlaps in interest also occur in the service panels, such as e.g. IHP/SMP in the matter of the computer environment problem, or IHP/SMP/DMP in the case of the core/log-correlation problem.

Proposals: In the case of overlapping interests between JOIDES and other international and national groups, informal liaison and information transfer is working well to promote cooperation and should continue to be pursued. More formal relations in addition to those already established by JOI Inc. do not appear to be necessary.

In cases of important overlapping themes within JOIDES more use should be made of the opportunities for joint meetings of panels.

Discussion: The existing overlaps of panel and committee memberships between JOIDES and other organizations are serving the desired purpose of communication; they should be continued and encouraged. They can be supplemented by informal contacts at national and international meetings.

Panels should be sensitive to the usefulness for occasional joint meetings with other panels having related objectives. The JOIDES office may help by steering meeting scheduling to facilitate such communication.

Subject 4: Handling of drilling proposals

Problems: Under the present system, PCOM annually updates the general direction of the drilling vessel for the next 4 years. Proponents submit proposals to the JOIDES office; these are then distributed to thematic panel chairs. All proposals are rated for thematic relevance, scientific merit, and interest. Reviews are returned to proponents for proposal revision. Revised proposals go through the same process all over again. Finally some emerge as being highly ranked by one or more panels. These are then presented to PCOM by PCOM watchdogs or (since December 1992) by panel chairs for the schedule for 1+ year hence at the December PCOM meeting. Proposals placed on the schedule are carefully reviewed by SSP, PPSP, etc.

The problems with this system are as follows: Many proponents submit proposals which are a waste of time for both of them and the panels, because their objectives are not highly ranked in thematic interest, the technology is not yet available, and/or ship operations are not where proposed in the reasonable future. Adequate expertise is not always available on panels to completely evaluate proposals. Some proposals are found to be deficient in site survey or safety after they are scheduled by PCOM and, more rarely, after co-chiefs have been selected. PCOM is spending a large part of its time discussing the value of each hole, time needed, various options of combining legs, etc.

There is very often a long lead time between submission of a proposal and the corresponding drilling even if the proposal is good, quite mature, and in the current area of operations. Only about 10 % of all proposals are successful, and therefore it seems that the advisory structure spends too much time on too many proposals.

Proposals: The procedure should be changed as follows:

PCOM should continue to update its 4-year preliminary plan for the general direction of the drilling vessel at its April meeting. This theater of operations should be larger than the area that can conceivably be covered in a single year of drilling, thus allowing the proposal pressure to refine where the ship is likely to go one year later. Then all through the year proposal abstracts or proposals including a proposal abstract could be submitted to the JOIDES office. All thematic panels get the proposals/proposal abstracts. The abstracts have to contain all of the relevant information concerning scientific merit and interest, thematic relevance, scientific feasibility, site survey maturity, and technical feasibility. Under scientific feasibility, proponents must present a chain of arguments why they think that drilling will solve the stated scientific problem. In addition, they contain a rough list of survey lines, type of survey data collected, approximate drill sites with water depths, desired depths of penetration, and - as far as predictable - formation conditions.

Thematic panels preview such abstracts during all regular meetings and encourage or discourage the proponents to prepare full proposals. Full proposals submitted to the JOIDES office until the end of the year 199(x-1) are to be reviewed by the thematic panels at their February 199x meeting, and a first cut is made such that each panel is bringing forward at most 6 to 8 proposals (some of which may be brought forward by more than one panel). The abstracts of those proposals which have survived the first cut are previewed by the standing Site Survey Group (SSG) (see subject 5) and by PPSP, TEDCOM (with advice from TAMU), and DMP at their meetings during the next two months (February to mid-April) to come up with any major objections at this early stage. (The full proposals should be available to all chairs.)

The proponents are informed by the JOIDES office as soon as possible on the results of the panel discussions permitting them to react to the remarks/objections by improving their proposals, adding additional data, etc. Those proposals which have not survived the first preview of the thematic panels are not considered further at this stage, but they may re-enter the process only one year later. If they should not re-enter the process there should be frank discouragements. It might also happen that a thematic panel will decide to send one or more proposals out for external review after that proposal has survived the first cut. The proposals should be sent for review immediately after the February meeting, with the intent of returning the reviews to the proponents by mid-April to give the proponents time to react to the reviews before the next cut by the thematic panels in July. The thematic panels are well staffed for determining the thematic relevance and scientific merit of the proposal, but we envision that such external reviews might be solicited to answer questions on scientific feasibility when there is insufficient expertise on the panel. For example, the solution to some drilling problem might require precise dating, and thus the proposal might be sent to an expert to ascertain whether the dating is likely to be precise enough.

At the April meeting, the thematic panel representatives inform PCOM on the general themes, objectives, and operational areas which have passed the first cut by thematic and service panels. At this point PCOM can narrow the likely area of operations so that at their July meetings, the thematic panels can cut otherwise worthy proposals that nevertheless cannot be placed on the drill schedule for the year under consideration on account of ship track logistics.

In advance of the July meetings of the thematic panels, TEDCOM (and/or DMP) and PPSP provide preliminary evaluations on the technical feasibility and safety problems, respectively, based on their preview. The SSG gives its most recent evaluation on the site-survey maturity using as criteria - as stated in their mandate - the adequacy of the data for optimally siting holes, for assessment of safety (by PPSP), and for the determination of scientific feasibility. At their July 199x meeting, the thematic panels make their final selection and ranking concerning

- scientific merit and interest,
- thematic relevance, and
- scientific feasibility.

Thus by the end of the July meetings, each proposal will have been judged on the following criteria:

A. Scientific Merit and Interest (by Thematic Panels)

A1. Outstanding

A2. Meritorious

A3. Average

A4. Below average

B. Thematic Relevance (by Thematic Panels)

B1. Highly relevant to top thematic objectives

B2. Relevant to thematic objectives

B3. Could be relevant with minor revisions

B4. Not relevant to thematic objectives

C. **Scientific Feasibility (by Thematic Panels)**

C1. High probability of achieving scientific objectives

C2. Needs more supporting data to achieve objectives (e.g., will need other sorts of data to interpret drill results)

C3. Insufficient data to assess scientific feasibility

C4. Scientific feasibility highly questionable

D. **Site Survey Maturity (by SSG)**

D1. Fully mature - all data in hand

D2. Largely mature, acquisition scheduled for data not inhand (via a field program, visit to a data repository, etc.)

D3. Partially mature - still need to arrange for acquisition of more data via field program or otherwise

D4. Immature - practically no data in hand

E. **Technical Feasibility (TEDCOM and DMP)**

E1. Technology in hand and tested

E2. Technology in hand, untested

E3. Technology under development

E4. Technology not available

At the August PCOM meeting, the thematic panel chairs or designated panel representatives each present their 3 highest-ranked proposals, including an additional one if ranked fourth by 2 or more panels. PCOM, from these 12+ proposals, selects 6 plus 2 or 3 reserve proposals based on their rankings by the relevant panels in all of the categories above. PCOM then constitutes a special Detailed Planning Group (DPG) and appoints its chair.

This annual DGP (aDPG) should have: 1-2 members of each thematic panel as well as representatives from PCOM, SSP and the operators. The members will be chosen for their expertise and experience with respect to the assigned thematic topics and the regions where they are addressed. In choosing the members, conflict of interest has to be avoided.

PPSP, SSP, and a subgroup of DMP should have separate meetings in October before the aDPG meets early November to make a thorough review of these 6 +2-3 proposals. Proponents should be invited to present data and arguments at the SSP and PPSP meetings which therefore should be scheduled in a contiguous manner, preferably at Lamont or TAMU. The best place for the aDPG to meet would be also ODP/TAMU.

The aDPG then gathers all the information and transforms the proposals into several options for concrete plans of operations for 12 months. The reserve proposals are included in this detailed plan only if there are major objections from SSP and PPSP with respect to 1 or 2 out of the 6 proposals. The aDPG submits the options to PCOM at its December meeting. PCOM then makes the final decisions for the legs to be drilled from February 199(x+2) through January 199(x+3). This shift of time is proposed to give the operator four additional months' time to prepare the drilling legs.

Discussion: This proposal could first be applied for x=4: i.e. announcing the area of operation for 1996 in April 1993. The main goals of this proposal are

- to reduce the number of proposals at an early stage

- to get early comments from service panels
- to have PCOM fully involved in the discussion of the science of the highly-ranked legs, but not in details of the operations for individual legs.

This operations micro-management should be done by the thematic panels (with comments coming from the service panels) and the aDPG, which has a high level of regional knowledge and can provide optimum alternatives for drilling.

Prior to the aDPG meeting the proponents and the respective thematic panel has to describe the importance of each proposed drillhole, in order to enable the aDPG to optimize the use of the drilling time for the 6 legs.

The scientific community should be well aware of which technological developments will be available at what date, and such information should be kept up to date. The community should also be aware of operations which may not be carried out due to the special safety situation of JOIDES Resolution.

Annex

Flow chart for handling of proposals

199(x-1)

Ap	PCOM 4 year prelim. plan	)
My		) proposals or
Ju		) prop. abstracts
Jy		) submitted;
Au		) them. panels'
S		) preview any
O		) meeting
N		
D	PCOM decision on legs up to Jan. 199(x+2)	

199x	proposals submitted incl. formalized abstracts
Ja	
F	Them. Panels 1st cut leaving 6-8 proposals by each panel
Ma	TAMU/TEDCOM, SSG, DMP, PPSP preview
Ap	PCOM updating 4 year plan, general directive to them. panels
My	
Ju	improved proposals submitted
Jy	Them. Panels ranking
Au	PCOM selection of 6 proposals + reserve; appointment of aDPG
S	
O	SSP, DMP-subgroup, PPSP, TEDCOM/TAMU review 6+ reserve proposals
N	aDPG
D	PCOM final decision for Febr. 199(x+2) to Jan 199(x+3)

199(x+1)

Ja	)
F	)
Ma	) to be continued as in 199x
Ap	)
My	)
Ju	)

Subject 5: SSP, PPSP

Problem: Both of these panels provide inmportant services to the ODP. Their advice is given as to the adequacy of data upon which the drilling of each proposed site is based and upon the degree of risk its drilling will incur.

Riserless drilling as conducted by JOIDES Resolution does not permit the circulation of drilling returns to the rig floor, nor can a standard blow-out preventer be employed to stop the accidental release of over pressured fluids and gases encountered down hole. Special precautions must therefore be taken to avoid such encounters. The first defense against this type of accident is to drill only at locations where the risk of penetrating over pressured deposits is judged to be acceptably low. A careful review and study of the data available for each individual proposed site, and an assessment of the risk involved in its drilling is made by the PPSP. The PPSP is composed of experienced and highly qualified petroleum geologists, geophysicists, and geochemists whose combined expertise includes a global knowledge of hydrocarbon deposits and the conditions under which they are found. Each proposed site is examined, discussed, and either approved for drilling, moved to a safer location in agreement with the site objectives, or rejected as being too hazardous to drill. It is important that these safety reviews be made as far in advance of the scheduled drilling as possible in order to allow safety related changes to be incorporated in the final cruise plans. Problems can arise when a leg enters the schedule only a few months ahead of its sailing date. Only then is the formal safety review made and time may be short for replacing rejected sites. Such unpleasant surprises are sometimes avoided by "safety previews", or informal PPSP examinations of the data for a highly ranked but not yet approved proposal. This may provide the proponents with an early warning of safety problems in time to consider reasonable alternatives.

Proponents are aware of the requirements of site survey data as published in the JOIDES journal. Sometimes due to various reasons site survey data which according to these requirements are considered as necessary are not available and will probably not be available. But deep sea drilling is very expensive and has to be well prepared. Else drilling legs will fail or drilling results cannot be well interpreted. PCOM has been given the power to overrule SSP's judgement and to drill a site despite a protest by SSP. As this is the case, it would be wise for PCOM to do this only in very exceptional cases, and, if done, to give the community detailed reasoning why the decision was done that way. Else there would be a credibility gap. To gather the necessary data to present well prepared drilling proposals has always been a problem, especially to get the necessary ship's time. Thus proponents have to get very early comments by SSP if SSP thinks that additional data will be necessary. There should be more international cooperation to collect necessary site survey data.

Proposal: PPSP/PCOM/TAMU should state the limitations of ODP with respect to safety. PPSP should have an early chance to inform proponents that there might be serious reasons for PPSP not to accept a proposal. PCOM should set up a subgroup to revise the SSP data rquirements and determine the necessity of site survey data, especially differentiating which data are required always and which data are not necessary in any case. SSP should set up a standing subgroup (SSG) meeting at the site of the ODP data bank at least two times between February and July to give early comments on proposals (s. Subject 4). The ODP data bank plays a very important service function in this respect. SSG should be involved in very early stages of proposals as it might take much time to get additional data. The JOIDES office should offer help to identify colleagues, vessels, equipment to obtain the necessary data. The full SSP should then meet only once a year at the decisive October meeting (s. Subject 4).

Discussion: Safety and pollution issues are very important in this time of ever-increasing awareness of the environment and requirements for permission to drill. They are also necessary to avoid a major accident which could stop the whole project. Therefore, PPSP should remain a panel giving independent advice to PCOM and TAMU, i.e. its opinions should be developed outside the influence of scientific objectives and program goals. The PPSP should have the time to think about more general requirements in order to avoid situations as now with the New Jersey sea-level change leg.

A standing site-survey group could give early and timely advice to proponents to make the proposals more mature. The proposal abstracts (as outlined under subject 4) will be a great help in SSG's evaluation efforts.

Subject 6: Panel and Shipboard Party membership

Problem: The non-U.S. members are entitled to one representative on each panel per country or consortium. Each member nominates its own panel members and no formal rotation schedule is in place. The U.S. is entitled to a minimum of 50 % of the membership on each panel and maintains a 3 year rotation schedule for all of its members. (This term may be extended by being appointed as chair.) Since the non-U.S. nomination mechanisms are not sensitive enough to the expertise requirements of the panels, additional "members-at-large" are added to fill in gaps in expertise, causing panels to become unwieldy and imbalanced.

Similar problems exist with respect to the setting up of shipboard scientific parties. Co-Chief Scientists are nominated by PCOM and the thematic panels on the basis of scientific expertise and selected by the Operator according to MOU guidelines. Shipboard participants are also selected by formula (about 50 % U.S., 50 % non-U.S. or 2 participants per cruise per country or consortium). U.S. participants are selected for expertise by the Operator from the U.S. applicant pool; non-U.S. participants are selected for expertise from a limited slate of nominees provided by each country. Two problems have arisen from these nomination/selection mechanisms:

a) Principal scientific proponents have occasionally been passed over by the Operator during Co-Chief selection in order to honor non-scientific constraints.

b) The range of scientific expertise on the national slates is often too limited.

Proposal:

a) To prevent entrenchment, it is recommended that the non-U.S. members adopt the same 3 year or a maximum 5 year rotation policy (plus a term as chair, if appointed).

b) To reduce the membership-at-large of panels, it is recommended that when a non-U.S. panel member rotates off, that country should nominate a slate of candidates with a range of expertise for PCOM consideration, allowing the necessary coverage of disciplines without adding additional members for this purpose. The appointment should certainly only be made in consensus with the national ODP representatives.

c) To aid corporate memory, each panel might return a past member after a reasonable hiatus and when rotation allows.

d) While many factors must be taken into consideration in the selection of Co-Chief Scientists, the principal grounds must be scientific expertise and the qualification to head a large group of scientists.

e) Non-U.S. members are asked to nominate a slate of candidates with a range of expertise appropriate to each cruise, if possible.

Subject 7: Selection of new JOIDES Office

Problem: The JOIDES Office rotated among the JOI institutions in the U.S. every 2 years. The rotation did not guarantee that office and PCOM chair were the best available at that time. US scientists at non-JOI institutions were ineligible regardless of their interest/qualifications. International partners were not allowed to have office or chairmanship. Now for the first time the location of the JOIDES office has been selected based on an RFP (in this case for locating the office at an institution in one of the international partner countries).

Proposal: Continue the RFP process every 2 years in the same way as done in 1992. To gain experience the PCOM-chair-elect should be added to PCOM for the period ahead of his/her chairmanship.

Discussion: This recommendation is easy to implement since it is a continuation of a procedure just recently tried successfully. This provides opportunities also for non-JOI institutions/ scientists of the US to lead the program. It should result in more choices.

Subject 8: PCOM

Problems: PCOM and PCOM's chairperson have the decisive functions in JOIDES. All panels and the TEDCOM report to PCOM, PCOM has the final decisions on scientific planning and an important role also in the budgetary process. PCOM assembles three times a year (April, August, December) to meet certain dates mainly determined by the budgetary process.

There are several conflicts:

- service panels and TEDCOM have to react fast on special problems, but their advice has to go through PCOM, and this takes too much time; also PCOM may not contain enough technical knowhow to evaluate some questions brought up by the service panels and TEDCOM.
- a crucial role concerning drilling proposals has so far been played by watchdogs whom PCOM has assigned to such proposals, and by liaisons assigned to the panels. It seems to us that the chairpersons of the thematic panels should play more important roles in the decision process, and there is too much watchdogging and liaisoning.
- PCOM is so much embroiled in debating the merits and flaws of proposals selected and presented to them, that too much of their meeting time is consumed by decisions that they should not involve themselves in. After endlessly discussing the details of cruise plans for the coming months, the length and intensity of the discussion on long range plans, i.e. strategy, is alarmingly short and not profound. Possibly, our committee got this impression in Bermuda in part due to the tasks PCOM had set for the December meeting. But taking into account the other meetings as well, we conclude that PCOM definitely should devote more time for discussing the long range decisions to be taken for 1995 to 98 and the time beyond. Longer meetings are not the solution.
- In the early days of the Ocean Drilling Program, the ship schedule was set by the concept of circumnavigation. PCOM would announce that the ship would spend 1.5 years in each ocean (with western and central Pacific counting as 2 oceans). This practice was later discarded as being inappropriate for a thematically-driven program. More recently, "proposal pressure" has supposedly given PCOM guidance on where to send the ship, but in actuality few proponents would take the time to prepare a drilling proposal for any geographic area other than that where the ship was announced to be going in the near future. Thus there has been no real

replacement for the concept of circumnavigation, leaving PCOM open to certain national pressures for where to send the ship.

- PCOM does not play as active role in the decision process on SOE funds as was envisioned by EXCOM when the SOE fund was established.

Proposals:

1) PCOM should work more effectively, by partly working as subcommittees during PCOM meetings and by leaving more work and decisions to the thematic panels (see subject 4 on handling of proposals). The time saved could be invested in more profound long-range planning, especially for the period after 1998. In order that necessary technical developments be carried out early enough, it is essential to anticipate where major progress might be made, to decide on which technical developments the program should concentrate, and which syntheses should be done. ODP needs a timely recognition of which aims could be realistically pursued and how that could be done.

2) PCOM should have a small technical subcommittee to handle the needs of the service panels and TEDCOM. That subcommittee could react immediately on requests or proposals according to urgency, it should meet also with service panel chairpersons during PCOM meetings. The in-between work would not necessarily have to be done by meeting, but mostly by telecommunication. PCOM should meet once a year at College Station. That meeting should also be attended by the service panel chairs.

3) PCOM should take special care of its relationship with TEDCOM strengthening that committee's role and input into the ODP structure. Special proposals are made under subject 10. PCOM has an important role in the Budget Committee (BCOM) to decide on the Special Operations Expenses. As these are to a large extent spent on development costs for drilling and borehole measurement equipment, PCOM needs proper advice by TEDCOM and DMP on such developments and has to set priorities. The PCOM technical subcommittee proposed under 2) should well prepare the necessary discussions. Technology decisions by PCOM should be communicated widely and frequently.

4) The thematic panel chairpersons or other thematic panel representatives should attend of the PCOM meetings and should thus introduce the full amount of their panels' work into the discussions and decisions of PCOM. This proposal and those made in connection with the subject "handling of proposals" should lead to a large reduction in the amount of PCOM watchdogging and liaising to the thematic panels.

5) Under the proposed procedure for how drilling proposals should be handled, at their February meeting thematic panels are only seriously considering proposals for a general area of operations as defined by PCOM the previous April, and at the July meeting they cut these down to proposals in a narrower geographic area that can be covered by the ship in one year. This plan therefore does not provide a mechanism for deciding how best PCOM should define the broader area of operations for which proposals should be encouraged in the following year. It is our opinion that for an international program with some high-priority themes only satisfied through global drilling (e.g. global seismic networks, sampling for paleoenvironments) the concept of circumnavigation continues to have merit. What we view as the principal shortcoming in its previous implementation was the setting of the number of legs that should be drilled in each ocean regardless of the quality and quantity of proposals for that area.

Discussion: It will not be denied by many colleagues involved in ODP that PCOM is burdened too much with short-term planning and routine decisions in connection with ODP operations, and that there is not enough time in the PCOM meetings to discuss long-term planning and the necessary accompanying technical requirements. Such discussions have to be based on continuous evaluations of the real progress made and the shortcomings observed. The panel chairpersons could contribute much to such evaluations.

Part of the large burden on PCOM and the panels results from the current procedure of too little focussing on highest priority objectives. One could imagine that perhaps 2/3 of legs should be focussed on important objectives of the "focussed ODP-plan" while 1/3 might be reserved for other new ideas. PCOM could base their discussion largely on the outcome of the proposed revision of the white papers. By this type of discussion there is a much better chance for a truly thematically-driven program. This would avoid criticisms ODP is just a tool and that proposals come in mainly for oceans where the vessel is supposed to go. The additional burden of the thematic panels must be supported by the JOIDES office which has to be somewhat strengthened (see subject 12). We think that one cannot underestimate the task of planning for the second part of the prolongation period, and the task is such that it has to be started now. This work must not be delayed because there will be a decisive evaluation of ODP probably as early as 1996. If we want to keep the major international ocean drilling efforts together with a structure such as we have it now - not with several planning committees, executive committees etc. PCOM must actively take up this task now.

Subject 9: Scientific Syntheses

Problem: Individuals can organize workshops to produce scientific syntheses. Funding is done from various sources (e.g., generally JOI-USSAC for US participants). The results are published by societies in peer-reviewed books/journals. This has happened several times, but more is definitely better.

Proposal: Ask thematic panels to encourage scientific syntheses and special sessions at geoscientific meetings. To avoid adding unduly to the thematic chair's work load, perhaps someone other than the chair should be asked now and again to find an appropriate group of scientists to produce such a synthesis and help them in organizing/funding the enterprise. PCOM and EXCOM should encourage these activities and define possible additional themes and actions.

Discussion: JOIDES should not consider this task as one outside of its interest. Syntheses' results will be very important for long range planning and the evaluation of the worthiness of future proposals.

Subject 10: TEDCOM, Engineering Developments

Problems: Technological developments are essential for the achievement of several important scientific objectives of ODP. Yet, ODP engineering developments have been hampered by gaps in understanding and expertise. Delays and failures have hampered the development of new, high-tech tools and techniques for drilling, coring, and downhole measurements. These failures consume a significant portion of the ODP budget and impede the attainment of certain high-priority goals. The ODP community, which has been surprised by delays and cost revisions, need to seek ways to anticipate and reduce such surprises, not to seek groups to blame. Central to minimizing such problems in the future is refinement of the relationship between TEDCOM and the Science Operator's development engineers. This relationship does not appear to function as well as intended by the TEDCOM mandate. In part this may be because the principal contact is only through inconsistent TEDCOM attendance at twice-annual meetings. TEDCOM is briefed on the principal developments at these times, but such meetings generally do not allow for the in-depth kind of exchange of ideas and advice that the operator needs. Some misunderstandings seem to exist. For example, TEDCOM feels that it cannot carry out its mandate to assist engineering development without having an advising role in the writing of RFP's and the awarding of contracts. This conflicts with the Operator's understanding of his ultimate responsibility and is also made difficult by the lack of communication between meetings. Thus many unresolved differences of opinion exist between the TEDCOM and the Operator as to the wisdom of certain original decisions.

Proposals:

1) Engineering development, which is crucial to the success and renewal of ODP, deserves a more thorough examination than has been possible for recent review groups. We therefore suggest that a small group from outside the Ocean Drilling Program be appointed to evaluate the engineering development efforts at TAMU and to seek a way to make this high-tech task more effective in the future. This group would be composed of experts in drilling technology and in the organization and management of small engineering-development groups. This evaluation should include TEDCOM/TAMU relations and ways of enhancing both the teamwork between these two groups and the personal involvement of TEDCOM members, therefore, the proposed group's tasks cannot be delegated to either TEDCOM or TAMU.

2) We propose that the present TEDCOM mandate be simplified and clarified as follows:

The Technology and Engineering Development Committee (TEDCOM) is responsible for recommending to PCOM drilling tools and techniques to meet the objectives of the scientific plan and for monitoring the progress of their development through liaison with the ODP/TAMU Engineering development department.

The members of this committee are nominated by TEDCOM and approved by PCOM. Liaison should be maintained between TEDCOM and the Downhole Measurements Panel. An ODP/TAMU engineer is assigned to act as Science Operator liaison with TEDCOM.

This mandate should be fully accepted by all partners within ODP and should be fully exercised, in order to give TEDCOM a more proactive role in ODP engineering development.

3) In detail we propose that for the planning of engineering developments the following procedures are adopted:

- The current inventory of all planned or desired ODP engineering development projects should be expanded to include an analysis of projects or project steps which failed in the past, the chances of realisation or success of proposed projects and the expected costs of engineering development, construction and testing. The inventory should include technology available from outside ODP.
- With the scientific priorities of the thematic panels in mind, TEDCOM and the TAMU development engineers should discuss and set up a list of realizable engineering development projects, the probable cost, and the means of realization. PCOM then prioritizes this list. This list should then be the basis for the future ODP work in this field. There should be no modifications of the priority list without the consent of PCOM in consultation with the TEDCOM chair. The TEDCOM chair should attend the PCOM meetings and report on the progress and necessary modifications.
- The budgetary planning by ODP-TAMU, JOI Inc. and BCOM should follow the lines of this priority list. The thematic panels interested in the developments will be informed routinely in writing, and in addition at special request.
- Engineering development projects should be discussed by TEDCOM with the ODP TAMU engineers, and if necessary with specifically invited guests; such discussions should also be arranged if a development

project enters a critical phase. (This has already been done for the diamond coring system.)

- For each engineering development project there should be one or two TEDCOM members with special expertise who are willing to serve as advisors; they should be supplied with all necessary detailed information on a continuous basis by TAMU. If TEDCOM has no specific expertise in a certain field, the TEDCOM chair should contact the PCOM chair for having a competent expert as an additional temporary TEDCOM member.
- In concert with PCOM's long-term plan on scientific priorities and drilling platforms for the period1998-2003, TEDCOM should undertake intense discussions of necessary engineering developments to support these projects.

Subject 11: New technologies for downhole measurements, DMP's role

Problems: Some scientific objectives of ODP require downhole-measurement technology that has not been developed or that is currently incompatible with ODP drilling requirements. For example, use of the diamond coring system for drilling on zero-age crust will require slimhole, hothole downhole tools. Previous ODP development of such techniques has been inadequate, partially because of funding limitations. Delays and failures in developments of new technologies have raised concerns about the viability of already scheduled legs.

Proposal: With the scientific priorities of the thematic panels in mind, DMP should expand their current list of existing, planned, and desired ODP downhole-measurement tools, to include analysis of failures, chances for success of planned tool developments, and uncertainties in both expected costs and expected completion times. PCOM should use this revised list in assigning priorities for development of downhole-measurement tools, and budgetary planning should be in accord with this priority list. Each high-priority downhole tool development should be monitored by a DMP watchdog. Thematic panels interested in these developments should be informed routinely of any changes of development plans or progress.

Subject 12: Mode of operation of panels, more support of panels's work by the JOIDES office staff.

Problem: The workload of the panel chairs has caused them already several times in the past to ask for more support or funding to enable them to do their jobs. As we propose to transfer additional responsibilities to certain thematic or service panels it is important to support them even more. Therefore we suggest in the following some changes in the mode of operation of the planning groups that should produce economies of time and facilitate their deliberations.

Proposals: All advisory groups, but particularly PCOM, TEDCOM and SSG (SSP), should make more use of Executive, Standing and Ad hoc Subcommittees. Subcommittees can prepare position papers in advance for the entire committee to discuss and modify. All panels should get more help from the JOIDES office, which should have one or two additional staff members.

PCOM should routinely include an Executive Session in its agenda to allow for free discussion of items that may be unusually sensitive.

Chairs should delegate more duties to committee and panel members. In most instances the work loads are unevenly distributed at present, with the chairs performing most of the work of the committee. This imbalance could be reduced by delegating responsibilities.

Routine work common to more than one panel should be handled by the JOIDES office. In particular, we suggest that the JOIDES office take on the responsibility to:

1) Develop a set of instructions to proposers, including abstracts, cover sheets and checklists to ensure that all required information is addressed so that proposals can be evaluated on an even footing. They should include a release statement to ensure that the proposers are aware that the proposals are not treated as proprietary information and are widely distributed.
2) Copy and mail extended abstracts or full proposals to all panel members,
3) Maintain a current checklist of the ratings of all proposals and the status of the relevant site survey information, and publish this regularly in the JOIDES Journal.
4) Respond to inquiries from interested parties for copies of proposals for the purpose of contributing information or expertise to existing proposals, for combining proposals and efforts, etc. The JOIDES office should inform the author of a proposal if a copy is sent to another potential investigator.

The JOIDES Office staff might also take on responsibility for providing the following standard information that should accompany full proposals: to prepare preliminary drilling time estimates, to provide information on regional oceanic conditions, such as currents, winds, and wave height information for proposed drill sites, etc.

Proposals that are of high scientific merit but do not fall within the mandate of any of the thematic panels should be referred to a subcommittee of the Planning Committee for consideration.

In view of the restructuring proposed, each Panel should review its requirements for watchdogs and liaisons.

Panels and Committees should meet regularly (preferably once a year) at the ODP in College Station, Texas to facilitate liaison with the engineering development group and other relevant components of the Program.

Discussion: We believe that modifications of the operation mode of the panels, use of subcommittees, and delegation of duties, will reduce the load on the Panel Chairs and free up time for them to have closer interaction with other parts of the advisory structure.

The additional duties suggested for the JOIDES office will also reduce the work load on panel chairs, but will require additional personnel at the JOIDES office.

We hope that suggestions presented above and in the other more specific sections will serve to reduce the amount of time of panel members and Project personnel spent in liaison with other groups while at the same time providing for a more effective transfer of information.

InterRidge Update

InterRidge has moved forward in several respects during the past few broadcast mailing, the Global component of the program selected the Indian Ridges and the Pacific-Antarctic Ridge for focused coordination efforts in the near term. An open meeting was held in Paris on April 8-9, 1993, to discuss next steps in coordinating research in these areas; the meeting report will be available from the InterRidge Office. Four major areas of interest were delineated: SW Indian Ridge, SE Indian Ridge, Pacific-Antarctic Ridge, and Arctic ridges. "Particular priority" should be focused on the Pacific-Antarctic Ridge.

The Meso-Scale Working Group, under the leadership of Martin Sinha, has focused its efforts into three components: (1) Segmentation at Mid-Ocean Ridges; (2) Crustal Accretion in Marginal Basins; and (3) Quantification of Fluxes at Mid-Ocean Ridges. Each of these subgroups is planning a workshop, as follows:

Ridge segmentation -- progress toward predictive models (Symposium)

Convenors: Roger Searle, Jian Lin, and John Sinton
Dates: September 22-23, 1993
Location: University of Durham, UK

Fluxes workshop

Convenors: H. Elderfield and C. Mével
Dates: September 24-25, 1993
Location: University of Durham, UK

Segmentation workshop

Convenors: Roger Searle, Jian Lin, and John Sinton
Dates: September 24-25, 1993
Location: University of Durham, UK

Marginal Basins workshop

Convenors: Julian Pearce and Kensaku Tamaki
Dates: October 11-13, 1993
Location: Seattle, Washington, USA

Please contact subgroup convenors for further information about the workshops.

The Active Processes Working Group is currently being constituted under the leadership of J. Cann (Leeds); probable subgroups include (1) Ridge-Crest Observatory, including system design, power supplies, sensor development, and communications; and (2) Event Detection and Response, focusing on detection techniques, communications network, baseline surveys, and response conduct. A workshop will probably be convened in late 1993.

The roster of "official" InterRidge member countries is growing. Principal members include France, Germany, Japan, Spain, UK, and US. Canada, Iceland, and Portugal are likely to sign on as Associate members for 1993; Australia is likely to become an Associate member in 1994; and discussions are ongoing in other countries.

The InterRidge Steering Committee will probably meet in October-November 1993 to assess progress of the program to date. No venue has yet been selected for this meeting.

The next InterRidge General Meeting is likely to be held in early 1994. Germany has offered to host the meeting; details will be forthcoming.

GLOBAL SEDIMENTARY GEOLOGY PROGRAM
A COMMISSION OF THE INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
Secretariat: University of Miami, RSMAS/MGG
4600 Rickenbacker Causeway
Miami, Florida 33149-1098

8 July, 1993

William Collins
JOIDES Office
School of Oceanography HA 30
University of Washington
Seattle, WA. 98195

Dear Bill,

Here is an abbreviated report on GSGP activities for inclusion in the PCOM book as per your e-mail request. Now that I realize that the August meeting is the time for these reports, we can have a bit more lead time.

When our Report is mentioned, it will be appropriate to bring up our plans to organize a workshop that may be titled "Anoxic Events and Source Rocks of the Cretaceous and their Sequence Stratigraphic Settings". The purpose of the workshop would be to assemble a collection of representative case histories of Cretaceous examples that might advance understanding of these exceptional deposits. Certainly some of the examples would come from the Ocean Drilling Program and we would therefore welcome expressions of interest and suggestions from your community.

Sincerely yours,

Bob

Robert N. Ginsburg
Chairman

CC: J. Natland, K. Becker

Phone: (305) 361-4684, 361-4663 Fax: (305) 361-4632 Telex: 317454

GLOBAL SEDIMENTARY GEOLOGY PROGRAM

A COMMISSION OF THE INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

Secretariat: University of Miami, RSMAS/MGG
4600 Rickenbacker Causeway
Miami, Florida 33149-1098

ACTIVITIES OF GSGP, 1992-1993

RESEARCH PROJECT CRETACEOUS RESOURCES, EVENTS AND RHYTHMS.

An Atlas of Cretaceous Carbonate Platforms consisting of some 40 case histories is being edited for a special publication of AAPG by Toni Simo (Wisconsin) and Robert Scott (Amoco). A second collection of papers on Paleoenvironmental models of Cretaceous Platforms is being assembled by Jean Philip (France). The Carbonate Platform Working Group organized a workshop on platform sedimentation that was held in Tremp, Spain in August, 1992 and it also put on a full day session of papers at the AAPG-SEPM Convention in New Orleans in June, 1993.

The Working Group on K/T held a Workshop in Tunisia during spring, 1991 that attracted fifty participants, twenty-five of whom were from overseas. Two days were spent collecting closely spaced samples from the El Kef Section that is the proposed type section for the boundary. To settle a controversy over the interpretation of the extinctions of foraminifera across the boundary, splits of these samples are being analyzed by several micro-paleontologists.

RESEARCH PROJECT PANGEA.

A second GSGP research project was developed during a week-long Workshop organized by George Klein (Illinois) and Benoit Beauchamp (GSC, Calgary) that was held in May, 1992 at the University of Kansas. With support from NSF, the co-conveners assembled 65 experienced researchers and 15 graduate students from 13 countries. The objectives of Project PANGEA developed by the Workshop are: 1) to understand global processes during the development and demise of the supercontinent PANGEA; 2) characterize the special features of the global sedimentary record from Pennsylvanian through Middle Jurassic; 3) determine climate variability during Pangean time and seek explanations for it; 4) examine the relationships between extinctions and the sedimentary records of environments, climates and sea level fluctuations.

GSGP is a co-sponsor of an International Symposium on PANGEA organized by the Canadian Society of Petroleum Geologists that will be held in Calgary, August, 1993.

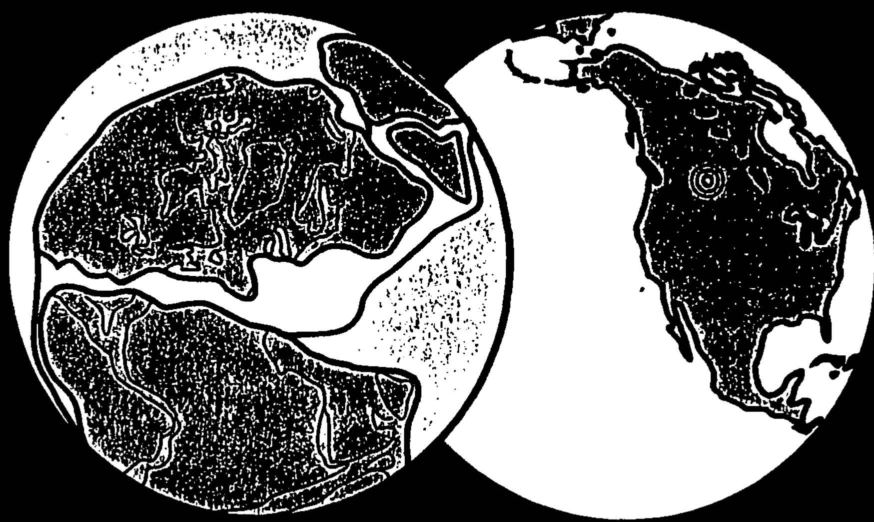
RESEARCH PROJECT ALBICORE-APTICORE.

A new initiative on greenhouse climates and oceans of the mid-Cretaceous was sparked by one of the working groups in our Project CRETACEOUS RESOURCES, EVENTS AND RHYTHMS. The Working Group on Cyclostratigraphy headed by Alfred Fischer, first proposed a test of global synchronous sedimentation through a study of widely spaced cores of Albian carbonates. Subsequently, a connection developed between this Albian initiative and a proposal by Roger Larson to study the effect of volcanism on climates in the Aptian. With support from JOI-USSAC, Fischer and Larson organized a five-day Workshop held in Perugia, during early October, 1992 that attracted 74 scientists from 18 countries. The plan for assembling a global data base to test ideas of greenhouse climates and Milankovitch rhythms is to be distributed in the next few months.

Phone: (305) 361-4684, 361-4663 Fax: (305) 361-4632 Telex: 317454

CARBONIFEROUS TO JURASSIC

PANGEA



AUGUST 15-19, 1993

CALGARY CONVENTION CENTRE

ANNUAL CONVENTION

CANADIAN SOCIETY OF PETROLEUM GEOLOGISTS

WITH GLOBAL SEDIMENTARY GEOLOGY PROGRAM

SECOND CIRCULAR & REGISTRATION INFORMATION

WELCOME TO PANGEA

"It is only by taking long excursions in time and space that we come to understand the world in which we live" (H. Poincaré)

Pangea is an excursion in time and space to a world very different from today's and that of most of Earth history. It was a world at the extremes of global change and one which can be a stimulus to develop global-scale models of the genesis and distribution patterns of sediments. These new models can illuminate Earth history and provide guidance to the search for natural resources and their wise management in the twenty-first century.

The Pangea interval was a time of extremes of climate and sedimentary environments, of cataclysms and innovation of marine and terrestrial biotas, and of mountain building and intense volcanism. Glacial deposits are extensive, red beds and evaporites are widespread, reef building is prominent at certain episodes and lacustrine beds or black shales at other times. The end-Permian extinction of 95% of marine invertebrates and the demise of some three-quarters of many groups of amphibians and reptiles are the largest biotic crises in geological history and are succeeded by the appearance of new reef builders, new benthic biotas, new plant communities as well as dinosaurs. Continental collisions at the end of the Paleozoic led to widespread mountain building in North America (Appalachian Orogeny), in Europe (Hercynian Orogeny) and around the Siberian craton. In the Triassic, volcanic deposits ringed the Pacific Ocean and floored rift basins of eastern North America.

Pangea sedimentary deposits are rich in natural resources: oil and gas in West Texas, New Mexico and around the Ural Mountains; major coal deposits in North America and Europe; phosphates, potash and uranium ores in the Western United States.

This International Symposium, which is another example of the innovative leadership of the Canadian Society of Petroleum Geologists, is a milestone in the long history of research on Pangean deposits and their rich store of resources. On the one hand, it provides state-of-the-art summaries and new findings on this critical interval of Earth history; on the other hand, it marks the beginning of an intensified global approach to understanding the climates, environments, sequences and biotas under the aegis of the Global Sedimentary Geology Program, a Commission of the International Union of Geological Sciences. This new Program will be led by six working groups each with international representation that will assemble global-scale data bases on resources, climates, sedimentary sequences, biotas, chronology and paleogeography and seek to develop their interrelationships and connections with tectonic, volcanic and eustatic events.

I invite you all to the Pangea Conference.

Robert N. Ginsburg
Chairman and Founder
Global Sedimentary Geology Program
Honorary Chairman
Pangea Conference

TECHNICAL PROGRAM

About 350 presentations (260 oral, 90 poster) will be given at the Calgary Convention Centre on a variety of topics dealing with environments, evolution and resources of the supercontinent Pangea. Paleogeographic and tectonic syntheses ranging from a global perspective to a local one are the backbone of the program. In many cases associated oil, gas and mineral resources are integrated into these presentations. Complementing these syntheses are topical presentations on diverse subjects such as source rocks, reefs, paleoclimate, sequence stratigraphy, global events, paleoceanography, tectonics and sedimentation, biostratigraphy, coal and evaporites. Canada will be especially well represented with about 60 presentations on Carboniferous to Jurassic strata.

Specialists studying the Carboniferous to Jurassic record will find papers of direct interest to their research as well as ample opportunity for discussions with colleagues from many other countries. The Conference will be of special interest to explorationists because the strata described and interpreted in many presentations are important source or reservoir rocks. The worldwide coverage of the program will be especially valuable to those involved in international exploration and will provide many useful analogues.

The following is a preliminary list of papers arranged in broad themes.

PRELIMINARY LIST OF PAPERS

CARBONIFEROUS-JURASSIC OF CANADA

Triassic Gas Resources of Western Canada Sedimentary Basin - Geological Play Definition and Resource Assessment - T.D. Bird, J.E. Barclay, R.I. Campbell, P.J. Lee

Triassic Paleotectonics, Paleoclimate, Paleo-Oceanography, and Precursor Mass Extinctions: Impact on Depositional and Reservoir Facies of Middle and Upper Triassic Sequences in the Western Canada Sedimentary Basin - G.R. Davies, T.F. Moslow

Upper Triassic Carbonates of the Western Canada Sedimentary Basin: Hosts for the Biggest Gas Play in Western Canada - G.R. Davies, H. Majid

Sequence Stratigraphic Setting of Transgressive Barrier Island Sandstones in the Middle Triassic Halfway Formation, Wembley Field, Alberta - A. Willis, T.F. Moslow

Stratigraphic Framework and Lithofacies Relationships, Middle Triassic (Ladinian-Carnian) Halfway-Doig Interval, Peejay Field, Northeastern British Columbia - M.L. Caplan, T.F. Moslow

Peace River Arch, Worsley Area, Comparing Sequence Stratigraphy and Seismic Stratigraphy at the Play Level - S. Carroll

Anomalously Thick, Shelf Margin Sandstone Bodies and their Sequence Stratigraphic Significance in the Interrelation of Middle Triassic Strata in West-Central Alberta - J. Wittenberg, T.F. Moslow

Trace Element and Isotopic Data as Provenance Indicators of late Jurassic Strata from Western Montana, Southern Alberta and Southeastern British Columbia - J.M. Sablock

Jurassic-Cretaceous Boundary in the Medicine River and Sylvan Lake Areas, South Central Alberta - R.S. Strobl, J.W.K. Kramers, G. Dolby

Age of Jurassic Valley Fill Successions, Medicine River and Gilby Areas, Central Alberta - P.R. Handcock, J.C. Hopkins, R.S. Strobl, G. Dolby

Carboniferous Strata of the Western Canada Sedimentary Basin - B.C. Richards, J.E. Barclay, D. Bryan, A. Hartling, C.M. Henderson, R.C. Hinds

Carboniferous Tectonic Elements, Southern Western Canada Basin - B.C. Richards

Belloy Formation (Lower Permian), Fort St. John Area, B.C.: Condensed, Mixed Siliciclastic-Carbonate-Chert Sequences of Channelized, Marginal Marine Origin - F.G. Young, S.R. Leggett, S. Eibenschutz

"Grassy High", Northeastern British Columbia: A Structural High with Eroded Upper Triassic Section Coincident with Optimum Mississippian Hydrothermal Dolomite Reservoir Development - G.R. Davies, H. Majid

Depositional Facies and Resultant Reservoir Quality of Mississippian Strata, Northern Alberta Foothills - D.J. Robinson, G.T. Hassler, F.A. Stoakes

ODP FOUR-YEAR PLAN ARTICLE IN *EOS*

EOS

SECTION NEWS

OCEAN SCIENCES

Editor: Paul J. Fox, Graduate School of Oceanography, University of Rhode Island, Kingston, RI 02881; tel. 401-792-6229

ODP Sets 4-Year Plan

The Ocean Drilling Program, a consortium of countries led by the United States, with a broad mandate to drill in the world's oceans, has set the direction of its drilling vessel for the next 4 years. During the various upcoming legs, researchers will address some of the themes considered to be high priority by ODP's advisory panels and will develop the drilling technology to achieve these goals.

Scheduled legs of the ODP program include:

Leg 150, New Jersey Sea Level, May 30–July 25, 1993. The primary objectives are to determine the geometry and age of Oligocene to Miocene depositional sequences and evaluate the role of relative sea-level changes in developing this record. The drilling will consist of a transect across the continental slope and rise.

Leg 151, North Atlantic Arctic Gateways, July 30–September 24, 1993. This leg is the first of two recommended legs of drilling to study high-latitude oceanic circulation and sedimentation through the Cenozoic. This leg will concentrate on the northernmost sites to document the evolution of the Arctic.

Leg 152, North Atlantic Rifted Margins, September 29–November 29, 1993. This is the second leg of the multileg North Atlantic Rifted Margins Detailed Planning Group. The drilling will be on the East Greenland margin and will encompass a transect across a passive margin with thick deposits of extrusive volcanic deposits seen by seismic profiles as dipping reflector sequences. The purpose is to document the overlying sedimentary sequences to constrain age and subsidence history of the volcanic eruptives, study the nature of the seaward dipping reflector sequence (SDRS), and sample the underlying rocks.

Leg 153, Mark, November 29, 1993–January 24, 1994. The purpose of this leg is to sample lower crust and upper mantle created at a slow-spreading ridge. Specific drilling targets include an exposed gabbro massif and a residual mantle section along strike to the south of the gabbro.

Leg 154, Ceara Rise, January 29–March 25, 1994. The purpose of this leg is to study the Cenozoic history of Atlantic deep water circulation and southern-source deep water in an area where the two water masses converge. The study of carbonate dissolution along a bathymetric transect will provide information on the mixing of these water masses. The mixing influences the initial chemical and physical characteristics of the deep water that flows into the Indian and Pacific oceans.

Leg 155, Amazon Fan, March 31–May 26, 1994. The purpose of this drilling is to determine the lithology, facies, and age of several acoustic units comprising the Amazon Fan and their relationship to sea-level change. The data will provide information on the terrestrial paleoclimate, western equatorial Atlantic paleocurrents, and regional tectonic influences, such as Andean uplift, on fan sedimentation.

Leg 156, Barbados Ridge, May 31–July 26, 1994. The primary objective of this program is to drill and log five holes along a transect. The holes will be cased and sealed, and fluid flow along the decollement will be measured. This will yield information on the dynamics of deep-sourced fluids, tectonic features, and geochemical signatures in the decollement zone.

Leg 157, Engineering, July 31–September 25, 1994. The prime purpose of this engineering leg is to test the diamond-coring system, in particular, the secondary heave compensation system. The test will take place on the Vema Fracture Zone. Drilling is expected to take place on the median ridge, starting in the limestone cap.

Leg 158, Tag, September 30–November 25, 1994. The drilling objective is to characterize the fluid flow, geochemical fluxes, and associated alteration and mineralization, and to investigate the subsurface nature of an active hydrothermal system at a slow-spreading ridge. The data should provide an analogy for modern land-based mineral deposits of similar seafloor origin.

In the remainder of fiscal year 1993, legs 150, 151, and 152 are confirmed as part of the current program plan. During fiscal 1994, legs 153–158 are confirmed as first approved in the program plan in December 1992, noting that the precise location of test leg 157 may change. 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.

During 1995–1996, further investigation of the above and other high-priority themes, including sea-level change, high-latitude paleoceanography, fluid circulation in the lithosphere, and carbon cycle, will continue. After 1996, ODP's planning committee encourages the submission of proposals for any ocean-addressing, high-priority themes. Proposals received before January 1, 1994, that are given high rank have the potential to modify the fiscal 1996 and subsequent ship track.

ODP is currently staffing legs 156–158. Shipboard participation is by invitation from ODP's science operator at Texas A&M University. Information and applications may be obtained by contacting Ocean Drilling Program, Texas A&M University, 1000 Discovery Drive, College Station, TX 77845–9547; tel. 409-845-2673; fax 409-845-4857.

Expressions of interest or proposals for drilling are accepted at all times of the year and will be reviewed following January 1 and July 1 deadlines. Opportunities also exist for post-leg data acquisition. For more information, contact JOIDES Office, HA-30, University of Washington, Seattle, WA 98195; tel. 206-543-2203.—*Bill Collins, JOIDES Office, University of Washington, Seattle*

40 Vol. XV, No. 1

SEDIMENTS AND OCEAN HISTORY PANEL WHITE PAPER

INTRODUCTION

The Sediments and Ocean History Panel (SOHP) was charged with advising the JOIDES Planning Committee (PCOM) on all matters relating to paleoceanography, stratigraphy, sedimentary processes, and geochemistry. This covers an extraordinarily wide range of fields as is evident from the fact that seven of the twelve final recommendations of COSOD I and three of the five working groups of COSOD II fell within the SOHP mandate. Because of concerns that this mandate was too broad to be adequately represented by a single panel, SOHP has been divided into two panels--the Ocean History Panel (OHP) and the Sedimentary and Geochemical Processes Panel (SGPP). The preparation of this white paper predates the division of the panel; the first four of the six themes are most appropriately placed under the mandate of OHP, and two under the mandate of SGPP.

NEOGENE PALEOCEANOGRAPHY

Overview of Objectives

Understanding the causes and consequences of global climatic and environmental change is one of the most important challenges facing us today. Virtually all aspects of the history of life on Earth are controlled by the surface environment; an understanding of the complex interactions in the Earth climate system is essential if we are to learn to deal with the consequences of future global change. Paleoceanographic records give us the chance to reconstruct the temperature, chemical composition and circulation of the atmosphere, the changing wind- and water-borne flux of materials from the continents, the level of productivity of different regions of the ocean, and the evolutionary response of the biosphere to all these changes. Thus they allow us to test current models of the fundamental processes controlling the working of the global ocean-atmosphere-cryosphere-biosphere system.

When less than a decade ago deep ocean drilling gained the capability to recover truly undisturbed records of Neogene sediments, it was rapidly appreciated that the ultimate origin of most environmental variability on geologically short timescales is changes in the geometry of the Earth-Sun orbital system. The amplitude of response to this external forcing was surprisingly high during the middle and late Pleistocene (ice-age cycles). This discovery provides us with the basis for constructing and testing useful models describing the operation of the whole climate system; these models in turn permit us to target future drilling with increasing precision. Were this the whole story, it would be appropriate to focus only on the recent past. However, we have also learned that the sensitivity of the system to orbital forcing has changed in the past--sometimes slowly and sometimes rather rapidly. The environmental changes that will occur over the next century will depend very much on whether this sensitivity remains stable as projected atmospheric carbon dioxide levels go outside the range that has been experienced at least over the past million years.

The record of the history of global change has proved to be best studied in pelagic sediments. One reason is that the regional overprint in marginal marine and lacustrine sediments is usually large enough to interfere with the recovery of the global signal. For the past 0.3 million years the ocean record is accessible to conventional piston coring. However for older material, ocean drilling and particularly the hydraulic piston corer, is the only tool capable of recovering sequences of appropriate quality and resolution to tackle these problems. Even for the past 0.3 My, ultra-high resolution records like those collected from the Gulf of California, are accessible only through HPC/APC drilling.

During earlier phases of ocean drilling we have established that climate-related signals can be recovered and decoded. We have also demonstrated that we can correlate and date these signals with sufficient precision that they can be integrated, allowing us to build up a picture of the working of the whole system and to evaluate the phase relationships between different components of the whole system. In addition, thanks to the computer revolution, we are beginning to have models (of varying complexity) that evaluate this system and can guide us towards those parts of the system that are under-determined due to lack of geological data. These modelling efforts will be of increasing value in guiding us as the interaction between modelers and observational scientists in the drilling program increases.

Scientific Opportunities and Objectives for Future Drilling

1. **To reconstruct the spatial and temporal variability of the oceanic heat budget:** For today's state oceanographers have constructed atlases and sections describing the distribution of temperature, salinity, dissolved oxygen, nutrients, radiocarbon, and other tracers in three dimensions. These distributions are used in constructing models of considerable complexity describing the dynamics of ocean-atmosphere interaction in terms of the heat budget, and enabling us to evaluate the role of the ocean in climate development. Future drilling will be designed to approach this kind of coverage for the past, encompassing the time dimension. Since total coverage is, of course, impossible to even contemplate, our task is to identify and sample those specific regions of the past ocean that are critical to the understanding of particular aspects of the system.

2. **To reconstruct the record of variability in the chemical composition of the ocean and its influence on atmospheric carbon dioxide, and to calibrate its climatic significance:** Within the past few years we have rapidly gained understanding of the way in which the atmospheric carbon dioxide level has varied over the last major climatic cycle (160ka), and, at the same time, have made great steps in understanding the mechanisms by which this is controlled by the chemistry of the ocean. We are now in a position to build up records of the changing carbon-related chemistry of the ocean and so to recontruct a longer record of the composition of the atmosphere. This, in turn, will enable us to evaluate the sensitivity of the climate to changes in atmospheric carbon dioxide.

3. **To understand the evolution of marine organisms:** The investigation of evolutionary mechanisms remains a central area in the Earth Sciences, and the sequences that are available from deep-sea drilling are those best suited to address some of the most pressing problems being discussed at present (e.g. the question of punctuated versus gradual evolution). The study of interactions within the biosphere at times of evolutionary change may also give us insight into the implications of massive anthropogenic intervention in the marine biosphere. Additionally, with improvements in non-biostratigraphic chronostratigraphic techniques, it should be possible to map migrations and diachronous events over broad geographic areas.

The Drilling Approach Needed to Meet These Objectives

How has the temperature and chemical structure of the deep ocean varied in response to orbital forcing? By what mechanism is Milankovitch frequency variability imprinted on deep ocean sediments (including their seismic character) in glacial and pre-glacial times? What aspects of whole-ocean chemistry have responded to orbital forcing? How has the abyssal fauna responded to high-frequency variability in food supply? These questions all require drilling transects to recover sediment deposited over a range of water depths. Ideally, the sites are closely spaced so as to have experienced the same flux of material from the photic zone, in which case the dissolution flux can be determined as a function of paleo-waterdepth. Examples would be Ceara Rise; Walvis Ridge (where DSDP Leg 74 obtained very valuable Paleogene sequences but poor Neogene records); Ontong Java Plateau; the North Pacific (where a depth transect could only be constructed from widely spaced topographic highs); 90°E Ridge; both sides of the sills bounding the Norwegian Sea. It is also essential that we exploit the opportunity for recovering high-resolution records in older (Paleogene and Mesozoic) sections so that the response of different ocean states to the same astronomical forcing may be measured.

How has the latitudinal temperature gradient, the mid-latitude East-West temperature gradients, the East-West equatorial temperature gradient (all monitoring heat transport) varied? These questions require the drilling of carefully planned transects capable of monitoring the gradients and their evolution. Transects across the California Current; the Subantarctic Indian Ocean around Broken Ridge; the Subantarctic Pacific Ocean on the East Pacific Rise; the equatorial Atlantic (well covered only in the East); the mid-latitude South Atlantic. Arctic coverage has extremely high priority; when the Arctic Ocean was not ice-bound (perhaps only a few million years ago) as it is today, it must have played an important role in climate control that cannot be evaluated so long as we have absolutely no records from the Arctic ocean. We believe that when the results of recent Antarctic drilling have been evaluated it will be found that there are still gaps in our knowledge of the Neogene at high Southern latitudes that must be filled if we are to understand the operation of the carbon system.

How has the mass budget of the ocean varied? How has the productivity changed? How has the flux of aeolian sediment changed? How has the input from the world's great rivers changed? These questions are addressed in some of the transects outlined above, with a few additional sites towards the gyre centers and sites toward the margins where fluxes rise rapidly. An important additional requirement here is that extremely precise time control is needed to generate flux estimates; virtually no DSDP site and only selected ODP sites, have sufficiently good recovery and continuity for this purpose.

Many of the important questions regarding the changing chemistry of the ocean (including the carbon system) will be tackled in the transects outlined above. However the solution of these questions will guide their prioritization; for example, for nutrient cycling and atmospheric carbon dioxide reconstruction it is especially important to record the "new" (at present, North Atlantic) and "old" (at present, North Pacific) extremes of the first order deep circulation path. On the other hand, the average chemical composition of the ocean is best monitored at an intermediate point along this path.

Technology Issues

A requirement that is common to all the objectives considered under this theme is the complete recovery of undisturbed sections. We believe that the JOIDES RESOLUTION is capable of achieving this very effectively; if any different platform were to be considered, it would be important not to sacrifice the advances that have been made since the end of DSDP. In the past, the HPC/APC has not been deployed as efficiently as desirable; frequently optimum recovery has not been achieved, though the quality of the material recovered is excellent. The recent drilling at Site 758 has shown that the recovery of a complete, oriented section is possible. However, sample requirements are increasing rapidly as the quality of recovery improves, and thought should be given to ways of increasing the quantity of material available for study. The critical need for data from the Arctic regions presents extremely difficult technological challenges. The JOIDES RESOLUTION is capable of drilling in some subpolar regions, but for high Arctic drilling another platform will be needed. In addition, the question of site surveys in Arctic regions must also be addressed.

HISTORY OF SEA LEVEL

Overview of Objectives

Sea level fluctuations provide some of the most dramatic and pervasive influences on the stratigraphic record, and have ramifications in almost all aspects of Earth history. The hypothesis that certain sea level events are globally synchronous and are expressed as depositional sequences of onlap and offlap (and intervening unconformities on continental margins) has, in the past decade, revolutionized the interpretation of seismic data from marine sedimentary environments. As our stratigraphic, geophysical and geochemical tools improve, the originally proposed 'eustatic sea level curve' is now recognized to be the result of a complicated interaction between sediment supply, tectonic history, subsidence, and eustacy. We have recognized links between sea level fluctuations and climatic variations, tectonic events, ocean chemistry and circulation changes, as well as faunal boundaries. However, fundamental questions remain with regard to the true synchroneity of these events and the causal linkages among them.

Much of our present knowledge of the timing and amplitude of sea level changes has been derived from studies of passive margins and from the oxygen isotope records of pelagic and benthic microfossils. The passive margin signal is greatly influenced by changes in subsidence, sediment supply and tectonic uplift, and is susceptible to numerous sources of error. The best opportunity for reconstructing a complete picture of global sea level history lies in a well formulated program of drilling a series of holes in the slopes, rises and abyssal plains of the world -- a program that only ODP can undertake.

The history of sea level fluctuations is so complex that no single technique or single site can be expected to provide a global picture of sea level variations. In support of the recommendations of the COSOD II we propose three independent approaches, each with its limitations and advantages, to attempt to document and quantify global sea level history. These include passive margin and atoll drilling, and the recovery of pelagic sedimentary sequences in order to establish a complete high resolution oxygen isotope record. Probably more than any other SOHP objective, drilling to establish a global sea level curve will have to be supported by high resolution geophysical surveys, high-quality well log records, and complete core recovery.

Scientific Opportunities and Objectives for Future Drilling

The fundamental task of a global sea level history program is to quantitatively establish the timing and amplitude of major global sea level fluctuations. Specific objectives for sea level related drilling include:

1. **Determination of the timing and global correlation of sea level cycles.**

2. **Determination of amplitude of sea level cycles (2nd and higher order).**

3. **Evaluation of the mechanisms responsible for global sea level cycles.**

4. **Extraction of regional sea level signals from a composite and global sea level curve and understanding of mechanisms responsible for the regional signals.**

5. **Determination of the effect of sea level fluctuation on basin sedimentation and the deep sea record.**

The Drilling Approach Needed to Address These Objectives

Three independent approaches needed to address these objectives defined by COSOD II and SOHP include: (1) drilling of passive margin transects; (2) atoll drilling; and (3) the recovery of continuous sedimentary sequences to establish oxygen isotopic records. By combining these different approaches it may be possible to overcome the limitations inherent to each approach, and extract a global sea level signal.

The passive margin approach, developed by Vail and his colleagues, estimates global sea level variations from stratigraphic information coded in coastal onlap and offlap patterns on different continental margins. Because of the uncertainty of the prediction of subsidence and other factors affecting sea level fluctuations in any one area, it is necessary to stack information from different margins in order to extract the eustatic component. We propose to drill transects on passive margins with different tectonic histories and sediment (carbonate and siliciclastic) supplies. Drilling on margins with relatively simple subsidence histories is required, preferably near to where good land outcrop sections and industry data from wells are available. At least one transect per margin type is needed, extending from the contintal shelf onto the adjacent basin plain and penetrating a sedimentary sequence as completely as possible. The approach should be sequential, beginning with the Neogene, where we have the highest resolution and then applying our results and models to older sequences. There are only a few areas on the globe where a high resolution (third and higher order) seismic sequence stratigraphy and the means to date it precisely (e.g. by bio-, magneto-, and isotopic stratigraphies) exist. Potential areas for the Neogene record include the Northeast Australian Margin, the South China Sea Margin, the Maldives, and the Gulf of Mexico. Transects along the east coast of North America or the west African Margin, the Exmouth Plateau and the east African Margin are proposed to obtain the longer Mesozoic-Cenozoic history.

The atoll approach has recently been proposed because the advent of Sr-isotope dating now permits the dating of previously undatable atoll carbonate sequences. This approach uses the stratigraphic record of atoll carbonates as dipsticks in areas having a simple subsidence history. Although this strategy yields discontinuous records with variable resolution, it may offer the best chance of obtaining reliable, quantitative, low-frequency (greater than 2 Ma) information on the amplitude of post-Eocene eustatic sea level variations. It is important to locate sites in areas where uncertainties in modelling subsidence history are minimal. These conditions appear to be met in the Marshall-Gilbert Islands. Because these islands lie on crust that is locally compensated, it is probable that they have undergone a straightforward subsidence history since the Eocene. Paired atoll/drowned atoll depth transects, in a major atoll chain that extends over a wide latitude and age are preferable in order to drill the early sea level record on the drowned atoll and the more recent record on the current atoll. The transects should also include atoll apron, rim and lagoon sites. It is recommended that lagoon sites be drilled on a current atoll to provide a tie into the platform top. The USGS Eniwetak and the French Mururoa sites may provide this information.

To test the validity of results based on atoll drilling, core transects along low-relief carbonate bank-slope-basin systems should be compared to the proposed transects on Pacific high-relief atoll transects. Gentle carbonate slope-to-basin systems should be compared to the proposed transects on Pacific high-relief atoll transects. Gentle carbonate slope-to-basin transitions contain low-stand sedimentary records. Sea level curves derived from the lower relief areas of the Maldives and Queensland Plateau may be an ideal comparison with sea level curves derived from Pacific-atoll drilling.

A third approach to the sea level problem depends on the oceanic oxygen isotope record which is one component of the required multiple stratigraphies and, more importantly, can provide insight into the mechanism of sea level change. The oxygen isotope approach infers changes in global ice volume from the isotopic composition of benthic and planktic foraminifera. The reliability of this approach depends on the accuracy of assumptions regarding water temperature and the isotopic composition of glacial ice (an important component of Theme 1). Proper use of this approach requires the compilation and validation of records from both benthic and planktic low-latitude foraminifera, with sufficiently high resolution and stratigraphic calibration to ensure that each sea level event registered by other indicators can be matched against the time correlative oxygen isotope record.

Technology Issues

There are demanding engineering developments required to be able to address the topic of global sea level fluctuations. Further developments in the short term should emphasize: (1) continuous core recovery of all types of sediments including sands, chert and especially shallow water carbonates (i.e. coral debris); and (2) continuous core logging. Intermediate range objectives will require drilling within atoll lagoons and on atoll rims. It is probably not cost effective (or feasible in some instances) to use the JOIDES RESOLUTION for such a task and alternative platforms should be sought. Long term developments should be aimed at the ability to drill deep (2500-3000 m), stable holes required for margin transects and to provide the pre-Neogene sea level record.

PRE-NEOGENE PALEOCEANOGRAPHY

Overview of Objectives

The Paleogene and Cretaceous, dominated by warm oceans, represent a vast period of time with circulation and sediment patterns entirely different from those of today. Exploring the Earth's response to significantly different conditions offers the opportunity to gain critical insight into the behavior of the earth/ocean system. After 20 years of deep drilling, however, this promise has not yet been realized; there are wide gaps in our knowledge of how the oceans and their biota behaved during the Jurassic, Cretaceous and Paleogene. Reconstructing the ocean-climate history during this expanse of time represents a major challenge to future ocean drilling. For the Paleogene, the challenge will be to elucidate the important ocean-climate changes that include transition from an ice-free to a glaciated world and formation of deep cold waters in polar regions. For the Cretaceous, the next ten years of drilling will focus on better understanding the interaction and effect of global warmth, widespread anoxia, carbonate chemistry, high global sea levels, and changes in atmospheric and oceanic circulation on the evolution of oceanic biota (particularly the dramatic evolution of calcareous nannofossils, radiolaria and plantonic foranminifera). For the Jurassic, where recovery is spotty, sampling will allow us to draw analogies to the Cretaceous and explore the differences.

Key questions include: Did tectonic and orbital forcing functions drive the global environmental changes during these time periods as they did during the Quaternary? What are the mechanisms linking changes in the global environment with the successive rise to dominance of various calcareous and siliceous plankton groups in the ocean? Was the Earth environment periodically perturbed by extra-terrestrial causes as indicated by the episodic recurrence of mass extinctions of biota? How were large volumes of organic material concentrated and preserved on the continental margins and deep-sea basins, during certain periods of the Mesozoic and Tertiary when sea level stood higher and climate was more equable than at present? The critical objective in the study of pre-Neogene oceans is the recovery of information about a range of ocean dynamics which are outside of present day experience, e.g. haline-dominated deep circulation, slow deep-water renewal, low oxygen content and hyper-stratification. In addition, the pre-Neogene offers insights into the transitions from warm- to cold-ocean dynamics (e.g. onset of psychrosphere in the late middle Eocene).

Our knowledge about the geographic configuration of ancient ocean basins has increased rapidly in the last two decades. However, we do not know how changes in geographic configuration translate into changes in circulation, ocean chemistry, productivity, and evolution. Although speculation abounds, our models are quite primitive. Much of our information on the early history of present day ocean basins comes from sequences of the former Tethyan and Atlantic margins (mostly disturbed by subsequent orogeny and plate collision) or from sequences deposited in shallow epicontinental seas.

The limitation of the Paleogene record is derived from an incomplete geographical sampling, specifically from the Pacific. For example, the Paleocene-lower Eocene Pacific carbonate record is represented at only one site (577), and there is no suitable middle Eocene Pacific carbonate record in low latitudes. Characterization of Mesozoic oceanic conditions will be based on the relatively more extensive, more stratigraphically continuous Cretaceous record. Fortunately, there is a broad correspondence in biochemical patterns between the Cretaceous and Jurassic periods. Much less than 1% of all recovered deep-sea sediments is pre-Cretaceous in age. To date, however, open marine sediments of early Liassic age either on land or through deep drilling (Leg 79) rest on subsiding passive margins of the Tethys. No data are available on the type of sediments that accumulated in the abyssal plains, if indeed they existed.

Scientific Opportunities and Objectives for Future Drilling

1. **To understand circulation patterns in a warm ocean, entirely different from today's.** Were Mesozoic oceanic conditions always more equable and stable than today's? If so, why?

2. **To study the mechanisms of climatic change in a predominantly ice-free system.** What were the oceanographic conditions that led to the transition from an ice-free to glaciated world in the Paleogene?

3. **To study productivity and biogenic sedimentation patterns in a low-oxygen ocean.** What oceanographic conditions led to the onset of ocean anoxia? Were conditions constant through the Mesozoic?

4. **To determine the environmental conditions that led to the transitions from silica-rich to carbonate-rich sedimentation and the increase in deep-sea carbonate during the Mesozoic.** Are these global changes due to major evolutionary changes or are they driven by changes in environmental parameters? What are the consequences of cycling carbonate and carbon in the oceans–how did this affect atmospheric circulation?

5. **To understand whether evolution is more strongly dominated by environmental change and stability, or by internal (biological) mechanisms.** Have geographically isolated areas such as those in high latitudes and deep water basins given rise to new species or did they diverge along evolutionary gradients?

6. **To determine the conditions that led to major and minor extinction events. Although these changes are well**

documented, the causes of extinction are still poorly understood. Do species extinctions occur independently of one another, or are they "clumped" in time? Are mass extinctions simply scaled-up versions of the smaller, clumped extinctions? To what extent was the biota affected by global anoxia? Was the ecologic specialization of bathyal foraminifers during the mid-Cretaceous related to the development of oxygen minimum zones or in surface productivity? What is the relationship of changes in productivity to the evolutionary turnover of marine biota?

7. **To investigate biotic radiation events.** Examples include a rise to dominance of a biotic group, and radiation following extinction events. What are the rates of diversification? Do they differ between the styles of radiation events? Are the rates uniform or do they fluctuate with time? Do the rates become high immediately following extinction events, or are there substantial lags?

8. **To study rhythmic sedimentation patterns in oceanic sediments and to develop a coherent cyclostratigraphy.** Do certain cycles record orbital variations? How widespread are such signals in space and time? What can they tell us about geochronology, orbital variations, paleoclimate and sedimentary processes? Are there short magnetic polarity reversals in the Cretaceous long-normal superchron that can be used for more precise global correlations?

Approach Needed to Address These Objectives

The recovery of undisturbed Mesozoic to Paleogene oceanic sedimentary sequences from different ocean basins is required in order to obtain a record of global environmental changes with high temporal resolution. The limited occurrence of pre-Neogene crust implies that sites will have to be selected within a well controlled plate reconstruction framework. This program will require the recovery of cores from thick, continental- margin sequences (deep stratigraphic test holes), ocean-basin sediments, and carbonate caps on submerged volcanic edifices. The recovery will form a global array of Cretaceous and Jurassic sites that will utilize HPC/APC and multiple reentry technologies. Specifically, transects are required in:

1. High latitudes: Knowledge of pre-Neogene ocean history suffers from a lack of data from high latitude sites. Specific target areas include the Arctic Ocean, Bering Sea, Norwegian-Greenland Sea, areas surrounding Antarctica, and sites originally formed at high latitude, i.e. Louisville Ridge and areas adjacent to Australia.

2. Old Mesozoic sediments: To address questions of ocean chemistry, anoxia, climate changes and biotic evolution in the Jurassic and early Cretaceous of particular interest are targets in the Western Pacific, Moroccan Basin, Venezuelan and Somali Basins (deep stratigraphic test holes).

3. Atolls, guyots and oceanic plateaus: Drilling of caps and flanks of topographic highs to recover a record of subsidence, sea-level changes and biogeochemical changes resulting from plate motions. (see Theme 2). Targets of special interest are Manihiki, Ontong Java, and Ogassawara Plateaus.

4. Passive margin transects: Deep sequences are needed to examine anoxia, high productivity, and early rifting environments. Important areas are the southern and western Australian margins, and the eastern and western South Atlantic margins.

5. History of Old Tethys to Paleogene closing of the seaway: Eastern Mediterranean.

6. Deep ocean basins: To address the formation of deep bottom waters, biotic evolution and anoxia. Areas of particular interest are Argentine and Angola Basins, and the western Pacific.

Technology Issues

To achieve many of the goals identified, good recovery of geologically older material is imperative. This means an improvement in XCB capabilities. Recovery of alternating hard and soft layers and shallow water carbonates requires new technology to be developed. New technology must be developed to assure deeper penetration of the ocean floor. Well-log data obtainable with the use of the borehole televiewer and microscanner are complimentary to laboratory core data and their continuity often leads to the solution of problems, such as those of cyclicity, which continuous core data alone cannot address satisfactorily. Once again, the requirement for Arctic and high latitude drilling implies the use of an alternative platform and specialized site survey techniques.

THE CARBON CYCLE AND PALEOPRODUCTIVITY

Overview of Objectives

The thermal and atmospheric balances of the Earth are intimately linked to the global cycling of carbon. The marine carbon cycle, and thus the partitioning of carbon between reservoirs, is closely linked to climate in two ways: (1) climatic change produces changes in the patterns of deposition of carbonate and organic matter, and (2) changes in such patterns affect the chemistry of the ocean and hence the carbon dioxide concentration in the atmosphere. This, in turn, affects the radiation budget of the Earth. The chief means for reconstructing the carbon cycle are the recovery of the global patterns of carbonate stratigraphy, of the record of preservation and $\partial^{13}C$ in calcareous fossils, and of the inventories of productivity-sensitive microfossils.

Fluctuations in the distribution patterns of carbonates--the carbonate cycles and supercycles--are the dominant facies aspect of pelagic marine sedimentation. These patterns are a direct, albeit complicated, response of deep ocean circulation and the geochemical balance of carbon input and output to climatic forcing. Much of this forcing has been shown to be ultimately tied to orbital variations, so that it can, in principle, be predicted, allowing a quantitative extraction of the response function. Thus the carbonate record, together with associated organic carbon patterns, reflects the dynamic state of carbon throughput at any one time, and hence the level and character of biological activity which provides the background for climatologic, ecologic and evolutionary studies.

High-productivity zones (HPZs; equatorial, coastal and high latitude) play a special role in that they are very sensitive to changes in wind patterns and to the nutrient content of intermediate waters. In places, HPZs yield a record reflecting changes in the global ocean-climate system in a very distinct manner. Also, HPZs are crucial in controlling fractionation of dissolved inorganic carbon between the major ocean reservoirs, and in the extraction of carbon from seawater and its sequestration into the sediment. In this way, productivity fluctuations control the oxygen content of the deep sea, and general biogenic sedimentation patterns, as well as provide feedback to climate change. The sediments in coastal HPZs record not only the productivity of overlying waters but also the influx of terrigenous organic material (as well as other terrigenous contributions). Thus they directly reflect the patterns of exchange between ocean and continental carbon reservoirs, and yield clues to sea level fluctuations and their relationship to coastal ocean productivity.

Short and long-term cycles: The presence of Pleistocene-type carbonate cycles has now been established back into the middle Miocene, and similar cycles are seen in earlier periods as well. It appears that for the Neogene, Pacific and Indian Ocean cycles run parallel, while the Atlantic follows different dynamics. These patterns contain clues to basin-shelf exchange patterns, and to the intensity of basin-basin fractionation through time. The same processes are also reflected in the $\partial^{13}C$ signals within the benthic foraminifera. Together with the corresponding $\partial^{18}O$ records, these signals provide a qualitative view of the relationships between the major components of ocean dynamics and ocean carbon chemistry, as they respond to Milankovitch forcing.

Similar to the carbonate cycles, pelagic and hemipelagic organic carbon cycles are tied to glacial-interglacial climatic fluctuations, and can be followed back to the middle Miocene. Again, similar cycles are observed even earlier in the record, within an ocean-atmosphere system whose dynamics differed considerably from those of the Neogene. Silica cycles show parallel patterns, presumably likewise tagging productivity fluctuations. Amplitudes, interrelationships between carbon and silica facies, and relative power within the frequencies of the fluctuations change through time, as a function of as yet largely unknown mechanisms.

The less vigorous circulation in warm oceans as compared with the present cold ocean, and the lesser oxygenation of deep waters, provides for overall differences in depositional patterns of biogenic sediments. Of special interest is the influence of productivity in upper waters and of preservation on the seafloor of the distributional patterns of organic matter in Paleogene and Cretaceous sediments. The discovery that carbonate/organic carbon cycles are forced by Milankovitch frequencies as far back as 100 million years ago has raised questions regarding climate feedback mechanisms in an ice-free or ice-poor world.

Scientific Opportunities and Objectives for the Future

1. **Reconstruction of atmospheric CO_2:** A number of critical issues relating to the carbon cycle and paleoproductivity should next be addressed by the drilling program. These include the detailed correspondence of short-term changes in sedimentation patterns from one ocean to the other, and from the deep sea to the margin. These patterns must be put within the framework of changes in microfossil content, to capture clues on climate and productivity control. Also, the exact relationships to the $\partial^{13}C$ record must be established on a global scale.

   In principle, it is possible to test rigorously the various propositions, from geochemical modelling, regarding CO_2 fluctuations in the atmosphere for the last 100 million years. It can be shown that a full global characterization of the ocean carbon system, from its calcareous and carbonaceous sediments, is sufficient to obtain reliable estimates of the carbon-dioxide content of the atmosphere and the level of productivity of the ocean. Such reconstruction will be necessary if the feedback mechanisms between ocean and climate are to be fully documented.

2. **The Role of HPZs:** The expanded records in the HPZs are of special significance in that the details of climatic forcing can be resolved on a much finer time scale here than in normal pelagic sediments. In places, it is possible to obtain windows into annual variations of climatic state. Thus, varved sediments in the Gulf of California and elsewhere allow the recovery of the frequency of unusual climatic events (e.g. Super El Niños) as a function of general climatic state. In addition, hemipelagic sediments of coastal upwelling systems commonly reflect climatic-tectonic events on the adjacent continents. Finally,

sediments of HPZs, being major repositories of carbon and phosphorus, act as sinks and also as transient reservoirs for these elements, potentially functioning as geochemical amplifiers of climatic forcing. Intriguing reactions of broad significance take place in HPZ sediments, including nitrate reduction, sulfate reduction, trace-metal mobilization and fixation, hydrocarbon fractionation, phosphorite production, and dolomite formation.

3. **History of upwelling systems and relationships to global climate:** Present upwelling systems are well defined. Occupying less than 10 percent of the area of the ocean, they determine more than 50 percent of the carbon cycle. Does this dominance extend into the past? When did these systems become established? Did they turn on and off, and, if so, when and why did this happen? Did upwelling systems exist in areas where they are now?

Most prior efforts on the history of upwelling and productivity have focused on the Quaternary record. We now need to go further back to examine older records, to appreciate the role of upwelling in entirely different climatic and geochemical settings, including that of an ice-free or ice-poor world. In addition we need to expand global coverage of past ocean productivity to include records from entirely different geographic settings, including tropical and subpolar ones. This should bring elucidation of the relative importance of tropical versus subpolar upwelling in the short-term control of atmospheric CO_2, under different conditions through geologic time.

The history of upwelling must be compared with that of climate, and the two linked through proper modelling. How have upwelling systems evolved in response to major paleoclimatic and paleoceanographic changes? And how did these changes affect global fluxes of C, P, and Si? What is the effect of the onset of events like glaciation, or deglaciation, on the different upwelling systems? For example, what effect did the development of polar ice masses have on the intensity and location of Cenozoic high-productivity areas? Was there positive feedback between ice buildup and upwelling, as suggested, e.g., in the "Monterey" scenario?

In this context, the role of small, high-productivity ocean basins along the continental margins is of special interest. For example, the Gulf of California accounts for about 3 percent of the silica output of the ocean. How important are marginal basins as sinks for carbon, phosphate, and silica, and what is the history of this role? What are the effects of opening and closing of deep (and surface) water passages between these basins and the world ocean? Can we relate the climate records of mid-marginal basins to the high latitude climate record?

Such questions are of great importance in view of the climate modification expected from the changing CO_2 content of the atmosphere.

<u>The Drilling Approach Needed to Meet These Objectives</u>

The drilling strategies necessary to achieve the objectives of carbon cycle reconstruction and paleoproductivity must proceed from building a global three-dimensional matrix based on depth, latitude and level of productivity, for the major ocean basins, and for typical geographic settings along continental margins and within small marginal basins.

For a global picture of carbonate sedimentation, depth transects across the slopes of plateaus and across MOR flanks are needed in regions of importance, including the equatorial areas of each major ocean basin, the gyre centers, the major eastern and western coastal systems, and the subpolar systems. Also, transects are needed at right angles to productivity gradients, so that a cross-transect pattern is established, within a depth/productivity matrix. Obvious examples of favorable regions for drilling are the Ontong Java Plateau in the western equatorial Pacific and other plateaus like it in various settings, Ceara Rise and Sierra Leone Rise in the tropical Atlantic, Walvis Ridge in the South Atlantic, and Kerguelen-Gaussberg Ridge in the Indian Ocean. Other promising target areas for transects are on the sediment-covered flanks of the MOR wherever it crosses the equator, or runs through the central gyre, or intersects the Antarctic Circumpolar Current.

For the history of HPZs, and their influence on the carbon cycle, closely spaced sites are needed along and across productivity gradients, within the major high productivity systems: eastern equatorial areas, coastal upwelling regions, selected Antarctic and Sub-arctic areas. These transects are to provide records of the changing extent and intensity of driving currents and accompanying upwelling activity. The history of the major HPZs, pelagic and coastal, needs to be compared from one to the other, and the productivity record of polar regions and of selected marginal basins needs to be tied to that of the dominant HPZs.

Since there is reason to believe that the carbon cycle runs in a number of strictly different modes–depending on the partitioning of carbon between the more reactive reservoirs, and the degree of mobility of the carbon in the exchange between them–detailed records must be established for a number of periods within the Cenozoic and within the Cretaceous. The meaning of the proxies of productivity may change from one period to another: the correct transfer functions will only be discovered if the various proxies are compared in parallel within a high-resolution time-scale, on a global basis (using, in addition to biostratigraphy and magnetostratigraphy, strontium isotopes and other chemical tracers). Thus, the type of studies here envisaged will require complete recovery of undisturbed sections, as far as possible.

Technology Issues

As with Theme I, the basic strategy of a carbon cycle program calls for high-resolution transects with broad geographic coverage. The JOIDES RESOLUTION has demonstrated its ability to provide the material appropriate for these types of studies in the part of the section that can be recovered with the HPC. Similar capabilities are now needed for the XCB to allow us to extend the high-resolution record further back in time. Recovery of gassy sediments and full development of the pressure core barrel also will be required. Because of their importance to global budgets, HPZ studies should include regional survey data for targeting drilling such that the results can be extrapolated to provide a budgetary assessment of the HPZ through time. Also, the carbon cycle program will require the capability to drill deep holes (for long-term cycles and margin sections) and the technology for Arctic drilling and site surveys.

SEDIMENTARY GEOCHEMICAL PROCESSES

Overview of Objectives

Reactions and chemical redistribution of elements within the sediment column affect many aspects of the evolution of the ocean, atmosphere, and sediment system, as well as our ability to interpret global environmental change from sedimentary records. In this section we consider the role that ocean drilling can play in understanding major sedimentary geochemical processes which, for this discussion, are subdivided into the overall categories of fluid processes and diagenesis.

Recognition of the importance of fluid flow through the oceanic crust is viewed as an important new scientific breakthrough. In the marine realm, this revolution touches on several subjects including evolution of seawater, the alteration of deep-sea sediments and oceanic crust, and metallogenesis; ultimately fluid flow affects the budget of most major and minor elements. Specifically, our concepts about the history of seawater now reflect advances made in tracing fluid flow through the oceanic crust. For example, the geochemical cycle of Mg could not be understood without recognition of the important sink for this element within altered mid-ocean ridge basalt. More recently, new fluid-flow regimes have been recognized involving fluxes *via* expulsion of pore fluids in subducting and accreting sediments on active margins, free convection of seawater through low-temperature ridge flanks, and leakage of continental fresh and saline groundwaters along continental margins. The lithification of accretionary prism complexes by carbonate cementation and compaction as well as the short-circuited pathway of volatiles through décollement zones (particularly carbon and water) are but two examples of the fundamental role of convergence-induced fluid processes. As highlighted in the COSOD II document, these sediment-based fluid-flow systems may play a significant role in fine-tuning the geochemical cycles of elements and gases whose balances affect the composition of the atmosphere and thus climate.

Studies of diagenesis have played a long-standing role in our understanding of geochemical, mineralogical and paleoceanographic processes. In the context of ocean drilling, three new aspects have emerged that are of special importance: First, diagenesis can enhance physical property contrasts within a sedimentary sequence that allows for recognition of paleoceanographic events and cycles by seismic methods. Second, it produces an overprint on the stratigraphy that interferes with the interpretation of sediments in terms of the orginal environment but offers insights into the nature and rates of reactions within the sediment column (i.e. the significance of early chert formation). Third, the recognition of fluid flow through oceanic crust and sedimentary systems has opened new perspectives on the genesis of metalliferous ore deposits. At present, we lack a three-dimensional picture of the active processes of metal and sulfur transport and deposition required to understand fully modern and ancient equivalents to ocean-basalt-hosted massive sulfide and sediment-hosted, Mississippi Valley-type deposits, both of significant economic value.

<u>Scientific Opportunities and Objectives for Future Drilling</u>

Through studies of the processes of submarine fluid circulation, we are now in a position for major advances in our understanding of geochemical cycling of major elements in seawater, carbon, nutrients and metals; we are at the threshold of gaining new understanding of how accretionary complexes and ridge flank sediments are dewatered, lithified, and how they respond to tectonic stress. A large portion of the scientific community has agreed that this frontier of research should be exploited and become the target for a suite of future drilling efforts in which tectonic, lithosphere, and geochemical objectives become intertwined. Major objectives for this drilling include:

1. **Fluids and circulation patterns:**

   - **Can the mass transport of critical elements be quantified? What changes in mass transport rates have occurred over the last 100 million years?**
   - **What is the magnitude of subduction-zone cycling compared to mid-ocean ridge cycling, i.e., what is the subduction equation?**
   - **What is the range of composition of the fluids? Are there diagnostic compositions for MOR-, subduction-, and gravity-driven fluids?**
   - **What are the driving mechanisms of fluid flow (gravity, heat, tectonic overpressure) and how do they affect the nature of the fluids?**
   - **What are the sources of fluids in plate-collision zones (i.e., gas hydrate decomposition, ultralithification, clay**

dehydration, subduction-slab dewatering)?

2. **Diagenesis:**

•What are the reaction dynamics and rates of alteration and how are they expressed as diagenetic overprint? How do these dynamics vary as a function of sediment and fluid type and time?
•Can diagenetic "fronts" be identified on high-resolution seismic profiles and, if so, can seismic records be used to map paleoceanographic events?
•What is the three-dimensional nature of changes in metal and sulfur concentrations in pore fluids of sediment-hosted systems and oceanic basalt systems?
•What is the effect of differences in host sediment type (porosity, permeability and chemical make-up) on determining the nature of metal deposits.
•Can paleoceanographic information (e.g. rates of hydrothermal circulation, oxygen content of bottom waters) be extracted from metalliferous deposits?

<u>The Drilling Approach Needed to Address These Objectives</u>

<u>Fluid Circulation:</u> To understand the effect of fluid exchange on oceanic and sedimentary geochemistry and how the lithosphere is altered by the exchange processes and, as a consequence, how it responds in different tectonic environments.

Our strategy calls for transects of both active and passive margins. These transects should be designed to evaluate the fluid-flow systems and associated sedimentologic-diagenetic phenomena. Such studies must be linked to geophysical data providing the structural and geotechnical constraints upon fluid flow. The key parameters to be addressed here are: fluid driving forces, source depths and origin, the influence of sediment and style of deformation on fluid migration rates and flow paths. The fluid compositions are affected by all these parameters and may develop diagnostic criteria. Since these fluid-flow systems are not static, evaluation of their dynamic evolution in space and time is required to assess their global geochemical impact. Ultimately we seek to develop dewatering models in concert with thermal models, constrained by seismic information and relying on chemical criteria and tracers.

Accretionary wedges are the sites of active fluid venting to the seafloor. Transects of these systems (e.g., the Barbados, Nankai, and Cascadia prisms), perpendicular and parallel to the deformation front, will allow the study of fluid evolution as a function of evolving tectonic settings. These transects must be linked to geophysical and geotechnical information on the tectonics of deformation to develop a three-dimensional view of fluid-flow rock alteration patterns. Variability in tectonic style, type of sediment, thickness of accreting sediments and thermal history of subducted slab are the major parameters by which to select the drilling transects. In addition, the hydrology of the forearc should be the target of drilling. The possibility of fluids originating from the subducted slab, penetrating through the leading edge of the continental massif and escaping in the forearc basins should be considered along with drilling targets which would track long-distance fluid flow across the margin.

For ridge-flank sediments, we need a program coordinated with lithosphere objectives. Drilling transects on the flanks of both fast- and slow- spreading ridges will provide information on the crustal and sedimentary chemical exchange due to free convection of fluid.

Specific strategies for the study of continent-derived pore fluids along margins call for drilling transects perpendicular to the shoreline in order to establish gradients in pore water salinity and concentrations of specific cations and anions. Appropriate sites would be off the Atlantic margin of the U.S. where large fresh-water prisms occur or the coast of South America off Peru where continent-derived brines occur in the sediments. A companion program should be to drill longitudinal transects parallel to the coastline, crossing climatic zones (e.g. from near the equator to mid-latitudes). For example, we could examine pore fluids in forearc basins west of South America starting off Ecuador and extending south to southern Chile.

Diagenesis: Diagenesis encompasses a wide range of chemical reactions and the redistribution of elements below the sediment-water interface; it has been, and will continue to be, a cornerstone of geochemical and sedimentary process studies. There are several newly recognized processes of interest because of their effects on interpretation of sediment stratigraphy, on formulating geochemical mass balances and on understanding metallogenesis.

Overprint stratigraphy occurs in practically all environments and affects a large range of investigations. The focus here is on a matrix that encompasses as many different types of sedimentary sequences as possible. Thus any strategy that results in providing a variety of sediments from a number of depositional settings is appropriate to this purpose. Normally the coring strategies associated with detailed paleoceanographic work of Themes II, III and IV, will provide appropriate materials for this work.

Sediments of upwelling areas, with their abundant carbon, phosphate and opal-A, are chemically very reactive and known to produce a variety of authigenic minerals during diagensis. The nature of this distinctive diagenesis, in the context of paleoupwelling studies, will be important to determine; i.e. if upwelling systems in high and low latitudes, with different fluxes of C, P, and Si yield different sequences in response to diagenesis, and if pore fluids in sediments of coastal upwelling sequences show latitudinal differences. Evaluation of the potential of the high-resolution seismic record as a means of identifying and mapping diagenetic horizons requires continuous cores and logs (along with digitally recorded seismic records) in regions of high sedimentation rate and with well established stratigraphic markers. Depth and latitudinal transects across major water-mass boundaries and fronts are quite similar to those required for Themes I and III and call for depth transects on low-latitude oceanic plateaus (Ceara Rise, Ontong Java Plateau) and latitudinal transects in equatorial high-productivity regions. The focus of studies of metallogenic processes should be to define the three-dimensional fluid flow and chemistry, and rock-alteration characteristics within the oceanic ridge sediments hosting metal sulfide and oxide accumulations. Defining the three-dimensional nature of a hydrothermal system requires both longitudinal and transverse sections in a matrix of sediment lithologies. For example, hydrothermal-fluid circulation in the Guaymas Basin occurs within siliceous, organic-rich muds. In contrast, hydrothermal processes in the Escanaba Trough off the Oregon coast are hosted by relatively organic-poor interbedded turbidites and pelagic sediments. Finally, because the fluid movement is thermally driven in these systems, it will be necessary to examine metallogenesis at ridges with varying spreading rates.

Active back-arc spreading centers in sediment-filled basins provide environments for accumulation of metalliferous deposits as yet not adequately explored by drilling. Current work in back-arc basins may identify new drilling objectives. Metallogenesis within the submarine portions of island arcs provide an additional exciting prospect for future drilling targets.

Technology Issues

The study of sedimentary diagenesis, fluid flow and metallogenesis requires a comparative study of undisturbed sediments and their contained pore fluids. For certain of the programs, *in situ* physical property measurements of the sediments are also required.

The dominant role in fluid flow played by coarse-grained terrigenous clastic sediments in continental margin prisms demands improved recovery of undisturbed sediment and uncontaminated pore fluids. As noted in COSOD II, stabilization of reentry holes in unstable sedimentary sections is urgently needed.

Each of the programs described requires a careful analysis of pore water chemistry and, for certain of the processes, the development of new technologies capable of measuring *in situ* pore pressure, temperature, *p*H, and other dissolved constituents, including gases perhaps with a top hole packer that contains passive (diffusive) tracers to monitor advection of pore fluids both up and down the hole. A pressure core barrel will be needed to recover hydrates and volatile pore-fluid constituents. This device should also be capable of preserving the sediment fabric for transfer to shore based labs. A side wall corer with *in situ* pore-water probe and sampler will be required to recover sediment from the hole in core gaps, and to provide additional solid and aqueous sample material at important depth boundaries. Finally, we look towards the ability to recover variable lithologies (chert-limestone sequences) without disturbance in order to address some of the important problems in sediment geochemistry. Long-term goals require the ability to drill in high temperature environments, the emplacement of borehole monitoring devices (for temperature, tilt, stress, fluid flow, etc.) and the use of wireline reentry instrumentation.

FACIES EVOLUTION AND DEPOSITIONAL ENVIRONMENTS: DEPOSITIONAL MANIFESTATIONS OF CONTINENTAL UPLIFT AND EROSION

Overview and Objectives

The deposits of the continetal margins and adjacent basins contain within them records of the tectonic, volcanic and surficial processes within the continents. Historically, these processes have been studied only in sedimentary sections that, through tectonism and erosion, have been incorporated into mountain belts and exposed. The resulting record is overprinted and fragmentary at best. Deep sea drilling provides the only means possible to collect undisturbed records of the biologic, geologic and chemical processes on adjacent continents, to tie this record directly to open-ocean sequences, and to integrate continental geologic studies with those of modern marine systems. These studies will contribute to understanding global sediment balances, the origin of sedimentary basins (and the role of sea level in their evolution), and the testing of models for the development of sedimentary facies. For example, Hay et al. (1987) propose a model for using mass balance in a system of sources and sinks to derive paleotopography. In this model, the primary inputs are the average stratigraphic column and variations in sea level. To test such models properly, however, will require an understanding of the sedimentary processes that are responsible for the stratigraphic column.

PCOM convened a subgroup of the COMFAN II Conference to prepare a submission dealing with sedimentary processes. The following represents the contribution of that group.

The objectives of this section are discussed under three basic headings that reflect different spatial and temporal scales of both the products and processes of marine sedimentation. At the largest scale, **stratigraphic** problems that need to be addressed include sediment mass balances, carbon budgets, and glacial history. Regional-scale models of the controls on **deposition and basin evolution** also need to be tested (including both allocyclic controls and autocyclic processes). The evolution of the physical properties of the sediments is an integral part of this theme. Finally, at the scale of individual depocenters, there is a need to evaluate (and develop) models for **facies evolution and depositional processes.** The history of the continental regions as recorded in deep-sea sediments cannot be correctly deciphered without reliable and tested models for depositional controls on facies (the rock record). Conventional drilling programs can accomplish the first and second objectives, but special strategies are required for evaluating the facies models, the study of which will provide the building blocks for understanding the growth of continental areas.

In general, ocean drilling on continental margins has not been aimed at testing general process-oriented models; instead, it has complimented efforts to address regional tectonic and gross stratigraphic questions. In many cases, sedimentologists did not have a fundamental role in either the selection of sites or the definition of drilling objectives. Industry drilling on continental margins in water depths to 2500 m has not answered the questions presented because (1) sequences above economic-objective intervals are generally not cored, (2) biostratigraphic control lacks the resolution to address critical aspects, (3) data are not released in a timely fashion (if at all), and (4) the specific sites selected by industry are those most likely to cause concern from ODP safety concerns.

<u>Scientific Opportunities and Objectives for the Future</u>

Stratigraphic Objectives:

1. **Sediment mass balance for the world ocean:** Drilling is required to document changes in the sediment input from the great rivers of the world because the sediment mass balance is a result of the denudation history of orogens, recycling of continental crust, and shelf-to-ocean basin sediment balance related to sea-level change.

2. **The margin expression of major oceanographic events:** Determine the timing, extent and magnitude of geostrophic circulation to evaluate its effect on the erosion and transport of slope-rise-fan sediments and its relationship to regional deep-water unconformities.

3. **Carbon budgets:** Determine the long-term record of the carbon contribution to the continental margin and evaluate its importance as a sink; relate cyclicity in the carbon flux recorded in margin sediments to that in the open ocean.

4. **Glacial history:** Determine the timing, location and intensity of continental glaciation to provide independent boundary conditions for climatic models based on other types of data. Determine the contribution by glacial erosion to the denudation history of continental areas, and examine the relation between eustacy and ice loading of the continents.

5. **Record of volcanic eruptions and large earthquakes in sequences:** The offshore stratigraphic record lying closest to the orogens will give a superior record of volcanism and large earthquakes. Both direct air-fall pyroclastic material and fluvial/marine resedimented debris can record major volcanic eruptions. Large earthquakes along continental margins can be detected through mass-wasting products, missing stratigraphic sequences, and changes in sediment supply related to modification of relief between source area and marine depocenters.

Basin Evolution:

1. **Allocyclic controls on basin evolution:** Drilling in the main types of marginal basins can address several important questions: (1) What is the influence of sea-level changes on the nature (type, source area, rate and transport path) of sediment provided to the basin? (2) What is the influence of the source-area gradients (tectonism) on the sediment supply to the margins? (3) What is the influence of shelf characteristics,

including width, intrabasinal sediment generation (e.g. carbonate), and storage potential (providing a staging area for sediment eventually moved to the deep sea) on various sedimentary systems beyond the shelf break?

2. **Autocyclic controls:** Tests are necessary to address growth patterns of rapidly accumulating clastic systems where allocyclic controls outlined above remain relatively constant. This includes determination of rates of aggradation and shifts in depocenter position of critical morphologic features formed by deposition along the margin.

3. **Physical properties evolution in basin sequences:** Determination of the relation between the physical properties of the sediment and the deformational behavior with respect to diapirism, slumping, and associated mass-wasting processes, and tectonic deformation; diagenetic properties change both vertically (with burial depth) and through time and thus need to be determined for individual margin depocenters.

Facies Evolution and Depositional Processes:

The depositional processes on continental margins (and related facies) are of major importance to understanding the history of the Earth and, specifically, continental areas. Turbidites and related deposits, such as deposits of mass wasting and interbedded pelagic material are volumetrically the most important accumulations in the deep ocean. Many components of margin depocenters are poorly documented (e.g. volcanic and glacial influx to the total sediment budget). One major objective of this aspect of drilling will be the ability to relate facies distinctions based on seismic-stratigraphic analyses to the *in situ* character of the sediment bodies. A second objective achievable only through drilling is to relate detailed chronostratigraphy to the rates of growth and migrations of the sedimentary facies units and thus help to establish depositional processes. Specific problems to be addressed include:

1. **Turbidite facies:** Turbidite facies are quite varied and the form of the deposits reflects variations in sediment type (lithology, grain size), basin shape, tectonic activity, number and size of sources, sea level variations, geostrophic currents, and other environmental factors. In addition, individual facies types can vary in horizontal and vertical scales by as much as two orders of magnitude. As a minimum, "type localities" for drilling are needed for the following distinctive facies: overbank (with and without levee relief), channel floor, depositional lobe, channel/inner-lobe transition zone, basin plain, mass-wasted intervals and base-of-slope ramps.

2. **Volcanic sedimentary facies:** Evaluation of pyroclastic and volcaniclastic transporation processes in the marine environment, including the transformation from pyroclastic process to normal pelagic settling and subaqueous sediment gravity flow.

3. **Ice margin deposits:** Evaluation of ice-margin processes in large continental ice-sheet systems. Distinguishing deposition from direct glacial input to slope and deep-sea environments from remobilization of sediment temporarily stored on glaciated margins.

4. **Sediment drifts:** Testing sedimentation models for sediment-drift structures and contourite depositional processes, especially with an aim to improving recognition of sediment-drift deposits in the geologic record and to using bedforms for determining past variations in bottom-current flow.

5. **Mass-movement facies:** Determination of *in situ* properties of the range of deposits attributed to mass failure on continental margins.

Providing distinction of deposit characteristics relative to the mechanism of failure and analysis of subsequent flow structures. Relate failure type and age to continental-margin type (or setting; e.g. do certain types of failures characterize passive-margin deposits as distinct from other slope environments?).

6. **Resedimentation products from carbonate-producing margins:** Unconsolidated carbonate sediment moved from shelf and upper slope areas of continental margins provides significant volume of deep sea sediments. The different physical and chemical characteristics of carbonate grains contribute to significantly different facies characteristics relative to siliciclastic deposits formed by the same depositional processes. Thus, the distinction of turbidite and mass-movement facies for carbonate environments will require a distinct drilling program to understand the differences in depositional processes (from siliciclastic systems).

The Drilling Approach Needed to Meet These Objectives

The site survey requirements and drilling strategies will differ for the three themes based on the spatial and temporal scales of the site objectives. The stratigraphic objectives will be targeted for specific chrono-stratigraphic levels; only normal site-survey documentation will be required.

The basin-evolution objectives can be achieved through any suitable stratigraphic level(s) and normal site-survey data will suffice. The basin setting and history, however, will need to be well documented to ensure that the conditions exist for a definitive test of the model proposed.

Drilling for facies evolution and depositional processes will require well studied "type" examples from which particular facies models have been distilled. The complicated three-dimensional geometry of the architectural elements that comprise the primary sedimentary facies means that testing requires a high degree of morphologic and stratigraphic control. In addition, the facies testing requires a high degree of morphologic and stratigraphic control. In addition, the facies units(s) to be tested must be clearly understood within the framework of tectonic setting and allocyclic controls. extensive site survey data will be required to define the three-dimensional character of the facies and its lateral equivalents. Detailed studies of small areas with several drill sites may be required.

Technology Issues

Past problems with sand recovery have resulted in a serious bias toward mud-rich systems (in both our understanding of margin sedimentation and the selection of drill sites). Huge gaps in our knowledge must be filled before we can understand the total sediment budget of margins. Sandy targets need to be added to our overall drilling framework.

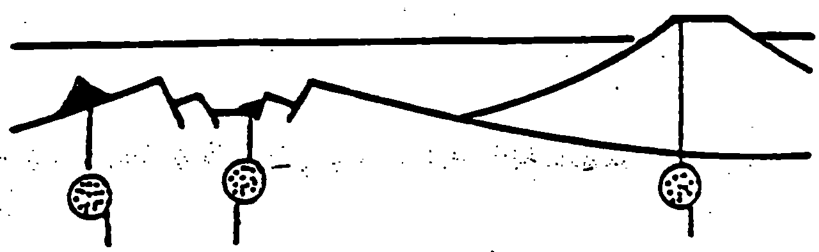
Discussion of recovery problems at two recent scientific meetings that included industry participants (SEPM and COMFAN II) indicated that the technology for drilling unconsolidated sand exists and may be transferable to ODP. We recommend immediate investigation of the possibility of adapting this technology. If existing techniques cannot be adapted, the we request their development within ODP.

Logging of sites on continental margins is of high priority to address adequately many of the objectives described above. There is a special need to log the upper portions of holes in order to tie facies distinctions to the morphologic controls available only in the upper tens of meters of many depositional environments.

JOIDES

Lithosphere Panel

WHITE PAPER



May, 1987

PREFACE

The JOIDES Lithosphere Panel is one of three thematic advisory panels established by the JOIDES Planning Committee to "redefine as scientific drilling objectives, scientific problems identified by COSOD I (November, 1981) and by the JOIDES 8-year program for drilling (April 1982)." The mandate of the Lithosphere Panel is quite broad, encompassing "the origin and evolution of oceanic crust, and more particularly the volcanic, metamorphic, hydrothermal and diagenetic processes occurring in the oceanic crust."

The COSOD I report identified two high-priority problems to be investigated by drilling into the oceanic crust: (1) the processes of magma generation and crustal construction operating at mid-ocean ridges and (2) the processes of hydrothermal circulation in the oceanic crust. In addition to these two fundamental geological processes, the COSOD I report also recognized a number of other important lithospheric problems that could be significantly advanced by drilling. These included (1) the compositional heterogeneity of the mantle and mantle evolution, (2) the aging and evolution of the oceanic crust, (3) the formation of overly thick crust, (4) the role of transform faults, (5) processes operating in young ocean basins, and (6) island arcs and backarc basins.

The purpose of this White Paper is to take the broad thematic problems related to the origin and evolution of the oceanic lithosphere presented in the COSOD I report and identify a series of questions that can be addressed, at least in part, by ocean drilling, and develop more specific recommendations on the drilling strategies and technical development required to answer these questions. We have organized the discussion that follows under six principal headings based on the evolution of oceanic crust:

1) Magmatic processes in young ocean basins
2) Magmatic and hydrothermal processes at ocean ridges
3) Structure of the oceanic crust and its variation with age
4) Intraplate volcanism
5) Magmatism at convergent margins
6) Temporal and spatial variation of magma sources in the mantle

In each section we present the basic scientific questions that need to be addressed, discuss the contributions from crustal drilling and present specific recommendations on drilling strategies and priorities. Achieving the lithospheric drilling objectives outlined in this report will require both a substantial, long-term commitment from ODP to improve crustal drilling technology and a recognition in the planning process that many important lithospheric drilling targets require substantial amounts of drilling time, including multiple legs at a single site. Without this dual commitment to engineering development and drilling time it is unlikely that many of the important lithospheric drilling objectives outlined in this White Paper will be achieved in the foreseeable future.

CONTENTS

LITHOSPHERE PANEL MEMBERS AND CONTRIBUTORS TO THE WHITE PAPER

R. Batiza	Northwestern University
K. Becker	University of Miami
K. Bostrom	University of Stockholm
J. Delaney	University of Washington
R. Detrick	University of Rhode Island
T. Fujii	University of Tokyo
J. Hawkins	Scripps Institution of Oceanography
C. Langmuir	Lamont-Doherty Geol. Observatory
J. Malpas	Memorial University
M. McNutt	Massachusetts Inst. of Technology
C. Mevel	Univ. Pierre et Marie Curie
J. Mutter	Lamont-Doherty Geol. Observatory
J. Pearce	Univ. of Newcastle upon Tyne
N. Petersen	University of Munich
G.M. Purdy	Woods Hole Oceanographic Institution
A. Saunders	Leicester University
J.G. Schilling	University of Rhode Island
J. Sinton	University of Hawaii
H. Staudigel	Scripps Institution of Oceanography

MAGMATIC PROCESSES IN YOUNG OCEAN BASINS

The transition from a continental to oceanic rift and the initiation of sea floor spreading is a fundamental geotectonic problem that is still poorly understood. Seismic surveying over a large number of margins and drilling of sequences of dipping reflectors off Norway suggest that at some margins volcanism may be much more important than previously recognized. Among the questions that must be addressed are:

* What is the petrological and geochemical nature of the upper mantle beneath an embryonic oceanic rift?

* What is the nature of the earliest "oceanic" crust emplaced in a continental rift?

* What controls the development of thick volcanic sequences at some margins, but not at others?

* What is the geometry of the initial emplacement of oceanic crust?

* How does the composition of the ocean crust evolve in space and time during the initial few million years of sea floor spreading?

Contributions from drilling

The abundant terrigenous sediment supply at developing oceanic rifts quickly buries the volcanic products of early rifting under thick accumulations of sediment and leads to extensive sill injection within the sedimentary section. Drilling thus offers the only way of sampling this crust. Drilling can also provide a vertical stratigraphic record in the syn-rift sediments providing important constraints on the age of rifting and the uplift and subsidence history during the splitting process. Full sampling of the sequence of volcanism by drilling will also provide critical information on the geochemical evolution of magmatism during the rifting process, and by inference provide important constraints on the thermal and compositional evolution of the the underlying mantle.

Drilling strategy and priorities

There are two different ways drilling can be used to address the magmatic evolution of young oceanic rifts. The first is to drill in young rifts like the Red Sea or Gulf of California. Both areas were drilled during the Deep Sea Drilling Project with considerable success. Further drilling in these areas, which is technically feasible with present ODP capabilities, is clearly warranted. A second approach is to drill relict rifts preserved in passive continental margins such as those bordering the Atlantic or off Australia. In many cases, the thick accumulations of post-rift sediments along these margins make this approach impractical. But in other sediment-starved areas, it is feasible to drill into rift-related volcanics as was successfully demonstrated on Leg 104. Additional basement drilling should be an important objective of future passive margin drilling efforts.

MAGMATIC AND HYDROTHERMAL PROCESSES AT OCEAN RIDGES

Sixty percent of the Earth's surface is created at ocean ridges, as magmas generated within the mantle are cooled to form the oceanic crust. Increasingly detailed geological and geophysical investigations of spreading centers over the past two decades, and field mapping and drilling of a few well-preserved ophiolite complexes, have lead to a basic conceptual model for the complex and interrelated magmatic, tectonic and hydrothermal processes involved in the formation of oceanic crust. However, many important questions remain, some of which can only be addressed by drilling. For purposes of discussion we will consider the magmatic and hydrothermal components of this system separately, but it should be recognized that these two processes are intimately linked.

Magmatic processes at ocean ridges

The magmatic system at ocean ridges can be viewed as having four basic components: (1) the production and segregation of melt in the upper mantle, (2) the ascent of this melt to crustal depths, (3) the temporary storage of the magma in a crustal reservoir, and (4) the eruption and crystallization of the magmas forming oceanic crust. All four processes are still poorly understood. The most important questions which must be answered to better understand this system are the following:

* What is the horizontal and vertical extent of the zone of melt production in the upper mantle? What is the extent of partial melting and how does it vary temporally and spatially? What is the expression of variations in source composition on the chemistry of the erupting basalts?

* How is magma transported from a presumed wide zone of melt generation to a narrow magma chamber? To what extent does the melt interact with the surrounding mantle? Over what time and space scales are crustal magma reservoirs supplied?

* What are the shape and dimensions of crustal magma chambers? Are they large and steady-state or small and ephemeral? Do they act as "open" or "closed" systems? Can ocean crust form without a crustal magma chamber?

* What are the characteristic length and time scales of ridge crest magmatism? Does a single, tectonically defined spreading center cell act as a single magmatic unit or is it segmented on a much finer scale?

* What controls the apparent episodicity of the sea floor spreading process? How does it vary as a function of spreading rate? Tectonic setting?

Contributions from drilling

The answers to these basic questions will require a multidisciplinary approach involving detailed geologic mapping and sampling, geophysical experiments and, ultimately, long-term monitoring of selected sites along the ocean ridge system. Drilling at spreading centers can make four unique contributions to ocean ridge studies:

First, drilling can sample deeper crustal levels not generally accessible at the sea floor and offers the best hope of recovering relatively fresh rocks essential for detailed geochemical analyses. Dredging and submersible sampling of fault scarps, especially at slow spreading ridges, have provided some access to deeper crustal levels. However, the tectonic setting is often anomalous (e.g., a fracture zone) and the samples are frequently badly weathered or metamorphosed. Drilling offers the potential of in situ sampling of deeper crustal levels in a "normal" tectonic setting.

Second, drilling can provide a vertical stratigraphy of lavas, unavailable from dredging, that can be used to investigate temporal variations in magmatic activity at a single location on a time scale shorter than that required to construct layer 2 (10^4-10^5 yrs). Accurate dating of individual flow units on time scales of less than 10^5 yrs is still not feasible. As a result, it is very difficult to separate temporal and spatial variability when mapping and sampling basalts exposed at the sea floor. The lava stratigraphy determined in drill holes thus offers the best hope of documenting temporal variations in magma supply, composition and evolution on a small spatial scale.

Third, drilling can "ground-truth" geophysical horizons such as the pillow/dyke or dyke/gabbro boundaries that may be mapped much more widely and cost-effectively using other geophysical techniques. The use of boreholes to define the nature of seismic reflectors which can then be mapped over large areas by reflection profiling is a common and powerful technique in the study of sediment stratigraphy on land and in the ocean. The same approach could be applied to the igneous crust, especially since improvements in geophysical techniques over the next few years promise to improve our ability to image these boundaries.

Fourth, drill holes can be used for bore-hole logging, downhole experiments and long-term geophysical monitoring. Major advances in logging techniques have been made in the past few years and these new tools can provide a wealth of new information on the physical properties of the oceanic crust. Crustal drill holes are an essential component of the long-term ocean bottom observatory concept and could be used to emplace a variety of geophysical sensors (short or long period seismometers, strain-meters, magnetometers, etc.) in future years.

Drilling strategy and priorities

The Lithosphere Panel strongly endorses the "natural laboratory" concept advocated in the COSOD I report: drilling at ocean ridges should be concentrated in selected areas that have been extensively surveyed and studied using a variety of geological and geophysical methods. Long-term use of the drill hole for geophysical experiments and monitoring is essential. Drilling should be focussed within a single spreading cell (thought to be the fundamental unit of crustal accretion) with holes located both along and across-strike. The holes need to be relatively deep (>100-500m) since the shallower crustal levels can be effectively sampled by dredging or submersibles.

Our highest priority is for a single, deep (>500m), zero-age hole at both a fast (>5-6 cm/yr) and slow (<2 cm/yr) spreading ridge with at least two shallower holes located in an "L" pattern along and across-strike at both ridges. The holes should be positioned close enough to permit cross-hole tomography and other geophysical experiments. Ideally the site at the fast spreading ridge should be located where a crustal magma chamber has been clearly identified geophysically; at the slow spreading ridge the site should be located as far as possible from a fracture zone. Once these holes have been established a series of intermediate depth (100-500m) holes should be drilled along-strike toward transforms or other ridge axis discontinuities to assess their affect on crustal accretion processes. Drilling of near-axis seamounts can also provide important information on the formation, transportation and composition of melts generated in the upper mantle beneath mid-ocean ridges (see p. 13).

In order to achieve these drilling objectives, a bare-rock spud-in capability will be required. With the development of the hard rock guide base and the use of downhole drilling and coring motors this problem appears to have been solved, although bare-rock drilling is still both time consuming and expensive. Based on the results of Legs 106 and 109 at the Mid-Atlantic Ridge, the major limitation in young crustal drilling is hole stability in young, highly fractured basaltic rock. A solution to this problem will be essential to obtain deep penetration in zero-age rocks that have not been substantially altered or cemented by hydrothermal activity. A long-term engineering development effort to improve penetration and recovery rates in crustal drilling is thus our panel's highest engineering priority. It is also clear that achieving the drilling objectives outlined above will require a substantial commitment of drilling time, including multiple legs at a single site. A total of 6 drilling legs may be required to establish the suite of 3 holes proposed above at both a fast and slow spreading ridge.

Hydrothermal processes at mid-ocean ridges

Ridge crest hydrothermal systems are an integral part of a fundamental planetary process. They transport a large fraction of the Earth's heat flux to the surface and are associated with the formation of metallic sulfides that may be analogues to economically important ore deposits on land. Heat lost through hydrothermal circulation has a pronounced effect on the size and longevity of crustal magma chambers, and the circulating fluids are responsible for a major part of the flux of Mg and other elements into or out of the oceans. Understanding the mechanisms and consequences of ridge crest hydrothermal activity is a basic goal of lithospheric studies.

Three kinds of submarine hydrothermal systems have been identified. The most spectacular are the high temperature, black smoker systems found at sediment-free ridge crests such as the East Pacific Rise and Mid-Atlantic Ridge. They are associated with 350°C springs of sulfide-bearing water on the sea floor which precipitate iron, copper and zinc sulfides in chimneys and mounds. The second is associated with sediment-buried ridge crests like Escanaba Trough, northern Juan de Fuca or Gulf of California. Here the system is modified by the relative impermeability of the sediments, and chemical reactions between the hydrothermal fluids and the sediments. The third kind of system is the low temperature type (10-20°C) which is associated with oxide deposits and which may account for a large fraction of the total heat loss from ocean ridges.

There are three essential components to any hydrothermal system: (1) a heat source, (2) a permeable medium, and (3) a circulating fluid. Processes operating in hydrothermal systems are highly interactive. The system is thermally driven by the presence of hot rock or magma, while the crystallization history of the magma is controlled by the rate at which it cools. Conductive heat transfer from the magma chamber to the host rock intensifies the local state of stress through expansion of the fluid-saturated host, leading to fracturing and increased permeability which in turn augments fluid circulation and the rate of heat transfer. This may be balanced by the precipitation of alteration assemblages in veins of the fracture network, decreasing permeability. Despite the fundamental nature of this interface between molten and cracked rocks, it is one of the most poorly understood aspects of any active hydrothermal system.

A basic understanding of submarine systems requires answers to the following questions:

* What is the size, shape, depth, temperature, and time-dependent behavior of the heat source?

* What are the spatial and temporal variations in permeability and composition of the host rocks?

* What are the time/space variations in physical properties and composition of the circulating fluids?

* What are the feedback loops linking the evolution of these principal components?

Contributions from drilling

Studies of fossil hydrothermal systems preserved in ophiolites have provided valuable insight into the subsurface geometry and composition of a submarine hydrothermal system. One important objective of drilling must be to test the hypothesis that these systems are a useful analogue of the active hydrothermal systems at ocean ridges. However, even if this hypothesis is valid, there are many aspects of hydrothermal systems that cannot be determined from an extinct system, including the variations in permeability and porosity of the host rocks, the physical properties and composition of the circulating fluid, and the dynamics of the water-hot rock interface. Drilling is the only available tool for constraining many of these parameters in an active submarine hydrothermal system. In particular:

* Drilling provides the only technique for penetrating the deeper levels of an active hydrothermal system

* Drilling can determine in-situ physical properties in the host rock (porosity, permeability, temperature, etc.) and sample hydrothermal and pore-water fluids.

* Drill holes can be used for long-term monitoring of hydrothermal activity

* Drilling off-axis can provide a record of the time-integrated alteration history of the oceanic crust.

Drilling strategy and priorities

The primary goal of a ridge crest drilling program should be the establishment of a deep penetration (>1000 m), high-temperature reference hole in an active ridge crest hydrothermal system. The target should be the penetration of the boundary between a vigorous hydrothermal system and an identifiable heat source (or at least the magma chamber reflection). The physical and chemical properties, the thickness and dynamic behavior of this boundary are completely unknown, yet they control the style and vigor of heat and mass transport within the magma chamber as well as that of the surrounding hydrothermal system.

Another goal of a hydrothermal drilling program should be to examine along-axis and across-axis variations within a single ridge segment. Along-strike variations include at least two scales of investigation, the segment scale (10s of kilometers) and the scale of individual on-axis hydrothermal circulation cells (size uncertain, but probably of the order of 0.5 to 4.0 km).

Ideally, these shallower holes (100-500m) would sample both the discharge and recharge zones of the circulation cell. The cross-axis holes would investigate the aging of the hydrothermal system and their spacing would ideally reflect the size of ridge flank hydrothermal cells determined from detailed heat flow investigations prior to drilling.

A third goal of a long-term hydrothermal drilling program should be to investigate the fundamental differences between hydrothermal systems at sedimented and sediment-free spreading centers. The presence of a relatively impermeable sediment layer strongly moderates heat loss from the system and has a profound chemical effect on fluid compositions. These systems may be a modern analogue of the large, sediment-hosted massive sulfide deposits frequently found on land.

Finally, any serious approach to drilling seafloor hydrothermal systems must take into account the positioning of drill holes and arrays of drill holes to optimize post-drilling experiments. For example, seismic and electromagnetic tomography from boreholes, together with multichannel seismic imaging of the roof of the magma chamber, promise to provide important physical constraints on key components of submarine hydrothermal systems.

Some hydrothermal drilling objectives can be obtained with existing drilling technology. For example, characterizing a hydrothermal system at a sedimented ridge crest involves reaching the high temperature basalt-water portion of the system which can be achieved by drilling less than a kilometer of overlying sediments. The principal technical difficulty in this case will be the high temperatures (>350°C). ODP has not yet carried out high temperature drilling, but it is commonly done on land by vigorous pumping of cold water into the hole to depress the actual temperature of the rock being drilled. Special heat-resistant logging tools and bore-hole instrumentation will also be required. The next most drillable hydrothermal target is an off-axis transect perpendicular to an unsedimented ridge crest which has partial sediment cover close to the rise axis. By locating the holes in small sediment ponds bare-rock drilling will not be required, although rubble and hole stability may still be a problem. The technically most difficult hydrothermal objective is the deep, zero-age hole at a sediment-free ridge crest. This hole will require bare-rock spud-in, improved crustal drilling technology and a substantial commitment of drilling time (3 legs ?) to be feasible.

STRUCTURE OF OCEANIC CRUST AND ITS VARIATION WITH AGE

The geologic structure and physical properties of oceanic crust are still known largely by inference from ophiolites or indirectly from geophysical experiments. The general structure of the oceanic crust inferred from these studies consists of a 1 km-thick extrusive basaltic carapace that grades into a 1 km-thick complex of sheeted dykes characterized by pervasive greenschist and amphibole facies alteration. In this model the sheeted dykes are underlain by a 3-5 km-thick plutonic section consisting at shallow levels of isotropic gabbro and at deeper levels by cumulate gabbros that grade downward into cumulate ultramafics.

The deepest crustal drill hole (Hole 504B) has sampled only the uppermost 1288 m of this section, bottoming in the sheeted dykes of seismic layer 2C. We thus lack direct information from more than 80% of the oceanic crust. A major objective of ODP lithospheric drilling should be to sample the remaining part of seismic layer 2, the layer 2/3 boundary, and at least the upper portion of seismic layer 3. More than two-thirds of the oceanic crust is layer 3-type material, but we still have no direct knowledge of its composition or physical properties. Except at 504B and a few other relatively shallow crustal holes, we also have little knowledge of the variation in the physical properties (porosity, permeability, density etc.) of oceanic crust with depth and almost no information on how these properties vary with age.

Contributions from drilling

Deep crustal drilling will provide a critical test of the ophiolite model of oceanic crust. Drilling at 504B has confirmed part of the ophiolite hypothesis in the presence of the sheeted dyke unit. However, correlation of oceanic seismic layer 3 with the thick plutonic section in ophiolites has yet to be verified by drilling. Important questions remain as to the tectonic setting in which ophiolites formed and the degree to which they are a good structural analogue of normal oceanic crust. Recent detailed chemical and mineralogical studies of ophiolite complexes have demonstrated that many classic ophiolites are more closely related to an arc-marginal basin setting than to a typical mid-ocean ridge. Most MORBs are depleted tholeiitic lavas, although lesser amounts of more evolved basalts, including alkalic basalts, are found along certain parts of the mid-ocean ridge. In contrast, ophiolites may include compositions ranging from calc-alkaline to highly calcic-andesitic, arc tholeiitic or boninitic rocks typical of intraoceanic island arcs such as Tonga or the Marianas. Although the chemical and mineralogical evidence of a supra-subduction zone setting for many ophiolites is persuasive, the classic ophiolite definition is based upon stratigraphy and overall lithologic associations. To date these are not well defined in the deep ocean basins or the island arc environment. It is thus possible that ophiolites may still be a good structural analogue for oceanic crust, but this can only be tested by drilling.

Another important problem that can be addressed by deep crustal drilling is the source of marine magnetic anomalies. The upper 1-2 km of oceanic crust are generally assumed to be the source layer of marine magnetic anomalies. However, one of the surprising results to emerge from the crustal holes drilled so far is the observation of frequent reversals of remanent magnetization in most of the deeper holes, even when the sites were located in the center of a magnetic anomaly. This reduces the integrated magnetic intensity correspondingly and requires a much thicker source layer. The best explanation of the occurrence of mixed magnetic polarities is a statistical emplacement model. This model could be tested by drilling several crustal holes along a transect across a reversal boundary. A deep crustal drill hole could also provide constraints on the possible contribution of the lower oceanic crust to marine magnetic anomalies.

We still have few constraints on how the composition and physical properties of the oceanic crust vary with age or whether there have been significant temporal variations in the crust accreted at ocean ridges. Studies of the alteration history of old crust are important for understanding the geochemical fluxes in both the crust and the oceans. As ocean crust is transported away from spreading centers, it undergoes chemical changes, first by rapid high temperature hydrothermal processes, then by slow interaction with pore waters, often through a significant sediment blanket. These processes may continue for tens of millions of years. The full extent of both the high and low temperature alteration can only be studied in old ocean crust, and only by drilling since old crust is covered by sediment.

Drilling strategy and priorities

Our highest priority is to obtain at least one crustal hole that penetrates below the layer 2/3 boundary into layer 3. Right now 504B is the deepest existing hole in oceanic crust and appears to offer the best chance of achieving this objective in the next ten years. However, the total penetration of only 212 m in 29 days of drilling on Leg 111 suggests that we may be approaching the limits of deep crustal drilling with present technology (it should be pointed out, however, that most of the 29 days was spent in fishing/milling/holecleaning operations; penetration rates when actually drilling were about 3 m/hr). Achieving this very important lithospheric drilling objective will thus require a significant improvement in deep crustal drilling technology. Along with the related problem of young crustal drilling, this is our panel's highest priority for engineering development. This development effort should be combined with an attempt, at the earliest possible opportunity, to re-occupy 504B, clean out the hole, and deepen it into layer 3. If this proves not to be technically feasible, then drilling should concentrate on deepening other existing crustal holes (e.g., DSDP 597C, 418A) into layer 3.

Another high priority is to obtain several relatively deep holes in older, sedimented parts of the ocean basins in order to investigate temporal and spatial variations in the geologic structure and physical properties of the oceanic crust. This drilling is well within the present technical capabilities of ODP and will provide unique information on the composition and alteration history of old oceanic crust that can be obtained in no other way. Finally, it is essential that all existing deep crustal holes be logged. This objective has largely been achieved with the work at DSDP holes 395A, 418A and 504B in the first two years of ODP. It is also important that all future crustal holes deeper than 100m be logged.

Although a deep crustal drill hole on "normal" oceanic crust is the only direct way of testing the ophiolite model, given the arc affinities of many ophiolites, it is important that one or more crustal holes be drilled in an island arc setting, both for comparison to the oceanic crustal section and to the typical ophiolite stratigraphy. Site selection for a hole of this kind is not obvious. Ophiolites may well be composite sections made up of fragments of the oceanic crust, forearc crust and back-arc basin crust. We thus rank this as a lower priority than deepening 504B or other deep crustal holes in a normal mid-ocean ridge tectonic setting.

The attenuated crustal section present at oceanic fracture zones, especially those along slow spreading ridges, may offer a window into the lower crust and upper mantle, albeit in an unusual tectonic setting. The magmatic, metamorphic and hydrothermal processes within fractures zones are also interesting in their own right. Drilling in oceanic fracture zones should thus be an important component of any long-term lithospheric drilling program.

INTRAPLATE VOLCANISM

Intraplate volcanism is the second most common type of volcanic activity occurring in the ocean basins. It takes many forms including small near-axis seamounts, linear volcanic chains, aseismic ridges, oceanic plateaus and thick intrusive complexes. Studies of the products of mid-plate volcanism can provide important constraints on the composition and chemical evolution of the upper mantle, the thermo-mechanical properties of the lithosphere and plate kinematic models. In the following discussion we focus on four specific problems: (1) the formation of seamounts near mid-ocean ridges, (2) linear volcanic chains and the geochemical evolution of mid-plate hotspots, (3) the effect of mid-plate volcanism on lithospheric properties, (4) origin of oceanic plateaus and the great mid-Cretaceous volcanic event.

Seamounts near mid-ocean ridges

Recent high-resolution bathymetric surveys along ocean ridges have revealed the frequent presence of small seamounts at or near spreading centers. Geochemically and petrologically these seamounts are magmatic products of the ridge crest system, although the chemical composition of the seamount lavas often differ from those of the surrounding seafloor. Some of these seamounts occur near inflated (shallow) ridge segments and may form because of a local excess of magma supply. However, many of these seamounts form near offsets of the ridge system. This is potentially interesting since independent evidence suggests that ridge offsets of various kinds are associated with a diminished magma supply. Eruptions near offsets may thus provide a sensitive record of temporal variations in magma supply at the adjacent spreading center and may help distinguish between different magma supply models. Hydrothermal activity at near-axis seamounts may also provide an interesting contrast with ridge crest activity due primarily to the higher elevation (lower pressure) of the upper portions of the upflow zone. Of particular interest is the enhanced likelihood of 2-phase separation (boiling) with related effects on seamount sulfide deposits (e.g. higher precious metal contents).

Contributions from drilling

As in the case of ridge crests, one of the main advantages of drilling over sea floor sampling techniques like dredging or submersible sampling is that a vertical stratigraphy of lava flows is obtained that can be used to investigate temporal variations in magmatism. For example, drilling seamounts at various distances from spreading centers may provide information on the rates of magma supply and how they have varied through time. Drilling a relatively deep hole (>500m) on a small (<500-1000m high) seamount could also provide unique constraints on its internal magma plumbing system as well as "ground-truthing" geophysical models for still controversial problems such as the origin of seamount magnetism.

Drilling strategies and priorities

Studies of near-axis seamounts are a logical complement to investigations of magmatic and hydrothermal processes at nearby spreading centers. Thus any drilling of near-axis seamounts should be part of a larger program of geological and geophysical investigations (including drilling) of the adjacent spreading center. Potential drilling targets are Axial Volcano on the Juan de Fuca Ridge, Mic, Mok and Sasha on the East Pacific Rise south of the Clipperton Transform and the seamounts near the 12°54'N OSC on the East Pacific Rise. The principal objective should be the establishment of a single deep hole (>500m) on the summit of the volcano. A summit hole is likely to provide the best opportunity of obtaining a simple and complete stratigraphic succession from a single volcanic vent (further down the flanks, the stratigraphy is likely to be a mixture of eruptions from several vents). A summit hole could also provide samples of lava lakes (caldera), cone-sheet intrusive feeders and shallow, sub-caldera plutonics, as well as investigate seamount hydrothermal systems.

Drilling a near-axis seamount will be technically difficult and will require both a bare-rock drilling capability and improved drilling techniques for young, fractured basaltic rocks. Achieving the primary drilling objective will require at least one drilling leg and the entire program outlined above may require as many as two drilling legs.

Linear volcanic chains and geochemical evolution of hotspots

Hotspot volcanism, and the linear volcanic chains often associated with them, are of considerable lithospheric interest both for the constraints they provide on plate kinematics and absolute plate motions and as a means of investigating the composition and geochemical evolution of the mantle. Extensive studies, including drilling, of the Hawaiian-Emperor chain and 90E Ridge have demonstrated the time transgressive nature of activity which can be related to fixed hotspots. Other features that also probably have a hotspot origin include the linear chains of French Polynesia, the Cocos and Carnegie aseismic ridges, the Louisville Ridge, the Marshall-Gilbert-Ellice chain, the Chagos-Laccadive Ridge, the New England Seamounts, the Walvis and Rio Grande Rise and others. These features are still very poorly known and important questions exist concerning the extent to which they can be related to fixed hotspots, the nature of the magma sources forming them, and the timing of activity along the chains.

Another aspect of hotspot volcanism of particular interest at the present time is the early evolution of hotspot magmas. The traditional view of Hawaiian hotspot volcanism was that a long tholeiitic phase of activity constructed the volcanoes and was followed by a short capping phase of alkalic activity. The discovery of Loihi seamount around 1980 indicated there may also be an early alkalic phase of volcanism that has been attributed to mixing of the primitive hotspot magmas with remelted lithosphere during their ascent to the surface. However, this interpretation is based entirely on rocks exposed at the surface recovered in dredges or by submersibles. We still do not have good stratigraphic control on the relationship between the alkalic and tholeiitic basalts forming Loihi, and fundamental questions still exist regarding the source composition, degree of partial melting, fractionation history and lithospheric contamination during the early evolution of hotspot magmas.

Contributions from drilling

Drilling linear island chains can provide three key pieces of information to address these problems. First, by drilling older linear island chains and aseismic ridges and dating either the basement rocks or the overlying sediments it will be possible determine the timing of volcanic activity along the chains and thus determine both the azimuth and rates of absolute plate motions. Second, drilling will provide a unique set of stratigraphically controlled basement samples that will provide a window into the composition and heterogeneity of the upper mantle from which these magmas were derived. Third, by drilling a young, incipient hot spot volcano like Loihi it will be possible to study the still largely unknown early eruptive products of hot spot volcanism in a continuous, stratigraphic section.

Drilling strategies and priorities

Studies of hot spot volcanism have played a pivotal role in current models of mantle chemistry, dynamics and evolution. The ODP could make a significant contribution to this effort by drilling a young, hot spot volcano and sampling, with good stratigraphic control, the first eruptive products of hot spot volcanism. One obvious target is, of course, Loihi. It is already well-studied and mapped, it is logistically convenient to Hawaii for permanent instrumentation, and is in relatively shallow water (~2000m). However, other targets such as Mehetia in the Society Islands may be suitable as well. The drilling strategy, technical problems and time-requirements are essentially the same as those described above for drilling a near-axis seamount.

Sampling of basement at hot spot related island chains and aseismic ridges is also important. Often holes are drilled on these shallow features for paleoceanographic and tectonic objectives and it is essential that these holes be extended, whenever possible, into basement at least until bit destruction.

Mid-plate volcanism and lithospheric flexure

Mid-plate volcanism represents a thermal perturbation to the cooling lithosphere that can be exploited as a natural laboratory to study the thermo-mechanical properties of the lithosphere. Most mid-plate volcanos are surrounded by broad regions of anomalously shallow seafloor called swells. Most of the characteristics of swells (height, geoid anomaly, subsidence history, heat flow) can be explained by the reheating of the mid- to lower lithosphere. However, there is no consensus as to the mechanism by which the heat is added to the lithosphere, the role played by the volcanoes themselves in raising temperatures, or the dynamic contribution of the upwelling asthenosphere in producing swells.

The sedimentary sequences preserved in the flexural moats of hotspot volcanoes are a sensitive measure of the thermal history of the swell that can be used to address these problems. The stratigraphy of the moat sediments is largely controlled by variations in the effective elastic thickness of the plate supporting the volcanic loads, and the thickness of the plate roughly corresponds to the depth of the 600°C isotherm. After an initial period of rapid thinning of the plate as it relaxes from its instantaneous elastic thickness to its long-term value, additional changes in the thickness of the elastic plate are controlled by heat transfer within the swell. As the elastic plate thickness varies with time, the pelagic and volcanoclastic sediments deposited in the flexural moat will show characteristic onlap and offlap patterns due to changes in the flexural width of the moat. Multichannel seismic profiling in the flexural moat flanking the island of Oahu has imaged onlap and offlap sequences consistent with variations in the effective elastic thickness of the lithosphere with time. However, without dates for the sedimentary horizons it is not possible to determine the time interval between volcano formation and the onset of plate weakening, or even definitively tie the offlap pattern to the process of heat transfer within the swell.

Contributions from drilling

Drilling in the flexural moats of hot spot volcanoes is the best method of dating the sedimentary horizons observed on reflection profiles and thus quantifying the subsidence rates at various times during the development of the moat. With this information it should be possible to determine the elastic response of the plate to the volcanic load and assess the relative importance of lithospheric reheating and other factors, such as the formation of a deep crustal sill complex, on this response. Drilling in flexural moats will also provide two other important kinds of information on hot spot volcanoes. The compositional variations of the ash flows and volcanoclastic debris deposited in the moat can reveal the stratigraphy of the adjacent volcanoes to depths not accessible by drilling the volcano itself. The variation in sediment supply to the moat can also be used to infer erosion and subsidence rates for the adjacent islands and may provide information on sea level fluctuations.

Drilling strategies and priorities

There is no question that models of the thermal and mechanical evolution of the lithosphere are at the point where distinct hypotheses exist that can be tested only by drilling. The kind of drilling required, which involves penetration of 100m to several hundred meters through the volcanoclastic sediments in the flexural moat, is clearly within the present technical capabilities of ODP. The main uncertainty is how well the stratigraphic horizons observed in reflection profiles can be dated either paleontologically or by other means (e.g., magnetostratigraphy). One possible target is the Hawaiian moat where good reflection data already exist, but fossil preservation may be poor. Another possible location is the Marquesas Islands where proximity to the equator increases the likelihood of datable fossils in the moat, but more site survey work would be needed. The main objectives of a drilling program of this kind (several holes across and along the moat) could easily be accomplished in a single leg.

Oceanic plateaus and mid-Cretaceous volcanism

Despite their huge size and distinctive morphology, the vast oceanic plateaus such a Hess Rise, Shatsky Rise, Manihiki Plateau, Ontong-Java Plateau and Kerguelen Plateau remain among the least understood features in the ocean basins. Geophysically, these plateaus are characterized by 20-30 km thick crust more typical of continental areas than the ocean basins, leading some investigators to propose that they are continental fragments. Others have argued that they have an overthickened oceanic crustal section formed by excess volcanism associated with a ridge-centered hot spot (the Iceland analogy) or a ridge-ridge-ridge triple junction. Still others have speculated that the plateaus may represent voluminous volcanic outpourings associated with meteoric impacts. Data on the age, chemical composition and structure of basement rocks of plateaus are required to resolve this controversy and advance our understanding of how and why these plateaus form.

Many of the plateaus in the western Pacific appear to have formed in the mid-Cretaceous during a period spanning perhaps 30 my of remarkably intense mid-plate volcanism. In addition to these plateaus this event appears to have formed several major guyot chains and at least one major deep sea intrusive event in the Nauru Basin. Diverse magmatic products were erupted during this period, and there were complex episodes of uplift and subsidence in different parts of the region whose timing and significance are still poorly understood. The volume of volcanism indicates a major disturbance of the normal thermal and convective pattern in the mantle which perhaps coincidentally overlaps with the long Cretaceous period of normal magnetic polarity. An important goal of crustal drilling in this area should be a systematic investigation of the composition, subsidence history, and temporal relationships between the various plateaus, island chains and basins in this area.

Contributions from drilling

Generally, plateau crust is buried under as much as 1.5 km of sediment, hence drilling is in most cases the only method of recovering samples of basement rock for petrological and geochemical studies. Samples obtained by drilling are also usually less altered than dredged rocks and have unambiguous stratigraphic control. Paleontological evidence from the sediments deposited on plateaus will provide important constraints on the age of these features and their long-term subsidence history. Drilling into volcanic basement at atolls and guyots, aseismic ridges and in mid-plate intrusive complexes will provide similar information on the origin of these features.

Drilling strategies and priorities

Drilling is the only method of unambiguously determining the age and composition (oceanic vs continental) of oceanic plateaus. The drilling is technically feasible (although penetration of

Cretaceous cherts may be a problem on some plateaus) and should be included in any long-term crustal drilling program. Potential targets include Kerguelen plateau in the Indian Ocean and Ontong-Java and Manihiki plateaus in the western Pacific. Holes drilled on these shallow plateaus will have important paleo-oceanographic and tectonic objectives as well. However, it is important to emphasize that achieving the basement objectives at these sites will require more than penetrating a few meters in "basement", since intrusive sills may mask true basement and such limited penetration will yield no information on the temporal variability or stratigraphic relationships in the basement rocks. A relatively deep (100-500m), re-entry hole should be drilled on each plateau with several shallower (<100m) single bit holes to sample spatial variability in basement structure and composition in different parts of a single plateau.

INTRAOCEANIC CONVERGENT MARGINS

Intraoceanic convergent margins are comprised of three principal tectonic components: (1) forearc, (2) volcanic arc, (3) backarc basin. In order to understand these margins as a system, we need answers to the following fundamental questions:

* What are the relative contributions from volcanism, intrusive activity, accretion and tectonic erosion in the evolution of arc and forearc regions?

* What roles do serpentine diapirism and block faulting play in forearc tectonism?

* What is the temporal and spatial variability of magma types in arc-forearc regions? How are magmatism and tectonism interrelated?

* What initiates backarc basin development? How does the geochemistry of backarc basin crust vary during the history of the basin?

* What are the nature of hydrothermal systems in arc-forearc-backarc regions? How do they compare with ocean ridge hydrothermal systems?

* What are the relative roles of mantle, subducted sediments and oceanic crust in the sources for magmas in the forearc-arc-backarc regions?

The answers to these questions are of fundamental importance to our understanding of how intraoceanic convergent margins form and evolve, and what sort of chemical communication exists between crust and mantle. These problems must be attacked by a combined program of geological mapping (Sea Beam, Sea MARC), geophysical surveys (MCS), dredging and submersible studies, as well as a carefully designed and focussed drilling program.

Contributions from drilling

Drilling can make a number of important contributions to studies of intraoceanic convergent margins:

* Drilling can provide vertical stratigraphic records for deciphering the uplift/subsidence history of both the forearc and backarc regions. We do not know, for example, whether the frontal arc and outer-arc high develop by igneous construction or differential uplift, whether the upper-slope basin between them is due to forearc spreading or differential subsidence, or whether flexural loading by the arc volcanics is an important process. Drilling is the best means of determining the form of vertical movements that have occurred in the forearc.

* Drilling can provide a nearly complete tephrachronological record useful for deciphering time-dependent relations among forearc, arc and backarc processes. This kind of information is essential in order to investigate temporal variations in arc magmatism or the relationship between tectonism and magmatism in the early development of backarc basins.

* Drilling into forearc diapirs and their flanking sediments may be the best way to study their formation and tectonic history. Drilling these features should provide constraints on the timing of their emplacement and the emplacement mechanism, as well as the extent of fluid circulation through the outer forearc and the chemistry of the fluids.

* Drilling provides the only access to igneous basement beneath large portions of the forearc, arc and backarc that are covered by sediments. The nature of igneous basement forming the frontal arc, outer-arc high and beneath the intervening forearc basin must be determined in order to answer critical questions regarding the initial stages of arc magmatism and the development of the forearc massif. Drilling provides the only way of sampling the early magmatic products of back-arc basin rifting and testing models for the geochemical evolution of back-arc basin magmatism.

* Drilling in backarc basins, as at ocean ridges, can provide unique constraints on processes of crustal construction and hydrothermal activity at backarc basin spreading centers.

* Drilling can establish the composition of the sediment and basaltic crust being subducted in order to assess their role in arc magmatism.

Drilling strategies and priorities

The various problems of lithospheric interest outlined above at intraoceanic convergent margins require both a spatial perspective, to investigate the different components of the system (forearc-arc-backarc), and a temporal perspective to compare convergent margins in different stages of evolution (mature vs immature). Our panel thus favors a "transect" drilling strategy involving multiple holes extending from the backarc spreading center (where zero-age drilling could be carried out) across the arc and forearc to the undisturbed plate about to be consumed. Ideally, margins in different stages of development should be drilled. The highest priority objective should be to investigate the evolutionary development of each component of the convergent margin system and the interplay between tectonic and petrologic variables. Drilling should be concentrated in areas where the subaerial geology and overall geologic history are well-characterized (Indonesia, western Melanesia, Vanuatu, Tonga-Kermadec, Fiji, Mariana, Izu-Bonin, Japan, S. Sandwich-Scotia, Aleutian, Antilles). The emphasis in these transects should be on intermediate to deep basement holes (>100-500m) in order to adequately sample the predicted vertical variability in areas representing initial stages of back-arc basin development, and the deeper portions of the arcs and forearcs. Most of the basement drilling objectives in convergent margins can be achieved using existing drilling technology, although hole stability may be a problem in some holes dominated by volcanoclastics and breccias. Bare-rock and young crustal drilling techniques will be required for drilling backarc spreading centers.

Reference holes drilled into basement on the subducting plate are an essential component of all drilling programs investigating magma genesis in convergent margins. Two approaches can be taken. First, areas can be studied where the composition of the subducting crust varies substantially to determine if there are corresponding changes in the arc volcanics. Second, areas with substantial chemical variations along the arc can be investigated to determine whether there are corresponding variations in the subducting crust. Both approaches can be accomplished only through drilling and substantial progress can be made with current drilling technology. A series of holes are required paralleling the volcanic arc on the subducting plate. Some of these can be single bit holes (provided the chert penetration problem is solved), although a few should be deep (>500m) reentry holes to insure a representative vertical section through a substantial part of layer 2 is obtained. Potential locations for these studies include the Bonin, Mariana, Aleutian, and Antilles arcs.

A single transect of the kind outlined above will require about three legs of drilling. In the context of a ten year drilling program, at least two such transects should be completed.

MANTLE HETEROGENEITY

The spatial and temporal distribution of heterogeneities in the mantle, and their relative scales are closely linked with the problem of deciphering the dynamic or convective state of the mantle and mixing conditions that may exist between different zones of the Earth's interior. Some particularly important questions are:

* What have been the variations in mantle temperature and degree of partial melting temporally and spatially?

* Is convection mantle-wide or limited to different zones such as the upper and lower mantle?

* If the latter case prevails, how much exchange has taken place by entrainment between the two systems?

* What is the source of so-called mantle plumes and how do they interact with the overlying plates or upper mantle?

* How do mantle plumes affect magmatism at mid-ocean ridges? What is the role of fracture zones in this process?

These questions also pertain, of course, to understanding how the earth has outgassed, how mantle differentiation has taken place and how the ocean, the atmosphere, and the continental crust have grown and evolved through geologic time.

The geochemical and isotopic composition of lavas erupted along ocean ridges, at island arcs and in backarc basins, at oceanic islands and along hotspot chains can provide some of the needed constraints. Radiogenic isotope ratios (Pb, Nd, Sr, He, etc.) and related information on time integrated parent/daughter element ratios are particularly useful at identifying different mantle reservoirs, their mean ages, any mixing that may have taken place, and whether crustal recycling into the mantle is an important process. For example, Pacific Ocean basalt glasses tend to have distinctly lower Sr isotopic values at the same Nd isotopic value compared to most Atlantic and Indian Ocean basalts. Indian Ocean basalts which are depleted in incompatible trace elements can have substantially higher Sr isotopic ratios than the most incompatible element enriched Pacific ocean ridge basalt. These global differences must reflect the nature and timing of melt extraction and recycling. Mapping such variations through time could have considerable consequences for our understanding of the circulation of materials through the earth's mantle.

Another example is the recent recognition that basalt chemistry is giving information about temperature variations in the underlying mantle. There are global correlations among basalt chemistry, axial depth and crustal thickness which are quantitatively consistent with long wavelength temperature variations in the mantle. These correlations include basalts from hot spots, cold spots, backarc basins and normal ocean ridges. Recovering basalt from older crust can thus provide important information about temporal and spatial variations in mantle temperature and degree of partial melting.

Contributions from drilling

Rock sampling by dredging along the ocean ridge system provides only a one-dimensional snapshot of mantle heterogeneities and is limited to constraining the pattern of convective mantle currents in planform. Also, sampling of islands along a hotspot track provides only an intermittent picture limited to the peak cycles of volcanism.

Drilling can make two unique contributions. First, drilling can provide a continuous, high resolution record of the history of magmatic activity at one location on a time scale shorter than that of the construction of layer 2 (10^5 to 10^6 years). This good stratigraphic control permits studies of short-term variations in mantle chemistry and temperature at a single location. Second, drilling provides the only method of sampling older, sedimented crust providing constraints on the temporal variability over time scales of 10^6-10^8 years and spatial scales of up to 10^4 km.

Drilling strategy and priorities

These fundamental questions concerning temporal and spatial variations in mantle chemistry and temperature can be addressed by drilling holes with 100m or more of basement penetration on crust of various ages in different ocean basins. They cannot be addressed solely by dredging programs, and they are achievable with present drilling technology.

Several different drilling strategies can be employed. Grid sampling using scales relevant to the particular problem, such as carried out during DSDP leg 82 in the N. Atlantic around the Azores, is one approach. Another strategy is to drill transects of shallow holes (~100m) along a spreading flow line. Sampling of basement at seamounts, aseismic ridges and oceanic plateaus is another approach. Finally, the geochemical reference holes discussed in the previous section will also be valuable in constraining variations in the chemistry of the ocean crust through time. It will ultimately be the accumulation of data from all of these approaches, together with continued dredging and drilling at ocean ridges, that will provide the critical information needed to understand the thermal and chemical evolution of the upper mantle.

RECOMMENDATIONS FOR A LITHOSPHERIC DRILLING PROGRAM

Table 1 summarizes the ten highest priority lithospheric drilling objectives listed in the order they were presented in this White Paper. Also included is information on the number and depth of holes, technological and time requirements, and possible drilling locations based on the strategies and priorities discussed above.

It is first worth noting the breadth of problems indicated in this Table. They include not only volcanism and hydrothermal objectives at oceanic spreading centers, but also encompass magmatism associated with hotspot volcanoes and convergent margins, near-axis seamounts and oceanic plateaus, fracture zones and young oceanic rifts. Drilling can also be used to study the aging and metamorphism of oceanic crust, the composition and geochemical evolution of the Earth's mantle and the thermo-mechanical properties of the lithosphere. There are clearly a wide variety of important problems of lithospheric interest that drilling can address, many of them with existing drilling technology.

In devising a coherent, long-term lithospheric drilling program two principal difficulties arose. The first concerns the maturity of our understanding of the basic scientific problems. In some cases (e.g., deep crustal hole to test the ophiolite model or flexural moat drilling) our geological and geophysical models are at the point now where distinct hypotheses exist that can only be tested by drilling. In these cases it is relatively easy to identify a specific, drilling strategy. However, in other areas (e.g., ridge crest processes, mantle heterogeneity) our models are still rapidly evolving as new data are collected and interpreted. In these cases it is more difficult to define a specific drilling program at this time and we expect that our ideas about how and where these targets should be drilled may change over the next few years as new data are collected and new models developed. Another problem we face in defining a lithospheric drilling program is that many of our highest priority drilling objectives will only be feasible if substantial improvements are made in current crustal drilling technology. We do not know when, or if, these advanced crustal drilling techniques will be available.

In light of these problems, two different approaches could be taken. The first would be to design a program around only those scientifically mature problems that are technologically feasible now. Clearly, much good science could be done this way, but 5 or 10 years down the road we would be no closer to solving many fundamental lithospheric problems (structure of seismic layer 3, validity of ophiolite model, etc.) than we are now. An alternative approach would be to devote all of our resources to overcome the technical problems associated with young and deep crustal drilling, deferring most lithospheric programs until that technology is available. The problem with this option is that there are many important lithospheric problems that can be addressed <u>now</u> with <u>existing</u> drilling technology that would be overlooked.

Table 1
Summary of High Priority Lithospheric Drilling Objectives+

Drilling Objective	# Holes	Crustal Drilling Depth	Advanced Crustal Drilling Technology	Legs	Example Locations
Young oceanic rifts	Multiple	<100m to >500m	High temp. drilling (for some holes)	1-2	Red Sea, Gulf of California
Drilling at fast and slow spreading ridges*	2-6	2 >500m 4 100-500m	Bare-rock, young crust, high temp.	~6?	MAR, EPR, Juan de Fuca Ridge
Drilling a sedimented ridge crest, hydro-thermal system	>3	>500m	High temp. drilling	1-2	Juan de Fuca, Escabana Trough, Gulf of Calif.
Deep crustal hole into layer 3*	1	>2000m	Deep crustal drilling	>2?	DSDP 504B, 418A
Fracture zone drilling	Multiple	<100m to >500m	Bare-rock, young crust (for some holes)	1-2	Kane, Oceano-grapher, AII, Vema
Near-axis seamounts; hotspot drilling	Multiple	<100m to >500m	Bare-rock, young crust (for some holes)	>2	EPR, Loihi, 90E Ridge, Mid-Pac. Mts.
Flexural moat drilling	Multiple	none	none	1	Hawaii, Marquesas
Oceanic plateau drilling	Multiple	~100m	none	2	Kerguelen, Ontong-Java, Shatsky
Drilling old oceanic crust	Multiple	<100m to >500m	none	~3	Atlantic, Pacific or Indian Oceans
Intraoceanic convergent margin transects (2) (incl. reference holes)	Multiple	<100m to >500m	none (except at backarc spreading centers)	3-6	Izu-Bonin, Tonga Kermadic, Aleu-tian, Antilles

+Listed in order presented in text.

*New crustal drilling technology required to achieve this objective.

We favor a hybrid approach. The high priority, long-term goals for lithospheric drilling should be clearly identified upfront with the technical requirements to achieve them. A complementary, short-term plan should also be devised with achievable drilling goals designed to address important, mature scientific questions, as well as to contribute to the technical and scientific requirements of the long-term goals. This approach allows identification of a spectrum of targets ranging from those that are presently drillable to those that are currently undrillable. With a parallel engineering development effort, the necessary tools should be available when the technically difficult holes are ready to be drilled.

This is the approach we have taken in constructing Table 1. Our most important long-term drilling objectives are to complete one or more deep holes into the lower oceanic crust (to Moho?) and to establish a suite of crustal drill holes at both fast and slow spreading ridges. However, in the short-term there are also important problems at intraoceanic convergent margins, on oceanic plateaus and aseismic ridges, at sedimented ridge crests and in young oceanic rifts that can and should be addressed with existing drilling techniques.

Achieving our long-term drilling objectives will require a major engineering development effort to solve the hole stability problem in young crust and to improve penetration and recovery rates when drilling deep crustal holes. This effort must begin now and must be continued over at least the next 5-7 years if these significant technological problems are to be overcome. We believe an expenditure on the order of 5% of the annual drilling budget (~$1.5 - 2 M/yr) is a reasonable estimate of the level of resources that should be devoted to this engineering development effort.

We believe the lithospheric drilling strategy outlined above is feasible. In the context of a 10 year drilling program it is reasonable to expect that most of the objectives listed in Table 1 can be achieved, especially considering that many of the proposed legs (convergent margins, oceanic plateaus, lithospheric flexures, young oceanic rifts, etc.) have important tectonic or paleo-oceanographic objectives as well. However, achieving these objectives will require both a substantial long-term commitment from ODP to engineering development and a recognition in the planning process that many important lithospheric objectives require substantial amounts of drilling time, including multiple legs at a single site. The Lithosphere Panel strongly believes that ODP should focus on a smaller number of thematic problems, like those outlined in Table 1, and devote the technological resources and drilling time to achieve those objectives.

Boston University

Department of Geology
675 Commonwealth Avenue
Boston, Massachusetts 02215
617/353-2532

Office of the Chairman

May 31, 1993

To: Members of the Lithosphere panel, JOIDES office, and interested parties

From: Sherman Bloomer, Chairman, LITHP

Re: Revision of the White Paper

My first duty. A little Memorial Day present. Susan's at sea so I've taken the pieces we had from the Spring meeting (though I realize I'm missing a few bits) and stitched them into a draft that we can work on. I can hear Susan laughing from the Mid-Atlantic. We are trying to set up an open meeting to get community input in September; whether we succeed in obtaining funding for that meeting or not, we need to have a draft that we can circulate in the community for comment by the end of July. Wit that in mind, I would greatly appreciate some editing and modifications of this document.

The present version is a bit ragged. I need a review of goals accomplished to date--if you could synopsize what you think the program has accomplished in your discipline, in would help greatly. Some of the sections are well fleshed out, some are a bit thin. Convergent margins needs some work--particularly since the goals and strategies are ones I've put up there as strawmen, they are purely my opinions. We need to trim the ocean lithosphere sections a bit. Right now we have 5 pages of LIPS, 5 pages of convergent margins, and 12 pages of oceanic lithosphere. It likely will be a bit longer than the other two, but it needs to be much more concise than that. I might suggest breaking Oceanic lithosphere into three sections: A. Formation and modification and spatial variability, focusing on zero age, or near zero age processes; parts of fracture zones and variability could go in here, B. Hydrothermal processes. I would suggest that the back-arc section go in convergent margins with the addition of a section on the potential for examination of hydrothermal systems in the arc; and C. Evolution of the lithosphere--this could include what's there now, and perhaps some of the long term evolution of the mantle questions. Only a suggestions, but we need to streamline that first section. We also need to be clear about some priorities; I pulled off a list from the Spring meeting to pt in the introduction. I think we want to have our short list of objectives right up front.

Anyway, see what you think--its very rough, but I'm off to our field camp for June and its this or nothing. If you can have some comments back to me by the end of June it would be wonderful; if you can do it by mid-July it would be good; and if you can do it by the end of July I can live with it. Thanks, have a good summer.

Oh yes. If you have any agenda items for our joint meeting with DMP in the fall, please let me know. Peter and I have listed a discussion of some of the legs with demanding downhole programs (TAG, Barbados), logistics and problems with fluid samplers, and progress with the ocean seismic network so far. If you have concerns about the use of downhole measurements, questions about what can and cannot be done, or anything else concerning downhole measurements, let me know. Best bet is to e-mail me at bloomer@crsa.bu.edu. Cheers.

Draft document-not for general circulation; May, 1993

JOIDES Lithosphere Panel White Paper

Table of Contents

Draft document-not for general circulation; May, 1993

Draft document-not for general circulation; May, 199?

JOIDES Lithosphere Panel White Paper

Part I. Introduction

1.1 Scientific Objectives as Defined by COSOD I and II

The thematic panels of the Ocean Drilling Program identify long-range objectives for the programs. The panels receive input from the community in the form of proposals, panel reports and white papers and are responsible for reviewing and ranking proposals for the use of the drilling platform. The Lithosphere Panel, as defined in the Guide to the Ocean Drilling Program (1988) is concerned with the origin and evolution of oceanic crust and mantle. Specific areas of interest are:

a. Processes of submarine volcanology, intrusion and plutonism; crustal construction at spreading axes; petrology, geochemistry, mineralogy, and magnetic and other physical properties of igneous and metamorphic rocks form the ocean floor, form seamounts, form oceanic plateaus, from volcanic arcs and from basins adjacent to volcanic arcs.

b. Processes of submarine hydrothermal circulation; petrology, geochemistry and mineralogy of hydrothermally altered rocks and hydrothermal deposits form the ocean floor; geochemistry and physical properties of hydrothermal solutions; aging of ocean lithosphere.

c. Processes of mantle convection and melting and their relationship to basaltic rocks of the ocean basins. Mapping of mantle (geochemical) reservoirs and domains. Implications of solid earth geochemical cycles and fluxes of the global plate tectonic cycle. Mass balance problems.

Within these broad topical guidelines, specific priorities for drilling to meet answer questions about the lithosphere have been set by two Conferences on Scientific Ocean Drilling (COSOD). COSOD I, held in November, 1981, identified two high priority problems: the processes of magma generation and crustal construction operating at mid-ocean ridges and the processes of hydrothermal circulation in the oceanic crust. The COSOD I report also recognized 6 other areas which should receive attention: the compositional heterogeneity of the mantle and mantle evolution, the aging and evolution of the oceanic crust, the formation of overly thick crust, the role of transform faults, processes operating in young ocean basins, and island arcs and backarc basins.

COSOD II, held in July, 1987, examined drilling priorities in the context of global systems, rather than in terms of specific tectonic settings; lithosphere problems were addressed in workshops on "Mantle/Crust Interactions", "Fluid Circulation in the Crust and the Global Budget", and "Stress and Deformaton of the Lithosphere". The first workshop stated that their thematic priority was to "understand the present systematics of the solid earth circulation system, and the record of its action through time". The most important contribution of drilling was viewed to be the penetration of complete sections of the ocean crust and therefore made their highest priority the development of "the capability to drill such total crustal sections". They suggested a phased approach of drilling two or three 2-3 km holes into basement, with one of these extended to the Moho, followed by one year of drilling allocated to processes on spreading centers and one year to the problem of fluxes at convergent margins. An additional year would be allocated to deep drilling on seamounts and plateaus.

Draft document-not for general circulation; May, 1993

The fluid circulation workshop proposed drilling programs desinged to udnerstand fluid flow in three hydrodynamic regimes: active (convergent) margins, active mdi-ocean ridges (including bare rock and sedimented ridges), and mid-ocean ridge flanks. Each program included one or two deep holes (3-4 km) and arrays of 4 to 6 shallow (0.7-1 km) holes.

Finally, the group on stress and deformation in the lithosphere identified high priority objectives concerning the physical state of the lithosphere, rifted and passive margins, mid-ocean ridges, and convergent margins. In all of their objectives, they stressed the necessity of coordinating drilling with detailed geophysical surveys. For the mapping of stress in the lithosphere, they proposed a three phase program of !) using all holes (drilled for whatever program) over 100 m into basement for stress measurements, 2) siting holes specifically to address stress problems, coupled with the deployment of ocean-bottom geophysical observatories, and 3) drilling deep holes through the ocean crust. Drilling at passive margins was considered to require examination of volcanic and non-volcanic margins, where: 1) conjugate margin segments were accessible, 2) there were substantial thicknesses of pre- to post-rift sediments, 3) samples of deeper crystalline basement could be recovered, 4) typical ocean crust with good magnetic lineations existed adjacent to the margin, 5) there was no complicated post rift deformation, and 6) there was existing industry or DSDP/ODP data. The program at mid-ocean ridges included, first, a series of shallow holes in young or zero age crust along and across flow lines, and second, 2-3 km deep holes within some of the shallow hole arrays. Both strategies would characterize the local and regional stress at ridges. Finally, drilling at convergent margins focused on understanding the flow patterns of materials through forearcs using a phased approach of 5 shallow holes in four or five different forearcs, followed by several deep holes in a transect across the forearcs.

Many of the objectives outlined by the two COSOD groups have been met in part; others have not been addressed or have proved to be technologically difficult. The goal of this white paper is to review the progress made in answering questions about the lithosphere using ocean drilling and to establish the outstanding scientific problems that should be addressed in the next ten years of the Ocean Drilling Program.

1.2 Status of Scientific Objectives at the End of phase I of ODP (1992)

[This section is still being written. I would appreciate a synopsis from anyone and everyone about what they view as the lithospheric objectives that have been accomplished in their particularly discipline over the course of the program (Leg specific would be good, and if there were significant goals met in DSDP those could be touched o too). Thanks.]

1.3 Summary of Recommendations for Lithospheric Drilling for Phase II of ODP (1993-1998) and Beyond (1998-2003)

The scientific problems discussed in Part II below are all important and their solution could occupy the program full-time for a number of years. However, because of the limited time available in the next ten years for drilling lithosphere objectives, the panel views some of these scientific objectives as first-order problems whose solutions should be a priority of the lithosphere component of the Ocean Drilling Program. THese first order problems include (in no order of priority):

Draft document-not for general circulation; May, 199?

Oceanic Lithosphere

◊ Crustal Evolution-drilling along a flow line
◊ Hydrothermal processes coordinated with experiments and monitoring efforts
◊ Lithosphere structure and composition--offset drilling
◊ Deep drilling
◊ Initiation of rifting--drilling in an area such as the Red Sea

Large Igneous Provinces (LIPS) and Intraplate volcanism

◊ Mantle Plumes and continental breakup
◊ Timing of the formation of large oceanic plateaus

Convergent Margins

◊ Arc initiation and supra-subduction zone ophiolites
◊ Back-arc initiation, propagation and source distribution
◊ Subduction zone mass balances and geochemical fluxes

Part II: Scientific Problems and Objectives

A. OCEANIC LITHOSPHERE

A1. Formation and Modification of Oceanic Lithosphere

A1.1 Processes at mid-ocean ridges

Sixty percent of the earth's surface is created at oceanic spreading centers as magma upwelling from the mantle is cooled to form oceanic crust. Models of how this crustal accretion process proceeds have been refined over the past two decades, based on increasingly detailed geological and geophysical investigations at oceanic spreading centers, on DSDP and ODP drilling results, and on the study of a few well-preserved ophiolite complexes.

Seismic data have shown that the velocity structure of the oceanic crust is remarkably similar at a global scale, and is defined by two major velocity intervals: layers 2 and 3. Studies of ophiolites and comparison with the variety of extrusive and plutonic rocks recovered from ridge crest environments have suggested that layer 2 may be composed of basalt flows grading downward into diabase dikes, and that layer 3 may be made of gabbros. Drilling at Hole 504B on the flank of the Costa Rica Rift brings support for this layered geological model: a transition between basalt flows and dikes was found at 600 to 800m below seafloor, and the hole, now 2000m deep continues in dikes. However, sample studies, geological mapping and geophysics in the axial region of slow-spreading ridges such as the Mid-Atlantic and Southwest Indian ridges, suggest a level of structural and lithological heterogeneity that had heretofore not been appreciated and may be typical of magma-starved accretionary environments. The main characteristics of such environments appear to be the lack of a long-lasting axial magma chamber, the existence of complex interactions between magmatic, deformational, and hydrothermal processes (best documented so far in the gabbro section drilled at Hole 735B in the Southwest Indian Ocean), the uplift of upper mantle rocks to the seafloor and their intrusion by gabbro dikes and sills, and the presence of large offset ductile and brittle normal faults. Thus, drilling at Hole 504B suggests that the layered crust model is at least locally valid, there are indications that the geological structure of the oceanic lithosphere may be spatially heterogeneous and controlled by factors such as ridge magma supply variations. To document this heterogeneity, and the mantle and crustal processes that lead to it, is an important goal for oceanic lithosphere drilling in the coming years.

A1.1.2 Magmatic and Tectonic Processes

The magmatic system at ocean ridges can be viewed as having three basic components: (1) the production of melt in the upper mantle and its segregation and ascent to crustal depths; (2) the evolution of magmas in crustal reservoirs and their crystallization to form gabbros; and (3) the eruption of basaltic melts on the seafloor, forming the uppermost oceanic crust. Tectonic processes linked with plate divergence at mid-ocean ridges, and with the associated motion along large and small transform faults, are intimately coupled with the magmatic evolution of the crust. Understanding the crustal accretion process and constraining the interplay between magmatism and tectonism at and near the ridge axis is of primary importance for the Lithosphere Panel. The most important questions which must be answered to better understand this system are the following:

- What is the horizontal and vertical extent of the zone of melt production in the upper mantle?
- How and why is magma focused at a narrow ridge axis when it is presumed to be generated from wide melt zone in the mantle.
- What are the shapes, sizes and longevity of crustal magma chambers?
- What are the relationships between magma chambers dynamics and solid state deformation of the newly accreted axial lithosphere?
- What are the characteristic length and time scales of an MOR volcanic cycle?
- What is the role and extent of off-axis volcanism in the formation of oceanic crust?
- How is oceanic crust chemically and physically modified as it is transported away from the ridge crest?
- How does the newly accreted axial lithosphere deform?
- What can be learned about lithospheric accretion processes through studies of lower crustal and upper mantle sections exposed either within or near fracture zones?

Contributions from Drilling

The answers to almost all of these questions will require a multidisciplinary approach involving detailed geologic mapping and sampling, geophysical experiments, and long-term monitoring of selected sites along the ocean ridge system. This will require close collaboration with other initiatives (especially RIDGE and InterRidge) to ensure coordination of research on selected parts of the mid-ocean ridge system. Drilling, however, can make unique contributions to the effort of understanding the magmatic and tectonic processes of mid-ocean ridges.

- Drilling is the *only* way to ground-truth models of crustal structure and composition beneath the seafloor, and to test the geological correspondence of seismic horizons and reflectors. Dredging and submersible exploration of large fault scarps such as fracture zones or rift valley walls may complement, but cannot replace drilling for the achievement of this goal, as large faults are by, definition, discrete zones of lithospheric discontinuity.

- Drill cores, complemented with logging data in intervals of poor recovery, provide vertically continuous sections in which it is possible to assess the stratigraphic relationships between units, the geometry, vertical extent, and crosscutting relationships of successive sets of magmatic intrusions, hydrothermal veins, and deformational structures. This is of primary importance for a number of issues such as: the fractionation processes and dynamics of axial magma bodies, the kinematics and distribution of deformations, the interplay of deformational, hydrothermal and magmatic processes in the lower crust and upper mantle; and the episodicity of volcanic eruptions at a single location (by counting the number of individual lava flows in a given time interval). Furthermore, through precise age dating it may be possible to develop true age-related stratigraphic sections, to assess the importance of off-axis volcanism and intrusion, and to determine the length of time required to develop the characteristic litho- and magneto-stratigraphy that is generally observed.

- Drill holes can be used for borehole logging, downhole experiments and long-term geophysical monitoring. They are an essential component of the ocean bottom observatory concept. Downhole geophysical experiments in two or more closely spaced drill holes may also prove to be a unique way to assess the small scale heterogeneity of the oceanic lithosphere. Such experiments must be designed so as to characterize both the tectonic sources of heterogeneity and those related to magmatic variations.

Drilling Strategies and Priorities

(1) <u>Sampling of upper crust</u>. Many of the above questions concerning ocean ridge magmatic and tectonic problems can be best addressed by drilling young (< 1 m.y.) to depths of only a few hundreds of meters or less. In order to achieve many of the near axis drilling objectives including drilling through a magma chamber seismic reflector and the installation of natural laboratories on the seafloor, will require further development of the diamond coring system ("DCS"). Without such a system, deep (100-500m) penetration and recovery of young and highly fractured upper oceanic crust will not be possible. Hence, the highest engineering priorities of this panel is the continued development of DCS. The panel clearly recognizes that this endeavor will require a substantial commitment of ODP resources, however, without a bare-rock drilling capability many upper crustal drilling objectives can not be accomplished with the present drilling technology.

Once DCS is "on line" a high priority objective of this panel will be to establish a natural laboratory near and along an active ocean ridge segment. The idea is to drill a series of isochron and flow line holes at depths ranging from 100 to 500 meters within a recognized active magmatic cell. The holes would be positioned close enough to permit cross-hole tomography and other geophysical experiments. At a fast spreading ridge the laboratory, including the deep (7500m) axial hole, should be located where a crustal magma chamber has been identified geophysically. The 9°N region of the EPR, where

DCS system has already been tested, may be an ideal area to set up a long term ridge monitoring laboratory. It's anticipated that near axis seamounts will also need to be drilled in order to provide important information on the formation, transportation and composition of melts erupted in a near ridge environment.

(2) Sampling of the lower crust and upper mantle. The best constraints on processes below the upper crust will come from direct samples of rocks formed at those depths. Two strategies exist for sampling such rocks: moderate-depth holes in tectonic windows that have exhumed lower crust and mantle rocks, and deep drilling of unextended lithosphere. For the near future, the greatest returns will come from moderate-depth holes in tectonic windows, following strategies outlined in the Offset-Srilling Working Group report. Recently drilled Hess Deep sites are examples of the Offset Drilling approach and provide valuable data on processes occurring in a fast spreading ridge magma chamber and crust-mantle transition. Scheduled drilling in the MARK area, in the Atlantic, will follow a similar strategy and help characterize processes of crustal formation and emplacement of upper mantle rocks at a slow spreading ridge. These results should complement the lower crustal sections already available from drilling at site 735B.

For the long term, there are advantages to very deep holes reaching the lower crust and mantle in unextended areas of thick upper crust because it appears that such areas are characteristic of a large proportion of the lithosphere created at mid-ocean ridges, especially at fast and intermediate spreading rates. In such areas, deep drilling is the only way to characterize crustal and upper mantle processes, with no interference from superimposed extension linked with the formation of tectonic windows. Despite accute technological difficulties, site 504B has provided valuable data on such an unextended crustal setting in an intermediate spreading rate context, and there may be good prospects for recovering gabbro at this site in the near future. Due to the extent of gabbro recovery from Hole 735B (very slow spreading rate) and the excellent prospect for gabbro recovery from Hole 504B (intermediate spreading rate), the top priority for the next deep drilling initiative is at a fast spreading locality. Preference should go to a site where basement morphology and seismic structure suggest formation at ridge analogous to active cases with an axial magma-chamber reflector at 1.0-1.5 km depths. Age of the site will have to be more than 1-2 Ma to be sure that high temperatures will not prevent drilling to 1.5 km, and an age above about 10 Ma will ensure that temperature is not a limiting factor at any crustal depth.

A1.1.2 Hydrothermal Processes

A1.1.2.1 Hydrothermalism at Mid-Ocean Ridges

Ridge crest hydrothermal systems are an integral part of a fundamental planetary process. They transport a large fraction of the Earth's heat flux to the surface and are associated with the formation of metallic sulfides that are analogues to economically important ore deposits on land. Heat lost through hydrothermal circulation has a pronounced effect on the size and longevity of crustal magma chambers, and the circulating fluids are responsible for a major part of the flux of Mg and other elements into or out of the oceans. Understanding the mechanisms and consequences of ridge crest hydrothermal activity which affects the composition of both seawater and oceanic crust (and leads to the creation of unusual biological communities) is a basic goal of lithospheric studies.

Draft document-not for general circulation; May, 19

Three kinds of submarine hydrothermal systems have been identified. The most spectacular are the high-temperature, black smoker and lower temperature white smoker systems found at sediment-free ridge crests such as the (fast spreading) East Pacific Rise and (slow spreading) Mid-Atlantic Ridge. They are associated with sulfide-bearing fluids with temperatures up to 360°C. on the sea floor which precipitate iron, copper and zinc sulfides in chimneys and mounds in response to mixing with cold seawater. The second is associated with sediment-buried ridge crests like Middle Valley (northern Juan de Fuca Ridge), Escanaba Trough (southern Gorda Ridge) or Guaymas Basin (Gulf of California). Here the system is modified by the relative impermeability of the sediments, and chemical reactions between the hydrothermal fluids and the sediments. Thermal maturation of organic matter in the sediments might have played a role in the generation of petroleum occurrences in the geologic record. The third kind of system is the low temperature type (10-20°C) which may be largely a product of subsurface mixing of high-temperature hydrothermal fluids with seawater. At the seafloor, this type of system is associated with oxide deposits, whereas metallic sulfides are supposed to occur beneath the seafloor. Ridge crest and, probably more important, off-axis low-temperature hydrothermal activity may account for as much as 80% of the total heat loss from ocean ridges.

There are four essential components to any hydrothermal system: (1) a heat source, (2) a source rock, (3) a permeable medium, and (4) a circulating fluid. Processes operating in hydrothermal systems are highly interactive. The system is thermally driven by the presence of hot rock or magma at shallow crustal levels (2-3 km) and high-temperature pulses of hydrothermal activity may be related to periodic replenishment of a magma chamber. Conductive heat transfer from the magma chamber to the host rock intensifies the local state of stress through expansion of the fluid-saturated host, leading to fracturing and increased permeability which in turn augments fluid circulation and the rate of heat transfer. This may be balanced by the precipitation of alteration mineral assemblages in veins of the fracture network, thereby decreasing permeability. Despite the fundamental nature of this interface between molten and cracked rocks, it is one of the most poorly understood aspects of any active hydrothermal system.

A basic understanding of submarine hydrothermal systems requires answers to the following questions:

- What is the size, shape, depth, temperature, and time-dependent behavior of the heat source?
- What are the spatial and temporal variations in permeability, composition and alteration of the host rocks?
- What are the time/space variations in physical properties and composition of the circulating fluids?
- What are the feedback loops linking the evolution of these principal components?

Contributions from drilling

Studies of fossil hydrothermal systems preserved in ophiolites have provided valuable insight into the subsurface geometry and composition of submarine hydrothermal systems. One important objective of drilling must be to test the hypothesis that these systems are a useful analog of the active hydrothermal systems at ocean ridges. However, even if this hypothesis is valid, there are many aspects of hydrothermal systems that cannot be determined from an extinct system, including the variations in permeability and porosity of the host rocks, the physical properties and composition of the circulating fluid, the dynamics of the water-hot rock interface, and the nature of the formation of sulfide deposits. Drilling is the only available tool for constraining many of these parameters in an active submarine hydrothermal system, and is particularly important for:

- Evaluation of the processes which lead to the formation of large sulfide deposits at and below the seafloor (i.e., recrystallization and replacement).
- Penetration of the deeper levels of an active hydrothermal system (i.e. the upflow and underlying reaction zones).
- Determination of the in-situ physical properties in the host rock (porosity, permeability, pressure, temperature, etc.) and recovery of samples of deep hydrothermal and pore-water fluids.
- Three-dimensional characterization of the hydrologic regime and the geochemical fluxes within a hydrothermal system.
- Long-term monitoring of hydrothermal activity to determine how these systems evolve with time.
- Recovery of a record of the time-integrated alteration history of the oceanic crust by drilling off-axis.

Drilling strategy and priorities

The primary goal of a ridge crest hydrothermal drilling program should be the establishment of a deep penetration (>1000 m), high-temperature reference hole in an active hydrothermal system. The target should be the penetration of the boundary between a vigorous hydrothermal system and an identifiable heat source (or at least the magma chamber reflection) which may require at least 2000 m of drilling. The physical and chemical properties, and the thickness and dynamic behavior of this boundary are completely unknown, yet they control the style and vigor of heat and mass transport within the magma chamber as well as that of the surrounding hydrothermal system.

Another goal of a hydrothermal drilling program should be to examine along-axis and across-axis variations within a single ridge segment. Along-strike variations include at least two scales of investigation, the segment scale (10s of kilometers) and the scale of individual on-axis hydrothermal circulation cells (size uncertain, but probably of the order of 0.5 to 4.0 km). Ideally, these shallower holes (100-500 m) would sample both the discharge and recharge zones of the circulation cell. The cross-axis holes would investigate the aging of the hydrothermal system, and their spacing would ideally reflect the size of ridge flank hydrothermal cells determined from detailed heat flow investigations prior to drilling.

A third goal of a long-term hydrothermal drilling program should be to investigate the fundamental differences between hydrothermal systems at sedimented and sediment-free spreading centers. The presence of a relatively impermeable sediment layer strongly moderates heat loss from the system and has a profound chemical effect on fluid compositions. These systems may be a modern analog of the large, sediment-hosted massive sulfide deposits frequently found on land.

Finally, drilling seafloor hydrothermal systems must take into account the positioning of drill holes and arrays of drill holes to optimize post-drilling experiments. For example, seismic and electromagnetic tomography from boreholes, together with multichannel seismic imaging of the roof of the magma chamber, promise to provide important physical constraints on key components of submarine hydrothermal systems. Implementation of a borehole seal (CORK system) permits time-series fluid sampling and long-term monitoring of properties such as temperature and pressure.

Some hydrothermal drilling objectives can be obtained with existing drilling technology. For example, characterizing a hydrothermal system at a sedimented ridge crest involves reaching the high-temperature basalt-water portion of the system which can be achieved by drilling less than a kilometer of overlying sediments. The principal technical difficulty in this case are the high- temperatures (>350°C). ODP has successfully carried out high temperature drilling at Middle Valley (northern Juan de Fuca Ridge), where downhole temperatures were depressed by cold seawater flowing into the hole. Special heat-resistant logging tools and borehole instrumentation are however required. The technically most difficult hydrothermal objective is the deep, zero-age hole at a sediment-free ridge crest. This hole will require bare-rock spud-in, improved crustal drilling technology and a substantial commitment of drilling time (3 legs ?) to be feasible.

A1.1.2.2 Hydrothermal Processes at Back-Arc Ridges

The local tectonic features of ridge formation and rifting in back-arc environments are similar to those of mid-ocean ridges, the major difference being that back-arc rifts are developing in oceanic crust above a subduction zone. In some cases, back-arc rifting may occur in fragments of continental crust close to continental margins (e.g., Okinawa Trough, East China Sea). Hydrothermal systems forming at back-arc rifts also display many similarities to those at the mid-ocean ridges. The composition of fluids and hydrothermal precipitates, however, is a consequence of the host rock lithology. Sulfides in immature back-arc rifts which are commonly associated with lavas that are more siliceous than those normally found on the mid-ocean ridges are usually enriched in elements such as Pb, As, Ag and Au. In contrast, massive sulfides forming in more mature, basalt-dominated, back-arc rifts have a composition which parallels that of mid-ocean ridge sulfides. Hydrothermal systems in immature back-arc settings are believed to closely resemble major sulfide ore deposits found in felsic volcanic sequences on land. Contributions from drilling as well as drilling strategy and priorities outlined for hydrothermal systems at the mid-ocean ridges largely also apply to back-arc environments. Drilling deep into back-arc hydrothermal systems, however, is the only way to answer questions related to in situ interaction of seawater with felsic lavas and to determine possible contributions of subduction-related magmatic fluids. Drilling arc and fore-arc regions will help to constrain fluid circulation in those environments.

A1.1.3 <u>Fracture Zones and Transform Fault Processes</u>

Though the kinematic role of transform faults has long been understood, transforms and their off-axis extensions remain the most enigmatic of the common features on the seafloor. Fracture zones often include the deepest points on the mid-ocean ridge system, a fact generally attributed to a thin crust caused by excess cooling at the ridge-transform-intersection (RTTs). Paradoxically, some RTT's include a topographic high (especially on fast spreading ridges), which may be caused by enhanced volcanism. Transforms also often include median or transverse ridges that are often shallower than the adjacent spreading ridge segments. These features are poorly understood, and a number of mechanisms have been suggested for their presence. These include excess volcanism (a leaky transform), serpentinization of the upper mantle, flexural deformation related to cooling, and dynamic uplift.

Fracture zones often expose rocks believed to originate in the lower oceanic crust or upper mantle. In fact they provide some of the best support for the "ophiolite" model for oceanic crust because most of the stratigraphic units of ophiolites have been observed in various fracture zones. However, fracture zones are, by definition, anomalous (but common), and therefore caution needs to be exercised when extrapolating fracture zone observations to the crust in general.

Draft document-not for general circulation; May, 1993

There are a number of unanswered questions concerning fracture zone volcanism and tectonics:

- How do fracture zones affect the dynamics of the adjacent spreading ridges?
- What is the mechanism by which median and transverse ridges form?
- Is the mechanism of formation of highs at Ridge-Transform-Intersections the same as for median ridges, or is there another mode of formation?
- How is the strike-slip faulting associated with seafloor spreading distributed in time and space in the relatively wide transform fault zone?
- What can be learned about crustal accretion processes through studies of sections of crust exposed on fracture zone cliwa?
- How does the bathymetry of fracture zones evolve with time?
- How do fracture zones behave in their "inactive" or "aseismic" extensions? Do these extensions accommodate hydrothermal activity in older crust? Are they the site of extensive ongoing vertical tectonics?

Contributions from drilling

In order to answer the above questions, a number of avenues of research are required, including geophysical measurements, theoretical modeling and bottom observations. Drilling can make a fundamental and irreplaceable contribution through both sampling and innovative downhole experiments.

Coring can provide constraints on timing of uplift and subsidence by recovering stratigraphic sections from sedimented fracture zones, including those where the topographic highs once extended to the ocean surface and therefore include carbonate caps. The dramatic bathymetry of fracture zones limit the resolving power of surface geophysical measurements. Yet seismic observations can be the most powerful tool to resolve between mechanisms for uplift and subsidence in fracture zones. Deep drilling can drastically improve the quality of seismic information through the use of offset seismic profiles and vertical seismic profiles. This requires that site and hole location should be partly constrained by the design of these experiments, and not just by sampling criteria.

Drilling Strategies and Priorities

Several proposals already exist for drilling into or near fracture zones, with the main goal of many being to sample the "normal" crust exposed by the transform activity. Of equal importance is gaining an understanding of the dynamics and structures of the transform activity itself (e.g. median ridges, bathymetric deeps etc.). A start on both of these very important objectives will be made in 1994, when drilling is scheduled for two regions. The first is the MARK area where an offset drilling strategy will begin to sample sections of gabbro and peridotite that are exposed near the Kane Fracture Zone. The second is the transverse ridge of the Vema Fracture Zone, which will be drilled as an Engineering Test of the DCS system, and will address the subsidence history of the ridge by drilling through the carbonate cap.

Transforms on fast spreading ridges may be fundamentally different than those on slow spreading ridges. Therefore, a drilling program needs to include features of transforms within both types of settings. A high priority for the short term should be to drill a series of holes at a transform fault on a fast-spreading ridge. It is also desirable to drill fracture zones away from the mid-ocean ridges since they may provide the major conduit for continued hydrothermal circulation, perhaps ongoing volcanism and ongoing (perhaps aseismic) tectonism in older crust.

Draft document-not for general circulation; May, 1993

A1.2 Physical state and evolution of the oceanic lithosphere

A1.2.1 Physical State of the Oceanic Lithosphere

A knowledge of the thermal and mechanical evolution of the oceanic lithosphere, and the stresses acting on the plates, is important for understanding a number of fundamental problems, including the subsidence history of oceanic crust, the kinematic evolution of plate boundaries, and the coupling between lithospheric and asthenospheric processes. While these problems can be approached with a variety of different techniques (e.g. satellite geoid and gravity studies, seismic reflection and refraction investigations, heat flow measurements, etc.), drilling represents a potentially valuable tool.

Contributions from Drilling

Recent compilations of maximum horizontal stress orientations suggest that global stress orientation is oriented primarily along directions of plate motions. To date, however, there are only a few reliable in situ stress measurements made in oceanic crust which could shed further light on these continent-based observations. One high priority focus of drilling should be to determine the stress and deformation history of the lithosphere in the critical tectonic regimes that characterize mid-ocean ridges. A program of this type coucould closely integrated with drilling to meet other thematic objectives discussed in this paper.

Drilling Strategies and Priorities

Reliable in situ stress measurements can now be made in drillholes by using stress-induced borehole breakouts and acoustical imaging logging tools. Determining the stress regime at a mid-ocean ridge would involve drilling a series of holes that penetrate 100-200 m into basement located in a number of relatively closely-spaced (<1 km to tens of km) arrays or transects along and across the ridge crest. These should be augmented with detailed physical property and borehole studies which would help define the kinematics of brittle crustal deformation and the physical properties of the crust.

Such a program could begin immediately. In many cases, the same holes drilled for studies of paleoclimate change, extinction events, or crustal geochemical variability can be used for in situ stress measurements, provided the hoe is deepened 100-200 m into basement. Ridge axis stress studies will require improvements in drilling capabilities into young crust, but they can be closely coordinated with other ridge crest drilling.

A1.2.2 Physical and Chemical Evolution of the Oceanic Crust

Seismic refraction and reflection experiments have shown that on a large scale, the oceanic crust is strikingly uniform as would be expected since it is generated at the mid-ocean ridges by similar (although complex and poorly understood) processes. However, oceanic crust is not a passive passenger riding the lithosphere from ridge crest to subduction zone, but rather is maturing and evolving along the journey.

Dramatic changes in the physical and chemical characteristics of the shallow oceanic crust can occur near the ridge axis in zones of high temperature, forced hydrothermal convection driven by ridge crest igneous activity. Hydrothermal alteration of basalt, diabase, and gabbro is locally intense, but the alteration may be highly focused along high permeability pathways, especially near the seafloor in hydrothermal discharge zones. As oceanic crust moves out of the neovolcanic zone, the porosity and permeability structure are highly modified by tectonic extension.

As the crust ages to a few hundred thousand years, seismic studies in the Pacific have shown that layer 2A thickens. Two causes for this observation have been suggested:

- off-axis volcanism adds to the highly porous extrusive layer of the crust
- on-going fracturing and fissuring increases the porosity in the pre-existing extrusive and intrusive crust.

Further compositional and structural evolution continue over longer periods. In particular, seismic velocities in layer 2A increase as the crust ages to 20 (or more) million years. Because seismic velocities are particularly dependent upon bulk porosity, this has generally been attributed to the sealing of pores by alteration minerals. Much of this alteration presumably occurs due to passive hydrothermal convection driven by conductive cooling of the oceanic lithosphere initially open to exchange with overlying sea water. At a greater distance (age) from the spreading center, the seafloor becomes sealed from open hydrothermal convection when the blanketing sediment becomes thick enough to bury the sea floor topography. Passive hydrothermal circulation will continue in the more permeable basalt, but will be sealed from exchange with ocean water by the impermeable sediment cover. Isolation from recharging seawater and closed convection within the upper oceanic crust should result in reduced thermal gradients that will approach isothermal in the most permeable basalt. The composition of the circulating fluid should also change to reflect the increasing rock dominance of the system.

The integrated effects of seawater-rock interaction result in the vertical metamorphic gradients observed in ophiolite sequences and in Hole 504B in the oceanic crust. The chemical flux between the hydrosphere and the lithosphere is most intense within the uppermost oceanic crust (but may extend to the lower crust as well). Some fundamental changes include hydration of the oceanic crust and exchange of Mg and Ca between the hydrosphere and lithosphere. The effects of these chemical fluxes extend far beyond the bottom of the ocean, for the altered oceanic crust is eventually subducted thereby influencing the evolution of volcanic arcs and the flux of crustal material into the mantle. In spite of the global importance of the energy and chemical fluxes between the hydrosphere and the lithosphere, the timing, magnitude, and in some cases, even the direction of these fluxes remain poorly known. The above observations lead to a number of fundamental questions about the evolution of the ocean crust:

- What causes the thickening of the low velocity, high permeability layer 2A in very young crust?
- What causes the long-term increase in upper crustal seismic velocities (that is, the apparent thinning of Layer 2A)?
- If the long-term increase in seismic velocities is caused by precipitation in pores from hydrothermal circulation, what is the timing and nature of the circulation?
- Is the evolution of the uppermost crust accompanied by circulation in, and alteration of, the rocks of the mid and lower crust (layers 2B, 2C and 3)?
- Does the crust continue to evolve beyond the 30 million years "limit" indicated by seismic experiments?
- How much geochemical exchange occurs between the crust and the overlying sediments and water?

Draft document-not for general circulation; May, 19

Contributions from Drilling

The physical and chemical evolution of oceanic crust is a subseafloor process that can only be addressed by drilling. The porosity and permeability structure of the oceanic crust is vertically zoned with the lithostratigraphy of the oceanic crust, and hydrothermal circulation is driven by vertical temperature gradients. It is therefore necessary to drill deeply into the oceanic crust to elucidate the processes and effects of chemical evolution of the oceanic crust. Samples recovered by drilling and geophysical logging of drillholes provide the necessary ground-truth and intermediate scale data to evaluate the larger scale geophysical techniques used to map variations in the oceanic crust. The evolution of the oceanic crust results from the time-integrated superposition of a continuum of processes that occur on-axis, near axis and beneath the sediment cover well away from the spreading axis. Understanding the processes that result in the evolution of oceanic crust therefore requires drilling in several environments that represent different stages of the evolution.

Drilling Strategy and Priorities

The Lithosphere Panel recognizes that deep drilling provides the only method for testing hypotheses about crustal evolution. The highest priority for drilling to understand the evolution of the oceanic crust is to examine the process in a number of environments that are representative of the continuing stages of the progressive evolution. At a minimum, this requires drilling in the neovolcanic zone to investigate high temperature forced hydrothermal convection, drilling in the near axis zone of passive hydrothermal circulation open to recharging seawater, and drilling well off-axis where passive hydrothermal circulation is closed from exchange with seawater by an impermeable sediment blanket. The age and distance from the spreading axis for each of these zones are clearly functions of the spreading rate, seafloor morphology, and sediment accumulation rates. Detailed geological and geophysical mapping, including high resolution seismic and heat flow, are required to define the stage of evolution in any area.

The most profound geophysical changes in oceanic crust with increasing age are the velocity increase in layer 2A, and its eventual merger with layer 2B. Therefore the highest priority drilling targets are the uppermost oceanic crust. An ideal experiment would drill a time transect along a flow line of oceanic crust that had a simple and constant history that could extrapolated to "typical" oceanic crust. Questions about layer 2A require holes penetrating at least to seismically resolved thicknesses (200-600 meters). Deeper would be preferable, particularly to examine evolution of the deeper crustal layers. Obviously, only a few such holes can be drilled over a ten year period, and the selection of sites must be judicious. The majority of sites should be in 0 to 10 million year old crust where the most rapid changes are taking place. Sites at about 20 million years plus two older sites could also be very important. Clearly, the sites should be chosen so that they address other priorities in the drilling program. Because evolution of oceanic crust is clearly influenced by tectonic history, second stage experiments would examine the evolution of the oceanic crust as a function of spreading rate and tectonic setting.

Draft document-not for general circulation; May, 1993

A2. Structure and scale of compositional variability of oceanic crust and upper mantle

A2.1 Spatial Heterogeneity of Crust and Upper Mantle

The global oceanic spreading center is a non-uniform structure that displays significant variations in its morphology, crustal thickness, gravity and chemical composition along axis. In addition, the ridge displays a pattern of tectonic segmentation that is observed at scales ranging from 101 to 102 kilometers (i.e. devals, OSC's, transforms). Often the observed petrological provinces correspond with the defined structural segmentation. Since MORB's are produced from pressure release melting of the upper mantle, the observed spatial zonation in basalt composition supports the belief that the upper mantle beneath the ridge must be chemically heterogeneous on similar scales. The origin of these mantle heterogeneities and their size and mechanism of dispersion in the upper mantle beneath the ridge are still unknown. However, the existing spatial variations in oceanic crust can provide valuable insight into the processes relating to temporal changes in the volumes of melt formed in the mantle and the patterns of delivery to overlying crust. Understanding how the observed spatial chemical variations of the oceanic crust relate to the extent of melting, mixing of melts, depth of melting and source heterogeneity as a function of time is now of critical importance.

The observed variations in ridge structure and composition are a consequence of the temporal and spatial changes in the MORB source regime and the mantle melting conditions. In order to understand ridge magmatism and crustal formation, we need to document the nature and scale of mantle heterogeneities not only at zero age, but also for older oceanic crust. At the present time, our knowledge of the ridge system is both spatially and temporally restricted since the majority of the petrologic and geophysical data have been collected in close proximity to the sparsely sedimented active ridge crest. The geochemical record that is preserved in the oceanic crust away from the ridge axis is concealed beneath sediments and is accessible only by drilling. Systematic off-axis drilling will provide the required spatial and temporal sampling necessary to adequately evaluate the processes responsible for producing spatially variable oceanic lithosphere.

Contributions from Drilling

Recovering older (> 1 m.y.) basaltic crust by drilling can provide important information about temporal and spatial variations in upper mantle composition and the processes responsible for generating ORB melts. Drilling can make two unique contributions. First, drilling can provide a continuous, high resolution record of the history of magmatic activity at one location on a time scale shorter than that of the construction of layer 2 (105 to 106 years). This type of vertical stratigraphy, which is unavailable from surface sampling (e.g. dredging, rock coring), permits evaluation of short-term variations in the magmatic budget and mantle chemistry at a single location. Second, drilling provides the only method of penetrating heavily sedimented older crust. Drilling and recovering older oceanic crust can provide constraints on the temporal variability on time on scales of 106 - 108 years.

Drilling Strategy and Priorities

The fundamental questions concerning temporal and spatial heterogeneity of the oceanic crust and upper mantle can be addressed by systematically drilling off-axis holes, with 100 meters or more of basement penetration, both parallel and perpendicular to the ridge axis within a regional context. The number and pattern of spacing of these drill sites will depend on spreading rates, ridge morphology, segmentation, etc. In terms of drilling priorities in regions identified for off-axis "temporal and spatial" drilling, segments should first be structurally and chemically well documented along strike. Both plume and non-plume segments need to be investigated.

A2.2 The long-term evolution and dynamics of the Earth's mantle

Long term questions of mantle composition, heterogeneity and dynamics are of fundamental importance to our understanding of the differentiation of the mantle, plume driving forces, and the evolution of the ocean basins and continents through geologic time. Apart from the information on the chemistry and dynamics of the mantle contained in the chemical and isotopic signatures of lavas erupted along ridge, at seamounts and hot spots, and on oceanic plateaus, a complementary perspective comes from three-dimensional seismic imaging of the mantel. Tomographic images of the mantle show large regional variations in the seismic velocity of the upper and lower mantle that can be related to patterns of mantle convection. Integrating these geophysical observations with a global program of geochemical mapping holds great promise for increasing our understanding of the mantle over the next decade.

Contributions from Drilling

ODP can make two unique contributions to these studies:

- expansion of the Global Seismic Network to include ocean-bottom seismic stations located in drillholes to improve the resolution of the tomographic studies. One hole has already been drilled off the coast of Hawaii specifically as part of this program.

- systematic sampling of older, sedimented crust, seamounts, oceanic plateaus and hot spot volcanoes to improve constraints on the global geochemical variability of the mantle over time scales of 106-108 years.

Drilling Strategies and Priorities

Establishing a network of seafloor seismic stations will emplacement in all the major ocean basins with a distribution that will complement the land-based stations of the Global Seismic Network. These stations should be in crustal holes that are 100-200 m deep, and should include both short-period and long-period, broad-band seismometers. This program needs to be carefully coordinated with ODP all drilling, as holes drilled for other purposes may be suitable for seismometer emplacement at a later date.

Recovering older oceanic crust to investigate mantle evolution through variations in chemical and isotopic compositions is discussed in the previous section.

B. LARGE IGNEOUS PROVINCES

Large igneous provinces (LIPs) are a continuum of voluminous crustal emplacements of predominantly mafic extrusive and intrusive rock which represent a fundamental mode of mantle circulation. This mode of circulation and igneous activity is commonly distinct from that which characterizes plate tectonics and sea floor spreading. LIPs are a global phenomenon and include oceanic plateaus, submarine ridges, seamount groups, and ocean basin flood basalts, as well as continental flood basalts and volcanic passive margins. LIPs are the most voluminous accumulations of mafic material on the

Earth's surface, other than basalts and associated intrusive rock emplaced at spreading centers. They therefore provide windows into the compositions and dynamics of those regions of the mantle which do not generate normal mid-ocean ridge basalt (N-MORB). They now account for between 5% and 10% of the heat and magma expelled from the mantle. These fluxes, however, are not evenly distributed in space and time; their episodicity punctuates the relatively steady-state production of crust at seafloor spreading centers. These intense episodes of igneous activity temporarily alter the flux of solids, particulates, volatiles, and heat from the lithosphere to the hydrosphere and atmosphere, possibly resulting in global environmental change and excursions in the chemical and isotopic composition of seawater. To account for voluminous magmatism which creates LIPs, two fundamentally different and mutually exclusive models have been proposed. In the "active" plume model, igneous activity is caused when a transient broad mantle plume "head" impinges on the base of the lithosphere and is sustained by a deeper narrow plume "tail" that rises through the thermal wake of the plume head. In the "passive" plume model, lithospheric extension allows a preexisting steady-state mantle plume to penetrate the crust and initiate igneous activity. A third model, which pertains largely to volcanic rifted margins, is that of "secondary convection", in which asthenospheric mantle convectively overturns close to the conjugate trailing edges of pre-existing thick and cold lithosphere. Lithospheric plate motion vectors are recorded by persistent volcanism that produces a linear submarine ridge or seamount chain.

Contributions from Drilling

The major objective of LIP studies is to describe and understand upper crustal to upper mantle igneous and deformational processes related to their emplacement, how they relate to deeper mantle processes and dynamics, and how they relate to plate tectonic processes. Generally, LIP crust is buried under as much as 1.5 km of sediment; hence, drilling is in most cases the only method of recovering samples of basement rock. Paleontological evidence from the sediments deposited on the plateaus will provide important constraints on the age of these features and their long-term subsidence history.

ODP legs 104, 113, 114, 115, 119, 120, 129, 130, 143, and 144, although primarily reconnaissance drilling, have paved the way for implementation of transect strategies on LIPs and of more site-specific strategies on seamounts. Drilling of LIPs in different tectonic environments will address questions regarding:

o Behavior of mantle plumes. Do plumes play an "active" or a "passive" role in LIP emplacement? Is there evidence for any plumes to have originated from extraterrestrial impacts? Emplacement environments range from purely extensional (e.g., Iceland) to intraplate (e.g., Hawaii), but the original tectonic setting for many LIPs (including the two giants, Ontong Java and Kerguelen-Broken Ridge oceanic plateaus) remains unknown. Because parental magma of basalts in the two models originates at different mantle depths and follows different time-temperature paths, petrological and geochemical studies of drill core samples and estimates of magma production rates will constrain relative contributions from the two processes. "Active" and "passive" plume models both predict that volcanic sequences would show evidence of high mantle temperatures (deep melting), and an associated source composition anomaly near the locus of plume upwelling. The "active" plume model should show diminution of inferred mantle temperature and source composition anomalies both with distance from the plume locus and with decreasing age of rocks within a LIP. In addition, mixing of lower mantle with entrained upper mantle in the plume head may produce major fluctuations in magma composition reflected, for example, in variations in trace element and isotopic systematics with stratigraphic height in the volcanic sequence. For LIPs emplaced near continental lithosphere, significant contamination of the earliest emplaced basic lavas could be a hallmark of this model because mantle melts have to actively rift and traverse a thick and only moderately fractured crust. Scales of heterogeneity are poorly understood. For the "passive" plume model, however, volcanic sequences may document decoupling between thermal and source composition effects with increasing distance from the locus of plume upwelling.

o Interaction of mantle plumes and lithosphere. How is heat added to the lithosphere and what is the role of volcanoes in raising temperatures? Is significant thinning a prerequisite for voluminous magmatism, or is lithospheric deformation a direct consequence of hot asthenospheric material rising to shallow, crustal levels? What is the vertical tectonic history of the LIP, and what are the relative thermal and dynamic contributions of upwelling lithosphere in producing swells? Deep LIP basement (500-1000 m) and sedimentary equivalent (moat) samples, in conjunction with high-quality geophysical data, can constrain (i) overall timing of the deformation, and (ii) relative timing of elastic response from which strain rate, effective elastic thickness of the lithosphere, flexural rigidity, relative importance of lithospheric reheating, and possible lateral flow of material at deeper levels can be determined.

o Deformation and timing of the entire LIP emplacement process. Drilling can provide a vertical stratigraphic record in syn-constructional sediment which constrains absolute and relative ages of uplift, magmatism, and subsidence during LIP emplacement and evolution. Reference holes on older normal oceanic crust will provide evidence for nature of the initial stages of volcanism. Accurate dating of LIPs, in particular their extrusive components, will provide input for correlations and cause-and-effect relationships with changes in the Earth's magnetic field, true polar wander, and hydrospheric-atmospheric physical and chemical changes, including biotic extinctions, paleoclimate, paleoceanography, paleoenvironment, paleogeography, and sea level. With respect to volcanic rifted margins, drilling can help to resolve whether they develop symmetrically or asymmetrically. Is significant thinning a prerequisite for voluminous magmatism, or is lithospheric deformation a direct consequence of hot asthenospheric material rising to shallow, crustal levels? What is the vertical tectonic history of the seaward-dipping reflector wedge and the earliest oceanic crust?

o Mechanism of magma emplacement. What are the petrological, geochemical, and volumetric characteristics of magmatism, and what is the role of magmatic underplating? What is the duration, rate and episodicity of volcanism and what is the nature of the eruptive style (i.e. are subaerial flows present)? How do LIPs compare with continental flood basalt provinces. Full sampling of the sequence of volcanism by drilling a LIP and its sedimentary equivalents will provide critical information on the petrological and geochemical evolution of magmatism during rifting, and by inference constrain the thermal and compositional evolution of the underlying mantle. Igneous basement samples can provide information on asthenosphere-lithosphere interactions.

o Flux of volatiles and heat from the lithosphere. How do intense pulses of igneous activity associated with LIP emplacement affect the physical, chemical, and isotopic character of the oceans and atmosphere? LIPs may represent a major, heretofore little-considered instigator or contributor to global environmental change. Is off-axis hydrothermal circulation significantly different than ridge-crest hydrothermal activity? Thermal and permeability structure of old oceanic and transitional crust invaded by LIP heat sources likely differs from mid-ocean ridges. Therefore the products and consequences of hydrothermal activity in this setting may differ significantly. Is oceanic crust underlying LIPs fundamentally altered by this hydrothermal activity and could this contribute to the flux of seawater-derived components back into the mantle at subduction zones?

Draft document-not for general circulation; May, 1993

B1. Oceanic Plateaus

Despite their huge size and distinctive morphology, the oceanic plateaus (e.g., Wallaby, Shatsky Rise, Ontong Java, Kerguelen-Broken Ridge, etc.) remain among the least understood features in the ocean basins. They are characterized by 20-30 km thick crust, with many constructed entirely from some combination of MORB and OIB source magmas, but some composed at least partially of continental crust (e.g. Mascarene Plateau).

The plate setting of emplacement of the two primary classes of oceanic plateaus – those exhibiting persistent and those characterized by transient volcanism, is not defined in many instances. Identification of magnetic anomalies on adjacent oceanic crust and of fracture zone traces are required to determine the plate setting of a plateau. Most oceanic plateaus probably result from some sort of hotspot-type volcanism. The associated flux of mass and heat is liberated in non-uniformly both in time and space. For example, the Early to Mid-Cretaceous was marked by a period of about 30 m.y. of unusually intense volcanism, with eruption of diverse magmatic products and complex episodes of uplift and subsidence. The volume of volcanism indicates a major disturbance of the normal thermal and convective pattern in the mantle, which may imply a connection between plateau emplacement and plate tectonics. The two giant oceanic plateaus, Ontong Java and Kerguelen-Broken Ridge, are of particular interest because of the potential environmental impacts of their emplacements. Major questions, however, still exist concerning the duration, rate, and episodicity of volcanism and intrusion on oceanic plateaus.

Post-emplacement, oceanic plateaus appear to subside somewhat along a thermal subsidence curve. However, dynamic flow in the mantle and resulting lithospheric thinning associated with the formation of the plateaus may lead to departures in the vertical motion history with respect to predictions of the standard thermal plate model. Other processes such as extension, compression, and shear bearing little or no relationship to thermal subsidence models may also affect the vertical tectonic history of an oceanic plateau. More information is needed to determine the temporal and spatial development of post-emplacement deformation, which could provide insight into the stress regime of the plateau. The state of lithospheric stress in the vicinity of oceanic plateaus could be estimated by examining whether deformation preferentially occurs on plateaus as opposed to adjacent oceanic crust.

Drilling Strategies and Priorities

The principal drilling strategy for oceanic plateaus would be based on transect sampling, supplemented by holes of opportunity. A drilling transect would normally consist of a series of holes sampling key igneous, sedimentary, and metamorphic rock units, tied to reference holes in normal oceanic crust. Moderately deep (500-1000 m) basement penetration should be achieved to establish uppermost igneous stratigraphy. On some plateaus, e.g., Manihiki and Kerguelen-Broken Ridge, an offset drilling strategy may be applied where deep rifts expose rocks from deeper crustal levels. All drill holes should be continued at least 150 m into igneous basement to constrain age and petrology/geochemistry, and to sample geomagnetic field behavior.

Two drilling strategies are recommended, each of which would address the initiation, emplacement, and post-emplacement phases of oceanic plateau evolution:

o drill longitudinal and latitudinal transects of one of the two giant oceanic plateaus -- Kerguelen-Broken Ridge or Ontong Java -- together with reference holes in the adjacent oceanic crust. At a minimum, this would involve 1 site per 100,000 km2 (i.e., Iceland-size), with at least one site having basement penetration of about 1 km, in order to test for composition and age variations. The longitudinal transect would be drilled normal to magnetic lineations on the adjacent oceanic crust. There has already been some drilling on each of these giant plateaus, which has provided the first samples for dating, petrology and geochemical analyses, and has set the stage for more problem-oriented studies.

o drill longitudinal and latitudinal transects on a plateau of purely oceanic origin -- e.g., Manihiki, Shatsky, Hess, or Wallaby -- which represents one end-member in crustal composition. Minimal areal coverage should be the same as for the giant oceanic plateaus, resulting in about 5 sites not including reference holes. Vertical tectonism could be addressed by drilling the oldest reef-capped volcanoes within a given LIP.

B2. Transition between Continental and Oceanic Lithosphere at Rifted Margins

Divergent rifted margins are among the most prominent topographic features on our planet, and they are the primary storehouses of information on continental breakup. The transition from continental rifting to incipient oceanic rifting to recognizable sea floor spreading, however, remains poorly understood. Asymmetric development of continental margins, as embodied in "simple shear" models, is now a viable alternative to symmetric development as characterized in "pure shear" models. Whether pure or simple shear, traditional views that the crust is significantly thinned prior to rifting have been contradicted by seismic reflection studies which show that an ever-increasing proportion of rifted margins are characterized by large-scale magmatism. Volcanism, commonly observed as, but not limited to, seaward dipping reflector (SDR) wedges, exceeds that in most Phanerozoic continental rifts volumetrically, and crust thickens at the ocean-continent transition (OCT). Three models to account for this voluminous magmatism along divergent passive margins have been proposed: the "active" and "passive" plume models discussed above, and a third "secondary convection" model, in which asthenospheric mantle convectively overturns close to the conjugate trailing edges of pre-existing thick and cold lithosphere. The "active" and "passive" mantle plume models are mutually exclusive, but "secondary convection" could contribute additional magmatism to either.

Contributions from drilling

The overall objective of volcanic rifted margin studies is to describe and understand upper crustal to upper mantle igneous and deformational processes related to continental breakup, and in turn how these relate to deeper mantle processes and dynamics. Because of the abundant supply of terrigenious sediments at developing oceanic rifts, the volcanic products of early rifting are usually deeply buried and the sediment section extensively injected with sills. Drilling is therefore the only way tosample this crust. Drilling at volcanic rifted margins will addressquestions delineated above, as they apply to rifted margins regarding:

Drilling Strategies and Priorities

A drilling strategy based on transect drilling, supplemented by holes ofopportunity, has been recommended for passive margin sequences. A drilling transect would normally consist of a series of holes sampling key igneous, sedimentary, and metamorphic rock units on a volcanic margin, tied to reference holes in normal oceanic crust and/or on the adjacent continental margin. Moderately deep (500-1000 m) basement penetration should be achieved to establish igneous stratigraphy of each SDR, and we strongly recommend that all drill holes be continued at least 150 m into igneous basement to constrain age and petrology/geochemistry.

Two implementations of the transect strategy are proposed:

o the first is to drill a series of holes beginning at a plume locus and then along the strike of a single or conjugate volcanic passive margin(s) in order to evaluate temporal and spatial involvement of the plume with continental breakup. At least one hole should be drilled in each margin segment bounded by major fracture zones away from the plume locus. Such a strategy would allow testing of "active" and "passive" plume models and the secondary convection model. ODP legs 104 and 152 represent the beginning of such a strategy.

o the second strategy is to drill transects across conjugate volcanic passive margins in order to test pure and simple shear models of lithospheric deformation, and to examine the role and temporal evolution of accompanying magmatism. Implementation of this strategy has not yet commenced.

B3. Seamounts and submarine ridges

Hotspot volcanism generates submarine ridges and seamount chains, some of which are clearly built on older oceanic crust as the plate moves relative to the hotspot. However, important questions regarding the coincidence of the ridge and the hotspot and its long term maintenance still have to be resolved. Such features are of considerable lithospheric interest both for the constraints they place on plate kinematics and absolute plate motions, and as a means of investigating the composition and geochemical evolution of the mantle, particularly during the early stage of volcanism.

Mid-plate volcanism represents a thermal perturbation to the cooling lithosphere that can be exploited as a natural laboratory to study the thermal-mechanical properties of the oceanic lithosphere. The thermal anomaly associated with mid-plate volcanism appears to form a broad region of shallow seafloor before significant emplacement of extrusive or intrusive material in the crust. During and after emplacement, the thermal regime of the lithosphere continues to be perturbed, and through time the composition of the magmas reflect to thermal history of the underlying mantle. Ultimately the constructional phase ends and subsidence begins. Most of the characteristics of swells can be explained by the reheating of the mid- to lower lithosphere. However, there is no consensus as to the mechanism by which the heat is added to the lithosphere, the role played by the volcanoes in raising temperatures, or the dynamic contribution of the upwelling asthenosphere in producing swells.

Drilling Strategies and Priorities

Drilling strategies for seamounts, because their igneous basement is more accessible to dredging, and in many cases to onshore drilling, will vary widely depending on specific scientific objectives. As an example, the early evolution of plume magmas, in particular temporal relationships of alkalic and tholeiitic volcanism, source composition, degree of partial melting, fractionation history, and lithospheric contamination, might be studied through intensive sampling of a young seamount.

Draft document-not for general circulation; May, 1993

C. CONVERGENT MARGINS

Convergent margins comprise three tectonic units--forearcs, volcanic arcs, and back-arc basins. The tectonic and magmatic character of these three provinces are linked together, and understanding any of the three requires an understanding of the convergent system as a whole. Convergent margins are of interest to the lithosphere community in two important ways:

•these margins are an important part of global geochemical cycles. Subduction of the oceanic lithosphere is a fundamental part of the mantle's convection cylce and arc and back-arc magmatic activity are important contributors to the chemical evolution of the mantle. Alteration and dewatering reactions in the downgoing slab are part of hydrospheric and atmosphere cycles, and may have a profound influence on the structural and magmatic evolution of forearcs.

•the oceanic crust constructed and modified at convergent margins is that most likely to be preserved in the geologic record. The recognition that many ophiolites form in supra-subduction zone environments --forearcs, arcs, and back-arc -- indicates the need to study oceanic crust in these environments.

The lithosphere community's objectives at convergent margins can be discussed broadly in terms of the problem of quantifying geochemical fluxes. That quantification requires knowledge of lithosphere structure and composition, fluid processes, and magmatic variability in space and time. All of these topics are related--understanding any one requires some understanding of the others.

The quantification of geochemical fluxes through the lithosphere is one of the long-standing objectives of the Ocean Drilling Program. These fluxes, in the broadest sense, include low-temperature fluid fluxes in forearcs, hydrothermal reactions in arcs and back-arcs, magmatic transfer of material from the sub-arc mantle, and return of components to the mantle through the subduction and melting or dewatering of the subducting slab. Understanding the pathways involved in convergent margin geochemical fluxes, and more importantly, quantifying the transport in each of those pathways requires the examination of entire convergent margin systems, from the downgoing plate, through the forearc and arc, to the back-arc and its associated magmatic and hydrothermal systems.

C1. Lithosphere Composition and Structure

One part of understanding geochemical fluxes requires unraveling the distribution of rock units with the convergent margin lithosphere. Understanding that distribution must begin with the material being carried into subduction zones on the outboard plate. Both the sedimentary sections and the underlying, altered oceanic crust may be important contributors to fluid flow and magmatism in the convergent margin system. Recent studies of existing oceanic sediments show a striking correlation between the incoming sedimentary section and the concentration of some geochemcial tracers in arc lavas. More carefully crafted experiments are needed to constrain the links between what is entering trenches and what is observed in fluid and magma flow in the upper plate. These mass balances may be most easily accomplished at intraoceanic arcs, which lack the complexities of margins with thick, ancient continental crust adjacent to the subduction zone.

Forearc tectonics play a crucial role in geochemical mass balances in subduction systems. The forearc structure and sedimentary sections record the history of sediment subduction or accretion and of subduction erosion. It is necessary to understand not only what is currently happening at these margins, but what has happened, and at what rate, in the past. Much of the dewatering of the plate must occur as it passes under the forearc; this dewatering will be manifest in fluid flow and metamorphism in the forearc. Convergent margin forearcs also record three important aspects of volcanism in convergent margins. First, there is growing evidence that many forearcs are floored by voluminous arc volcanics produced early in the development of the subduction zone. However, there is no clear idea of how much of the forearc crust is older, trapped ocean crust and how much is newly produced arc crust. Second, the only record of arc volcanism from its inception to the present is contained within forearc basin sediments.

The evolution of the arc itself has been addressed directly only at a few sites. The volcanologic or chemical evolution of single arc volcanoes and of the hydrothermal systems associated with them are poorly understood. The arc volcanoes play an important part in both the high-temperature igneous geochemical fluxes in the margin and the lower temperature hydrothermal interactions with seawater. One of the most significant gaps in our ability to understand chemical fluxes in convergent margins is our lack of understanding about the nature of geochemical changes within individual arc volcanoes.

Finally, many convergent margins include an actively spreading back-arc basin. Recent studies have shown that these back-arc systems share many features in common with their counterparts in larger ocean basins, including spreading geometries, development of propagating rifts, and the development of robust hydrothermal systems. However, there is also evidence that the lavas in these basins are compositionally more diverse than those in large ocean basins, ranging from compositions indistinguishable from arc lavas to those approaching normal mid-ocean ridge basalts. The diversity of volcanism in time and space indicate a complex distribution of sources beneath the basins. We have, as yet, only a limited knowledge of the systematics of the variations in back-arc lava chemistries and the consequence effect on the nature of hydrothermal systems and of the real differences between mantle beneath the arc and that beneath the backarc basin. Some models are beginning to emerge for the nucleation and evolution of back-arcs, particularly in regard to the amount of extension accommodated by stretching of the lithosphere.

C2. Fluid Processes

The evolution and migration of fluids in the lithosphere is one important part of geochemical cycles in convergent margins. Fluid processes include flow due to the dewatering and dehydration of the subducting plate and hydrothermal reactions at arc and back-arc volcanic centers.

The composition and flow of fluids derived from the subducting slab will depend upon the nature of the material entering the trench, the thermal regime beneath the forearc and arc, and the rates of dewatering and dehydration. Much of the fluid flow will occur beneath the forearc, from dewatering due to compaction and from low temperature dehydration reactions. The record of this fluid flow is manifest in active venting of forearc fluids, as observed in several forearcs, and in the nature of metamorphic reactions recorded in forearc rocks. The record of this fluid flow is complicated by the superposition of reactions due to circulating seawater; the recognition of young igneous activity in some forearcs emphasizes the possibility of active hydrothermal circulation even in apparently "cold" forearcs. Quantifying the fluid flow through the forearc requires an examination of the offshore crustal section and the vertical stratigraphy of altered forearc crust.

The dehydration of the slab at depths beneath the arc or back-arc can only be examined by looking for the evidence of that dehydration in the magmatic products of the arc or back-arc volcanoes. Spatial or temporal evolution of convergent margin magmas may in part be linked to changes in this fluid component.

The second class of fluid processes at convergent margins, hydrothermal flow, can be examined directly by drilling. Both arc and back-arc volcanoes develop robust hydrothermal systems. We are only beginning to understand the dynamics of mid-ocean ridge hydrothermal systems, and have, as yet, little knowledge of the differences that characterize back-arc or arc hydrothermal circulation. However, convergent margin hydrothermal deposits may be more likley analogs for many on-land ore deposits than are mid-ocean ridge systems, and we need to quantify their abudance, chemical diversity, and fluid flow in much the same manner as for mid-ocean ridge hydrothermal fields.

C3. Magmatic Variability in Space and Time

The magmatic activity at convergent margins produces the record from which we must determine the fluxes of elements from the mantle to the crust, from the subducted slab back to the crust, and by difference from the subducted slab back into the mantle. Understanding the origin of arc and back-arc volcanism requires identifying the characteristics of that magmatism which are process-related and those which are source-related. One of the only ways to separate these factors is to examine the spatial and temporal variability in magmatic products in an attempt to isolate single processes or sources. Systems with both back-arc and arc volcanism are particularly suited to this approach as they provide spatially and temporally parallel records of differing composition. Drilling becomes an essential tool in examining this problem, because of the limited accessibility of many parts of the convergent margin basement and because of the importance of vertical sections through the crust.

Drilling to date in the Westen Pacific has led to a reexamination of long-standing models for the evolution of arc volcanoes. Arcs show a diversity along and across strike from tholeiitic to shoshonitic which are as profund as the long-term temporal changes. The contribution of subducted sources, mantle sources, and arc rifting to this diversity is as yet unknown. Rifting and reestablishment of arc volcanism are clearly the most prominent non-steady state phenomenon in convergent margins, but the arc lavas do not show consistent changes through these rifting events at different times and in different arcs. Low-K rhyolites, boninites, and shoshonites have been recognized as important components of different arcs at different times, but the patterns in their distribution and their significance in piecing together the importance of source vs. process in the composition of arc magmas is as yet unclear. DSDP and ODP drilling has shown the utility of ashes and vitric turbidites in constrainign thelong term evolutin of the arc--in fact, thse sedimenatry records are really the only way to define thelong term changes in thea rc.

One of the most striking findings of Western Pacific drilling in intraoceanic convergent margins has been the recognition that the earliest volcanism associated with intraoceanic subduction produced voluminous volcanic constructs with different morphologies and compositions than the later developed arc edifices. These early arc constructs are now preserved in the forearcs of intraoceanic systems and have striking petrologic, structural, and geochemical similarities to many ophiolites. This model of early arc volcanism derives principally from work in the Izu-Mariana-Bonin system. Drilling, dredging, and island studies have documented a middle to late Eocene arc complex 200 to 300 km wide and 2000 km long. This crust was the first constructed as a consequence of subduction in the IBM system and developed at eruption rates more like those of slow-spreading ridges than of modern arc volcanoes. The identification of dike complexes is some forearc islands (Chichijima) and the absence of any preexisting oceanic crust suggests that the construction of this arc crust proceeded by rifting and spreading. This early arc massif is very similar to ophiolites like those in Troodos and Oman in the abundance of depleted arc tholeiites or boninites, the abundance of cumulate orthopyroxene in norites and gabbronorites, and the highly depleted natures of associated residual peridotites. The early arc crust has become the forearc to the later developed linear arc crust and records in its overlying sedimentary section the history of subsequent arc volcanism and the history of forearc uplift and subsidence has subduction erosion and accretion waxed and waned.

The identification of these voluminous early arc constructs is a radical addition to models of arc development and initiation. These early arcs also provide one of the best analogs for a true supra-subduction zone ophiolite and bear a number of morphologic and petrologic features in common with many.

Drilling in back-arc basins of the Pacific has identified the importance of distributed extension vs. sea floor spreading. Different types of volcanism contribute to each stage and range from pure arc end members to nearly pure mid-ocean ridge type end members. There is now sufficient information on these basins to develop detailed tests for models of the transition from arc volcanism, to volcanism associated with rifting, to back-arc basin volcanism. Quantification of the distribution and pattern of various back-arc components is a critical part in the construction of a convergent margin geochemical balance. Drillng in backarc basins of the western Pacific have suggested that a number of these bsins have developed by propagation away fromlarge strike-slip zones.

Contributions from Drilling

Convergent margins consist of linked tectonic and magmatic units. Any study of a part of these systems, with the goal of understanding the construction or evolution of the lithosphere, needs to address the links between the drilled part of the system and its associated forearc, arc, or back-arc. Drilling serves a unique role in convergent margin studies, as it is the only technique which can obtain two critical types of information:

1. The thick sedimentary accumulations of convergent margins typically make drilling the only way to obtain samples of basement, and consequently the only way to constrain the age of that basement.

2. Arcs differ from spreading ridges in that they are relatively fixed through time, producing vertical accumulations of material to a much greater degree than do ridges. This means that vertical sections of convergent margin crust are essential for quantifying geochemical fluxes, for examining temporal records of magmatic activity (recorded in tephra), and for deciphering temporal records of tectonism (as evidenced in uplift, subsidence, and deformation histories). Drilling provides the only way to constrain the long term evolution of arcs through the vertical stratigraphy of ashes, turbidites, and lavas. It also provides one of the only ways to develop a quantitative understanding of the nature of geochemical change within individual arc volcanoes. Drilling of arc volcanoes is likely to be most successful in deeper submarine edifices, which have less coarse volcaniclastic debris than shallow or subaerial centers.

Draft document-not for general circulation; May, 1993

Drilling Strategies and Priorities

There is a tremendous range of problems that can be addressed by drilling at convergent margins, but there are three problems which have emerged from recent studies as of first-order importance. These three high priorities for drilling along convergent margins are (1) fluid and solid mass balances in accretionary and non-accretionary margins, (2) the history and causes of subduction initiation and incipient arc volcanism, and (3) the nucleation and development of back-arc basins, and the associated evolution in mantle sources contributing to back-arc volcanism..

1. Mass balances at subduction zones.

The balancing of the mass flows at convergent margins has been a priority of the lithosphere community in both the COSOD I and COSOD II plans. There has not, however, been significant progress towards realizing that goal. Drilling is only one part of a program to quantify the flux of material through a convergent margin system, but it is a critical one because it provides a temporal and stratigraphic record. A drilling program to constrain the mass fluxes at a convergent margin should be integrated with a program of structural, physical properties, geochemical, and geophysical studies, and at a minimum should include a study of an accretionary marginand a non-accretionary margin. These transects need to include sites on the offshore plate, to characterize the incoming crust, and sites along a transect across the forearc and arc to provide information on the flow of materials through the forearc wedge. These transects need to be done at margins which have been extensively studied, so that the compositions and production rates of the associated arcs and back-arcs are well known, or can known with additional, focused studies. The interpretation of these experiments would be simplified if the transects were across margins with relatively simple chemistries in their associated arc volcanoes.

2. Subduction initiation and early arc volcanism.

A test of this model requires identification of a drilling experiment to constrain basement ages, compositions, and geographic distributions in a well characterized developing or mature arc system. Mature intraoceanic arc systems appear to leave their initial record as crustal fragments buried beneath forearc sediments; these rocks are accessible in most places in the forearc basins. A test of this hypothesis requires a drilling array which brackets the distribution of the early arc crust—at a minimum, four holes, 2 pairs of sites spaced across the forearc (of the pair at the frontal arc and the other at the trench slope break) and separated laterally by several 100 km parallel to the trench. These sites should include a substantial sedimentary section, to constrain the tectonic history of the forearc crust, and at least 100 m of basement penetration to examine the chemical characteristics of the early arc volcanism. This volcanism should reflect the characteristics of the mantle before there has been significant modification by the downgoing lithosphere.

A drilling experiment in a developing arc system first requires the identification of a system in which an arc is in the earliest stages of evolution and is volcanically active. Appropriate places might be the northern end of the Luzon Trench or the Macquarie Ridge.

Draft document-not for general circulation; May, 1993

A drilling program to examine the development of early arc volcanism will also address two other important aspects of convergent margin lithospheric evolution. The sedimentary section overlying the forearc volcanic basement is the most complete record of changes in arc composition with time. This sedimentary record also documents the history of tectonic motions in the forearc after the development of the basement. This tectonic history reflects a changing balance in the system between subduction erosion,, accretion, serpentine diapirism, and thermal equilibration. A drilling study in intraoceanic forearcs would also document the extent of later forearc volcanic flows, dikes or sills intruded within forearc basin sediments. Drilling in the Tonga, Mariana and Bonin forearcs have all encountered young volcanic rocks with the forearc basin which document at least local episodes of reheating. An important art of any arc or forearc drilling program would also be the retrieval of oriented sediment and basement cores to expand the paleomagnetic constraints on the plate geometries within which arc initiation occurred.

3. Back-arc nucleation and source evolution

Drilling in the Japan Sea and the Lau Basin has produced evidence that both basins nucleated along a major strike-slip boundary and propagated away from that boundary, splitting the active arc as it went. This work also showed that the basins develop first by a stage of crustal stretching with distributed volcanism, followed by true sea floor spreading with centralized volcanism. This model provides a hypothesis of back-arc basin evolution which allows predictions to be made about the timing of backarc opening and allows the volcanism in the basin to be examined at different stages of separation from the associated arc.

Drilling in backarc basins has not been designed to test the mechanisms and consequences of the earlyiest stages of back-arc opening, because we lacked a predictive model for that opening. With the hypothesis of backarc propagation, a drilling transect can test the timing of backarc development, the associated vertical uplift or subsidence, and the fine-scale compositional changes associated with the rifting of an arc and subsequent re-establishment of a new arc. Such an experiment requires two transects in a back-arc basin, one across the terminus of a basin, to examine the earliest stages of rift opening and to establish the age of that opening, relative to the older, or wider, parts of the basin, and the vertical motions and volcanic activity associated with that opening. A second transect laterally along the basin is required to establish the rate of basin opening and the age progression. Such a drilling experiment in a backarc could build on drilling which has already been done in backarc basins.

SEDIMENTARY AND GEOCHEMICAL PROCESSES PANEL: WHITE PAPER

INTRODUCTION

The ocean can be regarded as a major component of the complex system of interacting fluids, gases and solids forming the Earth's surface layers. The ocean is the largest fluid reservoir in terms of both the mass of water and of dissolved materials. Seen as the central component of the Earth's surface system, the ocean receives inputs from land and the atmosphere as well as from fluids circulating through the underlaying oceanic crustal rocks and expelled from the sediments deposited on the ocean floor and margins. Material entering the ocean in particulate or dissolved form is processed and removed from the water as either a component of sediment or alteration product of crustal rocks. Both the composition and depositional architecture of the sediments record the processes that have acted on the ocean system. Ultimately, material deposited on the ocean floor is subducted to return to the mantle or become volcanics, or is accreted and obducted onto the continents to become continental crust. The Ocean Drilling Program provides the information needed to treat the Earth as a closed system and the processes shaping its surface.

The goal of the JOIDES Sedimentary and Geochemcial Processes Panel (SGPP) is to encourage investigation of processes affecting inputs, interior processing of materials, and outputs from the ocean. These studies would include, but not be limited to, the aging of the Earth's crust, fluid circulation and geochemcial budgets, mass balances of the sediments and elements, organic and inorganic geochemistry and diagenesis, and sedimentary processes, facies and physical processes. Hence, this White Paper, identifies five themes under which the overall goal may be attained and which should be addressed by future ocean drilling:

1. SEA LEVEL: Record of eustatic change
2. SEDIMENTS: Material cycling and sediment distribution processes
3. FLUIDS: Circulation through the crust and geochemical balances
4. METALLOGENESIS: Control by tectonics and host material
5. PALEOCEAN: Fluctuations in chemistry and geochemcial budgets

These themes encompass the mandate of SGPP as envisioned by the JOIDES Planning Committee (PCOM), the recommendations of the 2nd Conference on Scientific Ocean Drilling (COSOD-II, 1987), and the highlights of the first five years of the Ocean Drilling Program (ODP). The themes also reflect a consensus on high priority topics gleaned from the proposals submitted for drilling by the international scientific community. The order in which the themes appear here does not reflect a prioritization but rather is a sequence that follows the material transport pathways and processing mechanisms through the changing global ocean system. It is intended as a source for the scientific community to draw information and inspiration on utilizing the unique opportunities for scientific discovery provided by ODP.

NEW TECHNOLOGIES

These technological developments are scientifically critical and operationally extensive. They must be implemented so as to ensure optimum scientific returns while being orchestrated with on-going drilling objectives. New technologies are of such crucial importance to the future of ocean drilling that they are grouped and summarized here as goals to be fulfilled within the next decade:

<u>I. Phased improvements of present drilling capabilities:</u>

1. Solve problems of sampling and stabilizing sandy strata
2. Stabilize re-entry in sediment holes
3. Drill deep holes into sediment and into basement
4. Deal with "hot holes" through gradual improvements of logging and sampling capabilities
5. Re-seal holes to arrest vertical flow and allow return to equilibrium

6. Complete development of continuous recovery of undisturbed sediments and rocks of all lithologies for studies of diagenesis and metamorphism, characterization of *in situ* sediment structure, strain measurements, and continuous core logging

II. Developments of sampling and *in situ* profile measurements of physical properties and chemical compositions:

1. Assure closely-spaced *in situ* sampling of truly representative, uncontaminated fluids and gases, coupled with temperature measurements

2. Approach this essential capability by perfecting the pressure core sampler system; i.e. initiate PCB-phase II; this device should be capable of recovering sediment at *in situ* temperatures and pressures for analyses of clathrates, pore fluids, gases and microbial activity; it must also preserve sediment structures for fabric analyses and physical properties measurements, allow through-wall imaging of internal structures, have transfer capabilities through pressure ports for shipboard separation of gases, fluids, and solids, and provide for the calibration of logging tools

3. Augment this capability by the use of a wire-line side-wall corer with an *in situ* pore water sensor and sampler; this device is to be used to recover sediment and pore waters in coring gaps or where recovery is poor, to satisfy the demand for additional material for high-resolution studies, to recover pore fluids under *in situ* conditions without risk of jeopardizing further drilling of a hole, and to measure *in situ* temperature, pore pressure, pH, and other constituents by specific ion-electrodes

4. Develop *in situ* permeability, porosity, electrical resistivity, seismic velocity and pore fluid pressure measurements for successively higher bore hole temperatures; then adapt the capabilities of the chemical logging tools for the same temperature environment

5. Be aware that for "hot holes" such chemical logging tools will not be available in the short-term; therefore, devote efforts to develop a bore hole water sampler or sensor package which should either be used during packer deployment or as a separate, self-contained, wire-line instrument.

6. Develop in parallel near *in situ* pore fluid and gas sampler for frequent and multiple samples per deployment plus appropriate packer; for this to be useful, better hole isolation has to be achieved

7. Think about insulating the pressure core sampler for it to be used at high temperatures and making it resistant to corrosive chemicals.

8. Decide which logging tools should be slim-lined, if the diamond coring system (DCS) becomes the favored alternative drilling method, since not all tools are suitable for adaptation to enter the smaller DCS bore holes.

III. Long-term experiments for steady state versus episodicity of fluid flow:

1. Monitor *in situ* temperature and pressure gradients

2. Monitor fluid pressure, temperature, fluid and gas chemistry, and strain in sealed holes

3. Obtain repeated samples from sealed holes via alternate platform

IV. Other technological developments and considerations:

1. Consider drilling atolls and guyots using alternate platforms or on-land drilling

2. Emplace and recover long-term and short-term sea-floor monitoring experiments

3. Conduct extended site surveys

4. Explore alternate platforms to complement the drilling vessel *JOIDES Resolution*

SEA LEVEL: Record and Causes of Eustatic Change

Overview

It is generally recognized that eustatic fluctuations constitute one of the most important controls on the stratigraphic record. Yet, neither the timing and amplitudes nor causes of eustatic change are well known. Possible relations between eustasy and tectonics, climate, the origin and deposition of siliciclastic and carbonate sediment, ocean chemistry and circulation, and organic evolution are largely a matter of educated speculation. Little is known about feedbacks between these phenomena or about the possible leads and lags that may be involved. It is for these reasons that the history of eustatic change has been identified as a first-order problem to be addressed by the Ocean Drilling Program.

Advances during the past fifteen years in elucidating the eustatic record can be traced to the development of seismic stratigraphy, and more generally, sequence stratigraphy. The basis of this approach is to identify depositional sequences bounded by unconformities and their correlative conformities. Unlike transgressions or regressions of the shoreline or changes in paleo-bathymetry, the development of prominent sequence boundaries is relatively insensitive to sediment supply, and major sequence boundaries of eustatic origin should be of very nearly the same age in all marine basins. Sequence stratigraphy should be the basis of all attempts to gauge eustasy directly from the stratigraphic record. The problem of estimating amplitudes and rates of change is difficult, and cannot be achieved by seismic or sequence stratigraphy alone, but requires a quantitative assessment of the tectonic forces that drive subsidence and uplift at any depositional site.

No single technique or single site can be expected to provide a realistic picture of sea-level change on a global scale. In support of the recommendations of the Second Conference on Scientific Ocean Drilling (COSOD II), we propose three approaches: the drilling of both terrigenous and carbonate-dominated successions in transects across passive continental margins, the drilling of atolls, and the establishment of a complete high-resolution benthic and planktonic foraminiferal $\partial^{18}O$ record from pelagic sediments. Oxygen isotopic variations reflect a combination of ice-volume and temperature fluctuations, and they are a useful proxy for one of the most important components of the eustatic signal in post-Eocene time.

Drilling to establish the record of eustatic change must be supported by high-resolution geophysical surveys, high quality logging, and complete core recovery. Also, the recommendation of transects presupposes that alternative platforms will be available for drilling in shallow water, and that, where appropriate, it may be useful to sample outcrop sections onshore.

Scientific opportunities for future drilling

The principal objective of drilling is to establish the timing and amplitudes of eustatic change on timescales of 1-10 m.y. in late Paleogene and Neogene time. The temporal focus is justified for three reasons: (1) the late Paleogene and Neogene are times of substantial continental ice cover, and this allows the stratigraphic record of eustatic change to be compared directly with the oxygen isotopic record of sea-level change; (2) strata of this age are relatively easily dated by means of biostratigraphy, magneto-stratigraphy and Sr-isotopic stratigraphy; and (3) strata of late Paleogene and Neogene age are preserved at shallow depths on numerous continental margins and atolls, and in many cases can be reached easily by drilling. For Plio-Pleistocene time, very high-resolution seismic surveys and drilling in areas of rapid sediment accumulation has potential for relating the record of sea-level change to high-frequency climatic oscillations.

Mesozoic targets are also of some interest. The evaluation of eustasy in Cretaceous time is one of the main goals of the Global Sedimentary Geology Program on Cretaceous Resources, Events and Rhythms. That program is primarily land-based but might usefully interface with ODP. The Cretaceous offers the opportunity of investigating sea-level change during an interval of minimal continental ice, and hence to investigate non-glacial mechanisms of sea-level change.

When the eustatic record has been established, subsidiary objectives of anticipated drilling are to evaluate the mechanisms that may be responsible for the observed variations in sea level, as well as to determine the consequences of sea-level change for sedimentation along the margins of the continents and in the deep sea.

Drilling strategy

Three independent approaches are proposed to address these objectives: (1) drilling of passive-margin transects (terrigenous and carbonate-dominated successions); (2) atoll drilling; and (3) the recovery of continuous pelagic carbonate sections to establish oxygen isotopic records. By combining these different approaches, it may be possible to overcome the limitations inherent in each of them individually, and to place constraints on the global sea-level signal.

Transects across passive continental margins will improve the likelihood of dating unconformities at or near regions of conformity, and we emphasize the need for a concentrated effort to improve dating by a combination of all available tools, where possible in the same samples (e.g., biostratigraphy, magnetostratigraphy, Sr-isotopic stratigraphy). High-resolution dating will also require improved core recovery through critical intervals, as well as appropriate logging so that boreholes can be tied precisely to seismic reflection profiles.

Criteria for the selection of appropriate passive margins include: (1) relatively simple or predictable subsidence history; (2) high-quality, publicly available seismic coverage; (3) suitable existing well data to calibrate seismic interpretation; (4) exposures of equivalent stratigraphy in nearby onshore areas; (5) laterally persistent depositional sequences that allow one or more transects from the inner part of the continental shelf to the deep sea; (6) a relatively complete section in the target interval; (7) relatively high sedimentation rate and well defined sequence boundaries that can be traced to correlative conformities; (8) stacked sequences boundaries that can be investigated with a relatively small number of holes; (9) stratigraphic objectives that are within reach of the drill string; (10) high quality correlation/calibration potential; and (11) a well-established age for the onset of sea-floor spreading. Potential areas for the Paleogene-Neogene record include the margins off the eastern United States, New Zealand, northwestern Australia, the South China Sea, the Maldive archipelago, and the Gulf of Mexico. Transects across the margins off the eastern United States, western Africa, eastern Africa, and the Exmouth Plateau are suggested for obtaining information about Mesozoic sea-level change.

To ensure success, for a given geological interval it will be necessary to select a minimum of three suitable margins in widely separated areas, with at least one transect per margin, and at least five drill sites per transect. The purpose of these sites is not only to provide information about the ages of sequence boundaries, but also to permit quantitative analysis of the subsidence history of a particular margin. Calculations of amplitudes of sea-level change require assumptions about the tectonic or driving subsidence, and achievable precision is also limited by uncertainties in paleobathymetric change through time, and the effect on basin subsidence of compaction and isostatic compensation due to the emplaced sediment load. Estimates for each of these factors are needed at the same age resolution as the eustatic signal to be estimated. While ages of unconformities are best constrained in deep water, amplitudes are best measured in shallow-water facies.

Sr-isotope stratigraphy now permits the dating of previously undatable atoll carbonate successions. This approach uses the stratigraphic record of atoll carbonates as dipsticks in areas thought to have comparatively simple subsidence history. Although this strategy yields discontinuous records with variable resolution, it may offer the best chance of obtaining reliable, quantitative, low-frequency (greater than 2 m.y.) information on the amplitude of post-Eocene eustatic variations. It is important to locate sites in areas where uncertainties in modelling subsidence history are minimal. These conditions appear to be met in the Marshall-Gilbert Islands. Because these islands lie on crust that is locally compensated, it is probable that they have undergone a straightforward subsidence history since Eocene time. Paired depth transects off currently forming atolls and drowned atolls along a major atoll chain that extends over a wide latitude and age range are preferable drilling targets.The early sea-level record would be encountered on the drowned atoll and the more recent record on the currently forming atoll. The transects should also include atoll apron, rim and lagoon sites. It is recommended that lagoon sites be drilled on a current atoll to provide a tie to the platform top. The USGS Eniwetak and the French Mururoa sites may provide this information. One problem with atoll drilling is the difficulty of relating shallow-water and deep-sea records. In this respect, prograding margins of carbonate platforms offer certain advantages.

A third approach to the sea-level problem depends on the oceanic oxygen isotope record, which is one of the components of the recommended multiple strategies, and perhaps more important, can provide insight about the mechanism of sea-level change. The oxygen isotope approach infers changes in global ice volume from the isotopic composition of benthic and planktonic foraminifera. Proper use of this approach requires the compilation and validation of records of both benthic and planktonic low-latitude foraminifera, with sufficiently high resolution and stratigraphic calibration to ensure that each sea-level event registered by other indicators can be matched against the correlative oxygen isotope record.

Technology

Technical developments are required to be able to address the topic of global sea-level fluctuations. In the short term these should be devoted to: continuous core recovery in all types of sediments, including sands, chert and especially shallow-water carbonate sediment; and continuous core logging. Intermediate-range objectives will require drilling within atoll lagoons and on atoll rims. It is probably not feasible to use the *JOIDES Resolution* for such a task, and alternative platforms should be sought. Long-term developments should be aimed at the ability to drill deep (2500-3000 m), stable holes required for continental-margin transects, and to provide the pre-Neogene sea-level record.

SEDIMENTS: Material cycling and sediment distribution processes

Overview

One goal of the SGPP is to promote investigation of the sedimentological and geochemical budgets of the ocean system. These investigations would include studies of processes that alter inputs to the ocean, the interior processing of materials, and the output from the ocean.

Material cycling

Sedimentary mass balance requires a closed system. With respect to materials carried to the sea in solution, the system is global; input and output sites may be widely separated. However, with respect to material introduced in particulate form, a region may be effectively a closed system. An alternative to a truly closed system is a defined system, in which the gains to and losses from the region under study are specified. Elements of the mass balance equation that have major potential for change and hence are of particular interest are:

(1) Sediment inputs, including materials transported from land to the ocean by (a) rivers, (b) glaciers, (c) wind, and (d) groundwater, and material introduced by (e) volcanic activity, (f) hydrothermal activity, (g) dewatering of sediment wedges, and (h) diagenetic processes.
(2) Deposition, movement, redeposition and recycling of sediment within the ocean system, including (a) alternate storage and erosion of material on the continental shelves, (b) mass wasting of material on the slopes of continental margins and oceanic platforms, (c) downslope re-sedimentation, (d) sedimentation of biogenic material, (e) deposition of evaporites, and (f) reworking and recycling of sediments by bottom currents and corrosive waters and the relation of these processes to regional deep-water unconformities.

(3) Residence times of sedimentary materials in different tectonic and environmental settings.
(4) Sediment output, largely comprising return of materials including solids and fluids to the mantle by subduction but also estimates on accreted and obducted material.

Depositional processes, facies and architecture

Although we understand in general how sediment is eroded, transported and deposited in the oceans, our knowledge in most cases falls far short of specific mechanics and physical parameters of the processes involved. We must understand about the way these processes change in space and time to form sedimentary units on seismic profiles.

Major processes about which a greater understanding is required include: (1) turbidity currents, (2) bottom currents, (3) volcanic sedimentary processes, (4) ice margin processes, and (5) mass-movement processes. In order to read a given sedimentary succession as a record of change in the past environmental conditions, we need to know more about the detailed characteristics of the range of sediment facies and how they vary laterally and vertically, i. e. their depositional architecture or geometry. One major objective of this aspect of drilling will be to relate facies distinctions based either on seismic-stratigraphic analyses or on morphometric characters of surface sediment distribution to the *in situ* character of the sediment bodies. A second objective achievable only through drilling is to relate detailed chronostratigraphy to the rates of growth and migrations of sedimentary facies units and thus help to establish depositional processes and architecture. Efforts must be made to relate the ocurrence, cycling, and geometries of these systems to both allocyclic and autocyclic controls.

<u>Scientific opportunities for future drilling</u>

Bottom current sedimentation

Bottom currents play a major role in reworking and redistributing sediments in the world ocean basins. These bottom currents can have two sources: the thermohaline circulation system which results from sinking and lateral flow of dense waters and benthic storms which result from the contact of the wind-driven surficial eddies with the bottom. The form of the resulting sediment deposits is controlled mainly by the nature of bottom current present in any given area and the availability of sediment. The history of thermohaline bottom current processes is preserved in sediment drifts and sediment waves moulded under relatively steady currents. The role of benthic storms in creating strata is less clean, but sediment accumulation beneath regions of benthic storms may be reduced. Drilling transects will test sedimentation models for sediment structure and bottom current depositonal processes and use these models to determine past variations in the bottom flow regime of the ocean.

Re-sedimented systems

Future drilling must attempt to document the three-dimensional geometries of a range of sedimentary facies and environments and to relate these geometries to images recorded by seismic profiling and other techniques. Facies variations occur over an area of a few square kilometers and less in the oceans, and this information is crucial to our understanding of the sediments and their depositional processes, as well as to their use in any models for fluid flow or for global sediment budgets. Drilling to date has barely addressed this aspect.

Type-localities are needed for distinctive facies and environments. Two particular examples are re-sedimented systems (carbonate and siliciclastic), including overbank (with and without levee relief), channel floor, depositional lobe, channel/lobe transition zone, basin plain, mass-wasted intervals and base-of-slope ramps and contourite systems, including drift margins, drift axes, open-ocean drifts, interbedded marginal contourites and deep-water passageway drifts.

Of equal importance is an effort to relate processes and facies within different parts of sedimentary systems to the major external and internal factors that control their formation and distribution (geometry):

(1) Allocyclic controls. Drilling in the main types of margins can address several important problems: (a) the influence of sea level changes on the nature (type, source area, rate and transport path) of sediment provided to the basin; (b) the influence of the source-area gradients (tectonism) on the sediment supply to the margins; (c) the influence of shelf characteristics, including width, intra-basinal sediment generation (e.g., carbonate), and storage potential (providing a staging area for sediment eventually moved to the deep-sea) on various sedimentary systems beyond the shelf break; (d) relationships between sea level and other factors that affect sediment distribution.

(2) Autocyclic controls. Tests are necessary to address growth patterns of rapidly accumulating clastic systems where the allocyclic controls outlined above remain relatively constant. This includes determination of rates of aggradation and shifts in depocenter position of critical morphologic features formed by deposition along the margin, including the influence of channel avulsion, lobe switching and the effects of clogging bottom current strengths and positions. It is also important to determine the deformational behavior with respect to diapirism, tectonic deformation and the timing and mechanics of slumping and associated mass-wasting processes.

Ice margin processes

Todays most unknown depositional environments are beneath the permanently ice-covered Arctic Ocean. Clearly, Arctic Ocean drilling must be a prime future objective. More achievable and equally important targets lie at the ice margin where both bottom-current and turbidite sedimentation may occur and within the oceanographic gateways that connect the Arctic with adjacent seas. These gateways have a profound affect on both surface and deep-water circulation and hence also on deposition and erosion within the adjacent seas. Variation of sedimentary facies and architecture in these ice-margin environments and associated gateways and their influence on global budgets require special attention.

Volcanic sedimentary processes

Volcanic sediments are one of the major component sediment types in active plate margins, oceanic ridges, and oceanic islands. Variation of depositional facies and architecture of pyroclastic and volcaniclastic sediments, including the transformation from pyroclastic processes to normal marine settling and subaqeuos sediment gravity flow, should be tested in response to tectonic activities, eruption types, and nature of magmas. Volcaniclastic sediments are chemically unstable and play an important role in controlling early diagenesis and geochemical mass balance in oceanic environments.

Physical properties

Sediment physical properties change through time and space in response to environmental processes. Fluid circulation through the sea floor, consolidation of sediments, diagenesis and generation of gas are the most important processes that cause change in sediment physical property in ocean basins. The determination of the regional distribution of diagenetic patterns in basal sediments in ocean basins will greatly aid in the development of coherent models of mass, fluid and heat transfer in the oceanic regime. Ultimately, it should lead to a more complete understanding of geothermal and hydrothermal oceanic systems.

<u>Drilling strategy</u>

Deposition by bottom currents

Both the North and South Atlantic Oceans contain well-documented examples of large current deposits; modern examples have formed from flow of bottom, deep and intermediate water masses. The primary drilling targets are sediment drifts, including at least one site up-current from the drift deposit to evaluate the contribution of sediment by erosion of the deep-sea floor. Large-scale sediment-wave fields constitute the other major type of target. Special technological requirements include oriented cores and logging, especially dip determinations. Site-survey data should include SeaBeam and high-resolution seismic-reflection profiles.

Re-sedimented systems

There are two major classes of re-sedimented systems: Those formed in basins on continental crust, and those on oceanic crust along passive margins. The North Pacific Ocean has the best examples of margin-basin deposits that can provide the information on architectural elements needed for modeling fluid flow in accreted margin wedges. Drilling these margin deposits will also provide the closest tie to the geoscience community at large. The Atlantic Ocean provides the best targets for drilling large, continental-rise deposits fed by major rivers; drilling of these systems will be critical to determining global sediment budgets and autocyclic controls on sedimentation. Special technology requirements include recovery of unconsolidated sediment, logging, and casing the hole if VSP-experiments are to be conducted. High-resolution seismic-reflection profiles are recommended as part of the site-survey data set.

Physical properties

Physcial-property studies of sediment types should be conducted at sites selected for the biogenic end-members and from sites selected for re-sedimented systems and bottom-current deposits for terriginous supply. The full range of logging measurements are of prime importance for physical-property studies. For ice-margin processes the Arctic Ocean is one of the prime areas. Site-survey data should include high-resolution seismic-reflection profiles.

Volcanic sedimentary processes

The prime target areas are in the western Pacific and northeastern Indian Oceans for arc-related volcanism, and oceanic islands such as Hawaii and Iceland. No supplemental work is required. Special technological considerations are the recovery of loose sediment and probable requirement for diamond drilling or Navidrill. Site-survey data should include high-resolution seismic-reflection profiles and, for the oceanic island sites, SEABEAM bathymetry.

Technology

Past problems with sand recovery has resulted in a serious bias toward mud-rich system, in both our understanding of margin sedimentation and the selection of future drill sites. Discussion of recovery problems at two scientific meetings that included industry participants (SEPM mid-year meeting in 1987 and COMFAN II in 1988) indicated that the technology for drilling unconsolidated sand exists and may be transferable to ODP. We recommend immediate investigation of the possibility to adapt such technology. Simultaneously and if existing techniques cannot be adapted, we also request development in house. Logging of sites on continental margins is a high priority to adequately address many of the objectives described in this section. There is a special need to log the upper portions of the holes to tie facies distinction to morphologic controls available only in the upper tens of meters of many depositional environments.

FLUIDS: Circulation Through the Crust and Geochemical Balances

Overview

Large-scale circulation of fluids within the oceanic lithosphere is of fundamental importance to global geochemical budgets. It is now clear that fluid circulation and the transport of solutes and gases by fluids are of major importance. The interaction of fluids with oceanic sediment and basalt is a first-order process affecting the cycles of elements and determining the transfer between geochemical reservoirs.

The SGPP believes that continental margins, both active and passive, are of the highest priority for drilling during the period through 1994. One of the major achievements of the first four years of the ODP, as also identified in the COSOD II documents and recently in the ODP Long Range Planning Document, was the demonstration for the first time that fluids moving through and flowing out of margins are major contributors to the geochemical fluxes in the lithosphere and hydrosphere. Because the discharge regions at all margins are submerged, ocean drilling is essential. The emphasis by SGPP of drilling in continental margins is complemented by the emphasis of LITHP for drilling the ridge axes (JOIDES Journal XIV No.1, 24-36, 1989) and hence the latter will not be repeated here.

Scientific opportunities for future ocean drilling

Through studies of submarine fluid circulation, we are at the threshold of gaining new understanding of how margins are dewatered, lithified and how they respond to tectonic stress. Ocean drilling permits investigation of fluid circulation in different geologic environments and the possibility of long-term experiments in re-entry holes. A consensus among a large portion of the scientific community holds that this frontier of research should be exploited as the target of future drilling efforts in which tectonic, lithosphere, and geochemical objectives become intertwined (see for example: TECP White Paper, *JOIDES Journal*, 1989, XV (3), 41-60 and LITHP White Paper, *JOIDES Journal*, 1989, XIV (1), 24-36). Specifically, drilling must be used to define: (1) geologic settings; (2) physical characteristics and chemical composition of fluids; and (3) existing pore pressures and rates of flow and solute transport. Fluid pore pressures, chemistries, and temperatures indicate fluid sources and the nature of chemical reactions affecting both the fluids and host rocks. These parameters, along with *in situ* permeability measurements and theoretical analyses, will permit rates of fluid flow and chemical transport to be estimated in different tectonic settings and on a global scale. Long-term experiments in re-entry holes will provide transient *in situ* measurements of fluid and sediment properties and can be used to determine the importance of time-varying fluid and matrix stress states. These objectives are:

Geological environment of the fluid circulation:

1) Large scale plate tectonic setting: ridges, flanks, basins, active margins, passive margins.
2) Local geological setting: bare rock ridges vs. sedimented ridges; continental vs. marine subduction zones; ridge crest subduction and similar configurations; scale and nature of fluid flow boundaries.

Characteristics of fluids:

1) Sources of the fluids: terrestrial vs. marine dewatering; membrane controlled vs. dewatering by mineral dehydration.
2) Physical state of the fluids: one phase vs. two phase liquid states; gas phase formation and phase separation.
3) Chemical changes affecting the fluids: crustal alteration, cementation gas hydrate formation.

Magnitude of flow regimes

1) Constraints on the fluid flow: temperature gradient, pressure gradient, initial permeability and diagenesis-introduced permeability changes of porous media.
2) Location and extent of recharge and discharge areas.
3) Three-dimensional circulation pattern.
4) Time scale and modulation of the fluid flow regimes.

These objectives will also provide answers to questions regarding the complexities of material balances of the total Earth system; those questions are:
•Can the mass transport of certain elements be quantified that are critical to the mass balance?
•What are the driving forces of fluid flow?
•What changes in mass transport rates have occurred over the last 100 My?
•What are the reaction dynamics and rates of alteration?
•What are the mode and location of deposition of base metals as well as gas and petroleum migration and emplacement?
•How do fluids and their migration pathways affect styles of tectonic deformation?

The major advantage of ODP and its unique role with respect to these SGPP objectives are that ocean drilling is the only means by which to gain direct access to:

- Material properties and tectonic settings within active submarine fluid regimes
- Long-term experiments in re-entry holes
- Critical space and time scales of fluid processes
- Three-dimensional pattern of circulation
- Environments with controlled sources and gradual evolution of fluids between sources.

Of the submarine fluid regimes, the SGPP believes that those on active margins are highest priority for drilling in the immediate future. Hence, the scene is set for the design of a major drilling experiment on active margins, that will complement the LITHP- priorities of the ridge axis (*JOIDES Journal*, 1989, XIV (1), 24-36).

Drilling on passive margins and the sedimented ridge axes is the next priority for the SGPP in this context. The SGPP recognizes that the flow regimes on ridge flanks and their relationship to basin-wide flow patterns may well be of major importance too, but anticipates that drilling proposals addressing this theme will require longer to achieve maturity.

<u>Drilling strategy</u>

The overall strategy calls for drilling in tectonic environments that represent contrasts in convergence rate and sediment type, accumulation rates and sediment thickness. Such a strategy provides key data which can then be used to extrapolate to global fluxes. Drill hole locations and depths should be designed to delineate the overall hydrogeologic setting and provide detailed data on depth variations in the critical parameters. Deep drilling beyond the accreted or subducted sediment packages into underlying basement is essential. Models of fluid flow and chemical transport combined with physical convergence and compaction models should be used in planning these transects. Tracers for source depths of fluids and other criteria for sources need to be developed. A drilling strategy for margins should take into account the following considerations:

1) Fluid flow at active margins is driven by tectonic and gravitational stresses. As sediments are incorporated into an accretionary complex, they are either off-scrapped into an accretionary prism or carried downward with the subducting plate. In both cases, the sediments compact in response to increasing stress and water is driven from the complex laterally seaward and toward the ocean floor. Mechanical deformation of accreting and subducting sediments controls: (a) rates of compaction and amount of fluid driven from the complex; (b) rates of tectonic transport of pore waters; and (c) permeabilities and dispersion properties of the sediments.

2) At passive continental margins, meteoric water may enter relatively permeable strata that extend beneath the continental shelf. This water may migrate long-distances, vertically and horizontally, and mix with pore waters of different origin. Both fluid chemistries and temperatures alter fluid densities, thus modifying fluid flow, driving forces and circulation rates and patterns. To understand these processes at a specific location, it is essential to: (a) delineate the regional hydrogeologic setting; (b) obtain point measurements of pore pressures and hydraulic properties (e.g.,permeability, porosity) of the geologic material; and (c) measure temporal and spatial variations in pore pressure, fluid chemistry and fluid temperatures.

3) For ridge crest and flank environments, transects on the flanks of both fast and slow spreading ridges will provide information on the crustal and sedimentary chemical exchange due to free convection of fluid.

<u>Technology</u>

For a complete characterization of the fluid regimes in active and passive margin settings extensive technological developments will be required. As in the recent past important insights and great scientific leaps in understanding these fluids regimes will be achieved by continued drilling and parallel development of technologies. Extensive surveying of both regional and detailed targeting of sites will be needed; most of the required technologies for surveying exist.

Drilling developments should be directed to:
1) Stabilize re-entry sediment holes;
2) Drill deep holes into sediment and into basement;
3) Solve problems of sampling and stabilizing in sandy horizons;
4) Re-seal holes to arrest vertical flow and allow to return to equilibrium;
5) Core ahead of drill bit, providing less chemical and vertical disturbances.

Developments of sampling and *in situ* profile measurements of physical and chemical properties should be directed to:
1) Recover undisturbed sediment cores for chemical and physical properties;
2) Correct closely spaced *in situ* sampling of truly representative, uncontaminated fluids and gases, coupled with temperature measurements
3) Develop near *in situ* pore fluid and gas sampler (for frequent and multiple samples per deployment), plus appropriate packers; for this to succeed better hole isolation will have to be developed;
4) Measure *in situ* permeability, porosity, electrical resistivity, seismic velocity and pore fluid pressure;
5) Develop pressure core system and procedures for on-board sampling of fluids, gases and gas hydrates at *in situ* pressure and temperature; e.g. PCB-phases II and III;
6) Recover continuous undisturbed sediments and rocks for lithology, diagenesis and metamorphic characterization, *in situ* sediment structure analysis and strain measurements.

Developments in long-term monitoring experiments should address:
1) steady versus episodic fluid flow by instrumentation;
2) temperature and pressure gradients (and strain ?) on the seafloor;
3) fluid pressure, temperature, fluid and gas chemistry, and strain in sealed holes.

METALLOGENESIS: Control by Tectonics and Host Material

<u>Overview</u>

A major manifestation of the thermally-driven migration of fluids through oceanic sediment and underlying oceanic crust is the mobilization and concentration of metals, locally to economically important levels. In this sense, metallogenesis represents a special case in which an otherwise diffuse fluid flow field is highly focussed to yield considerable amounts of metal precipitation. All stages of the "Wilson orogenic cycle" involving initial hot spot magmatism/intra-cratonic rifting, creation of oceanic crust, ocean floor subduction-back-arc spreading as well as continent-continent and continent-arc collision are known to be capable of driving fluid migration. Hence metal enrichments are associated with the full spectrum of tectonic environments. Ocean drilling can be employed as a means to access all hydrologic/metallogenic processes in these settings. "Extinct" ore deposits are overprinted and the result of integrated, complex tectonic, hydrologic, magmatic, sedimentary, thermal and geochemical processes. From these alone it is difficult to unravel the hydrologic/metallogenic history.

A spectrum of modern settings should be investigated in order to fully appreciate the possible range of controls on ore formation. Furthermore, this same broad approach may contribute significantly to the understanding of oceanic rifts, which are now recognized as potential source and/or host environments for Ag, Co, Ni, As, Bi ores and as sites of hydrothermal petroleum formation.

Special opportunities in studying these processes through ocean drilling arise from the ability to examine in three dimensions the active fluid flow field together with changes in metal and sulfur concentrations within the fluids and their interaction with the parent rock during active metallogenesis. The final product, that is, the accumulation of metals, contains the fingerprint of fluid flow paths, fluid geochemistry, and processes of deposition. Although metal accumulation occurs in a spectrum of marine environments, interest focuses on the so-called "volcanic massive sulfide deposits". These are now recognized to have formed as a result of oceanic-based tectonism and comprise over a thousand deposits including some of world's major sources of Cu, Pb, Zn, Ag, and Au. Massive sulfides can be divided into those formed at ocean ridge spreading centers and those associated with felsic volcanism in island arc settings or active marginal basins. Metallogenesis in the former setting has received somewhat more attention in the Ocean Drilling Program but among the presently recognized ore districts, perhaps 70%, are associated with felsic volcanism of convergent margins.

Scientific opportunities for drilling

A number of oceanic settings are known for their potential to yield significant data for the understanding of metallogenesis. Targets include those with proven ore deposition and 'frontier' areas. Studies of these environments complement each other to contribute to a more complete picture of metallogenesis. Oceanic environments with proven ore deposition are targets in the following settings: bare rock mid-ocean ridges, sedimented mid-ocean ridge crests, spreading ridges in back-arc basins and intra-continental young ocean basins. They share a suite of common drilling objectives and, conversely, each poses a set of environment-specific questions; these common questions are :

•What are the sources of the metals, of sulfur, of the gangue (non-ore) constituents?

•What are the primary controls of the three-dimensional hydrologic flow paths?

•What specific conditions focus the fluids sufficiently to produce a significant metal accumulation?

• What is the nature and scope of rock alteration along hydrothermal flow paths?

•What are the physio-chemical and -perhaps- microbiological conditions of metal precipitation?

•How do these processes evolve through the life of a hydrothermal system?

For mid ocean bare ridge settings a detailed understanding of the deeper part of the sulfide system, confined within oceanic layer 2, is needed. Access to these systems cannot be attained by any other means except by drilling. Further questions address the scale and extent of metallogenesis in these settings --why have some massive sulfides evolved to giant size while others are limited in scope? Finally, how have such deposits been preserved in different settings under a variety of post-emplacement histories? Within sedimented ridge environments and back-arc basins, the varying composition of the sediment cover and facies modify hydrologic flow paths and thermal evolution and influences metal sources, sulfur sources, and overall fluid evolution.

SGPP encourages for sedimented environments studies of the geometry and chemical composition of the sulfides in the sediments as well as within the basaltic sections. Many of the objectives associated with metallogenesis in intra-continental young ocean basins and back-arc basins are similar to those for sedimented ocean ridges because of the controlling role of the sedimentary cover. However, boundary conditions for hydrologic flow in young ocean basins are distinct from those in mature rifting systems. Furthermore, the influence of underlying red-bed clastics, rift evaporite deposits, and organic matter accumulations needs to be considered. These same constraints may apply in more evolved -and more deeply buried-rift settings. The marine-based thermal regime in young rifts may also influence ore deposition in adjacent continental blocks. Hence an understanding the ocean-based hydrothermal flow regime provides significant constraints on ore genesis in continental settings.

Three additional tectonic environments provide new frontiers for the understanding of metallogenesis: (1) Ore formation has clearly occurred in sub-environments of island arc settings in addition to back-arc basins; drilling these can potentially open up exciting opportunities to understand metal deposition. (2) Carbonate reefs are known to host significant Pb-Zn (Cu, Co, Ni) ores of the so-called Mississippi-Valley type (MVT). This type of mineralization is believed related to oceanic-based tectonic events, but ore emplacement occurred long after host-rock deposition. Nonetheless, early diagenesis may control the initial host-rock permeability and porosity structure, which would ultimately influence the ore deposition. Drilling provides the opportunity to study these controls on secondary ore deposition. (3) Intra-plate volcanoes can provide locations for ore genesis. They are characterized by localized thermal sources and fluid conduits and are potential sites to study the phenomenon of fluid phase separation (boiling) because of their shallow depths. Again, drilling provides the only access to sample these actively forming ore bodies and their precipitating fluids.

Drilling strategy

Quite well known and well-surveyed drilling targets exist for the mid-ocean ridge and early rift-basin settings. For bare ridges these include the Endeavour segment of the Juan de Fuca Ridge, 21°N of the East Pacific Rise, the Galapagos Ridge segment, and the TAG area of the Mid-Atlantic Ridge. Sedimented ridges that are well surveyed include the Middle Valley, the Escanaba Trough, and the Guaymas Basin. The ridge Valu Fa is a back-arc spreading center with volcano-clastic sediment cover. The Red Sea is an example of an early rift basin, while Guaymas Basin also shares affinities to this type of setting. Site characterization prior to drilling should address the hydrologic regime, the composition of fluids vented at the seafloor, and the regional extent of alteration (e.g. models based upon magnetization of the crust). Effective drilling also must contain programmatic elements designed to understand fluid flow and evolution of hydrothermal fluids. Both these requirements necessitate a three-dimensional approach and thereby converge towards the strategy outlined in the previous chapter on Fluids: Circulation through the Crust and Geochemical Balances.

Technology

Radically new technologies are needed for characterizing the "hot" hydrologic regime, including ways to measure *in situ* permeability, porosity, thermal structure, and fluid flow. These are the same as those discussed in more detail in the previous chapter. However, drilling technology specifically required for metallogenesis studies is in the context of access and sampling of "very high temperature" environments and "improved drilling recovery" of: (1) sulfides and associated sediments and rocks, including sandy sediments and coarse rubble zones; (2) uncontaminated pore fluids, with specific precautions for sampling trace metals; (3) volatile and ephemeral constituents, particularly H_2S, CO_2, He and CH_4.

PALEOCEANS: Fluctuations in Chemistry and Geochemical Budget

Overview

Major and minor perturbation in the global sedimentary record document that the chemistry of ancient oceans was not constant throughout geologic time but deviated from the composition of modern oceans considerably. For example, evaporite deposits are a primary sink, as well as a source, for the major ions (Na, Ca, Mg, Cl and SO_4) in sea water, but evaporite giants are not equally distributed throughout geologic time. Thus, ocean salinity has probably fluctuated sporadically with sequestering of salt into evaporite deposition and release from evaporite erosion. Knowledge of the chemical budget of paleoceans has implications for understanding changes in the chemical material balances as well as for evaluating changes in the global environment.

Another example is the cycle of carbon. The variation in the burial of biogenic forms of oxidized (calcium carbonate) and reduced (organic matter) carbon in the marine sedimentary record plays a role in regulating the pCO_2 and pO_2 in the atmosphere. Spatial patterns of preservation for these different forms of carbon has fluctuated back and forth over geologic time. The causes are a complex interplay between marine primary production, sediment influx, sedimentation rate and ocean circulation. Detailed knowledge of spatial patterns and mechanisms of carbon preservation in key areas of the ocean throughout the geologic past is essential to the formulation of accurate models for paleoproductivity and defining causal relationships between bio-production and climate change and hence regulating atmospheric pCO_2 and pO_2. Developing such models of the paleocean environment is central to our attempt in predicting how human influence will impact future, otherwise, naturally controlled, climate fluctuations.

Fluctuations in the biogeochemical processes of the Earth's ocean and atmosphere during the Mesozoic and Cenozoic eras are recorded in the biogenic and authigenic components of deep-sea sediments. Understanding the controls on the distributions of geochemical indicators of global environmental change in time and space allows detailed reconstruction of past oceanographic conditions and key events related to global change. This leads to an understanding of the interactions between terrestrial, atmospheric and oceanic systems. Examples of environmental information accessible through ocean drilling include changes in the: (1) patterns of oceanic thermohaline and surface water circulation, shifts in the locations, strengths and ecology of equatorial and high latitude fronts and upwelling zones; (2) rates and locations of continental weathering and erosion due to uplift and tectonics or to changes in rainfall patterns; (3) rates of sea-floor spreading and hydrothermal circulation through mid-ocean ridges; (4) the redox state and corrosiveness of bottom and interstitial waters; (5) patterns of delivery of wind-blow and fluvial material to the oceans; and (6) the climate change linked to radiative forcing, ice volume, atmospheric CO2 and other greenhouse gases, and biologic recycling of nutrients.

The sedimentary biogenic record contains two types of historical information: *paleochemical tracers and accumulation rates.* High-resolution chemostratigraphies in biogenic material document isotope or trace element perturbations of the paleoceans and, in conjunction with bio- and magneto-stratigraphies, can be used to evaluate the timing, causes, and consequences of these geochemical events. Within and beyond the next decade the application of paleochemical tracers will include not only the traditional paleoceanographic foraminiferal tools (∂18O, ∂13C, 87Sr/86Sr, Cd/Ca) but also new ones under development for plankton (Ba), for calcitic microfossils (Sr/Ca, Li/Ca, ∂34S {in sulfate}, ∂15N {in calcified protein}, REE, 143Nd/144Nd), for siliceous microfossils (∂18O, Ge/Si, REE), and for organic matter (biomarkers such as unsaturated alkenones and ∂13C and ∂15N in isolated biomarkers). Biogenic components, such as marine organic carbon, calcite, opal, and detritial organic carbon (introduced to the oceans erosionally from land sources) record changes in the global balance of dissolved fluxes to and from the sea, changes in global climate (as a response to Milankovitch forcing), continental aridity, ecology of surface water production, local front migration, bottom water sources and chemistry of the paleocean. Global rates of accumulation of biogenic material on the seafloor are fundamental information for quantifying global geochemical balances and thus the fluxes of elements through the ocean-atmosphere system. Recent oceanographic observations suggest that the flux of iron may provide an important control on marine biogenic accumulations in large expanses of past oceans.

The climate controls air-sea interactions, oceanic circulation and ultimately the deposition of biogenic as well as eolian sediment. Except for the central oceanic areas the climate is strongly influenced by the extent and relief of adjacent lands. Hence the reconstruction of paleotopography is critical to understanding the distribution of sediments in the ocean.

The sedimentary authigenic record results from post-depositional changes in the mineral components due to diagenetic alteration, the influx of new material by diffusion across the sediment/water interface or hydrothermally-driven circulation. Authigenic components, such as clays, zeolites (and other silicates), iron and manganese minerals, diagenetic carbonates, phosphorites, and cherts, reflect geochemical conditions at the time of depositon and yield clues to fluid movements and material fluxes. The importance of evaluating the distribution and occurrences of authigenic minerals to global geochemical balances has been emphasized with the recent discovery of new oceanic source terms, such as the expulsion of pore fluids from subducting and accreting sediments on active margins, free convection of seawater through low-temperature ridge flanks, and leakage of continental fresh and saline groundwater from passive margins. Also, metallogenesis as controlled by fluid migration at active margins leaves a lasting sedimentary imprint of chemical exchange among reservoirs.

Scientific opportunities for future drilling

Important questions to be addressed by future deep ocean drilling include the following:

1) What are the global removal rates of elements in biogenic and authigenic sediments?

2) How do oceanic processes, affecting these removal fluxes, impact atmospheric and oceanic chemistry and climate?

3) What are the locations, accumulation rates and nature of biogenic sediments deposited under high latitude frontal zones, and how important is Southern Ocean ventilation-nutrient removal on atmospheric CO_2 and climate?

4) What is the timing and state of diagenetic alteration or removal from the sediment column of the bio-calcareous, bio-siliceous and bio-organic components and how does this affect the internal long-term cycling of nutrients, Ca, Sr, alkalinity, CO_2 and volatiles in the ocean, as well as the integrity of paleochemical signals derived from biogenic microfossils and bulk sediments?

5) What are the most promising proxy indicators for water mass properties and where are the key areas and critical time periods for which paleocean hydrography (Paleo Geosecs) should be reconstructed?

Recovery of the paleochemical and accumulation record will require a detailed global inventory of continuous high resolution sections, including coverage of the biogenic sediment facies (calcareous, siliceous, and organic carbon rich) and paleolatitude and paleodepth transects in all oceans. A systematic documentation of the state of *in situ* diagenetic alteration, including key boundary sections containing evidence of dramatic environmental changes, will also be required. Assessment of global fluxes into the ocean on ridge flanks and active and passive margins will require site -and process-specific experiments.

Drilling strategy

In order to meet the overall objectives of SGPP in evaluating geochemical fluxes, balances and the water mass properties of paleoceans, the following strategy should be adopted:

1) Drill the "missing" ages and poorly-recovered time intervals in existing DSDP and ODP sites, including re-occupation of some sites with APC/XCB to core continuous Neogene and Paleogene sections. Complete geochemical logging will be required to ensure the best possible "recovery" of continuous chemical information to complement the core-derived date. This strategy is identical to that driving Neogene and Paleogene paleoceanography (OHP White Paper; *JOIDES Journal* 1989, XV (1), 40-58), with the exception that biosiliceous sediments must not be ignored. Sites to be considered include the condensed biogenic sections on the flanks of the Southeast Pacific-Antarctic Ridge, the topographic features associated with the Southwest Indian-Antarctic Ridge, and re-occupation of older DSDP sites between Australia and Antarctica. In the northern high latitudes drilling must include the Arctic Ocean, the Bering Sea and the Sea of Ochotsk. Also, drilling of paleochemical events recorded in Mesozoic sediments should be emphasized

2) Co-ordinate a drilling program with LITHP on both fast- and slow-spreading ridge flanks to obtain information on both

crustal and sedimentary chemical exchange due to forced and free-convection of fluids. This must include a modern pore water chemical program, and new technology to measure *in situ* pore pressure, temperature, pH and other dissolved constituents with specific ion-electrodes, perhaps with a top hole packer that contains passive (diffusive) tracers to monitor up-hole and/or down-hole advection.

3) Augment the drilling strategy for fluid flow through both active and passive margins; or where there is mineralogic evidence from authigenics for flux of material through the sediment package. Proposed drill sites should include accretionary wedges, the boundary zone between continental and oceanic crusts, and continent-continent collision zones.

4) Extend the existing logging program to allow for logging of more holes with the Geochemical Logging Tool (GLT) that yields continuous down-hole elemental compositions, and development of other tools for rapid real-time analog analyses of both recovered cores and holes drilled. This provides a complete, rapid and inexpensive global evaluation of paleogeochemical signals contained within the sediment column and permit identification of missing core sections.

5) Initiate deep micro-biological and shipboard organic geochemical studies which would distinguish between recent chemoautotrophic and heterotrophic processes operating within sediments and hydrothermal processes acting upon organic matter transported by fluid, sedimentary and tectonic mechanisms. Studies of deep microbial activity is a new research frontier of enormous importance that helps define the lower boundary of the Earth's biosphere.

Technology

New technology is needed to accomplish these drilling objectives, including ways to recover sediments, fluids and gases at *in situ* temperatures and pressures as well as a wireline side-wall corer with *in situ* sensor and sampling capabilities. The pressure core sampler and side-wall corer are discussed in greater detail in the chapter on fluids, however, a specific requirement to advance paleocean objectives are enhanced drilling capabilities in areas with thin sediment cover (< 50 m on upper ridge flanks) and in areas with alternating sediment types. The ability to recover variable lithologies, such as carbonate-siliciclastic sediments, their diagenetic equivalents: chert-limestone sequences, intervals of hard-soft interlayers, such as reefal limestones and carbonate sands and muds without severe disturbance or loss of material is essential.

JOI/USSAC Booth at the Circum-Pacific Energy and Mineral Resources Conference

Don't forget to drop by Booth #25 at the Circum-Pacific Energy and Mineral Conference, July 29 - August 3, 1990, at the Hilton Hawaiian Village in Honolulu, Hawaii. Information and brochures about ODP and the JOI/U.S. Science Support Program will be available.

DRAFT, TECTONICS PANEL WHITE PAPER
(EDITED FOR INCLUSION IN THIS ISSUE)

INTRODUCTION

This article summarizes the contribution of the Tectonics Panel (TECP) to the JOIDES/ODP long-term planning process. The prioritized tectonic themes embrace the deep structure of the planet as well as the crust, the driving forces of the plates as well as their relative motions, interactions, and responses to both compressional and extensional forces. Although many of the tectonic processes of interest to earth scientists, including the most fundamental ones, are beyond the reach of the drill, the philosophy of the TECP is that the ODP should contribute to the understanding of these processes wherever practical. Deep seated processes can be addressed by indirect methods such as seismology and stress determination, shallow ones by examination of cores and *in situ* measurement of physical and chemical properties. Both types of approach need to be undertaken with complementary geological, geophysical and geochemical studies. The prime criteria for identifying a tectonic project suitable for the ODP are scientific quality and absolute need for deep sea drilling.

The paper presents five themes, outlines the specific tectonic significance of each, summarizing the state of knowledge, and pointing out the contribution that can be made by ocean drilling. The background data and technical development necessary for a successful drilling program are outlined, and drilling strategies are suggested. Specific drilling targets are mentioned as examples only. It is the task of the science community to develop these ideas and propose specific drilling experiments.

TECP believes ODP must move into a mode of drilling for tectonic objectives that is characterized by technical development and increased use of physical and chemical measurements. Proposals to study any of TECP's main themes are likely to involve multiple, related sites, including sites distributed over single plates, across conjugate rifted margins, along the lengths of hot spot chains and across convergent margins. Consideration could also be given to carefully designed drilling programs in single oceanic regions or small ocean basins that involve interplay of key tectonic processes. The transect of holes drilled in the Tyrrhenian Sea, for example, demonstrates the related roles of rifting, passive margin development and convergence in a young, small ocean basin that has considerable potential for ultimate preservation in the geologic record. Comparable tectonic laboratories for integrated study include the Caribbean Sea, Atlantic Ocean, Japan Sea, Scotia Sea, and elsewhere in the Mediterranean basin. The Mediterranean basin has obvious potential to unlock outstanding secrets of Alpine mountain buiding. The Japan Sea, Caribbean and Scotia basins have similar potential for Cordilleran orogenesis. The Atlantic Ocean basin is the obvious laboratory for studying supercontinental break-up and the long-term development of both volcanic and non-volcanic rifted continental margins. Ocean drilling for tectonic goals should thus interface with other types of geoscience investigation, on land as well as at sea, and involve a broad cross section of earth scientists, as envisaged by the COSOD II participants.

MAJOR THEMES FOR FUTURE TECTONIC DRILLING

Deformation Processes at Convergent Plate Boundaries

• *Tectonic significance*

Convergent plate boundaries are first order tectonic features. Tectonic processes operating at these boundaries need to be investigated using simple examples with well established kinematic histories and settings. Here, the lithospheric surface area added at divergent boundaries is consumed. In the process, material is scraped off the downgoing plate to generate an accretionary wedge, or in other cases eroded from the overriding plate to contribute to an underplating process (subcretion). The magmatism at longlived convergent plate boundaries is second only to the generation of oceanic lithosphere at spreading ridges and a major factor in the generation of continental lithosphere. Deformation of the overriding plate can, even without significant collisional events, generate major mountain ranges, *e.g.* the Andes. Generation and destruction of marginal ocean basins at convergent plate boundaries is a vital link, as yet poorly understood, between deep-seated processes and orogenesis.

• *State of knowledge*

In the past few years sediment accretion has been demonstrated at many margins, but non-accretion and/or tectonic erosion has been inferred at other margins. Increasingly sophisticated models have been developed to explain the geometry, kinematics and mechanics of accretion. Effluents of accretionary complexes are known both from direct observation and by inference from reduction in the porosity of the constituent sedimentary rocks.

Mass transfer and balance are important underlying themes in convergent margin studies. Information is needed with regard to how much sediment is added to accretionary wedges and how this sediment is deformed, how much sediment is subducted into the mantle, whether accreted sediment and crystalline basement can be lost by tectonic erosion, whether there are episodes of growth and loss, and the extent to which sediment drawn down into the mantle has been dewatered by shallower tectonic, diagenetic and metamorphic processes.

Although rapid advances have been made in our understanding of convergent margin processes, many questions still remain. Models of stress systems in accretionary wedges require high pore-fluid pressures at the basal décollement to reduce shear stress, but reliable measurements of elevated fluid pressures directly in the vicinity of the décollement are nonexistent, and the distribution of fluid pressure within the wedge or the flow regime within the wedge is unknown. The distribution of stresses in the forearc is also poorly understood. Deeper processes within the wedge have only been inferred from seismic images and vertical movements of the wedge. While seismic images and drilling have revealed various styles of deformation in parts of accretionary wedges, more information about modes of deformation is needed. Although topographic features, such as seamounts, ridges and oceanic plateaus, are carried into subduction zones, the response of accretionary wedges to such collisions is poorly documented.

• *Potential ODP Contribution*

Mechanics of deformation: Most accretionary complexes are wedge-shaped in cross section. As sediment is added to the leading edge, or toe, of the wedge, the wedge thickens in response to the increased horizontal stress resulting from the increase in its length. The processes by which wedges thicken include vertical extension associated with horizontal shortening, motion along and rotation of the thrusts by which sediment is accreted to the toe, the formation of new out-of-sequence thrusts, and subcretion of sediment to the base of the wedge. Drilling and other data suggest that some wedges are undergoing tectonic erosion along their bases. The process of accretion at the toe of the wedge has been well studied, but little is known of other processes that add or remove material from the wedge and how they are influenced by the stress regime and strength of the wedge.

Accretionary wedges constitute a natural laboratory for studying the response of porous sediments to deformation and consolidation under differential stress. Environmental conditions (stress, temperature), physical properties (strength, porosity, permeability) and mechanical state (cohesion, internal friction, compressibility) in the deforming sediments must be quantified.

It is important to determine the gradients in density and porosity of accreted sediments accurately as a function of both depth within the wedge and distance from the toe of the slope. An understanding of the strength and state of failure in deforming sediments can only be achieved with extensive experimentation and *in situ* measurements, including logging, geotechnical probes, and vertical and offset seismic experiments. Most models explicitly or implicitly invoke high pore-fluid pressures to reduce the stresses acting on the base of the wedge. Variation in pore pressure within an accretionary wedge causes variation in strength, hence, in shape and the kinds of structures that form within it. *In situ* measurements of pore water pressure within the wedge and in the décollement region will constrain the other variables in the models and probably eliminate some proposed models. Similarly, sampling and laboratory testing for stress-strain behavior will constrain the rheology appropriate for models of accretionary wedges, and when tied to microstructural studies of core material will produce information on the mechanisms that control rheologies during different stages of development of the wedge. A much neglected, but important aspect of the deformation of wedges is the time dependency and episodic nature of deformation and the extent to which it can be related to seismicity in the subduction zone. Long-term sea-bed monitoring of strain, fluid pressure, and seismicity is required.

The movement history on major out-of-sequence thrusts, which provide one mechanism of preserving wedge taper, can be obtained by drilling where slope sediments are overridden. The processes that add and remove material from the wedge can also be examined indirectly by their effects upon the overlying accretionary wedge and slope drape sediments. Opportunities for direct sampling exist where the wedge is thin and subcretion occurs near the toe of the wedge. The study of forearc basins will be of great value in understanding the dynamics of accretionary wedges. The nature of the basement of most of these basins is unknown and needs to be determined with deeper (~2 km) holes. In the so-called residual forearc basins that overlie what is believed to be igneous or metamorphic crust of the overriding plate, the pattern of sedimentation associated with subsidence and uplift reflects the growth of the wedge and the deformation of the sediment records the landward motion and propagation of the wedge. Slope basins, situated on an accretionary wedge, record the absolute and relative variations of uplift associated with its growth or subsidence associated with tectonic erosion. It would be valuable to determine how the episodic development of many forearc regions is related to changes in plate motion and sediment input. Many of these changes are recorded in the interaction between slope sedimentation and tectonic activity. The question of mass balance, particularly partitioning of materials that are being offscraped, subcreted, eroded or subducted, will only be resolved by a better understanding of how wedges "work." Until then, reliable estimates of the subduction zone contribution to the global geochemical cycle will be difficult to quantify.

Hydrogeology: The pressure of pore fluids reduces the effective confining pressure acting on a rock mass, and can influence deformation strongly, especially if pore fluid pressures vary to produce local zones of very low shear strength. Some models suggest that fluid pressures in excess of 90% of the lithostatic pressure make possible low-angle faults with large displacements.

The production of high fluid pressures and expulsion of fluids are associated with compaction and diagenesis within both the sediments of the wedge and underlying terrain. The fluids transport heat, and the chemistry of the fluids reflects both the conditions in the source region and water-rock interactions along fluid migration pathways. Geochemistry of the fluids is important to fluid motion and pathways within the prism, particularly in the deeper parts not accessible to direct sampling. Hydrogeochemical studies may provide specific information on fluid flow rates and permeabilities in otherwise inaccessible parts of the wedge, critical to assessing the state of stress. Fluids are a vital component controlling the strength of rocks and deformation styles, yet the nature of the basic fluid budget is poorly known at present. A comprehensive fluid-budget and migration pathways program can be developed using combined geophysical and geochemical techniques. For example, long-term geochemical monitoring of selected sites should provide a sensitive means of evaluating temporal and episodic development within a wedge.

Collisional Processes: One of the most challenging objectives for the next decade will be to relate, more directly that is currently possible, collisional processes at convergent margins to continental orogenesis. After oceanic lithosphere is consumed, continent-continent collision ensues, forming Alpine-type and Himalayan-type mountain ranges. Short of this extreme, topographic highs, *i.e.* seamounts or aseismic ridges, may be swept into convergent margins with variable, and as yet poorly understood, consequences. Land studies (*e.g.* in the Tethys and lapetus) suggest that the early stages of continental collision show many features similar to oceanic convergent zones, although the nature of the sediments accreted and the structures may differ. Contemporary collision zones vary considerably and it is not yet known how the thick sediment cover of continental margins interacts with the forearc, or how collision affects the distribution of deformation across the entire zone of convergence. Drilling incipient collision zones may shed light on the nature and timing of vertical and horizontal displacements, synchronous sedimentation, crustal flexure and deformation style. The precise targets require careful consideration.
During collision large slices of oceanic crust may be emplaced onto continental margins. Land studies suggest that major ophiolite slices form part of the forearc that converges on a subducting continental margin, but the deep structure and composition of oceanic forearcs remain very poorly understood. Well exposed ancient ophiolites document the end product of deformation and emplacement, not the collisional mechanism. Young ophiolites, like those obducted in Papua-New Guinea, are partly concealed by young continental margin sediments. Critical relationships between the emplacing oceanic slab and the parent oceanic crust are not exposed. Key questions still to be answered include the petrology, geochemistry, structure and tectonic setting of incipient ophiolites and the process of detachment, uplift and emplacement onto continental margins.

Extensional collapse of high collisional ridges may result in the formation of arc-shaped orogenic belts. A phenomenon common to these structures is that they develop in convergent settings, yet they are underlain by thinned crust on the inner sides of the arc. Research into the dynamics of this process is critical for the understanding of mountain building. The study of the structure, subsidence history and basement of such inner-arc basins may be most rewarding in areas of restricted post-orogenic sedimentation (*i.e.*, where the basement is readily accessible).

Dynamics of Convergent Plate Margins: One of the most intriguing areas in which to conduct submarine stress measurements is in the overriding plate. Despite the assumptions that go into theoretical modeling of convergent margins, relatively little is known about their stress fields. The stress measurements that exist are largely on or adjacent to islands, which are, by nature, anomalies. The transition from compressional to extensional strain fields upslope from the trench and toward the back arc is commonly interpreted to mimic a transition in the stress field. Indirect geological indicators have been used to infer the orientations of stress axes, but there is little in the way of direct data bearing on such critical questions, for example, as the origin and inversion of marginal basins (*i.e.*, the transition from Marianas-type to Chile-type margins).

The magnitudes of different stresses beneath the landward trench slope can be uncertain by an order of magnitude or more. In many cases, much can be learned from measurements of stress orientations over a wide range of depths. This is particularly true where rate of stress-axis rotation with depth depends upon relative strengths of two different forces (*e.g.* slope-related gravitational stresses and friction along a fault) that can be predicted theoretically to contribute differently to total stress. A sequence of measurements in the accretionary prism on the outer-arc high, and in the forearc basin, arc, and back-arc basin would shed light on basic issues related to how stress is transmitted and modified near a plate margin.

Additional measurements could resolve the forces acting on the Nazca plate and the overriding South American plate, where tectonic erosion is believed to be an active process. Comparison of the stresses on the South American plate above "flat-slab" subduction and "normal" subduction segments, and north and south of the Chile Rise triple junction, could also provide important constraints for orogenic processes.

• *Background Data*

All of the above themes relevant to ODP drilling on convergent margins require a clear understanding of the geometry of the structures. It is also essential that a comprehensive recent history of plate interactions and kinematics for the margin be available. This should include plate ages, convergence directions and rates. For present day motions, seismicity, fault plane solutions and other stress/strain indicators should be as fully investigated as possible. "Site Survey" is no longer merely a matter of identifying a satisfactory and safe place to drill. Detailed seismic surveys are required. It is necessary to image: The top of the undeformed lower plate and subducted sediments; the internal geometry of the wedges including folds, thrusts, normal faults, duplexes and mud diapirs; the lateral changes in the structures (3D) including thrust faults and ramps.

Accurate depth-corrected images must be provided. This requires improved geophysical estimates of the velocity structure.

Specific proposals to study the role of fluids would be greatly improved by initial reconnaissance of the hydrothermal vents, including heat flow measurements and direct diving observations.

• *Technical Developments*

The principal technological development required to drill deeper and maintain hole stability in undercompacted sediments or clastic materials is a riser. Drilling into the deepest parts (25-30 km) of convergent margins is impracticable, but drilling 2-4 km into inferred zones of incipient subcretion is feasible. It is a prime requirement to obtain an undisturbed, oriented core.

Development of packers for *in situ* pressure measurements is of the highest priority. The clear understanding of the role of fluids will require a knowledge of pore pressures, flow rates and the fluids themselves. Long-term instrumentation should be planned for specific holes, in order to measure the thermal regime, fluid circulation and seismicity over long periods of time.

Instrumentation needs to be improved for *in situ* stress and strain measurements. Besides existing dip meters, new tools for orientation of the cores are still needed. Logging time should be increased to allow time for the downhole measurement and sampling required. Vertical or offset seismic profiles will be required in most holes to provide accurate ties to geophysical data and to estimate the physical state of the rocks away from the drill holes. The full value of drill holes will not be realized until there is a well established pathway of information from microstructural studies of core materials and experimental work on its dynamic and physical properties, through borehole logging of *in situ* properties, to the mapping of structural and physical properties away from the drill sites by geophysical and other means.

• *Drilling Strategy*

Investigation of accretionary wedges should continue by focusing a broad suite of investigative strategies on a few selected regions and treating these regions as natural laboratories that would ultimately be permanently monitored to investigate dynamic processes that have both temporal and spatial variability. Processes that should be investigated include hydraulic circulation and related dewatering processes, the development of stress fields and related strains, and mass transfer processes that occur throughout the forearc region. A thorough investigation by geophysical means including seismic reflection and side-scan sonar techniques, will lead to an image of structures which are related to these processes. Then holes can be drilled into these structures both to investigate the structures at scales smaller than the resolution of geoacoustic techniques and to measure physical and chemical parameters related to dynamic processes. The future drilling will vary in two fundamental ways from previous drilling efforts: improved drilling techniques will permit much deeper penetration and better core recovery; and improved instrumentation will permit a broader range of observation over a longer time span.

•Locations

In nearly all cases the choice of location for drilling programs to understand tectonic processes at convergent margins should be influenced by substantial benefits to be gained from integration with geological and geophysical work on land. Drilling should take place in at least one clastic-dominated margin (*e.g.* Nankai, Cascadia, southern Barbados), one pelagic-dominated margin (*e.g.* northern Barbados, Costa Rica) and one non-accretionary/erosional margin (*e.g.* Japan, Peru Trench).

An appropriate drilling strategy is needed to document the role of collisions, large and small, in orogenesis. Collision of an active mid-ocean ridge is best exemplified by the Chile Rise-Chile Trench triple junction, but has been a dominant feature of the history of other margins such as the western Antarctic Peninsula. The process of collision between an island arc and continental margin involving thrusting of the island arc over continental crust as exemplified by the Sunda arc-Australian continent collision, also deserves to be better understood.

Back-arc basins formed during convergence may later be inverted, leading to arc-continent collision and subsequent mountain building, as hypothesized on land in the West Pacific region (S. China/Taiwan/Japan), southern Andes, the Alps and the Appalachians. The initial stages of back-arc underthrusting appear to be taking place in the West Pacific region (Banda Sea, S. China Sea).

Collisional processes are diachronous in space and time. The Mediterranean, for example, offers a rich tectonic laboratory to study comparative collisional processes, ranging from steady-state consumption of oceanic lithosphere under the Hellenic arc, to possibly initial stages of collision in the Eolian arc in the western Mediterranean, and potentially more advanced collision along the Cyprean arc in the eastern Mediterranean.

Deformational Processes at Divergent Plate Boundaries

•Tectonic Significance

The rifting of a continent is commonly the first event in the formation of an ocean basin. Such breakup typically involves normal faulting, igneous activity, uplift and subsidence, erosion and sediment deposition, and encompasses the time interval between initial extension and normal sea-floor spreading. Breakup varies in duration from a few million years to 50 million years or more, and forms the basis for all important aspects of subsequent margin evolution. Patterns of continental breakup are one of the primary indicators of the structure and rheology of the continental lithosphere. Preexisting continental structures and tectonic fabric play a key role in controlling rift location and style. The age of the continental lithosphere, *i.e.* the time since the last major heating or tectonic event, controls the geotherm, the most important factor in determining its strength. Anomalous heating from mantle sources may produce weaknesses in continental lithosphere that are exploited by rifting. These and other factors control the lateral distribution of continental extension and its surface manifestation. The heat budget of the margin is also established by extension. The distribution and amount of extension determine the tectonic subsidence and uplift during the post-rift phase. The change in sedimentary evironment in response to tectonic activity is complex and depends on the amount of sediment supplied.

The major problems to be investigated at rifted margins are: (1) What is the distribution of strain in the crust and mantle across the margin and its conjugate; (2) What is the distribution of volcanics and intrusives on a margin; and (3) What is the distribution of flexural strength across a margin and how does it vary with time? Naturally, the causes for these distributions are of interest, but first the distributions are on different margins must be established. Only then can patterns be discerned in the data.

Rifted continental margins differ in width, distribution of crustal extension, amount, nature, and timing of igneous activity and symmetry. Hotly contested end-member models for various tectonic aspects of continental breakup exist; end-member models of rifting by pure or simple shear reflect a debate about whether extension is distributed evenly through the continental lithosphere or localized at one or a few very large shear zones. Variations in volcanism during rifting have spawned both debate and numerous models to explain the observed differences. Transform rifts are predicted to behave quite differently from normal pull-apart rifts. Rift diversity is undoubtedly a result of the interplay of all these phenomena.

Rifting in oceans is also of great interest, and it would appear that oceans should be an excellent place to study the rifting process because of the comparatively simple structure of the oceanic crust. The tectonics of mid-ocean ridges with propagating rifts, overlapping spreading centers and changing rift profiles offers much that is new and exciting in the study of tectonics, especially in relation to magmatism. Equally interesting are questions of how intraoceanic rifting is initiated, how it ceases, and how ridge topography is preserved for periods of several tens of millions of years. Understanding of the nature and evolution of faulting, distributed strain and block rotation at ridges is an important tectonic theme that can be pursued in parallel with other studies of the oceanic lithosphere (e.g. petrology and geochemistry).

• *State of Knowledge*

Until recently, rifting was viewed as a symmetric tectonic process. Many geological and geophysical observations now emphasize the importance of asymmetric structures in the crust. For example, regionally extensive low-angle normal faults have been traced from the surface to mid-crustal depths in the Basin and Range of the western United States using seismic reflection techniques. A related class of asymmetric crustal structures is represented by certain metamorphic core complexes, where mid-crustal rocks have been tectonically denuded by normal detachment faults that are now nearly flat-lying. Strong topographic and volcanic asymmetries also exist across some conjugate rifted margins. Asymmetric deformation is commonly characterized as being a result of simple shear. This has led to the suggestion that the entire lithosphere may deform through simple shear.

Rifting must extend the crust and mantle portions of the lithosphere by the same overall amount, but the question remains concerning how that extension is distributed spatially and temporally. The problem of the spatial distribution of extension is often cast in terms of end-member models of pure- versus simple-shear deformation. The key difference between these models of extension is whether lateral offset of crustal extension relative to mantle extension occurs. For the simple-shear model, there is spatial separation between crustal thinning and lithospheric thinning, while for pure-shear rifting, the crust and lithosphere in any vertical crustal column extend by the same amount. Lithospheric deformation is surely more complex than these idealized models, but it is useful to try to evaluate data in terms of the amount of offset of crustal and mantle extension. One example of a hybrid of these models has no offset between the center of crustal extension and mantle extension, but the mantle extension is spread over a wider area than the crustal extension. This leads to initial uplift of the area flanking the crustal extension.

Some rifted margins require a component of simple-shear extension. For example, the Newark Series basins in the United States east coast contain synrift sediments, but no postrift section, and they do not exhibit thermal subsidence. However, these basins were eventually abandoned, and it appears that pure-shear deformation, centered east of the Newark basins, led to extreme crustal thinning and eventual formation of the North Atlantic Ocean basin.

Data suggest that pure-shear deformation has been the dominant mechanism of extension at some rifted margins. For example, heat flow data for the northern Red Sea require that most of the approximately 100 km of extension that has occurred there in the last 20 My has not involved lateral offset of lithosphere and crustal thinning.

Modeling lithospheric deformation will eventually lead to quantification of the process by which lithospheric extension transforms from simple shear to pure shear. Nonetheless, very limited data on the timing of progressive changes in the mode and width of extension exist, and only drilling can supply such information.

In addition to determining the distribution of deformation, the role of volcanism in extension must be quantified. Some margins seem to have little or no volcanic rocks overlying extended continental crust. In other regions, seismic data reveal that volcanics cover broad areas, and their thickness may be greater than that of adjacent oceanic crust. Models are presently being developed for extensive volcanism on rifted margins. In one, partial melting is related to anomalously high temperatures in the mantle caused by mantle plumes. In another, extra melting is due to vigorous asthenospheric convection driven by lateral temperature gradients. These models are not mutually exclusive, but they predict testable differences in the average degree of partial melting and chemistry of the magmas produced. Again, the rocks essential for testing the models can only be sampled by drilling.

Over the past four years, ODP has made substantial strides towards understanding the geological evolution and kinematics of both volcanic and nonvolcanic rifted margins. Site 642 penetrated a seaward-dipping reflector sequence on the Voring Plateau, suggesting strongly that these edifices, which are known to characterize some rifted margins from Norway to the Antarctic, are rapidly emplaced volcanic piles deposited at or near sea level. Off Galicia, Leg 103 addressed the geologic evolution of perhaps the best known example of a sediment-starved, nonvolcanic margin. The drilling of the Tyrrhenian Sea on Leg 103 allowed a determination of the timing and magnitude of subsidence across the rifted basin, which is critical for constraining models of extension. A transect of shallow holes not only refined prerift, synrift and postrift sedimentary history, but raised provocative new questions regarding the nature of reflector S, a prominent, continuous seismic horizon which may be a low-angle detachment. Leg 121 showed that Broken Ridge formed by a rapid uplift event, documenting the importance of flexure during extension.

• *Potential ODP Contribution*

In the decade to come, the main goal of ocean drilling on rifted margins will be to continue to test and discriminate among existing (and undoubtedly new) end-member models of margin evolution. It is of fundamental importance that ODP develop process-oriented investigations aimed at resolving fundamental rifting mechanism(s) controlling extensional deformation. In order to do this, drilling must sample continuously thick, postrift, synrift and prerift volcaniclastic sections *en route* to deep crustal structures elucidated both from remote sensing and other types of regional geologic studies. As an example, Leg 103 results have recently led some investigators to propose a simple-shear origin for the

Galicia margin and its conjugate off the southeastern Grand Banks. This hypothesis has been supported by new, deep geophysical data and a great deal of petroleum industry-derived well-control offshore eastern Canada. The model may be testable with the drill off Galicia, where one or more deep holes to reflector S could confirm its postulated identity as a through-going, low-angle detachment characteristic of a lower plate margin. The nature of continental crust thinned under extreme conditions of ductile shearing could also be determined in places like the Alboran Sea in the western Mediterranean.

As another example, geochemical studies of ODP samples of seaward-dipping reflector sequences (SDRS) from various rifted margins should offer a continuing and outstanding opportunity to understand one of the more obvious roles that volcanism plays during lithospheric extension. While Leg 104 found that the Voring Plateau SDRS is a basaltic edifice, drilling did not confirm its oceanic affinity because of rocks of continental affinity encountered near the base of the hole. Samples recovered from future SDRS drilling should improve our knowledge concerning the degrees of partial melting and the nature of the underlying mantle source(s) which produce SDRSs. An added complication is that SDRSs on other margins, *e.g.* off southwest Africa, are known to be at least partially silicic, suggesting the probability of the complex involvement of continental fragments in the transition from continent to ocean basin. Detailed geochemistry may be able to constrain degrees of nonoceanic interactions during emplacement, thereby allowing more definitive assessments of the "oceanic" vs. "continental" character of SDRSs to be made. Integration with land-based petrologic and geochemical studies in the Thulean and Gondwanaland igneous provinces will provide a complete picture of the igneous activity associated with supercontinental breakup. Furthermore, as ODP continues to sample rift basins in the marine environment, other, less seismically obvious, forms of volcanic involvement in rifting processes will undoubtedly be documented.

Other tectonic problems at mid-ocean ridges that can be investigated with the drill are: Are the inclined seismic reflectors in the oceanic lower crust faults, or are they related to magma emplacement; is the crustal fabric close to fracture zones and overlapping spreading centers different from "normal" oceanic crust?

•*Background Data*

The primary objective of rifted-margin studies is to recognize and characterize the transition between oceanic and continental lithosphere and to understand the geologic processes that control that evolution.Though at a scale of thousands of kilometers the tectonic evolution of oceanic regions and initial plate configurations is now well understood, significant deviation exists at scales of hundreds of kilometers and less. Consequently, the success of any drilling operation depends heavily on the collection and anaylsis of all possible geological and geophysical information from the region in which the drilling is to be carried out. To distinguish the wide variety of processes which may have taken place prior to the separation of large lithospheric plates, a precise understanding of the kinematic history of the adjacent oceanic basin is required. Therefore geophysical data on *both* conjugate margins must be synthesized prior to drilling.

In particular, pre-drilling geophysical data must be able to discriminate pre-rift structures and syn-rift versus post-rift sedimentary successions within rift basins to ensure precise site selection. Acquisition methodologies should provide data allowing direct comparison between conjugate margins in terms of age and volcanic and tectonic history. Much of the focus should be on the deep crust and upper mantle, because the interpretation of detachment faults, the inferred role of pure- versus simple-shear extensional mechanisms, and the importance of magmatism during extension depend heavily upon establishing the nature of the lower crust and the manner in which it deformed.

Furthermore, the formation of sedimentary basins landward of many rifted margins is fundamental because of the hydrocarbon resources that these basins contain and their almost continuous geologic record of rifting processes. Information obtained through the search for hydrocarbons must be integrated with ODP drilling results to fully elucidate the rifting process.

• *Technical Developments*

Deep drilling on rifted margins will require significant advances in technology to improve hole stability and ensure adequate recovery while maintaining the requisite level of safety, even on young margins. Holes penetrating to depths of 2-3 km and more will probably require at least a slimline riser capability. The COSOD II participants recommend even deeper holes on rifted margins. Engineering development for such sites should definitely be initiated, but implementation is probably several years away, after the highest priority riserless sites have been drilled.

• *Drilling Strategy*

Future studies of continental rifting, including ocean drilling, should examine a margin and its conjugate whenever possible. This should manifest itself both in the acquisition of data and in their interpretation. For ocean drilling, this does not necessarily require that holes be drilled on both sides, but it does require that in doing site surveys or other regional work, the conjugate margin be considered part of the site region. A common, though overly simplistic, way to distinguish between currently debated pure- and simple-shear models of rifting is the degree of symmetry of lithosphere extension. The key difference between simple-shear and pure-shear margins, which can be shown by drilling, is the ratio in thickness between synrift sediments and postrift sediments. These ratios are indicative of the differences in vertical motions produced by the mechanisms. An extreme simple-shear model would result in no postrift sediments over the location of the maximum synrift section. Generally, the horizontal distribution in this ratio is needed to determine the contribution of each mode of deformation. The flexural strength of the lithosphere also affects the distribution of subsidence sedimentation. Subsidence is spread over a broad area if the lithosphere rigidity is high. To evaluate this requires looking at conjugate margins and determining their configuration late in the rifting process. Conjugate margin basins also share common basement and sedimentary systems during rifting, and such similarities may be exploited by drilling one part of the system on one margin and the other on its conjugate.

A significant problem with using ocean drilling to solve tectonic problems on passive margins is the thickness of sediment deposited during and following rifting. While some useful information about subsidence history may be extracted from continuously deposited sediments, they can constitute a technological challenge to reaching rocks directly affected by rifting. However, this problem is less pronounced either when rifting has been recent or there has been slow drift sedimentation. Therefore, ocean drilling should continue to focus on young and/or sediment-starved rifted margins. Types of targets that we feel are most valuable are: Basement rocks; prerift and earliest synrift sediments; and prominent seismic reflectors of unknown geologic origin.

The drilling of oceanic ridges to determine the composition of the crust is a top priority of the Lithosphere Panel. Sites should be selected where tectonic problems (*e.g.* faulting and block rotation) can be addressed along with studies of composition.

• *Locations*

ODP should concentrate initially on drilling young conjugate passive continental margin pairs, where the sediments are thin, the thermal signature of rifting is more pronounced, and there is greater potential to discriminate between rifting models. These opportunities exist, for example, in the Red Sea and Bransfield Strait (late Tertiary rifting), Gulf of Valencia/Gulf of Lyon (mid-Tertiary rifting), and SE

Greenland/Norway (early Tertiary rifting). Sediment-starved conjugate margins, such as the Flemish Cap/Goban Spur margin of Late Cretaceous age, should be considered, also. Significant tectonic problems can be addressed in each of these areas using current or only slightly augmented drilling capability to drill holes to 1-2 km depth. Immediate, significant effort should be made to develop extensive geological and geophysical data bases to support drilling on these margins. The importance of obtaining adequate geophysical data both before and after drilling cannot be overestimated. As most tectonic problems are two- or three-dimensional, drilling must be used in concert with geophysical data that can provide three-dimensional regional control.

Intraplate Deformation

• *Tectonic Significance*

Plate interiors, away from the complexities of plate boundaries, are ideal locations for study of the behavior of the lithosphere under deviatoric stress. A vast area of the interiors of the major plates are water-covered, so the deformation resulting from loading can best be studied by the drill. By comparing the displacements, subsidence/uplift history or other expressions of the deformation to model predictions, it is possible to learn much about the rheology of the crust and upper mantle.

• *State of Knowledge*

Surface Loading: Much of our current knowledge of the long-term strength of oceanic lithosphere has come from studies of how it responds to loads such as those imposed by volcanoes and sediments, and studies of the response to various loads at island arc-trench systems. These loads are all of sufficient size that they strain the lithosphere almost to the limits of its strength. The largest load on the Earth's surface is at the Hawaiian Islands in the interior of the Pacific plate. The weight of the volcanoes has caused the oceanic lithosphere to flex by up to 4-5 km over distances of about 250 km. The geometry and timing of such large deformations place constraints on the long-term mechanical properties of the lithosphere. Drilling offers the opportunity to determine precisely the magnitude of the displacement and the state of stress at a point in the deformed lithosphere. Moreover, by determining the displacement history as recorded by the material infilling the moats that flank large loads it may be possible to constrain the form of the recovery as the lithosphere "relaxes" from its short-term thickness to its long-term elastic thickness.

Side-driven Loading: One result of flexure studies has been to demonstrate that on a geologic time scale, oceanic lithosphere behaves much like a thin elastic plate overlying a fluid substrate. The plates should act as stress guides, at least with regard to the forces that originate at plate boundaries, such as ridge-push and trench-pull. Deformations resulting from plate-driving forces may be observed in the plate interiors, and the driving forces themselves may be assessed. One such area is the interior of the Indo-Australia plate just south of Sri Lanka. Gravity and geoid data suggest the oceanic lithosphere in this region is thrown into a series of gentle folds with amplitudes of up to a few hundred meters and wavelengths of up to several hundred kilometers. Composite focal mechanism solutions suggest that the area is in a state of compression and that, in a sense, it is behaving as an incipient plate boundary. Preliminary results from Leg 115 have shown that drilling provides a unique opportunity to date the timing of deformation and to determine if it can be correlated with collisional events at the plate boundaries.

Loading from Below: Another type of deformation arises from loads acting from within or below the lithosphere due to thermal convection, thermal reheating around hot spots or other processes. Numerical modeling studies have shown that density-driven thermal convection can lead to significant displacements of the upper boundary layer. The amount of the displacement depends on the rigidity of the lithosphere and the relative proportion of buoyancy to viscous forces in the convecting material. Gravity anomaly and geoid studies suggest that surface displacements of 1-2 km with wavelengths of about 2000 km could occur as a result of convection. A related type of load results from buoyancy forces associated with reheating of the lithosphere around hot spots. These loads could cause displacements with amplitude and wavelength similar to those resulting from thermal convection. The areal extent of the displacements associated with such deep processes in the Earth is probably best mapped by constructing residual depth anomaly maps. The detailed record of the form of the displacements and the question of whether the subsidence/uplift patterns have persisted through time can, however, only be addressed by drilling.

- *Potential ODP Contribution*

The ODP contribution will come from determining the geometry and timing of deformation in the plate interiors. Stress determinations will also play a role in understanding both the deformations themselves and the driving forces on the plates.

- *Background Data*

In order to conduct drilling that has a good chance of making a contribution to understanding of the rheologic behavior of the lithosphere based on intraplate deformation it is necessary to have extensive regional geophysical surveys of the deformed fabric(s) to be studied.

- *Technical Developments*

This type of study probably does not require any special technologic development beyond those mentioned elsewhere in this document for the assessment of the tectonic environment.

- *Drilling Strategy*

Well designed experiments are required in areas where the chronologic resolution is sufficient to discriminate between different models of lithospheric rheology. Holes drilled to basement (or at least to lithified sediments) are required for stress determinations.

- *Possible Locations*

Locations for drilling to address the rheologic behavior of the lithospheric plates by studying the effects of intraplate loading include: The Hawaiian Islands, the Cape Verde Islands, the Marquesas Islands, the central Indian plate, and the east-central Pacific plate.

Plate Kinematics

- *Tectonic Significance*

Ocean basins contain the majority of information used to reconstruct former positions of the world's plates. Fracture zones and magnetic anomalies provide the only direct measurement of the long-term divergence histories of the plates, while paleomagnetic data and hot-spot tracks are used to relate these displacement histories to various global reference frames. Global plate reconstructions, in turn, offer the critical linkages necessary to study spatial and temporal relationships within nearly all branches of earth science. This synthesis of the geologic histories of oceans and continents demands well determined oceanic basement ages for constraints on spreading history and magnetic-time scales, an understanding of magnetic quiet zones, widespread data on hot-spot tracks, and a large volume of high-quality paleomagnetic data.

- *State of Knowledge*

Global plate-displacement histories are fairly well determined for the past few tens of millions of years, but poorly known prior to about 65 Ma. For instance, major uncertainties exist for plate kinematics within the Cretaceous Normal Superchron interval from 120-180 Ma. Evidence exists that unresolved magnetic anomalies may be present within this tectonically and paleoenvironmentally critical time interval. Basement ages are also badly needed for dating of the M-sequence magnetic anomalies from 170 to 120 Ma. These two time intervals account for 90 million years of Earth history. Plate motions within this interval will remain highly uncertain until more data are obtained.

Hot-spot traces are widely used as a viable frame of reference for relating motions between oceanic and continental plates in areas where subduction has erased much of the record. However, valid applications of hot-spot hypotheses to earlier times are possible only after the demonstration that they show consistency in Cenozoic times. Hot-spot traces such as the Hawaiian-Emperor chain have shown a remarkable age progression along their small-circle trends, but few equivalent studies on other traces have been carried out. Critical comparisons of age progressions and relative positions of traces within each plate and between ocean basins are needed to further establish the validity of this valuable reference frame. Of equal importance is the extension of these types of data sets into the Mesozoic. Because of problems encountered with global circuits, the hot-spot framework may be the only hope for establishing pre-80 Ma plate motions.

Paleomagnetic data from ocean basins have proven valuable in the determination of paleolatitudinal displacements, apparent polar-wander paths and true polar wander. Episodes of relative motion between the spin-axis (paleomagnetic) and hot-spot (mantle) reference frames have been proposed and could provide important insights into Earth's internal processes. Other types of paleomagnetic investigation contribute to the understanding of polarity transition, secular variation, geomagnetic excursions, and rock magnetic properties, all of which enhance our ability to successfully interpret marine anomalies and paleomagnetic data sets.

• *Potential ODP Contribution*

Although many of the advances in the understanding of plate tectonics have come through marine geophysical techniques, the verification and calibration of ocean-floor ages and magnetic time scales is, perhaps, the greatest achievement of DSDP. Drilling still remains the only available technique for widespread sampling of the ocean floor for age dating and paleomagnetic measurements. Continuing refinement of plate reconstructions and the understanding of plate motions is, in many instances, totally dependent upon an ongoing program of drilling.

The major areas in which ODP can contribute are: Hot-spot reference frames; seafloor age; Mesozoic plate motions; paleomagnetism.

Hot-spot Reference Frames: The hot-spot reference frame has been remarkably successful in establishing, confirming and underpinning global plate motions. Nevertheless, a number of specific and general uncertainties remain, such as: Do hot spots move, how fast, and in what direction? Manifested as seamounts, large portions of global hot-spot chains do not appear above sea level. Although magnetic-anomaly modeling and dredging can give some information, only drilling can reach and sample the basal igneous rocks of these structures. Among the specific goals of an ongoing program of ocean drilling should be: (1) The age progression of hot-spot chains, providing information about plate velocities, particularly in places with no currently calibrated hot-spot traces and on pre-Tertiary chains; (2) Geochemical evolution and discrimination, providing information about the nature of hot-spot volcanism itself and providing signatures for distinguishing superimposed, merged or cross-cutting hot-spot traces; (3) Relative motions, through paleomagnetism, establishing paleolatitudes and motions relative to the paleomagnetic framework and addressing fundamental problems of true polar wander and hot-spot motion.

Seafloor Age: The magnetic reversal time scale is the fundamental tool for ocean-floor age determination. Nevertheless, in many cases where magnetic anomalies are disturbed, subdued, destroyed by hydrothermal processes, or fragmented, the method cannot be applied. Large portions of sea floor such as the Bering Sea basin, the Canada basin, and the South Pacific Ocean basin are undated. Plate reconstructions for major areas of the globe (*e.g.* Alaska and West Antarctica-New Zealand) remain uncertain until the age and provenance of these pieces of ocean floor can be fitted into a satisfactory framework.

Mesozoic Plate Motions: The Mesozoic motions of oceanic plates are not well known because of the limited occurrence of Mesozoic oceanic lithosphere and increased uncertainties in the magnetic reversal chronology (particularly in the Cretaceous and Jurassic Quiet Zones). In consequence, global plate reconstructions become progressively less accurate in the Mesozoic. With a coherent drilling program, ODP can aim at reducing uncertainties to a minimum through:
(1) Identification of Mesozoic ocean crust and crustal remnants (*e.g.* Mozambique Basin, W. Pacific); (2) Establishing the spreading geometry, history, evolution and "absolute" motion of this crust; (3) Improved calibration of the Cretaceous-Jurassic reversal time scale (M-sequence).

Paleomagnetism: The number of fully oriented paleomagnetic samples from the ocean basins is remarkably small. This has resulted in a highly land-biased data set from which characteristics of the paleomagnetic field throughout the Earth's history have been modeled. Currently it is not possible to obtain a good definition of possible nondipole components of the Earth's field prior to the Neogene. Clearly, because the paleomagnetic field remains one of the most critical reference fields against which motions are measured, refinement of these models is essential for more reliable calibrations in many fields of geoscience. ODP should aim to provide much more comprehensive paleomagnetic sampling in both age and geographic distribution for contributions toward these goals. High-resolution paleomagnetic studies should be undertaken at nearly all future ODP sites to enhance our knowledge of the following: (1) Long-term behavior of the Earth's magnetic field through global correlations of magnetostratigraphic sections; (2) Short-term magnetic field behavior through investigations of polarity transitions, geomagnetic excursions, and secular variation; (3) Characterization of rock magnetic signatures to explore the age-dependent nature of oceanic crustal magnetization with particular emphasis on marine magnetic anomaly parameters.

• *Background Data*

The establishment of specific drilling sites for oceanic crust and seamounts requires the standard spectrum of marine geophysical techniques. In terms of oceanic crust, apart from bathymetric and seismic data to establish basement depths, the single most important parameter remains the magnetic anomaly field. Through a systematic magnetic survey grid (*e.g.* ≤ 10 km spacing) the grain and structure of the crust needs to be securely established. This is essential to ensure that a basement age sample comes from normal, lineated crust (undisturbed by transforms, propagators, ridge jumps or seamounts) from which the direction and polarity of spreading can be determined. Experience in areas over which detailed magnetic surveys have been carried out suggest that a line spacing of twice the ocean depth over an area of at least 50 x 50 km is not unreasonable.

In terms of seamounts, it is clear that detailed bathymetric (Seabeam) and swathmapping (SeaMARC, GLORIA) are also essential to locate flows, slumps, incised canyons and other features that should be either avoided or targeted in a drilling strategy. A preliminary dredging program should have been carried out both to provide supplementary information for drilling results and perhaps to eliminate the need for certain holes. Ideally, drilling will be sited within such a context that it will be clear whether samples are likely to represent the last eruptive phase, early flows or typical edifice geology. The age of the surrounding ocean floor established through regional interpretation of magnetic lineations is also an essential constraint.

• *Technical Developments*

The major technical goal underlying the achievement of useful measurements for kinematic purposes is a method of acquiring fully oriented samples (of both sediments and igneous rocks) for paleomagnetic and magnetic property measurements. Although methods have been developed commercially and are currently available, they suffer from a number of drawbacks and are not applicable in all modes of drilling. For instance, methods of downhole orientation of cores which depend on internal magnetic compass measurements are likely to be many degrees in error in basaltic sequences. It is clear that a significant initiative needs to be taken to develop new tools and orientation methods (perhaps considering the feasibility of a logging tool for measuring total magnetization direction *in situ*) before some of the objectives outlined above can be efficiently and economically achieved.

Shipboard improvements in achieving a magnetically clean environment, core barrel demagnetization and preservation of core orientation during handling should also be addressed.

• *Drilling Strategy*

Hot-spot Reference Frames: Clearly, for the achievement of goals of determining plate motions and relative hot-spot motions, it will be important to choose hot-spot chains which, through length and position, satisfactorily define poles and rates of motion for individual plates. Ideally, two separated hot-spot chains for each plate would satisfy the kinematic requirements. In practice, achievement of one fully callibrated hot-spot chain on each major plate would be a significant advance of our present knowledge. For the determination of relative hot-spot motions, a broad global distribution of hot-spot traces is necessary.

Seafloor Age: Major gaps in seafloor dating are currently evident. The paucity of drilling results in the southern oceans may be partially compensated by magnetic coverage, but lack of knowledge of areas such as the Arctic Ocean and Bering Sea severely limits northern hemisphere plate reconstructions. Drill sites should be proposed within the context of a thoroughly modeled plate reconstruction scheme so that results will have an immediate consequence in terms of prediction and can lead directly to the formulation of new, testable hypotheses. Attention should be paid to calibration of gaps in the paleomagnetic reversal time scale.

Mesozoic Plate Motions: Drilling should be designed to calibrate M-series magnetic anomalies and, where possible, address any resolution of absolute motions for this period.

Paleomagnetism: The principal successes in oceanic paleomagnetic measurements conducted to date have been in basalts and limestones. Although pelagic and/or clastic sediments may provide more continuous sequences, sedimentary and diagenetic processes may produce systematic biases in paleomagnetic directions. Achievement of a broad spread of samples in both space and time is likely to come from a coherent plan of "add-on" measurements to drilling sites initiated for other reasons. Recognition that this plan has priority, even though drilling may be primarily sited for other purposes, needs to be part of the approval process.

• *Possible Locations*

Hot-spot Framework: Louisville-Gilbert-Marshall-Marcus-Geisha; Emperor (Detroit and 50-55 Ma); Gulf of Alaska; New England; South Atlantic hotspots; oceanic plateaus.

Sea-floor Age: Bering Sea; Canada Basin; polar oceans; Kula fragments; Weddell Sea.

Mesozoic Ocean Floor: Atlantic margins; Mozambique-Somali; North Australia basin; West Pacific (Mariana-Nauru basins).

Paleomagnetism: All areas.

Plate Dynamics

The Ocean Drilling Program is now in a position to make unique contributions to understanding of the most fundamental tectonic processes through stress determinations and deployment of ocean-floor geophysical observatories.

• *Tectonic Significance*

Measurement of stress within plates and at plate boundaries can provide new understanding of fundamental tectonic processes. Data on the stresses within plates can help assess the relative importance of various forces acting on the plates: Ridge-push, trench-pull, plate-drag, etc. Ultimately, this will lead to better understanding of orogenesis and help forge links between oceanic and continental tectonics.

Long-term ocean-floor geophysical observatories working in unison with the land-based seismological stations, can provide data pertinent to several broad subject areas, three of which we consider to be of primary tectonic significance, particularly in the areas of plate dynamics: Global earth structure; oceanic upper mantle dynamics and lithospheric evolution; earthquake source studies. In addition, the existence of a global network involving ocean-floor observatories would impact the following areas: Oceanic crustal structure; tsunami warning and monitoring, and studies of sources of seismic noise.

• *State of Knowledge*

At present, the global stress map has enormous areas virtually devoid of data. Stress indicators consist almost entirely of earthquake focal mechanisms, with only a very small number of direct downhole stress measurements (only three by ODP). Results of preliminary stress-orientation studies conducted for several lithospheric plates (*e.g.* North America, Indo-Australia and Nazca) suggest that measurements in comparatively few additional localities can discriminate between different models of plate driving forces. More detailed studies, particularly those around the San Andreas fault, have emphasized the potential usefulness of reliable stress orientation data in understanding tectonic processes. They have highlighted the difficulty of using focal mechanisms alone to derive stress orientations near plate boundaries. Measurement of both the orientations and magnitudes of the stresses can be of enormous tectonic value.

The land-based digital seismographic data collected since the mid-70's provide novel information on three-dimensional Earth structure, leading to a significant improvement in the quantification of earthquakes. Even though the resolution of current 3-D maps of the Earth's interior is rather low because of the inadequate distribution of the stations, the information content was sufficient to discover the dominant role of very large wave-length lateral heterogeneities in the lower mantle.

Very broad-based techniques of studying source-time functions allow the retrieval of fine details of source radiation and correct determination of the total moment released even for a very complex event. The current density of stations is insufficient to undertake a general analysis of the source radiation in both space and time. Generally, there is a sufficient body of knowledge and the technical means to take full advantage of data provided by a new global network including stations sited in ODP drill holes in oceanic lithosphere.

•*Potential ODP Contribution*

Intraplate Stresses and the Driving Forces: Although considerable progress has been made over the past 10 to 15 years, many aspects of plate-driving forces are still poorly understood. One important way in which this deficiency can be attacked is by adding to the available data base of intraplate stress measurements. At present, stress fields in the oceans are virtually unknown. Most stress orientation data points from the oceans are derived from earthquake focal mechanisms, which are not direct indicators of stress orientation and therefore can yield ambiguous results.

The accumulation of a global stress map might be considered analogous to the process of putting together the geologic time scale: For the most part, it is an iterative, "unglamourous" task, but the information contained in such a data set would be of great importance in understanding a wide range of geologic problems. Intraplate stress measurements can be very useful in differentiating between various possible plate driving-force models, as long as the measurements are from areas in which the predictions of different models diverge. For this reason, measurements from areas near corners and bends in plate geometry are likely to be particularly useful. Gradients in stresses across large plates may yield constraints on distributed (not boundary) driving forces and on the nature of areas of active midplate seismicity.

Plate Boundary Stresses and Deformation: Measurements of strike-slip faults can yield important insights into the mechanics of crustal rocks, even if only principal stress orientations can be obtained. Recent results from the San Andreas region demonstrate clearly that the San Andreas represents a weak zone within otherwise strong crustal rocks. This conclusion is based upon the observation that the San Andreas is inclined at an angle of only a few degrees to the least horizontal stress axis. Because it is so close to one of the principal stress axes, the shear traction along the San Andreas is far smaller than the regional differential stress in magnitude. This result explains the well known lack of an observed geothermal anomaly across the San Andreas. Potentially important candidates for such studies exist in many other geologic settings, including oceanic transform faults and the strike-slip faults found in many convergent margins.

The stress field required to drive strike-slip faulting in arc and back-arc regions is of considerable interest because its activity appears to be related to other attributes of the margin, including the obliquity of convergence and the overall balance between the compressional and extensional tectonics in the overlying plate. It is not well understood whether strike-slip faulting in the overriding plate near subduction zones is controlled by the strength and geometry of coupling along the subduction boundary, whether fault strength is a function of total displacement (as some rock-mechanical studies suggest), or if there are significant differences between the strengths of such faults at different margins.

Active ridge-transform systems present other interesting mechanical questions related to stress fields: How strong are transform faults? Are they sufficiently strong as to be a significant factor in the balance of plate driving forces? Is their strength dependent on age? What is the contribution of thermal contraction and of plate-boundary effects to the stress field of ridge-transform system? What is the stress field around overlapping spreading centers?

Deep Structure: It is expected that full deployment of the ocean bottom components of the global network will be an international undertaking. The most important and irreplacable contribution of ODP would be the drilling of holes for seismographic stations and initial emplacement of sensors and recording equipment. It is assumed that support for seismographic equipment will be available from other sources.

• *Background Data*

No special data are required for stress measurements *per se*. Extensively detailed site surveys need to be undertaken before deployment of a long-term geophysical observatory. Both stress measurements and deployment of a seismologic observatory are envisaged as part of a major tectonic experiment involving seismic, side-scan sonar and submersible work (for example a study of transform-fault dynamics or one of ridge-crest propagation).

• *Technical Developments*

The Borehole Televiewer is a very useful tool for determining orientations of horizontal stress components. This instrument will be able to obtain breakout orientations in well lithified sediments, as well as in basalt. It is anticipated that it will be used in most logged holes. If so, it will offer the opportunity of gathering the sort of routine measurements of stress orientations that is necessary for the gradual building up of the data base.. One possible limitation is that penetration of some holes may be shallower than the depths at which breakouts occur.

Packer experiments, like the one to be attempted in the Argo Basin, can also be of significance. There are numerous tectonic problems, particularly those associated with strike-slip and thrust faulting, for which magnitudes of stresses are key data, but unfortunately, are poorly known. Although they can be combined with other valuable

measurements such as permeability, measurements with a packer are inevitably time-consuming. Therefore, such measurments must be carried out only where there is a clear objective. However, fundamental issues related to the mechanics of deformation simply cannot be answered without judicious application of the packer. In the future, it may be possible for ODP to obtain information on stress magnitudes with alternative approaches, such as breakout shape used in conjunction with hydraulic fracturing.
and experimentation before specific plans for deployment of permanent geophysical observatories can be made.

(1) Seafloor and subseafloor noise: Although knowledge of deep ocean noise sources and propagation mechanisms has increased substantially in recent years, insufficient understanding exists to guide deployment of permanent observatories.

(2) Islands and seafloor stations: Island seismic stations play an important role in the global seismic network and are at present the only locations where permanent observatories may exist in the oceans. Pilot studies are required to resolve how adequate these stations are (*i.e.* can downhole observatories by fully justified?).

(3) Short-term technical issues: An urgent priority is to adapt a presently available broadband sensor for operation on the ocean floor. One year recordings will be necessary during pilot experiments and, though systems with the data storage capacity and timing accuracy necessary for this are currently under development, they have never been deployed.

(4) Long-term technical issues- telemetry, power, sensors: The major problems here are related to how a permanent global ocean-floor netowrk would be operated. With a data rate of approximately 50 MBytes per day, the problems of both internal recording (with periodic data retrieval) or real-time telemetry are extremely challenging.

•*Drilling Strategy*

There are several alternative approaches that could be taken in planning ODP stress measurements. COSOD II has emphasized the importance of determination of stress in oceanic lithosphere, and pointed out the large gaps in the world stress map. There is a clear need to bring about a gradual filling of the stress map, but the map is now so sparse that a sporadic, target-of-opportunity approach is likely to yield useful measurements for several years into the future. TECP emphasizes that collection of stress orientations is something that should be done as a matter of course in at least one hole in any area where logging to sufficient depths is to be done. A dedicated hole may be justified where a critical gap exists on the stress map. Even if drilling of an entire hole to obtain stress data in a certain area is not justified, it is important to take advantage of cases in which drilling carried out largely for other purposes has reached, or is close to a depth, at which stress measurements are possible.

A second approach is one of carefully planning regional stress measurement programs, especially where existing data provide a framework for constraining models of plate-driving forces and/or the generation of important structures. Such an experiment would have the advantage of being able to resolve stress gradients that can yield important information on the dynamic processes involved in plate motions. It may be some time before enough stress measurements have been collected in the world's oceans to justify plate-scale experiments, but we do not believe that carefully posed experiments need to be of this scale. Even a few measurements could conceivably yield very valuable results, if drilling were done at sufficiently critical locations with respect to plate geometry. It is important to develop a set of models that yield predictions that are sufficiently different for the data to be able to discriminate between them.

Finally, opportunities should be taken in deep holes (including re-entered ones) to measure stress magnitude as a function of depth. Details of a drilling strategy for deployment of geophysical observatories have yet to be worked out.

They are dependent on the results of the experiments outlined above.

•*Locations*

Several interesting and potentially valuable examples of stress-measurement programs exist. For example, data from the northwestern corner of the Nazca plate suggest that trench-pull, rather than ridge-push, may be the dominant force there, since compression axes are parallel to the trench along the western margin of South America and not perpendicular to the Nazca-Cocos Ridge. The Indo-Australian plate is another potentially fruitful, if complex, laboratory with a variety of plate-boundary settings and a zone of central intraplate deformation. Small plates (e.g. Juan de Fuca and the Philippine Sea) would make interesting targets because comparatively few measurements would produce stress gradients that could be related to different types of plate boundary and hence to possible driving mechanisms.

It is logical to assume that the greatest benefit for the deployment of ocean bottom seismic stations will be in places far distant from land masses (including islands) and where detailed interdisciplinary studies of phenomena such as plate rifting and accretion, transform motion, and plate convergence can be undertaken.

PHASED IMPLEMENTATION PLAN

TECP has devised a 12-year program that indicates the progress required to achieve the scientific objectives outlined above.

Phase I (1989-92)

This phase comprises a transition from the present strategies and technologies for tectonic drilling to those required for later years of the program.

Convergent Plate Boundaries:

•Complete two case studies of deformation processes and fluid flow in accretionary wedges with appropriate logging and instrumentation; appropriate sites include Nankai, Cascadia/Vancouver, Barbados; 4 legs.

•Undertake thorough study of ridge crest-trench collision processes; Chile Rise/Trench triple junction; 2 legs.

•Conduct study of aseismic ridge/island arc collision zone; Vanuatu; 1 leg.

Divergent Plate Boundaries:

•Conduct studies of the structural development of oceanic lithosphere in conjunction with other mid-ocean ridge drilling.

Intraplate Deformation:

•Undertake a study of deformation associated with top surface intraplate loading; Hawaii?; 1 leg.

Plate Kinematics:

•Refine Mesozoic magnetic anomaly time-scale; Western Pacific; 1 leg.

•Refine hot-spot reference frame in Pacific; North Pacific; 1 leg.

Plate Dynamics:

•Initiate routine intraplate stress measurements on an opportunity basis.

•Deploy and test seismic observatory (off Hawaii?) on an opportunity basis.

Development for Phase 1:

•Tools for quantifying environments of active tectonism.

•Accurate core orientation and paleomagnetic measurements.

•Deep and closed circulation (riser) drilling capabilities.

•Geophysical observatories.

Planning for Phase 2:

•Establish detailed planning groups for deep continental margin drilling and sea-floor geophysical observatories.

•Initiate new generation of detailed site surveys for tectonic objectives including geophysical observatories.

Phase 2 (1993-96)

Convergent Boundaries:

•Advanced case study of deformation and fluid flow in an accretionary wedge including long-term instrumentation; Middle America, Barbados; 2 legs.

Divergent Plate Boundaries:

•Conjugate rifted continental margins

(volcanic and nonvolcanic); North Atlantic, Mediterranean basins, Bransfield rift; 6 legs (3 dedicated).

Intraplate Deformation:

•Deformation associated with lithospheric loading in compression and/or extension; central Indian Ocean, east-central Pacific Ocean; 2 legs (1 dedicated).

Plate Kinematics:

•Plate motions including hot-spot histories using paleomagnetism; 4 legs.

Plate Dynamics:

•Stress determinations for driving forces on a plate; Nazca or Juan de Fuca plates; 2 legs.

•Dynamics of transform faulting; east-central Pacific, Atlantic; 2 legs.

•Establish geophysical observatories; 2 legs.

Development for Phase 3:

•Tools for quantifying environments of active tectonism.

•Deep drilling and riser capabilities.

Planning for Phase 3:

•Complete site surveys for deep drilling sites at convergent and divergent boundaries and for geophysical observatories.

Phase 3 (1997-2000)

Convergent Plate Boundaries:

•Augment earlier case studies with deep drilling; establish long-term observatories; W. Pacific, Middle America, Barbados; 6 legs.

Divergent Plate Boundaries:

•Augment earlier drilling and industrial data with deep drilling and establish geophysical observatories; Atlantic and Mediterranean margins; 6 legs (2 dedicated).

Intraplate Deformation:

•Continue study of intraplate deformation; Indian Ocean, east-central Pacific; 2 legs.

Plate Kinematics:

•Continue study of hot-spot reference frame.

Plate Dynamics:

• Complete deployment of geophysical observatories; 2 legs.

The overall plan calls for 48 legs over 12 years; 2.5 per year in Phase 1, 5 per year in Phase 2, and 4.5 per year in Phase 3. Although this may seem to be a high proportion of the available time, only approximately 50% needs to be dedicated to TECP legs, and we believe that with appropriate planning to combine TECP objectives with those of other thematic panels, this is an ambitious but not unrealistic goal.

INTERFACE WITH OTHER GLOBAL PROGRAMS

The type of study proposed in this plan is going to lead to much greater interaction between the Ocean Drilling Program and other global geoscience programs than in the past. Specific examples are the Global Geoscience Transects Project of the Inter-Union Commission on the Lithosphere, the U.S. EDGE project, global seismic networks, RIDGE, and continental tectonics and petrology/geochemistry studies of orogenesis and magmatism related to supercontinental breakup.

Date: Tue. 25 May 1993 10:08:30 -0700 (PDT)

Subject: JOIDES white papers

To:

PCOM's white paper subcommittee -- Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bn.edu>, Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <kiddr@geology.cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldeo.columbia.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Ulrich von Rad <vonrad@gate1.bgr.dbp.de>

To: Subcommittee of PCOM on white papers

From: Brian Lewis

Subject: Outline of our membership and task.

PCOM established, at its April 1993 meeting, a subcommitte to work with the thematic panel chairs to develop the white papers. The PCOM members of this group were to be the liasons to the thematic panels. These are;

LITHP	Mevel, Mutter
OHP	Mix, Arculus *
SGPP	Kidd, von Rad, Berger**
TECP	Taylor, Larsen.

* I added Dick Arculus because he presently does not have a liason and his input would be welcome.

** Wolf Berger is presently somewhere in Norway and not on email so I suggest Ulrick von Rad serve for the next few months until he leaves PCOM and we can straighten this out.

The purpose of the subcommittee is to work with the thematic panel chairs on their white papers so we can (a) clearly define the goal of the white papers and (b) achieve a uniform and useful product with the least waste of time and energy.

As a starting point I would say the goal is twofold. In the first instance we need to focus on maximising science returns in the next few years. In the second instance we need to define the goals of a post 1998 program.

In my opinion these papers are aimed not so much at the experts in each of our own fields, but at the those in the general area of geology/oceanography and other earth sciences who need convincing that the science of this program is worthwhile.

The time frame is such that a roadmap is desired by the August PCOM meeting.

LITHP has been given the go ahead for their white paper and their plan, which includes a large meeting in Sept.

Before we get to the meat we need to agree on some basic issues;

1. That we use internet as a means of communication (no travel).
2. That the broad goals are as stated above

As a practical matter there are two ways for making sure all particpants see all the email comments (except that Hans-Christian Larsen is not yet on email, but will be very soon ?). One way is for me to act as distributor. The other way is for each member to set up their own mailing list for this group (which is contained in this mail message or I could supply) and thereby copy everyone. This would be the simplest option.

Because LITHP is well along with their paper I suggest that Sherm be prepared to tell us early on the details of their plan.

So there are two action items. All members of this subcommittee should respond soon with comments on the goals and the use of internet. Sherm Bloomer should prepare some info for us on the LITHP white paper.

Looking forward to an interesting task.

From acm@gfdl.GOV Ukn May 25 10:47:36 1993

Date: Tue, 25 May 93 13:47:42 EDT
To: joides@ocean.washington.edu
Subject: Re: JOIDES white papers
Cc: delaney@cats.ucsc.edu, rarculus@metz.une.edu.au

Brian - Thanks for your note about thematic white papers updates. I am already making progress on the OHP end, and will also welcome input from Dick Arculus. I have discussed the situation with the MESH steering committee. They are moving a bit slower than originally planned, and now will probably have a meeting in late August rather than in June, unfortunately after the PCOM meeting but that is life. I also talked to Peggy Delaney, and she and I would like to get together in late July to blend words prior to PCOM. She would like to come to Corvallis for a day or two in July. How do we get her travel authorized and paid for? I think it will be very helpful to have Peggy, Nick Pisias (MESH chair), and me sit in the same room and hammer out a draft. We can keep Dick posted via internet. The goal would be to have a first draft ready for Peggy to bring to OHP in October, to assign tasks of fleshing out.

Cheers, Alan Mix.

From Moores@garnet.ucdavis.edu Ukn May 25 14:22:34 1993

Date: Tue, 25 May 1993 14:23:11 -0800
To: JOIDES Office <joides@ocean.washington.edu>
Subject: Re: JOIDES white papers

Hi Brian et al. At our March Meeting TECP began the task of revision of its white paper. (see TECP minutes, pp. 23-24). Writers were assigned for various sections, with the deadline of July 15 for the drafts to be received by myself for melding into a coherent document. Our hope is to have a complete draft ready for review by the Fall Meeting. What do you think of this plan. Should I send the pertinent pages of the document to the white paper subcommittee? Please advise.
Eldridge

Date: Tue, 25 May 1993 14:42:02 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>
Subject: Re: JOIDES white papers
To: Moores@garnet.ucdavis.edu
Cc: PCOM's white paper subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <kiddr@geol.cf.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldgo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Ulrich von Rad <vonrad@gate1.bgr.dbp.de>

Eldrige, Thanks for your response. This is just what the whole group needs to know. The intent is not to slow down the process you have started, but to make sure we are all going in the same direction to the same place. Once we have comments like yours from all the thematic panel chairs we can compare notes and fine tune our plans.
Brian

Date: Tue, 25 May 1993 16:41:05 -0800

Received: from garnet.ucdavis.edu by tsunami.ocean.washington.edu
To: Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bn.edu>, Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <kiddr@geol.cf.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment%czheth5a.BITNET @uwavm.u.washington.edu>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, John Mutter <jcm@lamont.ldgo.columbia.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Ulrich von Rad <vonrad@gate1.bgr.dbp.de>From: Moores@garnet.ucdavis.edu
Subject: TECP white paper plans

May 25, 1993

Dear Colleagues:
Pursuant to Brian's message on white papers, I enclose a copy of the section of TECP's minutes outlining the proposed revision, to be undertaken over the next several months.
Eldridge Moores

TECTONICS PANEL White Paper Revision (from Mar. 1993 minutes)

TECP discussed the question of the revision of the White Paper. It was agreed that the preliminary working outline wouldbe as follows:

I. General Preamble

Technical developement

Structural processes in general

Each person will write a portion or comment of preamblefor his/her sectionto be merged with the rest.

II. Sections

	Writer(s)
Convergent settings:	
Active Margins	GregMoore/Roland Von Huene
Collisional processes	Carlo Doglioni
Divergent settings	
Rifted margins	Phil Symonds/Mike Steckler
Marginal basins	Yujiro Ogawa
Mid-Oceanic Ridges	
Rifts	Jeff Karson
Transforms	Yves Lagabrielle
Translational settings	
Transforms	A. Robertson/Uri TenBrink
Plate Kinematics	Steve Cande/Joann Stock
Intraplate deformation	?
Plate dynamics	Mark Zoback
Plate history, magnetics, etc.	Steve Cande
Paleo-stress, deformation mechanisms	Sue Agar

Each section to include:

- State of knowledge
- Current status of drilling progress
- Opportunities achievable for drilling through 1998
- Opportunities beyond 1998
- Suggested drilling strategy, technical developments, locations andachievable results (will tabulate all together in final writeup)
- Map keyed to themes

"Brainstorm" list of items to include, asappropriate:

Structural processes: stress and strain,deformation paths, chronology
Vertical motion--uplift and subsidence
Fluid in deforming crust
Age dating of sediments and basement
Comparison--tectonic and magmatic processes
- *Creation--oceanic lithosphere*
- *Subduction*
- *Passive-rifts, etc.*
- *Mass balance*

Ductile structures--fabrics, kinematic indicators, geometry
Temperature and thermal history
Sediment-tectonic interaction
- *Response to deforming lithosphere*
  - *Fabric in rock*
  - *Composition*
  - *Age*
  - *Geochemical and physical properties*

Shows complexity--all factorspoint to solution to tectonic problems
Dating deformation--relative chronology, absolute age.
Rate of deformation
Scale problem
- *Microfabric, core--correlation with other cores*
- *Regions, plates, plate margins, orogenic belts, etc.*

Integration and synthesis:
- *Site surveys, drilling, seismics, other geophysics,dredging, on-land geology*

3-D presentation (characterization)
Hypothesis testing--quantitative vs. qualitative
Experimental Rock deformation--application tointerpretation of core, deduction of rheologic properties frommicrostructures

Appendices:

1. Suggestions on how totranslate tectonic objectives into shipboard scientists' assignedduties
2. Tectonics guide for shipboard scientists. How todistinguish drilling disturbances from real primary structuralfeatures.

Writing plan:

1. Each person towrite assigned section, send to Eldridge Moores as e-mail or Word 4 (Macintosh) disk by July 15, 1993
2. Moores to collate, combine into single document for review at FallMeeting.
3. Sections should be shorter and morefocused than equivalent sections in current White Paper.
4. Prepare two versions--shorter one to publish, and longer onefor Panel and to send to proponents

Date: Fri, 28 May 93 17:14:50 -0400

From bloomer@crsa.bu.edu Ukn May 28 14:14:49 1993
From: bloomer@crsa.bu.edu (Sherman Bloomer)
To: blewis@ocean.washington.edu, cam@ccr.jussiew.fr, delaney@cats.ucsc.edu, jcm@lamont.ldgo.columbia.edu, kiddr@geol.cf.ac.uk, mix@oce.orst.edu, moores@garnet.ucdavis.edu, rarculus@metz.une.edu.au, sediment@czheth5a.bitnet, taylor@elepaio.soest.hawaii.edu
Subject: LITHP white paper

In response to Brian Lewis's note of 25 May:

Internet is by far the best way to communicate for me--though its a bit of amoot point right now as I am off to the field for June.

The current state of the LITHP white paper revision is synopsized below. I'd appreciate any comments or suggestions anyone might have. I hope we'll have some confirmation from USSAC about funding for an meeting to discuss the revision by the end of June.

The Lithosphere Panel's White Paper is being rewritten, with the objective of producing a document which reflects the diverse interests of the lithosphere community and which sets some specific priorities for drilling in the next ten years.

To accomplish the revision of the White Paper with these objectives in mind, the Panel established the following schedule at its fall 1992 meeting in Paris,:

October 1992*:	Draft Table of Contents Preparation of draft sections assigned to LITHP members
February 1993*	Draft sections compiled by LITHP Chair
March 1993*	Draft reviewed and revised at LITHP Spring meeting
June/July 1993	Open meeting on "Lithospheric Objectives of ODP" to obtain community input
August 1993	Rewrite white paper on basis of community response
October 1993	Approval of final draft at LITHP Fall meeting
December 1993	Presentation of White Paper to PCOM and distribution of White Paper to community

*completed April 1993

The working table of contents for the revised white paper is:

JOIDES Lithosphere Panel White Paper
(Updated 1993) Table of Contents

The revised document prepared at the Spring Panel meeting outlined a draft list of important objectives (in no order of priority):

Oceanic Lithosphere

- Crustal Evolution-drilling along a flow line
- Hydrothermal processes coordinated with experiments and monitoring efforts

- Lithosphere structure and composition--offset drilling
- Deep drilling
- Initiation of rifting--drilling in an area such as the Red Sea

Large Igneous Provinces (LIPS) and Intraplate volcanism

- Mantle Plumes and continental breakup
- Timing of the formation of large oceanic plateaus

Convergent Margins

- Arc initiation and supra-subduction zone ophiolites
- Back-arc initiation, propagation and source distribution
- Subduction zone mass balances and geochemical fluxes

Susan Humphris and I have written a proposal to USSAC requesting funds to support the participation of 25 or more U.S. scientists in a workshop to revise the white paper which defines the objectives of the Lithosphere Panel of the Ocean Drilling Program. This revision will emphasize the identification of specific thematic goals and will provide recommendations for both a short-term (1993-1998) and a long-term (1998-2003) plan to accomplish those objectives. The meeting is tentatively scheduled for the 17th and 18th of September, 1993 at the University of Leicester, Leicester, United Kingdom. The site was selected to make participation easier for at least some of the foreign members of the Program.

We are finishing a draft of the white paper now; we will circulate this to the JOIDES office and the Lithosphere Panel for final comments. I will then prepare a draft which will be circulated widely in the oceanographic community late this summer, whether we receive funding for the meeting in Leicester or not. The feedback on this draft will be incorporated into a final draft prepared at the October meeting of LITHP in Santa Fe.

Date: Thu, 10 Jun 93 15:46 N

From: <SEDIMENT@CZHETH5A.bitnet>
Subject: SGPP White Paper
To: joides@ocean.washington.edu

Dear Brian, SGPP's white paper was written during the first year of the panel's existence and was subsequently published in JOIDES Journal, Vol. XVI, No. 2, June, 1990, p.45-60. Since its publication 3 years ago, the membership of the panel is almost 100% new (except for 2 individuals). Thus, I think it would be a good idea to have SGPP review the document in light of drilling results from the last three years and critical technologic developments that have been and have not be made. As this document was recently formulated, I am not sure it needs to be totally rewriten, but only updated. I would suggest the following: The PCOM subcommitte members (Berger and Kidd) who were selected to work with SGPP should familiarize themselves with the document. I can send them copies if they cannot locate one. I will be attending the next PCOM meeting as the ESF alternate for Hans Christian Larsen. If possible, Berger, Kidd and I could discuss the document prior to the beginning of the meeting in order to determine what needs to be changed or added to the existing white paper. I could then after the PCOM meeting instruct SGPP members on what needs to be done in preparation for the revision of the white paper. This could then be a major item in the agenda for our fall meeting in mid-Spetember. I feel that the revision requires a broad spectrum of input from specialists representing both the geochemical and sedimentological communities, Thus, I would prefer to have the revision made within the panel structure, where the various disciplines are fairly well represented by indiviual SGPP members. I will await any comments on this proposed plan.

Best wishes, Judith McKenzie, SGPP Chair

Date: Thu, 10 Jun 1993 09:05:47 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>
Subject: SGPP White Paper (fwd)
To:

PCOM's White Paper Subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <sglrbk@cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldeo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Wolf Berger c/o <eystein.jansen@geol.uib.no>

This was received from Judy McKenzie.

H-C Larsen wishes to delay particiption in this sub-com until later in the year when he has some time and email. I will be sending some general comments as a way to start discussion in a week or so.

Brian

Date: Thu, 17 Jun 1993 15:44:26 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>

Subject: some comments from b.lewis and some info from tamu

To: PCOM's White Paper Subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <sglrbk@cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldgo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Wolf Berger c/o <eystein.jansen@geol.uib.no>

To stimulate some comments on the white papers I will offer a few comments of my own and I also attach a list of accomplishments which TAMU used in the formulation of the 1994 program plan.

Brians comments:

A review of the LITHP paper and the proposed TECP paper shows them to look somewhat like the originals, long shopping lists with something for everyone and written for the experts in the field, not for those who need to be convinced.

I also note that the hardest parts to write, the accomplishments and the focussing in the future (sec 1.2 and 1.3 of the LITHP paper) are not yet written. However I do like the layout of part 1, with COSOD objectives, achievments, and future targets.

In general my impression is that the hard part will be stating the accomplishments in a manner that will convince other earth scientists, and in identifying goals where drilling can play a critical role in solving a particular problem. I have the feeling that many of the goals are scientifically interesting in a general way, but it is not clear how drilling will contribute to the solution.

My suggestion at this time is that the panels think hard about the accomplishments and where drilling has been most effective.

Herewith the accomplishments section from TAMU:

SCIENTIFIC HIGHLIGHTS--FIRST SEVEN YEARS OF DRILLING OPERATIONS

The Ocean Drilling Program (ODP) has now completed 48 internationally staffed expeditions and eight years of scientific ocean drilling. JOIDES Resolution, the scientific drillship of ODP, has travelled in the Atlantic, Pacific, and Indian oceans, including high latitude zones bordering East and West Antarctica, and the Mediterranean, Caribbean, Weddell, Sulu, Celebes, Philippine and Japan seas, in search of answers to important scientific problems designated by the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). As of Leg 147, she has revisited, drilled and cored 696 holes at 281 sites and retrieved 77,638 meters of cored material. As of Leg 148, 1179 shipboard scientists from around the world have participated in cruises (Figure T-1). These scientists have brought more than 449,553 individual samples to their home institutions for further study. Figure T-2 illustrates drilling locations for Legs 100-158; Tables T-1 and T-2 summarize leg and site statistics for Legs 100-147.

During the first eight years of drilling operations, ODP has addressed many of the objectives of the Conference on Scientific Ocean Drilling I (COSOD I) held in Austin, Texas, in 1981, and

COSOD II held in Strasbourg, France, in the summer of 1987. These objectives include investigating the tectonic evolution of passive and active continental margins, origin and evolution of oceanic crust, origin and evolution of marine sedimentary sequences, and causes of long-term changes in Earth's atmosphere, oceans, cryosphere, biosphere, and magnetic field.

Some significant results of ODP drilling obtained during the past eight years are summarized below. This is followed by summaries of scientific and operational plans for FY94 cruises (Legs 153-158). Results of cruises 141-147, completed during FY92 and the first part of FY93 are presented in Appendix D; these summaries are taken from preliminary cruise reports published at the Ocean Drilling Program.

A. Significant Scientific Results: Cruises 100-147

1. Changes in the Global Environment

a) Paleoclimate Array

A broad-scale linkage, at least for the last 3 million years, has been documented between the polar components of the climate system (ice sheets, sea ice, and polar ocean) and the low-latitude ocean atmosphere components (surface ocean, upwelling, wind circulation, and land climate).

1) North Atlantic Ocean

Major drift sedimentation began in the Labrador Sea about 10 million years ago.

The onset of glaciation occurred about 2.5 million years ago in the Labrador Sea, 2.9 million years ago in the Norwegian Sea, and as early as 3.4 million years ago in Baffin Bay.

2) Equatorial Atlantic Ocean

A substantial intensification of coastal upwelling has occurred since 3 million years ago along the north-west African margin. A first order correlation exists between this equatorial trend and that seen in polar climates.

Drilling at sites on the north-west African coast recovered a variety of windblown sediments that document the orbitally driven cycles of aridity and humidity in source areas located in North Africa and provide a better understanding of the gradual desertification of Africa in the Pliocene and Pleistocene.

3) North Pacific Ocean

A depth transect drilled across the Ontong-Java Plateau provided high-resolution data for understanding global ocean dynamics and climate for past 25 million years and demonstrated that acoustic reflectors are synchronous and associated in time with important paleoceanographic events, relating to sudden changes in carbonate accumulation, to diagenesis, or to carbonate dissolution pulses.

4) Equatorial Pacific

The paleoceanographic evolution of the eastern equatorial Pacific during the last 12 m.y. was documented by the completion of high resolution analysis on 5500 m of core recovered from 11 sites arranged in two N-S transects crossing the numerous oceanographic regimes.

Real-time laboratory core-logging of sediment density, magnetic susceptibility and color spectral reflectance was completed through double- and triple-coring at sites in the eastern equatorial Pacific to allow near real-time construction of composite sections and assure complete recovery and continuous sediment/paleoceanographic records.

Drilling conducted on the Ontong-Java Plateau indicate that global ocean changes in the carbon cycle take precedence over changes in bottom water activity by itself, in the control of major patterns of carbonate accumulation in the late Neogene.

5) South Indian Ocean

The age of the oldest sediment in the Argo Abyssal Plain is about 20 million years younger than previously believed and suggests a Cretaceous rather than Late Jurassic opening of the Indian Ocean with important consequences for plate-tectonic evolution in the southern hemisphere and the demise of Tethys.

A major regional unconformity in the Kerguelen Plateau region, identified on seismic sections as the boundary between pre-rift and post-rift sequences, is at least 20 million years younger than previously thought.

6) Antarctic

Drilling off Antarctica indicated that there was no significant glaciation prior to 42 million years ago and that 65 million years ago the climate of Antarctica was warm; therefore, non-glacial mechanisms are necessary to explain sea-level fluctuations during this time period.

Glaciation at sea level first occurred about 35 million years ago on eastern Antarctica and between 5 and 10 million years ago on western Antarctica.

The West Antarctic ice sheet has been a stable and permanent feature since about 4.8 million years ago.

A major glacier complex reached Prydz Bay, East Antarctica, about 35 million years ago and possibly as early as 42 million years ago.

A shallow seismic horizon in the Weddell Sea, interpreted to be an unconformity at about 25 million years ago, is actually about 125 million years old.

7) Arabian Sea

Increased productivity in the surface waters on the Oman margin began between 10 and 16 million years ago.

b) Atoll Transect

1) North Pacific Ocean

Drilling at Resolution and Allison Guyots in the Western Pacific documented shallow-water limestone caps, respectively 1600 m and 700 m thick, which preserve the history of the guyots from submergence of the pedestals in the Barremian and Albian, respectively, through the final drowning.

Sediments accumulated on both Resolution and Allison Guyot during the late Albian and, despite rapid subsidence, shallow water conditions prevailed throughout most of the platform histories.

Drilling results from, and guyot morphology of, the western Pacific guyots indicate a relative sea-level fall of at least 160 m between the late Albian and middle Turonian.

Drilling on guyots in the Marshall Islands and off Japan documented at least three major episodes of carbonate platform drowning, specifically in the Albian, late Maastrichtian, and middle Eocene.

The results from investigations on the Western Pacific guyots have provided evidence that, in contrast to modern atolls having a coral-algal reef framework surrounding a lagoon, Cretaceous and Eocene carbonate systems may have produced vast quantities of loose carbonate sediment in large shoal deposits with rudist-algal-coral boundstones forming relatively thin bioherms on the exterior ridges near the margins of the guyot.

c) Passive Margin Transects

1) North Atlantic Ocean

Drilling operations at the Galicia margin has extended the age of the syn-rift period to at least 130 million years ago.

A temporal link exists between drowning of the Bahama shallow-water platform and worldwide oceanic oxygen deficiency about 100 million years ago.

2) South Pacific Ocean

Drilling off northeastern Australia demonstrated that the Great Barrier Reef formed < 1 m.y. ago, and documented an extremely high-resolution sea level history with more than 20 sea level lowstands, characterized by high magnetic susceptibilities, low carbonate contents, and a correlation to seismic reflectors.

d) Continental Margin Drilling

1) North Pacific Ocean

Drilling in the Santa Barbara Basin recovered cycles of laminated and non-laminated sequences which document changes in basin oxidation, water temperature, terrigenous input, climate, and onshore vegetation and are tentatively interpreted to reflect Quaternary glacial oscillations.

2) South Pacific Ocean

Upwelling cells along the Peru margin migrated landward in response to subsidence of the continental margin.

e) Deep Stratigraphic Tests

Continuous, undisturbed sections, critical for high-resolution paleoceanographic studies of the Earth's climatic history, have been recovered from a wide variety of basin settings and latitudes ranging from 70°N to 71°S.

Sediments have been recovered from the high southern and northern latitudes, specifically the Norwegian Sea, Baffin Bay, the Weddell Sea, and Prydz Bay.

1) North Pacific Ocean

In the high-latitude North Pacific, drilling has recovered very long APC cores which allowed the construction of long and continuous magnetic reversal stratigraphies.

Significantly increased sedimentation rates were recorded in the high-latitude North Pacific at the Pliocene/Miocene boundary and at 2.6 Ma, the time of onset of Northern Hemisphere glaciation, in addition to the occurrence of abundant volcanic ash layers in sediments older than 2.6 Ma, and an increase in opal fluxes at 12 Ma with a maximum between 6 and 3 Ma.

Several Eocene volcanic ash horizons were recorded from the high-latitude North Pacific, adding further definition to the poorly known history of Eocene volcanism.

A 1.5-km shallowing of the carbonate compensation depth (CCD) was documented in the high-latitude North Pacific since the early middle Miocene, in contrast to the deepening of the CCD since the early Miocene documented elsewhere in the world.

2) Equatorial Pacific Ocean

A complete complement of bio-, physical property-, litho- and magneto-stratigraphies have been recovered from sites drilled on the eastern equatorial Pacific transects to allow development of a high resolution bio-magnetostratigraphy framework and an improved geopolarity timescale.

2. Mantle-Crust Interactions

a) Mantle Composition and Dynamics

Extensive downhole geophysical and logging data was collected at a number of important oceanic crustal sections, including 110-million-year-old crust, zero-age crust, oceanic-continental transitional crust, and gabbro.

1) North Pacific Ocean

A cased reentry hole was established for the Ocean Seismic Network (OSN) 225 km southwest of Oahu. This is the first of a proposed global array of permanent geophysical observatories on the deep ocean floor dedicated to the investigation of earthquakes and Earth's structure.

Cores recovered from the Detroit Seamount in the high-latitude North Pacific recorded magnetic reversals associated with the Brunhes/Matuyama boundary, the Jaramillo, Olduvai, and Reunion events, and the Matuyama/Gauss boundary.

Drilling at the Hess Deep rift valley retrieved continuous sections of gabbroic rocks of Layer 3 of the Pacific oceanic crust and peridotites from the uppermost part of the Pacific oceanic mantle, the first recovery in core.

The Reunion-Nazareth Bank-Chagos-Maldive-Laccadive lineament was confirmed to be a hot-spot trace constructed of oceanic volcanic rocks with increasing ages to the north.

2) South Pacific Ocean

Drilling in the Lau Basin returned evidence that back-arc rifting was far more complete than previously though with initial brittle extension followed much later by seafloor spreading. Collected lavas included basalts, basaltic andesites, and andesites with affinities to both oceanic-arc and mid-ocean ridge lavas. Where preserved, the isotopic signatures of these lavas indicate a complex, heterogeneous mantle source.

Massive tholeiitic basalt flows were recovered from the Ontong-Java Plateau, indicating it formed largely by deep-water effusion of flood basalts during Aptian time.

3) North and South Indian Ocean

Basement sampling of the Ninety-east Ridge is consistent with the origin of the ridge as the trace of the Kerguelen/Ninety-east hotspot on the Indian Plate.

The basaltic nature of the Southern Kerguelen basement was clearly established.

b) Creation of Oceanic Crust at Spreading Centers

The feasibility of "bare-rock" spud-in has been demonstrated.

Data critical to understanding the processes of magma generation and crustal construction at a fast-spreading mid-ocean-ridge environment is continually being accumulated.

1) North Atlantic Ocean

Drilling to basement in the southern Labrador Sea confirmed that the crust in this region formed about 55 million years ago.

2) North Pacific Ocean

Drilling operations at the Juan de Fuca Ridge examined how ocean crust is created and then altered during the early stages of rifting at a sedimented spreading center in the Middle Valley region.

The Jurassic age of the Pigafetta Basin was conformed by the recovery of Jurassic sediment and basement samples.

3) South Pacific Ocean

The Lau Basin is older than expected (>5.6 Ma instead of 2.5-3.0 Ma) and seafloor-type spreading has occurred in the backarc only during the last 1 to 2 Ma.

4) Tyrrhenian Sea

Basement drilling has recorded the sequential development of a number of small basins in the Tyrrhenian Sea and the relative youth of the Tyrrhenian Sea as a whole.

c) Crust/Mantle Interactions at Convergent Plate Margins

1) North Atlantic Ocean

The seaward-dipping reflectors along the outer Norwegian passive margin (similar to reflectors flanking a number of other passive margins) are a series of volcanic flows that extruded through rifted continental rock, representing the last stage of drift prior to seafloor spreading.

2) North Pacific Ocean

The first evidence for Pliocene or younger magmatic activity in an extant intraoceanic forearc terrane was recovered in the Mariana region.

Some forearc serpentinite seamounts can form, at least in part, by flows of clast-bearing serpentinite mud from a central conduit.

The first successful drilling was achieved through an accretionary prism into subducted sediments.

The Celebes Sea originated in an open ocean setting in the middle Eocene, while the Sulu Sea appears to have originated as a backarc or intra-arc basin in the late early middle Miocene, during collision of the Cagayan Ridge with the rifted continental margin.

Drilling on the Oki Ridge recovered an excellent Plio-Pleistocene paleoceanographic reference section containing a remarkable series of light-dark cyclic deposits that imply rapid and extreme variations in the dissolved oxygen content of the bottom water, perhaps related to periodic isolation of the Japan Sea from the Pacific.

3) South Pacific Ocean

Dramatic changes on the Peru margin, from subcrustal erosion and subsidence to accretion and uplift, have been attributed to subduction of the Nazca Ridge and to changes in plate convergence.

Drilling on the arc-trench slope in the Tonga forearc region recovered late Eocene or older dacitic tuffs, welded tuffs, and lavas in fault contact with overlying upper Eocene to lower Oligocene carbonates and Miocene volcaniclastics. These subaerially erupted dacitic igneous rocks have subsided more than 6 km since their formation, representing profound tectonic foundering.

4) Tyrrhenian Sea

Rifting and subsidence in the Tyrrhenian Sea occurred very rapidly, and was diachronous across the Sardinian continental margin.

3. Fluid Circulation in the Crust and the Global Geochemical Budget

a) Hydrogeology of the Oceanic Lithosphere

Ongoing drilling operations have accumulated data about the configuration, chemistry, and dynamics of active hydrothermal systems at both sedimented and unsedimented spreading centers.

b) Hydrogeology of the Ocean Margins

Advective hydrologic flow in continental-margin settings impacts greatly on the geochemical and sediment facies of organic-rich deposits.

1) North Atlantic Ocean

Drilling operations have defined two distinct hydrogeologic systems through which the Barbados accretionary prism (and probably many others) dewaters.

2) North Pacific Ocean

Drilling operations have documented inactive flow off Oregon at the depth of the frontal thrust and active fluid dispersal and localized advection above the frontal thrust.

Massive gas hydrates were recovered in cores from below the Oregon continental slope with active fluid flow indicated by geochemical anomalies in pore waters, fluid pressure, and local higher temperature excursions form a linear increase with depth.

Hydrate occurs in sediments above the bottom-simulating-reflectors (BSRs) at the Cascadia margin while free gas is present below the BSRs in a lower velocity zone.

Long-term observations on crustal hydrogeology are being carried out at the sedimented Juan de Fuca Ridge through the installation of 300-m-long ten-thermistor temperature sensor strings, pressure sensors, and plumbing for fluid sampling.

Drilling operations recovered a complete section through the accreted sediments, decollement, and subducted sediments into ocean crust near the toe of the Nankai Trough accretionary prism, finding evidence for large-scale concentrated fluid flow through prism.

Low chlorinity fluids and hydrocarbon-rich gases of subduction-related origin were documented within the Mariana serpentinite seamounts.

4. Stress and Deformation of the Lithosphere

a) Mid-Oceanic Ridge Systems

1) South Indian Ocean

Rifting between Broken Ridge and the Southern Kerguelen Plateau was by far field in intraplate stress (passive rifting) rather than by a mantle convection (active rifting).

b) Convergent Margins

Convergence-related stresses are transmitted through sediments up to 6 km seaward of the deformation front.

1) North Pacific Ocean

Drilling on the Okushiri Ridge demonstrated that compressive tectonics began to collapse the northeast margin in the Japan Sea beginning about 1.8 Ma, possibly representing initiation of a new subduction zone.

A major shift in physical properties occurs in the decollement zone of the Nankai Trough accretionary prism, marking a boundary between pervasive structural deformation features above and almost no structural deformation below.

2) South Pacific Ocean

In the New Hebrides Arc, drilling operations documented two differing kinds of forearc deformation caused by collision of the DEntrecasteaux Ridge with the arc. Where the Northern DEntrecasteaux Ridge collides with the arc, sediments and MORB basement rocks have been offscraped and accreted to the forearc to form an accretionary complex. In the Southern DEntrecasteaux Chain, more buoyant andesitic basement rocks of the Bougainville Guyot may allow it to float up onto forearc slope before being subducted or accreted.

Figure T-1: Summary of Shipboard Scientific Participation on ODP Legs 101-148.

Figure T-2: Drilling Locations for Legs 100-148 and future Legs 153-158.

LEG	BEG. DATE	SITE	Operations Area	St. Scientist	Co-Chief Scientists
100	1-11-1985	625	GULF OF MEXICO	R. KIDD	P. RABINOWITZ
					L. GARRISON
101	JAN-29-1985	626	N. Atl. Ocean	A. PALMER	J. AUSTIN
		627	N. Atl. Ocean		W. SCHLAGER
		628	N. Atl. Ocean		
		629	N. Atl. Ocean		
		630	N. Atl. Ocean		
		631	N. Atl. Ocean		
		632	N. Atl. Ocean		
		633	N. Atl. Ocean		
		634	N. Atl. Ocean		
		635	N. Atl. Ocean		
		636	N. Atl. Ocean		
102	MAR-14-1985	418	N. Atl. Ocean	C. AUROUX	M. SALISBURY
					J. SCOTT
103	APR-25-1985	637	N. Atl. Ocean	A. MEYER	G. BOILLOT
		638	N. Atl. Ocean		E. WINTERER
		639	N. Atl. Ocean		
		640	N. Atl. Ocean		
		641	N. Atl. Ocean		
104	JUN-19-1985	642	Norwegian Sea	E. TAYLOR	O. ELDHOLM
		643	Norwegian Sea		J. THIEDE
		644	Norwegian Sea		
105	AUG-23-1985	645	BAFFIN BAY	B. CLEMENT	M. ARTHUR
		646	Labrador Sea		S. T SRIVASTAVA
		647	Labrador Sea		
106	OCT-27-1985	648	N. Atl. Ocean	A. ADAMSON	R. DETRICK,JR
		649	N. Atl. Ocean		J. HONNOREZ
107	DEC-26-1985	650	Tyrrhenian Sea	C. AUROUX	K. KASTENS
		651	Tyrrhenian Sea		J. MASCLE
		652	Tyrrhenian Sea		
		653	Tyrrhenian Sea		
		654	Tyrrhenian Sea		
		655	Tyrrhenian Sea		
		656	Tyrrhenian Sea		

108	FEB-18-1986	657	N. Atl. Ocean	J. BALDAUF	W. RUDDIMAN
		658	N. Atl. Ocean		M. SARNTHEIN
		659	N. Atl. Ocean		
		660	N. Atl. Ocean		
		661	N. Atl. Ocean		
		662	S. Atl. Ocean		
		663	S. Atl. Ocean		
		664	N. Atl. Ocean		
		665	N. Atl. Ocean		
		666	N. Atl. Ocean		
		667	N. Atl. Ocean		
		668	N. Atl. Ocean		
109	APR-17-1986	395	N. Atl. Ocean	A. ADAMSON	W. BRYAN
		648	N. Atl. Ocean		T. JUTEAU
		669	N. Atl. Ocean		
		670	N. Atl. Ocean		
110	JUN-19-1986	671	N. Atl. Ocean	E. TAYLOR	C. MOORE
		672	N. Atl. Ocean		A. MASCLE
		673	N. Atl. Ocean		
		674	N. Atl. Ocean		
		675	N. Atl. Ocean		
		676	N. Atl. Ocean		
111	AUG-16-1986		N. Pac. Ocean	R. MERRILL	K. BECKER
		677	N. Pac. Ocean		H. SAKAI
		678	N. Pac. Ocean		
112	OCT-20-1986	679	S. Pac. Ocean	K. EMEIS	R. VON HUEN
		680	S. Pac. Ocean		E. SUESS
		681	S. Pac. Ocean		
		682	S. Pac. Ocean		
		683	S. Pac. Ocean		
		684	S. Pac. Ocean		
		685	S. Pac. Ocean		
		686	S. Pac. Ocean		
		687	S. Pac. Ocean		
		688	S. Pac. Ocean		

113	DEC-25-1986	689	Weddell Sea	S. O'CONNELL		J. KENNETT
		690	Weddell Sea			P.BARKER
		691	Weddell Sea			
		692	Weddell Sea			
		693	Weddell Sea			
		694	Weddell Sea			
		695	Weddell Sea			
		696	Weddell Sea			
		697	Weddell Sea			
114	MAR-11-1987	698	S. Atl. Ocean	B. CLEMENT	P. CIESIELSKI	
		699	S. Atl. Ocean		Y. KRISTOFFERSEN	
		700	S. Atl. Ocean			
		701	S. Atl. Ocean			
		702	S. Atl. Ocean			
		703	S. Atl. Ocean			
		704	S. Atl. Ocean			
115	MAY-13-1987	705	S. Indian Ocean	A. MCDONALD		J. BACKMAN
		706	S. Indian Ocean			R. DUNCAN
		707	S. Indian Ocean			
		708	S. Indian Ocean			
		709	S. Indian Ocean			
		710	S. Indian Ocean			
		711	S. Indian Ocean			
		712	S. Indian Ocean			
		713	N. Indian Ocean			
		714	N. Indian Ocean			
		715	N. Indian Ocean			
		716	N. Indian Ocean			
116	JUL-02-1987	717	S. Indian OceanC. AUROUX	J. COCHRAN		
		718	S. Indian Ocean	D. STOW		
		719	S. Indian Ocean			
117	AUG-19-1987	720	Arabian Sea K.EMEIS	W. PRELL		
		721	Arabian Sea	N. NIITSUMA		
		722	Arabian Sea			
		723	Arabian Sea			
		724	Arabian Sea			
		725	Arabian Sea			
		726	Arabian Sea			
		727	Arabian Sea			
		728	Arabian Sea			
		729	Arabian Sea			
		730	Arabian Sea			
		731	Arabian Sea			

118	OCT-18-1987	732	S. Indian Oc.	A. ADAMSON	P. ROBINSON
		733	S. Indian Ocean		R. VON HERZEN
		734	S. Indian Ocean		
		735	S. Indian Ocean		
119	DEC-14-1987	736	S. Antarct. Ocean	J. BALDAUF	J. BARRON
		737	S. Antarct. Ocean		B. LARSEN
		738	S. Antarct. Ocean		
		739	S. Antarct. Ocean		
		740	S. Antarct. Ocean		
		741	S. Antarct. Ocean		
		742	S. Antarct. Ocean		
		743	S. Antarct. Ocean		
		744	S. Antarct. Ocean		
		745	S. Antarct. Ocean		
		746	S. Antarct. Ocean		
120	FEB-21-1988	747	S. Indian Oc.	A. PALMER	R. SCHLICH
		748	S. Indian Ocean		S. WISE, JR
		749	S. Indian Ocean		
		750	S. Indian Ocean		
		751	S. Indian Ocean		
121	APR-30-1988	752	S. Indian Oc.	E. TAYLOR	J.WEISSEL
		753	S. Indian Ocean		J. PEIRCE
		754	S. Indian Ocean		
		755	S. Indian Ocean		
		756	S. Indian Ocean		
		757	S. Indian Ocean		
		758	N. Indian Ocean		
122	JUN-28-1988	759	S. Indian Oc.	S. O'CONNELL	U. VON RAD
		760	S. Indian Ocean		B. HAQ
		761	S. Indian Ocean		
		762	S. Indian Ocean		
		763	S. Indian Ocean		
		764	S. Indian Ocean		
123	AUG-28-1988	765	S. Indian Oc.	A. ADAMSON	F.GRADSTEIN
		766	S. Indian Ocean		J. LUDDEN
124	NOV-01-1988	767	N. Pac. Ocean	M. Breymann	E.SILVER
		768	N. Pac. Ocean		C. RANGIN
		769	N. Pac. Ocean		
		770	N. Pac. Ocean		
		771	N. Pac. Ocean		

124E	JAN-04-1989	772	Philippine Sea	W. ROSE	NONE
		773	Philippine Sea		
		774	Philippine Sea		
		775	Philippine Sea		
		776	N. Pac. Ocean		
		777	N. Pac. Ocean		
125	FEB-16-1989	778	N. Pac. Ocean	L. STOKKING	P. FRYER
		779	N. Pac. Ocean		J. PEARCE
		780	N. Pac. Ocean		
		781	N. Pac. Ocean		
		782	N. Pac. Ocean		
		783	N. Pac. Ocean		
		784	N. Pac. Ocean		
		785	N. Pac. Ocean		
		786	N. Pac. Ocean		
126	APR-18-1989	787	N. Pac. Ocean	T.JANECEK	K. FUJIOKA
		788	N. Pac. Ocean		B. TAYLOR
		789	N. Pac. Ocean		
		790	N. Pac. Ocean		
		791	N. Pac. Ocean		
		792	N. Pac. Ocean		
		793	N. Pac. Ocean		
127	JUN-19-1989	794	Japan Sea	J. ALLAN	K. PISCIOTTO
		795	Japan Sea		K. TAMAKI
		796	Japan Sea		
		797	Japan Sea		
128	AUG-21-1989	794	Japan Sea	M. BREYMANN	K. SUYEHIRO
Note: Leg 128 includes		798	Japan Sea		J. INGLE, JR
drydock & transits		799	Japan Sea		
129	NOV-20-1989	800	N. Pac. Ocean	A. FISHER	R. LARSON
		801	N. Pac. Ocean		Y. LANCELOT
		802	N. Pac. Ocean		
130	JAN-19-1990	803	N. Pac. Ocean	T. JANECEK	W. BERGER
		804	N. Pac. Ocean		L. KROENKE
		805	N. Pac. Ocean		
		806	N. Pac. Ocean		
		807	N. Pac. Ocean		

131	MAR-30-1990	808	N. Pac. Ocean	J. FIRTH	A. TAIRA IAN HILL
132	JUN-08-1990	808	N. Pac. Ocean	F. RACK	J. NATLAND
		809	N. Pac. Ocean		
		810	N. Pac. Ocean		
133	AUG-09-1990	811	S. Pac. Ocean	A. JULSON	P. DAVIES
		812	S. Pac. Ocean		J. MCKENZIE
		813	S. Pac. Ocean		
		814	S. Pac. Ocean		
		815	S. Pac. Ocean		
		816	S. Pac. Ocean		
		817	S. Pac. Ocean		
		818	S. Pac. Ocean		
		819	S. Pac. Ocean		
		820	S. Pac. Ocean		
		821	S. Pac. Ocean		
		822	S. Pac. Ocean		
		823	S. Pac. Ocean		
		824	S. Pac. Ocean		
		825	S. Pac. Ocean		
		826	S. Pac. Ocean		
134	OCT-14-1990	827	S. Pac. Ocean	L. STOKKING	J. COLLOT
		828	S. Pac. Ocean		G. GREENE
		829	S. Pac. Ocean		
		830	S. Pac. Ocean		
		831	S. Pac. Ocean		
		832	S. Pac. Ocean		
		833	S. Pac. Ocean		
135	DEC-22-1990	834	S. Pac. Ocean	J. ALLAN	J. HAWKINS
		835	S. Pac. Ocean		L. PARSON
		836	S. Pac. Ocean		
		837	S. Pac. Ocean		
		838	S. Pac. Ocean		
		839	S. Pac. Ocean		
		840	S. Pac. Ocean		
		841	S. Pac. Ocean		
136	MAR-2-1991	842	N. Pac. Ocean	J. FIRTH	A. DZIEWONSKI
		843	N. Pac. Ocean		R. WILKENS
137	MAR-20-1991	504	N. Pac. Ocean	A. GRAHAM	K. BECKER G. FOSS

138	MAY-5-1991	844	N. & S. Pac. Ocean	T. JANECEK	N. PISIAS
		845	N. & S. Pac. Ocean		L. MAYER
		846	N. & S. Pac. Ocean		
		847	N. & S. Pac. Ocean		
		848	N. & S. Pac. Ocean		
		849	N. & S. Pac. Ocean		
		850	N. & S. Pac. Ocean		
		851	N. & S. Pac. Ocean		
		852	N. & S. Pac. Ocean		
		853	N. & S. Pac. Ocean		
		854	N. & S. Pac. Ocean		
139	JUL-10-1991	855	N. Pac. Ocean	A. FISHER	E. DAVIS
		856	N. Pac. Ocean		M. MOTTL
		857	N. Pac. Ocean		
		858	N. Pac. Ocean		
140	SEP-15-1991	504	N. Pac. Ocean	L. STOKKING	H. DICK
					J. ERZINGER
141	NOV-15-91	859	S. Pac. Ocean	R. MUSGRAVE	J. BEHRMANN
		860	S. Pac. Ocean		S. LEWIS
		861	S. Pac. Ocean		
		862	S. Pac. Ocean		
		863	S. Pac. Ocean		
142	JAN-18-92	864	N. Pac. Ocean	J. ALLAN	R. BATIZA
143	MAR-22-92	670	N. Pac. Ocean	J. FIRTH	E. WINTERER
		865	N. Pac. Ocean		W. SAGER
		866	N. Pac. Ocean		
		867	N. Pac. Ocean		
		868	N. Pac. Ocean		
		869	N. Pac. Ocean		
		870	N. Pac. Ocean		
144	MAY-23-92	800	N. Pac. Ocean	F. RACK	J. HAGGERTY
		801	N. Pac. Ocean		I. PREMOLI-SILVA
		871	N. Pac. Ocean		
		872	N. Pac. Ocean		
		873	N. Pac. Ocean		
		874	N. Pac. Ocean		
		875	N. Pac. Ocean		
		876	N. Pac. Ocean		
		877	N. Pac. Ocean		
		878	N. Pac. Ocean		
		879	N. Pac. Ocean		
		880	N. Pac. Ocean		

145	JUL-24-92	881	N. Pac. Ocean	T. JANECEK	D. REA
		882	N. Pac. Ocean		I. BASOV
		883	N. Pac. Ocean		
		884	N. Pac. Ocean		
		885	N. Pac. Ocean		
		886	N. Pac. Ocean		
		887	N. Pac. Ocean		
146	SEP-25-92	888	N. Pac. Ocean	R. MUSGRAVE	B. CARSON
		889	N. Pac. Ocean		G. WESTBROOK
		890	N. Pac. Ocean		
		891	N. Pac. Ocean		
		892	N. Pac. Ocean		
		893	N. Pac. Ocean		
147	NOV-25-92	894	N. Pac. Ocean	J.ALLAN	K. GILLIS
		895	N. Pac. Ocean		C. MEVEL

Table-2

ODP Operations Summary--1985 - 1993

Leg	Operation Area	# of sites	# of holes	meters cored	meters recov.	% recov.	deep. pen.	max. water depth	# of re-entries
100	G. Mexico	3	4	266	264	100%	185	905	1
101	Bahamas	11	19	2977	1429	49%	535	3581	0
102	W.Atlantic	1	0	0	0	0%	0	5505	2
103	Galicia Bank	5	14	1460	593	41%	547	5321	0
104	Norweg. Sea	3	8	2419	1695	70%	1229	2780	11
105	Labrador Sea	3	12	2960	1884	64%	1147	3870	3
106	Mid-Atl. Ridge	2	12	92	12	13%	33	3529	18
107	Tyrrhenian Sea	7	11	3297	1908	48%	721	3606	0
108	NW Africa	12	27	4244	3843	91%	381	4750	0
109	Mid-Atl. Ridge	3	3	102	12	11%	93	4494	27
110	Lesser Antilles	6	10	2404	1898	79%	691	5018	0
111	Panama Basin	3	5	641	428	67%	1562	3474	21
112	Peru Margin	10	20	4710	2666	57%	779	5093	0
113	Weddell Sea	9	23	3361	1944	58%	647	4665	0
114	South Atlantic	7	12	3602	2297	64%	672	4637	0
115	Mascarene Plat.	12	22	3955	3075	78%	353	4440	0
116	Bengal Fan	3	10	2299	991	43%	961	4747	0

117	Oman Margin	12	25	5847	4367	75%	994	4045	0
118	SW Ind. Rid.	4	20	780	447	57%	501	5219	15
119	Prydz Bay	11	22	3652	2102	58%	716	4093	2
120	S Kerguelen	5	12	2140	1082	51%	935	2041	2
121	Broken Ridge	7	17	2722	1824	67%	677	2937	3
122	Exmouth Plat.	6	15	3911	2446	63%	1037	2710	3
123	Argo Aby. Pl.	2	5	1793	1080	60%	1196	5758	1
124	SE Asia Basins	5	13	3115	2122	68%	1271	4916	1
124E	Luzon Strait	7	15	264	156	59%	532	5811	0
125	Bon/Mar	9	15	2917	1019	35%	829	4912	1
126	Bon/Mar II	7	19	4737	2127	45%	1682	3269	3
127	Japan Sea I	4	10	2917	1655	57%	903	3311	2
128	Japan Sea II	3	9	2044	1548	76%	1084	2820	0
129	Old Pac. Crust	3	5	1708	469	27%	594	5980	4
130	Ontong Java	5	16	5889	4822	82%	1528	3873	5
131	Nankai Tr.	1	7	1463	735	50%	1327	4696	6
132	W/Cent. Pac.	3	11	205	165	81%	325	4682	28
133	N/E Aust.	16	36	7973	5505	69%	1011	1650	0
134	Vanuatu	7	16	4831	2044	42%	1107	3101	0
135	Lau Basin	8	18	3356	1249	37%	834	4814	3
136	OSN-1	2	6	129	66	49%	764	4441	5
137	Hole 504B	1	1	49	9	18%	1622	3475	16
138	Eastern Pacific	11	42	5542	5537	100%	394	3873	0
139	J. Fuca Ridge	4	22	2656	933	35%	936	2	13
140	504B	1	1	379	48	13%	2000	3474	21
141	Chile Triple J.	5	13	2515	1019	41%	743	2760	1
142	E Pacific Rise	1	3	2	0.5	25%	15	2583	35
143	Atolls/Guy. I	6	12	3995	1076	27%	1744	4838	3
144	Atolls/Guy. II	11	21	3205	1088	40%	910	5685	4
145	N. Pac. Trans.	7	25	5015	4322	86%	930	5726	1
146	Cascadia	6	20	2266	1190	53%	600	2675	11
147	Hess Deep	2	13	487	123	25%	155	3874	21
TOTALS:		281	696	127353	77638				

FIRST EIGHT YEARS OF DRILLING OPERATIONS

Developed new technology to support scientific and operational needs and improved reliability and performance of existing coring systems.

Adapted mining technology to improve hard-rock coring operations. A 9.5 inch, positive displacement coring motor has been tested allowing the unsupported spudding/coring of hard seafloor formations.

Deployed the newly developed hard rock guide base (HRGB). To date, two HRGBs have been set and used as a means to initiate a hole on hard fractured, rubbly formations. The first HRGB was deployed on Leg 106 in 3344 m water depth on the mid-Atlantic Ridge. On Leg 118, the second HRGB was set on an undersea plateau in 700 m of water on the Southwest Indian Ridge.

Developed and successfully deployed a "mini" free-fall cone. That reentry cone can be free fall deployed around the drill string to the seafloor, providing a means of reentry where premature bit failure or fishing operations would normally terminate drilling.

A deep water TV system is used to monitor reentry, guide base site selection, and seafloor drilling operations. It was first successfully deployed in 3344 m water. The system is now routinely used for reentry, in conjunction with the sonar system.

The development of a lockable float valve allows deployment of tools and logging instruments through the XCB bottom hole assembly and into the open hole without becoming trapped by the float valve or requiring the entire bit release.

Coordinated the design, fabrication, and successful deployment of a new conical side entry sub for use on the JOIDES Resolution.

Coordinated with third-party investigators to help develop the wireline packer, geoprops probe, and the lateral stress tool for improved downhole measurements.

Successfully designed and deployed a "mini" hard rock guide base (HRB) during Leg 132. This replaces the more expensive and operationally cumbersome HRGB. The new mini HRB was moved to a variety of sea bed locations and ultimately recovered back aboard ship, demonstrating superior operational flexibility.

Successfully spudded a hole on the bare, fractured rock of a young crustal spreading center during Leg 132. The upper 6.9 meters of formation were isolated behind a prototype drill-in-BHA (DI-BHA) assembly, and a nominal 4 inch diameter DCS hole was cored 79 meters into the formation. Excellent hole stability characteristics were demonstrated, while achieving 60 plus percent core recovery through the fractured interval.

The first Ocean Seismic Network reentry site (OSN-1) South of Honolulu, Hawaii was emplaced in 4 km of water during Leg 136.

An Amoco designed low-friction 9-7/8" PDC bit was used on Leg 136 to core into basaltic basement. The bit was designed to incorporate an "anti-whirl" feature to increase both ROP and core recovery to core. The bit averaged 5.5 M/HR or twice a standard roller cone bit, but core recovery was not improved.

During Leg 137 and 140, Hole 504B was successfully fished and deepened by 438 meters (to a total of 2 kmbsf). This is the deepest hole for DSDP/ODP and represents the greatest penetration of oceanic crustal rocks in scientific drilling.

A new DSDP/ODP total and percentage recovery record was established when 5537 meters of sediment was recovered during Leg 138 (99.9%).

During Leg 138, only recoverable command beacons were deployed. There were 12 beacons launched and 12 recovered. Through Leg 141, only commandable beacons have been deployed, with 35 launched and 33 successfully recovered.

Coring and logging operations were successfully carried out with the highest downhole temperatures (estimated 350°C) ever recorded in DSDP/ODP on Leg 139. Also on this leg, nearly 160 meters of massive sulfide deposits were cored in two separate holes. The first operational deployments of the "CORK" with installed thermistor instrumentation was accomplished during Leg 139.

Adapted mining technology to improve hard rock coring operations. A 9.5 inch positive displacement coring motor has been developed and tested which assists in unsupportedspudding/coring holes in hard seafloor conditions.

Developed and deployed three different versions of hard rock guide bases for assistance in stabilizing the bit while establishing holes in difficult terrain with little or no sediment cover, including hard and/or rubbly rock formations, hard and/or broken limestones on guyots and atolls, and sloping rocky outcrops. The latest version is a mini-guide base which has been used successfully on Legs 132 and 142 in DCS operations plus on legs 144 and 146. On two occasions mini-guide bases have been used and then retrieved allowing for refurbishment and later reuse at a reduced expense.

Developed and successfully deployed on many occasions a free fall funnel (FFF) "mini-reentry cone". The FFF can be dropped to the seafloor around the drillstring, providing a means of reentry where premature bit failure, a remedial pipe trip, or junked hole would normally terminate drilling.

A deep water B&W TV system, which is deployed on a frame traveling external to the drillstring, was obtained commercially and integrated into ODP operations. It is used routinely to facilitate reentry, monitor seafloor drilling and recovery operations, assist in guide base citing, and conduct some seafloor surveys.

A lockable float valve was developed which allows deployment of tools and logging instruments through the APC/XCB bottom hole assembly into open hole without requiring release of the entire bit or risking trapping instruments attempting to reenter the pipe.

Coordinated the design, fabrication and successful deployment of a new conical side entry sub for use in logging operations in holes with poor stability or excessive bridges and ledges. An important feature of the new side entry sub, the ability to recover logging tools out the side "door" back to the ship with the drill pipe stuck in the hole, was utilized on Leg 146.

Successfully spudded a hole on the bare, fractured rock of a young crustal spreading center during Leg 132. The upper 6.9 m of formation were isolated behind a prototype drill-in-BHA assembly, and nominal 4 inch diameter DCS hole was cored 79 m into the formation. Excellent hole stability characteristics were demonstrated, while achieving 60+ percent core recovery through the fractured interval.

The first Ocean Seismic Network reentry site (OSN-1) south of Honolulu, Hawaii was emplaced in 4 km water depth during Leg 136.

During Legs 137 and 140, Hole 504B was successfully fished and deepened by 438 m (to 2000.4 mbsf) and a full suite of logs and downhole experiments were conducted. During Leg 148 the hole was deepened a further 81 m where a fast drilling interval of 7 m was encountered where the bit become stuck. The pipe was removed except for a small portion of junk at the bottom. The majority, but not all, of the junk was removed. This is the deepest hole for DSDP/ODP and represents the greatest penetration of oceanic crustal rocks in scientific drilling.

Recoverable command beacons have been developed and tested to the point that they are now the standard beacon for most ODP operations. Successful recovery rate for these beacons average 89.0% through Leg 147.

During Leg 139 coring and logging operations were successfully carried out with the highest downhole temperatures (estimated 350°C) ever recorded in DSDP/ODP operations. A significant amount of safety training and equipment was prepared for Leg 139 in anticipation of encounters with H2S in the cores and/or water column.

Although not an important element of Leg 139 operations, the H2S preparedness paid off during Leg 146 when sulfide-bearing methane hydrates were cored and recovered.

Successfully developed the "Cork", a reentry cone seal and instrument feed-thru device, which can isolate a reentry borehole from the sea while supporting a thermistor string, fluid sampling tube/manifold, and associated data logger. The instrumentation and data logger were developed by third party investigators in concert with ODP engineers. Four Cork installations have been emplaced in the western Pacific, the last two of which include perforated liners across the open hole section.

Developed a wireline retrievable pressure core sampler (PCS) compatible with APC/XCB type coring. The PCS is capable of recovering cores up to 0.86 m long at hydrostatic pressure.

Developed a sonic core monitor (SCM) which measures and records core entry into the core barrel against time for later comparison to bit penetration records in order to determine where partial recovery cores should be placed in the cored interval.

Integrated a commercial electronic "multishot" survey instrument (the Tensor tool) into ODP operations for core orientation.

Developed elements necessary to achieve hard rock core orientation (HRO) where only partial recovery is achieved. This includes scribing core catchers, a special core barrel swivel/latch mechanism, and non-magnetic bearings and pressure housings for the Tensor magnetic survey tool. The HRO system includes the sonic core monitor.

Developed a reliable wireline retrievable motor-driven core barrel (MDCB) which is compatible with APC/XCB coring. The MDCB uses a 3-3/4 inch positive displacement mud motor married to a mining-type diamond core barrel for advancing holes into hard or elusive formations where other coring technologies are inadequate.

Developed a Diamond Core Barrel (DCB) system using slimline diamond bits, stabilizers and drill collars and a standard RCB wireline core barrel to allow diamond coring in 7-1/4 inch holes where roller cone coring techniques are unsuccessful.

Converted to a commercially available, highly reliable casing hanger and deployment system (Dril-Quip) which will allow deployment up to four concentric casing strings for use in deep penetration holes in the future.

Performed successful dynamic positioning experiment in 38 m water depth during Leg 143 using the taut wire positioning system. This experiment enabled definition of the minimum good weather water depth acceptable for planning future drilling operations.

OTHER HIGHLIGHTS

In May 1992, TAMU-ODP hosted its sixth annual Co-Chief Scientists' meeting. ODP responded to the Co-Chiefs' recommendations for improvements to operations on shore and at sea (see Appendix C).

A total of 1179 participating scientists will have sailed on the Resolution on Legs 101-148 (see Figure T-1).

By the end of FY93 the Initial Reports volumes through Leg 146 and Scientific Results volumes through Leg 134 will have been published.

By the end of FY92, Technical Notes through No. 17 had been published.

CD-ROMs were published in Initial Reports Vols. 138 and 143, and in Scientific Results Vol. 130. Standard logging data including formation microscanner images, now are scheduled to be published routinely in Initial Reports volumes. We expect more Scientific Results authors as well to want CD-ROMs for supplemental material for publication with these volumes during the remainder of FY93 and in FY94.

Provided trained personnel aboard each voyage to process FMS data gathered by BRG/Schlumberger

The ECR completed their conversion of ambient storage area in the basement of the Geoscience Building to refrigerated space in anticipation of receiving core from the Atlantic Ocean (beginning in early 1993 with Leg 149). The additional refrigerated space should provide enough core storage for another six legs. The first phase of the expansion included auxiliary equipment and one FTE to improve core and sample request handling.

All reprints from outside journals are now entered into the BIBLIOGRAPHIC data set. Each reprint is keyworded to aid in searching for specific topics.

The recuration program continues during the summer of 1993.

The Information Services Group was established by combiningthe existing Database Group and Computer Services Group into a single department.

A new communication system was installed on the JOIDES Resolution after completion of field and acceptance testing. This provides higher speed communications allowing greater interaction between the ship and shore operations.

A standard E-Mail connection to the JOIDES Resolution was implemented. This allows the scientific party to maintain a connection with shore based activities in which they are involved.

Completed proposal development phase of the computer/data base upgrade.

Quality control editing of the CORELOG data set is complete in preparation for the migration of the ODP data base to a new data base management system.

The Ethernet network installation at ODP/TAMU is complete. This is in support of the migration of the computer environment from the present minicomputer centered system to a LAN based client server environment. The movement of larger amounts of data between work groups is facilitated by this model.

A Windows 3.1 base program to collect and process WSTP data was released for production use on the ship.

The sampling programs SHIPSAM, REPSAM, and SAMUTL were released for use at the repositories and on the ship.

Version 1.0.1. of the visual core description program (VCD) was released for use by the shipboard party during data collection.

Successfully completed an NSF directed audit of FY89-91.

Initiated conversion (Phase I) from the WANG system to a PC based network.

Resulting from a successful office of Naval Research audit, TAMRF-ODP's procurement and property systems were approved.

Negotiated a subcontract for an ice management vessel in support of Leg 151.

Core lab modifications were effected on Leg 142 that accommadated the cryomagnetometer at the forward end of the core lab. The aft end of the lab was changed to facilitate core sampling efforts and to provide space for core integration work stations and proposed half core MST installation. Smoother core flow through the lab guided much of the rearrangement.

All hands training for hydrogen sulphide familiarity was initiated after a dangerous concentration of the gas was unexpectedly recovered on Leg 146.

A natural gamma sensor array was designed and fabricated for inclusion in the Physical Properties lab Multi Sensor Track (MST). The array was sent to the Leg 149A portcall for installation during the transit.

Date: Tue, 29 Jun 1993 09:47:23 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>
Subject: long range planning and white papers
To:

PCOM's White Paper Subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <sglrbk@cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldeo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Wolf Berger c/o <eystein.jansen@geol.uib.no>

To: participants in the PCOM white paper subcommittee
>From : Brian Lewis
Subject: A proposed plan of action

At the last EXCOM meeting we were given the green light to proceed with our long range planning and asked to present a progress report at the Jan 1994 meeting of EXCOM.

As a reminder the purpose of this planning is; One, to define a plan for 1993-1998 that fits within the budget constraints that we will possibly know by the end of this year. The present LRP is based on the assumption of 7 partners and this is not a likely scenario.

Two, to define a plan for post 1998 that can be used as a proposal for renewal beyond 1998. This renewal activity will become serious in 1995-1996, in terms of negotiating MOU's with partners, and a science plan and platform options will be needed before then.

Since it is usually easier to start with an idea of what the output should look like let me propose that our desired output should be 2 items.

Item 1. A document with a table of contents as follows:

- Executive summary
- Introduction
- Thematic accomplishments of ODP drilling up to 1993
- Thematic foci for 1993-1998
- Technology objectives 1993-1998
- Science objectives post 1998
- Platform options post 1998

Appendices
Thematic panel white papers

Item 2. Videos

- A video on drilling methods

- A video on core analysis methods, logging, and core -log integration
- 1 to 4 videos on thematic objectives

In my opinion videos could be a very useful tool for selling the program internationally and if done correctly could be used in teaching. I know of no videos at present that are intellectually of a standard useful for teaching.

What do you think ?

In terms of who does what it seems clear that the thematic panels need to;

a. Revise their white papers

b. provide a statement on thematic accomplishments (I distributed the TAMU list to you as a starter)

c. Provide a section on thematic foci 1993-1998

d. Provide a section on post 1998 objectives

After these are finished, say by the end of the year, this subcommittee (with possible PCOM additions) will need to reformat and combine the white papers into a final document. We may also need to get other panels (TEDCOM,DMP, IHP, SMP) involved in the technology sections, but not just yet.

The LITH paper is nearly finished and a Sept meeting is planned (although it is not yet clear that funds will be available for the meeting). TECT panel is also quiet far along. An important issue is whether each panel needs to hold a large meeting to review their paper. My own feeling is that this is not necessary at this time. I think that once we have a draft of the whole document this would be a more appropriate time to get international input and opinion. What do you think?

At the upcoming August PCOM meeting I am planning on setting a half day aside for PCOM as a whole to review the overall plan in some detail. The more we can get in terms of ideas and opinions now, the more productive will be the PCOM meeting. I would like to have PCOM endorse an outline and an action plan along the lines suggested above. Could you please send me your comments and opinions by the end of the week (July 2). This will allow one iteration (the week of July 7) before we have to go to press with the Agenda Book

Date: Fri, 2 Jul 1993 10:20:25 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>
Subject: PCOM agenda and white papers
To:

PCOM's White Paper Subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <sglrbk@cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldgo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Wolf Berger c/o <eystein.jansen@geol.uib.no>

To: participants in the PCOM white paper subcommittee
>From : Brian Lewis
Subject: August Agenda.

A few days ago I sent you the memo which is attached herewith (see previous message) I have received no responses or indications that it was received. It makes me wonder if I pushed the write keys.

We are getting close to August PCOM time and we need to get the Agenda firmed up. Unless I hear to the contrary we will ask a liason to each of the thematic panels to make a 1/2 hour presentation on the white papers as they currently exist, how they see focusing in the next several years, how they see setting priorities for the post 1998 period, and their opinion on the output that PCOM should produce for long range planning purposes (the outline attached). The present white papers as well as the new ones (where applicable) will be included in the Agenda book.

The Liasons I suggest to make the presentations are;

OHP----A. Mix

LITHP--C. Mavel

SGPP---R.Kidd

TECP---B. Taylor

After the presentations PCOM should discuss the overall report, the specific content of the report, and timing. It should then finalize instructions for the thematic panels and if necessary the service panels.

Please let me know if you have a problem with this arrangement.

Date: Fri. 2 Jul 93 13:58:40 -0400

From: bloomer@crsa.bu.edu (Sherman Bloomer)
To: joides@ocean.washington.edu
Subject: August agenda

Brian:

Did indeed get all your memos, but I'm still digging out from under mail, electronic and otherwise. It was nice to hide out in the Maine woods and look at rocks for a while.

The tentative outline looks good to me. Susan and I have been assembling most of the pieces you asked for, so LITHP should be in good shape by August. I haven't talked to Ellen yet, but the scuttlebutt from Susan is that USSAC will not fund the requested LITHP meeting in September. IF that is true we'll go to the fallback position of a mail and e-mail solicitation of the community. We still plan to certify a final draft at the fall meeting in Santa Fe.

I'll work on a synopsis of LITHP thematic accomplsihments over the next couple of weeks. I've gotten no panel repsonses on the existing white paper draft, which is not surprising given that its summer. Let me know what else you may need. Catherine Mevel has a copy of the revised white paper

Sherm

Date: Fri. 2 Jul 93 08:16:18 HST

From: "Brian Taylor" <taylor@elepaio.soest.hawaii.edu>
To: joides@ocean.washington.edu
Subject: Re: PCOM agenda and white papers

Brian,

Concerning the white paper reports...

I generally agree with your proposed table of contents and the videos could be very useful. I do not agree that TECP is far along on their white paper - assignments were made at the spring meeting but no written products have been received. If you ask me for a half hour presentation I will sit down after five minutes of describing what they plan to do, not what is done.

Brian.

Date: Fri. 2 Jul 93 08:49:44 HST

From: "Brian Taylor" <taylor@elepaio.soest.hawaii.edu>
To: joides@ocean.washington.edu
Subject: Re: PCOM agenda and white papers

Brian,

Both the last and the proposed TECP white papers are shopping lists. I welcome guidance as to how we can streamline and focus them. Brian.

Date: Sat, 3 Jul 1993 16:25:33 +1000

From: Richard Arculus <rarculus@metz.une.edu.au>
To: joides@ocean.washington.edu

*as far as i'm concerned Brian, your outline for the planning of a PCOM White Paper SubComm > LRP is fine

*i've not seen anything yet of the OHP white paper and assume that will show up in Brisbane with Alan Mix

*i've been invited (at my expense) by Sherm Bloomer to the LITHP effort in the UK (assuming it takes place), but anyway have a copy of Sherm's draft, which i am preparing comments on for him by mid-July

*i believe we need to be coldly realistic about the technological developments, especially the DCS.

*At this stage,w e have nothin to be excited about although clearly DCS could be a major driver for many interests in teh coming years if successful in 94

*perhaps we should think about seoparating out what science we know we can do now and do very well (moving on with the Paleogene Ocean History and ever backwards to the Mesozoic; etc...) and what we couild continue doing that is exciting, from the challenging stuff (deep drilling for example). I do not think the general community is necessarily sold on the idea of committing the boat to a deep hole or two in a few spots for long periods of time. WE should present these as options - small vs big (ie deep) science !

*i like your general framework for discussion and I like the idea of the videos for selling the program to the sophisticated if non-ODP science funders - incidentally, what happened to teh ODP video that was supposed to have been made in the last year or two ?

*later

Date: Mon. 12 Jul 93 10:30:24 EDT

From: ekappel@iris.edu (Ellen Kappel)
To: joides@ocean.washington.edu
Subject: LITHP workshop

Brian....As I told you on the phone last week, USSAC has recommonded declining Bloomer's proposal to USSAC to fund a workshop to revise the LITHP White Paper. I should be sending Sherm a letter to that effect today.

See you soon in College Station...

Ellen

Date: Mon. 12 Jul 93 10:53:05 -0400

From: bloomer@crsa.bu.edu (Sherman Bloomer)
To: joides@ocean.washington.edu
Subject: Re: long range planning and white papers

Brian:

A brief question regarding finishing up the LITHP white paper. Given that USSAC will not fund an open meeting to review the objectives of the white paper, I want to touch base about how to proceed. PCOM endorsed our initial idea about revising this paper, which included the idea of an open meeting to comment on the objectives of the panel. Our principal reason for planning such a meeting was to insure that the process was, and was viewed, as being open to the lithosphere (and geological) community as a whole. PCOM felt that funding such a meeting was not an appropriate use of commingled funds and I understand that USSAC felt that such a meeting was more appropriately funded by such funds. Fair enough, but the end result is that such a meeting does not seem to be viewed as a high prioirity. I also gather from your notes of recent that PCOM now feels that an open meeting is more appropriate after there is a larger long-range document prepared. Is that correct?

If it is, I am still left with the question of how to solicit input from the community on what are viewed as the important short and long term objectives of the Panel. I think it behooves us to be thorough in soliciting as much advice from outside the present ODP panel strucutre as possible; the still exisitng perception of the program as a closed-shop needs to be corrected before the time comes for the post 98 renewal. The best idea Susan and I have now is to set up an email LISTSERVE with copies of the white paper and to advertise its availibiltiy. I also plan to do a mass mailing of the draft to potentially intersted parties for comment, and to assign a panel member with expertise in our high prioirity objectives to coordinate the accumulation of comments from colleagues with similar expertise. We still aim to have a final draft prepared on the October meeting.

Is such a plan of action in concert with your understadning? And will it do the job for you? At this point, I feel like its more important to get a draft done than to spend more time trying to fund a meeting we may not really need right now.

Cheers, Sherm

Date: Mon, 12 Jul 1993 14:55:46 -0700 (PDT)

From: JOIDES Office <joides@ocean.washington.edu>

Subject: Re: long range planning and white papers (fwd)

To: PCOM's White Paper Subcommittee -- Margaret Delaney <delaney@cats.ucsc.edu>, Robert Kidd <sglrbk@cardiff.ac.uk>, Brian Lewis <blewis@ocean.washington.edu>, Judy McKenzie <sediment@czheth5a.bitnet>, Catherine Mevel <cam@ccr.jussieu.fr>, Alan MIx <mix@oce.orst.edu>, Eldridge Moores <moores@garnet.ucdavis.edu>, John Mutter <jcm@lamont.ldeo.columbia.edu>, Richard Arculus <rarculus@metz.une.edu.au>, Sherman Bloomer <bloomer@crsa.bu.edu>, Brian Taylor <taylor@elepaio.soest.hawaii.edu>, Wolf Berger c/o <eystein.jansen@geol.uib.no>

Dear Sherm,

I am forwarding your message for Brian Lewis on to the PCOM White Paper subcommittee for their review and comments. Unfortunately, Brian is out of the office on vacation for two weeks so he won't be able to reply to you until he returns to the office on July 28th. I think Brian would generally agree with the plan of action you proposed--also, if needed, the JOIDES Office could offer some help with your mass mailing of copies of the draft.

If the subcommitte has any comments, please CC Brian at the JOIDES Office.

Thanks,

Karen Schmitt /Science Coordinator

JOIDES Office

Date: Wed, 14 Jul 93 20:35:40 HST

From: "Brian Taylor" <taylor@elepaio.soest.hawaii.edu>

To: bloomer@crsa.bu.edu

Subject: LRP et al

Cc: joides@ocean.washington.edu

Sherm,

Your and Susan's plans for getting input to the LITHP white paper (via mass mailing and LISTSERVE) while at the same time proceeding with revisions to the draft in time for the October meeting are excellent. Please e-mail a draft version to me. Brian.

STA/JAMSTEC PROPOSAL

" New Era of Ocean Drilling "

Joint EXCOM ODP Council Meeting

June 22-23, 1993

Texas A & M University

College Station, Texas

U.S.A

Science and Technology Agency, Japan

Japan Marine Science and Technology Center

(1) Japan gives its highest praise to the successful management of ODP and the scientific results achieved through ODP.

(2) That deep sea drilling research is indispensable for the progress of marine geoscience and oceanography, that we should continue to promote it as international cooperative effort in the future, and that it would not be too soon if we started international discussion now on the future international cooperation have been recognized both at the expert meeting on deep drilling of the Megascience Forum of OECD in November, 1992 held at Brest, and at the preparatory meeting of the international working group for a new deep-sea drilling program in March, 1993 held in Tokyo.

(3) Based on the recognition obtained in those meetings, we propose to call the international cooperative effort of the future or in the 21st century, specifically, a "New Era of Ocean Drilling". Japan, together with other nations of the world, would like to go on with discussions to realize the new program.

(4) We consider that the "New Era of Ocean Drilling" should be discussed as a further development of the scientific results and expertise of ODP, and thus studied under close liaison with the ODP/JOIDES.

(5) For further discussion, we suggest some basic premises as follows:
The first premise is that the "New Era of Ocean Drilling" will

be a research program to build common property for mankind's everlasting well-being, and that it will be carried out as an international cooperative program. Furthermore, the construction of a new deep sea research drilling vessel and the operations of the "New Era of Ocean Drilling" shall be carried out with resources -- funds, personnel, materials, equipment, and technology, etc., shared by the participating countries.

(6) Secondly, Japan intends to make an active contribution for the realization of the "New Era of Ocean Drilling": in program formulation in drilling ship construction,, and in program operations.

(7) Thirdly, while there might be several possibilities of an actual plan for the "New Era of Ocean Drilling", we consider the plan for a deep sea research drilling program using a new drilling vessel that Japan has been investigating so far can also be an element in the "New Era of Ocean Drilling". Through active international discussions to be made, we hope details of the "New Era of Ocean Drilling" will become clear and firm.

(8) About how we go about the study of the proposed "New Era of Ocean Drilling" : We need to address the following aspects from the international point of view:

i) Scientific strategy and requirements;

ii) Technical requirements;

iii) Management arrangements; and

iv) Legal and financial aspects.

As a possible base to help discussion of each of these items, we would like to show you, as we go, what we have been studying to date.

(9) At this meeting, we would like to propose a time schedule, namely "Action Program ", and to outline our views specifically on item i) above, that is, scientific strategy and requirements to the members of the ODP Council and the JOIDES Executive Committee.

(10)On more thing: Taking advantage of the ODP/JOIDES meeting scheduled for January 1994 in Japan, we would like to sponsor a workshop right after that meeting centering on the scientific strategy and requirements with the presence of the participants of the ODP/JOIDES meeting and other key overseas scientists invited.

(11)We sincerely hope that the proposed new international cooperative ocean drilling effort, the "New Era of Ocean Drilling" will become a reality and prove as successful a venture as the ODP. We earnestly ask that each member of the ODP Council/EXCOM will be able to understand and support the proposal so that formal commitments by all ODP participating countries will be made.

June 22, 1993

Action Program of the "New Era of Ocean Drilling" (Proposed)

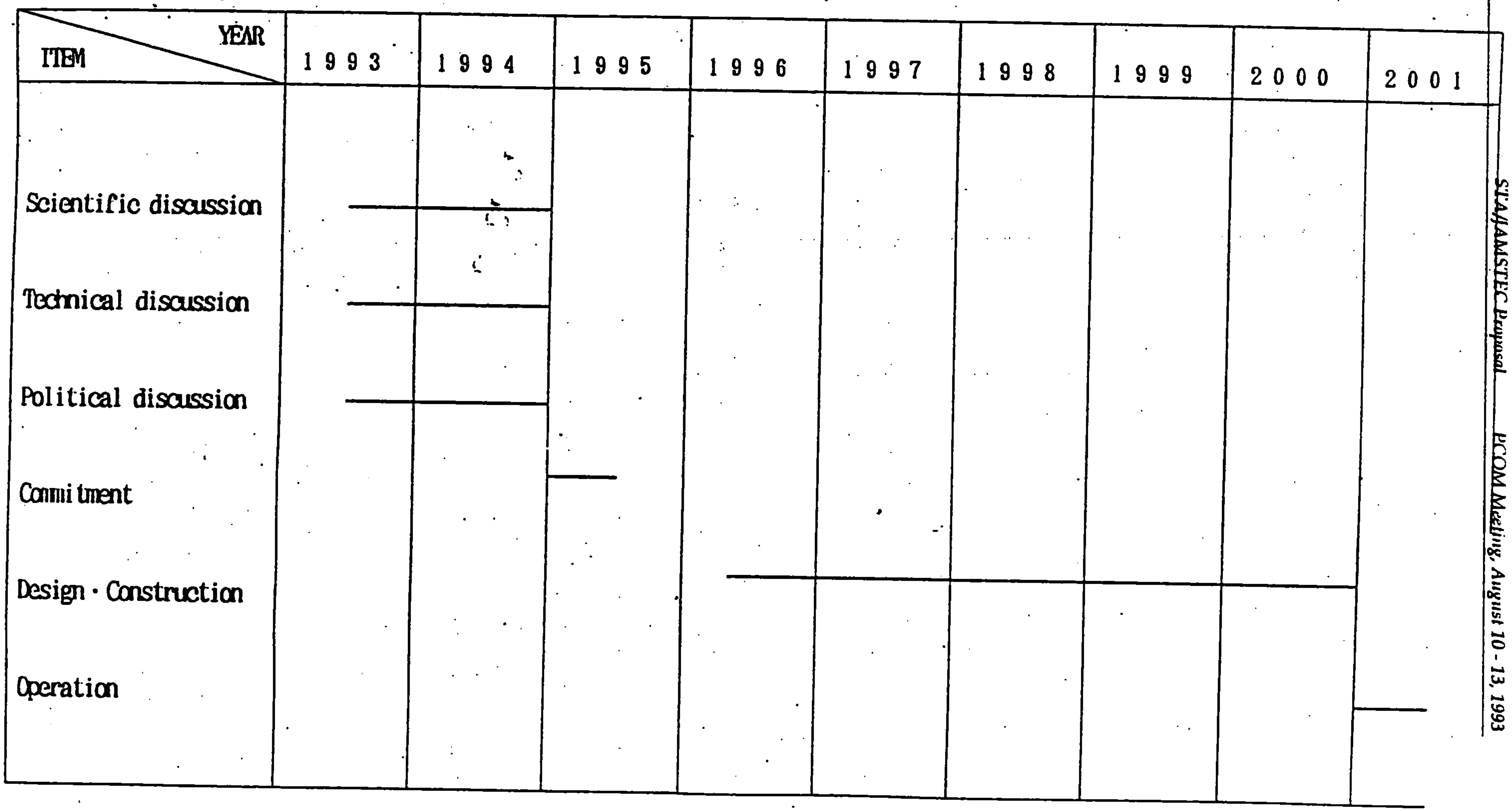
To bring the "New Era of Ocean Drilling" into operation at the earliest possible date after 2000, simultaneous study of the proposal to realize this program needs to go on maintaining close liason with each ODP committee. An action program is suggested to be:

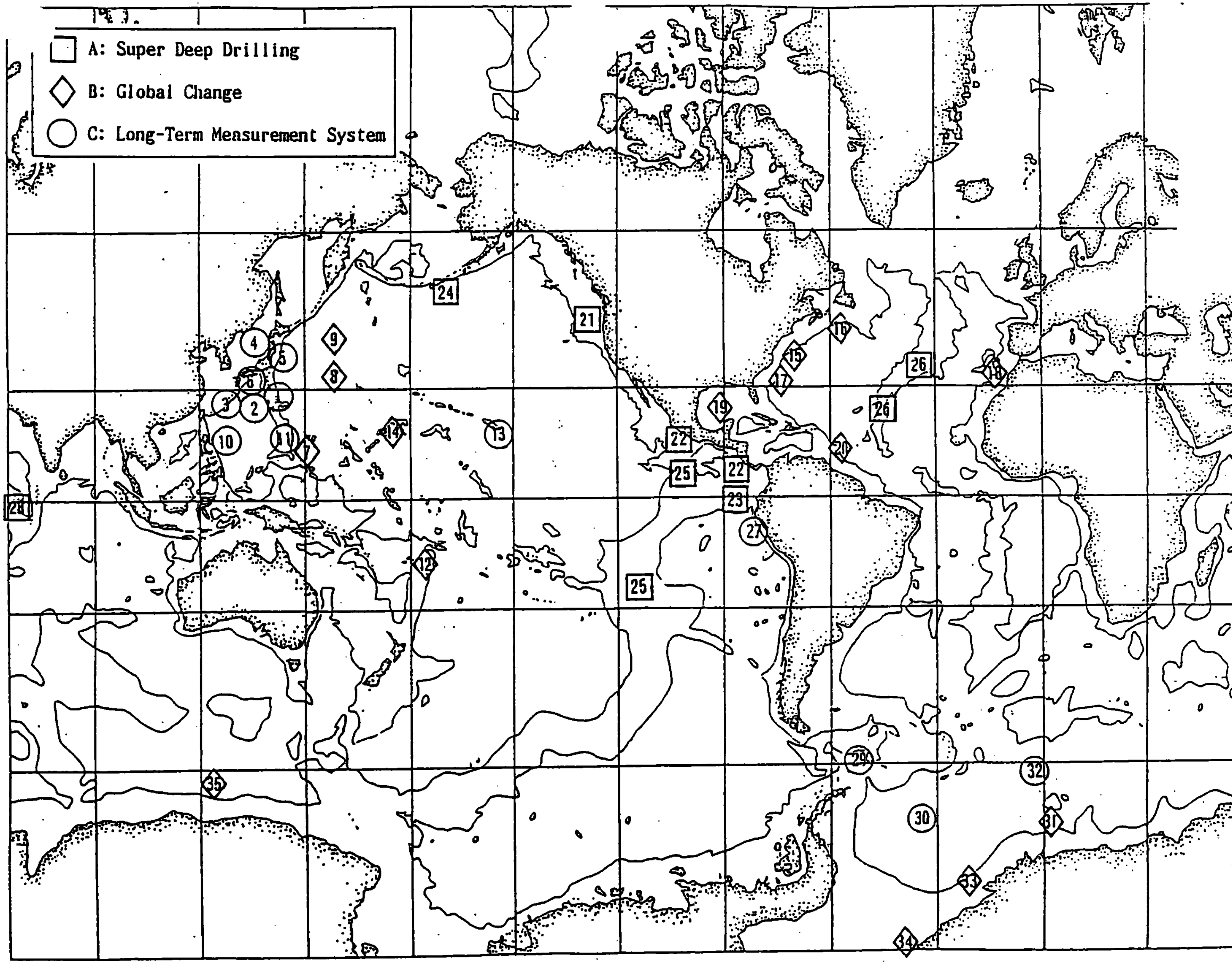
(1) Study the "New Era of Ocean Drilling" by breaking into three broad categories of ① Scientific discussion, ② Technical discussion, and ③ Policy discussion (Management arrangements, legal and finacial aspects), aiming to bring conclusion for each category at around early 1995.

(2) Aim at reaching agreement on each country's commitment by mid 1995.

(3) Aim at starting the design and construction of a new deep-sea drilling ship necessary for the "New Era of Ocean Drilling" from 1996.

ACTION PROGRAM (Proposed)





A: Super Deep Drilling
B: Global Change
C: Long-Term Measurement System
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

A New International Collaborative Initiative for Deep Sea Research Drilling

Science and Technology Agency of Japan
Japan Marine Science and Technology Center

Ocean Bottom Research Using a New Deep Sea Drilling Ship

Understanding the Structure of the Ocean Crust

The structure of the deep ocean crust is only poorly understood because we lack a direct way to observe it. To better determine its structure it is necessary to directly sample it through drilling. Not until we collect in situ deep crustal samples can we develop a correct understanding of the composition of the crust, heat transfer and stress within the crust, and the magnetic properties of the crust.

Drilling of oceanic crust permits not only the study of its vertical structure but also the comparison with geophysical models of the crust as well as determining the age of formation of the crust. Furthermore, downhole instruments can make in situ measurements of material flux through the crust in addition to the dynamic and thermodynamic conditions..

A long sought objective of deep sea drilling is to sample directly from the mantle by drilling through the Mohorovicic Discontinuity. Attaining this goal would lead to greater understanding of the overall structure of the earth, its composition, and the processes of crustal formation. In places where the oceanic crust is especially thin, it may be possible to reach the Moho by drilling only 3 or 4 km.

P

Understanding the Dynamics of Plate Movement

Plate tectonics is now widely recognized as a unified theory that kinematically describes the motion of the earth's lithospheric plates. However, developing a dynamic model for the forces that drive the plates remains a goal for the earth science community and is one that can be addressed through deep sea drilling. Data such as measurements of seismicity, stress, strain, and heat transfer are needed. Additionally, deep sea drilling allows study of the stratigraphy of the crust, its composing materials, and the existence of fault planes. These data are required from different regions in the ocean.

1. *Drilling in Plate Forming Regions.* Mid-ocean ridges are sites of crustal accretion that can provide clear evidence of the underlying mantle. Study of the major mid-ocean ridges is presently a major focus of the international earth science community and deep sea drilling can complement and support these investigations. Drilling will allow study of plate formation processes by providing data on crustal structure and composition, the stratigraphic relationship between the mantle and the crust forming rocks, crustal stresses, and the circulation of fluids.

2. *Drilling in Subduction Zones.* The destruction of oceanic crust occurs at subduction zones and can be studied in the Nankai Trough, the Japan Trench, and other trenches in the area. The mode and degree of deformation will be studied for the subducting plate as a whole and for the overlying sedimentary cover. Furthermore, drilling can allow study of the accretionary prism on the overriding plate, formations of folded and faulted layers, and the decollement. Downhole measurements can be used to learn about fluid circulation, fracturing phenonmena, and subduction zone earthquakes which is where the most destructive earthquakes occur. Moreover, the effect of subducted sediments on

island arc volcanism and the mechanism of volcanism in subduction zones may be studied.

3. *Understanding Seamount Structures.* Seamounts cover a major part of the ocean floor. Drilling into these structures will reveal the historical development of the seamount and the thermal history of the surrounding area. Drilling into seamounts at subduction zones will reveal the deformation accompanying subduction.

4. *Backarc Basin Formation Mechanism.* Commonly found in the Western Pacific, backarc basins share many features with mid-ocean ridges such as hydrothermalism and volcanism. However, compared with the mid-ocean ridge, these basins are poorly explored and there is little information on the crust in these basins. Drilling in these basins can lead to increased understanding of basins structures, formation mechanism, and the geological history of adjacent island arcs such as Japan.

Understanding Changes in the Earth's Environment

Pelagic sediments in some locations of the seafloor can be older than 100 million years. Through the fossils, isotope ratios, and other information contained within them, these sediments record the history of past climatic changes and paleo-environmental conditions. Also, limestone on drowned atolls contain information on the past fluctuation of sea levels. Sampling and studying these sediments reveals the transition history of the earth's environment including regional climatic fluctuations on the order of thousands of years to tens of millions of years. Additionally, polar regions greatly influence the heat balance of the earth and are the origin of the deep water in the world's circulation patterns. Study of these regions will lead to increased knowledge of changes in the global environment.

Deployment of a Global Observation Network

Studying the stress, strain, and the transfer of heat and materials generated within the crust and mantle are essential for understanding the movements within the earth's interior. Measurement by downhole instruments emplaced by deep sea drilling is the only direct means of observing these quantities. By deploying downhole instruments in key locations of the world's oceans, we may better understand the construction of the earth's interior and the dynamic processes taking place there. These downhole instruments would allow measurement of earthquakes, temperature, pressure, electromagnetism, and chemical composition.

II Plans for Developing and Constructing a Deep Sea Drilling Vessel System

Basic Concept of Developing Deep Sea Drilling Ship System

Research drilling of the earth's interior provides an important means of promoting earth and ocean science and technology. Direct sampling of crustal materials, taking verious measurements in situ, and carrying out both basic and applied research are what are involved in this science. We believe that through this effort, Japan can do its part to help advance science and technology throughout the world.

A main objective is to develop a capability to drill to the Moho and this is what will be attempted in the long term. To achieve this, we need to put together available resources from all related fields to develop the several new technologies and systems required. Such developments should be carried out in a time span of about 10 years under a broad comprehensive management paying due attention to development, utilization, and efficiency in research and development work.

Due consideration must also be given to international trends such as: requests from the scientific community, technological feasibility, projects in other leading countries, and progress in international cooperation. We also have to consider Japan's stance on basic research, especially development of "big" science projects, budget developments, and measures required to realize the development and operation as early as possible.

Specific Plans for Developing a Deep Sea Drilling Vessel System

A drilling system will be developed along the lines of the above mentioned guidelines aiming at its completion by the end of this century. The development of a great water depth riser (a special piping system connecting the sea bottom hole mouth and ship hull on the sea for mudwater circulation and for moving equipment up and down) and of high temperature drilling and measurement capability present a considerable technological challenge because the target levels are so high. Therefore, the present technological level will be thoroughly studied before starting development and construction work on the deep sea drilling ship system.

This sytem will have highest possible technological level for studying such things as earthquake generating mechanism, past changes in the global environment, and other subjects that require urgent attention. To this end, Japanese sea waters offer several potential sites for investigation, for example:

1) Sea water circulation accompanying igneous activity in the Bonin and Okinawa Trough,

2) Interaction between mantle and crust in the Shikoku Basin and Japan Trench

3) Accretionary prism structure in the Nankai Trough, and

4) History of backarc basin and island arcs.

Most drilling points in these sea waters have depths not greater than 6000 and 7000 m. In many areas where the sea depth is less than 4000 m, target drilling depths are so great or the possibility of hydrocarbon deposits is so high that it is necessary to use the mudwater circulation drilling method. The available technology for mudwater circulation drilling and wireline logging are not adequate so that enhanced technological development in these areas is necessary.

Such a deep sea drilling ship system, equipped with various experimental research facilities, analytical instruments, and computers, can be called a "floating comprehensive research center." World-class research would be carried out on the ship by researchers not only from Japan but foreign countries as well. It is hoped that sufficient measures are taken to this direction for promoting research, spreading results, and making international contributions.

Capability Requirements for the Proposed Deep Sea Drilling Ship System

Within Japanese waters, there are several scientifically interesting regions that are likely target drilling sites. Reaching these sites would be interesting from the engineering standpoint as well. Examples include the Japan Trench off Sanriku and the Izu-Bonin Trench (water depths of 6000 to 7000 m), the Shikoku basin (water depth 5000 m), the Nankai Trench, Ryuku Trench and Ogasawara Trough (water depth

4000 m), and the Japan Sea basin and Minami Daito Basin (water depth 3500 m).

In areas such as the accretionary prism on the Nankai Trough and the Japan Trench, drilling depths of approximately 2000 to 3500 m will be required. This is necessary to answer questions on the history of backarc basin and island arc formation.

On the other hand, a drilling depth of approximately 2000 m will be required for mid-ocean ridges where water depths reach between 2000 and 4000 m. Drilling depths of approximately 2000 m will be needed for other areas of the ocean floor as well where sea depths range between 3500 and 6000 m.

Drilling in certain sea waters where brittle layers and hydrocarbon deposits are expected requires downhole wall protection and blowout prevention measures. These sea waters include the Nankai Trough, the Ryuku Trench, part of the Japan Sea basin, the Japan Trench. In order to cope with these situations, it is necessary to use mudwater circulatory drilling using great depth risers.

Near sites of active volcanism such as mid-ocean ridges, crustal temperatures will be considerably high. In these areas it is necessary to allow for the possibility that downhole temperatures would reach 350° to 400°C.

We may thus conclude that the following are our development targets for the proposed deep sea drilling ship system:

Maximum operating sea depth:		7000 m
Mudwater circulation drilling		
Max. sea depth at drill point	initial goal	2000m
	final goal	4000m
Max. temp. in drillhole (drilling)		400° C
(downhole measurement)		300° C

Moreover, we need different types of corers that can collect undisturbed core samples, instrumentation and equipment for analyzing collected cores on board, and highly reliable devices for wireline logging.

Such a deep sea drilling ship system, equipped with various experimental research facilities, analytical instruments, and computers, can aptly be called a "floating research center", where a number of foreign as well as domestic researchers can conduct the highest level research while exchanging academic experience. We sincerely hope that adequate support will be forthcoming to help realize this project which will no doubt go a long way toward the advancement of science and international friendship.

A Brief Introduction to the New Era of Ocean Drilling

Science and Technology Agency of Japan
Japan Marine Science and Technology Center

I) Deep Sea Drilling: Past and Present

(1) From the inception of the Deep Sea Drilling Project (DSDP) through to the present investigations by the Ocean Drilling Program (ODP), deep sea drilling has greatly contributed to the development of the earth sciences. Some of the main scientific contributions of ocean drilling have been:

1) Verification of the theory of plate tectonics
2) Increased understanding of the processes of generation and aging of the oceanic crust
3) Elucidation of the structure of oceanic plates and plate boundaries
4) Elucidation of global change for the past several million years

Deep sea drilling has proven to be a most successful combination of science and engineering.

(2) Building upon the above mentioned scientific contributions and advanced drilling technology, the major scientific themes for study by the second phase of ODP as identified in the JOIDES Long Range Plan are:

1) the mechanisms that control changes in the ocean and climate over geologic time including changes in sea level, the carbon cycle and productivity, and the evolution of marine organisms,
2) the structure and composition of the crust and upper mantle,
3) the dynamics of lithospheric deformation and examination of the forces driving and resisting plate motion, and
4) the circulation of fluids within the crust and their relationship with global geochemical cycling and formation of mineral and hydrocarbon deposits.

This research requires an effort that is both international and interdisciplinary.

I) Scientific Objectives for the New Era of Ocean Drilling

Deep sea drilling in the next generation will succeed results obtained so far and results from the second phase of ODP. Thus, the scientific objectives for the New Era of Ocean Drilling should try to build upon these results, especially those having a direct societal impact such as global change or earthquake prediction. Those which meet these requirements are summarized below and candidate drilling sites are plotted in Fig.1 and listed in Table 1:

1) Super deep drilling which aims to penetrate the oceanic crust and ultimately reach the upper mantle. The structure of the oceanic crust is an important topic and to penetrate the Moho is a long sought goal of the earth science community.

2) Detailed reconstruction of global environmental changes. It is imperative to understand the mechanism of global change and to predict it by study of undisturbed sedimentary cores from all over the world.

3) Long-term observation systems. It is also very important to emplace seismometers as well as other geophysical and geochemical equipment. This will allow studies such as tomographic investigation of the earth's interior and also studies of plate motions and related crustal movement. It is also important for earthquake prediction studies.

The New Era of Ocean Drilling will be crucial to furthering our knowledge of our dynamic planet!

Table 1: Summary of proposed deep sea drilling sites by "Godzilla-maru". Symbols A, B, and C indicate sites of which main objectives are super deep drilling, global change, and long-term measurement system, respectively.

Figure 1: Location for proposed drilling sites. Numbers and symbols of A, B and C are same as those of Table 1.

Around Japan and Western Pacific

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
1	Izu-Bonin Arc	500~7,000	100~2,000	1,000~3,000	◎	C
2	Shikoku Basin	2,000~5,200	500~1,500	2,100~3,000	○	C
3	Ryukyu Arc	1,000~4,000	100~2,000	1,100~2,000	◎	C
4	Japan Sea	1,000~3,500	1,000~2,200	2,000~3,000	◎	C
5	Japan Trench	1,500~7,000	700~1,500	3,000~3,000	○	C
6	Nankai Trough	1,700~5,000	1,000~5,000	1,000~5,000	◎	C
7	East Mariana Basin	6,000	1,000	2,000		B
8	Shatsky Rise	3,500	1,500	2,500	○	B
9	Northwest Pacific Basin	5,500	400	1,000		B
10	West Philippine Basin	5,500	400	2,000		C

- Earth's environment history (including sea level change)
- Interaction between the earth's crust and mantle on island arc
- Igneous activity related hydrothermal circulation on island arc and/or back arc basin
- Paleoclimate
- Dynamics of accretionary prism
- Origin of oceanic plateau and it's subsidence history
- Stratigraphy beneath the chert layer

Back Arc Basins

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
11	Mariana Trough	2,000~5,000	0~	1,000~3,000	○	C
12	Lau Basin	2,000~3,000	0~100	1,000~3,000 (~7,000)	○	A

- Composition and emplacement history of the rocks
- The depth and extent of hydrothermal circulation and metamorphic alteration
- Chemical and thermal fluxes in and out of the crust

Seamounts Area

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
1 3	South Flank of Hawaii	1,000~4,500	0~1,000	500~3,000	○	C
1 4	Mid Pacific Mountains	1,000~2,000	0~1,500	1,000~3,000	○	B

- Structure of seamount
- Sedimentary body around seamount
- Sea-level change and paleoclimate

Passive Continental Margins

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
1 5	Off New Jersey	30~4,000	800~11,000	800~5,000	○	B
1 6	North of New England Seamounts	5,500	7,500~ 8,000	2,000~2,500		B
1 7	Off the Carolina	2,500~5,000	7,000~ 9,000	2,000~3,000	○	B
1 8	Off Morocco	3,000~5,000	6,000~ 8,000	2,000~3,000		B

- Maximum stratigraphic section from the J3 reflector
- Change in relative sea level recorded in passive margin sediment
- Oceanic basement samples and the oldest possible Jurassic sediments
- Maturation of organic rich sediments of the western North Atlantic, where they are deeply buried under the continental rise
- Contineta1/oceanic crustal boundary (evolution of the boundary from rifting to drifting to sea-floor spreading)
- Basement within the magnetic quiet zone

Gulf of Mexico

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
19	Gulf of Mexico	2,400~3,800	5,000~6,000	2,000~3,000	◎	B

- Origin and evolution of the Gulf of Mexico basin
- Age and origin of Gulf of Mexico salt deposits.
- Stratigraphic characteristics and depositional history of post-salt deposits in the deep Gulf of Mexico basin.

Active Continental Margins

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
20	Lesser Antilles (Barbados)	2,000~5,000	1,000~ (300~	1,000~4,000	○	B
21	Off Oregon-Washington	2,000~2,500	0~1,000	5,000 (~7,000)	○	A
22	Off Costa-Rica and Guatemala	2,000~5,000	1,000~	1,000~5,000 (~7,000)	○	A
23	Off Peru	1,000~5,500	1,000~	1,000~2,500	◎	C
24	Aleutian Trench	2,000~5,000	2,000	2,000	◎	B

- Mass transfer between plate during convergence
- Mass and fluid dynamics within an accretionary segment
- Monitoring the stress, strain, seismicity, fluid dynamics, chemistry and temperature within holes
- The processes by which materials are transferred from incoming oceanic crust to the accretionary wedge
- Intrawedge tectonics and the physical processes that occur within an accretionary wedge
- Sedimentology, structural geology, thermal evolution, seismcity and maturation of organic matter
- Subduction erosion processes

The Oceanic Ridges

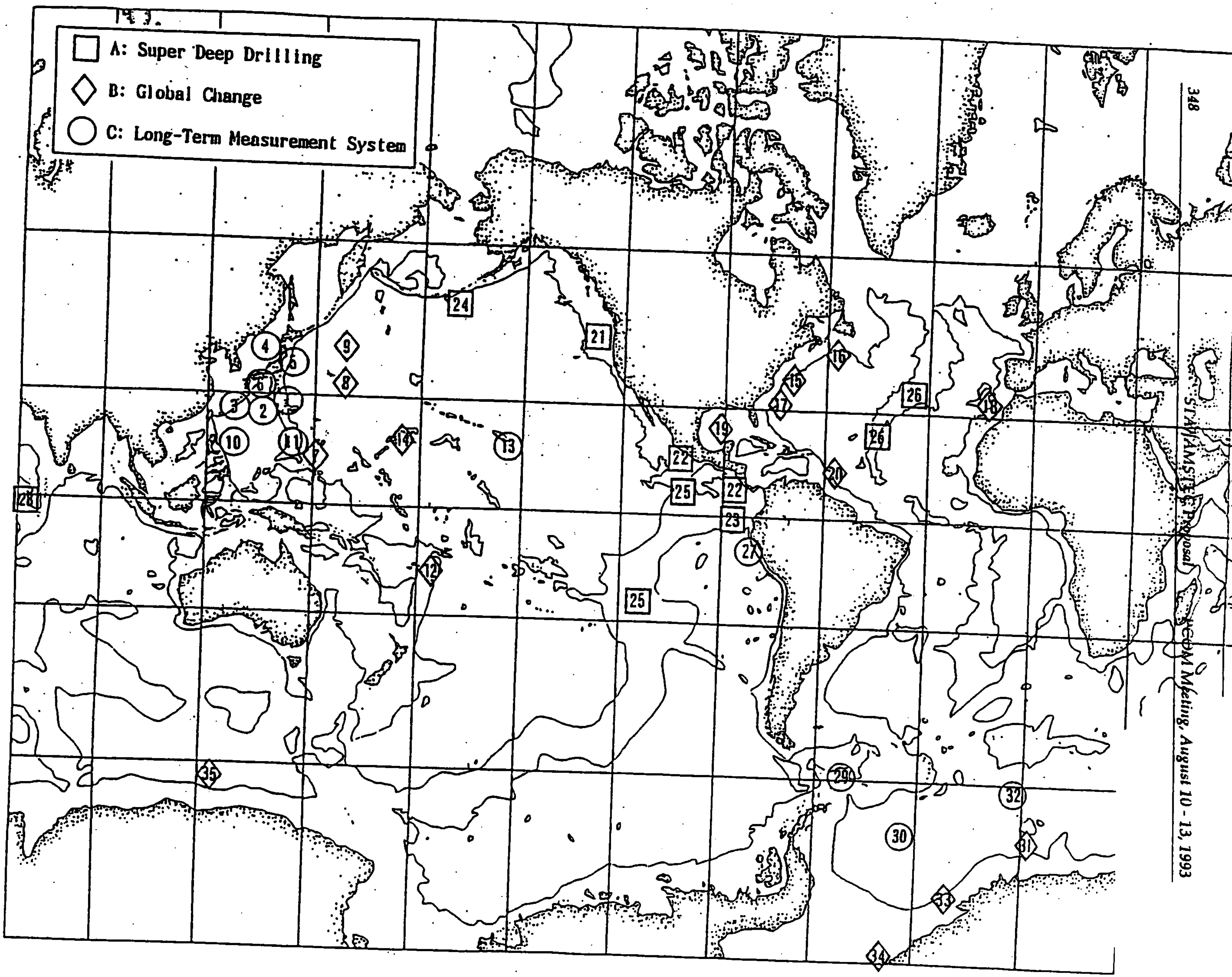
Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
25	East Pacific Rise	2,500～3,500	0～500	1,000～3,000 (～7,000)	○	A
26	Mid Atlantic Ridge	2,000～4,000	0～500	1,000～3,000 (～7,000)	○	A
27	Galapagos-Costa Rica Rift	3,500	270	3,000 (～7,000)	○	A
28	Central Indian Ridge	3,000	0～500	1,000～2,000 (～7,000)	○	A

- Composition and emplacement history of the rocks
- The depth where significant cracking and porosity exist
- The depth and extent of hydrothermal circulation and metamorphic alteration
- Chemical and thermal fluxes in and out of the crust
- The nature of magnetization of rocks as a function of depth
- The nature of the transition from Layer2 to Layer3 and difference between "normal" crust generated at slow and at fast spreading center
- Confirm the ophiolite hypothesis

Antarctic

Number	Area	Water Depth (m)	Basement Depth beneath Seafloor (m)	Depth to drill beneath Seafloor (m)	Riser	Symbol
29	Southeast Drake Passage	3,600	1,000	1,000	○	C
30	N.W. Weddell Sea	4,200～5,000	500～1,300	500～1,300		C
31	Maud Rise	3,000	500	500	○	B
32	Northern Weddell Sea	5,000	250	250		C
33	Caird Margin Transect	1,800～3,700	600～1,500	1,500	○	B
34	Crary Trough	1,200	900	900	○	B
35	Australian-Antarctic Basin	3,800	1,000	2,000	○	B

- Cenozoic paleoclimate and related phenomena, including glaciation and ocean currents
- Sedimentation under the influence of newly forming bottom water (AABW)
- Break up of Gondwanaland and the history of the calcite compensation depth in the Atlantic



A: Super Deep Drilling
B: Global Change
C: Long-Term Measurement System

JOIDES Resolution
Lisbon, Portugal,
25th May, 1993

Dr Brian Lewis,
Chairman, PCOM,
Ocean Drilling Program,

Dear Brian,

While I have been at sea, I have learnt that the Canadian Council for the Ocean Drilling Program has confirmed that Canada is presently unable to renew the present CanAus ODP membership arrangements, and that it will seek a third partner to join the consortium. This will very significantly reduce Canada's participation in the Program. Under the circumstances, I am hereby tendering my resignation as Chairman of the Information Handling Panel - I think it important that Panel Chairs should be from one of the major participating Nations. I resign with a sad sense of a job left unfinished. Major problems beset information handling within the Program. However, I think those problems are best tackled by a new Chair with new ideas. IHP meets in Halifax in July. I will persuade the panel to act quickly in this matter and I hope the new Chair will attend the Annual PCOM meeting in Miami at the end of the year.

Fortunately, my sense of gloom and despondency over Canada and ODP is relieved by a strikingly successful Leg 149. Each of the three major sites that penetrated basement will contribute significantly, but in a different way, to the understanding of major hardrock problems in the Earth Sciences. Together, the drilled sites greatly help our understanding of processes at extensional margins. At Site 897, we drilled one of the longest serpentinite sections ever recovered by ODP. However, it is the evidence for rock/water interaction at the site that may be the most interesting feature of the section. At Site 899, we recovered a nearly 100m section through a serpentinite breccia unit. Although this unit shows some similarities with the serpentinite mud flows drilled on Leg 125, it is significantly different and almost certainly provides evidence for a completely new type of geological feature/process! Finally, at Site 900, we drilled a short section through a highly sheared and metamorphosed gabbro, like the sheared gabbroic rocks recovered on Leg 118.

I return to Canada on June 12th, and am busy teaching in late June and July. My wife and I are going on sabbatical to New Zealand in early August and may be passing through Brisbane at the time of the PCOM meeting - perhaps we could meet for a beer!

With many thanks for your help and PCOM support,

Yours sincerely,

Ian L. Gibson,
Chairman, IHP

RECEIVED
JUN 7 1993
JOIDES Office

cc: John Malpas, Kate Moran, Tim Francis, Russ Merrill, and John Coyne

Date: Wed, 7 Jul 93 14:34:56 EDT

From: Jeff Karson <jkarson@rogue.geo.duke.edu>
To: blewis@ocean.washington.edu
Subject: Impact on Leg 153 of ODP Financial Problems

Dear Brian:

Pursuant to our phone conversation of 7/2/93 I am sending this brief note to remind you to bring up the topic of the cost of hard-rock drilling at the PCOM meeting.

As we discussed, it is anticipated that Leg 153 in the MARK Area will be similar in terms of outcrop geology and engineering aspects to that ofleg 147 at Hess Deep. In both areas the plan is to drill fractured gabbroic and serpentinized ultramafic rocks on relatively steep (ca. 30 deg.) slopes. At our pre-cruise meeting for Leg 153 we were lucky enough to have the co-chiefs from Leg 147 available for consultation. They raised a number of questions about engineering problems that came up during Leg 147 and discussed the Leg 147 engineers' suggestions for solving them before Leg 153. Some of these were relatively straightforward and have been addressed already. Others, in particular the question of casing the holes are more difficult to handle. One problem is that there is still limited experience with hard-rock drilling and there is a very broad range of success ranging from that of Leg 118 to 147. We anticipate that Leg 147 is the best model for what we can expect for the Leg 153 sites and so we feel that the lessons learned from Leg 147 should be applied to Leg 153 and later legs if we are ever going to move ahead with hard rock drilling.

At present, ODP plans to use 2 casing strings for each hole in the MARK Area. I am not certain exactly what diameter casings are intended. Leg 147 co-chiefs requested multiple casings (3 or 4) prior to their cruise and were given only 2. They and the engineers on that leg considered this to be a contributing factor to the limited success at those sites. At our pre-cruise meeting, we requested a number of the Leg 147 recommendations and Tim Francis was very good about accommodating our wishes. However, he made it very clear that the cost of equipment for this leg will limit such items as the number of guide bases, casings, etc.

Never having sailed on the Resolution before, it is difficult for me to know how to judge the opinions of the many different players in this effort. However, I am strongly inclined to accept the experience of the Leg 147 group. It appears that financial restrictions will prohibit us from following their recommendations. This is especially worrysome in the context of Leg 153 because the casing question will almost certainly impact upon the ability to re-enter and deepen the holes planned. Our leg will almost certainly not reach penetrations of more than 400m, whereas the proposal that was supported by the panels and PCOM was for deep holes of 500-1000m depth. Clearly, we needto establish holes on Leg 153 that can be deepened on later legs. Hole stability is a high priority and casing seems to be the most important factor in thisregard.

The bottom line is that we seem to be being told that there are in-sufficient funds to do the science proposed, if the Leg 147 experience is a reliable guide. Perhaps this is an overstatement of the situation, but I would like to have some input from PCOM on this issue. PCOM, the other panels, and proposal proponents should be made aware of this situation. As a proponent, panel member, and now a co-chief, I am beginning to wonder why we are all spending so much time and money to write and review scientific proposals that the program cannot afford to attack with all the benefits of its prior experience. If hard-rock drilling legs are going to be scheduled, ODP must be ready to pay for them. We all appreciate the cost of doing this type of scientific investigation and realize that there are limits to what can be done in the present funding situation. However, it seems more expensive (in many ways) to cut costs on drilling equipment and risk an unsuccessful leg than to invest the necessary funds to maximize the chances of success based on previous drilling experience.

I look forward to hearing from you and/or PCOM regarding this issue.

Sincerely,

Jeffrey Karson
co-Chief Scientist Leg 153

Date: Fri, 16 Jul 93 14:14:04 -0400

From: bloomer@crsa.bu.edu (Sherman Bloomer)
To: joides@ocean.washington.edu
Subject: Planning for Leg 153

Brian:

Recent conversations with Kathy Gillis and Jeff Karson have made me very concerned about he engineering planning for 153. I've outlined those concerns in the long letter attached here--I mailed a copy off to your office to. Let me know if I'm under a misimpression or if there's anything I can do to help with lobbying or talking with anyone about ht eplanning for the Leg.

Dr. Brian Lewis
Chair, PCOM
JOIDES Office
School of OCeanography, WB-10
University of Washington
Seattle, WA 98195

July 16, 1993

Re: Planning for Leg 153, MARK area

Dear Brian:

I am concerned about the engineering planning for Leg 153, in light of recent conversations with Kathy Gillis, one of the co-chiefs on Leg 147 at Hess Deep, and Jeff Karson, one of the co-chiefs for Leg 153. I understand that the current engineering plan includes only a single stand of casing for each of the two MARK sites; I believe that this will very likely prove insufficient for the hole conditions that will exist at MARK. Equally disturbing is that there appears to be a great deal of confusion, or at least imprecision, in the communication between the engineers at TAMU and the co-chiefs for Leg 153. LITHP expressed a concern about this lack of communication at our spring meeting (minutes of March 1993 LITHP meeting, p. 16). The MARK drilling was LITHP's highest priority in the last Atlantic prospectus and we want to make every effort before the cruise to ensure that it will be successful.

My understanding of the current state of affairs derives from conversations this week with Kathy and Jeff. Kathy and Catherine Mevel were at College Station for their post Leg 147 meeting at the same time that Jeff Karson and Matilde Cannat were there for their Leg 153 pre-cruise meeting. As a result, the two Leg 147 co-chiefs became aware of some of the engineering plans for Leg 153; the most important engineering decision was to provide materials to allow only a single string of casing (about 50 m) to be set at each of the two MARK sites. This concerned both Kathy and Catherine because the foremost operational recommendation from Leg 147 was that hard rock holes would need multiple sets of casing and cementing as soon as possible. Apparently, even planning to cement the holes at MARK was agreed to reluctantly. Kathy's impression in conversations was that the engineering planning for the Leg was being made on the assumption that Hess was a worst case scenario, unlikely to be repeated, and that comple

Kathy was concerned enough about the planning for Leg 153 that she contacted Jeff Karson to communicate some of her experience on Leg 147; she was surprised to learn that Jeff had left College Station under the impression that they would be sailing with the ability to set two lengths of casing at each MARK site. Jeff was concerned enough about having the ability to set multiple casings strings that he made sure the scientific prospectus for Leg 153 specified the ability to set multiple casing strings (prospectus, p. 13 3rd paragraph). Since there seemed to be diversity of opinion about what was planned for the Leg, Kathy called the engineering group at College

Station and was assured that only a single set of casing for each of the two holes was being ordered--limiting any casing ability to about 50 m.

That's my current understanding of the planning. I realize that my impressions are gathered from a number of conversations and some of what I've interpreted may not be what the parties involved said or intend. However, there is clearly enough confusion about the engineering plans for Leg 153 that I am very concerned. If the engineering plan is to provide only a single set of casing for each site, I believe that the objectives of the Leg may be seriously compromised, given what we know about drilling in these lithologies. I understand that there are serious financial problems in the Program right now, but saving a couple $100,000 on a $6 million leg, at the cost of compromising the scientific success of the drilling is a serious mistake. Speaking for myself (though I know many members of LITHP will concur) if the Leg cannot be planned with adequate equipment it would be better to postpone it.

The engineering decisions may be based on a couple of misconceptions about this hard rock drilling. Those misconceptions may exist because we on the science side have not communicated clearly enough to the engineers what our objectives are. The first misconception concerns the objectives of these legs. LITHP views MARK as one part of the offset-drilling approach to obtaining partial crustal sections. The offset-drilling strategy specifically stated that the goal is to "obtain long sections of crust and upper mantle and to construct composite sections at a limited number of localities". Long is the critical adjective--the group views long as 500 m or more. In fact, I note that though every version of the MARK proposal stated a goal of 1000+-500 m for the depth of MK1 and MK2, the goal stated in the Leg 153 prospectus on p. 13 is "at least 200 m or as deep as possible". I have no idea how, or where the goal was changed and, granted, that may be the logistic limit for one leg, but it is not the ultimate scientific goal. Understanding the crust requires long sections of rock--the 50 m of rock typically obtained in touch-the-basement drilling--is not sufficient. Obtaining these long sections may well require returning to the most promising sites, a reality recognized by the offset working group, LITHP and the Leg 153 prospectus (p. 13). This requires planning the initial holes to be as stable and as permanent as possible--and in these lithologies that means casing them to at least 100 m and cementing them as soon as possible. Of course, some of these holes, even carefully planned, will not prove appropriate for later re-entry. It will, however, be far more cost effective to drill a few well-planned holes, only a few of which we return to, than to keep

The second misconception concerns the nature of the lithologies to be drilled. Far from being a worst case scenario, the Hess Deep drilling is far more likely to represent typical conditions for lower crustal drilling than is Site 735B. Site 735B was a tremendous scientific success, but it may have made us complacent about drilling conditions in plutonic rocks. 735B was on an older piece of crust which had been eroded and planed at sea level. It was also in very shallow water which allowed lots of rapid bit and equipment changes. The success of that site sometimes obscures the fact that the first three weeks of the leg were spent drilling 18 holes, the deepest of which was 20 m and most of which were tremendously unstable. The gabbroic exposures at Hess and MARK are both tectonic, and are fractured, jointed, and likely mylonitized in places--it is very likely that the MARK hole will have instabilities very similar to those at Hess.

The peridotite hole at MARK is viewed as the easier of the two, in part because of the success in drilling peridotites on Leg 109 in the same area. This is true, but that hole only went to 89 m and did get only 2-17% recovery. Our most extensive experience drilling serpentinites is on Leg 125 in the Mariana forearc. Nearly every hole there in near bare or shallowly sedimented serpentine had serious hole stability problems, some from the beginning, some at 80-300 m (see Site operations for 778A, 779A and 783). Given that knowledge, I believe we'd be short sighted not to provide for the ability to case at least the top 100 m of this site as well.

The difficulties of these hard rock sites were well represented at Hess Deep. Both of the sites at Hess Deep had problems with hole stability and collapse and the Preliminary Report on Leg 147 made some very sound engineering recommendations (in fact the same recommendations were made at both the gabbroic and ultramafic site): "Future drilling programs in such formations would benefit from first coring a bare-rock pilot hole as deep as possible and logging, and then setting an HRB and drilling a separate large hole, running casings, and cementing as soon as possible (without coring or logging). The drilling would be done with stabilized BHAs to wipe out the ledges and control deviation. Multiple casing strings would be run as required (probably about every 100 m) for deep penetrations in unstable formations. The HRB should be locked to the slope as son as possible with an initial conductor casing and cemented to anchor it and prevent sediment washout". The formations to be sampled at MARK are the sa

I hope that my concern is misplaced and that MARK is being planned with the experience of Hess Deep in mind. If it is not, I think that it is imperative that PCOM examine the issue at its August meeting and make the science operator aware of what the minimum requirements for a successful leg are, while there is still time to order and ship the necessary materials. MARK has the potential to be tremendously successful and to form an important part of accomplishing the offset-drilling strategy.

Sorry for the length of my diatribe! Let me know if I can provide any more information on this issue, or if there is anything I should poll LITHP about in regards to the MARK site. I think this problem emphasizes our need to find a way to facilitate communication between the worlds of the scientist and the engineer.

Best regards,

Sherm

FAX TRANSMITTAL COVER SHEET
FAX: (206) 685-7652

JOIDES Office

School of Oceanography, HA-30, University of Washington, Seattle, Washington 98195
Tel: (206) 543-2203, Fax: (206) 685-7652, Internet: joides@ocean.washington.edu, Omnet: joides.uw

Thursday, July 1, 1993
10:56 AM

To: Enrico Bonatti
c/o LDEO

FAX: 34 58 271 873 **Fm: Brian T. R. Lewis**

If you have any problems with transmission call: (206) 543-2203

Dear Enrico,

Many thanks for your fax about the Romanche FZ.

I will bring this up for discussion at the August PCOM Meeting. It could be very useful for the testing of the DCS.

All the best —
Brian

DR. B. LEWIS
FAX 206-6857652

Lamont-Doherty Earth Observatory
of Columbia University

P.O. BOX 1000 / RT 9W / PALISADES, NY 10964-8000 USA / 914-359-2900

June 29, 1993

Dr. Brian Lewis
Chairman, PCOM/ODP

Dear Brian,

I was at sea for two months at the Romanche FZ, and upon coming back I learned that drilling on the limestone unit capping the Vema Transverse Ridge (Site VE-3 of my proposal) is firmly scheduled for 1994 as an Engineering Leg (Leg 157). However, I see from a memo by Dan Rendelhuber that the problem of the shallow depth (~600 m) of the carbonate cap has not been resolved yet.

Having just worked intensively at the Romanche FZ, I would like to suggest to the ODP community that the main scientific objective of site Vema VE-3 (i.e., understanding transform-related vertical tectonics) as well as the engineering objectives, can be addressed more effectively by drilling on the eastern Romanche transverse ridge (located near the equator). Four reliefs rise from the crest of the transverse ridge; three of them consist of a horizontal, wave-truncated reflector (top of the oceanic crust flattened by erosion at sea level during subsidence) capped by a carbonate platform/lagoon/reef system. Thickness of the carbonate caps ranges from 200 to 400 m. I attach a Xerox of reflection profiles from two such reliefs. The top of these reliefs ranges from 900 to 1200 m below sea level, in a range of depths that might fit the needs of the ODP Engineers better than Vema's (~600 m) VE-3 site. These reliefs are covered by multibeam and single and multichannel reflections data and have been sampled very extensively. They are essentially ready to drill.

I think it could benefit ODP having the choice of better scientific and engineering targets than VE-3 for Leg 157. I could rush in a proposal on this, even though we are rather late, and although I must say also that I am reluctant to make another big effort for ODP, given the way ODP has dealt with my Vema F.Z. proposal. Please can you let me know what you think?

With best regards,

Enrico

Enrico Bonatti

2 pages follow

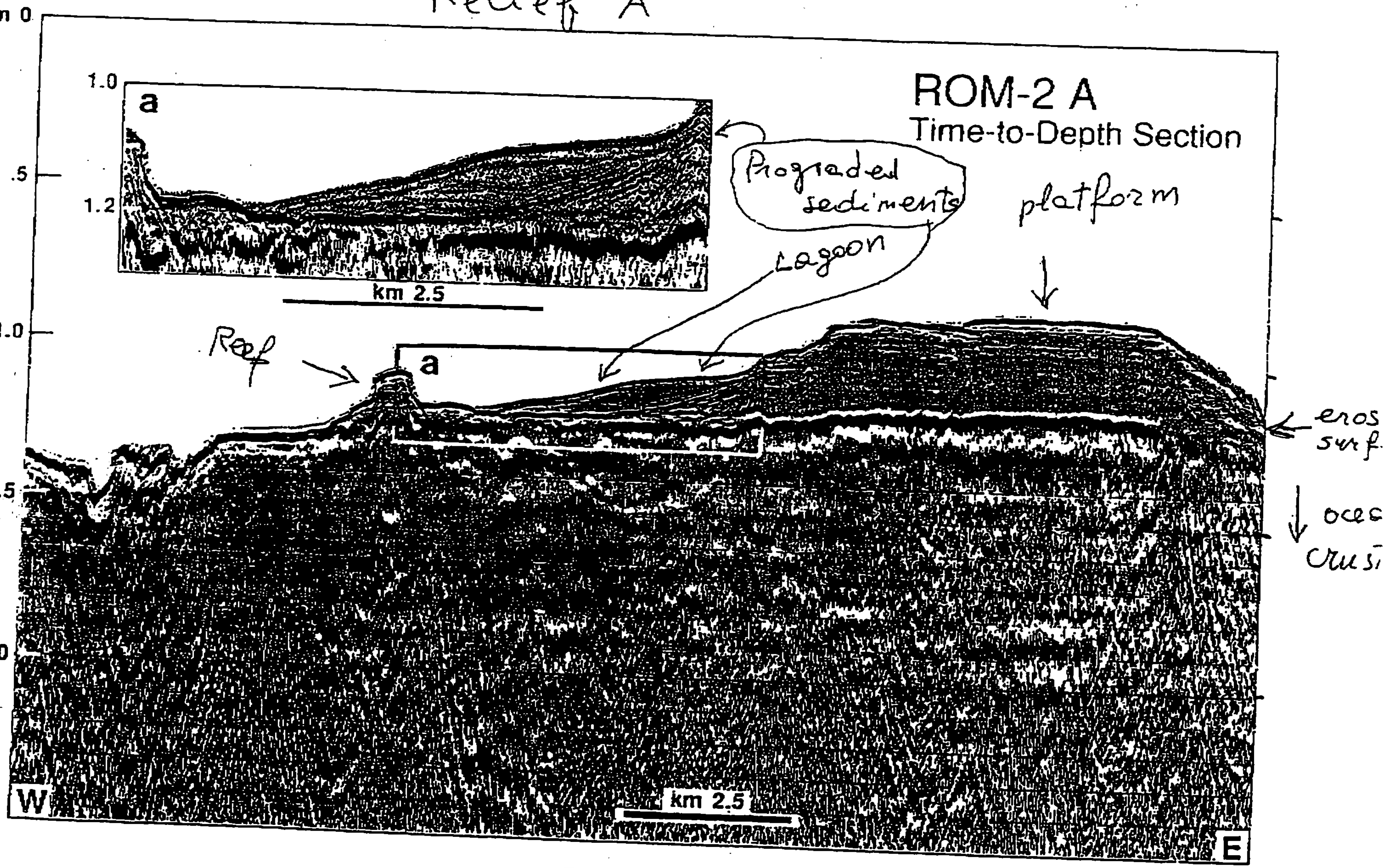
EB:db

FAX 914-3653183
" 011-39-51-243117

PCOM Meeting, August 10 - 13, 1993
Correspondence

To: Brian Lewis

Relief A



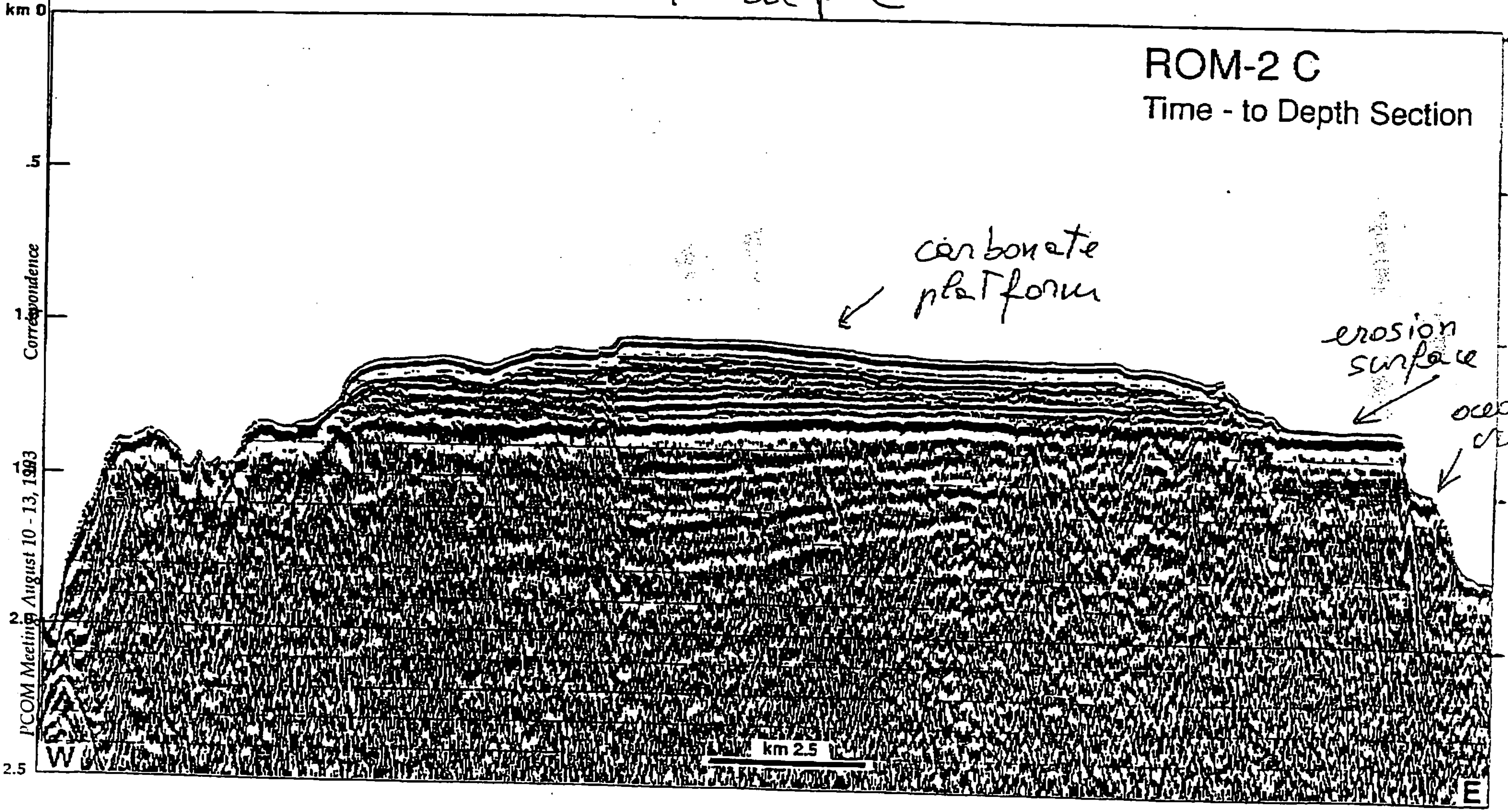
E. Bonatti et al

Figure 6b

To → Brian Lewis

PCOM Meeting August 10 - 13, 1993
Correspondence

Relief C



E. Bonatti et al.

JOI Joint Oceanographic Institutions INCORPORATED

Suite 800
1755 Massachusetts Ave., NW
Washington, DC 20036-2102 USA

Telephone: (202) 232-3900
Telemail: JOI.INC/Omne
Telex: 7401433 BAKE U
FAX: (202) 232-8203

28 June 1993

Dr. Philip Rabinowitz
Ocean Drilling Program
1000 Discovery Drive
College Station, TX 77845-9547

Dear Phil:

The National Science Foundation today informed me that they would like us to stop sending copies of the *Proceedings* of ODP to Russia after publication of results from the last leg Russian scientists sailed on.

I was also informed that we should drop any reference to Russia (inactive partner) from any of our materials as of 1 October 1993.

Sincerely,

Tom

Thomas E. Pyle
Vice President and Director,
Ocean Drilling Programs

cc: R. McPherson
E. Kappel
B. Malfait
A. Nowell
✓B. Lewis

S.001

RUSSIAN ACADEMY OF SCIENCES

INSTITUTE OF LITHOSPHERE

Staromonetny per., 22 Moscow, 109180. Tel.: 233-55-88

Fax: 7.(095) 233-55-90 TLX 411484 LITOS SU

__________№

USA
FAX: 1(206) 685-7652

ATTN: BRIAN LEWIS
JOIDES Planning Office
University of Washington (HA-30)
3731 University Way N.E.
Seattle, WA 98195

7 June, 1993

Dear Dr. Lewis:

Reading the Agenda Book for the June EXCOM Meeting, which comprises the PCOM Draft Minutes, I have learned about the discussion of our request for ODP scientists to go to Russia to speak on results of new Legs.

We are grateful to all PCOM participants who understood our difficulties and expressed sympathy to keep us involved in ODP through either such informal interactions or literature distribution in Russia. We greatly appreciate Cathrine Mevel's efforts to try to come to Moscow to talk on Leg 147, and will be glad to host her (and anyone from other Legs) if she will manage to get funds for air tickets (our Institute will cover hotel accomodation and per diem).

Our scientists would be glad to hear oral presentations from participants of further Legs, especially of those in the Atlantic, where we worked much and keep on working. In order to arrange such scientific meetings better and to invite people concerned from other cities of Russia and from new republics formed at the territory of former USSR, we need information in advance.

Thanks for your assistance.

Sincerely yours,

Nikita Bogdanov
Director, and
Chairman of Russian Committee on ODP

Fax: 7 (095) 233-5590
Telex: 411484 LITOS SU

FAX TRANSMITTAL COVER SHEET
FAX: (206) 685-7652

JOIDES Office

School of Oceanography, HA-30, University of Washington, Seattle, Washington 98195
Tel: (206) 543-2203, Fax: (206) 685-7652, Internet: joides@ocean.washington.edu, Omnet: joides.uw

Tuesday, June 29, 1993
9:13 AM

To: M. Kastner
SIO

FAX: (619) 534-0784 **Fm: Brian T. R. Lewis**

If you have any problems with transmission call: (206) 543-2203

Dear Prof. Kastner,

Many thanks for your letter of June 21, 1993 concerning a potential JOIDES ethical conclict. I will bring this up at the next PCOM Meeting.

Sincerely,
Brian

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY
GEOLOGICAL RESEARCH DIVISION

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093

M. Kastner
Telephone: 619-534-2065
Mail Code: 0212

June 21, 1993

RECEIVED
JUN 2 8 1993
JOIDES Office

Dr. Brian Lewis, PCOM Chairman
School of Oceanography
University of Washington, WB-10
Seattle, WA 98195

Dear Brian:

Dr. Wolfgang H. Berger urged me to write to you regarding the following new ethical problem, which we feel should be discussed at the upcoming PCOM meeting.

As a result of the successful deployments of sealed borehole systems (CORKs) for long-term monitoring of temperature, pressure and fluid chemistry, on two recent ODP Legs 139 and 146, an important serious ethical problem has evolved. Any sealed borehole CORK deployment requires a follow-up submersible program. Is it correct to exclude the appropriate shipboard scientists from the FIRST follow-up visit to the CORKed sites? The problem did not arise after ODP Leg 139, because the appropriate shipboard scientists were properly involved in the first follow-up cruise.

Specifically, some of the shipboard physical properties and geochemistry specialists spend days on the ship while the borehole systems are being deployed; but more importantly, throughout the cruise, they analyze and interpret the temperature and chemical profiles of the sealed sites. If they are then excluded from the FIRST follow-up cruise, if successful, the participating non-shipboard scientists (who are replacing the shipboard scientists), who have access to all the shipboard data and interpretations, with quick few analyses could "run-away" and immediately publish with no restrictions all the important interpretations originally acquired by the shipboard scientists. This is a very serious matter which should be of great concern to the ODP scientific community, especially to past and future shipboard scientists participating in ODP Legs involved in sealed borehole system deployments.

Non-shipboard scientists with special expertise or equipment, such as flow and seepage meters, should also be encouraged to participate in the FIRST follow-up cruise, in order to maximize the science acquired from these important expensive downhole experiments.

TELEX: 188929 • TELEMAIL ADDRESS: M.Kastner • INTERNET: mkastner@ucsd.edu • FAX: 619-534-0784

Dr. Brian Lewis
June 21, 1993
Page 2

The emphasis on the FIRST follow-up cruise is because ideally it should take place a few months after the drilling cruise, when the shipboard scientists are working on their samples and data, but are not permitted to publish.

Thank you for considering this matter at the upcoming PCOM meeting.

Sincerely yours,

Miriam Kastner

M. Kastner
Professor of Geochemistry

MK/cp

c: W. H. Berger
B. Carson

Lehigh University

Department of Earth and Environmental Sciences
telephone (215) 758-3660
fax (215) 758-3677

Williams Hall
31 Williams Drive
Bethlehem, Pennsylvania 18015-3188

20 May 1993

Dr. Brian Lewis
Chairman, ODP-PCOM
School of Oceanography
University of Washington, WB-10
Seattle, WA 98195

Dr. Peter Lysne
Chairman, ODP-DMP
Division 6252
Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185

Dear Brian and Peter:

By this letter we request that both DMP and PCOM consider allocating time aboard the JOIDES RESOLUTION for continued testing of the Geoprops Probe. If development of this tool is to move forward, further evaluation of its downhole performance is necessary. In the longer term, additional funding may be required to make the tool fully operational, but for the immediate future data collection is warranted.

Because development of the Geoprops Probe has a long and somewhat convoluted history, it may be useful for us briefly to summarize its evolution, to indicate where we stand presently in the process, and to recommend a program to continue evaluation and development. Development of Geoprops probe began in the late 1980's with two NSF grants ($222,000) to Karig. Based on specifications established at an ODP workshop on physical properties determinations (June 26-28, 1986), the intrument was originally designed and developed by TAM International (Houston, TX), under subcontract from Karig. Two tools were fabricated and tested. A land test (January 1991) that utilized an ODP BHA and a subsequent bench test (June 1991) resulted in determination by ODP engineering personnel that the instrument showed considerable promise but needed additional development before it could be taken to sea. However, TAM International declared that they had fulfilled their contract and ceased further development. In September 1991, Carson entered the picture to continue the development program, in the hope that the instrument could be made ready for sea trials on Leg 146 (Sept-Nov, 1992). After a review of the tool by ODP engineering staff and their recommendation of a 2-stage program to make the tool operational, an additional $30,000 was obtained from NSF, and an outside consultant (James Aumann, Salt Lake City) was contracted to make modifications to the two tools, under ODP engineering supervision. Those modifications were completed in September 1992 and the results of a bench test prior to departure of Leg 146 are detailed in Appendix 1. The ODP engineering staff and Carson agreed that the 2 tools should be tested on Leg 146, but that design deficiencies remained that would require subsequent modification.

Forty eight hours of sea tests were allocated in the Leg 146 schedule; the results of the actual tests are summarized in Appendix 2. The first test was conducted at Site 889D, under *very* poor weather conditions. The tool was deployed but could not be inserted fully into the small hole cut by the MDCB, either because the MDCB did not cut and remove a full 4 m of sediment, or because of fill that may have accumulated in the hole between recovery of the MDCB and deployment of the Geoprops probe. Additional tests were to be run at Site 892, but loss of all BHAs required for the MDCB prior to occupation of Site 892 precluded drilling of the small-diameter hole required for Geoprops. Therefore, additional testing was confined to conducting flow tests within the pipe to cycle the sequence valve and calibrate the pressure readings on the rig floor to the pressures recorded downhole by the Geoprops probe.

Evaluation of the bench test and Leg 146 sea trials results indicates that some design modifications will have to be made to the instrument. However, before time, effort, and expense are incurred in further development, it is clear that we need to determine that we can insert the tool into the MDCB hole. If fill accumulates regularly in that small hole before the Geoprops probe can be inserted, the tool cannot function. Tom Pettigrew and we are in agreement that a sequential, four-part strategic program is warranted:

(1) **Determine that we can create an MDCB hole and enter it with the Geoprops probe.** This first step should be accomplished by lengthening the MDCB so that it cuts a 6 m, rather than 4 m hole, that will allow accumulation of some fill and still accommodate full insertion (2.5 m) of the Geoprops probe. Field testing can be most efficiently accomplished with a dummy probe rather than the existing instruments. If these tests indicate that full insertion occurs on a high proportion of deployments, we recommend proceeding to the second stage of development. If proper insertion is an uncommon occurrence, we suggest that development of the tool be terminated.

(2) **Determine if the packer elements adequately isolate the MDCB hole upon inflation, retract sufficiently for the tool to be recovered through the bit, and are not subject to excessive abrasion in the recovery operation.** This second appraisal might be made with the existing tools, at relatively small additional cost (tool breakdown and rebuild, perhaps packer element replacement, shipping), despite the need for mechanical and electronic upgrades (see below). The flow tests at Site 892 suggest that the present tools will cycle through the inflation/deflation sequence which will allow evaluation of the active packer elements during both deployment and recovery.

(3) **Mechanically re-package the Geoprops Probe.** If the tool is to operate routinely and reliably, mechanical modifications are necessary. These modifications are detailed in Appendix 2, and relate primarily to redesigning the sequence valve which presently eats o-rings at an alarming rate, re-plumbing the water bottles (and re-working the frame) so that they can be installed and removed easily without flexing the tubing, improving the connections between sub-assemblies to that the tool can be broken down and re-built without damaging electronic and hydraulic connections, redesigning the shock subassembly, and implementing changes to facilitate handling on the rig floor. This step, to be taken only after positive recommendations on (1) and (2), above, will require additional funding for design and fabrication.

(4) **Rebuild the electronics package.** In the 5 years since the instrument was designed, significant advances in digital data loggers have been realized. Although the existing logger is operable, the interface box required to dump the data and reset the memory is cumbersome and intermittent, and the procedure is time-consuming. Furthermore, some of the existing electronic components (thermistors, pressure transducer) shorted out when immersed in the sea trial, and need to be replaced/redesigned. If the Geoprops probe is ultimately to come on line as a "standard" tool, it needs a modern, programmable data recording unit that does not require an interface to transfer data or manage memory.

We shall be pleased to oversee continued development of the probe, with the close cooperation of the ODP engineering staff. We have established a good working relationship with that group, and with our joint experience before and during Leg 146, we are intimately familiar with the tool. It is the common belief of both scientists and engineers involved in the development that the instrument holds considerable potential, if we can maintain the MDCB hole long enough to insert the Geoprops probe.

We request that DMP discuss the four-point plan outlined above, and make recommendations to PCOM on continued development of the Geoprops probe, including the desirability of additional tests at sea . If it is the determination of DMP that Geoprops testing should continue, and if PCOM concurs, we request that PCOM designate upcoming legs on which step (1) testing should be carried out. The initial phase of testing should be carried out over several legs, so that we can assess the stability/suitability of MDCB holes in a variety of lithologies. We estimate that 10-15 deployments of the MDCB/dummy Geoprops probe would be sufficient to establish this. We expect that each deployment would require 6-8 hours depending upon water depth. Certainly some of these tests should be conducted on Leg 156 as a principal use of the tool is envisioned in accretionary prism settings, but it would be most favorable to conduct several tests prior to Leg 156, so that we might move to phase (2) tests on that leg as well.

If we can provide additional information pertinent to your consideration of this development program, please do not hesitate to call us.

Sincerely yours,

Bobb Carson
Professor
Department of Earth and
Environmental Sciences
Lehigh University

Dan Karig
Professor and Chairman
Department of Geological
Sciences
Cornell University

cc: Tim Francis
Judith McKenzie
Barry Harding
Mike Storms
Dave Huey
Bob Olivas
Tom Pettigrew
Scott McGrath
Tom Pyle
Bruce Malfait

Appendix 1: Bench Test Report, September 1992

Geoprops Bench Test
College Station, Texas - 3-4 September, 1992

Introduction

A meeting to test the revised Geoprops tools was convened on 3 September 1992. Principal attendees were Scott McGrath, ODP engineer with particular responsibility for Geoprops, James Aumann, consulting engineer contracted to modify the original Geoprops design, Tom Pettigrew, ODP engineer, and Bobb Carson, Lehigh University. Carson and Pettigrew are responsible for deployment of the tools on ODP Leg 146.

The two original Geoprops tools had been modified by Aumann to (1) strengthen the support in the sample bottle section, (2) replace the original set of shear pins that controlled packer inflation/deflation, initiation of water sampling, and the slug test with a single sequence valve, and (3) include a shock isolation section that holds deceleration at the bit to ~10 g's. Neither tool was completely assembled nor operated normally during the test. Instead, all sections of each tool (electronics, sample bottle, and straddle packer sections), with the exception of one of the electronics packages, were individually tested and adjusted, and each component had operated properly by the end of the test period. Additional tasks that remained at the end of the test were to be completed before shipping the instruments to Victoria, B.C: (1) repair of one electronics package; (2) rewiring on thermistors in one straddle packer section (thermistors responded correctly, but outputs were reversed); and (3) preparation and assembly of an instruction manual.

Operational Improvements

The reader is referred to the Geoprops Manual for a detailed description of tool design and operation.

Unlike the original design which incorporated a series of shear pins to (1) inflate the packers, (2) start the water-sampling sequence, (3) initiate the slug test, and (4) deflate the packer, in the modified instrument these functions are controlled by a spring-loaded sequence valve. Pressure-up now accomplishes the first three of these operations, while packer deflation is effected by pressure reduction. This change means that more than one slug test could be performed during a single deployment, if desired.

Pore water samples in the modified instrument are collected in three 20 ml bottles, but are no longer drawn through the first bottle to fill the second and third containers. Instead, when the first bottle fills, flow is diverted directly to the second and third bottles to prevent mixing of pore waters collected early and late in the sampling interval.

Detailed Test Log

Tool 1002

(1) 4" I.D. pipe placed over packers
(2) Pressure gauge placed in pipe in interval between packer elements.
(3) Start data acquisition
(4) Packers inflated to 400-450 psi

(5) Sample bottles actuated by pumping at 250 psi to sampling ports in pipe over upper packer. Time = 13:15. Small leak at bulkhead between packer and sample bottle sections.
(6) Apply upper packer face pressure to test formation pressure (upper packer pressure port). Multiple leaks at bulkhead. Fluid appears to be leaking through thermistor and along wires at face pressures above 200 psi (rated capacity of packer)
(7) Apply lower packer face pressure. Leaks at 325 psi. Re-apply 325 psi to register on data logger. Time = 23:15.
(8) Fill interval between packer elements with water. Sequence valve tripped at 780 psi. Then shuttle operated normally at ~620 psi. Slug relief valve tripped at 560-580 psi. Packer pressure brought to 950 psi. Time = 41:30.

There ensued a long discussion of what caused the pressure to rise in the interval between the packer elements during the slug test. It is not the case that the pressure rise reflects the injection of a precise volume of fluid, for increasing the interval pressure also affects the volume of the packer elements. Carson is to check with Karig as to the intent of the original design: is a precise slug fluid volume to effect the pressure rise, or it is sufficient to simply induce a pressure spike (in the variable volume between the packer elements) and then record the rate of pressure decay? The current tool operates in the latter mode.

(9) Interval pressure reduced to 450 psi. Time = 59:00.
(10) Second slug test performed; brought interval pressure to 600 psi; set slug release valve; packer pressure = 980 psi. Time = 59:30.
(11) Interval pressure reduced to 450 psi. Time = 1:00:59.
(12) Third slug test performed; brought interval pressure to 600 psi; packer pressure = 1000 psi. Time = 1:01:45.
(13) Bled packer elements; retracted at ~200 psi; leaked to sample port. Time = 1:02:45.
(14) Saved to file as "Bobb".
(15) Adjusted sequence valve and interval limit settings.
(16) Interval pressure did not hold; changed teflon O-ring in interval limit shuttle.
(17) Pressure up:
  (a) Packer flow at 260 psi
  (b) Sample valve open at 180-200 psi
  (c) Slug test start at 540 psi
  (d) Slug limit at 320 psi
(18) Blew O-ring in slug limit valve (last O-ring as it travelled into threads on adjustment screw?). Replaced.
(19) Blew 2 O-rings in sequence valve. Replaced.
(20) Adjusted sequence valve and interval limit settings.
(21) Pressure up:
  (a) Packer inflates at 380 psi
  (b) Sample valve open (pressure not observed)
  (c) Slug test start at 680 psi
  (d) Slug limit at 350 psi
(22) Increase slug limit adjustment.
(23) Pressure up:
  (a) Packer inflates at 380 psi.
  (b) Sample valve opens at 200 psi

(c) Slug test start at 680 psi
(d) Slug limit at 480 psi.

(24) Sequence (23) above was deemed proper function as it closely approximated the desired values:
(a) Packer inflates at 400 psi
(b) Slug test starts at 700 psi
(c) Slug limit: 200 psi less than slug start
(d) Packer deflate at 300 psi

Tool 1001

(1) Pump up on sequence valve
(2) Twice sheared O-rings on sequence shuttle
(a) sheared first O-ring
(b) sheared first and second O-rings
(3) Leak in packer line at bulkhead between electronics and sample bottle sections. Tore down plumbing to correct leaks.
(4) Tested packer section of tool 1001 (coupled to tool 1002 electronics and sample bottle sections)
(a) Ice on upper packer thermistor first
(b) Ice on lower packer thermistor second
(c) print out indicates crossed wires from thermistors
(d) leads wrong coming out of packer; leads reversed.
(5) Adjust sequence valve and slug limit valve
(a) Packer inflated at 380 psi
(b) Sample bottles open at 180-200 psi
(c) Slug test started at 700 psi
(d) Slug limit at 420 psi
(6) Adjust slug limit valve to 500 psi
(7) Packer check valve malfunctioned; blew out with water to clean out debris.
(8) Pressure up:
(a) Packer inflated at 380 psi
(b) Slug test started at 650 psi
(c) Slug limit at 500 psi
(9) Adjust, and pressure up:
(a) Packer inflated at 420 psi
(b) Slug test started at 700 psi (note: this reading and previous readings made at the test pump gauge, not at the packer port which shows a higher and, according to Aumann, a more accurate reading).
(10) Slow leak in packer line at the tee just below the sequence valve. Connection tightened. (note: tee is positioned so sequence valve must be broken down to remove).
(11) Pressure up:
(a) Packer inflated at 420 psi
(b) Slug test started at 750 psi (continued at 680 psi)
(c) Slug limit at 510 psi
(12) Sequence (11) above was deemed proper function.

Observations

Failure of one or two O-rings in the sequence valves was a recurring problem. However, it seemed to occur when pressure was rapidly released to deflate the packer elements. For shipboard operation during Leg 146, it would be prudent to cycle the instrument through the pressure sequence to test proper function, and then remove the sequence shuttle to determine that the O-rings are not damaged before deploying the instrument. In the longer term, the design of the sequence valve should be examined to determine and correct the cause of the O-ring failure.

Although the new sample bottle mounting frame has had the desired effect of stiffening plumbing arrangement in the section, access for removal of the bottles or repair of leaks is very difficult. Larger ports should be cut in the frame, or one-half of the tubing should be removed to facilitate maintenance. Also some thought should be given to installing zero clearance (O-ring) tubing fittings at the three bottles (and perhaps at other high maintenance points), so that they can be removed easily without having to flex the tubes to gain clearance. It seems likely that in repeated use this latter (present) procedure will induce leaks in the hydraulic portions of the tool.

The packer elements relaxed sufficiently within 10-15 minutes to allow extraction of the tool from the test pipe. Whether they will collapse sufficiently to pass through the bit and trip up the pipe without damage under drilling conditions will require a sea test on Leg 146.

Bobb Carson
22 September 1992

Appendix 2: Geoprops Leg 146 Sea Trial and Development Summary Report, April 1992

GEOPHYSICAL PROPERTIES PROBE (GEOPROPS)
LEG 146 SEA TRIALS
and
DEVELOPMENT SUMMARY REPORT

T. L. Pettigrew
Ocean Drilling Program
Texas A&M University
April 1993

INTRODUCTION

The remarkable success of the Ocean Drilling Program (ODP) is evidenced by the voluminous samples and information acquired over the 8 1/2 years of its operation to date. The Program's success is also evidenced by its technological advancements.

The tools and equipment required by scientific ocean drilling are often very complex. Because of this complexity and the limited engineering capacity within ODP, the Program has historically relied in part on outside or "third party" tool development. Third party tools and equipment are required to go through rigorous testing on land and at sea before becoming "operational tools" in the ODP arsenal.

The Geophysical Properties Probe (Geoprops Probe or Probe) is a "third party developmental tool" which was subjected to testing at sea, referred to as "sea trials", during ODP Leg 146 (Cascadia Sept/Nov '92). This report is intended as a detailed account of the Geoprops Probe Leg 146 sea trials and a summary of its development to date.

CURRENT STATE OF THE GEOPROPS PROBE DEVELOPMENT

Based on the Leg 146 sea trials, it has been determined the Geoprops Probe is NOT ready for operational service aboard the JOIDES Resolution. The Probe has not been accepted by ODP and therefore is still considered a third party developmental tool.

Although the basic concept of the Geoprops Probe is sound, a complete redesign of the Probe is deemed necessary to make it reliable and "user friendly". It is estimated that approximately $150,000 and one year to 18 months of concentrated effort are required to carry out the redesign work and produce 2 new tools.

At this time, no further development of the Geoprops Probe is planned until another principal investigator comes forward with the required funds to complete the redesign work. The Geoprops Probe is currently stored at the Ocean Drilling Program, Texas A&M University, College Station, Texas.

GEOPROPS PROBE DESCRIPTION

The Geoprops Probe is a small straddle packer device intended to be deployed in a pilot hole cored by the ODP Motor Driven Core Barrel (MDCB). Embedded in the packer elements are pressure and temperature monitoring devices as well as a pore fluid sampling port. Upon inflation of the packer elements the pressure measuring ports, temperature measuring devices and pore fluid sampling port are placed in direct contact with the borehole wall. The borehole wall temperature and formation pore pressure are then measured and recorded. Also, a pore fluid sample is collected.

The Geoprops Probe can also pulse the formation between the inflated packer elements and record the pressure decay versus time. Once back on deck, the pressure and temperature data can be recovered by down-loading the integral memory unit into a PC for display and evaluation. The pore fluid sample is also recovered.

The Geoprops Probe is controlled and actuated by manipulation of the drill pipe pressure. During deployment from the JOIDES Resolution this control pressure is created and maintained by the rig pumps continuously pumping against nozzles located in the Geoprops Probe landing mechanism. The nozzles act as a choke point to the flow creating a pressure head which is used to control and actuate the Probe. The nozzles also allow for continuous circulation during deployment of the Probe which helps prevent the drill string from becoming stuck.

SEA TRIALS ASSEMBLY AND DECK TESTING

Although the Probe valve settings were preset and tested prior to shipping a deck test was performed to verify them. The sequence valve o-rings leaked and had to be replaced before the deck test could be performed. Nipping of the sequence valve o-rings was a common occurrence observed during bench testing prior to shipping for Leg 146. The sequence valve o-rings had to be replaced on several occasions during deck testing due to nipping. As a precaution the sequence valve o-rings were replaced after deck testing was completed. Deck testing confirmed the Probe's valve settings were as preset and no adjustments were required.

The thermistor recording ranges were set to the 20 - 50 °C range using the 5 position rotary switches as indicated in the Geoprops Probe Operation and Maintenance Manual.

The Probe was completely broken down for replacement of all o-ring seals prior to deployment.

When removing the electronics housing (350-GP-25) from the electronics section, break out torque is applied to the #3 bulkhead connection with the #4 bulkhead via the o-ring seals (reference Geoprops Probe Assembly drawing OZ3000). This connection is covered by the electronics housing during disassembly and can not be observed or backed up to prevented the #3 bulkhead from backing out.

On one occasion, the #3 bulkhead did back out during disassembly resulting in damage to the pressure transducer lead wires as they wrapped around the #3 bulkhead stem. The transducer leads were repaired and the electronics section retested. Testing indicated the packer pressure transducer was not responding and was assumed damaged internally. The rest of the electronics section functioned properly.

The backup electronics section (1001) was successfully disassembled, o-ring seals replaced and reassembled without damage to either the transducer leads or the o-ring seals. The unit was tested and found to be functioning 100%. The backup electronics section was then made up in the assembly for deployment.

During makeup of connections with o-ring glands, virtually every backup ring was pinched and damaged. On occasion even the o-ring seal itself was pinched and damaged. Pinching is the result of a poor gland design which requires a square shoulder to be driven over the seal during makeup. Since not enough room existed in the gland to add a "lead-in bevel" all backup rings were left off during assembly. Even with the backup rings removed several o-rings were found to have been damaged when the Probe was disassembled after deployment. Fortunately all the glands employ redundant o-ring seals and no leaking problems occurred.

With great difficulty the sample bottles were removed, cleaned and reinstalled. The support structure for the internal plumbing and sample bottles does not allow easy access to either the sample bottles or the internal plumbing. Also, the type of Swagelok fittings used on the sample bottles were very difficult to tighten properly in the confines of the support structure. Leaking connections were a problem which had to be addressed. To access some of the connections, the entire internal plumbing subassembly had to be removed from the support structure.

The Probe was finally assembled into it's subassemblies and staged for movement to the rig floor for final assembly during deployment.

SEA TRIALS DEPLOYMENT HOLE 889D

The Motor Driven Core Barrel (MDCB) was deployed in Hole 889D at 1656 m (330 mbsf) to produce a pilot hole for the Probe. The MDCB made an apparent text book run, operating for 28 min and giving an end of stroke indication. However, recovery of only 2.4 m of core rather than the full 4 m the MDCB is capable of, raised the question of how deep the pilot hole actually was. Since an end of stroke indication was observe it was assumed the pilot hole was 4 m deep.

A quick deck test of the Probe valving and back up electronics package indicated all systems to be functioning properly.

The Probe subassemblies were moved to the rig floor for final assembly. After considerable frustration while attempting to assemble the Probe subassemblies on the rig floor with the spanner wrenches provided, they were abandoned in favor of pipe wrenches normally used in rig floor operations. The spanner wrenches continually slipped when trying to torque up connections.

The electrical connectors between the subassemblies proved to be very difficult to make up on the rig floor. Also, it was difficult to keep the connectors dry while assembling the Probe in wind and rain.

Special care was taken while picking the Probe up since no clamping shoulders for use of standard ODP core barrel clamps were incorporated into the design. Obviously the same condition existed when the probe was remove from the drill pipe. The need for clamping shoulders had been pointed out to the original designers of the Probe by ODP engineering personnel in the early stages of the design.

A shock sub, intended to cushion the landing of the Probe was added to the assembly just prior to Leg 146. The shock sub scoped out completely as the tool was picked up. When the Probe was retrieved, the shock sub was completely scoped out and packed with mud. It appeared the shock sub never closed and thus did not function as designed. The shock sub had to be broken down and the mud removed before it would stroke closed.

The bottom hole assembly (BHA) was held 4-1/2 m off bottom while the Probe was free fall deployed. Upon landing of the tool, the drill pipe was pressured in 100 psi steps to 100, 200 and 300 psi while observing flow rates. The observed surface pressures versus flow rates were very close to previously calculated values. This information is critical for proper control during downhole actuation of the tool.

The drill string was pressurized to 300 psi and maintained by continuous pumping as the BHA was lowered to bottom. The 300 psi pressure head creates a 3,000 lb thrust on the Probe driving it into the MDCB pilot hole as the BHA is lowered. Maintaining the drill string pressure below 400 psi prevented the packers from inflating.

When the BHA was approximately 1-1/2 m off bottom the drill string pressure dropped from 300 psi to 150 psi while a constant flow rate was maintained. When the BHA was raised the pressure head increased once again to 300 psi.

The observed changes in the drill string pressure while maintaining a constant flow rate as the BHA was lowered was due to the Probe landing in the pilot hole before the BHA landed. This caused the Probe's landing sub to be lifted (relative to the BHA) off the BHA landing shoulder. Separation of the landing sub with the landing shoulder allows fluid to bypass the landing sub nozzles, increasing the available flow area through the BHA, thus lowering the pressure.

The BHA was raised and lowered several times with similar results. Also, with the BHA off bottom, the drill string was rotated in an attempt to change the Probe orientation with the pilot hole. If the Probe was encountering a ledge rather than fill a change in orientation might help the tool get past it. Unfortunately, the results did not change. The Probe would not extend further than approximately 1-1/2 m into the pilot hole.

The deployment was terminated and the Geoprops Probe retrieved.

SEA TRIALS DEPLOYMENT DISCUSSION

When the Probe annular pressure data from the deployment were analyzed they supported the theory of the Probe landing sub separating from the BHA landing shoulder. The annular pressure monitored by the Probe is measured in the volume below the landing sub and above the upper packer element. The annular pressure data indicated increases of 150 psi above hydrostatic pressure which corresponded to the applied pump pressure as separation occurred. With separation the choke point moves from the landing sub down to the main bit. Thus the 150 psi applied pressure was recorded by the annular pressure transducer.

Both upper and lower thermistors in both tools were checked prior to shipping for Leg 146. Ice was placed on the thermistors as the data output was monitored for the proper response. The thermistors were checked dry with the tool at ambient temperature and pressure.

The deployment data indicated that neither thermistor functioned properly during deployment. Neither thermistor recorded ambient deck temperature before nor after deployment. Both data sets indicated the temperature recording range was 0° to 30°C. Prior to deployment the temperature recording range for both thermistors had been set to 20° - 50°C as indicated in the Operations and Maintenance Manual. After initial review of the temperature data the rotary switch settings were double checked and found to be set for the 20° - 50°C range as indicated in the manual.

The upper thermistor suffered a pressure induced short circuit during deployment. Below 1,000 psi recorded annular pressure the data remains flat line at 0°C. Above 1,000 psi recorded annular pressure the data remains flat line at 30°C, maximum full scale deflection.

The lower thermistors shorted out immediately upon being immersed in water. The data record indicates a flat line at 0°C until the tool was lowered into the water. The data record then goes to a flat line at 30°C, maximum full scale deflection. Approximately 30 min after the tool was removed from water the data record began a slow non-linear drop below 30°C.

SEA TRIALS FLOW TEST

Since the Probe was not activated during deployment, numerous questions still remained to be answered. Knowing the Probe's internal pressure responses to changing flow rates as monitored on the rig floor is critical for proper actuation of the tool.

Also of interest is knowing the pressure drop through ship board plumbing i.e., stand pipe, kelly hose and top drive? This information is important to know since the pressure monitoring point in the system is in the rig floor stand pipe. Pressure data is collected before the fluid being pumped ascends the derrick through the stand pipe, passing through the kelly hose and top drive to finally enter the drill pipe.

For proper analysis of recorded data, the relationship between the driller's pressure gage and that of the instrumented pressure transducer in the down hole measurements lab must also be determined.

To answer these questions a flow test was preformed at the end of Hole 892E. Only the Probe's electronics package and landing shoulder section were required for the flow test. The Probe was configured as follows.

Landing Sub OP5703
10" Inner Barrel Sub OP3236
Sealing Quick Release OP5920/22
Top Connector/Filter Assembly
Geoprops Battery/Electronics Package
Modified Test Adapter

The Geoprops Probe upper test adapter was modified by machining another bulkhead connector pocket in the center. The pocket was drilled through into the existing internal flow paths. The pump connection port and annular pressure connection port were plugged using flush type pipe plugs. This configuration allowed the Probe's internal pressure as well as the annular pressure external to the tool to be recorded.

The electronics package (1002) originally damaged during removal of the electronics housing was modified by removing the bottom electrical connection plug and installing a blank plug making the unit pressure tight.

The Probe's upper end was assembled with the modified upper test adapter and free fall deployed. The BHA was maintained approximately 8 m off bottom at 673.5 m during the test. The rig pumps were engaged and the flow rate was increased in 10 spm (50 gpm) intervals from 10 spm (50 gpm) up to and including 90 spm (450 gpm). Each step in the test was held for 5 min.

At the completion of the flow test, the tool was retrieved via wireline. The pressure data was then downloaded for analysis.

SEA TRIALS FLOW TEST DISCUSSION

The relationship between flow rates controlled and monitored at the rig floor to internal pressure changes within the Probe was established from the flow test data.

The flow test data indicated the Probe's internal pressure was approximately 50 - 100 psi below calculated values. This was interpreted as being the pressure drop through the stand pipe-kelly hose-top drive system.

The stand pipe pressure recorded by the on deck pressure transducer closely matched the drillers pressure gage.

The flow test data can be used to accurately predict the required flow rates to precisely control downhole actuation of the Probe.

SEA TRIALS CONCLUSIONS AND RECOMMENDATIONS

The Geoprops Probe is not ready to be classified as an ODP operational tool. Many deficiencies of the tool were identified during the sea trials which must be addressed. A list of some of the Probe's deficiencies follows.

1. No operational guide written for rig floor operations during deployments exists. Correct flow rates have to be assumed.

2. The shock sub appeared not to have functioned. The shock should be evaluated further and if needed, redesigned or removed.

3. The internal plumbing is very difficult to access and work on.

4. The sample bottles are very difficult to remove and install.

5. Some type of quick release is required to allow faster and easier access to the electronics package.

6. The use of spanner wrenches needs to be abandoned in favor of pipe wrenches normally used on the rig floor.

7. Clamping shoulders need to be incorporated in the design so standard ODP core barrel clamps can be used.

8. The Geoprops Probe Operation and Maintenance Manual needs to be rewritten to remove the numerous errors.

9. The packer elements need to be of a better construction. Two of the packer elements were split, one completely

through the outer bladder.

10. The small diameter stainless steel tubing used to convey the wiring, pressure porting and fluid sampling porting between and through the packer elements is exposed and subject to damage.

11. The electrical wiring connections between the bulkheads are very difficult to make up on the rig floor.

12. All of the o-ring seal glands have a square shoulder which must be driven over the o-ring seals and back up rings during assembly often resulting in damage to the seals.

13. The threaded connection between bulkhead #3 and #4 must be prevented from backing out while removing the electronics housing to prevent damaging the pressure transducer leads.

14. The Swagelok fittings used through out the Probe should be replaced with fittings intended to be made up numerous times without leaking.

15. The interface box is clumsy to use when dumping data.

16. The fundamental question of whether the MDCB pilot hole will reliably remain open for insertion of the Geoprops Probe still remains unanswered.

GEOPROPS PROBE DEVELOPMENT HISTORY

The Geoprops Probe is a third party developmental tool originally designed and developed by TAM International, Houston, Texas, under the direction of Dr. Dan Karig, Cornell University. The original Probe development schedule was to have the Probe ready for use during ODP Leg 131 (Nankai, Apr/May '90). The Probe was not completed until late in 1990 and thus was not deployed during Leg 131.

A land test of the Probe was carried out by ODP engineering personnel early in January of 1991. The land test was a full scale test of the entire tool, carried out in an actual ODP BHA. The gross scale of the land test did not allow for detailed investigation into the intricacies of the Probe. However, the reliability of the Probe's slug valve, which introduces pressure pulses between the packer elements for permeability studies, did not perform reliably. Other aspects of the Probe's operation also appeared suspect. The land test resulted in a recommendation for further testing to investigate in detail the concerns raised.

A bench test of the Probe was carried out by TAM International at their facility in June of 1991. ODP engineering personnel were in attendance to witness the bench test. The bench test provided the first real look into the Probe's internal workings and associated problems. The bench test confirmed there were problems with the slug valve operation. The bench test also revealed the complexity of the Probe's internal plumbing and the difficulty of working on the tool.

The result of the bench test was a recommendation from ODP that modifications be made to the Probe to correct the numerous deficiencies observed.

At the end of the bench test, the vendor declared the Geoprops Probe's development completed and all contractual responsibilities regarding its development had been met.

The next viable window of opportunity for deployment of the Probe was determined to be Leg 146 (Cascadia Sept/Nov '92). Since Dr. Karig was not scheduled to sail on Leg 146, responsibility for further development of the Probe was turned over to Dr. Bobb Carson, Lehigh University, Leg 146 Co-Chief Scientist. Dr. Carson agreed to oversee the Probe modifications and Leg 146 sea trials.

Design modifications to the Probe were carried out by Mr. James Aumann, Aumann and Associates, Salt Lake City, Utah under the direct supervision of ODP engineering personnel working under the direction of Dr. Carson. The Probe was assembled with the modified parts and bench tested by ODP personnel prior to shipping for Leg 146.

This was the first time during the Probe's development that ODP personnel had been directly involved with the tool. It soon became evident the tool was a long way from being considered "operational". However, the modifications did enable the Probe to function more reliably and the decision was made to ship the tool for sea trials during Leg 146.

The Geoprops Probe sea trials were carried out during Leg 146. The conclusion after sea trials was that although the basic concept of the tool appears sound, numerous deficiencies with the tool and its design exist. The Probe is not developed enough to be considered an operational tool and should not be accepted by ODP as such.

Currently, further development of the Geoprops Probe has been put on hold until another third party investigator is identified.

RECOMMENDATIONS FOR FUTURE GEOPROPS PROBE DEVELOPMENT

Given the number of deficiencies identified a complete redesign of the Geoprops Probe is required to make the tool serviceable. The basic concept was proven during sea trials and should be used as the foundation for redesign. Perhaps another vendor should be identified to do the engineering design work and if possible supply the packer elements.

Before attempting a redesign the principal investigator and redesign engineer should take the following steps.

1. Answer the fundamental question, can an MDCB pilot hole be kept open long enough for insertion of the Probe.

2. Review the original specifications for the tool and determine if they are still valid.

3. Perform a through review of the Leg 146 sea trials report as well as reports from the earlier land and bench tests.

4. Review and analyze the data gathered from the Leg 146 sea trials to gain a good understanding of how the current tool design functions and how the tool responds to changes in flow rates during deployment.

5. Perform a bench test of the current tool including actuation of the various valves, resetting the valve actuation pressures, installing the sample bottles, removing the sample bottles, removing a sample from the sample bottles, etc., to get a "hands on" feel for the tool.

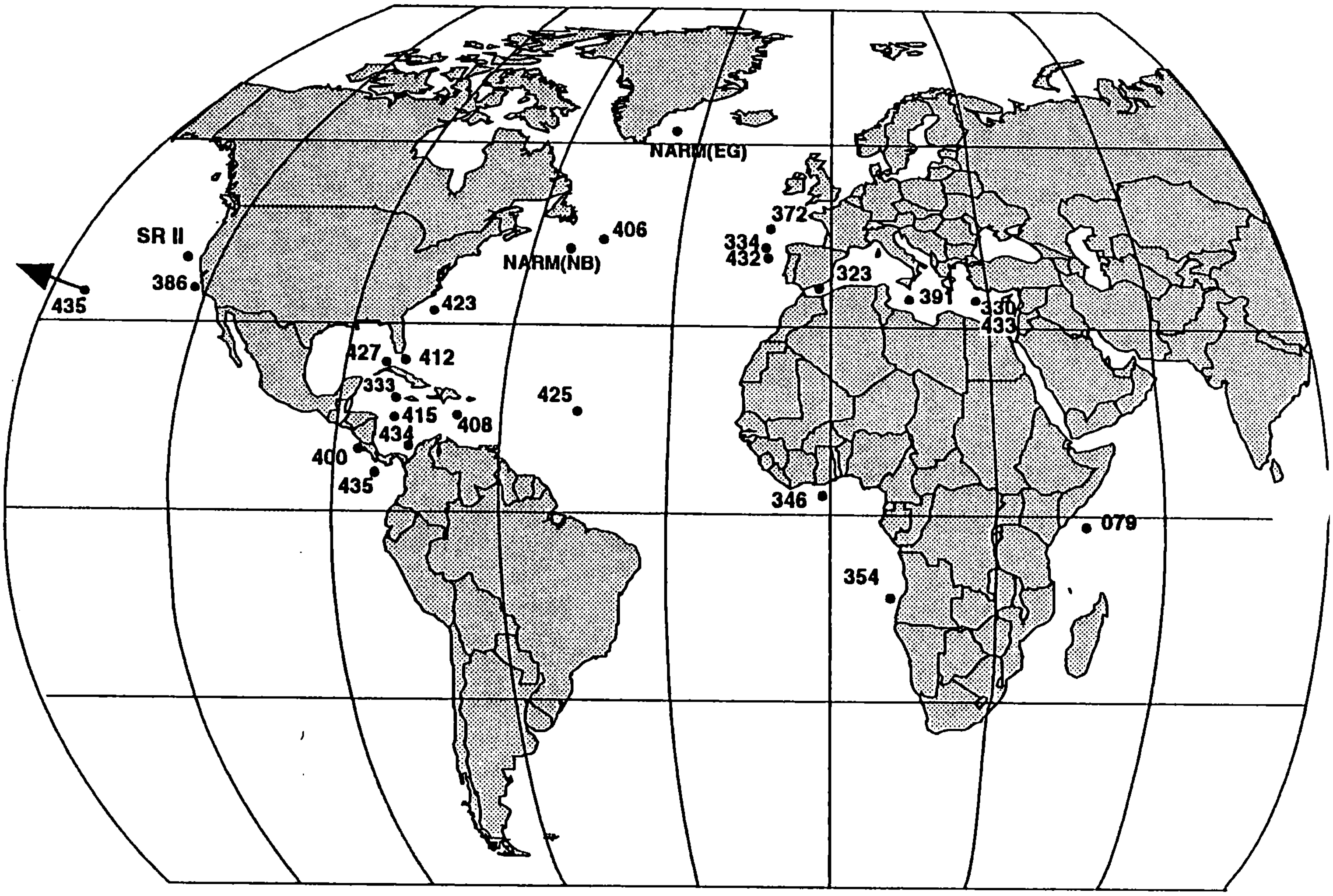
6. Perform a mock deployment of the tool including complete assembly the tool, picking the tool up, laying the tool down and disassembling the tool to get a "hands on" feel for handling the tool.

7. Confer with ODP engineering personnel concerning shipboard operations in assembling and deploying the Probe.

NEW PROPOSALS RECEIVED AT THE JOIDES OFFICE SINCE THE APRIL PCOM MEETING

Proposal No	Date Rec.	Brief Title	Proponent Contact
079-Rev2	06/28/93	Tethys and the birth of the Indian Ocean	Coffin, M.F.
323-Rev3	07/01/93	Tectonic evolution of the Alboran Sea	Comas, M.C.
330-Add3	07/01/93	Mediterranean Ridge accretionary complex (Phase 1)	Camerlenghi, A.
333-Rev2	07/01/93	Evolution of pull-apart basin, Cayman Trough	Mercier de Lépinay, B.
334-Rev3	06/30/93	Galicia margin S' reflector	Boillot, G.
346-Rev4	07/01/93	Ivory Coast - Ghana transform margin	Mascle, J.
354-Add2	07/01/93	Benguela Current and Angola/Namibia upwelling	Wefer, G.
372-Add2	07/01/93	Cenozoic circulation and chem. gradients, N Atlantic	Zahn, R.
386-Add	07/01/93	California Margin	Lyle, M.
391-Rev2	07/01/93	Formation of sapropels in the Mediterranean	Zahn, R.
400-Rev	07/01/93	Mass balance of Costa Riva accretionary wedge	Silver, E.A.
406-Add	05/24/93	North Atlantic climatic variability	Oppo, D.
408-Add	07/01/93	Testing two new interpretations, N Nicaragua Rise	Droxler, A.W.
412-Add2	07/01/93	Bahamas transect: Neogene/Quat. sea level and fluid flow	McNeill, D.F.
415-Add	01/15/93	Caribbean Ocean History, Ocean Plateau, & K-T impact	Sigurdsson, H.
423-Add	07/01/93	Gas hydrate sampling, Blake Ridge and Carolina Rise	Paull, C.K.
425-Rev	07/01/93	Mid-Antlantic Ridge Offset Drilling	Casey, J.F.
427-Add	07/01/93	South Florida Margin SeaLevel	Locker, S.D.
432----	06/28/93	Galicia deep hole S-reflector	Reston, T.J.
433----	06/30/93	East Med. Orogeny	Hsü, K.J.
434----	07/01/93	Caribbean Quaternary climate	Peterson, L.C.
435----	07/01/93	Nicaragua/Izu-Marianas Mass Balance	Plank, T.
NARM-Add	06/30/93	NARM-Add	Austin, J.A., Jr.
NARM-Add2	07/01/93	NARM-Add2	Larsen, H-C
SR-Rev2	07/01/93	Sedimented Ridges II	Zierenberg, R.A.

New and Updated Proposals Received for Fall 1993 Review



ODP Proposal Log Sheet **079-Rev2**

Proposal received: Jun 28, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

The Mesozoic Somali Basin: Tethys and the Birth of the Indian Ocean

M.F. Coffin, A. Bosellini, J.E.T. Channell, W.W. Hay, H. Jenkyns, J.G. Ogg and P. Blum

Abbrev. Title: Tethys and the birth of the Indian Ocean	Key: Tethys/Indian Ocean	Area: Ind

Contact:

Dr. Millard F. Coffin
Institute for Geophysics
University of Texas at Austin
8701 N Mopac Expressway
Austin, TX 78759-8397 (US)

Tel: (512) 471-0429
FAX: (512) 471-8844
Omnet: UTIG.Austin
Internet: mikec@coffin.ig.utexas.edu

Objectives:

1. Mesozoic global change including paleoceanography and paleoclimate.
2. Geochemistry, petrology, and hydrothermal alteration of Jurassic ocean crust.
3. Gondwanna plate kinematics.
4. Mesozoic bio-magnetostratigraphy chemostratigraphy.
5. Sedimentary mass balance.
6. State of stress of the Somali Plate.

Specific area: Western Somali Basin
Proposed Sites: As on site summary form of this proposal

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
WSB-1	3°0'S; 45°0'E	4000	2500	500	3000	Mesozoic global change, bio-magnetic & chemostrat.

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Coffin, M.F.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 079-Rev2

Title: The Mesozoic Somali Basin: Tethys and the Birth of the Indian Ocean

Proponents: M.F. Coffin, A. Bosellini, J.E.T. Channell, W.W. Hay, H. Jenkyns, J.G. Ogg and P. Blum

Abstract

We propose to drill deeply (~3000 m) into sediment and oceanic basement of the Western Somali Basin in order to obtain Mesozoic sediment and basalt associated with the waning Tethyan Ocean and the nascent Indian Ocean. Our site, WSB-1, addresses:

1) Mesozoic global change, including paleoceanography and paleoclimate;
2) geochemistry, petrology, and hydrothermal alteration of Jurassic oceanic crust;
3) Gondwanan plate kinematics;
4) Mesozoic bio-magnetostratigraphy and chemostratigraphy;
5) sedimentary mass balance; and
6) state of stress of the Somalian plate.

ODP Proposal Log Sheet 323-Rev3

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☒ Revised proposal ☐ Addendum to proposal ☐ Other

Tectonic Evolution of an Extensional Marine Basin in a Collisional Setting: The Alboran Sea

M.C. Comas, A.B. Watts, V. García-Dueñas, R. Kidd, A. Maldonado, J. Platt, R. Stephenson and J. Woodside

Abbrev. Title: Tectonic evolution of the Alboran Sea	Key: Alboran Sea evolution	Area: N Atl

Contact:

Dr. Maria C. Comas
Inst. Andaluz de Geologia Mediterranea
C.S.I.C. y Universidad de Granada
Avda. Fuentenueva s/n
E-18002 Granada (E)
Tel: 34 (58) 24-33-57
FAX: 34 (58) 27-18-73

Objectives:

1. the nature of the pre-existing crust 2. models for Miocene rifting 3. post-rift deformation 4. recent collapse of the basin 5. sediments and paleoceanography

Specific area: Alboran Basin, Mediterranean

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
Alb-1	36°14.69'N; 4°20.14'W	1000	2250	150	2400	volcanic interbedding; metamorphic basement
Alb-1A	36°13.84'N; 4°20.14'W	1000	2250	150	2400	volcanic interbedding; metamorphic basement
Alb-2	36°12.61'N; 4°18.95'W	1080	540	150	690	basement DSDP Site 121: petrology & rifting geometry
Alb-2A	36°10.95'N; 4°20.146'W	1095	620	150	770	basement DSDP Site 121: petrology & rifting geometry
Alb-3	35°41.71'N; 3°21.36'W	967	250	0	250	intra-pliocene unformity in compressional deform zone
Alb-4	36°13.96'N; 2°3.46'W	1900	650	0	650	sed sequence in graben structure, post-rift subsidence

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Comas, M.C.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 323-Rev3

Title: Tectonic Evolution of an Extensional Marine Basin in a Collisional Setting: The Alboran Sea

Proponents: M.C. Comas, A.B. Watts, V. García-Dueñas, R. Kidd, A. Maldonado, J. Platt, R. Stephenson and J. Woodside

The attributes of the Alboran Sea Basin are typical of the so called "Mediterranean Back-Arc Basins" The causes of the extension in these basins, and the rapid evolution of a collisional zone into superimposed regions of extension and adjacent contraction has not yet been adequately explained, and different working hypotheses regarding lithosphere models have been considered. The Alboran Basin represent a clear cut, well-defined, and well-studied example where these competing hypothesis can be full investigated. As the processes mentioned above operate to some extent independently of plate tectonics, to improve the understanding of their nature and causes - *the overall objective of this proposal* - is vital to the development of a truly global tectonic theory.

The Neogene extensional basin beneath the Alboran Sea developed behind an arc-shaped mountain belt (the Betic and Rifean chains and the Gibraltar Arc) and is located on the site of Late Cretaceous/Paleogene orogen generated from collisional stacking. The region straddles the boundary between two major plates - Europe and Africa - which converged during the Neogene. The Alboran Basin therefore formed in an overall environment of plate convergence. We postulate that during the Miocene the migration of the arcuate mountain front was nearly coeval with extension in the inner part of the arc that resulted in crustal attenuation and basinal spreading on the Alboran Domain (pre-Miocene-nappe metamorphic complexes). In such a way , the Alboran Basin formed from early Miocene onwards, whereas outside the Arc the thrusting processes continued.

The scientific merits of deep drilling in the Alboran Sea basin has now been considered three times by each of the JOIDES thematic panels. The revision presented here takes into account the comments of the SSP, PPSP and TECP and present a new drilling plan to JOIDES that can be considered as intermediate between the "deep" hole and "shallow" hole options. Specifically, we have taken three of the sites proposed in 323-Rev2 and combined them into a single drilling leg. The sites have been modified to take into account the concerns of PPSP but, the scientific drilling objectives remain the same.The new drilling plan includes : a) *a deep hole replacement for the problematic site Al-1, located only 6.5 km away,* b) *modifications to the position of sites Al-3 and Al-4* and lowering of the total depth at these sites, c) *site priority statement* and, d) *realistic estimate of the drilling time as possible.* In despite of the changes in the holes we do not believe that this will compromise our tectonic objectives.

We propose to drill three sites: ***Alb-1*** **(Western Alboran)** on a rift-graben flank to sample the basement and the overlying syn-to-postrift sedimentary sequence; ***Alb-3*** on a deformed flank of the **Alboran Ridge**, to recover post-rift sediments and; ***Alb-4*** on a graben structure **(Eastern Alboran)**, to sample syn-to post rift sediments .

Our program is intended to provide accurate information on *nature of the basement, stratigraphic control of basin evolution, basin geometry, timing and nature of deformation, rates of subsidence and, volcanism* . Drilling results are essential to test the predictions of some of the competing hypotheses. on the origin of the basin. Secondary objectives concern the *Neogene paleogeography and paleoceanography.*

ODP Proposal Log Sheet **330-Add3**

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

Time Progressive Continental Collision: The Mediterranean Ridge Accretionary Complex in the Eastern Mediterranean (Phase 1 Shallow Drilling)

A. Camerlenghi, E. Suess and M. Torres

Abbrev. Title: Mediterranean Ridge accretionary complex (Phase 1)	Key: Med. Ridge (Phase 1)	Area: Med Sea

Contact:

Dr. Angelo Camerlenghi
Osservatorio Geofisico Sperimentale
P.O.Box 2011 (Opicina)
I-34016 Trieste (I)
Tel: 39 (40) 214-0255
FAX: 39 (40) 327-307
Bitnet: acam@itsogs.bitnet

Objectives:

This addendum supports the scientific objectives presented in 330-Rev.

Specific area: eastern Mediterranean Sea

Proposed Sites: As seen on 330-Rev with exceptions as mentioned in text.

Site Name	Position	Water depth	Penetration Sed Bsmt Total	Brief site-specific objectives

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Camerlenghi, A.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 330-Add3

Title: Time Progressive Continental Collision: The Mediterranean ridge Accretionary Complex in the Eastern Mediterranean (Phase 1 Shallow Drilling)

Proponents: A. Camerlenghi, E. Suess and M. Torres

Abstract

This addendum supplements the original proposal N° 330-Rev submitted one year ago. The need for the addendum was generated by the comments provided by the Sedimentary & Geochemical Processes and Tectonics Panels after their 1992 fall meetings. In addition, new high resolution site survey data acquisition, partly completed and partly still in progress (enclosed 1), has suggested slight changes to the drilling program. The final site selection, at least for some of the sites, will be after the completion of the last of the cruises, expected to end on 29th of September 1993. The new data so far available have already been submitted to the Site Survey Data Bank. The drilling strategy now includes fluid flow and diagenetic objectives. The proposal integrates the work in the area of the Sirte deformation front to be conducted over the next three years by two funded CDC programs (Commission for the European Communities) called MEDRIFF (An Integrated Investigation of the Fluid Flow Regime of the Mediterranean Ridge, Westbrook et al., 1992; enclosed 2) and IMERSE (Innovative Mediterranean Ridge Seismic Experiment, von Huene et al., 1993; enclosed 3). These two programs provide information on potentially two fluid regimes to be tested by drilling: one collision drive, predominantly originating below the salt layer and dewatering through fault zones; the second density-driven, potentially originating by osmotic pumping and dewatering along the upper contact between salt and hemipelagites. In addition, the rates of sediment deformation at the toe of the accretionary complex, already included in the tectonic objectives of the proposal, will provide constraints for the estimation of the fluid budget and its changes through time.

ODP Proposal Log Sheet 333-Rev2

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

Cayman Trough: Ocean-Continent Boundary in a Transform Environment

B. Mercier de Lépinay, P. Mann, U. ten Brink, E. Calais, and M.R. Perfit

Abbrev. Title: Evolution of pull-apart basin, Cayman Trough	Key: Cayman Trough	Area: N Atl

Contact:
Dr. Bernard Mercier de Lépinay
CNRS - Institut de Géodynamique
Université de Nice - Sophia Antipolis
F-06560 Valbonne (F)
Tel: 33 (93) 95-42-43
FAX: 33 (93) 65-27-17
Internet: Mercier@mimosa.unice.fr

Objectives:

1. To study an asymmetric conjugate margin.
2. To study ocean/continent transition.
3. To study the effect of lateral heat loss on a short ridge/long transform system.
4. To study the inception of a spreading ridge.
5. To study an active transform margin.
6. To study the effects of strike-slip faults on metamorphism and record present day strain and stress.
7. To study constant vs. episodic plate motions (Caribbean paleography).

Specific area: Cayman Trough

Proposed Sites: See Proposal 333-Rev

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Mercier de Lépinay, B.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 333-Rev2

Title: Cayman Trough: Ocean-Continent Boundary in a Transform Environment

Proponents: B. Mercier de Lépinay, P. Mann, U. ten Brink, E. Calais, and M.R. Perfit

Abstract

The Cayman Trough, a 1400 km long submarine depression and present transform northern boundary of the Caribbean plate (Fig. 1), is a unique morphotectonic feature ideally suited for the investigation of a number of major tectonic and lithospheric themes through ODP drilling. It allows us to address several problems that we consider to be globally significant, and present many advantages for drilling.

1. Unequivocal asymmetric conjugate margins;

2. Cayman Trough is relatively sediment starved;

3. Accessible Ocean/Continent Transition;

4. Effect of lateral heat loss on short ridge/long transform system;

5. Initial stages of transform margin system and inception of a spreading ridge;

6. Active transform margin;

7. Effects of strike-slip faults on metamorphism;

8. Present-day record of strain and stress associated with a strike-slip plate boundary;

9. Constant *vs.* episodic plate motions: Caribbean paleogeography.

We believe that the Cayman Trough is one of the most adequate natural Laboratories for the study of the main tectonic and petrological processes associated with a strike-slip plate boundary, as well as the evolution of asymmetric passive margins in such a setting.

ODP Proposal Log Sheet **334-Rev3** Proposal received: Jun 30, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

Galicia Margin S' Reflector

G. Boillot, M.O. Beslier, D. Rappin, E. Banda and M.C. Comas

Abbrev. Title: Galicia margin S' reflector	Key: Galicia margin S' reflecto	Area: N Atl

Contact:
Dr. Gilbert Boillot
Laboratoire de Géodynamique sous-marine
Observatoire Océanologique
BP 48
06230 Villefranche-sur-Mer (F)
Tel: 33 93 76 37 42
FAX: 33 93 76 37 66
Omnet: IFREMER.ODP

Objectives:

To sample terranes overlaying, at the level of, and underlaying a master, syn-rift detachment fault zone within the stretched lithosphere of a typical passive margin.

Specific area: Galicia margin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
GAL 1	42°40'N; 12°48'E	4500	600	1100	1700	Sampling major Mesozoic syn-rift detachment fault.

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Boillot, G.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 334-Rev3

Title: Galicia Margin S' Reflector

Proponents: G. Boillot, M.O. Beslier, D. Rappin, E. Banda and M.C. Comas

Abstract

The well-known S seismic reflector of the west passive Galicia margin is interpreted as the seismic signature of a master, syn-rift detachment fault zone which puts into contact terrains very different in nature, densities and seismic velocities. There is a consensus to consider drilling through S as a very exciting and promising target for ODP.

Two distinct strategies can be proposed for sampling this feature:

To locate the drill site in the area of the Galicia margin where S was defined originally, and where it is clearly imaged by the seismic data. This is the rationale for the proposal by Reston, *et al.* "a deep hole off Galicia" in which some of us are proponents (M.O. Beslier, G. Boillot). We consider that it is the best scientific approach, although also the most ambitious for the drilling technology, S being buried at 3 km or more below the seafloor.

Alternatively, to look for a site where S or a similar reflector gets up close from the seafloor, and become more accessible to drilling with the current technology. This is the rationale for this proposal 334 "Galicia margin S' reflector," and for drilling at site GAL 1. S' is a probable continuation of S to the north-west of the Galicia margin, a place that has been uplifted by Cenozoic tectonjcs; GAL 1 is a site S' is accessible by drilling at a depth of 1.5 km below the seafloor. Unfortunately, the direct connection between S and S' is not clearly established due to the disruption of the Galicia margin crustal structure by a Cenozoic transverse fault. Consequently, doubts can be expressed about whether the target S' reflector (this proposal) is really the S reflector (the new proposal by Reston, *et al.*). For that reason, we consider drilling through S' to be ranked after drilling S in the order of scientific priorities. However, technological constraints also must be considered. If technological difficulties prevent to undertake or to achieve drilling through S, we propose to come back to the alternative strategy and to drill through S'.

ODP Proposal Log Sheet **346-Rev4**

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

The Côte d'Ivoire Ghana transform (translational) margin (Eastern Equatorial Atlantic)

J. Mascle, C. Basile, R. Scrutton, M. Moullade, and C. Ruppel

Abbrev. Title: Ivory Coast - Ghana transform margin	Key: E eq. Atl. transform	Area: N Atl

Contact:
Dr. Jean Mascle
Laboratoire d/Géodynamique sous-marine
Observat. Oceanogr. Villefranche s/mer
B.P. 48
F-06230 Villefranche-sur-mer (F)
Tel: 33 (93) 763-740
FAX: 33 (93) 763-766

Objectives:

1. Deformation and sedimentation related to the development of the Côte d'Ivoire/Ghana transform margin
2. Nature , structure and deformation history of transform boundary
3. Constrain oceanic gateways between the Central and South atlantic druing the opening of the Equatorial Atlantic, particularly during the Cretaceous

Specific area: Ivory Coast, Ghana margin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
IG 1	3°37.6'N; 2°44.1'W	2100	1600	0	1600	post-tectonic sedimentary cover for history of movements
IG 1 bis	3°35.3'N; 2°43.9'W	2062	780	0	780	post-tectonic sedimentary cover for history of movements

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Mascle, J.
Proposal forwarded for review:	Jul 16, 1993	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	Jul 16, 1993	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 346-Rev4

Title: The Côte d'Ivoire Ghana transform (translational) margin (Eastern Equatorial Atlantic)

Proponents: J. Mascle, C. Basile, R. Scrutton, M. Moullade, and C. Ruppel

Proposals for scientific drilling of transform continental margins have recently received increased attention for two main reasons:

(1) Transform faults represent the third category of major plate boundaries, but are still less understood than the two others (divergent and convergent). Among transform faults, transform continental margins are still poorly known, and have never been investigated by the potentialities of scientific drilling.

(2) Drilling at a transform margin can constrain the structure and evolution of the ocean - continent transform boundary, particularly deformational history, vertical movements and its effects on the sedimentary records.

These main scientific objectives have been stressed during the COSOD II conference and were included within the tectonics objectives of the white paper.

This proposal is a revised and updated version of JOIDES proposal 346 (Côte d'Ivoire-Ghana transform margin), submitted in summer 1989. Since the last version (summer 92), new migrated multichannel seismic reflection sections and results of deep scientific dives have considerably improved our knowledge of the Ivorian - Ghanaian transform margin. These new data allow better definition of drilling objectives and targets, concerning sedimentary and tectonic processes active at transform margins. This update also fully takes into account scientific and technical critiscism expressed by several ODP panels, particularly the Tectonic Panel.

This proposal is divided in two parts:

(1) A general introduction to the Equatorial Transform Margin, which can be considered as a typical transform margin, and the best documented.

(2) The scientific problems that drilling of the margin can solve. We proposed three specific proposed drilling sites and their alternates. Site survey data available and rationale for drilling each of these sites is given, together with an indication of the likely results to be obtained.

ODP Proposal Log Sheet 354-Add2

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

Neogene History of the Benguela Current and Angola/Namibia Upwelling System

G. Wefer, V. Spiess, U. Bleil, M. Breitzke, K. Gohl, R. Schneider and G. Ünzelmann-Neben

Abbrev. Title: Benguela Current and Angola/Namibia upwelling	Key: Benguela Current	Area: S Atl

Contact:
Dr. Gerold Wefer
Fachbereich Geowissenschaften
Universität Bremen
Bibliothekstraße
28359 Bremen (G)
Tel: 49 (421) 218-3389
FAX: 49 (421) 218 3116

Objectives: For scientific objectives see 354-Rev.
This addendum gives the results of high resolution seismic data collected during the cruise of R/V Sonne, April-June 1993.

Specific area: N/mid/S Angola Basin, Walvis Ridge, N/S Cape Basin
Proposed Sites: See 354-Rev and Table 1 of 354-Add.

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Wefer, G.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 354-Add2

Title: Neogene History of the Benguela Current and Angola/Namibia Upwelling System

Proponents: G. Wefer, V. Spiess, U. Bleil, M. Breitzke, K. Gohl, R. Schneider, and G. Uenzelmann-Neben

Abstract

Until now the eastern South Atlantic is poorly covered by DSDP and ODP drill holes. At the West African Margin, only Sites 364 and 365 off Angola and several sites on and near the Walvis Ridge were studied in some detail. High resolution information remains sparse however, for the Cenozoic and in particular the Neogene sedimentation history of the area. Modern high quality coring techniques have not yet been applied, and data relevant for the analysis of the oceanographic development of the Benguela Current System since Miocene times are still fragmentary.

Pre-site survey cruise SO-86 with *R/V Sonne* was undertaken to collect seismic data from three different areas which were proposed as adequate drilling targets for the paleoceanographic reconstruction of the Benguela Current/Upwelling System.

ODP Proposal Log Sheet 372-Add2

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

Cenozoic Evolution of Intermediate Water Circulation and Vertical Chemical Gradients in the North Atlantic

R. Zahn

Abbrev. Title: Cenozoic circulation and chem. gradients, N Atlantic	Key: N Atl. paleo.	Area: N Atl

Contact:

Dr. Rainer Zahn
Research Center for Marine Geosciences
GEOMAR
Wischhofstrasse 1-3
D-2300 Kiel 14 (G)

Tel: 49 (431) 720-2265
FAX: 49 (431) 725-391
Omnet: J. Thiede
Internet: rzahn@geomar.uni-kiel.d400.de

Objectives:

1. Reoccupation of DSDP Leg 12, Site 116, 2. Reconstruct water mass behavior in the North Atlantic, 3. Document water mass structure in the North Atlantic late middle Miocene, 4. Obtain pre-middle Miocene sections to document North Atlantic water mass circulation when there was no NADW

Specific area: Rockall Plateau

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
NAMD01	57°29.8'N; 15°55.5'W	1150	820	0	820	water mass properties in northern North Atlantic
NAMD02	59°30'N; 19°0'W	1500	250	0	250	water mass properties in northern North Atlantic

Proposal acknowledged by JOIDES Office: 00/00/00 to: Zahn, R.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 372-Add2

Title: Cenozoic Evolution of Intermediate Water Circulation and Vertical Chemical Gradients in the North Atlantic

Proponent: R. Zahn

The primary goal of North Atlantic mid-depth drilling on the Rockall Plateau is to determine the long-term evolution of water mass convection in the northern North Atlantic. As was pointed out in the original proposal (Joides Ref. No. 372) and the later addendum (Joides Ref. No. 372-Add) the northern North Atlantic is an important source region for deep-ocean ventilation. North Atlantic Deep Water is composed of water masses forming in the Norwegian-Greenland Seas, the Irminger Sea south of Iceland and the Labrador Sea. Surface water salinities are high in these areas (generally > 34.8 PSU) and thus, winter time cooling increases surface densities to an extent that deep convection occurs. The different type-water masses move into the greater Rockall Plateau area from the north via the Iceland-Faroe Ridge Overflow and from the west and northwest via geostrophically-driven lateral advection. They mix and leave the northern North Atlantic as North Atlantic Deep Water (NADW), a young, well-oxygenized and nutrient-depleted water mass. NADW penetrates southwards across the Atlantic Ocean into the Southern Ocean where it is incorporated into the Circum Antarctic Deep Water current system from where it spreads into the Indian and Pacific Oceans. As such, in today's ocean the formation of NADW in the Northern Atlantic is an important contributor for deep water renewal in the world's ocean.

During glacial periods surface waters in the northern North Atlantic may have lost much of their salinity due to major cooling of the regional sea surface temperatures (SST) as has been hypothesized on the basis of benthic foraminiferal paleo-geochemical proxy records (Boyle and Keigwin, 1987). These records imply a slowdown of deep ventilation in the North Atlantic due to decreased surface salinities in the northern North Atlantic. In exchange, intermediate depth water masses would have formed at rates higher than today. The glacial SST drop would have lowered the temperature difference between surface waters and overlying atmosphere thus reduced evaporation rates. The loss of the high-salinity domain in the northern North Atlantic would have resulted in a shut down of deep water convection and favored the formation of less dense intermediate waters (Figure 1; Duplessy et al., 1988). Using planktonic foraminiferal oxygen isotope data and statistical analysis of the planktonic foraminiferal community it was recently demonstrated that cold glacial temperatures in the northern North Atlantic indeed coincided with low-salinity surface waters (Figure 2; Duplessy et al., 1992). To a large extent this dramatic change of the North Atlantic's thermohaline momentum was brought about by a southward shift of the North Atlantic Polar Front (NAPF) from its interglacial position in the Norwegian-Greenland Seas to its glacial position across the northern North Atlantic. This shift was associated with the formation of steep gradients of surface water properties in the North Atlantic (Figure 3; Duplessy et al., 1991). Regional positive salinity anomalies may hint at source areas for intermediate water formation.

ODP Proposal Log Sheet 386-Add

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

Ocean Drilling in the California Margin and Southern California Borderland

M. Lyle, S.D. Stott and J. Barron

Abbrev. Title: California Margin	Key: Calif Margin	Area: N Pac

Contact:
Dr. Mitchell Lyle
CGISS
Boise State University
5840 Collister Drive
Boise ID 83703 (US)
Tel: (208) 385-1419
FAX: (208) 385-4061
Internet: lyle@gozer.idbsu.edu

Objectives:

This addendum combines proposals 386-Rev2 and 422-Rev.

Specific area: California Margin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
BA-1	32°15'N; 118°28'W	1835	300	0	300	Upwelling basin ventilation, paleoclimatic history
BA-2	32°57'N; 118°55'W	1715	300	0	300	Upwelling basin ventilation, paleoclimatic history
BA-4	33°47'N; 118°49'W	895	300	0	300	Pleistocene record, history of C-org burial & preservation
BA-5	32°03'N; 117°17.8'W	1300	200	0	200	Pleistocene record Cal Current, Borderlands Transect
BA-6	30°20'N; 117°0'W	2600	300	0	300	Neogene record, Cal Current, Baja Transect
BA-6A	30°25'N; 116°45'W	2240	320	0	320	Neogene record, Cal Current, Baja Transect
CA-1	41°40'N; 124°57'W	975	440	60	500	Plio-Pleistocene record, Gorda Transect
CA-2	39°58'N; 125°27'W	2927	320	0	320	Neogene paleo. record of climate change off N. Cal.
CA-3	42°20'N; 125°51'W	2640	195	0	195	Detailed Plio-Pleisto. paleo. record; Gorda Plate rotation.
CA-4	41°0'N; 126°15'W	3045	225	0	225	PlioPleistocene record, Gorda Transect, CCD
CA-4A	40°27'N; 126°20'W	2980	490	0	490	PlioPleistocene record, Gorda Transect, CCD
CA-5	39°06'N; 127°45'W	4220	416	0	416	Neogene record, Cal Current, CCD, NE Pacific
CA-6	40°59'N; 130°07'W	3273	115	0	115	Neogene history of Cal Current, CCD, NE Pacific
CA-7	39°26'N; 124°16'W	1410	250	0	250	Record of upwelling from central California coast.
CA-8	36°59'N; 123°15'W	2590	250	0	250	Plio-Pleistocene record, Cal Current, N/S Transect
CA-9	34°32.7'N; 121°06'W	873	500	0	500	Plio-Pleistocene record, Cal Current, Conception Transect
CA-9A	35°15'N; 121°49'W	1630	400	50	450	Plio-Pleistocene record, Cal Current, Conception Transect
CA-10		588	200	0	200	Santa Barbara Basin
CA-11A	34°33'N; 122°03'W	3750	330	0	330	Neogene record of Cal Current, Conception Transect
CA-11D	32°50'N; 120°50'W	3780	280	0	280	Conception Transect, San Juan Seamount
CA-12A	34°0'N; 123°0'W	4160	280	0	280	Neogene/Conception Transect: paleoproductivity/upwelling
CA-12B	32°50'N; 120°50'W	4120	224	0	224	Neogene/Conception Transect: paleoproductivity/upwelling
CA-13	32°54'N; 123°20'W	4165	145	0	145	Neogene/Conception Transect: paleoproductivity/upwelling
CA-14	28°54.5'N; 117°31.1'W	3555	165	0	165	
CA-15	32°40'N; 119°29'W	1315	400	0	400	Neogene/Borderlands Transct: paleoproductivity/upwelling

Proposal acknowledged by JOIDES Office: 00/00/00 to: Lyle, M.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 386-Add

Title: Ocean Drilling in the California Margin and Southern California Borderland

Proponents: M. Lyle, S.D. Stott and J. Barron

Abstract

This Addendum is in response to Ocean History Panel's recommendations about the drilling proposals 386/Rev2 and 422Rev for the California Margin of North America. We have combined and trimmed the two programs until they fit into a single 56.6 day drilling leg. The high sedimentation rate sites will be crucial for understanding the carbon cycle, important to SGPP. These goals do not require any special modification of the program design. The program will also sample gas hydrates as part of the drilling program in the Eel River Basin (CA-1) and will provide important data on their stability fields and their means of growth. While tectonics is only of secondary importance to this project, it has been designed to investigate deformation of ocean crust on the Gorda Ridge, by examining paleomagnetic records of the sediments. Drilling in the marginal basins along the Ca margin will also provide important stratigraphic data for better understanding their history.

ODP Proposal Log Sheet **391-Rev2**

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

Depositional History and Environmental Development During the Formation of Sapropels in the Eastern Mediterranean

R. Zahn, M.B. Cita, G. de Lange, K-C Emeis and A. Cramp

Abbrev. Title: Formation of sapropels in the Mediterranean	Key: Med. sapropels	Area: Med Sea

Contact:
Dr. Rainer Zahn
Research Center for Marine Geosciences
GEOMAR
Wischhofstrasse 1-3
D-2300 Kiel 14 (G)
Tel: 49 (431) 720-2265
FAX: 49 (431) 725-391
Omnet: J. Thiede
Internet: rzahn@geomar.uni-kiel.d400.de

Objectives: The first-order issues to be addressed by this survey are to study:

1. the long-term history of sapropel formation in relation to the history of atmospheric circulation and water mass varibaility in the Mediterranean.
2. the inter-sapropel geochemical variability as a function of different environmental boundary conditions.
3. water column redox conditions and (paleo-)productivity levels during sapropel formation.

Specific area: Mediterranean Transect

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
MS 2C	34°37.5'N; 20°25.8'E	2782	80	0	80	Recover late Quaternary sapropels
MS 2B	33°45.1'N; 24°42.3'E	1930	150	0	150	Recover late Quaternary sapropels
MS 3	36°15.3'N; 17°44.3'E	3640	0	0	0	Calabrian sites crucial for land-sea correlation
MS 4A	37°1.9'N; 13°10.9'E	470	300	0	300	Current regimes during sapropel deposition
MS 4B	37°3.9'N; 13°15.3'E	502	450	0	450	Plio-Quaternary land/sea correlation
MS 5	40°21.3'N; 12°8.6'E	3466	188	12	200	Westernmost sapropels
MS 6A	38°53.9'N; 4°30.5'E	2369	350	0	350	evolution of surface/intermediate water masses in west. Med
MS 7B	36°9.7'N; 4°22.4'E	1163	690	0	690	tectonic/sealevel changes in Atlantic gateway

Proposal acknowledged by JOIDES Office: 00/00/00 to: Zahn, R.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 391-Rev2

Title: Depositional History and Environmental Development During the Formation of Sapropels in the Eastern Mediterranean

Proponents: R. Zahn, M.B. Cita, G. de Lange, K-C Emeis and A. Cramp

Abstract

Numerous studies have revealed the existence of laminated organic-rich layers in marginal seas such as the Black Sea, Japan Sea, and the Mediterranean. Deposition of these layers - commonly referred to as sapropels - occurs in a rhythmic fashion which is not related global glacial-interglacial cycles but seems to be driven by very distinctive changes in physical circulation and biogeochemical cycling which are in some cases related to precession-induced fluctuations of monsoonal atmospheric circulation.

Despite an ever-increasing data base of chemical, faunal, and stable isotope proxy data, the origin of sapropels is still controversial. Opinions are divided into two groups, one promoting the stagnation hypothesis which postulates that the deeper water column went anoxic during the formation of sapropels thus fostering the preservation of organic carbon at the sea floor; a second hypothesis is more in favor of increased primary productivity as the ultimate stimulus for sapropel formation through increased rates of carbon flux to the sea floor. Evaluation of published data has led to the conclusion that variations in sediment texture, dilution and the settling flux of carbon exert a dominant control on the carbon contents of sediments and that water column redox conditions play only a secondary role (Pedersen and Calvert, 1990). Moreover, recent evidence that the early-Holocene sapropel found in the Black Sea - the "type" euxinic basin usually referred to by those favoring the stagnation/anoxia hypothesis - has accumulated under well-ventilated conditions (Calvert, 1990), appears to underscore the importance of productivity over anoxia.

We propose a systematic survey of the eastern Mediterranean sapropels using new chemical tracers which would allow independent estimates of redox conditions and carbon fluxes. In order to reveal the individual importance of bottom-water anoxia and biological productivity in surface waters for each of the Mediterranean sapropels we must understand the paleoceanography of the Mediterranean Sea as a whole. Long high-quality multi-proxy records along an east-west transect across the entire Mediterranean are therefore needed so as to synoptically map the hydrographic and climatic conditions at the sites of sapropel formation in the eastern basin and at sites in the western basin where no sapropels formed. The records have to go back in time to the Miocene, when the monsoonal circulation over the Indian Ocean started to evolve in response to the final tectonic uplift of the Himalayas and the Tibetan Plateau. Only this stratigraphically long and Mediterranean-wide multi-proxy data base will allow to determine how the Mediterranean's physical circulation and chemical cycling preconditioned its eastern basin towards sapropel formation. In view of the required long stratigraphic range and the intrinsic lability of some of the geochemical tracers to be used the goals of this program can not be achieved by using regular research vessels even if they can handle "long coring facilities" nor can we use samples from sapropel deposits exposed on land.

ODP Proposal Log Sheet **400-Rev**

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

Determination of mass balance, fluid flow, and deformation mechanisms of the Middle America Trench and accretionary complex off Costa Rica

E.A. Silver, K. McIntosh, M. Kastner, T. Plank, J. Morris, and T. Shipley

Abbrev. Title: Mass balance of Costa Riva accretionary wedge	Key: Costa Rica acc. wedge	Area: N Pac

Contact:

Dr. Eli A. Silver
Earth Sciences Department
University of California
Santa Cruz, CA 95064 (US)

Tel: (408) 459-2266
FAX: (408) 459-3074
Internet: silver@earthsci.UCSC.EDU

Objectives:

1. To determine the relative importance of frontal accretion, underplating, out-of-sequence thrusting, sediment subduction and subduction erosion
2. To detemine the timing, rate, and modes of accretionary prism development
3. To determine the importance of fluids in both strengthening and weakening of the prism, particularly in the presence of underthrust carbonates
4. To determine the fate of subcrustally subducted sediments and associated fluxes

Specific area: Middle America Trench

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
CR-1	9.64°0'N; 86.2°0'W	4350	450	50	500	Lower plate reference (lithology, geochem., phys. prop.).
CR-2	9°.662'N; 86°.18'W	4160	700	0	700	Age, strat., structure of apron and prism.
CR-3	9.73°0'N; 86.12°0'W	3320	1400	0	1400	Age, strat., structure of apron and top of prism.
CR-4	9.78°0'N; 86.02°0'W	2200	950	0	950	Age, strat., structure of slope apron in zone of extension.

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Silver, E.A.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 400-Rev

Title: Determination of mass balance, fluid flow, and deformation mechanisms of the Middle America Trench and accretionary complex off Costa Rica

Proponents: E.A. Silver, K. McIntosh, M. Kastner, T. Plank, J. Morris, and T. Shipley

Abstract

We propose a program of drilling on the Costa Rica convergent margin to investigate mass and fluid flow patterns through the accretionary prism. We will integrate structural analysis and sediment, fluid, and chemical mass balance calculations facilitate by the drilling. Our objectives are to determine (1) the relative importance of frontal accretion, underplating, out-of-sequence thrusting, sediment subduction, and subduction erosion, (2) the timing, rate, and modes of strengthening and weakening of the prism, particularly in the presence of underthrust carbonates, and (4) the fate of subcrustally subducted sediments and the associated fluxes. drilling on the Costa Rica margin could provide us with the first good estimates of the total material and chemical fluxes through a subduction system, because of the ideal conditions (the capping sediment apron and the lack of trench turbidites), extensive seismic imaging of the accretionary complex, and the opportunity to constrain the deeper parts of the sediment cycle, which are reflected in the fore-arc fluids and arc volcanics.

ODP Proposal Log Sheet **406-Add**

Proposal received: May 24, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

North Atlantic Climatic Variability: Sub-Orbital, Orbital, and Super-Orbital Time Scales

W. Broecker, G. Bond, D. Oppo, S. Lehmann, M. Raymo and T. van Weering

Abbrev. Title: North Atlantic climatic variability	Key: N Atlantic climatic vari	Area: N Atl

Contact:

Dr. Delia Oppo
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)

Tel: (508) 548-1400 x681
FAX: (508) 457-2187

Objectives:

Addresses thematic panel comments by describing plans for site survey work.

Specific area: Northwestern Atlantic, Feni Drift and Hatton Bank/Rockall Plateau

Proposed Sites: As per Proposal 406---

Site Name	Position	Water depth	Penetration Sed Bsmt Total	Brief site-specific objectives

Proposal acknowledged by JOIDES Office: May 27, 1993 to: Oppo, D.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 406-Add

Title: North Atlantic Climatic Vaiability: Sub-Orbital, Orbital, and Super-Orbital Time Scales

Proponents: W. Broecker, G. Bond, D. Oppo, S. Lehmann, M. Raymo and T. van Weering

Abstract

This addendum to JOIDES Proposal 406 describes plans which address problems summarized by the thematic panels: the lack of high resolution seismics and low sedimentation rates at the proposed sites. For the site survey, D.W. Oppo (WHOI), S.J. Lehman (WHOI), P. Manley (Middlebury), and G.S. Mountain (LDEO) submitted a proposal to the Ocean Drilling Program at the National Science Foundation for a site survey proposal to the Ocean Drilling Program at the National Science Foundation for a site survey cruise to the subpolar North Atlantic. The cruise on UNOLS vessel R/V Ewing will leave Woods Hole on May 27 and arrive in Reykjavik on June 20. We will collect approximately 11 days of high-resolution single channel seismic, Hydrosweep multibeam each sounding, and 3.5 k Hz echo sounding surveys. The surveys will take place on the northern flank of the Flemish Cap, along the Bjarni/Gardar Drift, and on the Hatton Drift.

In each of there regions we will also collect 20-m long sediment cores. With a logger on board (GRAPE, magnetic susceptibility, and p-wave velocity) we should be able to determine approximate sedimentation rates and ages. The geophysical and core data will be submitted to the ODP data bank by July 1, 1993. In addition to data collected on our cruise and supporting data from these regions, geophysical and core data from the northern Feni Drift will be submitted by the July 1 deadline.

ODP Proposal Log Sheet 408-Add

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

Miocene Segmentation of the Carbonate Megabank covering the Northern Nicaragua Rise: Gateway Opening for the Initiation of the Carribean Current

A.W. Droxler, A.C. Hine, P. Hallock, E. Rosencrantz, R. Buffler and A. Mascle

Abbrev. Title: Testing two new interpretations, N Nicaragua Rise	Key: N Nicaragua Rise	Area: N Atl

Contact:
Dr. André W. Droxler
Department of Geology and Geophysics
Rice University
6100 Main Street
Houston, TX 77251 (US)
Tel: (713) 527-4880
FAX: (713) 285-5214
Internet: andre@geophysics.rice.edu

Objectives:

This addendum is in response to Thematic Panel reviews of Spring, 1993.

Specific area: N Nicaraguan Rise

Proposed Sites: Included in this addendum, repeated from 408-Rev.

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
NR-1	16°52.5'N; 79°23'W	1200	350	250	600	North Nicaraguan Rise: initiation of Caribbean Current
NR-2	16°52.5'N; 79°43.5'W	1140	400	700	1100	North Nicaraguan Rise: initiation of Caribbean Current
NR-3	16°52.5'N; 80°05'W	800	440	360	800	North Nicaraguan Rise: initiation of Caribbean Current
NR-4	17°23.5'N; 77°41'W	1050	320	350	670	North Nicaraguan Rise: initiation of Caribbean Current
NR-5	17°48'N; 77°53'W	400	350	200	550	North Nicaraguan Rise: initiation of Caribbean Current
NR-6	16°09'N; 81°14'W	200	150	50	200	North Nicaraguan Rise: initiation of Caribbean Current
NR-7	18°20'N; 79°53.5'W	2500	500	0	500	North Nicaraguan Rise: initiation of Caribbean Current
NR-8	15°38'N; 77°30.5'W	2500	500	0	500	North Nicaraguan Rise: initiation of Caribbean Current

Proposal acknowledged by JOIDES Office: 00/00/00 to: Droxler, A.W.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 408-Add

Title: The Mesozoic Somali Basin: Tethys and the Birth of the Indian Ocean

Proponents: M.F. Coffin, A. Bosellini, J.E.T. Channell, W.W. Hay, H. Jenkyns, J.G. Ogg and P. Blum

Abstract

The late Quaternary sedimentary record in periplatform oozes and muds deposited on the northern Nicaragua Rise results from the interplay of four main controls: (1) input of pelagic carbonates and bank-derived fine aragonite and magnesian calcite; (2) input of siliciclastic sediments; (3) dispersal and removal of sediments by the Caribbean Current; and (4) partial seafloor dissolution of metastable carbonates. High accumulation rates of the calcite coarse sediment fraction throughout the study area demonstrate that planktonic foraminiferal productivity peaked during interglacial stages. Neritic carbonate productivity also peaked during interglacial stages, when bank and shelf tops along the Nicaragua Rise were submerged within the photic zone. Because the bank and shelf tops remained mostly exposed during glacial stages, the surface are available for the neritic carbonate productivity was drastically reduced to a narrow band along the margins of Pedro Bank and the southern shelf of Jamaica. A large volume of siliciclastic sediments, transported from the coastal area of South America and the eastern and western regions of Jamaica, were deposited during glacial stages within the eastern and western deep extensions of Walton Basin. This finding contrasts with the input pattern of siliciclastic sediments in Walton Basin itself, where the largest input of siliciclastic sediments occurred at each of the interglacial climatic optima, corresponding to intervals of maximum sea level transgression. Finally, cores in water depths exceeding 100 m display during interglacial stages aragonite accumulation rates systematically lower than rates in cores form water depths shallower than 1100 m. This indicates that some bank-derived aragonite and magnesian calcite has been partially removed by seafloor dissolution in areas from water depths exceeding 1100 m. Results from this study on the northeastern Nicaragua Rise indicate that not only do offbank transport and water column saturation states influence the late Quaternary record but also that the variable strength of the Caribbean Current and the proximity of sources for siliciclastic sediments have played a major role in the development of the late Quaternary periplatform high resolution stratigraphy.

ODP Proposal Log Sheet 412-Add2

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

The Bahamas Transect: Neogene/Quaternary Sea-Level Fluctuations and Fluid Flow in a Carbonate Platform

G.P. Eberli, D.F. McNeill and P.K. Swart

Abbrev. Title: Bahamas transect: Neogene/Quat. sea level and fluid flow	Key: Bahamas transect	Area: N Atl

Contact:
Dr. Donald R. McNeill
Rosenstiel School of Marine & Atm. Sci.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 (US)
Tel: 361-4790
Internet:
DMcNeill@rsmas.miami.edu

Objectives:

To respond to panels' comments regarding chronostratigraphy and fluid flow . For original objectives see 412----.

Specific area: Great Bahama Bank

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
BT1	24°33'N; 79°10'W	170	1300	0	1300	Quaternary facies, boundary ages in carbonate sequences
BT2	24°31'N; 79°14'W	338	930	0	930	L. Mioc.-Recent lowstand facies; isotope strat.; fluid flow
BT3	24°30'N; 79°18.5'W	525	1300	0	1300	Neogene O-18 record, sequ. bound.; fluid flow; Gulf Stream
BT4	24°28'N; 79°21.5'E	600	820	0	820	Basinal facies of prograding sequ.; Gulf Stream deposits
F1	25°30'N; 79°15'W	200	300	0	300	Fluid flow across platform margin & slope

Proposal acknowledged by JOIDES Office: 00/00/00 to: McNeill, D.F.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 412-Add2

Title: The Bahamas Transect: Neogene/Quaternary Sea-Level Fluctuations and Fluid Flow in a Carbonate Platform

Proponents: G.P. Eberli, D.F. McNeill and P.K. Swart

Abstract

This second addendum to ODP proposal #412 presents a summary of the scientific objective of the Bahamas Transect and specifically addresses two main points that arose from previous thematic panel discussion. The first is in regards to OHP queries related to the chronostratigraphy of the existing core borings from the proximal part of the transect. The second addresses in detail queries from the SGPP regarding fluid flow.

In summary, the chronostratigraphy of the existing core borings Clino and Unda is still ongoing, pending additional biostratigraphic confirmation and additional Sr-isotope age data. Furthermore, our age model will rely on the ODP deep water sites for final confirmation. At the time of the first addendum, we thought the planktic forams to be more reliable age indicators. Since then, discrepancies in the forams and nannofossil have forces our biostratigraphers to re-evaluate ranges and possible reworking/premature last occurrences in both data sets. Final biostratigraphic data will be reconciled with the magnetostratigraphy and Sr-isotope age constraints. The dynamic slope processes active in the proximal part of the transect have revealed the complexity of applying normal, deep water biostratigraphic approaches. The sea level controlled progradation of the platform acts to greatly dilute the pelagic components and provide avenues of reworking/redeposition, and thus, makes foram and nannofossil biostratigraphy progressively more difficult as depositional environments transform to extremely shallow water. As no one has ever before tried to date these types of carbonate environments with such high resolution, a multidisciplinary biostratigraphic and chronostratigraphic approach was necessary to assess which age indicators were reliable. High-resolution biostratigraphy, stable isotope stratigraphy, and magnetostratigraphy in the sediments from the proposed ODP drill sites will serve as the unequivocal test for the ages of the slope/margin sequence. More importantly, we have in hand already a lithologic and seismic sequence record which can in itself be tied to the ODP deep water sites.

With regards to fluid flow in carbonate platforms, we have included new discussion regarding methods of determining fluid flow, new models fluid flow, and methods of identifying specific circulation mechanisms.

ODP Proposal Log Sheet **415-Add**

Proposal received: Jan 15, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

Caribbean Ocean History, Ocean Plateau and the Cretaceous-Tertiary Boundary Impact Event: Multi-objective drilling in the Caribbean Sea

H. Sigurdsson, S. Carey, S. D'Hondt, L.J. Abrams, T.W. Donnelly, R. Duncan and C. Sinton

Abbrev. Title: Caribbean Ocean History, Ocean Plateau, & K-T impact	Key: Caribbean KT/paleo.	Area: N Atl

Contact:

Dr. H. Sigurdsson
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882 (US)

Tel: (401) 792-6596
FAX: (401) 792-6811

Objectives:

This proposal is a combination of Proposals 415-Rev and 411. It comprises about 2 legs of drilling.

Specific area: Caribbean Sea

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
Site 1	20°19.5'N; 86°25'W	1200	500	0	500	proximal section of K/T sequence in Chixculub crater
Site 2	20°10'N; 81°7.5'W	3000	900	50	950	proximal section of K/T sequence, date age of crust
Site 3	15°7'N; 74°35.5'W	4125	1000	50	1050	high resolution, deep water K/T sequence
Site 4	14°22'N; 67°6'W	5000	1400	50	1450	distal section of K/T sequence, nature of crust
Site 5	15°0'N; 77°57'W	2000	600	50	650	age & evolution of lower Nicaraguan Rise
Site 6	12°35'N; 78°58'W	3000	1050	0	1050	western K/T sequence, crust of sw Colombian Basin
Site 7	15°26'N; 69°31'W	3750	600	200	800	distal section K/T sequence, Caribbean basalt province

Proposal acknowledged by JOIDES Office:	Feb 17, 1993	to:	Sigurdsson, H.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 415-Add

Title: Caribbean Ocean History, Ocean Plateau and the Cretaceous-Tertiary Boundary Impact Event: Multi-objective drilling in the Caribbean Sea

Proponents: H. Sigurdsson, S. Carey, S. D'Hondt, L.J. Abrams, T.W. Donnelly, R. Duncan and C. Sinton

Abstract

The ODP thematic science advisory panels have recognized high priority objectives within several recently submitted proposals for drilling in the Caribbean region. These objectives include investigation of late Cretaceous through Cenozoic ocean history, study of the KT boundary impact event, and investigation of the anomolously thick and shallow basaltic crust that occurs over much of the Caribbean plate, as a type example of an oceanic plateau. To date, the strongest support for Caribbean drilling has come for OHP, which has ranked proposal 415-Rev highly. Because the proposals share many common drill sites, both LITHP and TECP have asked that proponents meet to discuss planning a coherent, multi-objective Caribbean drilling program. Two groups of proponents, who viewed their programs and drill sites to be scientifically and logistically most compatible, me at the Fall '92 AGU meeting and agreed to collaborate. The result is this Addendum to proposals 415-Rev and 411, which describes our distillation of the highest priority objectives that can be accomplished in a common set of drill sites that comprise about 2 legs of drilling, logging and transit time. The Addendum also provides responses to criticisms raised by the JOIDES thematic panel reviews of proposals 415-Rev and 411, and addresses our progress in carrying out site surveys of the proposed drill sites.

ODP Proposal Log Sheet 423-Add

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

Gas Hydrate Sampling on the Blake Ridge and Carolina Rise: A Proposal to the Ocean Drilling Program

C.K. Paull, W.P. Dillon, T. Collett, S. Holbrook, K.A. Kvenvolden, R. von Herzen, W. Ussler

Abbrev. Title: Gas hydrate sampling, Blake Ridge and Carolina Rise	Key: Gas hydrate sampling	Area: N Atl

Contact:

Dr. Charles K. Paull
Department of Geology
University of North Carolina
213 Mitchell Hall
Chapel Hill, NC 27599-3315 (US)
Tel: (919) 966-4516
FAX: (919) 966-4519

Objectives:

This addendum changes the location of holes BHR-1, BHR-2, and BHR-3. The option of drilling through a bottom simulating relector is proposed.

Specific area: Blake Ridge, Carolina Rise

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
BRH-1a	31°50.59'N; 75°28.12'W	2722	480	0	480	sample acoustically transparent sediments, crest of Blake Ri
BRH-2a	31°52.84'N; 75°25.11'W	2828	800	0	800	drill through base of hydrate stability in BSR
BRH-3a	31°54.40'N; 75°23.02'W	2965	500	0	500	sample same units as BRH-2a, only where gas-hydrates
BRH-1ae	31°50.59'N; 75°82.12'W	2722	750	0	750	sample sediment/gases associated with strong BSR
BRH-3ae	31°54.4'N; 75°23.02'W	2965	750	0	750	sample sediments/gases around weak BSR
CRH-2e	32°46.74'N; 75°55.20'W	2732	750	0	750	sample sediments/gases associated w/moderately strong BSF

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Paull, C.K.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 423-Add

Title: Gas Hydrate Sampling on the Blake Ridge and Carolina Rise: A Proposal to the Ocean drilling Program

Proponents: C.K. Paull, W.P, Dillon, T. Collett, S. Holbrook, K.A. Kvenvolden, R. von Herzen, W. Ussler

Abstract

This addendum offers two changes to ODP Proposal 423-Rev:

1. The location of the proposed holes BRH-1, BRH-2, and BRH-3 have been shifted a few kilometers to better correspond with the location of the refraction, heat flow and piston core data. The location of the revised hole sites are indicated with respect seismic reflection data and in map view in figures 1 and 2 respectively. The new hole locations are referred to as BRH-1a, BRH-2a, and BRH-3a on the new site summary forms and in figure 1. This change does not alter the scientific objectives of the proposal in any way.

2. The option of drilling through the bottom simulating reflector (BSR) at three sites is also proposed in this addendum. Thus, the completion depth for proposed holes BRH-1a, BRH-3a ext. and CRH-2ext.

ODP Proposal Log Sheet 425-Rev

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☒ Revised proposal ☐ Addendum to proposal ☐ Other

Offset Drilling within the rift Valley of the Mid-Atlantic Ridge in the 15°20'N Region: Drilling of lower Crustal Gabbros, Mafic/Ultramafic Transition Zones, and Residual Mantle along Magma-starved Ridge Segments

J.F. Casey, H.J.B. Dick, M. Cannat, H. Bougault, S. Silantyev and A. Sobolev

Abbrev. Title: Mid-Antlantic Ridge Offset Drilling	Key: Mid-Antl. Ridge	Area: N Atl

Contact:

Dr. Jack F. Casey
Department of Geosciences
University of Houston
Houston, TX 77204-5503 (US)
Tel: (713) 749-3399
FAX: (713) 747-4526

Objectives: Combine scientific objectives: 407 & 425

1. Two leg offset drilling program to sample sites along the ridge axis, the first leg to sample high priority sites to the north and south of the 15°-20' transform; 2. To sample a long residual ultramafic section and upper most mantle transition zone within a very large untramafic massif to the north of the 15°20' transform; 3. To sample a long gabbro section, a gabbro/ultramafic transition, and long ultramafic section to the south of the 15°20' transform

Specific area: 15°20'N Fracture Zone, Mid Atlantic Ridge

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
S 1	15°2.4'N; 44°57.4'W	3373	0	500	500	drill through detachment zone
S 2	15°3.4'N; 44°56.8'W	3804	0	500	500	drill detachment, sample dunite section
S 3	15°5.68'N; 44°58.9'W	2560	0	500	500	drill detachment, sample dunite section
N 1	15°37.18'N; 46°31.7'W	3322	0	500	500	penetrate gabbro, magmatic history
N 2	15°37.19'N; 46°31.91'W	3512	0	500	500	penetrate gabbro, magmatic history
N 3	15°37.42'N; 46°34.28'W	3384	0	500	500	penetrate gabbro, magmatic history
N 4	15°37.08'N; 46°41.58'W	3250	5	495	500	penetrate gabbro, magmatic history

Proposal acknowledged by JOIDES Office:	Jul 16, 1993	to:	Casey, J.F.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 425-Rev

Title: Offset Drilling within the rift Valley of the Mid-Atlantic Ridge in the 15°20'N Region: Drilling of lower Crustal Gabbros, Mafic/Ultramafic Transition Zones, and Residual Mantle along Magma-starved Ridge Segments

Proponents: J.F. Casey, H.J.B. Dick, M. Cannat, H. Bougault, S. Silantyev and A. Sobolev

Recent revisions of previous drilling strategies for the study of lower oceanic crust and upper mantle suggest that, as a short-term priority, a systematic program of drilling offset partial sections of tectonically exposed lower oceanic crust and upper mantle should be undertaken. This strategy has been adopted because of the current technological difficulties encountered in achieving total oceanic crustal penetration, the more traditional and highest priority long-term objective of the drilling program. An essential element in implementing this new strategy is the identification of well-constrained sites where lower crustal and upper mantle rocks are exposed on the seafloor in both slow and fast spreading environments.

Recent investigations along the Mid-Atlantic Ridge in the regions north and south of the 15°20' N Transform have documented the most extensive ultramafic and gabbroic exposures along the rift valley walls yet sampled. They present ideal sites for offset drill holes to sample the lower crust, upper mantle and a mafic/ultramafic transition zone. Here we propose a two leg offset drilling program to sample sites along the ridge axes to the north and south of the 15°20' Transform. We propose two priority sites to initiate the drilling and five additional offset sites for future drilling (that could also serve as alternate sites during the initial drilling leg). One high priority site S1 (with additional offset sites S2, S3) is proposed to sample a long residual ultramafic section and an uppermost mantle transition zone within a very large ultramafic massif documented along the western wall of the ridge segment immediately south of the 15°20' Transform. A second high priority site N1 (and additional offset sites N2, N3, and N4) along the ridge segment immediately north of the 15°20' Transform will attempt to sample a long gabbro section, a gabbro/ultramafic transition, and long ultramafic section. Each separate re-entry site at priority sites N1 and S1 would be ~500 meters deep during the initial phase of drilling. We anticipate that future offset holes will require a second leg to complete, but recommend that the initial phase of drilling be devoted to completion of reference holes at the northern and southern priority sites, N1 and S1 (1 month each) with completion of other offset holes (N2, N3, N4 or S2 and S3) during a second leg based on initial results. Alternatively, one leg could be devoted to the southern sites and a second to the northern site.

ODP Proposal Log Sheet 427-Add

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ New proposal ☐ Revised proposal ☒ Addendum to proposal ☐ Other

High-Resolution Sequence Stratigraphy and Sea-Level History, South Florida Margin

S.D. Locker, A.C. Hine, G.P. Eberli and E.A. Shinn

Abbrev. Title: South Florida Margin SeaLevel	Key: South Florida sea level	Area: N Atl

Contact:

Dr. Stanley D. Locker
Department of Marine Science
University of South Florida
140 7th Ave. South
St. Petersburg, FL 33701 (US)
Tel: (813) 893-9502
FAX: (813) 893-9189
Internet:
slocker@msl1.marine.usf.edu

Objectives:

Response to panel comments in the areas of:

- adequate stratigraphic interpretations
- expanded climatic and paleoceanographic records
- drilling strategy

Specific area: South Florida Margin

Proposed Sites: See Proposal 427----

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Locker, S.D.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 427-Add

Title: High-Resolution Sequence Stratigraphy and Sea-Level History, South Florida Margin

Proponents: S.D. Locker, A.C. Hine, G.P. Eberli and E.A. Shinn

Abstract

This is an addendum to ODP Proposal 427, initially submitted to the Spring 1993 review session. In this document we have responded to comments from the SGPP, OHP and SSP reviews. For the most part, the panels' comments addressed similar concerns, which have been combined in our outline response below. At this time we hope to clarify our study approach, address logistical issues, and discuss additional scientific objectives. We emphasize that the necessary pre-drilling seismic stratigraphic framework analysis is currently underway, but specific site survey studies are yet to be conducted. Hence, we anticipate submission of a fully revised proposal for Spring 1994 at the earliest.

ODP Proposal Log Sheet 432----

Proposal received: Jun 28, 1993
Proposal reviewed: Fall 1993

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

A Deep Hole off Galicia to study the Mechanism of Continental Breakup: Sedimentary and Subsidence History and the Nature of the S Reflector

T.J. Reston, G. Boillot, M.-O. Beslier, C.M. Krawczyk, and J.-C. Sibuet

Abbrev. Title: Galicia deep hole S-reflector	Key: Galicia Deep Hole	Area: N Atl

Contact:
Dr. Tim Reston
GEOMAR
Forschungszentrum für Marine Geowiss.
Wischhofstraße 1-3, Geb. 4
D-2300 Kiel 14 (G)
Tel: 49 (431) 7202 284
FAX: 49 (431) 7202 293

Objectives:

1. To drill a single deep hole on the west Galicia rifted margin
2. To determine the timing of rifting, and derive a subsidence curve in an area underlain by a possible detachment fault (the S reflector), thus constraining the mechanism of lithospheric thinning
3. To provide a coninuous record of the sedimentation of the margin, and of changing diagenetic processes within the sediment pile
4. To determine the nature of the S reflector itself
5. To constrain the temperature-pressure evolution of the upper lithosphere

Specific area: West Galicia Banks rifted margin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
S1	42°8.5'N; 12°37.8'W	5250	2600	500	3100	nature of S; timing, conditions, deformation
S2	42°10.6'N; 12°38'W	5300	2400	700	3100	nature of S; timing, conditions, deformation
S3	42°8.5'N; 12°39.9'W	5250	3000	500	3500	nature of S; timing, conditions, deformation
P1	42°8.5'N; 12°33.1'W	4800	1000	50	1050	subsidence & sediment history; basement age

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Reston, T.J.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 432----

Title: A Deep Hole off Galicia to study the Mechanism of Continental Breakup: Sedimentary and Subsidence History and the Nature of the S Reflector

Proponents: T.J. Reston, G. Boillot, M-O Beslier, C.M. Krawczyk and J-C Sibuet

Abstract

We propose a single leg to drill a single deep hole on the west Galicia rifted margin to sample the entire postrift-synrift sedimentary succession, and to penetrate up to 700 m into basement. The state of knowledge for this margin is mature, in terms of previous drilling results, sampling by submersible and geophysical studies. Deep drilling and coring will complement these results, greatly improve our understanding of the rifting process and strengthen the case for subsequent drilling on the conjugate margin off Newfoundland. The fundamental aims of the proposed hole are:

- to determine the timing of rifting, and to derive a subsidence curve in an area underlain by a possible detachment fault (the S reflector), thus constraining the mechanism of lithospheric thinning;
- to provide a continuous record of the sedimentation of the margin, and of changing diagenetic processes within the sediment pile;
- to determine the nature of the S reflector itself;
- to constrain the temperature-pressure evolution in the upper lithosphere and particularly the kinematics of deformation, and the circulation of fluids within or adjacent to a probably major lithospheric shear zone, the S reflector.

At ca. 3 km total depth to be drilled, in a water depth of just over 5 km, the hole will represent a major technological challenge, pushing the capabilities of the current technology to the limits, but we believe that such a hole is the only way to address fundamental questions concerning the evolution of rifted margins. We also believe that the time is right for just such a challenge.

ODP Proposal Log Sheet 433----

Proposal received: Jun 30, 1993
Proposal reviewed: Fall 1993

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

A Proposal to Test a new Theory of Orogeny by Drilling the Eastern Mediterranean Sea, especially the area in the Vicinity of the Eratosthenes "Seamount"

K.J. Hsü, G. Udintsev, J. Makris, X. Le Pichon, Y. Mart and W. Ryan

Abbrev. Title: East Med. Orogeny	Key: East Med. Orogeny	Area: Med Sea

Contact:
Dr. Kenneth J. Hsü
Geologisches Institut
ETH-Zentrum
Sonneggstrasse 5
CH-8092 Zurich (CH)
Tel: 41 (1) 256-3669
FAX: 41 (1) 252-0819

Objectives:

1. To test the theory that orogenic deformations, in most cases, are not inter-plate, but mainly intra-plate.
2. To drill a North/South transect of 6 holes across the Eratosthenes Seamount to verify the presence of both a volcanic arc and accretionary complex.

Specific area: Eastern Mediterranean, Eratosthenes Seamount

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
E-1	33°44'N; 32°52'E	814	150	850	1000	Penetrate sed sequence, top of seamount
E-2	33°35'N; 32°50.5'E	1201	100	1025	1125	Penetrate to granite basement, sample sapropels
E-3	33°27'N; 32°49'E	1608	300	825	1125	Sample tectonic mélange in accretionary complex
E-4	33°19'N; 32°48'E	1765	400	850	1250	Sample tectonic mélange in accretionary complex
E-6	34°1'N; 32°54'E	1938	100	1025	1125	Sample sed cover of seamount/sapropels
E-5	33°12'N; 32°47'E	1774	600	0	600	Sample pre-messinian or plio-quaternary sediments

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Hsü, K.J.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 433----

Title: A Proposal to Test a new Theory of Orogeny by Drilling the Eastern Mediterranean Sea, especially the area in the Vicinity of the Eratosthenes "Seamount"

Proponents: K.J. Hsü, G. Udintsev, J. Makris, X. Le Pichon, Y. Mart and W. Ryan

Abstract

The current paradigm of the plate-tectonics theory postulates mountain-building by plate interactions. The Circum-pacific and Tethyan mountains have resulted from ocean-continent and continent-continent interactions, respectively. The origin of the Alps has served as a model for the three stages of Wilsonian cycle: (1) rifting leading to seafloor-spreading and sedimentation on Atlantic type of passive margins, (2) consumption of ocean plate, (3) orogeny by continental collision. Analyses of the genesis of orogenic belts of the world have falsified several postulates of this theory. Hsü proposed, therefore, that orogenic deformations are, in most cases, not inter-plate, but mainly intra-plate. Lithospheric plates are rigid near active plate margins, the "collapse" of back-arc basins and the consequent arc-continent or arc-arc collisions took place within a lithospheric plate behind an island-arc type of margin. Continental collision played only a secondary, if any, role in orogenic deformations.

A synthesis of the geological and geophysical data of the Tethyan Mountains and of the Mediterranean Sea, on the basis of the theory of intra-plate deformation by Hsü, led him to conclude that southern boundary of the European Plate has been island-arc/ocean-trench system since the Permian time. The present boundary south of the Hellenic Arc came into existence during Late Miocene. The pre-Messinian arc is now largely buried under the thick upper Neogene sediments of the Mediterranean Ridge and of the abyssal plains. Only on the Eratosthenes Seamount and on the Medina Plateau are the upper Neogene sediments thin or entirely missing. An accretionary complex of tectonic melanges crops out south of Eratosthenes and has been sampled by dredging. We propose to drill a N-S transect of 6 holes across the Eratosthenes Seamount to verify the presence of the volcanic arc and of the accretionary complex on the postulated European Plate margin.

Although the proposal is aimed at a tectonic problem, the necessity of penetrating Neogene sediments before reaching the pre-Messinian objectives provides an opportunity to secure data which are of interest to ODP Panels of Sed9imentary and Geochemical Processes, of Ocean History, and of Lithosphere. The limiting depth of sapropel defines the redox level in the Levantine basin during times of basin anoxia. The distribution of pre-Pliocene weathered surface gives information on the extent of the Messinian subaerial exposure.. Messinian reefs might be encountered on the top of the seamount. Sampling of the Tertiary marine sequence contributes to our knowledge of the timing of separation of the Indo-Pacific and Atlantic faunal provinces. Finally, a sampling of the Paleotethys ophiolites in the accretionary complex south of Eratosthenes permits a comparison of mid-ocean ridge ophiolites of the Paleotethys to the back-arc basin ophiolites, such as those of the Troodox Complex on Cyprus.

Although not all the proponents accept completely the Hsü model of intra-plate deformation in back-arc region, we recognize the revolutionary implications of the hypothesis, if it is verified. We support, therefore, the proposal. If the verdict is positive, we might have to make a major revision in our thinking about the pattern of tectonic evolution on active plate-margins. We might pose the question if the continental border of West North America or the region of rises and basins east of Australia were once situated behind an island-arc. The new theory, if valid, should be the starting point for a new five-year program to investigate other former active margins of the buried island-arc type.

ODP Proposal Log Sheet 434----

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☒ New proposal ☐ Revised proposal ☐ Addendum to proposal ☐ Other

Late Quaternary climate variability in the tropical Caribbean/Atlantic region: A proposal for Ocean Drilling in the Cariaco Basin (Southern Caribbean)

L.C. Peterson

Abbrev. Title: Caribbean Quaternary climate	Key: Carib. climate	Area: N Atl

Contact:

Dr. Larry C. Peterson
RSMAS
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149-1098 (US)

Tel: (305) 361-4692
FAX: (305) 361-4632
Internet:
PetersonL@rcf.rsmas.miami.edu

Objectives:

1. To extend current high-resolution reconstrucitons of regional oceanography and climatology back through at least the last several hundred thousand years
2. To document how climate change over the southern Caribbean/northern South America region relates to global scale change and to climate forcing mechanisms
3. To utilize the varied nature of the sediment sequence to study the rates and magnitudes of climate change at interannual to millennial times scales over the late Quaternary
4. To examine the relaitonship between Cariaco Basin ventilation and climate and paleoceanographic change in the late Quaternary
5. To evaluate the history of organic carbon burial in the Cariaco Basin and its relationship to surface productivity

Specific area: Cariaco Basin (Southern Caribbean)

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
Cariaco-1	10°39.3'N; 65°0'W	920	200	0	200	upwelling/circulation history; climate

Proposal acknowledged by JOIDES Office: 00/00/00 to: Peterson, L.C.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number 434----

Title: Late Quaternary climate variability in the tropical Caribbean/Atlantic region: A proposal for Ocean Drilling in the Cariaco Basin (Southern Caribbean)

Proponents: L.C. Peterson

Abstract

Annually-laminated, high deposition rate sediments of the anoxic Cariaco Basin (Venezuela) offer an exciting opportunity to recover high resolution information on late Quaternary paleoenvironmental change in the tropical Caribbean and western Atlantic region. The Cariaco Basin is ideally situated to record in its sediments a detailed history of trade wing-induced coastal upwelling and fluvial discharge from northern South America, phenomena both related to past changes in the strength and position of the ITCZ. By their varied nature, the sediments of the Cariaco Basin make possible the study of rates and magnitudes of tropical climate change at interannual to millennial time scales, and offer the prospect of examining how short-term climate sensitivity responds to past changes in large-scale global boundary conditions. Cariaco Basin sediments also provide an opportunity to study the relationship between climate variability and processes that influence the burial of organic carbon in anoxic settings.

This proposal describes the scientific rationale for ocean drilling in the Cariaco Basin and identifies a site for hydraulic piston coring of the late Quaternary section (≈0-300,000 years B.P.). Recovery of a high-resolution paleoenvironmental record from the Cariaco Basin would provide an important Atlantic counterpart to the record recovered by recent drilling of Santa Barbara Basin (ODP Site 893), would provide a "downstream" link to paleoceanographic objectives of Amazon Fan drilling (Leg 155), and complements the scientific goals of existing ODP proposals to recover comparable high-resolutions records from the California Borderland Basins.

ODP Proposal Log Sheet 435----

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

Crustal Fluxes into the Mantle at Convergent Margins: Nicaragua and Izu-Marianas Margins

T. Plank, M.J. Carr and J.B.Gill

Abbrev. Title: Nicaragua/Izu-Marianas Mass Balance	Key: Nicaragua/Izu Balance	Area: N Pac

Contact:

Dr. Terry Plank
Department of Geological Sciences
Cornell University
Snee Hall
Ithaca, NY 14853-1504 (US)

Tel: (607) 255-4384
FAX: (607) 254-4780
Internet:
tplank@geology.cornell.edu

Objectives:

The scientific objectives of proposal are to determine the crustal inputs and outputs at convergent margins:

- to calculate the mass and chemical composition of the sedimentary section approaching the trench
- to calculate mass and compostion of the oceanic crust approaching trench
- to determine how much sedimentary material is being accreted, underplated, or eroded at the fore-arc
- to determine the fluid & chemical fluxes lost from the dehydrating sediments & basalt to the fore-arc crust &
- to compare the subducted fluxes with the volcanic fluxes at the arc
- to test whether the chemical variations observed along the entire arc derive from lateral variations in
- the composition of the subducting plate

Specific area: Seaward of Nicaragua Trench

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
NIC-1	10°40'N; 87°36'E	3900	500	300	800	constrain crustal input flux to Nicaragua trench
NIC-2	11°0'N; 87°24'E	4875	400	0	400	determine the extent of frontal accretion and to sample fore-a
NIC-3	11°12'N; 87°36'E	3000	500	100	600	Age, strat., structure/slope apron
801C	18°38.312'N; 156°21.3'E	5674	300	0	300	sample oxidative alteration zone in basement
BON-8	31°18'N; 142°54'E	6000	300	300	600	constrain crustal fluxes into Izu trench

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Plank, T.
Proposal forwarded for review:	00/00/00	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	00/00/00	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number 435----

Title: Crustal Fluxes into the Mantle at Convergent Margins: Nicaragua and Izu-Marianas Margins

Proponents: T. Plank, M.J. Carr and J.B.Gill

Abstract

We propose to determine the net crustal fluxes being recycled into the deep mantle at the Nicaragua and Izu-Marianas margins by mass balance of the inputs (sediment and basaltic portions of the incoming plate) and outputs (sediment and fluid fluxes to the fore-arc crust and mantle, crustal components recycled to the volcanic arc and back-arc). This mass balance has not been possible previously because it requires a focused effort to constrain fluxes at all levels in the subduction zone at a single margin, preferably in the form of a drilling transect. The goals of such a transect are to: 1) sample the entire sedimentary section and at least the upper oxidative alteration zone in the basaltic basement of the incoming plate, 2) use drilling and material balance to determine the extent of sediment accretion, underplating, erosion and subduction at the fore-arc, 3) determine the fluid fluxes lost from the subducting plate to the fore-arc crust and mantle by sampling pore fluids in fore-arc drill holes and by drilling fore-arc serpentines, 4) compare subducted fluxes to the volcanic fluxes at the arc and test whether regional variations observed along the arc derive from regional variations in the composition of the subducting plate. Although these objectives are not regional, we have identified the Nicaragua and Izu-Marianas margins as excellent targets. At Nicaragua, the sediment signal to the arc is among the highest globally (highest ^{10}Be and Ba/La), while at Izu-Marianas, the setting is at its simplest (complete sediment subduction, no continental material in the upper plate). Both margins show systematic regional variations in lava compositions along the volcanic arc which may derive from regional variations in the composition of the subducting plate. This can be tested by drilling.

ODP Proposal Log Sheet **NARM-A(**

Proposal received: Jun 30, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

NARM - Non-volcanic Transect I: Deep Drilling in the Northern Newfoundland Basin

J.A. Austin, J-C Sibuet, S.P. Srivastava, B.E. Tucholke

Abbrev. Title: NARM-Add	Key: NARM-Add	Area: N Atl

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

Objectives: Resp. to panels re: previous proposals to drill n. Nfld Basin to address issues of conjugacy/tectonic fabric; to address quality/quantity of existing multichannel seismic control; construction of balanced cross-sections

Specific area: Northern Newfoundland Basin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
NB4(A)-1	44°22.4'N; 46°49.7'W	3900	2790	150	2940	nature, age, environment of sediments; date U unconformity
NB4(A)-2	44°23.4'N; 46°55.7'W	3910	2700	150	2850	nature, age, environment of sediments; date U unconformity
NB4(A)-3	44°18.4'N; 46°49.9'W	3970	2610	150	2760	nature, age, environment of sediments; date U unconformity

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Austin, J.A., Jr.
Proposal forwarded for review:	Jul 16, 1993	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	Jul 16, 1993	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number NARM-Add
Title: NARM - Non-volcanic Transect I: Deep Drilling in the Northern Newfoundland Basin
Proponents: A. Austin, J-C Sibuet, S.P. Srivastava, B.E. Tucholke

Ascertaining the geologic history of passive continental margins has been a priority of scientific ocean drilling since COSOD-I (1981). Nonetheless, despite its long-standing thematic importance, a systematic approach to drilling non-volcanic conjugate passive continental margins in the North Atlantic, where they are better developed than anywhere else in the world, has just gotten underway.

This addendum details an initial approach to ODP drilling in the northern Newfoundland Basin (NB), specifically deep (~2.9 kmbsf) drilling at Site NB-4(A), the #2 priority for NARM non-volcanic drilling as proposed by the NARM-DPG (1991). The northern NB is one half of the NB-Iberia Abyssal Plain (IAP) non-volcanic transect. Drilling on the IAP half of this transect has just been successfully completed on ODP Leg 149. The NB contains a ~150 km-wide zone of apparently thinned continental crust, much like that postulated for the Iberia margin part of the transect. However, the NB differs significantly in one major way - it exhibits a very well-defined unconformity ("U"/Avalon unconformity) that caps and occasionally truncates underlying crustal blocks out to the interpreted continent-ocean boundary (COB) 20-40 km W of magnetic anomaly M0. The strong development, relative flatness and wide areal extent of this unconformity suggest that it was eroded at or near sea level near the time of breakup between Iberia and the Grand Banks. **The first-priority issue for drilling is to ascertain the origin of the "U" unconformity and the nature of the crust in the broad transition zone between known continental crust of the Grand Banks and known oceanic crust seaward of anomaly M0. This zone constitutes one of the largest areas of enigmatic sea floor in the North Atlantic**, and Site NB-4(A) occurs in the middle of it. If this transition zone proves to consist of continental crust that has been thinned, faulted and truncated in a subaerial environment, a *fundamental new class of highly-thinned continental crust* (not necessarily thinned by extension) will have been documented that must be considered and explained in any model of rifted-margin development. At the same time, drilling at Site NB-4(A) will provide the crucial geologic control for understanding the late rift-early drift geologic history of this part of the North Atlantic.

This addendum deals specifically with criticisms brought up by previous JOIDES reviews of northern NB drilling (originally as proposal #365-Rev., then as part of the NARM-DPG Report, 1991): **Issues of Conjugacy/Tectonic Fabric** - (1) accuracy of fit/degree of conjugacy of proposed offshore eastern Canada sites (specifically those in the northern NB) with those drilled as part of Leg 149, and (2) lack of a comprehensive tectonic map for offshore Iberia and eastern Canada, as a partial means of assessing conjugacy, **Quality/Quantity of Existing Multichannel Seismic Control** - (3) insufficient quality/quantity of existing multichannel seismic (MCS) control for detailed site selection in the NB, and finally, **Construction of Balanced Cross-Sections** - (4) need to construct (or at least attempt) balanced cross-sections along the top-priority NB-IAP non-volcanic corridor.

NARM science has grown out of a groundswell of enthusiasm for passive margin drilling expressed in the form of many highly-ranked, unsolicited proposals to ODP by a large, diverse scientific community. This addendum is designed to underscore the importance of drilling the non-volcanic passive margin offshore Newfoundland to understand its enigmatic crustal identity and late rift/early drift geologic history, without detracting from the larger impact of the NARM-DPG Report (1991). The recent success of Leg 149 in refining the location and geologic identity of the ocean-continent transition (OCT) in the IAP argues not only for further operations there, but for a coordinated, long-term study of its conjugate. That study should begin before the *JOIDES Resolution* leaves the Atlantic.

ODP Proposal Log Sheet

NARM-A

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☐ *Addendum to proposal* ☒ **Other**

Amendment to the North Atlantic Rifted Margin Detailed Planning Group Report (Narm-DPG): Volcanic Margin Transect East Greenland (EG63-transect)

H-C Larsen, C.K. Brooks, K.G. Cox, and T.D.F. Nielsen

Abbrev. Title: NARM-Add2	Key: NARM-Add2	Area: N Atl

Contact:

Dr. Hans-Christian Larsen
Geological Survey of Greenland
Øster Voldgade 10
DK-1350 København K (DK)

Tel: 45 (33) 118-866
FAX: 45 (33) 935-352
Internet: dahlj@ggu.dk

Objectives:

Extension of EG 63-5 (NARM volcanic) transect landward of EG 63-1. To recover deep crustal information on the deformation and extension (dyke injection and strong, tectonic rotation) of the continental lithospheric close to and below the further edge of the SDRS.

Specific area: East Greenland Margin

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
EG63-5	63°31.5'N; 39°55.6'W	474	10	290	300	identify sheeted dyke complex and crustal deformation
EG63-6	63°31'N; 39°54'W	459	5	320	325	drill main SDRS, recover break-up unconformity

Proposal acknowledged by JOIDES Office:	00/00/00	to:	Larsen, H-C
Proposal forwarded for review:	Jul 16, 1993	to:	LITHP, OHP, SGPP, TECP
Proposal copies:	Jul 16, 1993	to:	JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG:	00/00/00	to:	

Proposal Reference Number NARM-Add2

Title: Amendment to the North Atlantic Rifted Margin Detailed Planning Group Report (Narm-DPG): Volcanic Margin Transect East Greenland (EG63-transect)

Proponents: H-C Larsen, C.K. Brooks, K.G. Cox, and T.D.F. Nielsen

Based on new and extensive high resolution seismic data across the feather edge of the East Greenland Seaward Dipping Reflector Sequence (SDRS) it is proposed to amend with up to three more sites the volcanic margin transect – the EG63-transect – planned by the NARM-DPG. The three proposed sites are within the transition zone from continental basement to oceanic basement. An offset approach allow shallow drilling (< 500 m) to recover in part deep crustal information on the deformation and extension (dyke injection and strong, tectonic rotation) of the continental lithosphere close to and below the feather edge of the SDRS, i.e. within the continent to ocean transition of a volcanic rifted margin. This information is crucial for characterizing this type of rifted margins and for differentiating between the competing models for the excessive magmatism associated with these margins. Furthermore together with the drilling scheduled on the EG63 transect (Leg 152) the drilling proposed in this amendment will provide an almost complete sampling of the initial break-up volcanism ($\sim 1^+$ km in stratigraphic thickness) prior to the more steady state formation of the SDRS. This early volcanism is particular prone to rapid variations that may yield important constraints on the processes associated with volcanic break-up.

The drilling proposed here amounts to roughly one half drilling leg. Following Leg 152 drilling in late 1993 it is proposed to schedule a second leg to the EG63-transect in the late summer of 1995. This leg should include completion of the transect as planned and approved by the NARM-DPG, SSP and PPSP and the new sites proposed here at the landward end of the transect.

The proposed ODP drilling along the the EG63-transect will be part of a recently initiated, major ($\sim$7 mill. $US) field geological and deep geophysical research programme on the East Greenland margin by the Danish Lithosphere Centre. As part of this programme continental drilling of deep margin structures in excess of the present (and future) capability of the ODP will be proposed. An international symposium on the complete, multi-disciplinary study (field geology, geophysics and drilling) and publication of a thematic issue in a leading journal is tentatively planned for 1997/1998.

ODP Proposal Log Sheet **SR-Rev2**

Proposal received: Jul 1, 1993
Proposal reviewed: Fall 1993

☐ *New proposal* ☐ *Revised proposal* ☐ *Addendum to proposal* ☒ **Other**

Sed Ridges II: Revision of the Sedimented Ridges Detailed Planning Group Drilling Strategy Based on Results of Leg 139 Drilling at Middle Valley

J.M. Franklin and R.A. Zierenberg

Abbrev. Title: Sedimented Ridges II	Key: Sed. Ridges II	Area: N Pac

Contact:
Dr. Robert A. Zierenberg
Branch of Western Mineral Resources
U.S. Geological Survey
345 Middlefield Road, MS-901
Menlo Park, CA 94025 (US)
Tel: (415) 329-5437
FAX: (415) 329-5490
Internet:
robert@mojave.wr.usgs.gov

Objectives:

1. Second revision of the original Sedimented Ridges DPG Report with increased documentation of site survey information, 2. Three-dimensional characterization of the fluid flow and geochemical fluxes within a sediment dominated hydrothermal system, 3. A systematic investigation of the processes involved in the formation of sediment hosted massive sulfide deposits

Specific area: Middle Valley, Escanaba Trough

Proposed Sites:

Site Name	Position	Water depth	Penetration Sed	Bsmt	Total	Brief site-specific objectives
BH-1	48°26.05'N; 128°40.85'W	2435	200	50	250	sulfide deposit composition & thickness
BH-2	48°25.95'N; 128°40.9'W	2460	200	50	250	constrain gemetry & composition sulfide mineralization
BH-3	48°25.85'N; 128°40.9'W	2445	200	50	250	hydrothermally active massive sulfide; flow paths
BH-4	48°26.05'N; 128°41.1'W	2460	250	100	350	constrain massive sulfide/footwall; relative timing
857D	48°26.5'N; 128°42.65'W	2420	470	-470	0	measure temp, sample borehole fluids, replace thermister
DD-1	48°27.35'N; 128°42.6'W	2410	250	-150	100	physical properties of hydrothermal mound
DD-2	48°27.35'N; 128°42.6'W	2425	250	-150	100	physical properties of hydrothermal mound
DD-3	48°27.35'N; 128°42.55'W	2425	250	-150	100	physical properties of hydrothermal mound
ET-1	41°0'N; 127°29'W	3240	600	50	650	Central Hill adjacent to active massive sulfide deposit
ET-2	41°0'N; 127°29'W	3250	600	50	650	active sulfide deposite for hydrothermal alteration
ET-3	40°95'N; 127°30.5'W	3340	600	50	650	reference section sed sequence, transparent seismic marker
ET-4	40°95'N; 127°30.5'W	3170	600	50	650	large sediment hill, basement composition

Proposal acknowledged by JOIDES Office: 00/00/00 to: Zierenberg, R.A.
Proposal forwarded for review: 00/00/00 to: LITHP, OHP, SGPP, TECP
Proposal copies: 00/00/00 to: JOI Inc., SO (ODP/TAMU), SSDB
Proposal forwarded to DPG: 00/00/00 to:

Proposal Reference Number SR-Rev2

Title: Sed Ridges II: Revision of the Sedimented Ridges Detailed Planning Group Drilling Strategy Based on Results of Leg 139 Drilling at Middle Valley

Proponents: J.M. Franklin and R.A. Zierenberg

The Sedimented Ridges Detailed Planning Group (SRDPG) prepared a draft drilling prospectus in 1990 based on the thematic goals and scientific objectives for investigating hydrothermal circulation at sediment-covered spreading centers outlined in the LITHP White Paper, "A Drilling Strategy for Sedimented Ridge Crests" (Detrick et al., 1988). The SRDPG advocated a two-leg drilling program to include Middle Valley on the northern Juan de Fuca Ridge and Escanaba Trough on the southern Gorda Ridge. The first leg of drilling was primarily to investigate the large scale hydrogeology of Middle Valley. The second leg of drilling was to emphasize the formation of massive sulfide deposits, the fine-scale hydrogeology of hydrothermal vent fields, and the formation of oceanic crust under sediment-covered spreading centers. Leg 139 accomplished most of the goals of the proposed first leg of drilling and provided important impetus for planning a second leg of drilling. This proposal presents a revised drilling strategy for leg II based on the results of Leg 139. The thematic goals and scientific objectives for this leg remain as stated in the LITHP White Paper (Detrick et al., 1988) and the SRDPG prospectus and are not repeated here. Panel members who are unfamiliar with the contents of these reports, which include descriptions of the geologic and geophysical setting at Middle Valley and Escanaba Trough, are invited to review these documents to provide the background material upon which this revision is based.

Three sites are included in our revised drilling strategy. A suite of holes will be drilled through and adjacent to the Bent Hill massive sulfide deposit to investigate the extent and compositional variation of massive sulfide mineralization, mineralogical and chemical zonation related to late-stage hydrothermal circulation and the local hydrography, the nature of hydrothermal alteration associated with a high temperature fluid upflow zone, the tectonic and igneous setting of Bent Hill and its relationship to the sulfide deposits, and the structural controls on hydrothermal processes. A suite of short holes in the area of the Dead Dog vent field will investigate the small-scale hydrogeology of the vent field and determine the growth mechanism for hydrothermal mounds underlying active vents. A suite of holes in the NESCA area of Escanaba Trough will examine the tectonic evolution at on-axis intrusive/extrusive volcanic edifices, investigate the relationship of igneous processes to hydrothermal circulation and mineralization at both intrusive- and volcanic-dominated tectonic settings at a slow spreading axis, investigate the formation of a large, hydrothermally active sulfide deposit in an early stage of evolution, examine the flux of elements from sediment to hydrothermal systems by drilling through a massive sulfide deposit that has a composition dominated by sedimentary input, examine the nature of altered sediment and basalt underlying a large massive sulfide deposit, and investigate the changing sedimentary source regions and depositional regimes associated with eustatic changes in sea level during the Pleistocene. Drilling at Middle Valley and Escanaba Trough will greatly improve our understanding of the interrelationships of tectonic, igneous, and sedimentary processes in controlling fluid flow, energy and mass flux and formation of hydrothermal deposits at sediment-dominated rift environments. Sed. Ridges II also presents a unique opportunity for active experimentation and hole to hole geophysical imaging of an active hydrothermal vent field due to the detailed geological information available and the close spacing of instrumented and re-enterable drill holes.

JOI	joi@iris.edu
Kappel, Ellen	ekappel@iris.edu
Pyle, Tom	pyle@iris.edu
NSF	
Ambos, Beth	bambos@nsf.gov
Dauphin, Paul	jdauphin@nsf.gov
Heinrichs, Don	dheinrichs@nsf.gov
Malfait, Bruce	bmalfait@nsf.gov
Panel Chairs	
Ball, Mahlon (PPSP)	
Bloomer, Sherman (LITHP)	bloomer@crsa.bu.edu
Delaney, Peggy (OHP)	delaney@cats.ucsc.edu
Gibson, Ian (IHP)	guelph2@watdcs.uwaterloo.ca
Kastens, Kim (SSP)	kastens@lamont.ldgo.columbia.edu
Lysne, Peter (DMP)	pclysne@sandia.gov
McKenzie, Judith (SGPP)	sediment@czheth5a.bitnet
Moores, Eldridge (TECP)	moores@garnet.ucdavis.edu
Moran, Kate (SMP)	moran@agcrr.bio.ns.ca
Sparks, Charles (TEDCOM)	sparks@c1.ifp.fr
ODP-TAMU	
Baldauf, Jack	baldauf@nelson.tamu.edu
Coyne, John	coyne@nelson.tamu.edu
Francis, Tim	francis@nelson.tamu.edu
Rabinowitz, Phil	moy@nelson.tamu.edu
Storms, Mike	storms@nelson.tamu.edu
ODP-LDEO	
General account	borehole@ldeo.columbia.edu
Barnes, Deborah	barnes@ldeo.columbia.edu
Borehole Research Group, LDEO	brg-users@lamont.ldeo.columbia.edu
Broglia, Cristina	broglia@lamont.ldeo.columbia.edu
Demenocal, Peter	pdem@lamont.ldeo.columbia.edu
Filice, Frank	filice@ldeo.columbia.edu
Goldberg, Dave	goldberg@lamont.ldeo.columbia.edu
Pratson, Elizabeth	beth@lamont.ldeo.columbia.edu
Rodway, Katherine	rodway@ldeo.columbia.edu
Site Survey Data Bank	
Mountain, Greg	mountain@lamont.ldeo.columbia.edu
Giarratano, Milly	milly@lamont.ldeo.columbia.edu

Internet Directory

Please let the JOIDES Office know if you have an Internet address addition or correction

Executive Committee	Internet address
Beiersdorf, Helmut	beiersdorf@gate1.bgr.dbp.de
Briden, Jim	jbriden@mail.nsw.ac.uk
Caldwell, D.	d.caldwell.OSU@omnet.nasa.gov
Dorman, Craig	c.dorman.WHOI@omnet.nasa.gov
Duce, Robert	duce@triton.tamu.edu
Eaton, Gordon	g.eaton@omnet.nasa.gov
Falvey, David	
Frieman, Edward	e.frieman@omnet.nasa.gov
Helsley, Chuck	chuck@soest.hawaii.edu
Lancelot, Yves	y.lancelot@omnet.nasa.gov
Leinen, Margaret	mleinen@gsosun1.gso.uri.edu
Maxwell, Art	art@utig.ig.utexas.edu
Nowell, Arthur	nowell@ocean.washington.edu
Rosendahl, Bruce	brosendahl@rsmas.miami.edu
Sartori, Renzo	
Taira, Asahiko	taira@tansei.cc.u-tokyo.ac.jp

Planning Committee	Internet Address
Austin, Jamie	jamie@utig.ig.utexas.edu
Becker, Keir	kbecker@rsmas.miami.edu
Berger, Wolf	
Dick, Henry	send care of Bill Curry wcurry@whoi.edu
Fox, Jeff	jfox@gsosun1.gso.uri.edu
Kidd, Rob	kiddr@geology.cardiff.ac.uk
Larsen, Hans-Christian	
Lewis, Brian	joides@ocean.washington.edu
Malpas, John	ODP@Kean.ucs.mun.ca
Mix, Alan	mix@oce.orst.edu
Mével, Catherine	cam@ccr.jussieu.fr
Mutter, John	jcm@lamont.ldgo.columbia.edu
Sager, Will	sager@triton.tamu.edu
Suyehiro, Kiyoshi	suyehiro@aix3.ori.u-tokyo.ac.jp
Taylor, Brian	taylor@elepaio.soest.hawaii.edu
Von Rad, Ulrich	vonrad@gate1.bgr.dbp.de