JOIDES PLANNING COMMITTEE MEETING
22-24 AUGUST 1989
SEATTLE, WASHINGTON

AGENDA

Afternoon (1:30 PM) Joint meeting of members of US Science Advisory Committee and US members of JOIDES PCOM . Non-US guests welcome.

1. Concept of discretionary funds
2. Thematic publications
3. Editorial support
4. Quality, quantity, and commitment of shipboard scientific party
5. Proposal submission
6. Care and feeding of a scientifically balanced thematic drilling program

Evening:

PCOM-USSAC JOINT DISCUSSION OF ODP

Discussion leaders: R. Moberly and D. Scholl

Additional Attachments | White page

JOIDES MEETING SCHEDULE (08/04/89)

Date	Place	Committee/Panel
13-15 June	Ottawa, Canada	SRDPG
19-20 July	Palisades, NY	SGPP
25-26 July	College Station, TX	PPSP
22-24 August	Seattle, WA	PCOM
8-11 September	FRG	LITHP**
11-12 September	FRG	DMP
19-20 September	GEOMAR, FRG	SGPP**
25-28 September*	Honolulu, HI	TECP**
2-3 October	Palisades, NY	SMP
3-5 October	The Netherlands	EXCOM
16-18 October	Hannover, FRG	SSP
26-28 October	Giessen, FRG	OHP**
16-17 November*	Palisades, NY	CEPDPG
26 November	Woods Hole, MA	Panel Chairmen
27-30 November	Woods Hole, MA	PCOM
January, 1990*	United Kingdom	TEDCOM
24-26 April, 1990	France	PCOM
May or June, 1990	Washington, DC	EXCOM
7-9 August, 1990*	Hawaii or LaJolla, CA	PCOM
October, 1990	France	EXCOM
25 November, 1990*	La Jolla, CA or Hawaii	Panel Chairmen
26-29 November, 1990*	La Jolla, CA or Hawaii	PCOM
ex-IOP & Co-Chiefs***		

* Tentative meeting; not yet formally requested and/or approved.

** Each of the thematic panels will also meet between about 1 February and 15 March 1990.

*** This important meeting to be approved if and when requested.

JOIDES RESOLUTION OPERATIONS SCHEDULE

LEGS 127 - 135

LEG	AREA	DEPARTURE		ARRIVAL		IN PORT	DAYS AT SEA*
		LOCATION	DATE	LOCATION	DATE		
127	Japan Sea I	Tokyo	06/24/89	Pusan	08/21/89	08/21 - 08/25	58
128	Japan Sea II	Pusan	08/26/89	Pusan	10/16/89	10/16 - 10/17	51
	Transit & Dry Dock	Pusan	10/18/89	Singapore	10/27/89	10/27 - 11/11	09
	Transit	Singapore	11/12/89	Guam	11/22/89	11/22 - 11/23	10
129	Old Pacific Crust	Guam	11/24/89	Guam	01/19/90	01/19 - 01/23	56
130	Ontong Java	Guam	01/24/90	Guam	03/25/90	03/25 - 03/29	60
131	Nankai	Guam	03/30/90	Pusan	05/31/90	05/31 - 06/04	62
132	Engineering II	Pusan	06/05/90	Guam	07/30/90	07/30 - 08/02	55
	Transit	Guam	08/03/90	Port Moresby	08/10/90	08/10 - 08/11	07
133	N.E. Australia	Port Moresby	08/12/90	Brisbane	10/07/90	10/07 - 10/11	56?
134	Vanuatu	Brisbane	10/12/90	Suva	12/07/90	12/07 - 12/11	56?
135	Lau Basin	Suva	12/12/90	?	02/06/91	?	56?

revised 07/19/89

*Schedule subject to change pending detailed planning after Leg 131.

JOIDES PLANNING COMMITTEE MEETING
22-24 AUGUST 1989
SEATTLE, WASHINGTON

AGENDA NOTES

Tuesday 22 August 1989 (9:00 AM)
Room 123, Marine Science Building, University of Washington

A. Welcome and Introductions
Opening remarks and logistics (D. Cowan)
Introduction of members, liaisons, and guests

B. Approval of Minutes of 2-4 May 1989 Oslo Meeting
The attached revised draft minutes include corrections and additions received through 1 August.
After a call for additional corrections or additions, *PCOM should approve the minutes.*

C. Approval of Agenda
The two principal purposes of the summer PCOM Meeting are:

First, to prepare for the next two major planning sessions, namely the Annual Meeting, at which the scientific plan for FY91 will be established, and the spring meeting, at which is planned the general track of the vessel a few years in advance of drilling. We must bring ourselves up to date on the scientific objectives of the various programs that have been proposed, their maturity, and the status of engineering, site-survey, and other developments that affect them. We must also see that the thematic panels are prepared, by membership and any special charges we give them, to evaluate and rank in priority the proposed programs.

Second, to inform ourselves, discuss, and where necessary take action, on the range of other matters before the PCOM. Many of these are postponed from the two other meetings of the year when the ship-planning activities are paramount.

At this meeting we are also asked to reevaluate two earlier decisions: (1) our drilling plan for FY90, especially with regard to the removal of Geochemical Reference Sites from the FY Program Plan, and (2) the balance among the scientific themes proposed in the Long Range Plan.

D. ODP Reports by Liaison

NSF (B. Malfait) Timeline for a post-1993 program; resource constraints; the Washington scene; other comments.

JOI (T. Pyle) Present status of the FY90 Program Plan; responses to evaluations of ODP; preparation for a post-1993 program; other comments [see also items F, G, and O].

Science Operator (L. Garrison) Present status of the drilling program, including operations since Oslo and scheduled for the near future; activities at TAMU; other comments [see also items F and H].

Wire-line Logging (R. Jarrard) Present status of the logging program, including operations since Oslo and scheduled for the near future; activities at LDGO; other comments [see also item H].

E. JOIDES Reports by PCOM Liaison to Recent Meetings

DMP 23-24 May (D. Cowan). Minutes in Agenda Book.

EXCOM & ODP Council 31 May-1 June (R. Moberly). Principal results of importance to PCOM are excerpted in Agenda Book, from EXCOM draft minutes: Adopted the FY90 Program Plan and budget, with concerns about Geochemical Reference Sites and about future program costs; adopted the Long-range Planning Document with some modifications to come, including a request for PCOM to reconsider the balance of scientific objectives; were troubled with the likely incompatibility between the DCS and modern logging; reaffirmed that ODP is a global program driven by proposals that are thematically ranked; adopted the publications policy forwarded by PCOM, with the exception of the section on details; were exceptionally concerned about all aspects of the question of radioisotopes on board the drill ship; approved the mandate changes we proposed, and asked us to have a general statement on membership where not already present in mandates; and decided that no action was needed by EXCOM about the present method whereby ODP-TAMU selects co-chief scientists for drilling legs.

SRDPG 13-15 June (M. Langseth) The final report may be received in time to reproduce and carry to the PCOM Meeting. Mark Lahgseth's report is in this Agenda Book. That, and other news received in the JOIDES Office, indicate that the meeting was highly successful.

SGPP 19-20 July (M. Kastner) Too early for minutes.

PPSP 25-26 July (R. Moberly) Approved all remaining sites of the Nankai traverse, all newly surveyed sites for Old Pacific (the remaining two to be decided by M. Ball and L. Garrison), the 5 proposed Ontong Java Plateau sites., and, as a favor to NSF, two non-ODP shallow sites on the Bahama Banks. Reviewed the geochemistry of all petroleum shows in DSDP-ODP. Received information about probable drilling conditions at high-temperature targets. Indicated a need for back-up expertise in petroleum geochemistry.

Of great import to future planning: PPSP reviewed the Exmouth Plateau operations, including their own role in having approved Site 763, with implications against future "twinning" of industry holes or indeed against riserless drilling in known petroleum basins, especially ones with thick syn-rift or early post-rift Mesozoic sections.

F. FY90 Program Plan, including the Issue of Geochemical Reference Sites

Since our Oslo meeting, the JOIDES Office has received numerous spoken and written communications about removal of the Geochemical Reference Sites leg from the FY90 Program Plan. The range of comments is shown in the set of letters in the Agenda Book. Some complaints are more justified than others, perhaps depending on which rumors were intercepted, for example, an Atolls and Guyots leg was not removed from the Program Plan, and as PCOM has not met since Oslo, there can be no "stonewalling". These letters were answered, but the answers are not included here. Most answers were similar to the one to Bob Detrick (copies already sent to PCOM).

There appear to be two issues, here posed as questions. One is the decision itself: with due consideration to real and imagined factors including thematic worth, status of other planning, logistics, weather, and alternatives, *should PCOM reinstate a geochemical reference leg in the FY90 Program Plan?*

The second is the decision-making process: In the thematic panels, DPGs, and PCOM itself, and with respect to rankings, transfer of information, and record keeping, *how can PCOM improve procedures to prevent in the future whatever real (and imagined) faults there were in this planning process?*

G. Balance in Long-range Planning Document

EXCOM adopted, and passed on to JOI, the Long-Range Plan that Nick Pisias and several others in the JOIDES structure had prepared and that PCOM endorsed at Oslo. The adoption, however, was with the understanding that a number of modifications were to be made. Of specific concern to PCOM was the extensive discussion by EXCOM of the apparent imbalance between deep crustal drilling and sediment drilling in the proposed work, and the request that PCOM reconsider the balance.

Attached in the Agenda Book are excerpts of the EXCOM comments and of the proposed work in the Long Range Plan. *How, if at all, will PCOM modify the balance between major themes proposed in the document?*

H. Status of Engineering and Technical Developments

Logging and DCS (L. Garrison and R. Jarrard) The science operator and wireline logging subcontractors had been asked to advise PCOM on the relative costs as well as trade-offs in time and in data attainable, to achieve compatibility between hole size and logging if the diamond coring system is used. Preliminary estimates were received at Oslo. PCOM still needs to know such information as (1) a cost-and-time estimate of drilling a 4-inch hole with the DCS for core recovery with a second but larger hole drilled but not cored, for logging and wireline-packer work; (2) the general schedule by ODP-TAMU for testing greater depths and larger diameters with the diamond coring system; (3) the present status and likely developments in slim-hole, high-temperature logging, (4) which system (rotary APC + XCB; 4-inch DCS; 5-inch DCS; DCS as slim-hole riser; other?) is intended to be the primary one and which the secondary one(s) through the next decade of drilling, (5) the costs and trade-offs when changing from one system to another, and (6) is it envisioned that changes can be made within a leg, between legs, or between groups of legs.

EXCOM comments (and description of near-action) and other correspondence are in attached in this Agenda Book. Depending on the information received from the subcontractors, and the resultant discussion, *it may be necessary for PCOM to provide direction to the operating and logging subcontractors on ways to proceed.*

High Temperatures (L. Garrison; R. Jarrard) In addition to information about slim-hole logging at high temperatures (item above), the subcontractors are asked to report on the status of general preparation for high-temperature drilling and logging. Letters from Lysne, Worthington, and Detrick are attached.

Other Engineering Developments at TAMU (L. Garrison)

Other Logging Developments at LDGO (R. Jarrard)

Development of Third-party Tools A letter by D. Karig regarding Geoprops is attached. DMP and SMP updates will be available at the Annual Meeting.

Planning of Second Engineering Leg (Leg 132; L. Garrison) Status of intended testing, general areas, sites, co-chiefs, other staffing. Although not the normal call for a watchdog, *should PCOM appoint one?*

[If time remains, agenda item L (Role of DPGs), or possibly some of R (Other Business) should be moved forward rather than starting on the Wednesday agenda.]

Wednesday 23 August 1989 (8:30 AM)

I. Status of Scientific Recommendations

Thematic Basis The JOIDES Office was asked by EXCOM to prepare a detailed table showing the degree to which COSOD I objectives (major as well as minor objectives) have been met in ODP to date. When finished it will also be distributed to PCOM and the panel chairs.

A draft of the White Paper of the Tectonics Panel has been received (version edited for JOIDES Journal is attached). The LITHP and SOHP White Papers have been published, and were part of the basis for the Long Range Plan. It is not likely that SGPP and OHP will be able to revise the SOHP document before their proposal-evaluation work due before next April.

Proposals The rate of receipt of new and revised proposals has increased slightly. Recent ones are no longer overwhelmingly

Pacific. For PCOM's information about the general range of proposals since the list distributed in Oslo, a set of summaries is attached.

J. Preparation for One-year and Four-year Planning

FY91: At Oslo we decided that the FY91 Program Plan would be selected from among certain eastern Pacific programs. PCOM should become familiar with the scientific objectives and the maturity of these programs. The CEPAC prospectus (separate mailing) will aid the discussions, led by the PCOM watchdogs (watchdog checklist form distributed in Oslo).

Cascadia Accretionary Prism (D. Cowan)
Chile Triple Junction (was O. Eldholm! Dalziel says no change)
Eastern Equatorial Pacific Neogene Transects (M. Leinen)
East Pacific Rise Bare-rock Drilling (G. Brass)
Hydrothermal Processes at Sedimented Ridges (M. Kastner or M. Langseth; the report of the SRDPG may be available)
Lower Crust at Site 504-B (J. Malpas)

Remainder of CEPAC Set of Programs (Former prospectus, less Cascadia, et al. above, and less scheduled Old Pacific and Ontong Java legs). These and others will be considered next April. Some are revised in the new CEPAC Prospectus. (alphabetical)

Atolls and Guyots (B. Tucholke)
Bering Sea History (Y. Lancelot or J. Watkins)
Hawaii Flexure (J. Malpas)
North Pacific Neogene (Y. Lancelot or J. Watkins)
Shatsky Rise (H. Jenkyns)
Young Hotspots: Loihi (R. Moberly)

Additional Programs. Several proposals of apparently high promise will also be considered next April. These include ones that for one reason or other could not be included in the first circumnavigation of the *Resolution,* as identified by the former regional panels, as well as new ones. For example, attached are lists of proposals of the 1988 era that have moved on to SSP consideration, 7 leg-length programs remaining from WPAC (including Geochemical Reference), and the list from J. Austin of proposals and programs that were highly considered by ARP. SOP and IOP did not responded to PCOM's request. *Is it premature for PCOM to establish watchdogs for any of these? If not, which and who?*

Process of setting priorities. The chairmen of the thematic panels were told that there must be a common inter-panel scheme for reporting priorities to PCOM. They were provided a rather long-winded but (we hoped) complete draft set of working definitions and procedures (please see copy in your attachments), and asked to comment on the draft method of setting and listing priorities. Only one has done so (is in favor of the draft method).

Essentially, the proposed method is: Each thematic panel would send to PCOM a single priority list of programs, with *program* defined as one or more actual proposals addressing a published theme in a specific locality, and with a good probability for operational success, in terms of the status of such factors as site surveys, engineering developments, and safety.

PCOM should define a method of obtaining priority lists that are fair from panel to panel and will allow PCOM to plan in an optimum manner.

K. Reports of Recent Drilling Legs

124 (E. Silver) South-east Asia Basins

125 (P. Fryer) Bonin-Mariana Forearc

126 (B. Taylor) Bonin II

Thursday 24 August 1989 (8:30 AM)

L. Role of DPGs

Mark Langseth has written about the need to keep the responsibilities for planning and advice separate in JOIDES, and in particular about the function of DPGs (see attachment). The very name Detailed Planning Group indicates that he is essentially correct in his evaluation of the situation. His recommendations are:

1. DPGs be ad hoc short-lived groups formed by PCOM and reporting to PCOM.
2. Special Working Groups can be formed ad hoc by thematic (and other?) panels with PCOM approval.

After a discussion of Mark's proposals, *PCOM may want to adopt them.*

M. JOIDES Thematic Panels

Changes in membership or mandate or both may be required to prepare these panels for their work before the next two PCOM meetings. In view of the need by the thematic panels for continuity and even distribution of the heavy work load during the proposal review process during their next two meetings, replacements or additions should be made prior to the fall meetings of the thematic panels.

Thematic panels have been asked to supply lists of the expertise of existing panel members to be matched against panel mandates and also to indicate any perceived gaps. As of 3 August 1989, only LITHP has supplied such a list. Nick Shackleton, however, has again raised the question about the mandate of OHP concerning sealevel changes (see letter attached), and noted the need for someone with the required expertise (suggested to be N. Christie-Blick, now on SGPP), which Shackleton had requested at the Miami PCOM meeting.

LITHP The rotation of Bob Detrick has caused Rodey Batiza to ask for a replacement seismologist. Nominations, in order of preference, were:

Tom Brocher	USGS, Menlo Park
James McClain	UC Davis
Paul Silver	DTM, Carnegie
Nick Christensen	Purdue

These nominations were considered but not acted upon in Oslo. More recently, John Orcutt has resigned from the panel. John Mutter is the only remaining seismologist. Batiza has again made the case for at least two seismologists on the panel.

OHP PCOM Chairman has sent a letter of invitation to join OHP to Lisa Pratt, but there has been no reply.

A panel member with expertise in the interpretation of seismic stratigraphy needs to be nominated.

The Christie-Blick issue should be considered.

SGPP Additions to the membership will be considered to cover the areas of sedimentary mass balance, seismic interpretation, and crustal alteration.

TECP Replacements for Dan Davis and Roger Buck are needed before January 1990. Before the Oslo meeting, TECP had nominated Greg Moore as a possible replacement for Davis, but no action was taken at Oslo on the Davis replacement. The current membership of the Panel stands at 14, so immediate appointments to this panel are recommended so it can adequately evaluate proposals.

Charges to Panels *PCOM may want to add instructions to thematic panels.*

N. JOIDES Service Panels

Publication Policy EXCOM approved the proposed publications policy, with the deletion of paragraph C, which read, "Within this policy framework, PCOM will direct its Information Handling Panel to advise it of more detailed guidelines. They will include, for example, issues regarding copyright, site-survey publications, lead-times to meet publication dates, and editorial policy including the need for an editorial review board."

EXCOM's reasoning (abstracted in an attachment) was that ODP-TAMU can commence some parts now, e.g., copyright and lead-time scheduling, without the delay of waiting for IHP to meet and then advise PCOM, which in turn would meet and pass on advice to the Science Operator. IHP can provide the guidelines on science-related issues, and review what the Science Operator has started. (Incidentally, the most-recently completed leg, 126, is scheduled for the acceleration of the two volumes that we proposed.)

Other than policy advice regarding the aforementioned site-survey publications and continued need for an editorial review board, *does PCOM have any specific charges for IHP?*

Radioisotopes; The EXCOM motion calling on PCOM to "resolve the question of radioisotope-handling policy as a matter of urgency" failed by only one vote. The concern by EXCOM members who are geochemists or headed institutions where spills had occurred was over implications of the word *urgency* (see comments abstracted in an attachment). Nevertheless we must act as quickly as prudence allows.

SMP has been charged with providing PCOM with a draft policy. *Are there additional instructions for SMP relative to the isotope issue?*

Changes in Membership or Mandate; To prepare the service panels for their next meetings, *PCOM may want to consider changes in their membership or mandates.*

Mandate: EXCOM noted that in the terms of reference, no mention of membership is given for the SSP, PPSP, and IHP, and suggested that some general statement on membership be written.

Here is a general proposal, *for PCOM's consideration and possible action:*

"Terms of reference of JOIDES Service Panels are added or modified as follows:

Section 7.1 General Purpose [of Service Panels] is modified by having its last sentence transferred from that section to be the first sentence of a new Section 7.3 , which reads:

7.3. Membership. PCOM appoints the chairman and panelists and keeps membership, including representation from the non-U.S. JOIDES member institutions, under review. The Chairman serves at the pleasure of PCOM, and members serve at the pleasure of PCOM or their non-U.S. appointing member. Representation from all non-U.S. members should be maintained. Panel membership, not to exceed 15, should be maintained as small as is allowed by the range of expertise necessary to met mandate requirements. "

DMP: PCOM Chairman has sent a letter of invitation to join DMP to Mark Hutchinson, but there has been no reply. Eddie Howell is due to rotate off the panel at the end of 1989.

IHP: Ted Moore's chairmanship is due to end in January 1990, according to records in the JOIDES Office, and Moore, Ingersoll, and Loughridge would all normally rotate off the panel by January. Depending on what action, if any, is taken on EXCOM's suggestion for a common statement on membership of service panels, *PCOM may need to look at this panel.*

PPSP. Because the panel expertise in petroleum geochemistry is marginal with the change in George Claypool's employment, the panel proposes that Barry Katz (Texaco) be added. Texaco will cover his expenses. *Shall PCOM appoint him?*

SMP. No action needed at this time.

SSP. PCOM Chairman has sent a letter of invitation to join SSP to Jim Hedberg, but there has been no reply.

TEDCOM. Bert Dennis has been asked by Charles Sparks to step down because he has not attended any TEDCOM meetings during the past two years.

Charges to Panels In addition to the policy issues of publications and radioisotopes, *PCOM may want to add instructions to service panels.*

O. Global Geoscience Programs Other than JOIDES

To continue our series on the scope and current status of major programs in the geosciences, two scientists will present informational briefings about programs of interest to the ocean-drilling community.

Seismic Observatories (M. Purdy). FDSN and IRIS, with special reference to the concept of permanent downhole seismic observatories in the deep ocean.

Mid-ocean Ridges (J. Delaney). RIDGE and possible additional international efforts regarding interdisciplinary global experiments at the mid-ocean ridges.

Formal Liaison (T. Pyle and others). EXCOM has approved the establishment of liaisons between JOIDES and other global geoscience initiatives. With regard to: which programs to include, the mission or mandate of liaison bodies, and their size, membership, and place in JOIDES organization, *PCOM should decide specifically what the liaison should be.*

P. PCOM Assignments

PCOM liaison and watchdog activities will provide part of the information necessary for planning decisions at the Annual and Spring meetings. Preferably, of course, the PCOM liaison will attend the PCOM meeting both before and after the particular panel meeting (problem of alternates at PCOM meetings). The PCOM Chairman will attempt to visit each thematic panel at one of their next two meetings. *PCOM should up-date its liaison and watchdog lists, with special attention to coverage of upcoming panel meetings.*

Q. Future Meetings

27-30 November 1989, Woods Hole

Brian Tucholke will host this 4-day Annual Meeting leading to the FY91 Program Plan. The Panel Chairmen Meeting will be on 26 November.

24-26 April 1990, Southern France

Yves Lancelot will host this meeting near Nice, leading to a determination of the general direction of the vessel for the following four years.

7-9 August 1990, Hawaii or La Jolla or at another JOIDES- or USSAC-nominated site

The summer meeting is tentatively scheduled for early August. If there are no new volunteers it will have HIG or SIO as host.

26-29 November 1990, Hawaii or La Jolla or at another JOIDES-nominated site

The Annual Meeting is tentatively scheduled for late November. If there are no new volunteers, it will have HIG or SIO as host.

[US JOIDES institutions least recent as hosts are: UT, URI, SIO, LDGO, HIG, OSU, TAMU, RSMAS, UW (and WHOI). Non-US are: Germany, Canada-Australia, Japan, United Kingdom, the ESF (and France)]

PCOM should (1) set the venue of its August and November 1990 meetings, and (2) tentatively set the country and date for its April 1991 meeting.

R. Other business

S. Adjournment

Afternoon (1:30 PM) Joint meeting of members of US Science Advisory Committee and US members of JOIDES PCOM . Non-US guests are invited to attend.

AGENDA

1. Concept of USSAC discretionary funds
2. Encouragement of thematic publications
3. Editorial support
4. Quality, quantity, and commitment of shipboard scientific party
5. Proposal submission
6. Care and feeding of a scientifically balanced thematic drilling program

Late Afternoon (4:00)

Boat Trip

Evening (dinner and later):

PCOM-USSAC JOINT DISCUSSION OF ODP

Discussion leaders: R. Moberly and D. Scholl

JOIDES PLANNING COMMITTEE SPRING MEETING
2-4 May 1989
Voksenåsen Hotel
Oslo, Norway

REVISED DRAFT MINUTES

Members:

R. Moberly (Chairman) - Hawaii Institute of Geophysics
G. Brass - University of Miami
D. Cowan - University of Washington
O. Eldholm - University of Oslo, ESF Consortium
D. Falvey - BMR, Australia (for J. Malpas)
H. Jenkyns - Oxford, United Kingdom
M. Kastner - Scripps Institution of Oceanography
Y. Lancelot - Université Pierre et Marie Curie, France
M. Langseth - Lamont-Doherty Geological Observatory
M. Leinen - University of Rhode Island
N. Pisias - Oregon State University
T. Shipley - University of Texas at Austin
A. Taira - Ocean Research Institute, Japan
B. Tucholke - Woods Hole Oceanographic Institution
U. von Rad - BGR, Federal Republic of Germany
J. Watkins - Texas A&M University

Liaisons:

L. Garrison - Science Operator (ODP-TAMU)
R. Jarrard - Wireline Logging Services (ODP-LDGO)
B. Malfait - National Science Foundation
T. Pyle - Joint Oceanographic Institutions, Inc.

Guests and Observers:

M. Cita-Sironi - University of Milano, Italy
E. Kappel - Joint Oceanographic Institutions, Inc.
M. Storms - ODP-TAMU Engineering
J. Thiede - GEOMAR, Federal Republic of Germany

JOIDES Planning Office:

L. d'Ozouville - Executive Assistant and Non-US Liaison
G. Waggoner - Science Coordinator

Tuesday, 2 May 1989

769 Introduction

PCOM Chairman Ralph Moberly called the 1989 Spring Meeting of the JOIDES Planning Committee to order. Olav Eldholm welcomed everyone to Norway on behalf of the NAVF, the ESCO-Secretariat, and the Institutt for Geologi of the University of Oslo. Eldholm explained logistics including a dinner party to be hosted by the NAVF. A field trip led by Bjørn Larsen of Statoil Stavanger was planned for Friday and Saturday to visit the Oslo Rift.

770 Minutes of Miami PCOM Meeting 28 Nov.-2 Dec. 1988

Moberly called for comments, corrections and approval of the previous minutes.

Pisias asked that the following clarification be added to the first paragraph under Discussion on page 5 of the Minutes: "It was noted that the $800K cost for 2 HRGBs was not only for the purchase of the guidebases, but included all costs associated with deploying and using these items."

Lancelot asked for a correction to page 35 in minute 755 New Drilling Vessel, with the third sentence of the third paragraph under Discussion corrected to read: "Lancelot said that France has **modified** an ice-breaking vessel which will be run by TAAF ..."

PCOM Motion

PCOM approves the minutes of the 28 November-2 December 1988 Planning Committee meeting with amendments. (Motion Kastner, second von Rad)

Vote: for 16; against 0; abstain 0

771 Approval of Agenda

Moberly called for additions or revisions, and then for adoption of the agenda for the meeting. Lancelot and Brass asked for additions.

PCOM Motion

PCOM adopts the agenda for the 2-4 May 1989 Planning Committee meeting with amendments. (Motion Pisias, second Brass)

Vote: for 16; against 0; abstain 0

772 Reports By Liaisons

Reports were given by the ODP Liaisons to PCOM.

B. Malfait from NSF gave an update on the NSF budget and new US oceanographic research vessels (Appendix B). There has been a reaffirmation by the new administration to double the NSF budget on a 5-year time scale. There has not been as quick a matching commitment from congress. Overall the 1989 NSF budget has increased by 9.8%. The 1990 request working its way through congress is for a 13.9% increase. Within the Ocean Sciences Division this translates into a 4% increase in 1990. The increases in the Ocean Sciences Division are for some major new initiatives such as GOFS and WOCE. 1989 overall budget for NSF/ODP related programs is $31.4M. US ODP science support is divided between unsolicited proposals $5.1M and US Science Support/USSAC $4.3M.

B. Malfait discussed changes in the US research fleet. The *Conrad* has been retired. The *Knorr* and *Melville* will be stretched. The keel has been laid for the AGOR-23 which will replace the *Thompson* operated by the University of Washington. The Division of Polar Programs is proceeding to acquire services of an Antarctic research vessel. The Division of Polar Programs and NSF/ODP Program are jointly supporting a workshop at Woods Hole in late September to plan for future US geology and geophysics work in the Arctic.

T. Pyle from JOI reported on how the ODP FY90 budget was produced (Appendix C). The budget includes $1.5 M in SOE which are already committed. $53K of the SOE is for publishing the LRP, publication of a "highlights" brochure, and includes "seed money" for thematic publications. Pyle also discussed possible JOIDES liaisons with other global science initiatives (see below). Outside liaisons were again discussed in Minute 785.

T. Pyle presented the JOIDES response to the Performance Evaluation Committee and the National Science Board reviews of the program. Responses have been made in the following areas:

> Reorganizing the advisory structure on a thematic basis by: 1) deleting the regional panels; 2) emphasizing thematic panels; 3) splitting SOHP thematic panel into SGPP and OHP; 4) adding SMP service panel; and 5) revising and updating mandates.
>
> Emphasizing timeliness of publications and need for thematic synthesis publications by: 1) providing funds for temporary copy editors in FY90 (SOE); 2) providing seed money for thematic publications in FY90 (SOE).
>
> Criticism of JOI and the lines of communication have been addressed by: 1) providing a mandate for BCOM so that its purpose is not misunderstood; 2) clarifying the JOIDES chain-of-command; and 3) clarifying JOI is sensitive to the international character of the program.
>
> Coordination with other Earth Science programs has been proposed by: 1) Liaisoning with the following groups: Arctic Ocean Drilling; National digital seismic networks (IRIS, POSEIDON, etc.); RIDGE, BRIDGE, FRIDGE; Global Sediment. Geol. Project (IUGS); Continental Drilling; WCRP-WOCE, JGOFS, etc. and 2) Briefings of PCOM by other programs (see Minute 773).
>
> Question of why there is not deeper drilling: 1) less deep drilling being proposed; 2) some objectives reached earlier than expected; 3) some lithologies still causing drilling problems.
>
> Advice on increasing "dues" has been ignored. ODP will seek more partners.

T. Pyle and R. Moberly reported on the BCOM meeting. Some of the principal concerns of BCOM included (a) potential increases in the SEDCO day-rate for the vessel have not been budgeted, (b) there appears to be little attempt to constrain payroll costs, (c) the initial SOE was short of 4%, and (d) without increased funding in FY91 and FY92 it will not be possible to meet the technology and engineering developments necessary to move ODP into the 1990s. BCOM approved the addition of two editors to help reduce delay time for publications.

L. Garrison gave the Science Operator report on ship operations and staffing of cruises. Leg 124E was to test engineering developments, primarily the Diamond Coring System. It proved the concept of using a mining coring system for drilling core from the *JOIDES Resolution*. Leg 125 was located in the Mariana and Izu-Bonin forearc regions, where it successfully drilled serpentinite diapirs. Leg 126 has been encountering problems with loose sands and consequently getting the pipe stuck. B. Taylor has requested the relocastion of several sites. One day has been added to each of the upcoming Japan Sea legs. The request to collect a third APC core for an experiment to study biological activity using a C^{14} radiotracer elicited considerable discussion and was taken up again in Minute 779. The location of the scheduled late October dry dock has not been set, since bids are still out.

Co-Chief Scientists have been chosen through the Vanuatu Leg and staffing has been completed through Japan Sea II. Co-Chief Scientists for upcoming legs are: Loren Kroenke and Wolfgang Berger (Ontong Java Plateau); Peter Davies and Judith McKenzie (NE Australian Margin); Gary Greene and Jean-Yves Collot (Vanuatu Collision Zone); and L.M. Parson and James Hawkins (Lau Basin). Garrison also presented a breakdown by country of participation on ODP legs (Appendix D).

The 4th Annual Co-Chief Scientist Review Meeting for legs 119 to 124 was held in mid-April. It was a productive meeting with a thorough review; no major problems were identified. There was a concern that Co-Chiefs do not always fully understand the objectives of a leg. Proponents should be invited to the pre-cruise meeting if they are not otherwise participating on the cruise.

Cowan brought up a concern that the actual drilling results do not always meet the goals that were set in the proposals. Moberly said that a study is being made of expectations versus results of drilling by L. d'Ozouville. In general, HPC is usually sucessful while RCB is not as good under ODP as DSDP. Pisias noted that in general most sites do not reach the projected depth. Both Pisias and von Rad said that the proposed meeting of the former Indian Ocean Panel and Indian Ocean Co-Chiefs will be important for evaluating these kinds of problems. Malfait commented that since the scientific objectives have been reached, these kinds of problems have generated few negative evaluations. Brass said that something scientifically important usually comes out of these legs, even if it was not expected beforehand. Moberly said that at the next PCOM meeting recent Co-Chief Scientists will be present to answer questions.

R. Jarrard gave the Wireline Logging Services report. The Side-Entry-Sub (SES) has allowed increased logging of unstable holes (Appendix E), but results in increased logging time requirements and since it allows logging in unstable holes increases the risk of tool losses. There is a need for a new SES so that even if the pipe gets stuck, tools can be pulled out of the hole. Also the new SES will save up to an hour and a half for each tool change. WLS would like to go ahead and have it ready for use on the *Resolution* by early 1990. The TAM wireline packer continues to have development problems and may not be ready for the Nankai Leg. Use of the larger diameter AMOCO pump has solved the problem of inflating the packer, but deflation of the packer is now a problem. A smaller diameter pump will be tried. The chemical sensors require cleaning after about 24 hours of deployment, this will require the presence of an Electronics Technician onboard the vessel to maintain the tool, which may cause both budgetary and space problems. TAM is now somewhat reluctant to develop the packer further since it may take another 6 months to get the packer acceptable for ODP use.

Reports were presented by the PCOM liaisons to: LITHP by G. Brass; OHP by G. Brass; SGPP by M. Kastner; TECP by O. Eldholm; DMP by R. Moberly; IHP by Y. Lancelot; SMP by M. Leinen; SSP by T. Shipley; PPSP by R. Moberly; TEDCOM by J. Watkins; and the detailed planning group CEPAC by R. Moberly. Except for TEDCOM, draft minutes of recent meetings were included in the PCOM Agenda Book.

Items brought up for PCOM's attention during these presentations included:

LITHP was concerned that NSF-supported site survey work guidelines might not be consummate with thematic planning (see Minute 790). There is a concern that the cost of deployment of a worldwide seismic network estimated at $60 to $70M, will be entirely an ODP expense.

OHP was concerned that it did not have more direct access to TAMU drilling and engineering information needed for planning. The panel was confused about the proposal review scheme, whether they respond directly to proponents or through the JOIDES Office. OHP concluded that sealevel changes should be left to SGPP. Kastner said sealevel changes should be considered by both panels, OHP and SGPP, not just by SGPP. Pisias said that OHP cannot reject ocean history outside the Neogene and must consider sealevel change, since only the sedimentary response to sealevel change belongs to SGPP.

SGPP will be writing a new "White Paper". SGPP mandate is viewed as being concerned with the sources, sinks and behavior of elements in the ocean. Two or three additional members will be requested after evaluation of membership in July. Volume A can be speeded up, but should not be published immediately off the ship.

TECP recommends a DPG to coordinate efforts for convergent margin drilling. TECP's two highest ranked proposals are Chile Rise Triple Junction and Old Pacific. Proposals to drill volcanic margins, such as Rockall, while generally having a good thematic component, require more work before they are acceptable for drilling. TECP encourages the various proponents to interact with one another to improve the proposals. G. Westbrook was reminded that a report of the Fluid Processes in Accretionary Prisms Working Group is required.

DMP has suggested guidelines for Third-Party Tool Policies that needs PCOM approval.

IHP has done an extensive survey on publications, and made formal recommendations to PCOM in its minutes. Some more staff members are required at TAMU to speed up publications regardless of which options are chosen. Lancelot made the observation that IHP may operate too close to the Science Operator, and may need to have some meetings at other locations. Pisias and Lancelot were both concerned with the format and quality control used by ODP to archive data. Pisias said he would write up what he sees as the position PCOM should take on putting ODP data on CD ROM and problems with archiving data. Leinen commented that SMP is also considering these problems. Kastner was concerned about who makes the decisions about data storage.

SMP has made some specific recommendations for shipboard improvements.

SSP has complained that it doesn't see proposals until they are "mature". Moberly pointed out that they see those with thematic priority.

PPSP needs additional information for evaluating the Cascadia and Vancouver programs.

TEDCOM regards the cost estimates in the Long Range Plan for engineering development to be too low by a factor of 2. ODP-TAMU Engineering may be trying to do too much. TEDCOM wants to form a subcommittee of 5-6 people plus a consultant from the British Geological Survey (travel expenses paid by JOI) to focus on the DCS and mining drilling and make recommendations about development.

773 Arctic Drilling

Arctic drilling was discussed by J. Thiede. He presented the scope and present status of the proposed drilling program that is developing within some countries. The presentation was followed by a general discussion. Arctic drilling is representative of a number of major new international geoscience programs with which JOIDES intends to develop and maintain some sort of liaison for mutual advantage.

774 Engineering developments at TAMU

Engineering developments at TAMU were discussed by M. Storms, including principal systems under development, and results of the tests completed on the Engineering Leg. The Diamond Coring System was successfully deployed under severe operating conditions with successful "active" heave compensation under environmental conditions in excess of design parameters for the system. Increasing the drilling depth capability of the DCS from its present 2000 m depth limit to 3500-4500 m is estimated to cost $700K to $800K. A further test of the DCS will be conducted on land, probably in chert and chalk sequences in the UK or France.. Test of the Navi-drill core barrel showed that the new Mach 1P, "drainhole" mud motor, is a significant improvement over previous designs. Motor failures and other design problems, however, indicate more work is needed before the Navi-drill can be deployed routinely as required for use of the Geoprops probe.

Discussion

Lancelot was concerned that the on-land test would not be the same as drilling interbedded chert and calcareous ooze which is causing some problems.

Wednesday, 3 May 1989

775 Relative Costs to Achieve Compatibility between DCS Hole Size and Logging

The relative costs to achieve compatibility between hole size and logging were presented. A basic problem is that the Diamond Coring System (DCS) is designed to be most effective while coring holes with diameters too small for the present suite of logging tools. Assuming the DCS might be deployed on the *Resolution*, Mike Storms presented the ODP-TAMU Engineering estimates of the relative costs to achieve compatibility between the 4-inch diameter borehole made by the DCS and the minimum 5-inch (preferably larger) borehole required to use the present suite of logging tools. It is estimated that reaming a preexisting 4-inch diameter, 500-m borehole made with the DCS, to a 7.5-inch borehole compatible with the present suite of logging tools, requires 17.5 days of drilling time and would cost $76K for the drilling hardware needed for just the reaming. The estimated cost for increasing the size of the borehole drilled by the DCS to 5 inches is $2.72M (mainly purchase of larger diameter drill string and its racking system), and would require 2-3 weeks in dry dock for modifications to the *JOIDES Resolution*. Drilling a hole greater than 6.5 inches in diameter with the DCS would require even more extensive modifications to the *JOIDES Resolution*. It was noted that reaming, besides being exceptionally slow, has its own particular drilling problems including sticking the pipe.

Rich Jarrard for WLS provided an estimate of $60K per leg to rent a basic logging tool assembly for a 4-inch diameter hole. That assembly, however, would sacrifice a considerable amount of valuable information that is obtained with the suite of logging tools currently in use. Modifying the present tools for use in a 4-inch hole would be prohibitively expensive, and in the case of geochemical logs, impossible to achieve. With the current budgets a choice between renting tools for high temperature logging and logging 4-inch holes would also have to be made.

A further cost-analysis on drilling a 4-inch hole with the Diamond Coring System for core recovery with a second but larger hole drilled (but not cored) for logging purposes will be prepared before the next PCOM meeting for mailing to PCOM. Theoretical studies of hole cooling by circulation of drilling fluids will continue by WLS for presentation at the next meeting. In any event, an increase in funding appears to be necessary to achieve compatibility between hole size and logging if the DCS is used.

Discussion

Kastner, Langseth and Brass all expressed concern that the wireline packer cannot be deployed in the 4-inch DCS hole. Brass and Kastner were also concerned with the effect of corrosive environments on the packer. It was pointed out that the primary goal of using the DCS is to recover core.

Brass wanted to know the advantage of drilling a second hole over reaming the 4-inch hole. Storms said reaming is often unsucessful due to problems peculiar to reaming. Brass was concerned that cores and logs would not come from the same holes.

Lancelot expressed concern that with only a slow increase in funding, the chance of a major breakthrough in drilling technology is slim. A series of failures will put ODP in a poor situation. ODP should drill what it can do the best now and wait until after 1993 and any major increases in funding to develop these drilling capabilities. Brass was concerned that if an attempt is not made to reach COSOD I & II objectives by 1993, then ODP is equally open to criticism.

Pisias wanted to know if going to the larger pipe limits the depth of drilling. Storms said that the pipe storage capabilities will be reduced from about 9 km to about 7 km with the larger pipe. Pisias said that the thematic panels should be aware of this limitation.

Leinen wanted to know if the 5-inch DCS system could be developed now. Storms said that the optimum way to proceed is to prove the concept of deploying the DCS from the drill ship with the 4-inch DCS system and then develop the 5-inch system. Jarrard asked if using the larger pipe precluded using the smaller pipe. Storms said that this would be so due to ship modifications for using the larger pipe.

Eldholm said that for some programs recovery of cores is the most important factor. A reduced logging and downhole measurements program may be necessary to attain some COSOD goals.

It was generally agreed that continued testing of the 4-inch DCS system concurrent with other development studies was the most realistic choice.

776 CEPAC Programs

PCOM watchdogs for CEPAC programs reported on their maturity. There was virtually no change from the PCOM Agenda Book summary. In the order of the listing of the last CEPAC prospectus, these were the programs of high thematic rank through fall 1988, and their PCOM watchdogs. R. Moberly attended the recent CEPAC DPG meeting, where on 12 April each program's status was reviewed and is summarized in brackets below. All need PPSP reviews.

Hawaii Flexure: G. Brass [Little new information, except a response from D. Kent on dating: paleomagnetism may give reversal datums but provides no precision between datums. GLORIA records show products of abundant mass wasting in moat and of extensive volcanism on arch.] TECP needs to decide if the dating resolution is sufficient to test the flexure models.

Chile Triple Junction: O. Eldholm [Processing of MCS is continuing. Recently acquired GLORIA data in the region. Final endorsement by TECP as a 1-leg or 2-leg program will depend on final presentation of data.]

Cascadia Accretion: D. Cowan [Safety preview was in March. Extensive MCS funded for Oregon margin for summer, and probably funded for Vancouver margin for summer].

Old Pacific: A. Taira. [Needs specific drilling sites based on what is available now; proponents are to prepare. Sites for the Pigafetta Basin will be readjusted after Y. Lancelot cruise in late summer.]

Atolls and Guyots: B. Tucholke [Evaluation of recent cruise information virtually complete. Proponents will have revised proposals by early June. Remaining problems: design of 1-leg vs 2-leg program; uncertain recovery in part of reef holes. CEPAC has recommended that a test of recovery methods be made on MIT Guyot on the next engineering leg.]

Ontong Java Plateau: M. Kastner [This was approved for the FY90 schedule. In response to PCOM's directive, CEPAC members and a guest from OHP prepared a 1-leg program, based on the L. Mayer et al combined proposal, of 4 sites for the Neogene depth-transect objectives and one deep site for the Paleogene and basement objectives. There have been questions about the assignments of co-chiefs.]

Eastern Equatorial Pacific: M. Leinen [Sites can be placed on the two long north-south transects after the funded site-specific survey at the end of this summer.]

North Pacific Neogene: Y. Lancelot [In response to PCOM's directive, CEPAC members and guests have prepared a l-leg program based on combining the three proposals. It will be sent to the thematic panels. No additional survey or processing seems necessary.]

Bering Sea: Y. Lancelot [In response to PCOM's directive, CEPAC members and guests prepared a 1-leg program based on the proposals. It will be sent to Thematic panels. Information is complete for two areas. Soviet geophysical data would aid site selection at Shirshov Ridge, where the ideal site probably would lie west of the US-Soviet treaty boundary. Direct Soviet participation in ODP would help, but there will be attempts anyway to acquire the Soviet data.]

Shatsky Rise: H. Jenkyns [Much depends on the ability to recover alternating hard chert and softer chalk or limestone lithologies, especially in nodular sections in which a nodular "roller" blocks the bit throat. CEPAC recommended a site on Shatsky for the next engineering leg. An additional old seismic line through Hole 47 has come to light. The scientific aims for the Ogasawara Plateau proposal seem to fit closer to Shatsky Rise than Atolls and Guyots.]

Deep Crust at 504-B: G. Brass [Awaiting the clearing of junk that is in the hole.] Hangups have been at expansion joints, so there may not be a buckle in the casing.

EPR Bare-rock Program: G. Brass [In March the revised D. Fornari et al. proposal was received. Objectives are keyed to the LITH White Paper, and an area at 9° 43' N was selected based on a synthesis of new and older information. The French proposal will be revised by late summer, for an area farther north. LITHP should evaluate these proposals next fall. There are requirements for obtaining core and fluid samples and measurements in young brittle rocks, some of which may be hot.

In preparation for legs in young basalt, CEPAC recommends that a test site in the Mariana trough be included in the nest engineering leg.]

Sedimented Ridges: M. Langseth [PCOM has charged a DPG to plan a site-specific program of two Juan de Fuca legs, one in the Middle Valley hydrothermal system, and one in the sulfide system to the south. The DPG, composed of the former Bare Rock and Sedimented Ridges working groups and chaired by Bob Detrick, meets 13-15 June in Ottawa. There are requirements for sampling and measuring hot and corrosive fluids.]

Young Hotspots: Loihi: R. Moberly [All survey work is completed. The petrologic objectives require obtaining young, brittle rocks. The natural-laboratory objectives are not compatible with the M. Purdy et al. request for a hole for a down-hole seismometer near Hawaii to detect teleseisms because Loihi itself is an active seismic source.]

777 FY90 Rescheduling: Engineering Development Legs

In light of the probable delay at Nankai and the initial statement by TAMU engineers that they would need about one year after Leg 124-E to prepare for another engineering leg, Moberly had asked L. Garrison and also CEPAC to prepare some draft schedules for a revised FY90 program. To accommodate these delays and minimize weather and transit difficulties, the drafts proposed that in addition to the legs previously accepted, there be included an Old Pacific leg and one leg of the Atolls and Guyots program, based on the maturity of those proposals and their thematic standing.

Evaluation of FY90 rescheduling commenced with extensive discussion of the Nankai program, because of concerns about: 1) the uncertain status of several of the geotechnical instruments scheduled to be deployed during the Nankai Geotechnical Leg (Navi-drill, Geoprops probe, TAM wireline packer); 2) the weather; 3) one-leg versus two-leg drilling strategies; and 4) which sites were the proper ones to drill.

Brass and Pisias were both concerned that the thematic panels have identified the Navi-drill and Geoprops probe as necessary for a successful leg. Jarrard said that fluids can be sampled from cores and the scales of permeability can be measured using other tools which are available. The tools under development will enhance the types of measurements that can be made but a successful program can be done with what is available. Brass questioned why delay the program if it can be done now. Both Langseth and Kastner said that although better results will be obtained by having these tools available, scientifically valuable results could be obtained without them.

Cowan asked that Taira explain why the science is important without the measurements made by the new geotechnical tools. Taira explained that the original proposal was made without Geoprops, using the packers that provided good results at Barbados. Nankai will provide major understanding of processes at accretionary margins even without the new tools. Shipley said that the FPAP view is that a spectrum of structures, sediment types, convergence rates and other parameters involved in accretion need to be studied. Nankai has good geophysical imaging, the sediments provide good reflections and structures show up well. Other margins such as Vancouver will eventually have this quality of structural imaging, but Nankai is the best right now. It also has more background information provided by extensive drilling in surrounding areas. The weight of information favors drilling at Nankai.

Cowan, Leinen, and Eldholm all wanted to know if a conventional leg at Nankai would be a significant advance without the geotechnical tools. Why not wait and make a quantum leap at Nankai? There was a general concern that delay of the leg after 1990 might result in postponement until near the end of the current drilling program. Both Pisias and Langseth were concerned that the Japanese have invested considerable money in arranging the oblique seismic experiment and the "ONDO" experiment. Coordination with the Japanese vessel requires that any postponement be until March, which will allow additional time for finishing the Geoprops tool. von Rad said that the SGPP minutes suggest that Nankai can be done successfully without Geoprops.

Moberly asked Taira what the drilling strategy would be if the Geoprops tool is not available. Taira said it depends on whether it is a one-leg or a two-leg program. In a two-leg program drill NKT 10 & 1 on the first leg and NKT 2 on the second; in a one-leg program drill NKT 2 & 1. Both Taira and Kastner absented themselves after answering questions during the following discussion and votes.

A poll of PCOM members showed that although an initial drilling leg would benefit from the use of the geotechnical instruments under current development, it was generally agreed that the scientific objectives of the Nankai Leg, as originally proposed, stand on their own without the Geoprops probe; therefore the following motion was made.

PCOM Motion

PCOM reaffirms its acceptance in the FY90 drilling program of a Nankai Leg , independent of the availability of the Geoprops tool. (Motion Pisias, second Watkins)

Vote: for 13; against 0; abstain 1; absent 2

Because of the questions about the necessity of delaying the Nankai program if it can be done now, the following motion was proposed. Discussion by Garrison pointed out that this time period is the worst weather at Nankai and it does not allow any possibility of having the Geoprops ready. Jarrard also said that the new SES will not be ready at that time and that this would result in greater danger of loosing the downhole experiments. Langseth also pointed out that the "ONDO" experiment cannot be done until after the beginning of March.

PCOM Motion

Schedule the Nankai Leg to be immediately after the dry dock. (Motion Brass, second Leinen)

Vote: for 0; against 12; abstain 2; absent 2 **(Failed)**

Since there was a general consensus that new engineering developments are essential for the continued success of ODP, and field testing is a necessary component of the development process, PCOM next discussed how to manage future Engineering Development Legs.

Pisias suggested that a rigid policy may not be attainable, since the scientific needs should determine priorities. He suggested that participation of scientists in developing these legs is essential and there should be both a scientist and an engineer Co-Chief Scientist arrangement. Eldholm said that flexibility is needed, but PCOM should establish the priorities. Proper preparedness is required before sea trials.

Lancelot said that some initiative by TAMU Engineering is good, they have undertaken the solution of general problems associated with drilling, however PCOM needs to set some priorities for engineering developments. Brass said that high priority scientific requirements must be translated into engineering developments. Kastner, Tucholke, and Jarrard all emphasized the need for flexibility.

Garrison and Storms both commented on the problem of poor site selection on Leg 124E. The options seem to be either to occupy sites drilled previously or to do site surveys as extensively as is done for science legs. Leinen noted that the site surveys do not have to be as extensive as for the science legs, since the science content does not have to be evaluated against other competing programs, but rather if the specific goal of the engineering test can be done at that site.

Storms suggested that the science staffing should be limited in number, but should include those persons who understand the long-term engineering development goals. Proponents of engineering developments should also be included.

<u>PCOM Consensus</u>

PCOM affirms the use of the ship's time for testing of engineering developments in joint science-engineering legs or within a scientific leg, as opportunities and the stage of developments allow. PCOM, however, will not include such uses of the drilling vessel without some assurances that the time will be used to good advantage, and therefore provides some guidelines as follows: PCOM in consultation with ODP-TAMU Engineering and with the advice of JOIDES Panels, will establish priorities for these legs, check that preparations for tests are adequate, and determine if the necessary site surveys are available for proper site selection.

<u>PCOM Consensus</u>

There will be both an engineer co-chief and a science co-chief on the engineering development legs. Although the scientific staffing of these legs should be minimal, staffing should include JOIDES panel members or other scientists concerned with the long-term engineering development goals, and proponents of the particular engineering development undergoing tests. During the leg itself, engineering operations will have priority over scientific objectives.

PCOM Consensus

Engineering legs will not be given an "E" designation, but will be sequentially numbered along with the scientific drilling legs.

PCOM Consensus

The next engineering development leg should be a joint science-engineering leg to test developments aimed at bettering the drilling and recovery of chert-chalk sequences, reefal limestones, and young brittle crust. The JOIDES structure will be asked to find appropriate sites at Shatsky Rise, M.I.T. Guyot, and in the Mariana Trough (if too deep, Bonin back-arc basin), as well as provide appropriate advice on a scientific Co-Chief and other staffing. TAMU's estimate of approximately two months of ship time was thought to be reasonable.

The draft insertion of two scientific legs and a longer science-engineering leg into the FY90 schedule would delay the transit east across the equatorial Pacific from Lau to 504B by about 5 months. Concerns expressed by Kastner, Brass and Pisias about the coincidence of the EPR drilling with the end of the current drilling program showed that PCOM members wanted no such delay. Lancelot absented himself from the room during the following discussion. The position of the four southwest Pacific legs (Ontong Java, NE Australian Margin, Vanuatu, Lau) on the program, including their weather constraints, was evaluated, but most discussion concerned Atolls and Guyots, Geochemical Reference, and Old Pacific. These three programs were examined carefully, including rankings, maturity of proposals, the weather, and transit backtracking. Pisias pointed out that Atolls and Guyots has not yet been evaluated thematically by OHP and SGPP. Revised proposals for Atolls and Guyots also have not yet arrived for review, precluding any decision about which leg of two potentially strong ones should be drilled first. Additionally, concerns by Tucholke, von Rad and Brass about low recovery of reefal limestones might be answered on the science-engineering leg. These concerns resulted in the following motion.

PCOM Motion

Remove Atolls and Guyots from consideration for the the FY90 drilling program. (Motion Leinen, second Eldholm)

Vote: for 12; against 0; abstain 3; absent 1

A discussion was held comparing Old Pacific and Geochemical Reference programs. Old Pacific had received high ranking from both TECP and the former SOHP panels, while Geochemical Reference had received high but not the highest ranking by the LITHP. Jenkyns suggested that there was some question about whether Jurassic oceanic crust and sediments would be found at the proposed sites for Old Pacific, and consequently a pilot hole drilled in the Pigafetta Basin during the Engineering Development Leg might be more appropriate. Since the goal of the Old Pacific program is to sample the oldest oceanic crust, this was not judged to be a problem. Langseth questioned whether the site survey data for Old Pacific will be ready for drilling. Sites can be chosen however, from the present data and subsequently adjusted based on data obtained from the cruise of Lancelot. This discussion led to the following motion.

PCOM Motion

Remove Old Pacific from consideration for the FY90 drilling program. (Motion Kastner, second Brass)

Vote: for 6; against 6; abstain 3; absent 1 **(Failed)**

A straw vote showed that the majority favored the substitution of Old Pacific, because of its higher thematic ranking, for Geochemical Reference. Tucholke expressed his concern with this substitution. The thematic rankings given to Geochemical Reference by LITHP and WESTPAC were reviewed. Moberly pointed out that such global programs as geochemical reference, excursions of the magnetic field, stress in the lithosphere, and seismic observatories generally will fail in head-to-head competition with many individual programs, yet the start must be made sometime. Leinen pointed out that LITHP ranked it behind both 504B and EPR drilling, for whose advancement in the drilling schedule this rescheduling is being done. It was suggested by Kastner that results from drilling Old Pacific will help to improve any future Geochemical Reference Leg and it is not lost forever from the drilling schedule. A subcommittee of PCOM, consisting of Eldholm, Falvey, Pisias and Taira with the help of Garrison, was appointed to suggest a schedule for drilling in FY90 from the accepted programs. This led to the following motion and consensus, that in effect substituted an Old Pacific Leg for the Geochemical Reference Leg previously scheduled for FY90.

PCOM Motion

PCOM adopts the following approximate schedule for the FY90 drilling program.

129	Nov.-Dec. 1989	2 mo.	Old Pacific
130	Jan.-Feb. 1990	2 mo.	Ontong Java Plateau
131	Mar.-Apr. 1990	2 mo.	Nankai
132	May -June 1990	2 mo.	Engineering (Shatsky, MIT, Mariana)
133	July-Aug. 1990	2 mo.	NE Australia Margin
134	Sep.-Oct. 1990	2 mo.	Vanuatu
135	Nov.-Dec. 1990	2 mo.	Lau-Tonga

(Motion Brass, second Langseth)

Vote: for 12; against 0; abstain 2; absent 2

PCOM Consensus

Following Leg 135 there will be a transit of the *Resolution* eastwards across the Pacific to Site 504B and East Pacific Rise to prepare for drilling in these locations.

For Co-Chief Scientists on the Old Pacific Leg, PCOM nominated in no order of preference: Y. Lancelot, R. Larson, P. Vogt (who were suggested previously by SOHP and CEPAC) and J. Natland.

778 General Track of the Vessel, Spring 1989 - Spring 1992

PCOM had not been meeting its obligation to determine the general track of the vessel sufficiently in advance to be able to allow for orderly site surveys and reviews and maturation of proposals. To attain again a four-year general plan, PCOM was to advance its planning in two stages one year apart. The main order of business for PCOM at Oslo was to have been to determine the general course of the vessel for the period between the end of FY90 planning, and three years in advance of drilling, or to Spring 1992. The main order of business at next spring's PCOM meeting was to have set the general course for four years in advance, or to Spring 1994.

PCOM planned the direction through calendar 1991, somewhat less that three years in advance of the vessel, namely the specific legs for FY90 (see preceding minute), and a general direction in the easternmost Pacific in calendar 1991 from among programs that had received high thematic ranking as suggested by Brass.

PCOM Motion

PCOM will schedule the general ship track for calendar year 1991 from among the following list of programs given high priority by the thematic panels: Cascadia Accretionary Prism; Chile Triple Junction; Eastern Equatorial Pacific Neogene Transect; East Pacific Rise Bare Rock Drilling; Hydrothermal Processes at Sedimented Ridge Crests; Lower Crust at Site 504B. (Motion Brass, second Kastner)

Vote: for 13; against 0; abstain 2; absent 1

The effect of this motion will be that at its November 1989 Annual Meeting, scheduling for the Program Plan for FY91 will (a) start with the two-month engineering operations and transit Leg 136, to clear the junk from the bottom of 504B and set two hard-rock guidebases on the EPR, followed by (b) selection of 10 months of scientific drilling from the 9 potential legs of the 6 scientific programs listed in the motion. Presumably, 5 legs will be selected on the basis of continued thematic evaluations, engineering developments, and proposal maturity, as well as weather and transit constraints.

Eldholm, Brass, von Rad, Watkins, Tucholke, Lancelot and Kastner all expressed concern that a reasonably sufficient opportunity has not been given for new and revised proposals to be submitted for thematic evaluation and ranking, before planning the general position of the vessel beyond 1991 and the end of the present program. Eldholm suggested that the drilling community must be made aware of the deadline involved if proposals are to be considered for drilling in this phase of the program before these slots are filled. Watkins suggested that if there is a perception that the ship will stay in the Pacific, then proposals for elsewhere will not get submitted. Proposals need to be in the JOIDES Office no later than August 15, 1989 if the thematic panels are to receive them by fall. The thematic panels will meet twice (early fall 1989, late winter 1990) to provide rankings before spring 1990, when PCOM will determine the general direction of the vessel through spring 1994. The PCOM Chairman is asked to call again for revised and new proposals, and to alert the thematic panels to their major responsibilities over the next two panel meetings.

779 Radioactive Isotopes and Enriched Stable Isotopes

L. Garrison requested from PCOM the time to collect a third core at a site in the Japan Sea, and his request raised an unexpected problem. UK microbiologists had proposed to the Science Operator to conduct C^{14} radiotracer experiments onboard the *Resolution* on on a third APC core collected for that purpose. This disclosure generated considerable controversy. PCOM was concerned (a) that radioisotope reagents (as opposed to the radioactive sources sealed in logging tools) were going to be used onboard the *Resolution*, even though their use might lead to contamination of the vessel and (b) that another experiment was to be conducted that had not gone through the proper review by appropriate JOIDES panels and which had not received PCOM approval. Brass and Kastner explained the difficulties in maintaining clean laboratories on the vessel. Kastner stated that, even though the proposal would not involve stable isotopes, it was exceptionally important to keep solutions of concentrated stable isotopes from the ship, as spills become impossible to detect. Kastner and Brass emphasized the necessity of totally banning under any conditions all enriched stable isotope solutions from the *Resolution*. Pisias said that any policy that is adopted should govern both enriched-stable and radioactive isotopes. Furthermore, Taira pointed out that without proper approval from Japan, the use of these radioisotopes could prevent the *Resolution* from entering Japanese harbors. It was agreed that a formal policy on the use of enriched stable and radioactive isotopes is needed for the *Resolution*. UNOLS guidelines were suggested as a starting place. Jenkyns said the UK deems this experiment extremely important. PCOM also recognized the importance of this experiment towards broadening the scientific base of ~~participation in ODP and~~ regretted that it had not heard of the proposed experiments until such a late date. It was suggested by Taira and Tucholke that alternative laboratories to the *Resolution's* could be used to conduct these experiments, either by transfer of the core ashore or onto another vessel. Taira indicated he would help to identify an onshore lab. These discussions produced the following motion and consensus.

PCOM Motion

Neither enriched stable nor radioactive isotope reagents will be brought onboard the *Resolution* until such time as the Shipboard Measurements Panel provides satisfactory guidelines for their use to the Planning Committee. (Motion Brass, second Falvey)

Vote: for 12; against 0; abstain 4

PCOM Consensus

PCOM endorses the use of ship time for obtaining a third APC core for the UK bacteriological experiment. The proposed experiments using C^{14} radiotracers cannot, however, be done at this time on the *Resolution*. Use of laboratories on another ship or shore-based laboratories is recommended for the C^{14} radiotracer experiments.

Thursday, 4 May 1989

780 Publications

The problem of publications was extensively discussed since a major criticism of reviewers of ODP has been the delay in publication of Initial Reports and Scientific Results, as well as the lack of thematic (synthesis) publications. Related is the problem that ODP publications have not become fully accepted as peer-reviewed literature, especially outside the drilling community. There is strong sentiment among some that policy be changed to favor a more immediate and unrestricted publication in the open literature. A return to the style and guidelines of DSDP days has also been suggested, which could even be speeded up because so much work can now be done onboard ship with computers. PEC II recommended that Part A [Initial Reports] be published so as to appear within one year of the end of the cruise, "even if this means some sacrifice in appearance and makes for unhappy paleontologists." Two-thirds of respondents to the IHP survey thought IR publication could be accelerated by 1 to 4 months. The present schedule calls for 14 months, but the IRs are appearing about 16 to 18 months post-cruise. With most IR material now ready for publication at the end of a leg, the main requirements for time seem to be for 1) biostratigraphic adjustments, 2) preparing or improving illustrations, 3) editing, and 4) printing and binding.

PEC II also suggested that "every effort be made to publish [Part B, the Scientific Results] in less than 30 months." Sixty per cent in the IHP poll thought the results should be published less than 30 months post-cruise; only 5% said 36 months or more. At present, 36 months is the target, but about 45 months is the actual time to appearance of the SR volumes. A major delay is post-schedule receipt (or non-receipt) of manuscripts from authors.

Discussion

Brass said that the Initial Reports are an effective way of communication, while it does impede publication in the open literature, this may not be a serious problem. Lancelot said the Initial Reports are a specialized literature that gives the permanent results of ODP research, however, faster publication in the open literature is required. Kastner agreed that more publication in the open literature is needed. Cowan said that Leg 110 has produced numerous publications in the open literature. Taira emphasized that what is needed is a less restrictive policy on individual publication in the open literature. Pisias cautioned against creating a free-for-all onboard ship, if there are not some rules about joint authorship.

Both Brass and Pisias suggested that the Initial Reports are always going to be viewed as a "grey" in-house literature and that it is a waste of time and resources to try and "bleach it". Pisias recommended adoption of the IHP suggestions. Eldholm agreed that the discussion should focus on the IHP recommendations. Lancelot, von Rad, Brass, Pisias, Leinen, Kastner, Eldholm and Tucholke all affirmed that what comes off the ship is what should be submitted to the printer 3-4 months post-cruise. Langseth suggested that some flexibility should be retained.

Tucholke said that the IHP suggestions for outside publications is overly restrictive. Publication of new ideas based on personal experience should be allowed without having to include the shipboard science party. Some flexibility must be allowed. Lancelot suggested that the Co-Chief Scientists and staff representatives could decide what can be published in the outside literature at the 3-4 month post-cruise meeting. Brass suggested that during the 12 month period following a cruise, any paper that has had its topic and authorship agreed to by the shipboard party could be published outside. Tucholke said that obligations to contribute to Part B may have to be redefined, so that the inclusion of reprints satisfy these obligations. Lancelot said that preprints of outside publications would also satisfy the obligation and could save time for the reviewers. Garrison expressed concern that permission from outside publishers would have to be obtained to include reprints or preprints.

Langseth voiced his concern that the persons who do the site survey work sometimes have their data published by others, they also need to be included in this process. Moberly said that the site survey chapter can include both the shipboard team and those who did the initial surveys. Brass noted that present policy allows site survey persons to be included at their wish. Pisias observed that site surveys are funded by outside agencies and sometimes done by scientists outside the JOIDES structure, and their publications cannot be restricted by ODP policy. Falvey said that the rights of the site survey data owners should be respected.

von Rad was concerned that the quality of Part B might be decreased if there is a mixture of reprints, preprints, and manuscripts. Lancelot suggested that it would increase the value of Part B. Garrison was concerned that problems with copyrights may increase publication time. Brass suggested that a cover letter be sent out by ODP to publishers stating that ODP reserves the right to reprint the paper in Part B. Brass, Pisias and Eldholm suggested that IHP needs to draft a policy for ODP concerning rights of site survey data owners, copyrights, etc. to be published in the JOIDES Journal.

von Rad asked what period of time the ODP publication policy would cover after a cruise, would it be 30 months? Tucholke, Cowan and Pisias suggested that 30 months for publication was not an unrealistic time. Tucholke said that the main need is to set a deadline for submission of manuscripts.

Langseth questioned the continued need for the Editorial Review Boards if PCOM is backing off from the intent to make the ODP literature "white".

PCOM Motion

PCOM endorses the publication policy outlined below and forwards it to EXCOM for adoption by ODP. (Motion Brass, second Eldholm)

Vote: for 14; against 0; abstain 2

ODP Publication Policy

In order to provide a framework for more timely publication, both in the ODP literature and in the open literature, while maintaining the integrity of the Scientific Results volumes, PCOM recommends the following policies for publications.

A. The Initial Reports volume will be scheduled to appear within one year of the end of a drilling leg. A small meeting of the co-chief scientists and key personnel, about 3 or 4 months post-cruise, will refine, edit, and complete the Initial Reports volume, which essentially will be what had been written onboard ship.

B. The Scientific Results volume will be scheduled to appear 30 months from the end of a drilling leg. The volume can be composed of contributions directly to the volume, as well as reprints and preprints of publications submitted to the open reviewed literature. These latter two options are subject to the following restrictions:

1. Any submission for publication within 12 months post-cruise must have had its authorship and theme agreed to by a consensus of the scientific party before the end of the cruise. The co-chief scientists will examine the manuscript to ensure that the agreement about theme and authorship has been fulfilled.

2. Any submission for publication between 12 months post-cruise and the fulfillment of the author's obligation to the Scientific Results volume must have had its theme and authorship agreed to by a consensus of the scientific party at the main post-cruise meeting. The co-chief scientists will examine the manuscript to ensure that the agreement about theme and authorship has been fulfilled.

3. After the author's contribution to the Scientific Results volume has been accepted, authors may publish at will in the open literature.

C. Within this policy framework PCOM will direct its Information Handling Panel to advise it of more detailed guidelines. They will include for example, issues regarding copyright, site-survey publications, lead times to meet publication dates, and editorial policy including the need for an editorial review board.

781 <u>Thematic Publications</u>

The subcommittee of PCOM on Thematic Publications chaired by M. Leinen recommended that thematic publications cover multiple-leg topics, focus on themes (e.g. processes, conceptual models, environments, history), and highlight ODP results in the framework of their influence and contributions to science. They suggest a "Dahlem Conference" model, where papers are submitted in advance as a pre-requisite for attendance; papers evolve as a result of interactions; volumes of papers are published quickly; and Dahlem conferences are familiar to geoscientists. Thematic panels would suggest appropriate themes. To begin with, funding would be from co-mingled sources (estimate around $50K). Publications of the volumes would be by firms or societies outside of ODP, such as AGU or Kluwer, which have experience with these types of publications. Other funding sources will eventually take over when the conferences are well established. Thematic symposia at meetings are also to be encouraged, especially those that result in special issues of journals. PCOM has asked the thematic panels to take the lead toward thematic publications. The PCOM chairman and PCOM liaisons will keep reminding panels of this responsibility.

Discussion

Tucholke said that in order to be sucessful it is essential to find someone who is motivated to prepare the synthesis volumes. Lancelot was concerned that adoption of the "Dahlem" model would prevent other ways of generating synthesis volumes from being tried. Cowan thought that this was the wrong approach as well, since it does not get a wider community involved and participating in ODP. Falvey agreed that wider community involvement is required, with more open symposia. Kastner expressed the concern that symposia volumes are also "grey literature".

782 Third-Party Tool Policies

Third-Party Tool policies were discussed. Keir Becker wants to turn over to ODP-TAMU the operation and maintenance of the drillstring saddle packer that he developed. Because that would involve future support by co-mingled funds rather than by US funds alone, any transfer should first be approved for reasons of scientific value by DMP (they have done so) and for policy by PCOM. TAMU Engineering has agreed to accept the packer for routine operations.

PCOM Motion

PCOM accepts the Downhole Measurements Panel's recommendation that the operation and maintenance of the drillstring straddle packer developed by Keir Becker be turned over to ODP-TAMU. (Motion Pisias, second Langseth)

Vote: for 14; against 0; abstain 2

The Downhole Measurements Panel has suggested guidelines for monitoring third party tools. A subcommittee of PCOM consisting of D. Cowan, M. Langseth and N. Pisias, examined these guidelines and recommended their adoption by PCOM.

PCOM Motion

PCOM accepts the guidelines for monitoring third party tools suggested by the Downhole Measurements Panel. (Motion Langseth, second Cowan)

Vote: for 11; against 0; abstain 4; absent 1

783 Rewording of Panel Mandates

Some rewording of panel mandates have been proposed and the following motion resulted.

PCOM Motion

PCOM recommends and forwards to EXCOM for approval the following proposed rewording of mandates:

1) The Technology and Engineering Development Committee was concerned that it is described as responsible for ensuring, rather than for recommending, the proper tools. In section 5, paragraph 1, change *ensuring that* to *recommending to the Planning Committee,* so that the paragraph now reads "The Technology and Engineering Development Committee (TEDCOM) is responsible for recommending to the Planning Committee the proper drilling tools and techniques to meet the objectives of ODP drilling targets, especially those for achieving highly-ranked objectives identified in ODP long-range planning."

2) Shipboard Measurements Panel noted that an important shipboard activity was left out in last year's attempt to stuff all activities into the mandate. In section 7.6.2(d), add *paleontological* and *micropaleontological* to the listing so that the paragraph now reads "(d) Petrological, mineralogical, sedimentological, biological, paleontological, micropaleontological, organic and inorganic geochemistry analysis, and such equipment as microscopes for performing these measurements;"

3) Ocean History Panel requested that the phrase *ocean paleoproductivity* replace the phrase *sedimentation patterns* in view of the fact that this concisely describes one area of particular concern, so that section 4.5 now reads: "(a) Long-term history and driving mechanisms of the evolution of the ocean, atmosphere and biosphere. Central to this theme are relations among plate tectonics and ocean paleocirculation, ocean paleoproductivity, global paleoclimates, glacial and ice-sheet evolution, sea level change and its effect on marine sedimentation and evolution of marine life."

(Motion Langseth, second Eldholm)

Vote: for 15; against 0; abstain 1

784 Long Range Planning Document

The Long Range Planning document was reviewed. A new section on costs has been added. Pisias wanted to acknowledge the contributions of the thematic panel chairmen, L. Mayer, R. Detrick, I. Dalziel, E. Suess and N. Shackleton as well as input from PCOM members G. Brass, D. Cowan and J. Malpas. Pisias said that it appears that ODP has reached the optimum balance between the pace of engineering development and design of scientific drilling experiments.

Discussion

Langseth suggested that the hole diameter for the DCS should on page 67, be left more flexible than specifying that the 4-inch DCS system would be used. TEDCOM had suggested that the budget for engineering development was too low by a factor of 2, but since ODP-TAMU Engineering has a history of accomplishing their development for less than industry estimates, this was judged not to be a problem.

Cowan had some reservations about targets for future drilling on page 46-47; he thought the themes should be limited to focus on 4 items. Pisias said this was to provide an estimate of the level of effort required to accomplish drilling themes that are hard to do but thematically important. Moberly and Leinen both stressed the importance of including topics of interest to a broad community.

Eldholm thought that achievements should be emphasized more strongly. von Rad and Falvey agreed to write something about the benefits of ODP techniques to the oil industry.

JOI will be doing the production work, improving the look and style of the document. Any good figures or comments should be sent to JOI. An executive summary is required.

PCOM Motion

PCOM endorses the Long Range Planning document and forwards it to EXCOM for adoption by ODP. (Motion Leinen, second Brass)

Vote: for 16; against 0; abstain 0

785 Liaisons

The problem of liaisons was discussed. In many instances the need to exchange information more rapidly and completely than by mailed minutes requires liaison by individuals at meetings. The cost in man-hours and travel funds, however, may outweigh the usefulness of liaison. The recent change in the number of thematic panels and the elimination of regional panels, has led to some important gaps in liaison. There has been some confusion on liaison procedures. In many instances it may be more appropriate to ask for a guest or guests to attend a meeting to provide specific information, rather than have a formal liaison.

PCOM Consensus

Having previously accepted the principle of double liaisons between certain thematic panels, the suggested liaisons are approved. Other liaisons between panels will be approved on an *ad hoc* basis by the PCOM Chairman. PCOM reaffirms that panel liaisons to or from DPGs are not acceptable and that having panel members on DPGs is preferred to liaisons.

The attempt to provide mutual information and cooperation between JOIDES and other large international programs in the earth and marine sciences will require liaison or some sort of *ad hoc* committees. T. Pyle has informally contacted some of these programs about establishing more formal links with ODP. Several of these groups already have members who overlap with the JOIDES advisory structure. Pisias suggested that Pyle contact these programs and ask if they approve of establishing liaisons and whether overlapping members were appropriate.

PCOM Consensus

Establishment of liaisons between ODP and other international science efforts is desirable. If acceptable to these organizations, liaisons will be overlapping members of the JOIDES advisory structure and these other organizations.

The following liaisons established between PCOM and panels take into account impending changes in PCOM membership.

	TECP	LITHP	SGPP	OHP	TEDCOM	IHP	SSP	SMP	PPSP	DMP
J. Austin						•				
G. Brass				•	•					
M.Cita-Sironi								•		
D. Cowan										•
R. Duncan		•								
H. Jenkyns				•						
M. Kastner			•							
Y. Lancelot						•	•			
M. Langseth										•
M. Leinen								•		
J. Malpas		•								
R. Moberly									•	
A. Taira	•									
B. Tucholke	•									
U. von Rad			•							
J. Watkins							•			

PCOM Liaisons to DPGs

M. Langseth & M. Kastner	SRDPG
M. Leinen & R. Moberly	CEPAC
A. Taira	WPAC

786 Choice of Co-Chief Scientists

The problems associated with choosing Co-Chief Scientists and scientific staff had considerable discussion. Lancelot was concerned that in some instances the Co-Chief Scientists are chosen based on politically made decisions, rather than the best choice based on the science objectives. Proponents of drilling are the ones whose ideas drive the program. They invest time and effort to bring proposals to maturity and then someone else runs the cruise and the person with the best ideas is not in a position to make sure the science is done correctly. Because ODP is proposal driven, we need to have proponents onboard the ship. PCOM needs to take the position that science should lead more than politics. Brass agreed with Lancelot that relaxation of the rule that countries should expect one invitation of a Co-Chief per year. A greater emphasis should be placed on nomination of proponents of drilling where appropriate. Pisias said that PCOM should identify proponents. Garrison said that it has never been said that a proposal is a guarantee of participation. TAMU investigates candidates for Co-Chief Scientists by talking to thematic panels and concerned individuals both in the US and overseas, but has the right to choose who they see best fit to accomplish the science.

PCOM Consensus

Because the Science Operator is no longer obligated to select the Co-Chief Scientists from the rankings provided by PCOM and because ODP is now driven by thematically ranked scientific drilling proposals with the need to encourage proponents to invest the time and effort necessary to bring drilling proposals to maturity, PCOM recommends to EXCOM a change in emphasis for choosing the Co-Chief Scientists on drilling legs away from maintaining a political balance and more towards encouraging the participation of the primary science proponents without regards to nationality. The same recommendation holds for the staffing of the remainder of the scientific party. The wording of the MOU allows this flexibility.

787 Miscellaneous Business

Present core-sampling policy is so restrictive that it causes problems in obtaining the necessary sampling density for many isotopic and paleomagnetic studies of sedimentary sections and petrological studies of igneous cumulate sections. For the sedimentary sections adequate sampling is not allowed unless a section has double or triple coring runs, thus creating difficulties in scheduling logging and additional sites in a leg. Brass pointed out that this was an OHP concern, and high resolution studies are a critically important part of the science done on these legs. Leinen said that SMP has also made this recommendation.

PCOM Consensus

PCOM in principle endorses the use of cores for high resolution studies. The Information Handling Panel is asked whether a change in sampling density, additional APC cores or other policy is recommended.

In response to a request from Robert Ginsburg, Malfait stated that there has been a precedent that PPSP might review non-ODP proposals. Therefore PCOM approved the following.

PCOM Consensus

PCOM has no objections to the Pollution Prevention and Safety Panel conducting a safety review of the non-ODP drilling of the Bahamas Bank proposed by Robert Ginsburg.

788 Panel Membership

Moberly discussed the overall balance of the JOIDES advisory structure, with panel memberships and chairmanships approximately balanced in the US between JOIDES Institutions and Non-JOIDES Institutions (Appendix F). Memberships and chairmanships are also approximately balanced between the US and Non-Us Partners.

Panel membership decisions were made for the following panels.

LITHP is directed to examine its expertise to see if the present membership is adequate.

OHP new person to be invited to join the panel is Lisa Pratt. In recognition of his service to ODP and to complete his term of panel membership, Larry Mayer can attend the fall OHP meeting as a member of the panel. A new panel member with seismic stratigraphy interpretation expertise needs to be nominated for next year.

SGPP needs to evaluate its membership and make suggestions.

TECP new persons to be invited to join panel are Eldridge Moores, Kim Klitgord, and Dale Sawyers.

DMP new person to be invited to join the panel is Mark Hutchinson.

IHP new persons to be asked to join the panel are Will Sager and Bill Riedel.

PPSP members are to be asked to designate alternates who can cover meetings when they are unable to attend.

SMP has a new international partner member from the UK, R.B. Whitmarsh.

SSP new persons to be invited to join the panel are Jim Hedberg, Kim Kastens and Dick von Herzen.

CEPAC membership was discussed since there was a concern about who will be making the detailed programs for drilling in the Eastern Pacific. PCOM members are to make suggestions about who might move from thematic panels to CEPAC to provide the necessary expertise for preparing drilling programs for: Cascadia, Chile Triple Junction, Eastern Equatorial Pacific Neogene and ERP Bare Rock Drilling.

789 Possible New Detailed Planning Groups

Two new Detailed Planning Groups have been proposed. TECP has requested an *Accretionary Wedges DPG*, to evaluate, clarify objectives, and coordinate plans for Nankai, Cascadia, and Barbados programs. It would include considerations of fluids and gas hydrates, as well as structural and tectonic ones. Their proposal is for a joint TECP and SGPP group (i.e., making recommendations to both thematic panels), perhaps based on the membership of the ad hoc working group on Fluids in Accretionary Prisms. Langseth and Brass both observed that the proposed DPG would be doing the job of TECP and is therfore not needed. Eldholm pointed out that FPAP has yet to submit its report.

LITHP has recommended that a *Deep Crustal Drilling DPG* be formed early in 1990 to consider site selection criteria for deep crustal drilling sites and to consider specific proposals. Without any current need having been established, it was decided that no new DPGs would be formed at this time.

790 Effect of Site Surveys on a Thematic Program

A discussion was held about site surveys and how they affect drilling plans. Brass and some other PCOM members were dismayed that NSF Guidelines favoring proposals for surveys in the Atlantic Ocean may have the effect of returning ODP to a regionally driven program. It was pointed out by Malfait however, that the time between surveys and drilling is commonly four or more years, and so there should be no significant effect resulting from these guidelines (Appendix G).

791 Future Meeting Schedule

The next PCOM meeting will be held in Seattle, Washington on 22-24 August, 1989 and will be hosted by the University of Washington. A one day field trip is scheduled for Monday, 21 August to the San Juan Islands. The University of Washington will be within walking distance of the hotel.

The 1989 Annual PCOM meeting will be held at Woods Hole, Massachusetts on 27-30 November, 1989 and will be hosted by the Woods Hole Oceanographic Institution. It will be preceded by the Panel Chairmen meeting on 26 November. A glacial geology field trip of Cape Cod is tentatively scheduled.

The 1990 Spring PCOM meeting is scheduled near Nice in the South of France on 24-26 April, 1990.

The 1990 Summer PCOM meeting is tentatively scheduled for the 7-9 August 1990 to be hosted either by the Hawaii Institute of Geophysics or Scripps Institution of Oceanography.

The 1990 Annual PCOM meeting is tentatively scheduled for 26-29 November, 1990 to be hosted by either Scripps Institution of Oceanography, the Hawaii Institute of Geophysics or elsewhere. It will be preceded by the Panel Chairmen meeting on 25 November.

792 Conclusion of the Meeting

The Planning Committee expressed appreciation to the following persons:

Olav Eldholm, Nick Pisias and Tom Shipley for their dedicated service on PCOM.

Nick Pisias for his long-enduring efforts in developing and adjusting the Long-Range Planning Document.

Grete Andresen, Olav Eldholm and Bjørg Stabell for their efforts towards making this meeting both productive and enjoyable.

The 1989 Spring PCOM meeting adjourned at 4:12 PM so that participants could view the demonstration by N. Pisias of the CD ROM method of storing and retrieving drilling data using the NGDC disk and the computer facilities at the Institutt of Geologi of the University of Oslo at Blindern.

APPENDICES TO 2-4 MAY, 1989 OSLO PCOM MINUTES

A List of handouts at 2-4 May PCOM meeting

B FY 1989 and 1990 NSF Budget and Other Items

C JOI FY89-90 Budget Summary and Summary of FY90 SOE

D Participant Tally by Country for Shipboard Scientists and Co-Chief Scientists

E Drilling and Logging: Leg 124 - 125

F Representation in the JOIDES Advisory Structure

G Field Program Planning

OCEAN DRILLING PROGRAM

SITE SURVEY PANEL MINUTES

Naniloa Hotel
Hilo, Hawaii

April 10 - 12, 1989

Present:

Greg Mountain* (Chairman, USA)
Fred Duennebier* (USA)
Rob Kidd* (UK)
Birger Larsen* (ESF)
Steve Lewis* (USA)
Keith Louden* (Canada/Australia)
Heinrich Meyer* (Germany)
Guy Pautot* (France)
Kiyoshi Suyehiro* (Japan)
Mahlon Ball (PPSP)
Carl Brenner (Data Bank)
Suzanne O'Connell (TAMU, alt. for A Meyer)
Laurent d'Ozouville (JOIDES Office)
Tom Shipley (PCOM, alt. for J Watkins)
Doug Bergensen (HIG)

* panel members

SSP EXECUTIVE SUMMARY HILO HAWAII APRIL 10-12 1989

1. Site Survey Panel concentrated primarily on reviewing the status of CEPAC programs at its Hawaii meeting - one afternoon was spent in joint session with the CEPAC/DPG who were also meeting in Hilo.

2. Updates on scheduled and remaining WPAC legs were discussed, as well as the effects on site survey progress of likely changes in order of drilling being contemplated by PCOM. Delays in development of critical drilling tools may mean the early insertion of "Atolls and Guyots" and "Old Pacific" programs.

3. SSP noted good progress with most programs but highlighted problems with survey data for Shatsky Rise and the drilling location suggested for Osawara Plateau. There were no new developments reported at this meeting on Japan Sea II, EPR Bare Rock, Eastern Equatorial Pacific and Lower Crust 504B drilling.

4. Proponents have been asked to deposit data in the Site Survey Data Bank for the Hawaii Flexure, North Pacific Neogene, Bering Sea and N.W. Australia drilling proposals.

5. At the request of proponents, SSP provided advice on survey data to be collected on cruises in support of Oregon Margin, Vancouver Margin and 'Sedimented Ridges' proposals.

6. SSP requested that proponents of the North Pacific Neogene proposals prepare alternate as well as prime site data packages to allow for flexibility at sea should unexpectedly incomplete stratigraphic sections be encountered. Data necessary for some targets is held by Russian institutions. The Panel urges PCOM to once again, request that EXCOM do whatever is proper to ensure a speedy return of the Soviet Union to JOIDES.

7. SSP voiced concern that the progress of drilling proposals through the 'new' thematic structure could mean that shortfalls in survey data could be picked up too late for remedy; also that 'shelved' drilling proposals might be resurrected by thematic panels and they may not satisfy current survey standards. SSP will aim to operate under the new proposal guidelines but will put in place a procedure for tracking new and resurrected proposals through reports by JOIDES Office and Data Bank representatives at each SSP meeting.

8. Rob Kidd took over as Chairman of SSP at the end of the meeting from Greg Mountain, who is moving to NSF after an all-to-short term as SSP Chairman. The Panel thanked him for all his considerable efforts on SSP and wished him every success in Washington.

ACTION ITEMS - SSP HAWAII APRIL 1989

1. ACTION: JOIDES liaison Laurent d'Ozouvile is asked to bring to each SSP meeting information regarding old drilling programs resurrected since the previous panel meeting.

2. ACTION: Data Bank Manager Carl Brenner will log each proposal as it arrives from the JOIDES office, conduct a cursory assessment of data availability (NOT a complete archival search), and present this list of new arrivals at each meeting of the SSP.

3. ACTION Re-iterating its request from the last meeting, SSP asks that Jack Baldauf prepare a history of mini-cone deployment and its performance in various surficial sediment types and forward this information to Rob Kidd.

4. ACTION: After panel discussion, it was agreed that Louden will draft a letter as an SSP response (this WILL INCLUDE STRONG EMPHASIS ON NEED FOR 3.5 KHZ,THE VALUE OF STRIKE LINES, EFFICIENCY OF HI-RES SCS AND WILL RECOMMEND SOUND SOURCES

5. ACTION After panel discussion . Keith Louden will draft a letter as SSP recommendation on the Vancouver Margin WHICH AGAIN WILL INCLUDE STRONG EMPHASIS ON NEED FOR 3.5 KHZ, THE VALUE OF STRIKE LINES, THE EFFICIENCY OF HI-RES SCS AND WILL RECOMMEND SOUND SOURCES.

6. ACTION Keith Louden will contact Sedimented Ridges proponent Earl Davis requesting information pertinent to SSP needs regarding 1) Davis' upcoming cruise to Middle Valley, and 2) results of the working group meeting to be held in Ottawa this summer.

7. ACTION Carl Brenner will contact Dave Clark and Bill Normark to request USGS SCS data from north of Hawaii be deposited in the Data Bank. Furthermore, Carl will notify drilling proponents of SSP's perceived importance of this new data source, and urge that they examine these and all other profiles to identify the lines of highest acoustic resolution.

8. ACTION Fred Dunnebier will ask Loren Kronke to check on possible 1970? HIG SCS profiles over Ontong-Java Plateau. Also noted was a Kronke proposal for a 1980 cruise that could collect relevant data. Given the short lead times SSP will track these developments, should basement objectives continue to be pursued.

9. ACTION Carl Brenner will contact Andy Stevenson and request that the USGS data in the vicinity of Detroit Seamount and Meiji Drift be submitted to the Data Bank.

10. ACTION Carl Brenner to contact Andy Stevenson and request the USGS data in the vicinity of Unmak Plateau and Sounder Ridge.

11. ACTION Guy Pautot will draft a letter to Yves Lancelot, to be reviewed by the Panel at the end of the meeting, outlining SSP's interest in equipment and navigation for this summers's cruise. Furthermore, because of the possibility that the Old Pacific program could be inserted into the FY'90 schedule, an especially rapid data analysis will be required for these data to be useful.

12. ACTION Kidd will contact Audrey Meyer at TAMU for information on their needs for setting cone and casing at Bon-8 and Mar-5.

Carl Brenner also prepared a data package for Mar-5 - this he will make available to proponent Natland.

13. ACTION Rob Kidd will provide JOIDES office with some text to add to its guidelines for proponents pointing out the possible desirability of submersible data under the heading "high resolution imagery".

14. ACTION: Carl Brenner to supply statistics on Data Bank to Greg Mountain who will complete the letter to PCOM as input to the ODP Accomplishments Document.

15. ACTION: Rob Kidd will transmit to Moberley SSP's preferred choices for a USSAC member from the list provided by PCOM.

16. ACTION: Rob Kidd will transmit to Ralph Moberley SSP'S suggestions for a US institutional replacement for Greg Mountain who is moving to NSF.

17. ACTION: Rob Kidd is to supply JOIDES office with provisional information on the Hannover meeting as soon as key arrangements can be made by Henrich Meyer.

SITE SURVEY PANEL

Hilo, Hawaii
April 10-12, 1989

MINUTES

I PRELIMINARY MATTERS

The meeting began shortly after 9 am. Chairman Greg Mountain welcomed returning panel members and liaisons, and introduced new members Keith Louden, Guy Pautot, and alternate liaisons Suzanne O'Connell and Tom Shipley. Host Fred Duennebier welcomed the attendees to Hawaii, introduced guest Doug Bergensen and outlined logistical details and events that have been arranged. There were no changes to the minutes from the previous meeting. Ship schedules were collected (Appendix A1-A6). Ralph Moberly stepped into the meeting room to request that, in addition to the four programs already planned, SSP be prepared to discuss "Atolls and Guyots" and "Old Pacific Crust" during the afternoon's joint session with CEPAC-DPG. Tom Shipley requested time be allotted towards the end of the meeting to present the survey opportunities provided by 3-D seismic techniques. Greg Mountain read a letter from Ralph Moberly (March 23) addressed to all panel chairpersons, requesting comments on ODP benefits and accomplishments. Discussion of Mountain's response, not yet delivered, was inserted into the agenda.

II REPORTS

I PCOM (Tom Shipley)

Due to delays in the development of the GeoProps tool, the Nankai drilling program scheduled by PCOM during its December meeting in Miami may be postponed. Earliest readiness for this critical technology is late May, 1990. Though the experiment to devote Leg 124E to engineering tests proved valuable, it may not be repeated by a similar Leg 129E, as was scheduled at the December PCOM meeting. Because of these changes, it is possible that the "Atolls and Guyots" plus "Old Pacific" programs may be inserted into the 1990 schedule; these and other options will be discussed at the May PCOM meeting.

PCOM continues to be concerned about the rate at which both the Initial Results and Scientific Results volumes are being published; significant changes regarding this issue will be discussed at the next meeting. Laurent d'Ozouville mentioned that at the March meeting of IHP, changes were made in the schedule of post-cruise meetings: paleontologists will now be urged to meet 6 months after a cruise to firm up their biostratigraphies; the entire ship's science staff will assemble for its traditional post-cruise meeting 6 months after that. Laurent pointed out further that IHP has circulated a questionnaire regarding publication issues to 600 members of the marine science community, about 25% have responded.

PCOM notes that with this years 2% rise in the producers' price index there will be a commensurate rise in the operational costs of the JOIDES Resolution.

2 JOIDES (Laurent d'Ozouville)

Of the fifteen proposals deposited in the JOIDES office since our meeting in October, six represent entirely NEW drilling programs. A lengthy discussion followed concerning the time and route by which drilling proposals are delivered to SSP for assessment of survey adequacy. Laurent presented a graphic outline of the sequence of events between the time of proposal deposit and actual drilling (Appendix A7). Of concern to members of SSP is that in this scenario they will be furnished with programs to assess only after all thematic panels have completed their initial evaluations, returned them to PCOM and PCOM has sorted out the various recommendations. This process may take considerably longer than the 6 months implied by this diagram. Furthermore, it is likely that specific site survey recommendations may only be possible to make after DPGs have completed their tasks of picking exact site locations. Consequently panel members expressed concern that site survey assessments may in some cases flag shortfalls long past the time at which remedies can be made.

It was pointed out that an uncertain (but probably significant) number of approved programs have gone undrilled and remain in the system as "shelved" proposals. Any of these may be resurrected and placed onto the drilling schedule as interest is rekindled by 1) technological developments not available in the past, 2) redefinition of thematic interests, or 3) geographic proximity to a target region passed up previously for any of a number of other reasons. That such shelved programs satisfied site survey standards several years ago does not mean that each should automatically by-pass present-day SSP review. After much discussion it was agreed that SSP would aim to operate under the schedule as laid down in the graphic outline of the JOIDES Journal "Guidelines" issue (Dec '88) but would put in place a number of procedures aimed at tracking new and resurrected proposals.

ACTION: JOIDES liaison Laurent d'Ozouvilee is asked to bring to each SSP meeting information regarding old drilling programs resurrected since the previous panel meeting.

The JOIDES office presently distributes copies of new proposals to the Data Bank at the same time that it sends copies to each of the thematic panels. Until the influx of new and revised proposals becomes prohibitively large.

ACTION: Data Bank Manager Carl Brenner will log each proposal as it arrives from the JOIDES office, conduct a cursory assessment of data availability (NOT a complete archival search), and present this list of new arrivals at each meeting of the SSP.

The SSP Chairman will assign watchdogs to be responsible for overseeing the progress of both these resurrected AND new proposals through the review system.

3 Annual Chairperson Meeting (Greg Mountain)

Issues discussed at the annual panel chairpersons meeting in Miami were reported by chairman Greg Mountain. Progress on the "Long Range Drilling Plan" was presented in Miami by lead author Nick Pisias. When complete, this document will represent a "sales" brochure to the international community for drilling past FY93. The final draft is due for submission to PCOM in May '89; discussion among the non-US partners will continue through Oct '90 to be followed by presentation to the US Science Board in Oct '92. Nick Pointed out the lack of justification for both a permanent alternate platform and for deep riser drilling. Larry Mayer noted the apparent inconsistency that despite the widely recognised need for developing new engineering technologies that will be required past '92, the budget is fixed from now until then in the support of science. A total of sixteen drilling issues are described in the long range plan; the panel chairpersons commented that grouping under a small number of themes would be helpful. Several renditions of these groupings were discussed, with a leading foursome as follows:

"Structure and Composition of Oceanic Crust and Mantle"
"Causes and Effects of Oceanic Climate and Variability"
"Fluids in the Lithosphere"
"Dynamics, Kinematics, and Deformation of the Lithosphere"

Aspects of the new panel structure were discussed in Miami. Those present endorsed the use of "double liaisons" among most thematic panels. Features of Detailing Planning Groups (DPGs) were identified as follows they will be regional, ad-hoc, short-lived groups of experts drawn from a range of places both within and perhaps from outside the drilling community; they will likely include drilling proponents. Their recommendations will feed back to the specific thematic panel that formed them, not to PCOM. In essence, PCOM will establish drilling schedules, thematic panels will determine program rankings, and DPGs will select specific drill site locations.

Considerable discusion developed in Miami regarding problems concerning the publication of both the Part A (Initial Reports) and Part B (Scientific Resulsts) volumes of ODP reports. Highlights of possible changes included 1) shorten deadlines for Part A and/or for Part B; 2) release participants to publish outside of Part B before they submit their ODP manuscripts; and 3) eliminate Part B entirely, and periodically gather reprints into thematic issues.

CEPAC chairman Dave Rea reported in Miami that engineering development will be essential to the success of many CEPAC objectives. He noted further that engineering tests scheduled for 124E will not evaluate the following: improved recovery in chert/chalk sequences (chert/clay is to be penetrated on Leg 124E); reef limestone; and high temperature environments.

4 TAMU (Suzanne O'Connell)

A. Leg 124 E

The results of Leg 124E were summarised (Appendix A8). If additional engineering tests are conducted in the future, it is hoped that, as was done with 124E, SSP can provide assistance in the selection of all sites. The panel emphasizes the wisdom of returning to previously completed drill sites to minimise the chance of encountering unforseen hole conditions that can only complicate the already difficult task of evaluating the performance of new drilling technologies

B. Underway Geophysics

In the continuing discussion between TAMU and SSP concerning underway geophysics aboard the JOIDES Resolution, a response to our last assessment of capabilities and future needs was presented (Appendix A9).

Upon enquiry from the Panel, Suzanne stated that the operator emphatically holds the point of view that conducting reconnaissance geophysical surveys aboard the Resolution should not pre-empt the primary task of recovering cores. Effort should be expended in collecting opportunistic data between sites, but some question remains as to the need to prepare real-time navigation.

Steve Lewis expressed the view that site approach surveys, though short in time, are absolutely essential and require real time navigation and data assessment. He pointed out further that experience on Leg 124 showed that the re-location of the sonar dome forward of the moon pool has resulted in excellent 3.5 KHz records upt to 8 knots, with rapid deterioration above that speed. Fred Duennebier considered that there exists little chance for additional improvement.

C. Mini-cone

Contrary to general opinion, development of the free-fall "mini-cone" is a complex task that can take 18 hrs or more to complete. The TAMU engineers point out that in some cases pulling clear of the bottom and offsetting to a new hole may entail less time.

ACTION Re-iterating its request from the last meeting, SSP asks that Jack Baldauf prepare a history of mini-cone deployment and its performance in various surficial sediment types and forward this information to Rob Kidd.

5 PPSP (Mahlon Ball)

Mahlon first responded to an SSP request from its Swansea meeting that JOIDES distribute to proponents a safety guidelines package as new proposals arrive. He pointed out that the summary guidelines of PPSP were now included in both the New Joides Journal guidelines issue and in the information package sent out to potential proponents by Joides Office.

He distributed a review paper on hydrocarbon shows in cores taken by DSDP and ODP (Katz, B and K. Emeis, 20th Annual OTC, May 2-5 1988, pp 423-430) and noted that PPSP had liased with TAMU to ensure that the review data is regularly updated.

Mahlon reported that all sites have been approved for drilling in the Japan Sea (both Legs 127 and 128). He added that the safety review for both Japan Sea legs went smoothly, due in large measure to the excellent preparation by the co-chief scientists. SSP feels this was due in part to the cooperation that developed between the site proponents, PPSP and SSP during the review process, and the resulting effort made by all concerned that potential safety concerns be dealt with as soon as they were recognized. We look forward to future programs proceeding through the review process as well.

Because of safety concerns for the Cascadia program, a preliminary examination was conducted during the last meeting of PPSP. Numerous BSRs are observed in profiles offshore Vancouver,but PPSP feels that a properly designed survey grid can yield drillable targets. By contrast, no BSRs are known from the Oregon margin. H2S occurences are known (a potential hazard for drill floor fires if found as a free gas), but occur only in the dissolved phase.

6 DATA BANK (Carl Brenner)

The FY'90 budget has been submitted and approved by JOI, Inc. It contains a 4% increase over last year, amounting to 216K. The full-time secretary
left the Data Bank last September; many clerical tasks are now handled by a recently purchased Macintosh. The pending budget request includes 4 mos. per year for a computer operator/secretary to assist in clerical matters as well as in maintaining the digital data base of Data Bank archives.

Carl reviewed an analysis (prepared with help from Jeff Fox) of reproduction costs of the EPR data synthesis charts. It seems likely that these costs prohibit the wide distribution of additional sets of hard copies. Undoubtedly the 'atlas' will be a valuable guide for developing a final drilling program on the EPR, but SSP points to the need to investigate further other means of distributing this survey information. One suggestion is on CD-ROM.

In response to SSP's request at the last meeting, Carl has contacted Alan Cooper and requested submission of reprocessed JOIDES Resolution seismic lines collected in Prydz Bay during Leg 120.

III SITE SURVEY STATUS OF UNSCHEDULED PROGRAMS

1. Cascadia (Keith Louden)

Two drilling programs comprise the composite Cascadia program. No prioritization by the thematic panels has yet been determined. PPSP has conducted an early pre-site survey review.

Ten drill sites are proposed on the Oregon margin. In contrast to the active margin targets off Japan and Barbados where vertical heat loss/fluid flow gradients and fine-grained lithologies are found, respectively, these off Cascadia are designed to yield information about lateral contrasts of these properties in coarse-grained sediments. A considerable amount of survey data exists in the region (much of it summarised in an OMD Atlas), including recently declassified SeaBeam bathymetry. With the exception of MCS profiles, ample information is available for site selection. MCS data will be collected on the 'Washington' this summer. Chief Scientist Vern Kulm contacted Carl Brenner for recommendations regarding features of this survey that would satisfy SSP requirements.

ACTION: After panel discussion, it was agreed that Louden will draft a letter as an SSP response (this WILL INCLUDE STRONG EMPHASIS ON NEED FOR 3.5 KHZ,THE VALUE OF STRIKE LINES, EFFICIENCY OF HI-RES SCS AND WILL RECOMMEND SOUND SOURCES

Five sites have been proposed for drilling on the Vancouver margin. The very complex structural fabric of the Oregon margin calls for detailed seismic control in that region; equally detailed control is needed on the Vancouver margin because of the presence of BSR's. One site is intended to pentrate the base of the clathrate zone, and will require an especially detailed near site survey. An appreciable amount of data exists at present, but for adequate site selection and safety consideration, additional MCS profiles are needed. These will be acquired this summer by an industry vessel. Roy Hyndman has requested SSP input into the design of this survey program.

ACTION After panel discussion Keith Louden will draft a letter as SSP recommendation on the Vancouver Margin WHICH AGAIN WILL INCLUDE STRONG EMPHASIS ON NEED FOR 3.5 KHZ, THE VALUE OF STRIKE LINES, THE EFFICIENCY OF HI-RES SCS AND WILL RECOMMEND SOUND SOURCES.

2 EPR Bare Rock (Steve Lewis)

The only new development since the last meeting is that Dan Fornari has been funded to conduct an Argo cruise at the 9°N site in the Fall of '89.

3 Sedimented Ridges (Keith Louden)

Two drilling legs are proposed to investigate fluid flow, crustal alteration and metallogenesis in spreading centers buried by sediment. Two candidate regions are under consideration Middle Valley and Escanaba Trough. Both areas have an excellent data base of heat flow information. As outlined in the CEPAC prospectus, additional side scan and SeaBeam data would be useful, and SSP looks forward to reviewing final sites with this data in hand.

To gain better understanding of the safety as well as engineering hazards of drilling in high temperature environments (such as in Middle Valley) Lou Garrison (TAMU) has called a meeting of engineers, industry experts and proponents, that is assembled in Dallas this week.

ACTION Keith Louden will contact Sedimented Ridges proponent Earl Davis requesting information pertinent to SSP needs regarding 1) Davis' upcoming cruise to Middle Valley, and 2) results of the working group meeting to be held in Ottawa this summer.

4 Eastern Equatorial Pacific (Heinrich Meyer)

The only new development since the last meeting is that Nick Pisias has been funded to conduct a hi-res SCS survey cruise in the summer of '89.

5 Chile Triple Junction (Steve Lewis)

The one-leg, 5-hole drilling proposal given preliminary review at the last meeting has since been augmented by a second leg of 12 additional targets. The original set are largely confined to the region north of the active ridge/trench collision; the latter is within the collision zone and south of it. Together these sites could provide age and lithologic control on features of plate subduction where plate kinimatics and land geology are already relatively well known. Since our last meeting the entire region has been covered in a GLORIA survey by Graham Westbrook. Preliminary, migrated sections have been processed at L-DGO, and processing of ther MCS data set is progressing. SSP looks forward to the presentation of a complete data package.

6 Hawaii Flexure (Guy Pautot)

There are three objectives to drilling immediately north of Hawaii 1) to constrain the subsidence history of the lithosphere under the effect of the load imposed by the island chain; 2)to evaluate the role of large-scale mass wasting in the region; and 3) to determine the age of volcanism on the peripheral bulge. Five holes are proposed. Three difficulties are recognised at present: 1) lithologies are expected to be red clays and volcaniclastics without the appreciable biogenic content needed for biostratigraphic control; 2) mass wasting dominates much of the section and may be very complex; and 3) seismic resolution of key horizons that need to be tracked into the moat is severely limited by the chaos of mass flow deposits. SSP is concerned most with the last of these. John King recently completed a pilot study of magnetostratigraphy from piston cores in the area, which Guy Pautot summarised and showed that it holds reasonable potential. Nonetheless, the obviously large extent of mass flows shown in a "Washington" seismic profile submitted to the panel by Bob Dietrich suggest that without occasional biostratigraphic control, magnetostratigraphy will- provide only limited benefit to the stated drilling objectives. While this is clearly a problem, SSP's main concern is that seismic data that it has seen does not indicate adequate seismic resolution. The USGS has collected SCS data along the GLORIA tracks in this region, and consequently,:

ACTION Carl Brenner will contact Dave Clark and Bill Normark to request USGS SCS data from north of Hawaii be deposited in the Data Bank. Furthermore, Carl will notify drilling proponents of SSP's perceived importance of this new data source, and urge that they examine these and all other profiles to identify the lines of highest acoustic resolution.

<u>7 Lower Crust at 504B</u> (Carl Brenner)

Nothing new has developed since our last meeting.

<u>8 Loihi Seamount</u> (Fred Duennebier)

Nothing new has developed since our last meeting. Data look adequate at this stage in the absence of site specific proposals.

III STATUS OF PROGRAMS DISCUSSED IN JOINT SESSION

The following programs were assessed after presentations in joint session with CEPAC.

1 LEG 131 - <u>Ontong-Java Plateau</u> (Heinrich Meyer, Tom Shipley)

Results of the recent Washington cruise across the Ontong-Java Plateau were reviewed, and all survey data types deemed "vital" by SSP to meet the Neogene objectives are available. Preliminary site locations have been designated. The survey participants Larry Mayer, Tom Shipley and Jerry Winterer did an excellent job making these data available for site survey assessment in such a short time.

Several SSP members questioned the confidence with which seismic correlations can be made between the Plateau and Nauru Basin. Despite the efforts of the survey investigators to collect numerous profiles that transect the 3500-4000 m water depth range, correlations are very difficult to make because of complex and abrupt thinning of depositional units within a region of complex onlapping relationships.

Paleogene to Mesozoic sequences and basement itself are not imaged well beneath a high amplitude chert reflector that occurs across the top of the Plateau. Results at Site 289/586 showed a 30 m.y. hiatus across the K/T boundary; existing data suggests the pre-Neogene section thickens towards the NW, but the Washington water gun profiles are neither well distributed geographically, nor of sufficient penetration to identify a significantly better site. The panel is hopeful that when the 300 cu. in. airgun profiles collected on this same "Washington" cruise are processed that a clearer definition of pre-Neogene targets will be available for specific site designation. SSP noted that there is a possibility that HIG holds further data on the plateau (circa 1970).

ACTION Fred Dunnebier will ask Loren Kronke to check on possible 1970? HIG SCS Profiles over Ontong-Java Plateau. Also noted was a Kronke proposal for a 1980 cruise that could collect relevant data. Given the short lead times SSP will track these developments, should basement objectives continue to be pursued.

2 North Pacific Neogene (Birger Larsen) -

As a general comment for all of the North Pacific Neogene sites, SSP encourages the proponents to prepare alternate as well as prime sites. This effort of preparing what appears to be redundant site selection at present may pay off at sea by providing the opportunity to collect more complete stratigraphic sections should hiatuses be found unexpectedly.

(1) Detroit Seamount

The shallow site near 2400 m has sufficient survey data for specific site location; as a cautionary note, however, the proponents ought to recognise the local complexity in topography at this location. SSP feels that considerable work remains on the proper selection of the accompanying deep site. Care must be taken to identify and then avoid slumps that might originate on the flank of the seamount. SSP suggests the proponents consider moving the deep site to Meiji Drift, thereby avoiding mass-wasting deposits and possibly recovering a thicker, more expanded section. Whether below Detroit Seamount or within Meiji Drift, location of this deep site will benefit from examination of the extensive USGS data set that includes GLORIA, SCS and 3.5KHz data.

ACTION Carl Brenner will contact Andy Stevenson and request that the USGS data in the vicinity of Detroit Seamount and Meiji Drift be submitted to the Data Bank.

(2) Patton Seamount

a) Numerous E-W crossings of this feature provide adequate single-track topographic control, magnetics and SCS.

(3) Northwest sites, NW 1,3, and 4

a) NW is located on 20 year old, single channel data of barely acceptable quality.

b) NW3 and 4 are both located with more recent seismic data that was not available for examination

c) In general, SSP urges the proponents to assemble a data package more complete than now exists. Furthermore, the Panel points out that, though desirable, sites do not have to be located at line crossings if it can be shown that targets are clearly revealed a reasonably short distance away.

3 Bering Sea (Birger Larsen)

(1) Unmak Plateau. An exceptionally complete package of data has been collected by the USGS, and includes MCS, 100% GLORIA coverage with coincident SCS, magnetics and gravity, piston cores and heat flow measurements.

ACTION Carl Brenner to contact Andy Stevenson and request the USGS data in the vicinity of Unmak Plateau and Sounder Ridge.

(2) Sounder Ridge. The same complete catalogue of data as at Unmak Plateau exists across Sounder Ridge with the exception of a grid of MCS profiles defining the 3-D structure of this comparatively small feature. Existing SCS data can reportedly image the entire section and supply this control. As with the Unmak Plateau, SSP awaits review of a complete data package.

(3) Shirshov Ridge. The sole MCS line collected by the USGS across this feature is of good quality, but inadequate from an SSP perspective. Also members noted that the USGS line mistakenly shows a 2.5 sec penetration where the proposed hole is located while the prospectus calls for a 400 m T.D.(!).

The Russians appear to have the data (both MCS and dredges) required for survey definition of this drilling target.

SSP CONSENSUS - The Panel urges PCOM to, once again, request that EXCOM do whatever is proper to ensure a speedy return of the Soviet Union to JOIDES.

4 Atolls and Guyots (Fred Duennebier)

(1) SSP was presented with an assessment of the range of survey data either already collected or likely to come available for the Schlanger et al and Winterer et al proposals respectively. The Panel is agreed that adequate data exists and looked forward to reviewing the site specific proposals. Concern was expressed over the shortened lead time for assessment should this drilling now be inserted earlier in the Program.

(2) Without a review of nearby seismic data, plus a justification for locating the site OFF existing seismic lines as shown in the CEPAC prospectus, SSP cannot form an assessment of the Ogasawara Plateau site.

5 Old Pacific (Gred Mountain, Tom Shipley)

(1) Sonobuoy velocity gradients along with potential acoustic layering raise serious doubts about the location and nature of basement in the East Marianas Basin.

(2) Basement at Pig3 and 4 is adequately revealed in the re-processed FM35-12 MCS data.

(3) Results of the "Suroit" cruise (late Summer '89),will be needed to evaluate Pig 1 and 2, plus the occurrence and distribution of any shallow (<100 msec) chert not visible on the Fred Moore data.

ACTION Guy Pautot will draft a letter to Yves Lancelot, to be reviewed by the Panel at the end of the meeting, outlining SSP's interest in equipment and navigation for this summers's cruise. Furthermore, because of the possibility that the Old Pacific program could be inserted into the FY'90 schedule, an especially rapid data analysis will be required for these data to be useful. Lancelot may be invited to the next SSP meeting.

(4) SSP does not understand how the single A2-2 site could by itself represent a test of along-strike variability in magnetic anolmaly amplitudes.

6 Shatsky Rise (Kiyoshi Suyehiro)

Despite the unique and valuable potential of recovering anoxic sediments on Shatsky Rise, SSP judges the available data inadequate. Of primary concern is the sparse amount of seismic data of reasonable quality that has been shown to the panel. The proponents are urged to consider with a) developing a justification for a future engineering test leg on Shatsky Rise that would provide a reasonably improved data set or b) advocate a short pre-drilling survey by the Resolution.

IV ASSESSMENT OF SCHEDULED DRILLING LEGS

1 Leg 126 Bonin II

All sites were approved at the last SSP meeting.

2. Leg 127 Japan Sea I

At our last meeting J3B was located on the east flank of Okushiri Ridge and SSP expressed concern about:-

2.1. the poor definition of basement and sedimentary reflectors due to complex normal faulting in much of the section, and;

2.2. the uncertainty of identifying crystalline basement because of acoustic layering.

Since then, J3B has been moved to position on the western flank of the Ridge where item 2.1 is not an issue.

This site has now been approved by PPSP.

Layering in the vicinity of the basement is still apparent and SSP emphasises that the total depth to the objective (determination of the age and composition of the basement) remains uncertain.

3 Leg 128 Japan Sea II (Kyoshi Suyehiro)

No new developments since the Swansea meeting.

4 Leg 129 Nankai (Kyoshi Suyehiro)

Nankai drilling may be rescheduled to a later date. PPSP approved the entire survey package for the Nankai sites.

5 Leg 130 Geochemical Reference Sites (Rob Kidd)

Following the recommendations of the Swansea meeting, Carl Brenner prepared a site survey package for proponent Natland that includes Bon-8 and Mar-4. In addition attempts have been made at LDGO to process these seismic lines in order to image basement and the chert reflectors.

Mar-4 is at the same location as DSDP Site 452 and also became Eng-3 of Engineering Leg 124E (now ODP Site 777). Chert was encountered at between 30 - 40 meters subbottom and prevented penetration in a number of attempts. This was the depth predicted by the LDGO processing. It seems clear that sufficient sediment exists at both Bon-8 and Mar-4 for both re-entry cone and casing.

On the other hand, while the processing experiment by LDGO has shown that it is possible to image the chert and basement reflectors with some accuracy, the present data show no evidence of a 'window' through the cherts at either. If one could be found it might mean that casing would not have to be set.

ACTION Kidd will contact Audrey Meyer at TAMU for information on their needs for setting cone and casing at Bon-8 and Mar-5.

Carl Brenner also prepared a data package for Mar-5 - this he will make available to proponent Natland.

7 Leg 132 N.W. Australia (Rob Kidd)

SSP judged as adequate the site survey data for the N E Australian drilling presented by Peter Davis at the Swansea meeting and the proponents were asked to deposit the necessary data in the data bank. Some correspondence has ensued on this because of processing delays in Australia. SSP looks forward to the data being deposited in the near future.

8 Leg 133 Vanuatu (Guy Pautot)

No new data has come available to SSP since its Swansea meeting. SSP reiterates its request to TAMU for information on whether it has specific survey requirements for bare rock drilling here. Pautot observed that submersible dives being conducted by a French cruise could result in relevant data.

ACTION: Suzanne O'Connell is to alert TAMU of SSP's request that it should indicate any specific site survey requirements for Vannatu bare rock drilling.

9 Leg 134 Lau Basin (Fred Duennebier)

The main development since the Swansea meeting has been the search by proponents for locations in the back arc where basement objectives can be pursued without the need for bare-rock drilling.

New 'Thomas Washington' seismic data and 'Darwin' GLORIA and seismics suggest that: for Lau-2 - at least 3 alternate basement sites (Lau 2 - A, B and D) are available; for Lau-7 - TWO sites with sufficient sediment are available; Lau-9 replaces the original Lau Basin bare-rock site. Pautot noted that submersible surveys by 'Nautile' are presently underway in the Lau Basin with proponent Von Stackleberg aboard. SSP felt that, although it was too late for a beacon to be placed by the submersible as on Leg 106/109, we should encourage proponents to deposit any relevant photographic surveys or geotechnical testing in the data bank.

ACTION Fred Duennebier will write to proponent Lindsay Parson alerting him of SSP's interest in any submersible data.

V OTHER BUSINESS

1 Submersibles SSP discussed the usefulness of submersible surveys as part of the matrix of site survey data required for Panel approval of some sites. Guy Pautot updated the Panel on developments in French submersible technology, particularly in the field of geotechnical testing.

SSP consensus: Submersible surveys may be desirable for some sites, for example, cases where bare-rock or re-entry cones are to be placed.

ACTION Rob Kidd will provide JOIDES office with some text to add to its guidelines for proponents pointing out the possible desirability of submersible data under the heading "high resolution imagery".

2 3D Seismic Surveys Tom Shipley made a presentation to SSP on a detailed 3D-survey of the Costa Rica accretionary wedge. This new technique allows diffuse reflectiors to be imaged in areas of complex surface relief. More importantly, horizontal slices may be imaged through sequences to delineate the dimensions of mud volcanoes, 'bright spots', slumps, debris flows etc. The use of super computers now make this collection and processing technique no more expensive than normal MCS surveying over larger areas and it may even become necessary for drilling in highly complex active margin settings.

3 PCOM request for input to ODP accomplishments document

Greg Mountain presented a draft reply to this request that emphasises the role of the Site Survey Bank. After discussion, SSP agreed that Greg should complete the letter by incorporating statistics on data holdings and activity and send it on to PCOM as soon as possible.

ACTION: Carl Brenner to supply statistics on Data Bank to Greg Mountain who will complete the letter to PCOM as input to the ODP Accomplishments Document.

4 New Panel Members

a) SSP has been informed by Ralph Moberley that it is to be assigned a USSAC member in addition to its three U.S. institutional members; Duennebier (HIG), Lewis (USGS) AND Mountain (LDGO). The new member will be an industry researcher and four names were put forward by PCOM for Panel consideration.

ACTION: Rob Kidd will transmit to Moberley SSP's preferred choices for a USSAC member from the list provided by PCOM.

b) Greg Mountain is to rotate off the SSP because of his imminent move to NSF. The Panel is asked by PCOM to suggest names of possible US replacements. SSP reviewed its present spread of expertise and agreed on two names for consideration by PCOM.

ACTION: Rob Kidd will transmit to Ralph Moberley SSP'S suggestions for a US institutional replacement for Greg Mountain who is moving to NSF.

VI NEXT MEETING

Heinrich Meyer agreed to host the next SSP meeting at BGR Hannover, West Germany. The provisional meeting dates are 16th-18th October inclusive, assuming that suitable arrangements can be made in Hannover and meetings of other panels requiring SSP input remain as scheduled.

ACTION: Rob Kidd is to supply JOIDES office - with provisional information on the Hannover meeting as soon as key arrangements can be made by Henrich Meyer.

VII TRANSFER OF CHAIRMANSHIP

Greg Mountain officially passed on the Chairmanship of Site Survey Panel to Rob Kidd. Rob thanked Greg on behalf of the Panel for all his efforts during his all-too-short period as Chairman and wished him every success in his new position with NSF.

SSP APPENDICES - HAWAII MEETING APRIL 1989.

A-1 TO A-6 SHIP SCHEDULES

A-7 - PROPOSAL TRACKING OUTLINE

A-8 - LEG 124E RESULTS SUMMARY

A-9 - TAMU RESPONSES TO SSP REQUESTS FOR INFORMATION

A1 - US

Posted: Tue Jan 31, 1989 8:58 AM EST Msg: JGIJ-3865-8176
From: WOODS.HOLE
To: L.Clark, K.Kaulum, A.Bucklin
CC: Woods.Hole, Ship.Sched89
Subj: 1989 ATLANTIS II 1/31/89

R/V ATLANTIS II
1989 SCHEDULE

REVISED: January 31, 1989

DATES	AREA & OBJECTIVE	CHIEF SCIEN. PRINC.INVEST.	END PORT	AGENCY,DAYS FUND.STATUS
01/01 - 03/12	Maintenance		Woods Hole	
	The following programs are Non-ALVIN work.			
03/13 - 03/24	Transit		Funchal	13 NSF
03/28 - 04/06	47N - 60N, 20W	Honjo	Reykjavik	13 NSF
04/10 - 04/14	59N - 21W(ML-ML)	Trask(Marra)	Reykjavik	7 ONR
04/17 - 05/11	60N & 47N, 20W	Marra	Azores	28 NSF
05/15 - 06/08	47N & 60N, 20W	Ducklow	Reykjavik	29 NSF
06/13 - 07/06	Nfld Basin	Owens	Woods Hole	17 ONR
		Transits		9 NSF
08/01 - 08/05	Refit for ALVIN Sea Trials & Certification	Walden	St. George	4 NSF 2 ONR 2 NOAA
08/11 - 08/30	Cont. Margin	Ryan	Woods Hole	22 NSF
09/05 - 09/16	NE Atlantic DWDS 106	Grassle	Woods Hole	12 NOAA
09/22 - 10/14	28N, 30W (Non-Alvin)	Boyle	Azores	25 NSF
10/19 - 11/17	Mid-Atlantic Rdg. (Non-Alvin)	Langseth	Bridgetown	34 NSF
11/22 - 12/24	Mid-Atlantic Rdg. (ALVIN)	Thompson, et al	Woods Hole	26 NSF 9 NOAA
12/27 -	Shipyard and Biannual Overhaul			

Total Recommended Charge Days:

NSF: 203
ONR: 26
NOAA: 23

Posted: Thu, Feb 23, 1989 1:51 PM EST Msg: KGIJ-3886-1653
From: UNOLS.OFFICE
To: SHIP.SCHED89
Subj: UNIV RHODE ISLAND 89 ENDEAVOR

POC: Mr. John Bash
University of Rhode Island
Graduate School of Oceanography
Narragansett, RI 02881
TEL: (401) 792-6203
TELEMAIL: RHODE.ISLAND

LAST UPDATE: 23 Feb 89

RV ENDEAVOR 1989 PROPOSED SCHEDULE

CRUISE PERIOD	AREA/OBJECTIVE	SCIENTIST	END PORT	AGENCY,DAYS & FUNDING
1-12 JAN	MAINTENANCE		NARRA	
16-18 JAN	NO MANS LAND	WELLER	NARRA	NSF 3 (F)
19-21 JAN	DUMP SITE 106	McDOWELL	WHOI	EPA 3 (F)
22-25 JAN	MAINTENANCE		NARRA	
26-27 FEB	NO MANS LAND	WELLER	WHOI	NSF 3 (F)
28-28 FEB	WHOI	TRANSIT	WHOI	NSF 1 (F)
1-12 MAR	BERMUDA	BERTEAUX/CLAY	NARR	ONR 12 (F)
1-12 MAR	BERMUDA	BERTEAUX	NARRA	ONR 12 (F)
16-25 MAR	SEEP	SMITH	NARRA	DOE 10 (F)
1-28 APR	GULF STREAM	ROSSBY	NARRA	NSF_28 (F)
1-13 MAY	SEEP	BISCAY/BACON	NARRA	DOE/NSF 11/2 (F)
18 MAY-12 JUN	GR.SO.CHANNEL	WINN	NARRA	NSF 26 (F)
16 JUN-26JUN	NO.ATLANTIC	TRANSIT	REYKJAVIK	NSF 11 (F)
28 JUN-07JUL	ICELAND	JGOFS	REYKJAVIK	NSF 12 (F)
10 JUL-31JUL	GREENLAND SEA	DEMING	TROMSO	NSF 24 (F)
3 AUG-09 SEP	GREENLAND SEA	WORCESTER	TROMSO	NSF25 ONR16 (F)
10-14 SEP	NO.ATLANTIC	TRANSIT	GLASGOW	NSF3 ONR4 (F)
18 SEP-23 SEP	60N 21W	MARRA	REYKJAVIK	ONR 12 (F)
26 SEP-11 OCT	AZORES	HONJO(GOFS)	FUNCHAL	NSF 18 (F)

14-19 OCT	CENT ATLANTIC	TRANSIT	CAPE VERDE	NSF 6	(F)
21 OCT-07NOV	EQUATOR	KATZ	CAYENNE	NSF 20	(F)
10NOV-21NOV	NO.ATLANTIC	TRANSIT	NARRA	NSF 12	(F)

FUNDED CRUISES 257 DAYS

SCHEDULED 193 NSF; 40 ONR; 21 DOE, 3 EPA

PROGRAMS NOT ACCOMMODATED:

CHRISTENSEN GREENLAND SEA AUG 17 DAYS JOI (P)

BERTEAUX GREENLAND SEA 10 DAYS ONR (F)

Posted: Fri, Jan 20, 1989 6:50 PM EST Msg: NGIJ-3857-3674
From: UNOLS.OFFICE
To: SHIP.SCHED89
Subj: TEXAS A&M 89 GYRE

POC: Dean Letzring, Manager
Marine Operations
Texas A&M University
P.O. Box 1675
Galveston, TX 77533
TEL: (409) 740-4469

LAST UPDATE: 18 Jan 89

1989 R\V GYRE SCHEDULE

CRUISE PERIOD	AREA/OBJECTIVE	CHIEF SCIENTIST	END PORT	AGENCY
01/08-01/13	GULF OF MEXICO STUDENT TRAINING	E. BEHRENS	GALVESTON	STATE-5
03/06-03/15	GULF OF MEXICO INTERDISCIPLINARY	W. MERRELL	GALVESTON	STATE-10
03/20-03/29	ORCA BASIN ORGANIC GEOCHEM.	E. VAN VLEET	ST. PETE.	NSF-10
04/17-05/06	N. CENTRAL GULF GEOLOGY	E. POWELL	GALVESTON	NSF-20
07/06-07/15	WESTERN GULF INTERDISCIPLINARY	G. ROWE	GALVESTON	STATE-10
08/01-08/21	EASTERN ATLANTIC MARINE ZOOPLANKTON	M. ROMAN	MIAMI	NSF-21
08/24-09/07	BAHAMAS, LEMON SHARK STDY	S. GRUBER	MIAMI	NSF-15
09/16-09/20	N. CENTRAL GULF STUDENT TRAINING	J.SCLATER/ L.LAWVER	GALVESTON	STATE-5
11/15-11/25	WESTERN GULF INTERDISCIPLINARY	D. BIGGS	GALVESTON	STATE-10

FUNDING: NSF - 81
STATE - 40

TOTAL 121

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Posted: Mon, Mar 13, 1989 5:18 PM EST Msg: MGIJ-3898-8785
From: UNOLS.OFFICE
To: SHIP.SCHED89
Subj: SCRIPPS 89 MELVILLE

POC: Dr. George Shor, Jr.
Scripps Institution of Oceanography
La Jolla, CA 92093-0210
TEL: (619) 534-2853; FAX: (619) 534-0981
TELEMAIL: SCRIPPS.INST

LAST UPDATE: 6 Mar 89

SHIP OPERATING SCHEDULE 1989
R/V MELVILLE

Cruise Period	Area and Objectives	Chief Scientist	End Port	Agency Days
12/07-01/15	HYDROS LEG 2 South Atlantic Ventilation Experiment	Key	Cape Town	NSF-16
01/23-03/08	HYDROS LEG 3 SAVE/Long Lines	Smethie/ McCartney	Montevideo	NSF-49
03/13-04/19	HYDROS LEG 4 Long Line Phys.Oc.	McCartney/ Talley	Barbados	NSF-40
04/20-04/26	transit		Miami	NSF- 7 NAVY- 2
04/30-05/22	HYDROS LEG 5 Re-entry experiment South of Bermuda & Equipment tests	Spiess/Webb	Woods Hole	NAVY-20 JOI- 1 NSF- 4
05/25-06/25	HYDROS LEG 6 Benthic biology South of Bermuda (6/10 stop at St. George, Bermuda)	Williams/Druffel	Woods Hole	NSF-36
06/30-07/21	Re-entry experiment	Spiess/Orcutt	Miami	Navy-24
08/21-08/27	Re-entry experiment	Spiess/Orcutt	Miami?	Navy- 7

08/28 To shipyard for mid-life overhaul/refit

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Posted: Fri, Mar 17, 1989 12:45 PM EST Msg: DGIJ-3902-6696
From: UNOLS.OFFICE
To: SHIP.SCHED89
Subj: UNIV HAWAII 89 MOANA WAVE

POC: James W. Coste
University of Hawaii Marine Center
#1 Sand Island Road
Honolulu, HI 96819
TEL: (808) 847-2661
TELEMAIL: HAIAII.INST

LAST UPDATE: 13 Mar 89

SHIP OPERATING SCHEDULE 1989
R/V MOANA WAVE

PORTS	DATES	PROJECT TITLE AREA OF OPERATION	NO. DAYS REQUESTED	STATUS
HONOLULU HONOLULU	01 JAN 05 JAN	MAINTENANCE	05	N/A
HONOLULU HONOLULU	06 JAN 10 JAN	HAWAIIAN OCEAN TIME SERIES STATION (LUKAS)	05	NSF(F)
HONOLULU MALAKAL	16 JAN 01 FEB	TRANSIT	18	NSF(F)
MALAKAL MAJURO	05 FEB 04 MAR	10oN TRANSECT (BRYDEN)	31	NSF(F)
MAJURO HONOLULU	08 MAR 24 MAR	10oN TRANSECT (BRYDEN)	19	NSF(F)
HONOLULU HONOLULU	25 MAR 29 MAR	HOTS (LUKAS)	05	NSF(F)
HONOLULU RODMAN	02 APR 08 MAY	10oN TRANSECT (BRYDEN)	38	NSF(F)
RODMAN GULF PORT*	12 MAY 18 MAY	TRANSIT	05 04	NSF(F) HIG(F)
SHIPYARD SHIPYARD	19 MAY 07 JUN	MAINTENANCE	19	N/A
SHIPYARD MAYAGUEZ	08 JUN 09 JUL	SeaMARC II BAHAMAS HISPANIOLA (BREEN)	34	NSF(F)
MAYAGUEZ RODMAN	13 JUL 15 AUG	SeaMARC II CARIB PLATE (MANN)	37	NSF(F)
RODMAN PUNTARENAS	19 AUG 03 SEP	CANO ISLAND REEF DIVING (GLYNN)	19	NSF(F)
PUNTARENAS	07 SEP	TRANSIT	18	NSF(F)

HONOLULU	27 SEP		05	NOAA(F)
HONOLULU HONOLULU	02 OCT 06 OCT	HOTS (LUKAS)	05	NSF(F)
HONOLULU HONOLULU	06 NOV 10 NOV	HOTS (LUKAS)	05	NSF(F)
HONOLULU HONOLULU	04 DEC 08 DEC	HOTS (LUKAS)	05	NSF(F)
		OPERATING DAYS	253	

*SHIPYARD LOCATION TO BE DETERMINED BY COMPETITIVE BIDS.

Posted: Fri Jan 27, 1989 3:31 PM EST Msg: GGIJ-3863-8555
From: WOODS.HOLE
To: SHIP.Sched89
CC: Schedulers.East.Gulf, Schedulers.West
Subj: 1989 OCEANUS

POC: Barbara J. Martineau.
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543
Tel: 508-548-1400, Ext.2450 ** TELEMAIL: WOODS.HOLE

R/V OCEANUS
1989 - Schedule

REVISED: January 19,1989

DATES	AREA & OBJECTIVE	CHIEF SCIEN. PRINC.INVEST.	END PORT	AGENCY. FUND.	DAYS	STATUS
01/05 - 01/28	Tropical Atlantic SOFAR float study	Richardson	Bridgetown Fortaleza	NSF	29	F
02/01 - 02/21	Tropical Atlantic SOFAR float study	Richardson	Las Palmas	NSF	23	F
02/25 - 03/25	Tropical Atlantic CTD Study	Roemmich Hall	Bridge-town	NSF	33	F
03/30 - 04/03	Transit		St.George	NSF	8	F
04/06 - 04/24	CTD Study NE Atlantic	Joyce	Woods Hole	NSF	20	F
05/05 - 05/21	NE Sargasso Sea Nitric Oxide Study	Zafiriou	Woods Hole	NSF	17	F
05/25 - 06/21	38N.68W SYNOP Experiment	Watts (URI)	Woods Hole	ONR NSF	12 16	F F
06/26 - 06/28	Instrument Test	Luyten	Woods Hole	ONR	3	F
06/30 - 07/02	HEBBLE Tripod Recovery	Hollister	Woods Hole	ONR	3	F
07/07 - 08/02	Biannual Overhaul Shipyard & Maintenance					
08/05 - 08/22 08/24 - 09/01	38N.68W SYNOP SYNOP	Watts Watts	Woods Hole	ONR NSF	10 16	F F
09/08 - 09/10	Transit to Bermuda	Sayles	St.	NSF	19	F

09/13 - 10/05	Diagenesis study	Martin	George Woods Hole	NSF	[illegible]	P
10/11 - 11/24	NE Sargasso Sea Flow cytometry	Olson Zafiriou	Woods Hole	NSF	14	[illegible]
10/30 - 11/19	Swordfish Telemetry Mid-Atlantic	Carey	Woods Hole	NSF	21	F
11/28 - 12/04	Local-Sea water Sampler test	Berteaux Jenkins	Woods Hole	NSF	7	F

Total for Year	257
NSF	229
Navy	28
Funded:	248
Pending:	[illegible]

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Posted: Mon. Mar 13. 1989   5:27 PM EST                  Msg: DGIJ-3898-8846
From:   UNOLS.OFFICE
To:     SHIP.SCHED89
Subj:   SCRIPPS 89 T. WASHINGTON
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POC: Dr. George Shor, Jr.
Scripps Institution of Oceanography
La Jolla, CA 92093-0210
TEL: (619) 534-2853; FAX: (619) 534-0981
TELEMAIL: SCRIPPS.INST

LAST UPDATE: 6 Mar 89

SHIP OPERATING SCHEDULES 1989
R/V THOMAS WASHINGTON

Cruise Period	Area and Objectives	Chief Scientist	End Port	Agency Days
ROUNDABOUT EXPEDITION:				
12/31-01/10	Leg 12 Seismic survey Ontong-Java Plateau	T. Shipley	Majuro	NSF- 9
01/10-01/19	Leg 13 Transit/SeaBeam via Howland Island	N/A	Suva	NSF- 9 other-2
01/25-02/01	Leg 14 SeaBeam/SCS Lau Basin	J. Hawkins	Tonga	NSF-11
02/02-03/03	Leg 15 SeaBeam/Dredging Lau Basin	J. Hawkins	Pago Pago	NSF-26 JOI- 4
03/04-03/21	Leg 16-Transit: Sea Beam CO2 sampling via Society and Line Islands	Keeling(Guenther)	Honolulu	NSF-12 NSF- 7
03/25-04/28	Leg 17 Benthic Biology north of Hawaii	K. Smith	Honolulu	NSF-39
05/02-06/02	Leg 18 Transit, SeaBeam, Sea Marc II SeaMarc tests via Fieberling Seamount	P. Lonsdale	San Diego	NSF- 5 ONR-26 UC- 2
06/02-08/17	BIENNIAL OVERHAUL		SAN DIEGO	
08/28-10/02	Coring/SCS/SeaBeam Equatorial carbonate area	N. Pisias (OSU)	Acapulco	NSF-37
10/06-11/07	Dredging/SeaBeam East Pacific Rise 8-12N	J. Bender/ C. Langmuir/ K. Kastens	Manzanillo	NSF-37
11/12-12/16	ARGO photos/dredging Hydrothermal areas East Pacific Rise 9 N	R. Haymon/ D. Fornari	San Diego	NSF-37

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Command?
Command?
Command?  bye

   This mail session is now complete.

MAIL DISCONNECTED 00 40 00:00:02:00 124.13
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R/V Bernier

Preliminary Schedule as of April 7, 1989

- in yard for re-fit and cross-decking from *R/V Conrad* for remainder of 1989 -

Beginning Jan 1, 1990:

8 programs in the north, central and south Atlantic, 2 of which are funded

2 programs in the southern and central Indian Ocean

7 programs in the western and eastern Pacific

NERC RESEARCH SHIPS PROGRAMMES 1989/90

Apr 03 10 17 24 | May 1 8 15 22 29 | Jun 05 12 19 26 | Jul 3 10 17 24 31 | Aug 07 14 21 28 | Sep 04 11 18 25 | Oct 2 9 16 23 30 | Nov 06 13 20 27 | Dec 04 11 18 25 | Jan 1 8 15 22 29 | Feb 05 12 19 26 | Mar 05 12 19 26

RRS Charles Darwin

- 10 — 14 VALPARAISO, 38, Price, *Edinburgh*, Geochemistry Off Peru
- 11 — 15 BALBOA, 39, Sinha, *Cambridge*, Geophysics E Pacific Rise
- 16 — 20 BALBOA, 40, Westbrook, *Birm'm*, Geoph Off Colombia
- 20 — 22 B'BOA, 40A, Breen, *LDGO*, Geoph
- 07 — 10 WHOI, 41, Hogg, *WHOI*, Physics NW Atlantic
- 31 — 03 WHOI, Passage
- 15 — 22 BARRY, 42, Saunders, *IOSDL*, Physics NW Atlantic
- 16 — 20 TROON, 43, Taylor + Smith, *IOSDL* *UMIST*, Physics NE Atlantic
- 22 — 24 TROON, 44, Ellett, *DML*, Physics NE Atlantic
- 04 — 06 UK PORT, Refit
- 10 Charter or US Barter

RRS Discovery

- 01 — 08 BARRY VIGO, 181, Pollard, *IOSDL*, Physics Azores
- 03 — 07 BARRY, 182, Fasham, *IOSDL*, BOFS NE Atlantic
- 08 — 11 TROON, 183, Harris, *PML*, BOFS NE Atlantic
- 12 — 14 FALMOUTH, 184, McCave, *Cambridge*, BOFS NE Atlantic
- 14 — 19 BARRY, 185, Rice + Priede, *IOSDL* *A'deen*, Biol. Physiol. Porc. Bight
- 17 — 20 MADEIRA, 186, Tyler, *So'ton*, Biology Iberian Pen.
- 16 — 20 LISBON, 187, Weaver, *IOSDL*, Geochem Iberian Pen.
- 14 Nov — 16 LISBON, 188, Masson, *IOSDL*, Geophysics Canary Basin
- 22 BARRY (moved to ??)
- Vessel Conversion (or Lay-Up or Charter)

RRS Challenger

- 29 GY 49, Survey
- 10 — 12 GY 50, Burton, *So'ton*, Chemistry
- 25 — 27 GY 51, Survey
- 09 — 11 GY 52, Reid, *PML*, Sedim.
- 24 — 26 GY 53, Survey
- 07 — 09 GY 54, Joint, *PML*, Biology
- 22 — 24 GY 55, Survey
- 07 — 08 GY 56, James, *POL*, Physics
- 22 — 24 GY 57, Survey
- 06 — 07 GY 58, Hill, *UCNW*, Physics
- 21 — 23 GY 59, Survey
- 04 — 06 GY 60, Reid, *PML*, Sedim.
- 19 — 21 GY 61, Survey
- 03 — 05 GY 62, Watson, *PML*, Physics
- 23 — 26 BARRY, Refit — 30
- Charter : Lay-Up
- 03 — 24 DAFS Charter
- 27 BARRY
- 01 — 31 TROON, 63, Gordon+Ellett, *DML*, Biol. + Phys. NE Atlantic

Charter Ships

- May: 8 days, Ellett, *DML*, Physics NE Atlantic
- Aug: 8 days, Ellett, *DML*, Physics NE Atlantic

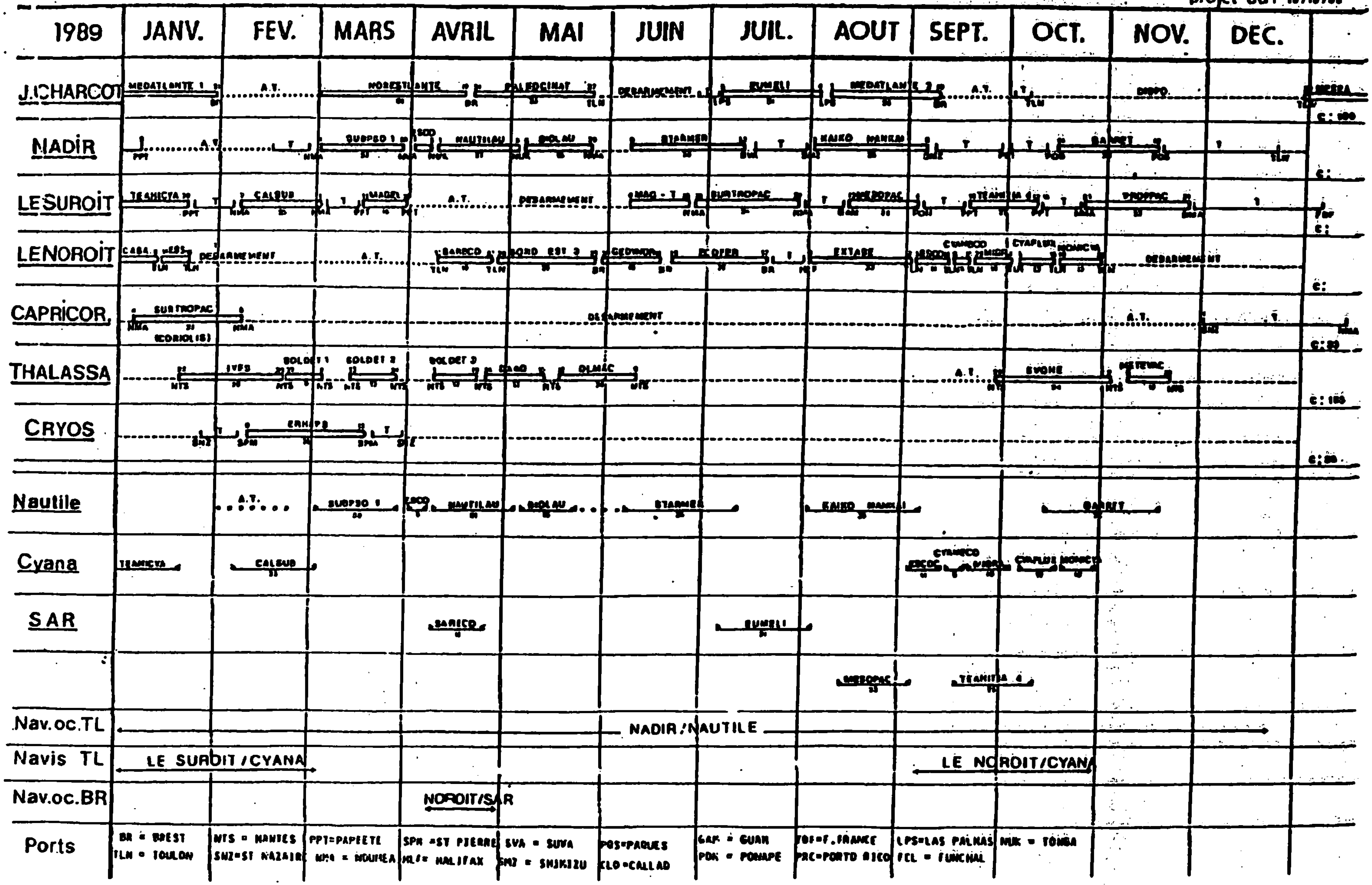
Version 2 (February 1989)

0772

IFREMER

PROGRAMME DES MOYENS NAVALS

projet du : 10/10/88



1989 FRANCE PROGRAMS

KEY: Charcot

NORESTLANTE : deep refraction seismics ocean-continent boundary
NE Atlantique : N et S part of bay of Biscay (Pendragon exc., Galicia Bank, Sibuet)

PALEOCINAT : paleoclimats and global changes N.W Atlantiq. (Labeyrie)

EUMELI : flux of ~~matter~~ materials in the oceans off Morocco, Mauritanie (Auffret)

NADIR + Nautile

SUBSO 1 : d'Entrecasteaux collision Vanuatu (Daniel)

NAUTILAU : Lau basin Valufu ridge (Fouquet, Von Stackelberg)

STARMER : N. Fiji basin ridge N Fiji (16°30 et 20°30) (Auzende - Honza or Urabe STA)

KAIKO-NANKAI : active faults and cold seeps in Nankai accretionary prism (Le Pichon - Kobayashi ORI)

GARRETT : deepest part of the Garett F.Z. F.Z. (Hekinian)

Suroit — TEAHITIA. (+ Cyana) hot spot near Tahiti (Cheminée)

MAGELLAN. same area Tahiti magneto-tellurique (Tenils)

MESOPAC paleoenvironnements - volcanic events of Cretaceous (projet OLD CRUST) (Lancelot) sismique multitrace

TEAHITIA 4 : hot spot Tahiti deep structure : refraction, sismique 3D,

F.S.SONNE Operations-schedule 1989-1990

cruise	dep. - arr.	from - to: (area)	Program (Charter)
SO-62	4-89 -- 7-89	Callao-Valparaiso	GEOMETEP 5 (BGR) [Geology,Geochemistry on East Pacific Rise]
SO-63	7-89 -- 9-89	-Callao	Uni Marburg [det.hydrthermal studies on special areas of the EPR]
SO-64	9-89 -- 10-89	-Callao	Uni Hamburg [DISCOL Biology and Geology environmental st. ,Central Pacific
SO-65	10-89-- 12-89	-Tahiti	Uni Kiel [MIDPLATE 2,Hydrthermal studies in south.centr.Pacific and Geophysic near Tahiti
SO-66	12-89-- 2-90	-Fidji Isl.	TU Clausthal [MIDPAC 4, Hydrthermal stud.within the area of KIRIBATI/equatorial Pacific
SO-67	2-90-- 4-90	-Fidji Isl.	BGR [Geology of the Manihiki Plateau,geolgical and hydroth. studies in the Lau Basin

F.S. POLARSTERN Operations-schedule 1989 - 1990

cruise	when	program (charter)	-	area
ANT VIII/1	7/89-8/89	Water geochemistry	-	South Atlantic
ANT VIII/2	8/89-10/89	Meteorology and Oceanography	-	northern Weddel Sea
ANT VIII/3	10/89-2/90	Glaciology,oceanography,marine geophysics		Weddel Sea
ANT VIII/4	2/90-4/90	Geophysics and marine geology		Astrid Ridge

F.S. METEOR Operations-schedule 1989 - 1990

Zeit	Fahrtabschnitt/ Endhafen	Aufgabe: Arbeitsgebiet	Aufgabe: Themen/Programm/wiss. Disziplinen	Koordinator	Fahrtleiter
1989					
	Teneriffe	Östl. Nordatlantik	SFB 133	Zenk	Wefer
19.03. - 27.04.	M10/1 Pt.Delgada	Zentr.Nordatlantik	"Plankton 89"	Zeitzschel	Zeitzschel
27.04. - 12.06.	M10/2 Reykjavik	Zentr.Nordatlantik	"Plankton 89"	Zeitzschel	Lenz
15.06. - 12.07.	M10/3 Reykjavik	Zentr.Nordatlantik	"Plankton 89"	Zeitzschel	Zeitzschel
15.07. - 31.08.	M10/4 Hamburg	Östl.Nordatlantik	BIOTRANS	Zeitzschel	Thiel
	W e r f t z e i t				
03.10. - 31.10.	M11/1 Rio Grande	Atlantischer Transect	SFB 133	Roether	Müller
02.11. - 21.11.	M11/2 Ushuaia	Drake Passage	Tracerozeanographie	Roether	Roether
23.11. - 21.12.	M11/3 Mar del Plata	Patagonischer Schelf	Fischereibiologie	Roether	Mellen
1990					
27.12. - 22.01.	M11/4 Ushuaia	Antarktische Halbinsel	Krill/BIOMASS	Roether	Sahrhage
24.01. - 26.02.	M11/5 Kapstadt	Zirkumpolarstrom	Tracerozeanographie	Roether	Roether
01.03. - 28.03.	M12/1 Pt. Delgada	südl. Ostatlantik	Partikelsedimentation	Wefer	Wefer
31.03. - 12.05.	M12/2 Pt. Delgada	Zentralatlantische Kuppen	Geophysik/Petrologie	Wefer	Weigel
15.05. - 19.06.	M12/3 Hamburg	Östl. Nordatlantik	BIOTRANS/JGOFS	Wefer	Thiel

1989 JAPANESE RESEARCH VESSELS

R/V HAKUHO-MARU (new)	Jun 01- Jun 15	test (K. Kobayashi)
(ORI, U. of Tokyo)	Jun 20- Jul 13	Nankai (J. Segawa)
	Jul 14- Jul 19	test (A. Taira)
R/V TANSEI-MARU	Apr 10- Apr 17	E. off Jpn (J. Segawa)
(ORI, U. of Tokyo)	Apr 20- Apr 26	E. off Jpn (J. Segawa)
	Sep 24 - Oct 05	Japan Sea (K. Tamaki)
	Nov 24- Dec 02	Nankai (K. Kobayashi)
	Dec 05- Dec 15	Nankai (K. Suyehiro)
R/V HAKUREI-MARU	Apr 17- May 19	Bonin (GH89-1)
(GSJ/JNOC)	May 26- Jul 03	Japan Sea (GH-89-2)
	Jul 21- Sep 05	Okinawa Tr.(GH-89-3)
	Sep 12- Oct 11	Japan Sea (GH-89-4)
R/V TAKUYO	routine seafloor mapping / Philippine Sea	
(Hydrographic Dept. MSA)		
CHARTERED SHIP	to be determined	
DELP project (national lithosphere program)		

	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
13 14	1 2 3 4	1 2	1 2 3 4 5 6	1 2 3	1 2 3
19 20 21	5 6 7 8 9 10 11	3 4 5 6 7 8 9	7 8 9 10 11 12 13	4 5 6 7 8 9 10	4 5 6 7 8 9 10
25 26 27 28	12 13 14 15 16 17 18	10 11 12 13 14 15 16	14 15 16 17 18 19 20	11 12 13 14 15 16 17	11 12 13 14 15 16 17
	19 20 21 22 23 24 25	17 18 19 20 21 22 23	21 22 23 24 25 26 27	18 19 20 21 22 23 24	18 19 20 21 22 23 24
	26 27 28 29 30	24 25 26 27 28 29 30	28 29 30 31	25 26 27 28	25 26 27 28 29 30 31
		31			

Labrador Sea

Geology (11,11,6) Long Coring

NFLD Ridge

Geology (GC) (10,5,7)

Physical Oceanography

Georges Bank

Geology

Conception B.

Gulf of St.L. Shelf

Maintenance

Gulf

herring acoustics

S. Gulf

Chedabucto Bay herring acoustics

Georges Bank groundfish survey

NAFO survey

charter

Georges B. herring larvae

Grand B.

G. of Maine pollock tagging

Bay of Fundy herring larvae

Gulf herring acoustics

Shelf

Sydney pollution

Dolphin Trials weekdays only

Grand Manan

NOTES

-Senior scientists on joint cruises are listed first

-cruises are Scotia-Fundy unless otherwise indicated

-unused cruise numbers: 12,18

...ME TO DUE TO PROGRAM OR VESSEL REQUIREMENTS. FOR MORE INFORMATION ON SCOTIA-FUNDY BASED VESSELS CONTACT A. ADAMS (902) 426-7392

Resources Canada | Ressources Canada
Geological Survey of Canada | Commission geologique du Canada

12 May 1989

GS7170-5

Dr. Keith Louden
IFREMER 940627F
IFREMER Centre de Brest
France

Dear Keith:

Attached, in three pieces, is a copy of the latest BIO ship schedule. Not certain in detail, but certain that the Hudson will be delayed at least a month from present schedule.

Sincerely,

Keith

Keith S. Manchester

attachment

Atlantic Geoscience Centre
Bedford Institute of Oceanography
Box 1006, Dartmouth, Nova Scotia
B2Y 4A2
Telex 019-31552
Fax 426-7827
Telephone 426-8513

Centre géoscientifique de l'Atlantique
Institute océanographique de Bedford
C.P. 1006, Dartmouth, Nouvelle-Ecosse
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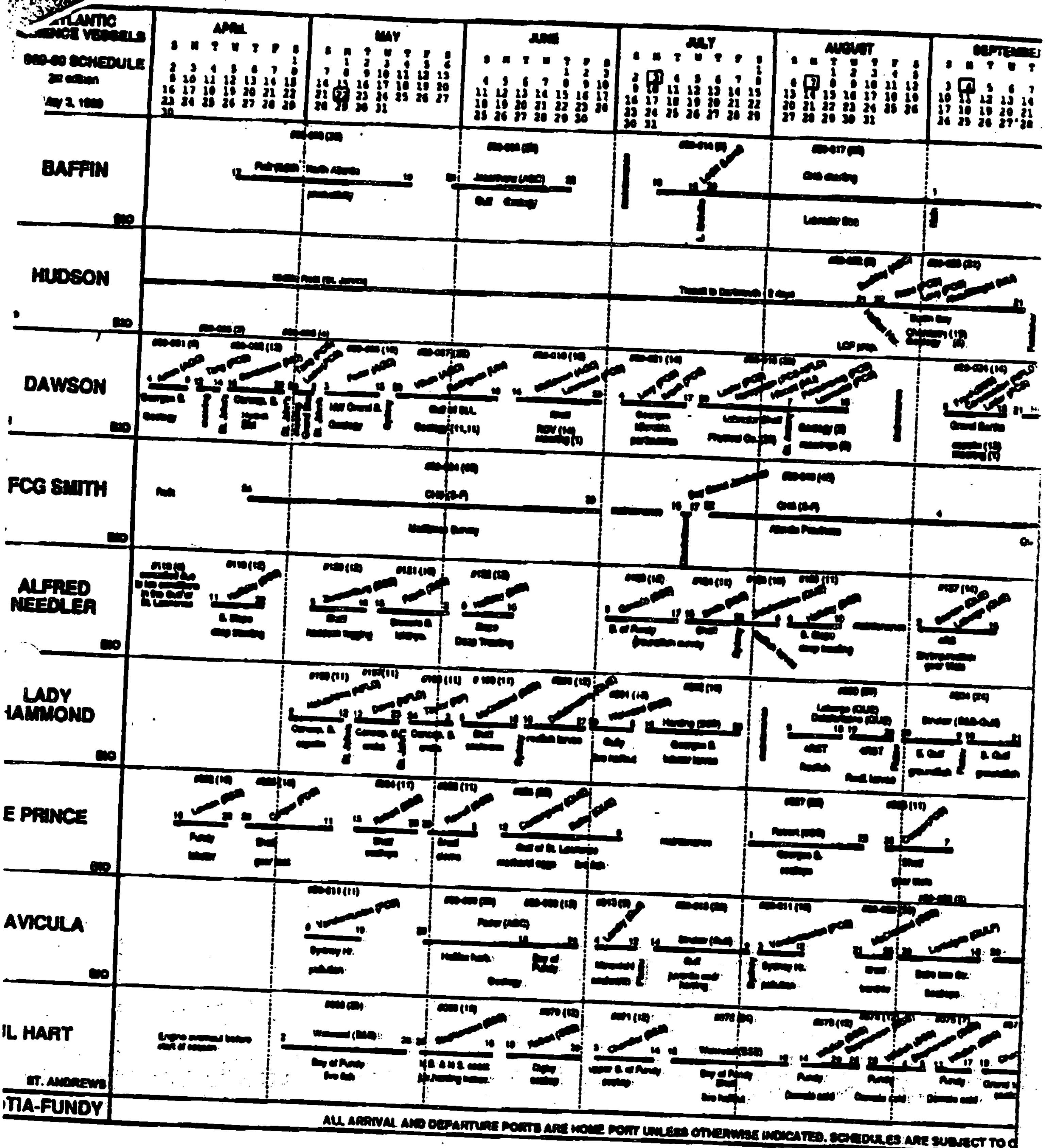
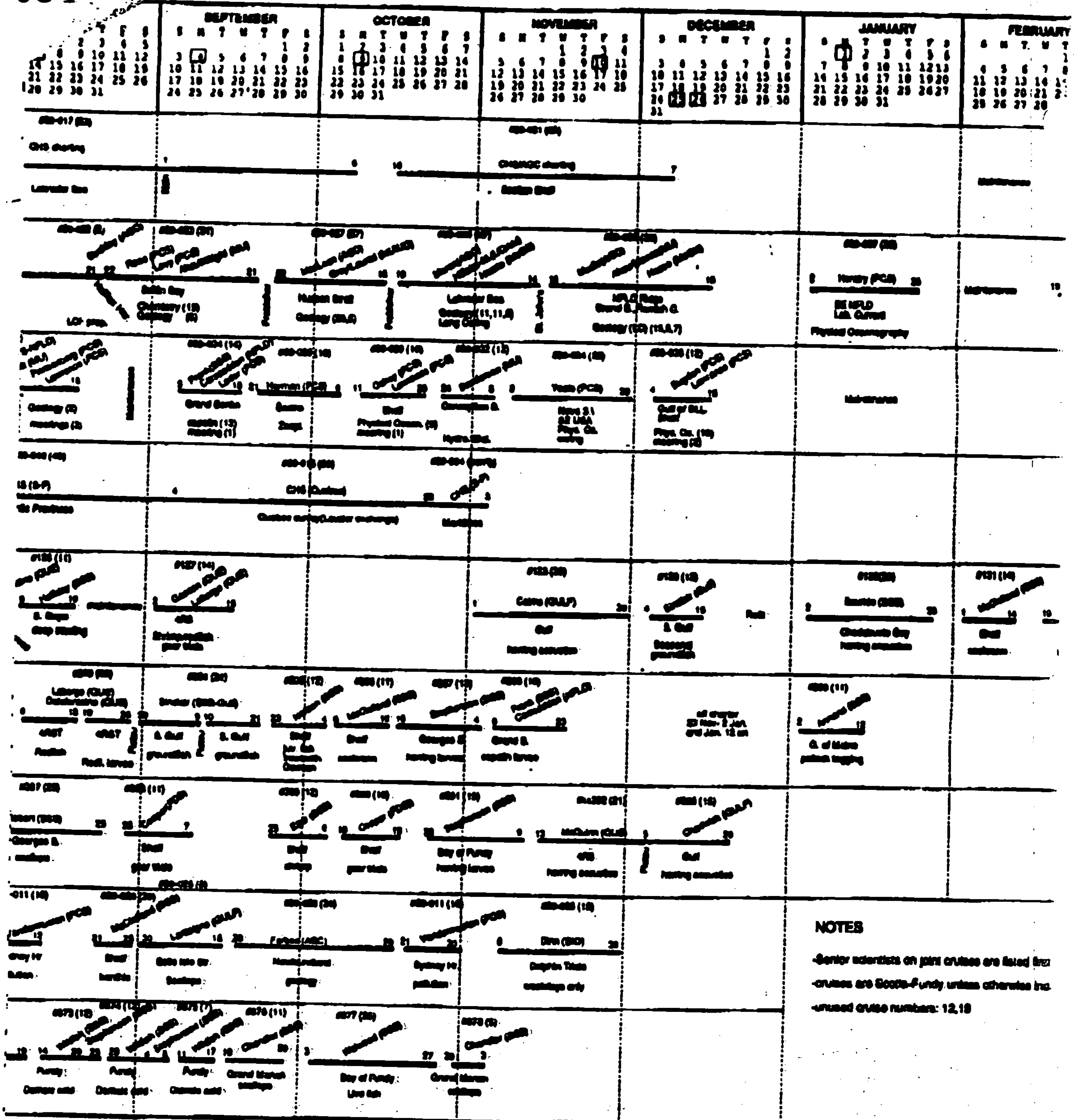
Canada


ATLANTIC SCIENCE VESSELS
1989-90 SCHEDULE
2nd edition
May 3, 1989
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
BAFFIN
BIO
HUDSON
BIO
DAWSON
BIO
FCG SMITH
BIO
ALFRED NEEDLER
BIO
LADY HAMMOND
BIO
E PRINCE
BIO
AVICULA
BIO
L HART
ST. ANDREWS
TIA-FUNDY
ALL ARRIVAL AND DEPARTURE PORTS ARE HOME PORT UNLESS OTHERWISE INDICATED. SCHEDULES ARE SUBJECT TO C



[…]NDICATED. SCHEDULES ARE SUBJECT TO CHANGE AT ANY TIME TO DUE TO PROGRAM OR VESSEL REQUIREMENTS. FOR MORE INFORMATION ON SCOTIA-FUNDY BASED VESSELS C[…]

Energy, Mines and Resources Canada
Earth Sciences
Pacific Geoscience Centre
9860 West Saanich Road
P.O. Box 6000
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Your file Votre référence

Our file Notre référence

89-04-25

Dr. Keith Louden
IFREMER Centre de Brest
BP 70
29673 Plouzane, France

Bon jour Keith,

Of relevance to ODP are the following cruises:

Scientists	Ship	Place:Work	Dates
Davis, Franklin, Becker, Zierenberg	Tully	Escanaba Trough, Middle Valley: Seismic, HF, pore pressure, pore fluid chemistry	May 8-June 2
Pedersen/Bornhold	Parizeau	Patton-Murray Smts: Seismic, coring	June 26-July 14
Hyndman/Yorath	Contract	Vancouver margin, Middle Valley: Multi-channel seismic	July
Rohr/Purdy	Tully	Juan de Fuca flank: Deep-source seismic refraction	June 5-June 23

I hope you and Adele are enjoying your stay in Brest,

All the best,

Earl Davis
PGC

Canada

Attachment 3

TIME TO DRILLING		PANEL REVIEW	DATABANK (DB)
D -4 yrs	General ship track determination	PCOM	
	Proposal submitted to JOIDES Office, which distributes copies.		Proposal deposited at DB Proponent identifies reference data
D -3 yrs	Initial evaluation	Thematic Panels	
	First Review Data Bank searches authorized.	PCOM commences tracking proposals with favorable thematic evaluation.	
			DB summarizes available data and initiates search of other databases
	Preliminary data assessment	Site Survey Panel	
	Prioritization and merging	Thematic Panels and Detailed Planning Groups	
			DB compiles site survey data package
	Specific site survey recommendations	Site Survey Panel	
	Supplemental site survey conducted		
		PPSP preview if required by the proponent	Site survey data deposited into DB
D - 2 to 1.5 yrs	Inclusion in drilling program	PCOM planning decision at Annual Meeting	
	Science Operator prepares for drilling		DB incorporates new site survey data and synthesizes final site survey data package
D -1 yr	Data assessment	Site Survey Panel	
			DB compiles safety package
D - 6 mo.			
	Safety review	Pollution Prevention and Safety Panel (PCOM final approval if necessary after PPSP changes)	DB compiles co-chief data package
*		DRILLING	*

LEG 124E
DIAMOND CORING SYSTEM
DCS - 2000 M

TEST RESULTS

* ESTABLISHED FEASIBILITY OF HANDLING/DEPLOYING DCS AT SEA
* DEMONSTRATED CONCEPT OF CUTTING DCS CORE FROM FLOATING VESSEL
    * IN 1600 METER WATER DEPTH
    * UNDER SEVERE ENVIRONMENTAL CONDITIONS
* SECONDARY COMPENSATION FUNCTIONED SUCCESSFULLY UNDER ENVIRONMENTAL CONDITIONS EXCEEDING THE DESIGN PARAMETERS
    * DESIGN: WOB ± 500 LB, 4-6 FT HEAVE, 8 SEC PERIOD
    * ACTUAL: WOB ± 500 LB, 4-6 FT HEAVE, 4 SEC PERIOD
* DRILL ROD STRING WITH WEDGE THREAD CONNECTIONS PERFORMED WELL
* TOP DRIVE, HYDRAULIC POWER PACK, MUD PUMPS, PLATFORM, MAST AND FEED CYLINDER ALL PERFORMED SATISFACTORILY

DESIRED IMPROVEMENTS

* STRENGTHEN WIRELINE TOOLS FOR RUGGED DEEP WATER ENVIRONMENT
* UPGRADE CORE WINCH - ADD BRAKE AND LEVEL WIND FEATURES
* IMPROVE UMBILICAL DESIGN
* REDUCE HANDLING/DEPLOYMENT TIME AND UPGRADE DEPTH CAPABILITY
* DEVELOP MEANS TO CONTROL UPPER HOLE STABILITY

Response to SSP Questions/Comments From October 1988 Meeting.

Items 1&2. HIGHRES

-Seismic acquisition is viewed as being adequate (at this point in time) with any potential modifications having a priority below that of improving shipboard navigation and plotting capabilities (see below). Previous inconsistencies with the bridge and underway logs have been resolved as a watchstander's manual was written to formalize the watch routine of the technical staff. ODP is aware of the inadequacies (software and documentation) of HIGHRES and the processing program, Define Process. This problem has been partly improved by the recent acquisition of SIOSEIS (written by Paul Henkart, SIO). This program [illegible] JOIDES Resolution during Leg 125.

Items 3-5. Streamers

-Negotiations are currently underway with LDGO for the loan of their french built high-speed streamer for evaluation during an upcoming ODP cruise (either Leg 127 or 128). If this streamer works as advertised, we will request approval and funds to purchase such a system for routine use on JOIDES Resolution.

-Deployment tests for depth control will be considered during evaluation of the high speed streamer. Previous tests using high-speed towing fish were completed during Leg 121 to improve the depth postion of the array. Current ODP streamers are not made for towing at high speeds.

Item 6. Sonar Dome

- Use of the Sonar Dome begining with Leg 123 has resulted in enhanced 3.5- and 12-kHz records collected at full speed. On Leg 124E records were improved as long as the water depth was <5000 m and the sea state was calm to moderate. In deeper waters the records were still poor. During the upcoming dry dock, we propose to replace the existing 3.5-kHz transducers (arranged in an array in the sonar dome) with a single (10kw) transducer in an attempt to get records in the combination of deeper water and rougher sea state.

Item 7. Time Standards

-Clocks accurate enough to track GPS on 2 satellites are currently onboard JOIDES Resolution, however, the LORAN-C on JOIDES Resolution operates in dual channel mode rather than in Rho-Rho mode (see statement by Randy).

Item 8. Underway Scientists

-ODP will continue alerting Co-Chief Scientists to the advantages of sailing "Underway Geophysicists" and will staff such a position when appropriate. ODP will also assist the "Underway Specialist" in becoming familiar with the shipboard operating systems. For examp..., ... happened for Leg 126 when the Underway Geophysicist came to ODP/TAMU prior to the cruise to become familiar with SIOSEIS and HIGHRES.

Item 9 Navigation

-ODP is investigating means to acquire the capabilities for plotting unsmoothed navigation x-y plots in real-time and smoothednavigation plots in near-real time (24-48 hours after data collection). The latter should be capable of plotting at least one additional parameter along trackline as well as strip charts for quality control. Three options are currently available (see comments from 10 November meeting). ODP considers this top priority and has implemented several preliminary steps to improve shipboard navigation:

1) ODP is in the process of scheduling an investigation group to evaluate the various systems available from various sources (LDGO, URI, Magnavox, for example) and to provide ODP with recommendations as to the best direction to proceed.

2) ODP is evaluating ways to improve the training of the technical support group.

INSTITUT FRANCAIS DU PETROLE

Direction de recherche
"Exploitation en Mer"

RE 20 ChS/JN Note 26

19 May 1989

SEVENTH MEETING OF THE JOIDES TECHNOLOGY AND ENGINEERING DEVELOPMENT COMMITTEE (TEDCOM)

College Station, Texas
27-28 April 1989

Ch. SPARKS

EXECUTIVE SUMMARY

1. The two day meeting had the following prime objectives:

   - assess results of the first engineering leg, and hence orientate future developments

   - formulate the TEDCOM response to the O.D.P. Long Range Plan.

2. A new wording for the TEDCOM mandate was agreed upon, in tune with the TEDCOM mode of operation. It was transmitted to PCOM for approval.

   (See Appendix B)

3. Following discussion of the engineering leg 124E, four recommendations were made:

   - The DCS should be retested as soon as possible in optimum conditions, with a cased hole, at a site already ~~known to have~~ basement at an acceptable level. Water depth should preferably be close to 1 500 m. This should only be increased if required by site considerations.

     (TEDCOM recommendation 89/1)

   - A TEDCOM subcommittee, composed of the following members, should be created to advise TAMU on mining drilling: W. Svendsen (coordinator), K. Millheim, F. Schuh, J. Coombs, P. Wickland. Their associated travel expenses should be paid by J.O.I.

     (TEDCOM recommendation 89/2)

   - A. SKINNER of B.G.S., a consultant with intimate knowledge of the D.C.S. systems of the "Pholas" and the "Bucentaur" should be encouraged to participate in the above sub-committee. His travel expenses should be paid by J.O.I.

     (TEDCOM recommandation 89/3)

- TAMU should study ways of modifying the DCS, so as to immobilize the lower end of the API string during all phases of DCS operation.

(TEDCOM recommendation 89/4)

4. During discussion of the development of the Navidrill, it was suggested that ways be studied of dissociating the weight on bit from the rotational speed, by using a sand line to reduce W.O.B.

5. The TEDCOM response to the Long Range Plan was formulated and immediately hand carried to the PCOM meeting in Oslo.

(See Appendix D)

6. Hard rock core orientation for Leg 130. This was discussed at the request of R. Moberly. The TEDCOM concurred with TAMU that no suitable (acceptable) system was commercially available today. An Arco system that suppressed the natural magnetism of the cores was considered unsuitable.

7. The TEDCOM considers that TAMU is spreading its research effort too wide. In particular high temperature drilling research, which is already being undertaken by Los Alamos and Sandia, should not be duplicated by TAMU.

8. TEDCOM members were alarmed at the frequency at which BHAs have been shot off in recent months.

9. The TEDCOM concurred with TAMU that the cleaning of hole 504B should not be combined with an engineering leg.

10. The TEDCOM recommended that O.D.P. should acquire, for the JOIDES RESOLUTION, an unconfined compression tester for hard rock, to give immediate knowledge of compressive strengths, to allow improved drilling and coring.

(TEDCOM recommendation 89/5)

11. SMP will look at ways of acquiring data from cores to give indications on swelling that could lead to stuck pipe.

12. <u>Next meeting</u>
    Probably England in Jan. 1990 (to coincide with land test of DCS). Date and place to be confirmed.

Charles SPARKS
10 MAY 1989

LIST OF ATTENDEES

TEDCOM Members

Charles SPARKS, Chairman	IFP
Jean BONASSE-GAHOT	ELF
Martin CHENEVERT	Univ. Texas, Austin
Keith MANCHESTER	CGS/BIO
Archie McLERRAN	Consultant
Keith MILLHEIM	AMOCO
Heinrich RISCHMULLER	KTB
Frank SCHUH	Drilling Tech. Inc.
Harald STRAND	Norsk Hydro.
Walter SVENDSEN	Consultant

TEDCOM Replacements

John COOMBS (for B. COTTEN)	CHEVRON
Junzo KASAHARA (for H. FUJIMOTO)	Univ. Tokyo

TEDCOM Liaisons

Joel WATKINS (for G. BRASS)	PCOM
Barry HARDING	TAMU
Al. SUTHERLAND	NSF
Paul WORTHINGTON	BP/DMP

Permanent Observers

Willie BRANDT	SEDCO
Percy WICKLUND	DOSECC

Guests

Kate MORAN	BIO	SMP
Keith FLOYD	BP	)
Karl SANDVIK	IKU	)
Alister SKINNER	BGS	) Participants
Ulrich DEUTSCH	ITE	) on Leg 124 E
Dave STEERE	UDI	)
Mark WALTZ	UDI	
Michel TEXIER	ELF	
Jacques DELACOUR	IFP	
Jean-François LEVIER	IFP	

TAMU Staff

Glen FOSS
Steve HOWARD
Eugene POLLARD
Dan REUDELHUBER
Michael STORMS

Apologies

Claus MARX	ITE
Paul STANTON	EXXON

AGENDA

April 27 8.30 AM - 6.00 PM

1.	Introduction	C. SPARKS
2.	PCHM/PCOM meeting Dec. 88	"
3.	TEDCOM mandate	"
4.	New from NSF	A. SUTHERLAND
5.	ODP organisational changes	B. HARDING
6.	Leg 124 E - Trial of DCS	S. HOWARD
7.	Leg 124 E - Navidrill Test	M. STORMS
8.	ODP Long Range Plan/TEDCOM Response	C. SPARKS

April 28 8.30 AM - 3 PM

9.	Leg 124 E - Other tests	M. STORMS
10.	Update on tools development	M. STORMS
11.	Coring of Chert/Chalk	Discussion
12.	Slimhole logging	P. WORTHINGTON
13.	Wellbore Stability Research at U.T. Austin	M. CHENEVERT
14.	Legs 123-125. Operations reports	G. FOSS
15.	Engineering Legs 2 and 3	B. HARDING
16.	Physical Properties Measurements for improved Drilling/Coring	K. MORAN
17.	Next meeting	C. SPARKS

1. INTRODUCTION

Charles SPARKS welcomed members, liaisons and guests to the seventh TEDCOM meeting.

He presented the agenda and stressed that the TEDCOM had two very important tasks in front of it:

- to draw conclusions from the first engineering Leg (124 E) that took place in Jan/Fev. 1989 and in particular to assess the DCS, which had been built and tried as the result of a TEDCOM recommendation (of 4 Feb. 1988)

- to formulate the TEDCOM response to the ODP Long Range Plan (LRP).

2. PCHM/PCOM MEETING NOV./DEC. 1988

Charles SPARKS mentioned the principal points, of importance to the TEDCOM, that were brought up during the meetings.

The decision had been taken that, from now on, all future ODP Legs should be "science driven" instead of "regionally driven". Many panel chairmen regretted that communication was not better between TAMU and the various panels. They requested the presence of a TAMU engineer at their meetings, at least once a year. C. SPARKS had suggested the some panel chairmen attend TEDCOM meetings. Unfortunately neither of the two invited to the present meeting were able to attend.

Technical objectives brought up during the PCHM meeting were virtually unchanged from the previous year (see Appendix A).

3. TEDCOM MANDATE

C. SPARKS had noted that the TEDCOM terms of reference, in effect since the beginning of ODP, bore little relation to the way the TEDCOM operated, and indeed conflicted with TAMU's responsibilities. At the PCOM chairman's request, a revised wording was proposed by the TEDCOM (see Appendix B).

4. NEWS FROM NSF

Al SUTHERLAND presented histograms (see Appendix C) giving revised figures for the Eng. & Ops. budget for 1990, when compared with those presented at the sixth TEDCOM. He also presented the break down of the TAMU and total ODP budget over the past four years. Ship costs for 1990 are expected to be slightly less than for 1989.

A. SUTHERLAND outlined the program plan schedule (see Appendix C) and transmitted NSF's comments about engineering. NSF is particularly concerned to know:

- if ENG LEG 1 (124 E) results have been fully evaluated
- if engineering legs are considered to be of value and how they should be scheduled
- if we are ready for a 4 000 m DCS

(see section 5 for TEDCOM comments on these points).

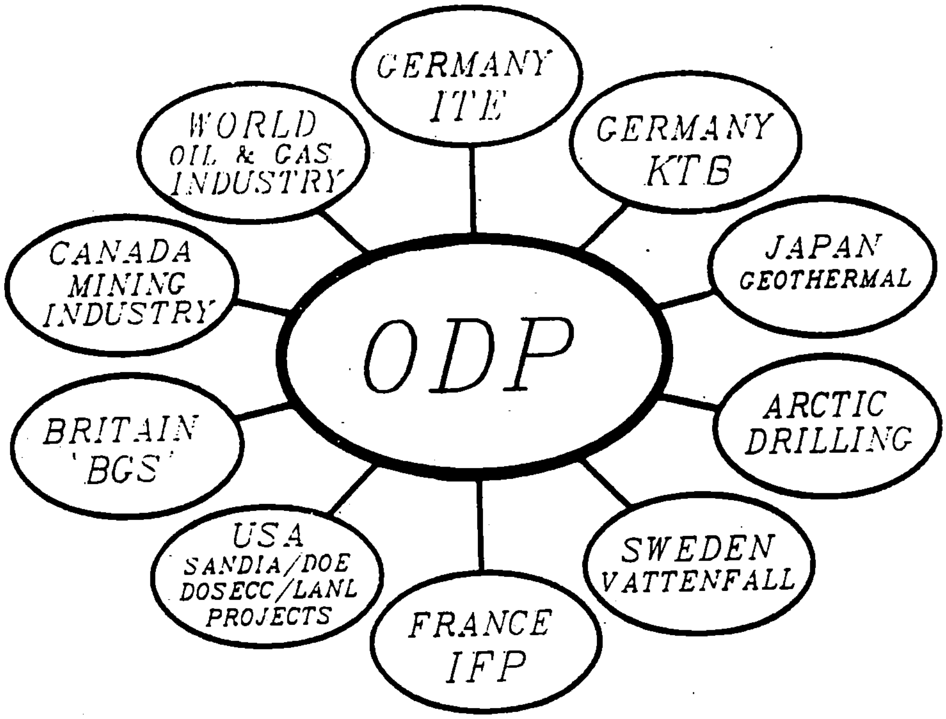
NSF also considered that JOIDES/PCOM should provide annual firm technical requirements, based on science.

When asked whether there was any chance of the USSR joining ODP, given their improved relationship with the US, A. SUTHERLAND replied that there were no developments in that direction at present.

100

5. ODP ORGANISATIONAL CHANGES

Barry HARDING presented the figure below, which summarizes the principal industries and organisations, throughout the world, on whose experience ODP is drawing.



6. LEG 124 E - TRIAL OF DCS

Steve HOWARD explained how the DCS test had been mounted following the TEDCOM recommentation of Feb. 1988. TAMU had first checked relevant experience in the US/Germany/Norway before defining details. It was thus decided to use a top driven system (instead of down hole turbine) with high speed narrow kerf diamond impregnated bits. A secondary heave compensator was incorporated in the design to limit weight on bit to 2500 +/-500 lbs.

The system had been designed, built, tested and shipped to Manila for Leg 124 E, in about eight months. This was a remarkable achievement by TAMU, as the chairman pointed out.

The test demonstrated the following:

- the system can be deployed in severe weather conditions
- the secondary compensator was effective in limiting W.O.B. as required. Furthermore, skilled operators could not control W.O.B. manually with the required accuracy, without the secondary compensator
- the mining system top drive could be used effectively in 1600 m of water, although it had not been used at high speed.

These results were very positive as Keith MILLHEIM stressed. They compensated for the disappointment of negligible core recovery (where 100-200 m had been hoped for). The discussion turned to ways of improving the DCS, which it was felt had not been given a fair trial on Leg 124 E, since basement was never found and terrible hole stability problems were encountered. (The performance of the DCS on Leg 124 E had been the object of several papers that TEDCOM members had already read, notably those by TAMU and leg participants Keith FLOYD, Karl SANDVIK and Alister SKINNER, Charles SPARKS.

Karl SANDVIK and Alister SKINNER mentioned that the key to the success of the DCS on the Bucentaur (used regularly for 200 m penetration in 500 m of water) was the stability of the API string. The API bit is deliberately locked into the formation, by drilling a short distance without circulation, just before deploying the DCS string. This provides an outside seal to the API bit, which ensures return circulation to the vessel via the annulus, when drilling with the DCS, and so avoids possible erosion of the API hole.

Keith FLOYD advocated retrying the DCS in 1500 m of water, in better conditions, before extrapolating towards 4000 m water depths where vibrational problems could be encountered.

Frank SCHUH mentioned that whirling vibrations can occur as a result of the two pipes sticking together and creating large centrifugal forces. This can be greatly reduced by increasing the lubricity of the annular fluid. Changing the rotational speed can be used to modify the string harmonics, as A. SKINNER pointed out.

Keith MILLHEIM mentioned that tool joints can cause damage to the well wall. He also suggested that a TEDCOM subcommittee be formed to cross check advice given to TAMU.

Frank SCHUH favoured suspending the API string from tensioners, so that the DCS could be operated from the rig floor (c.f. note on trial of DCS by C. SPARKS). Steve HOWARD mentioned that four tensioners would cost $600 000.

Mike STORMS mentioned that the great error of Leg 124 E, was to have agreed to hold the engineering leg in an area that had not been adequately surveyed and which turned out to be quite unsuitable.

Following the discussion, the TEDCOM adopted four recommendations:

- **the DCS should be retested as soon as possible in optimum conditions, with a cased hole, at a site already known to have basement at an acceptable level. Water depth should preferably be close to 1500 m. This should only be increased, if required by site considerations**

- **a TEDCOM subcommittee, composed of the following members, should be created to advise TAMU on mining drilling: W. SVENDSEN (coordinator), K. MILLHEIM, F. SCHUH, J. COOMBS, P. WICKLAND. Their associated travel expenses should be paid by J.O.I.**

- **A. SKINNER of B.G.S., a consultant with intimate knowledge of the DCS systems of the "Pholas" and the "Bucentaur", should be encouraged to participate in the above sub-committee. His travel expenses should be paid by J.O.I.**

- **TAMU should study ways of modifying the DCS, so as immobilize the lower end of the API string during all phases of DCS operation.**

7. LEG 124 E - NAVIDRILL TEST

Mike STORMS mentioned that the NCB had been deployed nine times during the leg. Mechanical failure had occurred five times, due to a defective motor (the new Mach IC failed to turn at all), mechanical separation of a core bit, and a broken thruster spring. On the four remaining runs some core was recovered, but bit plugging was a problem. Bit weight (W.O.B.) was between 4000-12000 lbs.

M. STORMS said the major problem of the NCB concept was that W.O.B. necessarily increased whenever the motor stalled. Some way should be found to vent the excess pressure in such a situation.

F. SCHUH suggested that a sand line be used to control W.O.B. M. STORMS added that it is theoretically possible to drill forward of the API bit by adding rod each time the NCB is pulled to recover core. This is quickly limited however by torque problems and weight on the sand line. He advocated more land testing, since penetration can be measured on land, but not at sea.

The normal procedure with the Navidrill is to ream down, after taking the core, rotating with circulation, to grind up the rubble and clean the hole.

Paul WORTHINGTON added that a gamma ray sensor could be used with the NCB to establish the position of partial cores. Prof. RISCHMULLER mentioned that such cores could be oriented using a micro-scanner. P. WORTHINGTON was doubtful that a micro-scanner would fit in a 4" hole.

8. LONG RANGE PLAN

Charles SPARKS introduced the plan and stressed that it was the result of four years discussion within the various panels and took into account the recommendations of COSOD 2. The plan was highly political with tough technical objectives. The TEDCOM was responsible for assessing as accurately as possible the ability to attain these objectives. If the TEDCOM were too cautious, it could spell the end of ODP in 1992. Likewise if the TEDCOM underestimated the difficulties, the consequences would be extremely serious for ODP.

After a very lengthy discussion, during which it was regretted that the technical objectives were not more precise, the enclosed carefully worded response of the TEDCOM was prepared and despatched to the PCOM meeting in Oslo by hand carrier (see Appendix D).

It was noted that the engineering of the 6 km DCS, shown in the budget table to begin in 1993, should be undertaken in 1989-92.

9. LEG 124 E - OTHER TESTS

Pressure Core Barrel (PCS)

Mike STORMS mentioned that the PCS had been deployed three times, of which two had been in the formation. Core samples had been recovered on both attempts. Full hydrostatic pressure had been recovered twice and the reason for the loss, on one attempt, had been identified (accumulator redressing problem). The tool was being improved, but the next required development was a pressure/temperature controlled lab chamber to which the core could be transfered.

Extended Core Barrel (XCB)

The new thread design had been effective in preventing over torque failures leading to a more reliable deep penetration (1000 m) coring system. The tool had been deployed in rugged environments without mechanical failure. The new cutting shoes had performed well except in Chert horizons.

The development of cutting shoes suitable for Chert formations would now be desirable, but may not be possible because of the inevitable high W.O.B. and low speed imposed by the system. Better circulation control to cutting shoes is also required. More experience with the XCB in different lithologies are required before a definite assessment can be made.

10. UPDATE ON TOOLS DEVELOPMENT

Core Orientation

Mike STORMS pointed out that there was no system commercially available today that could be used on Leg 130, as R. LARSON wished. He distributed a note (see Appendix E) giving the detailed response made by TAMU to PCOM on the subject.

Frank SCHUH mentioned that ARCO used a system some years ago that allowed cores to be orientated, but in the process it destroyed their natural magnetism. This would probably not be acceptable. He would nevertheless provide TAMU with the name of a contact person.

Sonic Core Monitor (SCM)

Mike STORMS mentioned that the SCM was under development with Diamont Boart. It was a downhole, self contained, core entry monitoring system using a sonic transducer. It was mated with the XCB.

The SCM will be under evaluation on Leg 126 but funding for continued development in 1990 has been cancelled.

Hydrolex Drilling Jars

A jar was deployed on Leg 124 but on retrieval was found to be impossible to rotate or stroke. This was probably the result of bending imposed during spudding and/on lack of lubrication. The design will be further evaluated on Leg 126. A modified and improved model of the jar will be deployed on Legs 127 and 128.

Barry HARDING asked Keith MILLHEIM if he would obtain permission to try jars with AMOCO.

High Temperature Drilling

Mike STORMS mentioned that TAMU's temperature objectives are progressive. TAMU is at present looking at ways of dealing with temperatures upto 400°C. They intended to use circulation for cooling purposes, although large flow rates would be required. TAMU is at present liaising with SANDIA and LANL.

Keith MILLHEIM concurred that it would make no sense for TAMU to work on these problems independently, given the great number of other subjects they have to treat. TAMU would do well to use a consultant.

Vibracoring

Mike STORMS explained that ODP was extremely interested in the application of vibracoring to ODP coring systems. They were particularly interested in applying it to:

- APC in loose flowing sands
- XCB in turbidities and chert/chalk
- DCS for enhanced life and improved penetration in crystalline rock.

Walter SVENDSEN pointed out that diamonds are fragile and do not like impacts. In mixed rock, diamonds could be sheared off.

M. STORMS added that TAMU is trying to keep up with research in this field. Jack PHEASANT of B.G.S. will be detached to TAMU shortly to work on vibracoring. He mentioned that the APC cannot at present be used in sand since it bounces back. As for the XCB, the sand gets washed out.

Atoll Drilling

TAMU have reviewed drilling records from the Enewetak coring and discussed them with Alister SKINNER who was the coring engineer concerned.

The DCS is being developed as a potential coring system for shallow water carbonate/reefal limestone lithologies.

11. CORING CHERT/CHALK - DISCUSSION

Mike STORMS mentioned that the only tool at present available to TAMU for coring chert/chalk was the NCB. The XCB had given poor results.

Keith MILLHEIM mentioned that AMOCO had got 100 % recovery in chert/shale, but emphasised that this cannot be done by drilling with water and impregnated bits. The latter ball up in soft interbedded layers. Surface set diamonds and oil based mud are essential. Alas TAMU cannot use oil based muds since they contaminate the cores.

Keith MILLHEIM said low bit weights were essential. It was important not to break off the chert below the bit. He recommended that the smallest possible cores be taken when drilling chert. The matrix must not be destroyed. Fluids are the key to success. AMOCO has drilled chert/limestone with compressive strengths upto 60 000 psi.

12. SLIMHOLE LOGGING

Paul WORTHINGTON reviewed the logging tools that are available as a function of hole diameter (see Appendix F). He pointed out that more than 75% of the information was lost when hole diameter was reduced from 6 1/4" to 4". The cost of developing new 4" versions of the tools would be quite horrendous, he added. He stressed that continuous cores do not mean that logging can be dispensed with. Measurements made insitu are complementary to and more precise than those made on cores, since the scale of material being measured is so much greater (about 100 times).

He pointed out that a workshop on "high temperature slimhole logging" had been proposed to JOI to be held towards the end of 1989 in conjunction with ODP, DOSECC, Continental Drilling and KTB.

About the Nankai leg (planned for late 1989), he added that the "geoprops probe" was indispensible for it. Furthermore the "geoprops probe" could not be used without the "NCB" and the "Wireline Packer". All three key tools for the Nankai Leg were experiencing problems at the moment, he noted.

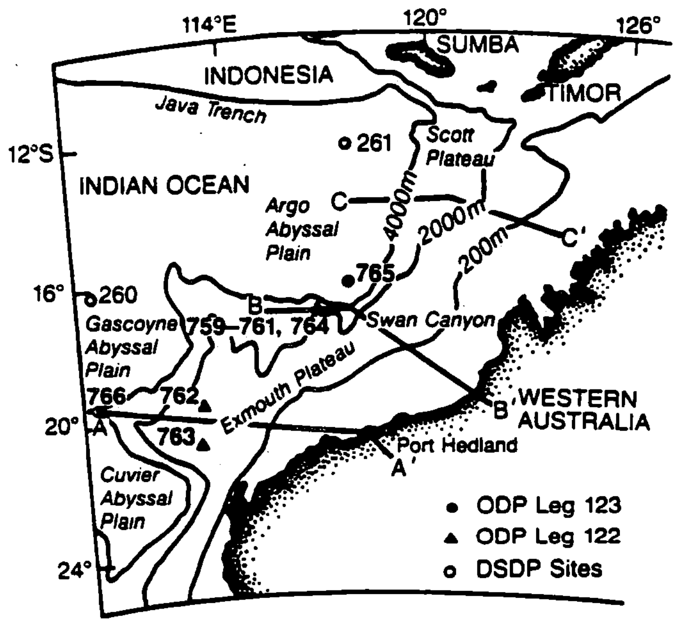
13. WELLBORE STABILITY RESEARCH AT U.T. AUSTIN

Martin CHENEVERT presented the research that he is involved in, related to wellbore stability. He explained that he was particularly concerned with the modelling of the state of stress in the immediate vicinity of the well wall. Some of the factors of concern are local swelling of shales pore pressures and resistivity. A plot of normal stress against octahedral shear stress can be separated into distinct "safe" and "failure" zones.

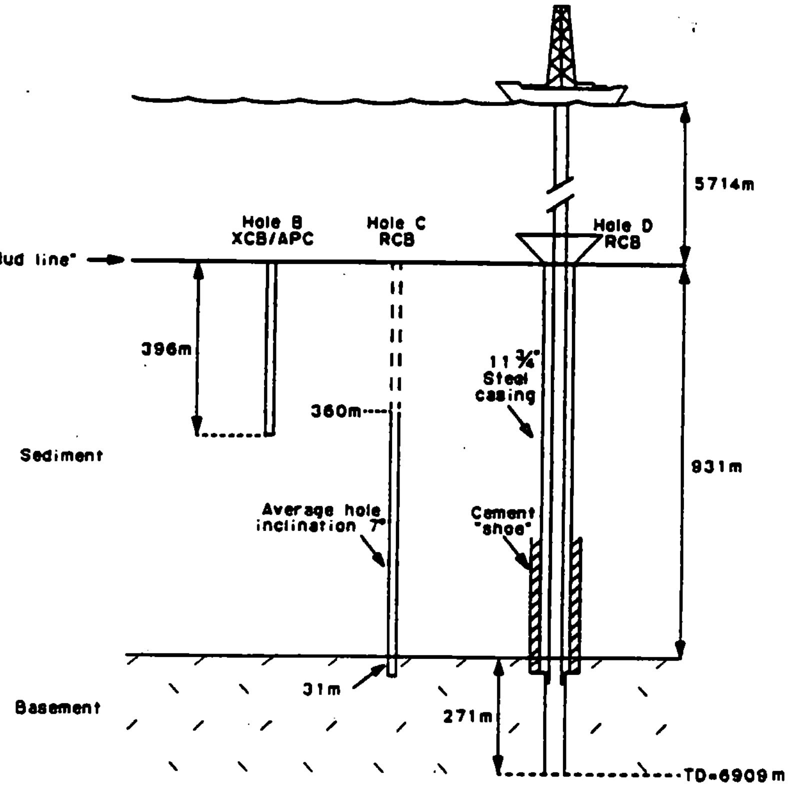
M. CHENEVERT quoted the operations report of Leg 124 and mentioned that some of the swelling observed was of mechanical origin and some of chemical origin. The first signs of swelling are stuck pipe. If clays are present, swelling is a potential problem. If there is no clay, inhibitive muds should not be used.

14. LEGS 123-125. OPERATIONS REPORTS

Glen FOSS explained that Leg 123 was spent investigating two sites on the Exmonth plateau (see sketch below), from 28 Aug. - 1 Nov. 1988, where a permant hole was hopefully established at site 765 D. A rentry core was set in 5714 m of water (deepest ever) and 930 m of 11 3/4" casing (longest ever in DSDP/ODP operations) was set to basement (see sketch below).



Leg 122-123 sites



Site 765

During this operation the derrick load reached a record 906 000 lbs.

Hole 765D was extensively logged. At one point a 20 m 3" diameter logging tool stuck inside the 11" casing and was only retrieved after working the line for more than four hours. No explanation was ever found for the sticking.

At the second site (766), in 4000 m of water, the RCB was used to continuously core through 440 m of sediment and 80 m of basalt. Cores in the upper sediment were highly disturbed and recovery was average. This improved below a chert layer at 200 mbsf. A 30 m section of coarse sand caused alarm but was drilled successfully without fill or torque.

During Leg 124 (Nov.-Dec. 88) two sites were investigated in the Celebes Sea and three sites in the Sulu Sea. Site 767, in 4916 m of water, was drilled to basement. Hole problems began at 714 mbsf and were explained by mechanical clay swelling in the lower hole section, induced by underbalanced drilling conditions. At 794 mbsf the pipe became irrevocably stuck and the BHA had to be shot off.

At site 768, in 4 395 m of water, three holes were drilled. Hole 768 B was abandoned at 364 mbsf when shows of hydrocarbon gas were detected. Hole 768 C was significant in being the deepest penetration hole yet drilled by ODP - to 1271 mbsf.

Leg 125 (Feb.-April 1989), following the engineering leg was devoted to drilling sites on the Mariana Arc and the Bonin Arc, just South of Japan. Very poor soil conditions had been encountered but at the final site 829 m of hole had been made in 3000 m of water. Problems had been encountered with gravels and fine volcanic sands.

When asked about the frequency at which BHAs had to be shot off as a result of stuck pipe problems, Barry HARDING replied that about five had been shot off in the first three years of ODP. More recently about ten had been shot off in the last eighteen months. The TEDCOM was alarmed by this increase.

15. ENGINEERING LEGS 2 AND 3

Barry HARDING mentioned that the second engineering leg had been postponed and was now scheduled to take place in May 1990. The top priority was to retry the DCS and some other tools such as the Navidrill and Jars. The tools would not be ready until late February after completion of land testing. A complete site survey prior to ENG. LEG 2 was essential, as had already been stressed during the discussion of Leg 124 E.

As for the third engineering leg, it was too early to discuss details. TAMU was not in favour of combining that Leg with the cleaning up of hole 504 B. The TEDCOM shared his point of view.

16. PHYSICAL PROPERTIES MEASUREMENTS FOR IMPROVED DRILLING/CORING

This point was included on the agenda following the TEDCOM recommendation of Feb. 1988, which said that physical properties measurements should be made on deck in order better to adapt drilling practices to the terrain encountered.

Kate MORAN (chairman of SMP) explained the present measurements made on board the JOIDES RESOLUTION. Glen FOSS explained the present drilling/coring procedures which consisted of using the APC followed by the XCB until refusal in both cases. After that a cone is normally dropped and the hole reentered with the RCB. Alternatively the latter is used to drill a new hole close by. He mentioned that cores could not be touched for two hours after retrieval until they had come into equilibrium with their surroundings.

K. MORAN suggested that further measurements could be made on cores not only to improve immediate drilling, but also to establish a data bank that could be useful for orientating future design and development of drilling/coring equipment.

The TEDCOM thought that what was most urgently required was information on drillability and on hole stability.

Following the discussion the TEDCOM adopted the following recommendation:

ODP should acquire an unconfined compression tester for hard rock to give immediate knowledge of compressive strengths to allow improved drilling and coring.

K. MORAN said that SMP would look at the possibility of using XRD data to give indications on swelling that could lead to stuck pipe.

17. NEXT TEDCOM MEETING

It is tentatively suggested that the next meeting should take place in England to coincide with land testing of the DCS in Kent (probably January 1990).

ENGINEERING DEVELOPMENT
NEEDS & PRIORITIES IDENTIFIED BY PCHM

- Improved core recovery

- Drilling of:

  chalk-chert sequences

  unconsolidated sediments

  fractured rocks

  deep holes

  at high temperatures

APPENDIX A

TEDCOM MANDATE (April 27, 1989)

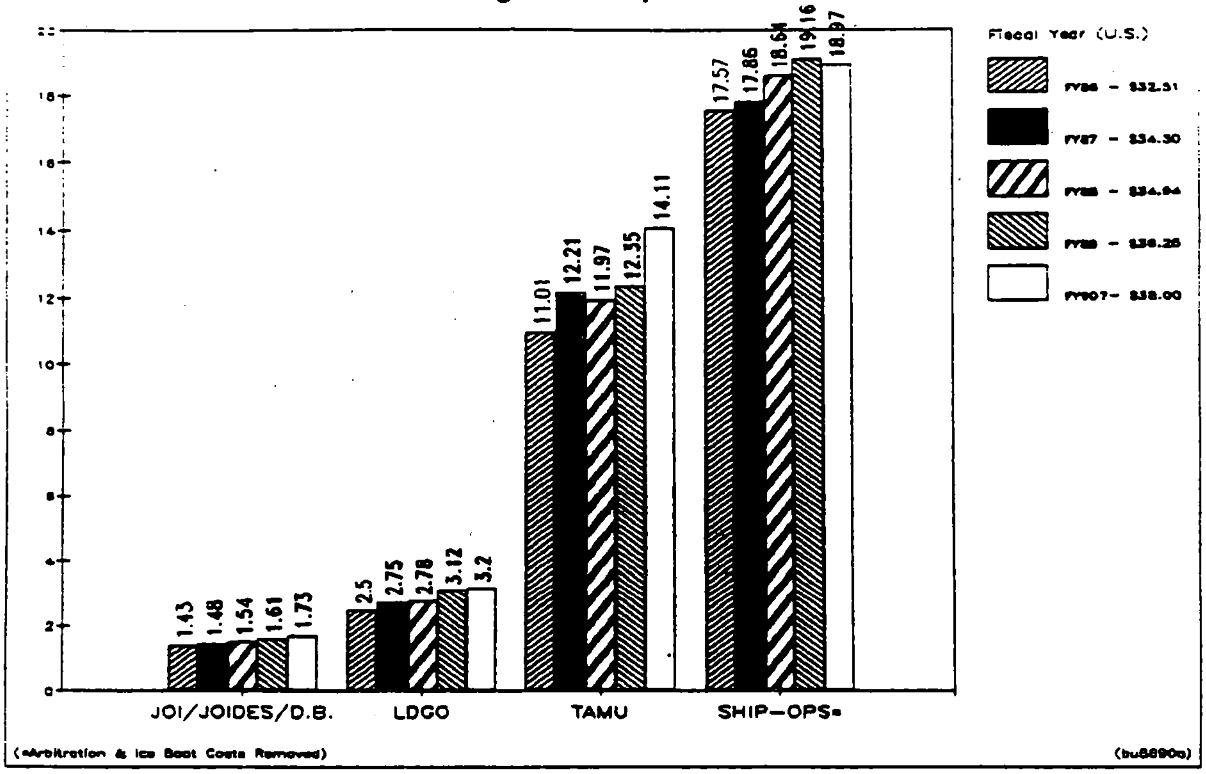
The TEDCOM is a consultative committee that is responsible for providing information and advice to the science operator (TAMU) on the technical developments necessary to meet the scientific objectives, defined by PCOM. It reports to PCOM on the required developments and necessary budgetary levels to meet them.

The TEDCOM assists the "Development Engineering & Drilling Operations" Group at TAMU with the conception of new tools and with the improvement of existing ones. It monitors the progress of their development. It occasionally assists TAMU/EDO with specific studies.

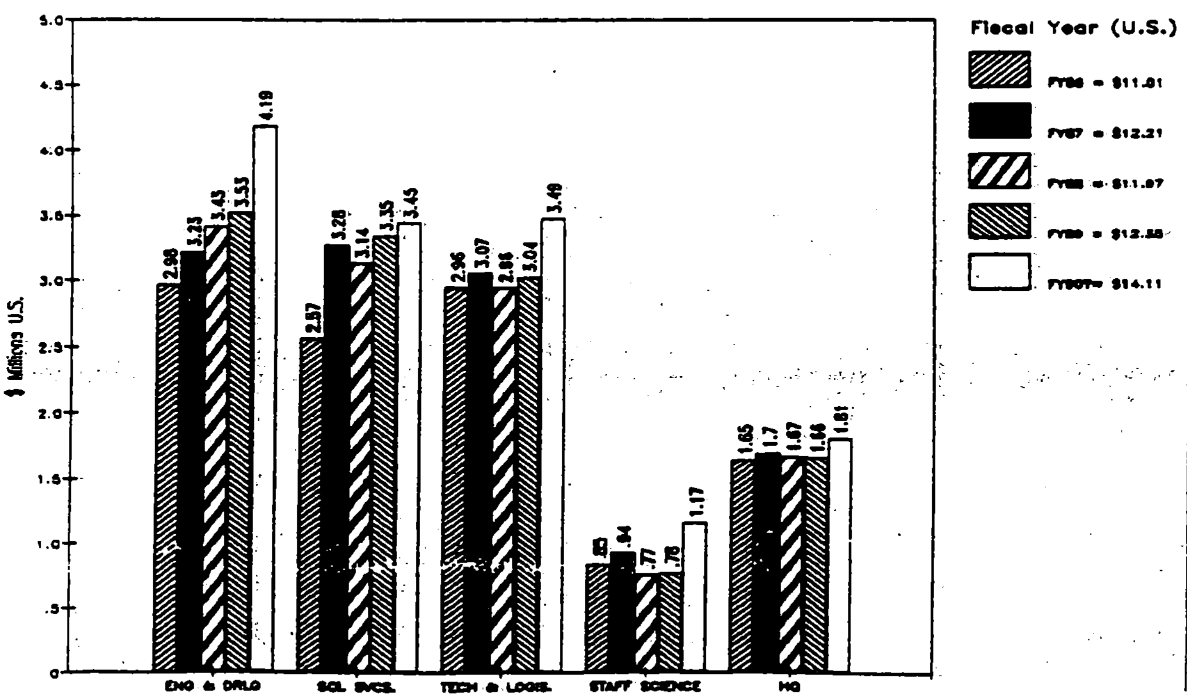
It organizes workshops and seminars on subjects relevant to the development program and arranges contacts between TAMU/EDO and companies or organizations, exterior to ODP, with pertinent experience.

TEDCOM members are generally engineers, nominated by PCOM. One of the tasks of the TEDCOM is to collaborate with the Downhole Measurements Panel.

Ocean Drilling Program
FY 86-90
Budget Comparisons

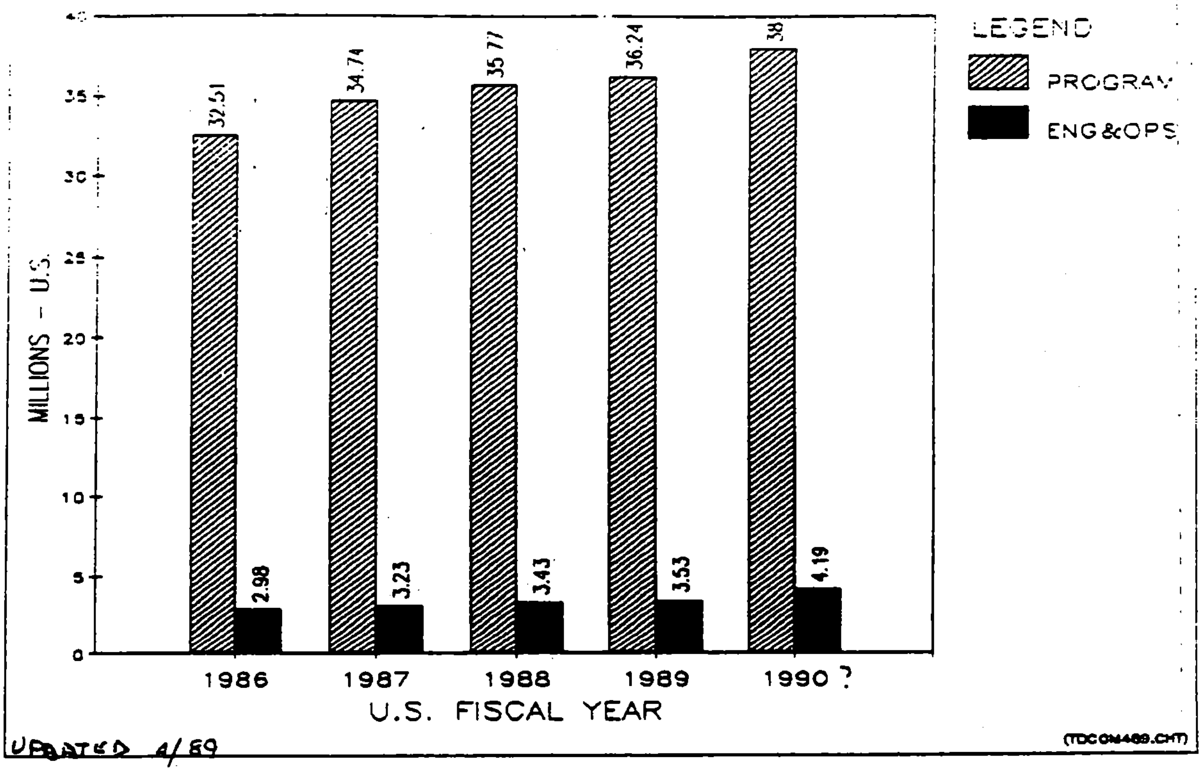


TAMU-ODP
FY 86-90
Budget Comparisons
(Ship Ops Removed)

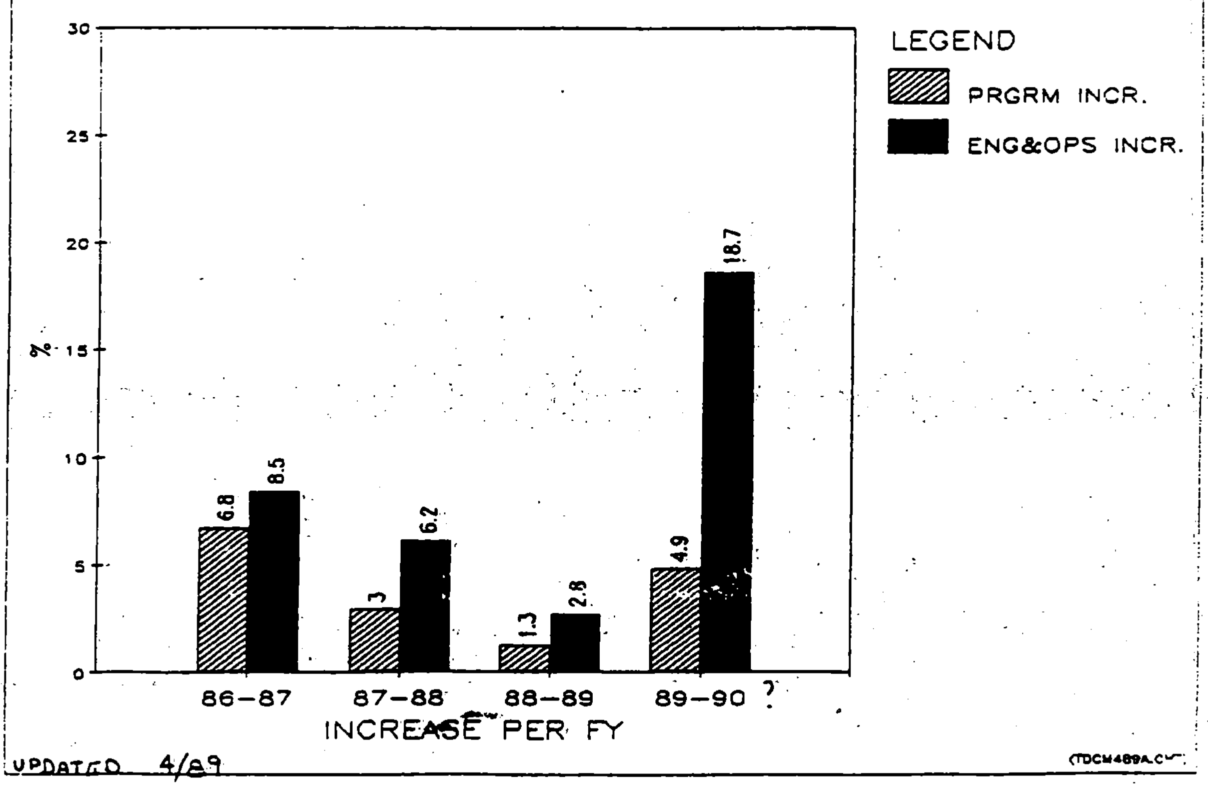


APPENDIX C

GROWTH OF ENG. & OPS IN ODP



GROWTH IN ENG & OPS IN THE ODP



PROGRAM PLAN SCHEDULE

DECEMBER	JOIDES SCIENCE PLAN
JANUARY	NSF BUDGET GUIDANCE TO JOI ⟶ TARGETS TO CONTRACTORS
FEBRUARY	BUDGET OUTLINE BCOM REVIEW
1 APRIL	DRAFT PLAN TO NSF FOR ADMINISTRATIVE REVIEW
1 JUNE	REVISED PLAN TO JOIDES EXCOM FOR REVIEW
AUGUST	FINAL PLAN TO NSF
SEPTEMBER	APPROVAL

April 27, 1989

TEDCOM RESPONSE TO ODP LONG RANGE PLAN
(Version 23 Nov. 88 - N. Pisias)

1) TECHNICAL REQUIREMENTS/PROBLEMS LISTED

The technical requirements are clearly defined in the LRP (see attached list) and appear to be correctly defined, given the scientific objectives. On the other hand, the list of problems related to drilling systems (see attached list from page 44) is incomplete and misleading.

The TEDCOM particularly endorses the remark that "we cannot predict the pace at which technological developments can be made, but it is essential that we commit enough resources, both in terms of engineering and operations, to a specific requirement to assume its proper completion". (LRP p. 54)

2) PROBLEMS ALREADY UNDER STUDY

Many of the requirements, that PCOM have drawn attention to, relate to problems that are already being addressed and will continue to be worked on as part of an on going, evolutionary process. These include drilling in chert/chalk sequences, improved core recovery, increased bit ~~life, development of~~ a pore water sampler and pressure core sampler.

3) DRILLING/CORING CHERT/CHALK SEQUENCES

It is not possible to be certain today that it will ever be possible to core all chert/chalk sequences. Success depends on firmness of the chalk matrix. The approach used at present is to develop methods that allow the position of the chert layers to be known as closely as possible; to control WOB and flow rates precisely; to drill with diamond bits. Land testing is essential to the success of this program.

4) CORE RECOVERY

In the case of core recovery, good progress is being made. ODP overall mean recovery rate today, in sedimentary formations and hard rock, is 67%. TAMU is continually working to improve this and has already set itself a target of 80%.

The LRP mentions a target of 75% in basement. ODP mean recovery rate to date in basement, mainly using the RCB, achieved on Legs 103 through 123 is 42 percent. The DCS promises greatly increased recovery, since, on land, rates of nearly 100% are achieved with such systems.

APPENDIX D

5) FIRST PHASE REQUIREMENTS NOT BEING ADDRESSED

Development work is not at present being done on the 'absolute orientation of ALL core samples', because of budgetary and manpower insufficiency. On the other hand, APC cores are already routinely orientated. Hard rock core orientation will be addressed once an acceptable hard rock coring system (DCS or equivalent) has been developed.

Also for budgetary and manpower reasons, research on vibrocore sampling in sandy sequences has had to be deferred, although ITE (FRG) developments in this area are being closely followed.

6) IMPROVED HOLE STABILITY

With an open circulation (riserless) system, the key to stability, in difficult terrain, lies in the use of mud and casing and in leaving holes open (uncased) for the minimum possible time. PCOM should not imagine that hole stability problems are likely to improve significantly. Some academic research on continuous hole linings is being pursued, particularly in Norway, but has not been applied in the field. It's practical application is probably five years away.

7) VERY DEEP DRILLING

The LRP very deep drilling goals in hard rock are very ambitious (in 1989) and may not be realistic, particularly as industry is not presently doing any relevant research that would help ODP to reach these objectives. Nevertheless, the phased approach adopted in the LRP gives the best hope.

If the MOHO (5Km penetration) is the main objective of the LRP, an international symposium devoted to all related problems should be organized in the near future so that necessary research can be logically planned and shared between interested organizations.

Phase I and II objectives appear achievable with the mining coring system providing the necessary manpower and budget are made available.

It is interesting to note how the limit of routine drilling in the oil industry has been extended over the ten year period (but note: drilling in sedimentary sequences, in shallow water, with virtually no coring). In 1979, 3000 m of hole was routine. In 1989 the industry is drilling regularly to 5 - 6 km. However this is the result of considerable research and development. But to anticipated this kind of continued development in the future is not realistic.

(Note: If similar evolution cannot be noted when comparing ODP achievements with those of DSDP, it is because increased depth has not been an ODP objective. However, ODP is far more effective than DSDP in core recovery and number of holes drilled, mainly due to increased engineering effort and budget.)

The required technology to reach the MOHO cannot be defined in detail today but could well be evolved and extrapolated today from the ODP diamond coring system (DCS), the KTB project and the Swedish Vattenfall project.

ODP should explore different scenarios and carryout feasibility studies with cost estimates NOW to see how such extrapolation could be logically planned and phased.

8) DEEP DRILLING WITH CIRCULATION AND SAFETY CONTROL

No water depth is given. Possible use of alternate platform is mentioned.

It is possible to consider transforming the DCS into a mini riser system with circulation back to the ship through the annulus between the API string and the DCS tubing. That would allow mud to be used to give improved hole stability. The TEDCOM recommends that such a study be undertaken immediately. A safety system, should be incorporated into the design.

The TEDCOM has already concluded that drilling from the JOIDES RESOLUTION with an oil industry type riser should not be considered. Even a 10" slimline riser would require excessive tension in 5 km of water. In great water depths the diameter and annular area must be kept as small as possible to limit top tension to an acceptable level.

The oil industry does not today have any proven solution for riser drilling in water depths in excess of 2.5 km. If the water depth is much less than this limit, ODP could use an alternate platform for riser drilling, or adapt the mini riser DCS system.

However, it should be noted that the oil industry might well be very interested by the development of a drilling system with mini riser and well control, for drilling in very deep water.

9) LRP TEXT MODIFICATION

LRP page 9 Line 32. The phrase "...have pushed riserless drilling to its limits" should be removed, since it is not necessarily true.

10) **SUPERLEGS**

LRP refers to several objectives requiring multiple legs or "superlegs". For such legs the standard ODP planning for 60 day legs should stop, since interruptions will be too disruptive. An independent vessel (wareship) should be considered for supplies and crew changes. It might even improve efficiency on present ODP operations. Cost of a wareship could be around $3M per year.

11) **ENGINEERING LEGS AND OTHER TESTING**

The TEDCOM:

- endorses JOIDES decision to hold 'periodic' engineering legs. The length, frequency and location of these legs should be determined by the requirements of engineering development, rather than by the convenience of a calendar fixed well in advance. Site selection and survey are of the greatest importance for the success of an engineering leg.

- recommends that the engineering legs be supplemented by land tests in certain cases such as to drill chert/chalk sequences, with the DCS.

12) **DOWNHOLE MEASUREMENTS**

Many of the technical requirements relate to improvements in Downhole Measurements. In particular the TEDCOM recommends that a workshop on high temperature slimhole logging be convened in the near future. The TEDCOM encourages continued liaison with DMP to ensure that technical developments are correctly coordinated.

13) **BUDGET**

The TEDCOM wishes to reiterate firmly that engineering development cannot take place at the required rate if the corresponding budget is not made available. This point has been raised frequently by TEDCOM chairmen at meetings of the planning committee (PCOM). The budget of the Development Engineering Office is not being increased in proportion to the demands made by the program. In 1986, the TEDCOM recommended that their budget be increased to $5M by 1991.

The budget figures, for phases 2 and 3, presented in Table 3 must be very approximate, since the corresponding problems have not bee posed precisely and the technical solutions have not been developed. Nevertheless, the TEDCOM feels that the budgeted figures for these phases may be considerably underestimated.

In order to accomplish the significant developments contemplated by the LRP, the TEDCOM recommends the allocation of specific funds for the evaluation and more accurate estimation of the corresponding costs.

ODP LONG RANGE PLANNING DOCUMENT
(23 Nov. 1988 - N.Pisias)

TECHNICAL REQUIREMENTS LISTED (see pages 43,44 and 48-52)

1) **Drilling/sampling/logging**
in young brecciated, sometime hot (>400 C), igneous rocks;

2) **Drilling very deep sites**
in
a) igneous rocks
b) unconsolidated, sometimes sandy, sedimentary sections
c) clastic sequences with complete circulation and safety control (possibly from alternate platform) (p.50)

Penetration targets:
. 1992 - 1 km of basement - 75% recovery
. 1996 - 2-3 km, well into Layer 3
. 2000 - entire crust to MOHO
(5 km hole - assumed to be in 5 km of water)

3) **Improvements in Downhole measurements**
especially in high temperature/corrosive environments
- downhole seismometers
- in-situ physical properties
- pore water sampling
- dissolved gas sampling

4) **Improved drilling and sample recovery**
- complete and undisturbed recovery in soft and semi-soft sedimentary sequences
- absolute orientation of all samples
- chert/chalk sequences (p.52)
- shallow water carbonates (p.52)

5) **Alternative drilling platforms**
- very shallow water drilling
- for areas with extensive sea ice

DRILLING SYSTEM - MAJOR PROBLEMS LISTED IN LRP (see page 44)

1) **Penetration and sampling**
   of young, highly fractured, extrusive basalts
   (upper part of Layer 2)

2) **Low penetration rates**
   - short bit life
   - hole instability
   - incomplete flushings of cuttings in deep crustal holes

3) **Low recovery rates**

Table 3. Cost Estimates for Additional Engineering and Operational Expenses

Engineering and Operational Requirements	Scientific Objective Addressed	Phase I 1989-1992 ($1000)	Phase II 1993-1996 ($1000)	Phase III 1997-2002 ($1000)
1. 4km Diamond Coring System.	1,2,3,4,7,8,9, 13	1390.	-----	-----
2. 6km DCS	1,2,3,4,7,8,9, 10,11,13	-----	1000.	200.
3. Slimline riser and blow out preventor	1,2,3,7,8,9,10, 11	300.	5000.	1500.
4. Improved sediment coring Systems	7,8,9,10,11,12, 13	250.	200.	150. –
5. Borehole Seismometers and Operations of Seismic systems.	2,4,5	600.	600.	600.
6. High-temp systems.	3,4,11	1000.	1510.	750.
7. Improved Packer and fluid samplers.	4,5,8,11	800.	500.	300.
8. Oriented core samples.	1,2,5,6	250.	250.	-----
9. In-situ pressure sampler.	7,8	250.	250.	150.
10. Slimline logging and borehole exp.	1,2,3,4,7,8,9, 10,11,13	650.	2000.	-----
TOTAL	1,7,8,13,15	5490.	11310.	3650.

The University of Rhode Island Graduate School of Oceanography
Narragansett Bay Campus, Narragansett, RI 02882-1197

December 5, 1988

Dr. Ralph Moberly, PCOM Chairman
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, Hawaii 96822

Dear Ralph:

I would like to request DMP, TEDCOM, and TAMU/ODP to investigate the possibility of developing or buying a system for hard rock core orientation to be operational for the geochemical reference hole drilling presently planned for ODP Leg 130, February-March 1990. I believe that the most immediate potential result from this leg has nothing to do with geochemistry but with the remanent paleomagnetic vector orientations of the basalt samples and their implications for the early tectonic history of the Pacific plate. You will recall that one of the results of Leg 32 was the suggestion that in the Late Jurassic/Early Cretaceous the Pacific plate of that time was moving south, and that sometime during the Cretaceous this motion switched to the northward motion that we have subsequently observed. Although this suggestion was based only on remanent inclination information from basalts of DSDP 303, 304, and 307, you will also recall that we had onboard a prototype hard rock orientation device. This device consisted of a non-magnetic (Monel) drill collar, a damped compass capable of being photographed or otherwise recorded, and a scribing or scratching device just above the throat of the bit. It didn't work very well on Leg 32. Potentially such a device could provide remanent declination information that, coupled with remanent inclination and the polarity of the sample, would yield a unique paleomagnetic pole location estimate for the Pacific plate at M16 time on BON-8 and M24 time on MAR-4 on ODP 130. These results could be compared to the inclination results of Leg 32, paleomagnetic seamount analyses (ranging back to ~100 m.y.), skewness analysis of M1-M10 (Larson and Chase, 1972), and skewness analysis of M10-M25 that I am now analyzing.

This device could also be available for subsequent legs in the western Pacific (Shatskey Rise, Old Pacific, and Atolls and Guyots) and for other areas. Such a device to solve this specific problem was also recommended and emphasized by the USSAC Workshop on Paleomagnetic Reference Frames held in College Station in May 1988. I imagine that this technology exists in the oil industry and would not be difficult or expensive to adapt to ODP drilling. The scientific return on such a device would be great, and as Jerry Winterer said at the workshop, "We've been asking for core orientation since 1967, why do we always have to go back to square one?" (add your own emphasis).

Sincerely yours,

Roger

Roger L. Larson
Professor of Marine Geophysics

RLL:cs

APPENDIX E

SUMMARY STATEMENT

ODP HARD ROCK ORIENTATION CAPABILITIES

Introduction

The purpose of this statement is to clarify the ongoing question of ODP's current ability and plans to provide magnetically oriented hard rock cores. It is unfortunate that this question has become a source of confusion and disgruntlement on the part of the science community (as is evidenced by Roger Larson's Dec. 5 letter to Ralph Moberly and Roger's quote from Jerry Winterer). It is certainly time to let the scientific community know that the problem has been a failure to properly communicate the accurate information and nature of the problems ODP faces, not a case of non-response on the part of ODP to a reasonable science request for a technological capability. Also included is an explanation and cost estimate for a short term alternative approach to hard rock orientation to be ready for presentation at the upcoming TEDCOM meeting in College Station (April 27-28) as specifically requested by Moberly. This approach is not recommended by ODP Operations/Engineering because it is considered not to be cost effective nor is it expected to offer a high probability of achieving worthwhile scientific results.

Past History & Current State of the Art

In his letter to Moberly, Roger Larson points out that DSDP tried out a hard rock orientation system in 1973, that such technology has existed in the oil industry for many years, and that it "would not be difficult or expensive to adapt to ODP drilling." In these statements he concisely summarizes what is probably the consensus opinion of the ODP science community. He is quite correct about the DSDP experiment and the oil industry capability. He is quite mistaken about the adaptability of the technology to ODP. It would not only be difficult to adapt to ODP, it would be, at this point, a fruitless exercise.

The industry standard technique for achieving oriented hard rock samples (mimicked in the DSDP experiments) relies on scribing axial marks on the core pieces as they enter the core barrel. Simultaneously, a multishot compass/camera (elsewhere in the core barrel) records the azimuth direction of the primary scriber every few seconds. Later correlation is made between the scribe marks, the compass images on the multishot film, the master clock for timing the operation, and the depth of penetration of the drillstring at incremental times during the coring interval. The mining industry achieves oriented hard rock cores using the scriber/multishot system mated to a wireline retrievable core barrel very similar to ODP technology. The oil industry equipment that is available off the shelf is "conventional", meaning that the core barrels are not wireline deployable and are retrieved by tripping the entire drillstring. It should be noted that hard rock orientation is not an "every day" procedure for the oil industry since oil and gas reserves are not normally associated with crystalline rock lithologies.

The primary difference between the industrial hard rock orientation capabilities and ODP's analogous situation is the ability to achieve virtually 100% core recovery in hard rock. Industry coring specialists are able to achieve 100% recovery often enough to net some meaningful results in their orientation attempts. DSDP and ODP have rarely achieved near-100% core recovery in hard rock except in unpredictable, exceptional cases (the bottom of the gabbro hole drilled on Leg 118, for example.)

The issue of 100% recovery is fundamental to the existing technology for hard rock orientation. No technology now exists (or to my knowledge, has ever been developed) to orient rock cores without this prerequisite. The oil industry is very well aware of this; witness the following quote:

> "Accurate depth correlations can be very difficult to achieve in cases where core recovery is 90% or less. .... As core loss increases, orientation data eventually becomes meaningless since no reasonable correlation is possible between core depths and surface-recorded depth." [1]

The situation is actually worse than that. Not only can there be no reasonable depth correlation as recovery drops below 90%, there is also no reasonable correlation between scribed pieces of rock core and the Multishot pictures which provide the actual azimuth data, thus all of the orientation data derived becomes meaningless.

DSDP attempted hard rock orientation on Legs 32 and 34. The pertinent excepts from the operations reports for those legs are attached. The experiments were ambitious but a little naive since even if the hardware problems described had not occurred the results still would have been dependent on 100% recovery whenever the orientation system was used. This was an unrealistic expectation as the recovery statistics of the two cruises eventually proved.

The next obvious question is: why can industry achieve 100% recovery in hard rock (at least for a portion of the time) while ODP essentially cannot? There are many reasons for this difference but the two most significant are the types of bits used and the stability of the bit and bottomhole assembly while the coring process takes place. Both the oil and mining industries do their coring using diamond core bits working from either stable rigs (land or fixed offshore platforms) or from floating platforms in shallow water (relative to ODP typical depths) where the heave

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[1] Bleakly, D.C., et al, "Controlling Errors Minimizes Risk and Cost in Core Orientation," <u>Oil & Gas Journal</u>, Dec. 2, 1985.

compensation problem is greatly minimized. The number of organizations, worldwide, that attempt to routinely core hard rock from a floating platform using roller cone bits can literally be counted on one hand. None of these organizations has the ability to orient hard rock cores, either. A roller cone bit, under even ideal conditions, produces an irregularly cut, roughly cylindrical core which is poorly suited to scribing for orientation reference. Worse still, the core recovery percentage problem is directly a result of using roller cone core bits.

So why not use diamond core bits for achieving ODP oriented hard rock cores? Because repeated experiments have failed to demonstrate that they can be made to work at ODP operating depths, with ODP drillstring technology and ODP heave compensation capabilities. The same was true during DSDP. Diamond core bits have been attempted as early as DSDP Leg 1 and as recently as ODP Leg 111. The reason they are not used by ODP, despite continued advances by the diamond bit manufacturers, is that the success rate in terms of core recovery and bit life has never come close to justifying their expense, which is from three to ten times the cost of a comparable, more durable and reliable roller cone bits. In fact if both were available at the same price the roller cone bits would be considered significantly more desireable. Most of the DSDP/ODP experiments with large diamond bits have resulted in performance far below expectations and premature pipe round trips for replacement of dull bits.

<u>ODP Plans and Alternatives</u>

There are three approaches to the problem of achieving a viable hard rock orientation capability available to ODP, the last two of which are currently under development.

1. A near-term solution using a modification of oilfield technology could be adopted specifically to satisfy a request for providing the capability on the Geochemical Reference Leg. This approach would be expected to have a very low probability of success (less than 20%) and is not recommended by ODP Development Engineering department although it is feasible. The cost would be about $120K. (See details below).

2. The most appropriate solution is to wait until the Diamond Coring System is developed to the point of common usage. Near 100% recovery in hard rock is a reasonable expectation of the DCS under good circumstances, particularly if the formation is not highly fractured. The off-the-shelf orientation technology available from the mining industry could then be readily adapted to ODP operations. This would, of course, entail some additional expense since all hardware in the vicinity of the Multishot compass would be have to be non-magnetic materials in place of the steel parts normally used.

3. An development project being pursued presently by ODP may ultimately solve the hard rock orientation puzzle. The system is known as the Sonic Core Monitor (SCM). It uses a small sonic transducer mounted inside the core barrel to continuously monitor the ingress of core as the coring process proceeds. This device will record the core entry over time and provide the data required to identify the exact locations of any lost core, thus filling in the gaps in the information chain caused by less-than-100% recovery and making a "conventional" hard rock coring system viable for ODP operations. The SCM system was on board for Leg 124E but was not tested downhole. It is currently configured to mate with the XCB coring system, but, if proven effective on Leg 126, could be adapted to the Rotary Coring (RCB) system in order to mate with an orientation system for hard rock.

   Note: Prior to the writing of this statement the funds for the Sonic Core Monitor development work were deleted from the ODP FY'90 budget on the basis of identified scientific priorities. This will certainly delay development of this technology as a means to help achieve hard rock core orientation.

<u>What Can be Provided in Time for the Geochemical Reference Leg?</u>

Assuming that the Geochemical Reference Leg is scheduled as Leg 129 (starting in October 1989) the time between a go-ahead decision and shipping deadlines for the Leg would limit the choice of hard rock orientation systems to two possibilities.

One would be adaptation of the Sonic Core monitor system to an RCB system set up for hard rock orientation. This would require an expenditure of about $75K plus significant realignment of ODP technical priorities (it is not currently planned to adapt the SCM to the RCB system until it shows significant merit using the XCB as the test bed.) This approach for the Geochemical Reference Leg would rely on complete prototype success in testing the SCM on Leg 126. It also assumes that a non-magnetic RCB system can be produced (using some parts retained from DSDP) including all new, non-magnetic components for the SCM system. It also assumes that the Multishot pressure case and SCM system can all coexist inside the special RCB core barrel and still leave enough space for a meaningful length of core. A reasonable guess would be that space for the core itself would be limited to 3-5m, compared to a normal 9.5m. All of the above is feasible but requires a number of separate events to "go just right" for the final package to be ready and operational for Leg 129.

The second possibility for near-term provision of oriented hard rock core is the hybrid approach mentioned above. This would consist of the following:

Buy several large diameter diamond core bits (9-7/8" x 2-3-8").

Produce the non-magnetic RBC system (described above in conjunction with the SCM adaptation.)

Plan on selected reentries with the required special bottomhole assembly into a reentry hole previously drilled to hard rock with roller cone bits (individual diamond bits will not cope with sediments, possible chert, AND hard rock)

Expect to take very short cores (1 - 2 meters long) in order to stand any chance of achieving near-100% recovery.

The anticipated cost for this option is about $120K. It could be ready for Leg 129 (assuming a May 1st go-ahead) but would not likely leave time in the development and procurement cycle for land testing. Extra rig time on the cruise, above and beyond normal coring requirements, would include the time required to do a reentry cone/casing emplacement, more-frequent-than-normal reentries, extra BHA make-ups, and extra wireline trips required by abnormally short core advances. This approach is not recommended and is provided to outline the magnitude of the problem so that a proper value judgement can be made in the tradeoff between time, money and potential scientific results.

LOGGING CAPABILITY IN BOREHOLES

OF DIFFERENT DIAMETERS

Tool	Tool Diameter (inches)	Slimhole Capability	Loggable Hole Diameter 6½"	5½"	4½"	4"
Phasor Induction	3 5/8	No	X	X		
Dual Induction	3 5/8	Yes	X	X	X	
Dual Laterolog	3 5/8	Yes	X	X		
HEL Dual Laterolog	2 3/4	Yes	X	X	X	X
Microlog	4 1/2	No	X	X		
Dipmeter	3 5/8	No	X	X		
FMS	3 5/8	No	X	X		
Induced Polarization	2 3/4	?	X	X	X	X
Full Waveform Sonic	3 5/8	No	X	X		
HEL Velocity	2 3/4	Yes	X	X	X	
Slimhole Velocity	1 11/16	Yes	X	X	X	X
Thermal/Epithermal Neutron Porosity	3 5/8	No	X	X		
HEL Porosity	2 3/4	Yes	X	X	X	
Slimhole Porosity	1 11/16	Yes	X	X	X	X

Lithodensity	$3\frac{5}{8}$	No	X	X		
HEL Lithodensity	$2\frac{3}{4}$	Yes	X	X	X	
Slimhole Density	$1\frac{11}{16}$	Yes	X	X	X	X
Induced Gamma Spectral (GST)	$3\frac{5}{8}$	No	X	X		
Aluminium Activation	$3\frac{5}{8}$	No	X	X		
Natural Gamma Spectral (NGT)	$3\frac{5}{8}$	No	X	X		
Natural Gamma	$3\frac{5}{8}$	Yes	X	X		
Borehole Televiewer	$3\frac{5}{8}$	Yes	X	X		
Slimhole BHTV	$1\frac{11}{16}$	Yes	X	X	X	X
Borehole Gravimeter	$3\frac{5}{8}$	No	X	X		
Magnetometer	$3\frac{5}{8}$	?	X	X		
Drill-string Packer	$3\frac{5}{8}$	Yes	X	X	X	X
Wireline Packer	$3\frac{5}{8}$	No	X	X		
Borehole Fluid Sampler	$1\frac{11}{16}$	Yes	X	X	X	X
Packed-off Fluid Sampler	$3\frac{5}{8}$	No	X	X		
VSP Multi-shuttle 3-component	$3\frac{5}{8}$	No	X	X		
VSP Single 3-component	$3\frac{5}{8}$	No	X	X		
VSP Single vertical component	$3\frac{5}{8}$	No	X	X		

MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

Scripps Institution of Oceanography
La Jolla, California

23-24 May 1989

EXECUTIVE SUMMARY

1. A major thrust of this meeting was to develop a proposed logging programme for CEPAC. The CEPDPG Chairman attended as a guest.

2. Specific recommendations were formulated in connection with the logging programmes for Legs 129 and 130.
[DMP Recommendations 89/9, 89/10]

3. Logging surveys were identified and proposed for the following CEPAC programmes which have not yet been structured into Legs: Cascadia accretionary prism, Chile triple junction, Neogene palaeoceanography in eastern equatorial Pacific, lower crustal penetration of layer 3 at 504 B, EPR bare rock drilling, and hydrothermal processes at sedimented ridge crests.

4. Panel noted that stress-direction measurements appear to have been overlooked in the Chile triple junction programme and wished to alert CEPDPG to this apparent omission.

5. Panel concurred that long-term sealing should be effected after further drilling at 504 B with subsequent in-hole experiments directed at temperature and fluid flow.

6. CEPAC programme contains several hostile-environment sites. These require urgent action to increase the probability of success in 1991. The key logging issue is one of high temperatures in slimhole environments.

7. "Hostile environment drilling programmes should be staggered to allow time for lessons learnt to be incorporated into subsequent Legs."
[DMP Recommendation 89/11]

8. The revised WPAC schedule has Nankai as Leg 131. Substantial changes to the drilling and logging programmes have emerged from the pre-cruise meeting. It was noted that these changes had impacted on the original thrust to obtain in-situ properties. More generally, the vast amount of time spent by DMP in discussing Nankai had been rendered partly irrelevant.

9. "Because of the importance of the Navidrill to the deployment of the geoprops probe during Leg 131, the Navidrill be modified to overcome operational problems prior to Leg 130 when it should be tested at sea."

[DMP Recommendation 89/12]

10. High temperature (slimhole) logging is the most important technical issue currently facing the Panel. This issue can be addressed through two scenarios:

    (i) a short-term scenario whereby existing technology is identified, evaluated, and accessed:

    (ii) a long-term scenario whereby shortfalls in this technology are identified and rectified through inter-programme funding.

    The previously proposed interprogramme workshop on high-temperature slimhole tools constitutes a potential bridgehead between these two scenarios. This workshop concept has been supported by TEDCOM.

11. Recognising that some full-time activity is needed if OPD is to prepare for high-temperature logging within 18 months, the following recommendation was formulated.

    "In view of the technical complexity and cost of high-temperature logging operations, an experienced engineering scientist be dedicated full time to evaluating the status of off-the-shelf high-temperature logging technology for possible future deployment in ODP. Because of time limitations this activity needs to be completed within a six-month period commencing as soon as possible. The deliverable would be technical advice to ODP on what is achievable with current technology at different temperatures and for different hole diameters. DMP considers this strategy to be the most cost effective in the short term, and one which would optimise the chances of success."

[DMP Recommendation 89/13]

12. The DMP guidelines for monitoring the development of third party tools are in place. Both the wireline packer and the geoprops probe need to have their development timetables advanced. Both tools are being developed by TAM, Inc.

13. A workshop on log data quality was co-convened by Worthington and Wilkens with JOI support in Washington DC on 13-14 April 1989. The workshop was attended by former JOIDES logging scientists and contractor representatives. Twenty recommendations were formulated to improve shipboard logging practices. DMP will monitor progress in bringing these recommendations to fruition.

14. Two thematic or synthesis publications on the role of downhole measurements in ODP are in press. These are a thematic JGR volume, based on a poster session at the December 1988 AGU meeting, and a multi-authored paper on "Scientific applications of downhole measurements in the ocean basins" in the journal Basin Research. A further possibility is provided by the logging component of the Geochemistry Workshop proposed by Kastner et al.

15. The recommendations formulated by the DMP subgroup on shipboard physical properties measurements, which met in August 1987, have not been input to the new Shipboard Measurements Panel (SMP). SMP also seem unaware of the DMP policy on VSP, i.e. that VSP should not be carried out routinely. DMP Chairman proposes to attend the next SMP meeting to provide the appropriate input. The possibility of a joint DMP/SMP meeting in 1990 should be explored.

16. The next DMP meeting is scheduled for 11-12 September 1989 in FRG, Villinger to host. The subsequent meeting is scheduled for 16-17 January 1990 in College Station.

Paul F. Worthington

7th June 1989

MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

Scripps Institution of Oceanography
La Jolla, California

23 - 24 May 1989

MINUTES

Present

Chairman:	P F Worthington (UK)
Members:	B Carson (USA) J Gieskes (USA) E Howell (USA) M Hutchinson (USA) D Karig (USA) P Lysne (USA) R Morin (USA) C Sondergeld (USA) R Wilkens (USA) J P Foucher (France) H Kinoshita (Japan) H Villinger (FRG)
Liaisons:	D Cowan (PCOM) A Fisher (TAMU) X Golovchenko (LDGO) R Jarrard (LDGO)
Guest:	D Rea (CEPDPG)
Absent:	S Bell (Canada/Australia) O Stephansson (ESF) K Becker (LITHP)

1. Welcome and Introductory Remarks

The meeting was called to order at 8.30 am. The Chairman welcomed DMP Members, Liaisons and Guest, especially those attending for the first time as members (Foucher, Hutchinson, Morin), as liaisons (Cowan, Fisher) or as a guest (Rea). The major thrust of this meeting was to develop a preliminary logging programme for CEPAC as an input to the formulation of a leg structure.

Review of Agenda and Revisions

The precirculated agenda was adopted as a working document for the meeting without modification.

2. Minutes of Previous DMP Meeting, HIG, 16 - 18 January 1989

The minutes were adopted without modification. The Chairman signed the master copy for ODP records.

3. PCOM Report

Cowan reported on the PCOM meeting held in Oslo during the period 2 - 4 May 1989. PCOM responses to DMP Recommendations 89/1 - 89/8 were as follows:

Rec. No.	Description	PCOM Response
89/1	Guidelines for monitoring third party tools	Approved
89/2	Nankai leg deferral	Deferred to March 1990
89/3	Site NKT2 to be given priority during Nankai	PCOM did not discuss NKT2 vs NKT1
89/4	Modified logging programme, Leg 130	Leg has been dropped
89/5	Modified logging programme, Leg 131	Not discussed at this stage
89/6	Modified logging programme, Leg 133	Not discussed at this stage
89/7	Reciprocal guest arrangements between DMP and detailed planning groups	Individual guest arrangement will be entertained as specific proposals
89/8	Workshop on high-temperature, slimhole logging	No comment beyond need to take advantage of work already done at Sandia

PCOM changed the drilling schedule for FY90:

Leg 129	Old Pacific
Leg 130	Ontong Java
Leg 131	Nankai
Leg 132	Engineering
Leg 133	N E Australia
Leg 134	Vanuatu
Leg 135	Lau Basin

Then the ship will move to E Pacific.

Calendar-year 1991 programme to be chosen from:

Cascadia accretion, EPR, 504B, sedimented ridges, Chile triplejunction, E Pacific Neogene.

Remaining Pacific programmes will compete with proposals in any ocean.

PCOM has changed its publications policy to allow earlier publication in the open literature.

PCOM identified the implications of a 4" or 5" diameter scenario for the Diamond Coring System (DCS). At 4" the cost of logging tool development increases, at 5" the cost of using DCS increases. The situation is compounded by the need to drill and log in high-temperature environments.

4. <u>CEPAC Planning</u>

Consideration of CEPAC programmes was re-ordered to conform to the new schedule proposed by PCOM. Initially, consideration was given to those legs already in place.

(i) <u>Leg 129 Old Pacific</u>

(viii) <u>Scientific Objectives</u>

Palaeoceanography and palaeoenvironments of the oldest ocean.

Petrology of oceanic lithosphere.

Calibration of the oldest magnetic anomalies.

Nature and history of the Cretaceous volcanic episodes

Pre - 70 Ma plate motions.

<u>Relevant DMP Thematic Thrusts</u>

Crustal composition and structure
Intraplate stress

Logging Programme

This leg to some extent encompasses the geochemical reference objectives since the Geochemical Reference Leg as such has now been dropped.

DMP Recommendation 89/9

"The following programme of downhole measurements be carried out during Leg 129, Old Pacific:

Sites PIG 1-3	Standard logging suite (excluding FMS) Magnetometer/susceptibility
Site PIG-4	Standard logging suite (including FMS) Packer/wireline packer BHTV *Magnetometer/susceptibility Dual laterolog Barnes/Uyeda tool (WSTP) in sediments

Site PIG-4 (or EMB-2) should not be the last one drilled so that the very important programme of downhole measurements is not jeopardised by the shortage of time. This aspect is particularly important as this site is also serving as a geochemical reference site."

*This leg should seek to deploy the French high-resolution magnetometer, developed by a consortium including Schlumberger and Total, which has been tested in the Paris Basin and is to be used in the North Sea in 1990. The tool is 9 cm in diameter and 5 cm long. This diameter is on the borderline for ODP use without modification Panel wishes to know about (i) the vertical resolution of the tool and (ii) the route to be followed in arranging its availability for ODP. J P Foucher will investigate.

[ACTION : FOUCHER]

(ii) Leg 130 Ontong-Java Plateau

Scientific Objectives

Depth transect for high-resolution Neogene palaeoceanography and palaeoclimatology.

Palaeogene and Mesozoic palaeoceanography, palaeoclimatology, and global anoxic events.

Age, nature and palaeolatitude of basement.

Relevant DMP Thematic Thrusts

Crustal composition and structure
Intraplate stress
Sediment cyclicity

Logging Programme

DMP Recommendation 89/5 made provision for running a shear wave sonic tool. This will not be available. An alternative might be the ARCO tool. ARCO is seeking to license its shear wave sonic tool to a service company. Until this has been done, ARCO will not entertain an approach for the use of the tool. With these developments DMP Recommendation 89/5 falls away and is superseded by the following.

DMP Recommendation 89/10

"The following programme of downhole measurements be carried out during Leg 130, Ontong-Java Plateau:

Sites OJ-7, OJ-12, OJ-14
Standard logging suite (including FMS)

Re-entry site:
Standard logging suite (including FMS)
BHTV

The Geoprops Probe should be tested at the re-entry site. This would enhance the chances of a successful deployment at Nankai. Pore fluid samples would contribute to the objectives of Leg 130, in any case."

(iii) Leg 132 Engineering Leg

Primary purpose is to test the DCS over difficult lithologies, e.g. chalk/chert sequences, and at barerock sites. At present no logging is planned for the next engineering leg. It is often more appropriate to test logging tools during the course of scientific drilling.

(iv) Cascadia Accretionary Prism

Scientific Objectives

Oregon Margin : present and past fluid expulsion processes, pathways, and effects in the several structural and stratigraphic settings ; chemistry, sources and diagenetic effects of the fluids.

Vancouver Margin : deformation at the leading edge of the decollement, geology and physical properties of the materials involved, flow of heat and fluids, long-term observatories.

Relevant DMP Thematic Thrusts

Intraplate stress
Long-term monitoring
Hydrogeology

Logging Programme

Nankai results are likely to guide the planning of this programme. Key issues are physical properties and fluid characteristics.

Each hole:

Standard logging suite (including (FMS)
Geoprops Probe every 30m to base of XCB (or wireline packer every 60m)
LAST every 30m in soft sediments
WSTP every 30m in upper sediments
Rotable packer (3 - 4 deployments/1000m)
Multichannel sonic (shear source) or Schlumberger array dipole tool

Deeper holes: OR-1, VI-1, VI-2

Additional measurements:

VSP
BHTV
Rotable packer (3 - 4 deployments/1000m)

(v) Chile Triple Junction

Scientific Objectives

Investigate subsidence, deformation, volcanism and metamorphism within the collision zone.

Investigate the process of ophiolite emplacement at Taitao Ridge.

Investigate the process of "rebuilding" of the margin after the triple junction passes northward.

Relevant DMP Thematic Thrusts

Intraplate stress
Hydrogeology

Logging Programme

Sites TJ-1 , TJ-4 , TJ-5 ;

Standard logging suite (including FMS)
Wireline packer
Geoprops probe
WSTP

Site TJ-7 ;

Standard logging suite (including FMS)

Sites TJ-2 and TJ-3;

Standard logging suite (including FMS)

There is a possibility of high temperatures at these sites. ODP needs to think seriously about high temperature tools. If FMS cannot be run because of temperature considerations, BHTV should be run. High-temperature cable or cableheads will need to be available.

DMP Consensus

Panel noted that stress-direction measurements appear to have been overlooked in the Chile Triple Junction programme and wish to alert CEPDPG to this apparent omission.

Sites TJ-8, TJ-9, TJ-10;

These three sites have recently been proposed to study how the continental margin develops. In the absence of further information, the logging programme should be the same as that for sites TJ-1 et seq.

(vi) Neogene Palaeoceanography - Eastern Equatorial Pacific

Scientific Objectives

Evolution of equatorial circulation of ocean and atmosphere.

Hemispherical symmetry/asymmetry of oceanic and atmospheric changes.

Miocene and Pliocene variability in contrast to the Pleistocene.

Circulation before and after closing of Panamanian Seaway.

Effects of the above on the history of biological productivity.

Relevant DMP Thematic Thrusts

Intraplate stress
Sediment cyclicity

Logging Programme

Logging at all sites, regardless of depth.

Standard logging suite (including FMS)

The stress aspects of this programme require that the BHTV be run at sites WEQ-4, EEQ-3, EEQ-4.

The possibility of deploying LAST should be explored.

(vii) Lower Crust - Penetration of Layer 3 at 504B

Scientific Objectives

Physical, chemical, seismic, magnetic and hydrological nature of Oceanic Layer 3.

Dyke to gabbro transition

Relevant DMP Thematic Thrusts

Crustal composition and structure
Hydrogeology

Logging Programme (assuming 5" hole or greater)

Entire hole (pre-existing and new sections);

Geochemical string
FMS
Wireline packer
Temperature tool
Magnetometer/susceptibility (high sensitivity tool)

New hole only;

Seismic stratigraphic string
Packer
BHTV (200 m of overlap into pre-existing hole)
Dual laterolog

Good temperature logs and water samples are needed before the junk is cleared from 504B.

Estimated bottom hole temperature in pre-existing hole is 160°C; at base of new hole (2000 m) it will be about 190°C. This raises a question concerning the temperature range of the above tools.

This logging programme assumes at least a 5-inch hole. It would be regrettable if 504B had to be re-accessed with a primitive logging suite as would be necessitated if the DCS were to be used for hole deepening.

Permeability can be evaluated through flowmeter injection. A spinner flowmeter would have to be included in the logging programme. Before making a final decision, Panel asked if a typical data scenario could be prepared with indications of ranges of permeability and corresponding accuracies and precisions.

[ACTION : MORIN]

The question was raised of sealing the hole after drilling to minimize downflow and thereby to recover subsequently better fluids and temperature. For the same reason it is desirable to isolate the bottom of the hole. The feasibility of this proposal should be established.

[ACTION : FISHER]

DMP Consensus

Long-term sealing should be effected after further drilling at 504B with subsequent in-hole experiments directed at temperature and fluid flow.

(viii) EPR Bare Rock Drilling

Scientific Objectives

Definition of water-rock reaction zone above the axial magma chamber.

Physiochemistry of earliest phase of hydrothermal alteration.

Physical nature of geophysical horizons.

Spatial and temporal variability of magma composition.

Physical and compositional nature of zero-age crust.

Long-term experiments to determine temporal variations in the physical state of the crust and the chemistry of circulating fluids.

Relevant DMP Thematic Thrusts

Crustal structure and composition
Intraplate stress
Long-term monitoring
Hydrogeology

Logging Programme

With no temperature and diameter limitations;

Standard logging suite (including FMS)
BHTV
Wireline packer
Packer
Temperature
Magnetometer/susceptibility
VSP

In reality, temperatures of up to 400°C are expected. Unless hole cooling experiments are successful, high-temperature tools will be needed. A possibility would be to run Schlumberger hostile environment logging (HEL) tools but only to intermediate depths. Target must be to get as close to the above suite as possible taking account of the expected temperatures and with the possibility of a 4-inch hole.

(ix) Hydrothermal Processes at Sedimented Ridge Crests

Scientific Objectives

3D characterization of fluid flow and geochemical fluxes within a sediment-dominated hydrothermal system.

Geophysical properties of crust formed at a sedimented ridge crest.

Relevant DMP Thematic Thrusts

As for EPR

Logging Programme

Standard logging suite (FMS in sediments only)
BHTV (in basalts)
WSTP
Geoprops probe
Wireline packer
Temperature
VSP
Magnetometer/susceptibility
Induced polarization

Temperatures of up to 400°C are expected. Similar comments as for EPR except that 4-inch diameter hole is less likely.

The times necessary to effect the logging programmes of Items 5(iv) - 5(ix) should be calculated as an input to the formulation of a leg structure.

[ACTION : JARRARD]

The hostile environment programmes require urgent action to increase the probability of success in 1991. This will necessitate expenditure, a trimming of ambitions, and rapid progress up a learning curve. The key logging issue is one of high temperatures in slimhole environments.

DMP Recommendation 89/11

"Hostile environment drilling programmes should be staggered to allow time for lessons learnt to be incorporated into subsequent legs."

5. Liaison Reports

(i) Technology and Engineering Development Committee

The Chairman reported on the TEDCOM meeting held at ODP/TAMU, College Station, on 27-28 April 1989 (Annexure I).

Key points were:

- the DCS concept was not proven on Leg 124E, only 20 m of core being recovered;

- the Navidrill had five mechanical failures out of nine deployments; the geoprops probe is dependent upon a functioning Navidrill;

- TEDCOM supported the idea of an interprogramme workshop to progress high-temperature logging developments as a basis for scientific work in the 'Nineties;

- newly formed Shipboard Measurements Panel was not aware of recommendations on physical properties measurement by the DMP subgroup which met in August 1987. SMP Chairman requested that these recommendations be presented to SMP at their next meeting in October 1989.

DMP Recommendation 89/12

"Because of the importance of the Navidrill to the deployment of the geoprops probe during Leg 131, the Navidrill be modified to overcome operational problems prior to Leg 130 when it should be tested at sea."

(ii) Shipboard Measurements Panel

Gieskes reported on the first SMP meeting held in College Station, Texas, on 27 - 28 February 1989.

A key concern of SMP is the lack of contact between experts in the areas covered by shipboard measurements and interested scientists who participate in Legs. Should, for example, a physical properties scientist receive training prior to a Leg? Specific improvements were recommended in the area of, inter alia, physical properties measurements.

The possibility of integrating a routine VSP programme with the underway geophysics was discussed. VSP is clearly within the DMP mandate. The concept of routine VSP is at variance with earlier DMP advice.

DMP supports the SMP view that there should be a greater flexibility of subsampling rules.

DMP views on the role of VSP within ODP should be outlined directly to SMP at their next meeting in October 1989.

[ACTION : WORTHINGTON]

(iii) KTB Update

Villinger reported that the pilot hole has reached 4000 m. The interval is completely cored. KTB is currently working on log analysis and the integration of log and core data.

Current need is to identify a site where deep drilling could take place without exceeding 300°C. Preliminary drilling and heat flow measurements have allowed a site to be identified where the 300°C limit is reached at 10 km. This depth is not adequate for reaching a major seismic reflector but it would avoid need for an ultra-deep drilling rig. These issues are being investigated further to try to optimise the outcome.

6. Report on Workshop on Log Data Quality

The Chairman reported on this workshop, co-convened with Wilkens, held in Washington, D.C., on 13 - 14 April 1989 (Annexure II). Twenty recommendations were formulated to improve shipboard logging practices. DMP will monitor progress in bringing these recommendations to fruition.

[ACTION: PANEL]

In order to build on these efforts, and to maintain the initiative, the JOIDES logging scientist should prepare a short report at the end of his Leg outlining perceived difficulties associated with shipboard logging operations. This requirement should form an integral part of the recommended Job Description for the post of JOIDES Logging Scientist. The Job Description is to be ready in draft form for the next DMP meeting.

[ACTION : GOLOVCHENKO, WILKENS]

7. Monitor Reports - Third Party Tools

(i) Wireline Packer

Howell reported on developments to date. TAM Inc are confident that a six-month delivery date can be met. At present the tool cannot pass the land test which is a prerequisite for handover to LDGO.

Wireline packer is scheduled for testing on Leg 129. With this schedule, the deadline for tool delivery, if dry-dock is in Japan, is early September. This allows lead time for import/export licences. If dry-dock is elsewhere, slightly more time is available for tool completion. Either way, the wireline packer may not be available for Leg 129 unless the delivery time is drastically shortened. TAM are receiving increased support from Amoco and are benefiting from liaison with ODP. There is some optimism that the shorter delivery time might be achieved.

The Chairman commented that the development of the wireline packer did not constitute a success story in view of contractual shortcomings, questionable subcontractor performance, and cumulative delays. Future tools developed in accordance with the recently formulated DMP guidelines on third-party tools would have a tighter control on their progress through the identification of agreed technical milestones at the outset.

(ii) Geoprops Probe

Karig reported that the contract has not yet been let, although the design phase has started. The reason is that a tighter contract is being drawn up. The contract requires delivery within nine months of signing. However, if the contract were signed now, this delivery time would not guarantee availability of the geoprops probe for Leg 131 which is scheduled to begin in March 1990. There is a need to advance this timetable through negotiation with TAM.

[ACTION : KARIG]

(iii) Lateral Stress Tool (LAST)

No Canadian representative was present to give this report. Panel considered it essential to have an updated report on LAST at the next DMP meeting. Kate Moran should be invited to give this presentation.

[ACTION : WORTHINGTON]

8. Third Party Tools

Golovchenko provided a list of third party tools scheduled for the next few legs. In essence these are:

Leg 128:

Large-scale resistivity	- Becker (Miami) & ORI (Japan) 2nd ship
Oblique seismic experiment	- ORI (Japan) 2nd ship
Long-term seismometer	- ERI (Japan)

Leg 129:

VSP/WST - no scientific proponents as yet

Leg 131:

Geoprops Probe	- Karig (Cornell)
Lateral Stress	- Moran (Canada)
VSP/WST	- Moore (HIG)
Long-term temperature	- ORI (Japan)
Wireline packer	- Stanford/TAM

The following monitors are (re-)appointed and asked to report on the specific tools for Leg 131 at the next DMP.

Geoprops Probe	- KARIG
LAST	- BELL (or MORAN)
VSP/WST	- WILKENS (for MOORE)
Long term temperature	- KINOSHITA
Wireline packer	- HOWELL

If any of the above cannot attend the next DMP, a written report must be submitted.

9. <u>Logging Contractor's Report</u>

Golovchenko reported that the new tool strings are in place. These are:

(i) DIT-E/LSS/HLDT/CNT-G/TCC (value $350,635)

(ii) GST/AACT/CNT-G/NGT/GPIT/TCC (value $222,915)

(iii) FMS/NGT/TCC (value $327,169)

A tool nomenclature is appended.

At present the limit of insurance cover is $275,000: this is only sufficient to cover the second tool string. Current premium is $139,000 with a $50,000 deductible.

The FMS has just been run successfully for the first time in ODP.

The GST is now fitted with a boron sleeve to reduce boreholeperturbations.

The contract for the new side-entry-sub (SES) has just been let.

A WBK digital borehole televiewer can be leased at $58,000 per year with an option to purchase the tool after three years. The tool would be available nine months after signing an agreement. Before signing, EXCOM approval is required. It is likely that FRG would provide a back-up televiewer for shipboard operations. Confirmation is awaited prior to proceeding. The target date for dispatch of a letter of commitment to WBK is 5 June 1989.

The latest version of the basic Terralog package (log reading and processing) can be available in the autumn at a price to institutions of $10,000. This availability would depend on the degree of potential interest. Panel members were asked to canvas opinion from their own areas and report at the next DMP meeting.

[ACTION : PANEL]

Terralog is not the only facility for reading LIS tapes. There may be other, more economic alternatives. Terrascience might sell the reading version only, at a much lower price. These aspects should be investigated and reported at the next DMP meeting.

[ACTION : HUTCHINSON]

Logging operations were reviewed for Legs 124 - 125. In particular, of the seven tests proposed for the Engineering Leg (124E) only two were actually done. The site drilled specifically for logging suffered a stuck BHA which necessitated testing the telemetry of the two new standard tool combinations in the drill pipe. The wireline heave compensator was tested and improved. The wireline packer test was cancelled because the tool is not ready. Leg 125, and recently Leg 126, have encountered problems of hole stability.

10. <u>WPAC Planning</u>

(i) <u>Leg 131 - Nankai</u>

Jarrard reported that the pre-cruise meeting had increased the number of holes to be drilled and that partly as a consequence, changes had been made to the logging programme. In particular, the BHTV has been dropped and the MCS (shear source) tool will not be available. Four holes instead of one are now planned at NKT 2 (or NKT 10) to reduce hole condition problems and one at NKT 1.

NKT 1 - target depth 900 m
Logging to be carried out at 600 m and total depth, as follows:

Standard logging suite (including FMS)
Wireline packer - 4 deployments
WSTP - 4 deployments
LAST - 4 deployments

NKT 2-A - target depth 600 m with XCB

Standard logging suite (including FMS)
Geoprops probe - 12 deployments
WSTP - 4 deployments
LAST - 4 deployments

NKT 2-B - target depth 950 m

Standard logging suite (including FMS)
Wireline packer - 4 deployments
WSTP if sediments allow

NKT 2-C - target depth 900 m

Hole dedicated to zero-offset VSP and rotatablepacker (3 deployments)

One wireline logging combination is to be run for correlation purposes, probably the FMS/gamma ray string.

NKT 2-D - target depth 1300 m

Hole to be drilled and cased for the temperature experiment.Coring scheduled for the deeper section, 950 - 1300 m, which will be logged with:

Standard logging suite (including FMS)
Wireline packer - 4 deployments

Karig commented that the substantial changes to the earlier DMP recommendations had jeopardized the thrust to obtain in-situ properties. However, it was recognized that the geoprops probe could still not be guaranteed to be ready in time for Leg 131.

The Chairman commented on the broader implications. DMP had spent 200 man-hours discussing the Nankai Leg, subject to the planning constraints laid down by PCOM. Now the goal-posts had been moved at the pre-cruise meeting, rendering much of the Panel's earlier discussion irrelevant. With this sort of changeability permitted by the system, the investment of substantial amounts of time at the technical planning stage cannot be defended. In future, the Panel should self-impose a two-hour time limit on discussions relating to any given leg. This policy would provide for some damage containment.

(ii) Legs 133 - 135

No changes to the previously recommended logging programmes for N.E. Australia, Vanuatu and Lau Basin.

11. Thematic or Synthesis Publications

PCOM have requested that DMP consider how to encourage such publications that relate to downhole measurements. Two initiatives have already been taken:

(i) a thematic JGR volume based on a poster session at the December 1988 AGU meeting;

(ii) a multi-authored paper on "Scientific applications of downhole measurements in the ocean basins" in the journal Basin Research.

Both of these are in press.

Panel was asked to propose further possibilities at the next DMP meeting.

[ACTION : PANEL]

12. ODP Accomplishments and Benefits

PCOM have asked what DMP considers these to be. The key is to identify those aspects of downhole measurements that have advanced science. Other benefits might include the education and training of earth scientists. Panel was asked to identify key areas for discussion at the next DMP meeting.

[ACTION : PANEL]

13. Proposed Workshop on High-Temperature Slimhole Tools

Lysne reported that the purpose of this proposal is to define common problems between ODP and other science programmes, e.g. Continental Scientific Drilling, with a view to collaborating in rectifying identified shortcomings in technology. The proposal was submitted to JOI/USSAC who suggested the establishment of long-term working groups instead. This indicates that progress will be slow. ODP has just 18 months to take effective action if there is to be a useful logging programme for the East Pacific Rise and at sedimented ridge crests. Thus, although the workshop concept will continue to be advanced, ODP needs a short-term strategy.

The Chairman commented that high-temperature (slimhole) logging is the most important technical issue currently facing the Panel. In the short term there is no prospect of a high-temperature logging suite which matches that for conventional temperatures. Also ODP does not have the resources to undertake tool development projects for hostile environments, In any case, there is insufficient time. We therefore have two scenarios:

(i) a short-term scenario whereby existing technology is identified, evaluated, and accessed;

(ii) a long-term scenario whereby shortfalls in this technology are identified and rectified through inter-programme funding.

The proposed workshop constitutes a potential bridgehead between these two scenarios.

Recognizing that some full-time activity is needed if ODP is to prepare for high-temperature logging within 18 months, the following recommendation was formulated.

DMP Recommendation 89/13

"In view of the technical complexity and cost of high-temperature logging operations, an experienced engineering scientist be dedicated full time to evaluating the status of off-the-shelf high-temperature logging technology for possible future deployment in ODP. Because of time limitations this activity needs to be completed within a six-month period commencing as soon as possible. The deliverable would be technical advice to ODP on what is achievable with current technology at different temperatures and for different hole diameters. DMP considers this strategy to be the most cost effective in the short term, and one which would optimise the chances of success."

Panel noted that, pursuant upon DMP Recommendation 88/11, there remains a PCOM action on TAMU and LDGO to provide further cost comparisons of slimholing vs drilling at different diameters.

14. <u>Proposed Geochemistry Workshop</u>

This has been proposed by Kastner et al. and is to have a logging component coordinated by Worthington and Howell. The Chairman had been unable to contact the proposers directly but it was believed that the workshop is scheduled for the autumn. The possibility was raised of using the logging component of the workshop as a basis for a thematic publication on geochemical logging, in the spirit of agenda item 11.

[ACTION : WORTHINGTON, HOWELL]

15. <u>Other Business</u>

The Chairman observed that with the vast amount of business transacted at DMP meetings, new panel members have a great deal to assimilate in a short time. The introduction might be facilitated by prior availability to new members of the previous year's DMP minutes. This proposal was welcomed by the new members who will shortly receive back-issues of DMP minutes for 1988.

[ACTION : WORTHINGTON]

16. <u>Dates and Formats of Next DMP Meetings</u>

The next DMP meeting is scheduled for 11 - 12 September 1989 in FRG. Villinger to host. This meeting will be followed by a workshop with KTB on topical logging problems. As the format of the workshop unfolds, some panel members will be invited to make presentations.

[ACTION : WORTHINGTON, VILLINGER]

The following DMP meeting is scheduled for College Station on 16 - 17 January 1990. Fisher to host. This would allow a timely meeting with TAMU engineers.

Subsequent panel meetings will be held in May and September 1990. Panel supported the concept of one of these meetings being held at a port of call to allow a tour of shipboard facilities on JOIDES Resolution.

Close of Meeting

The Chairman thanked Members, Liaisons and Guests for their contribution to the meeting, Scripps Institution of Oceanography for their kind hospitality, and Dr J Gieskes for his gracious hosting. The meeting closed at 2.46 pm on Wednesday 24 May 1989.

Paul F Worthington
27 May 1989

MEETING OF JOIDES TECHNOLOGY AND ENGINEERING DEVELOPMENT COMMITTEE

TEXAS A & M UNIVERSITY
COLLEGE STATION
27-28 APRIL 1989

REPORT

1. Statement of Purpose

The Seventh JOIDES TEDCOM meeting was attended in my capacity as Liaison from the Downhole Measurements Panel (DMP). These notes relate to those discussion items which have a bearing on the ODP programme of downhole measurements.

Main purposes of meeting:

(i) to assess the results of the trial deployment of the Diamond Coring System (DCS) during the Engineering Leg (124E);

(ii) to formulate a response to the ODP long range plan for submittal to PCOM.

2. NSF Report

Soviet membership of ODP: although there has been a relaxing of attitudes, there are no official indicators that the USSR might enter the programme.

3. Diamond Coring System (DCS)

The DCS is being developed as a speciality system for difficult drilling conditions or where substantial penetration into basement is sought. In other cases the existing APC/XCB/Navidrill system will be used and is likely to remain the standard drilling technique for the next 10 years. DCS has depth limitations of about 6000m including the water depth.

System uses a "top drive" concept rather than downhole turbines. Currently the Tonto hydraulic top drive is in place. During testing (124 E) only about 5% of allotted time was spent coring. Core recovery was about 85%. Total length of core recovered was less than 20m, compared to the expected 200m. Future activity includes re-designing the existing heave compensator, deciding whether to introduce an electric top drive to replace the hydraulic drive, and working towards a land test (in England?) in December 1989.

Reasons for disappointing core recovery during Leg 124E were unstable hole conditions and time spent in attempting to locate a site where drilling could take place without a re-entry cone.

Messages for next time:

Better site preparation: set a re-entry cone: then concentrate on a technical evaluation of the system. Site selection should draw upon 3D seismics where possible. Alternatively, an existing hole which already has a re-entry cone could be considered.

Key difficulty is the low speed of rotation (100 rpm). This needs to be increased but without introducing excessive vibration. ARCO have a useful vibration analysis facility which is to be commercialized. This should be accessed by ODP.

DCS technology is not yet proven. A sub-committee on mining drilling comprising five people was formed to take the subject further forward within TEDCOM.

4. **Test of Navidrill Core Barrel**

Deployed nine times; mechanical failure on five. Four runs recovered some core but bit plugging was a problem. Specific tool improvements are recommended. More land tests are planned before further ship time is committed to Navidrill testing. The Navidrill has to be available before the Geoprops Probe can be used.

5. **ODP Long Range Plan (LRP)**

TEDCOM formulated its response to the LRP. Many of the technical requirements for achievement of the scientific objectives relate to improvements in downhole measurements. TEDCOM encourages continuing liaison with DMP to ensure that technical developments are correctly coordinated. In particular, TEDCOM supported the proposal for a joint ODP - DOSECC - Continental Drilling Programme workshop later in 1989 to evaluate specifically slimhole logging in high temperature environments. Co-convenors are Worthington (ODP) and Lysne (Continental Drilling Prog.).

Cost estimates for additional engineering and operating expenses needed to address the objectives of the long range plan in areas related to downhole measurements are as follows:

	Phase I (1989-92)	Phase II (1993-96)	Phase III (1997-2000)
		$	
Borehole seismometers + operation of seismic system	600K	600K	600K
Improved packer + fluid samplers	800K	500K	300K
Oriented core samples	250K	250K	-
In-situ pressure sampler	250K	250K	150K
Slimhole logging and borehole experiments	650K	2M	-

These are ballpark figures which may turn out to be substantially underestimated.

6. Other results from 124E

(i) Pressure core sampler

Tool tested three times, once inside drillpipe, twice in formation. Core samples were fully recovered on both attempts. Full hydrostatic pressure was recovered two out of three times. Downhole mechanical function was flawless. Deployment/redressing is vastly improved over predecessor. Core size 36" long and 2" diameter.

(ii) Extended core barrel

Tool deployed in rugged environment without mechanical failure. New thread design effective in preventing over-torque failures leading to a more reliable deep penetration (1000m) XCB coring system. This has implications for the logging programme which has sometimes been truncated because of XCB sticking. The new XCB, in conjunction with the lockable flapper, should augur well for logging programmes at depth.

(iii) Sonic core monitor

Under development with Diamont Boart (Reed Dowdco System). Downhole, self-contained core entry monitoring system using sonic transducer, mated with XCB. The core locator is based on acoustic reflection which monitors the rate of entry of core into the barrel. This would allow the rate of penetration to be monitored and core depths to be identified in cases of poor core recovery. Tool is currently under evaluation on Leg 126.

(iv) Hard rock core orientation

Current industry standard technique for hard rock core orientation requires near 100% core recovery. ODP experiences less than 100% recovery due to current operating depths, drillstring technology, and heave compensation capabilities. There are three approaches to achieving viable hard rock orientation capabilities.

(a) Modification of current oilfield technology
(b) Use the DCS in conjunction with current oilfield technology
(c) Development of the sonic core monitor to be used with current ODP coring technology

Option (b) is favoured.

(v) High temperature drilling

A meeting was held with geoscientists concerning the definition of high temperature "hydrothermal" drilling requirements. Input details are currently being collated into a strategy document. Initial target temperature is 400°C.

The use of the side entry sub for circulating to cool logging tools is viewed cautiously because, although the tool is just below the pipe, it is considered too far away from the drillbit for effective cooling.

(vi) Vibracoring

Projected applications are:

APC, for possible undisturbed recovery of loose flowing sands.

XCB, for better recovery of turbidites and/or chalk/chert sequences.

DCS, for enhanced bit life and improved penetration rates in crystalline rock.

Jack Pheasant of BGS, who will be a visiting engineer to ODP from mid-summer, will be initiating the integration of "hydraulic" vibracoring into an ODP coring system.

7. Downhole Measurements

DMP Liaison commented on the reasons why logs are run; their continuous nature, providing data at reservoir conditions, a wide range of measurements at a scale intermediate between core data and geophysical measurements. In contrast, core is discontinuous, is rarely measured at truly simulated in-situ conditions, is at a small scale, and potentially suffers from recovery damage. Core and log data are complementary: neither is a substitute for the other.

The ODP standard logging suite was reviewed in the context of a 4-inch hole scenario as per the DCS. Data that would be lost from the standard suite include:

Sonic waveform
Dual induction
Geochemical logging tool
Natural gamma spectral
Formation microscanner

In response to a question, it was estimated that 50% of the information that is gathered by the standard suite would not be obtainable in 4-inch holes.

Slimhole options include BPB Industries, whose background in coal logging has stimulated slimhole tool developments at low temperatures, and the Schlumberger hostile environment logs (HEL) which operate up to 500°F. The latter tools, all 2.75 inches in diameter, are: single induction, gamma ray, neutron, density, sonic and caliper. These tools can be deployed in a 4 inch hole although the sonic requires to have its centralizers removed, an action which does degrade the data.

Miscellaneous topics included the miniaturized formation microscanner, now on board ship, the proposed workshop on slimhole and high-temperature logging, third-party tool delays in connection with Nankai, and the need to match downhole measurements with corresponding shipboard measurements of physical properties.

8. <u>Operations</u>

Leg 123: side-entry-sub successfully deployed to overcome bridging problems and allow logging to be undertaken.

Leg 124: again side-entry-sub used to allow logging which included the borehole televiewer for stress orientation. Planned hydrofracturing not undertaken because of difficulties in lowering a packer in uncased hole.

Leg 125: leg characterized by hole stability problems. Solution to these problems is impeded by absence of a riser. Hole stability is recognized as a major problem within ODP.

9. <u>Onboard Physical Properties Measurements</u>

Shipboard Measurements Panel (SMP) Chairman reviewed the current status. Physical properties measured on board ship include:

Acoustic velocity (Vp), magnetic susceptibility, density/water content, thermal conductivity, shear strength. resistivity.

Potential additional measurements are:

Improved shear strength
Rock quality evaluation
Engineering sediment classification
Swell index
Strain relaxation

SMP is a new panel, formed in early 1989, and has only had one meeting to date. It is in the process of formulating its policies. Reference was made to a one-day subcommittee meeting of DMP held in 1987 on the status of shipboard physical properties measurements. It would be helpful if those ideas could be input to SMP. Since there is facility for a DMP liaison to SMP, the DMP chairman was asked to attend the next SMP meeting (in October 1989) to outline the recommendations of that subcommittee.

10. <u>Next Meeting of TEDCOM</u>

To be held in the autumn (November). Venue to be decided.

Paul F Worthington

3 April 1989

ODP WORKSHOP ON LOG DATA QUALITY

Holiday Inn Central
Washington D.C.

13 - 14 April 1989

COMMUNIQUE

Since the inception of the Ocean Drilling Program (ODP) in 1983 the role of downhole measurements has steadily grown to become an important integral part of the overall scientific effort. This growth can be attributed to two complementary factors, an increasing rate of acquisition of wireline logging data and a wider appreciation of the scientific benefits of downhole measurements as a whole. This most satisfactory state of affairs is due to the efforts of the ODP logging contractor, Lamont-Doherty Geological Observatory (LDGO), and the wireline subcontractor, Schlumberger. As a result of these efforts, ODP has access to the most advanced logging suite that is run routinely in the world today, and these data are providing vital pointers in our drive to learn more about the earth's structure and history as it is revealed beneath the oceans.

Motivated by these successes, it was considered appropriate to re-examine the status of log data acquisition within ODP, in anticipation of an even greater usage of these data in the future. Accordingly, a workshop on log data quality was convened with the support of Joint Oceanographic Institutions (JOI), Inc. Convenors were Roy H Wilkens and Paul F Worthington. The workshop comprised former JOIDES logging scientists together with guest representatives of the science operator, Texas A & M University, the logging contractor and the wireline subcontractor. Three attendees were members of the JOIDES Downhole Measurements Panel (DMP).

The stated purpose of the workshop was:

"to evaluate the impact of shipboard logging practices on log data quality by identifying problematic areas and recommending ways in which these might be improved".

The workshop formulated the following recommendations:

(1) Data quality rather than quantity should be the overriding priority in log data acquisition: present time restrictions do not allow both to be achieved satisfactorily.
[JOIDES]

(2) Logging programmes should be identified *after* the thematic objectives have been formulated but *before* the provisional leg structure is established. Thereafter, logging should comprise an integral part of the planning process.
[LDGO, DMP]

(3) Co-chief scientists should be contacted by the JOIDES Downhole Measurements Panel (DMP) shortly after being named to be made aware of the role of downhole measurements in addressing the scientific objectives of their Leg. DMP should consult the Co-chiefs on any subsequent revisions to the DMP logging recommendations.
[DMP]

(4) The JOIDES logging scientist should be identified and trained at the earliest possible stage in the pre-cruise planning process. All prospective JOIDES logging scientists should attend LDGO for at least one week. Training is essential in view of the technical complexity of the downhole measurements program.
[TAMU, LDGO]

(5) DMP in consultation with LDGO should formulate a more specific job description for the JOIDES logging scientist.
[DMP, LDGO]

(6) Because of the remoteness of the shipboard location, LDGO should particularly ensure that at least one logging scientist is completely capable of operating and maintaining the shipboard systems. These should be simplified so that the JOIDES logging scientist can fully participate in the routine log processing and analysis.
[LDGO]

(7) The LDGO or the JOIDES logging scientist should make a presentation to the shipboard party early in a cruise to outline the scientific purpose of the logging program.
[JOIDES, LDGO]

(8) Adequate time for hole conditioning should be included in all Leg schedules.

[JOIDES, TAMU, LDGO]

(9) Development of the new side-entry-sub (SES) is essential in view of its safety, operational and time-saving benefits, relative to the existing facility.

[JOIDES, TAMU]

(10) The side-entry-sub should be run in all cases except where hole conditions appear to be superior.

[JOIDES, TAMU]

(11) Time provision should be made at the earliest possible stage of planning *either* to deploy the side-entry-sub without detriment to the scientific logging schedule *or* to drill a separate hole dedicated to logging at that site.

[JOIDES,TAMU]

(12) The wireline heave compensator (WHC) must be fully maintained by the time-shared SEDCO mechanic. Routine standard testing of the WHC should be undertaken at least six-monthly. Analysis of accelerometer data from the formation microscanner (FMS) would serve in lieu of routine testing.

[TAMU]

(13) LDGO should be formally assigned a half-time technician for shipboard electronics support.

[TAMU]

(14) The degradation of data from the neutron porosity and sonic tools, caused by the new standard tool combinations, is unacceptable in view of the emphasis on data quality. Where high quality neutron porosity and sonic data are deemed essential, provision should be made for running separately an eccentered tool combination and a centred tool combination taken from the seismic stratigraphy/porosity string. This will require an additional logging run.

[LDGO]

(15) A composite plot of total natural gamma, induction resistivity, lithodensity and sonic logs should be prepared and distributed as soon as possible after completion of the first logging run, subject to appropriate quality control criteria. This would ultimately require data transfer from the CSU to another shipboard system. A system should be developed to read raw Cyber Service Unit (CSU) field tapes directly into a processing system to facilitata the rapid presentation of primary field data.

[TAMU, LDGO]

(16) The shipboard whole core scanning facility should be extended to include natural gamma spectroscopy and, if possible, induction resistivity, for correlation with and calibration of borehole logs.

[JOIDES, TAMU]

(17) The TAMU computer users group are urged to give high priority to the implementation of a system to merge well-log and core-barrel data on board ship.

[TAMU]

(18) A software user-directory should be compiled of all shipboard systems, to include personal and mainframe computers. A synthesis of this should be distributed to the scientific party prior to each Leg.

[TAMU]

(19) The post-cruise integration of log and core data from selected Legs should be undertaken, with JOI support, to refine further the calibration and accuracy evaluation of well logs. JOIDES logging and physical-property scientists should be encouraged to submit joint proposals to JOI for funding post-cruise studies to correlate log and core data.

[JOIDES, JOI]

(20) An archive of tool response characteristics should be established at LDGO. LDGO should approach the logging subcontractor who should be asked to provide sufficient information to enable log response to be properly simulated.

[LDGO]

The following persons were in attendance.

Convenors	:	Roy H Wilkens (HIG) Paul F Worthington (BP Research)
Members	:	A Cooper (USGS) C Griffiths (IKU) M A Lovell (Nottingham University) P Lysne (Sandia) J Mendelson (MIT) D Moos (Stanford University) C J Mwenifumbo (Can. Geol. Survey)
Guests	:	C Broglia (LDGO) G Foss (ODP/TAMU) L Geiser (Schlumberger) R Jarrard (LDGO)
Observer	:	E Kappel (JOI)

Dated 11 May 1989

JOIDES DOWNHOLE MEASUREMENTS PANEL

FAX NUMBERS

NAME	COUNTRY CODE	AREA CODE	NUMBER
P F WORTHINGTON	44	932	763352
D COWAN	1	206	543 9285
J P FOUCHER	33	98	05 04 73
X GOLOVCHENKO/ R JARRARD	1	914	365 3182
M HUTCHINSON	1	405	767 4014
D KARIG	1	607	254 4780
P LYSNE*	1	505	846 6328
R MORIN	33	38	64 36 89
C SONDERGELD	1	918	660 4163
H VILLINGER	49	471	483 1149
R WILKENS	1	808	949 0243

* Number has to be switched to FAX mode: call ahead

EXCERPTS FROM 31MAY-1 JUNE 1989 EXCOM MEETING DRAFT MINUTES

FY90 Program Plan and Budget (PCOM Agenda Item F)

B. Raleigh said that he had received several letters about the substitution of the Old Pacific program for the Geochemical Reference program that were concerned that LITHP was not represented at the meeting and had no direct input. He questioned whether there should be some provision for thematic panels to have a direct input into PCOM meetings. He said he was disturbed by this substitution. R. Moberly agreed that the rescheduling is of significant concern. Panel advice reaches PCOM in the form of panel minutes and through liaison members, which PCOM had. He explained, however, that not having a lithosphere expert present at PCOM was a problem, but it was not known that J. Malpas would not attend the meeting until the last moment. EXCOM members had been asked previously, if possible, to replace retiring PCOM members with appointees with expertise in petrology or seismology, and also to lengthen the tenure of PCOM members to improve corporate memory.

R. Moberly explained that in terms of its thematic ranking, Geochemical Reference did not make the list of high priority legs for SOHP or TECP and that according to the available records, it ranked behind 5 other legs on the LITHP ranking. N. Pisias pointed out that at the December 1988 PCOM meeting Old Pacific did not have complete surveys and there was a question about reaching old crust. In May 1989, however, Old Pacific was highly ranked and surveys had shown that it could be achieved and was therefore the better proposal. N. Pisias also observed that other strong thematic proposals will be drawing the ship back to the Western Pacific area; Geochemical Reference will get drilled if the thematic rankings justify it.

R. Moberly said that because of letters received about the removal of Geochemical Reference from the FY90 plan, PCOM will reconsider FY90 planning at its August meeting.

EXCOM Motion

EXCOM adopts the FY90 Program Plan, including it budget. (Motion Maxwell, second Caldwell)

Vote: for 13; against 1; abstain 1; absent 1

Long Range Planning Document (PCOM Agenda Item G)

B. Lewis noted that there is an apparent change of emphasis in the program to deep crustal drilling targets. He was concerned that some of the objectives such as lower crust and mantle may not be achieved successfully, but are a major thrust of the proposed science. The future of the program may therefore depend on the success of the technological developments. N. Pisias said that the thrust is not necessarily to go for deep basement, but this is where the engineering development is needed to take the program beyond where it is already. B. Lewis wanted to know if it was the intention of the LRP to change the direction of the program to deep hard-rock drilling. N. Pisias said that the LRP drilling estimates came from what the thematic panels thought was required to achieve high priority objectives, and since crustal drilling takes greater amounts of time it may appear to be more dominant. There is no priority to the list. B. Lewis said that the number of legs associated with paleoceanography is not as large as those associated with hard rocks. N. Pisias said that the scientific effort cannot be equated to drilling effort alone, since high-resolution studies of sediment cores is time consuming.

B. Biju-Duval was concerned that six years ago the new drilling ship was chosen because it had a riser, however the riser is still not being used. D. Heinrichs wanted to know what plans were being made for using a riser. N. Pisias said a slimline riser needs to be developed for drilling continental margin deep-holes. A total of one year of time needs to be devoted to this drilling.

B. Biju-Duval was concerned that the section on educational opportunities was largely US-oriented and was not appropriate for France. N. Pisias said that he used all the information that was supplied to him and if the non-US partners want to add to the section on educational opportunities they need to prepare something in writing.

C. Helsley said that the COSOD I objective that needs more emphasis is the detailed understanding of the Earth's magnetic field over the last 200 m.y., which can only come from drilling. This objective has become lost in the present thematic panel structure and needs to be emphasized in the program. J. Briden agreed that paleomagnetism and the history of the Earth's magnetic field has gone hand-in-hand with the development of the drilling program.

B. Lewis was concerned that the move towards deep crustal objectives might not be achievable. J. Briden thought it was an excellent plan, but needed adjustments at the editorial level (what audience is being addressed?); education section (should be more international in scope); cautionary forward should state that the program is proposal driven and therefore the 95 legs are only an example of what might get drilled. R. Moberly said that N. Pisias had also received comments that the education section was largely a US statement, but he was unable to get a written response from the non-US members in this area. JOI agreed to polish the document. H. Dürbaum was concerned that modern logging techniques would be dropped if drilling pursues crustal objectives using the DCS. The wording on alternate platforms needs modification. J. Stel thought that the defensive tone needs to be polished away. He also questioned the Phase I technological development costs of $5.4M. T. Pyle said that the JOI office will use this science document as a basis for a more polished one, however, changes need to be written by the concerned parties. C. Helsley said that it is important to have the final document in place by next year. W. Merrell observed that this is a living, working document which needs to get out to the community to show what the science plan is going to be for the renewal. He cannot see any reasons for delaying its publication. C. Barnes was also concerned with the balance between hard-rock drilling and sediment drilling, as well as the remarkably small biological component in the plan with hydrosphere, cryosphere and biosphere only being about 1/3 of the drilling plans. W. Merrell said that PCOM thought about and approved this science balance using input from the thematic panels and besides it will get modified as new proposals arrive. C. Harrison wanted to know if PCOM will reconsider the balance. R. Moberly said they will take into consideration these comments. D. Heinrichs emphasized that the science plan is needed right now so that a working plan can be available for presentation to the NSB this fall.

EXCOM Motion

EXCOM adopts the Long Range Plan with modifications as listed below. Balance; Editorial; Educational Accomplishments and Opportunities; Example Only ~90+ legs; Logging; Alternate Platform; Are Costs in Phase I&II Correct. (Motion Merrell, second Caldwell)

Vote: for 14; against 0; abstain 1; absent 1

Engineering Development (PCOM Agenda Item H)

Because of the concern about the apparent incompatibility between the 4-inch diameter hole drilled by the Diamond Coring System (DCS) and the modern suite of logging instruments, A. Maxwell put forward the following motion, "EXCOM directs PCOM to proceed with near term (FY89-93) DCS engineering design that will allow the deployment of modern, geochemical and geophysical logging tools in future ODP drillholes". In the discussion of the motion, B. Raleigh noted that ODP has come to an impasse between logging or return of cores in some instances. He asked what PCOM was planning. R. Moberly said that PCOM was still getting cost estimates for making the systems compatible. We know there are physical limitations on the size of the logging tools, we don't know what the configuration of the DCS will be yet. A. Sutherland said that TEDCOM expresses cautious optimism about a phased deployment of the DCS. Paul Worthington of DMP has said that there would be a great concern for logging if the program developed with a majority of the holes drilled with the DCS.

H. Dürbaum was concerned that use of the DCS may also exclude many of the other downhole measurement tools. T. Pyle said it needs to be clarified whether the motion covers all modern logging tools or just some, since it is subject to interpretation. R. Anderson said the high tech tools are mainly geochemical.

W. Merrell said that the motion would require that the DCS pipe be redone at a cost of $2.72M without first having proven that the DCS can do the job for which it is intended. This motion will slow down the current development. We are not trying to ignore logging, but it may happen that some logging must be sacrificed to return necessary core. R. Anderson said that the concern is that a headlong dive into the DCS, if it is widely used, will result in the exclusion of logging from the program. B. Raleigh questioned if it would be acceptable to drill holes without logging them. D. Spencer said that it is implicit in the motion that the small-diameter DCS development will cease. W. Merrell said that with this motion logging will become the determining factor in the future direction of the program. B. Raleigh asked if the DCS is where the program is headed. R. Moberly said that Leg 132 will be the test of the DCS, until then we will not know. D. Spencer said that the motion will stop even the design development of the DCS.

EXCOM Motion

> EXCOM directs PCOM to proceed with near term (FY89-93) DCS engineering design that will allow the deployment of modern, geochemical and geophysical logging tools in future ODP drillholes. (Motion Maxwell, second Dürbaum)
>
> Vote: for 5; against 8; abstain 3 **(Failed)**

C. Helsley directed that the minutes reflect the concern of EXCOM on this matter. No further action was taken on engineering developments.

Political Constraints on Drilling (PCOM Agenda Item J)

D. Heinrichs said that the perception of the thematic panels that EXCOM has warned about political considerations is incorrect; EXCOM has reaffirmed that ODP is a proposal driven program. Several EXCOM members have suggested during their country reports that thematic interests could be met equally well in the Atlantic. R. van Lieshout discussed a statement suggesting that it could happen that some European countries might not be as interested in continuing participation in drilling, as they would be if the vessel returned to the Atlantic sometime soon. The way to solve this problem is the approach taken, which is to evaluate proposals on a thematic basis and if Atlantic proposals warrant drilling to do so. C. Barnes suggested that it is somewhat naive to think that science alone will justify the continuation of the program for all participants. PCOM makes decisions based solely on science while EXCOM may have to consider whether the program can continue if there is a loss of members. J. Briden indicated that what is being said is that there is merely danger ahead on this path. J. Baker said that this is a warning to scientists that good proposals from the Atlantic are needed to help insure the continuation of the program. B. Biju-Duval said that there is no problem in France with science keeping the ship away from the Atlantic, good science is done by French scientists in all oceans.

C. Helsley noted that the perception of where the program will be drilling influences the location of the proposals submitted. H. Dürbaum also suggested that because of the effort required to produce a mature proposal, perception of the likelihood of drilling influences submission. He said that good proposals will be forthcoming now that drilling is open. W. Merrell said near the end or perceived end of even a science-driven program, politics inevitably play a part. The way to avoid these problems is to avoid having a distinct end to the program by agreeing to continue it through 1999, the end of the contract for the *Resolution*. In that way the strong and good science in the present mode can continue. D. Heinrichs agreed that brinksmanship should be avoided. B. Raleigh said that in order to keep proposals coming in, a clear intent to extend the program beyond 1993 needs to be given. R. van Lieshout said that to go beyond 1992 the money suppliers need to see a benefit for continued participation in the program and this may be a problem if the ship is far away.

A. Maxwell suggested that a statement be made that the program will be returning to the Atlantic, but the amount of time spent there will depend on the proposals received. W. Merrell said that this would not be good unless the program goes through 1999. C. Barnes suggested that it should be made clear that ODP is a long-standing international program. B. Biju-Duval suggested that ODP reaffirm that it is a global program that is proposal driven. J. Stel said that this will give a signal to the community that the Atlantic is open to ~~drilling proposals. R. van~~ Lieshout said this will open up the possibilities for renewal of the MOU. J. Briden said that the problem is not in the EXCOM resolution but in the perception that the ship is going to stay in the Pacific. EXCOM should reaffirm its original motion. C. Helsley said the minutes will reflect that we are reaffirming the original motion.

<u>EXCOM Motion</u>

EXCOM reaffirms that ODP is a global program of ocean drilling, exploring all oceans and driven by the quality of the scientific proposals within approved thematic priorities. (Motion Barnes, second Stel)

Vote: for 16; against 0; abstain 0

<u>Publications Policy</u> (PCOM Agenda Item N)

H. Dürbaum said there is a perception that there has been nearly no publications in ODP phase. N. Pisias disagreed with that there are no publications, since over 18 Part A and Part B volumes are published. The "Scientific Results" may take over 3 years to publish, but they present important primary data and interpretations. P. Rabinowitz said that the PEC report was concerned that there were no Part B "Scientific Results" at that time. By the time of the renewal of the program there will be 60 volumes published, 39 Part A and 21 Part B volumes. Publication of papers outside of ODP that use information derived from the drilling program is very extensive. D. Heinrichs said that it is the perception that there is a lack of publications that is the problem. The depth of understanding of basic science that has been contributed by the drilling program needs to communicated more broadly.

J. Briden said that in addition to the permanent record provided by the Part A and Part B volumes, the "fruits of ODP" need to be highlighted in publications. He suggested a collection of papers similar to the Allan Cox book which presented the "fruits of paleomagnetism". C. Helsley, C. Harrison and J. Briden all emphasized the need for open publication of thematic papers.

Although he agreed with the first part, H. Dürbaum wanted Part C of the publication policy deleted, since he thought the Science Operator would be quicker in handling the problems of copyright and lead times than IHP. J. Briden wanted to know who does give the detailed guidelines to the Science Operator. R. Moberly said that PCOM prefers to use the advice given by the JOIDES advisory panels, which were established for this purpose. Some of the issues were identified by IHP and involve science-related issues rather than operational matters. C. Helsley told PCOM to direct its IHP to provide the guidelines; TAMU should get started on what it can. D. Spencer wanted to know if it were possible to shorten the time for publication of Part A even more, since it should be ready when it comes off the ship. R. Moberly said that some things, such as final graphics, require work off the ship. A minimum of 3 to 4 months are probably needed. T. Pyle pointed out that these time figures were based on a thorough survey by the Information Handling Panel.

<u>EXCOM Motion</u>

EXCOM adopts the new Publications Policy, with the deletion of paragraph C. (Motion Dürbaum, second Caldwell)

Vote: for 15; against 0; abstain 0; absent 1

<u>Radioisotopes Onboard the *JOIDES Resolution*.</u> (PCOM Agenda Item N)

J. Briden thought the matter of handling radioisotopes onboard the *JOIDES Resolution*. required immediate action and was better resolved by PCOM than being referred to SMP. J. Briden moved that "EXCOM calls on PCOM to resolve the question of radioisotope-handling policy as a matter of urgency". D. Spencer explained that the difficulty arises because of the incompatibility between low levels of C^{14} that occur naturally and the large amounts used by the biological experiments which are up to 10^9 times higher. WHOI has very restrictive policies. There is a very real danger of spreading radioisotopes over the whole ship. PCOM is wise in what it did. If the experiment has to be done immediately, then another vessel should be used. With the advent of tandem accelerator mass spectrometry, it is even more critical that contamination of the *Resolution* be prevented. The policies towards the use of these tracers needs to be looked at critically without pressure from EXCOM. If ***urgency*** means putting a policy in place without working out the proper safeguards then Spencer stated he could not vote for the motion. C. Harrison agreed that contamination could cause tremendous problems. A. Maxwell also agreed that strict policies are needed and suggested that the UNOLS guidelines be examined. J. Briden said he didn't contest the item about the danger of contamination, he was urging that the policies be formulated as a matter of urgency. In the PCOM wording "until such time" suggests delay. R. Moberly said that PCOM does not have a problem if the experiment is done on another vessel or onshore. If however, the experiment was to be done in a van onboard the *Resolution,* then formal procedures that are appropriate to the *Resolution* are required. PCOM would prefer this advice come from its advisory panel. B. Malfait pointed out that Asahiko Taira had volunteered to help locate a laboratory onshore where the experiment could be done. A. Maxwell wanted to know if it were possible to check the vessel to see if it is presently contaminated. D. Spencer said it would not be an easy matter.

<u>EXCOM Motion</u>

EXCOM calls on PCOM to resolve the question of radioisotope-handling policy as a matter of urgency. (Motion Briden, second Maxwell)

Vote: for 9; against 5; abstain 1; absent 1 **(Failed)**

<u>Changes in Mandates for Panels</u> (PCOM Agenda Items M & N)

J. Briden wanted to know why the panel memberships for the Site Survey Panel (7.2), Pollution Prevention and Safety Panel (7.3) and Information Handling Panel (7.4) were not given in the Terms of Reference as they were for other panels. N. Pisias said that these panels were intended to be small groups to handle specific problems and remain flexible. R. Moberly said that each member or consortia has the right to a member on each panel or committee. W. Merrell suggested that PCOM write some general statement.

The mandate changes proposed by PCOM for OHP, SMP and TEDCOM were accepted as written.

<u>EXCOM Motion</u>

EXCOM accepts the mandate changes for OHP, SMP and TEDCOM shown in the Agenda Book. (Motion Merrell, second Caldwell)

Vote: for 16; against 0; abstain 0

<u>Liaisons with other Global Geoscience Initiatives</u> (PCOM Agenda Item O)

<u>EXCOM Motion</u>

EXCOM approves of the establishment of liaisons with other global geoscience initiatives. (Motion Briden, second Harrison)

Vote: Approved by acclamation

<u>Co-Chief Scientist Selection</u>

C. Barnes did not think there was much of a problem with selection of Co-Chief Scientists and the policy should remain the same. H. Dürbaum recommended that the Co-Chiefs be confirmed by EXCOM after being proposed by PCOM. W. Merrell said that the contract calls for the choice to be made by TAMU and any changes will require renegotiating the contract with JOI. The present approach is reasonable and does not need to be changed. D. Heinrichs said that PCOM has not made a case for there being a problem; in two of three earlier cases since the beginning of ODP, further consideration showed that the proper action had been taken by TAMU. W. Merrell asked that the minutes reflect that no action by EXCOM was needed on this matter. C. Helsley said this is the consensus of EXCOM.

June 23, 1989

Dr. Ralph Moberly
Chairman Planning Committee
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Dear Ralph,

Tomorrow I leave on the JOIDES RESOLUTION and Leg 127. I will not return until August 22,and thus will miss the next PCOM meeting. Last week I attended the first 2 days of the Sedimented Ridge Detailed Planning Group meeting in Ottawa. I did not attend the last 1/2 day of the meeting, which was devoted to reviewing proposals for the LITH Panel. The chairman of the SRDPG, Bob Detrick is preparing a complete report; here I summarize some of the outcomes of the meeting from the point of view of a PCOM liaison.

The SRDPG carried out its mandate very effectively. The LITH panel's working group had identified two major objectives:

1. **To define the hydrogeological system at a sedimented ridge.**
2. **Study massive sulfide deposits.**

These served as the main guidelines for discussion and decisions.

Decision to concentrate on Middle valley to achieve objective number 1.-

The three prime candidate regions to drill (Guaymas Basin, Escanaba Trough and Middle Valley) were reviewed in terms of which was currently the best location to attack objective 1. The results of a recent cruise to Escanaba Trough were presented. These data provided a much clearer picture of the structural and geothermal characteristics of the northern part of Escanaba Trough. The DPG decided; however, that the new data did not characterize Escanaba Trough nearly as well as the comprehensive suite of geophysical data at Middle Valley. Guaymas Basin was briefly considered, but the lack of seismic imaging of basement, and the potential for major clearance difficulties put it at the bottom of the list. It was decided as a consequence that a suite of holes in Middle Valley would best define the hydrogeology of a sedimented ridge.

Drilling massive sulfide deposits: Well defined massive sulfide bodies have been mapped and sampled in Middle Valley and in the Escanaba Trough. Drilling to study massive sulfides will be done partly in Middle Valley. Sulfide bodies there that are actively accumulating. The SRDPG also felt strongly that drilling the sulfide deposits in Escanaba Trough was also important as a comparison and would provide valuable samples from a wider range of environments.

A Two leg program to achieve the two main objectives:

A preliminary cut at designing a two leg program that would address the two main objectives was comprised of the following three types of holes. (See the Sedimented Ridge Working Group report.)

Type A-holes. A-holes are nonre-enterable holes that will be cored by APC/XCB in the unconsolidated and semiconsolidates sediments. A-holes will bottom as close to the sediment-basement interface as possible. The DCS may be used to penetrate indurated sediments believed to make up much of the lower part of the sedimentary section.

Type B-hole.* B-holes are re-entry holes that will penetrate into basement, and be cased to basement. Some of B-holes will be drilled only a short distance (50 m) into basement. These will be available for later deepening or installation of experiments. Others B-holes will be deepened up to 300m into basement.

Sulfide drilling: Sulfide drilling will consist of a suite of closely spaced holes across sulfide bodies to sample and define their 3-D structure.

*At some sites A and B holes will be drilled in close proximity. The A-holes will be drilled first and the be used as a test to see where the more time consuming B-holes should be located. These are called A-B sites in the plan.

Some A-holes will be continued into basement if possible in areas like the Escanaba trough where no B type holes are planned. These are called A' -holes in the plan below.

Preliminary Plan for two legs of drilling*:

Leg 1:

Type of site	Location	Quantity	Est. Time

A-Hole	Mid. Val.	4	20 days
A-B Sites	Mid. Val.	2	22 days
Sulfides	Mid. Val.	1	5 days
Sulfides	Escanaba	1	5 days
Deepen B's	Mid. Val.	2?	6 days

Leg 2:

Complete			
A-B Holes	Middle Val.	2	6 days
A' Holes	Escanaba	2	12 days
Deepen B's	Mid. Val.	2	20 days
Sulfides	Escanaba Mid. Val.	2+	20 days

*From scratchy notes, errors highly likely.

The down hole measurements plan. The discussions of downhole measurements in these high temperature holes brought some new and interesting approaches. At A-Sites temperature measurements and bottom hole samples will be made every 20 m with a Hi-T Barnes Uyeda tool in unconsolidated and semiconsolidated sediments. When indurated sediments are encountered the DCS system could be used to continue coring to just above basement. Bottom hole temperature measurements will be made every 100m while using the DCS, taking advantage of the fact that the temperatures DCS holes will be less disturbed and that the thermal pulse decays faster in the smaller diameter hole. Additional Hi-T logging may be done in the DCS hole with slim logging tools. Subsequently, the DCS hole will be reemed out with the RCB to 11" diameter bit, which will allow standard and nonstandard logging to be done by taking advantage of cooling by circulation.

Another excellent idea is to do hydrological experiments at both A and B type sites by sealing the annulus between the standard drill pipe and casing, and at the same time the annulus between the standard drill pipe and the DCS drill pipe. This will seal off the hole below the casing to drill pipe seal, and allow measurements of permeability and pressure to be made at the well head (i.e. on deck)! This capability would allow for drawdown testing as well as slug tests. It has the great advantage that Hi-T packers would not be required.

A number technological needs that will be required to meet the goals of the sedimented ridge drilling were identified by the SRDPG and will be itemized in the report of the chairman.

The need for new technology motivated the SRDPG to recommend a one year interval between the first and second leg of their recommended program.

The SRDPG has developed a very solid program that will deliver exciting new results from ODP. It would be seriously hurt if it is curtailed by trying to pack it all into one leg or even 1 1/2 legs.

I'm sure that Bob Detrick's report will fill in gaps that I have left and answer questions I've raised.

Regards,

Mark

Mark Langseth

The University of Birmingham

SCHOOL OF EARTH SCIENCES
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13th June 1989

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Joides Planning Office
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Dear Dr Moberly

I enclose a copy of the report of the working group on fluid processes in accretionary wedges. I am sorry that I could not get this to you in time for the May meeting of PCOM, which had been my intention.

The working group are happy with the report in the present form, and I hope that PCOM will find it useful in assessing and planning legs devoted to the topic of the report. I have sent copies of the report directly to Ian Dalziel (TECP), Erwin Suess (SGPP), Paul Worthington (D.M.P.), and Kate Moran (SMP), who chair the panels with most interest in this field. I have asked them to copy their comments to you.

If you have questions and comments concerning the report I should be glad to hear them.

I shall be at sea on the R.R.S. Charles Darwin from 19th June until 1st August. If you need to contact me on the ship, the enclosed information should enable you to do so.

Yours sincerely

Graham Westbrook

Enc

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Drilling to understand the fluid regimes of accretionary wedges

A report prepared by a Working Group of the Ocean Drilling Program, comprising

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Summary

An understanding of the fluid regime of accretionary wedges will provide vital insights into the controlling influence of fluids upon the interdependence of tectonic structures, rock properties, diagenesis and metamorphism, and the geochemical budget at subduction zones. Drilling would form the principal component of an integrated study of this active geological system. New standards in site survey, sampling and logging will be required to maximise the scientific benefit of the investment in drilling. In-situ measurements of parameters such as porefluid pressure, permeability and temperature will be of equal importance to sampling. This will require some development of new tools, of which the Geoprops Probe is an example, and more extensive deployment of logging and sampling techniques used in the petroleum industry.

Intensive programmes comprising a minimum of three drilling legs, separated by sufficient intervals of time to assess results and improve techniques, are advocated for a small number of very well studied accretionary wedges that represent the spectrum of variation in accretionary wedges of such quantities as convergence rate and sediment type and thickness.

Contents

Scientific Case

Sediments entering subduction zones are typically composed of 50% water, whereas rocks preserved in subaerially exposed accretionary wedges have, on average, less than five percent porosity. The water expelled by this volume reduction, plus that produced by thermally activated mineral dehydration processes, must flow through the accretionary wedge, developing in it an active hydrogeological system.

In this setting, rapid tectonic loading generates high pore pressures that strongly influence the development of structures at an early state in their evolution. The effects of this process include generation of extensive detachment surfaces (Hubbert and Rubey, 1959, Westbrook et al., 1982); control of wedge geometry (Davis et al., 1983); transport of heat (Fisher and Hounslow, in press); movement of solutes and control of sediment-rock interactions (Schoonmaker, 1986); alteration of physical properties and constitutive relations of sediments (Karig, 1986; Ritger et al., 1987); and spawning of unique biological communities at sites of fluid expulsion (Kulm et al., 1986; Le Pichon et al., 1987). Simply stated, fluids affect virtually all aspects of the geologic evolution of accretionary wedges. Understanding of the fluid component of accretionary wedges is critical in analysis of their tectonics, and by implication the tectonics of mountain belts, of which accretionary wedges are an important component or submarine analogue. Indeed investigation of the role of fluids in tectonic processes in present-day accretionary wedges will be of great value in understanding the processes that were once active in old mountain belts. Furthermore the escape of fluids from the upper part of the subduction zone exerts a control upon the budget of water and soluble ions that will be taken into the Earth's mantle and be available to be involved in the generation of subduction zone magmatism.

The evolution of fluids in accretionary wedges can be investigated through studies of surface venting phenomena from which the geochemistry of the fluids provides an integrated signal. Similarly, investigation of subaerially exposed accretionary complexes can provide information on the long-term interaction of fluids and structural processes. However, ocean drilling is the principal tool necessary to evaluate the fluid-rock interactions when and where they are most active. Drilling not only allows documentation of the effects of fluids through lithologic sampling, but also provides real-time physicochemical measurements of the processes associated with fluid flow. Drill sites transecting convergent margins with a variety of lithologies and thermal structures are necessary to ascertain fully the influence of fluids in subduction zones.

Strategy of Investigation

The most effective strategy to pursue will be to undertake thorough and comprehensive investigations of a very small number of accretionary wedges, of which the structure and geological history are well known, and that represent fairly simple examples of the spectrum of development of accretionary wedges. The choice of wedge would reflect the need to determine the effects of naturally varying quantities such as sediment thickness, sediment type, rate of accretion, age of subducting lithosphere, and to keep other parameters as simple as possible, such as convergence direction being normal rather than oblique.

The drilling programme for any one wedge should form the vital component of a complete investigation involving geophysical methods, sampling, and monitoring at the seabed. The locations of drill sites should be chosen to sample adequately the vertical and horizontal changes in structure and physical properties in the wedge.

Deep holes through the toe of an accretionary wedge, ideally as deep as the oceanic igneous crust, are required to characterise flow through this region, which may be from sources much further landward beneath the decollement or even laterally along the sequence beneath the wedge. The toe region also shows the greatest rate of change of physical properties (Fig.1).

Shallower holes further landward would investigate the fluid regime of structures that are developed there, such as major out-of-sequence thrusts, and pervasive flow out of the surface of the wedge, following appropriate surveys. These holes would also investigate the progressive deformation of the wedge in relation to fluid content and chemistry, and would study fluids from sources deep within or beneath the wedge released by such processes as dehydration reactions. The evidence for flow into the wedge and forearc basins from adjacent continental crust would also be an objective of more landward sites.

For a "typical" wedge it is likely that a minimum of three drilling legs would be required, because of the penetration necessary for the sites at the toe of the wedge and the intensive sampling and logging of the sites. It would be sensible to leave time between the legs devoted to deeper drilling to enable results to be evaluated and the drilling strategy modified, if necessary, with improvements in the technologies.

For each site the following are essential for adequate description and understanding of the effects of fluids:

a. As complete a definition of structure as is possible using all methods pertinent to the situation investigated by the drill site
b. *Pore fluid pressure
c. *Permeability
d. *Temperature
e. Porosity
f. Pore fluid and gas chemistry, beyond the standard prescribed measurements
g. Lithology
h. Diagenetic history

For the starred quantities a significant advance on what has been done in the past is necessary.

Measurements of the in-situ stresses and mechanical properties are greatly to be desired. Also of high priority is the calibration from in hole of measurements of properties of the wedge such as seismic velocity and electrical resistivity made with surveying techniques.

It may appear that the technological requirements for drilling with the objective of understanding the fluid regime of accretionary wedges are so great in comparison to what has been used in the past that it is surprising that any worthwhile information has been obtained concerning fluids in accretionary wedges. In fact, discoveries of great importance have been made with relatively unsophisticated sampling in earlier legs. The questions raised by these discoveries, however, emphasise the need for the comprehensive approach advocated in this report. While it would be unduly restrictive to wait until all the proposed techniques were available as routine before commencing upon a programme of drilling, a significant improvement in the effectiveness of the techniques used to determine the important parameters (a-h, above) is necessary to justify a heavy investment in drilling time.

Surveys Prior to Drilling

The surveys prior to drilling require greater detail than is usual in most ODP studies. Therefore a two-stage strategy is appropriate, a first stage in which the predominating structure and the locations of vents or mud volcanoes are first delineated by well-located geophysical surveys, and a second stage of detailed studies where the conduits for fluid venting and circulation are targeted.

The first-stage surveys require 100% swath bathymetry to delineate the surface morphology. Long to medium range sonar images, preferably digitally recorded and processed to enhance the contrasts in reflective character of the seafloor are very desirable. These displays provide the base on which a grid of seismic reflection lines can be laid out at a scale suited to the sizes of the structures of interest. That scale must also be considered in the choice of an appropriately tuned seismic source and receiving array. Because of their complexity, mud diapirs, thrust faults, and folds should be imaged with digital multichannel seismic techniques and processed to resolve them clearly. The broad distribution of water outflow from the wedge might be obtained from heatflow stations, the geochemistry of pore water in piston cores or direct measurement of pressure gradient and permeability with a penetrating probe.

The second stage is designed to provide the high resolution data required to site the individual drill holes. The survey data should be located with acoustic navigation from an array of seafloor transponders. Effective placement of the drill sites may require high resolution sidescan sonar, probably a deep-towed instrument such as SAR, Seamark I or TOBI, high resolution seismic reflection, and underwater photography. (For example, a survey of the surface and near surface structure in the Leg 110 area by the French deep-towed sidescan system SAR revealed that the drill sites were displaced by 250 m relative to the structures from the positions that they were thought to occupy by the shipboard scientific party on the drilling leg.) Detailed heatflow and sampling around the prospective sites are needed to evaluate the data obtained from drilling fully in relation to the processes active in the areas of the sites. Drill sites that target very localised features such as vents almost certainly require investigation by submersibles.

Requirements for Logging

In general, high absolute accuracy of measurement of the parameters is required, not high spatial resolution of stratigraphy, thus, long-spacing tools (such as velocity) are most important. The principal requirements for logging are as follows:-

1 Porosity - a critical parameter in any modelling of deformation and dewatering; logs are critical to calibration of surface geophysics measurements (neutron porosity log, gamma density log, electric logs, velocity logs).

2 Seismic Velocity - important for calibration of surface measurements; used in permeability and pore pressure estimates (especially long spacing velocity log; also a variety of uphole and oblique seismic experiments VSP, WASP etc. - also shear wave tools).

3 Resistivity - calibration of surface electrical measurements, and porosity and pore structure indicator (various resistivity and induction logs, including long spacing, perhaps USEL type of large scale electric experiment).

4. Temperature - important fluid flow indicator; critical to modelling of deformation; helps to define earthquake faulting limits at depth; calibration of surface heat flow and hydrate temperature estimates; also thermal conductivity on core (downhole sediment probe, APC temperature shoe, high resolution logging HRT repeated at several time intervals to allow extrapolation to equilibrium and detect water flows - this needs more attention).

5 Pore Fluid Pressure - critical to understanding deformation mechanisms and fluid transport (several combinations of logs can give qualitative estimates of pore pressure; also pore pressure

sediment probes and packers as described in Downhole Experiments).

6 Permeability - needed for any models of fluid expulsion, pore pressure, thermal field and deformation processes (several combinations of logs can give qualitative estimates of permeability, laboratory measurements of core permeability, and downhole probes and packers as described in Downhole Experiments).

7 Stress and Strain Indicators - for deformation processes and geometry. They must be correlated with mechanical properties measurement (televiewer and microlog dipmeter for hole ellipicity and structure such as fault zone dip, packer hydrofracture in consolidated sections at depth for stress magnitude and orientation, anelastic strain measurements on consolidated core).

8 Geochemical Indicators - for mapping fluid flow and alteration in section penetrated by hole (a variety of log combinations now permit at least qualitative logging of downhole geochemistry). Improvement in the sensitivity of the **Salinity Index Ratio** (SIR) and testing of the resolution of this method would greatly advance work of this nature. The salinity index ratio is one of the properties measured by the gamma spectroscopy logging tool. Pore fluid salinity changes of about 10 per mil S were detected by logging during Leg 112 drilling (Fig.2) and confirmed by chloride titrations of squeezed pore fluids. Such large changes in salinity characterize drastically different subsurface hydrogeological regimes. Usually in active margins, pore fluids do not show changes of quite this magnitude. There is a need for improving the sensitivity of this logging tool and testing its limits for measuring reliably small salinity changes of around 1 per mil. Changes of such magnitude are ubiquitous in pore fluids of accreted margins and carry major information on the nature, source, and history of advected fluids.

Requirements for Sampling

The policy and methodology of sampling deep-sea drill cores has evolved over the span of drilling programs, and should continue to evolve as the scope and objectives of scientific drilling change. There should be flexibility in both policy and methodology to accommodate the objectives and characteristics of individual sites. Sampling in accretionary wedge sites, where principal objectives involve the physical and chemical characters of the sediments and fluids as well as the mechanical state of sediments, and where paleoclimatologic or historical objectives are generally of minor concern, should reflect these considerations.

In wedge sites the condition of the core is of paramount importance. For triaxial and reconsolidation tests, as well as for **anelastic strain recovery** (ASR) measurements, undisturbed, whole round cores must be collected and adequately preserved. To ensure that appropriate core samples are taken, core sections may have to have their liners removed (split, as for igneous rocks), so that the sections can be inspected. The length and number of whole round samples should reflect the type of test, the suspected vertical gradients in the quantity to be measured, and the competing demands for the material. In other words, blanket procedures on sampling should be avoided, except to form a "ceiling" on the total percentage of material sampled. It should also go without saying that programs requiring special samples should be integrated in order to minimize the number of samples needed, either by recycling material, or by sequential testing if some tests are nondestructive, as the ASR tests.

The gradient of change of dissolved ionic species and gases in pore fluids from accretionary wedges is the most important conventional parameter used to detect fluid movement. The shape of the gradient is the composite of diffusional and adective transport and of regenerative and consumptive diagenetic reactions. All inferences about active dewatering and the rates and directions flow are based on the shape of concentration gradients and, to some extent, on the magnitude of these dissolved concentrations. As with sampling for physical measurements maximizing the spatial resolution at downhole intervals, where changes in gradients are most pronounced, should be the objective during sampling of pore fluids. The optimal spacing required to resolve gradients cannot be predicted, but has to be determined in "real time" as drilling proceeds. With the existing procedures for fluid sampling by squeezing this requires extreme flexibility in sampling policy and more frequent whole-round samples at the discretion of the co-chiefs. To permit this flexibility and to avoid conflict with sampling for other objectives, the drilling of B and C holes at certain sites has definite advantages, as shown by Leg 112 drilling, and should be seriously considered for drilling in accretionary wedges.

Sampling of gases (mostly methane and carbon dioxide) in accretionary wedges - where the gas contents are the highest among all of the drilling targets - is presently inadequate. The gas contents downhole, measured by existing procedures, quickly approaches a maximum which " ... represents the limit of the amount of residual methane that can be retained by the sediment ..." as the core is depressurized and opened on deck (Shipboard Scientific Party, Leg 112, Site 683, p. 462). It is imperative that a **pressure core barrel system** be employed which allows not only sampling of sediment-fluid-gas at in situ conditions, but also ensures detection and measurement of the gas content onboard the drilling vessel. Requirements for this new shipboard procedure are that accurate total gas contents be unaffected by losses due to evolution and escape. This procedure should also address the problem caused by stripping of trace gases during degassing of methane and carbon dioxide. The trace gases, He, noble gases and thermogenic hydrocarbons, contain important information on the source depth of migrating fluids.

Requirements for Downhole Measurements and Experiments

The in situ measurement of pore pressure, permeability, temperature and stress are in greatest demand in the study of accretionary wedges. For various reasons, none of these parameters can be adequately determined from logs, but even where some idea can be deduced from logs there must be independent, direct measurements with which to calibrate the logging results. At present a number of tools to measure various properties in-situ measurements are under development.

In addition to tools that obtain in-situ measurements of properties directly, there are tools that measure "tracer" or "correlation" properties such as seismic velocity. Two such tools or downhole experiments are vertical (and variable offset) seismic profiles and large-scale electrical resistivity measurement. VSP's are needed in some cases to correlate in-hole and surface seismic data, to clarify structure below the hole, and to probe complex structure around the hole. Shear wave velocities may provide information concerning elastic moduli, gross permeability state of stress and fluid pressure, but such studies are not far advanced, even in the petroleum industry (as reported by industrial representatives on the DMP). High quality seismic experiments, with 3 component seismometer arrays, should be run in holes where they can be scientifically justified. Large-scale resistivity experiments have the great advantage over wireline logging techniques of measuring resistivity in a large volume of rock around the drill hole and are not so prone to the effects of invasion of sea water or drilling mud into the rocks immediately around the hole. Resistivity values reflect porosity and pore fluid chemistry, and are very informative when taken in conjunction with other geophysical measurements.

The success of downhole measurement will be, in part, a function of environmental conditions, but also of operational considerations. If useful data are to be obtained, adequate tools must be deployed with optimally prepared hole conditions. Samples retrieved by existing in-situ pore fluid devices yield valuable information on the fluid chemistry by sampling ahead of the drill bit where contamination is minimal. The infrequent deployment of in situ pore fluid devices, however, does not help in better defining the shapes of the concentration gradients. It is clearly desirable to increase the frequency of deployment of the in-situ pore water samplers per drill hole coupled with temperature sensors. The deterioration of drill hole conditions during in-situ sampling and temperature probing is a problem that needs to be overcome.

Packer deployment for sampling of fluids is very promising in certain structural settings such as venting conduits, decollement zones, faults and unconformities. Venting conduits channel fluids vertically and fault zones and unconformities horizontally. The setting of packers in drill holes should be in conjunction with permeability experiments and the accurate definition of the geometry of permeable zones by logging. Packer deployments yield large volumes of fluid samples and are suitable for sustained extraction experiments. Large volumes of fluids are needed for natural and artificial tracers for checking horizontal flow between two or more holes would also rely on packer technology. Such experiments appear to be realistic. Side-wall sampling for fluids seems an approach that is not very promising, as contamination by drilling fluid and caking of mud is highest adjacent to the drill hole wall.

Laboratory Measurements and Experiments

Laboratory experiments and measurements beyond the normal shipboard suite are necessary to obtain additional characteristics and to correlate or calibrate logging and other measurements. Included here are both special shipboard studies and shore-based laboratory studies. Before identifying the principal needs of such studies it must be stressed that they should be extremely well correlated, among themselves and with other measurements, because heterogeneities in properties and lithologies will result in rapid along-core changes. To the extent that it is possible, the same sample should be used for all tests.

Of the laboratory experiments pertinent to studies in accretionary wedges, intergranular permeability tests, anelastic strain recovery (ASR) measurements, structure (fracture) analysis, sediment mechanical tests and seismic velocity measurements at in-situ conditions were perceived as the most important. Intergranular permeability, both parallel and perpendicular to bedding must be measured as a complement to the gross permeabilities determined from in-situ effective stresses, using on board ODP equipment if available, but also in onshore laboratories.

A wide range of mechanical tests is appropriate, all oriented toward characterization of the mechanical state parameters (eg cohesion, internal friction), strength, and rheological behavior of the sediment at conditions found in the accretionary wedge. A minor but important objective is to determine porosity rebound as functions of porosity and elasticity, so that laboratory measurements of porosity can be corrected to in-situ values. All such tests are quite time-consuming, require accurate control of pore-fluid conditions, and reproduction of in-situ stresses, all of which imply that most testing be done in shore-based laboratories. Details of testing programs are a function of investigator bias and ingenuity, but certainly the program would involve triaxial and uniaxial strain (reconsolidation tests).

Seismic velocity measurements on samples are needed not only for the determination of elastic moduli, but also to correlate velocity with lithology and other properties at a fine scale. Adequate measurements must be made at in-situ pressures at least and temperature if possible. The necessary equipment may become part of the shipboard suite and should be used for as much of the shipboard velocity measurement as possible. Additional measurements in shore-based labs will almost certainly be required.

Measurements designed to determine stress orientation include anelastic strain recovery tests and analyses of structural features (primarily young natural features) in cores. ASR measurements are relatively simple but time consuming, and must be done with undisturbed cores as soon as possible after the core is brought on deck. It would be logical to preserve these same cores for subsequent mechanical testing. Because each test requires more than a day, the samples should be biased toward sections of hole where the stress orientation is suspected to change rapidly, as near major fault zones, especially across the basal decollement.

Structural analyses involve the quantitative measurement of recent fractures and other structures that can be related to the orientation of stress and in some cases to strain and mechanical state parameters. Again, the range and approach would depend on the structures that occur, but a point to stress is the need to split cores perpendicular to structures. Possibly some x-ray technique (eg x-ray tomography) or ultrasonic imaging method could be developed to determine the structural framework in the unsplit core.

Both ASR tests and structural analyses will require some method to orient the core. Although there is no way at present to orient cores of consolidated material at depths beyond APC penetration, a number of indirect methods should suffice. These include correlation of in-situ and core dips using the FMS tool and paleomagnetic measurements on the cores.

Thermal conductivity, which must be measured to determine heat flow, is difficult and time consuming in consolidated sediment using the needle probe on unsplit core. The development of a "thermal pad" that can be used to measure conductivity on the face of the split core is to be encouraged to save time and improve results.

In general, the facilities available for geochemical analysis on board or in labs ashore are adequate, but attention should be paid to the extra demands placed upon onboard equipment by the need to make measurements of samples with preserved in-situ conditions from a pressure core barrel system and to the problems of storage and transport of these samples. This includes adequate preservation for isotope analyses on gases and fluids such as copper coils and pressurized vessels. Thematic and service panels are urged to outline the specific details.

Finally, techniques with which the physical properties of gas hydrates can be determined should be developed. This would involve a cold chamber that could be brought to in-situ pressure and permit measurement of seismic velocity, thermal conductivity and other relevant properties.

Post Drilling Experiments

Evidence is accumulating from work on accretionary wedges, from survey information as well as drilling, to suggest that the outflow of fluids could have a significant episodic element. This episodicity could be produced by periodic stress build up associated with the production of earthquakes in more landward and deeper parts of the subduction zone. Just as it is important to define the spatial context of the drill sites as well as possible, it is important to know the temporal context and find whether the measurements made during the drilling leg are representative of long-term behaviour or sampls of a maximum or minimum of a short-period cycle.

The types of long term measurements in boreholes would be of strain (using tiltmeters), fluid pressure, temperature, and perhaps fluid chemistry if a suitable system for this could be developed. It is important that the borehole should be sealed, either artifically or naturally through collapse of the holes, to prevent fluid flow along it. The borehole measurements would be made in association with seabed monitoring of strain, temperature and fluid pressure gradient, and seismicity (borehole seismometers may also be used).

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Figures

Fig.1
Schematic cross-section of an accretionary wedge and upper part of subduction zone showing modes of fluid escape (listed below) and typical drill-site locations for the investigation of the fluid regime of the accretionary wedge.

Fig.2a
Summary cross section of the results of Leg 110 as they relate to the fluid regime, showing flow paths and the anomalies in the concentrations of chloride and methane in pore fluids in samples from four of the eight holes transecting the toe of the accretionary wedge of the Barbados Ridge Complex.

Fig.2b
Anomalies in the concentration of chloride in porewater from samples taken at Site 688, Leg 112, off Peru. Small negative anomalies indicated with small arrows are thought to be sampling artefacts produced by dissociation of methane hydrate during core recovery. Large negative anomalies shown by large arrows, are believed to indicate the flow of low chloride fluids. The BSR, bottom simulating reflector, at the base of the gas hydrate zone is shown at 400-415m depth.

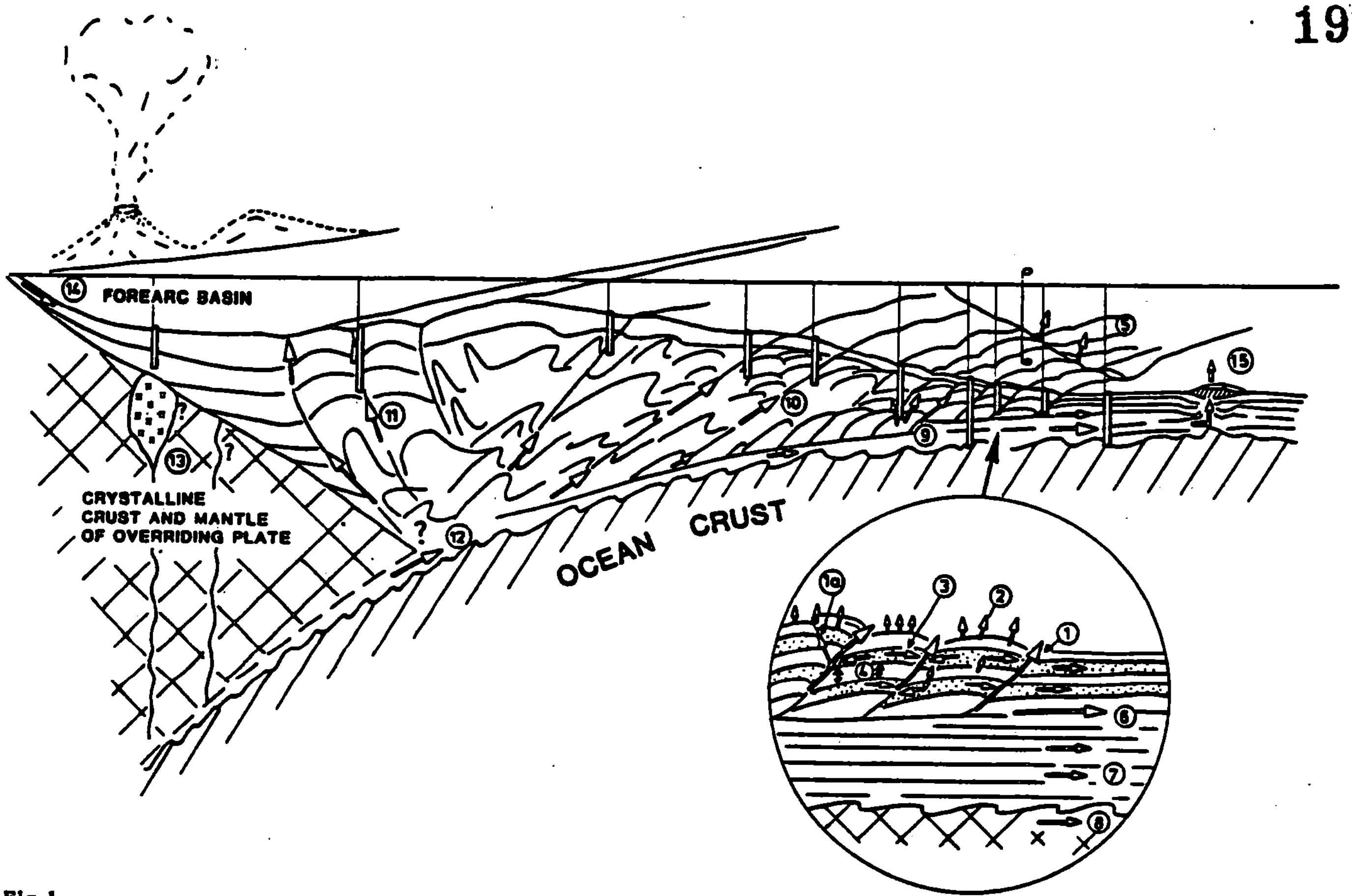
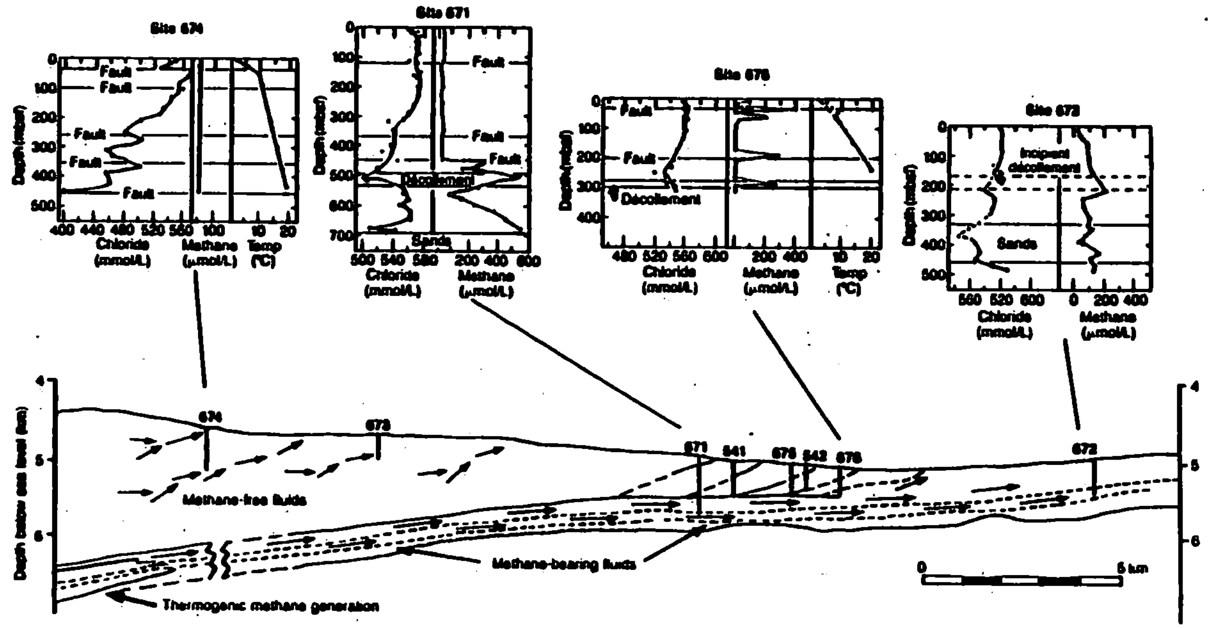


Fig.1
Schematic cross-section of an accretionary wedge and upper part of subduction zone showing modes of fluid escape (listed below) and typical drill-site locations for the investigation of the fluid regime of the accretionary wedge.

FLUIDS IN THE UPPER PART OF SUBDUCTION ZONES

1. Fluid escape along thrust fault associated with accretion at the front of the wedge, and (1a) along faults antithetic to these.
2. Diffuse flow out of the sea bed in response to compression. Fractures produced by local tensile stress at crest of anticlines may aid outflow.
3. Lateral flow along more permeable units in accreted sequence, feeding flow through to faults.
3. Flow from less permeable units into more permeable units.
5. Outflow from vertical strike slip faults intersecting the accretionary wedge.
6. Horinzontal flow along the decollement beneath the wedge.
7. Outward flow in sequence beneath wedge in responses to the load of the wedge.
8. Flow in permeable upper part of oceanic igneous crust.
9. Release of water into the wedge as a consequence of the deformation of subcreted (underplated) packets of sediment in duplexes.
10. Flow along major out-of-sequence landward dipping thrust that enable the wedge to maintain its critical taper. Local dilation and vein deposits from outflowing water may be the cause of the acoustic impedance contrast that gives these faults seismic visibility.
11. Flow along backthrusts into the forearc basin.
12. Upflow from deeper parts of the subduction zone of water released by dehydration reactions. This will be dependent to some degree on subduction rate.
13. Water from deeper part of subduction zone penetrating fractures in overriding lithosphere. Fractures are probably radial to the island arc. Hydration of ultramafic rock may cause formation of serpentinite diapirs.
14. Meteoric groundwater from island arc or cordilleran continental margin seeping into horizons in the forearc basin, and then out into basic.
15. Outflow through mud volcano or other types of vent on ocean floor in front of wedge. All localised sites of outflow are potential locations for communities of chemosynthetic biota.



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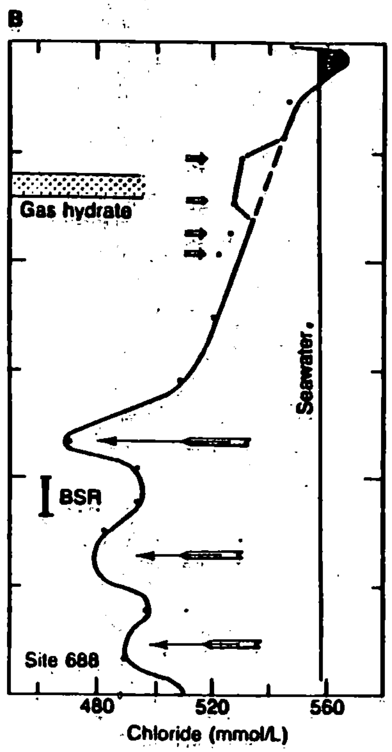

Fig.2b
Anomalies in the concentration of chloride in porewater from samples taken at Site 688, Leg 112, off Peru. Small negative anomalies indicated with small arrows are thought to be sampling artefacts produced by dissociation of methane hydrate during core recovery. Large negative anomalies shown by large arrows, are believed to indicate the flow of low chloride fluids. The BSR, bottom simulating reflector, at the base of the gas hydrate zone is shown at 400-415m depth.

file Osl. 197

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RECEIVED
MAY 26 1989
Hawaii Institute of Geophysics
University of Hawaii

Dr. Ralph Moberly, Chairman
ODP Planning Committee
Hawaii Institute of Geophysics
2525 Correa Road
Honolulu, HI 96822

Fri, May 19, 1989 89-227

Dear Ralph:

Along with many members of the crustal drilling community I was shocked and dismayed to hear of the decision at the recent PCOM meeting to remove the Geochemical Reference Hole leg (Leg 130) from the 1990 WPAC schedule, especially since it had been approved by such a wide margin at the PCOM meeting only last December. Although this program has been controversial within PCOM, the study of global geochemical cycles was identified as a very high priority at COSOD II and has broad support within the geochemical community. PCOM, of course, often has to make difficult, sometimes unpopular decisions, in evaluating programs such as this in the context of overall drilling plans and priorities. However, I find some of the circumstances surrounding this particular decision most disturbing.

First of all, I am very upset at **how** the decision was made. By all accounts, it was done without a formal vote, without the LITHP liaison present, and without prior notification to either the LITHP chairman or the Leg 130 co-chief that the program would be reconsidered at this meeting. Moreover, there does not appear to have been a general re-evaluation of all scheduled 1990 WPAC programs; instead only the reference hole program was singled out. If PCOM believed a leg had to be dropped from the 1990 schedule to accommodate adding the Old Pacific program, then in my view all the 1990 drilling legs should have been re-examined and the relative priorities of the respective panels solicited (e.g. reference holes vs. Lau Basin or Old Pacific vs. Vanuatu).

Second, I am upset over **why** the decision was made. A major factor appears to have been the incorrect view that this drilling was not a high LITHP priority in WPAC. As chairman of LITHP during most of the time this proposal was discussed and debated, I know that this is manifestly untrue. LITHP has consistently argued that drilling across the Bonin and Mariana arcs, including reference holes seaward of the trenches, were along with Lau Basin drilling, the highest priority lithospheric drilling programs in WPAC. LITHP spent more time discussing and advocating reference hole drilling than any other single program the panel considered during the three years I was chairman. Would LITHP devote that kind of time and energy to a program that it considered a second or third-rate priority? If PCOM really wanted to know how LITHP ranked this program why didn't it ask? In this case it appears to me that PCOM knew full well that LITHP ranked reference hole drilling very highly. However, by playing off stated LITHP priorities in CEPAC against this WPAC program a justification was constructed for removing a leg that LITHP always considered an essential part of its WPAC program.

The decision to remove a scheduled, partially staffed leg is, to my knowledge, unprecedented. However, the rationale which is given for this action hardly seems to justify such an extreme measure. The effect has been to undermine the credibility of the drilling program and the entire planning process. I urge PCOM to consider reinstating this leg and to take steps that will insure that similar situations do not arise in the future.

Sincerely,

Robert S. Detrick Jr.
Professor

cc: R. Batiza, LITHP Chairman
PCOM members

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Rostrumh May 26

May 19, 1989

89-230

Dear Dr. Moberly,

I was somewhat shocked at the recent decision by PCOM to withdraw the geochemical reference leg from the 1989-90 ODP plans. The theme of geochemical reference holes was strongly supported by the Lithosphere panel, and in particular by the geochemists/petrologists on the Lithosphere panel. I gather the project "fell through the cracks" during the recent PCOM meeting. This must partially be due to the absence of a petrologist/geochemist on the panel; a problem which is related to the rotation of the Canadian and Australian membership.

As the co-chief scientist on Leg 123 who was responsible for the basement and geochemical reference site objectives, I am surprised at the decision. The initial results from Leg 123 demonstrated that the concept of determining the bulk geochemistry of the oceanic crust was possible, and could provide firm constraints on the problems of crustal recycling. I could refer you to a May 1989 Nature article by Craig's research group. This paper questions the extent of crustal recycling in arcs, on the basis of He isotopes, and clearly states that we have a poor understanding of what is being subducted at the trenches. Obviously, to understand the problem of crustal recycling we require more than one reference section. The combination of the Leg 123 results and the proposed Leg in the Pacific Ocean would have significantly advanced our knowledge of the geochemistry of oceanic crust.

An important "spin-off" from the geochemical reference study on Leg 123, was the development of an interaction between the igneous petrologists, sedimentologists and sedimentary geochemists. Several combined papers are planned for the Scientific results volume. We established an analytical program for sedimentary rocks on the Joides Resolution, and produced the most comprehensive analytical package for sedimentary rocks in the oceans. Unfortunately, much of this initiative will be lost as a result of the PCOM decision.

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While I imagine a reversal of the PCOM decision may be difficult in the immediate future, I strongly suggest that PCOM consider reinstating the geochemical reference site objectives in the Pacific drilling program.

Yours sincerely

John Ludden
Professor

cc/
Dr. F. Gradstein, Co-chief scientist Leg 123
Dr. J. Malpas, Director, ODP Canada
Dr. R. Batiza, Lithosphere Panel
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May 22, 1989

Dr. Ralph Moberly
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Dear Ralph,

This letter is in response to several decisions made at the recent PCOM meeting in Oslo. First and most importantly, LITHP would like to request that PCOM consider reinstating the Geochemical Reference Site (GRS) drilling leg which previously had been scheduled as Leg 130. Secondly, and perhaps related to the GRS decision, I discuss the general issue of thematic scientific goals vs. regional drilling interests. Despite the firm decision that ODP drilling should be guided only by thematic scientific priorities, there seems to still be a strong influence of regional considerations in long-term planning.

1. Geochemical Reference Sites (GRS)

Drilling of geochemical reference sites as part of the Bonin drilling program has consistently been one of LITHP's top priorities in the WPAC. We are thus most distressed that the program has been dropped from the drilling schedule. There are several excellent reasons for reinstating the GRS program and we urge the PCOM to consider doing so at its August meeting. First, the GRS proposal is a direct spin-off from COSOD II, which put a very high priority on the study of global geochemical cycles and crust-mantle interactions. **The GRS program provides an excellent test of element recycling and offers promise of greatly advancing our knowledge of geochemical processes in subduction zones.** The GRS proposal closely follows the strategies agreed upon at COSOD II and thus has very broad support in the geochemical community. Questions of global geochemical cycles are difficult to approach with a single drilling leg, however the GRS program is a carefully designed experiment which should begin to provide an assessment of element cycling in subduction zones. The GRS program is the only program of its type which has been proposed. Since there is very wide agreement that the Bonin-Marianas system is the ideal place for this study, it is logical that the leg be scheduled during the WPAC drilling program. Many members of the international isotope geochemistry community who participated actively in COSOD II have expressed dismay at what they view as a repudiation of the COSOD II objectives by this PCOM action.

One of the reasons given for dropping the GRS leg is that it did not have high rankings from the thematic panels, including LITHP. This is incorrect. GRS is a WESPAC program and the LITHP has consistently ranked it as a top priority in the WPAC. **LITHP has consistently viewed the GRS as an essential component of the Bonin and Marianas drilling programs and thus ranks GRS at the top of its WPAC thematic priorities.** After the considerable efforts by LITHP to argue the scientific importance of this program, it is difficult to understand how anyone could believe that it has a low ranking by LITHP. LITHP has only a very modest list of priorities in WPAC: 1) Bonins, 2) Marianas and 3) Lau Basin. The GRS program is integral to the full scientific success of the top two priorities and addresses an important thematic objective of COSOD II.

In addition to very broad community support and scientific excellence of the program, there are other reasons for strongly considering the reinstatement of the GRS leg. First, the procedure by which it was dropped (no vote, LITHP liaison absent and no advance notice that it would be further discussed) is, to my knowledge, unprecedented and highly irregular. Why were other WPAC programs such as Vanuatu, Nankai and NE Australia, also not reconsidered? These procedural irregularities are very unfortunate because they reflect negatively on the planning structure of ODP. The GRS program had previously been approved by PCOM by a 12 to 2 vote. The withdrawal of this support under such irregular circumstances, cannot help but contribute to a misperception by the commmunity that the PCOM is a group of insiders which acts only in the interests of PCOM members. Though false, this perception is potentially damaging to the ODP and should be an important concern.

The GRS program has an additional goal/benefit of providing a reasonably deep penetration of Pacific ocean crust. This has not previously been done and is critical to several questions of crustal genesis. For this goal, it might be possible to consider deepening one or more of the Old Pacific sites.

Thus, in a recent telephone poll of available LITHP members, we considered whether deepening one or more of the Old Pacific (OP) program sites could also accomplish the goals of the GRS program. Apparently this was also discussed at the Oslo PCOM meeting. On one hand, deepening two OP sites on a flow line by 200 m could show that basement composition is constant with age which strengthens the strategy outlined in the GRS proposal. However, the OP sites are much too old to test the specific hypothesis of the GRS program.. Furthermore, significant deepening of one or more of the OP sites would require several weeks of drilling, and could compromise some of the important goals of the OP program. While there are several strong arguments for deepening OP sites further than 50 m into basement, LITHP feels **strongly that the goals of the GRS program can only be met as proposed.** Obviously any hole in the western Pacific (and elsewhere for that matter) contributes in some way to characterizing the crust which will ultimately be subducted, however the GRS program proposed a specific experiment--one which cannot be duplicated by random deep drilling.

2. Long-term Planning and LITHP Priorities

Another reason given for withdrawing support of the GRS leg is that there is considerable enthusiasm among PCOM members to shorten the Pacific program so a lengthy drilling program in the Atlantic can commence quickly. This claim is disputed by several PCOM members and we certainly hope it is untrue because this would preempt long-term planning on the basis of thematic scientific goals and presupposes that the thematic panels will rank Atlantic thematic priorities above continued work in the Pacific or Indian oceans. While this may indeed turn out to be the case, it is premature to assume so. From LITHP's point of view, an important consideration is that Pacific thematic objectives be adequately met.

Many of LITHP high-priority objectives are best studied in the Pacific. It is for this reason that LITHP has, for the last several years, put its share of drill time in the bank for CEPAC. While it may not be necessary or desirable to drill all these objectives (plus future high-priority Pacific thematic objectives) during a single long tour we **consider it essential that a very significant portion of LITHP's objectives be drilled in the next three years.** Drilling statistics for DSDP and ODP show clearly that crustal objectives have consistently received less than a fair share of drill time. If ODP is to continue attracting the support of scientists interested in the origin and evolution of the ocean crust and lithosphere, then it is essential that this pattern be reversed.

At its next meeting, LITHP will, as directed, begin to reconsider and rank previously submitted and new proposals for drilling in all ocean basins. The thematic priorities of LITHP are well known and include 1) processes at sedimented and unsedimented ridge crests and the origin of ocean crust, 2) establishing sea-floor seismic observatories and 3) ~~case studies of important~~ global questions relating to the evolution and modification of oceanic lithosphere. Studying the early evolution of hot spots (Loihi) is an example of a high-priority case study. As outlined in the ODP long-range plan, these objectives can be partly met by drilling at active ridge crests and deep drilling on older crust in a variety of tectonic environments. However, additional highly-ranked case studies are also a very important part of LITHP drilling objectives. While we expect that important thematic objectives will arise that are best tackled in the Atlantic (e.g. slow-spreading ridges, the nature of deep crustal reflectors), there are at present few mature proposals in hand for these objetives. In contrast, there are many proposals in the Pacific which have previously received high thematic ranking. Some are strong contenders for future Pacific case studies. It is therefore possible that LITHP will recommend extending the CEPAC program or returning to the Pacific after only a brief foray into the Atlantic.

In view of these considerations, LITHP is very concerned by the erosion of its very modest priorities for WPAC. Even more serious, is the possibility that LITHP's Pacific priorities will also be adversely affected for similar reasons. **Shortening of the CEPAC program is thus of very serious concern to LITHP and we urge PCOM to allow thematic objectives, not regional ones, to determine the ship track.**

To summarize: we request that PCOM consider reinstating the GRS leg into the 1990 drilling schedule. Also, we request that thematic scientific priorities be used as the main criterion for long-term planning, in accordance with recent policy decisions. Thank you for your consideration,

Sincerely,

Rodey Batiza
Chair, LITHP

RB:ctk

Canadian Secretariat and Canada/Australia Consortium for the Ocean Drilling Program

Centre for Earth Resources Research, Memorial University of Newfoundland, St. John's, NF, CANADA A1B 3X5

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May 25, 1989

Dr. R. Moberly
Hawaii Inst. of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI
96822 USA

Dear Ralph:

You have by now received a letter from John Ludden of the Universite de Montreal concerning his incredulity at the news that the geochemical reference leg had been dropped from the 1989\90 Pacific plan. I can only echo his thoughts and express my own shock on hearing this news. I have, in the past, argued vehemently in support of this proposal both as a petrologist on PCOM, as a liaison member to the Lithosphere Panel and as an interested scientist.

Due to unforeseen circumstances, I was unable to attend the PCOM meeting in Oslo, but the CanAus Board was no doubt ably represented by David Falvey. What I cannot understand is how geochemical reference holes "fell through the cracks" when the leg had been formally accepted into the 1989\90 program by a PCOM motion at the meeting in Miami. I realize that igneous petrologists are few and far between on PCOM; perhaps I am the only one, but I feel an opportunity was taken at the Oslo meeting to kill a program which previously had less than full support from other PCOM members simply because many did not understand it. It is my opinion that when proposals have been formally accepted into programs then every effort should be made to contact knowledgable authorities before the proposals are subsequently removed.

../2

Telephone: (709) 737-4708/4382 Facsimile: (709) 737-4702 Bitnet ODP@MUN Omnet: J. MALPAS

I would appreciate it if you could circulate a copy of this letter to PCOM members for their information. I will speak to the issue further in Seattle if given the opportunity. I hope that a reasonable explanation as to PCOM's action will be proffered at that time.

I apologize again for my absence at the Oslo meeting and hope to see you in Seattle.

Best wishes,

John Malpas
Director
Canadian Secretariat-ODP

cc: Ian Gibson - Chairman CNC
Chris Barnes - EXCOM
John Ludden - Co-Chief Leg 123
Felix Gradstein - Co-Chief Leg 123
Robert Detrick - SRDPG
Jim Natland - WPDPG
David Falvey - PCOM Australia
Rodey Batiza - Lithosphere Panel
Charlie Langmuir -

June 13, 1989

Dr. Ralph Moberly
JOIDES Planning Office
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, Hawaii

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Hawaii Institute of
University of Hawaii
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Dear Ralph:

This is my letter, on behalf of the scientists who labored to plan Reference Sites drilling, and who were anticipating participation in the leg, to add to the several you already have, concerning PCOM's decision at Oslo to cancel that drilling. I am copying this letter and an enclosure to all PCOM members.

Since PCOM has been asked by the LITHP chairman to reconsider its decision. I shall confine myself to two matters, panel rankings and the thematic basis for the Langmuir/Natland proposal. I believe PCOM made an error concerning interpretation of rankings, and I think its decision ignored some long-standing concerns of the lithospheric community.

Concerning my personal reaction to the decision, I will only mention that, since I am not to be a co-chief scientist, I am suddenly in serious difficulty for salary for early next year. I have explained this situation to appropriate people at Scripps Institution.

Panel Rankings

Rodey Batiza, the LITHP chairman, tells me that your data for the rankings, which you cite in defense of PCOM's decision in your response to a letter of Gerard Fryer (which you copied to me), are from the 3rd WPAC prospectus. These are my recollections, as a member of WPAC.

The rankings listed at the beginning of the prospectus are dated 12/86. That was the month that Charlie Langmuir and I submitted our proposal. I carried it from the AGU meeting to Menlo Park to present it for the first time to WPAC in December, 1986. Thus the proposal was not shown as ranked by SOHP or TECP in the 3rd prospectus because those panels had not yet seen it. Even LITHP hadn't seen it, but they had asked Charlie to prepare the proposal, and he invited my participation. Even without the proposal, however, LITHP had given first priority within the WPAC prospectus to the BON/MAR program, which included single-bit coring to basement at two reference sites, one opposite each arc, as explained in the 3rd prospectus. WPAC itself had given this multi-disciplinary program, one including the two single-bit reference sites, a very high ranking.

Our proposal basically asked to split these two holes off into a separate leg (or somewhat more) to which we added more basement drilling at one site, and holes in a sedimentary apron and at a seamount summit. At this stage, WPAC had long since been informed by PCOM that it should consider 9 programs in 12 legs, and there were already several highly regarded programs which clearly were not going to make this cut. The new Reference Sites proposal thus increased the squeeze as far as our regional panel was concerned. Moreover, since Reference Sites were to be drilled entirely on the Pacific plate, WPAC would not go beyond its original endorsement. This had very much to do with the geological (certainly not petrochemical) orientation of the panel, and with the mandate for WPAC, which most panel members viewed as regional/structural/tectonic, with a drawn boundary on the trench floors.

Thus your statement in your response to Gerard Fryer that WPAC left reference sites out of its 9-program plan because of low thematic rankings is not correct. Formally, it was not included because PCOM had instructed the regional panels not to consider proposals until after thematic panels had reviewed them. This had not yet happened (as of 12/86), but it did happen later. Even at that, WPAC inserted a summary of the program in the 3rd prospectus. As you well know, WPAC continued to plan the program at LITHP's (and PCOM's) insistence. WPAC's own opinion of the program became somewhat irrelevant; it acted essentially as a DPG with respect to Reference Sites from that time on. This was because, beginning with COSOD II in 1987, and following PCOM's instructions, the drilling program was to become more thematically driven. Reference-site drilling was almost purely a "global" thematic program rather than a regional one, and its strongest advocacy came from LITHP. That panel never again ranked WPAC programs, but it has been most concerned since 1987 with Lau/Tonga and Reference Sites.

In conclusion, far more weight should be attached to the high profile given this program in the COSOD II document (see attached pages), and the obviously high ranking given it verbally by Bob Detrick representing LITHP at the Miami PCOM meeting, and the recent letters to you from Bob and Rodey Batiza, the past and present LITHP chairs. I question whether TECP's or SOHP's opinions really should make a difference, for the same reason that LITHP's opinion clearly did not have much bearing on the scheduling of the drilling on the Great Barrier Reef.

Thematic Justifications

It is important to remember that this drilling has more than one objective. The earliest impetus came from the old Ocean Crust Panel. They long advocated deep drilling in old Pacific crust, to provide a fast-spread complement to the megaleg results at Sites 417 and 418. Such drilling was planned as part of a Pacific transect, and even was scheduled for Leg 55. But this drilling did not take place then, and has never since been attempted. The Ocean Crust Panel also required what they termed "reference sites" on ocean-crust locations adjacent to any arc system targeted for a drilling transect. Our proposal deliberately linked these two general objectives into a single program and, in addition, sought to recoup the "reference site" for the Leg 59/60 transect across the Mariana arc, which was attempted, but not successfully, during Leg 60.

The need for deep holes in old, altered, ocean crust, particularly in the Pacific, was emphatically reiterated by COSOD I. It is a matter of serious concern that principal COSOD I objectives for ocean-crust drilling, having to do with deep drilling in the ocean crust (specifically, reaching Layer 3), and bare-rock drilling at spreading ridges, have barely been attempted over the past ten years. The combined pace for these objectives is one leg every two years, since 1979. There is a critical gap in information concerning fast-spread crust, which I think is much the preferred target for truly deep penetrations into Layer 3 and the upper mantle. We have no holes in fast-spread crust exceeding 100 m basement penetration, and have not sent either drilling vessel out to attempt such a hole since 1977. Drilling results in young EPR crust up to 1977 were dismal. In my opinion, this should compel us to test drilling conditions in older fast-spread crust as soon as possible. Such crust (not young ridges) is our only option for a truly deep hole (since the mining coring system is not being designed to reach the mantle), and may provide information critical to the success of bare-rock drilling at the ridge crest. If we skip the opportunity to drill old fast-spread crust to depths of at least 200 m in FY90, we will be proceeding blindly to attempt young ridges, and will not have a fall back if that drilling fails.

The COSOD II report provided quite a new perspective on crustal drilling. This was chemical geodynamics, and it had two critical components: 1) establishing the bulk composition of the ocean crust; and 2) exploring chemical fluxes with respect to crust-mantle interactions. A critical aspect of the latter was establishing the compositions of crustal/sedimentary components entering subduction zones. The importance of this was expressed over several pages of the COSOD II report (see underlined and/or highlighted sections in the attachment). It specifically called for drilling of a number of holes near individual island arcs; it advocated component analysis as the geochemical approach; and it specified basement penetration to depths of 300 m as a necessary first step toward evaluating the contribution of the ocean crust to potential fluxes beneath island arcs.

There is not one aspect of these recommendations that the Langmuir/Natland proposal failed to take into consideration. Thus the PCOM decision to cancel the leg very seriously raises the question, just what has to be done to get an important COSOD II lithospheric objective into the schedule? It is clearly much easier to justify an ocean-history leg to the Planning Committee.

But we did not just launch this on our own. We worked closely with the panels, and also consulted a number of experts involved in Mariana/Bonin geochemistry (including Bloomer, Stern, Morris, Pearce, and Gill). To these people, we posed the very questions about strategy, number of holes, relationship to specific portions of the arcs, and the viability of using geochemical tracers for particular sediment/crust/fluid components that so persistently have dogged this proposal in its progress through the panel structure, and which most recently have inhibited PCOM's acceptance of it. In the end, our original proposal was intact; we achieved a concensus. I submit that the planning structure did its job very well, that the best possible program was submitted to PCOM, and that any scientific qualms that some members of PCOM may feel, have already been dealt with by experts.

Next, I note the recent ad in Eos issued by your office calling for proposals for A) deep crustal/upper mantle drilling; B) drilling of sedimented and unsedimented ridges; C) drilling pertaining to geochemically-oriented case studies; and D) downhole seismic observatories. My opinion is that Reference Sites is a program of deep crustal drilling. A re-entry hole would have been established. We planned to drill it to greater depths in fast-spread crust than any existing hole, and the hole would have been available for deepening. A full logging/packer program was recommended for this hole by Downhole Measurements Panel, and incorporated into the plans for the leg.

Reference Sites is also a case study. In fact, it is the "Type" case study, since the term was coined at the Newfoundland Lithospheric Panel meeting in consequence of discussion concerning the Reference Sites program.

PCOM thus abandoned the one program on the books that combines deep crustal drilling with a well-designed case study, for which your office is currently soliciting proposals.

In my opinion, the basement hole at BON-8 also would have provided information crucial to the future success of drilling at unsedimented eastern Pacific Ridges, and it may have become a seismic observatory, since the location is close to seismically-active regions of the western Pacific. Certainly, many members of the marine geophysical community (including Gerard Fryer) saw its potential significance to studying aspects of crustal structure. If successfully started, the hole would very likely have been deepened, and subjected to all sorts of geophysical scrutiny, providing information we have not attempted to get, through drilling, for nearly a dozen years.

Finally, I note the recent results of ODP Leg 125, which sampled pore fluids of unusual composition in Mariana forearc serpentinite diapirs. Among other things, the fluids had high abundances of hydrocarbons, which the Leg 125 scientific party considers were derived from subducted materials. Prior to Leg 125, I had arranged a sample protocol with Patty Fryer (and with Jim Gill who participated on Leg 126) to provide, for all three legs, rigorous interlaboratory comparisons of sedimentary solids, fresh and altered basalts, and pore fluids which I thought they might sample in the Mariana/Bonin forearc basement. I submit that Leg 125 has discovered a potentially very important link to underthrust sediments and ocean crust entering the arc systems from the Pacific plate, and that we will not be able to understand these results without reference sites.

There are thus many good reasons to reconsider the decision taken at Oslo, and reinstate Reference Site drilling in the 1990 Pacific schedule.

Sincerely,

James H. Natland
Associate Research Geologist, SIO

Copies to:
- PCOM membership
- C. Langmuir
- R. Batiza, LITHP
- R. Detrick, LITHP
- B. Taylor, WPAC
- J. Gill, WPAC
- G. Fryer
- J. Ludden
- D. Scholl, USSAC
- X. LePichon
- T. Pyle, JOI Inc.
- E. Frieman, Director SIO

From COSOD II Report

Mantle/Crust Interactions

Prepared by WORKING GROUP 2 (see p. 9)

ABSTRACT

The development of plate tectonics coupled with advances in the understanding of mantle convection has gradually led to the realization that the solid earth is a system in active circulation. This circulation includes not only the movement of the plates, but also intricate exchange between ocean crust and seawater through hydrothermal, sedimentary and biologic activity, recycling of material from the earth's surface to the mantle by various mechanisms at subduction zones, and redistribution in the mantle through convection. This circulation has through time created continents and the physical properties and chemical composition of a heterogeneous mantle. The most fundamental geochemical aspects of this cycle are the net flux out of the mantle at spreading centers and the net flux returned to the subduction zone.

To determine these fluxes, it is essential to determine the composition(s) of the bulk ocean crust. Although shallow drilling at diverse locations begins to constrain crustal composition, ultimately drilling through the entire ocean crust is required to determine these net fluxes. Drilling through the entire ocean crust would solve in addition a host of other scientific problems where there are long-standing controversies. These include: the validity of the ophiolite model for ocean crust, the relationship between crustal structure and spreading rate, the origin of the seismically defined stratigraphy of the crust, the compositions of primary mantle-derived melts and how they are modified by magma chamber processes, the total magnetization of the crust and how it is distributed with depth, and the depth and nature of hydrothermal interaction in the crust, with the resultant net flux between crust and seawater.

The drilling of total crustal sections would be a landmark for the ocean drilling program and for geology in the 1990s, and would produce a quantum leap in our understanding of the global plate tectonic geochemical cycle. It is also currently impractical in terms of engineering capability and planning structure. But because of its importance, the first priority of the Working Group is the development of the *capability* to drill through the entire ocean crust by the latter part of this century. "Capability" includes the requisite planning structure, engineering development, and site surveys that will be essential for intelligent site selection in a known geological context, so that the hole can be a calibration experiment for other techniques that can be used to determine lower crustal characteristics in other regions.

Understanding the global system also requires a knowledge of the processes by which interactions among crust, mantle and ocean occur. At spreading centers, it is clear that while ocean drilling is a key element in any program, it cannot proceed in isolation, but should be one part of an integrated program. The integrated program would include (1) extensive bathymetric and geophysical mapping and sampling of the surface; (2) focussed drilling efforts at undersea volcano observatories, including a varied use of the drill holes for geophysical and geochemical logging and as the locations for geophysical experiments; and (3) deeper drill holes down to the sheeted dykes on well-characterized older crust to obtain complete lava stratigraphy to test models of ridge crest segmentation and to determine the net effects of hydrothermal processes in the upper crust. Drilling in and adjacent to fracture zones may allow penetration of plutonic layers of the crust which would complement the holes in the volcanics.

Convergent margins are the key environment exerting control on global fluxes. Outputs to the overriding plate and their variation through time can be investigated by basement drilling and by drilling of clastic aprons in both the back-arc and forearc. Inputs to the mantle are key unknown pieces of information essential for evaluating models of mantle heterogeneity that rely on recycled components from subduction zones and models of the sources of arc volcanics. On the down-going plate, several holes that penetrate at least through the zone of greatest hydrothermal interaction are essential. These holes should be located on older oceanic crust adjacent to well-studied oceanic island arcs. The possible relationship of subducted compositions to arc volcanic compositions can be investigated by a series of holes outboard of arcs that exhibit systematic variation along strike.

A final important series of objectives relates to mantle convection and the time-integrated effects of the plate tectonic geochemical cycles. In analogy with magnetic anomalies of the ocean crust carrying a record of secular variations in the earth's magnetic field, the basaltic ocean crust contains a chemical and isotopic record of mantle convection. Mapping of crustal composition can provide quantitative information about the size, distribution and compositions of mantle reservoirs and the efficiency of convective stirring. This information could provide a test for geophysical models of mantle convection. In some specific settings, such as where ridges and hot spots interact, geochemical mapping can also directly reveal mantle kinematics. In addition, the longevity of geochemical signatures of rising mantle plumes or hot spots will provide important clues for the convective isolation of mantle reservoirs. Dating of hot spot chains can provide evidence for their relative motion which provides in turn boundary conditions for the dynamics of mantle convection. There are also important components of global fluxes, such as oceanic plateaus and seamounts not associated with clear hot spot tracks that are virtually uninvestigated and may have a unique and important place in the global circulation system. These various problems can be investigated by an extensive program of geochemical mapping using many holes with shallow basement penetration. Most of such a program could be carried out with a smaller drilling platform capable of limited basement penetration.

INTRODUCTION

The title given to Working Group 2 by the COSOD II Steering Committee was "mantle-crust interactions", which we

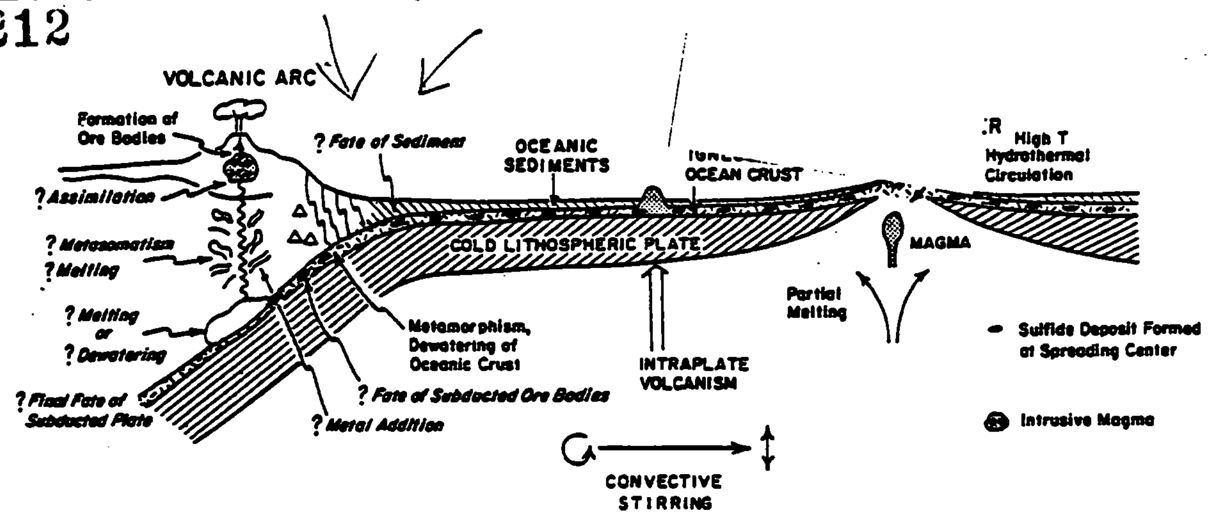

Figure 1. Cartoon of the plate tectonic cycle showing some of the fluxes, and the processes that control the fluxes.

have taken to encompass the present systematics of the solid earth, plate tectonic geochemical cycle and the record of its past action as revealed in the ocean crust. It is important to note at the outset that this thematic mandate is distinct from that given to the Lithosphere Panel of the present ODP planning structure, or to the COSOD I Working Group on "Origin and Evolution of the Oceanic Crust", and does not include hydrothermal problems. The emphasis of this report is on how to investigate the general thematic problems of the circulation of the solid earth, and the primary differentiation of crust and mantle that this circulation has brought about through time. This document grew out of a "white paper" prepared by the members of Working Group 2, but that white paper has been substantially modified as a result of the oral discussion at COSOD II and the many written contributions from participants in COSOD II and from other interested scientists.

The Thematic Framework: Solid Earth Geochemical Cycles

The development of plate tectonics coupled with advances in the understanding of mantle convection, exploration of the ocean floor and the development and application of precise geochemical techniques has gradually led to the realization that the solid earth is a system in active circulation. This circulation includes not only the movement of the plates, but also intricate exchange between ocean crust and seawater through hydrothermal, sedimentary and biologic activity, recycling of material from the surface to the mantle by various mechanisms at subduction zones, and redistribution in the mantle through convection prior to the return to the surface through volcanism at divergent margins, convergent margins, or intraplate settings. This circulation, or possibly a variant of it, has through time created continents, ocean basins, the physical properties and chemical composition of a heterogeneous mantle, and to a significant extent the chemical balance of seawater. "Mantle/crust interactions" might be termed "solid earth geochemical cycles", for the term "geochemical cycles" is now as apt for solid earth circulation as it is for surface circulation, and entails the same close connection between chemical fluxes and physical properties.

In this sense, the questions that are beginning to emerge are akin to those of Working Group 1 concerning the climate system, for once the solid earth is viewed as a system in circulation, then an understanding of that system requires knowledge of the material and energy that are transferred among the parts of the system. What are the fluxes between different reservoirs? What processes control the fluxes? How have the fluxes varied through time? Can we predict the fluxes with quantitative physical models, and test the models through carefully planned data collection? Addressing these questions is necessary for understanding the wider implications of plate tectonics and how the solid earth works. At the moment, however, there is a decided lack of data concerning many aspects of solid earth circulation.

Consider the first order fluxes and the data available concerning them. Figure 1 conveys the general problem in terms of the plate tectonic cycle. A convenient point of entry into the cycle is plate formation at spreading centers. Melt is generated by mantle upwelling at ocean ridges, and the emplacement of the melt in the crust causes vigorous hydrothermal circulation through which chemical exchange occurs between seawater and the new igneous crust. What is the bulk composition of the crust prior to the chemical exchange? We can infer it by several theoretical methods, but there is not a single definitive data point.

As the crust ages, both oceanic and continental detritus accumulate on it and there continues to be exchange via fluids between the igneous and sedimentary portions of the crust and the ocean. The crust may be affected by intraplate volcanism and thereby thickened and chemically modified. As the crust approaches a convergent margin, a significant component of sediment from the arc may be deposited, both from erosion of the overlying plate and from deposition of air fall from volcanic eruptions. This package of material then enters the subduction zone. What is the bulk composition of the subducted crust and how does it vary spatially in the oceans? What is the net exchange between crust and seawater, and how is it dependent on spreading rate and tectonic setting? Again, there are inferences but no definitive data.

Some portion of the subducted mass is transferred to the overlying arc through accretion, subcretion and volcanism; some may be transported via dehydration up the slab into the forearc or the ocean or into the mantle wedge; and the majority of it is recirculated into the mantle through convective mixing, presumably to reemerge either at hot spots or at ocean ridges. The processes of circulation thus exert control on the composition and organization of continents and of the mantle.

Time-Integrated Effects of the Geochemical Cycles

The time-integrated action of solid earth geochemical cycles has created the fundamental differentiation of the earth. Part of the record of that differentiation is preserved in the continents; an equally important record exists in the upper mantle as well. Although all ocean crust is relatively young, it provides a window into old mantle, and the nature and distribution of various mantle compositions provides clues to how the earth has evolved and how the mantle is organized. The ocean crust may also record in certain areas the interaction between various mantle reservoirs, and hence place constraints on the movement and interaction of the reservoirs.

extensive program of mapping and sampling the ridge crest and related environments to develop an accurate two-dimensional picture of the structural and chemical components in the system ; 2) focused drilling efforts on carefully selected, broadly representative portions of well-documented ridge crest with the goal of helping to characterize an active volcanic system ; 3) use of sea floor, bore hole, and watercolumn mounted instrument arrays to obtain a wide variety of coordinated and synchronized time series measurements of the interrelated igneous, deformational, hydrothermal and biological processes operating on a decadal time scale ; 4) deep drill holes on well-characterized older crust to obtain complete lava stratigraphy and the net effects of hydrothermal processes. This approach is designed with the recognition that deep penetration with good recovery is an order of magnitude more difficult on hot, active, fragmented volcanic crust than it is on older, cooler, altered crust, but that some shallower drill holes will be necessary in the active volcanic regime.

Ideally, there should be in the long run a carefully selected suite of shallow and deep drill holes that span several spreading cells at a range of spreading rates. The array of shallow holes should include a line of holes along strike in young lithosphere. Several such lines should be drilled at key isochrons along strike, and there should be at least two cross-strike lines, one near the elevated mid-section of the spreading cells, and one near the termination of the cells at ridge axis discontinuities. Provided the control with respect to various types of offsets can be determined well by the extensive site surveys, it is not necessary that this drilling occur in very young crust. In fact, optimal sites might be on older crust, particularly in the Atlantic, where multi-channel seismic studies can give good structural control only on older crust. Drilling should occur at different ridge discontinuities, including small and large offset fracture zones. At the latter, the non-transform wall, where several photogeologic and SeaBeam surveys have shown large areas of uplifted volcanic crust, should permit drilling of the fracture zone crust undisrupted by transform tectonics, permitting determination of the degree to which crustal structure is attenuated at different spreading rates.

Ultimately, assessment of magmatic processes requires long continuous cores of plutonic rocks of known orientation which are not provided by rock dredging. Hence a major goal of ultra-deep drilling in the ocean crust is to obtain a continuous section of the deep plutonic layers and shallow mantle to assess the processes by which melt is generated and transported from the mantle and the physical and chemical processes by which it is transformed into crust. Given the pronounced segmentation of the ocean ridges and the fact that the rate of magma supply must vary 30-fold to account for the relatively uniform thickness of the ocean crust and the large range of spreading rates (6-180 mm/yr), these processes, and the size and longevity of magma chambers, must vary considerably at different ridges and in space and time. It is unlikely that deep drilling, given the cost and time involved, will ever be sufficient to resolve all these variations.

Studies of transforms have shown that large and massive exposures of plutonic rocks are exposed along their walls and floors. To a lesser degree such exposures appear to exist in the rift mountains and valley walls of slow spreading ridges. Careful bathymetric, dredging, photogeologic and submersible surveys then could locate selected deep sections of tectonically exposed crust from which drilling could provide long continuous cores to complement the holes drilled into layer 2 and the rare ultra-deep holes.

The time scale on which the thorough mapping and sampling could be done properly, and on which the preliminary experiments could establish the appropriateness of any site for concentrated drilling, may be on the order of five to eight years. One could argue that selection of natural laboratory drill sites be delayed until the technology for such efforts is available and sufficient information is at hand to make wise choices. On the other hand, it may be necessary to progressively develop the capability of drilling in the zero-age environment and of deploying instruments in drill holes, and from this perspective early efforts in settings that might not yet be known to be optimal would be necessary for the eventual accomplishment of the scientific objectives.

CRUST/MANTLE INTERACTIONS AT CONVERGENT PLATE MARGINS

Fluxes at convergent plate margins include many more processes and distinctive components than those at spreading centers (Fig. 14), and many critical processes that ultimately control the fluxes, such as deep dehydration reactions in the down-going plate, are not possible to study directly, and in many cases are even difficult to study experimentally. Whereas a total crustal section of old oceanic crust immediately gives an unshakable data point concerning a product of sea floor spreading and the raw input for convergent margins, we can envision no such definitive data for net fluxes at a convergent margin. Despite the difficulties, convergent margin fluxes are so central to solid earth geochemical cycles that they demand study : the distillation of the continental mass from the mantle that may occur at convergent plate margins is one of the most fundamental aspects of terrestrial differentiation. And the potential for the creation of mantle heterogeneities at convergent margins is unparalleled as the mantle wedge is invaded by materials from the subducted slab as it is metamorphosed, dehydrated, and perhaps melted, and as the residual products of such reactions are recycled into the mantle.

There are two major aspects of fluxes at convergent margins that are accessible to study and require drilling as one of the means of study : raw input from the down-going plate, and crustal output into the over-riding plate. Neither of these two first order pieces of information for evaluating fluxes at convergent margins are well known. In fact, there is not a single hole on a down-going plate outboard of an arc that penetrates significantly into the zone of upper crustal hydrothermal alteration of the igneous basement !

Crustal Output to the Over-Riding Plate

A total inventory of the diverse magmatism above subduction zones over a specific time period yields the output flux for this environment. Study of crustal outputs obviously begins on land - where most study has been concentrated - but land-based studies can only partially address the problem. The subaerial portions of an intra-oceanic arc represent a tiny fraction of the present day magmatic budget at a convergent plate margin. In some arcs less than 50% of the edifices are subaerial, and of these perhaps only 20% are accessible.

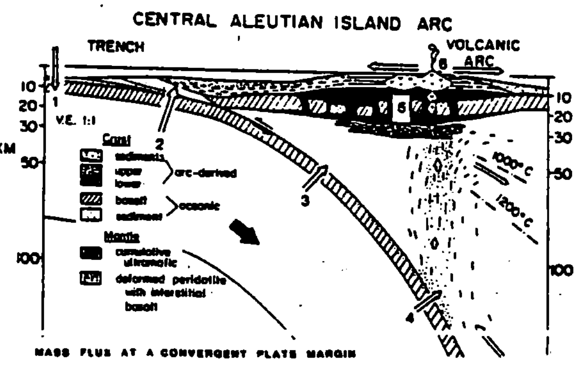

Figure 14. Some potential fluxes and processes that may operate at a typical convergent margin.

Surface exposures also tend to provide a highly inadequate record of early magmatism in any particular arc.

There are two ways to obtain a more complete and representative record of arc output through drilling. Drilling in the over-riding plate is essential to complete the available record from surface exposures in volcanic arcs and from dredge hauls on scarp slopes in both island arc and back-arc regions. Such drilling can also explore the arc basement, and hence obtain information concerning the characteristics of its earlier history and how it may have evolved through time. It is also noteworthy that the case to reject ophiolite sequences as typical of the ocean crust largely reflects suggestions that many were formed at or near a convergent margin. Thus deep drilling in the over-riding plate is further identified as a test of models for ophiolite generation.

An even more promising approach lies in the sediments of oceanic regions adjacent to arcs, where there should lie the intact record of the arc's evolution. Clastic aprons in back-arc areas, together with forearc basin deposits, offer an excellent opportunity to obtain a continuous and undisturbed record of subduction-related magmatism. Moreover, recovering a complete section of at least the thinner of these deposits requires fewer technological advances in sample recovery than drilling in the poorly consolidated sands of proximal deposits. Clastic aprons can record magmatic activity over the last 25 Ma, and thus they can provide information on present-day output fluxes, which should arguably be averaged over a 2-5 Ma time span, and on the links between tectonics and magmatism on a regional scale. Most observers regard magmatism as episodic, and there is some suggestion of a 10 Ma period of relatively little magmatism between 25-15 Ma in circum-Pacific arcs (Kennett *et al.*, 1977). Drilling in selected clastic aprons would test that suggestion and provide an exciting new data base with which to evaluate the local causes of magma generation and of magmatic periodicity. Drilling is perhaps the only way magmatic fluxes can be charted back in time. It is also important to note that the oceanic plate contains crustal components from the arc that appear to be recycled into the mantle at the arc. Thus drilling on the over-riding plate also contributes in some sense to the input side of the convergent margin problem.

An additional important component of arc output in intra-oceanic convergent margins are the back-arc spreading centres, which constitute a significant portion of the total mass flux from the mantle at some convergent margins. Even in continental areas the equivalent regime may be a site of material brought into the over-riding lithosphere. Chemical constraints suggest that back-arc basins tap a mantle source with striking similarities to the source of ocean ridge basalts (*e.g.* Hawkins, 1977). Back-arc basalts also contain, however, a significant, although variable "arc component" which present models derive from the down-going slab (*e.g.* Hawkins and Melchior, 1985). A proper understanding of the nature and origins of such subduction components in both arc and back-arc magmas requires much clearer documentation of the interaction between such magma types both spatially, and with time in the development of an arc-back-arc system.

Input to the Subduction Zone

In the 0-200 my transit of the ocean crust across the earth's surface, pre-existing continental crust is added to the oceanic column as sediment and as hydrothermal alteration by seawater. The fate of this crustal material at the subduction zones is a key unanswered question in studies of global geochemical fluxes. At successively greater depths it can be scraped off, sweated out, melted out as a recycled component added to new continental crust, or returned to the mantle (see Figure 14). That the subduction process might have profound effects on the chemical evolution of both the continental crust and mantle was first recognized by Armstrong (1968). Since then there have been periodic appeals to convergent margin processes to explain the geochemistry of the mantle (*e.g.* Hofmann and White, 1982 ; Dupré and Allègre, 1983 ; Weaver *et al.*, 1986), but it is not yet clear that the convergent margin fluxes are in fact responsible for all the effects they are called upon to account for.

In some arcs there is now clear isotopic evidence for a contribution from sediments to arc magmas. This evidence resides principally in the Pb isotopes (*e.g.* White and Dupré, 1986 ; Fig. 15), and in recent data from the cosmogenic radionuclide ^{10}Be (Tera *et al.*, 1986). Data from Sr and Nd isotopes are more ambiguous because of virtually complete overlap between volcanics from convergent margins and from the ocean basins. Although there is isotopic evidence for some sediment contribution at some arcs, this contribution can still be argued only in the most general terms. One of the long-standing enigmas of arc volcanic chemistry concerns the very different ratios of incompatible trace elements that are observed there. As a general observation, there is much more homogeneity in these ratios in some arcs than there is likely to be in the lithologically diverse subducting sediments. If the source of these characteristic trace elements lies in the sediments, as it plausibly may, then the interelement ratios should to some extent reflect those in the specific mixture of sediments being subducted, and this mixture should vary from arc to arc. It may be that sediment mixtures are much more homogeneous than the end members of which they consist. But as of yet there is not a sufficient data base outboard of different arcs to address this question definitively.

The effect on the neighboring arc is only one aspect of the recycling problem at convergent margins ; another aspect concerns the creation of mantle heterogeneities that are later revealed at ocean ridges and in intraplate settings. The composition of subducted oceanic crust, with or without its sedimentary veneer, should differ in a number of ways from ordinary mantle, in part because of the effects of magma genesis at ocean ridges, in part because of the reaction with seawater, and in part because of the presence of sediment. These compositional differences can provide the basis for testing the recycling hypothesis : any mantle reservoir alleged to contain recycled oceanic crust should share the compositional characteristics of oceanic crust. The evidence that mantle plumes and oceanic island magmas contain a recycled component is, however, contradictory. The high $^{206}Pb/^{204}Pb$ ratios of some ocean islands would seem to be consistent with the recirculation of subducted crust with very high U/Pb resulting from hydrothermal alteration of the ocean crust. But

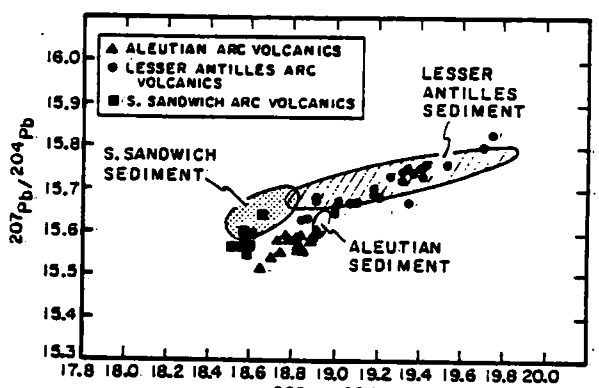

Figure 15. Pb isotopic compositions of three selected island arcs compared with Pb isotope ratios of sediment potentially being subducted beneath those arcs. Note the general correspondence between the isotopic characteristics of the sediments and the neighboring arc. From White (1987).

this argument may not be consistent with Th/U ratios (Hart and Staudigel, 1987). Pb/Ce ratios in all oceanic basalts are quite constant, and distinct from the ratio of continents and continent-derived sediments (Fig. 16) (Hofmann *et al.*, 1986; White, 1987). The uniformity of Pb/Ce ratios, together with the high concentrations of Pb in sediment and low Pb concentrations in the mantle, appear to be a strong constraint on sedimentary recycling. But Pb is abundant in hydrothermal effluents at ocean ridges and Ce is not, which may lead to low Pb/Ce ratios in deeper portions of the altered ocean crust. In this case the Pb/Ce ratio of the slab might balance the Pb/Ce ratio of the sediments, removing the objection based on Pb/Ce to mantle recycling. The major point of both these examples is that geochemical inferences concerning the importance of plate recirculation require detailed information concerning the compositions of the down-going ocean crust. In many cases, we know only the direction of the chemical effects associated with these processes (*e.g.* decrease in Pb concentration, increase in U concentration). We do not in general know the magnitude of the effects. In other cases, low temperature and high temperature alteration produce opposing effects (*e.g.* for the alkalis) and we cannot even be sure of the direction of net change (*e.g.* Hart and Staudigel, 1982).

A proper evaluation of the chemistry of the down-going plate, therefore, is central to any estimates of present input rates. Sampling of the oceanic section by drilling, including penetration to the limit of hydrothermal alteration, has not yet been accomplished for any oceanic crust adjacent to an arc. The crustal mass balance of many critical trace elements (*e.g.* U, Th, Pb, Sr, and K) in oceanic crustal hydrothermal circulation remains largely unknown. It is not surprising that published attempts at mass balance for recycling at arcs have resorted to unconvincing compositional averages or ranges. Yet, while the power of isotopic tracers in the arc context is obvious, as shown in Figure 15, the potential of the method has not been realized. With the mass flux calculation for the major global process of crust/mantle interaction mired in generalities at present, drilling offers the best chance for progress.

Drilling Strategy

From the above discussion it is clear that drilling adjacent to convergent plate margins is urgently needed to advance studies of convergent margin chemical fluxes and to better understand processes of crustal recycling. Such drilling should occur on the incoming plate, and in the forearc and backarc environments. Initially, on the down-going plate, several holes that penetrate at least through the zone of greatest hydrothermal interaction are essential. They should be located in older oceanic crust with minimal present-day hydrothermal activity, adjacent to well-studied oceanic island arcs. In the longer term, multiple holes through the sediment and the upper alteration zones of the crust in a variety of settings outboard of arcs will provide important new constraints on the arc volcanism problem. A significant portion of the input from the slab to the sources of arc magmas may come from the uppermost crust, and this crust also has the largest enrichments in incompatible elements - much higher than the more refractory and less altered gabbros in the lower crust. Thus, moderate basement penetration (300 m) in a variety of settings would make a substantial contribution to this area of investigation, particularly if there were other deeper holes that could be referred to for information about the chemical characteristics of the deeper crust.

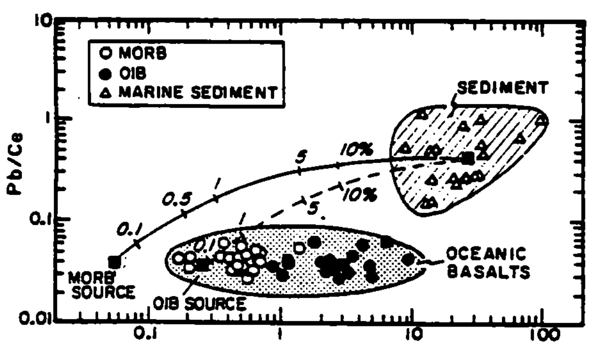

Figure 16. Pb concentrations and Pb/Ce ratios in oceanic basalts and modern marine sediments. Solid line sediment-MORB source mixing curve. Numbered ticks show percentage of sediment in the mixture. MORB source is assumed to have Pb and Ce concentrations 10 times lower than average MORB. Dashed line illustrates the effect of mixing sediment with a hypothetical OIB source having Pb and Ce concentrations 5 times higher than the MORB source. Addition of less than 1% sediment increases Pb/Ce ratios beyond the range observed. From White (1987).

Despite considerable work on subduction-related magmatic rocks, there is little consensus on the source of different elements in island arc rocks and on how their distinctive trace element compositions developed. Such questions are clearly fundamental to any attempt to establish geochemical fluxes, and they might be addressed by drilling (i) parallel to the trench on down-going plates where there are systematic lateral variations in sediment cover or in the chemistry of the volcanics from the neighboring arc; and (ii) around anomalies (hot spots or fracture zones) on the down-going plate that presumably should have some effect on the chemistry of the arc volcanics. By matching down-going chemical heterogeneities with variations in the arc volcanics it may be possible to constrain the sources of different elements in new continental crust.

To evaluate fluxes on the over-riding plate in a convincing way, clastic apron drilling must be preceded by base-line studies of volcanic and plutonic arc rocks, and of sediment derived from them. These studies should establish the arc-wide distribution of mineralogical, trace element and isotopic tracers. To evaluate the fluxes from the arc through time, there should probably be at least two holes in clastic wedges so that temporal correlation can be tested between them. Ideally the clastic apron drilling would be coordinated with deeper basement drilling on the arc basement as well. A transect of comparatively shallow basement holes across an arc-back-arc transition, carefully sited near one or two deep holes in the over-riding plate, would also be a useful contribution to constraining the net output fluxes at convergent margins.

PRIORITIES, RECOMMENDATIONS, AND DRILLING TIME ESTIMATES

The entire Working Group assembled at Strasbourg established an overall thematic priority and one top drilling priority.

The thematic priority is *to understand the present systematics of the solid earth circulation system, and the record of its action through time.* In this context, the single most important contribution would be drill holes through the entire thickness of the ocean crust. Since this objective is not technologically tenable at the present time, the specific first priority of the Working Group is *to develop the capability to drill such total crustal sections.* This capability has several aspects. It requires:

(1) a planning process that can encompass such a major, focussed long-term objective;

(2) a substantial program of engineering development that is insulated from the distractions of leg by leg operations;

(3) an inclusion of the necessary site surveys as essential

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Dr. Ralph Moberly
JOIDES Planning Office
Hawaii Institute of Geophysics
2525 Correa Rd. Honolulu HI

3 July 1989

89-262

Dear Ralph,

I have recently returned from ODP Leg 126 to a flood of correspondence concerning the PCOM's decision in Oslo to change the FY90 drilling plan and in the process cancel the previously scheduled Leg 130: Geochemical Reference Sites (GRS). As a long-serving member of the ODP planning structure, and the former Chairman of WPAC, I find this action unprecedented and ill-conceived, and am at a loss as to what message PCOM thought it was sending to the community. Several issues are at stake:

1) The Planning Process

The procedure by which proposals are reviewed and ranked by panels, combined into programs, and then voted into the next FY operations plan, have undergone several modifications during the ODP. This procedure is still evolving, but one of the groundrules was that the major programatic decisions for the next FY are debated and decided at the annual PCOM meeting at which all the panel chairman are present. The advisory panels Fall meetings are focussed on providing input to this meeting. The relative thematic priorities for competing programs in a given region are carefully weighed at the annual meeting and PCOM chooses the programs to be included in the next FY drilling. TAMU develops an operational plan, chooses co-chiefs and staffs the ship, based on these programs. USSAC solicits student Fellowship proposals and allocates its funds for site survey augmentation and VSP acquisition based on the same programs. Individual scientists use the annual program plan to schedule their participation in drilling and auxiliary activities. After several years of uncertainty, the scientific community looking at most of PCOM's decisions last December could see the thematic planning process working. This orderly state of affairs was totally shattered by PCOM's decision in Oslo to change the FY90 plan so as to exclude an already approved thematic drilling program for which co-chiefs and other staff had been chosen. There is a need for logistical flexibility, but this was not done on logistical grounds. After the extensive discussion of GRS in Miami, culminating in a 12-2 vote for the program, to subsequently remove it, without voting on the specific program, and in the absence of the PCOM's LITHP liaison, was a mistake. Not to acknowledge and correct it would be an even bigger mistake. The friends of ODP in the scientific community would be outraged and the detractors would have a field day, especially given the appearance of vested interests of several PCOM members in the replacement program.

2) Thematic Priorities

There has been considerable confusion concerning the thematic ranking of the GRS proposal because it was one of the proposals caught in the transition from Regional to Thematic panel oversight. The last (3rd) WPAC prospectus was formulated before the Langmuir-Natland GRS proposal was formally reviewed by LITHP and SSP. Strong LITHP support for GRS was communicated to WPAC by its liaison, but a ranking could not be assigned as previously LITHP had considered GRS as part of its highest priority WPAC program (Bonin-Mariana) but not as a separate program. Because CEPAC did not consider GRS as part of its region, WPAC inserted a summary of the GRS program in its 3rd prospectus so that PCOM and SSP would at least have a focussed statement of the objectives and proposed sites. In this respect WPAC acted as a DPG to aid both PCOM, SSP and LITHP. Although subsequently LITHP did not re-rank all the WPAC programs, there can be no question of their consistent high ranking of this program, as documented in their minutes and communicated directly to PCOM by the LITHP Chairman at two annual meetings. In contrast, TECP did not rank its favoured CEPAC programs until this year!

3) Politics and Logistics

In your response of 26 May to Bob Detrick's letter, Ralph, you suggest that "a lot of thematic issues to be addressed in the Pacific are likely to get put off for several more years to allow the ship to show itself in the Atlantic for the purpose of renewal of MOU's, and that under the circumstances we (PCOM) tried to pick the leg with strongest thematic support that reasonably met the location, maturity, and weather criteria". (The Old Pacific program can not be considered mature for November-December drilling as MCS surveys of several sites will not be completed until late summer!). Consideration of deferring Pacific programs IN ORDER THAT the drill ship could return to the Atlantic by 1993 was first voiced at PCOM on the last day of its December 1987 meeting. After the initial shock to the fledgling, "thematically driven", planning process, the matter was referred to EXCOM for guidance. The response from EXCOM was for PCOM to review mature, "thematically-reviewed proposals, in any ocean, in order to plan a general direction of the vessel in the period after 1991". The advice seemed clear: plan the best science, not politics. This guidance formed the basis for a broad solicitation of drilling proposals in all oceans from the scientific community, with the clear message that clusters of strong thematic programs would direct the drilling operations. That message was well received by the community and EXCOM's guidance was adhered to in Miami. However, it was totally undermined by PCOM's Oslo fiasco and is further eroded by your statement above. Let us be honest with the community and member countries; publicise reality: either good science will determine how long the drill ship stays in the Pacific or any ocean, or it won't. If you want support to renew MOU's then don't frustrate the thematic scientific community.

4) A Solution ?

Please do something to change the message which the community is hearing based on your statements and PCOM's actions in Oslo. Return to the perception and reality of thematically-driven planning without political overtones. Accept LITHP's recommendation and re-instate a GRS leg in FY90. It could be re-inserted anytime before the southwest Pacific legs without detriment to logistics or weather windows. It would decrease the transit time and improve the weather for Nankai if inserted prior to Nankai. Surely it is not logistically too late to reconsider. I wish you and PCOM good judgement in another tough decision.

Yours sincerely,

Brian Taylor

Brian Taylor
Assoc. Prof.

cc: C. Helsley, EXCOM
PCOM members
B. Malfait, NSF
T. Pyle, JOI Inc.
L. Garrison, TAMU
D. Scholl, USSAC
R. Batiza, LITHP
J. Gill, WPACDPG
J. Natland, SIO

UNIVERSITÉS DE PARIS 6 et 7

Département des Sciences de la Terre (P. 7) Institut de Physique du Globe (P. 6)

LABORATOIRE DE GEOCHIMIE DES ISOTOPES STABLES

Paris,

To R. Moberly,
Joides Planning Office, Hawaii Institut Geophysics,
University of Hawaii, 2525 Correa Road,
Honolulu, Hawaii, USA.

From P. Agrinier,
Laboratoire de Géochimie des Isotopes Stables,,
U.E.R. des Sciences Physiques de la Terre and I.P.G.P
Université Paris VII, 2 place Jussieu, 75251 Paris Cedex 05, France.

Paris, July 7th, 1989,

Dear Sir,

To my knownledge, the main objective of leg 128 (Bonin site 8 ODP autumn-winter 1989) was to drill geochemical reference holes. Because one of my research subjects is the modelization of mass exchange between the reservoirs of the earth, I planned to participate to that leg as a cruise participant or as a shore based participant (I sent all the requested forms to ODP France). But then I learned that this leg has been cancelled and that another one has been programmed instead.

Therefore I would like to know the reasons for this cancellation and I would like to know when this leg will be reprogrammed since I am still interested to participate to it.

I really hope that this particular Bonin ODP program will be not delayed for a long time and that I will not face again to such a late cancellation of it (because, for the present time, the sample analyses were already included in my laboratory plans for 1990).

Sincerely yours, Pierre Agrinier

2, PLACE JUSSIEU • 75251 PARIS CEDEX 05 • TOUR 54-64, 1er ÉTAGE • TÉL. ~~330-12-24~~ POSTE ~~60-91~~

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19 July 1989

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Hawaii Institute of
University of Hawaii
89-304

Dr. Ralph Moberly
JOIDES Planning Office
Hawaii Institute of Geophysics
2525 Correa Rd
Honolulu, HI 96822

Dear Ralph,

As current Chairman of the Western Pacific Detailed Planning Group, I too ask that PCOM reconsider its decision to replace the Geochemical Reference Sites Leg 130. Brian Taylor's 3/7/89 letter accurately reflects the history of WPAC's considerations and recommendations, and the effects of the decision within the larger scientific community. I add only two comments.

First, in all the deliberations about regional versus thematic panels, one underlying premise was that thematic science drove priorities. The GRS Leg came at the crossover between regions and between panels. As such it was a litmus test for how ODP would operate in its post-WPAC mode. First Pisias and then you asked WPAC for scientific advice and advised us not to prioritize GRS within our regional frame of reference in the same way that other proposals were prioritized. PCOM would handle that. What is shocking is that the decision apparently was reversed without substantive debate about scientific merit. If something had changed concerning the scientific potential of GRS, both thematic and the relevant regional panels should have been consulted. Otherwise our role is a sham and ODP will find it hard to staff DPG's (perhaps even thematic panels).

My second point is specific to the rationale of the WPAC plan itself. Legs 125, 126, and 130 were planned together as a transect. Leg 125 cored an excellent sequence of recent forearc serpentinite extrusions. Leg 126 recovered an excellent tephra history, replete with >200 ash layers, of Quaternary volcanism for both the arc and backarc. Comparative study of these arc outputs together with the subducted inputs to be drilled in a GRS Leg is exactly what both COSODII and the subsequent "Margins Initiative" of the US-NAS have called for. Because of this, the geochemists of Legs 125 and 126 worked with Natland in planning for standardization of analyses between all three Legs. Given ODP investment in 2/3 of the project it seems capricious at best to call off the final 1/3 after so much planning for it had been completed.

In short, I trust that PCOM is wise enough in political acumen and generous enough in scientific spirit to recognize and rectify a mistake in judgment. Most member nations can learn from recent political history that stone-walling works only when citizens are docile or when armies are strong. Neither applies to the scientific community.

Sincerely,

James Gill
WPACDPG

xc: R. Batiza, LITHP
PCOM Members

orig + amen in 203E file
Copy " + " into Settle agenda

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SCRIPPS INSTITUTION OF OCEANOGRAPHY

GEOLOGICAL RESEARCH DIVISION
LA JOLLA, CALIFORNIA 92093

May 23, 1989

RECEIVED
MAY 26 1989
89-N 224

Dr. Ralph Moberly, Chairman
JOIDES Planning Committee
Hawaii Institute of Geophysics
2525 Correa Road
Honolulu, HA 96822

Dear Ralph:

I herewith transmit 10 copies of mature drilling proposal 203E, entitled Cretaceous Guyots in the Northwest Pacific. This proposal replaces preliminary proposal 203E of the same title, which was submitted to PCOM on June 10, 1986, as part of the report of the USSAC-sponsored Workshop on Carbonate Banks and Guyots. That preliminary proposal was given a high priority by both the Sediments and Ocean History Panel and the Central and Eastern Pacific Panel.

This mature proposal is the outcome of a 34-day, NSF-funded cruise to study a number of guyots in the Northwest Pacific, for both purely scientific purposes and to characterize targets for ODP drilling. The cruise was done aboard the Scripps vessel R/V Thomas Washington during November and December of 1988. The four proponents of this proposal, myself, Marcia McNutt, Jim Natland, and Will Sager, all participated in the cruise and in the subsequent analysis of the data and dredge samples. The seismic, SeaBeam, magnetic, and gravity data collected on that cruise were sent by me to the ODP Data Bank at Lamont in March, 1989. A brief overview of the cruise results were presented by Sy Schlanger at the recent meeting of the Site Survey Panel in Hilo, where I think you were present.

The principal topical objectives and the guyot strategy, set out in detail in the proposal, are long-standing high-priority JOIDES objectives, to which PCOM has not yet allocated ship time. The Report of the first (1981) COSOD meetings, on p. 52-53, deals specifically with the relevance of drilling on carbonate banks and reefs for studies of global sea level fluctutations, for vertical tectonics, and facies models. On p. 74-78, the COSOD I report points up the importance of understanding the hypsometry of the Mesozoic Pacific, where midplate volcanism was on a stupendous scale. The Report of the July, 1987, COSOD II meetings, in Table 1 on p. 18, gives the atoll- transect strategy the highest priority in testing models of eustatic sea level history. Proposal 203E proposes just such a transect on a drowned Early Cretaceous atoll, a half a world away from the Atlantic-centered passive margins that provide the data for the coastal-onlap scheme for estimating sea level changes during that time of "greenhouse" climates on the Earth, so unlike the "icehouse" Earth of the Neogene. To date, JOIDES has not dedicated any ship time to address these long-standing topical problems via drilling on carbonate platforms.

Beyond the COSOD reports, other important international conferences have given the drilling of guyots a high priority. You are in possession of a letter from Wolf Schlager, conveying the strongly positive recommendations of the Carbonate Platform Working Group of the Cretaceous Resources and Events Conference, sponsored by the Global Sedimentary Geology Program, and held in September, 1988, in France. Very shortly, the USSAC-sponsored Workshop on Sea Level Changes, chaired by Greg Mountain and Joel Watkins and held in El Paso in October, 1988, will issue its report, giving strong endorsement to the topical objectives and strategy embodied in Proposal 203E.

I am concerned that this proposal get a fair hearing in the advisory structure of JOIDES. The very high priority that the preliminary version earned in the Sediments and Ocean History Panel should not be lightly set aside. I would therefore ask that you place this mature proposal before the appropriate panels in plenty of time for them to take up the matter at their next meetings, and I herewith formally request that PCOM reexamine its hastily-taken action that side-tracked consideration of scientific guyot drilling until some distant -- and perhaps chimeric -- future extension of the drilling program.

Best regards.

Sincerely yours,

Edward L. Winterer

copies to:
- M. McNutt
- W. Sager
- J. Natland
- M. Kastner
- C. Helsley
- S. Schlanger
- J. Watkins
- W. Schlager
- R. Ginsburg

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June 22, 1989

E.L. Winterer
Scripps Institution of Oceanography
La Jolla
Calif 92093 U.S.A.

Dear Jerry,

Thank you for your Telemail and your concern about interest in Sea Level. I share your concern and only yesterday wrote to Miriam Kastner about it as well as sending Ralph Moberley a Telemail message; I enclose a copy of my letter to Miriam.

My perception of what happened last year is that in response to the continued concern in SOHP that our mandate was far to broad to be encompassed by one panel, PCOM decided to break it in two, one concerned with the history of ocean surface and deep circulation and the intimately related histories of life and climate on Earth; the other concerned with sedimentary processes and geochemical or diagenetic processes in sediments. When I agreed to take over as chairman of OHP I assumed that sealevel as a major "ocean history" concern of SOHP, would have been within my mandate as we concluded in the introduction to the November 1988 SOHP white paper which anticipated the new structure, and I requested that I be assigned a panel member with expertise in that area. I had a list of several appropriate people but ideally would have liked somebody with geophysical as well as seismic stratigraphy expertise because it is an absolute necessity if the problem is to be "solved" that the solution is geophysically sensible. I consulted several people at the December PCOM and it was Greg. Mountain who suggested that Nicholas Christie-Blick would be ideal. In the event PCOM selected him but allocated him to SGPP. Rather than react with fury, I re-read the panel mandates and concluded that sea-level is indeed implicit in their mandate and not ours.

As you well know, COSOD 2 emphasised the great importance of the history of sea level as one of the major geological concerns that can only be evaluated and understood through ocean drilling. PCOM mandates thematic panels to ensure that each major theme does stand as a priority target for drilling proposals in one or other of the panels. For clarity and equity one could argue that each major theme should be mandated to a single panel, so that in a collection of panel white papers each theme can be clearly identified in one or other. Equally, a panel mandate should not be cluttered with items that are not components of major themes.

I suspect that the reason PCOM allocated the sea level theme to the mandate SGPP is that PCOM realized that SGPP is where the expertise to evaluate proposals to study the history of sea level resides. Successful application of the Halley approach, for example, depends largely on geochemical methods; evaluating the seismic stratigraphy approach depends on sedimentologists who also see other approaches to sea level (eg in fan deposits). In OHP we have the expertise to study the history of climate/glaciation, one of the causes of sealevel change, and we have the expertise to look at many of the symptoms of sealevel change. I say "I suspect" because PCOM minutes are very brief and there is no indication from the Miami meeting minutes as to why my request for a sealevel expert was ignored, and Christie-Blick assigned to SGPP.

I believe that PCOM must discuss this problem seriously. If this important theme is transferred to the OHP mandate, it may prove difficult for SGPP to develop a strong impetus in non-geochemical directions. However, I consider that a specific item in the mandate of either OHP or SGPP ought to be something like:

Changes in sea level: documentation of their eustatic or non-eustatic nature; evaluation of their magnitudes, their causes, and their important consequences.

In the meantime let me assure you that all proposals are evaluated by all panels with the thematic objectives delineated in the COSOD reports in mind and that your new proposal will certainly be competently and sympathetically reviewed by OHP. Since I have replied to your message at length, I will copy this letter to appropriate persons for consideration.

All the best,

Nick

N.J. Shackleton, Chairman OHP

cc OHP, SGPP, PCOM

Table 1. Targets for Future Drilling.

Theme	Drilling Targets	Number of Legs
Structure and Composition of Lower Oceanic Crust and Upper Mantle [Objective 1].	Deepening of 504B Deep holes on old crust: i) fast spreading crust ii) slow spreading " iii) thin crust One hole to MOHO.	12
Intraplate volcanism [Objective 3].	Selected case studies e.g. hotspots, near-axis seamounts, backarc spreading centers.	4
Magmatic and hydrothermal processes associated with crustal accretion [Objectives 2, 10].	i) sedimented ridge crests (East Pacific) ii) un-sedimented ridge crests (East Pacific) iii) Mid-Atlantic ridge crest. iv) establish observatories: a single hole > 500 meter deep hole and at least 2 shallow holes at each location.	14
Dynamics of Oceanic crust and upper mantle [Objective 5].	Global stress map (sites of opportunity).	
	Specific experiments: e.g. NW Nazca Plate, S. Shetlands, Juan de Fuca, Philippines.	3
	Series of 100 to 200 m instrumented holes.	5
Plate Kinematics [Objective 6].	One to two hotspot traces on each major plate. M-series dating	4
Processes at Divergent Margins [Objectives 7, 11].	Young conjugate margins: e.g. Red Sea, Greenland-Norway, Gulf of Valencia-Gulf of Lyon, Flemish Cap-Goban Spur.	10

Table 1 continued

Theme	Drilling Targets	Number of Legs
Processes at Convergent Plate Margins [Objectives 4, 8, 11].	Clastic dominated accretionary wedges: e.g. Nankai, Cascadia, S. Barbados; pelagic dominated: e.g. N. Barbados; erosional : e.g. Peru, Japan.	10
	Geochemical reference: deep crustal sites on down-going plates in well studied convergent zones.	3
Intraplate Deformation [Objective 9].	Case studies in regions of mid-plate deformation.	2
Short period climate changes [Objective 12].	Horizontal transect across oceanographic and atmospheric fronts; depth transect in major ocean basins. Arctic and high latitude sections.	8
Longer period changes [Objective 13].	Deep stratigraphic sites on old oceanic crust, Arctic Basin, oceanic plateaus.	8
History of sea level [Objective 14].	Atoll and guyots drilling and passive margin transects.	6
The Carbon Cycle and Paleoproductivity [Objective 15].	High productivity regions.	4
Evolutionary Biology [Objective 16].	Selected sites in regions not sampled as part of other paleoceanographic studies.	2
	TOTAL =	95

Table 3. Cost Estimates for Engineering Developments and Special Operations

Engineering and Operational Requirements	Scientific Objective Addressed	Phase I 1989-1992 ($1000)	Phase II 1993-1996 ($1000)	Phase III 1997-2002 ($1000)
1. 4km Diamond Coring System.	1,2,3,4,7,8,9, 13	1390.	-----	-----
2. 6km DCS	1,2,3,4,7,8,9, 10,11,13	-----	1000.	200.
3. Slimline riser and blow-out preventor	1,2,3,7,8,9,10, 11	300.	5000.	1500.
4. Improved sediment-coring Systems	7,8,9,10,11,12, 13	250.	200.	150.
5. Borehole Seismometers and Operations of Seismic systems.	2,4,5	600.	600.	600.
6. High-temp systems.	3,4,11	1000.	1510.	750.
7. Improved packer and fluid samplers.	4,5,8,11	800.	500.	300.
8. Oriented core samples.	1,2,5,6	250.	250.	-----
9. In-situ pressure sampler.	7,8	250.	250.	150.
10. Slimline logging and borehole experiments.	1,2,3,4,7,8,9, 10,11,13	650.	2000.	-----
TOTAL		5490.	11310.	3650.

11. Alternative 1,7,8,13,15 vessels.			
Jack-ups	-----	2000.	2500.
Arctic D/V	-----	-----	-----

Explanatory Notes:

Item	Comments
1/2	The adaptation of small diameter, high speed diamond coring from a mining technique to a full fledged deep sea coring system is envisioned as evolving through several stages. The terms "4km DCS" and "6km DCS" do not signify a simple extension of depth capability, but rather represents points of the learning curve for a **totally new technology**.
3	A slimline riser system appears to be the only feasible and affordable way we can conduct riser drilling in water depths greater than about 2500-3000 m. The longest existing conventional riser is about 7,500 feet (2200 m) and it seems unlikely that the oil industry will build a larger one in the near term. The cost to ODP of leasing a second drilling vessel equipped with an up to 10,000 foot riser to drill a special hole would be prohibitive. However, there is no technological reason that the JOIDES Resolution cannot be modified to handle a "slim riser" at more affordable costs by the end of Phase II. In fact, the development of the DCS can be considered the forerunner of a slimline riser system in that two strings of pipe, i.e. a drill rod inside the standard ODP drill pipe, are being handled successfully in the prototype DCS. Although this is not in any sense a riser system with circulation capabilities and blow out control, it conceivably could be developed in that direction. The $300K in Phase I is intended only to develop concepts and designs that go beyond the pipe-within-a-pipe of the DCS. The $5,000K in Phase II would buy the riser system materials and fabrication. Testing of the system would be completed during Phase II so that it would be in operation for the Phase III of this plan. The $1500K in Phase II represents an increase in expenses due to the greater operating costs of riser drilling.
4	This item encompasses a variety of tasks aimed at

minimizing core disturbance and increasing core recovery. They include the ongoing efforts to improve the extended core barrel (XCB) and advanced piston coring (APC) hardware, the design and testing of new bits and efforts to extend the life of coring components so as to reduce operating costs.

5. The development of borehole instruments is not now part of normal ODP operations. The estimated costs shown for each phase represents estimates associated with deployment and operations. The exact mechanism for developing such borehole instruments as seismometers is not considered in this document.

6. Many aspects of drilling into regions of high temperature in the ocean environment are an undeveloped technology. However, based on experience from on-land drilling of hydrothermal systems it is clear that certain critical elements of the ODP drilling and coring systems now in use must be redesigned and fabricated with different materials. The Phase I costs would include a period of intensive study and experimentation which by Phase II would provide the tested tools for addressing the scientific objectives of ODP. It is assumed that cost during Phase II will be principally for operations.

   Operations in high temperature regimes also require significant modifications of the present ODP downhole measurements operations because of the high temperatures and highly corrosive environment expected. The logging approach used must be consistent with the type of drilling utilized: either a 10-12" hole or, more likely, a small diameter diamond-coring hole. The two approaches require much different strategies for downhole measurements, with different financial implications.

   With a 10-12" conventional hole (or a 5" diamond-coring hole, See Note 10), nearly all of our present downhole tools could be used in most hot holes. With a carefully monitored program of cooling the hole by circulation, the tools would never exceed their 150°C operating limits and the adverse effects of corrosive pore fluids would be minimized. Approximately $20,000 per year in 1990-1992 would be required for modeling studies of the effect of different circulation strategies on borehole temperatures, culminating (after field experiments) in software to guide real-time decision-making so that adequate cooling is maintained with minimum expenditure of ship time.

Some holes will have active advection of high-temperature fluids into the borehole, overwhelming the ability of circulation to cool the hole. Such aquifers must be spotted with a hot-hole temperature tool ($60,000) at the beginning of logging, studied and sampled with the wireline packer, and then probably cemented in and redrilled before other logging.

7. Packers and fluid samplers are examples of specialized tools which have been mostly developed outside of ODP by "third" parties. However, the objectives for drilling in high temperature regimes will require significant improvements to existing tools. Since circulation will not solve the hot-hole problem for every tool and every hole, drillstring packers and particularly the wireline packer will require the development of high-temperature packer elements. In addition the entire wireline packer will need to be replaced with one capable of sampling high-temperature, corrosive fluids. These developments are estimated to cost about $300,000 and are planned for Phase I. Other cost during Phase I and costs shown for Phases II and III assume reflect added operational expenses associated with the deployment and use of these tools.

8. At present the only core samples which are routinely oriented are collected by the APC system. Orientation of cores cut with rotating bits is a much more difficult task. The lack of effort to develop this technology reflects the limited budget for technological developments within the present ODP program. The relatively small costs shown here envision the testing of a number of concepts during Phase I with ultimate deployment of a successful method during Phase II.

10. At the present time it is difficult to estimate the cost of converting the more highly sophisticated logging tools now used by ODP to a small diameter dymond coring system. The cost will depend on which size hole will ultimately be drilled with the DCS envisioned under items 1 and 2. The size of hole also effects the estimates for cost of the DCS. For this cost estimate we assume that the DCS will drill a 4 inch diameter hole. This size hole can be drilled by a DCS system using the existing drill string on the JOIDES Resolution. A larger diameter DCS system requires a larger drill string and thus would require significant costs to modify the ship and purchase new drill string and associated hardware. Since the DCS is still under development and there are a number of uncertainties about the system, we therefore make this

assumption. However, we will continue to examine the cost trade offs of slimlining downhole measurement tools versus up-sizing the DCS.

With a 4" DCS hole, none of the many downhole tools deployed in previous ODP operations can be used. We will need either to lease or to purchase and modify slimhole tools. One possible option is that ODP will lease tools already designed and used at temperatures of up to 400° C and in highly corrosive environments. Leasing charges are currently $60,000 per leg for a suite consisting of sonic, density, gamma ray, neutron, resistivity, caliper, and temperature tools. Alternatively, we could purchase these kinds of slimhole tools (for about $450,000) and repackage them in dewared pressure cases to increase their capabilities from 65°C and 1500 psi to 300-400°C and 10,000 psi (for about $200,000). The costs for purchasing are listed as part of Phase I.

To move from this relatively primitive downhole logging capability closer to the capability already employed by ODP at such basement sites as Site 504, we would need to design and build high-temperature slimhole versions of the following:

> Temperature tool ($60,000), waveform sonic (because existing slimhole sonic tools will not provide reliable velocities in highly fractured rock; $150,000), wireline packer ($100,000 for high temperature packer elements, $200,000 for measurement and sampling of hot corrosive fluids, $150,000 for a slimhole design), televiewer ($100,000 for high T modification of the WBK televiewer), DCS packer ($200,000), and magnetometer ($75,000). Modification of the geochemical tools (except maybe K, U, Th), formation microscanner, and susceptometer would face design limitations that make slimhole conversion completely unfeasible or prohibitively expensive (>$1,000,000).

These costs are included in Phase II.

Unfortunately, at present a 4" diamond coring hole would result in the loss of the ability to log holes with all the advanced tools introduced during ODP.

11. For drilling deeply into lagoonal areas of atolls, the use of a jack-up rig, specially leased for this purpose seems to be the most economic approach. Estimates

shown here assume that this mode of atoll drilling will be programmed after 1992, and that in Phases II and III, single drilling campaigns of 60 days each will be conducted.

Arctic drilling represents the only regionally oriented scientific priority presented in this document. However, the importance of this region in terms of the evolution of earth's global climate alone makes drilling in this region a very high priority, but at this time it is not possible to estimate the cost associated with operations within the permanent ice of the Arctic.

As can be seen in Table 13 the additional cost above the normal operations of ODP of this implementation plan is on the order of $24M over the 14 years represented by the three Phases of this document. While this represents an average of only $1.71M per year it is clear that a significant increase in development monies is required during Phase II.

Plom Settle file

Sandia National Laboratories

Albuquerque, New Mexico 87185

May 30, 1989

RECEIVED
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Hawaii Institute of ...
University of Hawaii
89-235

Dr. Ralph Moberly
Hawaii Inst. of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822

Dear Dr. Moberly:

Paul Worthington passed on your query as to the possible use of Sandia's high temperature logging tools in the ODP. I will address this question and suggest additional actions that may be beneficial.

Sandia tools were developed to support DOE-funded, geothermal drilling activities. Our CSDP work focuses on diamond drilling and our core recovery is never less than 95%. Thus our logging activities are generally limited to those measurements that cannot be obtained from core specimens. Budgetary constraints also play a role so not all desired measurements are made.

All of our holes are temperature logged during and after drilling. This enables one to identify flow zones and it provides temperature relaxation data for heat-flow calculations. This work is done in holes of 3-inch diameter and larger. We have consistently measured temperatures to 295°C and on equipment should work to 400°C, but it is untested.

Fluid samples are taken using a Los Alamos slim-hole sampling tool. This tool has functioned at 295°C.

Presently Sandia is building a 4.5-inch diameter, high-temperature televiewer. This tool is too large for diamond cored holes but it could be used in conventional ODP holes.

I see no overriding problem with using Sandia's tools with ODP if there is no conflict with DOE interests and if they are insured. I suggest that such an exchange be part of a formal agreement between the ODP and the DOE/CSDP. Other parts of such an agreement would deal with technology development. I am interested in hearing your thoughts.

Sincerely,

Peter Lysne
Geoscience Research
Drilling Office
Division 6252

PL:6252:ia

Copy to:
P. Worthington

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T. Pyle Esq.,
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Suite 800,
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U.S.A.

Reference: RTB/611/1

6th July 1989

Dear Tom,

HIGH TEMPERATURE SLIMHOLE LOGGING

Thank you for your letter explaining the rationale behind the workshop scenario. I had, as you say, received a garbled version.

By now you should have received the minutes of our most recent DMP meeting. The minutes identified high-temperature slimhole logging as the major technical issue currently facing the Panel. Because of the short time (18 months) before the first projected deployment of these tools, Panel recommended that a full-time special investigator should appraise the status of this subject area over a six-month period commencing imminently. I gather that LDGO have this matter in hand. The aim is to prepare a guide to the logging tools that are available off-the-shelf for different high-temperature and slimhole-diameter scenarios. It is already clear that in the short term at least, we will have to mould our logging programmes in hostile environments to what is available as existing technology, even if this means accepting a reduced data acquisition. There should be no question of ODP developing in isolation expensive new technology in this complex area, especially as the DCS is not yet proven, a final decision on its diameter has not been taken, and DCS will be subordinate to the APC/XCB combination which will remain the primary drilling tool throughout the next ten years (Foss, personal communication).

Returning to the subject of an inter-progamme workshop, we see this as a natural sequel to the report of the special investigator. The brief of such a workshop would be to identify necessary technology which is not available off-the-shelf and to formulate a strategy for its development, almost certainly on an inter-programme basis. The workshop is therefore seen as providing a foundation for long-term scientific planning, rather than meeting the specific short-term needs of ODP. The most appropriate time for this to be held would appear to be April 1990.

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I trust that we are assured of your support in progressing this initiative, and I look forward to the prospect of working with you, and Peter Lysne, in bringing these important matters to fruition. You may rest assured that our goals are common: we want the maximum return for the minimum outlay and recognise that in order to achieve this, we will almost certainly have to lower our sights in terms of data acquisition.

Kind regards,

Yours sincerely,

Paul Worthington

Paul F. Worthington
Chairman, JOIDES DMP

CC

Peter Lysne, Sandia Labs
Ralph Moberly, PCOM chairman
Roger Anderson, LDGO

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Copy into Agenda Book
File w. SRDPG

University of Rhode Island
Graduate School of Oceanography

MEMO

To: Ralph Moberly, PCOM Chairman
Barry Harding, ODP/TAMU
Roger Anderson, L-DGO BRG
Paul Worthington, DMP

Date: July 11, 1989

From: Bob Detrick, Sedimented Ridge DPG Chairman

Subj: Drilling and logging technical development needed for drilling sedimented ridge crests

At its June meeting in Ottawa the Sedimented Ridge DPG put together a detailed prospectus for a two-leg drilling program in Middle Valley and Escanaba Trough. The DPG devoted considerable time to discussing logging and sampling requirements in these potentially high-temperature holes. The purpose of this memo is to highlight for PCOM, and the engineers at TAMU/ODP and L-DGO, what measurements the SRDPG believes are (1) essential, and (2) desirable for the successful outcome of the program. **Urgent action is required in a number of areas to insure that these capabilities are available by mid-1991, the likely timing for the first sedimented ridge drilling leg.**

Drilling strategy. The drilling program developed by the SRDPG has two major scientific objectives: (1) to define the hydrogeology of a sediment-dominated hydrothermal system, and (2) to study the processes involved in the formation of sediment-hosted massive sulfide bodies. Three types of holes are proposed to address these objectives:

Type A holes. A-holes are non-reentry holes that will be drilled down as close to the sediment-basement interface as possible (up to 500 m bsf). The unconsolidated and semi-consolidated sediment in the upper part of the section will be cored by APC/XCB; the highly indurated sediments expected in the lower part of the sedimentary section will require the RCB or DCS.

Type B holes. B-holes are reentry holes that will penetrate into basement, and be cased to basement. All B-holes will be drilled at least a short distance (~50 m) into basement; at least two will be deepened substantially into basement (>300 m). The DCS would be desirable for basement drilling.

Type S holes. S-holes will consist of a suite of shallow (<100 m), closely spaced holes across sulfide bodies to sample and define their structure in three dimensions. High sample recovery is extremely important in these holes; the DCS and "pogo" guidebase would be very desirable for this part of the program.

Drilling of the A-holes would primarily be done on the first leg; the B-holes and S-holes primarily on the second leg. The DPG recommended the two legs be separated in time by approximately 1 year both to allow additional time to develop the tools needed to make measurements in the hottest parts of the hydrothermal system (sampled by the B- and S-holes), and to analyze the results from the first leg.

Downhole measurements strategy. Four types of measurements were considered essential to the success of the sedimented ridge drilling program: (1) temperature, (2) pore pressure, (3) permeability, and (4) fluid sampling. In the A-holes, temperature, pore pressure and fluid sampling would be carried out every 20 m with a high-temperature version of the Barnes-Uyeda tool in unconsolidated and semi-consolidated sediments. In more indurated sediments, bottom hole temperature measurements will be made every 100 m using a tool like the USGS/Sandia slimline high-temperature probe; the Japanese P-T tool; or the high-temperature tool being designed by von Herzen and Cann. Standard physical property measurements and fluid sampling will also be routinely carried out on core material aboard the drillship. Permeability will be measured by setting a near-surface (low temperature) packer and determining the integrated permeability in step-wise fashion as the hole is drilled. A similar suite of measurements would be carried out in the basement reentry holes. If these are drilled with the DCS, reaming these holes with the RCB could allow some standard logging to be done through the side-entry sub while maintaining circulation.

If the DCS is available, borehole hydrological experiments would be feasible in the B holes by developing seals between the standard drill pipe and casing, and between the standard drill pipe and the DCS drill pipe. This would allow measurements of permeability and pressure to be made on the rig floor of the drillship and allow drawdown and slug tests. It will also be necessary to develop some type of post-drilling seal (ideally wire-line re-enterable) for the B-holes.

Required technical development. Based on the drilling and borehole measurement strategies summarized above, and presented in more detail in the Sedimented Ridge Drilling Prospectus, the DPG prioritized the technical development required for a successful sedimented ridge program as follows:

Essential development:

- High temperature drill bits and core liners
- Barnes-Uyeda tool modified for higher temperatures (up to 200°C) and to make it stronger (shorten its length?)
- Slimline, self-contained probe to measure temperatures up to 350°C (borrow/lease USGS/Sandia or Japanese P-T tool?)
- Post-drilling seal for reentry holes (drillable okay, but highly desirable that it be wire-line re-enterable)

Desirable development:

- DCS
- "Pogo" guidebase
- Openable annulus seal for DCS
- Standard logging through side-entry sub while maintaining circulation
- Pressure core barrel
- Capability to measure H_2S and related gases on drillship
- Slimline high-temperature logging tools (of various types) and high temperature logging cable
- High-temperature packers

Additional details on the drilling sites proposed by the Sedimented Ridge DPG and drilling and logging time requirements can be found in the Sedimented Ridge Drilling Prospectus.

cc: R. Batiza, LITHP Chairman
Sedimented Ridge DPG

Cornell University
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89 - 269

June 29, 1989

Dr. Ralph Moberly
PCOM Chairman
Proponents of Ocean Drilling
JOIDES Planning Office
Hawaii Institute of Geophysics
School of Ocean and Earth Sciences and
Technology .
University of Hawaii
2525 Correa Road
Honolulu HI 96822

Dear Ralph:

Because you asked, here's a quick update on geoprops. At long last the contract has been finalized but work has been going quite well at the same time. Design drawings are nearly complete, parts have been ordered, and metal will soon be cut. The best thing is that all aspects of construction and testing have been discussed extensively and are very well thought out. We don't expect surprises.

A very informal estimate has the animal still ready for land testing late this fall. Everyone is geared up now and we have watchdogs watching, so I'm once again optimistic. Tell me it hasn't been a hassle, however. Oh, the final detail is that we have to go back to NSF for ~40K more - 19K for increased estimate, 7.5K for spare parts, and 12.5 K for land testing. Malfatt isn't happy, I'm sure, but there wasn't much choice.

Cheers,

Daniel E. Karig
Professor

meg

I. SSP STATUS OF CERTAIN PROPOSALS

PROPOSALS WITH FAVORABLE EVALUATIONS (as of 10/88) AND NOT YET EVALUATED BY SSP:

290/E	Axial Seamount, Juan de Fuca Ridge	P. Johnson & al.
291/E	Drilling in the Marquesas Island Chain	J. Natland & al.
296/C	Ross Sea/Antarctica	Cooper & al.
297/C	Pacific Margin of Antarctic Peninsula	P.F. Barker
305/F	Arctic Ocean Drilling	P. Mudie & al.
308/E	Reactivated Seamounts, Line Island Chain	B. Keating
310/A	Geochem., Dipping Reflectors, E-Greenland	A. Morton & al.
311/A	Sedim. Equiv. Dipping Reflectors, Rockall	D. Masson & al.
316/E	To Drill a Gas-Hydrate Hole (West Pacific)	R. Hesse & al.
315/F	Network of Perm. Ocean Floor Seismic Observ.	G. Purdy & al.
271/E Rev.	Paleoceano. Transect of California Current	J. Barron & al.

PROPOSALS WITH UNFAVORABLE EVALUATIONS (as of 10/88) AND NOT YET EVALUATED BY SSP:

307/E	Cross Seamount, Hawaiian Swell	B. Keating
312/A	Potential of Drilling Reykjanes Ridge	J. Cann & al.
313/A	Evolution of Oceanog. Pathway, Equatorial Atlan.	E. Jones & al.
59/A Rev.	Continental Margin Sediment Instability	P. Weaver & al.

PROPOSALS WITH UNFAVORABLE EVALUATIONS (as of 10/88) AND BEING EVALUATED BY SSP:

3/E Rev/2	Flexural Moats, Hawaiian Island	A.Watts & al.

II. TARGETS RECOMMENDED BY WPAC (alphabetically):

Watchdog

1. Banda Sea and South China Sea basins: 194/D Rev/2 — G. Bross
2. Geochemical Reference sites
3. Nankai II — M. Kastner
4. South China margin: 46/D — Darly Taira
5. Valu Fa Ridge
6. Vanuatu back-arc rifts: 294/D — Bob Duncan
7. Zenizu Ridge: 163/D Rev., 177/D Rev.

III. ASSESSMENT OF EARLIER ATLANTIC DRILLING PROGRAMS by ARP (10/88)

The Atlantic is a unique place to address the following themes:

1. Conjugate passive continental margins.
2. Slow-spreading mid-ocean ridges.
3. Latitudinally compartmentalized ocean: Arctic vs. Antarctic paleoceanography.

Paleoceanography

74/A	Continental margin off Morocco	Winterer & al.
63/A	Madeira abyssal plain	E. Duin & al.
254/A	NW Africa: Black shales in pelagic realm	Parrish & al.

Eustatic sea levels through time

276/A	Equat. Atlantic transform margins	J. Mascle
313/A	Evolution of oceanog. pathway: Equat. Atl.	E. Jones & al.

Continental break-up and evolution of oceanic lithosphere

310/A	Geochem. sampling, dipping reflectors, E-Greenland	A. Morton & al.
311/A	Sedim. equiv. dipping reflectors, Rockall	D. Masson & al.

Leg 102: Further deepening is desirable to examine oceanic crust variation with age, tectonic setting and spreading history.

Leg 103: Further drilling is needed:
- -to recover more complete sections of syn- and prerift sections;
- -to sample to and through the "S" reflector;
- -to conduct investigations of the well-studied conjugate margin off eastern Canada.

Leg 104: Drilling transects are required:
- -to learn more about the structure, petrology and paleomagnetic record of the wedge under the Voring Plateau.
- -to compare the Norwegian margin with its conjugate.
- -to understand the evolution of the Voring Plateau in the context of the North Atlantic volcanic province.

Legs 104, 105, 113, 114: Gateway evolution in the Atlantic.

Legs 106, 109: Understanding the crustal accretion process at slow-spreading mid-ocean ridges.

Leg 110: To understand defluidization and growth mechanisms of secimentary forearcs.

IV. NO RESPONSE FROM SOP OR IOP.

PROPOSALS RECEIVED BY THE JOIDES OFFICE SINCE OSLO MEETING

JOIDES Number: **325/E**
Title: **A Proposal to Drill a High-Temperature Hydrothermal Site on the Endeavor Segment: Northern Juan de Fuca Ridge**
Proponents: **H. Johnson, J. Franklin, J. Cann, R. Von Herzen**

The authors propose to examine in detail the sub-surface properties of a high-temperature hydrothermal system, using drilling as part of an integrated, long-term, interdisciplinary study of seafloor hydrothermal processes. The most important objectives of drilling into an active hydrothermal upflow zone at a spreading center are to characterize both the tectonic/geochemical/physical environment in which the flow is embedded, and the dynamic characteristics and parameters of the flow itself. Specific objectives are to determine: (1) What physical and chemical processes control the flow rate and residence time of fluids within a hydrothermal system; (2) to what depth and in what amount do fluids penetrate to the top of a magma chamber (cracking front) and what sequential mineral assemblages are forming with depth within an active system; and (3) what interactions are taking place between high temperature metalliferous fluids and locally advecting unmodified seawater with the wall rocks in the discharge zone. To accomplish these objectives a series of three re-entry and single-bit holes will be drilled on the Endeavour Segment of the northern Juan de Fuca Ridge. Samples of rock and fluid from the sub-surface region, together with simultaneous measurements of the physical and chemical environment of the sampled region will be placed in their full geologic context with a set of companion time-series, co-registered geophysical measurements adjacent to the drill holes. At the Endeavor site, drilling below the surface in the center of this active field has the distinct possibility of initiating a new high-temperature vent system, a prospect that has a wide range of scientific opportunities that this program is prepared to explore.

JOIDES Number: **326/A**
Title: **Proposal for ODP Drilling on the Continental Margin of Morocco/Northwest Africa**
Proponents: **K. Hinz, H. Roeser and W. Weigel**

This proposal reinforces proposal JOIDES Number 74, of the same title, by Winterer and Hinz. A supplemental drill site at the oceanic end of the Morocco transect, in the region between the Tafelney Terrace in the south and the Mazagan Plateau in the north, is proposed for the purpose of determining the nature and age of the oldest volcanic/magmatic products associated with the opening of the Atlantic Ocean.

JOIDES Number: **327/A**
Title: **Proposal for ODP Drilling on the Argentine Continental Rise**
Proponents: **K. Hinz, R. Stein, M. Block, M. Hemmerich, H. Meyer and C. Ronda**

Two sites are proposed for the Argentine continental margin to sample regional seismic unconformities, Mesozoic black shales, and the wedge of seaward-dipping reflectors and its substratum. Specific objectives for a site on the Argentine Rise are the age and nature of a pronounced regional seismic unconformity, which marks a change in the paleoceanography and the depositional environment in the South Atlantic and determination of the litho- and biostratigraphy of a giant drift. Specific objectives for a site on the Argentine continental margin are to obtain a section through the oldest portion of a wedge of seaward-dipping reflectors; at this site the base of the section could be reached. Further, the sampling of black Mesozoic shales and the confirmation of age and nature of the regional seismic unconformities observed at the first site are proposed.

JOIDES Number: **203/E Rev.**
Title: **Proposal for Drilling of Guyots in the Central Pacific**
Proponents: **E.L. Winterer, J. Natland, M. McNutt and W. Sager**

This proposal replaces preliminary proposal 203/E, of the same title, which was submitted in June, 1986, as part of the report of the USSAC-sponsored Workshop on Carbonate Banks and Guyots. Proponents for 203E seek to drill eight holes at the summits of five carbonate-capped guyots in the Mid-Pacific Mountains, Wake Seamounts and Japanese Seamounts in the central and western tropical Pacific. The drilling will address a number of important problems of broad thematic interest including: Early Cretaceous sea-level fluctuations; causes and timing of mid-Cretaceous carbonate platform drowning; extent, magnitude and timing of regional uplift associated with massive mid-plate volcanism in Western Pacific; Early Cretaceous Pacific plate latitudinal changes and plate kinematics; fixity of hot spots; longevity and stability of the "Dupal" anomaly in mantle composition; and, Cretaceous history of the South Pacific "Superswell" and the Darwin Rise. Preliminary targets are: Allison Guyot, and "Huevo" and "Caprina" guyots in the central and western Mid-Pacific Mountains, respectively; "M.I.T." Seamount in the west-central Pacific between Japanese (Geisha) and Wake seamounts; and Charlie Johnson Guyot at the eastern end of the Japanese Seamount chain.

JOIDES Number: **328/A**
Title: **Proposal for ODP Drilling on the Continental Margin of East Greenland, North Atlantic**
Proponents: **K. Hinz, H. Meyer, H. Roeser, M. Block, M. Hemmerich and H. Miller**

Drilling at two sites on the East Greenland continental margin is proposed in order to sample the outer wedge of seaward-dipping reflectors and the regional seismic unconformities observed there. Objectives for the two sites include: (1) Differentiation between kinematic models for the emplacement of seaward-dipping structures (reflectors); (2) investigation of the relationships between dipping-reflector sequences and continental flood basalt, and magnetic anomalies; (3) study of conjugate volcanic features of the East Greenland and Norwegian continental margins; (4) obtain samples of all major volcanic periods/zones, necessary to determine the petrological, geochemical, magnetic and kineamtic variability of extrusive igneous rocks of the Early Tertiary "North Atlantic Volcanic Event" in space and time.

JOIDES Number: **329/A Rev.**
Title: **Cretaceous Paleocommunication Between the North and South Atlantic Seas: Formation of the Atlantic Ocean**
Proponents: **J. Herbin, J. Mascle, L. Montadert, M. Moullade and C. Robert**

In order to study the Cretaceous paleocommunication between the North and South Atlantic seas, the recovery of Mesozoic rocks is proposed from three sites off the intermediate oceanic margins of Sierra Leone, Liberia, and on the Demerara Rise in the largely unexplored Equatorial Atlantic. These sites would provide new and essential data to determine the kinematic and structural evolution and the paleoceanographic, paleoclimatic, and paleoenvironmental conditions. The main objectives for drilling in this region are: (1) To discover the nature and age of the first sediments deposited on the oceanic crust, as well as the age of the crust itself, and to reconstruct the initial position of the continental masses; (2) to study the formation of sedimentary facies during the opening phase as consequences of the kinematic evolution and particularly the black shales that were deposited at one and the same time in the North and South Atlantic up to the Turonian-early Coniacian; and (3) to understand better the relationships between volcanism, sedimentation and tectonic events during the movements of the equatorial fracture zone.

JOIDES Number: **330/A**
Title: **Mediterranean Ridge: An Accretionary Prism in a Collisional Context**
Proponents: **M. Cita, A. Camerlenghi, L. Mirabile, G. Pellis, B. Della Vedova, W. Hieke, S. Nuti and M. Croce**

The study of two accretionary prisms has been planned by ODP for 1989-90 (Nankai Trough and Cascadia Trench). The need to study a wide spectrum of prisms in order to compare data from different tectonic settings provides the framework for this proposal to drill in the Eastern Mediterranean region. Preliminary sites are located along the crest of the Mediterranean Ridge and outer slope of an accretionary prism (southern transect); on the Ionian abyssal plain, outer slope of an accretionary prism and re-occupying DSDP Site 125 (southwest transect); and on the crest and flank of the Mediterranean Ridge (western transect). This proposal will be updated, and additional drill sites will be proposed after the completion of two site surveys planned for the Fall of 1989 and mid-1990. General objectives are: (1) deformation pattern and fluid circulation in an accretionary prism; (2); fluid circulation in an accretionary prism versus brine circulation; (3) Plio-Pleistocene paleoceanography; (4) the comparison of stress and fluid circulation in areas of different deformational styles; and (5) the history of sapropels and explosive volcanic activity.

JOIDES Number: **331/A**
Title: **"Zero-Age" Drilling on an Extinct Spreading Axis: The Aegir Ridge, Norwegian Sea**
Proponents: **R. Whitmarsh, W. Weigel, H. Miller and F. Avedik**

By drilling at the center of the Aegir Ridge, a sediment-covered, but no longer active (circa 32-26 Ma) mid-ocean ridge in the Norwegian Sea, the proponents hope to avoid problems caused by high temperatures and corrosive hydrothermal fluids anticipated at actively spreading ridges. This work is proposed as a strategic intermediate step pending the development of equipment to overcome the practical problems mentioned above. General objectives are the study of magma processes and hydrothermal processes associated with crustal accretion, and investigation of the structure and composition of the lower oceanic crust and upper mantle. A preliminary site is proposed to drill into the frozen magma chamber (2000-3000 mbsf), into crust which has not undergone substantial normal faulting and within which the fissures have been sealed by secondary hydrothermal mineralization, as well as to sample the result of decaying axial hydrothermalism on sediments in the "dying" rift. The final choice of site will be constrained by sediment thickness in the median valley axis, pending further site survey work.

JOIDES Number: **332/A**
Title: **Florida Escarpment Drilling Transect**
Proponents: **C. Paull and M. Kastner**

The drilling of a three-site, east-west transect across the edge of the western Florida continental margin at 26°01'N is proposed. The objectives of the transect are to determine: (1) Patterns of fluid circulation through the carbonate platform and rates of lateral exchange with seawater, (2) the diagenetic history of the platform edge as it relates to the patterns of fluid circulation, (3) the effects and geologic record of seafloor brine seeps with respect to sulfide mineralization, deposition of chemosynthetically produced organic carbon-rich layers, and the escarpment's erosional history, (4) the stratigraphic development and facies succession across a carbonate continental margin, (5) the paleoceanographic history of the Gulf of Mexico and (6) the facies pattern in the distal submarine fan. A Florida Escarpment drilling program will elucidate the geological and geochemical processes which form and modify carbonate continental margins. Drilling these sections to recover the fluids which circulate between the oceans and its edges should be within the capabilities of the JOIDES Resolution. This drilling program was recommended by the ODP working group on carbonate banks and atolls. (1 Leg)

JOIDES Number: **333/A**
Title: **Tectonic and Magmatic Evolution of a Pull-apart Basin: A Drilling Transect Across the Cayman Trough, Caribbean Sea**
Proponents: **B. Mercier de Lepinay, E. Calais, P. Mann, E. Rosencrantz, M. Perfit and T. Juteau**

This proposal presents a drilling program of six sites for the Cayman Trough, a 1400-km long pull-apart basin and present transform boundary in the Northern Caribbean. The central and eastern parts of the basin are sediment-starved, hence basement structure is accessible to drilling. Drilling in the eastern end of the Cayman Trough (2 sites) provides a unique opportunity to examine the timing and direction of propagation of faulting in a pull-apart setting. Information on age of subsidence, subsidence patterns and basement lithology would assist both in the interpretation of the basement structure of deeply buried (inaccessible) pull-aparts, as well as the interpretation of exhumed and deformed pull-aparts in ancient mountain belts. Drilling on the eastern and western sides of the trough (3 sites) will provide information about the inception and controls on a spreading ridge and a magmatic history test of depth versus age relations. The objectives for a single site in the mid-Cayman Spreading Center is direct sampling of layer 3 and its magmatic evolution. Additional objectives for all sites are the state of stress in strike-slip zones and Caribbean paleoceanography-constant versus episodic plate motions. (1.5 Legs)

JOIDES Number: **334/A**
Title: **The Galicia Margin New Challenge: Drilling Through Detachment Faults, Lower Crust and Crust-mantle Boundary**
Proponents: **G. Boillot, E. Banda and M.C. Comas**

Extensive drilling of basement at the Galicia Margin, N.E. Atlantic, is proposed for two sites, one on the west Galicia Margin and the other on the Iberian Abyssal Plain. Proposed work seeks answers to major geodynamic questions raised by previous drilling at the Galicia margin, Leg 103, concerning the upper lithosphere and the ocean-continent crustal transition. The general thematic objectives of the proposal are: (1) To test the simple shear model for the stretching of the lithosphere during rifting; on the

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Galicia Margin, the best candidate for this shear zone is the S seismic reflector; (2) to determine by sampling the nature of the basement beneath the S reflector; depending on models and hypotheses, it could be underplated gabbros, stretched lower continental crust, or serpentinite resulting from alteration of the uppermost mantle by synrift and/or postrift hydrothermal activity; and (3) to estimate the westward extension of the serpentinite seafloor.

JOIDES Number: **335/E**
Title: **Drowned Atolls of the Marshall Islands: Paleoceanographic, Lithospheric and Tectonic Implications**
Proponents: **S.O. Schlanger and F.K. Duennebier**

This drilling program in the northern Marshall Islands consists of eight proposed sites atop drowned atolls of Eocene (Harrie Guyot), Cretaceous (Sylvania Guyot) and unknown (SCH Guyot) age now at depths of 1300-1400 m and at nearby deep-water archipelagic apron settings. This proposal replaces JOIDES Number 202/E, entitled "Geologic Evolution of the Northern Marshall Islands," submitted to JOIDES on 9 January 1986 as part of the report of the USSAC workshop on carbonate platforms. Information from proposed sites will by applicable to a broad set of major problems: (1) Drilling atop Sylvania and Harrie Guyots will provide information on the chronology of reef growth and drowning related to sea-level paleolatitudinal history and vertical tectonics; (2) investigate the "paradox of drowned reefs"; (3) determine the chronology of volcanic events in the region as related to the passage of the Marshall Islands over thermal anomalies; (4) obtain reliable paleolatitudes and formation dates for these edifices; (5) determine the sources of Marshall Islands basalts and their relationship to the DUPAL/SOPITA anomalies; and (6) drilling at Sylvania, Harrie and related archipelagic apron sites will provide a data base for studies of depositional and diagenetic histories of archipelagic carbonate sequences and the chronostratigraphy of acoustic reflection horizons as related to paleoceanography. (1 Leg)

JOIDES Number: **336/A**
Title: **Arctic to North Atlantic Gateways, Oceanic Circulation and Northern Hemisphere Cooling**
Proponent: **J. Thiede**

The target areas proposed for drilling are arranged in terms of two transects: One transect extends from the Fram Strait along the East Greenland continental margin to the Denmark Strait following the eastern boundary of the East Greenland Current. The other transect extends from the northern Iceland Plateau to the south of the Iceland-Faeroe Ridge. Drilling in the central Fram Strait will provide data on the depth of evolution of the oceanographic gateway and the initiation and evolution of shallow- and deep-water flow through this passage. Proposed sites at the East Greenland continental margin are intended to (1) date the onset of the East-Greenland Current, monitor the deep-water formation and surface waters in the Greenland-Iceland Sea, (3) determine their influence on the variability of the polar front and northern hemisphere paleoclimate, and (4) decipher the evolution of the Greenland ice sheet. Sites on the Iceland Plateau are proposed to describe the paleoenvironmental conditions following the very early rifting stages of the Norwegian Basin. Proposed drilling of the Iceland-Faeroe Ridge will yield key information on the early spreading stages of the southern Norwegian Sea, the subsidence history of the Iceland-Faeroe Ridge and the early phases of warm surface-water inflow from the North Atlantic-a key parameter for northern hemipshere climate. Drilling is the Denmark Strait is proposed for a better understanding of the development of oceanic gateways and their influence on oceanic circulation patterns and climatic conditions during Cenozoic times in the Nordic Seas; it is aimed at determining the exchange rates of water masses between the Nordic Sea basins and the North Atlantic.

JOIDES Number: **337/D**
Title: **Ocean Drilling Program Tests of the Sedimentary Architecture of the Exxon Sea-level Curve**
Proponents: **R. Carter, C. Fulthorpe, L. Carter, J. Beggs, K. Miller and G. Mountain**

A multiple-leg program is proposed consisting of four groups of sites in the New Zealand region. A transect consisting of four sites will cross known mid-late Pleistocene shelf-margin sequences, offshore Wanganui Basin, western North Island. The main objective there is to establish the sedimentary architecture of known sea-level controlled sequence systems tracts, both for its intrinsic importance and for comparison to pre-Neogene sequences. A second transect will cross identified Miocene Exxon-type seismic sequences in Canterbury Basin, eastern South Island. The objectives for this transect are threefold: To establish the facies architecture of presumed pre-Plio-Pleistocene sea-level controlled seismic sequences, to test the global applicability of the mid-miocene part of the Exxon sea-level curve, and to establish the validity, and document the sedimentology, of a high-frequency part of the Exxon sea-level curve. Two sites, one on the Canterbury shelf platform and one on the flank of the Campbell Plateau, are proposed to establish the paleoceanographic nature of the 29 Ma event in the southwest Pacific. Lastly, a pair of sites in the Great South Basin, southeast of South Island, are intended at establish a high-resolution stratigraphic record through well developed southern hemisphere Paleocene sequences.

JOIDES Number: **338/D**
Title: **Absolute Amplitude of Neogene Sea-Level Fluctuations from Carbonate Platforms of the Marion Plateau, Northeast Australia**
Proponents: **C. Pigram, P. Davies, D. Feary, P. Symonds and G. Chaproniere**

Drilling is proposed along an E-W transect of five sites on the Marion Plateau, the most southerly of the marginal plateaus located along the northeastern margin of Australia. The principal objective of the proposal is to determine the amplitude of Neogene second- and third-order sea-level cycles. This objective, identified in the OH panel white paper, COSOD II, and the El Paso Workshop (EOS, March, 1989), can be achieved in this region because sites that have undergone identical subsidence histories can be located within two phases of platform accretion. Furthermore the Marion Plateau is a low-relief carbonate bank-slope-basin system that OHP considers essential for comparison with proposed Pacific atoll transects. As subsidence can be eliminated as a control on the Marion Plateau, it is an ideal area in which to define the amplitude of Neogene glacioeustatic events. A further objective is to obtain information on the changes in oceanography and climate as the world's ocean changes from an equatorial to a gyral circulation pattern. This information will help decipher the history of evolution of the East Australian Current and the effects of these factors in the development of subtropical platforms.

JOIDES Number: 339/C
Title: **Preliminary Australian Ocean Drilling Proposals in the Southern Ocean and the Conjugate Margins of Southern Australia and Antarctica**
Proponents: **P.A. Symonds, Australian ODP Scientific Committee Coordinator**

A series of mature proposals are being developed by the Australian ODP Scientific Committee relating to the Southern Ocean and the Australian and Antarctic margins addressing three very broad, main themes: (1) Lithospheric extension between Australia and Antarctica; (2) Magmatism associated with Southern Ocean opening and magmatic signatures of mantle evolution, emphasizing the Australia-Antarctic Discordance; and (3) Climatic and sea-level change in the Southern Ocean. Major scientific drilling objectives are: (1) The development, evolution and sedimentological expression of the Sub-tropical Convergence, the Antarctic Convergence, and the Antarctic Divergence, and the relations of circulation and seafloor erosion to Australia-Antarctica plate tectonic history through an examiniation of the chemical, biological and sedimentological signals; (2) the onset and cyclicity of glaciation which in East Antarctica may have been diachronic; (3) the relationship of sealevel change to distinctly tectonic or glacio-eustatic factors and the ensuing effect on sediment patterns; and (4) the evolution of temperate carbonate margins.

JOIDES Number: 340/D
Title: **Northern Australia Passive Margin to Foreland Basin (Tectonics, Oceanography and Paleoclimate)**
Proponents: **P.A. Symonds, Australian ODP Scientific Committee Coordinator**

Abstract to be provided.

Draft: Working definitions and procedures related to Selection of the general track of the vessel for highly ranked Thematic Drilling in the period of January 1992 through April 1994.

First, what is meant by general track? It means, in general, where and when the drilling vessel will be in order to carry out highly ranked drilling programs with a good chance for success. It does not mean a leg-specific schedule, but it may mean a program-specific one. The purpose of setting a general track will be to ensure any time needed for completing site surveys or engineering developments, to allow proposals to mature, to allow choices to be made relative to weather windows, and to reduce as much as possible the proportion of transit time to drilling time. It will have put programs and proposals into head-to-head competetion for several months so that the best drilling schedules can be hammered out at the Annual Meetings one to one and one-half years before drilling. The general track probably will be worded in terms of general directions or areas with general lengths of time, for particular programs. A few examples of general tracks might be:

(a) North Pacific 1992 for programs a, b, & c;
North Atlantic and Mediterranean 1993 for programs d, e, & f;
Western Indian Ocean early 1994 for programs g & h; or

(b) North Atlantic early to late 1992 for programs a, b, & c;
Central and North Pacific late 1992 through early 1994 for programs d, e, & f; or

(c) South and Central Atlantic early to late1992; prog. a & b;
Antarctic late 1992 through early 1993 for programs c & d;
West Pacific mid-1993 for programs e & f;
North and Central Pacific late 1993 through early 1994 for programs g & h; or

(d) you name it.....

Next, what are meant by programs? I believe we look at these as some combination of a panel *theme* and the actual *proposals* likely to address that theme *successfully* in some *area*. If proposals don't address any theme, there is no program. If a theme has no proposals, there is no program. If thematic proposals don't identify a place for their drilling, there is no program. If thematic proposals in an area have no chance of success with existing or developing technology before 1994, there is no program before 1994. If thematic proposals in an area are weak, there can be only a weak program.

Preferably, a theme can be identified as a statement in a panel's current white paper. Themes may, however, have been written in the white paper of a predecessor panel, as a COSOD I "recommendation", a COSOD II "goal", or an "objective" in the Long Range Plan, because not all panels have current white papers. To be fair in our declared aim to have a thematically driven ODP, proposers have to know what the themes are, and their proposals have to be matched against these published themes. By the way, Performance Evaluation Committee II said we should be careful to complete the COSOD I recommendations before starting the COSOD II ones. We haven't done that, but nevertheless we have addressed at least a part of each of the 12 COSOD I recommendations. Assuming equal quality of proposals, we ought to try to finish off COSOD I soon; of course, many are repeated in COSOD II and the later documents.

Preferably, a proposal is one with a fairly good chance of reaching success in the next few years, i.e., not only having the chance to mature with site-specific surveys and expected developments in engineering, but also not requiring, for example, riser drilling, or work in the central Arctic, or in the waters of some anti-social nation. Finally, programs are not exactly legs; a program may take part of a leg, one leg, or more than one leg.

For example, LITHP might define some programs like this:
Theme: Determine magmatic and other ridge-crest processes by drilling arrays on sedimented and non-sedimented ridges.

1. Sedimented Ridges	
11. Atlantic	no proposals
12. Pacific	
121. Juan de Fuca	some proposals
122. Gulf of California	some proposals
123. Chile Triple J.	some proposals
13. Indian Ocean	
131. Red Sea	some proposals
2. Non-sedimented Ridges	
21. Atlantic	
211. N of 50°N	some proposals
212. 10°-50°N	some proposals
213. Equatorial	no proposals
etc.	

This ridge-crest theme may have, say, 15 to 20 possible programs. LITHP would have to rank these programs among themselves and rank them relative to programs in the other LITHP themes (deep crustal drilling; global network geophysical stations; case studies). In the example above, LITHP might decide, for instance, that 121 ranks high as a program because there are good proposals, a report from a DPG, a good chance that instruments will be developed on time to collect and measure hot fluids, a past record of support from the panel and the general community, etc., and might consider it to be a two-leg program. 122 might be of great interest with proposals that have good survey data, but lack of blow-out prevention where the ridge-crest is heating organic-rich sediments may cause 122 to be an unranked program for the next few years. 123, which is mainly a TECP program, does have some SGPP and LITHP thematic interest, and so might get ranked by LITHP but probably not high. 131 had old but interesting proposals (and interesting sediments!) and has TECP interest as a young rift, but safety and clearances have been unsurmountable problems in the past. LITHP might rank it low with the proviso that it would be re-ranked if proposals are updated or new ones arrive with safe sites in uncontested areas. 211 may have some combination of old formal proposals and new ideas not yet formulated into sites, new survey information; LITHP might rank it, say, high as a program because it believes the thematic interest is high and it is likely that the surveys will occur and a revised proposal will follow. And so on through all the areas of ridge-crest proposals.

PCOM stated that for fairness, priorities given by panels should have some common basis so we are not forced to try to compare unlike schemes. For instance, we do not want one panel to say "these are our top 7 programs, all of equal rank", while a second panel says "these are our top 20 legs in exact priority", while a third says "if the vessel goes into the Atlantic these are our top 6 programs in priority, but if the vessel goes to the Antarctic these are our top 3, but if it stays in the Pacific these are our top 5". PCOM, however, did not develop guidelines for ranking. I would like each of you to give me your opinion about how priorities should be transmitted to PCOM. As a starting point, I'll say that my own view is that each panel should send a priority list of programs, using programs as defined above (actual proposals addressing a published theme in a specific locality)

Continuing the fake LITHP example above, LITHP's ranking might be, in part:

1

2

Priority 3: Unsedimented Ridges, Mid-Atlantic Ridge MARK Area, 1-leg program coring peridotites near Site 670.

Priority 4: Sedimented Ridges, Juan de Fuca Area, 2-leg program with Middle Valley Hydrothermal System ranking above Escanaba Trough Sulfide System.

5, etc.

As a final comment: at the Annual Meeting PCOM will select the 1991 schedule from 6 programs (Cascadia, etc. listed in the letter) of perhaps 9 legs, but only 5 or 6 legs (depending on engineering-science legs) will be available. So be sure to put these 6 programs into your overall ranking.

June 22, 1989
JOIDES RESOLUTION

TO: Planning Committee
From: Mark Langseth

We are about to leave the dock in Tokyo for Leg 127, which according to the latest plan will dock in Pusan Korea on August 21. Too late for me to attend the PCOM meeting in Seattle. I want, nonetheless to call your attention to my growing concern about how we are defining and using the new element of the planning and advisory structure-- the Detailed Planning Groups. I believe that we have gotten off on the wrong foot, and that we should reconsider the mandate of DPG's, how DPG's are formed and to whom DPG's report. In this memo I discuss how I think DPG's should fit into the JOIDES planning and advisory structure and reasons why PCOM should consider a change.

To anticipate-- I recommend that:

1. DPG's be an ad hoc short-lived group that is formed by PCOM and reports to PCOM.

2. I recommend that we re-institute special working groups that are formed by thematic panels with PCOM approval.

My reasons for these recommendations are fundamental. Within the ODP structure there are four main areas of responsibility: management of operations which is handled by ODP/TAMU and BRG/L-DGO; policy and oversight which falls to EXCOM, scientific planning which is PCOM's responsibility; and scientific and technical advice which rests with the panels, in particular the thematic panels. The thematic panels also serve as the principal link with the earth science community.

There are good reasons to keep responsibility for planning and advice separate. In my view a healthy relationship between PCOM and thematic panels is an adversarial one, in which the Panels are continually disappointed at how few of their objectives PCOM can implement, and PCOM is perpetually distressed by the unreasonable demands and criticisms from the thematic panels. To maintain the proper level of friction it is important that the thematic panels remain detached from the detailed planning process. How else can they criticize? If thematic panels manage DPG's they become deeply involved in the detailed planning of future legs and they will compromise their objectivity.

During discussions of the streamlined advisory structure last August the dominant opinion was that we can make the program more thematic by putting more planning responsibility in the hands of the thematic panels. In truth, the program is made more thematic by making effective plans. Thus PCOM bears the main responsibility for making the program more thematic. It does so by selecting the best scientific objectives put forward by the community, and transmitted to PCOM by the thematic panels, and designing a program that accomplishes these objectives to the maximum degree possible!

If PCOM's main job is designing the best possible program, then it needs lots of help and support from groups of experts who can put together detailed plans to accomplish the scientific goals. In line with our current mandate, DPG's provide specific information needed for planning in the form of prospectuses which would be shared with the thematic panels for their review and comments.

Let me cite a recent example the illustrates the above points-- the SRDPG meeting I attended this June. SRDPG addressed PCOM's mandate to provide a detailed 2 Leg drilling program for sedimented ridge axes. The SRDPG did an excellent job! They took as guidelines the scientific priorities established by the LITH panel (augmented by inputs from its Working Group on Sedimented Ridge Drilling). The SRDPG was a balanced group of interested and informed scientists. They reviewed the geophysical data and selected the best locations to drill holes to address the scientific problems; defined a downhole measurement program and made rough estimates of the drilling time required to drill various types of holes. Then to the best of their ability, they assembled the components to design a strong program for two legs. (I recently sent a letter to Ralph describing the outcome of the SRDPG meeting in more detail). The DPG will prepare a prospectus of this program that you will see in the near future.

At the same meeting the DPG was assigned an additional task by the LITH Panel, which was to review and provide advice to LITH panel on some recent drilling proposals on sedimented ridges. That is not what the DPG should be doing! But it is typical of the type of task a thematic panel would assign a working group. Without doubt the people in the SRDPG are capable of giving sound advice on the proposals, that is not the problem! The problem is, that after they have expended two full days developing a detailed plan, will they be able of look objectively at the new proposals? Perhaps they will, but most likely their judgment is going to be compromised by their own commitment.

Another more obvious point is that the scientific objectives of ODP often span the purview of two or more thematic panels. A good example is the Chile Triple Junction drilling, which spans interests of the TEC, LITH and Geochemical and Sedimentary Processes Panel. Which panel selects the members and writes the mandate? What will PCOM do if there are conflicting responses from the panels to a DPG's efforts. My guess is that PCOM will take over the DPG, which is what it should have done in the first place.

For these reasons and others I believe that the DPG's should directly serve PCOM. Conceptually they could be very simple; they should be ad-hoc and short-lived planning groups that take scientific objectives put forward by the thematic panels and accepted by PCOM for consideration in the drilling schedule, and convert them in to detailed plans for legs. One or two meetings of DPG's should suffice and they should be held only as needed. The members would be selected by PCOM, possibly with advice from the thematic panels. The specific mandate should be defined by PCOM. It is likely and desirable that some members of DPG's would come from thematic panels and service panels.

Lastly, it has been well demonstrated that thematic panels often need expert advise particularly in such areas as: assembling groups of proposals into a coherent package; assessing the drilling techniques needed to meet objectives, and selecting the best areas to address specific goals and evaluating geophysical information in terms of whether scientific objectives can in reality be met in areas under consideration. Thus I believe that we should re-institute the panel working groups under the name of Thematic Working Groups. These groups would be formed as in the past, i.e. proposed by the panels and approved by PCOM.

End of Memo.

DRAFT, TECTONICS PANEL WHITE PAPER

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.

ODP ACCOMPLISHMENTS RELEVANT TO TECTONICS

Because ODP is still in its infancy, significant accomplishments are not evenly distributed among the thematic objectives identified here. Nonetheless, this brief review addresses drilling achievements in the context of the long-range thematic objectives of the TECP.

Plate Convergence

The tectonics of convergent plate boundaries are of major thematic interest. Results of previous drilling have altered the thinking of many tectonicists about convergent margins, especially with regard to the role of fluids. Drilling in the Barbados Ridge accretionary wedge of the Lesser Antilles arc, and offshore Peru has begun to demonstrate the nature of the structural controls upon fluid migration and the effects of transport of heat and solutes. Drilling provides evidence of the partitioning into separate fluid regimes above and below the wedge basal décollement, the flow of fluid from beneath the wedge several kilometers in front of it, the reduced salinity of outflowing water, and in the case of Peru, for another source of saline water in the forearc basins. Drilling off Barbados, investigating for the first time the state of strain in the sediments beneath the accretionary wedge, revealed that "new" out-of-sequence thrusts, which cross cut the original accretionary thrusts and provide a mechanism for wedge thickening, can develop quite close to the front of the wedge.

Along portions of some convergent margins, *e.g.* southern Peru, stratigraphic signals from cores have been interpreted to reflect episodes of local subsidence. This, in turn, has been explained as the consequence of a phenomenon called tectonic erosion, *i.e.*, the removal by descending oceanic lithosphere of portions of the upper plate resulting in its thinning and collapse. Although this remains a poorly understood and sometimes disputed process, the potential importance is far reaching, not only to tectonicists but also to geochemists concerned with crust-mantle recycling.

Plate Divergence

The effects of rifting are well known as they relate to the formation of ocean basins, but processes and styles of rifting remain controversial, and the structural evolution of oceanic crust as it accretes has been deduced from fragments preserved on land. The roles of pure shear versus simple shear processes attendant to continental and oceanic rifting are debated. Additionally, rift margins may or may not be associated with large volcanic build-ups. A variety of drilling results have helped in characterizing the nature of specific rift margins, although results in several instances remain a topic of controversy. For example, ODP drilling on the Voring Plateau proved unequivocally that one of the seaward-dipping reflector sequences (SDRS) that characterize the outermost regions of some continental margins is indeed a large pile of volcanic material. Drilling did not penetrate their full thickness, hence the basement beneath these volcanics is not known, *i.e.*, thinned continental or oceanic crust. Already, however, ODP drilling results have yielded new models of continental rifting.

Off the Galicia margin of the Iberian Peninsula, mantle-like ultramafic rock occurs at shallow crystal levels, and elsewhere along this margin peridotite crops out on the seafloor. Some geologists consider that to be evidence of simple-shear rifting, involving low-angle detachments that cut the entire crust. An alternative interpretation holds that these peridotitic rocks are older remnants of ophiolites accreted during the late Paleozoic Hercynian orogeny.

Mountains and crustal uplift are not restricted to convergent margin settings. Prominent ranges such as the Transantarctic Mountains and the Sierra Nevada of California are believed to be flaps of crust that rebounded after breaking from a larger piece of depressed lithosphere. Recent drilling on Broken Ridge in the Indian Ocean has provided another possible example of rebound-style tectonics. The rebound mechanism is poorly understood, particularly as crustal subsidence usually follows a rifting event.

An important realization of the past several years is the way in which both divergent and convergent tectonics can occur simultaneously in a single orogen. Results of drilling in the Tyrrhenian Sea clearly documented the age of back-arc rifting to be post-late Miocene and the formation of oceanic crust to be Pliocene to Recent. These young ages correspond exactly to the age of thrusting in the Apennine fold belt that is trenchward from the Tyrrhenian Sea.

Intraplate Deformation

Intraplate behavior of the lithosphere under load is best studied at distances remote from the complexities of plate interactions. Preliminary results of drilling in the interior of the Indo-Australian plate have demonstrated the ability to both time deformation and attempt correlation with plate boundary events, quantifying the rheologic behavior of the oceanic lithosphere.

Plate Kinematics

The history of plate motions is fundamental to our understanding of global tectonics. Drilling is critical in many kinematic studies, as core material provides a means to date various portions of the ocean crust. These ages are necessary to calibrate plate vectors inferred from magnetic-lineation analyses and/or hot-spot trajectories. The history of spreading of the Atlantic

Ocean basin is reasonably well known, while plate kinematic histories of the Indian and Pacific ocean basins are less certain. Principal results from Indian Ocean drilling include confirmation and refinement of the northward motion of India away from east Antarctica over the last 100 Ma. More importantly, age relations of the various segments of hot-spot traces drilled generally confirm the model that, to first order, hot spots are stationary features in the upper mantle for periods at least as long as 100 Ma. Paleomagnetic results from core material from Reunion hot spot indicate, however, that inferred motion toward the magnetic pole is at variance with plate motion across the hot spot. Because of the congruence of hot-spot traces that indicate a fixed frame of reference, these data seem to suggest that the magnetic pole has shifted in space relative to the mantle. Thus the old idea of "true polar wander" is rekindled.

Plate Dynamics

The driving forces responsible for plate motions and lithospheric deformation represent an area of great debate. To date, little has been done to apply ocean drilling to these problems. Using new technology the relations and relative importance of the driving forces will be a focus of future drilling through state-of-stress experiments on selected areas of crust. Instrumentation of a hole in the Sea of Japan may result in the first data on deep crustal and mantle structure obtained as a direct result of ODP drilling. These data will improve resolution of the seismicity and structure of the Japanese island arc, and serve as a model for future studies of deep earth structure and dynamics using downhole instruments.

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 long-lived 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. Apparently, deformation of the overriding plate can, apparently even without significant collisional events, generate major mountain ranges like 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.

Material transfer and mass balance are important underlying themes in convergent margin studies. We are concerned with 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 even 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, such as subcretion, 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. We need to quantify and relate environmental conditions (stress, temperature), physical properties (strength, porosity, permeability) and mechanical state (cohesion, internal friction, compressibility) in the deforming sediments.

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 in detailing 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 critical 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 a combination of geophysical and geochemical techniques. For example, long-term geochemical monitoring of selected boreholes 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. Subduction dominates where oceans and continents interact, but after oceanic lithosphere is consumed, continent-continent collision ensues, forming Alpine-type and Himalayan-type mountain ranges. Short of this extreme, topographically high features , such as 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 Iapetus) 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 remains 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 (*e.g.* Alps, Carpathians, Betic Cordilleras-Morrocan

Atlas). 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 their 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, such as fold and faults, earthquake focal mechanisms, and the geometries of volcanic structures, 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, a great deal 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 for the increased 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 very with time? Naturally, the causes for these distributions are of interest, but first the distributions are on different marginsmust 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. End-member models for various tectonic aspects of continental breakup exist and are hotly contested. 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. The ultimate product of rifting can be a steady-state ocean ridge. 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 structure 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 control 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 SDRS's 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 SDRS's. An added complication is that SDRS's on other margins, *e.g.* off southwest Africa, are known to be at least partially silicic rather than basaltic in composition, 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 SDRS's 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 systematic geophysical data on both conjugate margins must be collected and 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). Attention should also be paid to sediment-starved conjugate margins. An example is the Flemish Cap/Goban Spur margin of Late Cretaceous age. 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 the long time scales of geologic processes, 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 events at the plate boundaries, such as the collision of India and Eurasia.

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 both 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.* $\leq$ 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*

<u>Hot-spot Reference Frames</u>: 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, satifactorily 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.

<u>Seafloor Age</u>: 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 constrains 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. Careful 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). Nonetheless, preliminary stress-orientation studies have been conducted for several lithospheric plates (*e.g.* North America, Indo-Australia and Nazca). The results 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. At the same time, 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 as yet insufficient to undertake a general analysis of the source radiation in both space and time. The necessary theory has been developed, but a truly global network would provide sufficient resolution to use these algorithms. 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.

Four problem areas need investigation 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.