JOIDES PLANNING COMMITTEE MEETING
25-29 August 1987
Nikko, Japan

AGENDA

ITEM C: EXCOM REPORT

Budget Recommendations

-- For the immediate fiscal year EXCOM charged JOI, Inc. with implementing reductions of $1.15M in the proposed budget, including cuts at TAMU headquarters, publication of Parts A & B, and science services.

-- EXCOM approved the requirement that 4% of each fiscal year's base budget be set aside for special operations and purchases.

-- The standard operations budget must include the ongoing development of systems essential for the achievement of COSOD I goals.

-- EXCOM followed the recommendation of BCOM in that the science plan, as outlined by PCOM, could be accomplished within the existing budget.

PCOM Mandate

EXCOM formally amended the PCOM Terms of Reference, using guidelines from the NSF, to provide general planning of the drillship track four years in advance of drilling (changed from three years).

Wireline Re-entry

EXCOM formulated a resolution regarding wireline re-entry of ODP and DSDP holes (see below). It is hoped that this resolution will be adopted by major international geoscientific organizations such as IUGG, IUGS, ICSU.

RESOLUTION

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

USSR Membership

EXCOM expressed strong dissatisfaction with the disinvitation of the USSR to ODP D.Heinrichs announced the disinvitation during the meeting as a decision of the U.S. Government.

Miraculously, all EXCOM decisions were unanimous. EXCOM will meet next from 6-9 October 1987 in Nikko, and then in April, 1988.

ITEM E: JOI, INC. REPORT

Tom Pyle will give a summary of the FY88 budget solution approved by EXCOM. EXCOM passed a motion consistent with the PCOM in that 4% of ODP's base budget is to be reserved for special operations.

EXCOM also approved the following changes with regard to publications:

1. Print 1,000 copies of ODP Proceedings (hard copies), with another 1,000 available as microfiche.
   With 1,000 hard copies all MOU requirements will be covered. Present distribution of ODP volumes is shown in the table on the following page.

2. Switch to author-prepared, camera-ready manuscripts for contributions to the ODP Proceedings.

3. Consider other alternatives, such as using outside publication services, (A very interesting AGU proposal has been received for publishing Part B of the ODP volumes; it may be discussed at the meeting).

Cuts in other services have been suggested as adjustments to meet the FY88 base budget. PCOM is asked to prioritize these adjustments (priorities were not made at the April PCOM meeting because of PCOM member's resistance to prioritization).

SHIPBOARD TECHNICAL SERVICES
(Lab Specific)

		Maint. & Supplies	Sal	[# Techs]	Total*
1.	X-Ray Lab	$ 59K	$ 70K	[2]	$ 129K
2.	Sem Lab	12	--		12
3.	Chem Lab:				
	a. Total	150	140	[4]	290
	b. All but Safety	50	70	[2]	120
4.	Computer Maint.	58	70	[2]	128
5.	Offices/Library/Yeopers.	31	70	[2]	101
6.	U/W Geophysics	130	--		130
7.	Paleontology	16	--		16
8.	Thin-Section Lab	5	--		5
9.	Phys. Prop.	20	70	[2]	90
10.	Paleomag.	43	70	[2]	113
11.	Downhole Tools	65	--		65
12.	Core Lab/General	--	420	[12]	420
13.	Photo Lab	--	70	[2]	70
14.	Elec. Techs.	--	140	[2]	140
15.	Superv./Lab Officer	--	70	[2]	70
	TOTAL	$639	$1,260K	[34]	$1,899K

* Note: These numbers represent "full service" cost. Compromises in level of service and budget amount may be possible.

Item E: JOI, Inc. Report (continued)

DISTRIBUTION POLICIES AND PROCEDURES FOR ODP PROCEEDINGS

Recipient	# of Copies	Total
1. Each ODP member country	100	600
2. Current U.S.JOIDES institutions	10	100
3. NSF	2	2
4. JOI Inc.	2	2
5. Non-ODP & U.S panel members	ca.85	ca.85
6. Current IHP members	10	10
7. Government Printing Office library	1	1
8. Borehole Research Group	2	2
9. Shipboard party	25	25
10. First authors of papers in ODP Proceedings (if not covered elsewhere)	25	25
11. Libraries:		273
Academic libraries (US and others)	254	
Oil companies	19	
12. TAMU (working sets):		77
Director	20	
Others	34	
JOIDES Resolution	3	
Archive	20	
13. Others (as determined by ODP's Director/Manager of science services)	?	?
TOTAL (not including Item 13.)		1,202

(as of October 86; following DSDP Initial Report distribution)

ITEM I: INDIAN OCEAN PLANNING

Leg 118: SW Indian Ridge

Co-chiefs: P.Robinson (C), R.von Herzen

PCOM defined the median ridge site, with deployment of the guidebase, as first priority. Ten operational days have been added, optionally to be used for pogoing in the gravel pit. A well defined logging program of 8-10 days has been endorsed by PCOM (see PCOM minutes p.45) .

- After problems on Leg 114 the Navidrill motor is undergoing major modifications and will hopefully be ready for field evaluation during Leg 118.
- LITHP is pleased with the logging program proposed for this leg. The panel recommends logging even at the expense of additional penetration.
- TECP reiterates its recommendation that a transect of holes is preferable to one deep hole using a guidebase.

PCOM has ranked deployment of the guidebase as first priority for Leg 118. This decision is based on arguments that deep crustal rocks are known to outcrop on the median ridge. In addition, there is a need to give TAMU further experience in deploying the guidebase. Because of potential logistical problems, clarification of PCOM's decision is necessary. For example, if weather prohibits deployment of the guidebase early in the leg, and a hole in deep crustal rock is established elsewhere, is deployment of the guidebase as an engineering test required when weather improves?

Leg 119: Kerguelen North & Prydz Bay

Co-chiefs Leg 119: J.Barron, B.Larson (ESF)

At present the following sites are considered for this leg:

KHP-1	8.5 (days)
SKP-6a	5.7
PB1-4*	14.0
Transit	24.8
10% Contingency	5-6
Total	ca. 59 days

* (alternative: SKP-6B: 13.7 + 0.3 televiewer)

The Prydz Bay program has been approved by the safety panel. Drilling is allowed to 500 m depth at line 21 except between "shot points" 34.092807 and 33.213708. A site on a structural low at 34.030904 has also been approved (see PPSP report, p.62-63). This leaves the co-chiefs the room necessary to adjust exact site locations according to the first drilling results.

Item I: Indian Ocean Planning (continued)

To accommodate air schedules and national holidays, two days were added to Leg 119; **for a total of 61 days** [24.8 transit, 28.2 on site, 8 contingency].

PCOM IS ASKED TO:

1. **CONSIDER WHETHER AN ADDITIONAL FIRST PRIORITY DRILLING SITE SHOULD BE CHOSEN FOR LEG 119 IN ORDER TO MAKE BEST USE OF THE EXTRA TIME** (are 8 days of contingency time too much?).

Leg 120: Kerguelen South

Co-chiefs Leg 120: R.Schlich (F), W.Wise

The following sites compose the Leg 120 program:

SKP-1	5.3
SKP-2	5.6
SKP-3	12.3
SKP-4A	12.5
Transit	ca. 19 days
10% Contingency	5-6
Total	ca. 60 days

SSP is concerned with the lack of crossing seismic lines for re-entry site SKP-3 (especially -3A) and asks whether this site can be repositioned to the south at the crossing of line RS02-27 with lines 30 or 32 (see SSP minutes, p. 90). SSP needs full-sized seismic sections for the SKP sites before they can be approved.

There are two requests for science programs to be done with the support vessel:
D.C. Biggs: Sediment Trapping Program
G.F. Fryxell: Plankton Study

PCOM IS ASKED TO:

1. **RECOGNIZE THE EXISTENCE OF SSP'S CONCERN WITH REGARD TO SITE SKP-3.**

2. **RECOGNIZE THE REQUESTS FOR SCIENCE PROGRAMS FROM THE SUPPORT VESSEL.**

Leg 121: Broken Ridge & 90E Ridge

Co-chiefs: J.Peirce (C), J.Weissel

Four Broken Ridge sites (BR1-4) of ca.450 m penetration are planned with one APC/XCB run through the youngest sequence and the rest rotary cored. Jeff Weissel promised to send site specific data which will be circulated during the meeting.

The 90ER program consists of sites 90ER-1 (A & B), 90ER-2 and 90ER-5 from N to S.

Item I: Indian Ocean Planning (continued)

LITHP recommends drilling the 90 ER site during Leg 116, particularly as Leg 116 site 5 did not get approval. The time saved could be used for proper achievement of the objectives of the two remaining 90 ER sites.

TAMU is undertaking efforts to learn about mining-type diamond coring systems. If such a system is deemed feasible, efforts will be made to have a system available for sea trial during Leg 121. RFP's have been sent out.

Leg 122: Exmouth Plateau

This leg consists of four sites:
EP6 (possibly re-entry), EP7, EP2A and EP10A; a length of 52 days, including logging, is recommended. (Site EP9 is planned as part of Leg 123.)

- A logging program must still be discussed.
  An update might be available after the DMP meeting in early August.

- SSP has stated that it is essential to get fully processed seismic data (including deconvolution and migration) for sites EP-9 and EP-10 (and back-up sites EP-8, EP-11) for proper evaluation. An isopach map of thinning Neogene cover is essential to work out alternative drilling strategies as it might be impossible to spud into the Mesozoic carbonates at the edge of the plateau (see SSP minutes, p. 92).

PCOM IS ASKED TO:

1. DISCUSS AND DECIDE ON A LOGGING PROGRAM FOR THIS LEG.
2. SELECT CO-CHIEFS FOR THIS LEG.
3. RECOGNIZE SOME PROCESSING NEEDS FOR PROPER SITE EVALUATION BY SSP.

Leg 123: Argo Abyssal Plain

Two sites have been defined:
AAP-1B with about 300 m basement penetration, and EP9B; a total of 40.3 days drilling time is presently being considered.

SSP has approved the sites, after fully processed seismic data and accompanying navigation are deposited with the databank.

- DMP recommendations for logging should be discussed.
- LDGO borehole group would like to add hydrofrac experiments, requiring four extra days.

PCOM IS ASKED TO:

1. DISCUSS AND DECIDE ON THE LOGGING PROGRAM FOR THIS LEG.
2. SELECT CO-CHIEFS FOR THIS LEG.

Item I: Indian Ocean Planning (continued)

CO-CHIEF RECOMMENDATIONS FOR INDIAN OCEAN LEGS:

Invited:
Leg 119 (Kerguelen & Prydz Bay): J.Barron, B.Larson (ESF)
Leg 120 (S-Kerguelen): W. Wise, R.Schlich (F)
Leg 121 (Broken Ridge & 90 ER): J.Weissel, J.Peirce (C)

EXMOUTH PLATEAU: (Leg 122)

IOP	N.Exon (A), J.Mutter, R.Larson, U.von Rad (FRG), P.Williamson (A)
SOHP	Exon (A), von Rad (FRG)
TECP	Exon (A), F.Gradstein (C), von Rad (FRG)

ARGO ABYSSAL PLAIN: (Leg 123)

IOP	Gradstein (C), J.Honnorez (F?), C.Langmuir, J.Ludden (C)
LITHP	F.Frey, C.Langmuir, J.Natland
SOHP	R.Buffler, Gradstein (C)

ODP Operations Schedule
Legs 115 - 123

LEG	OBJECTIVE	DEPARTS LOCATION	DEPARTS DATE	ARRIVES DESTINATION	ARRIVES DATE	IN PORT
115	Mascarene Plateau CO_3 dissolution	Mauritius	21 May	Colombo	2 July	July 2-6
116	Bengal Fan Intraplate Tectonics	Colombo	7 July	Colombo	19 August	August 19-23
117	Oman Margin paleoenvironment	Colombo	24 August	Mauritius	18 October	October 18-22
118	Southwest Indian Ridge Fracture Zone	Mauritius	23 October	Mauritius	14 December	December 14-18
119	Kerguelen Plateau and Prydz Bay (?)	Mauritius	19 December	Mauritius	20 Feb. '88	February 20-24
120	Central Kerguelen Plateau	Mauritius	25 Feb. '88	Fremantle	26 April	April 26-30
121	Broken Ridge and Ninetyeast Ridge	Fremantle	1 May	Jakarta	23 June	June 23-27
122	Exmouth Plateau	Jakarta	28 June	?	21 August	August 21-25
123	Argo Abyssal Plain and Exmouth Plateau	?	26 August	?	21 October	October 21-25

Revised 6/18/87 [signature]

NOTE: Ports and dates for Legs 121, 122, and 123 are **tentative** and should be used as estimates only.

Note: To accomodate air schedules into Mauritius and national holidays in Australia, two days have been added to Leg 119. All subsequent legs remain the same length, but reflect this 2-day change.

ITEM J: WESTERN PACIFIC PLANNING

1. **WPAC:** The 3rd WPAC Prospectus was distributed prior to the April PCOM meeting, and describes the 12 top-ranked programs in the Western Pacific region.

   At its 2-4 March meeting in Tokyo, WPAC broke the top 9 ranking programs into legs of reasonable size and proposed a preliminary drilling schedule for the Western Pacific. This drilling schedule lists 12 legs of differing length and covers approximately 22 months. A table with tentative leg numbers is shown on p.12 (**see WPAC minutes in April PCOM-package**).

   Brian Taylor, WPAC Chairman, contacted CCOP (a United Nations committee which coordinates offshore activities in Asia), and asked them to identify sites which might have clearance problems (see CCOP letter, p.105).

2. **TECP:** After reviewing the 3rd WPAC prospectus several changes were recommended (see TECP minutes p.134, and p.138-142):

   - Sunda: Relocation of S-sites to properly address collision processes;
   - Banda-Sulu-SCS: Add site SUL-8 in Celebes Sea to provide more complete study of evolution of small ocean basins;
   - Bonins: Reinstate serpentinite diapirism sites as a high-priority tectonic problem.

3. **LITHP:** The following changes to the prospectus have been recommended (see LITHP minutes, p.167-169):

   - Bonins: BON-7 would better drill ridge basement than diapir;
     Reference Hole: 3 sites be added, one deep (BON-8) and two shallow ones at Marianas (Note: Would equal one full leg !);
   - Japan Sea: Shift site J-2a and deploy mini-cones at J-1e & 1d;
   - Lau-Tonga: Concentrate on sites LG 2, 6, 3, 7, and 1.

4. **SSP:** During review of the programs in WPAC's 3rd prospectus "a startling number of unanswered questions arose". This is because virtually no data has reached the databank except Nankai and the Bonins. A full set of site survey matrices for all programs will be included in the final SSP minutes.

5. **DMP:** Specific logging recommendations for most of the WPAC sites have been listed by DMP in its Nov.86 meeting minutes. An excerpt is attached, see pp. 67-70.

6. **PCOM:** At the April PCOM meeting watchdogs where assigned to the 12 WPAC programs. Most of the PCOM watchdogs have prepared short written summaries outlining the strong and weak points of the WPAC programs. The summaries are attached, see pp. 107-132.

7. **CLEARANCE ISSUES:** PCOM should be aware that getting clearances in this part of the world might be more difficult than elsewhere; this is of topmost priority as clearance problems have the potential to jeopardize long-term planning efforts. PCOM might discuss strategies for this challenge, for example: in April 1986 EXCOM considered the concept of having one person at TAMU or JOI, who would exclusively handling clearance issues (see p.106). **If considered appropriate PCOM may forward a recommendation to EXCOM.**

Item J: Western Pacific Planning (continued)

PCOM IS ASKED TO:

1. **DISCUSS THE MERITS OF THE WELL PREPARED PRELIMINARY DRILLING SCHEDULE WHICH IS BASED ON THE 9 TOP RANKING PROGRAMS.** (This could be done on a leg-by-leg basis, taking advantage of the assigned "watchdogs").

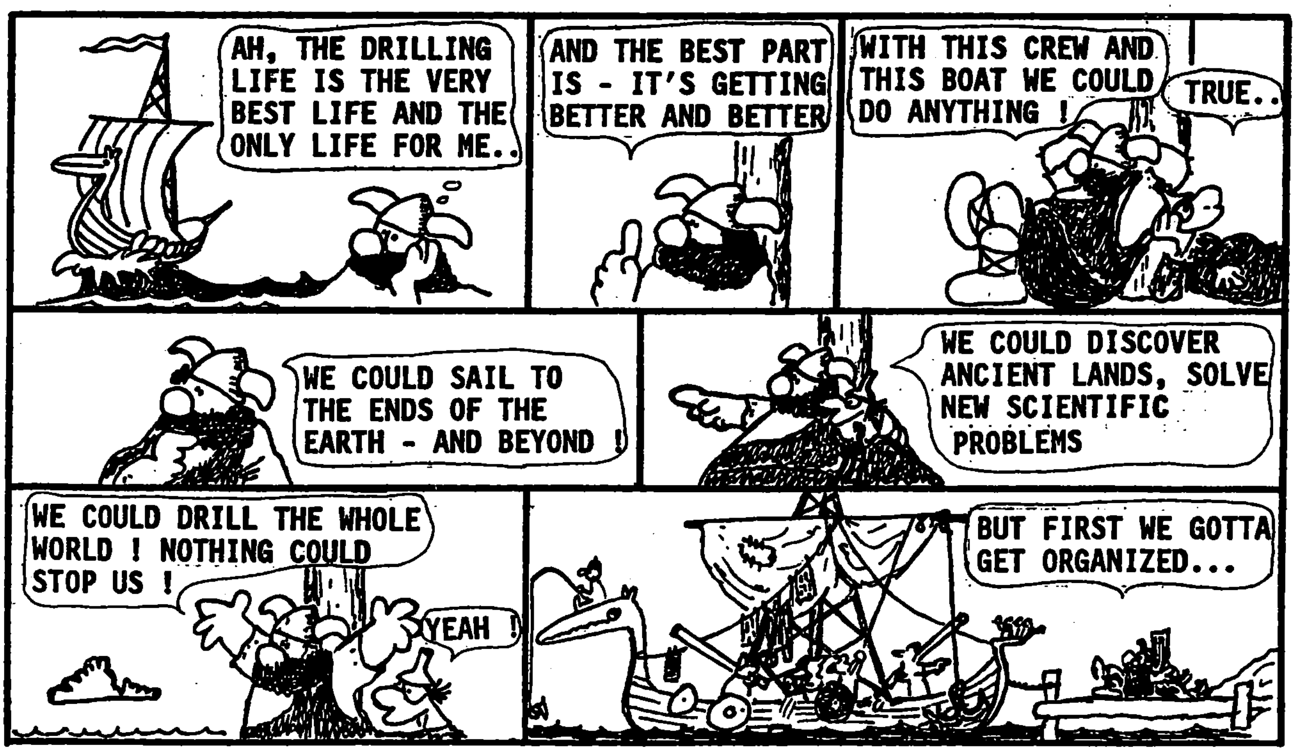
2. **DEFINE THOSE LEGS OR PROGRAMS WHICH MIGHT NEED ADDITIONAL WORK, CHANGES IN COMPOSITION, SITE SELECTION, ETC.**

3. **CONSIDER WHETHER THERE SHOULD BE AN ALTERNATE PLAN FOR EACH PARTICULAR LEG IN ORDER TO AVOID LAST-MINUTE PROBLEM SOLVING WHEN CLEARANCES ARE NOT OBTAINED.**

4. **BEGIN TO CONSIDER WHICH PROGRAMS/LEGS SHOULD BE INCLUDED IN THE WPAC PROGRAM, SPECIFICALLY THE FY89 DRILLING PROGRAM.** (Note: PCOM is reminded that at next meeting a formal FY89 science plan has to be finalized.)

5. **PROMOTE THE CLEARANCE ISSUE TO AVOID MARGINAL SEA WHIRLPOOL SITUATIONS.**

6. **CONSIDER INSERTING CEPAC PROGRAMS/LEGS INTO THE WPAC SCHEDULE** as shown in the preliminary schedule on the following page. Important questions include: how many, which ones, & when/where ?



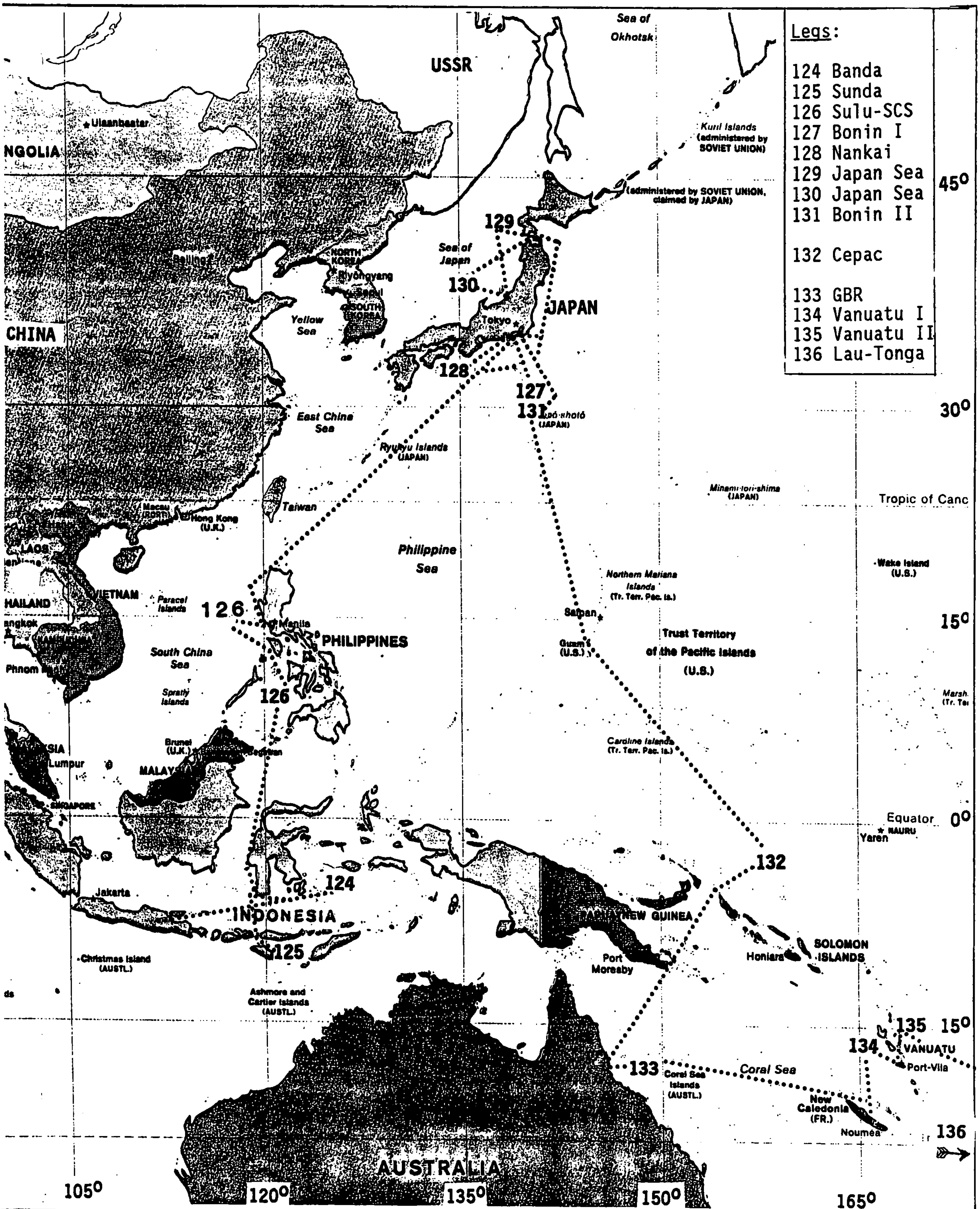
PRELIMINARY SCHEDULE FOR DRILLING IN THE WESTERN PACIFIC AS WORKED OUT BY WPAC AT THEIR LAST MEETING IN TOKYO, 2-4 MARCH 1987

[Leg numbers have been added tentatively]

Months	Leg	Program (Sites)	Starting Port	Drill &log	Trans	TIME[d] Total
Oct88 - Nov	124	Banda (1-3)	Jakarta/Sur.	33	7	40
Nov88 - Jan89	125	Sunda	Ujung-Padang	50	6	56
Jan - Mar	126	Sulu(4,5)-SCS(5,9)	Ujung-P.	27&15	7	49
March	Drydock/Transit to Japan		Manila			
Apr - May	127	Bonin I (1,2,5A&B)	Yokohama	51	4	55
Jun - Jul	128	Nankai (1,2)	Yokohama	53	3	56
Aug - Sep	129	Japan Sea I (1b,d,e,3a)	Hakodate	48	6	54
Oct	130	Japan Sea II (2a,JS-2)	Niigata	25	5	30
Nov - Dec89	131	Bonin II (6,7,8)	Yokohama	44	7	51
Jan90 - Feb	132	CEPAC	Guam			56
Mar - Apr	133	GBR (1-5,9,10,12)	Cairns	50	6	56
May - Jun	134	Vanuatu I (DEZ 1-5)	Noumea	37	2	39
Jun - Jul	135	Vanuatu II(IAB1&2,BAT2)	Port Vila	34	4	38
Aug - Sep90	136	Lau-Tonga (2,3,6,7,1/4)	Suva Pago-Pago	52	4	56

Note: Portcalls between legs are estimated to be 5 days long;

WESTERN PACIFIC TENTATIVE SCHEDULE:



Legs:

124 Banda
125 Sunda
126 Sulu-SCS
127 Bonin I
128 Nankai
129 Japan Sea
130 Japan Sea
131 Bonin II

132 Cepac

133 GBR
134 Vanuatu I
135 Vanuatu II
136 Lau-Tonga

Item J: Western Pacific Planning (continued)

<u>REMARKS TO THE PROGRAMS OF WPAC's 3rd PROSPECTUS:</u>
(Programs in alphabetical order)

BANDA-SULU-SCS BASIN:(see p.107) [Rank: TECP:5, SOHP:SCS=3,Sulu=4, LITHP:-]

TECP recommends adding Site SUL-8 in the Celebes Sea to get a more complete study of the small ocean basins in the Western Pacific.

SSP Comments:
- Banda: Impossible to assess without proper maps and sections.
- Sulu: Data coverage appears to be adequate if quality is OK (new SONNE survey data). SONNE data is needed in the databank.
- SCS Basin: Quality and coverage not known.

Because this drilling package is early on the WPAC schedule, full review must be held at the SSP meeting planned for January 88.

The HMS DARWIN will be transiting Banda Sea in Feb. 88 and might do a small amount of opportunity site work (? too late ?).

BONINS: [Rank: TECP: 1, SOHP: BON-6 important, LITHP: Bonin I= 1, Bonin II= 3, Geochemical Reference site= 5]

Presently two legs are proposed (Bonin transect).

TECP recommends reinstating the serpentinite diapir Sites MAR-2 and -3, which have been dropped from this program.

LITHP recommends drilling geochemical reference holes (1 deep BON-8 and 2 shallow MARiana sites = 1 full leg). LITHP also prefers to drill ridge basement over serpentine diapir at Site BON-7. These recommendations require either changes in the program or additional time (3rd leg plus...).

All site survey data needed are collected or being collected this summer. (There is some confusion about the correct location of Site BON-8.)

GREAT BARRIER REEF (GBR):(see p.111) [Rank: TECP:-, SOHP: 1, LITHP:-]

SOHP's 1st priority ! Prime sites: NEA-1, -5, -8, -9, -12. The panel doesn't support shifting some NEA sites to fit requirements of the MVT-ore deposit proposal. Site selection of both proposals is not well compatible, with the exception of site NEA-12.

SSP Comments: This proposal is totally inadequate in present form. Most seismic data are not processed, or not adequately processed, for ODP drilling objectives. No seismic base map worth using was provided. This proposal needs to be revised before SSP can seriously consider reviewing it again (see SSP minutes for details, pp. xx-xx). Acquisition of water gun profiles is recommended. Note: An Australian MCS cruise is planned for summer/fall 1987.

Item J: Western Pacific Planning (continued)

<u>JAPAN SEA</u>:(see p.113) [Rank: TECP: 3, SOHP: 2, LITHP: 4]

LITHP recommends relocating Site J-2a to the edge of the basin to achieve more basement penetration; and to consider deploying mini-cones at J-1e and J-1d to enable up to 100m basement penetration.

SSP: Outstanding requirements:
J-1b (re-entry) a geotechnical core
J-1d Crossing seismic lines (planned in 88)
J-1e Crossing seismic lines (planned in 88)
J-3a Side Scan or Sea Beam
JS-2 High resolution SCS unless existing SCS can be shown to be adequate for site objectives.

<u>LAU-TONGA</u>:(see p.117) [Rank: TECP: 8, SOHP:-, LITHP: 2]

LITHP recommends focusing on fewer sites, and ranked the sites as follows:
- 1st priority (in rank order): LG2,LG6,LG3,LG7 and LG1 (re-entry, test for young crustal drilling);
- 2nd priority: LG4,LG5 (Valu Fa Ridge; Note the discovery of hydrothermal fields on Valu Fa Ridge during the recent SONNE cruise SO-48).

SSP Comments: The most critical site survey needs are a digital high resolution SCS line along lat 18°45'S (Sites LG1, LG2, LG7) and site scan sonar survey of the same area (for details see p. --).

The HMS DARWIN might be in this area in October 1988. A French/German diving program to Valu Fa Ridge is planned for 1989.

<u>NANKAI</u>: [Rank: TECP:2 (Geotech:7), SOHP:-, LITHP:-]

TECP reiterates its support for the geotechnical program at Nankai, whether it needs a separate hole or not.

DMP recommends placing a temperature array in NK-2 or a physical properties hole, if this will be approved. New tools have to be developed in order to successfully address this program. PCOM should tackle this problem in time (now). Which (new) tools are needed? What comments can DMP offer?

SSP Comments: There is a possible BSR problem at NKT-2 which will remain unsolved until a new crossing line is examined.

<u>SCS MARGIN</u>: [Rank: TECP: 10, SOHP: 5, LITHP:-] (p. 125)

SOHP and TECP reconsidered this program but didn't change their rankings.

Item J: Western Pacific Planning (continued)

SUNDA:(see p.127) [Rank: TECP: 9, SOHP:-, LITHP:-]

TECP has asked for better justification/relocation of the S-sites (S-1, S-2, S-3) in order to better address collision processes. As E.Silver is conducting a site survey cruise in October, PCOM's recommendation/decision on this issue would be helpful/needed.

SSP had no information beyond the 3rd prospectus. A fully documented data package is needed ASAP after Silver's Oct.87 cruise is completed. Because of the early position of this program on the (present) schedule the data package must be prepared **before** all seismic processing of new data is completed (96 channel data).

VANUATU: [Rank: TECP: 6, SOHP:-, LITHP:-]

SSP Comments:
- Site IAB-2: migration needed (expected in early 88);
- Site BAT-2: seems to be bare rock (basalt ?);
- Sites DEZ 1, 3, 5: **all may be positioned on bare rock** (basement or hard carbonates); existence of soft sediment for spudding in has yet to be demonstrated.
- Sites DEZ 2, 4: good velocity control desirable but hard to get.

A diving cruise is planned and may resolve some of these questions. Sites IAB-1, BAT-2b, DEZ 2 & 4 appear to be OK.

ZENISU: (see p.131)[Rank: TECP: 11, SOHP:-, LITHP:-]

TECP recommends adding an abbreviated program consisting of sites ZEN-1 and ZEN-3 to the approved plan for WPAC drilling.

SSP Comments: A new site survey has just been completed. Data will be reviewed as soon as an updated drilling proposal is available.

THEMATIC PANEL RANKINGS OF WPAC PROGRAMS

LITHP	TECP	SOHP
1. Bonin I	1. Bonin transect	1. Great Barrier R.
2. Lau Basin	2. Nankai Trough	2. Japan Sea
3. Bonin II	3. Japan Sea	3. SCS Basin
4. Japan Sea	4. Bonin-Marianas	4. Sulu Sea
5. Reference Sites	5. Banda-Sulu-SCS Basins	5. SCS Margin
	6. Vanuatu	
	7. -Nankai Geotech -Lau Basin	
	9. Sunda	

ITEM K: CENTRAL & EASTERN PACIFIC PLANNING

A first prospectus for drilling in the Central & Eastern Pacific is presently being prepared and will be ready after the CEPAC meeting in late September 87.

A summary of the priorities from the three thematic panels follow below. All three panels expressed concern about the tight timeframe of CEPAC drilling (18 months).

SOHP:

(see p.221ff for details)

Prioritized themes and the relevant proposals are listed below. SOHP ranked these proposals as to their thematic importance and preparational status; this ranking is given behind the proposal. Also indicated are those proposals which are considered in CEPAC's prospectus outline (marked X), prepared at CEPAC's March 87 meeting (see p.20):

Priority/Theme	Proposals	[Rank]	Prospectus
1. Pac Neogene Paleoenvironment	a. Eq.Pacific 221E	[1.]	
	b. OJP (trans) 142E	[4.]	X
	c. NE Pac transect 247E	[8.]	
	d. Calif. margin 271E	[10.]	
	e. S-Pac	[16.]	
2. Mesozoic-Paleogene Pac Paleoceanography	a. Bering Sea 182E,195E	[2.]	X
	b. N-Pac gyre 199E	[7.]	X
	c. Ogasawara 260D	[10.]	
	d. some N-Pac atolls		
3. Old Pacific	a. Old Pac crust 261E	[3.]	X
4. Anoxic events	a. Shatsky Rise 253E	[5.]	X
5. Atolls & guyots	a. Marshalls 202E	[10.]	X
	b. Ogasawara 260D	[10.]	
	c. Pac guyots 203E	[14.]	X
6. Fans & sed processes	a. Navy Fan 250E	[6.]	
	b. Zodiak Fan 241E	-	
	c. Monterey Fan	-	

Item K: Central & Eastern Pacific Planning (continued)

TECP:

Summarized below are thematic topics (mature high-priority) for the CEPAC area, as discussed in TECP's White Paper (attached, p.147-160) and minutes from the last meeting (attached, p.133-146). An X indicates proposals, which are included in CEPAC's prospectus outline (p.20):

HIGH-PRIORITY THEMES	PROPOSALS	PROSPECTUS
I. PLATE KINETICS:		
A. Calibration of the reversal time-scale	M-series anomalies & anomaly 1-34	
B. Kinematics for times lacking magn. lineations		
B1. Cretaceous quiet zone	231/E	X
	Liliuokalani Ridge	
B2. Jurassic quiet zone	261/E	X
	285/E (just received)	
C. Short-scale variab. in plate-mantle motion recorded by hotspot traces	Louisville Ridge French Polyn. chains Hawaii-Emperor chain Gulf of Alaska chain	
D. Pre-70 Ma hotspot traces	203/E	X
	280/E Wilde, Majuro, Allison or Menard guyots;	
	Sites HAR-1,2,3 in 202/E .	X
E. Absolute subduction rate for intervals of 105 years	Aleutian Trench	
II. Arc magmatism and its relation to the composition of the descending plate	Marianas Bonins E.Aleutian	
III. Ridge-Trench interactions	? Chili T-junction ?	
IV. Deformation deep in accretionary prisms	273/E (site more upslope) .	X
V. Flexure of the oceanic lithosphere		

immature: VI. Oceanic plateaus & aseismic ridges
VII. Structures in oceanic crust

Item K: Central & Eastern Pacific Planning (continued)

LITHP:

The panel developed a White Paper (attached, p.179-205, see especially **p.204**), which served as a basis for evaluating particular proposals (see minutes p.169-176). Below you see a combination of thematic topics and the ranking of proposals as done by LITHP (see **minutes p.176** for details).

THEMATIC OBJECTIVE	LOCATION/PROPOSAL	[RANK *] [CATEGORY]	CEPAC PROSPECTUS
Young oceanic rifts	Manzanillo r. (275E)	[4]	
Fast & slow spreading ridges	EPR (76E)	[1]	X
	Explorer Ridge (263E)	[4]	
Sedimented ridge crest hydrothermal system	JdF (232E)	[1]	X
	Escanaba Trough (224E)	[2]	
	Guayamas (275E)	[2]	
	Galapagos stockw.(258E)	[4]	
Deep crustal hole into layer 3	Site 504B,	[1]	
Near-axis seamounts; hotspots	at EPR (279E)	?	
	Loihi Seamount (252E)	[1]	X
	Atolls ..(202 & 203E)	[3]	(XX)
Flexural moat	Hawaiian flexure (3E)	[2]	
	Marquesas		
Oceanic Plateaus	OJP (248E)	[3] . . .	X
	Shatsky Rise (253E)	-- . . .	X
Old oceanic crust	Nauru Basin (261E)	[2] . . .	X
	(Magn.quiet zone (231E)	[3] . . .	X
Intraoceanic convergent margin transect (& reference holes)	Izu-Bonin	?WPAC	
	Tonga-Kermadec	--	
	Aleutian Arc	--	
[FZ drilling	No Pacific location recommended]		

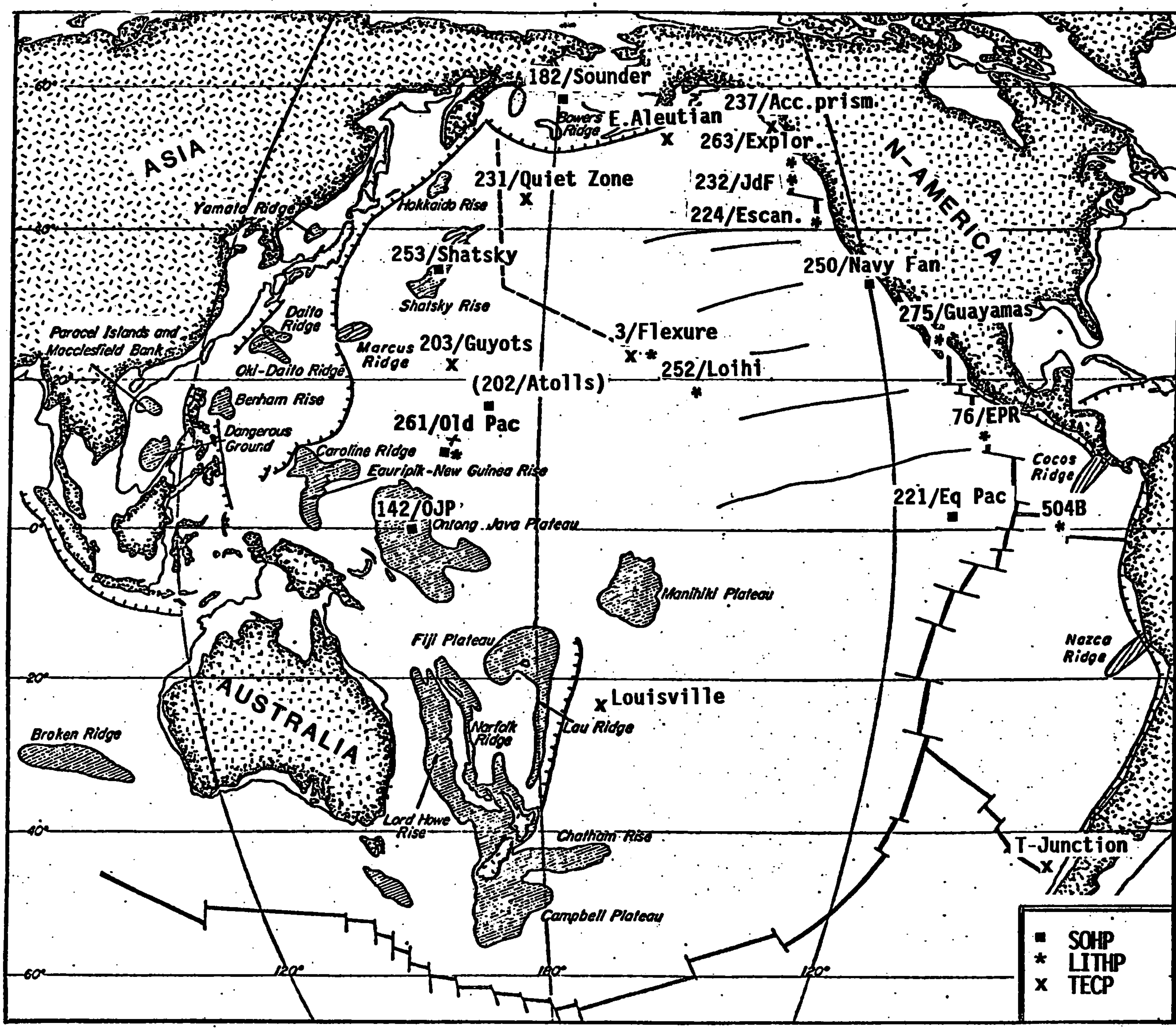
* Top-ranked proposals are underlined

Item K: Central & Eastern Pacific Planning (continued)

FIRST OUTLINE OF A CEPAC PROSPECTUS

(As defined at the 30-31 March 87 CEPAC Meeting)

PROGRAM	PROPOSAL	COMMENTS
- Juan de Fuca	232/E	ca.1 leg
- EPR 13°N	76/E	several legs
- Guyots (Cret.) & drowned atolls	203/E 202/E	ca.2 legs
- Old Pacific	261/E	ca.1 leg
- Ontong Java Plateau	142/E 222/E	ca.2 legs
- North Pac	199/E 231/E 259/E	undetermined
- Bering Sea	195/E 182/E 225/E	undetermined
- Young midplate hotspot volcanism	252/E	proposals expected
- Cascadia convergent margin	233/E 237/E	
- Shatsky Rise	253/E	ca. 1 leg



SOHP:

1) 221/Eq Pac
2) 182/Sounder
3) 261/Old Pac
4) 142/OJP
5) 253/Shatsky
6) 250/Navy Fan
.
.
10) 202/Atolls

LITHP:

1:
232/JdF sedim
252/Loihi.
76/EPR
Site 504B

2:
275/Guaymas
3/Hawaii Flex.
224/Escanaba Tr
261/Old Pac

TECP:
(Examples)

231/Cret Quiet Z.
261/Jur Quiet Z.
Louisville Ridge
203/>70 Ma Hotspot
Aleutian (Subduct. rate; arc geochem)
?Chile (Ridge-Trench)
237/Accret Prism
3/Lith Flexure

Note: TECP didn't rank proposals but listed examples

ITEM L: EVALUATION OF ODP ADVISORY STRUCTURE

At the August PCOM meeting it was decided to begin a review of the ODP advisory structure. One issue is whether there is unnecessary duplication of work by having two sets of panels, thematic panels and regional panels, both reviewing the same proposals and both developing their own priorities. In a program that considers itself as being thematically driven, priorities should ultimately be set by thematic considerations.

The thematic panels were asked to present their views on this matter. Below are their first responses:

SOHP: Cannot respond before its next meeting in August 87.

TECP: The advisory system is working fine (see p.146).

LITHP: (see p.177-178)

The program still has a regional focus. Some constraining factors are seen in:

- Having regional panels write regional prospectuses instead of thematic panels writing global ones;
- Having no mechanism to ensure a thematically balanced PCOM membership;
- Having arbitrary constraints like "two circumnavigations .." within a certain timeframe;

Constructive remarks:

1. The idea, a priori, of a 2nd circumnavigation be dropped.
2. Thematic panels be asked to develop a ca. 12 leg global drilling prospectus (details p.178) for a 5 year drilling program.

COSOD II:

There were some comments at COSOD II to the effect that changes were desired in the advisory structure of ODP, however no specifics were mentioned. As many of the PCOM members attended the conference, somebody might have picked up some enlightening background on this issue? M.Kastner may report on recommendations from the COSOD II Steering Committee.

The bottom line is: Can PCOM better formalize how panels should evaluate proposals? A basic **outline** is attached (p.269-270), which illustrates how to direct the advisory panels toward a more thematically focussed process.

PCOM IS ASKED TO:

1. DISCUSS THE MERITS OF THE PRESENT ADVISORY STRUCTURE;
2. CONSIDER WHETHER SUGGESTED CHANGES MIGHT BE AN IMPROVEMENT;
3. DISCUSS POSSIBLE CHANGES IN LIGHT OF COSOD II RESULTS WITH AN EYE TOWARD LONG-TERM REQUIREMENTS & RECOMMENDATIONS.

ITEM M: PUBLICATIONS AND IHP REPORT

Publications is one area where budget cuts were agreed upon by PCOM and EXCOM during their last meetings.

Presently, Tom Pyle (JOI, Inc.) is investigating the possibility of publishing the Proceedings volumes through an outside publisher, such as AGU. Some definite numbers will be available at the meeting.

IHP will discuss the publication issue in detail at its 3-6 August meeting. Their recommendations will be available at the PCOM meeting.

PCOM IS ASKED TO:

1. **RECOGNIZE IHP's RECOMMENDATIONS WITH REGARD TO THE PUBLICATIONS ISSUE, WHICH WILL BE PRESENTED AT THE PCOM MEETING.**

2. **DISCUSS THE ESSENTIALS OF ODP PUBLICATIONS.**

ITEM N: PANEL MEMBERSHIP

1. ARP:	Rotating off:	K.Klitgord (Woods Hole)
	Nominations:	J.Karson (Duke University) J.Fox (URI) H.Dick (Woods Hole)
2. DMP:	Rotating off:	F.Sayles (Woods Hole) M.Salisbury (Dalhousie) 1 open slot
	Nominations:	to be presented at meeting
3. LITHP:	Rotating off:	J.Sinton (Hawaii) J.Delaney (Washington)
	Nominations:	L.Cathles (Cornell) N.Sleep (Stanford) J.Karston (Washington)
4. TEDCOM:	Resigned:	D.Wilson (Chevron)
	Nomination:	W.Lowe (Chevron)

ITEM O: OTHER BUSINESS

1. <u>7th Micropaleontology Reference Collection</u>

At key locations around the world, DSDP and ODP have established micropaleontological reference collections to provide easy access to this material for paleontologists.

The JOIDES Office has received a request from Dalhousie University (M.Salisbury), Canada, volunteering to house the seventh collection, which seems to still be available at TAMU.

This issue has been forwarded to IHP for consideration. Recommendations will be available after their meeting in early August.

PCOM IS ASKED TO:

1. CONSIDER CANADA'S REQUEST TO HOUSE THE 7TH MICROPALEONTOLOGICAL REFERENCE COLLECTION AND MAKE A RECOMMENDATION TO EXCOM.

---

2. <u>New ODP Sediment Classification</u>

In May, 1987 recommendations made by von Rad and Schmincke regarding volcaniclastic sediment classification were forwarded to TAMU and SOHP for review. SOHP will review these recommendations at their August 87 meeting and their comments will be available at the November 1987 meeting.

3. <u>Chairman for Annual Panel Chairmen's Meeting</u>

A chairman for the upcoming Annual Panel Chairmen's meeting in late November is needed. PCOM should do this early enough so that a Chairman can make adequate preparations. The JOIDES Office suggests Darrel Cowan (TECP) as an excellent candidate.

PCOM IS ASKED TO:

1. NAME A CHAIRMAN FOR THE UPCOMING ANNUAL PANEL CHAIRMEN'S MEETING.

Item O: Other Business (continued)

4. DMP Recommendations

DMP forwarded several recommendations from its April 87 meeting (for details see minutes, p.71-83):

1. VSP should not be a routine experiment on the ODP drill ship;
2. Whenever possible logging through pipe with geochem/neutron combination should be routinely carried out;
3. A more realistic definition of what is an acceptable level of risk to the drillstring should be defined.
4. Side entry sub should be used to make a dedicated comparison of nuclear logs in pipe and in open hole.

5. Site Survey Scientists

SSP recommends that scientists chiefly responsible for site surveys for ODP legs (and were not member of the shipboard party) should normally be invited to post-cruise meetings, have access to cruise data and be encouraged to submit papers on their work to the ODP Proceedings, Part A. Interpretations of survey data in light of drilling results should be included in Part B (see p.87).

ITEM P: NEXT MEETING

The next PCOM meeting will be held at Sunriver, Oregon from 30 November - 4 December 1987. This will be the Annual Meeting and PCOM will meet in conjunction with the Panel Chairmen. Brochures outlining the facilities at Sunriver will be made available at the August meeting.

JOIDES PLANNING COMMITTEE MEETING
10-12 April 1987
Washington, DC

MEETING MINUTES

Members:

N.Pisias (Chairman) - Oregon State University
H.Beiersdorf - Federal Republic of Germany
G.Brass - University of Miami
W.Coulbourn - University of Hawaii
T.Davies (for T.Shipley) - University of Texas
O.Eldholm - ESF Consortium
J.Francheteau (for J.P.Cadet) - France
T.Francis - United Kingdom
S.Gartner - Texas A&M University
M.Kastner - Scripps Institution of Oceanography
M.Langseth - Lamont-Doherty Geological Observatory
R.Larson - University of Rhode Island
R.McDuff - University of Washington
P.Robinson - Canada
D.Ross - Woods Hole Oceanographic Institution
A.Taira - Japan

Liaisons:

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

Guests / Observers:

R.Anderson - Wireline Logging Services (ODP/LDGO)
P.Barker - Leg 113 Co-Chief Scientist
D.Fisher - NSF/OCE
X.Golovchenko - Borehole Research Group (LDGO)
D.Heinrichs - NSF
G.Leonard Johnson - Office of Naval Research
A.Sutherland - NSF
H.Zimmerman - NSF

JOI, Inc.:

E.Kappel
R.Smith

JOIDES Office:

S.Stambaugh
M.Wiedicke

10 April 1987

647 INTRODUCTIONS AND OPENING REMARKS

N.Pisias, Chairman, opened the meeting by displaying a viewgraph, the moral of which was that cooperativeness and assertiveness can lead ideally to consensus.

Pisias then introduced M.Langseth, new Planning Committee member from Lamont-Doherty and D.Ross, new member from Woods Hole Oceanographic Institution. PCOM alternates J.Francheteau (for J.P. Cadet, France) and T.Davies (for T.Shipley, U.Texas) were welcomed.

Also introduced were Dr.Peter Barker (U.Birmingham), Leg 113 co-chief scientist, Dr. Xenia Golovchenko (Borehole Research Group, LDGO), and A.Sutherland, Darlene Fisher and Herman Zimmerman, all at the National Science Foundation. Doris Rucker of JOI,Inc. provided logistics details; Pisias then thanked local host, Tom Pyle (JOI).

648 ADOPTION OF MEETING AGENDA

Pisias explained that the agenda item on a possible change in PCOM's Term of Reference had been added at the request of the NSF for consideration by EXCOM at its next meeting. No further additions to the agenda were requested by PCOM.

<u>PCOM Motion:</u>

> The agenda for the 10-12 April 1987 Planning Committee meeting as presented is hereby adopted. (Motion Brass, second Kastner)

Vote: 16 for, 0 against, 0 abstain

649 APPROVAL OF PCOM MINUTES

G.Brass asked that the previous minutes reflect his concerns about vertical seismic profiling during P.Worthington's presentation for the DMP. As PCOM discussed VSP at this meeting, Brass later indicated that amending the minutes would not be necessary.

<u>PCOM Motion:</u>

> PCOM approves the minutes of the 19-25 January Annual Meeting. (Motion Brass, second Kastner)

Vote: 16 for, 0 against, 0 abstain

650 BCOM REPORT

G.Brass, PCOM representative to the Budget Committee (BCOM) along with N.Pisias, opened the report. At its 25 February meeting, BCOM examined the draft FY88 budget to make sure that PCOM's scientific plans could be accomplished within the base budget. BCOM determined that to achieve the COSOD goals of drilling beyond temperate/tropic climates, special operations (e.g. ice support) should not be considered "enhancements." BCOM attempted to bring down the FY88 standard operating budget $1 - $1.25M lower than the target figure ($35.5M). BCOM agreed that any planned special operations should be included in that figure as "planned shortfalls". For PCOM's scientific planning, BCOM agrees that there may be years in which no special operations (e.g. high latitude drilling) are possible when other standard operations are necessary (e.g. drillstring replacement).

Brass said that by the time EXCOM meets next (28-30 April), the reductions to the base budget should be established. Details on the proposed reductions are included in the JOI report.

N.Pisias, presented an estimate of special operations needed for the next four years (Appendix A). To achieve the science goals as set out by PCOM, about $1.25M per year is needed to support operations beyond normal drilling.

Discussion:

Pisias explained that BCOM would present the budget and describe the cuts at the next EXCOM meeting and that PCOM would now have to prioritize the cuts and provide recommendations for EXCOM. Final adoption of the FY88 budget will be delegated to BCOM.

651 NSF REPORT

FY88 BUDGET

R.Buffler reported for the NSF. Although the increase in the NSF FY88 budget for ODP was only 4%, recent budget hearings in Congress have been optimistic.

The $35.5M target figure will be guaranteed by NSF even without USSR participation ($20.5M from NSF, $15M from the six international partners). The delayed Soviet membership has impacted the FY87 budget: $130K for ice boat support on Leg 114 and extra funds for riser drilling engineering development ($36K) are identified FY87 cost overruns.

The settlement of a lawsuit between M&M Shipyards and UDI (SEDCO) for cost overruns on the ship conversion has resulted in a $681K payment to M&M; $200K was set aside in FY85 and the remaining $481K must come from FY87 funds (U.S. contribution only). An increase in day rates, triggered by a 2% increase in the price index, will require additional funds. Buffler estimated that $817K beyond the FY87 base budget will be required from the U.S. contribution.

USSR MEMBERSHIP

D.Heinrichs reported that the USSR is not yet an official member to ODP. He reviewed the history of the invitation to the Soviets, stating that the U.S. and international partners had explored the scientific, financial and political issues before issuing the invitation on October, 1985. At the October 1986 EXCOM meeting, V.Krashenninikov announced that the financing to join was in place.

The FY87 budget for ODP assumed the Soviet membership. In November 1986, the U.S. Office of Science and Technology Policy asked for a second review of the Soviet membership. Although the civilian agencies approve, Department of Defense strongly disagrees. The issues are being discussed at the National Security Council. The final decision on Soviet membership is due in about one month (not in time for the April EXCOM meeting).

[Note: At the 28-29 April EXCOM/ODP Council Meeting, a National Security Council statement announced that Soviet participation in the ODP was denied due to technology transfer issues.]

Discussion:

Heinrichs said that recent political events had made timing very bad for the Soviet membership. He hoped that the international partners would come forward to express the scientific merit of Soviet membership. R.Larson reminded PCOM that a similar budgetary shortfall had occurred when the United Kingdom membership was delayed in 1985. He heeded that the impact would be felt now; needed site surveys in the Pacific will suffer as NSF can only "raid" U.S. funds set aside for geophysical surveys. Heinrichs added that site surveys will not stop, but there may be fewer funds for shipboard services on them.

Regarding the Canadian/Australian joint subscription, NSF's latest news is that Australia has raised a 40% contribution through industry and academic participation and the venture has strong scientific support there.

652 JOI, INC. REPORT

T.Pyle opened the JOI,Inc. report with an update on COSOD II. As delays have occurred in notifying U.S. participants through Casey Moore, Pyle advised PCOM to informally notify known U.S participants of their selection. JOI will issue official notifications. The late timing will create problems with reservations, although JOI has set aside 50 airline reservations until 1 May.

FY88 BUDGET STATUS

Pyle presented the development of the FY88 base budget (Appendix B). The proposed total FY88 budget was $35.752M, and BCOM recommended a reduction to $35.5, which was to include significant adjustments to the base and enhancement budgets. The response of the subcontractors (total budget of $35.531M) included an unacceptable cut (no publication of Part B ODP Proceedings volumes). The current target figure of $35.511M requires that additional cuts be made.

Proposed enhancements, referred to as "special operating expenses" by BCOM, are:

Ice support vessel	$ 850K
Day rate increase	250K
Drilling supplies (for guidebase dev.)	158K
	$1.258M

Pyle presented the reductions submitted by the subcontractors to achieve the BCOM recommended budget of $35.5M. The JOI/JOIDES budget was cut by $200K, largely by staff reductions at JOI including the international project specialist position for a revised budget of about $1.521M (-$20K of BCOM figure).

LDGO responded with a $2.782M figure (an acceptable +$31K over BCOM's recommendations; the JOI/JOIDES budget can be cut an additional $20K over BCOM recommendations if necessary). The LDGO cuts were achieved by reducing the standard operating expenses in order to keep the third wireline packer on order.

Pyle showed a list representing JOI's proposed cuts to TAMU's FY88 budget (which appears in a slightly different format in Appendix C, in which two additional cuts suggested by PCOM are included.)

Pyle then presented a list of lab-specific proposed cuts to shipboard technical services (Appendix D).

Discussion:

J.Francheteau expressed strong support for the mining coring system, a proposed cut, as development has already been delayed. Pyle added that the reduction of shipboard services represented a "major impact on future science."

PCOM discussed the publications budget. Brass suggested that savings could be found by cutting the run of hard-back copies of the Part A volumes to 1000 and putting the remaining 1000 on microfiche. ODP participants and libraries would get their volumes, and the program could save $140K. He also suggested that subsequent press runs could be made on microfiche, but not on hard-back volumes, an added benefit. (Brass's recommendation was subsequently added to the proposed budget cut list which appears as Appendix C).

Robinson said that the base budget ought to reflect COSOD objectives and that basement drilling would further be postponed with the elimination of the Leg 118 guidebase. He suggested looking not just at the science operations, but at the TAMU headquarters budget as well. Pyle reported that the $1.7M TAMU administrative costs are not readily reducible from TAMU's standpoint.

L.Garrison explained that TAMU Research Foundation charges $200K to administer the project and that the remaining $1.7M administration budget is the direct charge ($1.5M). He said the program could not be administered for less and that science services represent cuts that can be made whether they are acceptable or not. He added that the 4% administrative cost for a $31M program is not unreasonable.

H.Beiersdorf said that it would be hard to justify cuts in zero-age crust and high-latitude drilling, as well as publications, a visible result of the program, to the German ODP participants. Kastner added that high-temperature drilling will continue to be a COSOD II priority.

N.Pisias reiterated that his list (Appendix A) is based on long-range program plans and that about $1.25M per year is necessary to carry out special operations.

T.Pyle said that BCOM had recommended that $0.5M of the total $1.5M TAMU administrative direct costs be cut, but did not specify where, as they had only the FY87 Program Plan as a guide.

L.Garrison gave additional information on the ice boat needed for Prydz Bay. The $850 figure is the maximum cost. But because it was a originally a budget enhancement, science services have to be reduced now by $850K. Some PCOM members felt that both Prydz Bay and the hard-rock guidebase had been on the science program long enough for TAMU to budget them in.

M.Kastner suggested that PCOM designate those budget items which should not be compromised.

The PCOM Chairman called a recess for the members to further discuss how PCOM should respond to EXCOM on the FY88 budget. After the recess, the following motion was forwarded:

<u>PCOM Motion:</u>

The Planning Committee affirms the proposition that the budget for standard operations should be approximately $1.25 million less than the base budget, with the remainder reserved for those "special operations" necessary to meet the goals of COSOD I when required. This sum may be applied to special one-time purchases in years when "special operations" are not scheduled. (Motion Brass, second Larson)

<u>Discussion:</u>

M.Langseth said the motion should not be fixed in FY87 budget terms and suggested an inflation factor be embedded in the motion. Brass added that the NSF budget includes inflation and that eventually the non-U.S. contributions will have to increase. R.Jarrard added that, for example, the LDGO FY88 budget included a 3% increase in Schlumberger rates and a 1% total budget increase; he said that TAMU faces similar increases.

D.Heinrichs reported that the NSF inflation factor for FY88 over FY87 was 4%. At the last EXCOM meeting, the FY87 Program Plan was supposed to have identified long range impacts. EXCOM and the ODP Council projected the $35.5M funding level based on the inflationary factor and the participation of the seventh international member; the figure represented real growth to the steady state program. With one fewer international partner, PCOM should now advise EXCOM on requirements for a long-range program constrained by the $35.5M figure.

Brass reviewed budget definitions: "special operations" refer to occasional high-expense legs (hard-rock, high-latitude, e.g.); "standard operations" refer to standard legs in temperate regions; "special one-time purchases" refer to clear, one-shot costs (drillstring replacement, e.g).

PCOM discussed the need for special operations for certain COSOD objectives. M.Langseth pointed out that the envisioned goals of ODP, not COSOD, should be addressed in the motion, and Robinson added that ODP had defined new goals since DSDP and COSOD I. Brass said that TAMU must state their one-time expenses, such as drillstring replacement, to PCOM so they can be incorporated in future program plans.

S.Gartner recommended that a percentage factor rather than a set amount per year be set aside from the base budget to be used for special operations, and the following amended motion was forwarded:

PCOM Motion:

The Planning Committee affirms the proposition that the budget for standard operations should be approximately 96% of the base budget, with the remaining 4% reserved for those "special operations" necessary to meet the goals of the ODP program. This sum may be applied to special one-time purchases in years when "special operations" are not scheduled. (Motion Gartner, second Kastner)

Vote: 15 for, 0 against, 1 abstain

A second motion was then forwarded:

PCOM Motion:

The standard operations budget must include the on-going development of systems essential for the achievement of the goals of COSOD I. (Motion Brass, second Robinson)

Vote: 16 for, 0 against, 0 abstain

After some discussion, a third motion was forwarded:

PCOM Motion:

The Planning Committee supports the Budget Committee's recommendations that TAMU's budget cuts should seriously consider substantial reductions in the headquarters budget. TAMU's proposed FY88 budget cuts, essentially in the science costs, are not supported by the Planning Committee. (Motion Kastner, second Robinson)

Discussion:

Robinson said that TAMU's suggested budget cuts (staff scientists, computers, publications) were the most sensitive to the scientific community. Garrison responded that the TAMU Research Foundation requires the budgeted amount to run the program and suggested that PCOM request an audit if not satisfied with the figure. The program could not be run on one-third of the FY88 headquarters budget.

Brass, for BCOM, said that the recommendation was made on very little information from TAMU and if such a cut were detrimental to headquarters, then TAMU should specify what would be lost. Pisias added that some BCOM members were administrators of large programs and thought the $1.7M figure was a large one. BCOM wanted feedback on the cuts that it had suggested. Brass added that LDGO explained the cuts to its budget for BCOM, and although they were not those recommended by BCOM, they were found acceptable. T.Pyle hastened to add that an audit of the TAMU budget would not be possible before the April EXCOM meeting.

A vote was called on the motion with the following results:

Vote: 14 for, 1 against, 0 abstain

The Chairman proposed that PCOM review the FY88 science program before giving JOI specific input on the suggested cuts to the budget.

653 SCIENCE OPERATOR REPORT

LEG 114 REPORT

L.Garrison reported for TAMU.

The JOIDES RESOLUTION departed the Falkland Islands two-and-one-half days early as the fuel tanker was delayed, and therefore had time to rotary core the SA5 site to basement. Recovery in the weathered basalt was about 20%; chert and ice-rafted gravels were encountered.

A refueling operation out of S.Georgia Island was successfully carried out using the MAERSK MASTER as a fuel barge with a minimal delay to drilling operations.

The SA2 site was drilled to 518 mbsf but drilling was slowed by the core barrel jamming due to the granitic gravel and quartz-rich sand at the site. The ship was currently on the SA3 site, where sands were continuing to jam the hole.

NAVIDRILL TESTING

The first Navidrill was lost while testing the latching mechanism. The Navidrill was dropped down a length of pipe long enough to achieve terminal velocity. The latch sheared and both the Navidrill and a mud motor were lost. The back-up tool will be tested, using the sand line to lower it, at SA3. T.Francis made note that the tool was very important for the Kerguelen drilling and expressed his concern. Garrison said that Frederic Young, the engineer for the Navidrill was addressing the latching problem, and that his participation on the project and Leg 114 had been very welcome.

FUTURE LEGS

Staffing for Legs 115 is completed, and invitations issued for Legs 116 and 117, pending the decision on the 90°E Ridge site on 116.

ANNUAL CO-CHIEFS MEETING

Program suggestions resulting from the 26-27 March meeting of the Leg 108-112 co-chiefs included:

- Shipboard labs development, possibly with an ODP scientist to coordinate the labs and use of downhole tools.

- Improvements to the 3kHz seismic system.

- A second on-board freeze dryer.

- Better orientation for first-time co-chiefs and more information on shipboard structure.

- Nomination of co-chiefs 12 months before a cruise; reimbursement of U.S. co-chiefs with USSAC funds sooner post-cruise.

- An additional cryogenic magnetometer.

PCOM members who had been aboard the RESOLUTION also recommended that the food be improved, with the specific suggestion of less salt forwarded by G.Brass. M.Kastner also recommended that a second microbalance be added onboard.

LEG 113 REPORT

Dr.Peter Barker, co-chief with Dr.James Kennett, gave the report. Four areas were drilled on Leg 113, to study the Cenozoic evolution of the Antarctic water masses and continental glaciation: the Maud Rise depth transect (689, 690), the E.Antarctic margin (691-693), the central Weddell Basin (694) and the eastern South Orkney margin (695-697). Every site was drilled, but not always to the depths hoped. Barker believed the results would be valuable for planning Legs 119 and 120.

Problems were encountered with XCB failure in five holes while drilling alternating hard/soft lithologies, and the absence of carbonates at even the shallow sites during the Neogene would limit isotopic studies. However, Maud Rise had provided an excellent high-latitude biostratigraphic reference section, 693 showed stages in E.Antarctic glaciation, 694 revealed the latest Miocene creation of an Antarctic Peninsula glaciation, and 695-697 provided a depth transect of rapidly-deposited Pliocene and Quaternary siliceous sections, permitting high-resolution studies of bottom-water production. An anticipated gas hydrate at 695 had been disproved by heatflow measurements, but the nature of the inverse-polarity BSR remained uncertain. Heavy iceberg concentrations were encountered at 694.

Barker ended his report by stating that a more complete section with a good terrigenous signal will be necessary on the Antarctic shelf to sort out a pre-glacial history of the area. He said the Prydz Bay drilling will be one of the few opportunities to contrain the pre-glacial into glacial events.

Discussion:

Barker discussed the logging results from Leg 113. PCOM had required that W4, W5 and W7 be logged, but the XCB failures at 694 and 695 (W5, W7) would have required tripping the drillstring. Bad hole conditions prevented logging on W8 and a logging tool was lost. The most completely logged hole was at Site 693A (one run).

Robinson asked how the Kerguelen legs would resolve questions on the Antarctic glaciation. Barker hoped that the lack of a Neogene into Paleogene carbonates was a "quirk of the Weddell Sea"; otherwise, perhaps only the Prydz Bay shelf sections would be shallow enough to preserve carbonates for paleotemperature and ice-volume assessment. Prydz Bay should also contain the late Cretaceous and Paleogene record of pre-glacial E.Antarctic climate missing in the Weddell Sea. The Kerguelen sections were thicker and the record should be more continuous: a Neogene northward migration of the Polar Front through the drill sites was predicted. The Mesozoic stratigraphic objectives and basement objectives were compatible.

Several PCOM members asked if the failure to reach basement reflectors on the leg was related to the planning of the leg or due to technical failures only. L.Garrison said that not enough contingency time was planned into the leg in order to maximize drilling time in the Weddell Sea. Garrison said that a report on the XCB failures would be included in the Leg 113 Preliminary Report.

Barker said that the ice boat not only "kept us in the hole", but also minimized speed reductions in conditions of fog, ice or darkness, keeping average speeds up to 10 knots, and was essential to the success of the leg. Barker did not advise using ice vessels for regional geophysical surveys during drilling, but considered that some station work close to the drill sites could be undertaken.

Barker responded to additional questions on the logging program. Only one run on Site 693 was tried because the GST tool was not working; logging through the pipe was not considered. Garrison explained that the Operations Manager had to keep the pipe in the hole without circulation and the hole was too unstable. He added that the ODP policy continues to be that all loggable holes deeper than 400 meters will be logged, including through the pipe.

R.Anderson, Director of the LDGO Borehole Research Group, said that the nuclear/electrical/sonic combo needs two runs, not one. Garrison responded that two or three runs are recognized as standard, and logging estimates take this into account.

L.Garrison described the very efficient logistics for the crew change in the Falklands and said ODP owed a debt of gratitude to the United Kingdom and its troops stationed there.

654 <u>WIRELINE LOGGING SERVICES REPORT</u>

R.Jarrard reported for the Borehole Research Group. He focused on the reliability of ODP (Leg 111) geochemical results, the Leg 113 results, and an overview of the downhole objectives in the Indian Ocean.

RELIABILITY OF ODP GEOCHEMICAL RESULTS

Jarrard presented data from a Conoco test well (100% recovery) from the same downhole geochemical suite that ODP uses and from subsequent XRF analysis.

Error analyses for both major and trace elements was presented, with high standard deviation on Uranium (U) of particular note. Schlumberger has developed a spectral stripping technique for U. The Borehole Research Group wanted to try similar analyses on ODP cores, and used young basalts from Site 395A to test its reliability programs. Accuracy on Fe and Ca is not as good as industry results, but Si and Al is comparable to industry. For Hole 504B, the accuracy of the geochemical combo was tested using an internal consistency approach: the gadolinium/titanium ratio was plotted relative to the chondritic ratio line to see how values down to the 2C dikes compared. The values obtained above the Layer 2B fault were skewed toward Ti depletion. Jarrard said that either the gadolinium values are bad or the Gd/Ti in cores is due to alteration effects. More rare-earth element analyses are needed to test these promising consistency approaches, Jarrard said.

In a similar approach, Mg/Ca was plotted against Al/Fe. The dikes at 2C plotted toward olivine enrichment and Layer 2B above the fault was skewed toward plagioclase enrichment. Jarrard noted that high porosity and fracturing could affect these results.

LEG 113 RESULTS

Jarrard reported that two holes, 693A and 696 had been logged (one run each). At Hole 693A, resistivity and porosity results showed a major unconformity at 410 mbsf. Jarrard suggested that given the poor recovery at the site, enhancement of the amplitude spectra may yield some evidence of cyclicity. An analog logging tool was lost at Site 696, where 50m of logs were obtained; the tool was scheduled to be replaced by a digital model on Leg 114. At 696, pipe was taken out from the bottom of the hole and logs run at the same time.

LEG 114 UPDATE

Logs at Site 700 looked good, although the digital sonic tool failed and the back-up analog tool was used.

LOGGING PROGRAM UPDATE

Jarrard presented graphs on holes lost for logging due to operations failures (e.g. core barrel or pipe sticking). A number of operations changes, especially in side-wall entry sub (SES) deployment, were effected through combined efforts of LDGO and TAMU (see Appendix E).

<u>Discussion:</u>

R.Anderson gave an update on logging program since the PEC report. Since Leg 107, only 76% of holes penetrating deeper than 400 meters have been logged compared to the previous 90%. Problems with open holes, stuck core barrels and circulation continue. Since Leg 107, 46% of the holes were logged with only the sonic and not the nuclear tool. Anderson said the Downhole Measurement Panel is very concerned with these results.

Solutions suggested by Anderson were to improve the XCB technology, to risk loss of the BHA more often and to log through the pipe. M.Langseth, DMP liaison, added that time is not budgeted for logging properly and asked for a review of the Indian Ocean program estimates.

INDIAN OCEAN LOGGING PROGRAM

Jarrard showed a table of logging tools/objectives slated for the Leg 115-123 program, compiled with input from the DMP (Appendix F). The standard Schlumberger tools alone are planned for the majority of the legs. Much logging is planned for the SWIR program, including borehole televiewer (BHTV), and vertical seismic profiling (VSP) is recommended for Legs 117, the Kerguelen legs and Leg 123. The televiewer work on the Indian Ocean legs is partially in support of a DMP goal to compile a world stress map (relative magnitudes and direction) which would considerably broaden the scope of logging in ODP.

Discussion:

Pisias said that the Indian Ocean drilling times included the extra downhole experiments; R.Anderson added that the hydrofrac test on Leg 123 would need a few extra days.

In response to concerns about DMP/LDGO directives for logging, Jarrard said that, in the past, logging had been neglected in the program planning. Liaisons have gone to the Indian Ocean and Western Pacific panel meetings, and logging is now being planned much earlier. Pisias added that SOHP is very positive about the Exmouth logging program. Francheteau said that the more science per hole the better, but PCOM should still direct decisions on the logging program. Pisias confirmed that the panels, then PCOM, should evaluate the plans.

R.Anderson mentioned that TAMU's new lockable flapper design should enable step-wise logging while drilling, so logging will not be delayed until the risky, deep parts of the hole. In conclusion, Anderson said that planning logging does not necessarily mean that it gets done and though the leg-oriented co-chiefs are not always to blame, he thinks a big change will be seen by shifting the logging to Science Operations. This shift of responsibilities has been done, and PCOM will wait to see positive effects.

655 INDIAN OCEAN PLANNING

The Chairman opened the discussion by reminding PCOM of the possible change in timing of the Kerguelen Program. R.Larson, member to the Kerguelen Working Group (KWG) then gave an overview of the 18-month Indian Ocean program, constrained, he said by both weather and budget decisions.

LEGS 119 AND 120 PLANNING

Larson said that the KWG had devised programs with and without Prydz Bay (Appendix G). Larson summarized the KWG objectives as follows:

- The latitudinal/meridianal transect for Neogene history;
- The Paleogene-Mesozoic paleoenvironment;
- The paleoceanographic depth transect;
- The Kerguelen basement objectives;

The basic difference in the program with or without Prydz Bay is to better address the evolution of E.Antarctic ice sheet. The alternate program includes a southern site off the Kerguelen Plateau as substitute for the Prydz Bay drilling. The Kerguelen basement sites were shifted to the south to increase the probability of reaching basement (Miocene basalts?).

The Prydz Bay drilling anchors the latitudinal transect and is a unique place to see the signal of glacial drainage from the E.Antarctic ice sheet. As 65% of all glacial ice is in the E.Antarctic ice sheet, it drives the glacial climate. The Science Operator has estimated a 30-40% chance of drilling the planned sites and of achieving the desired scientific results in Prydz Bay.

Weather constraints have impacted the planning of the leg. Larson presented a map of the ice sheet by season. The KWG has devised a general drilling program to optimize the entire Leg 119-120 program (Appendix G). Leg 119 was arranged to include the N.Kerguelen sites (KHP-1, KHP-3, possibly SKP-1 or other single-bit sites) and the Prydz Bay. SKP-6B was designated the alternative to the Prydz Bay sites. Leg 120 was constituted by SKP-1, SKP-2, SKP-3 and SKP-4A. The placement of the four shallow Prydz Bay sites take advantage of the shallow (4-5°) dipping section and to optimize drilling in the area. The site survey did not provide crossing lines and the PPSP has said there may be some problems.

Garrison said the ice boat would be contracted only if the Prydz Bay sites are scheduled. He felt the sites were a gamble of time and money, and that contracting the ice boat will have a long-term impact on science services. Robinson and Francheteau argued for better site surveys before the drilling.

Pisias asked PCOM to first consider if the Prydz Bay drilling will be scheduled, then look at the specifics. The 10-day delay to Leg 119 appears to be a good compromise to get the best weather window. H.Beiersdorf presented the Southern Ocean Panel's suggestions for the Kerguelen program. Dropping the SKP-8 site is not supported by SOP and basement drilling on both Leg 119 and 120 is recommended. Garrison pointed out that both legs would run over the 61-day limit under SOP's plan.

A.Taira was concerned that only 4-5 days were scheduled for 1600m of drilling at KHP-3. Larson pointed out that the plans have been built with some redundancies and attempts had been made to prioritize the sites and to give the co-chiefs options depending on the weather conditions.

P.Robinson said that Prydz Bay was not worth $1M for a 35% chance of success. H.Beiersdorf responded that ODP has drilled on less sophisticated site survey data and that the opportunity to study the glacial history of the margin should not be given up. Pisias agreed that the panel should not compromise the science on the budget issue.

L.Garrison presented a compilation of eight years of ice data from the Prydz Bay. Based on the history of consecutive weeks of ice-free conditions, he gave a 50% chance for favorable weather for the drilling. Several members acknowledged that including Prydz Bay will take time from the other Kerguelen sites and other legs. Brass was not convinced that the other Kerguelen sites did not need ice support.

Barker said that ice reconnaissance by air was another option, but Garrison said the money for the ice boat would be budgeted regardless.

After these discussions, the following motion was forwarded:

PCOM Motion:
That the Kerguelen Program will contain a transect of Prydz Bay. (Motion Brass, second Eldholm)

Vote: 8 for, 8 against, 0 abstain

PCOM Consensus:
That the vote on the inclusion of Prydz Bay be reconsidered after the delay to the rest of the Indian Ocean program will have been discussed.

Discussion:

Garrison said the delay could add extra days to the Leg 118 program. The downside of the delay was putting 3/4 of the Kerguelen program into a bad weather window. December 9 is the earliest start date.

PCOM Motion:
If Prydz Bay is not included in the Kerguelen program, then there is no justification for the delay to the rest on the Indian Ocean program. (Motion Brass, second Kastner)

Vote: 5 for, 10 against, 0 abstain

PCOM Consensus:
To adjourn and consider the Prydz Bay drilling as the first order of business the following day.

11 April 1987

The Chairman introduced the Prydz Bay discussions by noting that SOHP and PCOM had ranked the program highly on the science and votes on including the program should be considered a thematic not a budgetary issue. Larson presented the seismic section on the transect (500m holes at each of the four sites) and more fully described the times and objectives for the drilling.

The trade-off between science and the costs of the Prydz Bay drilling were discussed. PCOM members mentioned the loss of lithospheric objectives in other programs and safety as potential problems. Pisias agreed that the program could be better documented, but that tremendous scientific benefits could result.

P.Barker (SOP Chairman) gave further details on the objectives of the Prydz Bay. A complete stratigraphic section and continental paleoclimate indicators make it the best area to see the early Neogene isotopic signal and get a pre-glacial record. Barker advised that the middle part of the section be drilled first for Neogene sediments. Several PCOM members were concerned that the ice boat would be needed for the other Kerguelen sites.

Garrison did not think that 3.5 days/site or 14 total days for the transect was enough and said other Kerguelen sites could be lost through delay. Larson told PCOM that the SPK-6B alternate site was a southern anchor for the latitudinal transect, but was not an alternate for the study of the E.Antarctic ice sheet.

The motion to include Prydz Bay was then reforwarded:

<u>PCOM Motion:</u>

That the Kerguelen Program will contain a transect of Prydz Bay. (Motion Brass, second Eldholm)

Vote: 9 for, 6 against, 1 abstain

<u>Discussion:</u>

R.Larson further described the weather window and the effects of delaying Leg 119 (Appendix H). M.Kastner asked why the long drilling on the KHP-3 site was justified as basement objectives were available at other sites (Broken Ridge, e.g.). Brass said no drilling to basement was planned on Broken Ridge, and KPH-3 was needed. Larson pointed out that the main objective at KHP-3 however is pre-Neogene stratigraphy. It is a possible re-entry cone site and SOP has suggested returning to KHP-3 on Leg 120 as an option. M.Langseth suggested that PCOM give the appropriate panels the timetable, and defer to their judgment on the sites. The following motion was then forwarded:

<u>PCOM Motion:</u>

The Planning Committee moves to adopt the Kerguelen Working Group's recommendations for the combined Leg 119-120 program prioritization. (Motion Larson, second Langseth)

<u>Discussion</u>:

The basement objectives of KHP-3 and KHP-4A were further discussed. To further delay planning the leg or to have the KWG meet again were rejected . Robinson requested that LITHP's minimum basement objectives (two sites, with one deeper) be incorporated in the planning.

Vote: 16 for, 0 against, 0 abstain

Related motions were forwarded:

<u>PCOM Motion:</u>

To accept Lithospheric Panel basement objectives as the minimum program (two basement sites, with one deep site to 200-300 m) and to include recovery from the northern and southern Kerguelen Plateau. (Motion Robinson, second Eldholm)

Vote: 16 for, 0 against, 0 abstain

PCOM Motion:

For accommodation of logistics and thematic considerations, SKP-8 and KHP-3 be viewed as the lowest priorities in the entire Kerguelen program. (Motion Larson, second Brass)

Vote: 12 for, 0 against, 4 abstain

Discussion:

PCOM continued to discuss the merits of various combinations of Leg 119-120 sites. Major concerns were to obtain appropriate basement objectives, to get the most complete stratigraphic sections, and to stay within the 61 day/leg limit dictated by SEDCO. Planning in contingency time due to weather conditions was also considered important.

As a possibility for Leg 119, Francheteau suggested the combination of KHP-1 (7 days) with the Prydz Bay sites (PB 1-4), for about 53 total days. A 10% weather contingency and the option of re-entry at KHP-1 was suggested. KHP-4A could remain a back-up for basement objectives. [Note: This was a PCOM consensus but a subsequent consensus added the SKP-6A site to the Leg 119 program.]

M.Langseth presented the DMP recommendations and estimated times needed for the Kerguelen program (VSP and BHTV). PCOM members agreed that the times for these experiments kept Leg 119 within the 61 days.

PCOM Consensus:

That the Planning Committee adopt the Downhole Measurement Panel's recommendations on vertical seismic profiling and borehole televiewer experiments on Leg 119.

The Science Operator requested that SKP-6A (placed on Leg 120 by the K-WG) be moved to Leg 119, and SKP-1 be shifted to Leg 120 in order to optimize ice conditions in Prydz Bay. PCOM agreed and the following program was endorsed:

PCOM Consensus:

The Kerguelen Program shall consist of the following:

LEG 119 KERGUELEN PROGRAM:

Sites	Time Estimates (days)
KHP-1	7.3 (+1.2 for VSP/BHTV)
PB-1	3.5
PB-2	3.5
PB-3	3.5
PB-4	3.5
SKP-6A	5.7
Transit	24.8
	=====
	53.0 Subtotal
Weather contingency	5 to 6 days (10%)
	=====
	ca. 59.0 days

LEG 120 KERGUELEN PROGRAM:

Sites	Time estimates (days)
SKP-1	5.3
SKP-2	5.6
SKP-3	11.4 (+.9 for VSP)
SKP-4A	12.5
Transit	19.0
	=====
	54.7 Subtotal
Weather contingency	5 to 6 days (10%)
	=====
	ca. 60 or 61 days

PCOM Consensus:

That the start of the Kerguelen Program be delayed 10 days, to now begin on 19 December 1987, in order to move the Prydz Bay drilling into a more favorable weather window.

LEG 115 PLANNING

N.Pisias opened the discussion with news from the recent site survey. Channeling and slumping detected at the Carbonate Saturation Profile sites will not allow relocating the sites as suggested by SOHP. The Indian Ocean Panel has recommended that the Droxler site (MLD-2) be added to the program if time allows.

Garrison said the time allotted for the primary program has been 38 days and 41 days are available. Time to drill to MLD-2 site is about 60 hours. Pisias reported that one other basement site has been recommended by co-chief R.Duncan. J.Francheteau raised objections to the late site survey for this program.

M.Langseth presented the DMP recommendations for Leg 115: to log the deepest three holes (CARB-1, 1600m with 50m into basement, MP-3 and MP-2). Langseth said that drilling 50 m into basement on these sites would help interpretations of the unconformities.

PCOM Motion:

To accept the program for Leg 115 as previously outlined (MP-1, MP-2, MP-3 and the CARB 1-4 transect), to include the Droxler/Maldives site (MDL-2) as a back-up site if time is available and to include time for the logging program as outlined by the Downhole Measurement Panel. (Motion Larson, second Brass)

Vote: 15 for, 0 against, 1 abstain

LEG 116 PLANNING

(G.Brass absented himself during discussion of this leg.)

R.Larson gave an update on the site survey data of this leg (Intraplate Deformation plus the N.Ninetyeast Ridge site). Sites 1 (a stratigraphic reference hole), 2,3, 4, 4A, 5 (with alternate 5A) and 6 have been proposed. The two objectives for the Intraplate work are to: determine the timing on the deformation, and a geotechnical/geohydrologic program (drill Site 5 or 5A into a reverse fault and test advective system; drill/log Site 6, a high heat flow site). Pisias added that packer experiments are planned at Site 6.

Langseth reported on the DMP's recommendations: all five holes should have standard logging, BHTV at Sites 1 and 5, and packer and heat flow measurements at 5 and 6. Jarrard said that the logging would require 0.5 days extra for the BHTV work. The revised Leg 116 program is shown on Appendix I. [NOTE: See planning discussions for Leg 121 for the status of the Ninetyeast Ridge sites.]

PCOM Motion:

To adopt the Downhole Measurement Panel's logging and downhole experimentation plan for Leg 116. (Motion Kastner, second Larson)

Vote: 15 for, 0 against, 0 abstain

PCOM Consensus:

The drilling schedule for Leg 116 shall consist of Sites 1,2 or 3, 5 and/or 5A and 6 to be drilled in that order for a total of 48.5 operational days.

[NOTE: At the 15 April PPSP meeting, Site 5 was not approved. The other primary sites and some alternates were approved. PPSP said, however, that if any hydrocarbon gases are detected at any site, approval of any subsequent sites would be in question.]

LEG 117 PLANNING

Pisias reported that the IOP recommendations for the Neogene Package matched those of PCOM. L.Garrison presented the revised drilling and logging estimates for the leg. Co-chief W.Prell had asked for double APC/XCB on each site and NP-2 has been designated a geochemical reference site as well. The new times are still within the limit for the leg (48.5 days plus transit).

M.Langseth presented the DMP recommendations. Standard Schlumberger runs (plus high-resolution resistivity tool, if ready) for NP-2,3,4,5,6 and 7, BHTV at NP-6 and 7, VSP at NP-6 and BHTV at NP-6 and 7 are recommended. If available, the Barnes pore water sampler is recommended for all holes.

Jarrard did not strongly advise the BHTV work as it is critical to save a working tool for Leg 118.

PCOM Consensus:

To take the Downhole Measurement Panel's recommendations for Leg 117 as a "strawman", without the use of the borehole televiewer, so that it is available for use on Leg 118. Vertical seismic profiling should be included at Site NP-6.

LEG 118 PLANNING

(P.Robinson, a co-chief for Leg 118, absented himself during these discussions.)

R.Larson gave an overview of the IOP recommendations, in basic agreement to those developed by PCOM at the Hawaii meeting. If time beyond 36 operational days is available, then IOP recommends drilling across the "gravel pit" to establish a stratigraphic transect across the displacement zone.

Successful deployment of the guidebase continues to be long-term objective of the program. L.Garrison presented a graphic of the engineering design of the guidebase (Appendix J). With camera surveying and reaming and casing to 280 meters, at least 23 days are required. This estimate assumes ideal conditions, and 25 days is a more realistic figure. Kastner suggested that the survey work might take even longer and wanted to leave flexibility to the co-chiefs. Langseth said that pogoing before setting the guidebase would provide more information on the ultramafic stratigraphy and to deploy the guidebase "blithely" was a gamble.

Brass referred to the previous hard-rock legs (106, 109) and said the poor performance of the single-bit attempts was also a risk. Francheteau said the scientific value of the median ridge was not demonstrably greater than a suite of carefully planned holes in the fracture zone, and therefore, the guidebase deployment was driven by engineering interest.

Pisias posed the question of whether to add the 10 days gained from the Leg 119 delay to Leg 118. Garrison presented the drilling schedule as it had developed thus far. Langseth then presented the DMP recommendations for the SWIR program: 10.5 days of logging and experimentation if a 250-300m hole is achieved. Recommended tools and times included:

Std.Schlumberger suite (with temp.)	45 hours
BHTV/magnetometer	16
Multichannel sonic tool	13
Gyro magnetometer (USGS tool)	15
Susceptibility tool	8
Packer	48
Wireline packer/Kuster sampler	14
Complex resistivity	12
Dual laterolog	11
Flowmeter	?
VSP	18

<u>Discussion:</u>

Brass recommended that if an extra 10 days were added to Leg 118, that it be used for pogoing. Kastner recommended that two of the days gained through the Leg 119 delay be added to Leg 116 instead.

PCOM Motion:

To add the ten days gained through the delay of Leg 119 to the Southwest Indian Ridge Program, with deployment of the guidebase a first priority. With the additional time, the pogoing of the gravel pit is an option. (Motion Ross, second Langseth)

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

LEG 121 PLANNING

R.Larson presented an update on the Broken Ridge program. Four holes are proposed, each 450m deep, with one XCB/APC run through the younger material and the rest rotary cored.

L.Garrison had information from J.Weissel on his priority sites (B1-4); Garrison also suggested adding the 90ER-1 to the leg. The Indian Ocean Panel has indicated that 90ER-1 is their priority site on the ridge. Garrison presented TAMU's estimations of drilling times for the program (Appendix K) with a total time of 52 days allotted. Garrison also said some sites may have safety problems; he added that better definition of site locations is needed from J.Weissel.

The DMP had no special programs for this leg, although the Borehole Group has recommended BHTV at the 90ER-1 site along with standard Schlumberger. Garrison said about 26 hours were planned for logging for two 90ER sites.

Pisias said that the drilling priorities for the IOP were: the four Broken Ridge sites (BR 1-4) and the northern and central Ninetyeast Ridge sites. The IOP will be asked to provide revised drilling times for the program by the August PCOM meeting. Francheteau asked that the extent of Seabeam coverage on Broken Ridge be indicated.

LEG 122 PLANNING

Pisias opened the discussion on the Exmouth program: as liaison to the last SOHP meeting, Pisias reported that SOHP had ranked the sites in the following order: EP-7, EP10A, EP2A, EP6 and EP9B. The potential safety problem of site EP6 were discussed, but obtaining the ~~Triassic~~ Cretaceous section there is a SOHP priority. SOHP has also indicated that all Exmouth sites are more important than a second Argo Abyssal Plain site. The following motion was forwarded:

PCOM Motion:

That Leg 122 shall consist of sites EP6, EP7, EP2A and EP10A. EP9B shall be moved to the Argo Abyssal Plain program (Leg 123). EP6 is a possible re-entry site, and a 52 day program, with logging, is recommended. (Motion Kastner, second Brass)

Vote: 16 for, 0 against, 0 abstain

LEG 123 PLANNING

The lithospheric objectives of the Argo leg were discussed. Robinson (LITHP liaison) said that the panel would like a deep reference hole (>500m) at AAP1B. Brass added that ridge crest geochemistry was last investigated on DSDP Leg 27.

After a short discussion on the Argo Abyssal Plain drilling and the Indian Ocean Panel's recommendations for the leg, the following consensus was reached:

PCOM Consensus:

Leg 123 will consist of re-entry Site AAP1B (32.2 days scheduled) and EP9B. Coring to 300m of basement should be undertaken at AAP1B; to greater depth if time allows. For logistical purposes, Site EP9B (8 days estimated) will be drilled first. Total drilling time recommended is 40.3 days.

The Downhole Measurement Panel's recommendations for the leg will be discussed at the August PCOM meeting. Jarrard mentioned that hydrofracture experiments at AAP1B, requiring four extra days, are recommended by the Borehole Group.

[NOTE: Appendix L is the tentative ODP drilling schedule for Legs 114-123 as prepared at this meeting by L.Garrison.]

CO-CHIEF SELECTION

The Science Operator asked for suggestions for co-chiefs through Leg 121. SOP recommendations, as well as names from PCOM, were added to the list compiled from other panel suggestions. Appendix M is the list as forwarded to the Science Operator.

656 FY88 BUDGET PRIORITIES

The budget alternatives presented by Tom Pyle were addressed, as suggested, after the review of the Indian Ocean science program.

The Chairman directed PCOM to prioritize the cuts suggested by Pyle (Appendix C) in order to reach the $1.5M reduction necessary to include the Prydz Bay drilling. Pisias reminded PCOM that it had asked to be included in the budget process and now EXCOM would need to know what items in the science plan were expendable. From the long-range goals of the program and the views forwarded by PCOM, the following items were considered "non-negotiable" ones:

Reduce/stretch out Mining Coring System (70K), high-temperature (20K) and drill string inspection	$100K
Eliminate use of guidebase, Leg 118 (SWIR)	$163K

The proposed cutbacks to ODP publications were discussed at length. As the visible product to the program, the publications quality was seen as important to the programs's success. The author-prepared camera-ready copy for the Part B volumes was seen by some international members as a burden considering that translation was also necessary. Pisias mentioned that the IHP has said the uncoated paper proposed for Part A will degrade the core photos. The following motion was forwarded:

PCOM Motion:

To refrain from budget reductions that will deteriorate the quality or timeliness of the Part A and Part B ODP publications. (Motion Robinson, second Eldholm)

Discussion:

O.Eldholm said that reductions to the TAMU staff scientists would automatically mean less coordination efforts for Part B proceedings. Pyle mentioned that TAMU had proposed cutting the Part B altogether.

Vote: 5 for, 8 against, 3 abstain

PCOM further discussed the publications issue. Gartner gave a review of the original intents of the ODP volumes: preliminary data were intended for Part A and synthesis papers for Part B. Delays in Part B were from previous budget shortfalls, but TAMU was now on line to produce them at PCOM's request. Outside publication of the Part B or subscriptions to it were not seen as cost-effective options.

Eldholm reported on his experiences with preparing a Part B volume. He said Part A is an updated shipboard report and that good syntheses are possible from the Part B in that 25-27 shipboard scientists have an obligation and a deadline to produce it. Larson agreed that the team approach is necessary to produce a stratigraphic framework for each leg. The following motion resulted from these discussions:

PCOM Motion:

To accept the proposed cut, namely, requiring author-prepared camera-ready copy for the Part B ODP Proceedings, for a projected savings of $171K to the FY88 budget. (Motion Taira, second Brass)

Vote: 12 for, 4 against, 0 abstain

[NOTE: This motion was subsequently rescinded when the projected cuts list as a whole was voted on. See Appendix C.]

G.Brass reiterated his suggestion to put 1000 copies of each Part A volume on microfiche and the suggestion was added to the list of potential program cuts. Larson recommended that a $200K budget cut to TAMU headquarters also be added.

The Chairman called on PCOM to rank the list as a whole to achieve the recommended $1.5M reduction, adding that PCOM would now have the opportunity to go through a process similar to proposal rankings by the panels. The rankings would be presented at the beginning of the next day's meeting. P.Robinson expressed his objections to the process, stating that items other than those named should be considered. [Results of vote are shown in Appendix C.]

657 WESTERN PACIFIC PLANNING

Pisias referred PCOM to the overview of the WPAC third prospectus in the agenda book. The 12 legs were arranged according to the typhoon weather window and included the core program identified by PCOM at the Hawaii meeting. As liaison at the last SOHP meeting, Pisias related that panel's objection to their top-priority program, the Great Barrier Reef, not being included in the core program.

A.Taira (WPAC liaison) explained how the prospectus had evolved by using the "core program" approach from the Indian Ocean program as a model. The panel developed both 9 and 11-leg scenarios, and took the nine top-ranked programs and translated them into 11 legs as well. Robinson expressed his concern that the JOIDES Journal report on the Hawaii PCOM meeting had misrepresented this process. Some confusion over the motions at the last PCOM meeting describing length of time for drilling in the Pacific was expressed by other PCOM members. It was agreed that the three years in the Pacific was intended to represent a planning figure only. Francheteau called for a motion regarding the double circumnavigation issue as interpreted from the COSOD I document, which he considered relevant to the issue of time allotment for the Pacific program:

PCOM Motion:

That the Planning Committee is not constrained by the requirement of a double circumnavigation of the drillship. (Motion Larson, second Brass)

Discussion:

Robinson agreed that PCOM should treat the important science in an area and not set arbitrary limits. Brass pointed out that the COSOD I document did not mandate the double circumnavigation, but recommended a global program that would terminate in 1999 near Panama. He saw no constraints in the COSOD document.

Vote: 16 for, 0 against, 0 abstain

Pisias then called for a clarification of the instructions for the Western Pacific program and the following motion was forwarded:

PCOM Motion:

For clarification of the Pacific planning, the Planning Committee reaffirms its advice to CEPAC, WPAC and the thematic panels that WPAC plan an approximately 22-month drilling plan based on their top nine programs and that CEPAC utilize an 18-month guideline for CEPAC planning. CEPAC shall include scenarios with and without a three-leg East Pacific Rise program. (Motion Larson, second Brass)

Discussion:

Taira said that WPAC was given 18 months for planning but believed the science justified a 22-month program; he encouraged PCOM to treat the CEPAC program similarly. Pisias suggested that CEPAC present well-justified, well-documented thematic programs; the 18-month guideline should be recognized, but is not a set limit.

Vote: 11 for, 4 against, 1 abstain

GEOCHEMICAL REFERENCE HOLES

PCOM discussed the WPAC program response to geochemical reference holes. Taira said that sites in the Marianas, Bonins, seamounts and near seamounts had been presented by WPAC member J.Natland, but that the issue was yet to be settled. He said that the four-hole program requested by LITHP was too extensive and only the Bonin shallow site looked definite. Robinson presented LITHP's recommendations for the sites; they seek a geographic distribution of lithologic end-members, plus a vertical section to sample various trench materials. Robinson said the Bonin program was well-defined scientifically.

Larson said that CEPAC could possibly endorse the late Jurassic reference site off the Marianas trench. Robinson added that the Natland-Langmuir proposal is a highly-ranked global program.

WPAC PROGRAM WATCHDOGS

PCOM discussed the thematic ranking of WPAC proposals and whether PCOM should further debate the program WPAC had designated. In reference to the previous ranking of the Great Barrier Reef program, Brass pointed out that many PCOM members were unaware of the relocation of sites. Kastner acknowledged the excellent prospectus provided by WPAC; she suggested that PCOM evaluate the rankings on their thematic basis only. Brass agreed that PCOM should rank the Western Pacific program and suggested that PCOM discuss this in detail at the next PCOM meeting.

Pisias assigned "watchdogs" for the WPAC programs with instructions that they were to report back to PCOM at the August meeting. The assignments were:

Priority / Program		PCOM Watchdog
1.	Banda-Sulu-SCS Basins	Brass
2.	Bonin I	Robinson
3.	Lau Basin	von Rad
4.	Vanuatu	Cadet
5.	Japan Sea	Langseth
6.	Nankai	Kastner
7.	Great Barrier Reef	Gartner
8.	Sunda	Francis
9.	Bonin II	Robinson
10.	Nankai Geotechnical	McDuff
11.	SCS Margin	Taira
12.	Zenisu Ridge	Larson

Taira reminded PCOM that programs 10-12 were still evolving and could well change in future rankings. The LITHP was to be given instructions on defining the geochemical reference holes and the Great Barrier Reef proposal would be reconsidered by the thematic panels. Pisias determined that, based on the strength of the prospectus, WPAC would not need to meet this summer.

656 FY88 BUDGET PRIORITIES (Continued)

The ranking of the TAMU budget cuts was presented. PCOM determined that separating out the item on camera-ready Part B manuscripts was not advisable, and the ranking would be redone to include it.

PCOM Consensus:

The previous vote for having authors prepare camera-ready Part B publications was rescinded.

Pisias said that this list would be presented at the budget discussions at the EXCOM meeting. The final ranking appears as Appendix C.

12 April 1987

PCOM reconvened and Pisias introduced Dr.Leonard Johnson, director of the Office of Naval Research Arctic drilling program who would present information on the recent Arctic drilling workshop.

658 CENTRAL AND EASTERN PACIFIC PLANNING

The Chairman opened the discussions by noting that CEPAC had been given instructions after the Hawaii PCOM meeting to begin ranking and draft a preliminary prospectus; only SOHP has met since the last PCOM meeting to add its thematic input to the CEPAC program.
Pisias offered to turn the Chairmanship over to R.Larson for the CEPAC discussion as he had a proposal under that panel's consideration; Larson pleaded a similar conflict of interest.

PCOM agreed that the program was in a preliminary stage and that proponents did not have to leave for these discussions.

An overhead with CEPAC's recent recommendations was shown (Appendix N). Coulbourn (CEPAC liaison) called the results of CEPAC's 30-31 March meeting a "initial first preliminary prospectus." The packages were deliberately not ranked as CEPAC did not wish to set priorities when site surveys are pending. He said CEPAC would have prioritizations for the next PCOM meeting. Coulbourn said "watchdogs" had been set up for the packages listed.

R.Larson asked about general ship tracks for the program, specifically if any packages that could be inserted in the WPAC programs had been identified. Pisias said that WPAC has tentatively included the Ontong-Java Plateau, a priority CEPAC package, in their drilling track.

Pisias said the LITHP and TECP would be asked to look at the CEPAC program in the same detail as SOHP had and have it available 3-4 weeks before the next PCOM meeting. CEPAC will be instructed to incorporate the rankings from the thematic panels into their next prospectus. Taira asked that the prospectus have a "thematic overview" (two or three pages) at the beginning and Kastner requested that the approximate number of legs required be identified.

659 PLANNING COMMITTEE LIAISONS

The Chairman noted that the panels had asked for more effective PCOM liaison at the Annual Meeting. A proposal from the JOIDES Office was presented in which liaison duties reflected geographic distribution and member expertise. A U.S. and non-U.S. member was suggested for each of the thematic panels to assure attendance to these important meetings. The listing was as follows:

Panel List: LITHP, SOHP, TECP, ARP, CEPAC, IOP, SOP, WPAC, DMP, IHP, PPSP, SSP, TEDCOM

	Rotation Date	Present liaison (and other jobs)	Proposed new liaison
H.Beiersdorf	87	SOP	--
G.Brass	91	-- (BCOM)	**SOHP**
J.-P.Cadet	--	ARP, IHP	**ARP, IHP**
B.Coulbourn	90	CEPAC, TECP	**CEPAC**
O.Eldholm	--	--	**TECP**
T.Francis	--	SSP, TEDCOM	**SSP, TEDCOM**
S.Gartner	89	IHP, SOHP	**IHP**
M.Kastner	89	IOP, SOHP	**LITHP**
M.Langseth	91	SOP	**DMP, SSP**
R.Larson	88	IOP (K-WG)	**IOP, CEPAC**
R.McDuff	88	DMP, LITHP	**DMP, SOP**
N.Pisias	90	PPSP, SSP (BCOM)	**PPSP,WPAC,SOP***
P.Robinson	--	TECP, LITH	**LITHP**
D.Ross	--	--	**ARP**
T.Shipley	90	ARP, CEPAC	**TECP**
A.Taira	--	WPAC	**WPAC**
U.von Rad	--	--	**SOHP, IOP**

*Only if other liaison cannot attend.

Listed by panels the proposed liaisons are:

LITHP:	Kastner / Robinson	WPAC:	Pisias / Taira
SOHP:	Brass / von Rad	DMP:	Langseth & McDuff
TECP:	Shipley / Eldholm	IHP:	Gartner / Cadet
ARP:	Ross / Cadet	PPSP:	Pisias
CEPAC:	Coulbourn & Larson	SSP:	Langseth / Francis
IOP:	Larson / von Rad	TEDCOM:	Francis
SOP:	McDuff & Pisias		

Pisias said that the listed pairs should decided who will attend a given meeting, and report the choice to the JOIDES Office.

PCOM Motion:

The Planning Committee accepts the new PCOM liaison designations to become effective on 1 May 1987, after the next Tectonics Panel meeting. (Motion Kastner, second Coulbourn)

Discussion:

PCOM did not consider having U.von Rad serve on IOP a conflict of interest; Pisias explained that he followed the past PCOM Chairman's example by placing himself on the regional panel most active in the planning process for PCOM.

Vote: 16 for, 0 against, 0 abstain

660 PRIORITIZATION OF DMP DEVELOPMENT RECOMMENDATIONS

M.Langseth, DMP liaison, reported that the following recommendations were seen as most important to the panel:

1. Physical properties lab upgrades (TAMU)
2. High temperature logging
3. Long-term observations

The recent physical properties workshop (USSAC),convened by Dan Karig, helped to define the physical properties prioritizations. Langseth said that downhole measurements were an important legacy of ODP and that new, high resolution logging tools will be important for correlations with the core record.

Pisias said that any recommendations on upgrades would have to go through PCOM and not directly to TAMU. Robinson wondered about the dollar impact of the upgrades considering the current cutbacks. Brass pointed out that PCOM may lack the expertise to decide on the more sophisticated tool's value to the program. Francis agreed that ODP petrophysics were not "state-of-the-art" and encouraged upgrade of the physical properties measurements.

Langseth suggested a specific working group to focus on the workshop recommendations as even DMP may not be expert in them. He added that many recommendations referred to increased frequency of measurements and thus, would not have a budget impact for new development.

PCOM Motion:

A modest, one time meeting, to be attended by three or four experts on downhole measurements, shall be held in conjunction with a regularly scheduled DMP meeting to discuss recommendations for physical properties measurements for the ODP. (Motion Brass, second Kastner)

Discussion:

Langseth suggested that such a group would benefit from meeting with TAMU staff and possibly touring the shipboard labs. Dan Karig, Bob Carson and Elliot Taylor (TAMU) were several names suggested by PCOM for this ad hoc group.

Vote: 14 for, 1 against, 1 abstain

VERTICAL SEISMIC PROFILING

In response to a PCOM request on VSP, Langseth reported that it should not be a routine run, but based on specific proposals. A USSAC workshop is being planned to address VSP. Brass asked if the program needs to invest in a tool, and suggested a separate NSF proposal as a means. Langseth said the tool would most likely be placed with the borehole research group. He said it was important for the interest in VSP to come from the scientific community. Eldholm wanted to see more VSP proposals and equipment; he believed it should be available on every leg with a geophysics-oriented co-chief in charge. Langseth responded that the DMP does not want to put VSP in its priorities list as they want an approved technical institution to take the lead on it. Langseth said he would report a strong interest in VSP by PCOM back to the DMP.

LOGGING THROUGH PIPE

DMP was asked to address the quality of logging through the pipe for this meeting. Langseth reported that the geochemical combo (neutron/clay tools) could get a muted signal through the pipe although two logs would have to be run due to interference from the pipe joint. Such logging is worthwhile as it is often the only method in an unstable hole. Logging through the pipe and the associated risk to the drill pipe has been discussed with B.Harding at TAMU. Jarrard reported that logging through the pipe was being done on Leg 114.

BUDGET IMPACT OF DMP RECOMMENDATIONS

DMP priorities for the current fiscal year are:

1. Temperature tools	$ 30K
2. User software/data dissemination	20K
3. Formation microscanner	150K

Langseth said that the formation microscanner is important for Leg 117. The possibility of leasing the tool was discussed. DMP recommends the purchase of the microscanner over the acquisition of the third wireline packer.

Langseth discussed the magnetometer needed for Leg 118. Although the USGS tool might be available, purchase of one is recommended. Beiersdorf said the German gyro and magnetic susceptibility tool might not always be available; Francheteau noted that the French are working on a new tool.

Beiersdorf asked that PCOM carefully think through downhole experiments as they are at the expense of drilling. He recommended a PCOM policy be set up for such experimentation. Brass also mentioned the funding needed for new tools .

Jarrard responded that a policy would be helpful but that the goal of his group is to log without taking time from the drilling operations with a separate run. Langseth reiterated that downhole experiments must have a scientist identified with the project and should be approached with flexibility in the programs. Brass asked that the thematic panels and DMP formulate a policy relating specifically to the use of special instruments. Langseth said that the recent workshop on wireline re-entry did address some of these concerns and that a draft "white paper" was in review for presentation at COSOD II.

Taira asked that a policy on long-term monitoring, such as the Japanese-U.S. joint venture for temperature measurements off Nankai, be considered as well. He mentioned the recent ridgecrest tomography proposals as particularly promising, but WPAC does not know the mechanism for handling such proposals. Pisias said that these ideas would have to be addressed for budget impact as well.

661 PANEL MEMBERSHIP

Suggestions for new panel members from the IOP (from Larson) and SOP (from Beiersdorf) were added to the list compiled by the JOIDES Office. Kastner wanted PCOM to review the representation to SOHP and LITHP so that sediment diagenesis was more thoroughly covered. Robinson agreed that this discipline was part of the LITHP Terms of Reference.

PCOM Motion:

> That a sediment geochemist with expertise in diagenesis be placed on the Lithosphere Panel. (Motion Kastner, second Robinson)

[NOTE: Vote not taken on this motion but PCOM later recommended that names of inorganic geochemists be forwarded for panel replacements.]

Discussion:

A more general discussion on the panel structure evolved from this motion. Francheteau asked if any change was envisioned to the current structure and whether thematic interests would be strengthened. Kastner mentioned that the COSOD working groups do not follow the current panel structure and that JOIDES panel structure would not be covered at COSOD II.

PCOM Motion:

> The Planning Committee will initiate a review of the advisory panel structure beginning at the August PCOM meeting. A full review of the structure will occur at the winter Annual Meeting with the Panel Chairmen present. (Motion Larson, second Brass)

Vote: 16 for, 0 against, 0 abstain

Pisias said that the thematic panels would be asked for their initial input to the issue. He said that the thematic/regional panel interactions had improved since the last review of the structure. Larson added that COSOD II may have long-term impact on the advisory structure.

MEMBERSHIP CHANGES

The panel membership changes were discussed by PCOM. The following recommendations were made:

LITHP: Sediment geochemist slot open
Nominations: Elderfield (U.K., member-at-large)
D.Crerer (Princeton)

SOHP: Rotating off: Arthur, Hay, Tauxe
Nominations: Geochemist: Froehlich (LDGO), Baker (Duke)
Paleomagnetist: Kent (LDGO), Channel (Florida)
Oceanographer: Berger (SIO), W.Curry (WHOI)

DMP: Four slots open
Nominations: Givens (Mobil)
Sondergeld (Amoco), alternate Cheng (MIT)
Carson (Lehigh)
Porter (U. Washington)

WPAC: PCOM does not recommend delaying Ingle's rotation. Taira suggests a biostratigrapher as his replacement; WPAC will provide nominations.

CEPAC: Rotating off: Mammerickx
Nomination: D.Rea (Michigan)

IOP: Rotating off: J.Curray, J.Sclater
Nominations: Davies (U.Texas)
E.Vincent (France)
Haq (Exxon)
W.Wise (Florida State U.)

[Note: T.Davies absented himself during this discussion]

SOP: Rotating off: J.Anderson, D.Elliot, J.Weissel
Nominations: Cooper (USGS)
W.Wise (Florida State U.)
P. Webb (Ohio State)
H.Thierstein (ESF)

662 ARCTIC DRILLING

Dr. Leonard Johnson (ONR) thanked PCOM for the opportunity to describe the work of the Arctic drilling group. He said that two committees, the ICL (Lithospheric group) and the IUGS were working together to define Arctic drilling priorities. A meeting was held this past fall in Halifax to discuss the technical feasibility of Arctic drilling, and the group determined that appropriate technology did exist. Steve Blasco, the convener of the workshop, is now addressing the site surveys required for such work.

Dr. Johnson presented an informative overview of the Arctic scientific interests and various projects such as the geophysical surveys of the Alpha Ridge. He said that different types of platforms are available for some of the work planned (such as man-made islands, existing drillships, and concrete drilling platforms). Johnson said the Canadian Class 8 icebreaker currently being configured for drilling would be a potential platform for all envisioned sites.

The Arctic Group is planning a thematic presentation at COSOD II. Eldholm said that ESF is interested in high-latitude drilling and believs drilling in the Bering, Labrador and Greenland Seas can be addressed with existing technology.

Johnson said there is much support for high-latitude drilling. His group would like to informally ask the JOIDES PPSP to serve as a resource to his ad hoc group. Johnson said that sites had not yet been prioritized. Johnson requested that Steve Blasco attend a safety panel meeting; L.Garrison suggested he bring information on the types of drilling problems anticipated. Johnson said that Soviet scientists are aware of the Arctic group. In conclusion, Johnson promised to keep PCOM informed of continued developments from the Arctic group.

ANTARCTIC DRILLING

H.Zimmerman, from the Polar Earth Sciences Program at NSF, said that his group has been sponsoring shallow Antarctic drilling. He wants to use the JOIDES safety panel as an advisory resource for their efforts (about one hole per year).

<u>PCOM Motion:</u>

> The Polar Earth Sciences Program of the National Science Foundation, (a funding agency of the ODP), shall have informal access to review by the JOIDES Pollution Prevention and Safety Panel of their drilling plans provided that no liability to ODP is incurred. (Motion Brass, second Pisias)

Vote: 16 for, 0 against, 0 abstain

663 <u>CITATION OF ODP PROCEEDINGS VOLUMES</u>

At the January PCOM meeting, the following motion on the citation of the ODP Proceedings was tabled:

> The suggested citation of initial ODP Proceedings follow the format developed for DSDP Initial Reports, with the addition of a statement identifying the TAMU staff scientist as volume "editor" or "coordinator".

R.Larson withdrew his motion, asking if there had been input from the co-chief scientists at their recent meeting. E.Kappel said that the co-chiefs wanted to reserve choice for the citation as was done with DSDP volumes. PCOM members, especially those who had served on cruises, added their views. Coulbourn, who had edited volumes at DSDP, said that the contribution by the staff scientists varied greatly according to the interest or disinterest of the cruise co-chiefs.

Robinson said that the staff scientist is given status as a "third co-chief" if named in the citation.

PCOM Motion:

The citation of ODP Part A proceedings should follow the example of DSDP Volume 85, namely, that co-chiefs be cited for the volume, with staff scientist and/or editor clearly identified, but not included in the recommended reference for the entire volume. (Motion Kastner, second Francis)

Vote: 10 for, 4 against, 2 abstain

PCOM further discussed the inclusion of "auxiliary science" such as site surveys or ice boat science. Gartner, IHP liaison, said the panel did not separately address the issue as yet. He acknowledged that the one-year rule stands for requests for drilling data by scientists involved in the site surveys.

664 PCOM TERMS OF REFERENCE

A change in PCOM's Terms of Reference had been requested by NSF so that a four year general track for the drillship is outlined. Pisias said the change would be reflected in future program plans and communicated to EXCOM at its next meeting.

PCOM Consensus:

The Terms of Reference for the Planning Committee can be changed to reflect a period planning four years in advance of the drillship (instead of the previously mandated "three" year period).

665 OTHER BUSINESS

The Chairman gave his parting remarks to PCOM on the advice he and Garry Brass would bring to EXCOM as Budget Committee members.

P.Robinson asked that the minutes of this meeting formally state his dissatisfaction with the organization of the COSOD II meeting and the delays in notifying participants.

HELMUT BEIERSDORF

H.Beiersdorf gave his farewell to PCOM and announced he would be succeeded by U. von Rad. Beiersdorf will continue to serve as the German ODP coordinator until a replacement is nominated. He told PCOM that BGR Marine Geology and Geophysics is facing funding difficulties and he has asked EXCOM members to support this cause to ensure continued site survey support to ODP.

The Chairman thanked Beiersdorf for his service to the Ocean Drilling Program and for releasing Michael Wiedicke, his able assistant at BGR, to fill the position of non-U.S.liaison to the JOIDES Office.

FUTURE MEETING SCHEDULE

A.Taira provided information on hotels and field trips for the upcoming PCOM meeting scheduled for 25-29 August 1987 in Nikko, Japan (Appendix O).

There being no further business, the Planning Committee adjourned.

APPENDICES A - O ARE ATTACHED ON THE FOLLOWING PAGES

'EXTRA EXPENDITURES' FOR THE UPCOMING YEARS:

FY88 (Second half of Indian Ocean)

Bare rock guidebase (HRGB)	$ 0.4 mio
Ice boat (Kerguelen)	$ 0.85 mio

TENTATIVE SCHEDULE:

118 SWIR
119 Kerguel
120 Kerguel
121 Brok.R.
122 Exmouth
123 Argo
(Begin Oct)

FY89 (First six legs in Western Pacific)

Nankai Geotech	$ 0.4 mio
Pressure Core Barrel (PCB)	?
Packers	$ 0.2 mio
Drillstring	$ 0.4 mio
Lau Basin (bare rock)	$ 0.4 mio
& high temperature	$ 0.5 mio

124 Banda
125 Sunda
126 Sulu-SCS
127 Bonin I
128 Nankai
129 Japan I.
(End Sep)

FY90/FY91 (Rest of WPAC + 9 legs in CEPAC)

5 guidebases (mudmotors, bits etc.)	$ 2.0 mio
Deep Hole (Bering Sea)	?
Ice boat (Ross Sea)	$ 0.90 mio
Reoccupation of site 504 B	?
TOTAL	$ 6.05 mio

130 Japan II
131 Bonin II
132 ? CEPAC
133 GBR
? Vanuatu I
? Van. II
? Lau
& ca.8 CEPAC Legs

On avarage, this is about **$ 1.5 mio/year**

APPENDIX A

35,500
TARGET

DEVELOPMENT OF FY88 BASE BUDGET ($K)

4/9/8.

	FY87	FY88			
	PROG. PLAN	PROP.	BCOM REC.	RESPONSE	CURRENT
TAMU	30,100	31,100	31,208 [1]	31,208 [2]	31,208 [3]
LDGO	2,750	2,951	2,751	2,782	2,782
JOI/JOIDES	1,430	1,741	1,541	1,541	1,521
	34,280	35,792	35,500	35,531	35,511

NOTES

1 INCL. SIGNIFICANT ADJUSTMENTS OF PROPOSED BASE & ENHANCEMENTS.

2 INCL. NO PART B VOLUMES.

3 INCL. PROGRAM DECREASES TO BE DISCUSSED WITH PCOM & BCOM.

APPENDIX B

FY88 TAMU BUDGET CUTS
As Proposed by PCOM

10-12 April 1987
Washington, DC

Rank	(Vote)	Item	$ (K)	(Σ)
1.	(52)	Only 1000 hard-bound copies 1000 microfiches	168	(168)
2.	(55)	Cut TAMU Headquarters	200	(368)
3.	(66)	Reduce software acquisition	95	(463)
4.	(68)	Eliminate 5 graduate research assistants/technicians	50	(513)
5.	(70)	Eliminate 2 positions at D.B.'s	42	(555)
6.	(78)	Eliminate res. elec. engineer (@ 73K) and reduce JOIDES panel liaison travel (@ 15K)	88	(643)
7.	(95)	Author prep camera-ready copies for Part B volumes	171	(814)
8.	(99)	Part A volumes to uncoated paper	48	(862)
9.	(104)	Eliminate 3 staff scientists	143	(1005)
10.	(124)	Eliminate shipboard labs and associated technical support	250	(1255)

==

	(128)	Reduce/stretch out Mining Coring System (70K), high-temp (20K), and drill string inspection (10K)		
	(144)	Eliminate use of Guidebase, Leg 118 (SWIR)		
		TOTAL		$1,255

APPENDIX C

SHIPBOARD TECHNICAL SERVICES (LAB SPECIFIC)

	M&S	SAL (# TECHS.)	TOTAL
1. X-RAY LAB	$59 K	$70k (2)	$129 K
2. SEM LAB	12	—	12
3. CHEM LAB a) TOTAL	150	140 (4)	290
b) ALL OUT SAFETY	50	70 (2)	120
4. COMPUTER MAINT.	58	70 (2)	128
5. OFFICES/LIB./YEOPERS.	31	70 (2)	101
6. U/W GEOPHYSICS	130	—	130
7. PALEONTOLOGY	16	—	16
8. THIN-SECTION LAB	5	—	5
9. PHYS. PROPS.	20	70 (2)	90
10. PALEOMAG.	43	70 (2)	113
11. DOWN HOLE TOOLS	65	—	65
12. CORE LAB/GENERAL	—	420 (12)	420
13. PHOTO LAB	—	70 (2)	70
14. ELEC. TECHS.	—	140 (2)	140
15. SUPERV./LAB OFFICER	—	70 (2)	70
	$639K	$1,260K (34)	$1,899 K

M&S = MAINT. & SUPPLIES

APPENDIX D

OPERATION CHANGES TO IMPROVE LOGGING EFFICIENCY AND SUCCESS

Problem	Solution
SES rigup slow	L-DGO and TAMU: SES design improvements
No bridges when SES used, bridges when SES not used	SES decision based on 1) TAMU: drilling conditions 2) L-DGO: CST tests
Tool loss (mud slug while tool in pipe)	TAMU & L-DGO: backflow preventer L-DGO: stronger weak point TAMU: cautious pumping if tool in pipe
Stuck XCB core barrel, no logs through pipe	TAMU: accepts greater risk to BHA TAMU: investigates causes of stuck core barrels
Mud effect on clay swelling	TAMU: carrying capacity tests with different muds L-DGO: clay swelling vs. XRF, salinity, mud, for ODP cores

			Logging Objectives										Logging Tools				
Leg #	Leg Name	# sites	# sites log	# days log	seis. strat.	mineralogy	geochemistry	subsidence	pore fluids permeability	fracturing	magnetic properties	stress direction	standard Schlumberger	VSP	borehole televiewer	other	Comments
115	Mascarene Carbonate Diss.	7?	3	4.5	x	x							x				
116	Intraplate Deformation	5	5	8.5	x	x			x	x		x	x		x	x	temperature, drill-in packer (packer time not included)
117	Neogene	7	5	8.5	x	x							x	x			VSP NP-6, Milankovitch
118	SWIR	1?	1	8.5	x	x	x		x	x	x	x	x	x	x	x	full tool arsenal
119	Kerguelen I incl. Prydz?	7	7	10.8	x	x		x				x	x	x	x		VSP KHP-3
120	Kerguelen II	4	4	7.1	x	x		x				x	x		x		interwell correlation, VSP SKP-3
121	Broken Ridge	~~8?~~ 9?	~~5~~ 6	~~5.6~~ 7.4	x	x		x				x	x		x		
122	Exmouth	4	4	6.1	x	x		x					x				
123	Argo	1	1	4.0	x	x	x				x	x	x	x	x		VSP AAP-1B, basement geochem.

APPENDIX F

March 30, 1987

TABLE 2
DRILLING PROGRAM

PROGRAM WITH PRYDZ BAY DRILLING

LEG 119

SITE	DRILLING TIME
KHP-1	7.3 Days
KHP-3	17.0 Days
SKP-1	5.3 Days
PB-1	3.5 Days
PB-2	3.5 Days
PB-3	3.5 Days
PB-4	3.5 Days

Drilling Time = 43.6 Days
Transit Time = 26.7 Days (10 kt)
Total 70.3 Days

Transit Time = 21.7 Days (12 kt)
Total 65.3 Days

LEG 120

SITE	DRILLING TIME
SKP-2	5.6 Days
SKP-3	11.4 Days
SKP-4A	12.5 Days
SKP-6A	5.7 Days
SKP-8	6.4 Days

Drilling Time = 41.6 Days
Transit Time = 24.0 Days (10 kt)
Total 65.6 Days

Transit Time = 19.4 Days (12 kt)
Total 61.0 Days

PROGRAM WITHOUT PRYDZ BAY DRILLING
(include SKP-6B)

LEG 119
(ALTERNATE)

SITE	DRILLING TIME
KHP-1	7.3 Days
KHP-3	17.0 Days
SKP-1	5.3 Days
SKP-6B	13.7 Days

Drilling Time = 43.3 Days
Transit Time = 22.3 Days (10 kt)
Total 65.6

Transit Time = 18.6 Days (12 kt)
Total 61.9 Days

LEG 120
(ALTERNATE)

SITE	DRILLING TIME
SKP-2	5.6 Days
SKP-3	11.4 Days
SKP-4A	12.4 Days
SKP-6A	5.7 Days
SKP-8	6.4 Days

Drilling Time = 41.5 Days
Transit Time = 24.0 Days (10 kt)
Total 65.5 Days

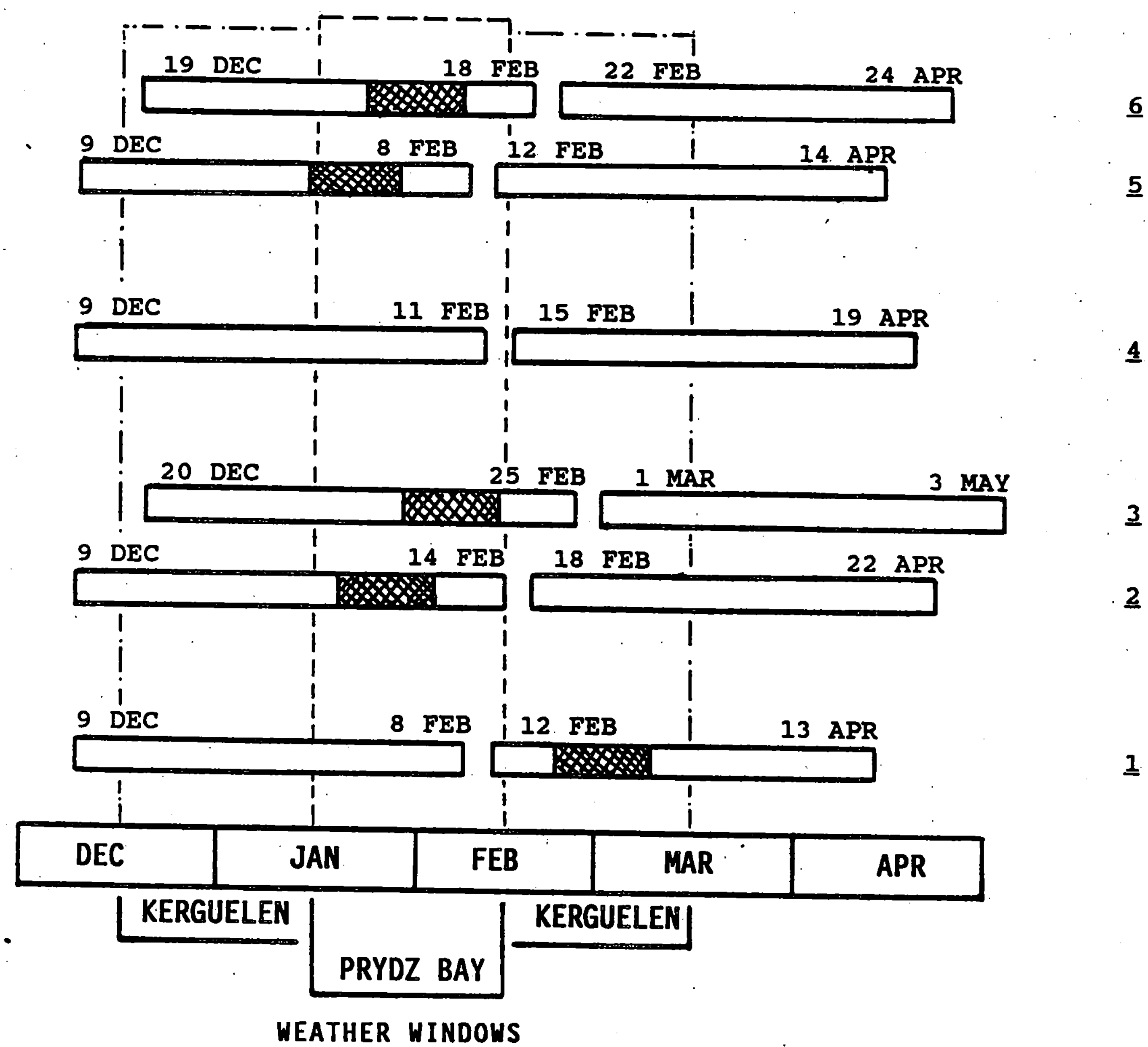
Transit Time = 19.4 Days (12 kt)
Total 60.9 Days

APPENDIX G

KERGUELEN PLATEAU & PRYDZ BAY DRILLING:

Versions (all assuming a speed of 11 knots):

1 As preliminary scheduled (61/60 days)
2 K-WG version 1, undelayed (length of legs: 67/63 days)
3 same as 2, but delayed by 11 days
4 K-WG version 2 (without Prydz Bay; 64/63 days)
5 K-WG version 1, without site SKP 8 (SKP 1 shifted to leg 120) undelayed
6 same as 5, but delayed by 10 days



APPENDIX H

TABLE 2: ODP LEG 116 PROPOSED SITES

Site	Location	Water Depth (m)	Total Penetr. (m)	Operations	Objective
1	00°55.725'S 81°24.000'E	4680	775	APC/RCB Logging	To establish a reference hole for seismic stratigraphy and physical properties.
2	00°57.375'S 81°23.985'E	4680	620	APC/XCB Logging	To compare sediment section with Site 1 to establish history of deformation.
3	00°57.875'S 81°23.985'E	4680	510	APC/XCB Logging	Same as Site 2.
4	00°58.650'S 81°23.985'E	4680	405	APC/XCB Logging	Same as Site 2.
4A	00°58.575'S 81°23.990'E	4680	290	APC/XCB	Same as Site 2.
5	00°58.975'S 81°22.000'E	4680	630	APC/XCB Logging and RCB Packer	To date the fault activity, to measure pressure, temperature and fluid characteristics above, below and at the fault-zone.
6	01°02.050'S 81°24.000'E	4680	230	APC/XCB Logging and RCB Packer	To measure pressure, temperature and fluid characteristics on a heat flow anomaly.

APPENDIX I

PROPOSED LEG 116 (INTRAPLATE) DRILLING PROGRAM

Site	Location	Travel Time (Days)	Time on Site (Days)	Logging	Date (approximate)
DEPART: COLOMBO (SRI LANKA)					
	UNDERWAY[1]	2.2			July 4, 1987
1	0°55.725′ S 81°24.000′ E		11.5	S.S. BHTV	July 18, 1987
	TRANSIT	0.1			
2	0°57.375′ S 81°23.985′ E		7.7	S.S.	July 26, 1987
	TRANSIT	0.1			
5	0°58.975′ S 81°22.000′ E		9.9	PKR, TEMP BHTV	August 6, 1987
	TRANSIT	0.1			
6	01°02.050′S 81°24.000′E		6.1	PKR, TEMP	August 13, 1987
	TRANSIT[1]	7.4			
ARRIVE: KARATCHI (PAKISTAN)					August 21, 1987
		9.9	35.2		48 days

[1]: Estimated at 10 knots;

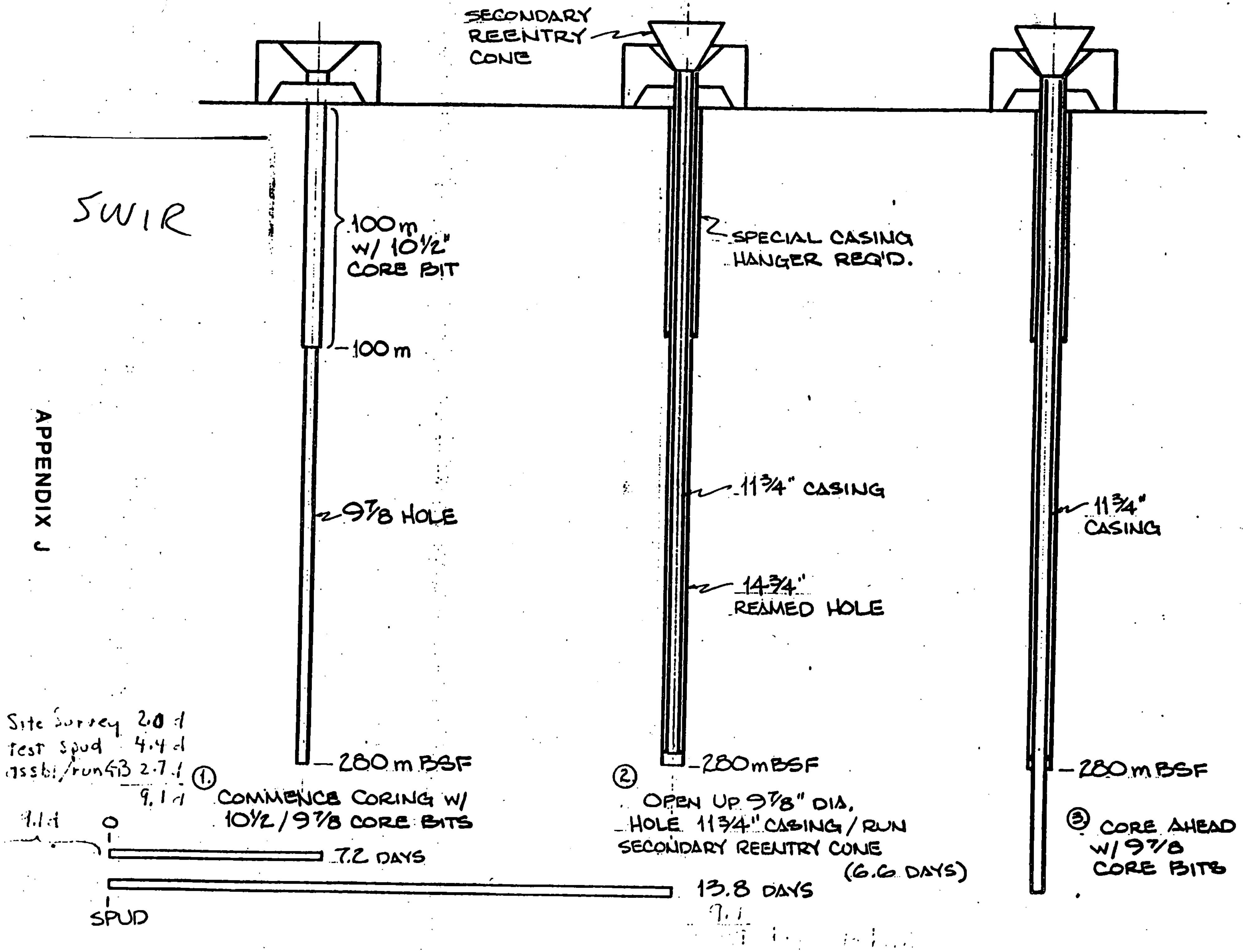
Note:

Glen Foss recommends to drill Site 5 or Site 2 before Site 1 to better estimate the possibility of reaching 750 m with the XCB.

3 operational days are currently unemployed.

APPENDIX J

HOLE P[illegible]GRAM C



APPENDIX K

BROKEN RIDGE/NINETYEAST RIDGE DRILL SITES

Number	Latitude	Longitude	Water Depth	Penetration	Priority	Drilling	Logging	Total
BR-1	30°56'S	93°34'E	1200 m	450 m (RCB)	1	2.6	1.2	3.8
BR-2	31°00'S	93°33'E	1065 m	450 m (RCB)	1	2.4	1.2	3.6
BR-3	31°06'S	93°32'E	1050 m	450 m (APC/XCB)	2	2.1	1.0	3.1
BR-4	31°09'S	93°31'E	1050 m	450 m (RCB)	1	2.4	1.2	3.6
90ER-1 (A)	0520.9'N	9002.6'E	2992	333 m (APC/XCB)		1.9	1.0	2.9
90ER-1 (B)	(RCB drill/wash 333 m)			RCB 517 + 50 bsmt		5.0	1.1	6.1
90ER-2	1715'S	8815'E	1800	APC/XCB 350 + RCB 200 to bsmt		4.5	1.0	5.5
90ER-5	2718'S	8730'E	2300	500 + bsmt		4.5	1.0	5.5
						25.4	8.7	34.1
Transit: Freemantle to Jakarta @ 10 kts.								18.5
TOTAL TIME								52.6

*** Tentative *** ODP Operations Schedule
Legs 114-123

	Departs		Arrives		In
Leg	*Location*	*Date*	*Destination*	*Date*	*Port*
114	Falkland Islands	16 March	Mauritius	14 May	May 14-20
115	Mauritius	21 May	Colombo	1 July	July 1-5
116	Colombo	6 July	Karachi	23 August	Aug 23-27
117	Karachi	28 August	Mauritius	18 October	Oct 18-22
118	Mauritius	23 October	Mauritius	14 December	Dec 14-18
119	Mauritius (Kerg)	19 December	Mauritius	18 February '88	Feb 18-23
120	Mauritius (Kerg)	23 February '88	Freemantle	24 April	April 24-28
121	Freemantle (BrR/NER)	29 April	Jakarta	21 June	June 21-25
122	Jakarta (Ex)	26 June	Darwin?	19 August	August 19-23
123	Darwin? (Argo)	24 August	????	19 October	Oct 19-23

Note: Ports and dates for Legs 122 and 123 are **tentative** and should be used as estimates only.

APPENDIX L

CO-CHIEF RECOMMENDATIONS FOR INDIAN OCEAN LEGS

LEG 120: (Kerguelen)

Anderson, Barron, Berendt, Berggren, Elverhoi, Hayes, Hays, Hinz (FRG), LeClaire (F), Mutter, Perch-Nielsen, Schlich (F), Segawa (J), Thierstein, Webb

LEG 121: (Broken Ridge/N90E Ridge)

Curray, Dimitriev, Frey, Gradstein (C), Haq, Herb (ESF), Ludden, Peirce (C), Sclater, Weissel, Whitmarsh (UK)

OUTLINE OF INITIAL TENTATIVE PROSPECTUS FOR CENTRAL AND EASTERN PACIFIC DRILLING

(not priority ranked)

Program	Proposals	Notes	CEPAC "Watchdog"
Juan de Fuca	232/E	Probably one Leg	E. Davis
EPR at 13°N	76/E	Question of doing this on sequential legs or in 504B style unresolved	J. Francheteau
Guyots (Cret.) Drowned Atolls	203/E 202/F	Presently as "package"; probably 2 Legs	M. Flower
Old Pacific	252/E	History indicates probably 1 Leg	H. Jenkyns
Ontong Java Plateau	142/E 222/E	Presently a "package"; possibly 2 Legs with one in WPAC schedule	S. Schlanger
North Pac	199/E 231/E 259/E	Presently a "package" of undetermined length	C. Sancetta
Bering Sea	195/E 182/E 225/E	Presently a "package" of undetermined length	H. Schrader
Young midplate "hotspot" volcanism	252/E	Presently a "package"; Loihi SM (252/E) and other expected proposals	M. Flower
Cascadia convergent margin	233/E 237/E	Presently a "package"	D. Scholl
Shatsky Rise	253/E	Probably a Leg	W. Sliter

Notes:

- Gulf of California and expected SOPAC proposals have not yet been considered.
- This outline prospectus is not to be viewed without consideration of preceding material.
- This outline prospectus will be subject to possible major modifications.

APPENDIX N

Proposed Plan for PCOM at Nikko

Narita Airport

Narita
↓ Shuttle Train
Uyeno
↓ subway
Asakusa
↓ Train
Nikko

Aug 25 — Tokyo —
↓ Train
Nikko
Sightseeing

26 ——
↑
27 PCOM $130/day (three meals)
↓
28
- - - - - - -

29 — Tokyo —

① Boso Peninsula Neogene Dewatering Structure
½ ~ 1 day $[illegible] 50

② Fly Oshima Volcanic Island
1 day 250 ~ $300

③ Train Fuji-Hakone Izu-Collision Zone (Ancient Zenisu)

④ Fly Shikoku Shimanto Accretionary Complex
[illegible]

30 — Tokyo Fly —— Hakone — Kochi —

Hakone: 1½ day, $200 ↓

Kochi: 1½ ~ 2 days, $400 ↓

— Tokyo —

31

United States Department of the Interior

GEOLOGICAL SURVEY

OFFICE OF ENERGY AND MARINE GEOLOGY
BRANCH OF ATLANTIC MARINE GEOLOGY
WOODS HOLE, MA 02543

June 22, 1987

87-465
RECEIVED JUN 30 1987

MEMORANDUM

TO: Chairman, JOIDES Planning Committee

FROM: Chairman, JOIDES Pollution Prevention and Safety Panel

SUBJECT: Report of the Safety Panel Meeting, 5-6 June 1987, Los Angeles, California

The JOIDES Safety Panel met at the Best Western InnTowne Motel in Los Angeles, CA on 5 June 1987, to review ODP Legs 117 and 118. Present at the meeting were:

JOIDES PPSP Members:

M. Ball
G. Claypool
G. Campbell
D. Mackenzie
N. Pisias (PCOM Liason)

ODP/TAMU Safety Panel:

L. Garrison
K. Burke
T. Thompson
H. Wories

Co-Chief Scientists

W. Prell (Leg 117)
G. Mountain (Leg 117)
N. Niitsuma (Leg 117)

JOIDES/ODP Site Survey Data Bank, LDGO

C. Brenner

ODP/TAMU:

G. Foss
K. Emeis

Unable to attend were D. Roberts, G. Stober, P. Ziegler, R. Byramjee, A. Green (JOIDES Safety Panel).

Safety Panel business was briefly discussed.

The next meeting of the JOIDES Safety Panel was planned for 9-11 September 1987, in College Station, TX to review ODP Legs 119 and 120.

I. Leg 117 Safety Review

This drilling program is designed to increase understanding of Neogene interactions of the Indian Ocean monsoon, upwelling, solar radiation cycles, tectonism and biotic evolution in the northwestern Indian Ocean. Drill sites are divided into three groups: Oman Margin, Owen Ridge and Indus Fan. Of these, the Oman Margin sites are clearly cause for the Safety Panel's greater concern because they occur in shallower waters (300-1400 m depth) with relatively thick sediments (greater than 2 km) in closer proximity to major oil and gas accumulations of the Arabian Peninsula. Site selections were designed to avoid structurally high positions on potential traps and penetrations are limited (700 m maximum).

A. Oman Margin Safety Reviews

OM-1, approved to 700 m penetration
OM-2, move onto line 13, two km northwestward from the projected position plotted on line 13, approved to 450 m penetration.
OM-3, move two km to the northeast on line 5, approved to 270 m penetration.
OM-4, move one km to the northeast on line 4, approved to 250 m penetration.
OM-5, approved as proposed.
OM-6, approved as proposed.
OM-7, disapproved.
OM-8, approved as proposed.
OM-9, move one km to the southeast on the SE-NW leg of line 19, approved to 400 m penetration.
OM-10, move five km toward southeast on line 19, approved to 340 m penetration.

B. Owen Ridge Reviews: Sites OR 1-4, approved as proposed.

C. Indus Fan Safety Reviews: Sites IN 1 and 2, approved as proposed.

II. Leg 116 Safety Reviews, 90 East Ridge Supplementary Sites:

NER-1 (9), move to time 10:10 on Line B, approved to drill to bit destruction.
NER-1 (10), move to time 1722.5 on line H, approved to drill to bit destruction.

III. Leg 118 Safety Reviews, Southwest Indian Ocean Ridge: approved all sites as proposed.

IV. Leg 119 Safety Reviews, Prydz Bay, Antarctica:

The Prydz Bay drilling program aims to increase understanding of Late Cretaceous to Recent climatic evolution of East Antarctica. This area is remote, unknown and requires accompaniment of an icebreaking vessel to conduct drilling operations.

The seismic survey for this area consists of 6 dip lines 300 to 400 km long spaced at 20 km intervals across the continental shelf. There are no tie lines. However, all lines generally show a sequence of seaward dipping reflections, whose angles of declivity are less than 5^{o}, extending across the entire shelf. These reflections appear to be truncated by an overlying, essentially horizontal, unconformity. The unconformity is typically overlain by a layer of horizontal material 100 m or so thick on the outer shelf. The unconformity appears to be exposed at the seafloor on the inner shelf.

The JOIDES Pollution Prevention and Safety Panel approves drilling on seismic line PB/021, seaward of 33-21-37-08 and landward of 34-09-28-07. These line segments include sites 6-8 and K_1-K_3, respectively. The safety panel also approves a specific site at 34-03-09-04. This specific site is site 5 of the drilling proposal. All drilling is limited to 500 m penetration.

Conditions permitting, Site 8, at the shelf edge, should be drilled first. Conditions permitting, the drill ship should run dip and strike lines using the ship's 80 in^3 water gun source at each drill site prior to drilling.

Walter M. Ball

DMP Recommendations

from Nov 86 meeting

INDIAN OCEAN

15. South Kerguelen/Prydz Bay

KP2, 10, 11, 12A
Standard logging suite — 1-1.7 d/site

KP5, 6

Standard logging suite	48 hrs
BHTV (bottom 100 m)	11
VSP (if holes 1 km or more deep)	24
	3.5 d/site

N.B. Use dipmeter in lieu of BHTV at sites KP5 and KP6 if available.

16. North Kerguelen

KHP4, 5
Standard logging suite — 1.3-1.4 d/site

KHP3

Standard logging suite	46 hrs
BHTV (bottom 200 m)	7
VSP	24
	3.25 d

KHP1

Standard logging suite	31 hrs
BHTV (bottom 200 m)	6
	1.5 d

N.B. Use dipmeter in lieu of BHTV at sites KHP 1 and 3 if available.

17. <u>90°E/Broken Ridge</u>

90 ER-1	
Standard logging suite	35 hrs
BHTV (bottom 100 m)	8
	1.7 d
90 ER-2, BR-1, 2, 3, 4	
Standard logging suite	1.0-1.2 d/site

18. <u>Intraplate Deformation</u>

BF-1	
Standard logging suite	46 hrs
BHTV (bottom 200 m)	12
	2.4 d
BF-3, 4	
Seismic stratigraphy and lithoporosity combination tools	24 hrs
BHTV (bottom 200 m)	10
T	8
Wireline packer or Barnes/Uyeda	12
Packer	24
Flowmeter	7
	3.5 d/site

N.B. Minicone required for packer

BF-2, 5	
Seismic stratigraphy and lithoporosity combination tools	24 hrs
T (Barnes/Uyeda)	2
	1.1 d/site

19. <u>Argo/Exmouth</u>

EP1, 1W, 3, 4A	
Standard logging suite	1.7-2.1 d/site
AAP-1A	
Standard logging suite	57 hrs
BHTV (bottom 200 m)	15
Magnetometer (basement only)	10
Susceptibility (basement only)	9
VSP	24
T (Barnes/Uyeda)	8
	5.2 d

20. Bonin I and II

BON1, 2, 8

Standard logging suite (plus HPC-T at BON1)	1.3-1.7 d/site

BON3, 4A, 4B, 5A, 5B, 7; MAR2, 3

Standard logging suite	38 hrs
Wireline packer	12
(plus HPC-T at BON3)	-
	2.1 d/site

BON6

Standard logging suite	43 hrs
BHTV (bottom 200 m)	11
Magnetometer (basement only)	7
Susceptibility meter (basement only)	6
Wireline packer	10
HPC-T	-
	3.2 d

N.B. RE cone required at one site for long term observatory.

21. Japan Sea

J1b

Standard logging suite	37 hrs
BHTV (bottom 150 m)	9
Magnetometer (basement only)	8
Susceptibility meter (basement only)	7
Oblique seismic experiment	7 d
T (HPC-T or Barnes/Uyeda)	-
Packer (frac)	24 hrs
	10.5 d

N.B. RE cone required; ship time reduced to 3.5 d if OSE done later by wireline RE.

J1d, e

Standard logging suite	39 hrs
BHTV (bottom 100 m)	9
Magnetometer (basement only)	8
Susceptibility meter (basement only)	7
T (HPC-T or Barnes/Uyeda)	-
	2.6 d/site

J2a

Standard logging suite	48 hrs
VSP	24
T	7

Wireline packer	10
Induced polarization	6
	4 d

J3a

Standard logging suite	34 hrs
BHTV (bottom 100 m)	8
Magnetometer	8
T	7
	2.4 d

N.B. RE cone required for long term observatory.

JS-2

Standard logging suite	29 hrs
T (HPC-T or Barnes/Uyeda)	-
	1.2 d

22. <u>Sunda</u>

S1, T1

Standard logging suite	38 hrs
BHTV (bottom 100 m)	8
	1.7-1.9 d/site

S2, T2

Standard logging suite	34 hrs
BHTV	9
T	6
Wireline packer	10
	2.5 d/site

F1, 2

Standard logging suite	44 hrs
T	7
Wireline packer	10
	2.5 d

S3

Standard logging suite	35 hrs
BHTV (bottom 100 m)	5
	1.7 d

23. <u>Banda/Sulu/S. China Sea</u>

SCS1, BND A2, SULU5

Standard logging suite	46 hrs
BHTV (bottom 100 m)	11
T (HPC-T, Barnes/Uyeda)	-
	2.4 d

N.B. Also run dipmeter at SULU5 if available.

BND A1, A3

Standard logging suite	44 hrs
T (HPC, Barnes/Uyeda)	--
	1.8 d

SCS2

HPC-T	-

24. <u>Great Barrier Reef</u>

GBR1, 2, 3A, 6

Lithoporosity and geochemical combination tools	37 hrs
Dual laterolog	9
12 Channel sonic	15
	1.7-1.9 d/site

GBR5C

Lithoporosity and geochemical combination tools	37 hrs
Dual laterolog	9
12 Channel sonic	15
VSP	24
	2.9 d

25. <u>Lau Basin</u>

Generic Sites (site details not available at time of meeting)

Standard logging suite	36-48 hrs
Magnetometer	8
Susceptibility meter	7
T (Barnes/Uyeda)	-
Wireline packer	10
	2.5-3 d/site

N.B. To be revised as site details become available.

26. <u>Nankai Trough</u>

NKT-1

Standard logging suite	44 hrs
BHTV (bottom 100 m)	11
T	8
Borehole geotechnical studies	24
	3.6 d

NKT-2

Standard logging suite	52 hrs
BHTV (bottom 100 m)	13
Borehole geotechnical (including frac.)	24
	3.7 d

N.B. In addition, DMP strongly recommends that a RE cone be set at NKT-2 for long term observatory studies and that a physical properties minileg be conducted at the site to conduct push and drill-in instrumented probe studies (per Karig proposal).

27. Vanuatu

IAB-1, 2	
Standard logging suite	1.7 d/site
DEZ-2	
Standard logging suite	46 hrs
BHTV (bottom 100 m)	10
Wireline packer	10
Packer	24
Pressure meter	10
	4.1 d
DEZ-3, 4	
Standard logging suite	44 hrs
BHTV (botom 100 m)	9
Wireline packer	9
Packer	23
	3.5 d/site
BAT-1, 2	
Lithoporosity and geochemical combination tools	28 hrs
Dual laterolog	8
12 Channel sonic	10
Magnetometer	10
Susceptibility meter	7
T	7
	2.9 d/site

87-326
RECEIVED APR 22 1987

EXECUTIVE SUMMARY

JOIDES DOWNHOLE MEASUREMENTS PANEL

Texas A & M University

College Station

2 -3 April 1987

HIGHLIGHTS

(i) Geochemical logs are proving to have a higher accuracy than previously envisaged. Log-derived weight-percent concentrations of Al, Fe and Si are accurate to within 5 per cent of quoted figures.

(ii) COSOD II white paper on logging is at draft 1 stage. Two further iterations envisaged.

(iii) Operational difficulties continue to prevent logging. Two basic problems have been Co-chief modifications to programme, sometimes without consulting LDGO scientist, and failure of TAMU to drill loggable hole.

(iv) TAMU have advised DMP that they will be prepared to expose BHA to some risk in order to facilitate logging through pipe, the omission of which is causing much useful information to be lost.

(v) A physical properties working group is proposed under the auspices of DMP to follow up the recommendations of the JOI/USSAC workshop of 1986.

072

87-326
Rec'd 4/22/87

MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

Texas A&M University
College Station

April 2-3, 1987

8.30 am

MINUTES

Present

Chairman:	P.F. Worthington (UK)
Members:	E. Howell (USA) G. Olhoeft (USA) R. Traeger (USA) H. Fujimoto (Japan) R. Jung (FRG) M. Salisbury (Canada) B. Steingrimsson (ESF) S. Bell (at-large)
Liaisons:	R. Anderson (LDGO) R. Jarrard (LDGO) C. Avroux (TAMU/ODP) M. Langseth (PCOM) K. Becker (LITHP)*
Guests:	B. Harding (TAMU/ODP)* C. Hanson (TAMU/ODP)* A. Meyer (TAMU/ODP)*
Absent with Apology	R. Stephen (USA)
Absent	J-P. Pozzi (France) F. Sayles (USA)

* denotes partial attendance

1. Welcome

The Chairman welcomed DMP Members and Liaisons. This was the first DMP meeting under the new Chair. Outgoing chairman Matt Salisbury was thanked for all his efforts both on behalf of DMP and in support of the cause of scientific well logging in general.

Introductory Remarks

The Chairman briefly summarized the current status of DMP and the key events since the last DMP meeting in November 1986. A strong support for downhole measurements was evinced at the annual meeting of PCOM and Panel Chairmen in Hawaii in January 1987, at which a report on present and future directions of downhole measurements was presented. The Chairman outlined the main points of the report for the benefit of members.

Review of Agenda and Revisions

Several items were modified/added as follows:

(a) Item 6(ii) to include an advisory statement to EXCOM on procedures for use of re-entry holes and policy on their long-term observational use. This has been requested by PCOM.

(b) Item 11 to include DMP priorities for New Technology.

(c) Item 24 to be extended to include new Japanese proposal for a focussed plan of downhole observatories and experiments in the Nankai Trough and the Japan Sea.

(d) Item 27 to include appointment of a DMP liaison to TEDCOM.

(e) Item 27 to include a description of recent DOSECC activity.

2. Minutes of previous DMP meeting, Tokyo, November 1986

These had only been received by the Chairman immediately prior to this meeting. As such, there had not been time to review them.

Adopted provisionally with the right to further change within the duration of this meeting.

3. Panel Philosophy

DMP Recommendation 1987/1

DMP decision-making should be driven by the following philosophy.

(i) ODP holes are not objectives in themselves. They constitute a scientific legacy for the future in terms of:

- seismic control points;
- standard logging suites;
- preserved core material;
- physical properties database;
- downhole experiments and long-term observations.

(ii) The acquisition of downhole-measurement data should be planned from a global standpoint, not a parochial one. Specific tools are being recommended in response to requests from the community for a global programme of downhole measurements.

(iii) When a site is vacated, properly executed logs provide the only continuous record of the succession. It is not possible to obtain the same information from core measurements. Logs provide an intermediate sampling scale between core and surface geophysics, they characterise the subsurface environment and record physical properties in that in-situ environment, and they allow active and transient phenomena to be studied.

4. Vertical Seismic Profiling (VSP)

PCOM Question

"Should VSP be a routine experiment on board ship and what is its scientific return?"

DMP Response

Application of VSP should depend on its relevance to the scientific objectives, its priority rating vis-a-vis other measurements and experiments, the existence of a science-driven commitment to its application, and the subsequent dedication of resources/effort for processing and interpretation.

The scientific returns of VSP include:

- detection of reflectors beneath the drill bit;
- measurement at a scale which is closer to geophysics;
- three-dimensional information;
- data from uppermost 70 m of sediment which is currently not logged;
- potentially better porosity characterisation in some basalts/carbonates.

DMP is prepared to encourage appropriate initiatives for VSP deployment including:

- scientific proposals;
- JOI-USSAC workshop on VSP;
- USSAC offer to fund acquisition of VSP capability;
- establishment of technical support within an approved institution.

DMP Recommendation 1987/2

VSP should not be a routine experiment on the ODP drill ship.

5. Logging Through Pipe

PCOM Question

"What is the quality of logs taken through the drill pipe?"

DMP Response

The "geochemical combination" of the natural gamma spectral tool (NGT), aluminium activation clay tool (AACT) and induced gamma spectral tool (GST) is the most useful for logging in drill pipe. The thermal-epithermal neutron tool (CNT-G) also incorporated within this string allows porosity to be determined. Log quality is degraded by pipe but the data remain useful. Steel effects can be smoothed by making a second logging run with the pipe displaced by a few metres. No quantitative comparisons are available of log data from the geochemical combination in open and steel-lined holes.

There are two distinct applications:

(i) logging in top pipe;
(ii) logging full hole in pipe where open hole logging cannot be done, e.g. when the core barrel is stuck.

In both cases logging is physically achievable in terms of tool diameter vs inner pipe diameter and indeed has been done already on Legs 101, 102, 105 and 111.

There are some lithologies through which it is always difficult to drill and for which logging through pipe might provide the only means of acquiring downhole measurements. Without this facility these lithologies might never be characterised and might therefore represent a permanent gap in our knowledge. For this reason logging through pipe should be routine where there is no other way of obtaining the data. This should be done even where there is some risk to the drill pipe.

DMP Recommendation 1987/3

Wherever possible logging through pipe with the geochemical/neutron combination should be routinely carried out even though this might place the drillstring/BHA at risk. This would provide further information on the formations that cause the swelling problems as well as furnishing data that would have been lost.

DMP Recommendation 1987/4

A more realistic definition of what constitutes an acceptable level of risk to the drillstring should be formulated. This definition should admit an element of risk since the occasional loss of a BHA is sustainable and would be costwise incremental to the cost of the drilling operation itself.

DMP Recommendation 1987/5

During an upcoming leg the side entry sub should be used to make a dedicated comparison of nuclear logs in pipe and in open hole for quantitative assessment of degradation.

6. USSAC Workshops

(i) Physical Properties

A summary of the recommendations from the JOI/USSAC workshop in June 1986 was followed by reiteration that physical properties are not represented in the JOIDES structure. DMP considers this to be a major omission.

DMP Recommendation 1987/6

DMP to be permitted to convene a technical working group on physical properties to pursue the recommendations of the JOI/USSAC workshop held at Cornell University in June 1986. The group should provide advice on and monitor progress in the establishment of improved facilities for the laboratory measurement of physical/mechanical properties. The group should report to PCOM through DMP.

DMP Recommendation 1987/7

The DMP physical properties working group should be internationally drawn and should comprise a maximum of seven members plus liaisons. Members should be drawn from the following nominees:

Dan Karig (Cornell Univ.)
Armand Silva (Univ. Rhode Island)
Bobb Carson (Lehigh Univ.)
Peter Jackson (British Geological Survey, UK)
Dick von Herzen (WHOI)
Eve Sprunt (Mobil)
Rick Carlson (TAMU)
Kate Moran (Atlantic Geoscience Center, Canada)

Karig/Silva nominated for Chair or Co-chair. Liaisons to be nominated from ODP/TAMU, DMP and IHP.

DMP Recommendation 1987/8

The DMP physical properties working group should meet 3-4 times over a 2-3 year period in the expectation that such an effort will lead to a substantial upgrade in laboratory physical properties: USSAC to be asked to meet costs of US attendees.

(ii) Research Possibilities for Use of Deep Sea Drillholes

Workshop held in February 1987. Principal thrust was development of a wireline re-entry capability. Wireline re-entry logging will never replace logging from the drill ship. Where long-term observations are planned holes should be drilled specifically with this purpose in mind. There is no clear policy on jurisdiction over ODP holes.

PCOM Request

"In order to give EXCOM direction for a policy on long-term use of ODP holes, could DMP give specifics on what aspects of re-entry need to be covered?"

DMP Response

(i) Considerable precedent exists for returning to DSDP holes for the purpose of re-entry and doing further science. This implies that JOIDES has always regarded the existing boreholes as a scientific resource that can be visited following appropriate consultation with and review by JOIDES planning bodies. This precedent also implies that JOIDES has a long-term interest in protecting this resource from damage or loss. This view and commitment form a basis for the use of a hole by both JOIDES and non-JOIDES communities.

(ii) Efforts within the JOIDES community to use the holes for scientific purposes should be done with the full knowledge and approval of the JOIDES EXCOM. The approval process should include an evaluation of the scientific merit of the work programme versus the potential jeopardy to the borehole for future use. The activity from non-ODP ships should be monitored by establishing strong communications before and after re-entry and requiring a prospectus and report.

(iii) Neither JOIDES nor any other body has clear legal jurisdiction over the use of boreholes outside EEZs. Nevertheless considerable control over the use of these holes could be exercised because of the breadth of the JOIDES community and its participating scientists. This control might be enhanced through the publication of a policy guideline emphasising the need for cooperation and communication.

7. Logging Contractor's Report

Successes:-

(i) Geochemical tool combination is being evaluated for accuracy of elemental concentrations. For Al, Fe and Si the tool is capable of furnishing a weight percentage concentration that is accurate to within $\pm$ 5% of quoted figure.

(ii) Leg 111 - first recognition of faulting from magnetometer confirmed by Ti vs Gd crossplot from mineralogy tool.

(iii) Leg 111 - successful run of analogue borehole televiewer with digital processing.

(iv) Leg 112 - recognition of turbiditic sequences from resistivity and gamma ray logs.

(v) Legs 112/113 - excellent synthetic seismograms.

Difficulties:-

(i) Greater incidence of stuck core barrels corresponding to use of XCB.

(ii) Of the total sites drilled 36% have been logged. Of sites with holes deeper than 400 m, 73% have been logged. Of these 73%, only 48% have been logged with two tool combinations. These statistics are getting worse.

(iii) Major problem continues to be bridging aggravated by mud system.

(iv) First use of side entry sub on Leg 113 resulted in a tool being blown off the wireline.

(v) Co-chief scientists are modifying scientific programme to exclusion of logging during course of a leg. This was a particular problem during Leg 113 when LDGO logging scientist was not even consulted.

8. TAMU Briefing

Led by B. Harding:

(i) Logging through pipe

No problem provided that drill pipe is safe. Panel considered that definition of "safe" is too conservative. Some risk should be accepted. TAMU advised DMP that they will be prepared to expose BHA to some risk in order to facilitate logging through pipe, the omission of which is causing much useful information to be lost.

(ii) Mud Programme

TAMU/ODP have inaugurated a research contract for alternative mud systems with Texas A&M University. This is primarily intended to look at flow loops and carrying capacities but it could be extended to encompass swelling of rock materials for those muds identified as having good carrying capacity. LDGO will advise TAMU of their requirements in this area.

(iv) Side Entry Sub

Guidelines for operation of the side entry sub should be available prior to Leg 115. To prevent repetition of tool loss, tool should be positioned below drill pipe during circulation.

DMP Recommendation 1987/9

DMP reinforces entrusting TAMU Operations Superintendent with authority to see that holes required to be logged according to PCOM directives and guidelines are logged. This recommendation requires that TAMU Operations Superintendent be aware of PCOM directives and guidelines concerning logging.

DMP Recommendation 1987/10

DMP reiterates that it is TAMU responsibility to provide loggable hole and, to this end, Panel endorses TAMU programme to investigate alternative mud systems. DMP recommends that this programme be extended to investigate clay swelling control aimed at improved borehole stability for both logging and coring.

8. Logging Technology Improvements

Post Leg 114 the three standard Schlumberger logging suites are to be merged into two digital combinations as follows:

(A) Eight-channel sonic (SDT)
Caliper
Natural gamma spectral (NGT)
Thermal-epithermal neutron (CNT-G)
Phasor induction (DIT-E)
Spherically focussed resistivity (SFL)

(B) Natural gamma spectral (NGT)
Aluminium activation (AACT)
Gamma spectral tool (GST)
* Lithodensity tool (LDT)

* Depends on availability of through-wired GST: not likely before Leg 116.

The move to two tool combinations is a recognition of the reality that it is difficult to get three logging runs in an ODP hole.

Two other major advances are:

(i) Acquisition of Schlumberger workstation for interpretation of activation logs. Can now reprocess old GST logs for Ti and Gd. (This is a classic example of the scientific legacy of well logs).

(ii) Acquisition of source spectra for the eight-channel sonic tool from Schlumberger.

PCOM Request

"Review the budget outline for FY88 and forward advice to PCOM."

DMP Response

Technical priorities agreed as follows:

(i)	Temperature tools	($30k)
(ii)	User software/data dissemination	($20k)
(iii)	Formation microscanner	($150k)
(iv)	Three-component gryo magnetometer	($30k)
(v)	Third wireline packer	($80k)
(vi)	Second digital televiewer	($94k)
(vii)	Induced polarization tool	
(viii)	High resolution gamma spectroscopy	

Notes: Second sidewall entry sub will happen anyway. Terralog work stations substituted by (ii). MWD and High Temperature Tools deferred.

DMP Recommendation 1987/11

The DMP-recommended priorities and time schedulings for logging technology developments are as follows. All items for FY87 and FY88 are considered essential and are in priority order.

FY87

(1) Temperature tools
(2) User software/data dissemination
(3) Formation microscanner

FY88

(1) Three component gyro magnetometer/susceptibility tool
(2) Third wireline packer
(3) Digital televiewer

FY89

Induced polarization

FY90

High resolution gamma spectroscopy
MWD
High temperature tools

9. <u>COSOD II White Paper</u>

A first draft was circulated based on contributions from nominated panel members. This was subjected to a preliminary review. Contributors to study and forward comments to Chairman within <u>two weeks</u>.

10. Logging Programme - Upcoming Legs

Leg 115

DMP Recommendation 1987/12

The three deepest holes of Leg 115 should be logged with the standard Schlumberger suite.

Leg 116

DMP Recommendation 1987/13

Seismic-stratigraphy and geochemical combinations to be run in all five holes of Leg 116 that are scheduled for logging. Additionally:

BF-1
BHTV (bottom 200 m)

BF-3,4
BHTV (bottom 200 m)
Temperature
Kuster Sampler
Packer

BF-2,5
Kuster Sampler

Leg 117

DMP Recommendation 1987/14

Standard Schlumberger suites plus high-resolution resistivity tool to be run in the following five holes of Leg 117: NP 2, 4, 5, 6 and 7. Borehole televiewer to be run in NP 6, 7. VSP survey at NP 6. Barnes new water sampler to be deployed in every hole if available.

Leg 118

DMP Recommendation 1987/15

Logging schedule for deep-mantle re-entry hole, Leg 118:

Schlumberger standard suite (with Temp)	45h
BHTV/magnetometer	16
Multichannel Sonic Tool	13
Gyro Magnetometer	15
Susceptibility	8
Packer	48
Wireline packer or Kuster T/H_2O	14
Complex Resistivity	12
Dual Laterolog	11
Flowmeter	?
VSP	18

DMP Recommendation 1987/16

Back-up logging schedule for Leg 118 if deep re-entry hole not drilled is as follows, in order of priority with priority being invoked as holes become shallower:

Schlumberger Standard Suite
Wireline Packer
Magnetometer
Multichannel Sonic
Borehole Televiewer
VSP

Legs 119 and 120

DMP Recommendation 1987/17

For Legs 119 and 120 all holes to be logged with standard Schlumberger suite. BHTV to be run at KHP-1, 3 and SKP6B. VSP to be run at KHP-3 and SKP-3.

11. Proposal 270/F

"Tomographic Imaging of a Hydrothermal Circulation Cell"

DMP Response

DMP endorses the concept of tomographic surveying between boreholes and would be pleased to consider a detailed proposal in the future.

12. Proposal 272/F

"Summary for long-term downhole measurements in seas around Japan" plus unsolicited addendum

DMP Response

DMP supports proposal 272/F and wishes to encourage it. Proposal is technically workable.

DMP Recommendation 1987/18

Consideration be given to placing temperature array in hole NK-2 or the physical-property probe hole if the latter is approved.

13. New Panel Members

DMP Recommendation 1987/19

DMP nominates the following to replace those four members rotated off in 1986:

Wendell Givens (Mobil)
Carl Sondergeld (Amoco)
(alternative Arthur Cheng (MIT))
Bobb Carson (Lehigh Univ.)
Bob Porter (Univ. of Washington)

This list supersedes that issued by DMP in 1986.

14. TEDCOM Liaison

Deferred until PCOM approve full Panel complement.

15. DOSECC

DMP members were briefed about DOSECC activity: no decisions on future DOSECC/DMP liaison.

16. Next Meeting

DMP Recommendation 1987/20

DMP to meet on 18/19 August 1987 at University of Washington, WA.

Paul F. Worthington
14 April, 1987

SSP Minutes
Copenhagen, 30 JUN-3 JUL 1987

1. PRELIMINARY MATTERS

The Chairman welcomed Jack Baldauf as liaison from TAMU for this meeting.

The minutes from the January meeting were accepted after noting that the underway geophysics trials took place on Leg 111 T, not 112 T.

Ship schedules for Germany and Japan for 1988 were received (Appendices A & B). The Chairman reminded others to bring ship schedules to our next meeting.

ACTION: Panel members bring updated ship schedules to next meeting.

2. REPORTS

a) PCOM (Francis)

Leg 113 went quite well, although there was a high rate of failure in coring tools which led to less logging time than desired.

Peirce mentioned that he had reports that scientific communications between the RESOLUTION and the ice picket vessel were very poor.

ACTION: TAMU should discuss communications issues regarding science on picket vessel prior to Prydz Bay drilling in order to prevent a recurrence.

A Navidrill was lost on Leg 114, and the second one failed to operate properly. TAMU hopes to have problems resolved in time for use on Leg 118. Leg 118 has been extended to 52 days. Their prime objective is still a deep hole in the median ridge.

ACTION: Baldauf send Peirce an update on the Navidrill problems and status for distribution to the panel members.

Leg 119 ice vessel will cost $850 K, J. Barron (USGS) is one Co-Chief. Other invitee has not yet replied. Leg 120 Co-Chiefs will be R. Schlich (France) and S. Wise (Florida State). Sites KHP-3 and SKP-8 dropped for lack of time. about five Australians have applied for scientific positions on either of the legs.

Note: Appendices A-F will be available at the PCOM meeting in August !

Leg 121 Co-Chiefs will be J. Weissel (LDGO) and J. Peirce (Canada) and will combine Broken Ridge and up to 3 sites on the Ninetyeast Ridge.

Leg 122 will include four sites on Exmouth Plateau. Leg 123 will include site EP-9 and the deep hole AAP1B.

PCOM passed a motion supporting the WPAC drilling plans laid out in the third prospectus.

A CEPAC first prospectus is expected from their meeting in early October.

b) TAMU Report (Baldauf)

Leg 115 drilling clearances in waters of Mauritius were denied at last minute, necessitating a large amount of last minute site selection. Site 706 (MP3) and 707 (~~near MP3~~ CB-1A) penetrated multiple basalt flow units. Site 713 (CB-1) penetrated 106 m of multiple basalt units. Site 715 (MLD-4) penetrated 100 m of shallow Paleogene limestone reef and 77 m of multiple basalt units.

Backup scenarios for Leg 116 were briefly discussed in case they encounter hydrocarbons.

Staffing for Legs 117 and 118 is nearly done.

Leg 118 site survey data were felt by TAMU to be less than adequate for a bare rock drilling site. It was pointed out the SSP had clearly indicated the need for a TV survey. They do not consider the 118 site survey to represent the normally acceptable standard for bare rock drilling sites. All site survey data for Leg 118 are not yet in the Data Bank.

ACTION: Baldauf send SSP a letter outlining key TAMU concerns regarding inadequacies of SWIR site survey.

Peirce write Dick (cc: von Herzen & Robinson) urging submission of all available data to Data Bank ASAP. Emphasize time necessary to produce overlays and synthesis.

A Drilling Engineering Workshop was held at TAMU on May 27/28 and attended by about 70 people, including Lewis for SSP. Proceedings will be published by Sandia in a few months. The conclusions reached were neither as sweeping nor as authoritative as people has hoped for, although some progress was made in the area of fluid sampling.

The towed 3.5 KHz fish was lost while testing it. Bill Robinson has proposed a scheme for mounting a 12 transducer hull mounted array without a dry dock at an estimated cost of $125 K.

RESOLUTION The SSP reiterates that it values highly the underway geophysics data collected by the JOIDES RESOLUTION, especially because her tracks are often in inaccessible locations. The SSP encourages TAMU to continue to strive to improve the underway 3.5 KHz and seismic systems. Our technical recommendations are given in the 111T geophysics report.

Because there seem to be several legs coming up where the scientists involved in site surveys may not be members of the shipboard party, the SSP felt it necessary to reemphasize the desirability of having site survey scientists a) invited to the post-cruise meeting, b) given access to shipboard data, and c) invited to submit papers on their work to the Part A volume. Therefore we restate our motion from our April, 1986 meeting to wit:

April, 1986 MOTION: (Langseth/Duennebier)

The SSP recommends that scientists chiefly responsible for site surveys normally be invited to post-cruise meetings in order to encourage collaboration between site survey and drilling scientific activities.

The SSP reiterates its support for the inclusion of a synthesis of site survey data within Part A of the ODP Proceedings. Part A manuscripts on site survey work should be submitted pre-cruise whenever possible. Interpretation of the survey data inlight of the drilling results should be included in Part B.

Passed 6 for, 1 abstention.

ACTION: TAMU will add this item to the pre-cruise agenda. Francis will remind PCOM of our recommendations.

c) Data Bank (Brenner)

The Budget Committee recommended that the one month of Sr. Scientist time be cut from the ODP Bank budget. This represents a cut of about 2 1/2%.

The SSP is concerned that the Data Bank may lose a senior advocate to defend itself within the Lamont system. Currently there seems to be an adequate network for technical and internal political support, but this situation may change as people change. The SSP consensus is to monitor the situation, but no immediate action appears necessary.

Data Bank activity is up slightly from 1985 to 1986.

Very little WPAC data has actually made it into the Data Bank as yet.

The Data Bank catalog will be reissued by the end of the summer. It will include a lengthy introduction regarding policies and procedures.

The changeover of the LDGO computer system from VAX to SUN network is proceeding. A new system for cataloging data bases on a centralized system (GEOBASE) is proceeding well. JOI has provided some additional $ to convert the DSDP/IPOD data base to this system.

Leg 115 site survey data was reviewed by John Mutter for the SSP.

The French proposal to drill the fossil ridge in the Wharton Basin is being considered as a secondary backup target for Leg 116.

ACTION: Wiedicke sends Peirce a copy of the Wharton Basin fossil ridge proposal.

d) Indian Ocean Panel (Brenner)

Brenner briefly reviewed the last IOP meeting held at LDGO.

e) West Pacific Panel (Suyehiro)

Suyehiro briefly reviewed the last WPAC meeting in Tokyo.

Some concern had been expressed that the Bonin sites were in areas leased by JAPEX, but apparently getting permission to drill will not be a problem.

SOHP has serious concerns regarding the hydrothermal proposal for drilling on the Great Barrier Reef. They are steadfastly opposed to repositioning the site locations already proposed.

WPAC does not consider bare rock drilling in the Lau Basin to be a high priority for them relative to their other objectives.

Duennebier reported that Fryer (HIG) has just completed a diving program on a serpentinite diapir in the Marianas. She discovered aragonite chimneys at depths below the stability field for aragonite, apparently being maintained by cold flowing water. A drilling proposal is being prepared.

f) Central and Eastern Pacific Panel (Lewis)

No report available as Lewis unable to attend.

g) TAMU Budget (Baldauf)

The FY 88 budget requires cuts at TAMU. Options being considered include printing only 1000 hard copies of parts A + B reports and 1000 microfiche copies (instead of 2000 hard copies), author prepared camera ready Part B volumes, elimination of the SEM and XRF and techs needed to run them on board as well as going to an older and simpler XRD system, elimination of 3 staff scientists, reduction in TAMU panel liaisons, reduction in headquarters budget, and reduced software acquisitions.

3. <u>SITE SURVEY ASSESSMENTS</u>

a) Kerguelen (Brenner/Baldauf)

Although Suyehiro is SSP watchdog for SKP and Prydz Bay, Brenner and Baldauf have participated in the meetings of the Kerguelen Working Group (KWP).

The objectives, priorities and recommendations of the KWG and PCOM were reviewed.

The Prydz Bay data were reviewed briefly now that parallel lines are available. These suggest that the strike of the

Bold

dipping beds at the landward end of line 21 is parallel to the coast, implying that their true dip is greater than shown on line 21.] The one cross line is in deep water and is not relevant to the proposed drilling.

It is not possible for the SSP to approve the SKP sites until they have seen the full-sized seismic sections and the associated magnetic profiles (to check for shallow volcanics shich may be present in places). We only had the French/Australian proposal to work from.

The Data Bank needs to receive full sized seismic sections, magnetic profies, and the MD-48 dredge descriptions as soon as possible. It has received digital navigation for both the French and the Australian cruises, and this has greatly simplified the data synthesis problem.

Sites SKP - 1, 2 and 8 appear to be OK, subject to reviewing the full-sized seismic sections and the magnetic profiles.

Specific concerns of the SSP regarding SKP sites are:

(1) SKP 3 or 3 A is a reentry site. **The SSP is very concerned about the lack of crossing seismic lines for such a deep hole, especially at site SKP-3A.**

A pinchout in reflectors apparently interpreted as basement exists at SKP-3. True basement may be much deeper. Are refraction velocities for "basement" available here? SKP-3A is positioned high on a fault-closed structure. Shallow volcanics may occur to the NE.

Could SKP-3 be repositioned to the south at the crossing of lines RS02-27 with lines 30 or 32?

The nearest core is nearly 100 km away.

ACTION: Duennebier and Baldauf talk to Schlich at Strasbourg. Peirce followup with a letter to Schlich and Coffin asking for a detailed explanation of the constraints which led to choosing sites SKP-3 and 3A and reiterating the need for the data requested above.

SKP-4A (200 m basement penetration) SSP needs to see nearby cross line RS02/27.

SKP-6A (50 m basement penetration).
Apparently straitforward, but need to see line 47-07 before turn to be sure.

SKP-6B (1000 m).
Not on cross lines, but not planned as a reentry. Need to see line 47-06 before turn to be sure.

ACTION: Brenner send copy of SKP proposal to Suyehiro. Send copies of data requested upon receipt for immediate watchdog review in light of above comments ASAP. Make copies of full-sized seismic sections available for PCOM annual meeting in Nov., and make core descriptions available to TAMU. Suyehiro complete watchdog report on receipt of data and forward to Peirce, cc Brenner and JOIDES office.

b) Broken Ridge/Ninetyeast Ridge (Peirce)

Peirce presented Curray's revised choices for the two holes at the **Northern Ninetyeast Ridge site. These sites were approved.**

Peirce reported a telephone conversation with Sclater who reported that all the SCS data are processed for the southern and central Ninetyeast Ridge sites. Sonobuoys are partially processed and will be completed in time for the September safety review.

ACTION: Peirce call/telex Sclater to be sure that the Ninetyeast Ridge SCS data be delivered to the Data Bank by August 1 with sites selected in order to allow timely preparation of the safety package.

Brenner and Peirce both remind Weissel that sites must be picked for Broken Ridge and seismic data submitted to the Data Bank by August 1 to allow timely preparation of the safety package.

c) Exmouth Plateau (von Rad/Larsen)

Von Rad gave a brief summary of the overall objectives for the program and then presented the data in a site by site presentation.

The processed versions of the new BMR seismic are not in the Data Bank. Apparently the processing is about 50% completed, but very little is reported to be done yet for sites EP-9 and 10. **It will be essential for PPSP to have fully processed seismic in order to make a proper evaluation, particularly at these sites. An isopach map of the thinning Neogene cover will be essential in working out alternative drilling strategies because it will be difficult or impossible to spud into the Mesozoic carbonates at the edge of the Plateau.**

Site EP-2: Planned to spud into Paleogene. Needs geotechnical core or other info on the hardness of the sediments of this age near the site. Perhaps 3.5 KHz data from RC-2703 exists which could help.

Site EP-6: Planned to spud in an area of active erosion. Need geotechnical core if reentry planned, but not yet clear if that will required.

Site EP-7: **Approved by SSP once all new data and maps are deposited with the Data Bank.** Structural maps show the site to be in a synclinal position. A possible concern to the PPSP may be the occurrence of several pinchouts above the Barrow Delta level.

Sites EP-8, 10 & 11: **The seismic data must be fully processed, including deconvolution and migration. Depth sections are highly desirable** because variable water depths make it difficult to be sure of the structural attitudes appearing on the time sections. Time structure maps exist. Because it will be difficult or impossible to spud into outcropping Mesozoic carbonates or to set a reentry cone in them, detailed information on bottom hardness is needed (cores if possible or 3.5 KHz (not currently available) or perhaps diving (not scheduled)). The alternative is to plan to spud into the toe of the Neogene section if PPSP will allow it.

Site EP-9: **Approved by the SSP once fully processed seismics and navigation are deposited with the Data Bank. However, the Paleogene and Cretaceous sections appear to be in a stratigraphic trap position and <u>PPSP may not approve this site</u>.**

ACTION: Perice write to von Rad and Exon, cc. Falvey, Larsen and Brenner, emphasizing the needs which SSP sees.

Brenner prepare map showing available cores and 3.5 KHz data to assist in geotechnical evaluation of spudding problems.

d) Argo Abyssal Plain (von Rad/Larsen)

Site AAP1-B: Von Rad presented a brief overview of the objectives and then presented the site data. Site approved by the SSP once the fully processed seismic data and acompanying navigation are deposited with the Data Bank. A depth transect of piston cores exists to the NE if needed. Some concern was expressed about turbidite sands coming out of Swan Canyon, but we were assured that the canyon is currently inactive. It seems likely that turbiditic sands will be encountered somewhere in the section.

e) Lau Basin (Duennebier and von Rad)

These notes combine the discussions of July 1 and 2.

The PCOM watchdog report by von Rad is attached as Appendix C, a report on site survey status by the Lau Basin Group is attached as Appendix D, and our updated site survey matrix is included as part of Appendix E.

In summary, the most critical site survey neds are a digital high resolution SCS line along latitude 18 45' S and a side scan sonar survey of the same area.

SONNE cruise 48 was completed in April, 1987. Results are discussed below.

ACTION: von Rad will send a copy of the So-48 cruise report to the ODP Data Bank once translation to English is completed by the end of the summer.

Fouchet collected some SeaBeam, magnetics and gravity on a CHARCOT transit, but no SCS due to equipment failure.

The DARWIN may have some time available in October, 1988. Julian Pearce hopes to do some dredging in the Valu Fa area. It is possible that DARWIN could do about 10 days of GLORIA surveying, SCS, magnetics, 3.5 and 10 KHz.

A French/German diving program to Valu Fa is planned for 1989.

ACTION: Peirce write to Prof. J.C. Bryden (UK Excom) regarding the need for the DARWIN time, particularly in the north (Area X).

Duennebeir contact Taylor/Gill regarding specific recommendations for the DARWIN work, details on site LG-7 (which are not given in the 3rd prospectus, and new choices for site LG-1 in light of the SONNE data. Determine if Gill should be invited to the next SSP meeting. Pass comments on to Peirce and Brenner.

Brenner write to Gill, cc. to Taylor, Duennebier and Peirce, to remind him of the need for data submission by the Lau Basin Group. In particular ask how to get a copy of Mobil's seismic base map covering their older work in the area.

The SONNE 48 cruise provided complete SeaBeam coverage of sites LG-1, 2, & 7 from approximately longitude 178° W to 175° 40'W. The Northern Lau Spreading Center (NLSC) is well defined, including a new hydrothermal site. There are no suitable sediment ponds west of the NLSC, but a possible site with pelagic sediments (as opposed to volcanoclastic turbidites) exists to the east of the NLSC at approximately 176° 18'W, 18° 32'S. There are many cores in this area.

Valu Fa is a young feature made up of highly differentiated andesitic lavas in contrast to the NLSC which has a MORB composition. This difference may be related to the positions of the spreading centers in relatively mature and immature parts of the back arc basin. Hydrothermal activity is less localized at Valu Fa than it is at the NLSC and the East Pacific Rise. No connection between Valu Fa and the NLSC has been defined as yet.

SONNE also completed nearly complete photo coverage of the Valu Fa area, as well as a side scan sonar survey (Kiel system), TV controlled grab samples and water temperature measurements on the camera runs.

4. West Pacific Drilling Packages

Each of the WPAC drilling packages was reviewed by the SSP watchdog responsible. A startling number of unanswered questions arose, largely because neither the SSP nor the Data Bank have the same degree of familiarity with the data available as

WPAC because virtually no data has reached the Data Bank except in Nankai and the Bonins. A much higher level of communication is needed over the next few months between WPAC proponents and SSP watchdogs.

ACTION: Peirce write Taylor summarizing critical areas needing immediate attention. SSP watchdogs will be writing WPAC site proponents. Peirce invite Taylor to next SSP meeting. Duennebier discuss with Taylor whether Gill should also be invited.

A full set of site survey matrices for all WPAC drilling packages is attached as Appendix E. These give the details of coverage and needed coverage on a site by site basis.

a) Banda - Sulu - South China Basin (H. Meyer)

Banda Sea - Adequacy of data base impossible to assess without proper maps and sections. Site positions inconsistent with diagrams.

ACTION: H. Meyer write to Silver, Jongsma and Hilde, cc to Taylor, Brenner and Peirce, to ask for synthesis of seismic tracks, dredge, heat flow and core locations, etc., and any other relevant information.

The Darwin will be transiting the Banda Sea in February, 1988, and may be available for a small amount of opportunity site work or a single GLORIA line.

Sulu Sea - New Sonne 48 channel MCS line 7 crosses site S5 and line 8 crosses site S8. Monitor record shows up to 6 seconds sub-bottom penetration. Data coverage in Sulu Sea appears to be adequate if data quality OK. Synthesis of Sonne data with older data needed. Site positions are inconsistent with diagrams.

South China Basin - The SSP does not know any details of data coverage or quality. Some site positions are apparently new.

ACTION: H. Meyer write to Rangin (U. Paris 6) and Pautot (IFREMER) for details of coverage at sites SCS-5 and 9 with cc to Taylor, Brenner and Peirce.

Because this drilling package will be near the top of WPAC drilling schedule, a full review must be held at our January meeting.

ACTION: Peirce write to Taylor, cc to Brenner, H. Meyer, to emphasize need and arrange for a full review of Banda - Sulu - SCS drilling package at January SSP meeting.

b) Bonin I and II (Duennebier)

All data needed either are collected or are being collected this summer. Much of the data has already reached the Data Bank.

Confusion exists as to the correct position of Bonin 8 as the 3rd prospectus does not agree with March WPAC minutes.

ACTION: Peirce write to Taylor requesting a site by site review of Bonin I and II at the January SSP meeting.

c) Vanuata (Mauffret)

Site IAB-1 OK.

Site IAB-2 - Expect to be able to choose a good site in an area complicated by reverse faulting from the MULTIPSO data. Migration needed; expect completion of same in early 1988.

Site BAT-2b - Expect to be able to choose a good site in a 100 m deep sediment pond along flank of a small spreading (?) ridge. BAT-2 seems to be bare rock (basalt?).

Sites DEZ 1, 3 and 5 all may be positioned on bare rock (basement or hard carbonate). The existence of soft sediments for spudding in has yet to be demonstrated.

Sites DEZ 2 and 4 appear to be OK. Good velocity control is highly desirable in these accretionary prisms, but hard to get.

ACTION: Mauffret write to Fisher (USGS), cc Brenner and Peirce, to see if better velocity control is possible at DEZ sites.

Brenner check LDGO data base for any refraction data or cores near DEZ sites.

Sites DEZ 1, 3 and 5 cannot be drilled unless soft sediment locations can be located. Diving may resolve some of these questions.

ACTION: Mauffret write Daniel and Coloot (OSTROM), cc Brenner and Peirce, to find out specific locations of planned diving.

d) Japan Sea (Suyehiro)

An explanation of the gas problem is contained in the WPAC 3rd prospectus.

A catalog showing all ODP relevant seismic sections in the Japan Sea has been prepared by Tamaki. It is titled "Geophysical Data of the Japan Sea for the ODP Data Bank". The SSP compliments and thanks Dr. Tamaki for this superb synthesis.

The Oblique Electrical Resistivity Experiment proposed by Hamano at site J1B was discussed. This experiment hopes to define resistivity structure in the upper 10 km of the crust by receiving electrical signals in a down-hole electrode array. The SSP welcomes this experiment as a novel use of the drill hole. Supporting deep seismic reflection and/or refraction data would be highly desirable to compare with the results of the Oblique Electrical Experiment.

Outstanding requirements for site surveys in the Japan Sea include:

Site J1b	(Reentry) - a geotechnical core
J1d	Crossing seismic lines (planned in '88)
J1e	Crossing seismic lines (planned in '88)
J2a	OK
J3a	Side Scan or Sea Beam
JS-2	High resolution SCS unless existing SCS can be shown to be adequate for the site objectives.

bold

These requirements must either be met or the SSP must be convinced that they are not necessary in these particular cases.

ACTION: Suyehiro will bring to the next meeting of the SSP a full set of data which focusses on these shortcomings for sites in the Japan Sea.

e) Nankai (Suyehiro)

All of the new JNOC-N55 seismic lines are in the Data Bank. However, the associated navigation has not yet been received.

The possible BSR problem at NKT-2 is still unresolved until the new crossing line is examined.

ACTION: Suyehiro strive to get Nankai MSC navigation submitted to the Data Bank. He will bring the JNOC line over NKT-2 and the crossing line, as well as any ESP data, for review at the next SSP meeting.

f) Zenisu (Mauffret)

A new site survey has just been completed. SSP will review it once WPAC produces an updated drilling proposal which takes the new survey data into account.

g) Great Barrier Reef (Jones for Kidd)

Although the proposal has been completely revised with new BMR seismic from 1982 and 1985 since the SSP last reviewed it,b the proposal is totally inadequate in its present form. Documentation provided to us, ~~ranes~~ ranges from very poor to totally disorganized. Most of the seismic data provided either has not been processed or has not been adequately processed for the objectives of ODP drilling. No seismic base map worth using was provided. The proposal needs to be totally revised and properly documented before the SSP can seriously consider reviewing it again.

Given the high potential of the scientific objectives and the almost certain objections of the PPSP to some of the sites proposed, **the proponents need to make a serious concerted effort to do their work properly ASAP.** Reviewing this proposal was a disappointing and frustrating experience for the SSP. The SSP reminds proponents that for an environment such as this we require the following minimum standards, as laid out in the Site Survey Data Standards matrix:

1. Good seismic base maps at 1:250,000 scale or larger showing shot point locations and line numbers. Digital navigation tapes to allow replotting at any scale preferred.

2. All sites must be positioned on MCS cross lines.

3. All seismic data must be deconvolved, and must be migrated where structural complications exist.

4. Sites which are positioned on anything resembling structural highs should be accompanied by structural maps (in depth and time if variable water depths or velocities exist) at appropriate levels. Isopach or isochron maps are also highly desirable in these situations.

The SSP applauds the paleo-environmental objectives of the Great Barrier Reef proposal, but it laments the lack of resolution in the newly presented seismic data. Perhaps proper processing will change our perspective, but we **strongly urge the site proponents to obtain watergun profiles from the Great Barrier Reef and from Marion Plateau to the Queensland Plateau.** The quality of the records and increased stratigraphic resolution which we have seen from recent site surveys using water guns convinces us that drilling these sites without a watergun survey will lead to serious compromises in the quality of the resulting science.

A brief site by site synopsis follows:

Site 4: Seismic definition is poor. **Site positioned on the side of a structural high (submerged reef?) which is a potential safety problem.**

Site 5: Seismic definition inadequate for paleo-environmental objectives. Ideally we need a watergun profile to obtain the needed seismic resolution.

Site 6: Thin section overlying apparent deeper evidence of Paleozoic rifting. Seismic definition of the upper section is poor. Better definition of the deeper events ~~are~~ is needed in order to be able to interpret the seismic data in this site properly.

Site 7: Reefal (?) targets at 760 m. **Grave safety problems may exist at this site. Superb seismic documentation will be necessary if the proponents seriously want this site to stand a chance of surviving PPSP review.**

Site 8: Very poor unsuitable seismic. Site positioned very near to an apparently young fault.

Site 8A: Poor quality seismic.

Site 9: Inadequate seismic.

Site 11: Seismic may be adequate if processing can resolve the sedimentary details.

Site 12: Seismic probably adequate if properly processed.

Sites 13 & 14: Seismic documentation [redacted] useless. Reefal (?) targets may present a safety problem.

NOT BOLD

h) Sunda (Larsen)

SSP had no information beyond the 3rd prospectus. A fully documented data package is needed ASAP after Silver's October cruise is completed. Because this drilling package may be scheduled only one year after the MCS site survey, it is essential to prepare the data package before all of the seismic processing is completed. Much closer communication between the site proponent and the SSP is needed.

Seismic cross lines will be needed for every site, as specified in the matrix for active margin environments. It is unclear to the SSP what, if any, SeaMarc data exist. A GLORIA survey by DARWIN by Masson is planned for the same area and needs to be carefully coordinated with the drilling proposals.

One major concern to the SSP is how Silver will get his 96 channel data processed in time for review by both the SSP and PPSP.

ACTION: Larsen write by August to Silver, cc to Taylor, Brenner and Peirce, to ask for documentation of existing Sunda data, to explain our requirements for site survey data in active margin environments, and to emphasize the need for timely postcruise communication.

Peirce write to Taylor, cc to Silver, Larsen and Brenner, in the same vein.

5. CEPAC Drilling Programs

As our liaison to the last CEPAC meeting was not able to attend our meeting, we had little detailed information to discuss. We agreed to assign watchdogs to the apparently high-ranking CEPAC proposals. List is attached as Appendix G. Once the first CEPAC prospectus is issued each watchdog will be sent a copy of his proposal(s) for review and synthesis at our January meeting.

ACTION: Peirce write Schlanger with list of CEPAC watchdogs. Ask to have Mauffret invited as next CEPAC liaison. Ask Schlanger to send a copy of whatever documentation is prepared for Aug. PCOM to Peirce and Mauffret. Ask to have copies of 1st CEPAC prospectus sent directly to Brenner, Mauffret and Peirce when issued.

Brenner send SSP watchdogs copies of relevant CEPAC proposals once 1st prospectus issued.

All SSP members prepare watchdog reports and site survey matrices for their areas for January meeting.

6. Miscellaneous

a. Next meeting: The next SSP meeting is tentatively scheduled for January 4-7, 1988, in Hawaii in order to have close access to WPAC data at HIG if necessary. A tentative date of October 13-15 was set as an alternative if PCOM should insist that we meet again prior to their November meeting. Duennebier will host. Taylor, possibly Gill, and the ODP Program Director will be invited guests. A tentative agenda is attached as Appendix H.

ACTION: Peirce write Pisias to schedule meeting and invite guests.

b. Liaisons to upcoming meetings:

i. CEPAC - Mauffret
ii. IOP - none
iii. SOP - none
iv. WPAC - Kidd or Jones
v. PCOM Annual Meeting - Peirce

c. Next Chairman

Individual discussions were held with all the panel members regarding their feelings regarding the next panel chairman. Peirce will summarize these discussions in a recommendation to PCOM. The next Chairman should take over at the end of the January meeting.

ACTION: Peirce make recommendation to PCOM regarding new Chairman.

d. Closing

The Chairman thanked Birger Larsen for hosting this meeting in Copenhagen.

APPENDIX "G"

Watchdogs for CEPAC Proposals

	Proposal	CEPAC	SSP
1.	Juan de Fuca	Davis	Peirce
2.	EPR fast spreading ridge	Fraucheteua	Lewis
3.	Guyots and Atolls	Flower	Duennebier
4.	Old Pacific Crust	Jenkyns	Kidd/Jones
5.	Ontong - Java Plateau	Schlanger	Mauffret
6.	Meiyi Drift/NPAC Gyre/ Plate reconstr. package	Sancetta	Larsen
7.	Bering Sea	Schrader	H. Meyer
8.	Young mid-Plate volcanism Loihi, French Society Is.?	Flower	Duennebier
9.	Convergent Margin Package (Vancouver/Washington/Oregon)	Scholl	Lewis
10.	Shatsky Rise	Sliter	Suyehiro

APPENDIX "H"

TENTATIVE AGENDA

SSP MEETING

HAWAII

JANUARY 5-7, 1987

1. Preliminary Matters.

   Introduction, 1988 ship schedules, minutes, logistics, etc.

2. Reports.

   a) PCOM (Langseth)
   b) TAMU (A. Meyer)
   c) Data Bank (Brenner)
   d) CEPAC (Mauffret)
   e) WPAC (Kidd)

3. Site Survey Assessments.

   a) Broken Ridge/Ninetyeast Ridge (Peirce)
   b) Exmouth Plateau - sites with potential spud-in problems (Larsen)
   c) Banda (Larsen)
   d) Sunda (Larsen)
   e) Sulu - South China (H. Meyer)
   f) Bonin I&II (Taylor)
   g) Japan Sea (Suyehiro)
   h) Nankai (Suyehiro)

4. Further review of other WPAC proposals.

5. Review of CEPAC proposals in 1st prospectus by each SSP watchdog.

6. New Chairman takes over.

7. Upcoming meetings and Liaisons.

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COMMITTEE FOR CO-ORDINATION OF JOINT PROSPECTING
FOR MINERAL RESOURCES IN ASIAN OFFSHORE AREAS
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RAS/86/138-REG.2.3.3.

7 April 1987

(Circular letter to all Permanent Representatives, SEATAR Transect Co-ordinators and Prof. Dr. John Katili)

COPY

Dear Sir,

We have recently received from Dr. Brian Taylor, Chairman of the Western Pacific Regional Panel (WPAC) of the Ocean Drilling Programme, documents relating to the planned programme of drilling in the western Pacific region, including the CCOP member countries. Copies of those document files are attached.

The proposed drilling will test/confirm many of the hypotheses on regional tectonics formulated during the extensive studies carried out in the region as part of the SEATAR transect programme. For that reason the CCOP Technical Secretariat places high priority on accomplishing this programme, in the interests of acquiring a better understanding of the tectonics and related mineral and hydrocarbon potentials of the region.

In order to facilitate implementation of the drilling programme in the region, Dr. Taylor has requested the following information from concerned member countries.

(i) identify any proposed drillhole locations in areas covered by leases or concessions.

(ii) identify proposed drillhole locations which may involve difficult clearance problems.

In view of the importance of this drilling programme and the need for advance planning we would like to request you to provide answers to the above questions directly to Dr. Taylor at your earliest convenience. Please also forward a copy of your reply to Dr. Taylor, to the CCOP Technical Secrtariat.

Yours sincerely,

Sermsakdi Kulvanich
Director
CCOP Technical Secretariat

FROM EXCOM MINUTES, APRIL 1986:

375 SHIP'S CLEARANCES

J. Baker indicated that UNOLS has decided to distribute a questionnaire on clearances to universities and others in order to produce a more effective mechanism for getting permission to operate in foreign waters. Baker suggested that JOIDES could follow this lead and perhaps take stronger action, such as hiring a person at JOI or elsewhere whose primary responsibility would be to handle clearances.

During discussion of this suggestion, it was noted that given the recent French/ German events in the Gulf of Suez and with the best of efforts, there is no guarantee of success. Further, as RESOLUTION ventures farther away from US and European ports, it is indeed possible that these problems will magnify. Therefore is was agreed by EXCOM that JOI and NSF should do all they could to minimize the problems associated with obtaining clearances. In closing discussion, it was suggested that the hiring of a person to exclusively handle clearances could follow the UK example, where a similar person works out of a headquarters location.

Watchdog Reports p.107-132

BANDA-SULU-SCS-TRANSECT

The proposals from which the Banda-Sulu-South China Seas Transect project was constructed consist of the following, by category:

1. Regional Studies	154D
2. Banda Sea	131D
3. Sulu Sea	27D, 48D, 82D
4. South China Sea	28D, 147D, 194D, 216D, 460

A description of the proposed drilling project appears in the WPAC second Prospectus, pages 21-25 (attached) and in the third prospectus, pages 49-50 (also attached). It consists of seven sites: three in the Banda Sea, two in the Sulu Sea and two in the South China Sea.

Proposal 154D by Hilde et al. proposes a transect through the Banda-Celebes Sulu Seas to study the proposition that the floors of these basins represent the fragmented and trapped remnants of an older, continuous oceanic plate. This regional study would attack a large scale problem and forms an interesting framework for consideration of the other proposals.

Proposal 131D by Silver proposed four holes in the Banda Sea. The Banda Sea is divisible into three provinces: the North and South Banda Basins and the Central, Lucipara Basin-Ridge region. The North and South Banda Basins appear oceanic; they are deep and have low heat flow. The prospectus lists one hole in each of these basins to measure age and stratigraphy, goals of the regional proposal as well. Paleoceanographic information on flow through the Indonesian Arc region will also be useful.

The third Banda Sea hole is meant to be in the Lucipara Basin. This central region is a ridge and trough province. It is not clear what the cause of ridge faulting is, what the nature of the basement is or what the origin of this terrain might be. Drilling is meant to discover the origin and history of this province.

Proposals for Sulu Sea drilling fall into two categories. Proposals 27D by Rangin and Proposal 48D by Hinze and Schluter and a sequence of modifications and addenda propose drilling to illuminate the extraordinarily complex tectonics of this region. Proposal 82D from Thunell intends to study the dynamics of the sub-oxic Sulu Sea and, in particular, its response to Pleistocene glacio-eustatic sea level changes; the sill is very shallow, only about 400 m.

The first drill hole proposed is located in the South Sulu Basin, which appears to be oceanic crust, and will be drilled to study both the tectonic and paleoceanographic history of the basin and to achieve an understanding of the origin of this particular chip of basement. Other objectives in Sulu Sea proposals such as the nature of "transitional" crust in the North Sulu Basin and the direction and timing of thrusting under Palawan will be attacked by drilling a site on transitional (?) crust in the Cagayan Ridges region.

The South China Sea (SCS) is a recently deceased, spreading, marginal basin. Drilling is proposed by a host of proposals, some with a strong focus on rifting and continental margin processes, others focussed more on the dynamics of the spreading process. There is, of course, a good deal of overlap in these proposal and I will not discuss them individually.

The drilling plan in the WPAC prospectus includes two holes, one to drill through 1 km of sediments and into basement believed to be of anomaly six age (anomaly 5 time was when spreading ceased). The choice of this particular site corresponds most closely to site S-A of proposal 147D by Zhu et al. The result will be a long sedimentary record back to Ca. 20 my and a confirmation of the anomaly assignments in the SCS spreading scheme.

Site SCS-2 is a quicky in the somewhat anomalous southwestern arm of SCS. This region is "V" shaped with the narrowest end pointing southwest. The axis of the "V" is not the same as the spreading axis in the eastern part of the basin. This site corresponsds with site SCS-3 in proposal 216D by Pautot et al. and will provide the age of the last epoch of spreading in this region. It is not clear to me how this "V" shaped region is opening. Is it stretched, transitional crust opening like a zipper? Is there a pole of rotation at the point of the "V"? Is spreading propagating to the southwest? Chinese investigators assert that the southwestern region opened long before the eastern region (proposals 194D and 147D). Drilling a quick hole to test the relationship of eastern to southwestern spreading is proposed.

In this summary, this transect is designed to study a (pardon the metaphor) Chinese menu of problems in the region north of Australia and South of China. WPAC gave this transect priority four in their second prospectus and priority one in their third prospectus. In the other panels, it was rated fifth by TECP, not rated by LITHP and the paleoceanographic objectives in the Sulu and South China Seas were ranked third by SOHP. The program length is presently 83 days.

My review of the proposals and the prospectus suggests to me that a great deal of essentially regional and local problems have been include in this transect and that it could be made to fit the available drilling window without doing violence to the scientific objectives. I would recommend shortening the Leg by reducing drilling in the Banda Sea to only one (or at most two, a ridges hole and a deep basin hole) site. I would recommend deleting the second hole in the Sulu Sea. Tectonics in this region are of enormous complexity and one hole will not solve much. Deep holes in the Banda and Sulu Seas to date the age of the crust and provide a stratigraphic and paleoceanographic record are good prospects. Two holes in the SCS to date the times of spreading and understand the process should be enough. To tackle the rifting problems is asking for a very extensive program. Subtracting say BNDA 2 and SUL 4 would reduce the leg by 22 days from 83 to 61.

This project as included in the prospectus hardly seems to me to merit priority one and 83 days. The interests of the regional panel in regional and local problems has probably gotten a bit out of hand here.

Great Barrier Reef

GREAT BARRIER REEF

General

Passive margin platforms are minimally affected by vertical tectonics except for a generally steady but decreasing subsidence. Consequently they faithfully record eustatic sea level changes. The NE Australia margin represents a mature (i.e., intermediate) stage carbonate platform. Rifting, rapid subsidence, and associated clastic sedimentation (the Red Sea stage) are far enough removed in time to be relatively unimportant. Carbonate sedimentation dominates. On the other hand, margin evolution has not yet progressed to the stable state represented by, e. g., the Bahamas.

The passive margin of NE Australia is developed on a late Cretaceous rift system. In addition to the modern reef system there are also several earlier systems, now failed and buried. By Eocene time subsidence-induced transgression led to reef development on Queensland Plateau. Oligocene, Miocene and Pliocene subsidence episodes caused succesive step-backs of reef development and drowning of earlier reefs. The latter now form the Queensland and Marion Plateaus as well as buried parts of the Great Barrier Reef. Clastic fluvio-delataic sediments prograde over some of the subsided areas.

Objectives

1. Timing and evolution of development of the Great Barrier Reef, Queensland Plateau, and Marion Plateau.

2. Relationship of seismic stratigraphy, sea level changes, and style and facies of slope and basin sediments (Queensland Trough and Townsville Trough)

3. Sea level changes and diagenesis

4. Sequence of reef formation on Great Barrier Reef, Queensland Plateau, and Marion Plateau (Why was normal reef growth unable to keep pace with subsidence? Were factors other than subsidence responsible for cesation of reef growth along earlier reef tracts?)

5. Effects of northward plate motion on growth and evolution of Great Barrier Reef, Queensland Plateau, and Marion Plateau

6. Diagenetic and paleoceanographic signal in periplatform sediments

7. Subsidence history and sediment evolution; subsidence pulses and sediment packages.

Proposal

1. E-W transect from Great Barrier Reef accross Queensland Trough and onto Queensland Plateau

2. N-S transect from Queensland Plateau accross Townsville Trough onto Marion Plateau.

Work Plan

15 sites are suggested, apparently all are on crossing seismic lines. Several of the sites may present safety problems and should be looked at very early by the safety panel. SOHP recommends a program of 7 sites that would require about 37.5 days drilling plus logging. P. J. Davis (representing Australian interests ?) urges for 8 sites, including deeper objectives as well, and would extend the leg to 42.5, possibly 52, days. Transit time betweeen sites is less tahn 2 days.

Addendum

Another proposal for this area (Sangster, Jansa and Welhan) addresses base metal mineralization in carbonates (Mississippi Valley Type - MVT). The Great Barrier Reef area is allegedly a good analog of the lower Paleozoic (Cambrian) mid-continent mineralized area. (It is not clear from the proposal that this type of mineralization is actually occuring on the NE Australia margin). The sites recommended to be drilled are all "discarded" sites of SOHP. The MVT proposal would require deeper drilling than proposed by SOHP at the same sites. Also the scope of the sampling would be expanded - pore fluids would be sampled extensively. Several of the MVT sites present particularly serious safety problems, but the need to sample migrating fluids in porous carbonates makes these dangerous sites the ideal location. As the GBR proposal stands now it cannot include the MVT proposal and remain one leg. SOHP does not endorse the MVT proposal.

SUMMARY OF WESTPAC DRILLING PROGRAM FOR THE JAPAN SEA

M. Langseth.

This summary and comments are primarily based on the prospectus of the Western Pacific Panel which in turn is a distillation of several individual proposals to JOIDES. In this review I have emphasized drilling targets as opposed to scientific objectives because most of the holes have multiple science objectives and I believe the balance or imbalance of the program becomes more apparent in this format.

Drilling Targets:

1) Drilling into basement in the Japan and Yamato Basins (J-1b, J-1d, J-1e)

Major scientific objectives:

a. Delimit the chronology of spreading in these basins. Dating opening of the Japan and Yamato Basins will provide an essential key to understanding the plate kinematics of the Northwestern Pacific and mechanisms of opening of the Japan Sea.

b. Determine composition of anomalously thick crust in the Yamato Basin. Backarc spreading in the Japan sea may be associated with rapid convective overturn of the mantle above the subducting slab. The ten km crust below Yamato Basin indicates copious volcanic activity during spreading. The chemistry of basement rocks may show a diagnostic mantle signal.

c. Downhole seismic experiments and temperatures at these sites. Seismic experiments will delineate the velocity structure of the anomalous crust beneath the Yamato Basin, and the long debated contribution of sediment heat sources to sea floor heat flow can be directly measured.

2) Drilling to basement on the Okushiri Ridge (J-3a).

Major scientific objectives:

a. Show ridge is obducted oceanic crust and define uplift history. Japanese scientists have suggested that Northern Honshu has recently been annexed to the North American plate by a jump of a triple junction once located at the intersection of the Kurile and Japan Trench to its present location southeast of Tokyo producing a new north trending convergent plate boundary in the Japan Sea just west of northern Honshu Margin. Obduction of the Okushiri Ridge may be an expression of this convergence. Dating its uplift history will date the time of the triple junction jump.

b. Date basement in Japan Basin. If Okushiri Ridge is obducted oceanic crust penetration to basement will provide another age determination of the Japan Basin crust.

c. Downhole measurements of stress and temperature. A stress measurement using hydrofracture and televiewer will determine the direction and magnitude of horizontal compression. Heat-flow may provide a measure of energy released by obduction.

3) Drill to basement in the Yamato Rise Trough-failed rift. (J-2a).

Major Scientific Objectives:

a. Determine timing of rifting and subsidence of Yamato Rise. Yamato Rise is thought to be a fragment of continental crust, and the graben that bisects it a failed rift. Defining the subsidence history may date initiation of rifting of the continental Japanese Arc from Asia.

b. Sample sediment hosted massive sulfide deposits. The setting of the Graben in the Yamato rise is analogous to failed rifts on Honshu where massive sulfide deposits are found.

c. Paleo-oceanography and climatology of Japan Sea. Sediments in the Yamato Rise Trough were deposited near the CCD and are less contaminated by tubidites than adjacent basin sediments. They should provide a good record of paleo-temperatures, etc.

d. Determine age and nature of basement in Yamato Rise Trough. The basement beneath the graben sediments may be volcanics coeval with rifting or old continental crust. Dating either or both is important.

4) Ocean history site on shallow Oki Ridge. (JS-2).

Major Scientific objectives:

a. High resolution stratigraphy of isotopes, magnetics, fauna/flora, chemistry and lithology of bank sediments deposited above CCD. Oki Ridge is just north of Tsushima Straits. The shallow sill depth of the Japan Sea, surface waters that are supplied by arms of different major current systems depending on glacial stage, and recent opening of the Japan should make its sediments a sensitive recorder of climatic change and tectonic movements.

General comments on the program:

The Sites to determine basement age in Yamato and Japan Basins are a compromise. Drilling in the center of the basins would be preferred but is precluded by the presence of ethane and gas in turbidites in the sedimentary layer. Except for Site J-1d targets have been chosen to avoid these layers by locating them near the margins of the basins, i.e on the lower flanks of the rises. There is a possibility that basement at these locations may not be characteristic. Additional refraction work at these Sites would be useful. J-1d is thought to be an extinct spreading center associated with opening of the Japan Basin. It is in the center of a narrow basin but there is a question whether spreading that formed this basin is associated with that of the Japan Basin or that of the younger Yamato Basin.

Geophysical and geological data in the Southern 2/3 of the Japan Sea is comprehensive and of excellent quality. The Basement and Yamato Rise Sites could benefit from further detailed refraction and MCS cross lines. Its a shame the Soviets are not in the program. This would be an unparalleled opportunity to get badly needed new data to the north and possibly important drill targets in the Northwestern sector of the Japan Sea.

List of planned drilling sites and estimated drilling days of the Japan Sea

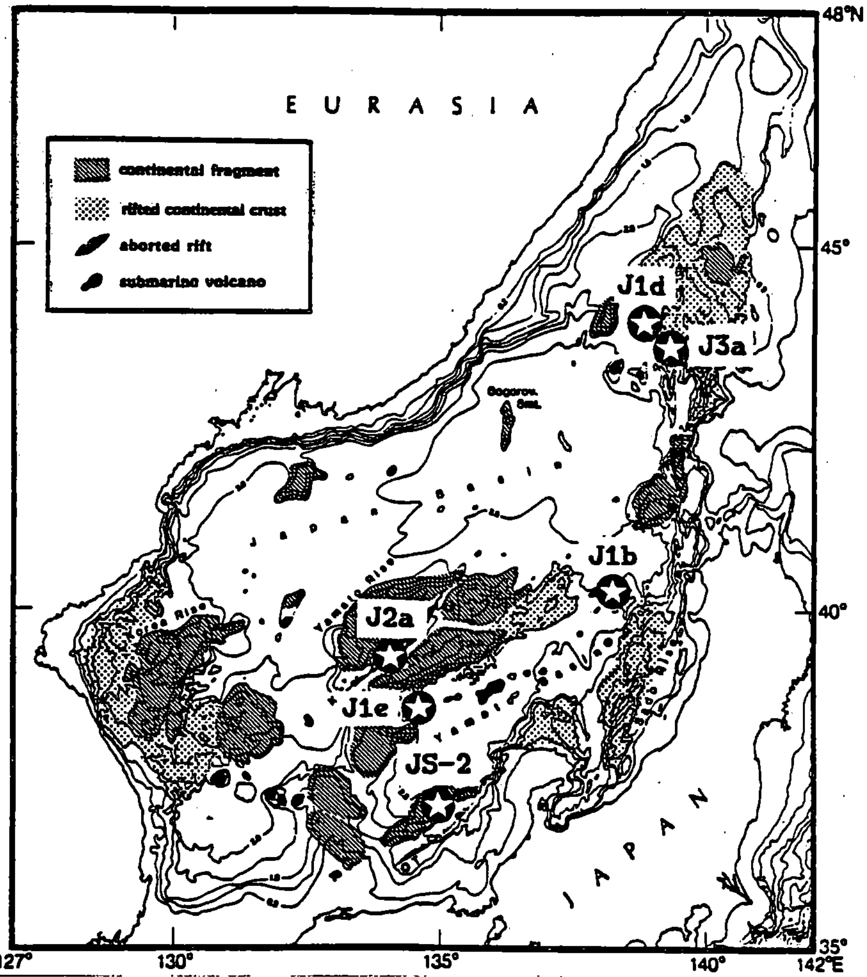
Japan Sea I (Basin Drilling/Tectonics)

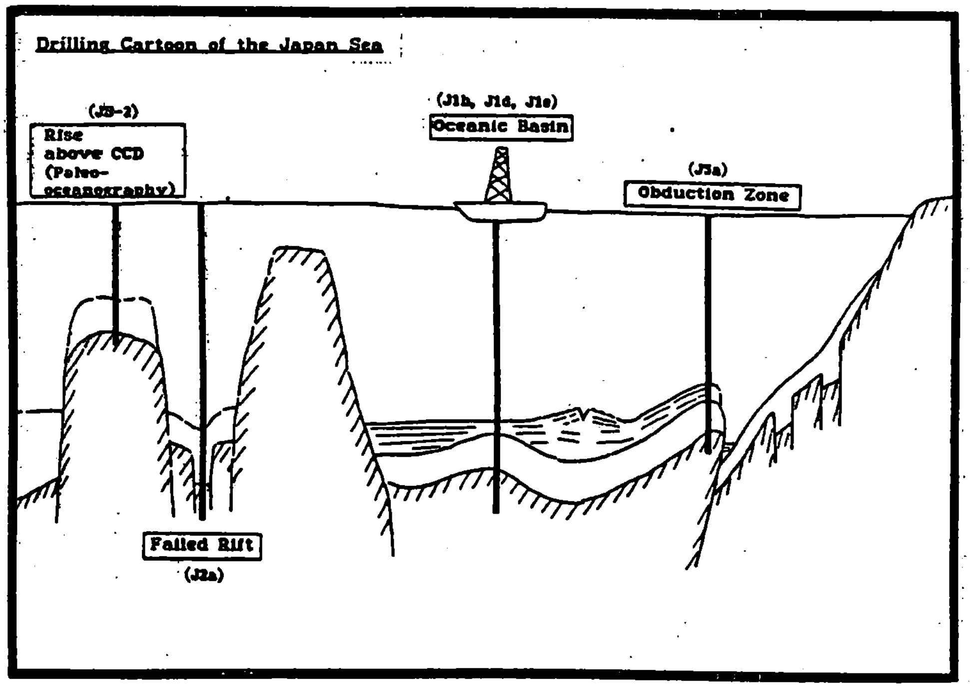
Site No.	Hole Type	Position Lat.	Lon.	W.D. (m)	Sed.Penet. (m)	Base Penet. (m)	Drill Time (days)	Log. Time (days)	Transit (days)
							(from Yokohama)		2.9
J1b	APC/XCB(Reentry)	40°14.6'N	138°15.1'E	2780	700	100	15.8	6.5(incl. VSP)	
									0.8
J1e	APC;RCB	38°37'N	134°33'E	2890	830	50	9.4	2.0	
									0.4
J3a	APC;RCB	43°50.7'N	139°09.0'E	2040	700	30	6.6	1.7	
									0.3
J1d	RCB	44°00.2'N	138°48.6'E	3170	350	30	4.7	1.5	
							(to Niigata)		1.4
						Total:	36.5	11.7	5.8
						Grand Total:		54.0 days	

Japan Sea II (Rise Drilling/Paleoenvironment & Metallogeny)

Site No.	Hole Type	Position Lat.	Lon.	W.D. (m)	Sed.Penet. (m)	Base Penet. (m)	Drill Time (days)	Log. Time (days)	Transit (days)
							(from Niigata)		0.9
J2a	APC/XCB(Reentry)	39°14.4'N	133°50.9'E	2050	1370	20	17.7	2.0	
									0.6
JS-2	APC/XCB;APC	37°05'N	134°45'E	998	600	0	3.8	1.2	
							(to Yokohama)		3.8
						Total:	21.5	3.2	5.3
						Grand Total:		30.0 days	

Planned Drilling Sites in the Japan Sea





Watchdog Report: LAU Basin

Ulrich von Rad

1. Existing Lau Basin Proposals, all incorporated into the "Lau Basin Drilling Program" (Lau Group, December 1986)

	Proponents	Site Surveys *	LG no
(1)	MORTON, VALLIER & HAWKINS (USGS/SIO)	S.P.LEE'82/'84: MCS,SBP,M,DR	LG-4
(2)	HAWKINS (SIO)	ANTIPODE (1971) PAPATUA'86 & other cruises SCS,M,DR	LG-1,2,8
(3)	CRONAN (Imperial College, London)	TANGAROA (1981) (?DARWIN 1987/88) C	LG-2,7
(4)	v.STACKELBERG, v.RAD & RIECH (BGR)	SONNE-35 (1984/85) SONNE-48 (1987) SB,M,SBP,DR,C,PH	LG-1,(2),4,(7)
(5)	FOUCHET, FOUQUET et al (IFREMER)	J.CHARCOT (1986) (?J.CHARCOT 87/88): SCS,SB,DR	LG-5

* SB= Seabeam, SCS= single-channel seismics, MCS= multi channel seismics, M= magnetics, SBP= subbottom profiler, PH= photo surveys DR= dredges, C=cores

2. Main objectives (after Lau Basin Group Proposal)
   1. Petrological evolution of the Lau Basin (mainly northern basin)
   2. Geodynamics of arc rifting and back-arc basin formation
   3. Petrology, metallogenesis and hydrothermal effects of an active, differentiated spreading ridge (Valu Fa Ridge, S Lau Basin
   4. Relationship between magmatism, tectonics and hydrothermal metal accumulation in sediments
   5. Tectonic history of the fore-arc basin (Tonga Terrace)
   6. Transect study of heat and fluid flow

3. Proposed Sites (* my favorite sites)

Site	Area (SR=spreading ridge)	Main objectives (see 2)	Site survey data (see 1)	est. drilling days (RE= reentry)
* 1	N Lau SR	1,4,6	1,2,3	14 + RE
* 2	W Lau Basin	1,2,4,6	1,2,3	6 + (RE?)
* 3	Tonga Platform	2,6	6	4
* 4	Valu Fa Ridge (SR)	1,2,3	1,4	14 + RE
5	east of NValu Fa Ridge (SR)	1,2,3	5	4
(*) 6	Tonga Forearc Terrace	2,5,6	6	8
7	mid-W Lau Basin	4	3	3
8	NE Lau Basin (SR)	4	2	6 + (RE ?)

4. Strengths of the Lau Basin Proposals

(1) First, maybe most representative and best surveyed example of active back-arc basin (+ transect to island arc and fore-arc);

(2) Excellent combination of petrological (hardrock), sedimentological (- tephrochronologic), and plate-tectonic objectives (e.g. basin opening versus magmatic evolution and vertical tectonic history of volcanic arc and forarc);

(3) Highly differentiated (andesitic to dacitic) volcanics at Valu Fa Ridge (interaction of back-arc spreading center with island arc magmatism), associated with new type of hydrothermal deposits (different from EPR!): mainly low-temperature sulfide impregnation of altered volcanics on top, high-temperature sulfides as stockwork mineralization below (new large hydrothermal field discovered by SONNE at S Valu Fa Ridge in March 1987!). French-German submersible presite survey with NAUTILE in 1989.

(4) Research groups from five ODP member nations (USGS, UCSC, SIO; IFREMER in France; Imperial College, U.K. ; BGR, FRG; Japan) have combined their ideas and pre-site survey knowledge to formulate a coherent, balanced, prioritized program which can be drilled in 1(-2) leg(s)!

5. Weaknesses

LG 1: location W or E of spreading ridge. Enough ponded sediments for spud-in only in the E, but ash turbidites ... (see objective 4). See also LG 4 ...

LG 2: additional seismic site survey necessary to avoid thick volcanoclastic sediment ponds(ash turbidites etc)and to find representative pelagic sediment section for last 2-3 Ma!

LG 4: I repeat my strong pledge for the necessity of bare-rock drilling (with the navidrill?) in zero-age crust, especially if we want to solve such important and localized problems as the third dimension of the discovered hydrothermal deposits and the crust below it. We might very well miss this important objective, if we do not drill at Valu Fa Ridge proper, but in one of the sediment ponds, 10-20 km east of it. We should invest the extra time to do the job properly!

LG 5: There are no unambiguous data (Mn and He anomalies on VFR proper, but not in the basin) to substantiate the speculation that the secondary ridge is a "site of active geothermal and hydrogeological processes", i.e. a Guyamas-Basin-type situation.

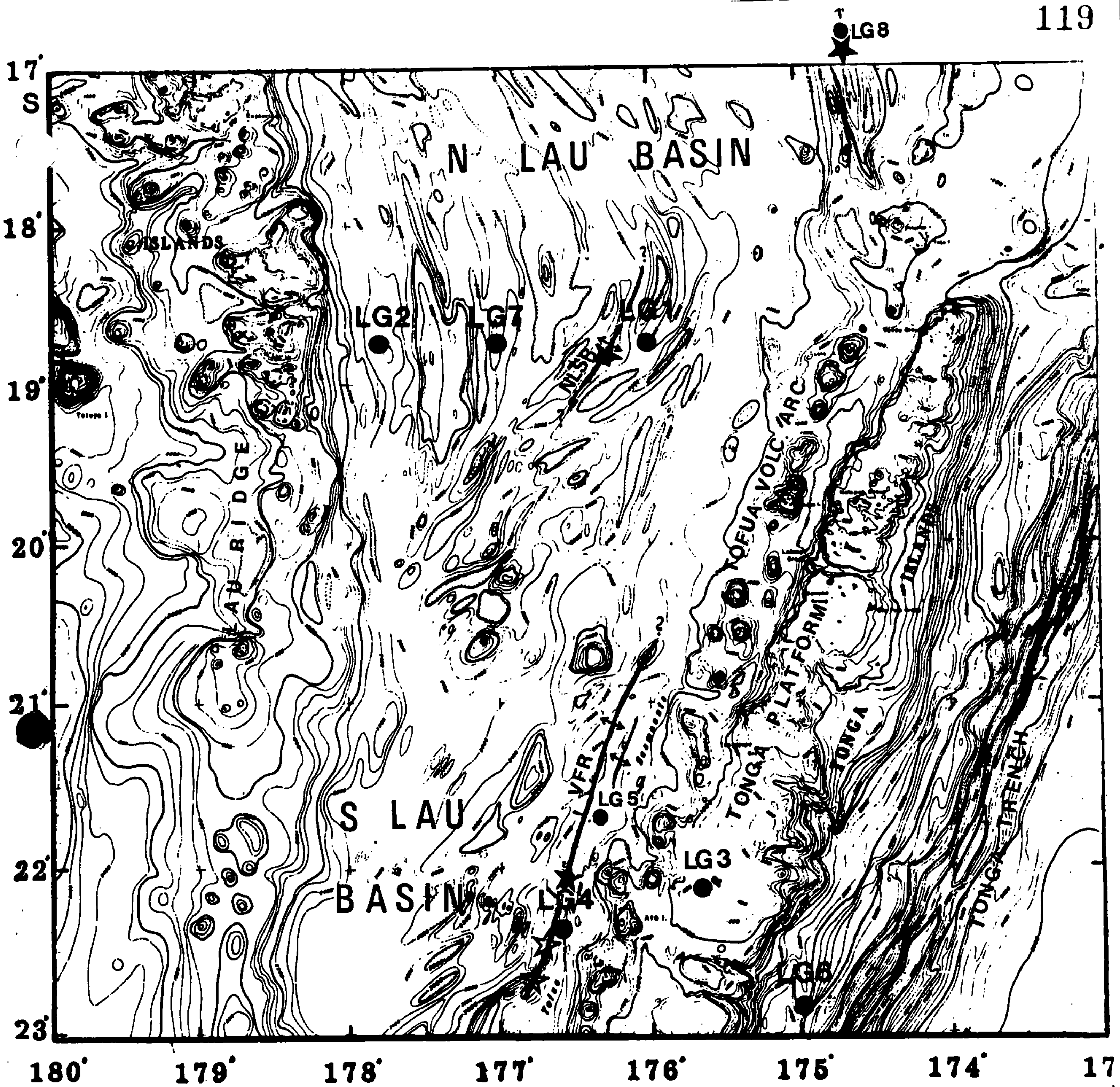
6. Summary

In general, this is an excellent drilling program, except for minor gaps in the site surveys. In my view, the drilling times are underestimated, especially those for the most important reentry and basement sites LG 1 and 4 (incl. detailed logging programs!). Maybe we should concentrate on LG 1,2,3,4, and 6 and spend a little bit more time at each site. This would probably make it a 1 ½ leg program.

P.S.: I apologize that this is not an independant, objective watchdog report, since I am involved in some pre-site studies and my institution has supplied information to the drilling proposals.

Hannover, 29 June, 1987

Ulrich v. Rad



Location of ODP Drillsite Proposals LG 1-8. NLSR = Northern Lau Spreading Ridge (MORB), VFR = Valu Fa Ridge (highly differentiated volcanics)

★ = active and inactive smokers, ☆ = low-temp. sulfide-impregnation of altered volcanic rocks

Nankai Geotechnical

PCOM Watchdog Summary: Nankai Geotechnical Hole
Proponents: Karig, Brandon, Carson, Cowan

Major Objective: determining how deformation in an accretionary prism is affected by the stress paths, physical properties, and behavior of fluids in the accreted sediments.

Principal Approach: integration and correlation of logging, *in situ* measurements, and laboratory measurements.

Site criteria: "In that such a drilling program would constitute a natural experiment, the experiment must be well-posed and simple enough to "solve." Thus we stress the need for clastic sediments, which are generally representative of accretionary prisms, and a structural setting that is seismically well defined and mechanically simple. Past drilling has demonstrated that an accretionary prism toe is a hostile environment, commonly plagued with unstable hole conditions and/or gas hydrate problems. Thus any proposed hole should have conservative and multiple objectives, as well as evidence from past drilling of relatively stable hole conditions. We are here proposing a hole in the Nankai prism" which with present knowledge best meet these conditions but "most points made here can be applied to a similar hole elsewhere. We hope to convince the Planning Committee that the general objectives are of such importance that such a dedicated hole should be drilled in whichever prism is to them most suitable."

Detail of Objectives:

1) Improved geomechanical models of accretionary prisms and thrust belts. Geomechanical models remain highly underconstrained without actual material parameters.
2) Development of basal decollement not understood, nor why material is sometimes transferred upward in some cases and downward in others. To resolve need to delineate patterns of heat flow and temperature and of movement and chemical evolution of pore fluids in conjunction with geomechanical models.
3) Intrinsic behavior of deforming sediments broader in scope, occurs in other geological settings. Laboratory simulations cannot fully duplicate natural conditions. Requires *in situ* measurements.
4) Important to establish meaning of lab and log data by comparison with *in situ* measurements.

Key measurements:

Porosity. discrete samples, logs
Seismic Velocities. logs, discrete samples for shear waves and anisotropies
Permeability. *In situ* for gross (fracture plus intergranular), discrete samples for intergranular.
Temperature and thermal conductivity.
Fluid chemistry.
Magnetic properties. discrete samples, logs.
structure. cores, televiewer.
Mechanical state. discrete samples (fracture and structural analyses on oriented samples), televiewer, *in situ* pore pressures.

Special needs, new technology:

1) *in situ* measurement probe and probe hole. Use Navidrill to drill a 3-3/4" hole ahead of drill bit (5 meters). Wireline trip for "geoprops probe", a new *in situ* geotechnical tool (determines pore pressure, permeability, temperature, components of stress, samples fluid) being proposed to NSF.
2) Casing. based on previous experience in area to several hundred meters.
3) Policy decisions regarding whole round sampling (needed more frequently).

Estimated times for dedicated hole:

set cone and casing	6.5 days	
re-entry and drill core time to 1300 m	16 days	
in situ tests	4.3 days	assuming 1 extra wire trip and 1 hr bottom time per test
logging	2 days	
probe hole to 300 m	2.5 days	if necessary
transit	2 days	if separate leg

Total: 29-33 days.

Possible Sites: Near Hole 583 or proposed NKT-2 depending on drilling results.

R.E. McDuff
July, 1987

SCS Margin

SUMMNARY OF SOUTH CHINA SEA DRILLING PROGRAM

The main objectives of this program is to study tectonic processes of rifting/drifting and sedimentary evolution of passive continental margin.

The South China Sea shows one of the best record of magnetic anomalies in any marginal sea basins in the world. Therefore age of rifting and spreading is relatively well constrained. The existing MCS coverage is excellent.

But why is itnecessary to study passive margin processes in the Western Pacific? The argument is that the South China Sea margin shows "a prime age" for such study, not too young and also not too old. The study of thermal history and subsidence record requires a certain age progression after passive margin formation; therefore the margin should not bee too young. However, too old margins are often contaminated by later tectonic modification and covered by thick sedimentary piles, which make the problem solution by drilling rather difficult. The South China Sea margin is about 30 m.y. old and seems to be quite suitable for passive margin study. At the same time, a good transect line has been obtained which displays well difined continental, transitional and oceanic domains. Importantly, the basement of all these domains can be drilled. This basement availability seems to be also a strong point for this program. Sedimentary history of slope to basin envirnoments at oxic/siliciclastic facies provides an end member for sedimentary evolution model of continental margin.

Although the South China Sea margin seems to be a good place to study passive margin processes, it may not be a good place to study the "backarc" basin evolution. The important thematic problem related to the Western Pacific is that the mechanism and processes of backarc basin formation: the objectives should be correlated with arc processes and subduction history. The complex tectonic history occured at the "arc side" of South China Sea makes this program difficult to be incorporated into overall evolutional scheme of trench-arc-backarc system.

Eastern Sunda Arc, Indonesia (Proposal 242D, Silver & Reed)

Overview

The Indonesian region has had a complex geological history. It marks the junction of four crustal plates: the Indo-Australian plate to the south and the Eurasian, Philippine and Pacific plates to the north and east. The central part of the Sunda Arc reflects the straightforward subduction of oceanic crust of the Indo-Australian plate beneath the Eurasian plate. At its eastern end, however, the geology is considerably complicated by the collision of the NW Australian continental margin with the volcanic arc.

Drilling is proposed in both the forearc and backarc regions of the eastern Sunda arc, focussing on the problems of backthrusting and back arc thrusting. The major objectives are to examine the tectonic coupling between backthrusting and back arc thrusting and the history of vertical motion in this zone of young collision.

Geology of Sumba, Sawu and Timor

On Sumba an apparent basement complex of pre-Tertiary age, intruded by small Palaeocene dykes and plutons, is occasionally overlain by non-marine and shallow marine Palaeogene strata. Overlying all these rocks are Miocene reefal carbonates in west Sumba and volcaniclastic turbidites and pelagic chalks in the east. Several models have been proposed for the uplift of Sumba ridge and the creation of Sumba - SE Asia fragment, forearc thrust or nappe, uplift as a result of Australian collision, microcontinent that collided with Sunda arc.

Sawu The Sawu thrust marks the tectonic contact between the diverse lithologic units of Sumba ridge and the accretionary wedge along the backthrust. Imbricated and deformed strata exposed on Sawu represent components of the accretionary complex ranging in age from Upper Triassic through to the Pliocene.

Timor A significant fraction of the accretionary wedge is exposed on Timor. In addition structural packages derived both from Asian sources and from the Australian continental margin are present. Debate about the tectonic evolution of Timor continues to rage.

In general, it is felt that enough is known about the rocks of Sumba, Sawu and Timor that they would be recognised if encountered in the drill.

Drill Sites

Seven drill sites are proposed (Figure 1). Sites S1, S2, S3 in the vicinity of Sumba and sites F1, F2 north of Flores form a 300 km long north-south transect across the volcanic arc (Figure 2). Sites T1, T2 are located some 800 km further east at the opposite end of Timor.

Site S2, just south of the Sawu thrust, and Site T2 are located to penetrate the rear of the accretionary wedge in order to sample material accreted from the forearc basin and possibly the earliest material accreted at the toe.

Sites S1, S3 and T1 lie within the forearc Basin. S1 will give the stratigraphy that could be accreted to the rear of the wedge along the Sawu thrust. Penetration into basement will allow comparison with basement rocks exposed on Sumba and Timor. T1 has similar objectives to S1 but is located in an area where the forearc basin is less affected by uplift and the sediment thickness is less. Site S3 close to the crest of Sumba ridge is designed to provide benchmark stratigraphy for tying seismic and land observations regionally.

The back arc region of the arc is a laterally discontinuous zone of back arc thrusting. These thrusts have produced small, young accretionary wedges. Two sites are located in the Flores backarc zone. Site F2, through the rear of the wedge, is located to sample the oldest accreted material and to date the inception of backarc thrusting. Site F1, seaward of the toe of the wedge, will sample the stratigraphic sequence of the lower plate.

Site	Water Depth	Sediment Thickness	Total Penetration
S1	1500 m	800 m	1000 m
S2	1100		800
S3	750	1000	1100
T1	2500	400	600
T2	2250	500	700
F1	4900	2000	800
F2	4000	400	1000

All single bit, RCB holes.

Strengths and Weaknesses

1. Collisional processes are an important area of geology and this is an appropriate region to study them if the sites are well chosen.
2. All sites have been proposed on the basis of existing SCS data, but 96 channel MCS surveys are proposed. PCOM needs to be informed on the status and timing of these proposed surveys.
3. Far too much drilling has been proposed for a single leg, 6000 m in all, of which 1300 m at least are in basement! It will need to be considerably trimmed.
4. Do sites T1, T2 add anything not already gained on the transect? Being so far to the east of the transect, there may not be much tectonic coupling between backthrusting in the T1, T2 vicinity and back-arc thrusting near F1, F2.
5. On the other hand, TECP has queried whether the S-sites will throw light on collision-related processes.

T.J.G. Francis
22 June, 1987

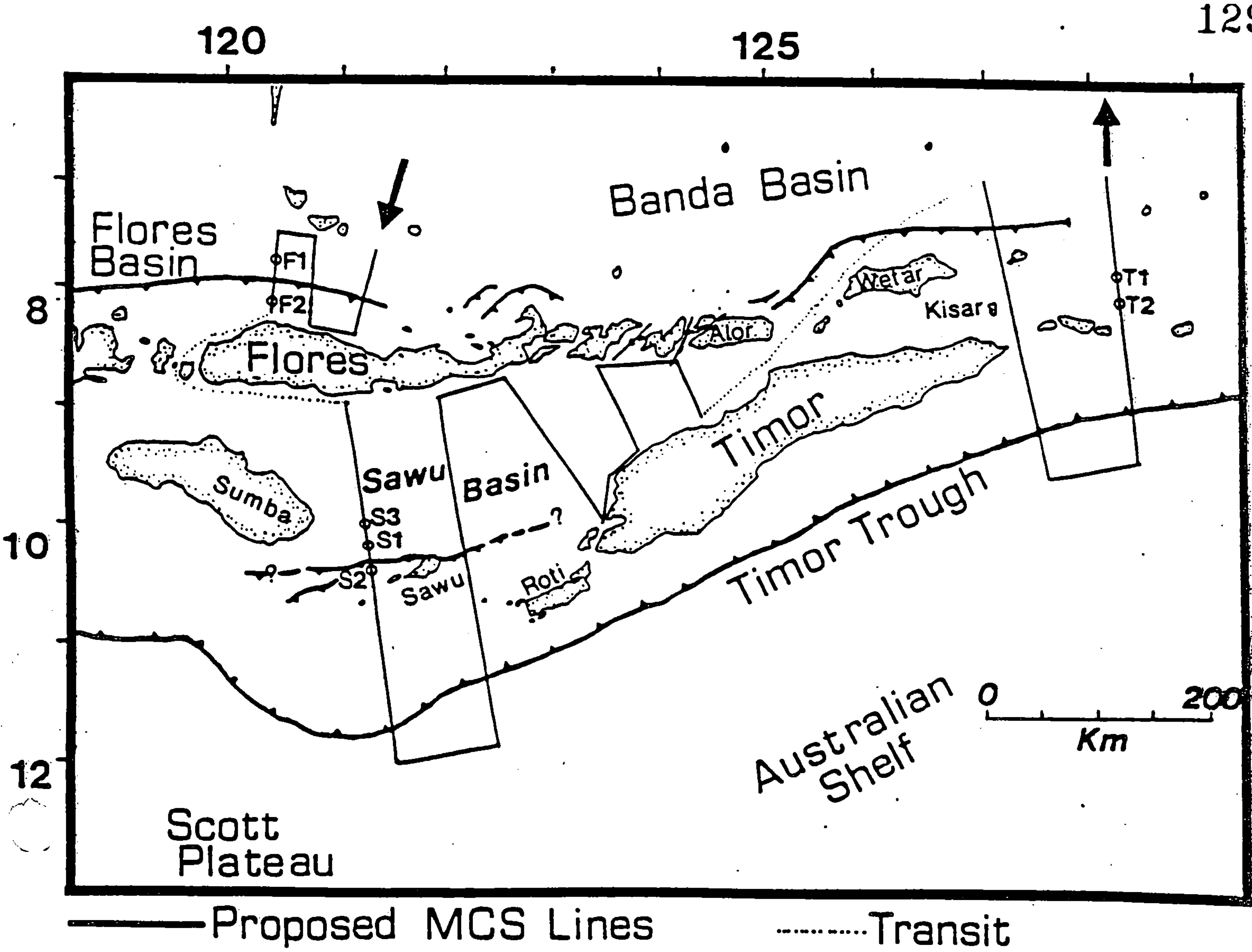


FIGURE 1

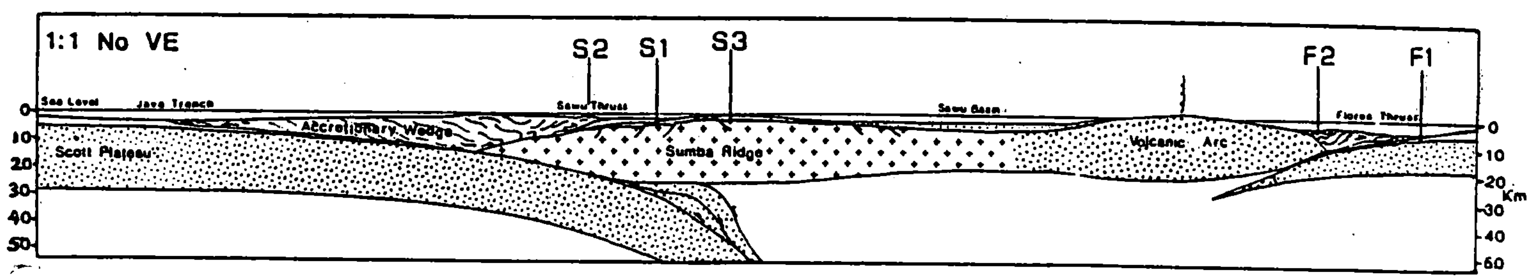


FIGURE 2

WPAC Watchdog Report
Zenisu Ridge
by PCOM Watchdog, R. L. Larson

Zenisu Ridge is a structure parallel to and offshore from the Nankai Trough, the latter being the location of the subduction zone where the Philippine Sea plate is being subducted beneath the Eurasian plate. Zenisu Ridge appears from geophysical and diving observation to be a zone of intraplate deformation (shortening) directly related to the adjacent subduction. Drilling transects are proposed to determine the age and nature of folding and reverse faulting, the nature of associated dewatering of the sediments, and the age of tilting and nature of Shikoku Basin oceanic crust.

Two different transects have been proposed, first by Lallemant et al. (163/D) and second by Taira et al. (177/D). The Lallemant et al. proposal is of a preliminary nature, the prime transect appears to be southwest of the main part of Zenisu Ridge, and the sites are poorly documented with single channel seismic data. This proposal should not be considered further.

The Taira et al. proposal places the transect directly across the main part of Zenisu Ridge, is somewhat better documented and considerably more clearly written. It is the proposal for which drilling should be considered, however, the seismic data shown in this proposal are still inadequate. The reverse faults and folds are not apparent, although the tilted Shikoku Basin basement is clear. These seismic data are substantially inferior to Barbados and the Indian Ocean intraplate deformation zone, similar tectonic environments that have been targeted for ODP drilling.

It would be of considerable interest to know the age of faulting and folding of Zenisu Ridge because it is likely to be very recently (post-Miocene) initiated. One hypothesis is that the Philippine Sea-Eurasian plate subduction zone is in the process of shifting seaward to Zenisu Ridge, leaving the Nankai Trough welded to the Eurasian Plate. On land evidence to the north on Japan suggests that such shortening and subduction zone transfer has occurred there in the past. Although this area lies along strike of Zenisu Ridge to the northeast, the tectonic relationship is not certain because the Sagami Transform that bounds the Philippine Sea and Eurasian plates to the north is crossed along strike at the latitude of the Izu Peninsula. Since outcrop seeps of dewatered fluids have been observed by diving, the subsurface continuation of this hydrologic system would also be of considerable interest. The Zenisu Ridge drilling transect should also be viewed as an integral part of the Nankai Trough program because they are different aspects of the same crustal shortening and subduction process.

In order for this to be a viable drilling program, the proponents must be able to document their structural targets with high-quality seismic data. The structural and geohydrologic evidence that can be obtained from drilling must ultimately be interpreted in light of the reverse faults and folds imaged by seismic lines. These higher quality data must also be accompanied by a more extensive write up. The Taira et al. proposal is clear but not detailed, and leaves to the reader's imagination how the goals that are proposed will be achieved.

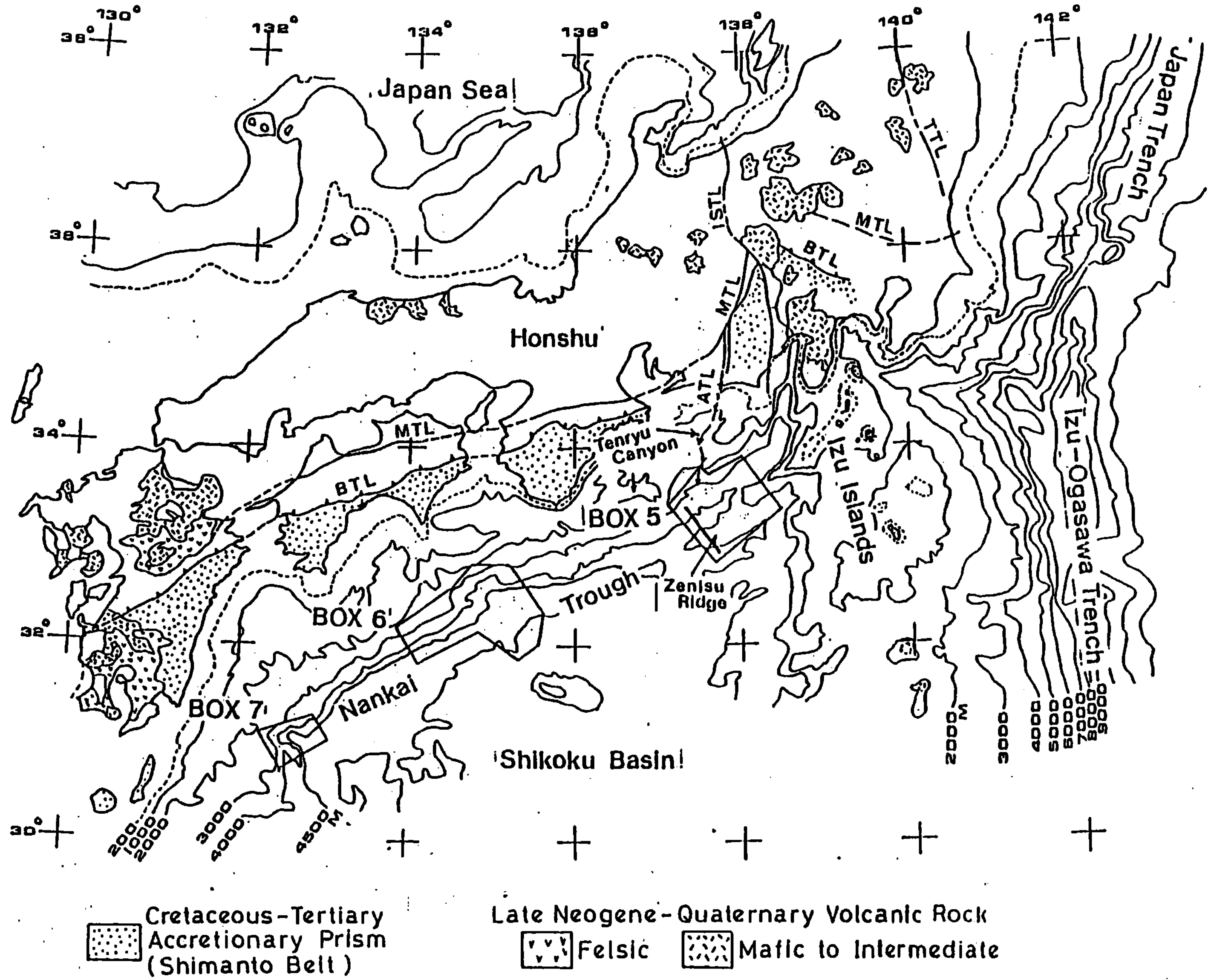


FIG. 1

(Figure 1 - 177/D)

NANKAI

NANKAI TROUGH AND SHIKOKU FOREARC DRILLING PROPOSALS

ACCRETIONARY COMPLEXES DRILLING - GENERAL SCIENTIFIC OBJECTIVES

Accretionary complexes are natural laboratories in which sediment deformation and consolidation processes could be related to physical and chemical parameters and provide information about convergence of plates. This includes: how physical properties of the sediments and fluid circulation control the deformation processes; origin, hydrology and evolution of fluids, their contribution to global chemical fluxes, to the chemistry of the subduction plate and to benthic biomass; why in some subduction zones accretion dominates, while in others it is erosion; how much sediment is accreted, subcreted or subducted, and what determines its distribution; factors controlling deformational style; causes of vertical tectonics; nature of earthquake processes.

WHY DRILL THE NANKAI TROUGH

The Nankai Trough represents an important end-member-class of thick clastic wedge convergence zones. It is complementary to the Barbados drilling in a hemipelagic mud convergent zone. Additional advantages are:

- The Nankai Trough has been extensively surveyed and studied. Excellent multichannel and single-channel data exist. Area drilled during DSDP Leg 31 (Sites 297, 298) and Leg 87 (Sites 582, 583). Results of Japanese-French Kaiko Project recently published in EPSL, 1987, v. 83, #1. Sea Beam mapping is available.
- Trough's depth is < 5000 m.
- Nankai area is tectonically and structurally relatively simple. Tectonomorphologic features are well defined.
- Heat flow surveys are available, show variability and abnormally high values as compared to other subduction zones (Fig. 1)
- The sediments are mostly terrigenous, hence can be considered as end-member system, with relatively well known sediment properties.
- An equivalent accretionary complex is exposed on land on Shikoku Island.

RESULTS FROM DSDP DRILLING (Table 1)

On the incoming plate the sediment cover includes two lithological sequences:

1. a thicker Pleistocene to Recent trench fill, laterally transported turbidites. Thickness varies from 300 to > 2000 m.
2. Plio-Miocene mostly hemipelagic sediments, the Shikoku Basin cover.

The décollement zone is at the boundary between the two sequences.

In undeformed sites, maximum penetration was 750 m, in deformed sites 610 m. Major problems with instability of holes were not encountered in either area. Sediment recovery was, however, rather poor, especially in sandy horizons and in fissile claystones and siltstones in the lower unit.

At Site 298, anomalous compaction was encountered already at 300 m and increased with depth. Porosity decreased to < 40%, lower than expected porosity at this burial depth. Chlorinities seem slightly irregular.

No difference in porosity distribution was observed, however, between deformed and undeformed sediments, at equivalent depths, at Sites 583 and 582, respectively. Shear strength was significantly higher at Site 583.

At Site 583 attempted sedimentological correlation between four shallow holes was unsuccessful.

PROPOSALS FOR NANKAI TROUGH DRILLING

The three drilling proposals include two complementary drilling programs:

1. A 9-site transect of Nankai Trough accretionary complex and Muroto forearc basin by Taira *et al*. Six of the sites are along MCS line 55-1. It starts from undeformed trench turbidites with maximum thickness of 500 m (NKT-1), through an imbricated thrust zone with clear décollement (NKT-2), across a major thrust (NKT-3), tilted slope basin (NKT-4), lower trench inner wall (NKT-5), upper trench inner wall (NKT-6). Sites NKT-7 through 9 are along a SCS line, along a transect of outer-ridge, forearc basin and upper continental slope. In addition to the basic suite of downhole logs, the proposal includes additional downhole physical properties, hydrology and fluid chemistry measurements, especially in the NKT-1 through 3 (Table 2 and Figs. 2-5). Complete penetration through accretionary complex is emphasized. (A proposal by Shiki and Miyake suggests drilling in adjacent Tosa Basin.)

2. A single deep hole at toe of accretionary complex, through the décollement to basement, dedicated to *in situ* measurements of physical properties and mechanical state of sediments and of fluid behavior, by Karig *et al*. Site should be adjacent to either NKT-2 of Taira *et al*. or to DSDP Site 583. The décollement is approximately 600 m shallower at NKT-2; therefore this site is preferred. Non-continuous coring (coring at approximately 30-m intervals) for whole-round laboratory measurements is proposed. This proposal assumes availability of prior extensive downhole logging, plus specific downhole measurements in continuously-cored adjacent deep hole.

Both programs require extensive *in situ* downhole physical geotechnical and chemical measurements which will be integrated with on-board and on-shore laboratory analyses.

ESSENTIAL MEASUREMENTS

1. Porosity: directly related to strength and to consolidation history, and closely related to other physical properties such as permeability, seismic velocity, density, thermal properties, electrical resistivity, etc. Intergranular and fracture porosity are needed. To be measured both *in situ* through a variety of downhole logs (intergranular and fracture) and in the laboratory on core samples (generally only intergranular).

2. Permeability: Pore and fracture fluids play a critical role in accretionary wedge processes, and their movement is controlled by the permeability. Both intergranular and fracture permeability must be estimated. Gross permeability to be measured downhole with newly developed and refined tools. Intergranular permeability will be measured in the laboratory.

3. Mechanical Properties and State: Provide constraints on the geometry of deformation and on its nature, i.e. effective stress state and mechanical modulii properties. Some stress data will be obtained from borehole televiewer and "breakouts." Pore pressure measurements with packer and "probe hole" instrument, and from laboratory measurements including fracture orientation and the anisotropic strain relaxation technique. Core orientation is essential. Mechanical properties will be obtained in situ and in the laboratory.

4. Seismic Velocity (including anisotropy): is related to many physical properties and processes. Velocity is the best method by which properties at depths beyond the reach of the drill may be estimated. Velocities are to be measured by downhole logs, and in the laboratory. A variety of seismic experiments may also be carried out with recording in the hole and shooting at the surface. Vertical seismic profile proposed for this hole.

5. Temperature and Thermal Properties: Temperature is a critical parameter for physical and chemical alteration processes within the accretionary complex, for delineating fluid motion, and for deformation models. Heat flow measurements provide the primary constraint on models for deep temperature. Data will be obtained through the APC (Von Herzen) temperature tool, the downhole sediment probe, and through continuous temperature logging (corrected for drilling disturbance). Thermal conductivity will be measured on cores in the laboratory.

6. Fluid Geochemistry: Provides valuable information about the nature of fluid flow in the accretionary complex, including the flow paths and origin. Fluid geochemistry also provides information on diagenetic processes. Fluid samples will be obtained by the in situ downhole probe (Barnes tool), by various packers, and in the laboratory by squeezing cores.

7. Chemistry of Gases: for organic matter maturation, clathrate understanding, etc. requires in situ sampling, e.g. pressure core barrel.

SPECIAL MEASUREMENTS AND TOOLS

The deep holes of the two programs require a comprehensive suite of downhole logs and special instruments: televiewers, packers and other in situ pore fluid tools, temperature and pressure probes, a multichannel seismic tool; a 4-arm caliper also is desirable.

For the single deep geotechnical hole proposal, primary development of small-diameter "probe-hole" ahead of main bit (by a Nandrill-type system), for in situ measurements in consolidated sediments is required. To permit all the necessary downhole measurements, the hole must be kept free of cuttings. Casing for hole stability, especially in upper few hundred meters, should be considered. A number of existing tools would have to be modified for use in "probe hole."

QUESTIONS AND PROBLEMS TO BE DISCUSSED

- An "immature" proposal for long-term downhole recording of earthquake-related processes apparently exists. Could require about half a leg for instrument emplacement, etc. What is the status of this proposal? Any other real time monitoring proposals?

- Sites NKT-1 and NKT-2 alone require a whole leg. Are these two holes considered as a comprehensive or adequate scientific drilling program for the understanding of multiple processes at accretionary complexes?

- A program that will include Sites NKT-1, 2, 3, 5, 6, and 7 will require two long legs.

- Can deep geotechnical single hole be somehow integrated with NKT-2 drilling? A special geotechnical hole will require at least half a leg with spotty coring.

- If attempts for deeper penetration at NKT-1 and 2 than in previous DSDP holes fail, not much will be gained scientifically; what is the contingency program? Are Sites NKT-3 through 9 considered only as contingency program?

- Biostratigraphic dating will be problematic and probably impossible below turbidite unit.

- Any contingency program for more favorable paleoceanographic information, e.g. history of Kuroshio current?

Table 1. SUMMARY OF DSDP SITES

DSDP Site	Position	Water Depth (m)	Maximum Penetration (m)	Recovery %	Oldest Sediment	Location
297	30°53'N 134°10'E	4460	680	51	Mid- to Late Miocene	Shikoku Basin
298	31°43'N 113°36'E	4630	610	4 to 56	Early Pleistocene	Deepest terrace on inner trench slope
582	31°47'N 133°55'E	4880	750	41	Pliocene	Floor of Nankai Trough, 2 km south of "deformation front"
583	31°50'N 133°51'E	4630	450	43	Early Quaternary	Deepest terrace on inner trench slope

Table 2. NANKAI TROUGH AND SHIKOKU FOREARC SITES (Proposed by Taira et al.)

NKT Sites	Position	Water depth (m)	Sediment thickness (m)	Total penetration (m)	Main objectives
1	32°26'N 135°08'E	4,750	1,200	1,250	• Complete sequence of undetermined sediments. • Reference site of physical and chemical properties
2* (Re-entry)	32°30'N 135°06'E	4,580	1,700	1,750	• Complete sequence of accretionary complex toe through décollement to ocean crust, for structural fabrics, physical and chemical properties.
3	32°38'N 135°01'E	4,280	> 5,000	700	• Across major thrust where accretionary complex thickens significantly and hemipelagic basin sediments scraped off, for fluid flow and chemistry.
4	32°41'N 134°59'E	4,280	> 5,000	700	• Tilted slope basin, for lithology contrast with accretionary complex, tilting history.
5	32°45'N 134°56'E	3,530	> 5,000	800	• Lower trench inner wall, for age of accreted sediment, structural fabrics and pore fluids.
6	32°53'N 134°52'E	1,650	> 5,000	700	• Upper trench inner wall, similar to NKT-5.
7	33°13'N 134°55'E	1,050	> 5,000	800	• Outer ridge vertical tectonics and complete stratigraphy of Muroto forearc basin.
8	33°24'N 134°51'E	1,320	> 5,000	600	• Muroto forearc basin subsidence history and filling processes.
9	33°29'N 134°49'E	820	> 5,000	700	• Subsidence history of upper continental slope.

* Also proposed by Karig et al. for geotechnical hole.

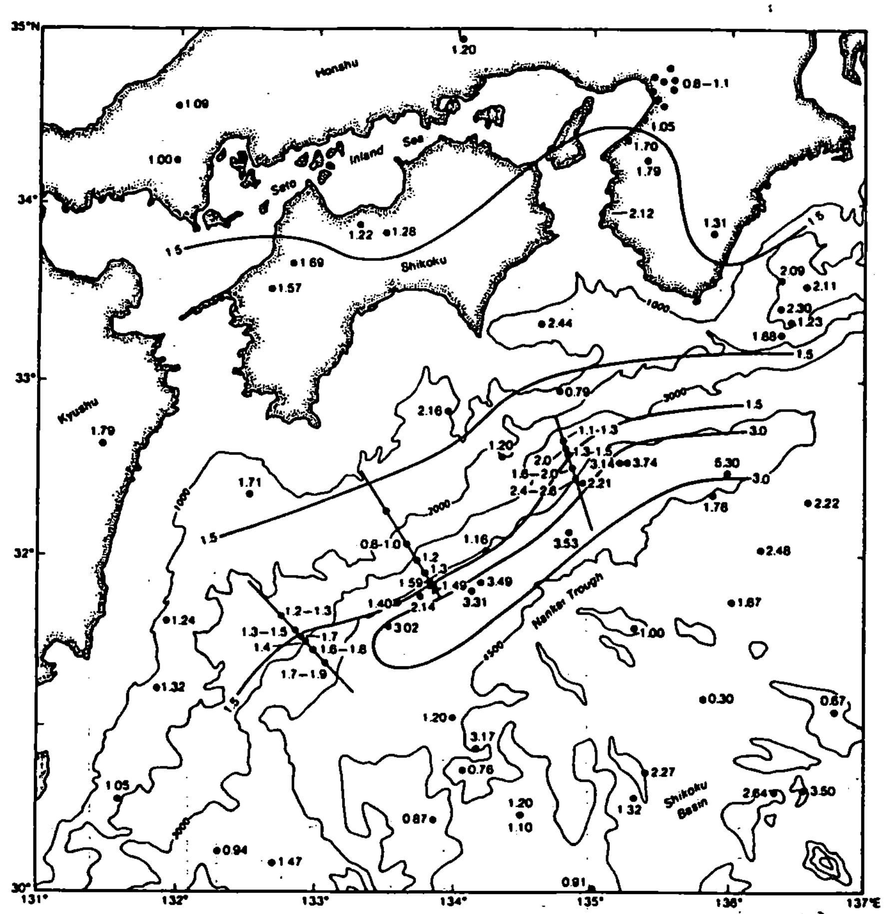


Figure 1, Regional distribution of heat flow, Nankai Trough. Asterisks indicate locations of Sites 582 and 583. (DSDP, V.87)

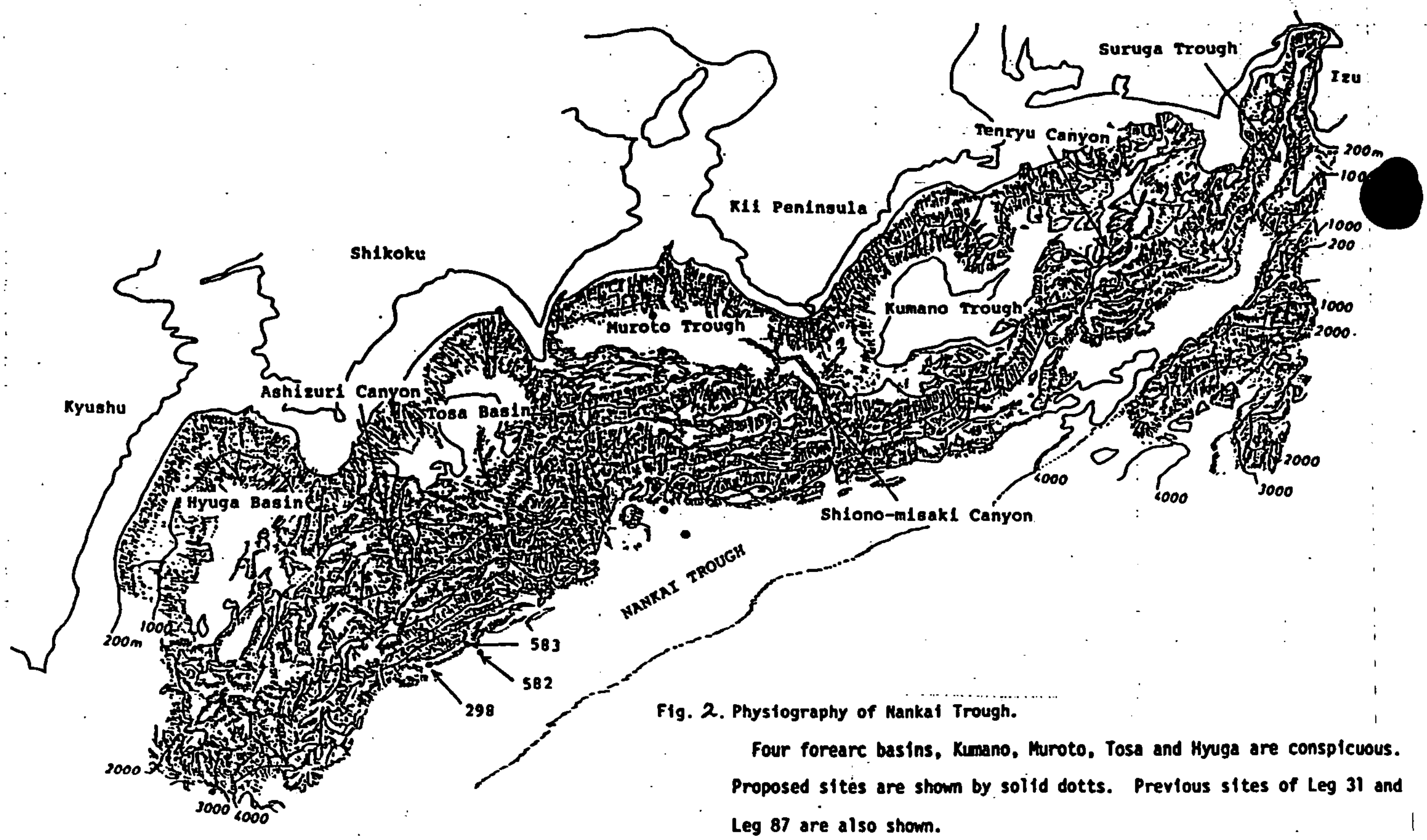


Fig. 2. Physiography of Nankai Trough.

Four forearc basins, Kumano, Muroto, Tosa and Hyuga are conspicuous. Proposed sites are shown by solid dotts. Previous sites of Leg 31 and Leg 87 are also shown.

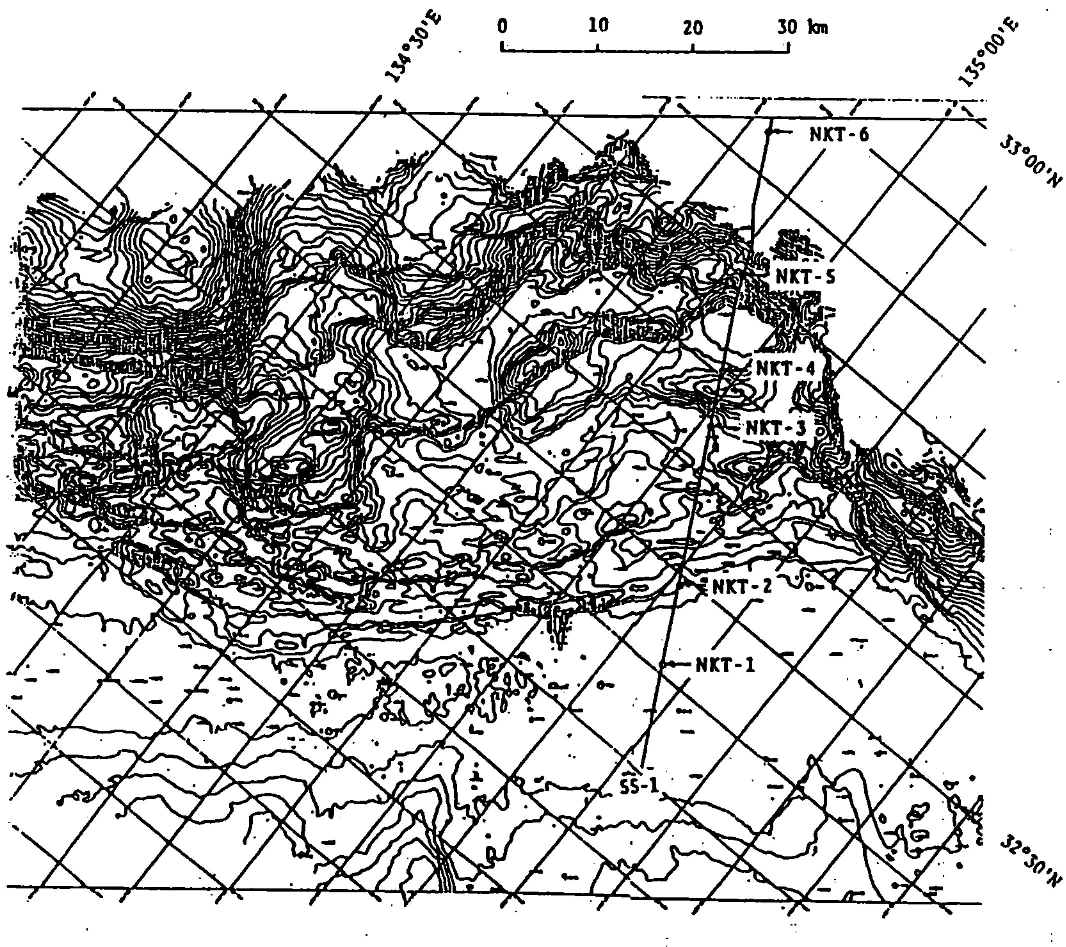
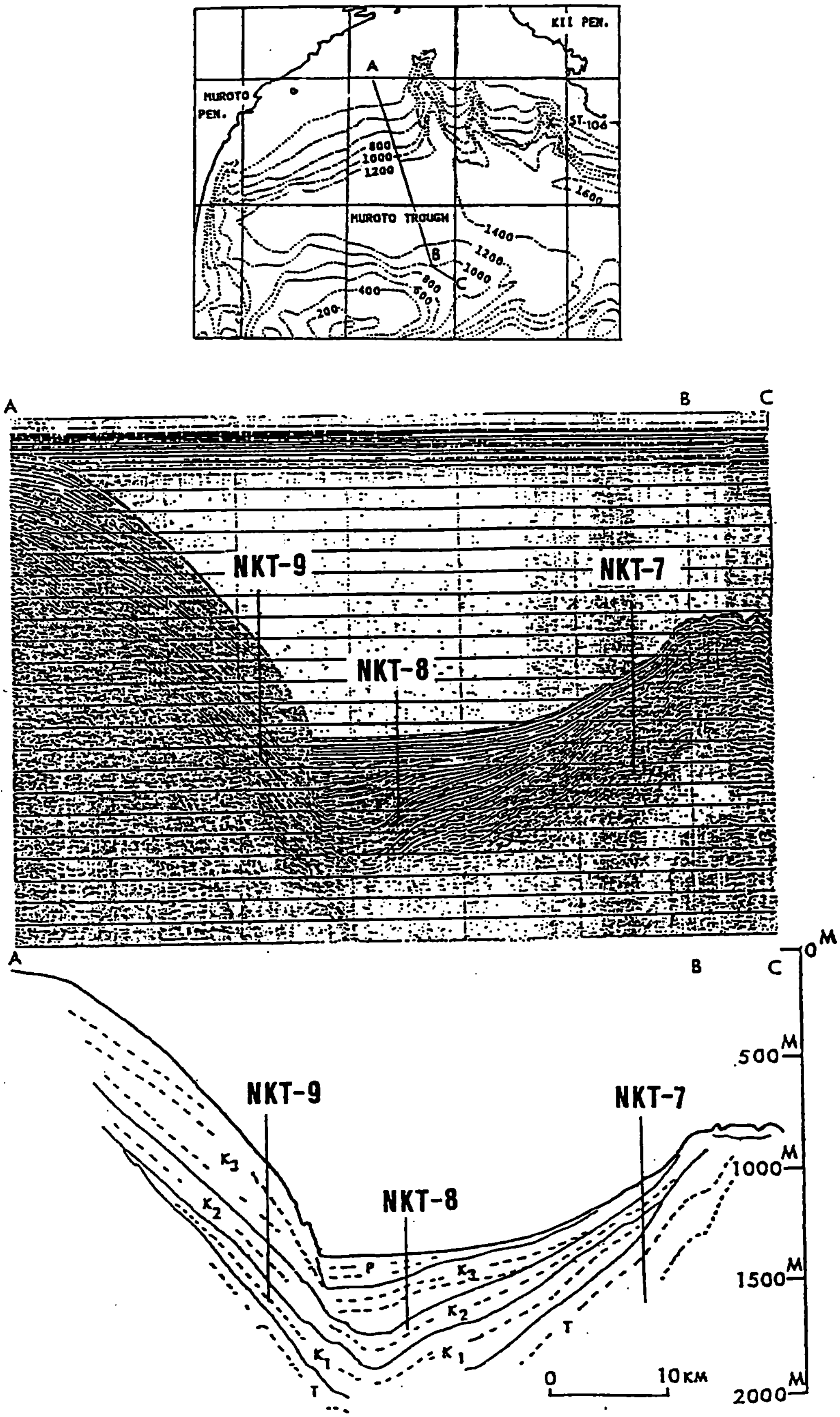


Fig. 3. Seabeam map of Box 6 and proposed sites.



Stratigraphic relationships between five beds in the south of the Kii Straits

P ——	Middle Pleistocene-Recent	K_3 ——	Early Pleistocene
K_2 ——	Middle Pliocene-Late Pliocene	K_1 ——	Middle Miocene-Early Pliocene
T ——	Early Miocene-Middle Miocene		

Fig. 4. Location of Muroto forearc basin transect and proposed sites in Muroto forearc basin, (Inouchi, et al., 1978).

Fig.17

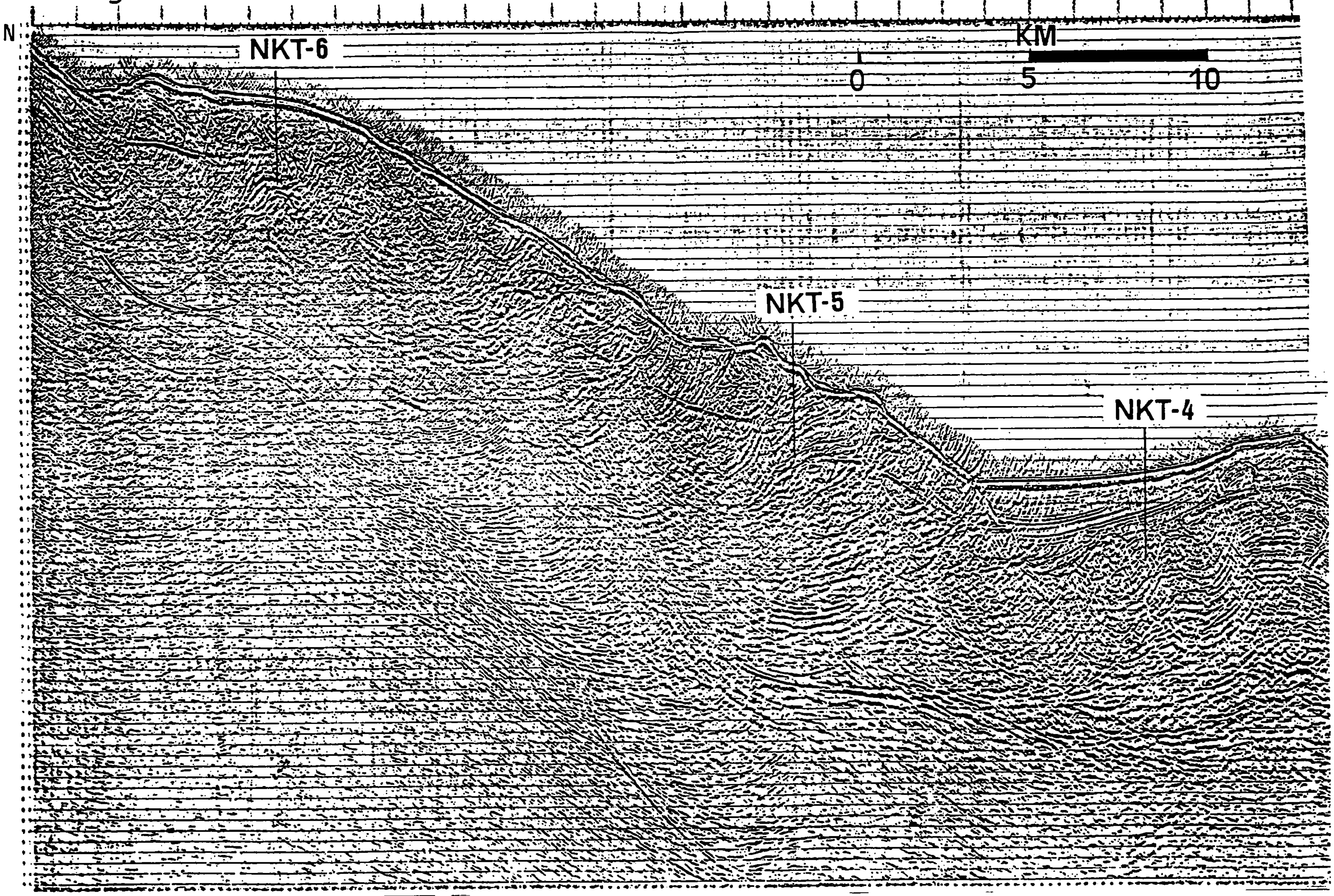


Fig. 4. Proposed ˙tes on Line 55-1 (JAPEX).

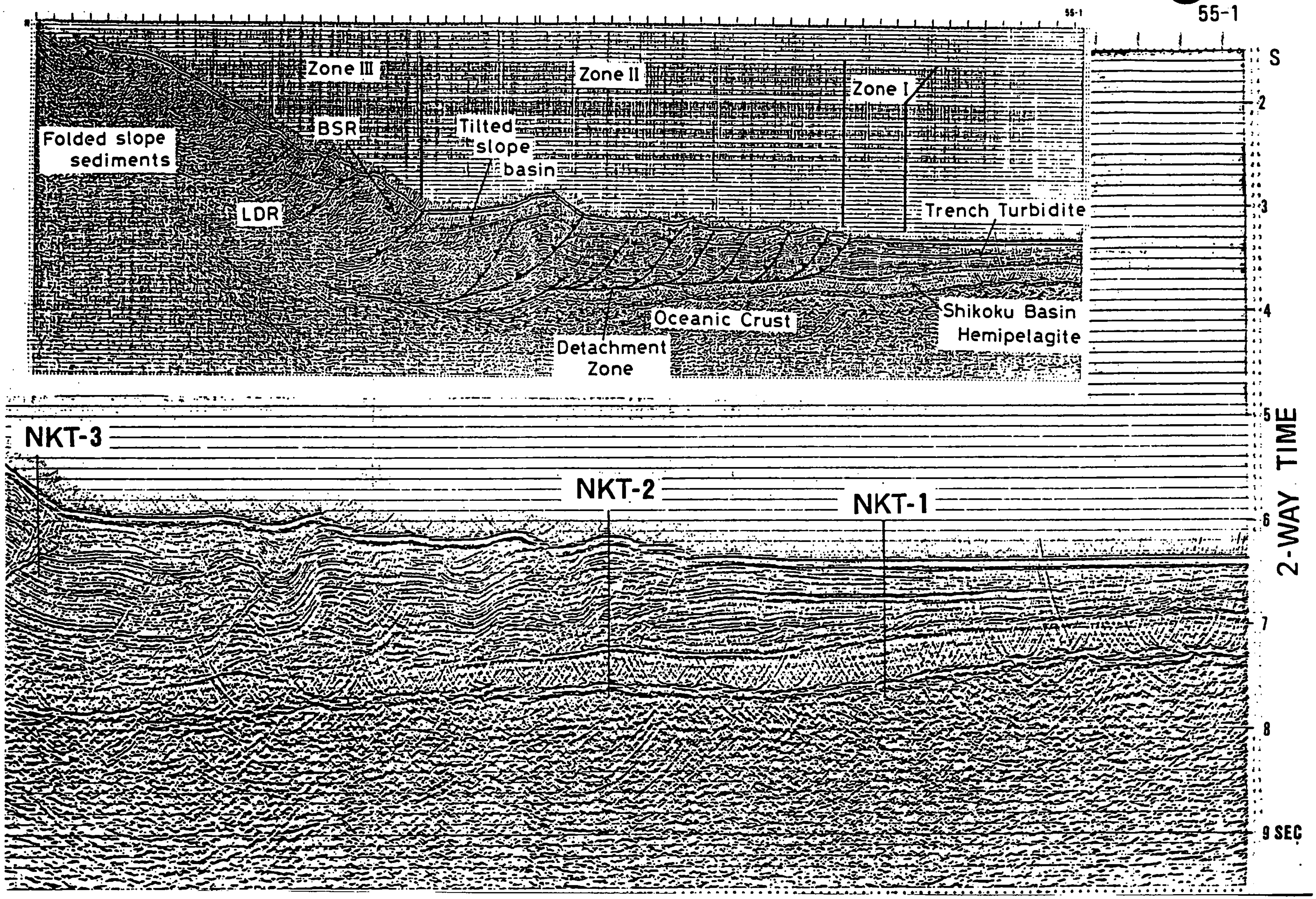


Fig. 4. Proposed sites on Line 55-1 (JAPEX).

VANUATU

WPAC Programme

Watchdog Summary: VANUATU

I - Geodynamic setting:

+ The proposals concern the central part of the New-Hebrides (Vanuatu) Arc resulting from the underthrusting of the Australia-India plate from the West at a rate of 10cms/yr.
+ The subduction process is complicated by the interaction with East trending asismic ridges, forming the D'Entrecasteaux zone; consequences are: a) deformation of the fore-arc, b) uplift of the arc at anomalous rapid rates, c) deepening of the AOBA intra-arc basin.

II- Proposals :

+ n°) 187: Taylor and Lawver. Univ. Texas, Austin.
+ n°) 190: Fischer, Greene, Collot, Recy. USGS and ORSTOM.

III. Objectives:

+ Themes: Arc-ridge collision
  Backarc rifting
  Formation of backarc basin
  Subduction polarity reversal.
+ Drilling objectives:

  A) Arc-ridge collision: Vanuatu forearc

  Determining what influence a linear ridge exerts on the style of accretion and the type of structures produced during collision with Arc.

  These objectives will be met by penetration of:

  - Reference section of D'Entrecasteaux ridge.
  - Lowermost accretionary wedge & interplate thrust fault
  - Section where a guyot (Bouguainville Spur) has collided with the Arc, to test if Guyot materials have been accreted onto the Arc, and to determine physical state of deformed rocks and paleobathymetric history during collision.

  B) Intra-Arc basin: Aoba basin

  Interaction between Arc-ridge collision and the development of intra-arc basins, and the evolution of the magmatic arc. Drilling will be used to test the relations between:

- The deepening and deformation of the basin, major incomformities and onset of the Arc-ridge collision.

C) Back-arc trough (Coriolis trough)

To determine the chemistry and volcanic strati-graphy of an incipient rift.

IV- Site survey:

+ Large data bases collected by USGS and ORSTOM.
+ For drilling-site survey:
  - ° Seabeam and single channel seismic by JEAN CHARCOT in 1985
  - ° OBS refraction survey in the Aoba basin -1986
  - ° MCS by JEAN CHARCOT in 1987.
+ Planned NAUTILE submersible cruise for winter 1988-89 focused on the Arc-ridge interaction.

V - Forces:

+ Only mature proposal focused on the study of collision, a first order thematic problem. Sunda collision zone is more focused on backthrusting,which is not a uniquely collisional phenomenon.
+ Complete transect of an Arc.
+ Wide range of objectives, which can be investigated within a small geographic area.
+ Large set of geophysical and onshore geological data: the area is well known, and the site survey ready.

VI- Weaknesses:

+ Back-arc trough (Coriolis) petrography must still be perfected. Preliminary studies have been published by the Brest team.
+ Heat-flow surveys in the basin are missing.
+ Total length to meet the objectives reaches 76 days (including 55 drilling days plus 15 days of logging and transit) which is too much for one leg.

WPAC Watchdog Report

Bonin Transect

by P. T. Robinson

The Bonin System has undergone a complicated tectonic history. Subduction of the Pacific Plate beneath the Philippine Sea Plate began in Early Eocene, building an intra oceanic island arc and broad fore arc. In mid-Oligocene, the arc was split by rifting to form a remanent arc (Palau-Kyushu Ridge) and the active Bonin: - Mariana arc and fore arc. Renewed rifting in late Miocene caused separation of the southern part of the Mariana arc from the remanent West Mariana Ridge. Compared to the Mariana region, the Bonin fore arc has undergone little deformation since its formation.

The Bonin Islands are the type locality of boninites, highly depleted arc lavas containing clinoenstatite. The fore arc region also has a narrow belt of serpentinitized ultramafics, which appears to control the location of the lower-slope terrace. This belt is marked by a series of serpentinite diapirs.

Drilling proposals have been received from Okada and Takayamagi (83/D Revised), Taylor (171/D Revised), Fryer (172/D) and Ishii (181/D). These call for a variety of holes to address problems of:

(1) Arc rifting and formation of back arc basins;

(2) Arc/fore arc magmatism, structure, stratigraphy and vertical tectonics;

(3) Outer fore arc serpentinite diapirism.

WPAC has proposed two legs--Bonin I and Bonin II--to drill a series of holes forming a transect from the edge of the Pacific Plate across the fore arc and arc to the back arc (Figure 1; Table I).

BON sites 1 and 2 are designed to address back arc spreading, synrift volcanism and sedimentation, hydrothermal circulation and the nature of arc and rift basement.

BON sites 3 - 6 provide a transect across the frontal arc, fore arc basin, and outer arc high. They will address problems of uplift and subsidence, fore arc stratigraphy, nature of fore arc basement and micro structural deformation.

BON site 7 will sample a serpentinite diapir to investigate the timing of emplacement, mechanism of emplacement, and fluid circulation.

Site 8 is a reference hole on the leading edge of the Pacific plate.

MAR sites 2 and 3 are on serpentinite diapirs in the Mariana fore arc.

Review of Program

In my opinion, the Bonin Drilling Program is a model for thematic drilling. It seeks to investigate a range of processes in a single, relatively simple, subduction zone. Once completed, we will have data on all major subdivisions of an arc system, and we will be able to integrate these data into a coherent model. All but two of the proposed drilling sites are in the Bonin, rather than Mariana, part of the arc because of the simpler tectonic environment. Also, the Bonin fore arc region is cut by several submarine canyons allowing the holes to be spudded at significantly greater stratigraphic depths. MAR 2 and 3 are on seamounts believed to be serpentinite diapirs. Pacman seamount (MAR 2) has breached the surface and erupted serpeninite flows.

The sites are well-justified and appropriate to answer the questions posed. The only real question I have is whether it is necessary or appropriate to drill three serpentinite diapirs. Having examined serpentinite diapirs and flows in the field, I am dubious that drilling will provide that much information. In my opinion, it would be more interesting to investigate the origin of these diapirs; that is, the nature of basement below the lower slope terrace. Is this a slab of oceanic lithosphere caught up in the inner slope trench well? Or perhaps an igneous intrusion of some sort? I would recommend against drilling two seamounts in the Mariana fore arc. Instead, I would recommend drilling either MAR 2 or 3 and BON 7. In place of MAR 2 or 3, I would suggest a hole on the Bonin inner slope terrace <u>between</u> the seamounts to explore the basement of this feature. Bonin 8 (the reference hole on the Pacific plate) is discussed separately in the next section.

Site survey data are generally adequate. MCS coverage is available from the Japan National Oil Company and many single channel profiles have been produced by the Geological Survey of Japan. All but BON 7 are located on such profiles although only a few have crossing lines. Some additional closely-spaced MCS lines are recommended by the proponents.

Geochemical Reference Sites

Watchdog Summary

P. T. Robinson

Ever since the role of subduction in arc volcanism was discovered, petrologists have debated the relative contributions to arc magmas from the subducted slab. The absence of thick accretionary wedges in many trenches suggested that sediments were subducted but until recently there were no tracers sufficiently sensitive to detect their contributions. It is now generally agreed that the subducted slab (sediments, basalts, and plutonics) does contribute to arc magmas, but the nature and extent of this contribution is not known.

A proposal by Langmuir and Natland is aimed at addressing this problem. They propose a series of geochemical reference sites on the leading edge of subducting plates in order to:

(1) Determine the compositions of sediment and igneous crust being subducted into the mantle;

(2) Test for correlation between the composition of the subducted plate and the associated arc volcanic rocks;

(3) Investigate temporal and spatial variations in composition of igneous crust;

(4) Compare the style of alteration and fossil hydrothermal activity in old fast-spreading crust with that in old slow-spreading crust.

The discussion of this proposal as it applies to the Western Pacific region focusses chiefly on goals one and two. In short, can we define a drilling strategy that will allow us to obtain a representative sample of the old Pacific crust for comparison with volcanic rocks in the Bonin and Mariana arcs. The proponents suggest five holes on the Pacific plate, one deep re-entry or four single-bit holes, to investigate the range of materials being subducted beneath the Bonin and Mariana areas (Table I and Figure 1).

Numerous questions have been raised about the proposed sites:

(1) Will the drill holes provide a representative vertical or horizontal sample of the Pacific crust;

(2) Can the drill data (crust that has not yet reached the subduction zone) be related to the present day arc volcanism;

(3) Will it be possible to recognize the different signatures of oceanic sediments, MORBS, and seamount volcanic rocks in the arc lavas?

These questions are very difficult to answer definitively at this time, and therefore, it is impossible to say what is the best drilling strategy. For example, TECP recommends a large number of shallow (approximately 20 m) basement holes on the assumption that only the uppermost altered crust can be recognized in the arc lavas. LITHP strongly endorses the concept of geochemical reference holes and favors the Langmuir/Natland approach.

Although I share the concerns listed above, I believe that this is a sufficiently important thematic problem that we must make a start. The Langmuir/Natland proposal provides such a start:

(1) It will test the extent of alteration vertically and laterally in the crust;

(2) It will sample normal MORB and seamount lavas;

(3) It will sample a range of sediments on the plate;

(4) It will sample materials in front of two arc systems (Bonin and Mariana), which differ in composition.

I believe that the <u>minimum</u> effort should include holes DP-1 (to assess the vertical alteration profile and sample normal MORB in front of Bonins), BON 9A (contribution to Bonins from seamount lavas), MAR 4 (sample MORB in front of Marianas) and MAR 5 (sample seamount volcanics in front of Marianas). This would be three single-bit holes and one re-entry hole. These could probably be drilled in a single leg if operations went smoothly. A fallback position would be to drill DP-1 and BON-8. These are the most important because they will complement the data that will be developed from the Bonin transect.

JOIDES Tectonics Panel Meeting
University of Texas, Institute for Geophysics, Austin
27-29 April 1987

Panel members present:	Darrel Cowan (USA), Chairman Ian Dalziel (USA) Dan Davis (USA) Hermann Kudrass (for Karl Hinz) (FRG) David Howell (USA) Ken Hsü (ESF) Bruce Marsh (USA) (27-28 April) Kazuaki Nakamura (Japan) François Roure (France) Peter Vogt (USA) Tony Watts (USA) (28-29 April) Graham Westbrook (UK)
In attendance:	Christian Auroux (ODP) Dick Buffler (NSF) (27 April) Greg Moore (WPAC) Paul Robinson (PCOM) Dave Scholl (CEPAC)
Members absent:	Robin Riddihough (Canada)

AGENDA

1. Minutes of previous meeting
2. Reports from liaisons
3. Indian Ocean drilling plans
4. Western Pacific drilling plans
5. Next meeting
6. Central and Eastern Pacific
7. Thematic objectives in other regions
8. TECP targets for riser drilling
9. Membership changes
10. IOP liaison
11. Sampling strategies
12. Other business

EXECUTIVE SUMMARY
TECTONICS PANEL MEETING
27-29 April 1987
University of Texas, Institute of Geophysics, Austin

1. SOUTHWEST INDIAN RIDGE FRACTURE ZONE

TECP strongly feels that in order to obtain the most comprehensive information concerning the three-dimensional disposition and geometry of structures and fabrics in the Atlantis II fracture zone, a *transect* of holes penetrating tens of meters into basement is definitely preferable to one deep hole on the median ridge using a guidebase.

2. WESTERN PACIFIC DRILLING PLANS

A. Regarding the approved nine-program (~ 22 month) plan:

- We recommend re-instating MAR-2 and 3 to address a high-priority tectonic problem: the nature of serpentinite diapirism in the forearc
- We recommend adding SUL-8 in the Celebes Sea to the Banda-Sulu-S. China Sea transect in order to provide a more complete study of the evolution of the system of small ocean basins in this region
- We do not see how drilling at S-sites in the Sunda program will uniquely address the general problem of arc-continent collision. We ask for either further justification of the rationale for these sites, or new sites that clearly address the processes of collision.

B. Regarding additional programs in the WPAC prospectus:

- We recommend drilling an abbreviated program at Zenisu Ridge, at sites ZEN-1 and 3 or their equivalents, to address the timing and setting of the inception of contraction of oceanic crust.
- We stand by our original endorsement of in situ physical-properties (geotechnical) measurements in the Nankai prism, and recommend that they be included using a conventional hole at NKT-2 or a companion dedicated hole.

MINUTES

The meeting began at 8:30 a.m.

Cowan welcomed Graham Westbrook, our new member from the United Kingdom who has replaced Jerry Leggett. Cowan asked for a volunteer to serve as Secretary for the meeting; Dave Scholl kindly agreed.

1. MINUTES OF THE PREVIOUS MEETING

Cowan noted that on p. 10, under agenda item #7, the Sulu-Negros program had been left out of the lower-priority grouping in the rank-ordered list of drilling legs in the Western Pacific. It would appear between Zenisu Ridge and Vanuatu (2nd leg), with 15 points.

2. REPORTS FROM LIAISONS

2.1 NSF

Dick Buffler reported that the Defense Department has thrown up a last-minute roadblock to prevent the Soviet Union from joining ODP, at least temporarily. He reviewed the ODP budget for the remainder of Fiscal Year (FY) 1987 and for 1988 and noted a potential shortfall. A new budget procedure for ODP, involving input from PCOM, has been adopted, and we should notify PCOM of special engineering needs and the like prior to its December annual meeting. In response Dalziel's question about COSOD II, Buffler reviewed the general procedure for inviting U.S. participants. Westbrook reviewed the five working groups and emphasized that each is actively soliciting information and recommendations from the geoscience community.

2.2 PCOM

Paul Robinson gave a detailed breakdown of the FY 88 budget and pointed out a possible $1.5 million shortfall, which will probably have to be met by cuts at TAMU, Lamont, and JOI/JOIDES. He then reviewed planning decisions concerning the Indian Ocean and Western Pacific. Those of interest to TECP include: Red Sea and Makran are out; Mascarene is in. PCOM asked for more basement sites on the Kerguelen Plateau, and the Kerguelen Working Group complied. Prydz Bay drilling (which would require an ice-support vessel) is designed basically to document the time of initiation and retreat of the E. Antarctic ice sheet. Leg 116-Intraplate deformation: there are safety problems near the faults. Leg 118 (SWIRFZ) was given ten more days, and the first priority is to deploy a guidebase for a deep basement hole. Leg 123 (Argo): Site AA1-B deep into oceanic crust approved.

In the Western Pacific, PCOM approved about 22 months of drilling (11-12 legs) that will achieve the top nine *programs* ranked by WPAC. In other words, the "top nine programs have been approved for planning purposes" (see WPAC 3rd Prospectus). A core of four programs (Banda-Sulu-S. China; Bonin-I; Japan Sea; Nankai) will definitely be drilled. PCOM also endorses the Langmuir-Natland proposal for geochemical reference sites but requests further advice from panels about drilling strategies and sites. PCOM needs our thematic recommendations for drilling in the Central and Eastern Pacific now.

Regarding the panel structure, PCOM has appointed two new liaisons to each thematic and regional panel. Which liaison attends a particular meeting will typically be determined by whether it is held inside or outside of North America. New liaisons to TECP are T. Shipley and O. Eldholm. It is expected that panels will meet twice a year rather than three times under ordinary circumstances.

2.3 ODP

Christian Auroux reviewed results from Leg 112 (Peru). One noteworthy interpretation of interest to TECP is that horizontal compression is apparently not transmitted into the "backstop" to the small accretionary prism. He also reviewed results from Leg 113 in the Weddell Sea. The Navidrill was tested successfully on land in Germany; the diameter is 3-4 cm. Navidrill is scheduled to be used on Leg 118 (SWIRFZ).

2.4 WPAC

Nakamura, Howell, and Moore each made comments about panel actions and Western Pacific drilling in general. WPAC would like all twelve of its programs drilled (including the nine already approved); this campaign would probably require on the order of 24 months. WPAC endorsed two shallow reference sites east of the Mariana arc, on the descending plate. There seems to be a slight jurisdiction problem here: is this CEPAC or WPAC territory? Bonin I and II do not now include the serpentinite-diapir sites in the Mariana forearc but rather a seamount on the Bonin forearc ridge. Moore said ALVIN dives on the Mariana diapirs are imminent.

A general discussion concerning longer-term drilling followed. Cowan asked specifically about how possible longer drilling campaigns in the Pacific might be balanced against a second circumnavigation. Robinson said PCOM is not yet wedded to a second circumnavigation; the quality of proposed science is of paramount importance. Results of COSOD-II will also be important. He said C. & E. Pacific drilling is tentatively scheduled for nine legs, but it is not yet certain how three legs of East Pacific Rise drilling will be accommodated. Dalziel, who attended a recent South Atlantic workshop, feels that many of the attractive tectonic objectives in that region may be too deep to drill.

2.5 CEPAC

Dave Scholl handed out excerpts from the minutes of the recent CEPAC meeting (March 30-31). A "1st Prospectus" is due out by the end of May; the handout listed the top ten scientific objectives that will be described more fully in the prospectus. He noted that at present, Ontong-Java drilling will address only the sedimentary record; SOHP-type objectives are similarly the driving force behind the Bering Sea drilling. CEPAC specifically notes its concern that the sediments in the Hawaiian moat may not be datable. CEPAC also wants us to clarify whether we consider deep drilling at convergent margins to be a mature (higher priority) or immature problem.

3. INDIAN OCEAN DRILLING PLANS

Tony Watts who acted as TECP liaison at the last IOP meeting in early April at Lamont, briefly reported on the meeting.

3.1 Southwest Indian Ridge (Atlantis II) Fracture Zone (SWIRFZ)

Cowan noted that the plan adopted by PCOM calls for, as first priority, setting a hard-rock guidebase on the median ridge and drilling a deep hole into basement, which is expected to be largely ultramafic on the basis of dredge hauls. Second priority is a series of shallower holes in a sedimented basin on the floor of the zone (the "gravel pit"). Robinson (who will be a co-chief scientist) reminded us that ten days have been added to Leg 118, which might insure that both ridge and basin will be drilled. Cowan had written a letter to PCOM, dated March 26, 1987, stating that it was his opinion that TECP strongly favors a transect of several intermediate-depth holes over one deep hole. According to Robinson, this letter had not been distributed to the PCOM members. Watts had, however, read it aloud to IOP in April.

Several TECP members again questioned the advisability of first drilling a deep guidebase-assisted hole. There was a general feeling expressed that PCOM's desire to obtain more experience using a guidebase had tilted the leg toward petrologic, rather than structural objectives. Marsh pointed out that TECP had advocated drilling in this fracture zone in the first place, but that now its thematic rationale was subordinated to perceived operational needs. He suggested that we reiterate our advice to PCOM.

TECP CONSENSUS: *TECP strongly endorses the recommendations in Cowan's letter of March 26, 1987: In order to obtain the most comprehensive information concerning the three-dimensional disposition and geometry of structures and fabrics in the zone, a transect of holes is definitely preferable to one deep hole using a guidebase.*

3.2 Broken Ridge drilling plan

In a letter to Cowan dated January 26, 1987, Pisias asked TECP to comment on the drilling strategy that could best address tectonic objectives. In view of the fact that we have not yet received any detailed drilling plan from PCOM or IOP, the panel feels that TECP is unable to offer any constructive comments at this time.

4. WESTERN PACIFIC DRILLING PLANS

Prior to this meeting, Cowan had sent the panel copies of the WPAC 3rd Prospectus and a summary of the minutes of WPAC's March meeting in Tokyo. He suggested that the goals of our meeting should be to: (1) Systematically review each of the twelve programs in the prospectus as they stand now; (2) Evaluate a few new proposals received since late 1986; and (3) Evaluate whether the nine-program (~ 22 month) scenario adequately addresses thematic objectives, or whether additional drilling is needed.

4.1 WPAC 3rd Prospectus

4.1.1 Japan Sea

The panel felt no action on its part is needed since this program is part of the core.

4.1.2 Zenisu Ridge

New seismic data have been obtained which may clarify the tectonic setting of the ridge. Earlier, at our October 1986 Ottawa meeting, TECP had ranked Zenisu in the lower-priority group of programs largely because we thought the seismic data didn't demonstrate the contractional origin of the ridge. The question now is whether we can boost it up in the ratings. Hsü explained that the scientific objective seems to be to study the initiation of a new subduction zone and the stacking of slices of ocean crust. Westbrook pointed out that drilling can potentially date the uplift, and from these data we can obtain strain rates and reconstruct the plate tectonic setting when uplift was initiated. He questioned whether all four sites in the proposed program were needed to achieve the primary objective of dating the uplift. Considerable discussion ensued. Cowan expressed his doubts about whether the general problem--shortening of the descending plate in advance of a subduction zone--was as important as other problems on the WPAC menu. He called for a vote on the issue to convey the sense of TECP as to whether Zenisu should be included in the Western Pacific program.

TECP MOTION: Holes at sites equivalent to ZE-3 and ZE-1, located on Line KT86-ILL4-1 at approx. SP 650 and 750, should be drilled to a depth sufficient to address the timing of formation of Zenisu Ridge. Drilling is subject to a demonstration that sediments are in fact datable.

MOVED: Westbrook
SECONDED: Davis
9 in favor
1 against
1 abstain
MOTION PASSED

4.1.3 Nankai prism

According to the prospectus, there are two types of drilling proposed for Nankai. A conventional leg would comprise two holes designed to study the accretionary prism and the sediments approaching it: NKT-2 in the toe of the prism, drilled through the decollement; and NKT-1, a reference site on the descending plate. A second program would consist of a hole devoted to the measurement of physical properties (a "geotechnical hole"), which would consume about 1/2 leg. We discussed whether we stood by our October ranking, which placed the geotechnical hole in 7th place in our list of nine programs. Moore said that a planned high-resolution ESP survey would be concentrated in the vicinity of proposed NKT sites, rather than near site 583, drilled on Leg 87. There was a question raised about why a separate hole was needed to NKT-2 and about whether a single hole there could also be used for measurements.

TECP CONSENSUS: *TECP stands by its original ranking of the Nankai physical-properties hole, and reiterates its support for including these types of measurements in the Nankai drilling program.*

4.1.4 Bonin I and II

The Bonin program, as now endorsed by WPAC and PCOM, does not include sites MAR 2 and 3, which were to be drilled on serpentinite diapirs in the Mariana forearc. The program Bonin II does include BON-7, a site on a seamount in the Bonin forearc. Cowan read excerpts from a letter to him from Patricia Fryer dated January 8, 1987, in which she pointed out her view that the evidence supporting a diapiric origin is stronger for the Mariana, rather than the Bonin, seamounts. She stated her concern that the general process of serpentinite diapirism in forearcs would not be addressed by drilling if MAR-2 and 3 were dropped.

Cowan asked the panel whether we still stood by our original endorsement of forearc diapirism as a tectonic objective worth pursuing with the drill. Moore asked what specific information drilling could provide, beyond what is known from dredging and what will be learned from ALVIN dives, scheduled soon. Marsh emphasized again that drilling will illuminate the dynamics, fluid budget, and thermal regime attending diapirism. Westbrook was concerned about whether the diapirs were adequately defined on the Sea MARC images and whether we could be sure that we were drilling into the diapiric mass itself, a debris apron, or uplifted wall rock.

We discussed the origin of the BON-7 seamount. Fryer doesn't think that it is like the Mariana features. Nakamura explained that the Bonin seamount is located on a forearc ridge that is a prominent feature in the Bonin arc and which continues in a subdued fashion southward. Westbrook noted that there are really two problems of interest here: The nature and origin of the forearc ridge, and the serpentinite diapirs themselves. The panel felt that drilling BON-7 may divulge something of interest about the nature of the forearc ridge. However, because it is not clear that BON-7 is actually a serpentinite diapir, we do not consider that drilling BON-7 will adequately address the problem of forearc diapirism as originally highlighted by this panel.

TECP CONSENSUS: *We recommend adding MAR-2 and 3 to the Bonin drilling program because of the compelling evidence that these seamounts are serpentinite diapirs. We endorse drilling at BON-7 as an opportunity to learn something about the forearc ridge on which it is situated, but not necessarily about the key thematic issue in question, serpentinite diapirism in the forearc.*

4.1.5 South China Sea (northern margin)

Cowan asked whether the panel wanted to reconsider its low ranking of this program. Westbrook asked what we could learn by drilling this particular passive margin. It was pointed out that the margin is youthful and the sediment cover is relatively thin, so it offers a chance to study early phases of passive-margin rifting. Hsü suggested that we stand by our earlier ranking, and the panel agreed.

4.1.6 Banda-Sulu-S. China Seas

No recommended changes or additions were proposed at this point in the meeting.

4.1.7 Sunda collision zone

Westbrook noted that although this program is supposed to address the process and results of arc-continent collision, the drilling as planned isn't well focused on this problem. There are two sets of sites: S, to study backthrusting of the accretionary prism on Sumba Ridge; and F, to study back-arc thrusting north of Flores Is. Westbrook said that backthrusting is not a uniquely collisional phenomenon, its connection with collision, if any, in this case isn't clear, and that there may be better places in the world to study backthrusting. Watts noted that the S-sites could document vertical motions coupled with contraction--i.e., the evolution of a small foreland basin. Again, this is may be an interesting problem of convergent margins in general, but not a uniquely collisional process. The panel felt there is definitely some merit to studying "upper-plate contraction", but collision is a higher-priority thematic issue. Recognizing that Silver has a site survey planned for October, TECP wants to encourage the selection of sites other than the proposed S-1, 2, and 3.

TECP CONSENSUS: *TECP still considers collision as a first-order problem worthy of investigation by the drillship. The F(Flores) sites do address this problem, but the S-sites, as presently proposed, do not. TECP recommends that either more thematic justification be provided for the S-sites, or that new sites with a clear connection to the collision process, be proposed.*

4.1.8 Vanuatu

The panel briefly discussed the necessity for drilling both the north D'Entrecasteaux Ridge and the Bougainville Guyot. TECP stands by its original ranking and concluded that all of the drilling in this program is worthwhile.

4.1.9 Lau Basin-Tonga

Scholl reviewed the tectonic setting and geology of the Lau Basin and Tonga Ridge and outlined the drilling program as it stands. Although certain sites will be devoted to geochemical and petrologic objectives, the panel felt that the program as a whole will result in new information concerning the timing of tectonic events and the overall evolution of this intraoceanic system.

4.2 New Proposals

4.2.1 NW Borneo

H. Kudrass displayed a spectacular BGR seismic section across the convergent zone offshore of Sabah (NW Borneo). It showed a series of folds and imbricate thrusts resulting from the consumption of the floor of the S. China Sea, which is a subsided platform covered by lower Miocene carbonates. K. Hinz and Kudrass were interested in whether TECP would encourage the submission of a drilling proposal in this system. Westbrook asked: What is the fundamental problem to be addressed here? Cowan pointed out the topical similarity to Makran: determine the rate of growth of an accretionary wedge, partly by dating and determining the subsidence history sediments in small basins on the wedge. He pointed out that the panel is more interested in drilling deeply in prisms than accomplishing another shallow transect. Roure said that you can study the development of thrust systems in some young examples on land, for example in the Apennines. Hsü emphasized that Sabah drilling results would definitely be of interest in a regional sense. Nakamura noted that the fundamental implications of drilling results here would be diminished because we do not know the convergence rate.

TECP CONSENSUS: *We do not encourage Hinz and BGR to prepare and submit a drilling proposal. However, we recognize that the basin problem--the rate of growth and distribution of deformation across a prism--is interesting and important, but cannot elevate it to a high priority at this time.*

4.2.2 Sulu-Negros collision zone (27D & 48D addendum)

We re-examined an addendum to 27/D and 48/D. This program does not appear on the WPAC list of twelve recommended programs; we ranked it in our low-priority group in October. Two of the sites (S-4 and S-5) are in the Banda-Sulu transect program and will be drilled. Hsü emphasized again how important it is to understand the evolution of this kind of small ocean basin and that it is essential that both holes be drilled to oceanic basement. There was general concern that top of basement could be identified with certainty on the available MCS data. Better quality data are probably necessary. TECP also endorses a hole at site S-8 in the Celebes Sea to provide a more complete picture of the evolution of the small Indonesian ocean basins. It seems that the origin and age of this basin is a valid problem in a regional context.

TECP CONSENSUS: *We endorse S-4 and 5 but request better quality seismic data and an assurance that these holes will reach oceanic basement. We advocate drilling S-8, to study the origin of the Celebes Sea, pending adequate site-survey data defining the top of oceanic basement and a thin, drillable sediment cover.*

4.2.3 Ogasawara Plateau region (260/D)

Vogt noted that one possible result of proposed drilling would be new information on the age and history of Westpac seamounts. However, it was not clear to the panel how any of the sites would address the processes of collision, because collisional structures are not defined in the data presented with the proposal. The geochemical and petrologic objectives outlined for OP-4 and 5 on the trench wall could possibly be achieved by dredging.

TECP CONSENSUS: *TECP cannot identify major high-priority thematic issues that would be addressed by drilling the proposed sites.*

4.2.4 W. Woodlark Basin (265/D)

It was reported that LITH felt that dredging, rather than drilling, would suffice in this area. Vogt felt that there are not enough data available or presented to permit evaluation of the model.

TECP CONSENSUS: *We cannot identify high-priority issues that could be uniquely addressed by the proposed drilling.*

4.2.5 Long-term down-hole measurements around Japan (272/F)

We briefly discussed this proposal. Nakamura said that new, site-specific proposals will be forthcoming. TECP encourages these kinds of measurements and gives the general concept our qualified support, pending specific plans.

4.3 Summary of recommendations for Western Pacific drilling

At this point, we tried to summarize our discussions and recommendations about the W. Pacific program. Considering the nine-program (approx. 22 months) scenario approved by PCOM, we had tentatively suggested standing by our original (October 1986) ranked list, but adding sites at SUL-8 (approx. 15 days), and two sites (equivalent to ZEN-1 and 3) on Zenisu Ridge (approx. 10 days). Moreover, we had recommended re-instating MAR-2 and 3 (approx. 20 days) and keeping the Nankai geotechnical measurements, whether they could be accomplished in a single hole NKT-2, or a companion (possibly adding 30 days). In effect, we had added 35 days (SUL-8 and MAR-2, 3) to the approved nine-program list, and endorsed a maximum of 40 days in two programs (Nankai geotechnical and Zenisu Ridge) that are in WPAC's twelve-program list but not yet approved. In short, we had recommended adding about (very rough estimate) 75 days to the approved program.

Westbrook felt that PCOM might be more inclined to approve some or all of our additions if we could delete some sites of low thematic priority from the approved program. He suggested that because several back-arc basins are scheduled to be drilled, we could trim the Coriolis trough sites from an already lengthy (1.5 legs) Vanuatu program and use the time to drill the Zenisu sites, which he particularly favored. But Marsh and Howell pointed out that we have consistently identified the evolution of back-arc basins as a high-priority problem.

TECP MOTION: Time be found for drilling an abbreviated Zenisu program (sites equivalent to ZEN-1 and 3) by deleting drilling in the back-arc region of Vanuatu.

MOVED: Westbrook.

SECONDED: Hsü
3 in favor
8 against
1 abstain
MOTION FAILED

TECP RECOMMENDATIONS TO PCOM AND WPAC:

The following sites should be added to those already in the approved nine-program drilling plan: SUL-8 (Celebes Sea), and MAR-2, 3 (serpentinite diapirs). Furthermore, we recommend adding an abbreviated two-site (ZEN-1 and 3) program on Zenisu Ridge to the approved plan. We stand by our original endorsement of geotechnical measurements in the Nankai prism, whether they can be made in a "conventional" hole or instead require a *separate dedicated hole. We recommend adding sufficient time to the drilling plan in either case. We also ask for either more complete justification for how S-sites in the Sunda program bear on the process of collision, or that new sites clearly relating to collision be proposed.*

5. NEXT MEETING

K. Hsü kindly invited us to meet in Switzerland in September. We selected September 28 and 29, and a half day on September 30 if necessary. Hsü will arrange a 2-1/2 day field trip after the meeting. [Field trip changed to before the meeting by letter from Hsü dated May 6.] He suggested we meet in Samedan, near St. Moritz. Cowan will write the JOIDES office and request these dates and venue.

6. CENTRAL & EASTERN PACIFIC

PCOM had requested our evaluation of the tectonic content of the drilling proposals and packages that CEPAC ranked highly. Also, PCOM wants us to comment on the tectonic content of specific proposals insofar as they deal with our key thematic issues. Because we had already scheduled, as a main item on our agenda, a discussion and finalization of the draft of our white paper, Cowan suggested that we first proceed through the topics in the draft. Scholl earlier had raised some questions arising from the March 1987 CEPAC meeting for our clarification and comment.

6.1 Geochemical reference holes

Marsh reviewed again the need for reference holes to study the contribution that descending oceanic sediments and upper crust make to arc magmatism. He felt that the Langmuir-Natland proposal (267/F) addressed these problems well with an attractive drilling strategy. Robinson and Cowan asked specifically about deep vs. shallow drilling, and which specific locations would be best. Marsh answered that although a deep hole will give an alteration profile through 300 km or so of oceanic crust, a series of shallow holes has higher priority because we need regional geochemical coverage on a scale comparable to what we already have from arcs. Any arc that is known to have regional variations in magmatism and a simple tectonic history is suitable. Thus, the Aleutians or any of the major W. Pacific intraoceanic arcs (Bonin, Mariana) are fine, as long as enough holes are drilled to encompass the aforementioned geochemical variability.

Marsh will contribute additional text on these issues for the white paper.

6.2 Plate kinematics

Vogt systematically reviewed the key points in his text for the white paper. In his view, the highest priorities are: Opportunistic holes in or transects across crust with M-series anomalies; holes in Jurassic crust; and holes to investigate pre-70 Ma hotspots. Drilling strategies and relevant proposals are detailed in the white paper. Nakamura summarized again how drilling in tilted sediments in trenches and dating them could provide convergence rate. In theory, any convergent margin featuring tilted sediments--Aleutian, Peru-Chile, Cascadia--would be suitable for drilling.

6.3 Ridge-trench interactions

Cowan asked whether we could add to Roure's text to point out how a drilling strategy could address specific questions about the evolution of such zones. The consensus was to leave the text as is. There will be a site survey in early 1988, so we can expect a more fully developed proposal pending new results.

6.4 Lithospheric flexure

Watts pointed out the basic question: What are the transient deformational effects when a load is imposed on the lithosphere? The phenomenon is observed in several distinct settings. A moat is developed around islands in the Hawaiian archipelago. Huge deltas cause flexure. The outer swell in front of oceanic trenches forms as the crust is loaded by the approaching prism. He emphasized that a major reason that the Hawaiian example is attractive is that we have excellent MCS data illustrating the progressive tilting of sediments in the moat.

Scholl brought up the dating problem: If sediments are largely or entirely red clay, can they be dated? Hsü felt there is a good chance that enough calcareous microfossils will be found to allow dating. The panel agreed that drilling in the Hawaiian moat is still warranted.

Watts will prepare a generic section on flexure for the paper.

6.5 Oceanic plateaus and aseismic ridges

The panel accepted the text as written and recognized that the problem is immature until much better site-survey data are available to define basement structure.

6.6 Accretionary prisms

Cowan asked that the panel clarify its objectives in clastic-dominated prisms, especially in light of possible results from drilling into or through the decollement at Nankai. Hsü wondered if we should wait and see what COSOD-II will recommend, but Scholl said that we should keep the subject active ourselves because CEPAC favors shallower drilling in prisms.

There was a clear consensus that we should not only endorse deep drilling, but elevate it to the "mature" category. Hsü, Davis, and Dalziel all stressed that we have no data on the physical properties of materials from deep within clastic-dominated prisms, and they advocated drilling as deeply as 2 km in the Cascadia prism off Vancouver Island (proposal 237/E) upslope from the deformation front. Davis noted that we particularly need to calibrate modeled velocities at these depths with actual measurements of sediment properties. With regard to a comment in the draft, Westbrook questioned the feasibility of testing the duplex model of accretion, say off Costa Rica, by drilling.

In answer to one of CEPAC's concerns as transmitted by Scholl, the consensus of TECP is to favor deep drilling off Vancouver rather than shallower holes off Oregon. Moreover, we elevate the concept of deep drilling--the problems it can address--to the mature category while recognizing that some of the operational and technical problems of deep drilling and in situ measurements are still to be overcome.

6.7 Structures in oceanic crust

In the absence of Riddihough, who wrote this section, the panel could only make a few general comments. It felt that the existing text serves as a preamble to the general problem but that more details are needed. Vogt stressed the importance of documenting the lateral variability of crustal properties; "crustal fabric" was another topic mentioned. Cowan said that Riddihough was sending additional text which would be incorporated into the final draft.

The panel agreed that our forthcoming white paper would serve, at this stage, as our statement of drillable thematic problems in the C. and E. Pacific. Scholl pointed out that there are several proposals concerning the Gulf of California that CEPAC has yet to consider. Cowan will distribute these to TECP in advance of our September meeting so we can discuss them as well.

7. THEMATIC OBJECTIVES IN OTHER REGIONS

The chairman thought that it would be advisable for TECP to start thinking about tectonic issues in oceans other than the Pacific, particularly with regard to whether they are important enough to be addressed during a second circumnavigation after the completion of Pacific drilling. He asked panel members, and especially those with expertise in the Atlantic, to identify key problems and to highlight any which we should discuss more fully in the near future.

South Atlantic: Dalziel reported on a South Atlantic workshop recently convened by J. Austin. Several tectonic themes were identified, but Dalziel feels that many interesting ones, especially along the continental margins, might be too deep to drill. Among the general issues discussed were: Ridge segmentation; comparison of conjugate margins; evolution of the South Atlantic TJ; evolution of transform-shear margins; tectonic controls of paleo-oceanographic gateways; absolute plate motions; and evolution of the Scotia Sea region.

North Atlantic: Vogt mentioned: The variation of crustal properties along strike, near fast- and slow-spreading ridge segments; testing for catastrophic impact structures.

Mediterranean: Hsü suggested investigating the active collision zone near Cyprus, and possible impact sites in general.

Caribbean: Westbrook listed: Age and origin of Caribbean basins and the Cayman trough; accretionary processes off Panama; and the nature of mid-plate volcanism in the Venezuelan basin.

General: Watts thought that the entire subject of passive margins needs an up-to-date review. There are important questions regarding eustacy, and competing models for subsidence, for example. We need a general discussion and identification of key problems and of how and where to address them. Are old or young margins better? How will the proposed drilling in the Gulf of California fit in? We agreed to begin our review at our September meeting.

8. TECP TARGETS FOR RISER DRILLING

Because Davis was going to attend a workshop on riser drilling at TAMU on April 30, we had a brief discussion of tectonic problems that could be addressed using a riser. The main advantages of a riser are fluid control and hole stability. New objectives at passive margins (identity of reflectors; unconformities) and in accretionary prisms (mud diapirism, for example) will become drillable targets.

9. MEMBERSHIP CHANGES

The Chairman reminded the panel that some U.S. members are due to rotate off at the end of calendar year 1987: Cowan as chairman and possibly as a member, Marsh, Howell, and Vogt. Howell and Vogt expressed a willingness to serve through the first meeting of 1988. Cowan asked the panel to suggest replacements at our next meeting.

10. IOP LIAISON

Leggett, who was replaced by Westbrook, was our liaison to IOP. Cowan, reminding the panel that planning for the imminent round of drilling in the Indian Ocean is largely complete, asked for volunteers. Westbrook and Hsü suggested we use a "liaison of opportunity"--someone, for example, located close to the next meeting--rather than the permanent liaison we assign to active panels. Robinson said this arrangement is OK in principle. Cowan will appoint a liaison when IOP finalizes plans for its next meeting.

11. SAMPLING STRATEGIES

The PCOM Chairman asked for our response to correspondence between him and Biju-Duval. It was generally not clear to our panel exactly what was involved. There seemed to be general agreement with Hsü's position that definite priority continue to be given to shipboard scientists rather than to an Apollo-style program where anyone can apply.

12. OTHER BUSINESS

Nick Pisias asked for our assessment of how the panel structure is working, particularly with regard to the identification of thematic problems. Cowan and Hsü felt the system is fine. Westbrook favored appointing new chairmen from existing panel members so that some continuity can be maintained. He wondered why regional panels stay active after drilling in their region is complete. It was pointed out that the off-season affords a good opportunity for thinking about issues and formulating the most important ones, out of many possibilities, for future drilling.

Dalziel asked when the next meeting, beyond the September one, would likely be. Cowan said PCOM endorsed a two-per-year meeting schedule for panels. Because we need to meet a couple of months in advance of PCOM, early May would seem an appropriate time.

Cowan thanked Paul Robinson for his conscientious and very helpful service to TECP as liaison from PCOM.

The meeting adjourned at 12:05 p.m. on April 29.

TECTONIC PROBLEMS IN THE CENTRAL AND EASTERN PACIFIC

A White Paper prepared by the JOIDES Tectonics Panel

May 1987

INTRODUCTION

This White Paper summarizes the tectonic problems that the Tectonics Panel would like to see addressed by drilling in the Central and Eastern Pacific. Out of the myriad candidates, we selected a few problems that meet the following criteria: (1) They are currently important from a global thematic standpoint; (2) the Central and Eastern Pacific is the best region in the world to address them; and (3) they can be effectively addressed by drilling.

Thematic issues are divided into two categories. "Mature" problems either are well identified in existing proposals, or it is clear how state-of-the-art drilling can profitably address them. Mature problems include:

- Plate kinematics: Calibration of the reversal time-scale; kinematics for time periods lacking magnetic lineations; short-scale variability recorded by hot-spot traces; pre-70 Ma hot-spot traces; and absolute rates of subduction for intervals of 10^5 years.
- Arc magmatism and its relation to the composition of the descending plate
- Ridge-trench interactions
- Physical properties of clastic sediments deep within accretionary prisms
- Flexure of the oceanic lithosphere

"Immature" problems deserve to be addressed by drilling, but more data and synthesis are needed before the best targets and drilling strategies can be selected:

- Origin of ocean plateaus and aseismic ridges
- Nature and evolution of structures in oceanic crust.

MATURE PROBLEMS

I. PLATE KINEMATICS

Deep drilling in the oceans is still the best way to address certain fundamental problems of plate tectonics. Foremost among these are remaining problems concerning the relative and absolute motions of plates. The Pacific Ocean offers a variety of targets where we can obtain first-order data pertaining to global problems of plate kinematics.

A. Calibration of the Reversal Time-scale

The geomagnetic reversal time scale is practically the only useful yardstick for measuring past rates of relative plate motion. Most of the recent reversal time scales rely on a few well-constrained ages and interpolate the ages of intervening magnetic chrons by assuming that some reference section of oceanic crust was produced at a constant rate of spreading (for


ALEUTIAN BASIN
EMPEROR SMTS
CHINOOK TROUGH
EMPEROR TROUGH
MENDOCINO FZ
PIONEER FZ
MURRAY FZ
MOLOKAI FZ
CLARION FZ
CLIPPERTON FZ
HAWAIIAN RIDGE
CENTRAL PACIFIC BASIN
MELANESIAN BASIN
NORTHWEST PACIFIC BASIN
KURIL BASIN
JAPAN BASIN
SHIKOKU BASIN
PARECE VELA BASIN
MARIANA TROUGH
WEST MARIANA RIDGE
EAST CAROLINE BASIN
WEST CAROLINE BASIN
PHILIPPINE BASIN
GILBERT SMTS
120 W
140 W
160 W
180 W
160 E
140 E
60 N
50
40
30
20
10 N
0

the M-sequence, the Hawaiian lineations provide the reference section). The ages are generally chosen in a way that minimizes changes in spreading rate. This "conservative" choice introduces a dilemma: on one hand the use of additional tie points would introduce spurious globally synchronized fluctuations in spreading rate; on the other hand, there is now persuasive independent evidence for real fluctuations in spreading rate over the last 10-20 Ma, a time for which the reversal time scale is most accurately dated. The fluctuations are of the order ± 10-25% of longer-term average spreading rates and cover time scales of the order 1-10 m.y. To an extent, the fluctuations appear globally synchronized. The fluctuations correspond to changes in island arc and mid-plate volcanism and other independently dated phenomena, and therefore cannot be artifacts of errors in the geomagnetic time scale.

If similar globally synchronized fluctuations in plate speed occurred throughout the last 160 m.y. (limit of oceanic-based reversal time scale) there must exist systematic but difficult-to-remove errors in the reversal time scale. These possible errors present a difficult problem for plate tectonic applications which derive their quantitative basis from the time scale (e.g., in calculating the rate of closure between two plates based on magnetic lineations and vector addition).

In light of the above, deep drilling can address the reversal time scale problem in several ways. First, it is possible that a significant increase in the number of basement ages on magnetic lineations will begin to resolve real spreading rate fluctuations on the scale indicated above. Second, drilling can identify and date volcanic or tectonic episodicity in convergence/subduction zones and mid-plate volcanic provinces. If such episodicity can be correlated to plate kinematic changes for times where the geomagnetic time scale is more reliable, then the episodicity may be useful as a proxy for spreading-rate changes for times when the reversal time scale is unreliable.

As a suggested long-term drilling strategy, TECP proposes holes (which may satisfy other drilling objectives as well) across the M-series and anomalies 1-34 where (a) stratigraphic dating is lacking; (b) anomaly identification is absolutely certain; and (c) spreading rates were relatively high (at least 3 cm/yr half-rate).

B. Plate Kinematics for Time Periods Lacking Magnetic Lineations

Of the period of time represented by significant areas of surviving oceanic crust (0-175 Ma) there are two intervals (superchrons) for which lineations have been identified (0-84 Ma, corresponding to anomalies 1 through 34; and 118-160 Ma, corresponding to anomalies M-0 through M-29, on the DNAG time scale). There are two other periods of time for which lineations are absent: 84-118 Ma, the Cretaceous "Quiet Zone"; and 160-175?Ma, the Jurassic Quiet Zone.

B.1 Cretaceous quiet-zone problem

In the Pacific, major plate reorganizations occurred during this superchron, and a number of major morphotectonic features were formed (Hokkaido, Chinook, and Emperor troughs, Liliuokalani Ridge, and Hess Rise). Several models have been proposed to account for these features. Drilling to basement could discriminate between different models wherever the predicted crustal ages differ sufficiently. Furthermore, drilling could establish spreading rates on the different spreading ridges. Several holes would have to be drilled on each of the flow lines to detect time variations in spreading rate over the Cretaceous Quiet Zone period (84-118Ma). Generally only the Pacific-plate flank of each spreading ridge/accreting plate boundary survives, the other flank having been subducted. However, where parts of the Farallon plate were captured by an eastward ridge jump(s), both flanks may be independently dated to yield a total opening rate.

Relevant Proposal: 231/E (Mammerickx, Engebretson, Rea, Scholl, Sharman, and Vallier) proposes six holes in three areas to test which of several models are correct and to estimate spreading rates on three ridge flanks.

Drilling strategy: It would be desirable to place one or more holes in extinct spreading centers to date the time of extinction. The crustal structure and last-erupted lavas on an extinct spreading center should be of interest to LITHP as well as TECP. The Mendocino FZ is one of the few FZs going entirely through the Cretaceous Quiet Zone. The crust formed during Cretaceous Quiet Zone time just south of the Mendocino FZ is exceptionally wide, supposedly because of a ridge jump which transferred Farallon crust to the Pacific plate. The plate reorganization appears to have been simpler here than in the other areas in the Pacific during Quiet Zone time. TECP therefore suggests a proposal be developed to date the cessation of spreading on the Liliuokalani Ridge (south of the Mendocino FZ) and to determine the spreading half rate on both flanks of this alleged extinct ridge.

B.2 Jurassic Quiet-Zone problem

The Jurassic Quiet Zone (160-175? Ma) occupies modest areas of oceanic crust primarily in the eastern and western North Atlantic and in the western Pacific. Magnetostratigraphic evidence on-land suggests that frequent reversals occurred during this period; the poor or non-existent correlatability and low amplitudes of the magnetic anomalies cannot entirely be explained by the rapid reversals and great water depths. A weak dipole field or other factor must be present. The Pacific Jurassic Quiet Zone appears to have been formed along three accreting plate boundaries which recorded the M-anomalies in the form of the Phoenix, Hawaiian and Japanese lineations. It is not known whether the Pacific Quiet Zone is simply an extension of these lineations or whether plate reorganizations occurred. Deciphering the evolution of this oldest crust is hampered by the presence of numerous seamounts and guyots.

Relevant proposals: Proposal 3 by Y. Lancelot, on p. 110 of the "workshop on Future Scientific Drilling in the South Pacific and Antarctic Margin" discusses further drilling in the Nauru Basin.

A proposal to drill two to four holes to basement in the Japanese lineations extension from M-29 to M-38, and just beyond M-38, is in preparation by D. Handschumacher, P. Vogt, and L. Henderson. A drillsite on M-38 was also strongly endorsed by the "Paleomagnetic Objectives for the Ocean Drilling Program."

C. Short-scale Variability in Plate-mantle Motion Recorded by Hotspot Traces

The available age dates from Pacific hotspot traces (mainly the Hawaii-Emperor chain) are consistent with relatively constant rates of plate-hotspot motion for tens of m.y. However, there is increasing evidence from relative motion data (spreading rates) for small (± 10-30%), short term (1-10 m.y.) variations in rate on many accreting plate boundaries for the last 10-20 m.y. for which data are most reliable. Absolute plate motions cannot yet be dated as precisely as seafloor spreading, but it would be reasonable to expect similarities between relative and absolute motion fluctuations. Absolute plate motions (hotspot reference) can be most accurately measured in the fast-moving Pacific plate, and the hotspot traces on this plate offer the best hope of measuring shorter term (1-10 m.y. scale episodicity) changes in rate of motion. Clearly this would require a significant increase in the number of age dates, many of which could only be obtained from deep sea drilling.

Two proposed episodes of faster spreading occurred from about 9 to 3 Ma (peak at 7 Ma) and again about 11-17 Ma (peak at 12-14 Ma). The best way to test for such finer scale motions would be to search for the 3, 9, 11 and 17 Ma aged edifices on various hotspot traces on the Pacific plate, since at these ages the age dates would show the maximum departure from what a constant motion model (no fluctuations) would predict. The best drilling strategy would place holes not only at speed changes but also at bends or kinks in seamount chains.

Relevant Proposals:

Louisville Ridge 0-65?Ma: 3a., p. 128 of South Pacific Workshop, sites LR-1, LR-2, LR-3 by P. Lonsdale

3b., p. 129-132 of South Pacific Workshop, "four or five sites" along entire chain, by S. E. Humphris

French Polynesian Chains: (related to at least six hotspots (McDonald Smt., Rarotonga, Society Is., Marquesas, and Easter)) pp. 113-128 of South Pacific Workshop.

Sites MI-1, MI-2, MI-3 in Marquesas; T1 on southeast flank of Tahiti, NT-1 and NT-2 on northern Tuamotu Is. by R. A. Duncan, W. M. White, M. R. Fish, and E. A. Okal

Sites AIC-1, AIC-2, and AIC-3 in Austral Island Chain, by E. A. Okal

Hawaii-Emperor Chain: Sites at Hawaii-Emperor Bend, northern end of Emperor Chain, and on adjacent crust (to test kinematic model placing Hawaii hotspot on Kula-Pacific spreading axis at that time). NorPac Workshop p. 13.

Seamount chains in Gulf of Alaska: Oceanographic, Climatic and Volcanic Evolution of the Northeast Pacific Ocean (247/E) by D. Rea, B. Bornhold, N. Pisias, R. Duncan, and T. Pedersen. Volcano migration rates for these chains close to rotation pole strongly constrain location of average rotation pole for Pacific/mantle motion during Oligocene to Recent time.

D. Pre-70 Ma Hotspot Traces

Pacific/mantle motion is now well constrained by hotspot traces for the period 0-42 Ma, and reasonably well known for the period 43-70 Ma. The oldest surviving Pacific crust, however, is almost 100 m.y. older than 70 Ma. Although the western Pacific contains large numbers of seamounts, guyots, and atolls older than Late Cretaceous, many of them are not obviously arranged in simple chains and only a few have been dated, far too few even to test the "fixed-hotspot hypothesis" for Mesozoic time.

It is plausible that the oceanic plateaus (Ontong-Java, Manihiki, etc.) were formed by hotspots near the accreting plate boundary, but if so, seamount chains should have formed by the same hotspots as the spreading ridges migrated away. No seamounts have been shown conclusively to be related in age, composition, or geometry to the plateaus, and it is unlikely that such an association could ever be demonstrated without drilling. No site on the Mid-Pacific Mountains has ever drilled to basement. Because this plateau-seamount complex is continuous with a relatively well-dated NW-trending seamount chain (the Line Islands), basement ages on this plateau would be the most useful for determining pre-100 Ma Pacific motions.

Besides testing the hotspot model and establishing Pacific/hotspot motion, the drill holes into Mesozoic edifices can determine paleomagnetic latitude at time of formation, which can be combined with paleomagnetic data from sediments. Comparison of three paleolatitude data sets (paleomagnetics, paleo-equator, and hotspot reference frame) has revealed a small but significant discrepancy: either the hotspot coordinate system (i.e., the "mean mantle") has moved relative to the Earth's spin axis, or the magnetic pole has oscillated somewhat with respect to the spin axis.

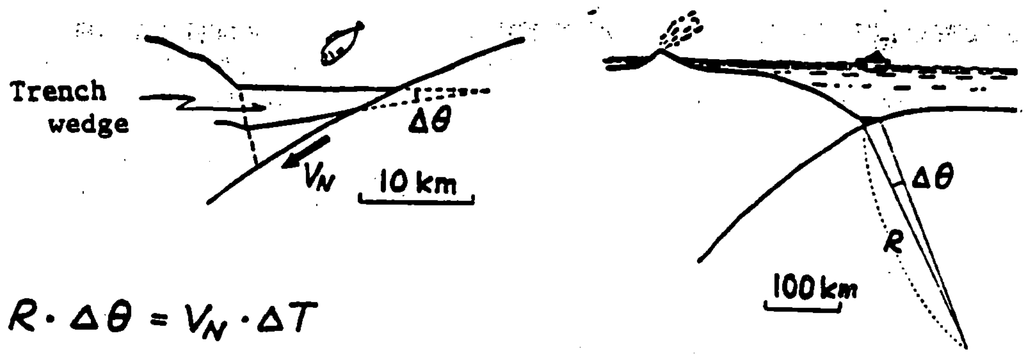
Relevant Proposals: Proposal 203/E by E. L. Winterer, J. Natland, and W. Sager: Geisha seamounts/guyots; Wilde, Majuro, Allison, or Menard guyots. Sites HAR-1, 2, 3 (Harrie Guyot) in Marshalls in Proposal 202/E by S. O. Schlanger.

Drilling strategy: Many holes could be drilled on and near seamounts and guyots in the western Pacific that would not contribute to the understanding of the past motions of the Pacific plate relative to all three reference frames. The best sites would therefore be along clearly delineated chains that have ages predicted by hotspot models. The Marshall (Radak)-Gilbert chain, between about 10°N and 10°S is the most obviously continuous NW-trending chain in the western Pacific. There are already a few age dates along the Marshall-Gilbert chain, and additional ones obtained by drilling to basement (at e.g., Harrie and Majuro) would help define the pre-70 Ma Pacific-to-hotspot rotations, while also satisfying other objectives such as the study of atoll drowning.

E. Absolute Rate of Subduction for Intervals of 10^5 Years

The most widely accepted estimates of the relative velocities of plates are Minster-Jordan type analyses, which average over the last 10^6-10^7 years. Measurements employing recently developed techniques of space geodesy suggest the possibility that these longer term average velocities are also valid for very short-term intervals of 10^0-10^1 years. If the stability of plate motions in the very short-term is established, we would have a firm basis for the practical prediction of interplate seismic rebound events that cause great underthrust earthquakes every 10^1-10^2 years. In order to establish that velocities are constant over long intervals, we need to measure the velocity over intermediate intervals of 10^2-10^5 years.

In theory, we can measure the in-situ rate of subduction (as opposed to convergence) over time intervals of about 10^5 years by drilling in trenches that contain wedges of seismically reflective sediments. As the oceanic plate descends, it bends downward, and trench sediments are progressively tilted before they are either incorporated into the accretionary prism or subducted beneath it. As shown in the accompanying figure, the tilting is related to the radius of curvature of the bending plate and the subduction velocity. Drilling strategy would require a hole (preferably two holes) that penetrates tilted sediments. It is also, of course, necessary that the sediments be datable. It is noted that this is the only method for determining the velocities of microplates which have not been resolved by either the Minster-Jordan method or space geodesy.



Of the candidates in the northern and eastern Pacific, the Aleutian trench appears to be an excellent place for this experiment because:

1) The trench wedge is well developed;
2) Geometry of wedge may be simple because monotonically increasing depth of trench floor toward the west suggests that the dominant supply of sand is from one end (the east);
3) Detailed MCS and seismic data are available to document the curvature of the subducting plate at various sites;
4) The trench is a boundary between two major plates; Minster-Jordan velocities are known and testable by drilling.

II. ARC MAGMATISM AND ITS RELATION TO THE COMPOSITION OF THE DESCENDING PLATE

The locus of volcanism in island arcs is striking in its display of an exeedingly strong volcanic front or string of active volcanoes. At any time volcanism is rarely diffuse transverse to the arc. At the same time, volcanic fronts are not smooth, continuous arcs, but rather segmented. In the Aleutians, for example, all historically active vents form a remarkably tight and delicate segmented front. Major breaks in the front typically correlate with fracture zones (possibly zones of weakness) in the subducting lithosphere. The arc plate itself, strictly speaking, may also be segmented by this structural fabric. Since the volcanic front usually occurs at a distinct position above the deep seismic plane (~125 km), segmentation of the slab into staves having slightly different angles of subduction in their deeper portions produces a segmented volcanic front. This apparent intimate and delicate relation between attitude of the volcanic front and the position of the descending plate appears worldwide, underscoring the strong possibility that other direct, undiscovered connections exist between arc volcanism and the nature of the slab.

Magma Chemistry

Before DSDP, arc basalts were shown to be impossibly related to ocean ridge basalts because their initial strontium (87/86) ratios are different (0.7025 versus 0.7040). The case seemed to be closed until it was noticed that basalts from the middle of plates had Sr-isotopic ratios identical to arc lavas. Hydrothermal alteration of the oceanic crust near the ridge raised its regal head. A very similar state exists today. Many believe that the neodymium-143/144 ratios of arc lavas and ridge basalts do not match. But when Wasserburg and Marsh measured the basalt of the uppermost oceanic crust in the eastern Aleutians (DSDP #18), they found the ratios to be essentially the same. And most people would argue that no more than about 2-3% of sediment can possibly be involved in magma formation. But the chemical composition of sediments varies greatly over the globe and relatively little is known of sediment composition along the trench.

In addition, arc magmas, like ridge rocks, are remarkably uniform in composition worldwide. From their major elements right down to their isotopic characteristics they are surprisingly similar, neglecting the strong contaminating influence of thick continental crust in some areas. But at second order there now appear to be some areas with distinctive, anomalous chemical features. For example, Unimak Island in the eastern Aleutians supports the largest flux of magma of anywhere in the Aleutians. Lavas from this island are anomalously rich in titania, sometimes having as much as 2.5 times normal values. Since these lavas appear normal in other respects, the question arises: Is this TiO_2 anomaly caused by "chemical patches" in the descending plate? The oceanic crust is always assumed to be normal tholeiitic basalt, but what of the high Fe-Ti rocks that are often found and the large fields of seamounts which must have had their feeder pipes extending through the whole lithosphere? These are generally more alkalic basalts, richer in titania, rare earths, and, typically, magnesia.

Role of Drilling

ODP could make an outstanding contribution to understanding arc magmatism if the true chemical nature of the plate could be ascertained just prior to subduction. The ideal drilling format would be to have a series of fairly closely spaced (~25 km) holes in four or five locations along the arc. Holes should be spaced on the order of the spacing of arc-volcanic centers (i.e. ~50-70 km), but not necessarily at the same locations as the arc centers. A series of shallow holes penetrating about 20 m of basement is preferable to a single deep hole because of the great need for regional coverage on the same scale as that already known on the arcs themselves. This is not to say that a deep hole is not also needed, but that it is of lower priority. Deeper holes (~ 300 m) will give fundamental information on the vertical alteration profile through oceanic crust, which is essential to understanding global ocean/mantle geochemical balances. These data will also bear on understanding the full three dimensional significance of the more regional coverage seaward of the arcs. The shallow holes need not be immediately adjacent to the trench, but can be combined with holes for other purposes, say for example, those planned for determining plate age. The deeper hole can also be opportunistic in that it may be made by re-entry deepening of a hole planned for other purposes. Samples must be analyzed in all ways (i.e. major and trace elements, Sr, Nd, Pb, O, and Hf isotopes, as well as mineral content and composition).

The ideal location for regional coverage (i.e. shallow holes) is in front of an arc already known to display regional variations in primary magma composition (e.g. as mentioned above in the eastern Aleutians). It is also of fundamental importance to choose arcs with simple or clear cut tectonic histories, because to relate present plate composition to present magma composition some tectonic extrapolation downdip over distances of order 150-200 km is of course inescapable. Any of the main intraoceanic Pacific arcs is suitable for such a program of drilling. But because each arc shows subtle geochemical distinctions, it is preferable to drill either in front of at least two arcs (e.g. Mariana and Bonin) or along two stretches within a single arc (e.g. Aleutians) showing significant chemical variations in the basalts.

The importance of this information to petrology and models of global geochemical balances can not be overemphasized. This is a chance to make a first-order discovery.

III. RIDGE-TRENCH INTERACTIONS (RIDGE-TRENCH "COLLISIONS")

General models of active convergent margins concern the effects of a single oceanic plate being subducted underneath a continent. Various factors, including rates and vectors of convergence, age of the oceanic crust, and thickness of the sedimentary pile on the subducted plate, may affect the geometry of active margins and influence factors such as the dip of the Benioff plane, distances between the arc volcanoes and the trench, whether the margin is characterized by accretion or erosion, and whether there are strike-slip faults or normal faults in the hanging wall of the trench. Complications may be expected where two distinct oceanic plates are in contact with a continental margin at a triple junction. For example, at trench-transform-transform triple junctions like the Mendocino, oceanic plates are separated by a transform fault.

Perhaps a geologically more interesting situation is where an actively spreading ridge intersects a trench at a ridge-trench-trench triple junction. Ridge-trench interactions have not yet been well documented, and numerous key problems are still awaiting a clear answer. Nevertheless, certain on-land tectonic and metamorphic phenomena in arc systems like the Aleutians have been ascribed to the "subduction" of a ridge, or the diachronous passage of a R-T-T triple junction. It is usually assumed that the subduction of an active ridge would deeply affect the thermal regime of convergent margins. Arc-volcanic activity is thus found closer to the trench there than anywhere else, either in response to the steep dip of the young subducted oceanic plates, or as adirect effect of an asthenospheric window underneath the upper plate. Transitory, anomalously high thermal gradients may affect the diagenetic and metamorphic history of sediments in an accretionary wedge. A change in the pattern or velocity of fluid advection could in theory affect the mechanical properties of consolidating sediments and hence the structures developed in them. Ridge-trench interactions may also induce oblique vectors of convergence between the trench and the oceanic plates, and thus might produce strike-slip faulting, pull-apart basins and/or terrane migration along the continental margin.

Deep-sea drilling is the only way to characterize the actual thermal and structural phenomena resulting from the interaction of an active ridge and a trench. A drilling strategy should include holes that sample the accretionary prism or hanging wall in at least three zones: In advance of the migrating triple junction, directly adjacent to the active ridge, and in the wake of the triple junction. Measurement of in situ physical properties such as temperature, and complete sampling and analysis of fluids is essential. In-situ measurements of fluid pressure or permeability are required to establish the patterns of fluid flow.

IV. DEFORMATION DEEP WITHIN ACCRETIONARY PRISMS

Many active convergent margins feature accretionary prisms composed largely of clastic sediments (mud and sand) scraped off a thickly sedimented descending plate. Most subduction complexes on land are similarly dominated by terrigenous clastic sediments rather than pelagic or hemipelagic sediments. A long-standing goal of DSDP, IPOD, and COSOD has been to document the evolution, internal geometry, and structural fabric of modern prisms using the drill. Part of the rationale for drilling is our difficulty in properly interpreting the deformational styles and structural fabrics of ancient complexes onshore; sampling active prisms may elucidate how fabrics are related to seismic-scale structures, for example. Moreover, the transfer of clastic sediment from a descending plate to a prism involves changes in physical state and mechanical properties. What better natural laboratory for studying the compaction and consolidation of clastic sediments in a tectonically active setting?

To date, only a few shallow (300-800 m) holes in clastic-dominated prisms have penetrated the blanket of slope sediments and have sampled accreted materials, so a major objective of deep-sea drilling is yet to be achieved. Recent drilling on Leg 110 at the toe of the Barbados Ridge (in the part of the prism made up dominantly of pelagic materials) suggests that deep holes through the decollement are indeed feasible using the RESOLUTION. Drilling planned in the Nankai trough in 1988 or 1989 calls for one or more deep (1.0 to 1.5 km) holes through the decollement near the toe of the prism. A companion hole dedicated to the measurement of in-situ physical properties has also been proposed.

The Pacific is the best ocean in which to address the unanswered questions about prisms composed chiefly of clastic sediments. Most of the active convergent plate boundaries rimming the Pacific, including the Manila trench, Nankai trough, Aleutian trench, Cascadia subduction zone, and the mid-America trench, have extensive, well-developed prisms. Although the Nankai drilling will potentially add much to our knowledge about accretionary processes, TECP endorses drilling even more deeply--at least 2 km-- into a prism dominated by clastic sediments. The major objectives include: (1) documenting the changes in physical properties (porosity, pore-fluid pressure, orientation and density of fractures, seismic velocities, state of stress) as sediments are dewatered and consolidated during accretion and offscraping above the decollement, and during subduction beneath it; and (2) establishing the compositions of fluids and their patterns of flow deep in a prism. Aside from high-resolution MCS or refraction data, deep drilling is the only way we can address the fundamental problems concerning the changes in physical state and the deformation of sediments in the interiors of prisms. For example, several models specifying gradients in velocity, porosity, and fluid pressure inside prisms have been proposed, but we need in situ measurements to corroborate and refine them. Transects of shallow holes that penetrate only a few hundred meters into the outer rind of a prism may tell us nothing about the behavior of materials deep inside.

On the basis of proposals at hand and our own thematic and regional expertise, we consider the Cascadia prism off Vancouver Island as an attractive candidate for deep drilling. It lies in shallow water on an excellent MCS line with clearly imaged, simple structures, and comprises offscraped clastic submarine-fan and abyssal-plain sediments. The convergence rate, direction, and recent history are well controlled by plate-motion analyses. Proponents may wish to consider a site upslope from those in proposal 237/E, where maximum penetration into offscraped and deformed sediments could be achieved.

We view the acquisition of data from deep within a prism as a high-priority, and thus mature, objective. From an operational and technical standpoint, however, such an objective may still be immature. New advances and refinements in downhole tools and instruments and in drilling capabilities can be expected by the time the RESOLUTION arrives in the E. Pacific.

VI. FLEXURE OF THE OCEANIC LITHOSPHERE

The text for this topic will be distributed later in an addendum.

IMMATURE PROBLEMS

VI. OCEANIC PLATEAUS AND ASEISMIC RIDGES

All of the world's ocean basins contain large, isolated and relatively shallow areas of the seafloor that are not associated with presently active oceanic spreading ridges. Although volcanism apparently played an important role in the build-up of many of these features, which are often referred to as "aseismic ridges" or plateaus, the origin and structure of most of them remain enigmatic. It is essential to resolve this enigma, especially since many of the terranes in the land masses rimming the Pacific have been interpreted as collided aseismic ridges or plateaus.

The Pacific is full of these features. The origin of some can be attributed to the action of hot-spots or mantle plumes, while others such as the Lord Howe Rise and the South Tasman Rise appear to be continental fragments. Some of these features are very large; the Ontong Java Plateau for instance, covers an area of 1,500,000 km^2; the Kerguelen Plateau is about 2,100 km in length and 700 km at its widest point, and the Lord Howe Rise occupies an area approximately the size of the Appalachian mountain chain.

From the more than a hundred or so plateaus, deep seismic crustal information is available for only a few. On the basis of these published velocity-depth data they have been divided into two categories: one group showed "continental affinities", while the other showed a velocity structure more similar to the crust of deep ocean basins, albeit not a normal oceanic crust in being substantially thicker.

The tectonic evolution of aseismic ridges and plateaus is an important problem. If a spreading origin is applicable, the accretion processes must create large, shallow volcanic structures, having a crustal thickness substantially greater than that of normal oceanic crust. A much enhanced rate of lava production and mantle melt is required by a dynamic process which can produce melt volumes considerably in excess of that formed in a normal spreading center. The formation of aseismic ridges by continental fragmentation is somewhat better constrained. There are dynamic models that can explain deep subsidence of continental crust at rifted margins, suggesting that the crust is modified in conjunction with extensional processes. Aseismic ridges underlain by continental crust would form as detached fragments of continents, isolated from the continent by trans-tensional events or a spreading ridge jump.

Many of the aseismic ridges are characterized by a peneplained acoustic basement and on some of them a series of narrow, asymmetrical v-shaped grabens have been recognized beneath the top of the acoustic basement (Falkland Plateau, Lord Howe Rise, South Tasman Rise, (?) Kerguelen Plateau). What processes cause this distinct peneplaining? Is there upwelling of hot asthenosphere which results in volcanism and doming, and what is the nature and origin of the narrow grabens often recognized beneath the peneplained acoustic basement? These are attractive drilling targets.

However, since it appears that volcanism played an important role in the build-up of most oceanic plateaus, simply drilling a deep hole into the crust of an oceanic plateau may not reach the primary objective, namely, a definite identification of the nature of its crust. More extensive and much better MCS across aseismic ridges and plateaus are necessary before sites can be selected. Holes should be designed to penetrate the volcanic cover and also sample seismically defined objectives beneath. It may be advisable to drill more than one plateau in view of the diversity manifested in existing seismic refraction and reflection data. Exposed and eroded oceanic plateaus, such as Iceland, should be studied carefully during design of a drilling program. Iceland, for example, is an exposed plateau that has already been drilled to 1900 m, almost 4 km below its original surface.

In summary, TECP strongly advocates further drilling on aseismic ridges and plateaus, but only after the acquisition of better geophysical data.

VII. STRUCTURES IN OCEANIC CRUST

The key to the discovery of plate tectonics lay in the understanding of the sea-floor. Although our concepts of the processes of plate tectonics have progressed considerably since the 1960s, sea-floor spreading still provides the predominant source of evidence for plate kinematics. As, in general, plates are regarded as rigid, knowledge of how they move apart is critical to the interpretation of plate interactions and convergences. Knowledge of the structures of the oceanic crust is in turn critical to the understanding of how oceanic plates move and, when they converge or subduct, to the interpretation of the resultant geology.

The Pacific Ocean contains the largest area of oceanic crust on the globe. It contains a history of sea-floor spreading and plate interactions that ranges from 0 to at least 150 million years. It includes oceanic plates that range from the micro (Juan de Fuca plate system) to the macro (the Pacific plate). It includes some of the longest and largest fracture zones on the earth (such as the Mendocino) and contemporary spreading rates from the moderately slow (Gorda Ridge) to the very fast (southern East Pacific Rise). Highly detailed magnetic anomaly maps together with intensive bathymetric and imaging surveys have established the process of propagating rifts and identified fossil rifts and ridge jumping.

With this background, the Pacific seems to offer a wide range of oceanic crustal structures for which detailed surveys and research projects already exist. The exercise of posing the problems that drilling can solve is thus well advanced. Among the particular problem areas that the Tectonics Panel has noted could be well addressed in the Pacific are: propagating rifts, fracture zones (active and inactive), fossil ridges, seamounts and volcano-tectonic features. The following three categories are ones which are of current interest but which seem to lack any mature proposals.

1. Propagating rifts have been shown to be a pervasive feature of the development of the East Pacific Rise. Their geometric consequences and the topographic effects of failed rifts and pseudo-faults are well studied. The motivation for propagation is still largely speculative; the nature of the crust created in the pseudo-fault zone between ridges, the processes occurring between two "overlapping" spreading centers or in front of a propagator are also unknown. Drilling may be a critical tool in such investigations.

2. A growing pattern in oceanic reconstruction is that of non-rigid plate deformation. Typified by the Gorda Plate, it may occur in a number of circumstances where it is unrecognized because only one plate remains. In both this situation and in other "rigid" plate situations, attempts to determine the in situ stress within the oceanic crust could be very valuable.

3. The magnetization of oceanic crust is a critically important attribute that is the basis of magnetic anomaly interpretation and plate kinematics. Nevertheless there are areas of oceanic crust which are virtually unmagnetized and which were clearly produced during periods of alternating polarity. The circumstantial associations of such crust with either contemporaneous or almost immediate sediment cover suggests rapid leaching with perhaps enhanced mineral deposition. Magnetic Quiet Zones observed in a number of oceanic areas may be the result of such subsequent "metamorphism" rather than lack of polarity reversals. A number of examples in the eastern Pacific are accessible by drilling.

RECEIVED JUN 1 2 1987

JOIDES Lithosphere Panel Meeting
Lamont-Doherty Geological Observatory
Palisades, New York
13-15 May 1987

Members present:

R. Detrick (URI), Chairman
R. Batiza (Northwestern)
K. Becker (RSMAS) - Days 2 & 3
K. Bostrom (ESF)
J. Delaney (UW)
T. Fujii (Japan)
J. Hawkins (SIO) - Day 3
C. Langmuir (L-DGO)
M. McNutt (MIT)
C. Mevel (France)
J. Mutter (L-DGO)
J. Pearce (UK)
N. Petersen (Germany)

In attendance:

A. Adamson (TAMU)
E. Davis (CEPAC)
P. Robinson (PCOM)

Absent:

R. Duncan (IOP)
K. Klitgord (ARP)
J. Malpas (Canada)
S. Scott (WPAC)
J. Sinton (Hawaii)

AGENDA

1. Approval of previous minutes; agenda
2. Reports from liaisons
3. LITHP White Paper
4. Indian Ocean Issues
5. Evaluation of 3rd WPAC prospectus
6. CEPAC objectives and proposal evaluation
7. Other matters
   Next meeting
   Panel membership
   Evaluation of ODP advisory structure

MINUTES

1.0 Opening remarks, approval of previous minutes and agenda:

The meeting began at 8:33 am with many panel members somewhat bleary-eyed after a 4:30 am fire alarm at the Holiday Inn. The minutes of the January meeting in London were approved with a minor change in the wording of the Lau Basin recommendations previously circulated to panel members. The agenda for the present meeting was also adopted with discussion of the WPAC prospectus deferred until Friday when Hawkins was expected to arrive from Guam.

2.0 Liaison Reports:

2.1 PCOM Report (P. Robinson)

The results of the April PCOM meeting, which concentrated on the FY88 budget, were summarized. The FY88 budget is projected to be $35.5 million (the U.S.S.R. will definitely not be joining). In order to meet this budget and provide for necessary program "enhancements" (ice boats, guidebases etc.) the PCOM budget committee recommended cuts of $1.15M by TAMU, and $200K each in the logging program and the JOI office. TAMU came back with a suggested set of cutbacks taken entirely from science operations and services that PCOM did not accept. PCOM passed three motions:

(1) 4% of the annual budget must be set aside each year for special operations (eg. high latitude and bare-rock drilling)
(2) engineering development must be maintained
(3) budget cuts should not come entirely out of science operations and services - TAMU HQ budget should be cut by at least $500K.

PCOM discussed and voted on a number of potential cuts (see PCOM minutes for details). Some options include making Part B volumes camera-ready rather than typeset, eliminating up to three staff scientist positions, less technical support, longer sample preparation time, removing XRF/XRD/SEM from the ship, etc.

The last option provoked considerable concern on LITHP. There was unanimous agreement that certain basic analytical tools must be available on the ship or it will be impossible to make critical scientific decisions affecting the drilling operations. It will also make it very difficult to attract good people to go to sea. LITHP therefore passed the following motion:

<u>For effective accomplishment of lithospheric objectives, the minimum shipboard analytical requirements are:</u>

<u>(1) sample preparation facilities</u>
<u>(2) facilities for bulk rock analysis (eg. XRF)</u>
<u>(3) facilities for mineral identification (eg. XRD)</u>
<u>(4) magnetometer</u>
<u>(5) technical support where necessary</u>

Turning to non-budgetary matters, the status of the Indian Ocean drilling program, approved at the January PCOM meeting, was reviewed. Of interest to LITHP:

Leg 115 - Mascarene plateau (1/2 leg) - ok as proposed

Leg 116 - Intraplate deformation - northern 90E Ridge site dropped from this leg by PCOM; safety panel has not approved two of the intraplate deformation sites (5 and 6A).

Leg 118 - SWIR - 10 days added to leg following LITHP recommendations

Legs 119 & 120 - Kerguelen plateau - PCOM has approved revised Kerguelen Working Group report which includes one deep, re-entry basement hole (SKP4) and possible basement objectives at two other sites. PCOM also approved Prydz Bay drilling.

Leg 121 - Broken Ridge/90E Ridge - transit across Broken Ridge and the two northern sites on 90E Ridge approved.

Leg 123 - Argo Abyssal Plain - basement re-entry hole approved for AAP1B as geochemical reference hole for Sunda Arc and to sample old Indian Ocean oceanic crust.

PCOM selected four "core" programs for WPAC (Banda-Sulu-S. China Sea; Bonin I; Japan Sea and Nankai), but has taken little other action on WPAC prospectus (they plan to discuss it in detail at their August meeting). PCOM has asked CEPAC to prepare a prospectus and for the thematic panels to give PCOM their initial evaluation.

2.2 PANCHM (R. Detrick)

R. Detrick reported on the annual PANCHM meeting held in Hawaii. Among the key issues raised were:

(1) Effectiveness of liaison structure: generally it was felt interpanel liaison had improved over the past year, but liaison with PCOM remained a problem

(2) Meeting schedule: the panels (and PCOM) should try to have a more regular meeting schedule.

(3) Engineering priorities: there was a consensus among the panels that hard rock drilling, high temperature drilling, drilling and recovery in alternating hard/soft formations and deep drilling were the highest engineering priorities.

2.3 TAMU (A. Adamson)

A. Adamson reviewed some of the budget cuts under consideration by TAMU (see PCOM discussion above). EXCOM will make final decision on FY88 budget. The preparations for Leg 118 (SWIR) were also summarized. Several modifications have been made to the guidebase - the legs have been made an integral part of the unit to make it easier to assemble, a hydraulic release system has been developed for the Kelly hose, stronger running cables will be used etc. The Navidrill, which was successfully tested in Germany, did not work on Leg 114. Major modifications will have to be made and it will not be available for Leg 118.

2.4 IOP (C. Langmuir)

At their last meeting the IOP made several recommendations affecting LITHP:

- IOP favored extending the length of SWIR (Leg 118)
- IOP noted slim weather window for Prydz Bay; supported LITHP recommendations on importance of basement drilling at Kerguelen.
- IOP prioritized sites for Leg 121 as (1) Broken Ridge transect of four holes (no basement objectives), (2) northern 90E Ridge site, (3) central 90E Ridge site
- IOP endorsed Argo Abyssal Plain basement re-entry hole and recommended dropping southernmost 90E Ridge site from Leg 123 to ensure adequate basement penetration at AAP1B.

2.5 Kerguelen Working Group (J. Mutter)

J. Mutter summarized the recommendations of the Kerguelen Working Group. Basement drilling objectives now have an equal priority with the latitudinal paleo-oceanographic transect. There is hope for basement penetration at three sites on Kerguelen - one of the sites (SKP4A) will be drilled as a basement re-entry hole. SKP6B is a back-up basement site if Prydz Bay is not drilled.

The following is a breakdown of the two Kerguelen legs:

Leg 119 - SKP1, SKP6A and Prydz Bay sites
Leg 120 - SKP2, SKP3, SPKP4A (re-entry) and KHP1

2.6 WPAC (Hawkins letter)

The panel reviewed a memo from J. Hawkins summarizing the last WPAC meeting (the WPAC liaison was not present). The WPAC panel has proposed an 11 leg program consisting of (in order of priority):

1. Banda-Sulu-South China Sea basins
2. Bonin I (BON-1,2,5A-B,6)
3. Lau Basin
4. Vanuatu
5. Japan Sea
6. Nankai
7. Great Barrier Reef
8. Sunda
9. Bonin II (BON-7 + Ref)
10. Nankai Geotechnical
11. SCS Margin
12. Zenisu Ridge

WPAC recommends only one reference hole (BON-8) and it is planned as only a single bit hole. The reasoning is: "devoting any more time to objectives **on the Pacific plate**, particularly a deep penetration into the ocean crust, would undermine its own priorities in the arc, backarc and marginal basins of the western Pacific" (p.35, 3rd WPAC Prospectus). CEPAC, of course, also believes that reference holes are important, but are a WPAC problem! As a result this drilling objective is in serious danger of completely falling through the crack between two arbitrarily defined regional panels. More discussion on this later (see p.8). In the Lau Basin, WPAC proposed a half-leg "core" program consisting of sites LG2, 3, 6 and 7. They also felt LG1 (central basin) and LG4 (Lau Basin) were important, but deferred judgement on whether to drill one or both sites pending ongoing site survey work and improvements in crustal drilling technology.

2.7 CEPAC (R. Batiza/E. Davis)

CEPAC at its last meeting put together a preliminary prospectus consisting of the following programs (not legs):

Juan de Fuca Ridge (232E)
EPR at 13^{o}N (76E)
Guyots, Atolls (202/203E)
Old Pacific Crust (261E)
Ontong-Java (222/248E)
North Pacific Gyre (199E)
Bering Sea (195E)
Young hotspot - Loihi (252E)
Cascadia margin (233E)
Shatsky Rise (253E)

CEPAC and PCOM have requested input from LITHP on this prospectus. Specific questions concern:

- further development of flexural moat proposals; CEPAC feels there are chronostratigraphic problems with drilling at Hawaii; can this work be done elsewhere?
- timing of EPR drilling; do the legs need to be drilled sequentially or could they be drilling in 504B fashion over several years?
- sedimented ridge crest/ hydrothermal systems; what are the relative merits of Juan de Fuca Ridge, Escanaba Trough and Gulf of California for addressing this problem?
- LITHP interest in Chile Triple Junction, Ontong-Java proposals

2.8 TEDCOM (C. Langmuir/K. Becker)

TEDCOM held a Riser Drilling Workshop in College Station which C. Langmuir and K. Becker both attended representing LITHP. Riser drilling is potentially interesting to LITHP since in industry the view is that continuous mud circulation while drilling is essential to remove cuttings and improve crustal drilling rates and recovery. Unfortunately, not only is riser technology extremely expensive, but it is currently limited to water depths of less than 6000'. A complete redesign of the riser would be needed to operate in greater water depths. It is also not clear there is enough room on the <u>Resolution</u>, as it is now configured, for a riser. The consensus was that a riser is probably not in ODP's future.

AMOCO presented results from development they are carrying out on using high-speed, small-kerf diamond bit systems for deep crustal drilling. This technology should be of great interest to ODP. It might be used with the conventional drill pipe as a riser. Side-wall coring was also discussed and apparently the technology is available now. Using this technology in ODP could vastly improve the representativeness of the cored material.

TAMU and ODP are concerned that they are getting too many important engineering development priorities without the manpower and financial resources to properly deal with them. Too much time is spent dealing with leg-to-leg problems that they cannot tackle the longer-term problems.

LITHP reiterates the need for significant advances in crustal drilling technology if many of the highest priority lithospheric scientific objectives are going to be achieved within the current drilling program. By analogy with industry, a staff of 3-4 engineers and an annual budget of $2-3 million/yr are the kind of resources that will probably have to be devoted to make significant progress in this area. **We believe this should be ODP's highest, long-term engineering development priority.**

3.0 LITHP White Paper

The revised draft of the LITHP White Paper was presented and discussed. The final section of the report, which outlines a long-term lithospheric drilling program, was extensively reviewed. A distinction was made between projects that are scientifically mature and technologically feasible now, with those where a specific drilling strategy is harder to define either because ideas are rapidly evolving or drilling technology is still being developed. There was general agreement that both kinds objectives should be included in a long-term drilling strategy with the long-term goals clearly identified along with the technical requirements to achieve them. Other suggestions were made regarding specific wording within this section and in the rest of the document.

With these changes the panel approved the White Paper. The final document will be distributed in early June to all PCOM members, to the chairmen of all the JOIDES advisory panels, and to the chairmen of the COSOD II working groups.

4.0 Indian Ocean Issues

Three Indian Ocean issues were discussed:

(1) **Logging:** PCOM has asked the thematic panels to review logging plans for upcoming legs of interest to their panel. LITHP reviewed logging plans for SWIR (Leg 118). A total of 8.3 days of logging is planned including the standard suite of Schlumberger tools, borehole televiewer/magnetometer, multichannel sonic, gyro-magnetometer, magnetic susceptibility, permeability, complex resistivity, dual laterolog, flowmeter and 18 hrs for a VSP experiment. LITHP was very satisfied with the Leg 118 logging program and strongly endorses this as a major objective of the leg - if a deep re-entry hole is established on SWIR it is of extremely high priority that this logging program be carried out even if

it comes at the expense of additional penetration. Logging plans for subsequent Indian Ocean legs will be reviewed at the next LITHP meeting.

(2) **90E Ridge:** As far as can be determined, the southern 90E Ridge site has not been formally eliminated from the Indian Ocean drilling program although PCOM did recommend that no 90E ridge sites be drilled on Leg 116 and IOP ranked this site below the other two 90E Ridge sites in priority for Leg 121. While LITHP agrees with the IOP priorities for Leg 121, in light of the safety panel's rejection of sites 5 and 6A for drilling on Leg 116, LITHP believes PCOM should reconsider drilling the northernmost 90E Ridge site on Leg 116. The remaining two 90E Ridge sites should be drilled on Leg 121.

(3) **Argo Abyssal Plain reference hole:** PCOM has approved drilling a basement re-entry hole in the Argo Abyssal Plain on Leg 123 as recommended by LITHP, but has asked LITHP to address some specific questions regarding drilling strategies and priorities which have been raised by other panels and at PCOM. We applaud the scientific vision displayed by PCOM in approving the Argo Abyssal Plain basement drilling - this hole will provide unique samples of old Indian Ocean crust as well as serve as a reference hole for the Sunda arc. Since many of the questions raised by PCOM center around the proposed western Pacific reference holes they will be discussed in the WPAC section below.

5.0 Evaluation of the 3rd WPAC Prospectus (this took place on Friday morning, except for the reference hole discussion which was on Wednesday afternoon)

5.1 Overview

In the Bonin transect, the Lau Basin drilling and the Japan Sea legs, the prospectus satisfies several important lithospheric thematic interests in the western Pacific. The most serious omission is the absence of a viable reference hole program which has been one of LITHP's top priorities in this area. LITHP questions the high priority assigned by WPAC to the Banda-Sulu-SCS program. This proposal is not ranked at all by LITHP and SOHP, and only in the middle of TECP's western Pacific priorities, yet it is the top priority WPAC program and is allocated two legs in the proposed WPAC schedule. This drilling is clearly of important regional interest, but it seems to lack significant global, thematic objectives. The eastern Sunda arc drilling is another project that has not received strong thematic endorsement, but remains one of WPAC's high priority programs. In general, LITHP believes programs with global, thematic objectives like the Bonin transect, Great Barrier Reef, Reference holes, and Japan Sea should receive a much higher ranking in this prospectus than drilling with more regional interests like Banda-Sulu-SCS, Sunda backthrusting, and Zenisu Ridge. The following are more specific recommendations on these issues:

5.2 Reference Holes

The WPAC proposal for a reference hole program consisting of only one, single bit hole at BON-8 is viewed as completely unacceptable by LITHP for two principal reasons.

First, an important part of the proposed program is the comparison of the Izu/Bonin and Mariana arc systems which have arc volcanics with distinctly different major and trace element chemistry. The most obvious difference between the arcs is the much greater abundance of seamounts on the subducting plate in the Mariana. Thus drilling reference sites at **both** arcs is essential to investigate the role of seamounts on arc chemistry.

Second, there are strong scientific arguments for drilling at least one relatively deep (100-500 m) reference hole. There is still no agreement on what part of the subducting crust is important in arc volcanism (none? just the upper few 10s of meters? a substantial fraction of the crust?). By sampling only the top 20 m of the crust, the range of hypotheses that can be tested will be very limited. Moreover, alteration in the top 20 m is likely to be spatially quite variable raising questions about how representative samples from a single shallow hole will be. A viable drilling program to investigate these problems must include one or more relatively deep holes to constrain the vertical variability, and a larger number of shallow holes to determine spatial variability along an arc or between arcs.

The panel also discussed several specific questions raised by P. Robinson on how to determine what part of the crust is involved in the arc signal and how to relate anomalous sea floor features, like seamounts, to arc volcanics. C. Langmuir replied that isotopic analyses (Sr, Li and B) can be used to distinguish between magmatic sources and alteration products in many cases. The effect of seamounts, or other anomalous features, can be addressed in two ways: (1) by comparing arc magmas from two different areas with different abundances of seamounts on the subducting plate (eg. Bonin vs. Mariana), or (2) examining the progressive changes in arc chemistry along an arc subducting a linear island chain obliquely (Louisville Ridge?).

The panel concluded by re-emphasizing the importance of reference hole drilling in the WPAC program. It is a thematic problem of global significance whose importance has been recognized by both the thematic and regional panels. <u>LITHP believes a minimum reference hole drilling program should consist of one deep (100-500m), re-entry basement hole in the Bonins (BON-8) and at least two shallow holes in the Mariana, one located on "normal" crust and one located on or adjacent to a seamount. This program will require a full leg of drilling.</u>

5.3 Bonin transect (Bonin I and II)

- this program is strongly endorsed by LITHP. Questions were raised, however, about the value of drilling into a serpentine diapir at BON-7. Samples can be obtained by dredging and submersibles. The panel consensus was that it would be better to drill the ridge these diapirs have intruded to determine the nature of basement, rather than the diapir itself.

5.4 Lau Basin System

- LITHP reaffirmed its priorities, established at the London meeting, for drilling in the Lau Basin. Our highest priority is looking at the interplay between volcanism and tectonics in the early opening of the basin and the petrological evolution of the basin. The sites were ranked, in order of priority: LG2, LG6, LG3, LG7 and LG1. LG1 should be drilled as a basement re-entry site in a sediment pond off-ridge (0.5-1.0 Myr crust) and should serve as an important test of new crustal drilling technology before a major crustal drilling effort in the eastern Pacific.

- Valu Fa (LG4 and LG5) is an important and interesting manifestation of back-arc volcanism, but the panel felt it ranked as a lower priority drilling target. The hydrothermal objectives of drilling in this area are better addressed in the eastern Pacific where more extensive geological and geophysical data exist to design a comprehensive hydrothermal drilling program. If both LG1 and LG4 are drilled neither will be very deep, limiting the value of both holes, unless two full legs of drilling are devoted to the Lau Basin. At this stage, LITHP believes more extensive dredging and submersible sampling of Valu Fa ridge should be a higher priority than drilling.

5.5 Japan Sea

- LITHP has strongly supported the Japan Sea program since it presents many interesting problems in back-arc basin evolution and is associated with an anomalously thick oceanic crust. LITHP is thus disappointed that the WPAC prospectus includes only two basement re-entry sites (J1-b, J2-a), one of which projects only 20 m of basement penetration because of the thick overlying sediments.

- LITHP recommends that the location of J-2a be reconsidered, possibly moving it from the center to the edge of the basin where the sediments would be thinner allowing greater basement penetration.

- LITHP recommends consideration be given to deploying "mini" reentry cones at J1-e and J1-d to enable up to 100 m of basement penetration at these sites

5.6 Vanuatu

- significant support exist on LITHP for drilling in this area, especially in terms of studying the very early evolution of intra-arc basins and the role of arc-ridge collision in the evolution of a magmatic arc.

6.0 <u>CEPAC Objectives and Proposal Evaluation</u>

The second day of the LITHP meeting was devoted entirely to a discussion of CEPAC objectives and proposal evaluation. The discussion began by reviewing the global lithospheric drilling objectives outlined in Table 1 of the LITHP White Paper and identifying those objectives that were best addressed in the CEPAC area. Of the ten objectives listed in the table, at least eight could be addressed by drilling in the Pacific. These include important global lithospheric themes such as:

- magmatic and hydrothermal processes at fast spreading and sedimented ridge crests
- formation and magmatic evolution of near-axis seamounts
- structure of the lower oceanic crust; test of the ophiolite model
- hotspot volcanism
- lithospheric flexure and thermal evolution
- origin of oceanic plateaus
- development of young oceanic rifts

The panel next turned to a review of specific proposals that have been submitted for drilling in CEPAC. We concentrated on those proposal of significant lithospheric interest.

1. Gulf of California (275E)

This proposal has three major components of lithospheric interest: (1) development of early continental rifting in the Manzanillo rift, (2) completion of a transect of holes along the Gulf of California and two transects across the Guayamas and Farallon basins, (3) geochemical and hydrothermal studies in the Guayamas and Farallon basins. In general, the Gulf of California is a good place to study the development of young oceanic rifts and hydrothermal processes at a sedimented ridge crest.

- several problems were identified with the proposed Manzanillo rift drilling: (1) the origin of the rift is not well-constrained, (2) it is unclear how drilling will test potential models, (3) this is probably not the best area to study the transition from continental crust to an incipient rift; the consensus of the panel was that this is an interesting problem, but not a high priority drilling target.

- the longitudinal Gulf transect to look at the geochemical evolution of magmas along a rift propagating into continental crust is of interest to LITHP, but in the northern Gulf the sediments may be too thick to reach basement with a single bit hole. This drilling could only be endorsed if basement were a realistic objective in the northern Gulf.

- transects across the Gulf to look at its early rifting history are the part of this proposal of greatest interest to LITHP. However, the panel felt it would be best to concentrate on one transect with re-entry holes to ensure basement is reached in the holes drilled in the thick sediments on the margins of the basin. MCS data is required to better define drilling targets; a synthesis of relevant continental studies is needed. Further development of this proposal should be encouraged.

- hydrothermal aspects of the Guayamas Basin drilling are of interest to LITHP, although as designed, the program does not address some fundamental aspects of the hydrothermal system at a sedimented ridge crest as well as the Juan de Fuca Ridge proposal

2. **Escanaba Trough ~~(232E)~~ 224E**

This proposal is focussed on studying the timing of volcanic activity and the chemical evolution of individual volcanos at an oceanic spreading center. It does not directly address hydrothermal problems, although recent studies have shown massive sulfides are present in this area.

- the problem of the timing of magmatic activity at mid-ocean ridges is a very important one

- questions exist as to whether or not the "turbidites" are actually hyaloclastite flows; dating resolution may not be as good as they claim

- a more 3-D perspective is needed to understand the sedimentological setting of potential drill sites; high-resolution (deep-tow?) reflection profiles and more coring needed

- hydrothermal drilling objectives investigating massive sulfides should be included

-the consensus of the panel is that this is interesting and important science and further development of this proposal should be encouraged

3. **Juan de Fuca Ridge, Middle Valley ~~(224E)~~ 232E**

This proposal is aimed at studying magmatic and hydrothermal processes at a sedimented ridge crest. Holes are proposed in an actively forming sulfide deposit and near the center of the valley above a sediment-sealed hydrothermal system. Two basement re-entry holes drilled to ~300 m are included.

- the panel felt this was a mature drilling proposal in an extremely well-studied area that addressed major COSOD I and LITHP thematic objectives; a first-rate proposal

- achieving all the stated objectives may require more than one leg; logging and downhole experiments are extremely important and sufficient time should be devoted to these experiments as well as the drilling

- for studying hydrothermal systems at a sedimented ridge crest the panel generally favored Juan de Fuca over Guayamas basin: tectonically it is a simpler system, it is better studied, some drilling has already been done in the Guayamas Basin. However, so little is known about these systems that at this stage it would be nice to work in both areas.

4. **East Pacific Rise 13°N (76E)**

This is a proposal to establish a suite of holes to study magmatic and hydrothermal processes at a fast spreading ridge. The original proposal is somewhat outdated and needs revision, but the proponents presently envision three bare-rock holes in an L pattern about 500 m apart - two on the rise crest within the axial graben and one located off-axis. The favored location is just south of the 12°54'N OSC in a well-surveyed, active hydrothermal area.

- this proposal addresses a major COSOD objective and is one of LITHP's highest priority drilling targets in the Pacific. It will require advances in crustal drilling technology and perhaps as many as three drilling legs to accomplish the primary objectives

- LITHP's highest priority is the establishment of a single deep hole through the pillow/dyke boundary (>500 m?) at the rise axis with shallower holes drilled along and across-strike. The best strategy may be to drill several shallow hole first, then select the best hole to deepen to >500 m.

- the 13°N area is a good site to establish this natural laboratory, but other potential sites exist - eg. the ridge segment south of the Clipperton fracture zone. Final site selection should await completion of EPR data synthesis now in progress

- EPR should probably not be drilled as three consecutive legs; it would be best to schedule the first leg as early in the CEPAC program as possible, with subsequent legs to follow at about six month intervals to allow the engineers to react to problems encountered in the early drilling. However, if the technology is available to make young crustal drilling feasible, all three legs should be carried out during this phase of drilling in the CEPAC area.

5. Explorer Ridge (263E)

This proposal has similar objectives the EPR proposal: establishment of a natural laboratory to study magmatic and hydrothermal processes at a mid-ocean ridge.

- the proposal is partially sold on the basis of proximity to U.S. ports, but this is offset by shorter weather window in this area

- Explorer Ridge is not a "normal" ridge segment: it is anomalously shallow and asymmetrically spreading; the spreading rates are slow. Given the time and resources required to establish a ridge crest natural laboratory, it would be far better to choose a more typical slow spreading ridge (eg. Mid-Atlantic Ridge).

6. Galapagos stockwork (258E)

This proposal is for a single 500 m deep hole into a fossil hydrothermal stockwork partially exposed on a small horst near the Galapagos spreading center.

- the principal criticism of this proposal was that many stockworks have been drilled on land in ophiolites and it is not clear what new would be learned by drilling here; the panel generally felt it would be far more worthwhile to drill an active hydrothermal system since the hydrothermal fluids can be sampled and physical parameters (eg. permeability, porosity) can be determined that will not be preserved in a fossilized system

- there are also practical difficulties with this proposal: a guide-base would probably be required and hole stability may be a serious problem; it may also be difficult to keep from drilling out of the stock-work at depth (ie, it may not be a simple vertical plug)

7. Atolls and Guyots (202/203E)

These two proposals address a variety of paleo-oceanographic, tectonic and lithospheric problems by drilling guyots in the Mid-Pacs and paired atoll-guyots in the Marshall-Gilberts.

- the Winterer proposal addresses several problems of lithospheric interest including hotspot age progressions, uplift and subsidence history, and mantle sources; basement drilling is an important objective

- the Schlanger proposal also has basement objectives of interest to LITHP, although the localized nature of the proposed drilling makes it of less interest

- these programs will not be driven by lithospheric drilling objectives; the final decision should be made by all the panels

8. Loihi (252E)

The principal objective of this proposal is to sample the earliest lavas erupted by a mid-plate hot spot; a secondary objective is to study a seamount hydrothermal system. Two holes are proposed - a deep hole (~800 m) at the summit and a shallower hole (~200 m) on the ridge flank.

- this proposal addresses a first-order problem of great interest to LITHP; with complimentary DOSEC drilling planned for Hawaii it may be possible to sample a nearly complete range of magmatic products from the earliest eruptions to the latest stages of activity at this one locale - this would be very exciting

- the present proposal has both magmatic and hydrothermal objectives; LITHP favors concentrating more on magmatic objectives

- consideration should be given to drilling on the flanks of the volcano to avoid caldera complications and intrusive bodies

- drilling will require advances in crustal drilling and dating techniques

9. Hawaii flexural moat (3E)

The primary objective here is to use the sedimentary sequences preserved in the Hawaiian flexural moat to constrain the thermo-mechanical response of the lithosphere to the formation of a large hotspot volcano. A dating precision of about 100,000 to 200,000 yrs is probably needed to distinguish between alternative models.

- drilling provides the best method of dating the sedimentary horizons observed in flexural moats and quantifying subsidence rates; it could have broad implications for rheological properties of lithosphere

- the main question is whether the necessary dating precision can be obtained in this area; CEPAC has noted problems with biostratigraphy techniques because of the absence of diatoms in Holocene and Recent sediments. They downgraded this proposal in their recent prospectus and suggested seeking alternative sites.

- an alternative site in the Marquesas was discussed by LITHP and M. McNutt summarized the results of a recent cruise to that area. Because of its location in the equatorial high productivity zone, the biostratigraphy of the pelagic sediments is likely to be much better; however the onlapping sequence of reflectors observed in the Hawaiian moat has not been documented in the Marquesas - this kind of data would be required before this area can be considered as a target for flexural moat drilling.

- it may be premature to eliminate Hawaii as a location to carry out this drilling; both magnetostratigraphy and tephrochronologic techniques could provide the necessary dating resolution. A. B. Watts has also noted in a letter to LITHP that cores only 3-4 m long from this area in the Lamont core collection have a few layers with high enough carbonate content that they may be datable using coccoliths

- more discussion on the dating question should be carried out between LITHP, CEPAC and TECP; proponents are encouraged to develop an alternative Marquesas proposal

10. Old Pacific Crust (261E)

This proposal seeks to drill Jurassic basement in the western Pacific in an area where previous drilling found a massive intrusive complex (Site 462 in the Nauru Basin).

- the nature and origin of the great mid-Cretaceous volcanic event is of interest to LITHP; thus sampling of the sill complex would be important, although questions were raised as to how useful samples from a single site would be

- Jurassic crust objectives duplicate to some extent drilling at AAP1B in the Argo Abyssal Plain

- the consensus of the panel was that this is a good proposal that has achievable drilling objectives if the site survey work is successful at finding a suitable site. However, this is not one of LITHP's top drilling priorities in the Pacific - the site survey work may be of greater interest to LITHP than the actual drilling.

11. Ontong-Java Plateau (222/248E)

This is actually a multi-disciplinary proposal aimed at a variety of lithospheric, tectonic and paleo-oceanographic objectives.

- origin and composition of large oceanic plateaus like Kerguelen and Ontong-Java an important lithospheric drilling objective

- basement should be an objective of as many holes as possible drilled on Ontong-Java and at least one basement hole should be a re-entry hole with 100 m or more of penetration

- for some of the tectonic/collisional objectives the role of drilling is not well-defined in this proposal

- LITHP believes Ontong-Java should be drilled as part of the Pacific program, but would not rank these proposals as highly as CEPAC

12. Magnetic Quiet Zone (231E)

The objective of this proposal is to drill six holes on old crust in the northwest Pacific in order to date basement and constrain tectonic reconstructions for this area.

- as written the proposal has no significant lithospheric drilling objectives

- should a ship with the capabilities of the <u>Resolution</u> be used to date basement to refine plate tectonic reconstructions?

- proposal of marginal interest to LITHP; we would not rate it very highly

13. Misc.

Proposals for drilling the Blanco fracture zone and a near-axis seamount were not discussed since they had not been distributed to the panel before the meeting. Older proposals such as Chile ridge triple junction and the Aleutian margin proposals were not discussed because of time constraints. These proposals and other new proposals will be reviewed at the next LITHP meeting.

14. Summary

Based on the themes outlined in the LITHP White Paper and the proposal evaluations described above, the panel divided the CEPAC proposals into four groups. Group 1 are the proposals which have LITHP's highest ranking - they all are programs that address fundamental **global** lithospheric problems and, in our opinion, should be part of any Pacific drilling program (one program, 504B, does not have a new proposal, but it is included on the basis of the strong endorsement given to this drilling in the COSOD I document and the LITHP White Paper). Group 2 proposals are ranked high by LITHP, but with certain qualifications mentioned above. If these problems are resolved they could potentially move into our Group

1 category. Group 3 proposals have important scientific objectives, but have limited lithospheric drilling objectives - we hope they get drilled, but they are not our highest priority in the Pacific. Group 4 proposals are either scientifically immature or have serious deficiencies - they are programs we recommend be dropped from further consideration.

Group 1 (Highest Ranking)	Legs
Juan de Fuca/sedimented ridge crest (224E)	1 1/2
Young hotspot volcano - Loihi (252E)	1
East Pacific Rise (76E)	3
Structure of layer 3 - 504B	1-2

Group 2 (High, but with qualifications)

Early continental rifting; Gulf of Calif. transect (275E)
Guayamas hydrothermal (275E)
Hawaiian flexure (3E)
Escanaba Trough (232E)
Old Pacific Crust (261E)

Group 3 (Limited LITHP interest)

Atolls and guyots (202/203E)
Ontong-Java (222/248E)
Magnetic Quiet Zone (231E)

Group 4 (Immature/serious deficiencies)

Galapagos stockwork (258E)
Explorer Ridge (263E)
Manzanillo Rift (275E)

The first CEPAC prospectus includes three of our four Group 1 programs and one of our Group 2 programs. Thus at this point, the prospectus includes a strong lithospheric drilling package. We do believe, however, that more of our Group 2 programs should be developed as mature drilling programs in the prospectus, especially given the present uncertainty concerning the technical feasibility of several of the Group 1 programs. <u>The main impediment to a strong lithospheric drilling program in CEPAC is still the arbitrary time limit of 9 legs placed on CEPAC drilling.</u> As the above table indicates, a realistic estimate of the time required to achieve only our four Group 1 objectives is about 7 legs. Clearly, if CEPAC is limited to a total of 9 legs for all drilling in the central and eastern Pacific we will be lucky to achieve more than one of our highest priority CEPAC objectives. <u>LITHP thus considers it essential that PCOM allocate sufficient drilling time to CEPAC to achieve the primary thematic drilling objectives in this area.</u> For LITHP, these requirements are clearly outlined in the above table.

7.0 Other matters

7.1 Meeting schedule

LITHP will try to meet regularly in late September and early March of each year. Our next meeting, which we hope will be a joint meeting with CEPAC, has been tentatively scheduled for 30 Sept. - 1 Oct. 1987 in Paris with C. Mevel serving as host. More tentative plans for a March 1988 meeting in Miami and a Sept. 1988 meeting in Tokyo were also discussed.

7.2 Panel membership

J. Delaney and J. Sinton are scheduled to rotate off LITHP this year. LITHP nominates Jill Karston (UW) to replace J. Delaney and L. Cathles (Cornell) or N. Sleep (Stanford) to replace J. Sinton (Cathles previously declined an invitation to join LITHP but with his new position at Cornell the panel hoped he might reconsider). PCOM should also note that it has yet to appoint a a geochemist to replace M. Leinen on LITHP.

The Panel thanks both Johns for the their long service on the panel and wish them well with their new found freedom.

7.3 Evaluation of ODP advisory structure

This provocative topic, suggested by the PCOM chairman, was briefly discussed, although the panel did not have time at the end of a long three day meeting to do the subject justice. There is, however, continuing frustration in LITHP that despite the changes that have been made over the past year, the program still has a regional focus that often serves as an impediment to achieving many of the global thematic drilling objectives outlined at COSOD. The controversy over reference holes and the exclusion of the Great Barrier Reef drilling from the core WPAC program approved by PCOM are only the latest symptoms of this problem.

The panel discussed several factors which may have contributed to this situation. One factor is the advisory panel structure itself in which the task of actually constructing a drilling prospectus or program is left to the regional panels. The role of thematic panels is purely advisory. Although it was noted that regional panels are composed of first-rate scientists who also are as interested in global problems as members of thematic panels, problems arise when regional and thematic objectives compete for the same limited amounts of drilling time.

A second problem may be PCOM itself. It was noted in the discussion that no effort is made to ensure that the PCOM membership has a necessary balance of expertise in the various key areas represented by the thematic panels. Decisions are too often made on the basis on incomplete or incorrect information provided by a liaison structure that has not worked well in the past. Suggestions were made to change the way PCOM membership is chosen, possibly having "thematic advocates" on PCOM, or having thematic panel chairman attend PCOM meetings (the last suggestion was vigorously opposed by the LITHP chairman!).

The main problem, however, may be how the **long-term** planning has been done in ODP and the circumnavigation philosophy that has driven the program in its first five years. This has led to totally arbitrary time blocks assigned to regional areas without consideration to global thematic drilling objectives, where they are best attacked, or how long it will take to achieve them. The result has been a program with a decidedly regional focus, with the regional and thematic panels fighting over the limited number of legs arbitrarily assigned to a particular area. As long as the long-term planning by PCOM is carried out in this fashion, no amount of fiddling with the panel structure, liaisons etc. is going to change the regional focus of the program.

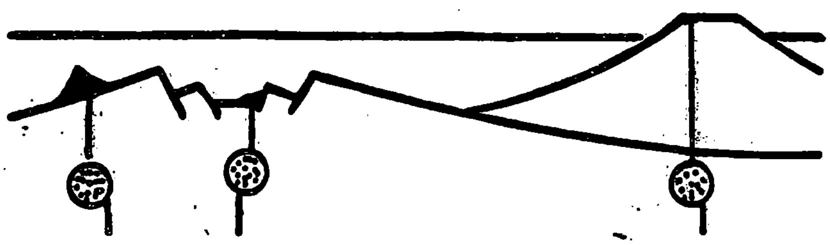
The most constructive suggestion to emerge from this discussion was that the long-term planning for the second five years of ODP be done in a different way. First, the idea, a priori, of a second circumnavigation, should be dropped. Each of the three thematic panels should be assigned the task of identifying a five year drilling program comprised of say 12 legs that would address the major global thematic drilling objectives outlined by COSOD I and II and these panels. In each case they would identify the key problems, where in a regional sense the drilling should be carried out, and the amount of drilling time required. Each "thematic prospectus" would be reviewed by PCOM and used to construct a tentative five year drilling plan outlining approximately where the ship will go and how much time it will spend in each area. These plans would then be publicized and specific drilling proposals solicited. The regional panels would then take these proposals, and working within the thematic guidelines already developed, produce a detailed drilling program for their particular area. These plans would be reviewed by the thematic panels and PCOM to ensure they fulfill the original global drilling themes, but if the regional panels felt important regional problems had been overlooked, they could make a case for changes to the original plan.

Clearly, this kind of approach will not eliminate the problems that will inevitably arise when a variety of groups with competing interests are using a scarce and valuable resource like a drillship. However, to us this is a far more logical way to plan a global drilling program than steaming around the world twice spending an arbitrarily assigned, equal number of legs in each major ocean basin!

JOIDES

Lithosphere Panel

WHITE PAPER



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PREFACE

The JOIDES Lithosphere Panel is one of three thematic advisory panels established by the JOIDES Planning Committee to "redefine as scientific drilling objectives, scientific problems identified by COSOD I (November, 1981) and by the JOIDES 8-year program for drilling (April 1982)." The mandate of the Lithosphere Panel is quite broad, encompassing "the origin and evolution of oceanic crust, and more particularly the volcanic, metamorphic, hydrothermal and diagenetic processes occurring in the oceanic crust."

The COSOD I report identified two high-priority problems to be investigated by drilling into the oceanic crust: (1) the processes of magma generation and crustal construction operating at mid-ocean ridges and (2) the processes of hydrothermal circulation in the oceanic crust. In addition to these two fundamental geological processes, the COSOD I report also recognized a number of other important lithospheric problems that could be significantly advanced by drilling. These included (1) the compositional heterogeneity of the mantle and mantle evolution, (2) the aging and evolution of the oceanic crust, (3) the formation of overly thick crust, (4) the role of transform faults, (5) processes operating in young ocean basins, and (6) island arcs and backarc basins.

The purpose of this White Paper is to take the broad thematic problems related to the origin and evolution of the oceanic lithosphere presented in the COSOD I report and identify a series of questions that can be addressed, at least in part, by ocean drilling, and develop more specific recommendations on the drilling strategies and technical development required to answer these questions. We have organized the discussion that follows under six principal headings based on the evolution of oceanic crust:

1) Magmatic processes in young ocean basins
2) Magmatic and hydrothermal processes at ocean ridges
3) Structure of the oceanic crust and its variation with age
4) Intraplate volcanism
5) Magmatism at convergent margins
6) Temporal and spatial variation of magma sources in the mantle

In each section we present the basic scientific questions that need to be addressed, discuss the contributions from crustal drilling and present specific recommendations on drilling strategies and priorities. Achieving the lithospheric drilling objectives outlined in this report will require both a substantial, long-term commitment from ODP to improve crustal drilling technology and a recognition in the planning process that many important lithospheric drilling targets require substantial amounts of drilling time, including multiple legs at a single site. Without this dual commitment to engineering development and drilling time it is unlikely that many of the important lithospheric drilling objectives outlined in this White Paper will be achieved in the foreseeable future.

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MAGMATIC PROCESSES IN YOUNG OCEAN BASINS

The transition from a continental to oceanic rift and the initiation of sea floor spreading is a fundamental geotectonic problem that is still poorly understood. Seismic surveying over a large number of margins and drilling of sequences of dipping reflectors off Norway suggest that at some margins volcanism may be much more important than previously recognized. Among the questions that must be addressed are:

* What is the petrological and geochemical nature of the upper mantle beneath an embryonic oceanic rift?

* What is the nature of the earliest "oceanic" crust emplaced in a continental rift?

* What controls the development of thick volcanic sequences at some margins, but not at others?

* What is the geometry of the initial emplacement of oceanic crust?

* How does the composition of the ocean crust evolve in space and time during the initial few million years of sea floor spreading?

Contributions from drilling

The abundant terrigenous sediment supply at developing oceanic rifts quickly buries the volcanic products of early rifting under thick accumulations of sediment and leads to extensive sill injection within the sedimentary section. Drilling thus offers the only way of sampling this crust. Drilling can also provide a vertical stratigraphic record in the syn-rift sediments providing important constraints on the age of rifting and the uplift and subsidence history during the splitting process. Full sampling of the sequence of volcanism by drilling will also provide critical information on the geochemical evolution of magmatism during the rifting process, and by inference provide important constraints on the thermal and compositional evolution of the the underlying mantle.

Drilling strategy and priorities

There are two different ways drilling can be used to address the magmatic evolution of young oceanic rifts. The first is to drill in young rifts like the Red Sea or Gulf of California. Both areas were drilled during the Deep Sea Drilling Project with considerable success. Further drilling in these areas, which is technically feasible with present ODP capabilities, is clearly warranted. A second approach is to drill relict rifts preserved in passive continental margins such as those bordering the Atlantic or off Australia. In many cases, the thick accumulations of post-rift sediments along these margins make this approach impractical. But in other sediment-starved areas, it is feasible to drill into rift-related volcanics as was successfully demonstrated on Leg 104. Additional basement drilling should be an important objective of future passive margin drilling efforts.

MAGMATIC AND HYDROTHERMAL PROCESSES AT OCEAN RIDGES

Sixty percent of the Earth's surface is created at ocean ridges, as magmas generated within the mantle are cooled to form the oceanic crust. Increasingly detailed geological and geophysical investigations of spreading centers over the past two decades, and field mapping and drilling of a few well-preserved ophiolite complexes, have lead to a basic conceptual model for the complex and interrelated magmatic, tectonic and hydrothermal processes involved in the formation of oceanic crust. However, many important questions remain, some of which can only be addressed by drilling. For purposes of discussion we will consider the magmatic and hydrothermal components of this system separately, but it should be recognized that these two processes are intimately linked.

Magmatic processes at ocean ridges

The magmatic system at ocean ridges can be viewed as having four basic components: (1) the production and segregation of melt in the upper mantle, (2) the ascent of this melt to crustal depths, (3) the temporary storage of the magma in a crustal reservoir, and (4) the eruption and crystallization of the magmas forming oceanic crust. All four processes are still poorly understood. The most important questions which must be answered to better understand this system are the following:

* What is the horizontal and vertical extent of the zone of melt production in the upper mantle? What is the extent of partial melting and how does it vary temporally and spatially? What is the expression of variations in source composition on the chemistry of the erupting basalts?

* How is magma transported from a presumed wide zone of melt generation to a narrow magma chamber? To what extent does the melt interact with the surrounding mantle? Over what time and space scales are crustal magma reservoirs supplied?

* What are the shape and dimensions of crustal magma chambers? Are they large and steady-state or small and ephemeral? Do they act as "open" or "closed" systems? Can ocean crust form without a crustal magma chamber?

* What are the characteristic length and time scales of ridge crest magmatism? Does a single, tectonically defined spreading center cell act as a single magmatic unit or is it segmented on a much finer scale?

* What controls the apparent episodicity of the sea floor spreading process? How does it vary as a function of spreading rate? Tectonic setting?

Contributions from drilling

The answers to these basic questions will require a multidisciplinary approach involving detailed geologic mapping and sampling, geophysical experiments and, ultimately, long-term monitoring of selected sites along the ocean ridge system. Drilling at spreading centers can make four unique contributions to ocean ridge studies:

First, drilling can sample deeper crustal levels not generally accessible at the sea floor and offers the best hope of recovering relatively fresh rocks essential for detailed geochemical analyses. Dredging and submersible sampling of fault scarps, especially at slow spreading ridges, have provided some access to deeper crustal levels. However, the tectonic setting is often anomalous (e.g., a fracture zone) and the samples are frequently badly weathered or metamorphosed. Drilling offers the potential of in situ sampling of deeper crustal levels in a "normal" tectonic setting.

Second, drilling can provide a vertical stratigraphy of lavas, unavailable from dredging, that can be used to investigate temporal variations in magmatic activity at a single location on a time scale shorter than that required to construct layer 2 (10^4-10^5 yrs). Accurate dating of individual flow units on time scales of less than 10^5 yrs is still not feasible. As a result, it is very difficult to separate temporal and spatial variability when mapping and sampling basalts exposed at the sea floor. The lava stratigraphy determined in drill holes thus offers the best hope of documenting temporal variations in magma supply, composition and evolution on a small spatial scale.

Third, drilling can "ground-truth" geophysical horizons such as the pillow/dyke or dyke/gabbro boundaries that may be mapped much more widely and cost-effectively using other geophysical techniques. The use of boreholes to define the nature of seismic reflectors which can then be mapped over large areas by reflection profiling is a common and powerful technique in the study of sediment stratigraphy on land and in the ocean. The same approach could be applied to the igneous crust, especially since improvements in geophysical techniques over the next few years promise to improve our ability to image these boundaries.

Fourth, drill holes can be used for bore-hole logging, downhole experiments and long-term geophysical monitoring. Major advances in logging techniques have been made in the past few years and these new tools can provide a wealth of new information on the physical properties of the oceanic crust. Crustal drill holes are an essential component of the long-term ocean bottom observatory concept and could be used to emplace a variety of geophysical sensors (short or long period seismometers, strainmeters, magnetometers, etc.) in future years.

Drilling strategy and priorities

The Lithosphere Panel strongly endorses the "natural laboratory" concept advocated in the COSOD I report: drilling at ocean ridges should be concentrated in selected areas that have been extensively surveyed and studied using a variety of geological and geophysical methods. Long-term use of the drill hole for geophysical experiments and monitoring is essential. Drilling should be focussed within a single spreading cell (thought to be the fundamental unit of crustal accretion) with holes located both along and across-strike. The holes need to be relatively deep (>100-500m) since the shallower crustal levels can be effectively sampled by dredging or submersibles.

Our highest priority is for a single, deep (>500m), zero-age hole at both a fast (>5-6 cm/yr) and slow (<2 cm/yr) spreading ridge with at least two shallower holes located in an "L" pattern along and across-strike at both ridges. The holes should be positioned close enough to permit cross-hole tomography and other geophysical experiments. Ideally the site at the fast spreading ridge should be located where a crustal magma chamber has been clearly identified geophysically; at the slow spreading ridge the site should be located as far as possible from a fracture zone. Once these holes have been established a series of intermediate depth (100-500m) holes should be drilled along-strike toward transforms or other ridge axis discontinuities to assess their affect on crustal accretion processes. Drilling of near-axis seamounts can also provide important information on the formation, transportation and composition of melts generated in the upper mantle beneath mid-ocean ridges (see p. 13).

In order to achieve these drilling objectives, a bare-rock spud-in capability will be required. With the development of the hard rock guide base and the use of downhole drilling and coring motors this problem appears to have been solved, although bare-rock drilling is still both time consuming and expensive. Based on the results of Legs 106 and 109 at the Mid-Atlantic Ridge, the major limitation in young crustal drilling is hole stability in young, highly fractured basaltic rock. A solution to this problem will be essential to obtain deep penetration in zero-age rocks that have not been substantially altered or cemented by hydrothermal activity. A long-term engineering development effort to improve penetration and recovery rates in crustal drilling is thus our panel's highest engineering priority. It is also clear that achieving the drilling objectives outlined above will require a substantial commitment of drilling time, including multiple legs at a single site. A total of 6 drilling legs may be required to establish the suite of 3 holes proposed above at both a fast and slow spreading ridge.

Hydrothermal processes at mid-ocean ridges

Ridge crest hydrothermal systems are an integral part of a fundamental planetary process. They transport a large fraction of the Earth's heat flux to the surface and are associated with the formation of metallic sulfides that may be analogues to economically important ore deposits on land. Heat lost through hydrothermal circulation has a pronounced effect on the size and longevity of crustal magma chambers, and the circulating fluids are responsible for a major part of the flux of Mg and other elements into or out of the oceans. Understanding the mechanisms and consequences of ridge crest hydrothermal activity is a basic goal of lithospheric studies.

Three kinds of submarine hydrothermal systems have been identified. The most spectacular are the high temperature, black smoker systems found at sediment-free ridge crests such as the East Pacific Rise and Mid-Atlantic Ridge. They are associated with 350°C springs of sulfide-bearing water on the sea floor which precipitate iron, copper and zinc sulfides in chimneys and mounds. The second is associated with sediment-buried ridge crests like Escanaba Trough, northern Juan de Fuca or Gulf of California. Here the system is modified by the relative impermeability of the sediments, and chemical reactions between the hydrothermal fluids and the sediments. The third kind of system is the low temperature type (10-20°C) which is associated with oxide deposits and which may account for a large fraction of the total heat loss from ocean ridges.

There are three essential components to any hydrothermal system: (1) a heat source, (2) a permeable medium, and (3) a circulating fluid. Processes operating in hydrothermal systems are highly interactive. The system is thermally driven by the presence of hot rock or magma, while the crystallization history of the magma is controlled by the rate at which it cools. Conductive heat transfer from the magma chamber to the host rock intensifies the local state of stress through expansion of the fluid-saturated host, leading to fracturing and increased permeability which in turn augments fluid circulation and the rate of heat transfer. This may be balanced by the precipitation of alteration assemblages in veins of the fracture network, decreasing permeability. Despite the fundamental nature of this interface between molten and cracked rocks, it is one of the most poorly understood aspects of any active hydrothermal system.

A basic understanding of submarine systems requires answers to the following questions:

* What is the size, shape, depth, temperature, and time-dependent behavior of the heat source?

* What are the spatial and temporal variations in permeability and composition of the host rocks?

* What are the time/space variations in physical properties and composition of the circulating fluids?

* What are the feedback loops linking the evolution of these principal components?

Contributions from drilling

Studies of fossil hydrothermal systems preserved in ophiolites have provided valuable insight into the subsurface geometry and composition of a submarine hydrothermal system. One important objective of drilling must be to test the hypothesis that these systems are a useful analogue of the active hydrothermal systems at ocean ridges. However, even if this hypothesis is valid, there are many aspects of hydrothermal systems that cannot be determined from an extinct system, including the variations in permeability and porosity of the host rocks, the physical properties and composition of the circulating fluid, and the dynamics of the water-hot rock interface. Drilling is the only available tool for constraining many of these parameters in an active submarine hydrothermal system. In particular:

* Drilling provides the only technique for penetrating the deeper levels of an active hydrothermal system

* Drilling can determine in-situ physical properties in the host rock (porosity, permeability, temperature, etc.) and sample hydrothermal and pore-water fluids.

* Drill holes can be used for long-term monitoring of hydrothermal activity

* Drilling off-axis can provide a record of the time-integrated alteration history of the oceanic crust.

Drilling strategy and priorities

The primary goal of a ridge crest drilling program should be the establishment of a deep penetration (>1000 m), high-temperature reference hole in an active ridge crest hydrothermal system. The target should be the penetration of the boundary between a vigorous hydrothermal system and an identifiable heat source (or at least the magma chamber reflection). The physical and chemical properties, the thickness and dynamic behavior of this boundary are completely unknown, yet they control the style and vigor of heat and mass transport within the magma chamber as well as that of the surrounding hydrothermal system.

Another goal of a hydrothermal drilling program should be to examine along-axis and across-axis variations within a single ridge segment. Along-strike variations include at least two scales of investigation, the segment scale (10s of kilometers) and the scale of individual on-axis hydrothermal circulation cells (size uncertain, but probably of the order of 0.5 to 4.0 km).

Ideally, these shallower holes (100-500m) would sample both the discharge and recharge zones of the circulation cell. The cross-axis holes would investigate the aging of the hydrothermal system and their spacing would ideally reflect the size of ridge flank hydrothermal cells determined from detailed heat flow investigations prior to drilling.

A third goal of a long-term hydrothermal drilling program should be to investigate the fundamental differences between hydrothermal systems at sedimented and sediment-free spreading centers. The presence of a relatively impermeable sediment layer strongly moderates heat loss from the system and has a profound chemical effect on fluid compositions. These systems may be a modern analogue of the large, sediment-hosted massive sulfide deposits frequently found on land.

Finally, any serious approach to drilling seafloor hydrothermal systems must take into account the positioning of drill holes and arrays of drill holes to optimize post-drilling experiments. For example, seismic and electromagnetic tomography from bore-holes, together with multichannel seismic imaging of the roof of the magma chamber, promise to provide important physical constraints on key components of submarine hydrothermal systems.

Some hydrothermal drilling objectives can be obtained with existing drilling technology. For example, characterizing a hydrothermal system at a sedimented ridge crest involves reaching the high temperature basalt-water portion of the system which can be achieved by drilling less than a kilometer of overlying sediments. The principal technical difficulty in this case will be the high temperatures (>350°C). ODP has not yet carried out high temperature drilling, but it is commonly done on land by vigorous pumping of cold water into the hole to depress the actual temperature of the rock being drilled. Special heat-resistant logging tools and bore-hole instrumentation will also be required. The next most drillable hydrothermal target is an off-axis transect perpendicular to an unsedimented ridge crest which has partial sediment cover close to the rise axis. By locating the holes in small sediment ponds bare-rock drilling will not be required, although rubble and hole stability may still be a problem. The technically most difficult hydrothermal objective is the deep, zero-age hole at a sediment-free ridge crest. This hole will require bare-rock spud-in, improved crustal drilling technology and a substantial commitment of drilling time (3 legs ?) to be feasible.

STRUCTURE OF OCEANIC CRUST AND ITS VARIATION WITH AGE

The geologic structure and physical properties of oceanic crust are still known largely by inference from ophiolites or indirectly from geophysical experiments. The general structure of the oceanic crust inferred from these studies consists of a 1 km-thick extrusive basaltic carapace that grades into a 1 km-thick complex of sheeted dykes characterized by pervasive greenschist and amphibole facies alteration. In this model the sheeted dykes are underlain by a 3-5 km-thick plutonic section consisting at shallow levels of isotropic gabbro and at deeper levels by cumulate gabbros that grade downward into cumulate ultramafics.

The deepest crustal drill hole (Hole 504B) has sampled only the uppermost 1288 m of this section, bottoming in the sheeted dykes of seismic layer 2C. We thus lack direct information from more than 80% of the oceanic crust. A major objective of ODP lithospheric drilling should be to sample the remaining part of seismic layer 2, the layer 2/3 boundary, and at least the upper portion of seismic layer 3. More than two-thirds of the oceanic crust is layer 3-type material, but we still have no direct knowledge of its composition or physical properties. Except at 504B and a few other relatively shallow crustal holes, we also have little knowledge of the variation in the physical properties (porosity, permeability, density etc.) of oceanic crust with depth and almost no information on how these properties vary with age.

Contributions from drilling

Deep crustal drilling will provide a critical test of the ophiolite model of oceanic crust. Drilling at 504B has confirmed part of the ophiolite hypothesis in the presence of the sheeted dyke unit. However, correlation of oceanic seismic layer 3 with the thick plutonic section in ophiolites has yet to be verified by drilling. Important questions remain as to the tectonic setting in which ophiolites formed and the degree to which they are a good structural analogue of normal oceanic crust. Recent detailed chemical and mineralogical studies of ophiolite complexes have demonstrated that many classic ophiolites are more closely related to an arc-marginal basin setting than to a typical mid-ocean ridge. Most MORBs are depleted tholeiitic lavas, although lesser amounts of more evolved basalts, including alkalic basalts, are found along certain parts of the mid-ocean ridge. In contrast, ophiolites may include compositions ranging from calc-alkaline to highly calcic-andesitic, arc tholeiitic or boninitic rocks typical of intraoceanic island arcs such as Tonga or the Marianas. Although the chemical and mineralogical evidence of a supra-subduction zone setting for many ophiolites is persuasive, the classic ophiolite definition is based upon stratigraphy and overall lithologic associations. To date these are not well defined in the deep ocean basins or the island arc environment. It is thus possible that ophiolites may still be a good structural analogue for oceanic crust, but this can only be tested by drilling.

Another important problem that can be addressed by deep crustal drilling is the source of marine magnetic anomalies. The upper 1-2 km of oceanic crust are generally assumed to be the source layer of marine magnetic anomalies. However, one of the surprising results to emerge from the crustal holes drilled so far is the observation of frequent reversals of remanent magnetization in most of the deeper holes, even when the sites were located in the center of a magnetic anomaly. This reduces the integrated magnetic intensity correspondingly and requires a much thicker source layer. The best explanation of the occurrence of mixed magnetic polarities is a statistical emplacement model. This model could be tested by drilling several crustal holes along a transect across a reversal boundary. A deep crustal drill hole could also provide constraints on the possible contribution of the lower oceanic crust to marine magnetic anomalies.

We still have few constraints on how the composition and physical properties of the oceanic crust vary with age or whether there have been significant temporal variations in the crust accreted at ocean ridges. Studies of the alteration history of old crust are important for understanding the geochemical fluxes in both the crust and the oceans. As ocean crust is transported away from spreading centers, it undergoes chemical changes, first by rapid high temperature hydrothermal processes, then by slow interaction with pore waters, often through a significant sediment blanket. These processes may continue for tens of millions of years. The full extent of both the high and low temperature alteration can only be studied in old ocean crust, and only by drilling since old crust is covered by sediment.

Drilling strategy and priorities

Our highest priority is to obtain at least one crustal hole that penetrates below the layer 2/3 boundary into layer 3. Right now 504B is the deepest existing hole in oceanic crust and appears to offer the best chance of achieving this objective in the next ten years. However, the total penetration of only 212 m in 29 days of drilling on Leg 111 suggests that we may be approaching the limits of deep crustal drilling with present technology (it should be pointed out, however, that most of the 29 days was spent in fishing/milling/holecleaning operations; penetration rates when actually drilling were about 3 m/hr). Achieving this very important lithospheric drilling objective will thus require a significant improvement in deep crustal drilling technology. Along with the related problem of young crustal drilling, this is our panel's highest priority for engineering development. This development effort should be combined with an attempt, at the earliest possible opportunity, to re-occupy 504B, clean out the hole, and deepen it into layer 3. If this proves not to be technically feasible, then drilling should concentrate on deepening other existing crustal holes (e.g., DSDP 597C, 418A) into layer 3.

Another high priority is to obtain several relatively deep holes in older, sedimented parts of the ocean basins in order to investigate temporal and spatial variations in the geologic structure and physical properties of the oceanic crust. This drilling is well within the present technical capabilities of ODP and will provide unique information on the composition and alteration history of old oceanic crust that can be obtained in no other way. Finally, it is essential that all existing deep crustal holes be logged. This objective has largely been achieved with the work at DSDP holes 395A, *418A and 504B in the first two years of ODP. It* is also important that all future crustal holes deeper than 100m be logged.

Although a deep crustal drill hole on "normal" oceanic crust is the only direct way of testing the ophiolite model, given the arc affinities of many ophiolites, it is important that one or more crustal holes be drilled in an island arc setting, both for comparison to the oceanic crustal section and to the typical ophiolite stratigraphy. Site selection for a hole of this kind is not obvious. Ophiolites may well be composite sections made up of fragments of the oceanic crust, forearc crust and back-arc basin crust. We thus rank this as a lower priority than deepening 504B or other deep crustal holes in a normal mid-ocean ridge tectonic setting.

The attenuated crustal section present at oceanic fracture zones, especially those along slow spreading ridges, may offer a window into the lower crust and upper mantle, albeit in an unusual tectonic setting. The magmatic, metamorphic and hydrothermal processes within fractures zones are also interesting in their own right. Drilling in oceanic fracture zones should thus be an important component of any long-term lithospheric drilling program.

INTRAPLATE VOLCANISM

Intraplate volcanism is the second most common type of volcanic activity occurring in the ocean basins. It takes many forms including small near-axis seamounts, linear volcanic chains, aseismic ridges, oceanic plateaus and thick intrusive complexes. Studies of the products of mid-plate volcanism can provide important constraints on the composition and chemical evolution of the upper mantle, the thermo-mechanical properties of the lithosphere and plate kinematic models. In the following discussion we focus on four specific problems: (1) the formation of seamounts near mid-ocean ridges, (2) linear volcanic chains and the geochemical evolution of mid-plate hotspots, (3) the effect of mid-plate volcanism on lithospheric properties, (4) origin of oceanic plateaus and the great mid-Cretaceous volcanic event.

Seamounts near mid-ocean ridges

Recent high-resolution bathymetric surveys along ocean ridges have revealed the frequent presence of small seamounts at or near spreading centers. Geochemically and petrologically these seamounts are magmatic products of the ridge crest system, although the chemical composition of the seamount lavas often differ from those of the surrounding seafloor. Some of these seamounts occur near inflated (shallow) ridge segments and may form because of a local excess of magma supply. However, many of these seamounts form near offsets of the ridge system. This is potentially interesting since independent evidence suggests that ridge offsets of various kinds are associated with a diminished magma supply. Eruptions near offsets may thus provide a sensitive record of temporal variations in magma supply at the adjacent spreading center and may help distinguish between different magma supply models. Hydrothermal activity at near-axis seamounts may also provide an interesting contrast with ridge crest activity due primarily to the higher elevation (lower pressure) of the upper portions of the upflow zone. Of particular interest is the enhanced likelihood of 2-phase separation (boiling) with related effects on seamount sulfide deposits (e.g. higher precious metal contents).

Contributions from drilling

As in the case of ridge crests, one of the main advantages of drilling over sea floor sampling techniques like dredging or submersible sampling is that a vertical stratigraphy of lava flows is obtained that can be used to investigate temporal variations in magmatism. For example, drilling seamounts at various distances from spreading centers may provide information on the rates of magma supply and how they have varied through time. Drilling a relatively deep hole (>500m) on a small (<500-1000m high) seamount could also provide unique constraints on its internal magma plumbing system as well as "ground-truthing" geophysical models for still controversial problems such as the origin of seamount magnetism.

Drilling strategies and priorities

Studies of near-axis seamounts are a logical complement to investigations of magmatic and hydrothermal processes at nearby spreading centers. Thus any drilling of near-axis seamounts should be part of a larger program of geological and geophysical investigations (including drilling) of the adjacent spreading center. Potential drilling targets are Axial Volcano on the Juan de Fuca Ridge, Mic, Mok and Sasha on the East Pacific Rise south of the Clipperton Transform and the seamounts near the 12°54'N OSC on the East Pacific Rise. The principal objective should be the establishment of a single deep hole (>500m) on the summit of the volcano. A summit hole is likely to provide the best opportunity of obtaining a simple and complete stratigraphic succession from a single volcanic vent (further down the flanks, the stratigraphy is likely to be a mixture of eruptions from several vents). A summit hole could also provide samples of lava lakes (caldera), cone-sheet intrusive feeders and shallow, sub-caldera plutonics, as well as investigate seamount hydrothermal systems.

Drilling a near-axis seamount will be technically difficult and will require both a bare-rock drilling capability and improved drilling techniques for young, fractured basaltic rocks. Achieving the primary drilling objective will require at least one drilling leg and the entire program outlined above may require as many as two drilling legs.

Linear volcanic chains and geochemical evolution of hotspots

Hotspot volcanism, and the linear volcanic chains often associated with them, are of considerable lithospheric interest both for the constraints they provide on plate kinematics and absolute plate motions and as a means of investigating the composition and geochemical evolution of the mantle. Extensive studies, including drilling, of the Hawaiian-Emperor chain and 90E Ridge have demonstrated the time transgressive nature of activity which can be related to fixed hotspots. Other features that also probably have a hotspot origin include the linear chains of French Polynesia, the Cocos and Carnegie aseismic ridges, the Louisville Ridge, the Marshall-Gilbert-Ellice chain, the Chagos-Laccadive Ridge, the New England Seamounts, the Walvis and Rio Grande Rise and others. These features are still very poorly known and important questions exist concerning the extent to which they can be related to fixed hotspots, the nature of the magma sources forming them, and the timing of activity along the chains.

Another aspect of hotspot volcanism of particular interest at the present time is the early evolution of hotspot magmas. The traditional view of Hawaiian hotspot volcanism was that a long tholeiitic phase of activity constructed the volcanoes and was followed by a short capping phase of alkalic activity. The discovery of Loihi seamount around 1980 indicated there may also be an early alkalic phase of volcanism that has been attributed to mixing of the primitive hotspot magmas with remelted lithosphere during their ascent to the surface. However, this interpretation is based entirely on rocks exposed at the surface recovered in dredges or by submersibles. We still do not have good stratigraphic control on the relationship between the alkalic and tholeiitic basalts forming Loihi, and fundamental questions still exist regarding the source composition, degree of partial melting, fractionation history and lithospheric contamination during the early evolution of hotspot magmas.

Contributions from drilling

Drilling linear island chains can provide three key pieces of information to address these problems. First, by drilling older linear island chains and aseismic ridges and dating either the basement rocks or the overlying sediments it will be possible determine the timing of volcanic activity along the chains and thus determine both the azimuth and rates of absolute plate motions. Second, drilling will provide a unique set of stratigraphically controlled basement samples that will provide a window into the composition and heterogeneity of the upper mantle from which these magmas were derived. Third, by drilling a young, incipient hot spot volcano like Loihi it will be possible to study the still largely unknown early eruptive products of hot spot volcanism in a continuous, stratigraphic section.

Drilling strategies and priorities

Studies of hot spot volcanism have played a pivotal role in current models of mantle chemistry, dynamics and evolution. The ODP could make a significant contribution to this effort by drilling a young, hot spot volcano and sampling, with good stratigraphic control, the first eruptive products of hot spot volcanism. One obvious target is, of course, Loihi. It is already well-studied and mapped, it is logistically convenient to Hawaii for permanent instrumentation, and is in relatively shallow water (~2000m). However, other targets such as Mehetia in the Society Islands may be suitable as well. The drilling strategy, technical problems and time-requirements are essentially the same as those described above for drilling a near-axis seamount.

Sampling of basement at hot spot related island chains and aseismic ridges is also important. Often holes are drilled on these shallow features for paleoceanographic and tectonic objectives and it is essential that these holes be extended, whenever possible, into basement at least until bit destruction.

Mid-plate volcanism and lithospheric flexure

Mid-plate volcanism represents a thermal perturbation to the cooling lithosphere that can be exploited as a natural laboratory to study the thermo-mechanical properties of the lithosphere. Most mid-plate volcanos are surrounded by broad regions of anomalously shallow seafloor called swells. Most of the characteristics of swells (height, geoid anomaly, subsidence history, heat flow) can be explained by the reheating of the mid- to lower lithosphere. However, there is no consensus as to the mechanism by which the heat is added to the lithosphere, the role played by the volcanoes themselves in raising temperatures, or the dynamic contribution of the upwelling asthenosphere in producing swells.

The sedimentary sequences preserved in the flexural moats of hotspot volcanoes are a sensitive measure of the thermal history of the swell that can be used to address these problems. The stratigraphy of the moat sediments is largely controlled by variations in the effective elastic thickness of the plate supporting the volcanic loads, and the thickness of the plate roughly corresponds to the depth of the 600°C isotherm. After an initial period of rapid thinning of the plate as it relaxes from its instantaneous elastic thickness to its long-term value, additional changes in the thickness of the elastic plate are controlled by heat transfer within the swell. As the elastic plate thickness varies with time, the pelagic and volcanoclastic sediments deposited in the flexural moat will show characteristic onlap and offlap patterns due to changes in the flexural width of the moat. Multichannel seismic profiling in the flexural moat flanking the island of Oahu has imaged onlap and offlap sequences consistent with variations in the effective elastic thickness of the lithosphere with time. However, without dates for the sedimentary horizons it is not possible to determine the time interval between volcano formation and the onset of plate weakening, or even definitively tie the offlap pattern to the process of heat transfer within the swell.

Contributions from drilling

Drilling in the flexural moats of hot spot volcanoes is the best method of dating the sedimentary horizons observed on reflection profiles and thus quantifying the subsidence rates at various times during the development of the moat. With this information it should be possible to determine the elastic response of the plate to the volcanic load and assess the relative importance of lithospheric reheating and other factors, such as the formation of a deep crustal sill complex, on this response. Drilling in flexural moats will also provide two other important kinds of information on hot spot volcanoes. The compositional variations of the ash flows and volcanoclastic debris deposited in the moat can reveal the stratigraphy of the adjacent volcanoes to depths not accessible by drilling the volcano itself. The variation in sediment supply to the moat can also be used to infer erosion and subsidence rates for the adjacent islands and may provide information on sea level fluctuations.

Drilling strategies and priorities

There is no question that models of the thermal and mechanical evolution of the lithosphere are at the point where distinct hypotheses exist that can be tested only by drilling. The kind of drilling required, which involves penetration of 100m to several hundred meters through the volcanoclastic sediments in the flexural moat, is clearly within the present technical capabilities of ODP. The main uncertainty is how well the stratigraphic horizons observed in reflection profiles can be dated either paleontologically or by other means (e.g., magnetostratigraphy). One possible target is the Hawaiian moat where good reflection data already exist, but fossil preservation may be poor. Another possible location is the Marquesas Islands where proximity to the equator increases the likelihood of datable fossils in the moat, but more site survey work would be needed. The main objectives of a drilling program of this kind (several holes across and along the moat) could easily be accomplished in a single leg.

Oceanic plateaus and mid-Cretaceous volcanism

Despite their huge size and distinctive morphology, the vast oceanic plateaus such a Hess Rise, Shatsky Rise, Manihiki Plateau, Ontong-Java Plateau and Kerguelen Plateau remain among the least understood features in the ocean basins. Geophysically, these plateaus are characterized by 20-30 km thick crust more typical of continental areas than the ocean basins, leading some investigators to propose that they are continental fragments. Others have argued that they have an overthickened oceanic crustal section formed by excess volcanism associated with a ridge-centered hot spot (the Iceland analogy) or a ridge-ridge-ridge triple junction. Still others have speculated that the plateaus may represent voluminous volcanic outpourings associated with meteoric impacts. Data on the age, chemical composition and structure of basement rocks of plateaus are required to resolve this controversy and advance our understanding of how and why these plateaus form.

Many of the plateaus in the western Pacific appear to have formed in the mid-Cretaceous during a period spanning perhaps 30 my of remarkably intense mid-plate volcanism. In addition to these plateaus this event appears to have formed several major guyot chains and at least one major deep sea intrusive event in the Nauru Basin. Diverse magmatic products were erupted during this period, and there were complex episodes of uplift and subsidence in different parts of the region whose timing and significance are still poorly understood. The volume of volcanism indicates a major disturbance of the normal thermal and convective pattern in the mantle which perhaps coincidentally overlaps with the long Cretaceous period of normal magnetic polarity. An important goal of crustal drilling in this area should be a systematic investigation of the composition, subsidence history, and temporal relationships between the various plateaus, island chains and basins in this area.

Contributions from drilling

Generally, plateau crust is buried under as much as 1.5 km of sediment, hence drilling is in most cases the only method of recovering samples of basement rock for petrological and geochemical studies. Samples obtained by drilling are also usually less altered than dredged rocks and have unambiguous stratigraphic control. Paleontological evidence from the sediments deposited on plateaus will provide important constraints on the age of these features and their long-term subsidence history. Drilling into volcanic basement at atolls and guyots, aseismic ridges and in mid-plate intrusive complexes will provide similar information on the origin of these features.

Drilling strategies and priorities

Drilling is the only method of unambiguously determining the age and composition (oceanic vs continental) of oceanic plateaus. The drilling is technically feasible (although penetration of

Cretaceous cherts may be a problem on some plateaus) and should be included in any long-term crustal drilling program. Potential targets include Kerguelen plateau in the Indian Ocean and Ontong-Java and Manihiki plateaus in the western Pacific. Holes drilled on these shallow plateaus will have important paleo-oceanographic and tectonic objectives as well. However, it is important to emphasize that achieving the basement objectives at these sites will require more than penetrating a few meters in "basement", since intrusive sills may mask true basement and such limited penetration will yield no information on the temporal variability or stratigraphic relationships in the basement rocks. A relatively deep (100-500m), re-entry hole should be drilled on each plateau with several shallower (<100m) single bit holes to sample spatial variability in basement structure and composition in different parts of a single plateau.

INTRAOCEANIC CONVERGENT MARGINS

Intraoceanic convergent margins are comprised of three principal tectonic components: (1) forearc, (2) volcanic arc, (3) backarc basin. In order to understand these margins as a <u>system</u>, we need answers to the following fundamental questions:

* What are the relative contributions from volcanism, intrusive activity, accretion and tectonic erosion in the evolution of arc and forearc regions?

* What roles do serpentine diapirism and block faulting play in forearc tectonism?

* What is the temporal and spatial variability of magma types in arc-forearc regions? How are magmatism and tectonism interrelated?

* What initiates backarc basin development? How does the geochemistry of backarc basin crust vary during the history of the basin?

* What are the nature of hydrothermal systems in arc-forearc-backarc regions? How do they compare with ocean ridge hydrothermal systems?

* What are the relative roles of mantle, subducted sediments and oceanic crust in the sources for magmas in the forearc-arc-backarc regions?

The answers to these questions are of fundamental importance to our understanding of how intraoceanic convergent margins form and evolve, and what sort of chemical communication exists between crust and mantle. These problems must be attacked by a combined program of geological mapping (Sea Beam, Sea MARC), geophysical surveys (MCS), dredging and submersible studies, as well as a carefully designed and focussed drilling program.

Contributions from drilling

Drilling can make a number of important contributions to studies of intraoceanic convergent margins:

* Drilling can provide vertical stratigraphic records for deciphering the uplift/subsidence history of both the forearc and backarc regions. We do not know, for example, whether the frontal arc and outer-arc high develop by igneous construction or differential uplift, whether the upper-slope basin between them is due to forearc spreading or differential subsidence, or whether flexural loading by the arc volcanics is an important process. Drilling is the best means of determining the form of vertical movements that have occurred in the forearc.

* Drilling can provide a nearly complete tephrachronological record useful for deciphering time-dependent relations among forearc, arc and backarc processes. This kind of information is essential in order to investigate temporal variations in arc magmatism or the relationship between tectonism and magmatism in the early development of backarc basins.

* Drilling into forearc diapirs and their flanking sediments may be the best way to study their formation and tectonic history. Drilling these features should provide constraints on the timing of their emplacement and the emplacement mechanism, as well as the extent of fluid circulation through the outer forearc and the chemistry of the fluids.

* Drilling provides the only access to igneous basement beneath large portions of the forearc, arc and backarc that are covered by sediments. The nature of igneous basement forming the frontal arc, outer-arc high and beneath the intervening forearc basin must be determined in order to answer critical questions regarding the initial stages of arc magmatism and the development of the forearc massif. Drilling provides the only way of sampling the early magmatic products of back-arc basin rifting and testing models for the geochemical evolution of back-arc basin magmatism.

* Drilling in backarc basins, as at ocean ridges, can provide unique constraints on processes of crustal construction and hydrothermal activity at backarc basin spreading centers.

* Drilling can establish the composition of the sediment and basaltic crust being subducted in order to assess their role in arc magmatism.

Drilling strategies and priorities

The various problems of lithospheric interest outlined above at intraoceanic convergent margins require both a spatial perspective, to investigate the different components of the system (forearc-arc-backarc), and a temporal perspective to compare convergent margins in different stages of evolution (mature vs immature). Our panel thus favors a "transect" drilling strategy involving multiple holes extending from the backarc spreading center (where zero-age drilling could be carried out) across the arc and forearc to the undisturbed plate about to be consumed. Ideally, margins in different stages of development should be drilled. The highest priority objective should be to investigate the evolutionary development of each component of the convergent margin system and the interplay between tectonic and petrologic variables. Drilling should be concentrated in areas where the subaerial geology and overall geologic history are well-characterized (Indonesia, western Melanesia, Vanuatu, Tonga-Kermadec, Fiji, Mariana, Izu-Bonin, Japan, S. Sandwich-Scotia, Aleutian, Antilles). The emphasis in these transects should be on intermediate to deep basement holes (>100-500m) in order to adequately sample the predicted vertical variability in areas representing initial stages of back-arc basin development, and the deeper portions of the arcs and forearcs. Most of the basement drilling objectives in convergent margins can be achieved using existing drilling technology, although hole stability may be a problem in some holes dominated by volcanoclastics and breccias. Bare-rock and young crustal drilling techniques will be required for drilling backarc spreading centers.

Reference holes drilled into basement on the subducting plate are an essential component of all drilling programs investigating magma genesis in convergent margins. Two approaches can be taken. First, areas can be studied where the composition of the subducting crust varies substantially to determine if there are corresponding changes in the arc volcanics. Second, areas with substantial chemical variations along the arc can be investigated to determine whether there are corresponding variations in the subducting crust. Both approaches can be accomplished only through drilling and substantial progress can be made with current drilling technology. A series of holes are required paralleling the volcanic arc on the subducting plate. Some of these can be single bit holes (provided the chert penetration problem is solved), although a few should be deep (>500m) reentry holes to insure a representative vertical section through a substantial part of layer 2 is obtained. Potential locations for these studies include the Bonin, Mariana, Aleutian, and Antilles arcs.

A single transect of the kind outlined above will require about three legs of drilling. In the context of a ten year drilling program, at least two such transects should be completed.

MANTLE HETEROGENEITY

The spatial and temporal distribution of heterogeneities in the mantle, and their relative scales are closely linked with the problem of deciphering the dynamic or convective state of the mantle and mixing conditions that may exist between different zones of the Earth's interior. Some particularly important questions are:

* What have been the variations in mantle temperature and degree of partial melting temporally and spatially?

* Is convection mantle-wide or limited to different zones such as the upper and lower mantle?

* If the latter case prevails, how much exchange has taken place by entrainment between the two systems?

* What is the source of so-called mantle plumes and how do they interact with the overlying plates or upper mantle?

* How do mantle plumes affect magmatism at mid-ocean ridges? What is the role of fracture zones in this process?

These questions also pertain, of course, to understanding how the earth has outgassed, how mantle differentiation has taken place and how the ocean, the atmosphere, and the continental crust have grown and evolved through geologic time.

The geochemical and isotopic composition of lavas erupted along ocean ridges, at island arcs and in backarc basins, at oceanic islands and along hotspot chains can provide some of the needed constraints. Radiogenic isotope ratios (Pb, Nd, Sr, He, etc.) and related information on time integrated parent/daughter element ratios are particularly useful at identifying different mantle reservoirs, their mean ages, any mixing that may have taken place, and whether crustal recycling into the mantle is an important process. For example, Pacific Ocean basalt glasses tend to have distinctly lower Sr isotopic values at the same Nd isotopic value compared to most Atlantic and Indian Ocean basalts. Indian Ocean basalts which are depleted in incompatible trace elements can have substantially higher Sr isotopic ratios than the most incompatible element enriched Pacific ocean ridge basalt. These global differences must reflect the nature and timing of melt extraction and recycling. Mapping such variations through time could have considerable consequences for our understanding of the circulation of materials through the earth's mantle.

Another example is the recent recognition that basalt chemistry is giving information about temperature variations in the underlying mantle. There are global correlations among basalt chemistry, axial depth and crustal thickness which are quantitatively consistent with long wavelength temperature variations in the mantle. These correlations include basalts from hot spots, cold spots, backarc basins and normal ocean ridges. Recovering basalt from older crust can thus provide important information about temporal and spatial variations in mantle temperature and degree of partial melting.

Contributions from drilling

Rock sampling by dredging along the ocean ridge system provides only a one-dimensional snapshot of mantle heterogeneities and is limited to constraining the pattern of convective mantle currents in planform. Also, sampling of islands along a hotspot track provides only an intermittent picture limited to the peak cycles of volcanism.

Drilling can make two unique contributions. First, drilling can provide a continuous, high resolution record of the history of magmatic activity at one location on a time scale shorter than that of the construction of layer 2 (10^5 to 10^6 years). This good stratigraphic control permits studies of short-term variations in mantle chemistry and temperature at a single location. Second, drilling provides the only method of sampling older, sedimented crust providing constraints on the temporal variability over time scales of 10^6-10^8 years and spatial scales of up to 10^4 km.

Drilling strategy and priorities

These fundamental questions concerning temporal and spatial variations in mantle chemistry and temperature can be addressed by drilling holes with 100m or more of basement penetration on crust of various ages in different ocean basins. They cannot be addressed solely by dredging programs, and they are achievable with present drilling technology.

Several different drilling strategies can be employed. Grid sampling using scales relevant to the particular problem, such as carried out during DSDP leg 82 in the N. Atlantic around the Azores, is one approach. Another strategy is to drill transects of shallow holes (~100m) along a spreading flow line. Sampling of basement at seamounts, aseismic ridges and oceanic plateaus is another approach. Finally, the geochemical reference holes discussed in the previous section will also be valuable in constraining variations in the chemistry of the ocean crust through time. It will ultimately be the accumulation of data from all of these approaches, together with continued dredging and drilling at ocean ridges, that will provide the critical information needed to understand the thermal and chemical evolution of the upper mantle.

RECOMMENDATIONS FOR A LITHOSPHERIC DRILLING PROGRAM

Table 1 summarizes the ten highest priority lithospheric drilling objectives listed in the order they were presented in this White Paper. Also included is information on the number and depth of holes, technological and time requirements, and possible drilling locations based on the strategies and priorities discussed above.

It is first worth noting the breadth of problems indicated in this Table. They include not only volcanism and hydrothermal objectives at oceanic spreading centers, but also encompass magmatism associated with hotspot volcanoes and convergent margins, near-axis seamounts and oceanic plateaus, fracture zones and young oceanic rifts. Drilling can also be used to study the aging and metamorphism of oceanic crust, the composition and geochemical evolution of the Earth's mantle and the thermo-mechanical properties of the lithosphere. There are clearly a wide variety of important problems of lithospheric interest that drilling can address, many of them with existing drilling technology.

In devising a coherent, long-term lithospheric drilling program two principal difficulties arose. The first concerns the maturity of our understanding of the basic scientific problems. In some cases (e.g., deep crustal hole to test the ophiolite model or flexural moat drilling) our geological and geophysical models are at the point now where distinct hypotheses exist that can only be tested by drilling. In these cases it is relatively easy to identify a specific, drilling strategy. However, in other areas (e.g., ridge crest processes, mantle heterogeneity) our models are still rapidly evolving as new data are collected and interpreted. In these cases it is more difficult to define a specific drilling program at this time and we expect that our ideas about how and where these targets should be drilled may change over the next few years as new data are collected and new models developed. Another problem we face in defining a lithospheric drilling program is that many of our highest priority drilling objectives will only be feasible if substantial improvements are made in current crustal drilling technology. We do not know when, or if, these advanced crustal drilling techniques will be available.

In light of these problems, two different approaches could be taken. The first would be to design a program around only those scientifically mature problems that are technologically feasible now. Clearly, much good science could be done this way, but 5 or 10 years down the road we would be no closer to solving many fundamental lithospheric problems (structure of seismic layer 3, validity of ophiolite model, etc.) than we are now. An alternative approach would be to devote all of our resources to overcome the technical problems associated with young and deep crustal drilling, deferring most lithospheric programs until that technology is available. The problem with this option is that there are many important lithospheric problems that can be addressed <u>now</u> with <u>existing</u> drilling technology that would be overlooked.

Table 1
Summary of High Priority Lithospheric Drilling Objectives+

Drilling Objective	# Holes	Crustal Drilling Depth	Advanced Crustal Drilling Technology	Legs	Example Locations
Young oceanic rifts	Multiple	<100m to >500m	High temp. drilling (for some holes)	1-2	Red Sea, Gulf of California
Drilling at fast and slow spreading ridges*	2-6	2 >500m 4 100-500m	Bare-rock, young crust, high temp.	~6?	MAR, EPR, Juan de Fuca Ridge
Drilling a sedimented ridge crest, hydrothermal system	>3	>500m	High temp. drilling	1-2	Juan de Fuca, Escabana Trough, Gulf of Calif.
Deep crustal hole into layer 3*	1	>2000m	Deep crustal drilling	>2?	DSDP 504B, 418A
Fracture zone drilling	Multiple	<100m to >500m	Bare-rock, young crust (for some holes)	1-2	Kane, Oceanographer, AII, Vema
Near-axis seamounts; hotspot drilling	Multiple	<100m to >500m	Bare-rock, young crust (for some holes)	>2	EPR, Loihi, 90E Ridge, Mid-Pac. Mts.
Flexural moat drilling	Multiple	none	none	1	Hawaii, Marquesas
Oceanic plateau drilling	Multiple	~100m	none	2	Kerguelen, Ontong-Java, Shatsky
Drilling old oceanic crust	Multiple	<100m to >500m	none	~3	Atlantic, Pacific or Indian Oceans
Intraoceanic convergent margin transects (2) (incl. reference holes)	Multiple	<100m to >500m	none (except at backarc spreading centers)	3-6	Izu-Bonin, Tonga Kermadic, Aleutian, Antilles

+Listed in order presented in text.

*New crustal drilling technology required to achieve this objective.

We favor a hybrid approach. The high priority, long-term goals for lithospheric drilling should be clearly identified upfront with the technical requirements to achieve them. A complementary, short-term plan should also be devised with achievable drilling goals designed to address important, mature scientific questions, as well as to contribute to the technical and scientific requirements of the long-term goals. This approach allows identification of a spectrum of targets ranging from those that are presently drillable to those that are currently undrillable. With a parallel engineering development effort, the necessary tools should be available when the technically difficult holes are ready to be drilled.

This is the approach we have taken in constructing Table 1. Our most important long-term drilling objectives are to complete one or more deep holes into the lower oceanic crust (to Moho?) and to establish a suite of crustal drill holes at both fast and slow spreading ridges. However, in the short-term there are also important problems at intraoceanic convergent margins, on oceanic plateaus and aseismic ridges, at sedimented ridge crests and in young oceanic rifts that can and should be addressed with existing drilling techniques.

Achieving our long-term drilling objectives will require a major engineering development effort to solve the hole stability problem in young crust and to improve penetration and recovery rates when drilling deep crustal holes. This effort must begin now and must be continued over at least the next 5-7 years if these significant technological problems are to be overcome. We believe an expenditure on the order of 5% of the annual drilling budget (~$1.5 - 2 M/yr) is a reasonable estimate of the level of resources that should be devoted to this engineering development effort.

We believe the lithospheric drilling strategy outlined above is feasible. In the context of a 10 year drilling program it is reasonable to expect that most of the objectives listed in Table 1 can be achieved, especially considering that many of the proposed legs (convergent margins, oceanic plateaus, lithospheric flexures, young oceanic rifts, etc.) have important tectonic or paleoceanographic objectives as well. However, achieving these objectives will require both a substantial long-term commitment from ODP to engineering development and a recognition in the planning process that many important lithospheric objectives require substantial amounts of drilling time, including multiple legs at a single site. The Lithosphere Panel strongly believes that ODP should focus on a smaller number of thematic problems, like those outlined in Table 1, and devote the technological resources and drilling time to achieve those objectives.

CENTRAL AND EASTERN PACIFIC PANEL

DRAFT MINUTES*

MEETING AT NORTHWESTERN UNIVERSITY, EVANSTON, IL

March 30-31, 1987

87-329
RECEIVED APR 2 7 1987

Members Present:

S. O. Schlanger, Chairman
Earl Davis
Martin Flower
Jean Francheteau
Hugh Jenkyns
Jacqueline Mammerickx
Connie Sancetta
David Scholl
Hans Schrader
Bill Sliter

In Attendance:

Mike Arthur (SOHP)
Rodey Batiza (LITH)
Dick Buffler (NSF)
William Coulbourn (PCOM)
Robert Detrick (LITHP)
Richard Jarrard (LDGO)
Steve Lewis (SSP)
Robin Riddihough (TECP)
Elliot Taylor (ODP)

Absent:

Hakuiyu Okada (CEPAC)
Tsunemasa Saito (SOHP)
Ulrich von Stackelberg (CEPAC)

OPENING REMARKS AND PREVIOUS MINUTES

The Chairman opened the meeting, after the usual amenities, by reporting on the PCOM meeting in Honolulu. There the embryo CEPAC program was presented as an ~17 Leg effort (see attachment 2 of CEPAC memo of March 13). Mammerickx questioned as to why PCOM published our "package" list (see JOIDES Journal, Feb. 87, pg. 62). This was evidently done in the JOIDES office. The Chairman emphasized the PCOM wanted an initial Prospectus well in advance of their August meeting and so the preparation of this document was the prime business of CEPAC now. The WPAC prospectuses could be used as models.

The minutes of the Ann Arbor meeting were accepted without major comment.

*People should look these over and send me comments for inclusion in final version.

LIAISON REPORTS

PCOM: Coulbourn reported on:

a) The Indian Ocean program
b) The progression of WPAC prospectus development
c) The need for a CEPAC prospectus
d) The PCOM plan for 3 years drilling for WPAC and CEPAC
e) The problem of fitting the EPR drilling into a circumnavigation-based program
f) The need to designate CEPAC Legs that could be drilled on a WPAC circuit
g) The desire of PCOM that thematic panel input be reflected in CEPAC planning.

ODP: Taylor reviewed the results of Legs 112 and 113 and progress on Leg 114 and plans for Legs 114-123. Also reviewed were publication plans for the "maroon" books. Progress on Navidrill system is being made, including testing.

LITHP: Detrick handed out a 5 page "white paper" on LITHP thematic objectives; 3 global themes are:

a) Nature and evolution of magma sources in the upper mantle
b) Magma chamber dynamics and water-crust interactions
c) Physical properties and thermal/mechanical evolution of oceanic lithosphere.

Specific problems *best* studied in CEPAC region are:

a) Crustal accretion and hydrothermal activity at intermediate and fast spreading centers
b) Vertical stratigraphy and physical properties of oceanic crust
c) Midplate volcanism, seamount formation, and plate flexure.

LITHP has not yet evaluated specific CEPAC drilling proposals or packages. However, based on the thematic interests outlined above, the following proposals (as of 3/30/87) would be of greatest lithospheric interest:

East Pacific Rise (76E)
Escanaba Trough (224E)
Explorer Ridge (263E)
Juan de Fuca Ridge (Middle Valley) (232E)
Loihi (252E)

Other proposals with important lithospheric objectives are:

Atolls and guyots (202E, 203E)
Galapagos Ridge stockwork (258E)
Gulf of California (75E)
Hawaii flexural moat (3E)
Ontong-Java Plateau (crustal) (222E)

SOHP: Arthur opened his presentation by stating that SOHP does not want to function as a regional panel. He further stated that SOHP has not seen all of the CEPAC proposals and that because of scope of Pacific Basin, PCOM should reconsider the time allottted to CEPAC. He handed out, after discussion, the following SOHP thematic ranking for CEPAC.

SOHP Thematic Ranking

1. High resolution surface and bottom water Neogene history of Pacific and relationship to paleoclimate, sea level changes and tectonic events: Equatorial Pacific, OJP.
2. Late Mesozoic-Paleogene high-low latitude paleoclimate: Sounder Ridge, Umnak Plateau, Atolls, South Pacific, N Pacific gyre.
3. Old Pacific crust and Jurassic ocean.
4. Anoxia — global carbon cycles, volcanism and upwelling: Shatsky Rise, Bering Sea (?).
5. Atolls and guyots — drowning, shallow-water biota, diagenesis, low latitude paleotemperature, volcanic episodicity: Marshalls, Pacific atolls/guyots, Ogasawara Plateau.
6. Sedimentary processes/fans: Navy fan.

SOHP Preliminary Ranking

12	Equatorial Pacific
11	Bering Sea
10	Old Pacific
9	OJP
8	Shatsky
—	————————
6	Navy Fan
5	NP gyre
4	GOC diagenesis
	NE Pacific
3	Louisville Ridge
	Ogasawara Plateau
	Marshalls
	Calif. margin
2	Peru margin
	Pacific atolls
1	JDF
	Oregon AP
	South Pacific

TECP: Riddihough discussed the results of the TECP Ottawa meeting and presented the following thematic objectives:

a) High priority, mature:

1. Dating oceanic crust; jigsaw problems in Pacific with emphasis on reversal time scale, kinematics without magnetics, K and JQZ, hot-spot tracks for pre-70 MA time.
2. Vertical motions and flexure

3. Ridge-trench interactions
4. Descending crust, sediments, volcanism,; geochemical reference holes
5. Subduction rates

b) High priority, immature

6. Oceanic plateaus (impact structures?)
7. Structures in oceanic crust, state of stress, non-rigid deformation, FZ propagation, seamounts

c) Lower priority

8. Transcurrent margins, accretionary prisms.

ECOD: (European Consortium for Ocean Drilling). Jenkyns reported on a meeting organized by ESF held at Gwatt, Switzerland, March 17-21. Attending were ESF representatives of the ODP community with visitors from France, Germany, the UK and the USA. The meeting was a pre-COSOD-II effort, the organization of which mimicked the upcoming COSOD meeting. White papers following the 5 thematic groups of COSOD-II were prepared for presentation at COSOD-II in Strasbourg in July.

COSOD-II: The Chairman briefly reviewed progress pointing out that the Working Groups have met, applications from individuals are being reviewed and that invitations will be forthcoming.

SSP: Lewis (filling in for Peirce) discussed SSP needs and CEPAC responsibilities so as to make us aware of SSP work. The following was emphasized:

a) High quality, well-processed MCS lines are very important now and in future.

b) SCS should be digitally acquired so that processing can be done. Older SCS shipboard records not good enough. Digital acquisition applies also to shallow (HPC) sed holes.

c) SSP and CEPAC need to arrange to contact proposal proponents in order to review site survey requirements and keep track of new surveys. Many proposals have, at the time of submission, inadequate surveys. Both SSP and CEPAC will assign "watch dogs" to programs on the prospectus to ensure follow-up. CEPAC began this system at this meeting. See below and attached Executive Summary and Outline of CEPAC Initial Tentative Prospectus sent to PCOM for the April meeting.

d) Mature vs. immature proposals. SSP considers a proposal to be immature if all requirements are not met. Proposal reaches maturity when a cruise to acquire specifically needed data is funded.

NSF: Buffler reported that:

a) NSF is reviewing proposals for 1988 cruises

b) USSAC will be in a position to deal with site-specific surveys as timing problems arise

c) 1989 field season proposals for drilling in 1991 will be due soon

d) Proposals now funded (CEPAC related) are: 1) Hawaiian Moat, 2) Old Pac, 3) Chile Triple Junction.

e) USSR status on joining ODP has been held up by US agency objecting to USSR membership in terms of technology transfer. NSC must make decision soon. Dollars were spent based on USSR contribution; these need to be paid out

f) The schedule set up by PCOM relating Legs 113-136 to proposal due dates, field programs and drilling area needs to be rated by CEPAC (see attached schedule)

g) The December 1987 PCOM meeting will firm up 1989 planning. By that time CEPAC will need to have produced firm plans. Note that attached schedule shows proposals for 89 CEPAC due by Jan. 88. June 1, 1987 is NSF deadline for 88 field programs.

LDGO (Logging) Jarrard presented a detailed view of the types of logs now available and future developments such as high resolution dip meter surveys. Stressed were applications to seismic stratigraphy, in situ properties and new geochemical logging. Scientists need to plan on ~1.5 days for the logging of each hole for standard runs. They need to be familiar with the new ODP Logging Manual produced by the LDGO Borehole Research Group. Note that holes deeper than 400 m should be logged with standard tools. The ODP Technical Note no. 1 — Preliminary Time Estimates for Coring Operations — also refers to logging.

CONSIDERATION OF NEW PROPOSALS

Ten new proposals were in hand for consideration. Discussion and voting followed procedures outlined in the CEPAC minutes of the Ann Arbor meeting.

252/E: Loihi Seamount, Staudigel et al. (Flower)
In general good idea. Is Loihi too close to Hawaii? Is it a separate source to plume? Is it simply a flank system? Important petrology and geochemistry objectives.

256/E: Queen Charlotte TF and OCZ, Hyndiman et al. (Scholl)
Study motion of slivers along BC/Pacific margin. Local interest only; problems with biostratigraphy and complex structure.

257/E: Farallon Basin, Lawver (Mammerickx)
Discussion deferred until total Gulf of California package can be discussed at July meeting

260/D: Ogasawara Plateau, Saito et al. (Sliter)
Complex proposal with many diverse objectives. Seamount chain evolution? Not enough length to test! History of K reefs? Could be done on other guyots. Subduction-collision tectonics. Consensus: needs focusing and redefinition.

262/E: Old Pacific, Larson and Lancelot (Jenkyns)
Based on Legs 61 and 89 and with expectations of new MCS work in 87 and 88 hopes for funding and drilling Mesozoic Pacific Ocean. CEPAC discussion of high merit; still want to see results of surveys before final prospectus.

263/E: Southern Explorer Ridge, Scott et al. (Francheteau)
Axial ridge drilling (like EPR?) 3-hole experiment in slower spreading and shallow ridge. Close to US-Canadian faults. Not as well-surveyed as EPR.

267/E: Aleutian Pyroclastics, Stix (Scholl)
Not a program for D/V Resolution

259/E: Meiji Sediment Drift, Keigwin (Sancetta)
A preliminary proposal that can be folded in NorPac gyre studies in package. Perhaps as one hole. Questions as to what is wrong with Site 192 record.

267/F: Old Crust at Convergent Margins, Langmuir (Flower)
Long discussion on utility of such geochemical reference holes. Flower believes Mariana is place to go. Proposal points to ARGO abyssal plain (an Indian Ocean site), the Bonins (BO-8) a WPAC site and others. Proposers want multiple re-entry in Old Pacific in M-series near Mariana and Bonins.

270/F: Tomographic Imaging, Nobes et al. (Davis)
Not actually a proposal in normal sense. Experiment needs to be done on another dripping program: new holes + 504B? Not voted on but CEPAC endorses general idea.

Note: 271/E Paleoceanographic Transect of Cal. Current and 275/E Gulf of California were late arrivals and will be considered at the July meeting. 270/F not voted on. 257/E deferred until GOC discussed.

VOTING ON NEW PROPOSALS

Results of the voting according to CEPAC procedures:

Voting Record, CEPAC Meeting, March 31, Northwestern											
262/E	2.0	1.0	1.0	1.5	1.5	1.5	1.0	2.0	2.0	2.0	**1.55**
252/E	2	2.5	1.5	2.5	2.5	2.0	3.0	3.0	1.0	1.5	**2.15**
259/E	1.0	2.5	2.0	3.0	1.5	2.5	2.0	3.0	3.0	2.0	**2.25**
267/E	3.0	3.0	3.0	2.5	2.5	2.6	2.0	2.5	1.0	2.5	**2.45**
260/D	3.0	3.0	2.5	3.0	3.0	3.5	2.0	3.0	1.0	2.5	**2.65**
263/E	4.0	2.5	2.0	3.0	-	3.6	3.0	3.0	2.5	3.0	**2.94**
256/E	4.0	2.5	3.0	4.0	-	3.5	4.0	3.0	4.0	3.0	**3.44**
269/E	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	**3.95**

CONSTRUCTION OF AN INITIAL PROSPECTUS

Before proceeding the Chairman emphasized that we need a prospectus for PCOM meeting in August. In view of the history of WPAC prospectus development we (and PCOM) must realize that for the next year prospectuses will evolve (see attached Executive Summary that went to PCOM on April 6th). Many points need to be clarified, proposals are still coming in and site survey status is still vague for many proposals.

Scholl made a motion that before proceeding we should discuss and re-vote on all older proposals that received a rating of less than 3.0. Discussion followed and the vote on the motion was: 9 against, 1 for. The motion was not carried.
The Initial Prospectus decided on is attached.

OUTLINE OF INITIAL TENTATIVE PROSPECTUS FOR CENTRAL AND EASTERN PACIFIC DRILLING

(not priority ranked)

Program	Proposals	Notes	CEPAC "Watchdog"
Juan de Fuca	232/E	Probably one Leg	E. Davis
EPR at 13°N	76/E	Question of doing this on sequential legs or in 504B style unresolved	J. Francheteau
Guyots (Cret. Drowned Atolls)	203/E 202/F	Presently as "package"; probably 2 Legs	M. Flower
Old Pacific	252/E	History indicates probably 1 Leg	H. Jenkyns
Ontong Java Plateau	142/E 222/E	Presently a "package"; possibly 2 Legs with one in WPAC schedule	S. Schlanger
North Pac	199/E 231/E 259/E	Presently a "package" of undetermined length	C. Sancetta
Bering Sea	195/E 182/E 225/E	Presently a "package" of undetermined length	H. Schrader
Young midplate "hotspot" volcanism	252/E	Presently a "package"; Loihi SM (252/E) and other expected proposals	M. Flower
Cascadia convergent margin	233/E 237/E	Presently a "package"	D. Scholl
Shatsky Rise	253/E	Probably a Leg	W. Sliter

Notes:

- Gulf of California and expected SOPAC proposals have not yet been considered.
- This outline prospectus is not to be viewed without consideration of preceding material.
- This outline prospectus will be subject to possible major modifications.

ACTIONS AND PROCEDURES AS FOLLOW-ON AND IN PREPARATION FOR FUTURE MEETINGS OF CEPAC AND OTHER ODP GROUPS

1. Watchdogs have been assigned to proposals and packages on Initial Prospectus. They are now responsible for:
   a) Preparation of these for formal Initial Prospectus that Chairman will coordinate for transmission to PCOM for the August meeting (see sample in CEPAC Mar. 13 memo).
   b) CEPAC people who discussed recent proposals should prepare a letter to be sent to proponents explaining status of their proposals. Chairman will coordinate and send these letters. Watchdogs need to prod proponents of programs for up-to-date site survey products and prospects. The Chairman will write to proponents of older proposals.
2. The Chairman will be responsible for writing the preface to the Initial Prospectus explaining the arguments for the program. At the time we are not limited to 9 Legs in our minds.
3. Cheril Cheverton (NU CEPAC secretary) will mail WPAC 3rd Prospectus as a guideline document to all panel members.

NOTES, CONCLUSIONS AND ITEMS FOR NEXT MEETING

1. We need to review problem of Chile Triple Junction program.
2. We need to review timing of the drilling program on the EPR at 13.° N.
3. We need to crystallize OJP plans because one OJP Leg will be drilled in middle of WPAC program (between Legs ~6 and 7).
4. We need to consider place of new enthusiasm for geochemical reference holes in the CEPAC program.
5. Proposal 221/E (Equat. Pac. Paleoenvironment) needs to be looked at (will someone remind me why this is to be done?)
6. Flexure proposals, i.e., Hawaiian moat, need to be especially tracked. Schlanger has written to Watts about the Hawaiian moat problem.
7. The annual PCOM/Panel Ch meeting will be 30 Nov - 4 Dec. We should have a fairly evolved Prospectus by that time, after our next 2 meetings. By Dec. 1988 the program we have will be regarded as firm by PCOM.
8. Rotation of members (Mammerickx off) and new members.

NEXT MEETING

Our next meeting is *planned* for July 2 and 3 in Paris. Francheteau will host. Schlanger will write to Pisias requesting meeting. Our Fall meeting is planned for Oct. 6 and 7 in Menlo Park, California (Scholl will host).

EXECUTIVE SUMMARY*
CENTRAL AND EASTERN PACIFIC PANEL MEETING

March 30 and 31, 1987
Northwestern University, Evanston, IL

The basic thrust of the meeting was the preparation of an Initial Prospectus (see attached) for transmission to PCOM by the end of April.

- Presentations, discussions and decisions emphasized:
  1) LITHP, SOHP and TECP thematic priorities to be considered in subsequent discussions of prospectus preparation.
  2) PCOM request to identify CEPAC programs that could be drilled withing the WPAC program.
  3) The need to keep the CEPAC prospectus open in order to accommodate expected proposals and site survey prospects and results.
- New proposals were reviewed and rated in view of previously considered proposals. Both sets were then used to prepare the Initial Prospectus. This prospectus must be viewed with the following points in mind:
  1) Gulf of California proposals were not received in time to be considered. These will be taken up during a proposed CEPAC meeting in July; GOC drilling may be added to a later prospectus.
  2) The question of the drilling schedule for the EPR at 13°N program remains open. Decisions are needed to determine whether this program should be drilled as a set of sequential Legs of drilled int he 504B style.
  3) The "Hawaiian flexure" proposal is not presently in the Initial Prospectus because serious questions arose at the joint CEPAC/SOHP meeting at Ann Arbor, Oct. 1986, concerning the dating of the sedimentary section to be drilled. CEPAC endorses the idea of flexure drilling but will need a new proposal to consider.
  4) CEPAC endorses the idea of geochemical reference holes but notes that the proposal in hand (267/F) has as its targets the Argo abyssal plain, an Indian Ocean program, and the Bonins (BON-8), a WPAC site. Other sites are still general; the subject will be discussed further at the next CEPAC meeting.
  5) The proposal (270/F) to carry out Tomographic Imaging of a Hydrothermal Circulation Cell is of interest but needs further study.
  6) One Ontong Java program can be drilled between Legs 6 and 7 of WPAC.

The next meeting of CEPAC is proposed for July 2-3 in Paris to be followed by a meeting in Menlo Park Oct. 6-7. At each of these meetings the CEPAC prospectus will be reviewed and revised as site survey status develops and as thematic panel objectives and new proposals are considered.

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* PCOM demanded an Executive Summary by April 6th. This was sent with prospectus to Pisias and Coulbourn.

CEPAC ITEMS FOR LITHP*

1) Further development of "flexure" proposals. The "Hawaiian Flexure" proposal is presently unsatisfactory because of problem of chronostratigraphy of sediment section to be drilled. Are there any other places that will serve? Can the community come up with a new proposal.

2) What is LITHP attitude towards the timing of EPR drilling? Is it necessary to drill entire program as sequential Legs or, because of schedule constraints (CEPAC is reluctant to assign 3 Legs out of 9 to EPR in this circumnavigation) and further technological advances, should this program be done on a 504B basis?

3) LITHP should note that the CEPAC Initial Prospectus (see attached Executive Summary) constrains many of the objectives described in LITHP "white paper" presented in the CEPAC meeting of March 30-31, 1987.

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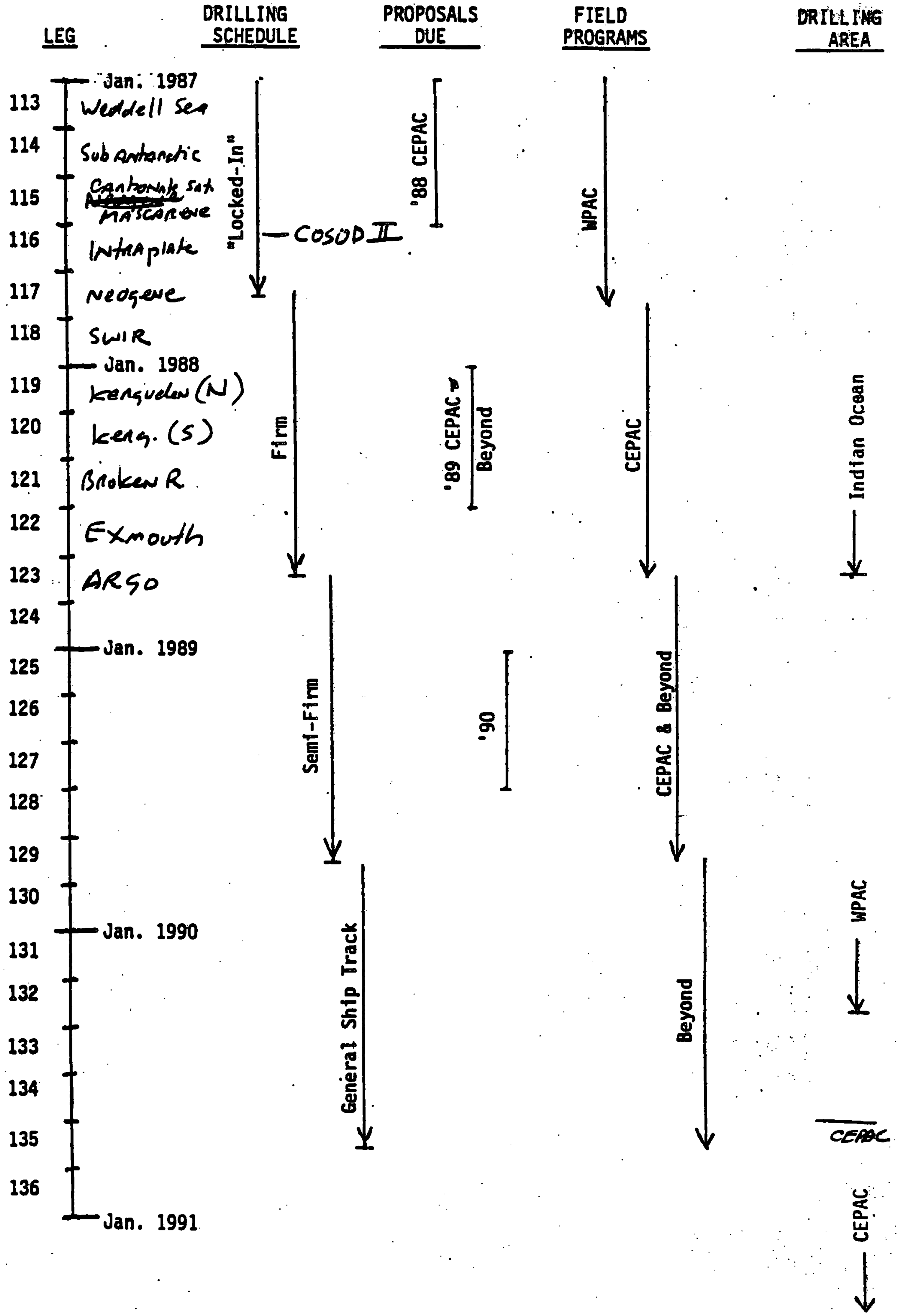
* At Batiza's request I supplied him with these notes for LITHP meeting in early May.



LEG
DRILLING SCHEDULE
PROPOSALS DUE
FIELD PROGRAMS
DRILLING AREA
Jan. 1987
113 Weddell Sea
114 Sub Antarctic
115 Mascarene
116 Intraplate
117 Neogene
118 SWIR
Jan. 1988
119 Kerguelen (N)
120 Kerg. (S)
121 Broken R
122 Exmouth
123 ARGO
124
Jan. 1989
125
126
127
128
129
130
Jan. 1990
131
132
133
134
135
136
Jan. 1991
"Locked-In"
COSOD II
Firm
Semi-Firm
General Ship Track
'88 CEPAC
'89 CEPAC → Beyond
'90
WPAC
CEPAC
CEPAC & Beyond
Beyond
Indian Ocean
WPAC
CEPAC
CEPAC

CENTRAL AND EASTERN PACIFIC DRILLING PROPOSALS:

#	THEME/AREA	AUTHOR(S)	RECEIVED (bold=last version)
2/E	Middle America trench and Costa Rica margin	(Crowe & Buffler)	12/82
3/E	Flexural moats, Hawaiian Islands	(Watts et al.)	**11/85**
4/E	Tuamoto Archipelago (French Polynesia)	(Okal et al.)	6/83
8/E	Southern Chile trench	(Cande)	9/83
9/E	Pre-Messinian hist. of the Mediterranean	(Hsu et al.)	1/84
14/E	Zero age drilling: EPR 13^{o}N	(Bougault)	1/84
34/E	Pacific-Aleutian-Bering Sea (Pac-a-bers)	(Scholl & Vallier)	2/84
37/E	Costa Rica, test of duplex model	(Shipley et al.)	**8/84**
75/E	Gulf of California	(K.Becker et al.)	8/84
76/E	EPR: oceanic crust at the axis	(Francheteau & Hekinian)	11/84
84/E	Peru margin	(Kulm & Hussong)	9/84
123/E	Studies at site 501/504	(Mottl)	12/84
124/E	To deepen Hole 504B	(LITHP -K.Becker)	1/85
142/E	Ontong-Java Pl.:Equat. Pacific depth trans.	(L.Mayer & Berger)	4/85
153/E	Three sites in the SE Pacific	(J.Hays)	7/85
182/E	Sounder Ridge, Bering Sea: Stratigraphy	(Taira)	8/85
192/E	Baranoff fan, SE Gulf of Alaska	(Stevenson & Scholl)	10/85
195/E	Bering Sea paleo-environment & -climate	(Sancetta)	12/85
199/E	N.Pacific: Pelagic sedim in subarctic gyre	(Janecek et al.)	12/85
202/E	N.Marshall Isl. carbonate banks	(Schlanger)	12/85
203/E	Guyots in the central Pacific	(Winterer et al.)	12/85
207/E	Bering Sea basin & Aleutian ridge tectonics	(Rubenstone)	1/86
210/E	NE Gulf of Alaska: Yakutat cont. margin	(Lagoe & Armentrout)	1/86
212/E	Off northern & central California	(Greene)	1/86
213/E	Aleutian subduction: accret. controlling p.	(McCarthy & Scholl)	1/86
214/E	Central Aleutian forearc:Trench-slope break	(Ryan & Scholl)	1/86
221/E	Equatorial Pacific: L.Cenozoic paleoenviron	(Pisias et al.)	3/86
222/E	Ontong-Java Pl.: Origin, sedim. & tectonics	(Kroenke et al.)	3/86
224/E	Escanaba trough (Gorda Ridge), NE Pacific	(Fisk et al.)	4/86
225/E	Aleutian Basin, Bering Sea	(Cooper & Marlow)	4/86
227/E	Aleutian Ridge, subsidence and fragment.	(Vallier & Geist)	5/86
229/E	Bering Sea, Beringian cont. slope & rise	(Cooper et al.)	5/86
231/E	North Pacific magnetic quiet zone	(Mammerickx et al.)	5/86
232/E	N.Juan de Fuca R.: High temp.zero age crust	(E.Davis et al.)	5/86
233/E	Oregon accr. complex: Fluid proc. & struct.	(Kulm et al.)	5/86
234/E	Aleutian trench: Kinematics of plate cover.	(von Huene et al.)	6/86
236/E	N.Gulf of Alaska	(Bruns et al.)	6/86
237/E	Active margin off Vancouver Isl., NE Pac.	(Brandon & Yorath)	6/86
241/E	Gulf of Alaska (Yakutat block) & Zodiak fan	(Heller)	6/86
245/E	Transform margin of California	(Howell et al.)	7/86
247/E	NE Pacific: Oceanogr.,climatic & volc.evol.	(Pisias et al.)	7/86
248/E	Ontong-Java Plateau	(Ben-Avraham & Nur)	8/86
249/E	Sedimentation in the Aleutian trench	(Underwood)	8/86
250/E	Navy fan, California borderland	(Underwood)	8/86

252/E	Loihi Seamount, Hawaii	(Staudigel et al.)	10/86
253/E	Shatsky Rise:Black shales in ancestr. Pac.	(Schlanger & Sliter)	8/86
254/E	NW Africa: Black shales in pelagic realm	(Parrish & Tucholke)	8/86
256/E	Queen Charlotte Transform fault	(Hyndman et al.)	9/86
257/E	Farallon Basin, Gulf of California	(Lawver et al.)	9/86
258/E	Stockwork zone on Galapagos Ridge	(Embley et al.)	10/86
259/E	Meiji sediment drift, NE Pacific	(Keigwin)	10/86
261/E	History of the Mesozoic Pacific Ocean	(Larson & Lancelot)	10/86
263/E	S.Explorer Ridge, NE Pacific	(Chase et al.)	11/86
269/E	Aleutian pyroclastic flows in marine envir.	(Stix)	12/86
271/E	Paleoceanogr. trans. of California current	(Barron et al.)	2/87
275/E	Gulf of California (composite proposal)	(Simoneit & Dauphin,eds)	3/87
277/E	Aseismic slip in the Cascadia margin	(Brandon)	4/87
278/E	Blanco transf. fault: Alter., layer three..	(Hart et al.)	5/87
279/E	Anatomy of a seamount:Seamount 6 near EPR	(Batiza)	5/87
280/E	Cretac.Geisha Seamounts & guyots, W-Pac	(Vogt et al.)	6/87

SOUTHERN OCEAN PANEL

Draft Minutes of 2-3 April 1987 meeting, Woods Hole

Participants

Peter Barker (Chair)	John Anderson	Helmut Beiersdorf (PCOM)
Brian Bornhold	David Elliot	Fred Frey
Rene Herb	Jim Kennett	Lucien LeClaire
Phil Meyers (SOHP)	John Mutter (LITHP)	
Suzanne O'Connell (TAMU)		Roland Schlich (IOP)

Apologies for absence from D. Futterer, K. Kaminuma, Y. Kristoffersen, P. Ciesielski, N. Shackleton, M. Fisk, L. Garrison.

1. The minutes of the last meeting, held 29-30 October at Univ. of Rhode Island, were approved.

2. <u>Reports of meetings of other Panels</u>

2.1 Beiersdorf reported on the January meeting of PCOM.

(a) Indian Ocean legs had been rescheduled because of technical problems with proposed SW Indian Ridge bare-rock drilling, impossible conditions imposed by Egypt for Red Sea drilling (and lack of Saudi response) and the downgrading of the Makran target. Now:

115 Mascarene Plateau carbonate dissolution
116 90E Ridge, intraplate deformation
117 Neogene package
118 SW Indian Ridge fracture zone
119 Kerguelen/Prydz Bay
120 Kerguelen
121 S 90E Ridge, Broken Ridge
122 Exmouth Plateau
123 Argo Abyssal Plain

Beyond lay W Pacific drilling. 9 targets had been identified by the W Pacific Panel, between the Great Barrier Reef and Kamchatka. South Pacific drilling would have to compete with existing CEPAC targets in the remainder of the Pacific. PCOM still has to finalise the W Pacific legs.

(b) The US Defence Dept. had objected to the Soviet Union joining ODP, and the matter is still under discussion.

(c) TAMU, LDGO logging and JOI had all had slight budget increases.

2.2 O'Connell reported from TAMU

Leg 114 had rotary drilled SA5, slightly E of the original site SA5C, to basement with 22% recovery, sampling 4.5 m of coarse IRD, 214 m of Eocene to Campanian ooze and 18 m of basalt.

At SA2alt the XCB core barrel had stuck at 500 m and the BHA had been lost. The cryogenic magnetometer was back aboard and working.

3. Leg 114 priorities and planning

The SOP wanted to know what had led to the resignation of John LaBrecque as co-chief scientist on Leg 114. Essentially, LaBrecque's interest in the leg was centred on basement at Site SA-5, which at the January PCOM meeting had been made the lowest prority site under circumstances which made it unlikely that basement would be reached. He felt this decision had been made too late, and on the basis of incomplete evidence.

It appears that several factors had contributed to the development of this situation:

(a) Site Survey had been undertaken very late. No panel had been able to pronounce on priorities from a complete knowledge of the site survey data. Thus, no panel had pronounced clearly and precisely, and PCOM was ill-informed at the outset.

(b) Because the SOP chairman (and immediate past chairman) were at sea on leg 113, PCOM had been asked to invite either Ciesielski or Bornhold as replacement, to its January 1987 meeting. Pisias (PCOM chairman) had invited Ciesielski despite his being a Leg 114 co-chief. Then however, PCOM had not sought SOP (ie. Ciesielski) opinion when discussing 114. SOP had recommended either an extension of 114 (impossible) or a moderate reduction of 2nd APC, logging and basement drilling, to keep intact the central aims of 114, and to retain 4 sites. SOP priorities were SA5, SA2, SA3, SA8.

(c) The PCOM minutes state that Larson (PCOM liaison at the last SOP meeting) and Robinson had proposed fewer, logged sites to basement (emphatically not SOP preference). SOHP priorities were requested (8,2,3,5) but SOHP chairman had no chance to point out that SOHP preference was also for 4 sites. TECP and LITHP opinion was not sought. The PCOM Minutes' description of SA5 ("a back-arc site of the same age as SA2") is incorrect.

(d) The significance of the 4 sites had been changed slightly by US State\Department insistence that they be located outside 200 mile range of South Georgia and the South Sandwich Is.

After discussion, SOP concluded that:

(a) Site Survey in sparsely-surveyed areas should be undertaken well ahead of time, so that the results can be properly assessed and sites carefully chosen. In areas of innate scientific interest but few data, USSAC should be encouraged to fund the more regional type of survey well in advance of the precise definition of drill sites.

(b) PCOM appears to have based its judgement on Leg 114 on inadequate information. It is most unfortunate that, having invited Ciesielski to Hawaii for its meeting, PCOM decided not to have him supply information about SOP priorities and the nature of the drill sites and objectives, before making its decisions.

(c) For legs in "frontier" regions, where drilling results are less predictable, it is necessary to leave some decisions to the co-chief scientists once appointed, rather than structure the leg to the extent that now appears common, at a late stage.

(d) The SOP should take great care in future to present PCOM with its priorities and opinions clearly and in detail, so that there can be as little doubt as possible as to what these are.

4. Report on Leg 113 - Barker and Kennett

(a) The scientific results are described in the draft Geotimes article (circulated at the meeting and to be attached to the final copy of these minutes).

(b) The drilling schedule was very optimistic; drilling was slower than indicated in the revised TAMU Tech Note 1, and no time had been allowed for equipment malfunction, ice etc. All sites were drilled, but only by drilling less at each site.

(c) SEDCO personnel were nervous about ice and poor visibility on passage, and the average speed was only 10 kts despite calm seas and slight or following winds for most of the leg. The presence of the ice support ship Maersk Master 2 or 3 miles ahead helped, so if no support ship is available for future high latitude legs even slower passage speeds might be attained.

(d) The ability of Maersk Master to tow icebergs of up to 12 million tons estimated weight was a considerable advantage; without it much more time would have been spent out of the hole or pulled to just below the mudline, waiting for bergs to move away.

(e) Because of the iceberg abundance at some sites, and SEDCO reluctance to let Maersk Master stray far, the program of magnetic survey aboard her was not very productive. The sediment trap study, which could be undertaken close to the drill ship, was probably more successful.

(f) 5 XCB and 2 APC corers failed, leading in 6 instances to loss of hole, with pipe trip. Only 2 of 6 scheduled logging runs (2 at each of 3 sites) were achieved. The logs would be useful, but had not produced any spectacular results as yet. One logging tool (gamma, caliper, resistivity, sonic) was lost in Hole 696A when mud was pumped with the tool inside the pipe.

(g) No drilling time was lost for bad weather. The weather for most of Leg 113 was calm, but even in the rougher seas of the final 3 weeks the only adverse effect was poor APC core quality in the uppermost ca. 40 m, where the BHA was not fully supported. It is clear that with correct precautions ODP can plan high latitude legs confident in the knowledge that the sea ice distribution is the only strict limitation.

5. Kerguelen Working Group

The WG had met in College Station in mid-March. Although the WG reports directly to PCOM, the SOP considered that its report could and should be reviewed at this meeting: 2 WG members also SOP members were present, as was Roland Schlich, and many of the lessons learnt on Leg 113 were relevant to Legs 119 and 120.

Anderson and Elliot reviewed the WG report.

(a) Prydz Bay drilling had received unanimous WG support as a high priority. Additional, parallel seismic lines had been received from Australia (via Falvey) and it was hoped that PPSP would approve the drilling. A seismic stratigraphic interpretation of the newly available profiles would be useful in assessing where to locate the first hole to be drilled. Based on Leg 113 results, the early Neogene, Paleogene and latest Cretaceous were the highest priority targets at Prydz Bay; the PPSP review should aim to provide the co-chiefs with the maximum flexibility to attack them.

(b) The ice window for Prydz Bay and the best drilling time for N Kerguelen overlapped. The WG concluded that the Prydz Bay window was critical, and had reorganised the drilling to minimise the damage to the remainder of the drilling from the bad weather likely later in the season.

Mutter described basement objectives, which had been re-emphasized at LITHP request. 200 m penetration into basement was planned at Site SKP-4A. Hypotheses for the origin of abnormally thick-crusted non-hotspot features within oceanic lithosphere (of which Kerguelen was one of the largest) would be tested. 50 m basement penetration is planned at 4 other sites.

There was general SOP approval for the recommendations of the Kerguelen WG. Since its meeting, however, TAMU had revised upward the drill time estimates for the 2 legs. Also, Leg 113 experience showed that transit times using faster speeds than 10 kts would be over-optimistic. The revised leg lengths were now therefore 70.3 and 67.1 days. Schlich reported that the IOP had proposed to reduce the total time required by eliminating the paleodepth transect component (Site SKP-8).

The SOP was asked to prioritise the four main component objectives of the 2 legs (mainly-Cenozoic latitudinal transect, paleodepth transect, basement, Mesozoic stratigraphy/evolution of the Kerguelen Plateau) by each member allocating 3 votes among a range of options for cutting time (ie. sites). The result was a very strong preference for cutting the time being allocated to the Mesozoic stratigraphy and structure (Sites KHP3 and SKP3, both re-entry sites). Since latitudinal gradients were smaller during the Mesozoic, it was not so important to drill the basal section at both sites. Further, since the deeper section at KHP-3 was probably duplicated on Broken Ridge, SKP-3 had a higher priority than KHP-3.

The priorities of the other three objectives were rated equally high.

SOP was anxious to make clear that all the Kerguelen objectives were important, and as usual the science in the Southern Ocean was being constricted by the environmental difficulties. However, PCOM should note an earlier point made by Schlich that N Kerguelen would probably be better drilled in June than in April, because the winds were less strong then. Schlich pointed out that other concerns were the start date for Leg 119 (in relation to the ice window at Prydz Bay and the weather window in N Kerguelen) and the length of time for which an ice support ship would be required (particularly if the USSR membership funds did not become available).

Discussion then centred on the mixing of objectives between the 2 legs. The Kerguelen WG had mixed the sites deliberately so as to encourage collaboration between the shipboard parties, although Leg 119 was dominantly Cenozoic latitudinal transect (including Prydz Bay), while 120 had dominantly basement and deep stratigraphic targets. Barker argued that it was better to give those concerned with a particular objective control over all of their resources (sites) rather than leave some as hostages in the camp of the other leg, which would have other prime interests. Both legs are tightly scheduled, so that sites or parts of sites may well have to be sacrificed during the legs, and it was important that the decision as to what should be sacrificed should not be made too easy. Schlich pointed out that the weather window was a constraint on swapping sites between legs, and that the WG had been told the ship could not carry sufficient cones for 3 re-entry sites on one leg.

After further discussion, Schlich proposed the following strategy;

LEG 119	
KHP-1	7.3 days
SKP-8	6.4 days
SKP-6A	5.7 days
PB1-4	14.0 days
KHP-3	set cone and start
Transit	26.7 days
Total	65.0 days

Leave Mauritius no later than 15 December to reach Prydz Bay no later than 15 January. Drill SKP-6B if Prydz Bay inaccessible. If KHP-1 is going well, deepen it further (minicone) as alternative to KHP-3, then drill KHP-4 for deepest part of the section.

LEG 120	
KHP-3	deepen as time allows
SKP-1	5.3 days
SKP-4A	12.5 days
SKP-2	7.1 days
SKP-3	11.4 days
transit	22.0 days
TOTAL	65.0 days

This minimises the length of time for which an ice support vessel is needed (Schlich considers only needed for SKP-8, 6A and PB1-4).

This strategy, which accommodates the SOP view that the paleoceanographic objectives were paramount but that deep stratigraphic objectives have a slightly lower priority, was approved by SOP. The timing (leave Mauritius no later than 15 December), which is optimal for Prydz Bay and not too sub-optimal for N Kerguelen, was very important.

Knowledge of the ice disposition in Prydz Bay is crucial to the success of Leg 119. Elliot will investigate the likely Division of Polar Programs response to an ODP request for ice reconnaissance by C-130 flying out of MacMurdo (possibly via South Pole). The ice conditions in which drilling would be possible are such (from Leg 113 experience) that satellite ice forecasts are unlikely to be sufficiently informative.

Requests for re-affirmed and addtional co-chief nominations produced:

Barron (119), Wise (120), Webb, LeClaire, Eittreim (119), Elliot (119), Thierstein, Wannesson (119), Malmgren.

6. TEDCOM had requested that panels consider their technology and engineering priorities, in particular what problems might be addressed through riser drilling. After discussion, SOP concluded that their main priorities were:

(a) Much better recovery than now possible in depths immediately below present APC operation, and in sequences of alternating hard and soft sediment.

(b) Good recovery of unlithified and semilithified coarse clastic sediments (sand).

(c) Elimination of the other problems of drilling sand, such as caving down hole.

SOP did not consider riser drilling a high priority for high southern latitudes. Further, SOP was concerned about the likely effects on high latitude drilling of a riser phase of drilling. It seemed likely that riser drilling would lead to much more time being spent at very few sites, and that none of these would be in high latitudes (because of the tendency existing at present to drill problems in lower latitudes if at all possible, and because of ice and weather windows). SOP was therefore actively opposed to the development of riser drilling.

PCOM chairman had requested that a SOP representative attend the next TEDCOM meeting in early May to present the SOP view. Given the nature of that view, SOP considered that a written submission would be sufficient.

7. Southern Ocean drilling and COSOD II

The final document of COSOD I had been extremely influential in guiding drilling plans in the succeeding years. High latitutde drilling had been highlighted by COSOD I, which had influenced the choice of a new platform and ensured that 4 Southern Ocean legs would be drilled. The SOP constituted the main formal body which might be considered to be guarding the interests of further studies in the Southern Oceans. What should be its response, considering the 5 topics being discussed, the approach being taken by each Working Group, and the stage which had been reached?

SOP reviewed the topics

1. Global environmental changes
2. Mantle-crust interactions
3. Fluid circulation and global chemical budgets
4. Brittle and ductile deformation of the lithosphere
5. Evolution and extinction of oceanic biota

It was considered that the topics did not dovetail perfectly to cover the entire field of what might be accomplished by drilling, but that each was of considerable interest.

In the past, because of the tendency to drill elsewhere those problems which could be drilled elsewhere, SOP activity had lain almost completely within (1) and (5). Although at present only 1.5 of the 4 Southern Ocean legs scheduled had been drilled, there seemed little doubt that the importance of Southern Ocean data to models of the global paleo-environment and of biotic evolution will continue to be high. SOP should ensure that this continued importance was acknowledged by the WG.

For some of the other WG, it was not easy to see what the emphasis would be. (2) for example, could decide that the important processes were all small-scale, and could therefore be studied at only a few sites in logistically more convenient locations than the Southern Oceans. On the other hand, the Southern Ocean does contain some features (the ensialic back-arc basin on Bransfield Strait and the 'cold spot' south of Australia, for example) perhaps sufficiently interesting to attract its attention. Similarly, the ridge crest - trench collisions of Southern Chile, the Antarctic Peninsula and South Scotia Ridge constitute more than half of the world's modern examples of this poorly known process, and would be suitable for consideration by WG(4).

- Given the diversity of the topics, and given SOP's imperfect knowledge of the approach of individual WG, a SOP "White Paper" similar to those being prepared by ODP thematic panels seemed inappropriate. SOP should submit a short document to each WG, but individual members were encouraged to write also. It was suggested that a SOP representative could usefully make a brief presentation during the opening, plenary session.

8. South Pacific Workshop, Gainesville April 1986

The Report of this Workshop contained a large number of proposals at varying stages of immaturity. In November 1986 the JOIDES Office at OSU, Corvallis had written to all named proponents to remind them that only mature proposals could be considered by the ODP panel structure, and urging them to upgrade their proposals as necessary and submit them. In practical terms, since PCOM has accepted the provision of 9 legs for W Pacific drilling, the earliest opportunity for S Pacific drilling was now probably in 1990-91, as a component of Central and Eastern Pacific drilling. Nevertheless, for S Pacific proposals to be considered for inclusion within such a programme, they would have to be submitted soon.

Only four mature S Pacific proposals could be identified at present:

1. Ross Sea. 2. Wilkes Land margin. 3. Chile triple junction. 4. Bounty Trough.

None of these was spawned by the Workshop. Of those which were first presented at the Workshop, a small number appeared to be of sufficient potential merit to be capable of pulling the drill ship south. SOP chairman was asked to contact the proponents of these to encourage them further. It was pointed out that for some (the proposed N-S transect of the E Pacific Rise flank for example), the immediate requirement was for broad regional survey data: although the merits of the proposal could be recognised, it could not even reach "maturity" as presently defined without some additional survey.

9. Panel membership

John Anderson has resigned. J. Weissel was being sought as a member of the Indian Ocean Panel. SOP proposed S.W. Wise (FSU) and A. Cooper (USGS) as replacements.

10. Next meeting

SOP should meet at least a month before the end-of-year PCOM meeting. D. Elliot invited SOP to Columbus, Ohio and would investigate possibilities in October. The main business should be review of S Pacific drilling proposals, which by then would be urgent. SOP hoped that it would not have to discuss Kerguelen/Prydz Bay again, but the meeting would be available to consider last-minutes revisions should these be necessary.

Southern Ocean Panel meeting, Woods Hole 2-3 April 1987
Brief Executive Summary

(Tabled at 10-12 April PCOM meeting, Washington)

1. SOP discussed events surrounding LaBrecque's resignation as co-chief scientist on Leg 114. Lessons to be learnt include:

(a) Site Survey should be undertaken much farther ahead of drilling so that panels can make informed judgements of priorities. Regional surveys of poorly known but innately interesting regions should be encouraged even farther ahead.

(b) PCOM appears deliberately to have avoided seeking information about SOP priorities for Leg 114 from its representative, because he was also a Leg 114 co-chief. PCOM should perhaps reconsider its approach to such situations.

(c) SOP should take care to present PCOM with its opinions and priorities clearly and in detail.

2. Leg 113 drilling experience is pertinent to future Southern Ocean legs, particularly

(a) Drilling was slower than in the revised TAMU TN1: all sites were drilled only by drilling less at each.

(b) SEDCO was nervous about ice and poor visibility on passage, and the average speed was only 10 kts despite good weather and following seas. Having Maersk Master 2-3 miles ahead helped, so passage could be slower if no ice picket ship is used.

(c) Maersk Master's ability to tow icebergs of up to 12M tons saved us much time out of the hole or pulled to just below the mudline.

(d) Because of bergs and SEDCO reluctance to let her stray far, Maersk Master's magnetic survey programme was not very fruitful. The sediment trap work, which could be carried out locally, was better served.

(e) 5 XCB and 2 APC cores failed, leading to hole abandonment 6 times and preventing logging twice. One logging tool was lost when mud was pumped with the tool in the pipe.

(f) No drilling time was lost for bad weather. With correct precautions ODP can plan high latitude legs happy that sea ice distribution is the only strict limitation.

3. Kerguelen Drilling

Despite the Kerguelen WG's brief to report directly to PCOM, SOP reviewed its latest proposal, in light of Leg 113 experience and because TAMU had since revised drilling times upward, making a cut necessary.

(a) SOP approved K-WG objectives and sites generally. Using new drilling times and 10 kts transit, times were 70.3 days for 119 and 67.1 days for 120, too long.

(b) SOP ranked the 4 main objectives
1. Latitudinal transect (incl. Prydz Bay)
2=. Paleodepth transect and basement
4. Deep (Mesozoic) stratigraphy

in order to see where time could be cut. Further, it decided the northern KHP-3 of the deep stratigraphic sites was less important than the southern SKP-3, since Broken Ridge probably duplicated the KHP-3 deep section and N-S gradients were in any case lower in the Mesozoic, making 2 complete sites less necessary.

(c) SOP approved a revised proposal giving 2 65-day legs as follows

LEG 119:	KHP-1	7.3 days
	SKP-8	6.4 days
	SKP-6A	5.7 days
	PB1-4	14.0 days
	KHP-3	set cone and start drilling
	transit	26.7 days
	TOTAL	65.0 days

Leave Mauritius no later than 15 December to reach Prydz Bay no later than 15 January. Drill SKP-6B if Prydz Bay inaccessible. If KHP-1 goes well, perhaps deepen it further (minicone) as alternative to KHP-3, then sample deeper section in KHP-4.

LEG 120:	SKP-1	5.3 days
	SKP-4A	12.5 days
	SKP-2	7.1 days
	SKP-3	11.4 days
	KHP-3	deepen as time allows
	transit	22.0 days or less
	TOTAL	65.0 days

This strategy minimises the time for which an ice picket ship is needed (Schlich says needed only for SKP-8, -6A, PBI-4), minimises passage time, incorporates the lower priority for KHP-3. December 15 departure from Mauritius is optimal for Prydz Bay, sub-optimal for N Kerguelen.

(d) Prydz Bay ice information is crucial for 119. Perhaps NSF Division of Polar Programs will sanction C-130 reconnaissance: Elliot enquiring.

(e) Revised co-chief list: Schlich (120), Barron (119), Wise (120), Webb, LeClaire, Eittreim (119), Elliot (119), Thierstein, Wannesson (119), Malmgren.

4. SOP technical priorities for TEDCOM were

(a) better recovery directly below present APC depths and in alternating hard/soft sediment.

(b) good recovery of sandy sequences and protection against sand-induced hole collapse.

SOP considered riser drilling malignant, since it would lead to even less time being spent on high latitude drilling, and actively oppose it.

Given these priorities, SOP consider a written submission to TEDCOM will suffice, and attendance of a SOP representative is unnecessary.

5. SOP will not submit a "White Paper" to COSOD II but will convey its views to Working Groups. A SOP representative should seek to address an early plenary session.

6. SOP will follow JOIDES Office in seeking S Pacific proposals from USSAC Workshop proponents for review at its next meeting, so that PCOM can consider their place in the program after W Pacific drilling.

7. J. Anderson has resigned from SOP and J. Weissel is being sought as an IOP member. SOP nominates S.W. Wise (FSU) and A. Cooper (USGS) as replacements.

8. SOP should meet next a month before November PCOM meeting, possibly at Inst. for Polar Studies, Columbus, Ohio.

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Atlantic Regional Panel Final Minutes: Executive Summary
April 2-3, 1987
Woods Hole Oceanographic Institution, Woods Hole, MA

The ARP had several drilling proposals on its agenda for review, but most of the members felt that it would be appropriate to spend time first on a group consideration of the members' regional/thematic interests in order to develop a viable context for the future consideration of such proposals. Each member was then asked to summarize his personal perspectives on important "Atlantic" problems and the best place(s) to consider their study/solution. The group then summarized and grouped these opinions under a number of major "Atlantic" topics. What follows probably constitutes the ARP's first (only?) attempt at outlining a "white paper".

Topics:

I. Continental Break-Up

A. Sequences of tectonic events (including the effects of episodes of vertical tectonism and the evolution of sedimentary sequences), e.g.'s various (conjugate and non-conjugate) passive continental margins: Galicia (tectonics) and Cape Basin (sediments).

B. Mechanisms of continental crust deformation and extension during rifting, e.g. Galicia.

C. Development, evolution and re-integration of (continental) microplates, e.g Rockall-Hatton-Greenland.

D. Magmatic events and their evolution (pre-, syn- and post-separation), e.g.'s selected (sediment-starved) margin features: J-Anomaly Ridge and Madeira-Tore Rise.

E. Identifying asymmetries in crustal structure across conjugate passive continental margins, e.g. Galicia-Newfoundland.

F. Ocean-continent boundary structure and evolution, e.g.'s a variety of passive margins of different age and structure: particularly Galicia-Newfoundland.

G. Sheared continental margins, e.g. Gulf of Guinea.

II. Evolution of Oceanic Lithosphere

A. Slow-spreading ridges, including their deformation, hydrogeology and the history of magma chambers, e.g. Kane FZ/MARK area.

B. Transform-ridge discontinuities, e.g.'s large-offset equatorial Atlantic FZ's.

C. Cretaceous-Cenozoic intraplate volcanism, e.g. Venezuelan Basin.

D. Paired aseismic ridges, e.g. Walvis Ridge/Rio Grande Rise.

E. Emplacement of ultramafics into oceanic crust, e.g. MARK area (Site 670).

F. Processes of aging in old oceanic crust; comparisons with ophiolites, e.g. Blake-Bahama Basin in vicinity of Blake Spur magnetic anomaly.

G. Seaward-dipping wedges*, e.g.'s Rockall-Hatton, SE Greenland. *ARP felt that this feature could have been listed under Topic I. as well.

III. Convergence and Collision

A. Continent-continent, e.g. Hellenic arc/Mediterranean.

B. Accretionary tectonics on thickly-sedimented oceanic lithosphere with normal convergence, e.g. Barbados.

C. Strike-slip convergent margins, e.g. North Scotia Ridge [continent-ocean], Azores-Gibralter Ridge [ocean-ocean].

D. Fore-arc basin evolution, e.g. Barbados.

IV. Paleoceanography

A. Gateways

--opening, e.g.'s from south to north: Agulhas FZ, Walvis Ridge/Rio Grande Rise, equatorial shear zone, Iceland-Faeroes Ridge, Davis Strait and others.

--closing, e.g.'s eastern Mediterranean, western Caribbean.

B. Circulation patterns.

1. History of deep circulation, e.g.'s eastern vs. western basins; northern vs. southern basins.

2. Upwelling, e.g.'s northwest Africa, southwest Africa.

C. Black shales.

1. Pelagic vs. terrestrial signals, e.g. Madeira-Tore Rise.

2. Distribution in space and time.

D. Deep Stratigraphic Tests and standard reference sections, e.g.'s every major Atlantic depocenter.

E. Initiation of glaciation--Arctic vs. Antarctic.

V. Eustatic Sea Levels Through Time

A. Timing and magnitude of eustatic sea level events, e.g.'s eastern U.S. and Canada, Cape Basin.

B. Controls on the sedimentary record: shelf/slope/rise/abyssal plain continuum, e.g.'s transects of various margins.

VI. Catastrophes

A. Impacts, e.g. Montaignais structure, Scotian shelf off Nova Scotia.

Consideration of Drilling Proposals

Following this (very productive) summary of its drilling interests, ARP moved on to a discussion of the four proposals submitted for its consideration. Three came directly out of the recent JOI-USSAC Black Shales Workshop convened by P. Meyers and M. Arthur: 254/A, pt. 1 (Tucholke), 254/A, pt. 2 (Parrish) and 255/A (Zimmerman/Herbin). The fourth (264/A) was submitted by Jansa and Pe.-Piper of Canada, and regards an interpeted impact structure discovered on the Scotian Shelf south of Nova Scotia. Motions regarding these proposals are summarized below. All statements were voted on by the panel, and all votes were unanimous.

I. 254/A, pt. 1 (Tucholke)

"ARP has discussed the black shale letter proposal by Tucholke and the panel plans to take concepts encompassed by this document into consideration during the development of a future Atlantic drilling program. ARP encourages the continued development of this broad statement of concepts into a more mature drilling proposal, incorporating the recommendations of the JOI-USSAC Black Shales Workshop and in conjunction with other researchers interested in the study of "black shales" in the Atlantic. The development of such a proposal, with supporting seismic reflection records necessary for the display of suitable drilling targets, will be welcomed by ARP."

II. 254/A, pt. 2 (Parrish)

"ARP encourages Tucholke and Parrish to revise and update their respective proposals, in particular consolidating the two into one, focusing on the space/time distribution of "black shales" in the eastern North Atlantic off Africa. In order to create a mature drilling proposal, objectives stated in the JOI-USSAC Black Shales Workshop should be incorporated, as should newer and better seismic data."

III. 255/A (Zimmerman/Herbin)

"ARP considers the Zimmerman/Herbin proposal an interesting target for black shale history and South Atlantic-Central Atlantic connections, but not relevant for understanding the evolution of sheared margins. ARP suggests that the proponents incorporate this proposal in a more comprehensive one targeting the Mesozoic black shale history in the equatorial Atlantic. As part of this proposal, better seismic lines in support of assigned drilling targets are necessary."

IV. 264/A (Jansa/Pe.-Piper)

"ARP is particularly pleased to see the proposal by Jansa/Pe.-Piper, which represents a novel and innovative new use of the Ocean Drilling Program. We view the proposal as reasonably mature, but still somewhat lacking in high resolution seismic reflection data. ARP strongly endorses continued utilization of industry seismic data and the acquisition of new seismic and geochemical data to support the contention that the Montaignais feature is an impact structure. ARP also endorses the presentation of this proposal as an example of a new type of ocean drilling initiative at COSOD-II."

Other Business

Summary of ARP-endorsed workshop activities:

1. South Atlantic Workshop: funded by JOI-USSAC and scheduled for April 6-8, 1987, at Woods Hole Oceanographic Institution. Convener: J. Austin. All preparations complete.

2. Caribbean Workshop: funded by JOI-USSAC and scheduled for November 17-21, 1987, in Jamaica (Discovery Bay). Convener: B. Speed. Austin will request that ARP hold its next meeting in Jamaica immediately following the workshop in late November.

3. Mediterranean Workshop: to be held in Europe (perhaps Greece) in October, 1988. Conveners: J. Mascle, with A. Maldonado (Spain) and Makris (Greece).

4. Central Atlantic Workshop: proposal not yet written, but Tucholke/Klitgord will either write it themselves or get someone to do it. ARP felt that this workshop should be held no later than late spring-early summer, 1988.

Panel Rotation

1. After next meeting, K. Klitgord plans to rotate off. Suggested replacements were J. Karson (Duke), J. Fox (U.R.I.) and H. Dick (W.H.O.I.).

Next Meeting

1. If the Jamaica meeting site and November,1987, timing are deemed unsuitable by PCOM, Austin will request Copenhagen, Denmark as an alternate. Time: mid-late March, 1988. H.-C. Larsen agreed to host that meeting.

Atlantic Regional Panel Final Minutes

On April 2 and 3, 1987, the Atlantic Regional Panel met at Woods Hole Oceanographic Institution, Woods Hole, MA. Brian E. Tucholke was our host. Attendance at the meeting was as follows:

ARP Members:

J. Austin, chairman
D. Sawyer
B. Tucholke
R. Speed
K. Klitgord (LITHP Liaison)
P. Meyers (SOHP Liaison)
C. Hemleben
J. Mascle
H. Okada
H. C. Larsen
F. Gradstein (alt. for L. Jansa)
D. Smythe (alt. for R. Whitmarsh)

Liaison:

J. P. Cadet, PCOM

Guests:

E. Taylor, ODP (Leg 108/Leg 110)
B. Bryan, WHOI (Leg 109)
H. Dick, WHOI

Day 1: April 2, morning

PCOM Report: Cadet

Summary of Hawaii (January 1987) Meeting

1. General administration

--Russian membership delayed by U.S.(NSC) reservations on transfer of technology aboard the drill ship. Resultant problems with budget (which included Russian contribution) may cause all planned drilling enhancements (i.e., drilling supplies, e.g. pipe, bits; development of riser drilling technology, maintenance of SEDCO crew levels) to be postponed/cancelled.

--Establishment of Budget Committee (BCOM) means standardization of PCOM meeting times.

--Panel membership (ARP): Sawyer replaces Mutter. Keen will probably replace Jansa next year.

--Panel meetings (U. von Rad motion): never less than once, but not more than twice without special permission. "Inactive" panels (e.g. ARP) should continue to meet at full strength, though. The ARP policy of developing a workshop schedule was endorsed by PCOM.

2. COSOD-II - Strasbourg, July, 1987

--Invitations are not yet "in the mail." There are nearly 450 applications from the U.S. for 150 spots. Considerably less pressure from France, Japan and other international partners.

--White paper preparation is going well. All technical (TAMU, IFREMER and DMP) and scientific (five thematic) papers should be complete by May 15.

--One of the most important topics will be consideration of a multi-platform ODP. White paper by IFREMER.

--Conference proceedings to be published in dedicated issue of Tectonophysics, and a special report.

--For ARP, one of the most important objectives for the long-term is to have a lot of targets ready well in advance. Those ARP members attending COSOD-II should begin to talk this up, perhaps using the forthcoming South Atlantic workshop document.

3. Technology Improvements

--Drilling through alternating hard and soft layers.(see PANCHM Meeting Report, below)

--Navidrill testing (Leg 114, Subantarctic South Atlantic)

--Pressure Core Barrel

--Improving packer systems (trouble during Leg 110)

--High-temperature drilling (e.g. along the EPR)

--Drilling through fractured rocks

--Developing a coring motor for bare-rock drilling

--Further guide base development (Leg 118, SWIR)

4. Sampling Strategy

--General concerns expressed with both shipboard and post-cruise sampling

--PCOM felt that both plans should be defined well in advance

--PCOM also asserted that shipboard sampling for non-shipboard investigators should be minimized, unless approved prior to drilling legs

Discussion of Indian Ocean Program

1. While discussing Leg 123 (Argo Abyssal Plain), ARP briefly discussed the issue/importance of "reference" holes. What petrology/ geochemistry needs to be done? It was noted that a meeting of TEDCOM will be held in late April-early May to address the

related questions of fly-in re-entry, riser drilling, etc. in preparation for COSOD-II. K. Klitgord will attend for ARP.

2. Indian Ocean problems: insufficient site surveys (and a continuous and perhaps in part consequent reorientation of drilling perspectives); strong weather constraints; politics (e.g., Red Sea).

Discussion of WPAC Program

1. Four core programs: Bonins, Japan Sea, Nankai Trough and Sulu/South China Sea. A total of 9 drilling legs. Back-ups are Great Barrier Reef, Vanuatu and Lau Basin, for a total of 13 legs. A cohesive program, largely the result of good liaison between the WPAC Panel and thematic groups.

2. For now, the PCOM is keeping a three-year limit on drilling in the Pacific. But the issues of WPAC/CEPAC balance, amount of time to be spent on the EPR, etc. are unresolved.

3. There should be a strong COSOD-II influence on this program.

PANCHM II Report: Austin

1. The Panel Chairmen (PANCHM) met for the second time just prior to the January PCOM Meeting in Hawaii.

2. The PANCHM agreed that the advisory system is working as well as can be expected, with the exception of PCOM liaisons. Improvements over the past year have included joint thematic-regional panel meetings and more effective panel-to-panel liaisons.

3. As requested by the PCOM, PANCHM made recommendations concerning the high-priority engineering goals of ODP. These included drilling and effective recovery through young, fractured rocks and alternating hard (i.e., chert) and soft formations. (Note: A complete list of these recommendations will form part of the PCOM minutes for the Hawaii meeting. See the JOIDES Journal.)

LITHP Liaison Report: Klitgord

1. LITHP is writing a white paper summarizing their perspectives right now. ARP eagerly awaits this document.

a. R. Detrick/J. Malpas putting this report together.

b. Six major ideas, inc. nature and interaction of oceanic spreading centers and transforms, aging of the oceanic lithosphere, the relationships of convergent margins and back-arc basins, geochemical mass balances and testing the ophiolite model for the formation of oceanic crust.

2. J. Mutter, ex-ARP member now on the LITHP, a strong spokesperson for ARP perspectives.

3. Kim's report led to a discussion of ARP's response to LITHP's statement of thematic objectives. Most felt that an ARP white paper was also necessary, perhaps a written response incorporating the results of the workshops which ARP has already endorsed (see Day 2).

SOHP Liaison Report: Meyers

1. SOHP has had little PCOM liaison, a persistent problem.

2. Major themes at present:

a. "Deep Stratigraphic Tests" (DST's): Fans, Somali Basin, Argo abyssal plain. Deep-penetration, rotary-coring with good recovery.

b. "Paleo-upwelling and Productivity" (PUP): HPC/XCB coring, multiple holes and very high stratigraphic resolution. Many regions of interest.

c. "High-Latitude Paleoceanography": Concentration on the Cretaceous and Neogene.

3. However, a white paper is not at present in the works. ARP urged Meyers to convey to SOHP its desire for such a comprehensive document as a future aid to planning.

Leg 109 Report: Bryan (Note: I summarize the co-chief's recommendations to ARP based upon his cruise experiences, not the leg itself. For such summaries, refer to the Preliminary Report and the JOIDES Journal.)

1. All engineering problems encountered on this leg can be solved, given sufficient time and money.

2. Unsupported bare-rock spud-ins on young oceanic crust are successful enough to warrant rethinking of the use of large, complex guide bases for work on mid-ocean ridges.

3. Coneless re-entry (Site 670) made possible by employing downpipe TV camera near drill-bit.

4. However, core recovery in these environments is still a major problem, as are hole stability and consequent sticking of the drill-string. Rubble appears to be both a natural product of the geologic environment and a result of drilling disturbance and downhole contamination.

5. Eight days of standard logging at Site 395 a complete success.

6. Recommendations:

a. Drilling jars must be stronger.

b. Design smaller, simpler guide bases, and use direct spud-in where feasible to save time and money.

c. Drill and occupy "zero-age" holes continuously and then leave for good, rather than waiting years to reoccupy a site in a tectonically active environment, where continuing hole stability is a real problem.

Science Operator's Report: Taylor

1. Leg 114 left the Falklands 2.5 days ahead of schedule because no fuel tanker arrived. The drill ship will refuel at sea.

2. Leg 115 co-chiefs: B. Duncan and J. Backman.

3. Leg 116 co-chiefs: D. Stow and J. Cochran.

4. Leg 117 co-chiefs: W. Prell and N. Niitsuma.

5. Leg 118 co-chiefs: P. Robinson and D. von Herzen.

6. In-house publications: Part A's: Legs 101/102 are out, 103 is in press, 104 is in review. Manuscripts for part B volumes are often late, and sample delivery is part of the problem.

7. Technological developments:

a. Leg 113 tested lockable flapper valve, which allows logging through XCB/HPC BHA without dropping the bit.

b. Leg 114 will test the Navidrill, which already works on land, where the weight on the drill bit is constant. This device should improve recovery in fractured basalt and alternating hard and soft formations.

c. Additional development of packers and pore-fluid samplers.

Leg 108 Report: Taylor (Note: As with Leg 109, refer to Preliminary Report and JOIDES Journal for a scientific summary of this leg. I concentrate only on this leg's scientific and technological recommendations for ARP. Jack Baldauf was invited as the staff scientist for this leg, but he could not attend.)

1. Technological developments:

a. Used "side entry sub" for the first time, in order to trip pipe without pulling the logging string. Unfortunately, logging tools failed.

b. In order to correlate complete stratigraphic sequences sampled by HPC, the shipboard party made both whole round magnetic susceptibility and compressional wave velocity measurements.

2. Scientific accomplishments:

a. Biostratigraphic resolution better than 60,000 yrs. in sections less than 2.8 m.y. old. Detailed enough to look at climatic vs. oceanographic forcing functions on upwelling and wind circulation/eolian sediment input in the eastern equatorial Atlantic.

b. Evidence for polar glaciations as a forcing function at ca. 2.8 m.y. B.P.

c. Slumps along flank of Romanche FZ at 1.9 m.y. B.P. may be related to periodic seismicity. Recognized both lithologically and biostratigraphically.

3. Recommendations:

a. HPC recovery ca. 98%, but much lower in sandy turbidite sections. Improvements are necessary here.

b. Used a small reentry cone, hinged so that it could be wrapped around and dropped down the drill string, for "fly-in" re-entry using a drill-string TV camera. These cones required little storage space, and should be used where re-entry is desirable in soft formations and time is short.

Leg 110 Report: Taylor (see note for Leg 108)

1. Technological developments:

a. Downhole logging objectives almost completely unsuccessful.

1.) Drill-in packer tested at two sites (671/675), pumped to pressure, and either never inflated at all or never seated. Completely ruptured when it came to the surface. (Perhaps it became partially inflated on the way down?)
2.) There was no "side-entry sub" made of the right alloy for the geologic conditions available on the ship. Consequently, hole stabilization prior to logging was a problem (e.g. only 20 m. was logged at Site 672).

b. Site 641 did not encounter overpressure at the depth of the seismically observed decollement, and previously observed overpressure may have been created by "charging" the formation with drilling fluids (ref. DSDP Leg 78A). Plans are now being made to sense overpressure ahead of the HPC.

The input of the Cornell University physical properties workshop will also be made available for planning future convergent margin drilling.

2. Scientific accomplishments:

a. East to west transect (Sites 671-676) across the Barbados forearc, with Site 672 as a reference section seaward of the seismically observed accretionary zone.

b. Drilled to and through the decollement (Site 671): scaly fabric, anomalous geochemistry (low chlorine, high methane), repeated and overturned stratigraphic sections, porosity discontinuities, temperature anomalies (also at Site 672).

c. Evidence for subduction-related deformation/diagenesis at Site 672 a surprise.

Day 1, April 2, afternoon; Day 2, April 3, morning

The ARP had several drilling proposals on its agenda for review, but most of the members felt that it would be appropriate to spend time first on a group consideration of the members' regional/thematic interests in order to develop a viable context for the future consideration of such proposals. Each member was then asked to summarize his personal perspectives on important "Atlantic" problems and the best place(s) to consider their study/solution. The group then summarized and grouped these opinions under a number of major "Atlantic" topics. What follows probably constitutes the ARP's first (only?) attempt at outlining a "white paper".

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B. Mechanisms of continental crust deformation and extension during rifting, e.g. Galicia.

C. Development, evolution and re-integration of (continental) microplates, e.g Rockall-Hatton-Greenland.

D. Magmatic events and their evolution (pre-, syn- and post-separation), e.g.'s selected (sediment-starved) margin features: J-Anomaly Ridge and Madeira-Tore Rise.

E. Identifying asymmetries in crustal structure across conjugate passive continental margins, e.g. Galicia-Newfoundland.

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G. Sheared continental margins, e.g. Gulf of Guinea.

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B. Transform-ridge discontinuities, e.g.'s large-offset equatorial Atlantic FZ's.

C. Cretaceous-Cenozoic intraplate volcanism, e.g. Venezuelan Basin.

D. Paired aseismic ridges, e.g. Walvis Ridge/Rio Grande Rise.

E. Emplacement of ultramafics into oceanic crust, e.g. MARK area (Site 670).

F. Processes of aging in old oceanic crust; comparisons with ophiolites, e.g. Blake-Bahama Basin in vicinity of Blake Spur magnetic anomaly.

G. Seaward-dipping wedges*, e.g.'s Rockall-Hatton, SE Greenland. *ARP felt that this feature could have been listed under Topic I. as well.

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D. Fore-arc basin evolution, e.g. Barbados.

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--opening, e.g.'s from south to north: Agulhas FZ, Walvis Ridge/Rio Grande Rise, equatorial shear zone, Iceland-Faeroes Ridge, Davis Strait and others.

--closing, e.g.'s eastern Mediterranean, western Caribbean.

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1. History of deep circulation, e.g.'s eastern vs. western basins; northern vs. southern basins.

2. Upwelling, e.g.'s northwest Africa, southwest Africa.

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1. Pelagic vs. terrestrial signals, e.g. Madeira-Tore Rise.

2. Distribution in space and time.

D. Deep Stratigraphic Tests and standard reference sections, e.g.'s every major Atlantic depocenter.

E. Initiation of glaciation--Arctic vs. Antarctic.

V. Eustatic Sea Levels Through Time

A. Timing and magnitude of eustatic sea level events, e.g.'s eastern U.S. and Canada, Cape Basin.

B. Controls on the sedimentary record: shelf/slope/rise/abyssal plain continuum, e.g.'s transects of various margins.

VI. Catastrophes

A. Impacts, e.g. Montaignais structure, Scotian shelf off Nova Scotia.

Day 2, April 3, afternoon

Consideration of Drilling Proposals

Following this (very productive) summary of its drilling interests, ARP moved on to a discussion of the four proposals submitted for its consideration. Three came directly out of the recent JOI-USSAC Black Shales Workshop convened by P. Meyers and M. Arthur: 254/A, pt. 1 (Tucholke), 254/A, pt. 2 (Parrish) and 255/A (Zimmerman/Herbin). The fourth (264/A) was submitted by Jansa and Pe.-Piper of Canada, and regards an interpeted impact structure discovered on the Scotian Shelf south of Nova Scotia. Motions regarding these proposals are summarized below. All statements were voted on by the panel, and all votes were unanimous.

I. 254/A, pt. 1 (Tucholke)

"ARP has discussed the black shale letter proposal by Tucholke and the panel plans to take concepts encompassed by this document into consideration during the development of a future Atlantic drilling program. ARP encourages the continued development of this broad statement of concepts into a more mature drilling proposal, incorporating the recommendations of the JOI-USSAC Black Shales Workshop and in conjunction with other researchers interested in the study of "black shales" in the Atlantic. The development of such a proposal, with supporting seismic reflection records necessary for the display of suitable drilling targets, will be welcomed by ARP."

II. 254/A, pt. 2 (Parrish)

"ARP encourages Tucholke and Parrish to revise and update their respective proposals, in particular consolidating the two into one, focusing on the space/time distribution of "black shales" in the eastern North Atlantic off Africa. In order to create a mature drilling proposal, objectives stated in the JOI-USSAC Black Shales Workshop should be incorporated, as should newer and better seismic data."

III. 255/A (Zimmerman/Herbin)

"ARP considers the Zimmerman/Herbin proposal an interesting target for black shale history and South Atlantic-Central Atlantic connections, but not relevant for understanding the evolution of sheared margins. ARP suggests that the proponents incorporate this proposal in a more comprehensive one targeting the Mesozoic black shale history in the equatorial Atlantic. As part of this proposal, better seismic lines in support of assigned drilling targets are necessary."

IV. 264/A (Jansa/Pe.-Piper)

"ARP is particularly pleased to see the proposal by Jansa/Pe.-Piper, which represents a novel and innovative new use of the Ocean Drilling Program. We view the proposal as reasonably mature, but still somewhat lacking in high resolution seismic reflection data. ARP strongly endorses continued utilization of industry seismic data and the acquisition of new seismic and geochemical data to support the contention that the Montaignais feature is an impact structure. ARP also endorses the presentation of this proposal as an example of a new type of ocean drilling initiative at COSOD-II."

Other Business

Summary of ARP-endorsed workshop activities:

1. South Atlantic Workshop: funded by JOI-USSAC and scheduled for April 6-8, 1987, at Woods Hole Oceanographic Institution. Convener: J. Austin. All preparations complete.

2. Caribbean Workshop: funded by JOI-USSAC and scheduled for November 17-21, 1987, in Jamaica (Discovery Bay). Convener: B. Speed. A discussion of this upcoming workshop produced the following points:

a. How will the workshop results be transmitted to ARP? Several members wanted to reestablish the Caribbean Working Group for this purpose, with a tenure lasting until completion of the next Atlantic drilling cycle. However, this motion was defeated by a vote of 7 opposed, 2 in favor, 1 abstention. Instead, ARP voted to nominate a subset of itself, consisting of Speed, Hemleben and Klitgord, for this purpose. Vote: 5 in favor, 3 opposed, 3 abstentions. Furthermore, Austin will request that ARP hold its next meeting in Jamaica immediately following the workshop in late November

b. Speed has requested UNESCO funding for Caribbean geologists (ca. 12 invited) to attend the workshop, but that support is uncertain.

3. Mediterranean Workshop: to be held in Europe (perhaps Greece) in October, 1988. Conveners: J. Mascle, with A. Maldonado (Spain) and Makris (Greece). ARP established another informal subset of itself, consisting of Mascle, Hemleben and Speed, to maintain communication between the Mediterranean workshop as it develops and ARP (Austin).

4. Central Atlantic Workshop: proposal not yet written, but Tucholke/Klitgord will either write it themselves or get someone to do it. ARP felt that this workshop should be held no later than late spring-early summer, 1988.

Panel Rotation

1. After next meeting, K. Klitgord plans to rotate off. Suggested replacements were J. Karson (Duke), J. Fox (U.R.I.) and H. Dick (W.H.O.I.). Austin will follow up on this with PCOM.

Next Meeting

1. If the Jamaica meeting site and November,1987, timing are deemed unsuitable by PCOM, Austin will request Copenhagen, Denmark as an alternate. Time: mid-late March, 1988. H.-C. Larsen agreed to host that meeting.

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OCEAN DRILLING PROGRAM

TECHNOLOGY AND ENGINEERING DEVELOPMENT COMMITTEE

REPORT OF THE 4th TEDCOM MEETING
HELD IN COLLEGE STATION (TEXAS) MAY 1, 1987

Contents :

I. LIST OF ATTENDEES

TEDCOM MEMBERS

Jean JARRY	IFREMER, Paris, France ; Chairman
Martin CHENEVERT	University of Texas at Austin, Austin, Texas
B. DENNIS	L.A.N.L.
David GRASSICK	Enterprise Oil plc., London, United Kingdom
E. LUNA SIERRA	Hispanoil, Spain
A. MC LERRAN	Consultant
Keith MANCHESTER	Bedford Institute of Oceanography, Dartmouth, Nova-Scotia
Claus MARX	Institut fur Tiefbohrkunde und Erdolgewinnung Clausthal, Federal Republic of Germany
Franck SCHUH	ARCO Oil and Gas Company, Dallas, Texas
Charles SPARKS	Institut Français du Pétrole, Rueil-Malmaison France
Paul STANTON	(in place of Mr GARDNER), Exxon Production Research Company, Houston, Texas
D.L. WILSON	Chevron Corporation, San Ramon, California

Absentee members

W. SVENSEN	LONGYEAR
J. KASAHARA	SCHLUMBERGER, Japan
Keith MILLHEIM	AMOCO Production Company, Tulsa, Oklahoma

Representing not attending members

J. JOHNSON	AMOCO Production Company
K. KABAYASHI	University of Tokyo, Japan

National Science Foundation

D. HEINRICH	N.S.F. Washington, D.C.
Al. SUTHERLAND	N.S.F. Washington DC

Permanent observer

Duke ZINKGRAF	SEDCO, Sedco-Forex, Dallas Texas

Industry observer

N. AVOCATO	Chevron

PCOM

Tim FRANCIS,	Institute of Ocenographic Sciences, Wormley U.K.

Other ODP panels representatives

M. SALISBURY	DMP	Dalhousie
G. CLAYPOOL	PPSP	USGS Denver
K. BECKER	LITHP	Miami
A. DROXLER	SOHP	Rice University
K. HYNDMAN	WPAC	PGS, Victoria
K. KLITGORD	ARP	WHOI
C. LANGMUIR	LITHP	LDGO
S. LEWIS	SSP	USGS

EDO (TAMU)

Barry HARDING	Ocean Drilling Program,	College Station, Texas
G. FOSS	"	"
C. HANSON	"	"
D. HUEY	"	"
A. MILTON	"	"
S. SEROCKI	"	"

II. AGENDA

1. KEYNOTE ADDRESS AND ACTIVITY REPORT SINCE THE OCTOBER MEETING — J. JARRY

2. EDO REPORTS - LEGS 111.112 AND 113 - PROCESSES ACCOMPLISHED IN ENGINEERING DEVELOPMENT. NEW PROBLEMS TO SOLVE. — B. HARDING, G. FOSS & S. SEROCKI

3. ENGINEERING PRIORITIES
   - PRESENTED BY THE ODP PANELS (LITH, TEC, SOHP, etc.)

4. ACTIVITIES OF THE WORKING GROUPS.

5. OPEN DISCUSSION ON ALL IDENTIFIED ISSUES.

6. NEXT TEDCOM MEETING AND FUTURE ACTIVITIES.

III. CHAIRMAN ACTIVITY REPORT

Jean JARRY told the members about his activity since the last TEDCOM meeting in September 1986. The report of that meeting has been presented to PCOM and all panel chairmen at their annual meeting (Hawaï, january 1987) : TEDCOM new organization in three specialized working groups and TEDCOM new policy of exchanges and discussions with TAMU engineers were considered as potentially fruitful and satisfactorily welcomed.

All panel chairmen and PCOM members agreed to the riser workshop to be held April 30th in College Station and encouraged representatives of each panel to attend that whorkshop as well as the regular TEDCOM meeting on the next day.

Jean JARRY added that he was glad to see so many panel representatives and thanked them for their presence. Asking them to introduce themselves (see Annex I list of attendees).

Further concerning on the Hawaï meeting, he said that the resolution adapted by TEDCOM about the budget was well received, but that unfortunately, its effects will not be short term, the 1988 budget being a low-profile one.

Jean added that probably the only way to improve this engineering budget would be the identification of a clearly defined ambitious engineering project, for which there would be a concensus from the whole ODP Science Community.

M. D. WILSON said he will resign because a new organization is taking place at CHEVRON. He proposed M. LOWE to replace him as TEDCOM member, which got the approval of all the other members.

IV. THE 1988 BUDGET

Alex SUTHERLAND explained how the 1988 budget, still in preparation, will be probably scissored, due to a combination of several factors :

- the likely absence of the USSR into ODP
- the rising of ship costs (after 2-3 years of stability)
- the will to make the PRIDZBAY legs (very expensive).

That explains why the engineering R and D budget cannot be increased in 1988.

260 V. EDO REPORTS

5.1. - EDO staff has increased slightly, Tom PETTIGREW is a full-time engineer, and Alan MILTON is a visiting engineer coming from Britoil. Barry HAR DING summarized quickly the legs 111 through 113 which have been already reported in the operationnal part of the monthly engineering reports, mailed to all members, and since 2 months to all panel chairmen.

All these legs in the Antartic and southern waters have been made possible thanks to the magnificent job of the MAERSK MASTER, a danish oilfield supply vessel which acted as an iceberg deflector as well as a support ship for the J.R. Moreover, magnetometer surveys were routinely made from that ship by 3 scientists on board.

5.2 - Stan SEROCKI updated the engineering monthly reports. Many have been achevied, a number of equipment working well, namely :

- hard rock guide base
- deep water television system
- side entry sub
- lockable flapper valve
- cutting shoe (for HPC) - (full annulus heat flow version)
- corecatcher flapper
- improved drilling jars

other goals are underway and will be achieved in the future.

- Navi drill motors: progress is encouraging and Eastman is doing a good job.

- Navi drill corebarrels: the first results indicate a R.O.P. of 90 meter/hour for a 2.4" core. Rentry and R.O.P. still need to be inproved in hard rock.

Those two developments were greatly helped by MM. C. MARX and F. YOUNG. The advantage of this system is its compatibility with the APC and XCB. Once tested at sea the Navidrill will have to be sent back to Germany for a last refurbishment.

Assembled in march, the co-chiefs for legs 108 through 112 made useful recommendations for those tools.

- TAM drilling packer : will be available for leg 116

- Pressure core barrel : a new PCB will be developped as soon as the budget will allow it.

- Drill sting analysis : the report is being [redacted] finalized and test cases

- XCB To explain the last accidents (many XCB were stuck on leg 113 mostly).

Dave HUEY said :

that the failures were unexpected and followed no logical pattern. The entire XCB system design will be relooked at in detail.

Other projects are making progress:

- mining coring system :
a RFP has been sent in march to 6 companies.

- high temperature drilling :
ENERTECH has done a parametric study on the steam flash conditions.

5.3. - On the operationnal aspects, Glen FOSS talked about the problems related to hole stability cuttings removal, and definition of the optimal mud slugs (they are designed most of the time to be used with freshwater and not salt water). Texas A&M PETROLEUM engineering Dept. is working on a one year ODP study of hole cleaning needs and best type of mud sweep.

VI - SCIENTIFIC ENGINEERING PRIORITIES

During the Hawaî PANCHMN meeting, a first approach of the priorities of the different panels had led to establish a rough matrix (annex 1).

The panels represented at this TEDCOM meeting presented a more detailed approach : LITHP, SOHP, ARP, WPAC, SSP, DMP. Others such as TECP, CEPAC and SOP has sent directly to J. JARRY papers summarizing their priorities.

6.1. - Lithosphere (K. BECKER) (see annex 2)

- improved techniques for positionning the guide-base, and if possible, design a lighter and cheaper guide-base. (development of 5 guide base in the next 5 years).

- smaller diameter corings.

- improve cuttings removal.

To drill in young and/or fractured basements, they need to have a better hole stability and they ask for :

- small diameter holes and high speed diamond bits.

- sidewall coring technics.

as well as many improvements on routine tools.

K. BECKER said that in a white paper prepared for the COSOD 2 conference (july 87 in Strasbourg, France) his "crust and mantle group" has expressively recognized the need of $ 1.5 M annual budget for R and D in engineering.

Then, C.H. LANGMUIR said that, in the very long term, the LITHP goal are much more ambitious, their aim is to drill the 5,000 meter of the entire crust, through 4,500 meters of water.

And the questions are :

Will it feasable and when ?
How much drilling time for one hole ?
How to go about the engineering development ?

Let us remember that to drill 420 meters in the hard fractured rocks of site 504 B, a total of 70 days has been necessary (legs 76-83-111) !

6.2. - SOHP, Sediments ans Oceans History Panel (A.DROXTER)

The first priority is the continuous core recovery and logging in sandy and gassy sediments (coarse-grained sediments) and in mixed lithologies (cherts).

SOHP wants also a pressure core barrel and the possibility of sampling in high temperature bare holes (hydrothermal deposits). A triple casing sting would be useful in the Somali basin. In the long term , they need to drill deep (2500-3000 m bsf) and to drill through salt. For those 2 reasons they need problems related to hole stability to be solved.

6.3. - WPAC, West Pacific Panel (Roy HINDMAN)

The panel is looking for a better hole stability, since they want to drill and to recover cores in hard and soft sands as well as in basalt, in over pressured areas and hot rocks. However, they do not need to drill very deep : 1000 meter is the maximum.

6.4. - ARP, Atlantic Regional Panel (K. KLITGORD)

For that panel, the propositions are :

- to drill deep : 2000-3000 m Bsf through 4,000 msw
- to drill in hard rocks : young and old crusts, seaward dippings.
- to drill in hard/soft sediments.
- to drill in fractured zones (thick sediments

6.5. - SSP, Site Survey Panel (S. LEWIS)

This panel has in charge the previous survey of the sites to be drilled.

6.6. - DMP, Downhole Measurements Panel (M. SALISBURY)

Logging can be down only if holes are stable enough. Besides DMP, has some interest of its own, and has rated its priorities as :

- wireline reentry
- high temperature tools
- logging in soft/consolidated sediments
- oriented hard rock cores (MWD).

6.7. - TEC P, Tectonics Panel (D. COWAN's report)

Priorities for that panels are :

- in situ measurements in consolidating sediments (permeability, pore-pressure, stress, etc.)

- push-in tools in soft sediments

- wireline packers for each category of sediments.

6.8. - CEPAC, Central and East Pacific Panel (S. SCHLANGER's report)

Their first priority is coring in "chert/chalk" sequences. Since some land sites (in France and in England on both sides of the British channel) presents great similarities with these marine sediments, it is suggested that TAMU proceeds to a land test in order to understand better what the problem is and try different tools and technics.

6.9. - SOP, Southern Oceans Panel (P. BARKER's report)

This panel has for main objectives to drill in :

- siliceous sediments and cherts. They ask particularly for the improvement of XCB.

- Coarse clastics, unlithified or semilithified sand.

Hole stability is a critical problem. SOP has more interest in core recovery than in logging, and since they work in latitudes where icebergs and high sea states prevail, they are not interested in a riser drilling technology, which they think be never available to them.

6.10 - Jean JARRY said that all these priorities can be translated and sorted in three categories.

1) Present tools to be improved.

Progress has been already achieved for many tools and will continue. It is the routine job of EDO to do this.

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2) New tools to be designed or purchased.

D. ZINKGRAF remarks that side wall coring has been already in use 30 years ago. This is no breakthrough necessary. Joe JOHNSON has a similar opinion for the core orientation problem.

If the needs are clearly expressed, EDO will solve them in the necessary time and budget frames.

3) New goals or goals expressed with a new order of magnitude and necessitating technological breakthrough, with large budgets, such as the four concepts presented at the riser workshop.

VII. WORKING GROUPS REPORT

The "pressured areas drilling" working group, led by F. SCHUH has had the heavy task to prepare and animate the riser workshop.

The "fractured rock drilling" group, led by K. MILLHEIM, has helped F. SCHUH, preparing the "Mining type riser" papers.

Then, B. DENNIS and M. CHENEVERT present the state of the art in high temperature drilling technology.

. at Fenton Hill, 14,000 ft were reached with a bottom-hole temperature of 320°C. Tools used were :

- dynamic seals
- lost circulation materials
- log tools
- bore hole televiewer
- electronic memory system

Special fluids have been developped for use up to 260°C (500°f). Research is needed for a better use of slugs mixed with clay. Slugs are reacting differently with fresh water and seawater.

As far as the steam blow out was concerned, B. HARDING said that the study subcontracted to ENERTECH has very encouraging results.

VIII. GENERAL DISCUSSION

. AMOCO has gained a wide experience in dealing with the hard/soft sediments problem : weight on the bit has to be controlled and a feed mechanism is necessary. It is generally preferable to use a roller core bit. Sometimes, it is better to drill as fast as possible with no coring, since time is an enemy for hole stability.

C. MARX asks if a general method cannot be proposed and D. ZINKGRAF proposes to use a conventionnal barrel (9 7/8).

Every one agrees with the land test and D. GRASSICK will do his best to get a site in U.K. (july would be a good period).

. About the priorities expressed by the science panels and their translation in terms of technical goals, B. HARDING proposes to have a mini panel to help him identify these goals before the COSOD 2 conference.

Four people are volunteers, (N. AVOCATO, F. SCHUH, P. STANTON and D. ZINKGRAF) and a one-day meeting in Dallas in early june is then decided.

IX. <u>NEXT MEETING</u>

Information will be forwarded to the TEDCOM members, in order they keep in touch with the program : Operationnal and engineering monthly reports, evolution of the science objectives.

Meanwhile, B. HARDING feels free to contact such or such member to get his advice on a particular question. Members of such or such working group have also to keep in touch with each other, in order to make the reflexion progress on these long term goals.

Finally it was agreed to have the next meeting in february 1988, just before or just after the OMAE conference. Meeting will take place either in Houston or in College Station.

***

Some people regret that no member of DOSSEC is attending our meeting. We learn also that F. SCHUH is not a member any more of the DOSSEC advisory committee.

Jean JARRY will see with J.O.I. what can be done to create new links between ODP and DOSSEC.

ANNEX 1

Engineering Priorities identified by Panel Chairmen at the FY87 Annual Chairmen's Meeting

	LITHP	TECP	SOHP	DMP	SOP	IOP	WPAC	CEPAC	ARP
A. Young crustal drilling (Navidrill/XCB/APC)	X			X	X	(X)	X	X	X
B. High temperature dril. and logging	X		X	X			(X)		(X)
C. In situ pore pressure permeability (packers)		X					X		
D. In situ physical properties		X					X		
E. Pressure core barrel gassy sediments		X	X			X	?		
F. Recovery in alternating Hard/soft sedimentary sequences (cherts)		X	X		X	X	X	X	X
G. Coarse grained, uncon-solidated sediments		X	X		X	X	X		X
H. Rotary/XCB/APC improve-ments			X		X				
I. Bare rock guide base (mini cones)	X			X		X		X	
J. Deep stable holes (2-3km)			X						X

A N N E X 2

Summary of High Priority Lithospheric Drilling Objectives+

OBJECTIVE	= HOLES	CRUSTAL DRILLING DEPTH	ADVANCED CRUSTAL DRILLING TECHNOLOGY	LEGS	LOCATIONS
Young Oceanic rifts	multiple	<100m to >500m	High temp. dril. (for some holes)	1-2	Red sea, Gulf of California
Zero-age hole fast & slow spreading ridges*	2-6	2>500m 4 100-500	Bare-rock, young crust, high temp.	-6?	MAR, EPR, at Juan de Fuca ridge
Zero-age sedi. ridge crest, hydrothermal	>3	>500m	High temp. dril.	1-2	Juan de Fuca Escabana Trough Gulf Calif
Deep crustal hole into layer 3*	1	>2000m	Deep crustal dril.	>2?	DSDP 504B, 418A
Fracture zone drilling	multiple	<100m to >500m	Bare-rock, young crust (for some holes)	1-2	Kane, Oceanographer, All Vema
Near-axis, seamounts ; hotspot volcanism	multiple	<100m to >500m	Bare-rock, young crust (for some holes)	>2	EPR, loihi, 90E ridge Mid-Pac. Mts
Lithosphere flexure	multiple	none	none	1	Hawaî, Marquesas
Oceanic plateaus	multiple	-100m	none	2	Kerguelen, Ontong-Java, Shatsky
Intraoceanic convergent margin transects (2) (incl. ref. holes)	multiple	<100m to >500m	none (except at backarc spreading centers)	3-6	Izu-Bonin, Kermadic, Aleutian, Antilles
Mantle hétérogeneity (incl. old crust)	multiple	<100m to >500m	none	-3	Atlantic Pacific or Indian Ocean

FORMALIZED PROPOSAL PROCESS
Suggested Outline

Issues to consider:

- thematically derived program
- review of proposals with adequate feedback to proponents

I. PROPOSALS ONLY SENT TO THEMATIC PANELS

IF panels accept proposal as having merit in terms of thematic issues

THEN proposals evaluated

IF proposal found to have merit
THEN proposals **GO TO** regional panels

ELSE [otherwise] deficiencies summarized and proposal returned to proponent

ELSE [otherwise] proponent informed that proposal does not address thematic issues and would need to be framed more in terms of program objectives. It is the responsibility of the proponent to do this.

II. REGIONAL PANELS evaluate proposals in terms of maturity, ~~and~~ adequacy of documentation.

IF proposal is acceptable

THEN it is returned to thematic panels and PCOM for further consideration and ranking

ELSE [otherwise] it is returned to the proponent with statement of nature of deficiency; thematic panels encourage proponent to provide supporting data and provide feedback to regional panels as to possible disagreements.

SUGGESTED PROPOSAL REVIEW FORM

(To be returned to Proposal File and Proponent)

Number:

Title:

Author(s):

THEMATIC PANEL EVALUATION:
1. [ ] Addresses thematic objectives
2. [ ] Addresses objectives with deficiencies
3. [ ] Not thematic

Statement of Reason for 2:

REGIONAL PANEL EVALUATION:
1. [ ] Mature
2. [ ] Deficient

Deficiencies:

Thematic Rank:

DALHOUSIE UNIVERSITY
Centre for Marine Geology
Halifax, N.S. Canada B3H 3J5 Telephone (902) 424-6461 Telex: 019-22848

7 May 1987

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Dr. Nicklas Pisias
Chairman
JOIDES Planning Committee
College of Oceanography
Oregon State University
Corvallis, Oregon 97331
U.S.A.

Dear Nick:

A number of years ago, a series of micropaleontologic reference collections consisting of splits from critical intervals in the DSDP core collection was established at key locations around the world in order to provide paleontologists with better access to the core. I understand from discussions with Russ Merrill at TAMU that seven splits were originally made but that only six reference collections have been established to date.

With Canada's participation in the Ocean Drilling Program as a full member, it would now seem appropriate to establish the seventh collection in Canada. We would like to volunteer the facilities of the Centre for Marine Geology at Dalhousie University to house the collection. Halifax, with its offshore industry and its major government and academic research institutions, has the largest user community in Canada, and Dalhousie is the only university in the country with a major core repository and a permanent curatorial staff. Thus, the collection would be well used and well maintained.

I would appreciate it if you would put this matter before the Planning Committee and advise us of your decision.

Best regards,

Matt

Matthew H. Salisbury
Director

cc R. Merrill

THE THIRD PROSPECTUS FOR WESTERN PACIFIC DRILLING

The ODP Western Pacific Panel at its March, 1987 meeting produced the following Drilling Prospectus having considered over 80 proposals from the scientific community together with input from ODP Thematic Panels on the major scientific problems that should be addressed in the region. The Planning Committee instructed that problems of global rather than local importance were to be emphasized, and at its January, 1987 meeting gave general endorsement, for planning purposes, to nine programs (11 legs) of the previous WPAC prospectus.

The western Pacific region constitutes a complex zone between the major Pacific, Australian and Asian plates and includes numerous arcs, back arc basins and collision zones. It may be compared to the early stages of formation of geological belts such as now preserved in the Alps, Himalayas and North America Cordillera. In addition to the major geoscientific problems listed below, a number of the drilling targets will provide information of global economic and/or social relevance, related to understanding the environments and processes in which sulphide mineral deposits form, petroleum accumulates and earthquakes are generated.

The proposed drilling targets address a wide range of scientific problems, and usually individual holes have more than one objective. The major thematic problems are listed below, along with the relevant western Pacific programs.

1. Island arc/forearc processes (Bonin, Vanuatu, Lau-Tonga)
   a. initiation and tectonic/stratigraphic development
   b. magma gensis and subduction mass balance

2. Mountain building and terrane accretion processes
   a. accretionary prisms (Nankai)
   b. collisions: arc-continent (Sunda)
      arc-ridge and arc reversal (Vanuatu)
      obduction (Japan Sea, Zenisu)

3. Formation of marginal basins
   a. magma genesis and geodynamics of back arc rifting (Japan Sea, Bonin, Vanuatu, Lau-Tonga)
   b. entrapment? (Banda-Sulu-South China Basins)
   c. passive margin evolution (South China margin)

4. Paleoceanography and sediment history (Great Barrier Reef and marginal basin programs)
   a. effect of global events on marginal basin water mass, faunal and depositional history.
      - including gateway closure between the Indian and Pacific Oceans.
   b. comparative basin stratigraphy: carbonate, siliciclastic and pelagic lithofacies patterns, anoxic vs oxic facies development, tectonic vs enstatic control.
   c. regional Cenozoic biostratigraphy and paleoclimate - including the effects of Himalayan uplift.

5. Hydrothermal processes and sulphide deposit formation (Japan Sea, Bonin rifts, Great Barrier Reef, Lau Basin)

To maximize the scientific return of WPAC drilling, engineering developments are needed to:

1. Enhance coring rates and recovery in:
   a. alternating hard and soft sediments and;
   b. course unconsolidated sediments; needed for all programs, by October 1988.

2. Provide special tools for geotechnical and pore fluid measurements; needed for Sunda (Nov. '88), Nankai especially (June '89), Great Barrier Reef and Vanuatu.

3. Enhance coring rates and recovery in young crust; needed for Lau Basin (Aug. '90).

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PANEL RANKINGS OF WPAC PROGRAM (12/86)

TECP

1. Bonin Transect
2. Nankai Trough
3. Japan Sea
4. Bonin-Marianas
5. Banda-Sulu-South China Basins
6. Vanuatu
7. Nankai physical properties (1/2 leg)
8. Lau Basin
9. Sunda Backthrusting

LITHP

1. Bonins
2. Lau Basin System
3. Sea of Japan
+ Reference Sites

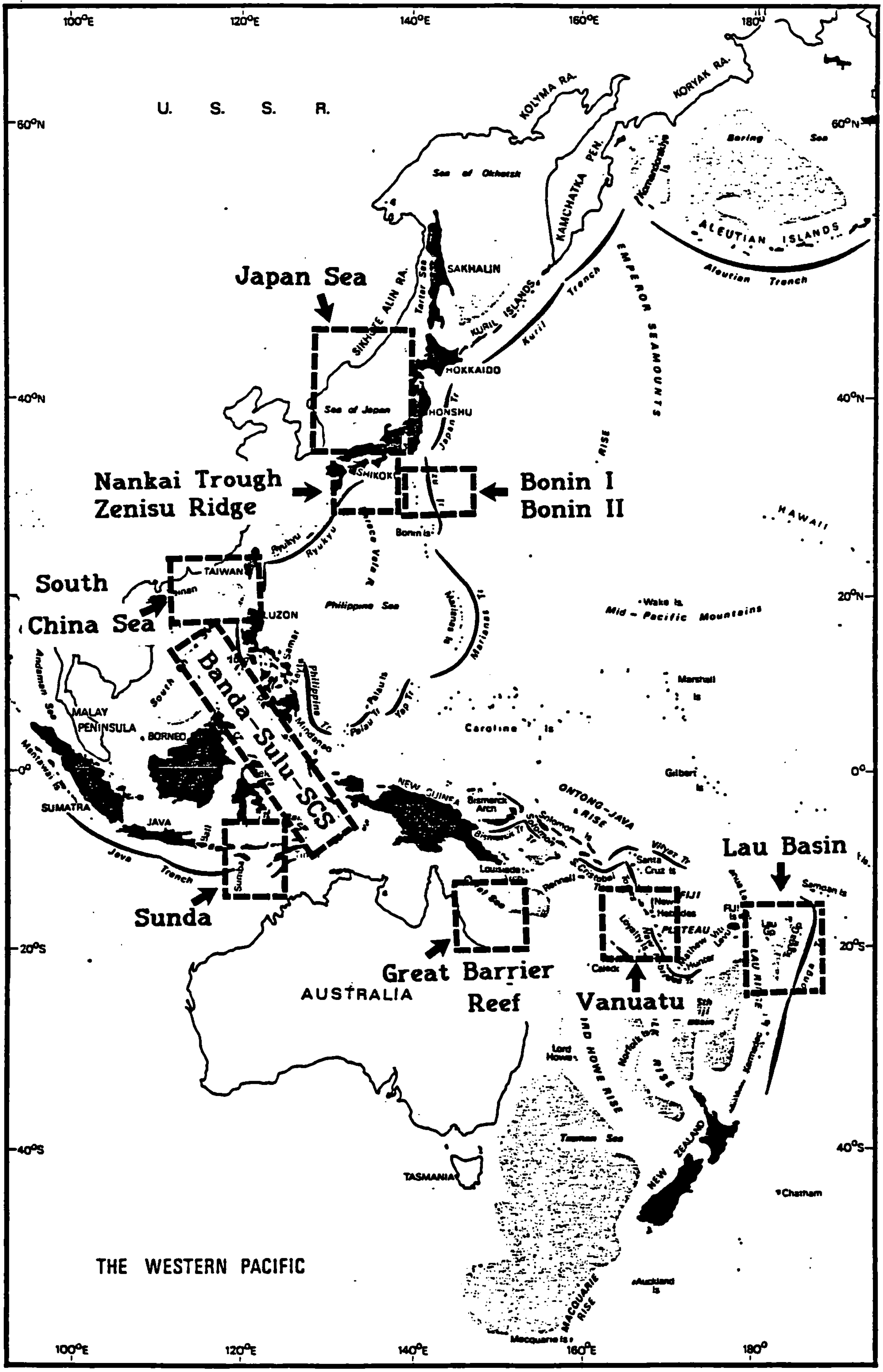
SOHP

1. Great Barrier Reef
2. Japan Sea
3. South China Sea
4. Sulu Sea
5. Bonin Site 6

WPAC

Priority/Program	Days Drilling	Days Logging	Special Expts.	Min. Transit	Total Days*
1. Banda-Sulu-SCS Basins	62	11	--	10	83
2. Bonin I (Bon 1.2, 5A-B, 6)	66	9	--	4	79
3. Lau Basin	48-50	6	1	3	58-60
4. Vanuatu	62	10	--	4	76
5. Japan Sea	53	11	3-5	5	72-74
6. Nankai	34-42	5	--	5	44-52
7. Great Barrier Reef	42-50	8-10	--	4	54-64
8. Sunda	39	11	--	5	55
9. Bonin II (Bon7 + 2 Ref)	29	5	--	6	40
10. Nankai Geotechnical	(23-25)		5	2	30-32
11. SCS Margin	43-58	7	--	4	54-69
12. Zenisu Ridge	19-20	6	1	2	28-29

* The estimated times in this prospectus are slightly revised from those of the December meeting.


Japan Sea
Nankai Trough
Zenisu Ridge
Bonin I
Bonin II
South China Sea
Banda-Sulu-SCS
Sunda
Great Barrier Reef
Vanuatu
Lau Basin
U. S. S. R.
SAKHALIN
HOKKAIDO
HONSHU
SHIKOKU
TAIWAN
LUZON
AUSTRALIA
MALAY PENINSULA
BORNEO
SUMATRA
JAVA
NEW GUINEA
NEW ZEALAND
TASMANIA
ALEUTIAN ISLANDS
Aleutian Trench
KURIL ISLANDS
Kuril Trench
EMPEROR SEAMOUNTS
KAMCHATKA PEN.
KOLYMA RA.
KORYAK RA.
Philippine Sea
Caroline Is
Marshall Is
Gilbert Is
ONTONG-JAVA RISE
Mid - Pacific Mountains
Java Trench
THE WESTERN PACIFIC
100°E
120°E
140°E
160°E
180°
60°N
40°N
20°N
0°
20°S
40°S

SUMMARY OF THE JAPAN SEA DRILLING PROGRAM

Introduction

The Japan Sea is one of the largest and best known back-arc basins of the Western Pacific region and is thought to have formed by multi-axial rifting of a former continental arc. The sea consists of several deep basins with established oceanic basement separated by ridges of continental crust. Intensive geophysical and marine geologic studies of the Japan Sea, together with information from petroleum exploration, onshore geologic studies, and previous deep sea drilling (DSDP Leg 31) form an unusually rich data base for evaluation of back-arc basin evolution. A series of six ODP drill sites is proposed herein to evaluate the timing and character of basin development including holes aimed at obtaining underlying basement rocks. The overall goals of this drilling program include the documentation of both the tectonic and paleooceanographic development of the Japan Sea in terms of the objectives outlined below.

Tectonic overview

Several models have been proposed to explain the spreading history of the Japan Sea. Some authors have argued for a double scissor-shaped opening accommodating clockwise rotation of Southwest Japan and counterclockwise rotation of Northeast Japan deduced from paleomagnetic data. Others have discussed development of this basin in terms of pull-apart basins or as a consequence of northward retreat of the Amurian plate during Cenozoic time, due to collision between India and Eurasia. In any event, better constraints on the age of rifting of the Japan Sea will help understand the kinematics of the entire region and the complex interrelationships between the Pacific and North American plates during Cenozoic time.

Age of Opening

The magnetic anomaly lineations in the Japan Sea are not easily identified. Moreover, oceanic basement was not reached in previous drilling DSDP Leg 31. Alternately, high and uniform values of heat flow in the sea suggest opening occurred prior to 20 m.y.B.P. Onshore data around the margins of the Japan Sea indicate that the main stage of opening probably took place during the late Oligocene-early Miocene (?). Rapid subsidence of basin margins apparently continued into the mid Miocene. Subsequent oceanic spreading led to a major plate boundary reorganization, inducing incipient composition within the Yamato Basin and potential obduction of young oceanic crust. Drilling into the Japan Sea will clearly help to document the age and nature of the Yamato Basin and its multiple rifting history and the obduction of oceanic crust along its eastern flank. Drilling in this same area will also provide insights into both the paleooceanography of the sea and details of the stratigraphy and petrology of a failed rift system.

Drilling Objectives

1. Nature and age of the basement of the basins (Sites J1b, J1d, J1e)
   Recent refraction data with 20 OBS in the Yamato Basin revealed anomalously thick oceanic crust (twice the thickness of normal oceanic crust). A recent detailed geomagnetic survey of the Japan Basin mapped a complex pseudofault pattern suggesting frequent ridge propagation during spreading of the basin. Drilling to basement will clearly assist in dating this newly mapped set of magnetic anomaly lineations as well as providing hard evidence of the anomalous oceanic crust known in this area. On a large scale, basement penetration will also provide critical constraints on timing of regional reconstruction of East Asia. Finally, drilling at proposed sites J1b, J1d, and J1e will also allow evaluation of fast spreading of the Japan Sea suggested by paleomagnetic data from onshore site in Southwestern Japan.

2. Style of multiple rifting (Sites J2a, J1b, J1d, J1e)
   Back-arc extension tectonics of the continental arc, associated with multiple rifting, complex pseudofault pattern, continental crustal extension, anomalously thick oceanic crustal structure, and contamination of MORB volcanism with arc volcanism, are comparatively studied with the Atlantic type extension tectonics.

3. Obduction of oceanic crust (Site J3a)
   Cumulative evidence all indicates that the EURA-NOAM plate boundary shifted to the western margin of the Japan Sea during Quaternary time effectively transferring NE Japan to NOAM. Seismic reflection profiles in the eastern Yamato Basin illustrate that incipient obduction as well as subduction of oceanic crust is ongoing along this new plate boundary which shifted from the central Hokkaido suture line. Drilling at proposed Site J3a is aimed at constraining the timing of initiation of this convergence and yielding data regarding the origin of ophiolites and obduction of oceanic crust.

4. Paleooceanography (Site JS-2)
   Stratigraphic columns to be sampled at all six proposed ODP drilling sites in the Japan Sea will yield important new faunal, isotopic, and lithologic data regarding the water mass and sediment history of the sea. Available onshore data and the results of previous DSDP Leg 31 drilling demonstrate that the sea experienced a basic three-fold evolution from anoxic, to suboxic, to fully oxic state accompanied by deposition of distinctive litho-facies including Miocene laminated diatomaceous muds and genetically related porcellanites as well as thick Plio-Pleistocene siliciclastic silts and sands. Results of ODP drilling shows allow effects of local tectonic control on basin sills to be separated from effects of global eustatic and climatic events. Similarly, quantitative faunal and floral analysis are expected to provide new insights regarding variations in rates of productivity, intensity of oxygen minima, and origin of deep, intermediate and surface water masses within the sea. In particular, proposed ODP Site JS-2, located on a local high above the basin CCD is aimed at yielding a detailed faunal and isotopic record of paleoclimatic-paleooceanogrphic events within the sea during the critical late Miocene period of intensified vertical circulation and lowered sea levels. Quantitative faunal analysis at all sites are expected to yield data on rates and mode of basin subsidence.

5. Metallogeny in a failed back-arc rift (Site J2a)
Ancient massive sulfide deposits now being mined on land have formed in failed rifts within continental margins, arcs and back-arcs. Different types of deposits form in this setting according to the nature of the materials that fill the rift, e.g. "Kuroko-type" deposits associated with rhyolites or "shale hosted" type associated with clastic sediments. The Kitayamato Trough is a heavily sedimented failed rift within the Yamato Bank, a fragment of continental crust formed by back-arc rifting during the Oligo-Miocene. This Trough represents an ideal setting for massive sulfide mineralization of either the Kuroko or shale-hosted type, depending on the amount of felsic volcanism attending the rifting. Drilling this site to the basement will furthen our understanding of ore genesis in back-arc environments and permit a comparison with similar environments now on land. A probable composition is with the Green Tuff Belt of Japan which is thought to be a failed rift. The Green Tuff Belt hosts a large number of Kuroko-type massive sulfide ores which are regarded world-wide to be the "type" massive sulfide deposits in felsic volcanic rocks.

Objectives of the down hole experiments

1. Vertical seismic profiling experiment at site J1b will present critical data for addressing the anomalously thick oceanic crust of the Yamato Basin.
2. In-situ measurements of the direction of the stress field with abundant earthquake mechanism solution in the Japan Sea will greatly improve the study of the stress field along developing new EURA-NOAM plate boundary.
3. Heat flow measurements in the bore hole will address the problem of the heat generation in the sedimentary column in the basin area that have been long controversial.

Shallow gas problem

A safety problem to be carefully considered before drilling of the Japan Sea is ethane gas production associated with Miocene diatomaceous muds. During previous DSDP Leg 31 drilling both sites 299 in the Yamato Baisn and Site 301 in the Japan Basin were abandoned before reaching basement due to ethane gas production (Karig and Ingle, 1975).

The gas charged layer is thought to have occurred in the lowermost horizons of Plio-Pleistocene turbidites immediately overlying organic-rich diatomaceous pelagic muds. This latter unit is a wide spread and easily identified layer throughout much of the sea and equivalent to the Onnagawa and Funakawa Formations of northern Honshu. The ethane gas is assumed to be generated within the largely Miocene diatomaceous sediments by high heat flow and ultimately trapped in alternating sand and clays of the basal Plio-Pleistocene turbidite facies. We have identified this latter horizon on seismic profiles as an acoustically stratified layer with reflective low frequency bands. Proposed ODP siteswere selected in areas where the presumed gas charged layer is absent. In this regard , it is particularly significant that drilling at DSDP Site 302 reached basement without encountering ethane gas although it penetrated the lower diatomaceous layer.

List of planned drilling sites and estimated drilling days of the Japan Sea

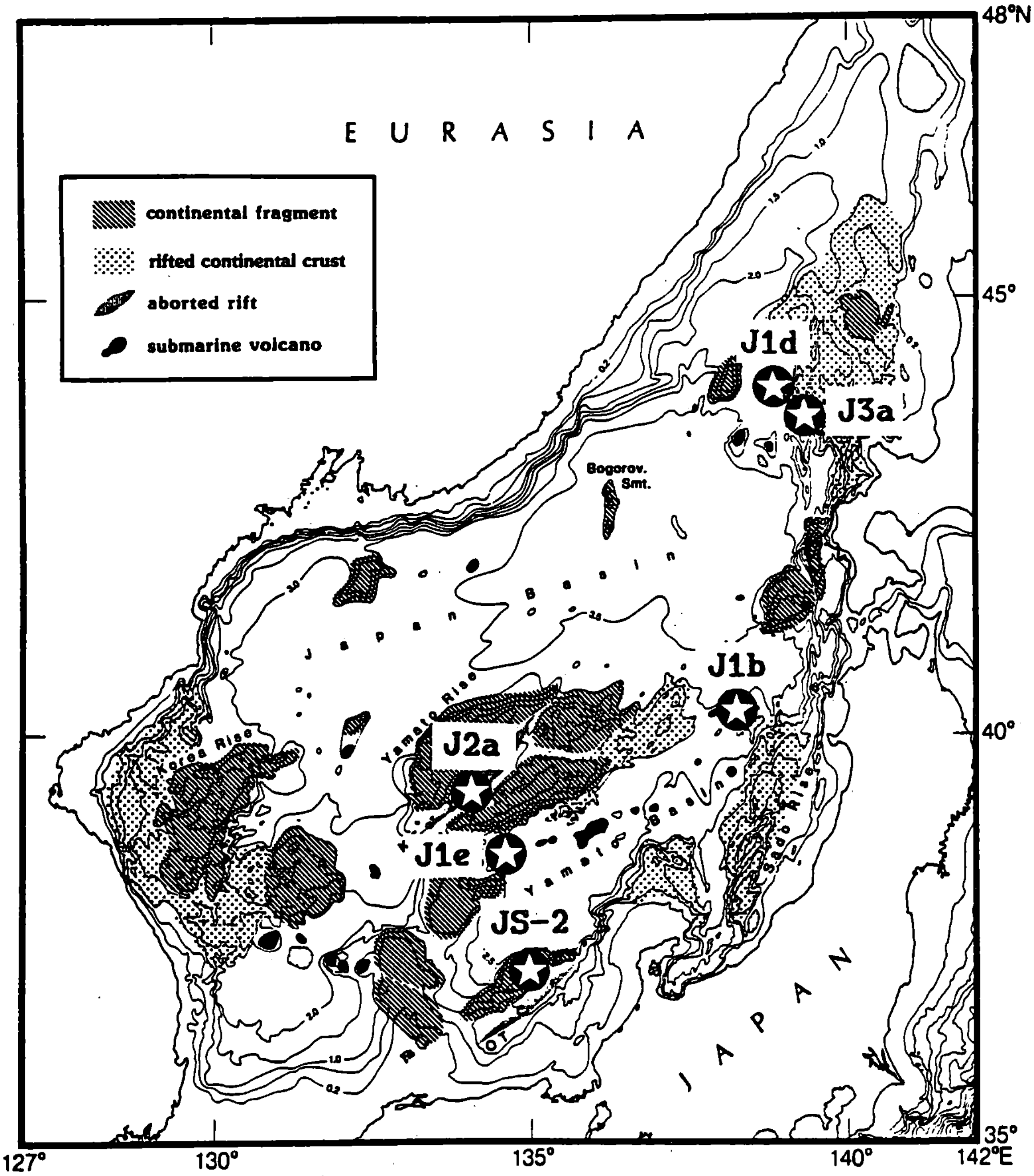
Japan Sea I (Basin Drilling/Tectonics)

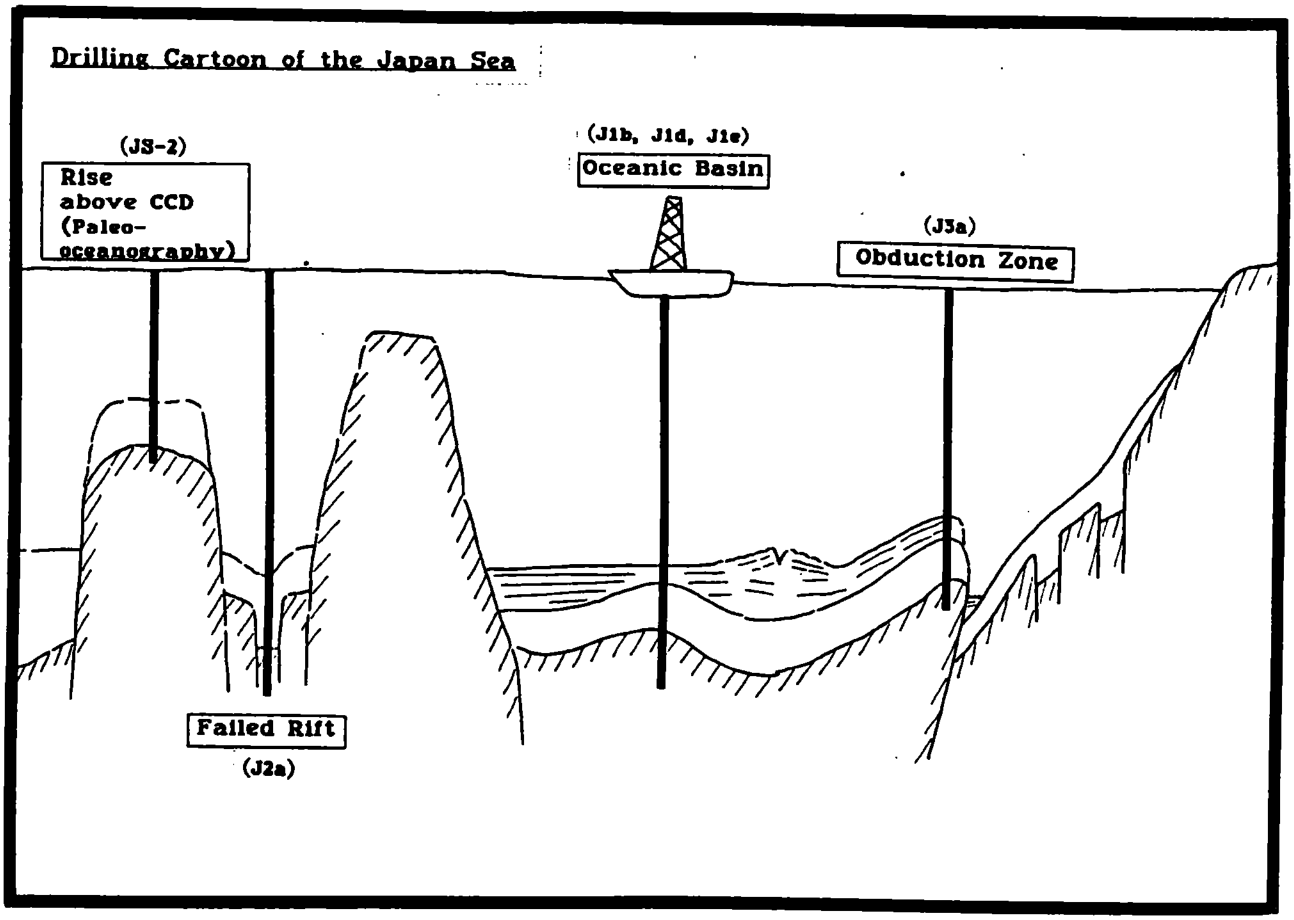
Site No.	Hole Type	Position Lat.	Lon.	W.D. (m)	Sed. Penet. (m)	Base Penet. (m)	Drill Time (days)	Log. Time (days)	Transit (days)
							(from Yokohama)		2.9
J1b	APC/XCB(Reentry)	40°14.5'N	138°15.1'E	2780	700	100	15.8	6.5(incl. VSP)	
									0.8
J1e	APC;RCB	38°37'N	134°33'E	2890	830	50	9.4	2.0	
									0.4
J3a	APC;RCB	43°50.7'N	139°09.0'E	2040	700	30	6.6	1.7	
									0.3
J1d	RCB	44°00.2'N	138°48.6'E	3170	350	30	4.7	1.5	
							(to Niigata)		1.4
						Total:	36.5	11.7	5.8
						Grand Total:		<u>54.0 days</u>	

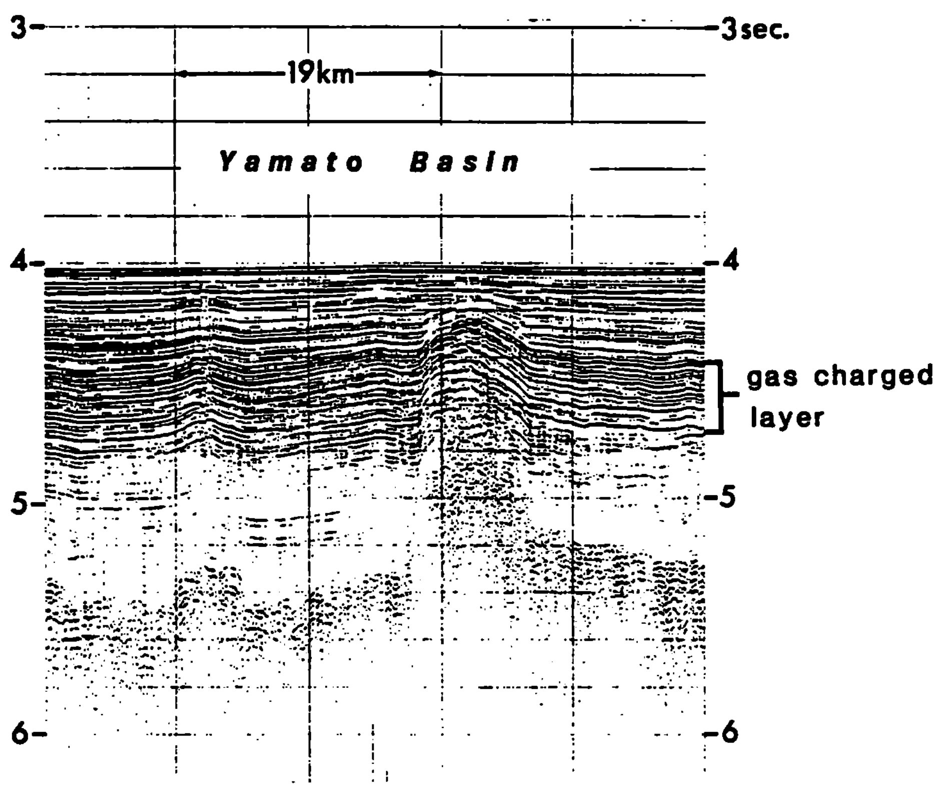
Japan Sea II (Rise Drilling/Paleoenvironment & Metallogeny)

Site No.	Hole Type	Position Lat.	Lon.	W.D. (m)	Sed. Penet. (m)	Base Penet. (m)	Drill Time (days)	Log. Time (days)	Transit (days)
							(from Niigata)		0.9
J2a	APC/XCB(Reentry)	39°14.4'N	133°50.9'E	2050	1370	20	17.7	2.0	
									0.6
JS-2	APC/XCB;APC	37°05'N	134°45'E	998	600	0	3.8	1.2	
							(to Yokohama)		3.8
						Total:	21.5	3.2	5.3
						Grand Total:		<u>30.0 days</u>	

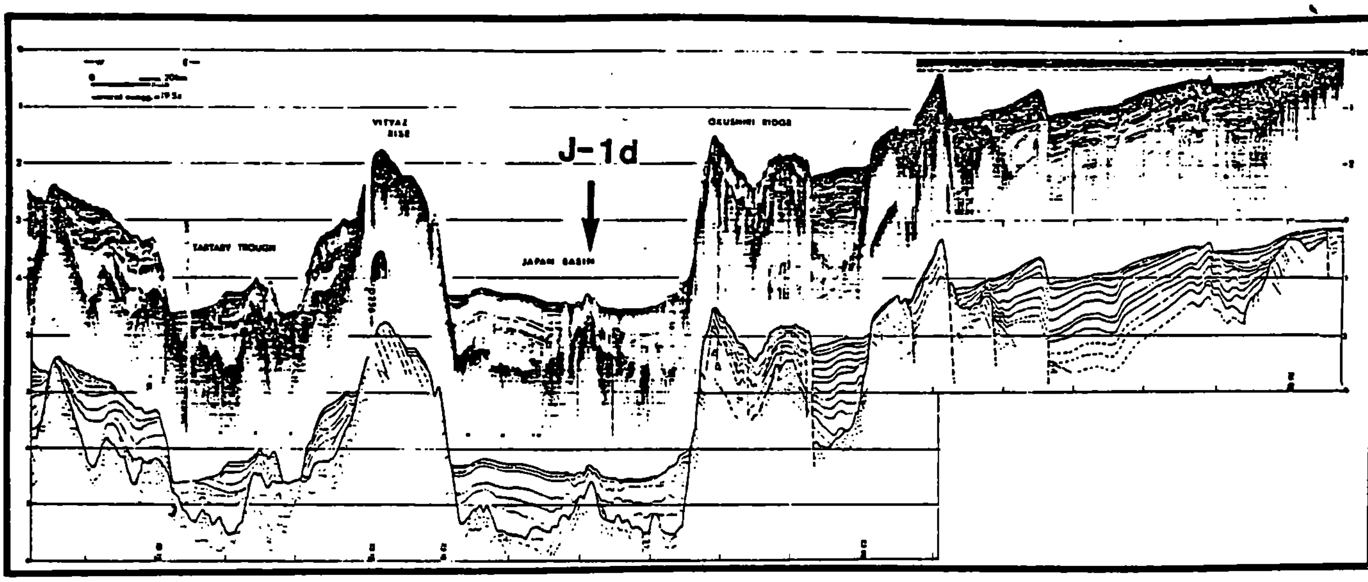
Planned Drilling Sites in the Japan Sea

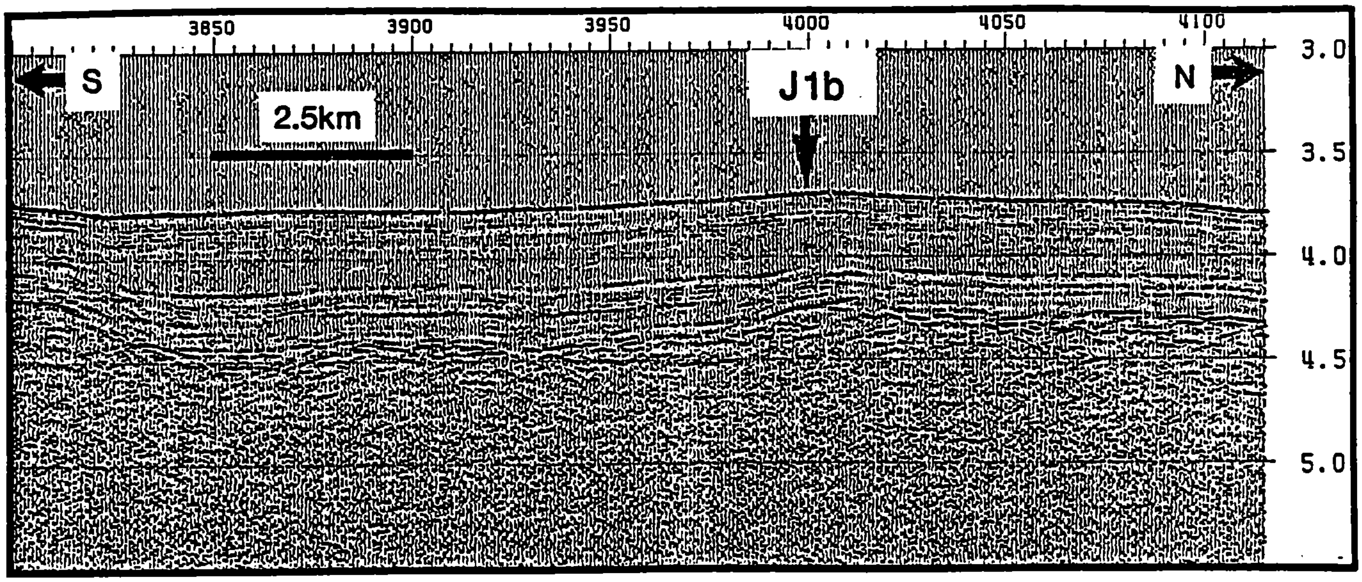


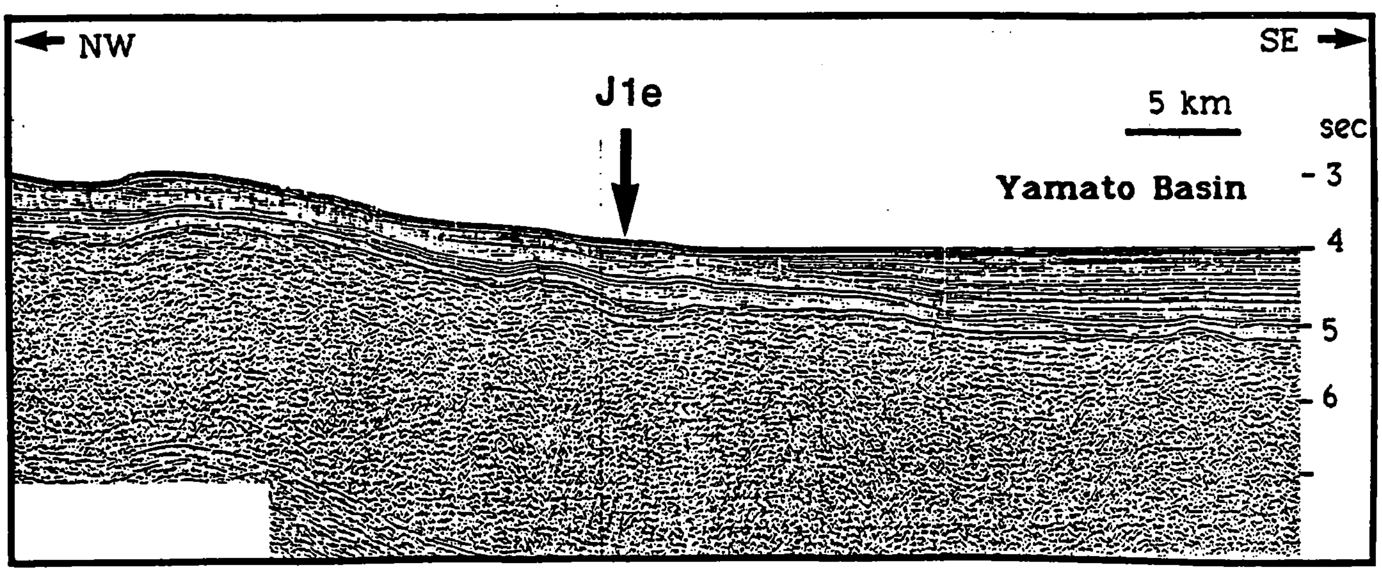


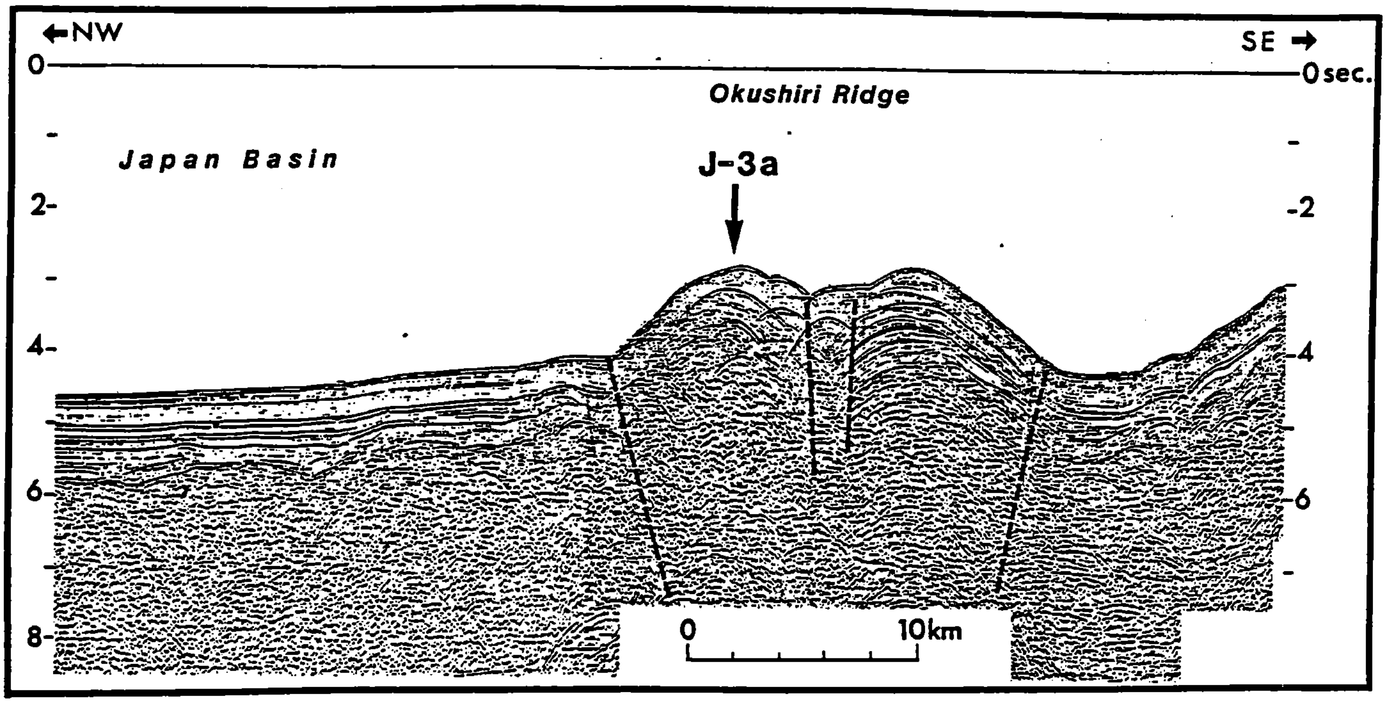


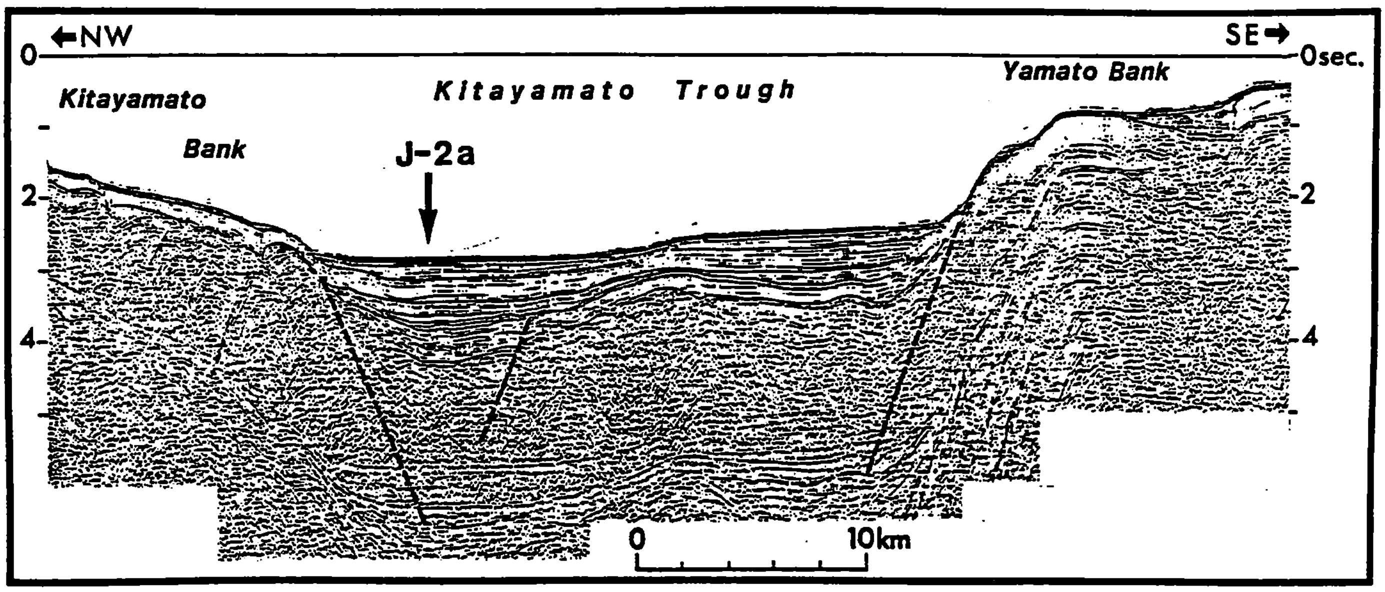
Gas charged horizon in the Yamato Basin. The horizon is characterized by bands of low frequency reflectors.

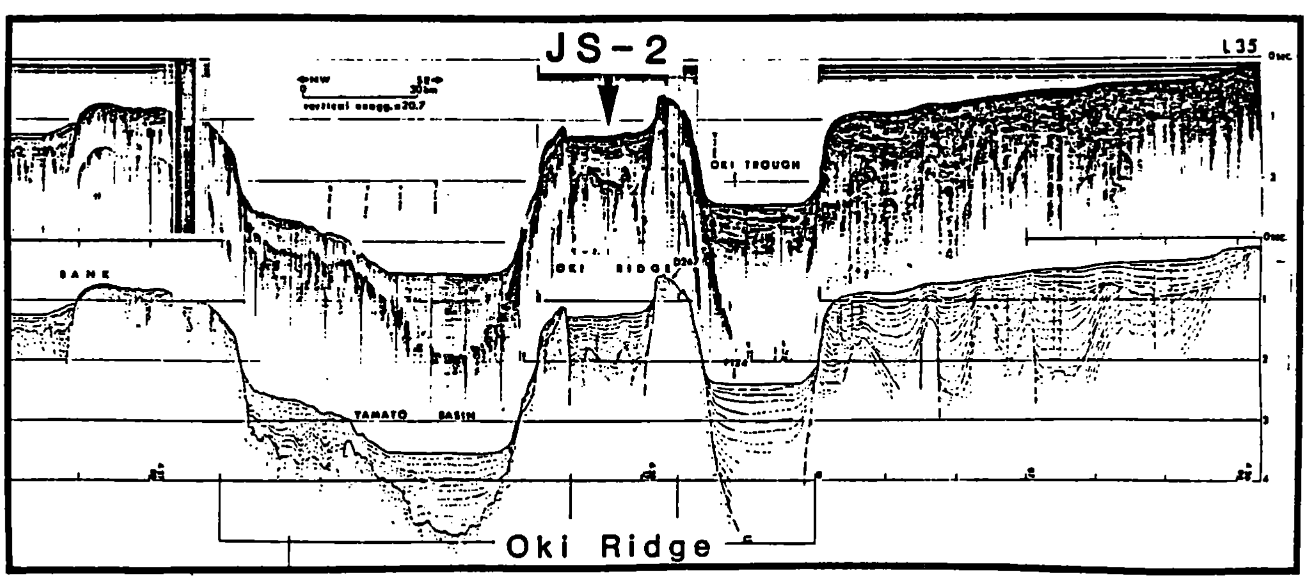

J-1d


3850
3900
3950
4000
4050
4100
S
N
2.5km
J1b
3.0
3.5
4.0
4.5
5.0


NW
SE
J1e
5 km
sec
Yamato Basin
3
4
5
6


←NW
SE →
0 sec.
Okushiri Ridge
Japan Basin
J-3a
0
2
4
6
8
0
10km


←NW
SE→
0 sec.
Kitayamato
Bank
Kitayamato Trough
Yamato Bank
J-2a
0
2
4
0
10km


JS-2
L35
OKI TROUGH
OKI RIDGE
BANK
YAMATO BASIN
Oki Ridge

II

SUMMARY OF ZENISU RIDGE DRILLING PROGRAM
- Study of Intra-oceanic Plate Deformation due to Collision -

A remarkable example of intra-oceanic plate shortening related to the collision of an island arc is occuring to the eastern sideof the Nankai Trough. The objectives of this program is to study the timing and nature of this deformation and related hydrogeologic phenomena.

GEODYNAMIC SETTING.

The Zenisu Ridge is a WSW-ENE trending linear structure located seaward of the Nankai trough, at the western edge of the Izu-Bonin arc.

From the morphological point of view, this ridge is vanishing progressively to the west, where it diasppears within the Shikoku basin. To the east, this ridge connects progressively with the Izu-Bonin ridge.

The structure of the Zenisu is characterized by a NW dipping monocline and fault bounded on its southeastern flank, being itself bordered by a sediment filled trough, called the Zenisu Basin. The sediments covering the ridge correspond generally to transparent seismic sequences, suggesting a hemipelagic origin, and are very similar to the seismic sequences recognized to the west on the top of the oceanic crust of Shikoku Basin. Magnetic anomalies trending NW-SE were recognized across the ridge and gravity analysis suggests an oceanic origin for this western part of the ridge. This NW-SE direction is fairly consistent with the magnetic lineations related to the first stage of Shikoku basin opening.

The tectonic framework of this ridge is controlled by N 60E trending low dipping faults and associated folds which are concentrated along the steep SE ridge and into the Zenisu basin. Here, sediments (partly basin fill sediments and partly hemipelagic sequence) are folded and accreted by thrust faults to the base of the ridge together with a large offset of oceanic crust suggestive of deep-seated intra-oceanic plate deformation.

The Zenisu Ridge appears as an oceanic crustal slab, dipping to the NW, with accreting clastic sediments at its base, which accomodates part of the convergence motion between Japan and the Philippine Sea plate. It can be considered as a classical example of intra-oceanic accretion.

On-land geology to the north of Zenisu strongly suggests that this type of deformation occured in ancient time. Progradation of an accreted arc massif, fringed by trough-fill sequence is recognized, suggesting a progressive retreat of convergent boundary since middle Miocene.

DRILLING OBJECTIVES

The deformation at the Zenisu ridge has been thoroghly documented by MCS, SCS, Seabeam and manned submersible observations. Drilling in this area could provide important information about such intra-oceanic deformation processes, marked by intense dewatering of sediments, water diagenesis,

organic matter maturation where development of benthic communities was observed by diving (KAIKO Program).
The objectives for drilling include:

1. To test the age and rate of tilting along the nothwestern slope of Zenisu ridge, by dating the observed unconformity and sedimentary facies. Because the Zenisu basin is filled by volcani-clastic turbidites, uplift and tilting by compressin should produce a fining upward sequence from turbidite to hemipelagite cover. On-land geology suggests that the Izu collision which might have triggered this intra-oceanic deformation occured one million years ago. Thus it will be possible to obtain important information on how the collision of arc massif is related to the ocenic plate deformation, what is the rate of deformation and how fast this intra-oceanic thrust was emplaced?

2. To check the nature of the basement of western Zenisu ridge, supposed to represent the oldest part of Shikoku basin oceanic crust.

3. To study the deformed sediments present along the South-eastern slope of Zenisu ridge and their dewatering stage. One site is proposed in the place where benthic communities were encountered during Kaiko diving Project. A comparison of the chemistry of the fluid produced by intraplate deformation with that of accretionary prism (i.e. Nankai) should produce an important data base for the nature of fluids in an oceanic regime.

SITE SURVEYS

A multichannel seismic survey was conducted with the R.V. Hakuho Maru (A. Taira, chief scientist) during November 1986. On basis of this new data, new sites will be presented in the final proposals, but will notdiffer thematically as well as in penetration depth than the sites proposed here.

Figure 1. Sketch of plate boundaries and geotectonic framework of Japanese Islands. Note that the collision of Izu-Ogasawara(Bonin) arc produced a bend in structural trend of the Honshu arc and an intraplate deformation within the Philippine Sea Plate.

Figure2. Geotectonic framework of Izu collision zone and location of Zenisu Ridge. (Zenisu Trough=Zenisu Basin=South Zenisu Trough).

Figure3. Sea Beam map of the Zenisu Ridge and location of proposed sites.

Figure 4. Tectonic map of the Zenisu Rdige.

Figure 5. Tectonic interpretation of Zenisu Ridge.

Figure 6. On-board monitor of MCS line across A-A'(see Fig.3).

Site	Location	W.D. (m)	Penetration (m)	EDT* (day)	Expected Geology & Reason for drilling
ZE1	137 28'E 32 55'N	4250	450	4.5	Turbidites and hemipelagite. Nature and age of the Zenisu basin.
ZE3	137 26'E 33 00'N	4150	450	4.7	Indurated hemipelagic muds. In situ pore water sampling for inorganic and organic analysis.
ZE4	137 48'E 33 04'N	3150	450 (50m, basement)	4.9	Hemipelagite, turbidite (or tuffaceous layers and lavas: oceancic basement). Establish nature and age of the crust.
ZE5	137 44'E 33 25'N	4100	650	6.6	Turbidite and hemipelagite. Age and rate of bsement filling - document the change of sedimentation.

* without logging

Total Drilling Time:	20.7	days
Total logging:	6	days
Transits :	2	days
Grand Total :	28.7	days

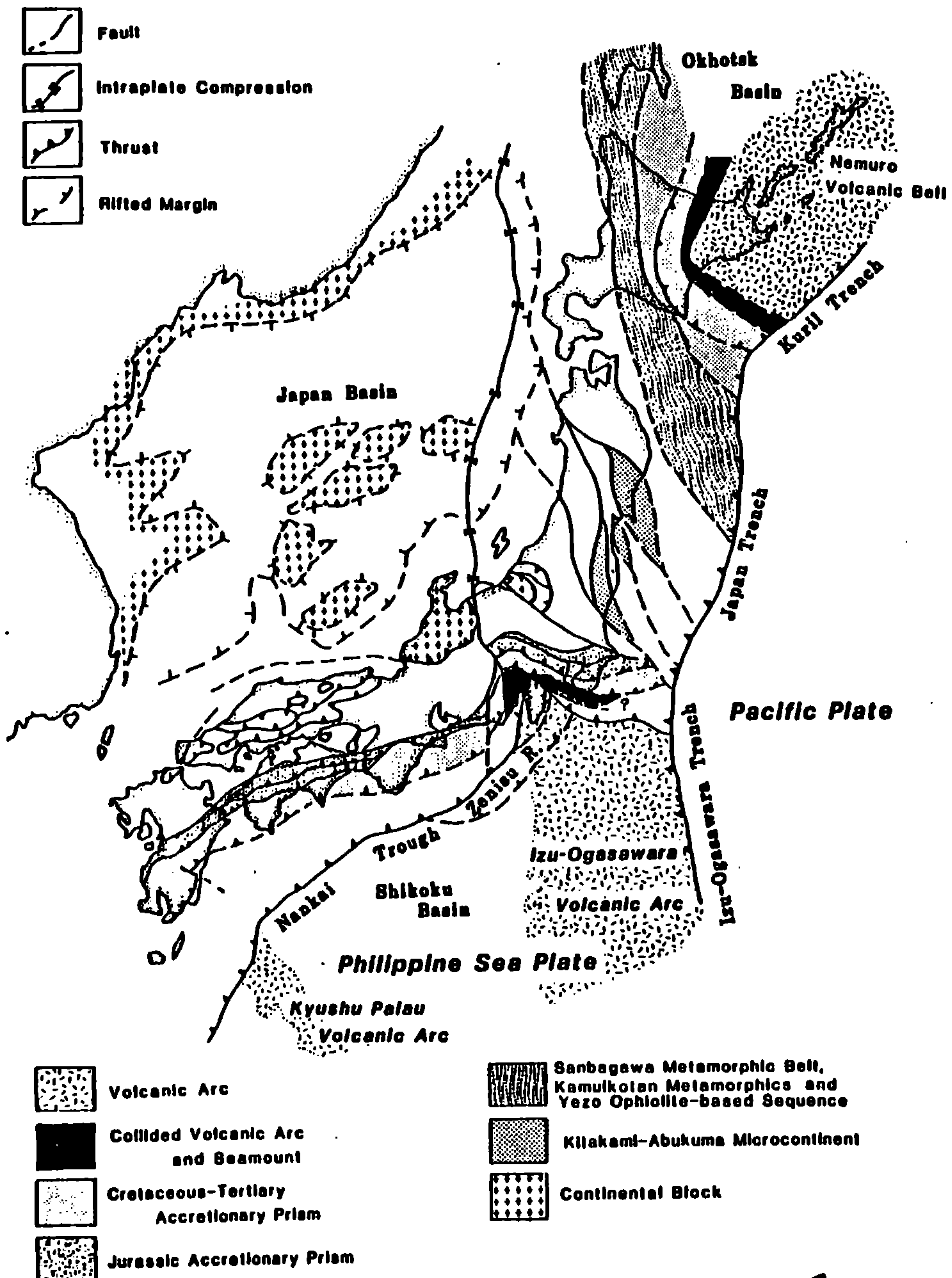

Fault
Intraplate Compression
Thrust
Rifted Margin
Okhotsk Basin
Nemuro Volcanic Belt
Kuril Trench
Japan Basin
Japan Trench
Pacific Plate
Izu-Ogasawara Trench
Zenisu R.
Nankai Trough
Shikoku Basin
Izu-Ogasawara Volcanic Arc
Philippine Sea Plate
Kyushu Palau Volcanic Arc
Volcanic Arc
Collided Volcanic Arc and Seamount
Cretaceous-Tertiary Accretionary Prism
Jurassic Accretionary Prism
Sanbagawa Metamorphic Belt, Kamuikotan Metamorphics and Yezo Ophiolite-based Sequence
Kitakami-Abukuma Microcontinent
Continental Block

Fig. 1

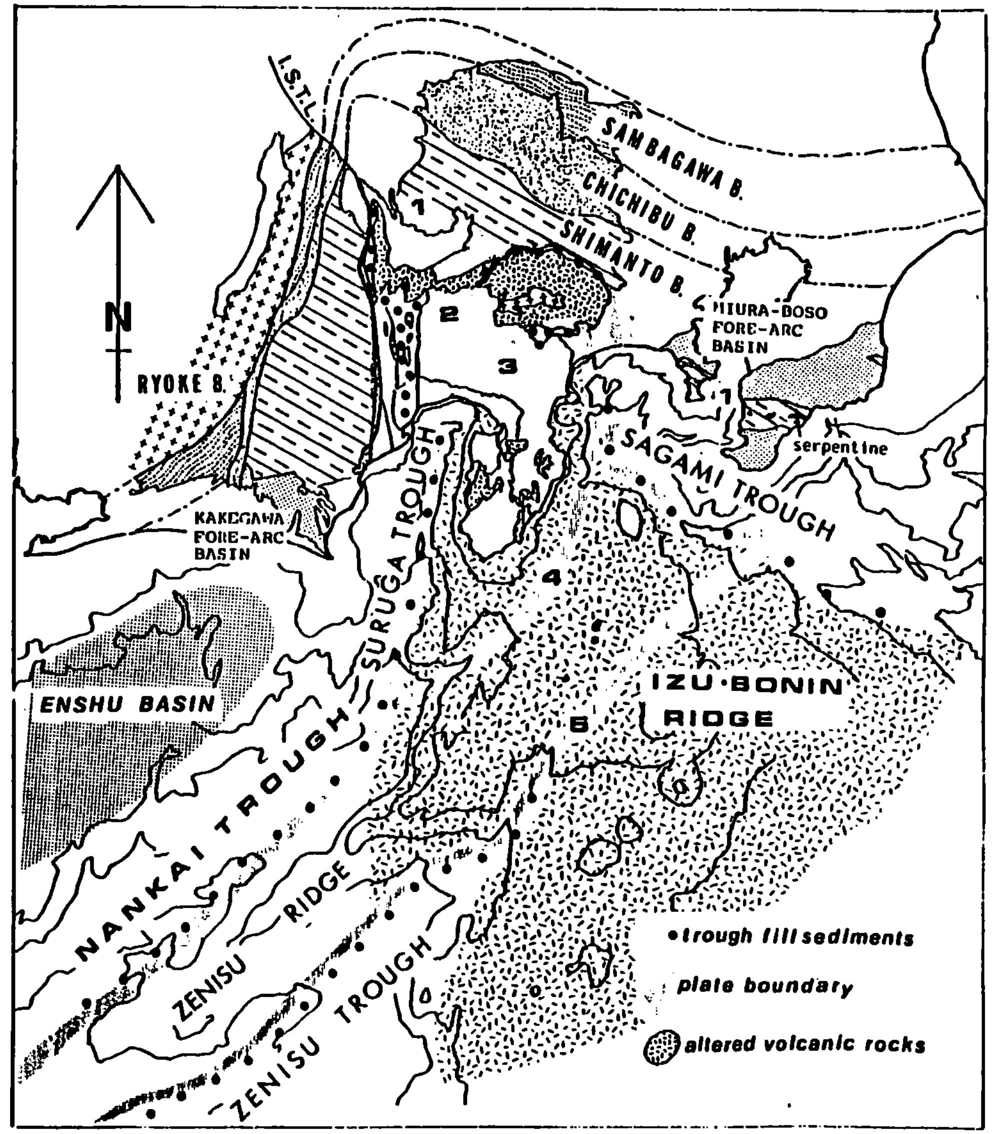

I.S.T.L.
SAMBAGAWA B.
CHICHIBU B.
SHIMANTO B.
N
RYOKE B.
1
2
3
MIURA-BOSO FORE-ARC BASIN
serpentine
KAKEGAWA FORE-ARC BASIN
SURUGA TROUGH
SAGAMI TROUGH
4
ENSHU BASIN
IZU·BONIN RIDGE
5
NANKAI TROUGH
ZENISU RIDGE
ZENISU TROUGH
trough fill sediments
plate boundary
altered volcanic rocks

Fig.2

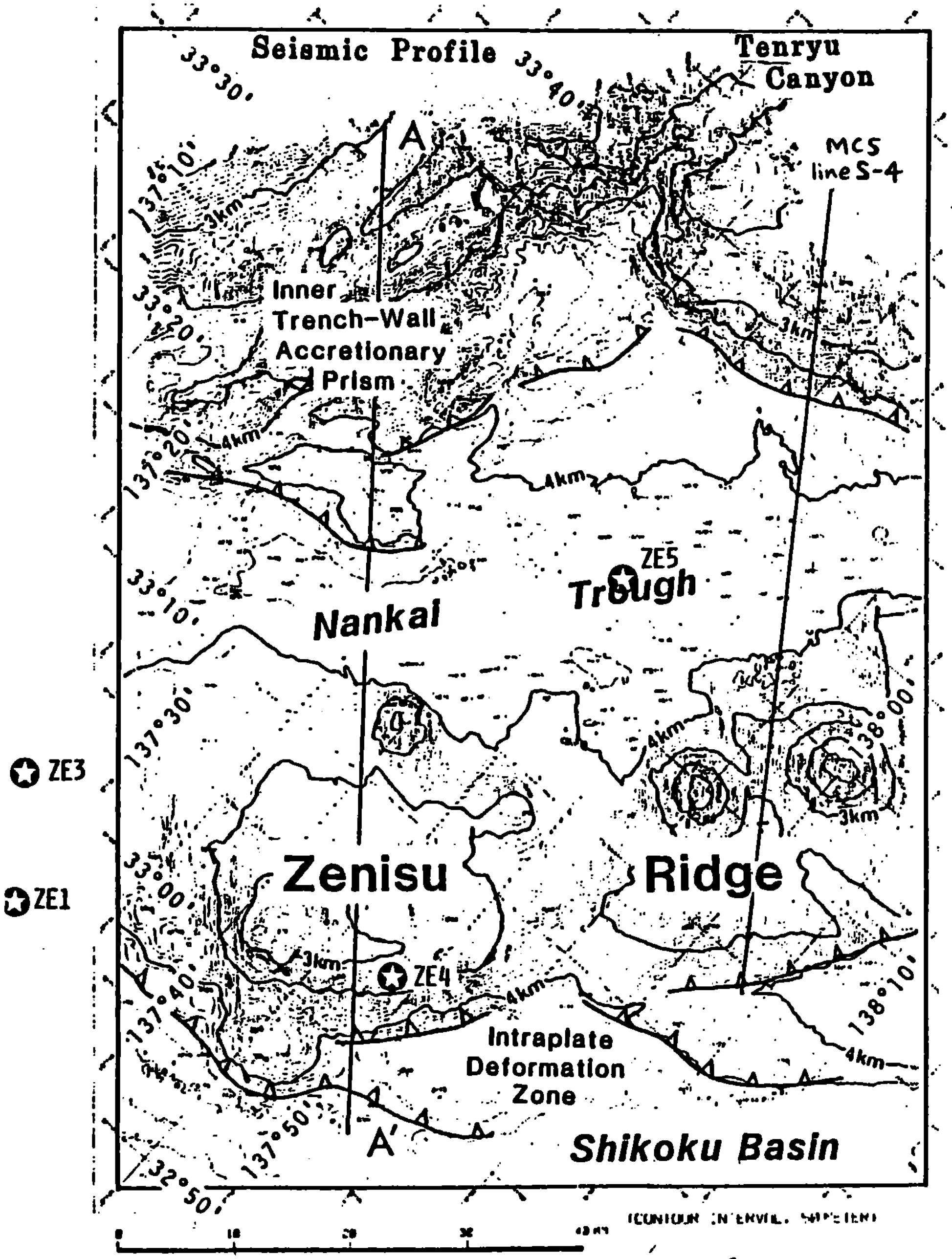


Fig. 3

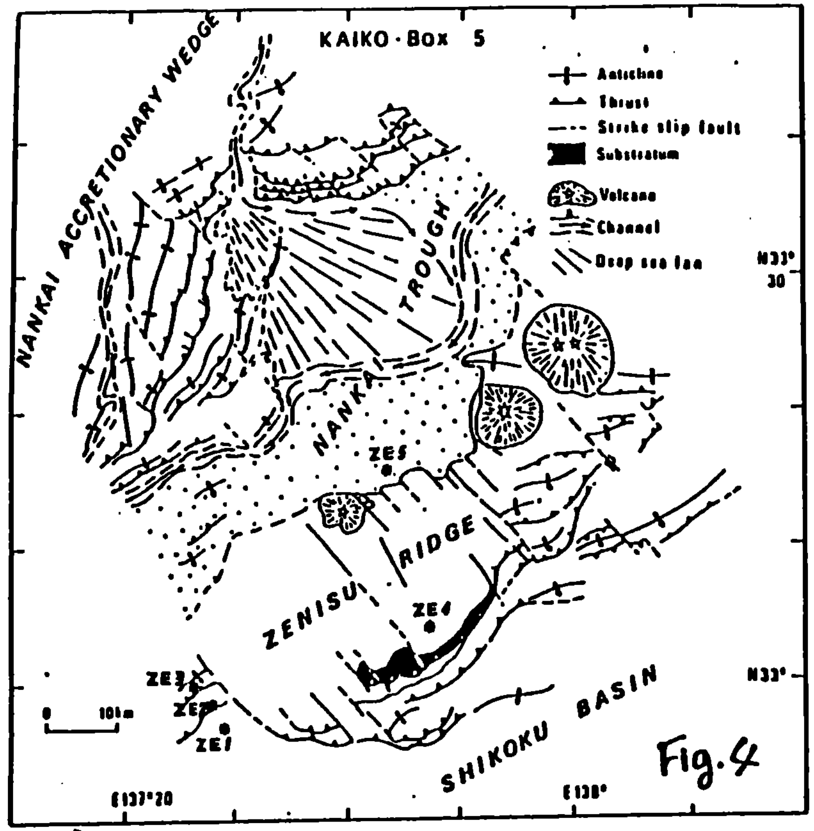


Fig. 4

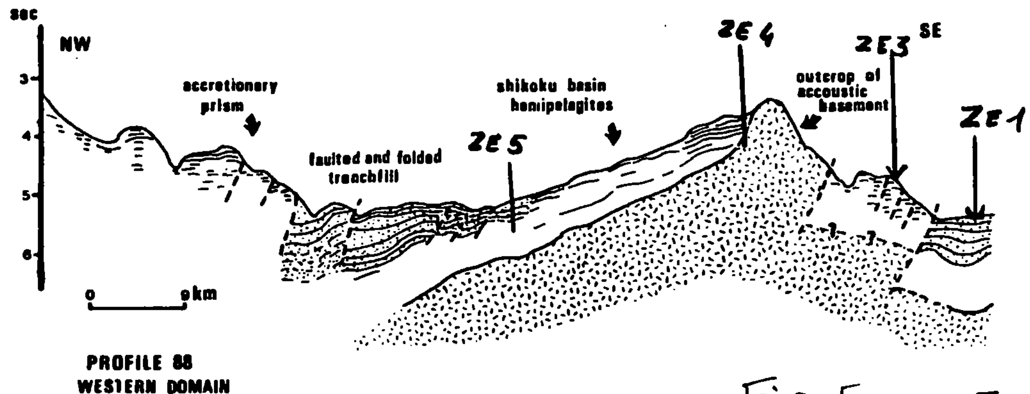
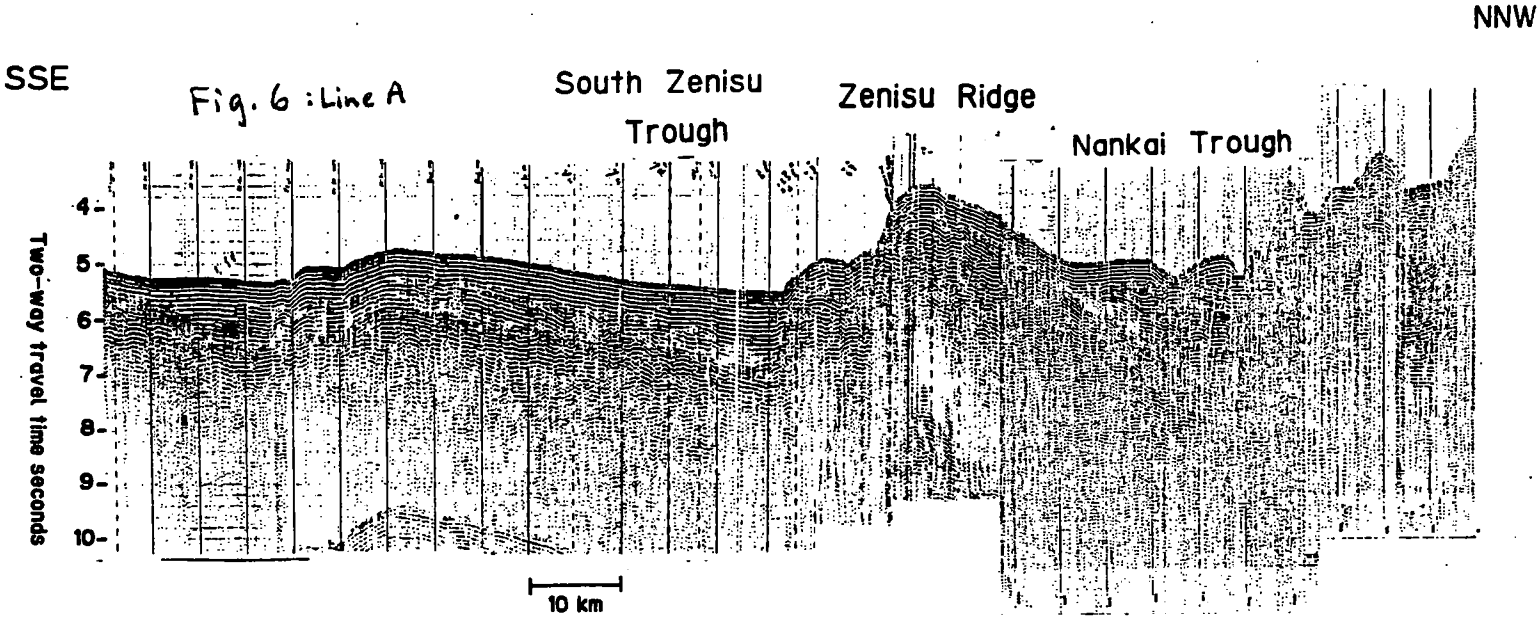


Fig. 5



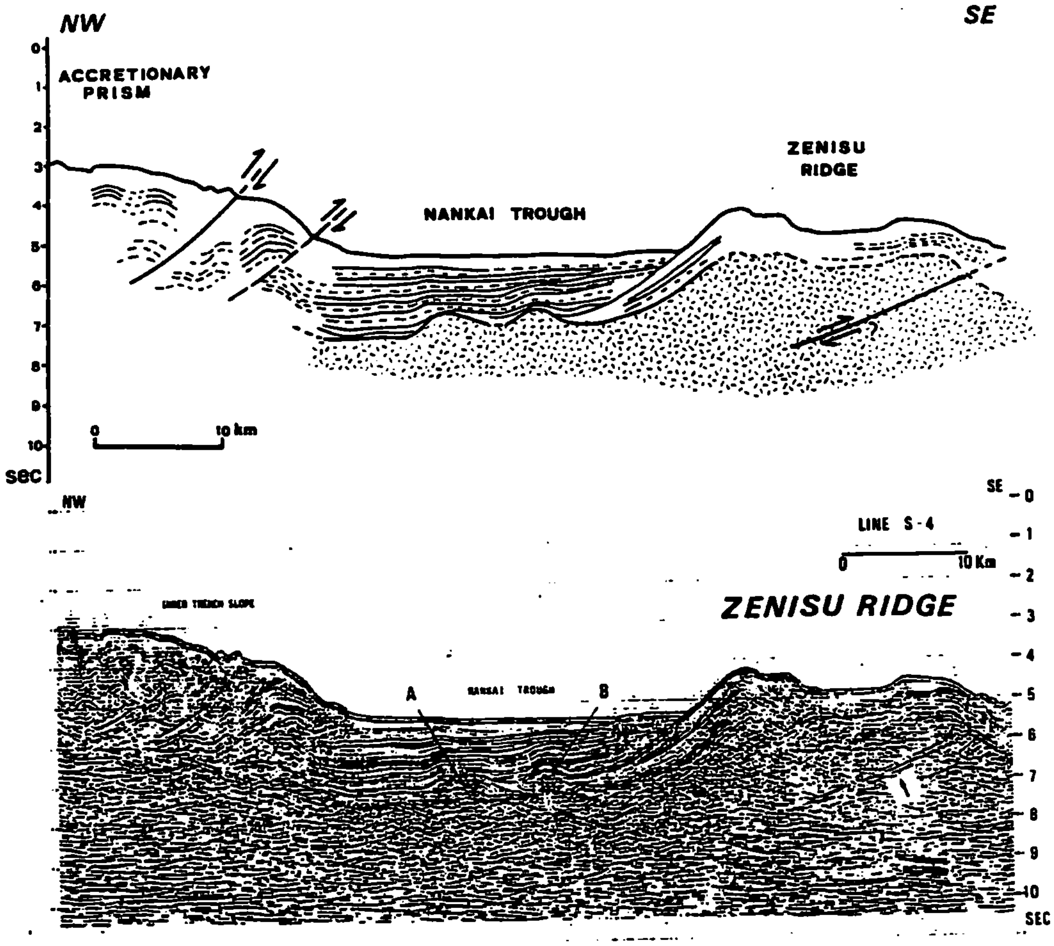


Fig. 7 : MCS line S-4 with interpretation

SUMMARY OF PROPOSED NANKAI TROUGH DRILLING AND GEOTECHNICAL PROGRAM

INTRODUCTION

Two types of drilling programs are proposed for the Nankai Trough to study processes within the toe of subduction zone sedimentary prisms.

a) Two holes. Sampling and measurement (approx 1 leg) of a hole through the major thrust decollement near the toe of the accretionary wedge, with an associated reference hole just seaward of the trench. Hydrogeology is emphasized.

b) Geotechnical hole (approx 1/2 leg). A single hole through the decollement dedicated to geotechnical measurements, in addition and adjacent to the above hole (or to a previous hole to the south). In-site measurement of physical properties and deformation processes are emphasized. Limited coring is proposed.

In addition, there have been general proposals for important long term downhole recording of earthquake related processes (perhaps 1/2 leg for emplacement if no new holes). Site specific proposals have not yet been received for the latter and they are not included below.

The objectives are not restricted to this location, but Nankai appears to be the most suitable of the West Pacific convergence zones. It represents the important class of thick clastic wedge convergence zones, and as such is complemetary to what has been done at the Barbados trench where pelagic mud is dominant . The Nankai area is also tectonically and structurally relatively simple and it is extremely well studied including some previous drilling, excellent multichanel data, documented vents showing fluid circulation, and detailed heat flow data. Previous drilling suggests reasonably stable hole conditions.

There are two sedimentary sequences on the incoming plate, an upper thick Pleistocene-Recent turbidite unit overlying a Plio-Oligocene hemipelagic unit. The decollement is developed in the upper part of the hemipelagic unit.

OBJECTIVES

The goal of the proposed Nankai Trough drilling and downhole measurement programs is to determine how deformation takes place in a subduction zone sedimentary prism, and the fluids and physical properties that control the defomation process. This includes determining why at some zones there is primarly accretion while there is erosion at others, why forearc uplift or subsidence occurs, and the nature of earthquake processes. Geomechanical models require a knowledge of the sediment deformation behaviour as it is chemically and physically consolidated and indurated with time, depth and position, and whether deformation takes place plastically, or through brittle fractures, Brittle deformation may be regionally distributed or on a few major faults. Dewatering and fluid flow must play a major role in the consolidation and deformation processes.

SOME PRIMARY MEASUREMENTS

1. Porosity - directly related to strength and to consolidation history, and closely related to other physical properties such as permeability, seismic velocity, density, thermal properties, electrical resistivity etc. Estimates of both intergranular and fracture porosity are needed. Porosity is to be measured both in-situ through a variety of downhole logs (intergranular and fracture) and in the laboratory on core samples (generally only intergranular).

2. Permeability - pore and fracture fluids play a critical role in accretionary wedge processes, and their movement is controlled by the permeability. Both intergranular and fracture permeabitily must be estimated. Permeability is a critical parameter to be measured downhole with newly developed and refined tools. Intergranular permeability is also to be measured in the laboratory.

3. Mechanical Properties and State - provide constraints on the geometry of deformation and on its nature ie. effective stress state and mechanical modulii properties (shear strength, cohesion and coefficient of friction). Some stress data is to be obtained inhole from borehole televiewer and "breakouts" (hole ellipticity), and pore pressure measurements with packer and "probe hole" instrument (see below) and some from laboratory measurements including fracture orientation and the anisotropic strain relaxation technique. Core orientation is important. Mechanical properties are to be obtained in-situ (see below) and by laboratory measurements (whole core proposed from geotechnical hole see below).

4. Seismic Velocity - (including anisotropy)- is related to many physical properties and processes. Velocity is the best method by which properties at depths beyond the reach of the drill may be estimated. Velocities are to be measured by downhole logs, and in the laboratory (allows determination of temperature and pressure dependence.) A variety of seismic experiments may also be carried out with recording in the hole and shooting at the surface (ie. "vertical seismic profile" proposed for this hole) that give information in the region surrouding and below the depth of the hole.

5. Temperature and Thermal Properties - temperature is a critical parameter for physical and chemical alteration processes within the sedimentary prism, for deliniating fluid motion, and for deformation models. Heat flow measurements provide the primary constraint on models for deep temperature. Data is to be obtained through the APC (VonHerzen) temperature tool, the downhole sediment probe, and through continuous temperature logging (corrected for drilling disturbance). Thermal conductivity is to be measured on cores in the

laboratory.

6. Fluid Geochemistry - provides valuable clues as to the nature of fluid flow in the accretionary prism including the flow paths amd depths of origin. Fluid geochemistry also provides information on alteration processes. Fluid samples are to be obtained by the downhole probe (Barnes tool), by packer sampling and by laboratory sampling from cores.

PROPOSED PROGRAM

a) A primary program of a single hole through the decollement to basement NKT-2, along with reference hole NKT-1. The area of 583 is an alternate.

This program involves complete core sampling and a basic suite of downhole logs and measurements. Specific problems to be addressed are the hydrology and fluid chemistry of the prism toe and decollement ; structural development of imbricate thrusts and diffuse deformation zones penetrated ; state of sediments beneath the decollement . A succesful program will require close integration of core analysis including laboratory measurements, downhole physical properties and state measurements (including regular logging), and of subduction zone sediment wedge deformation and hydrogeology models.

b) An additional dedicated hole is proposed at site 583 or NKT-2 focused on in-situ downhole geotechnical measurements, a unique new concept for ODP holes. Both sites have advantages, but present analysis argues for NKT-2 because of its shallower depth to the decollement (approx.1000 vs 1600m) (the times below are for the former). Primarily non-core drilling with some cores (approx.every 30m) for whloe round laboratory geotechnical measurements is proposed. The previous adjacent hole will have been continuously cored. The primary objective is to obtain mechanical (geotechnical) properties downhole under in-situ conditions, supplemented by pore pressure, and temperature and in-situ stress measurements and pore fluid sampling.

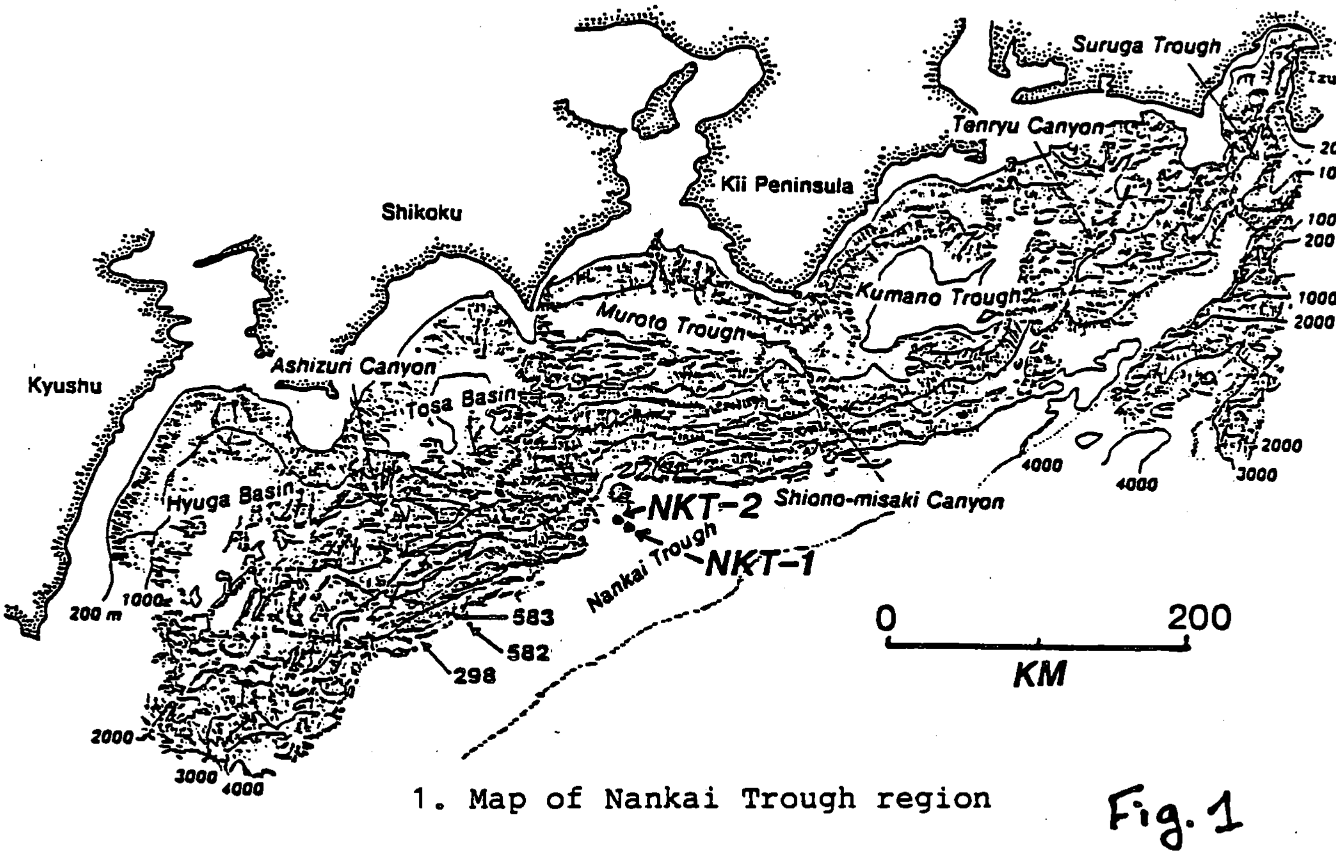
SPECIAL TOOLS AND MEASUREMENTS

The basic two hole program ("a" above) requires a very comprehensive suite of downhole logs, including televiewers, packers, pore fluid samples, temperature probes, multichannel seismic tool etc. a 4-arm caliper is desirable.

The additional special geotechnical hole ("b"above) has a primary development requirement of a small diameter hole ("probe hole") to be drilled ahead of the main bit by a Navidrill type system as is now being developed. It must be possible to keep this hole free from cuttings to allow instrument insertion. Probe hole measurements would include mechanical properties, pore fluid and temperature.

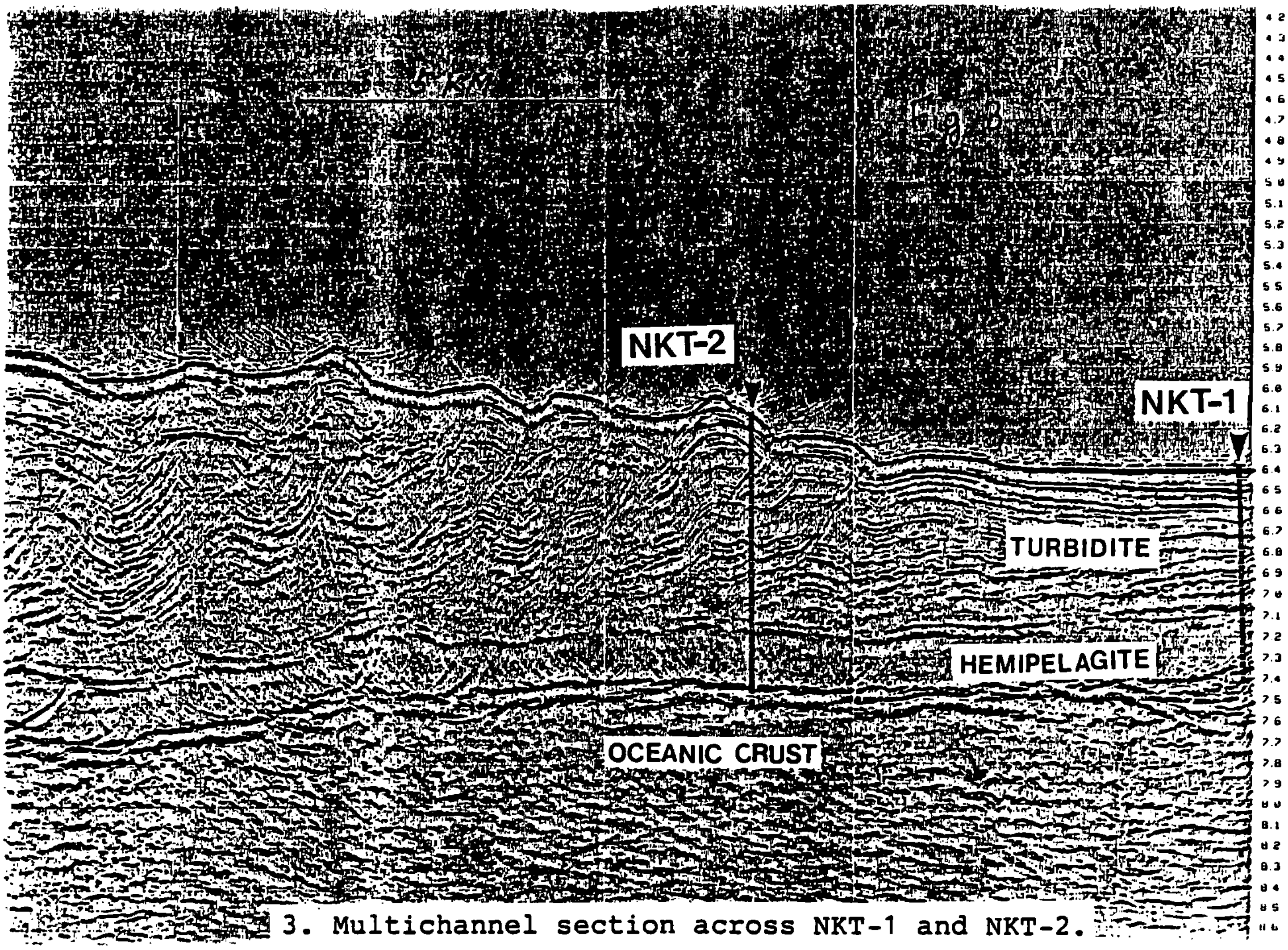
Summary of Proposed Sites

Site No.	Program A: NKT-1	Program A: NKT-2	Program B (Geotech): NKT-2 or New 58?
Hole Type	APC(to 200m) RCB(to 900m)	APC/XCB(to 1000m) Rentry(to 1300m)	APC/XCB(to 1000m) Rentry(to 1300m)
Latitude& Longitude	32°58' 134°58'	32°23' 134°56'	31°50' 133°51'
Water Depth	4803m	4730m	4630m
Sediment Penetration	900m	1300m	1300m
Basement Penetration	0m	0m	0m
Drilling Time	12 days	22 days	16 days (spot drilling)
Logging Time	5 days	10 days	10 days
Special Experiment	2 days	3 days	6
Transit Time	1.5 days (Tokyo to Site)	1.5 days (Tokyo to Site)	1.5 days (Tokyo to Site)
Total Days	20.5 days	36.5 days	33.5 days

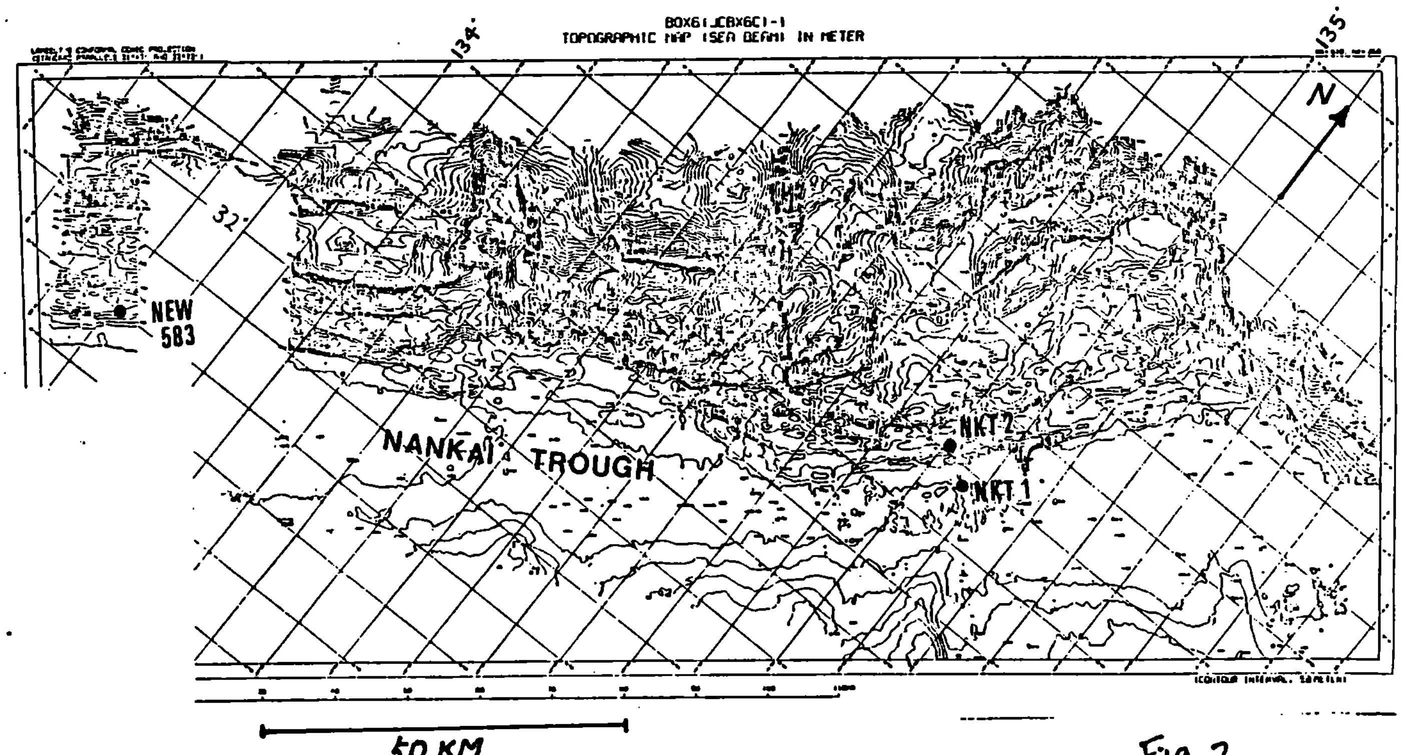


1. Map of Nankai Trough region

Fig. 1

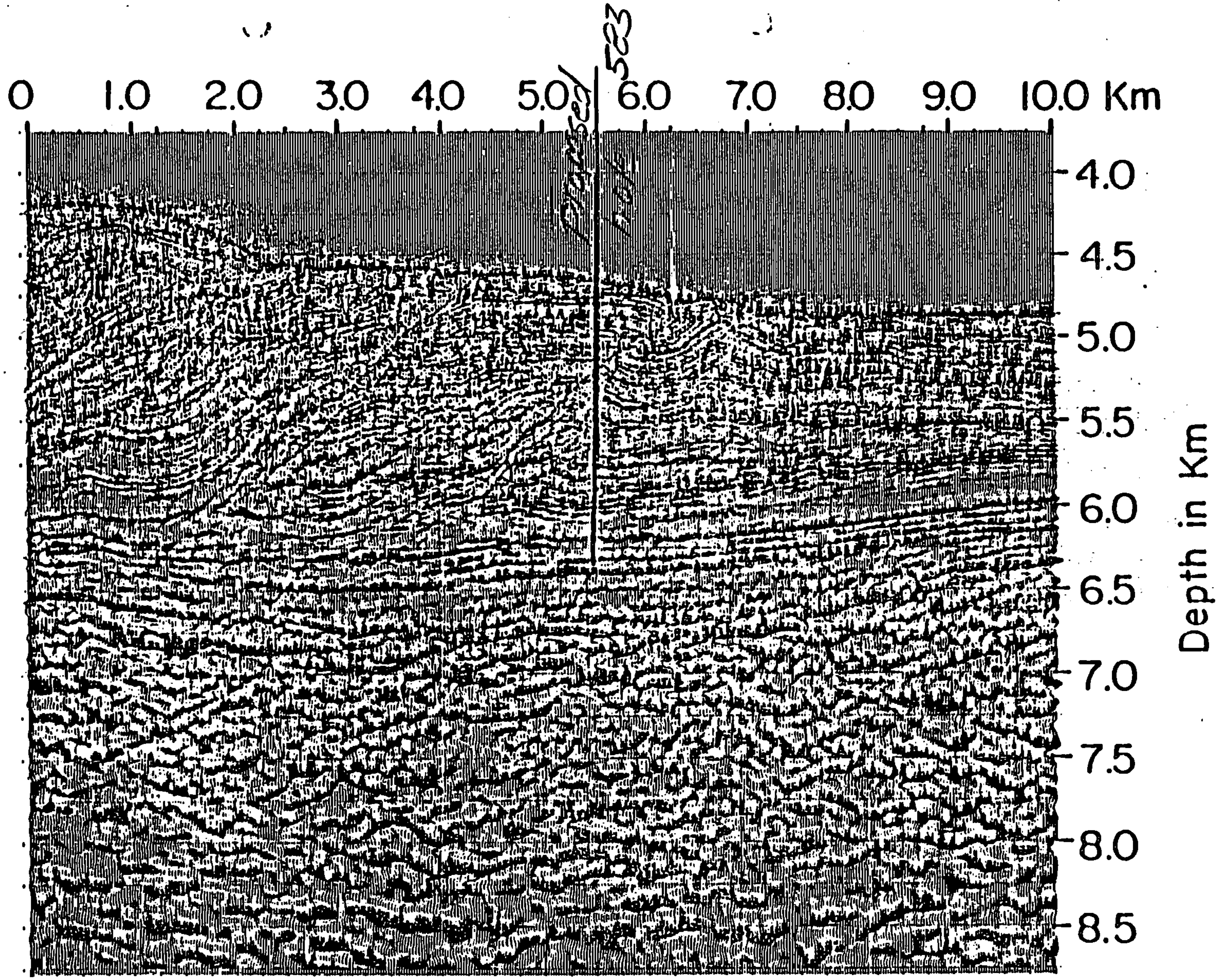


3. Multichannel section across NKT-1 and NKT-2.



2. Sea-Beam map of Nankai Trough covering NKT-1, NKT-2, and 583 regions.

New 583



4. Multichannel section across site 583.

Fig. 4

SUMMARY OF THE BONIN DRILLING PROGRAM

Addressing Processes of Intra-Oceanic Arc-Trench Development:

1) Arc Rifting: Nascent Backarc Basins
2) Arc/Forearc Magmatism, Structure, Stratigraphy and Vertical Tectonics
3) Outer Forearc Serpentinite Diapirism

TECTONIC SETTING

Subduction of Pacific lithosphere beneath the West Philippine Basin began in the Early Eocene, and through the Early Oligocene formed an intra-oceanic volcanic arc and a 200-km-wide forearc of arc volcanic material (tholeiites and boninites), possibly superimposed on previous oceanic crust. Mid-Oligocene rifting split the arc and late Oligocene-Early Miocene back-arc spreading in the Parece Vela and Shikoku Basins isolated the remnant arc (Palau-Kyushu Ridge) from the active Bonin-Mariana arc and forearc. The rifting and initial spreading was time transgressive, starting in the center of the Parece Vela Basin and at the northern end of the Shikoku Basin, resulting in the bowed and V'd shape of those basins, respectively. This process is being repeated. The southern part of the arc split again in the Late Miocene, and 6 to 8 my of seafloor spreading in the Mariana Trough has isolated the active Mariana arc from, and increased its curvature with respect to, the remnant West Mariana Ridge. Spreading in the Mariana Trough may be propogating to the north. In contrast, the Izu-Bonin arc is still in the rifting stage of backarc basin formation and is undergoing extension along most of its length. The major zone of rifting is immediately west of the active volcanic chain, but some arc volcanoes near 29°N are surrounded by grabens. Volcanism is continuing along both the active and "remnant" arcs. Volcanic centers have also developed in the rift basins. Their chemistry indicates a basalt-andesite-rhyodacite association, with the basalts having similar major and trace-element compositions to Mariana Trough tholeiites. The backarc rifts are semi-continuous along strike, being segmented by structural highs and chains of submarine volcanoes extending westwards from the island volcanoes.

The difference in arc/back-arc evolution between the Mariana and Bonin systems has produced corresponding differences in their forearcs. The Bonin forearc has experienced little structural disruption since its inception. A broad forearc basin has accumulated volcaniclastic and hemipelagic sediments behind an outer-arc high. The onlap of strata onto this high, together with Eocene shallow-water fossils found on the Bonin islands, indicates that it has been a relative structural high since early in the history of the arc. A mature, dendritic, submarine canyon system has developed by mass wasting and headward erosion, incising many deep canyons across the forearc, cutting as much as 1 km into the 1.5 to 4 km thick sedimentary section. In contrast, the Mariana forearc has not behaved as a rigid plate, but has undergone extension tangential to its curvature. This has produced radial fractures and, together with the disruption caused by numerous seamounts on the subducting plate, easy pathways for diapiric intrusions of serpentinised mafic/ultramafics of arc affinity. Eruption of these diapirs onto the seafloor, together with uplift of forearc material due to their subsurface intrusion, has formed a broad zone of forearc seamounts (up to 2500 m high and 30 km in diameter) 50 to 120 km from the trench axis. In the Bonins chloritised/serpentinised mafic/ultramafics occur along a narrow zone which controls the location of a lower-slope terrace. This zone appears to be the oceanic forearc analog of overpressured dewatering zones in accretionary sedimentary wedges. Possibly because most of the sediment has slumped off the trench inner wall, the large forearc canyons die out on the middle slope and do not cut across the lower-slope terrace. Only very minor, and probably ephemeral, accretionary complexes occur at the base of the inner wall of both the Bonin and Mariana trenches.

SITE RATIONALE

Investigating the processes of intra-oceanic arc-trench development in the same region has obvious logistic and scientific benefits. Several factors combine to make the Bonins the best of all the western Pacific locations in which to address these processes. They include (1) the present density of marine geological and geophysical information, (2) the plans for additional multidisciplinary surveys, (3) certain unique geological factors such as the presence of large submarine canyons and the Bonin Islands (a subaerial outer-arc high), and (4) the inherent simplicity of the system (continuous subduction since the Eocene without major collisions or arc reversal). However, the largest and best studied serpentinite diapirs occur in the Mariana forearc, and two sites in this two-leg drilling program are proposed there.

BONIN SITES 1 and 2 are located in the graben and on the bounding horst, respectively, of the active Sumisu rift, and seek to determine the:
1) differential uplift/subsidence history of the central graben and bounding tilted arc block, and whether this is compatible with stretching or detachment models of extensional tectonics.
2) duration of rifting.
3) nature of syn-rift volcanism and sedimentation, whether arc volcanism is continuous or interrupted by rifting, and when the extrusion of back-arc type basalts began.
4) extent and chemistry of hydrothermal circulation in a tectonic and petrologic setting similar to that of Kuroko-type massive sulphide deposits.
5) nature of the rift basement.
6) nature of the arc basement between (and isolated from the pyroclastic deposits of) major arc volcanoes. [Consider the limitation to our knowledge of continental arcs if we were restricted to exposures in the top 1000 m of only the largest stratovolcanoes.]

BONIN SITES 3-6 are located in the forearc near 32°N; BON3 on the frontal arc high, BON4 on the inner and BON5 at the center of the upper-slope basin, and BON6 on the outer-arc high. These sites were chosen to determine the:
1) uplift/subsidence history across the forearc (using backstripping techniques on cored/logged holes and seismic stratigraphic analysis of interconnecting MCS profiles) to provide information on forearc flexure and basin development, as well as the extent of tectonic erosion. We do not know whether the frontal arc and outer-arc high develop by igneous construction or differential uplift, whether the upper-slope basin between them is due to forearc spreading or differential subsidence, or whether flexural loading by either arc volcanoes or by coupling with the subducting plate is an important process. For example, the seismic stratigraphy laps onto and reverses dip over the frontal arc high. Is this due to an original Eocene volcanic high. to mid-Oligocene rifting of the arc, or to Plio/Pleistocene volcanic loads on the fractured (by rifting) edge of the forearc?

2) forearc stratigraphy, to ascertain (a) the sedimentology, depositional environment and paleoceanography, and (b) the variations in intensity and chemistry (boninitic, tholeiitic, calc-alkaline, rhyo-dacitic, alkaline) of arc volcanism over time, and the correlation of these variations with periods of arc rifting, backarc spreading and varying subduction rate.
3) nature of igneous basement forming the frontal arc, outer-arc high and beneath the intervening forearc basin (which has never been sampled) to answer questions concerning the initial stages of arc volcanism and the formation of a 200 km wide arc-type forearc massif (were the frontal arc and outer-arc high formerly contiguous and subsequently separated by forearc spreading, were they built separately but near synchronously on former West Philippine Basin oceanic crust, or are they part of a continuous Eocene arc volcanic province, possibly with overprints of later forearc volcanism?).
4) micro-structural deformation as well as the large scale rotation/translation of the forearc. Paleomagnetic studies of the Bonin Islands suggest 90° clockwise rotation and 20°N translation since the Eocene, which has major implications for reconstructions of the Philippine and surrounding plates.

BONIN SITE 7 & MARIANA SITES 2 & 3 are located on forearc seamounts; BON7 on the flank of a dome along the Bonin lower trench-slope terrace, MAR2 on the flank of Pacman seamount near the Mariana trench slope break (a large diapir which has breached the surface and erupted serpentinite flows), and MAR3 on a nearby conical seamount interpreted to represent an updomed forearc sequence resulting from subsurface emplacement of a diapir.

Forearc diapirs were first recognized AFTER the last round of western Pacific drilling. The proposed drill sites, in three different structural settings, seek to determine the
1) timing of emplacement: ongoing, dormant, Oligocene? — from the stratigraphy of the flows and intercalated sediments on the flanks of the seamounts, and from the history of tectonic uplift above the subsurface intrusion.
2) emplacement mechanism: diapirs of serpentinite with entrained wall rock in the Marianas vs. completely remobilized outer forearc in the Bonins?; and the internal structures (fracture patterns, flow structures) of the seamounts.
3) extent of fluid circulation through the outer forearc and the chemistry of the fluids (from the subducting plate, overlying lithosphere, circulating seawater?).
4) conditions at depth in the outer forearc from the igneous and metamorphic petrology of the lower crustal rocks.

Forearc diapirism may provide a model for emplacing some alpine-type ultramafic bodies common in accreted terranes pre- rather than syn/post-collision.

BONIN SITE 8 is located on the outer trench flexural bulge of the Pacific Plate near magnetic anomaly M15. Drilling objectives include:
1) a reference site for geochemical mass balance calculations: to what extent does subducted material influence the chemistry of arc and rift volcanism?
2) to determine changes in the Tertiary bottom currents, whether these caused the regional hiatuses in NW Pacific sedimentation and, by comparison with the Bonin arc/forearc sites, to what extent the Bonin-Mariana arc served as a barrier to divide the bottom currents.
3) to determine the earliest Cretaceous stratigraphy and crustal petrology (i.e., to penetrate the late Cretaceous cherts for the first time).

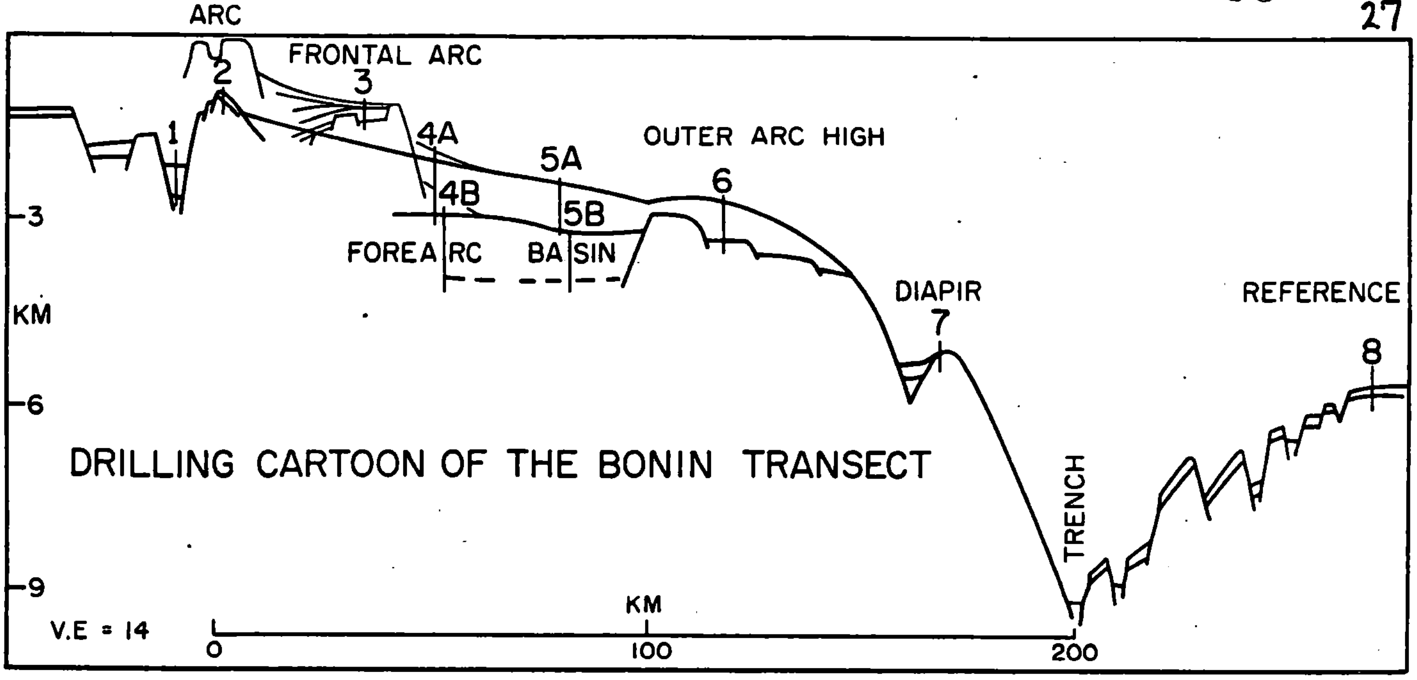
SITE SUMMARY

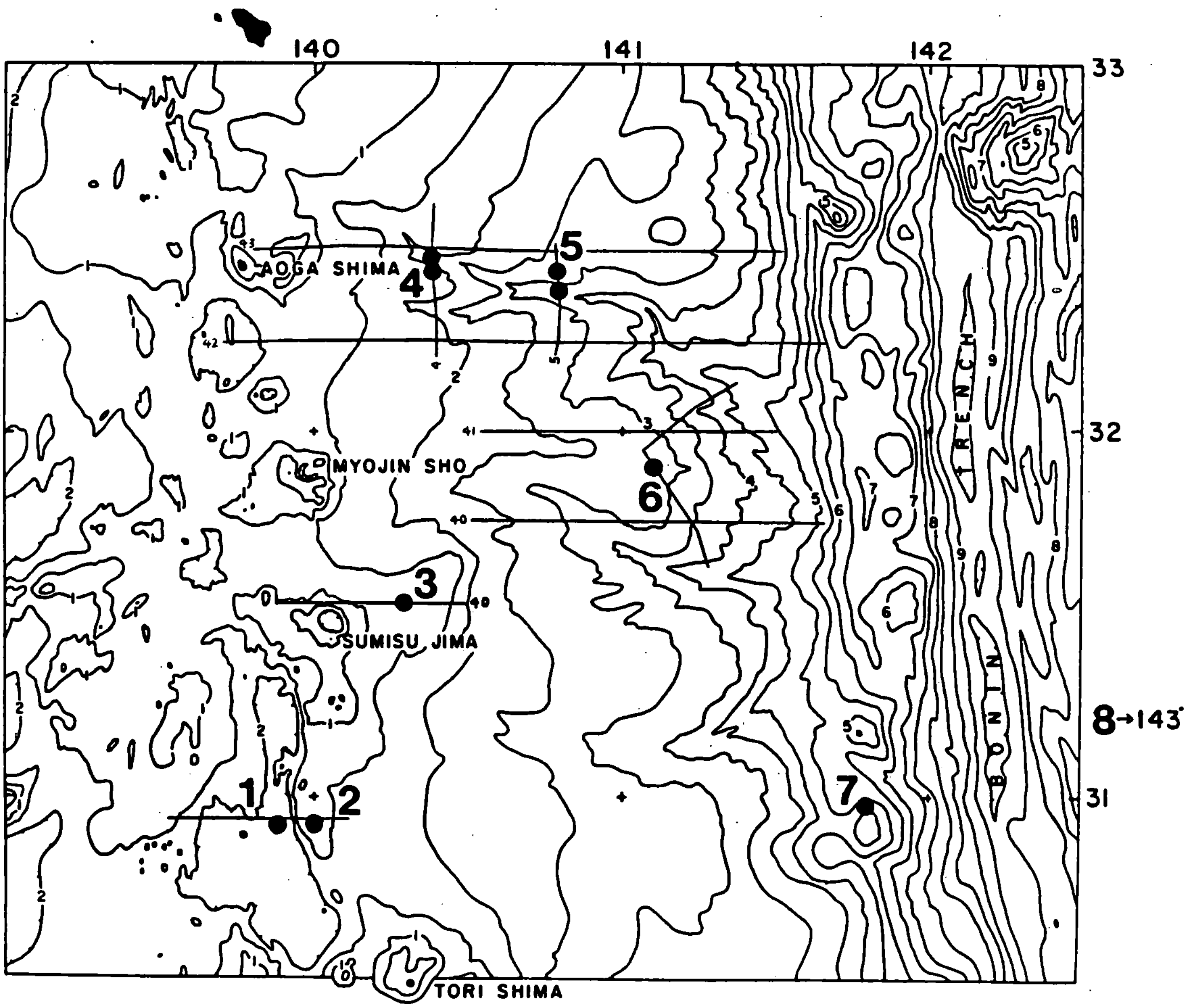
The sites that we propose to be drilled in the Bonins represent a compromise between deep basement and complete stratigraphic objectives. They were chosen from an extensive data base that needs some additional close-spaced MCS profiles. Twelve ALVIN dives in the Sumisu Rift are scheduled for July 1987, and 2000 nm of 48-fold MCS will be collected in June-July 1987. The additional MCS should be able to identify sites where shorter holes can meet the objectives (especially for forearc sites 4 and 5). The Mariana sites are extensively surveyed but need better seismic reflection data. Fourteen ALVIN dives are scheduled for May 1987. Nine of the twelve holes are in water depths less than 4000 m (average - 2400 m) which should result in very good biostratigraphy. The principal proposals on which this summary is based are #171 for the Bonins, with sections on paleoceanography from #83, and #172 for the Marianas.

Site #	Lat.(°N)	Long.(°E)	W.D.(m)	Penetration		Site Time* (days)		
				Sed.	Bsmt.	Drill	Log	Total
BON1	30°55'	139°53'	2270	850	50	8.5	1.6	10.1
BON2	30°55'	140°00'	1100	500	200	16.2	1.3	17.5
BON3	31°22'	140°17.4'	1250	600	50	5.2	1.2	6.4
BON4A	32°26.5'	140°22.5'	1820	700	—	4.9	1.4	6.3
BON4B	32°28.6'	140°22.5'	2420	950	50	9.6	1.7	11.3
BON5A	32°26'	140°47'	2700	950	--	8.7	1.7	10.4
BON5B	32°23'	140°48'	3400	900	50	10.9	1.7	12.6
BON6	31°54'	141°06'	2850	950	150	21.5	2.5	24.0
BON7	30°58'	141°48'	4650	500		6.1	1.5	7.6
BON8	31°18'	142°54'	6000	500	20	10.0	1.7	11.7
MAR2	19°20'	146°54'	3700	700		8.9	1.6	10.5
MAR3	19°30'	146°41'	4200	700		9.6	1.6	11.2

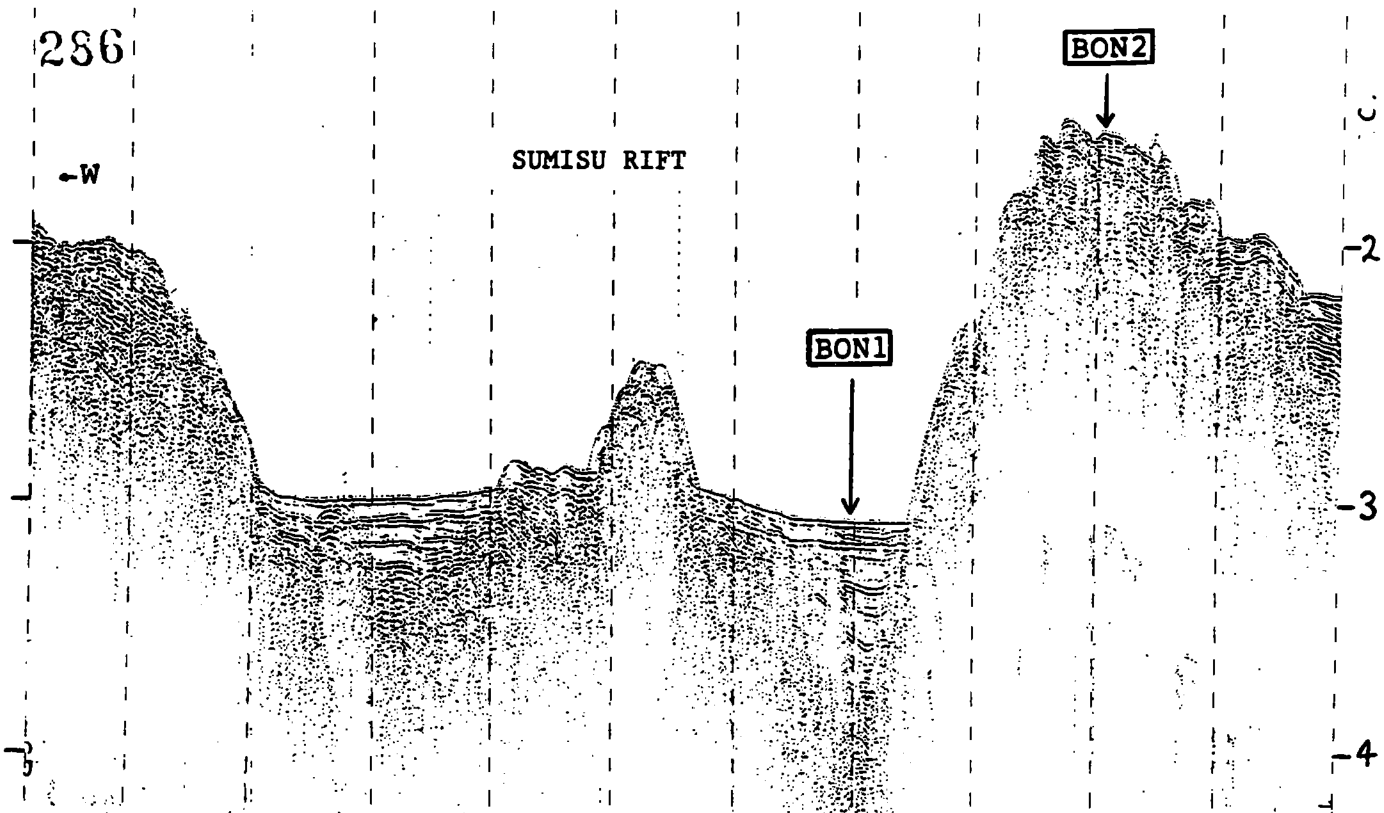
*Time estimates assume APC/rotary coring, with re-entry cones at sites 2 and 6 only and no special experiments.

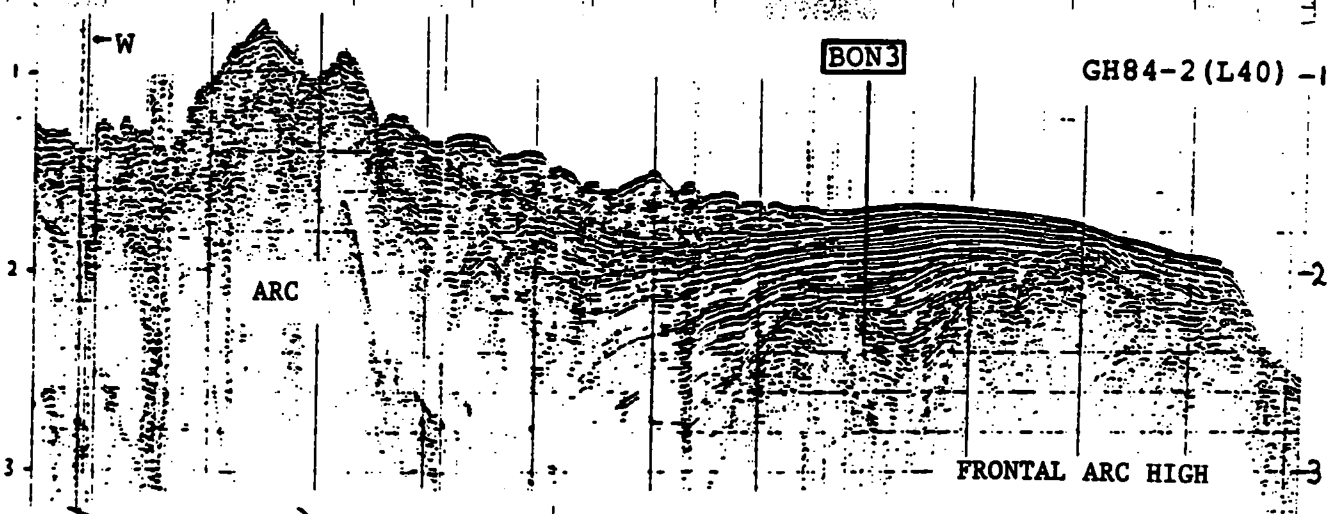
WPAC ranked proposed Bonin-Mariana drilling by considering two programs (page 1): Bonin Leg 1 = rifting and forearc objectives (sites 1, 2, 5A, 5B, and 6) with 4 days transit totals 79 days. Bonin/Mariana Leg 2 = diapir and reference sites (BON7, BON8 and MAR ref.) total 41 days, without re-entry sites and with 7 days transit.

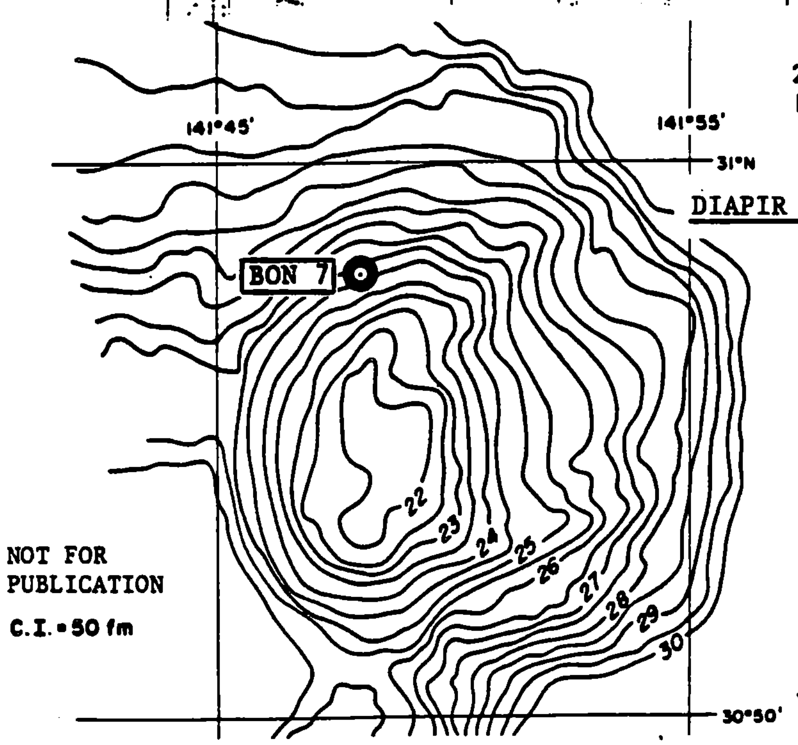


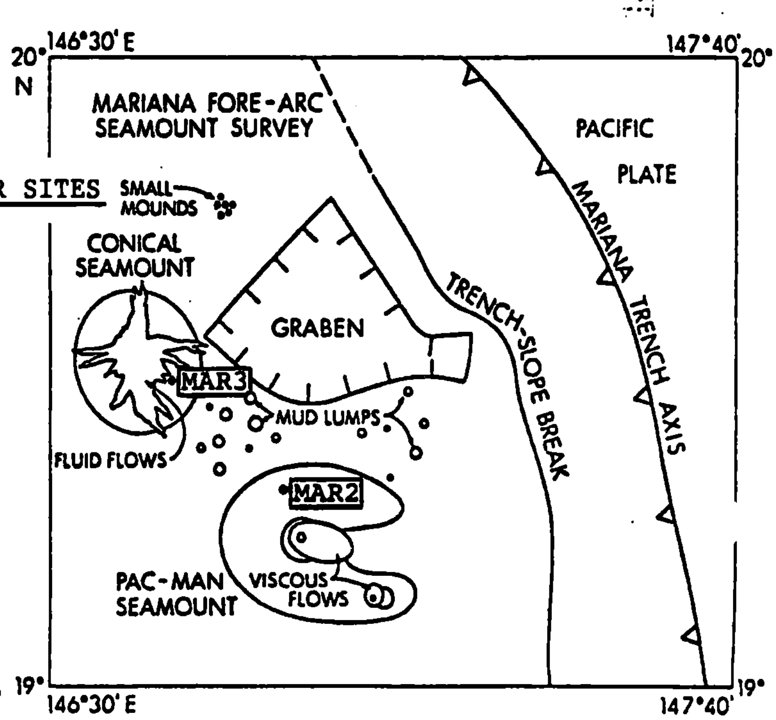


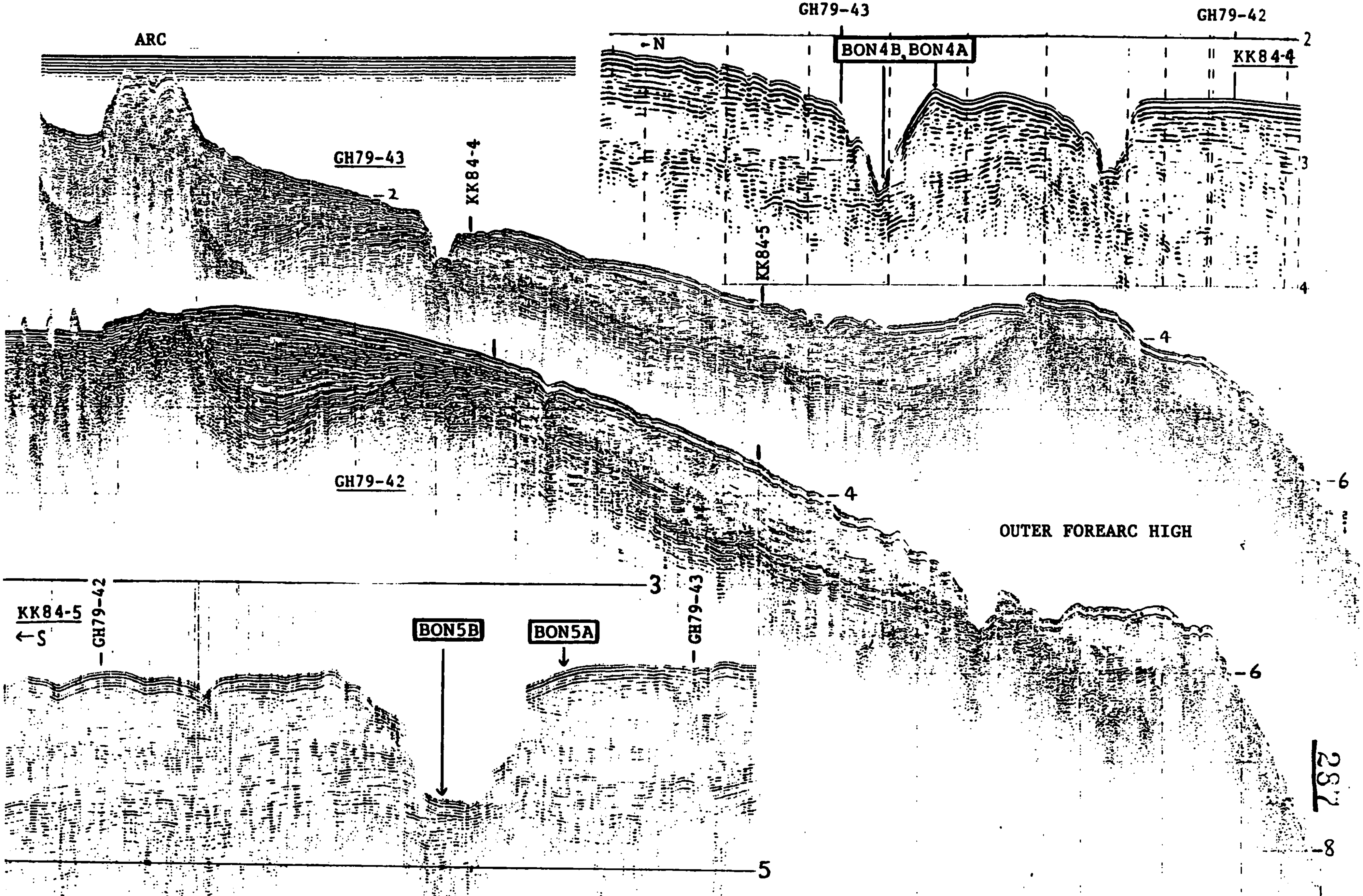
Location of proposed Bonin sites 1-8 and associated tracks of seismic profiles.


BON2
SUMISU RIFT
←W
BON1
2
3
4

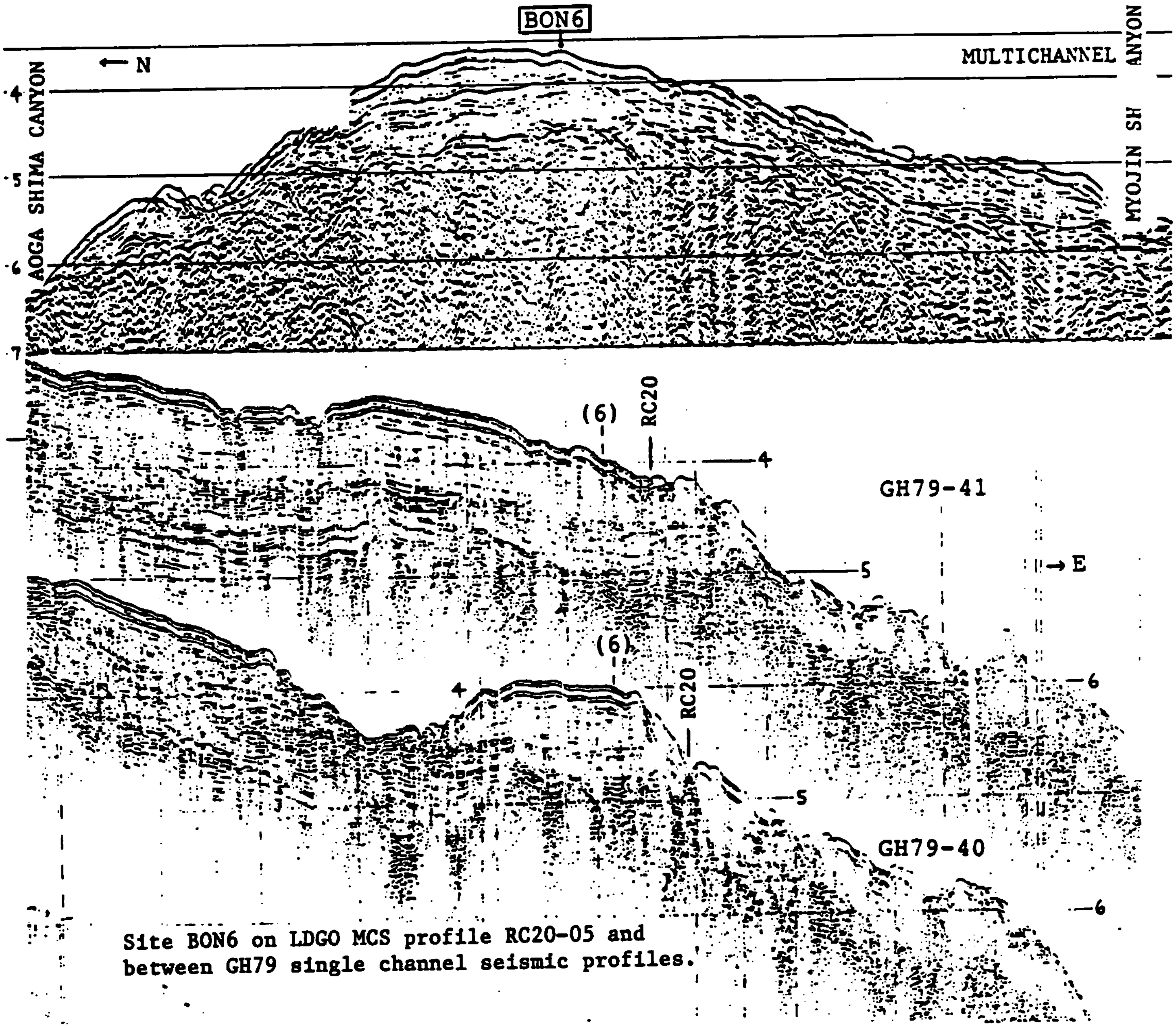

←W
BON3
GH84-2(L40)
ARC
FRONTAL ARC HIGH
1
2
3


141°45'
141°55'
31°N
DIAPIR SITES
BON 7
22
23
24
25
26
27
28
29
30
30°50'
NOT FOR PUBLICATION
C.I. = 50 fm

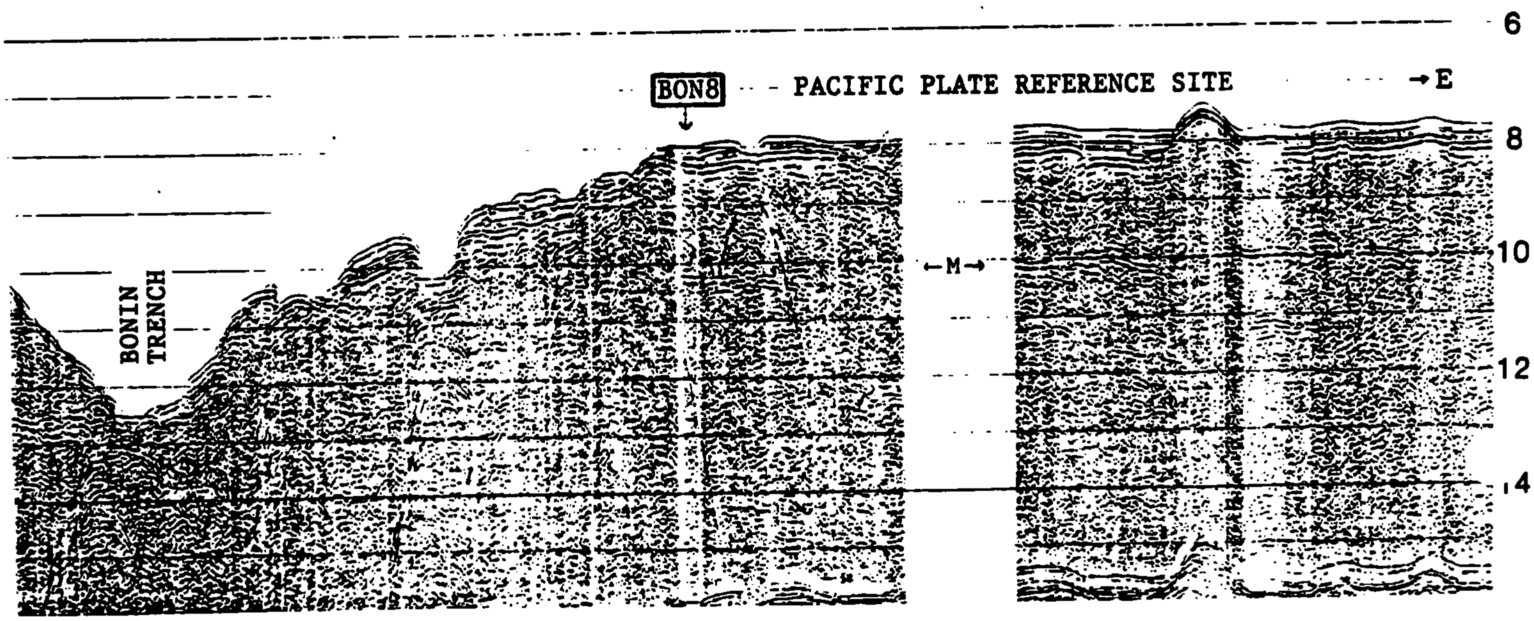

20° N
146°30' E
147°40'
20°
MARIANA FORE-ARC SEAMOUNT SURVEY
PACIFIC PLATE
SMALL MOUNDS
CONICAL SEAMOUNT
GRABEN
MARIANA TRENCH AXIS
TRENCH-SLOPE BREAK
MAR3
MUD LUMPS
FLUID FLOWS
MAR2
PAC-MAN SEAMOUNT
VISCOUS FLOWS
19°
146°30' E
147°40'
19°



Location of sites 4A, 4B, 5A, 5B on N-S KK84 profiles between E-W GH79 profiles.



Site BON6 on LDGO MCS profile RC20-05 and between GH79 single channel seismic profiles.



REFERENCE SITES

Introduction

Reference sites are designed to core sedimentary and igneous rocks on incoming plates next to trenches for comparison to the compositions of lavas from the adjacent arcs. The cored materials are plausibly similar to recently subducted materials that may be providing components to the arc magmas. Such components should have isotopic or other geochemical characteristics which can be identified in the lava compositions, and then be used in models of petrogenesis. It is important to understand the degree to which subducted sediments and ocean crust become involved in arc magmas because everything that is not scraped off, underplated, or incorporated into magmas returns to the mantle. The quantity and compositions of such materials returned to the mantle through geological time may be significant; accurate assessment of this will bear directly on application of mass balances to models of crustal differentiation.

The usual approach to either the arc-magma petrogenesis problem or the question of mass balances is to consider trace elements and isotopes as geochemical tracers. One may, for example, use them to determine the proportions of components that are involved in arc parental magmas by mixing. Another important application is to subject the materials cored to varieties of high-pressure, high-temperature experiments, in order to establish phase controls on melting, and the distribution coefficients at elevated pressures of both trace and major elements.

Ideally, it is necessary to establish the influence of ocean crust and the different types of sediments that may be subducting in different settings. Carbonates may be particularly abundant in one place, diatomaceous oozes in another, and continent-derived clastic materials in yet another. Since the distribution of various types of sediments on ocean crust varies from one place to the next, and can be gradational adjacent to a given island arc, two sorts of strategies for drilling reference sites might be considered. The first would be to sample more-or-less type sections, and then consider their hypothetical influences on arc magmas in general. The second is to consider actual differences in isotopic/geochemical characteristics of lavas of different arcs, or along individual arcs, and suppose that these might be related directly to compositions of materials recently subducted.

An example of the latter approach is the Lesser Antilles, where lavas show the clear isotopic imprint (Sr and Pb) of continent-derived clastic sediments, which flood the trench from southerly sources in South America. The isotopic effect diminishes to the north (White and Dupre, 1986) where the clastic wedge thins, and only a predominantly marine pelagic section is underthrusting the toe of the Barbados Ridge (DSDP 543; Natland et al., 1984; White et al., 1985),

The Lesser Antilles represent the only serious application of a reference site (DSDP 543) to the question of arc magma compositions.

Many intra-oceanic arcs, however, lack a thick offshore clastic wedge (or any wedge at all), and the question is, are these arcs, too, influenced by subducting sediments, but of radically different composition?

The Western Pacific: Different Sediments Have to be Involved

The western Pacific basin has had a rather unique sedimentary history which contrasts greatly with North Atlantic sea floor near the Lesser Antilles. All portions of the Pacific plate now approaching trenches in the western Pacific are Mesozoic in age. The sedimentary history of the region is dominated by pelagic, biogenic, and local (within-plate) erosional/magmatic processes acting on ocean islands and seamounts. Moreover, drilling at about a dozen sites shows that post-Cretaceous sedimentation has been virtually non-existent (Figure 1). Only about 10 m of Neogene sediments overlie Campanian cherts at DSDP 452, east of the Mariana Trench (Hussong, Uyeda et al., 1982). Thus any signature of subducted sediments in the arc lavas should be primarily that of Mesozoic sediments and their underlying ocean crust. This explains, for example, both the lack of offscraped sediments in the Mariana Trench, and the lack of a Beryllium-10 anomaly (which can be produced only by contamination with very young sediments) in Mariana arc lavas (Woodhead and Fraser, 1985).

A preliminary assessment of sediments and sedimentary rocks cored at various Deep Sea Drilling Project (DSDP) sites in the region strongly indicates that their isotopic and trace-element characteristics are dominated by the attributes of materials contributed from Mesozoic ocean-island sources, chiefly tholeiitic and alkalic basalts. This is illustrated for Pb isotopes in Figure 2, where compositions of sediments from DSDP 452, 462 (Nauru Basin), and 585 (Mariana Basin) are compared to lavas from various modern islands. Coarse volcanogenic sediments from DSDP 585 were produced by subaerial erosion of a dominantly tholeiitic source (Floyd, 1986) which isotopically compares to subalkaline lavas of Easter Island. Finer-grained sediments, including "pelagic" claystones have a more alkalic provenance (Viereck et al., 1986) and are similar isotopically to strongly radiogenic Samoan post-erosional lavas (Woodhead and Fraser, 1985; Wright and White, 1987).

Lavas of the Mariana arc show an apparent slight enrichment in radiogenic Pb in the direction of the fine-grained sediments (Figure 2), and differ from typical abyssal tholeiites on the one hand, and Mariana Trough backarc basalts on the other. This is taken by Woodhead and Fraser (1985) to represent the influence of subducted sediments on the arc lavas. The influence is subtle, if indeed it can be said to be discernable in Pb isotopes at all. More certain are slight enrichments in radiogenic Sr isotopes (Figure 3) which Stern (1982) attributed to ocean-island-type mantle sources, and which he described as increasingly apparent in arc magmas proceeding around the southwest tier of the Pacific rim from the Marianas toward the Tonga arc. The question now is, are there truly primary differences in the mantle sources, or are we seeing the consequences of subduction of sediments derived from distinctly enriched ocean-island sources? This is not a trivial question inasmuch as Mesozoic volcanogenic sediments are unusually abundant in that region of the Pacific now approaching trenches, rivalling in thickness (in those places where they have been cored; e.g. DSDP 462 and 585) the section of sediments now underthrusting the Lesser Antilles. The more subtle isotopic signature of the Mariana arc lavas may have to do with the basaltic (rather than granodioritic) provenance of subducting sediments.

Influence of the Ocean Crust: a Question

The role of the ocean crust is usually thought to involve its serving as a reservoir for fluids and (in alteration minerals) large-ion-lithophile (LIL) elements (K, Rb, Ba, Cs, etc.) and high 87Sr/86Sr (introduced by seawater). These may innoculate mantle sources of arc magmas following subduction, although some petrologists argue that arc andesites may also originate by partial melting of eclogite, to which subducted ocean crust basalts should transform with pressure.

The potential role of the LIL elements is deduced from the perception that dredged basalts (and many cored basalts) are usually enriched in these elements by secondary processes. This, however, is based on recovery from bare-rock exposures or thinly sedimented drill sites. A few holes have been drilled into crust with a widespread sediment blanket, however, and these give a different impression. At DSDP 543 off the Lesser Antilles, for example, K-enriched altered rock only exists in the very top few meters of basement; below this, non-oxidative alteration (mainly to the K-poor clay mineral saponite, plus pyrite), has actually depleted the basalts in LIL elements, in many cases to abundances lower than in unaltered glass (Natland et al., 1984). Sr- and Pb isotope abundances of DSDP 543 basalts are interpreted to be those of unaltered depleted abyssal tholeiites (White and Dupre, 1985). However, the samples analyzed came from intervals in the core dominated by non-oxidative alteration to a saponite-dominated mineral assemblage, and which typically contain about 40% of clay minerals (Natland et al., 1984); no fresh glass was measured for isotopes. In general, non-oxidative alteration to produce primarily saponite (at low temperature) or chlorite (at higher temperature) should have these effects, and such minerals are characteristic of secondary assemblages formed by continued circulation of basement formation fluids under thick sediment blankets (e.g. DSDP 418 and 504B), where access to oxygenated bottom waters did not exist. In the NW Pacific, such an assemblage occurs in the top few meters of Mesozoic basalt at DSDP 581 (drilled during Legs 86 and 88).

A serious question thus exists concerning whether subducting ocean crust can be, or typically is, a significant potential source of LIL elements to arc magmas. Given the typical thicknesses of the basaltic layer, a few meters of K-enriched basalts at the top may not compensate for a pervasive depletion below. Of course this will be a function of such factors as the shallow thermal structure (affecting the extrusive portion of the crust) of spreading ridges, and the particular sedimentary history that influenced that thermal structure. This is why it is essential to drill to significant depths beneath sediments in reference sites. The western Pacific, moreover, represents a type of crust (produced at a rapidly-spreading ridge) which we have never sampled to more than 50 m before, and it had an utterly unknown sedimentary (thus thermal) history after it formed.

Recommendations of Proponents

Reference holes may be used as a specific control on the Mariana/Bonin arcs, but also can be integrated with regional aspects of reference-site geochemistry between there and Tonga by using such sites as DSDP 462, 581, and 585 (already mentioned), Site 595 near the Tonga Trench, and surface sediment cores in existing collections. Obviously, though, all the potential inputs to subduction adjacent to a given arc cannot be sampled in a single hole. Next to the Mariana and Bonin arcs, a minimum of four holes is required:

1) a hole (BON-8) to sample sediments and Mesozoic crust (anomaly M-13) east of the Bonin arc, to link with the transect of holes in the Bonin I program, and which would sample a normal thickness of sediments presumably dominated by pelagic components;

2) a similar hole (MAR-4, equivalent to DSDP 452) on older Mesozoic ocean crust (anomaly M-25) east of the Mariana arc, to link with the transect of holes drilled during Legs 59 and 60, and which would also sample a normal thickness of sediments entering the Mariana Trench;

3) a hole (MAR-5) into a distal portion of the volcaniclastic apron adjacent to one of the large seamounts now entering the Mariana trench, and hopefully into the ocean crust beneath;

4) a hole (MAR-6) into the summit region of that same seamount, to sample shallow-water sediments that might be a significant portion of thicker portions of the proximal sedimentary apron, and Cretaceous ocean-island basement beneath.

One of holes 1-3 (probably BON-8) needs to be a re-entry site, in order to sample at least 200 m of ocean-ridge basement, which should give some sense of the alteration profile in basalts of this type of crust.

Complementary Programs

The holes recommended complement a number of long-standing scientific objectives which can be approached through drilling. Foremost among these is a deep hole into old crust produced at a rapidly-spreading ridge. Drilling in the eastern Pacific has thus far failed to produce an adequate reference section of ocean crust relevant to interpretation of seismic refraction results or crustal magnetics. Placing such a hole in the far western Pacific on a well-defined magnetic anomaly would meet these objectives, and optimize the chance for deep penetration, on the assumption that a thick sediment section combined with a long history of alteration and diagenesis would "heal" the extensive fracturing that plagued the previous drilling. For general lithospheric objectives, this hole is called DeepPac-1 on the Site Proposal Summary Form; it may be placed at BON-8.

Next, the suite of holes proposed here would complement other proposed drilling to study 1) old Pacific crustal and sedimentary history; 2) plate motions; 3) the timing and causes of Cretaceous reef-extinction events; and 4) the timing, age-progression, and general geochemistry of seamount (hot-spot) volcanism in the Mesozoic. Specifically, the holes in the volcaniclastic apron and summit region of a seamount in the Magellans chain would provide a necessary latitudinal contrast to drilling proposed in the Japanese (Geisha) and Wake Seamounts, in order to test whether Cretaceous reef extinctions were synchronous (hence related to regional or global factors), or not synchronous (and thus related to latitudinal climatic factors; see drilling proposal by Winterer, Natland and Sager). Since there are no large seamounts directly east of the Bonin arc, holes designated for these objectives are east of the Marianas.

Recommendations of the Western Pacific Regional Panel

At its March meeting in Tokyo, the WPAC Panel recommended drilling one reference hole adjacent to the Bonin arc (Bon-8) and not extending this beyond a single bit's penetration into basement. The primary consideration here was the tentative limitation in time (9 programs in 11 legs, or perhaps less) within which PCOM allowed WPAC to frame its program. The Panel felt that devoting any more time to objectives on the Pacific plate, particularly a deep penetration into ocean crust, would undermine its own priorities in the arc, backarc, and marginal basins of the western Pacific. Calculations of drilling time suggest that half a leg would be needed to devote to two single-bit holes into basement adjacent to both the Bonin and Mariana arcs, and that only a full leg would accomodate all the objectives mentioned above.

The previous sections of this summary have outlined the general rationale for a multi-hole effort adjacent to these two arcs. The immediately previous section listed relationships to other objectives. The full proposal documents objectives which should be important not just to WPAC, but to LITHP, DMP, CEPAC, and SOHP as well. Probably the single most time-consuming objective will be the deep penetration into basement, a long-standing Ocean Crust Panel and LITHP objective, and which LITHP probably should sponsor, if not here, than somewhere in old crust in the western Pacific. There are good reasons, however, listed above, to tie this drilling to a reference site. In all, the combined set of objectives, bearing on so many aspects of evolution of western Pacific island arcs, Mesozoic ocean crust, and sedimentary history, is worthy of a leg of drilling, sponsored by several panels.

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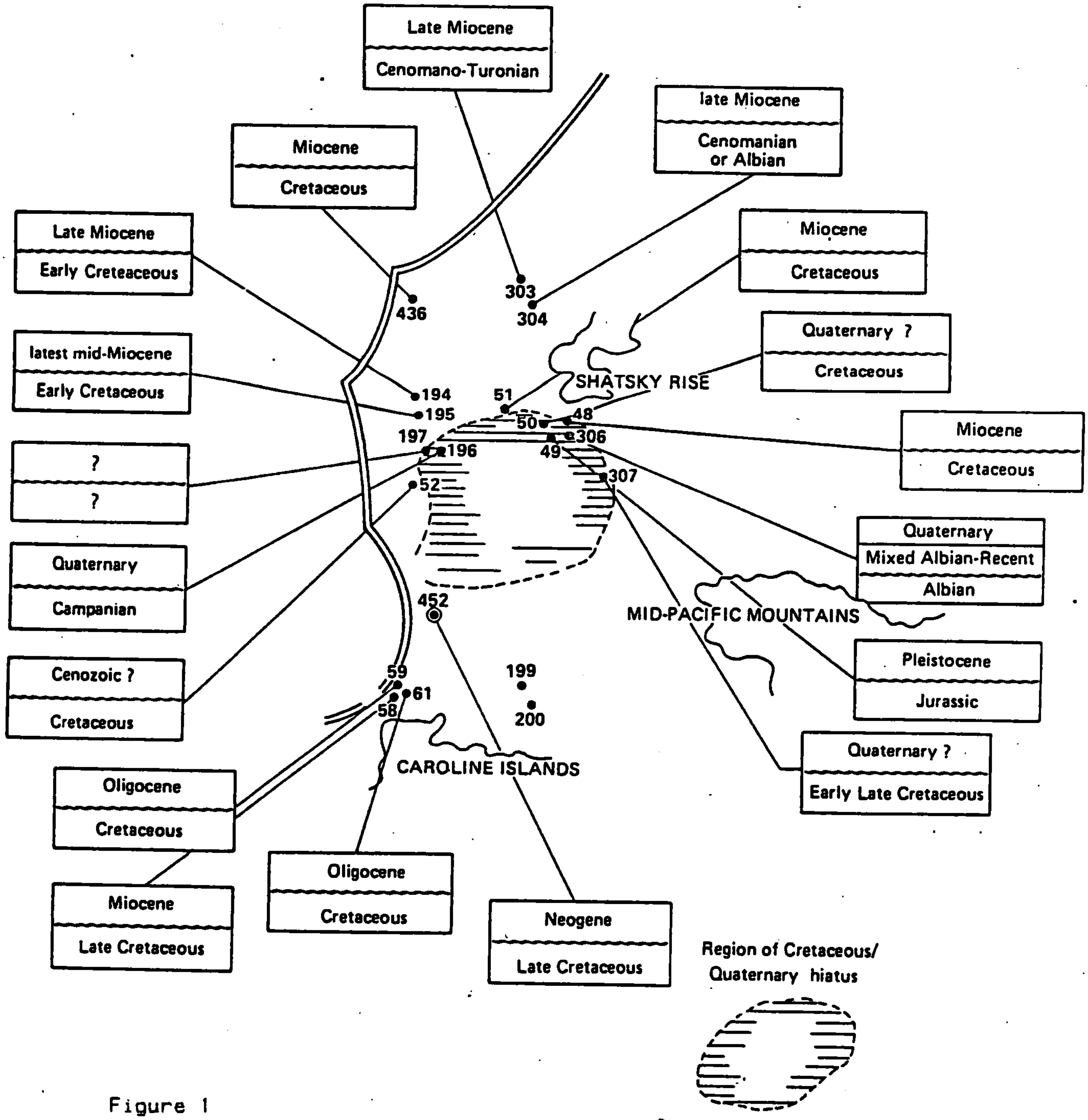


Figure 1

Stratigraphic relationships in DSDP drill sites in the northwest Pacific, indicating duration of intervals of near non-deposition since the Cretaceous. From Site 452 Report in Hussong, Uyeda et al (1982).

Except for site 436, all of these sites were spot cored, and only sites 197, 303, 304 and 307 reached basement.

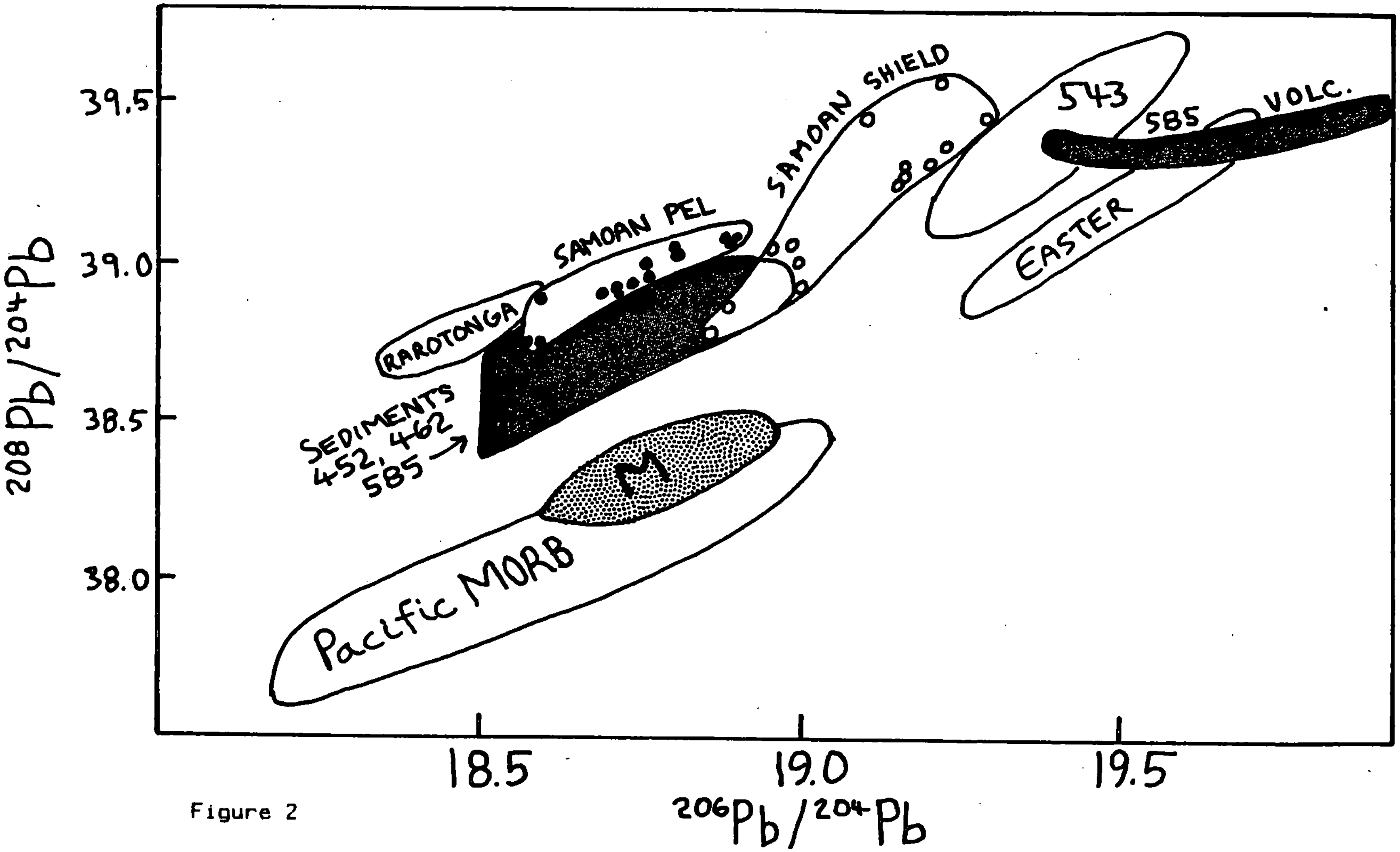


Figure 2

207Pb/204Pb versus 206Pb/204Pb in Mariana arc lavas compared with those in sedimentary rocks from the western Pacific, Samoan and other island basaltic lavas, and Pacific abyssal tholeiites (from Woodhead and Fraser, 1985). Stippled field labeled M is for Mariana arc lavas; others are as indicated in the figure. Fields for Easter Island, Rarotonga, and Samoa are from Wright and White (1987). Separate fields for Samoan shield tholeiitic and alkalic olivine basalts (open circles) and post-erosional lavas (filled circles) are shown. Also indicated are fields for DSDP 5434 "underthrust" sediments near Guadeloupe Island, Lesser Antilles (White et al., 1985) and Lesser Antilles lavas (White and Dupre, 1986).

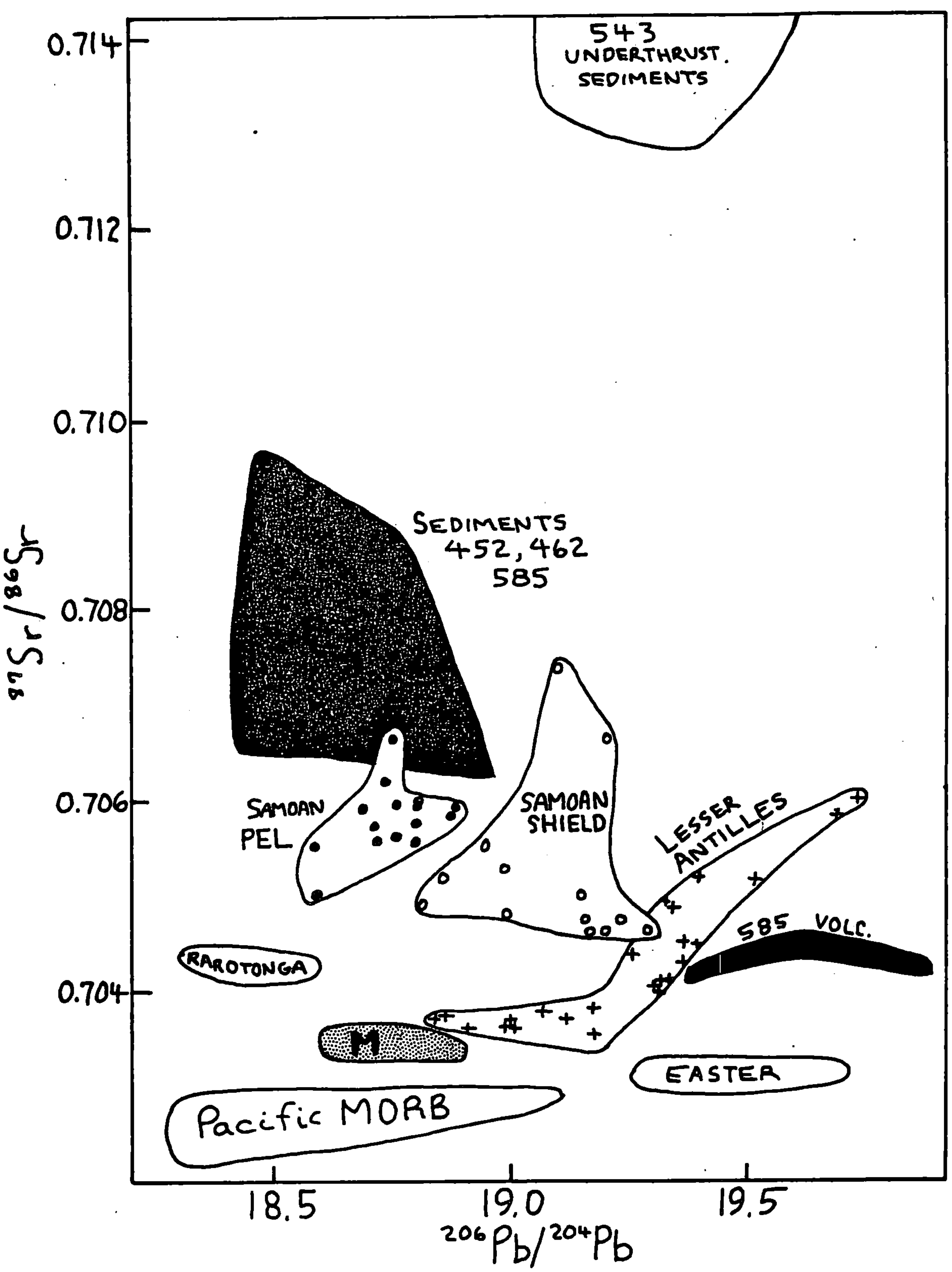


Figure 3

87Sr/86Sr versus 206Pb/204Pb in Mariana arc lavass compared with those in sedimentary rocks from the western Pacific, Samoan and other island basaltic lavas, Pacific abyssal tholeiites, lavas from the Lesser Antilles, and DSDP 543 "underthrust" sediments. Symbols, data sources are as in Figure 2.

SUMMARY OF THE SOUTH CHINA SEA MARGIN TRANSECT

INTRODUCTION AND OBJECTIVES

The northern margin of the South China Sea offers an exceptionally well constrained setting in which to document the tectonic, depositional, and paleoceanographic development of a young "Atlantic-type" marginal basin. Moreover, the South China Sea constitutes one of the four major marginal basins of the Western Pacific region and hence has played a significant role in dictating the timing and mode of water mass, faunal, and climatic evolution of this region including the cessation of communication between the Indian and Pacific oceans. A transect of ODP holes across the northern margin of the South China Sea is proposed to fully develope this history and to analyze the sedimentary and crustal processes driving rifted margin evolution. More specifically, our objectives require drilling four holes along a single transect (near 116° - 118° E) in the area of the margin that is both relatively simple and very well known from the existing geophysical data base (Figure 1).

East trending magnetic lineations identified in the eastern half of the South China Sea date sea floor spreading and basin formation as mid Oligocene through Early Miocene (32 to ca. 17 m.y.B.P.). The basin is bounded by passive margins both north and south with the northern continental margin covered with a thick and growing blanket of dominantly siliciclastic sediments which extend out onto the deep basin plain (Figures 2 and 3). In turn, seismic profiles illustrate that the proposed transect of ODP holes across the northern margin will allow scrutiny of shelf, slope, and basin plain sequences representing the entire history of basin formation--including sampling of underlying transitional and oceanic crust (Figures 2 and 3). Importantly, commercial bore holes penetrate the inner shelf in this same area, effectively extending the proposed ODP transect onto an area of established continental crust. Information from these latter holes, together with data to be garnered from the four-hole ODP transect and proposed deep basin sites to the south, clearly present a special opportunity to hindcast the full spectrum of tectonic, eustatic, depositional, and paleoceanographic events characterizing the evolution of the South China Sea basin across an entire margin segment encompassing continental, transitional, and oceanic crust (Figures 1, 2, and 3).

Thus, the northern margin of the South China Sea stands as an excellent area to (1) investigate the processes of early rifting, subsidence, and sedimentation of passive continental margins in general, (2) examine the changing patterns of sedimentation (including unconformities) across a young, evolving continental margin, (3) obtain quantitative faunal, isotopic, and sedimentologic evidence of variations in basin paleoenvironments (including sea level changes) and the history of an oxic basin as opposed to the silled anoxic history of the adjacent Sulu Sea, (4) test the validity of existing thermodynamic models of rifting in a place where the parameters of such models either have been or can be measured directly because of the youth of the basin, (5) provide tectonic constraints to help isolate the effects of rifting from the subsequent collisional processes that also occurred to the south along the conjugate margin segment, and (6) identify the petrology of the crystalline basement across the continent-to-ocean transect.

TECTONIC PERSPECTIVE AND SUPPORTING DATA BASE

The South China Sea is uniquely well suited for studying models of continental margin evolution because; (a) it is old enough not to have been affected by the complex, unquantifiable initial extension processes and tectonic conditions,

(b) it is young enough to still exhibit observable differences in its subsidence and associated thermal history as predicted by different crustal extension models, and (c) it provides an opportunity to study ties betweeneustacy and tectonism in a relatively simple setting.

In the South China Sea, all of the crucial pieces of supporting geophysical data have been collected to test existing passive margin models that predict the relationships between rifting/drifting, subsidence/uplift, sedimentation/seismic sequences, and thermal history/hydrocarbon maturation. The available data include; (1) excellent regional MCS coverage of the margin (Figure 3), (2) excellent single channel seismic and underway geophysics for the deep basin, (3) deep seismic crustal thickness data (to MOHO), and (4) detailed heat flow measurements along selected margin transects, including the proposed drilling transect across the northern margin (Figure 4).

PALEOCEANOGRAPHIC AND SEDIMENT HISTORY OBJECTIVES

Sedimentary environments represented within the South China Sea margin transect likely include syn-rift non-marine and shallow marine units, alternating siliciclastic and carbonate bank shelf-edge facies, upper and mid-slope oxygen minima facies of organic-rich muds, as well as intercalated fine grained basin plain pelagic and terrigenous units. The relatively rapid rates of sediment sccumulation in this setting suggest that all of these depositional sequences will contain rich microfossil assemblages of both planktonic and benthic origin. Thus, one of the prime goals in studying these sequences will be to establish high resolution biostratigraphic control which will subsequently provide the chronostratigraphic framework with which to evaluate margin geohistory, rates of sediment accumulation, dating of unconformities, and correlation of deep ocean and marginal events during basin evolution. In particular, studies of neritic and bathyal benthic foraminifera within these deposits can be used to decipher climatically and tectonically induced variations in water mass evolution and faunal migration as well as providing constraints on paleodepths and rates of margin subsidence. Similarly, the thick margin sequences should provide expanded paleoclimatic records based upon both isotopic (O^{18}, C^{13}) and quantitative faunal analysis.

One of the major sediment and ocean history goals of Western Pacific ODP drilling is the comparative study of the paleoceanographic and depositional histories of contrasting marginal basins of similar age. Of equal interest is the impact of global climatic events on marginal basin stratigraphies. The South China Sea margin transect and proposed deep basin sites to the south are expected to yield an unusually complete history of an oxic basin in a dominantly terrigenous siliciclastic province forming one end member of a series of marginal basin stratigraphies to be analyzed within; (1) the Great Barrier Reef mixed siliciclastic and carbonate margin setting, (2) the silled anoxic-suboxic Sulu Sea in a dominantly carbonate province, and (3) the alternating silled anoxic to fully oxic history of the Sea of Japan and associated variations of terrigenous, volcanogenic, and biosiliceous (diatom) regimes dominating depositional facies within this high latitude basin. Thus, the importance of the South China Sea margin transect is enhanced in the context of basin deposystems analysis planned for this region.

SUMMARY

The proposed South China Sea four-hole margin transect is unique in that it addresses an unusually broad spectrum of issues from a variety of perspectives, including;

(1) Thematic problems including paleoceanographic, sediment, and tectonic evolution of young passive margins,

(2) Regional problems including (a) the timing, duration, and nature of rifting/drifting processes within a presumably ~~a~~ pre-existing Andean-type terrane wherein microcontinental blocks (e.g. northern Palawan, Reed Bank) were moved southward from their original Paleogene positions during early rifting, (b) the role of the South China Sea in controlling paleoceanographic and tectonic development of adjacent marginal basins (e.g. Sulu Sea, Celebes Sea), and (c) the regional stratigraphy and biostratigraphy of Southeast Asia,

(3) Comparative studies of the evolution of three marginal basins in the Western Pacific including the Coral Sea (Great Barrier Reef), Sea of Japan, and the South China Sea from the Paleogene to present. Such comparisons are particularly crucial for separating the stratigraphic effects of tectonism versus eustacy and for identifying the paleoceanographic influences on depositional environments within the complex mosaic of marginal seas, arcs, and allocthonous terranes of Southeast Asia which form clear analogues to many ancient marginal basin sequences of Mesozoic, Paleozoic, and later pre-Cambrian age.

Proposed Holes	Relative Priority	Water Depth	Sediment Thickness	Penetration	Estimated Drilling	Logging	Total Days
SCS 1 (RCB)	2	3650m	1200m	1250m (into basement - ocean crust	14.7	2.0	16.7
SCS 2 (HPC+ XCB)	1	3150m	1000m	(into basement; transitional crust)	11.4	1.8	13.2
SCS 3	1	2060m	1200m	(into basement; transitional crust)	11.3	1.8	13.1
SCS 4	2	750m	2000m	(to 1000m)	5.7	1.4	7.1
					43.1	7.0	50.1

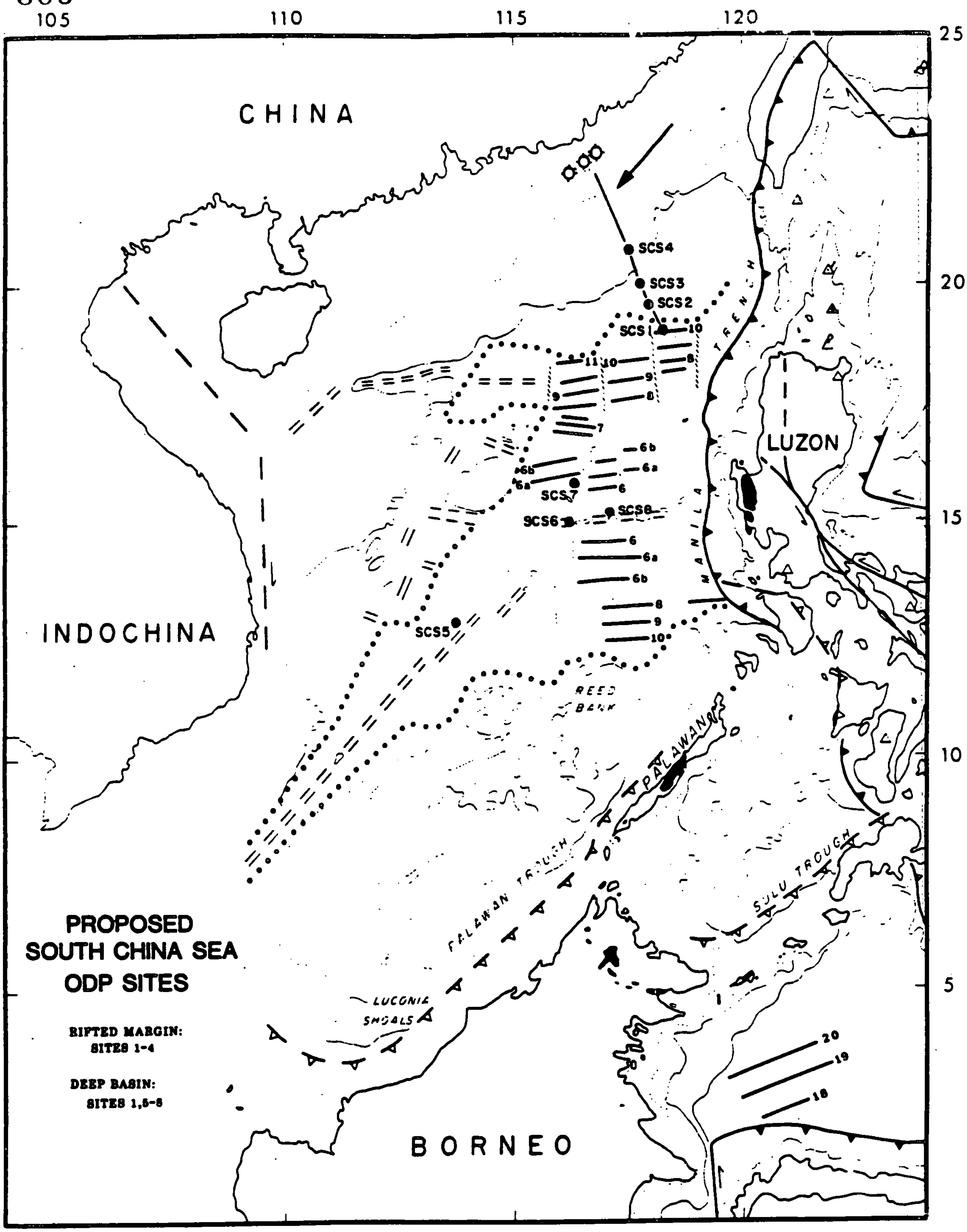


Figure 1. Major tectonic elements and magnetic lineaments in the South China Sea region. Proposed ODP sites (labelled SCS 1-4) along a margin transect (arrow) and location of key industry wells are shown. See Figures 2 and 3 for sections along the transect.

SOUTH CHINA SEA MARGIN TRANSECT

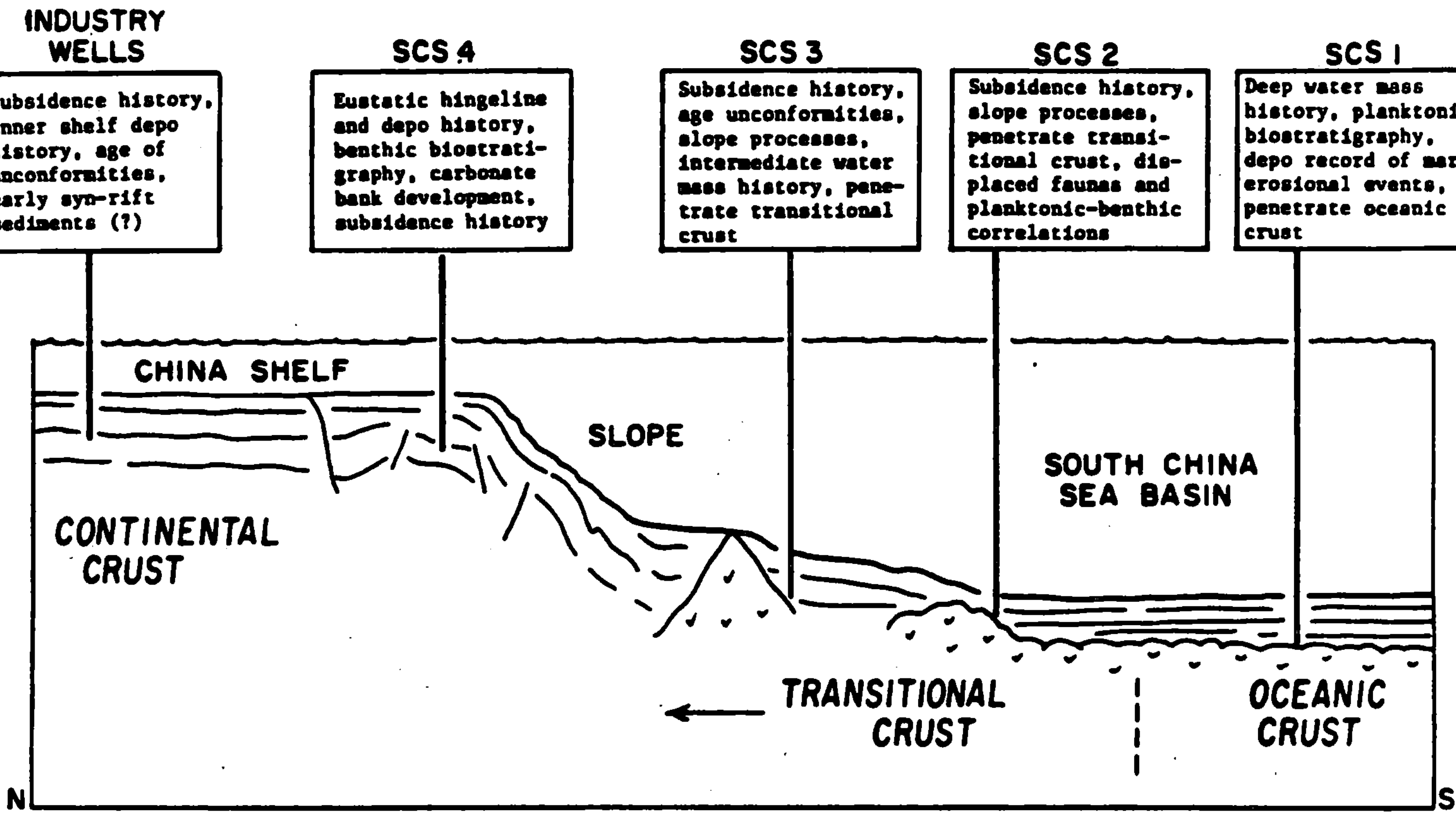


Figure 2. Cartoon along proposed margin drilling transect showing idealized location of sites and key drilling objectives; see Figure 3 for MCS profile from which this illustration was derived.

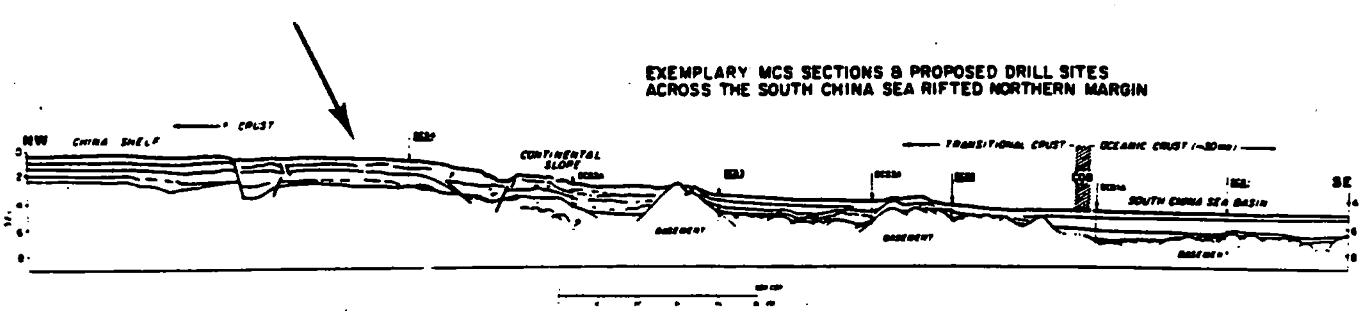


Figure 3. Line drawing of conventional MCS (CDP) profile along the proposed margin drilling transect. Locations of 4 prime sites and 3 alternate sites are indicated. The industry wells lay ca. 100 km NW of this section.

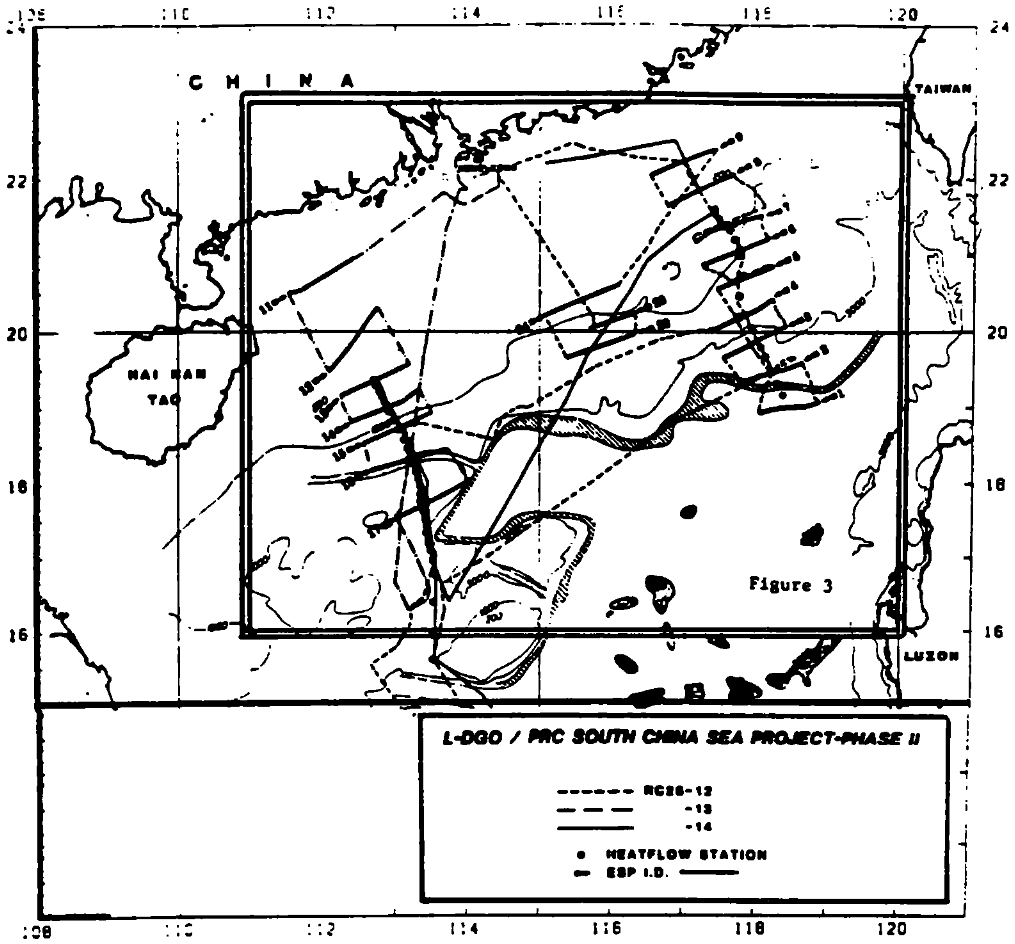


Figure 4. 1985 LDGO WACDP, ESP seismic and heat flow data across the northern rifted margin of the South China Sea.

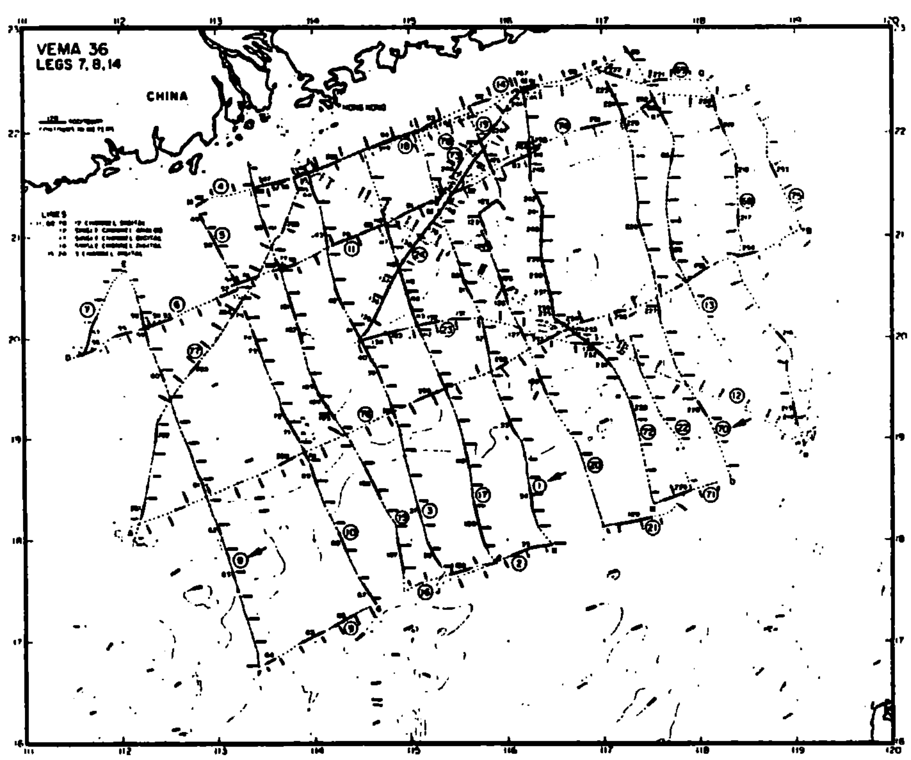


Figure 5. 1979-80 L-DGO MCS data across the northern rifted margin of the South China Sea.

Summary of Drilling Objectives for the Eastern Sunda Arc-Continent Collision Zone

TECTONIC SETTING

The collision between the Australian continent and the eastern Sunda arc has progressed to the stage where continental margin crust underlies the forearc in the western part, near Sumba island, and continental crust underlies the forearc beneath Timor island (Fig. 1). The young collision is associated with significant uplift of both accretionay wedge (exposed as the islands of Sawu, Timor, and others around the Banda arc to Seram) and forearc basement (exposed on Sumba island), backthrusting of the wedge over the forearc basin, and backarc thrusting along the north of slope of the arc. Backthrusting of accretionary wedge material over the forearc basin is observed in a number of convergent zones, both collisional and non-collisional, such as the Barbados accretionary complex, the Mediterannean ridge, Nias island in western Indonesia, the Ladakh region of the Himalayas, Taiwan, northern Panama, northern Venezuela, and southern Hispaniola. We are concerned with the sequence and magnitude of backthrusting and backarc thrusting, and the processes responsible for uplift of the forearc.

We hypothesize that collision will reactivate or initiate backthrusting between the accretionary wedge and the forearc basin, and geophysical data in the eastern Sunda arc tend to support this contention. We wish to date the inception of backarc thrusting, to compare with backthrusting within the forearc. We also propose to test whether the uplift of Sumba results from crustal duplexing, the passage of a marginal plateau, or the docking of a microcontinent, or whether it results from deformation within the backstop. These alternatives should show different uplift histories on the Sumba ridge.

PROPOSED DRILLING PROGRAM

The proposed drilling program (Figures 2-5) includes:

1) Drilling just behind the thrust in the forearc basin province (sites S1 and T1). This should provide data on the vertical motions of the forearc associated with backthrusting, which we predict to be negative (subsidence). Sites S1 and T1 will be additionally affected by the uplift of the Sumba ridge and the eastern counterpart of the Kisar ridge. These sites will provide stratigraphic data on the history of volcanism of the arc and its relation to forearc and backarc tectonism. They will also provide definitive tests of the basement rocks of the forearc and their relationship with thrust sheets on Timor and Sawu islands. Finally, the sites will give detailed histories of the uplift of Timor and Sawu islands, which are closely tied to collision by the Australian continental margin. Presently available geophysical data are adequate to define the locations of suitable sites for these objectives, but further MCS work is planned for 1987.

2) Drilling on the accretionary wedge near the backthrust (sites S2 and T2) will test whether forearc basin and basement material are incorporated into the rear of the accretionary wedge. We feel that it will also provide data on the timing of initiation of accretion at the toe of the wedge, based on results of physical modeling and interpretation of seismic data from other regions. Existing seismic data are not sufficiently good to define final sites, however, and these sites will depend on obtaining high

quality seismic reflection data.

3) Drilling on the Sumba ridge will allow us to distinguish several different models for the uplift of the forearc basement. One or more episodes of rapid uplift would be consistent with an origin by crustal duplexing beneath the Sumba ridge. Slow, steady uplift would suggest sediment duplexing at depth, continual deformation of the backstop, or slow changes in the thermal regime beneath the forearc. Rapid uplift followed by subsidence would support a model of subduction of a small marginal plateau. Docking of a microcontinent should not necessarily require vertical movement, but sutures should be evident on the margins of such a block.

4) Drilling beyond the toe (F1) and at the rear (F2) of the small accretionary wedge in the zone of back arc thrusting behind the island of Flores (Figs. 2 and 4) is designed to determine the age of initiation of backarc thrusting by two methods. The first is by dating the oldest accreted material in the rear of the wedge at F2, and the second is by determining the history of vertical motions of the lower plate (F1). We will use these results to establish coupling between the collisional effects in the forearc to those in the backarc, and we will address the question of whether or not backthrusting and backarc thrusting are sequential phenomena.

Existing Geophysical Data and Proposed MCS Survey

Most of the existing (available) geophysical data in the Sunda arc region are summarized in Figure 6. These data are of variable quality, ranging from single channel analog seismic reflection data to 24 channel, small source multichannel seismic data. The latter are all industry reconnaissance data, most of which have had only preliminary processing. Our best data are large source (550 and 1100 in^3) air-gun lines that were acquired digitally and processed through migration (Fig. 3 is a good example). We have proposed a large source 96-channel seismic survey for 1987 (Fig. 5) as a field experiment in preparation for the drilling program proposed here. That survey would provide a foundation for the drilling program, and the multitude of data shown in Figure 6 could be used for precise site definition and safety evaluation.

SUMMARY OF PROPOSED SITES (Includes Logging Times)

SITE #	LAT (S) LONG (E)	DEPTH	PENETRATION	DRILLING DAYS	LOGGING DAYS	TOTAL DAYS
S1	10.3 S 121.2 E	1500m	1000m	5.2	1.9	7.1
S2	10.7 S 121.0 E	1100m	800m	5.1	2.3	7.4
S3	10.1 S 121.3 E	750m	1100m	6.4	1.7	8.1
F1	7.7 S 120.2 E	4900m	800m	10.7	1.8	12.5
F2	8.0 S 120.2 E	4000m	1000m	11.7	2.7	14.4
TOTAL TIME FOR SITES S1, S2, S3, F1, F2						**49.5 DAYS**
ALTERNATE SITES						
T1	8.0 S 128.2 E	2500m	600m	5.5	1.7	7.2
T2	8.1 S 128.2 E	2250m	700m	6.0	1.4	7.4
TOTAL TIME FOR ALTERNATE SITES T1, T2						**14.6 DAYS**

Estimated site lithologies

S1	0 - 450 m	Distal Turbidites
	450 - 700 m	Pelagic carbonates
	700 - 1000 m	Pre-Tertiary Forearc basement
S2	0 - 800 m	Imbricated thrust blocks and scaley clay matrix
S3	0 - 500 m	Hemipelagic slope facies and uplifted distal turbidite facies
	500 - 800 m	Upper Miocene pelagic sediments
	800 - 1100	Lower Tertiary clastic and volcanic rocks
F1	0 - 200 m	Distal Turbidite facies
	200 - 800 m	Interbedded pelagic and carbonate clastic facies
F2	0 - 200 m	Slope basin strata; possibly volcaniclastic
	200 - 1000 m	Backthrust accretionary wedge material; interbedded pelagics and volcaniclastics
T1	0 - 400 m	Slope basin; interbedded volcaniclastic and clastic facies
	400 - 600 m	Forearc basement rocks
T2	0 - 450 m	Slope basin; may be similar to upper part of T1
	450 - 700 m	Deformed accretionary wedge and forearc basin material

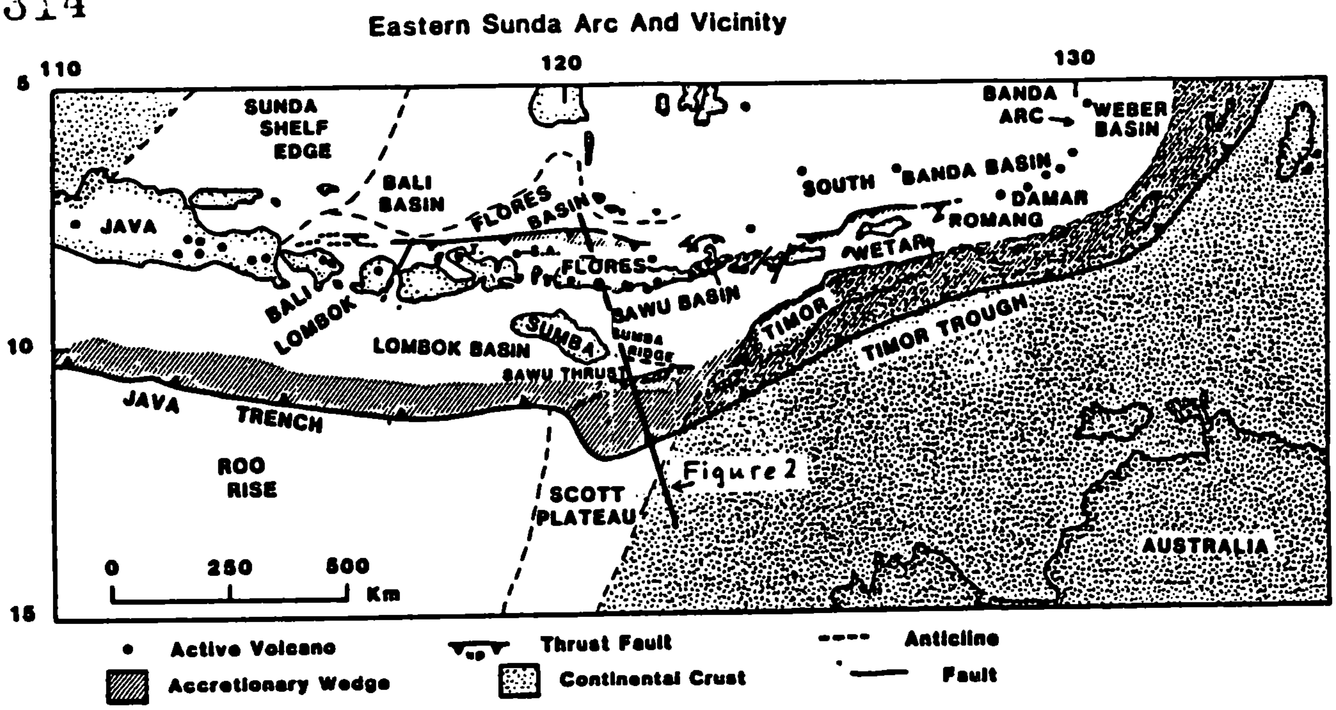


Figure 1. Map of the eastern Sunda arc region, showing locations of the major geographic features and of Figure 2.

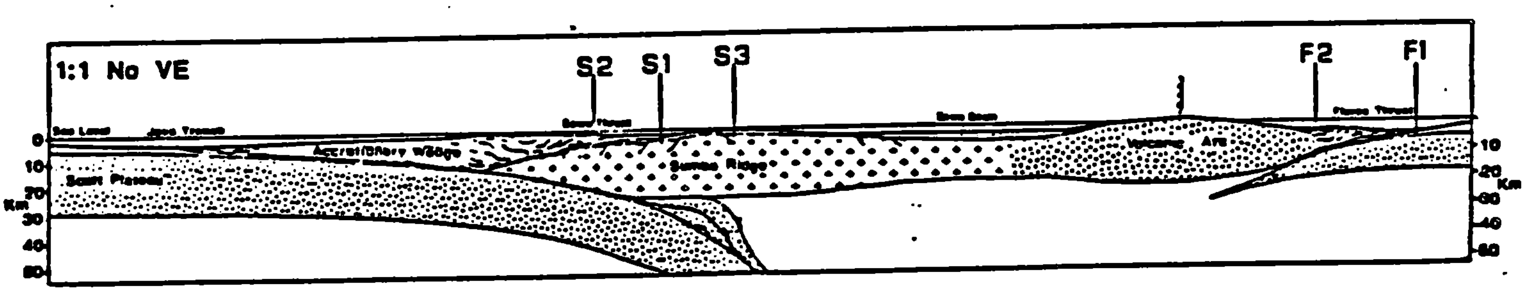
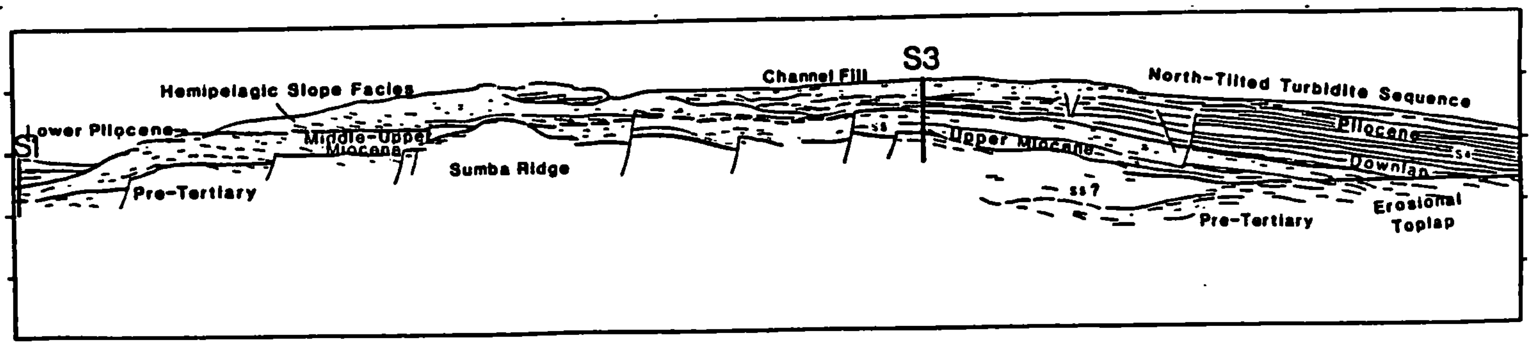


Figure 2. Interpreted crustal cross section across the eastern Sunda arc system, shown with no vertical exaggeration. Shown also are proposed drill sites S1, S2, S3, F1, and F2. Note hypothetical crustal duplex beneath S1 and S3.



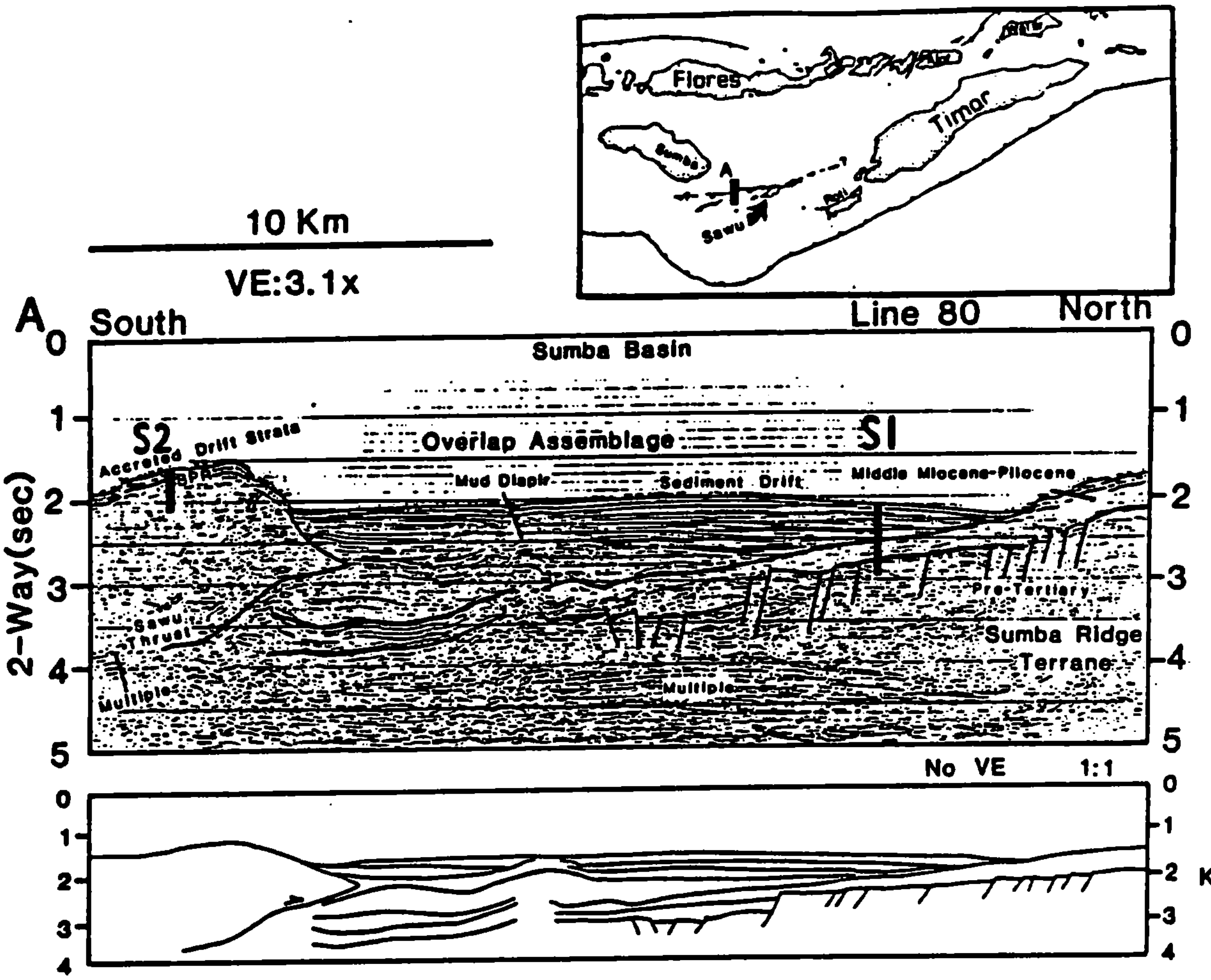


Figure 3. Migrated, digital single channel seismic profile across the Sawu thrust (modified from Reed et al., 1986), between Sawu and Sumba islands. Inset shows locations of profile and of Sawu island. Preliminary proposed drilling sites S1 and S2 shown also.

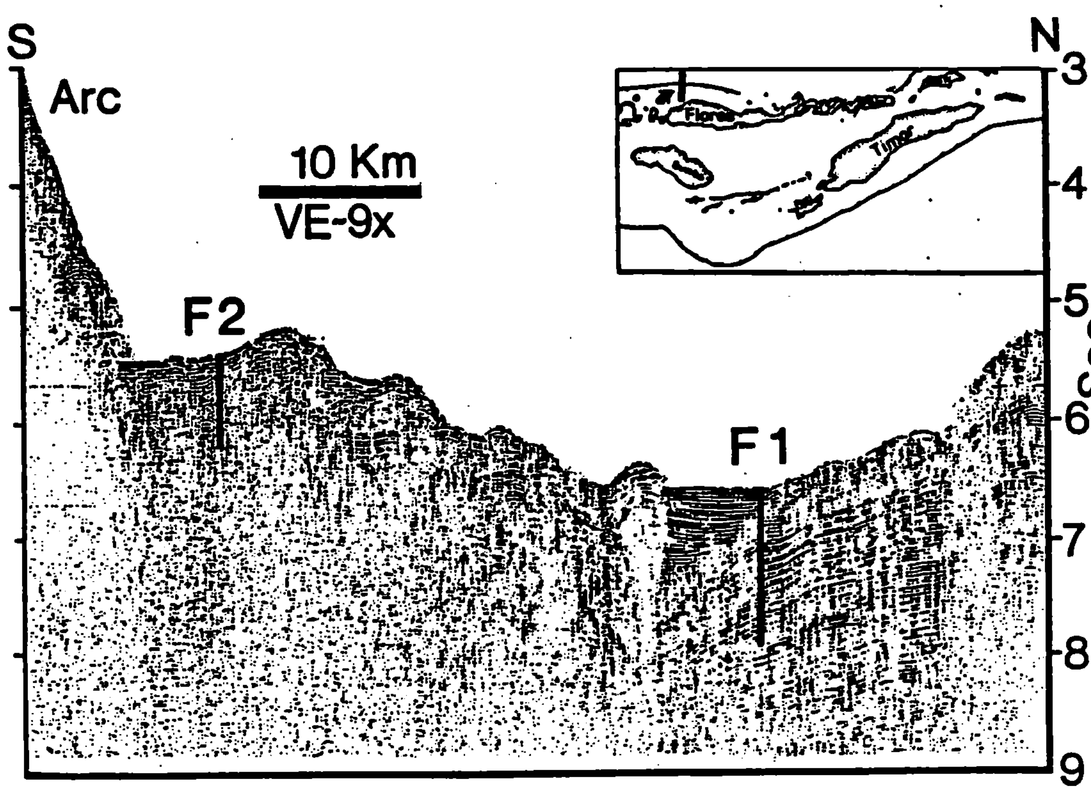


Figure 4. Seismic profile across the backarc thrust belt north of Flores Island, eastern Indonesia (see inset for location). Loactions of proposed drilling sites F1 and F2 shown also.

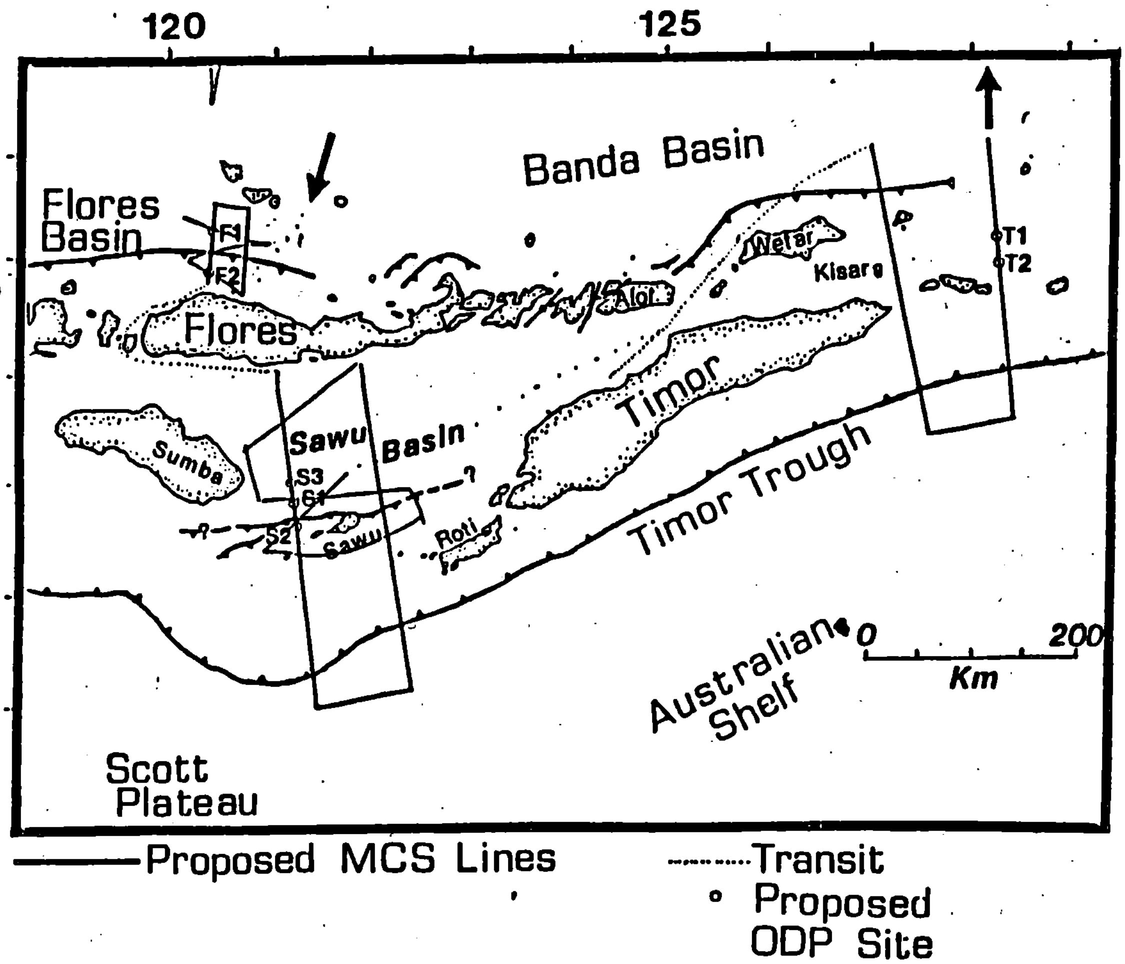


Figure 5. Map of eastern Sunda arc region, showing locations of proposed multichannel seismic profiles and proposed drilling sites.

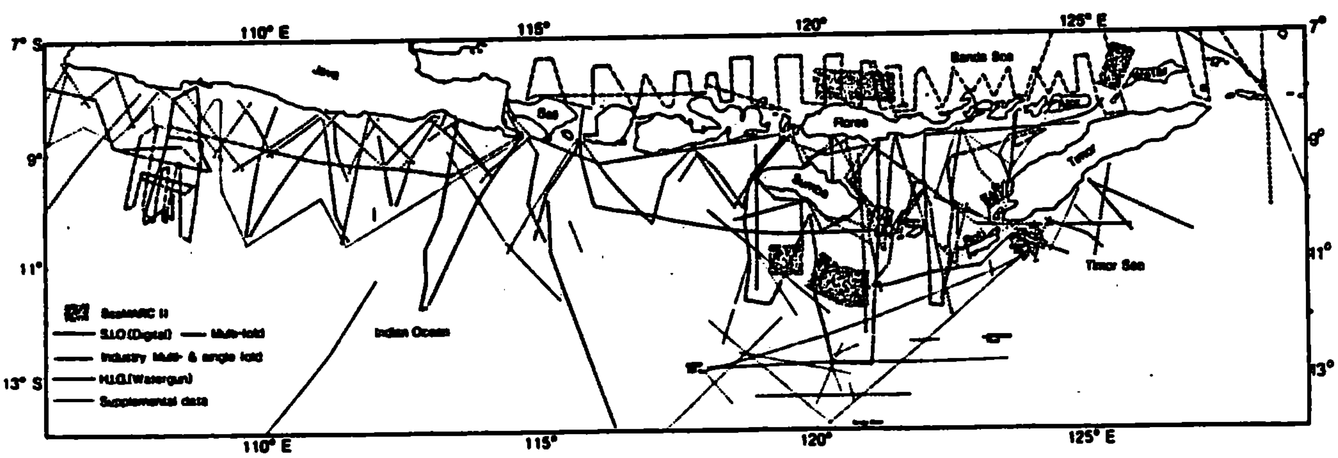


Figure 6. Locations of geophysical tracks in the eastern Sunda arc region. Specific cruises and sources are explained at lower left of diagram. Shaded regions showing SeaMARC II coverage also contain seismic profiles at a spacing too close to resolve in this figure.

Great Barrier Reef - Queensland Trough
ODP Leg Summary

The Great Barrier Reef - Queensland Trough province is composed of mixed reefal carbonate/siliciclastic shelf sediment thought to be principally controlled by climate, and relative sea level. During periods of low sea level, deltaic progradation occurred at the shelf edge accompanied by fan deposition on the mid- and lower slope. The oldest sedimentary sequences beneath the shelf occur eastwards of a major fault zone lying beneath the middle shelf, and forming the western boundary of the Queensland trough rift basin. An interpreted basal Late Cretaceous rift-fill sequence containing volcanics is overlain by a marine onlap facies interpreted to be Paleocene to Late Eocene in age. These strata are in turn overlain by oblique, complex sigmoid-oblique and sigmoid progradational facies of probable Late Oligocene, Late Miocene, and Plio-Pleistocene ages (Symonds, 1983).

Along the Central Great Barrier Reef continental margin, reef facies was established during the Pleistocene. The reefs grew on siliciclastic fluviatile and deltaic sediments during periods of high sea level, and were subaerially eroded during the intervening periods of low sea level. There is clear latitudinal variation in the nature and timing of reef growth. The reef is thicker in the north and has a multi-phase growth. In addition, side scan sonar profiles of the upper slope of the Great Barrier Reef have identified shelf parallel drowned reefs which are, apparently, low sea level analogues of the present outer barrier (P. Davies, written pers. comm., 1986). The earliest reef growth in the region probably began on basement highs on the Queensland Plateau in the Early to Middle Eocene (Pinchin and Hudspeth, 1975) although some consider that reef growth did not commence until the Late Oligocene and Early Miocene following stabilization of an equational circulation pattern (Taylor and Falvey, 1977). Reef growth today covers almost one-quarter of surface of the Queensland Plateau and the areas of buried reefs indicate this may have been even greater in the past.

In the Queensland Trough distinct seismic packages are identified and tied to major sea level oscillations. The eastern margin of the Queensland Trough is carbonate dominated and sediments have two sources: reef derived material from the Plateau area and planktonic material. Dredging of a series of seamount-like features in the Trough at depths down to 1200 m indicate a shallow water reefal origin for the seamounts and rapid subsidence rates (Plio-Pleistocene rates of 100-500 m per MY) for the Queensland Trough (P. Davies, written pers. comm., 1986).

The Great Barrier Reef area is an excellent example of a mixed carbonate/siliciclastic province in a passive margin setting. This area can provide important facies and stratigraphic models for understanding ocean history, the evolution of passive margins and ancient carbonate depositional systems.

The Great Barrier Reef is also a natural laboratory for studying the depositional and diagenetic environment of host rocks for ancient stratabound Mississppi Valley-type lead-zinc ores in carbonate rocks. By drilling the Queensland Trough, fore-reef slope and fore-reef edge, benchmark data can be acquired on rocks, minerals and fluids in a modern reef environment for comparison with similar data on ancient land-based mineral districts which will assist exploration geologists in recognizing ore-related phenomena. Specifically useful information which can be obtained only by drilling are early carbonate diagenesis, chemistry of pore fluids and H_2S generation in the reef, aquifer hydrodynamics in the siliciclastics underlying the fore-reef slope and sedimentary geochemistry of metals in the basinal source region.

The following objectives have been identified and would be addressed by ODP drilling on the slope of the Great Barrier Reef and in Queensland Trough:

(1) Sea level controls on sedimentation,
(2) the effect of plate motions and subsidence cycles on sedimentation and paleoceanography,
(3) an understanding of tectonic cycles in relation to sea level cycles.
(4) changes in paleoclimate related to plate position and the effect on sedimentation.
(5) slope/basin sedimentation - fans and lowstand deposits.
(6) basin fill history,
(7) Late Paleogene-Neogene paleoceanography.
(8) diagenetic history in a stratigraphic framework, and
(9) comparison of the history of a continental margin and an isolated plateau (Queensland Plateau).
(10) diagenesis of mixed carbonate/siliciclastic and pure carbonate sequences under an undersaturated ocean regime significantly different to that in the Carribean and Indian Ocean.
(11) depositional and diagenetic environment of carbonates which are comparable to host rocks for ancient lead-zinc orebodies.

In addition, a transect in this region would be able to be tied to a shallow-water continental shelf program, which the Australian Bureau of Mineral Resources has undertaken.

The immediate goal is a transect of eight holes. One hole would be in the slope area to drill the paleoshelf deposits and toe-of-slope carbonate detritus (NEA1). One hole would be at the paleoshelf margin for sediment history and slope deposition (NEA2). Two holes would be located to drill the toe-of-slope to basin transition, and the older Queensland Trough sediments (NEA3, 4). A fifth hole would be drilled in the central Trough for a basinal reference section, paleoceanography, and basin history (NEA5). Two holes are located on the southwestern margin of the Queensland Plateau to investigate the subsidence history of the Plateau and the periplatform sediment cycles (NEA9, 10). A final hole (NEA12) will test the older Tertiary depositional sequences to complete the basin fill history.

For holes NEA 1, 2, 3, 4, 5, 9 and 10, the total drilling and logging time is 39.5 days. If site NEA 2 is deepened to 800 m as SOHP has suggested, than the total drilling and logging time is 44.5 days. If site 12 is defined as the "deep" stratigraphic test, then the total drilling and logging time is 54 days.

References

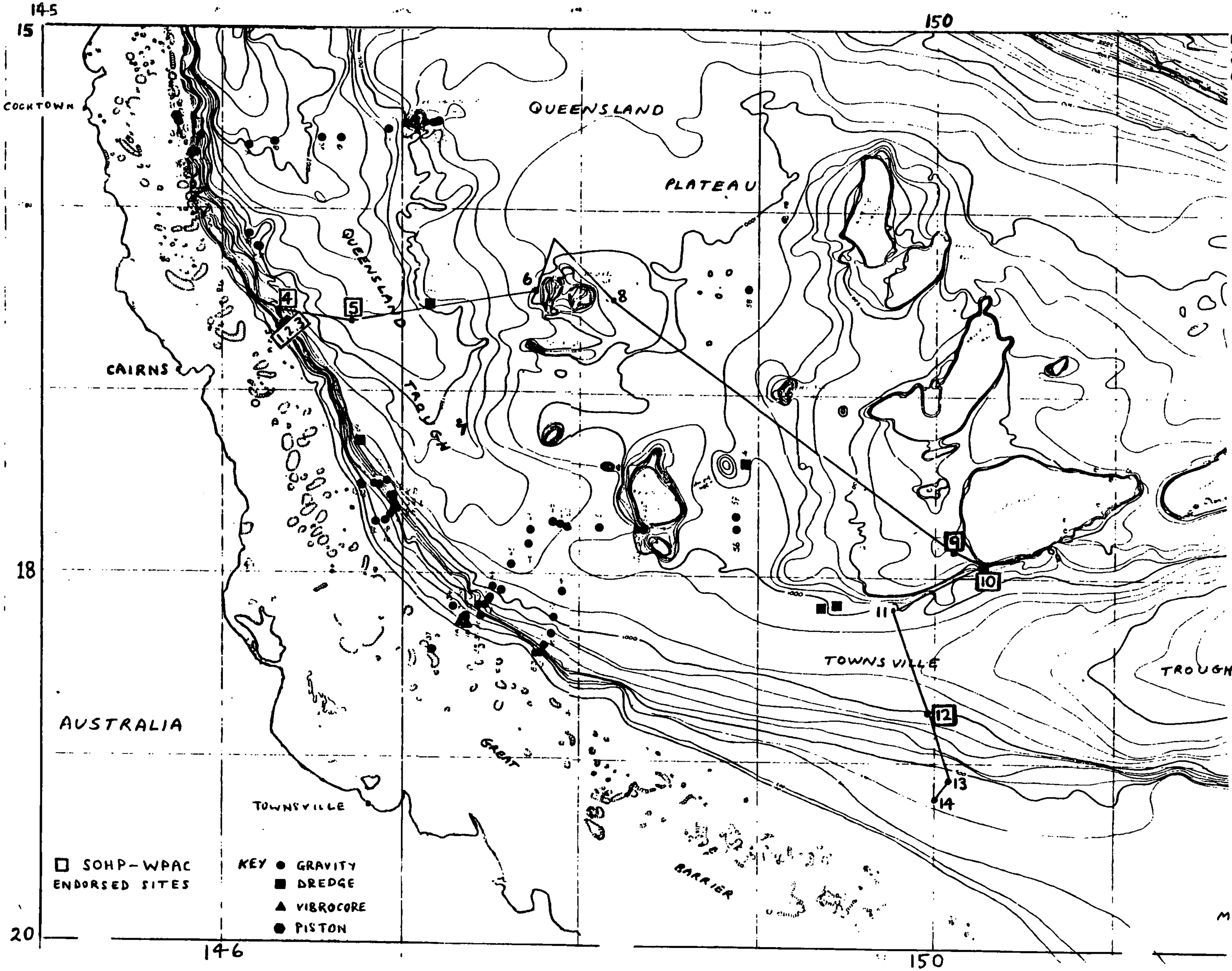
Pinchin J. and Hudspeth, J. W., 1975, The Queensland Trough - its petroleum potential based on some recent geophysical results: APEA Jour., v. 15, p. 21-31.

Symonds, P. A., 1983, Relation between continental shelf and margin development - central and northern Great Barrier Reef; in, Baker, J. T. et et. (eds.), Proc. Great Barrier Reef

Taylor, L. W. H., and Falvey, D. A., 1977, Queensland Plateau and Coral Sea Basin - Stratigraphy, structure and tectonics: APEA Jour., v. 17, p.13-29.

Site Name	Hole Type	Location	W.D. (m)	Penetration (m)	E.D.T. Days	E.L.T. Days	Transit Days	Expected Lithology	Assumed Av. Penetration rate m/hr
NEA1	APC/XCB	16° 38.7'S 146° 18.5'E	218	500	2.6	1.0		Siliciclastics with one 50 m bed of carbonates	20
NEA2	APC/XCB	16° 38.2'S 146° 18.5'E	285	800	3.5	1.4		As above	20
NEA3	APC/XCB	16° 37.5'S 146° 19.2'E	412	300	2.0	0.9		Siliciclastics	20
NEA4	APC/XCB	16° 26'S 146° 14'E	956	450	2.2	1.2		Siliciclastics	20
NEA5	APC/XCB (800) RCB (100)	16° 37'S 146° 44'E	1620	900	8.5-12.5	1.5		Mixed siliciclastic and pelagic carbonates	20 (800) 10
NEA6	APC/XCB	16° 27'S 147° 46'E	1050	300	2.5	0.9		As above	10
NEA7	APC/XCB (300) RCB	17° 09'S 147° 19'E	1450	760	9 - 10.3	1.3		Carbonates	20 5 (mounds)
NEA8	APC/XCB	16° 30'S 148° 11'E	1000	300	2.0	0.9		periplatform ooze	20
NEA9	APC/XCB	17° 52'S 150° 07'E	400	300	2.0	0.9		periplatform ooze	20
NEA10	APC/XCB RCB	17° 55'S 150° 15'E	487	250	9.0	0.8	28 hrs	carbonates	2
NEA11	RCB	18° 8.6'S 149° 46.2'E	990	750	8.5-10.0	1.3		pelagic and reef to bank carbonates	20 (p) 5 (r&b)
NEA12	RCB	18° 44'S 149° 58.8'E	915	1000	9-13	1.5		mixed siliclastics and carbonates	20
NEA13	APC/XCB RCB	19° 11'S 150° 0.5'E	420	400	5-6	0.9		pelagics over ?reef/bank carbonates	20 (p) 5 (r&b)
NEA14	APC/XCB RCB	19° 11'S 150° 01'E	420	350	5-6	0.9		pelagic over ?reef/bank carbonates	20 (p) 5 (r&b)
						Total	38 hrs @ 10 kts		

WPAC followed SOHP's recommendations to drill sites 1-5, 9, 10, 12 which total 45 to 53 days drilling & logging.



320
145
150
15
18
20
146
150
COCKTOWN
QUEENSLAND
PLATEAU
QUEENSLAND
TROUGH
CAIRNS
AUSTRALIA
TOWNSVILLE
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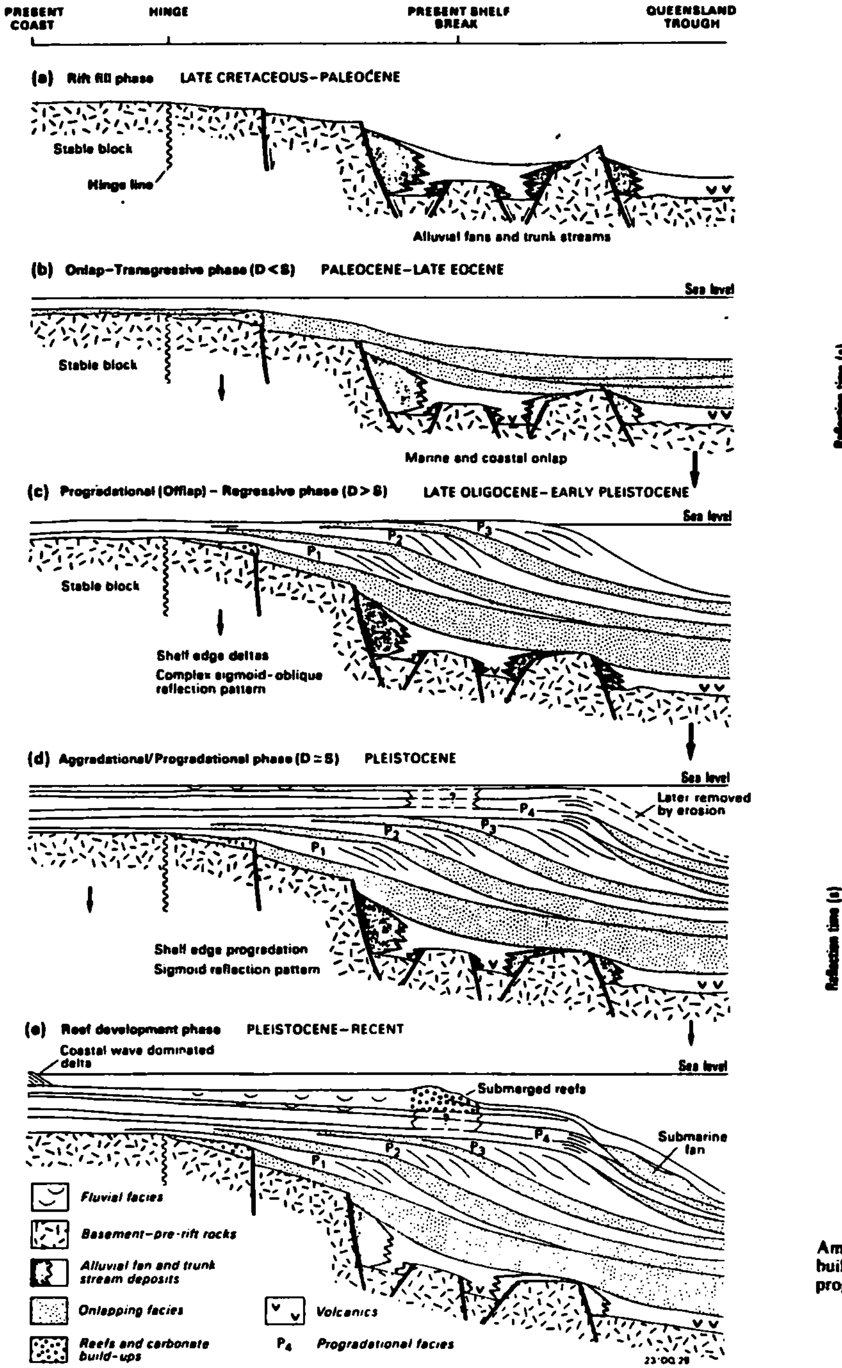
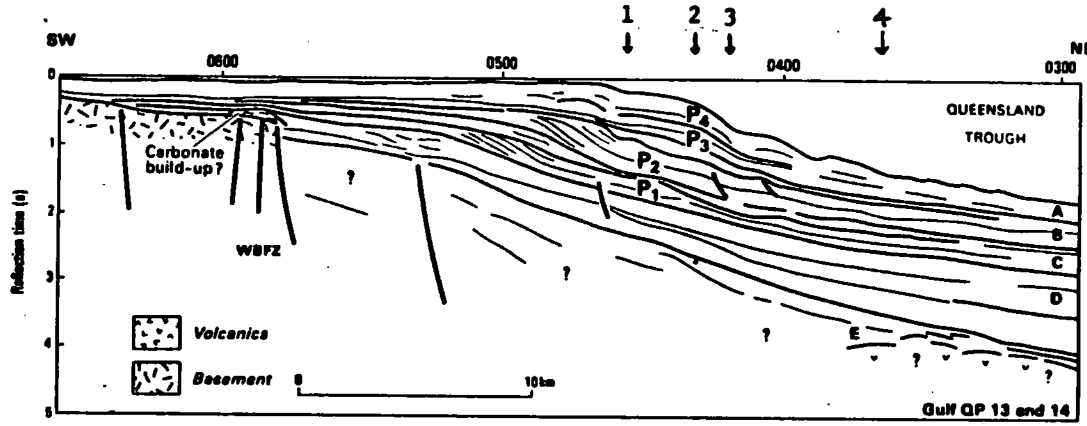
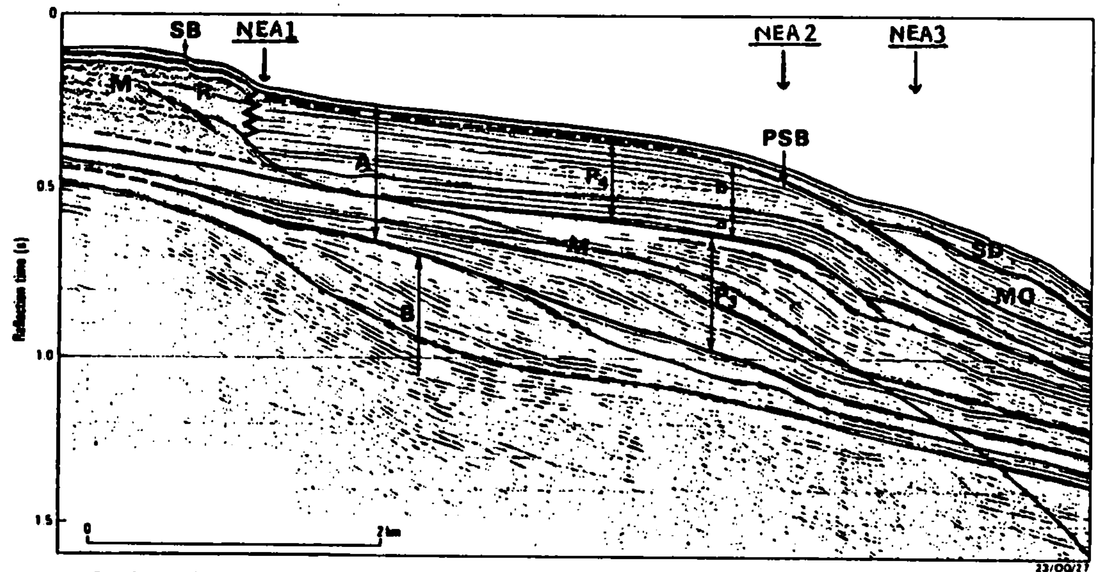
□ SOHP-WPAC
ENDORSED SITES
KEY ● GRAVITY
■ DREDGE
▲ VIBROCORE
● PISTON



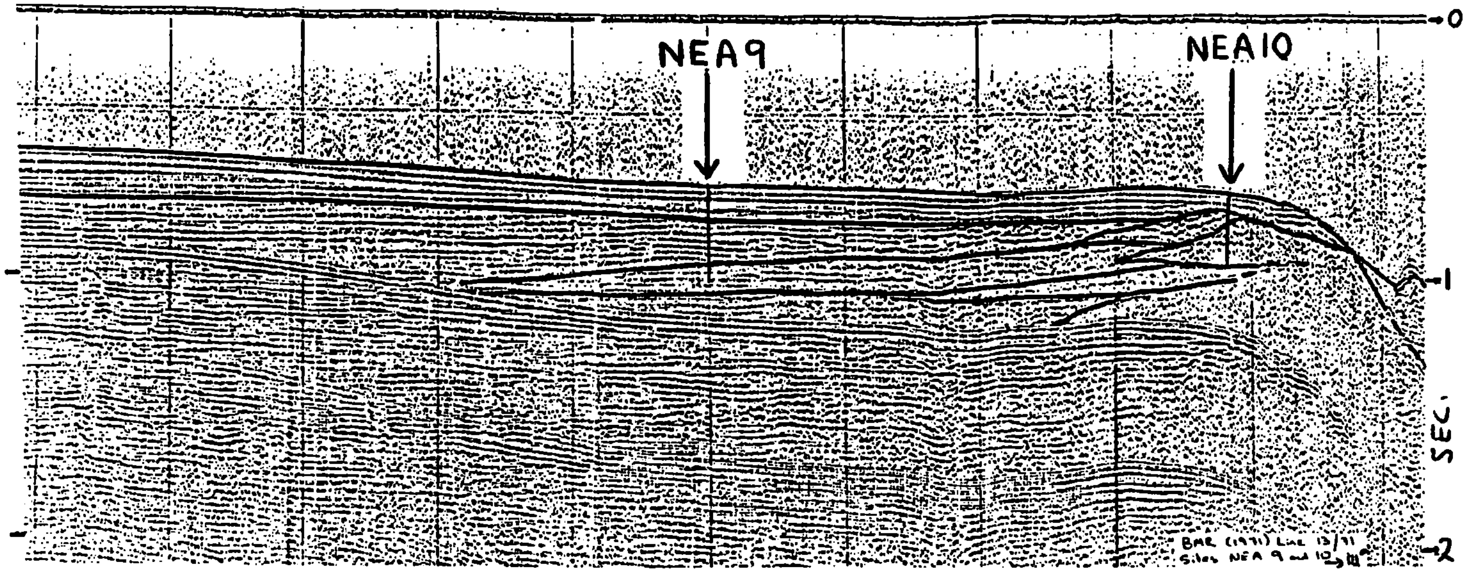
Conceptual evolutionary scheme for the development of the continental shelf in the central Great Barrier Reef Province.
D and S indicate the relationship between deposition (sediment supply) and subsidence (relative rise in sea level). The vertical arrows indicate the relative amounts of subsidence across the area

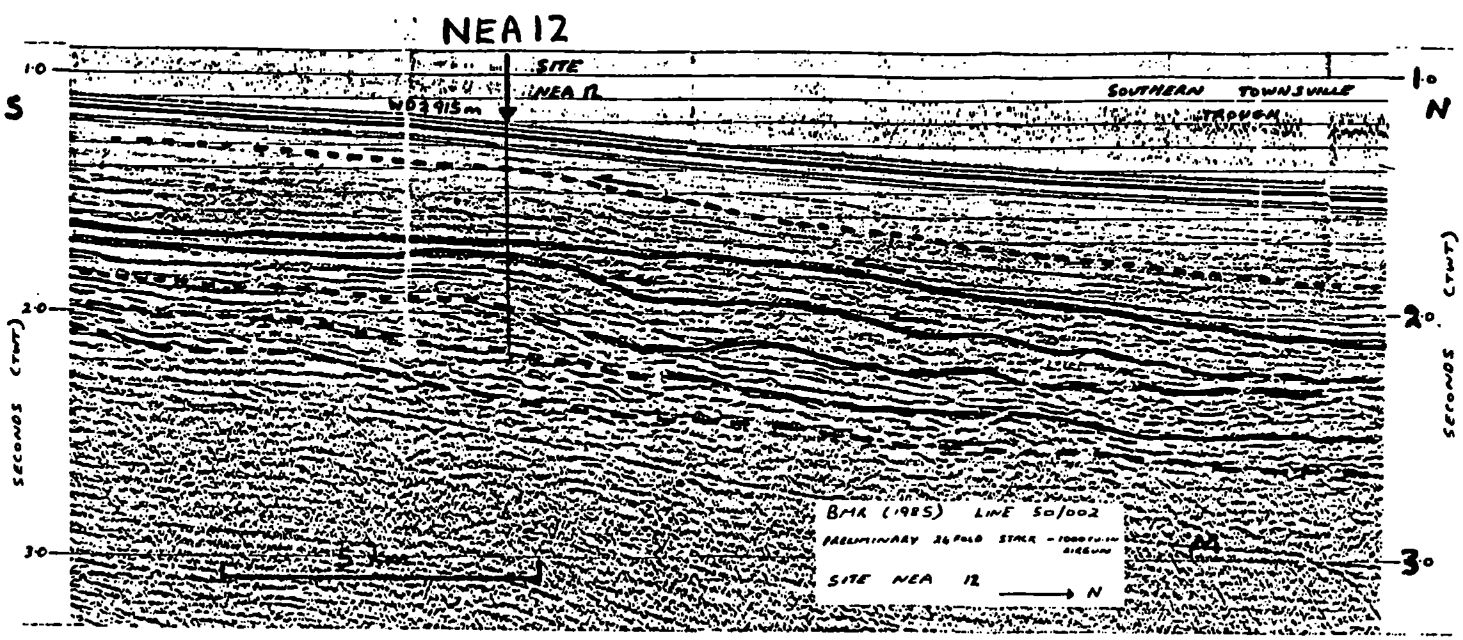


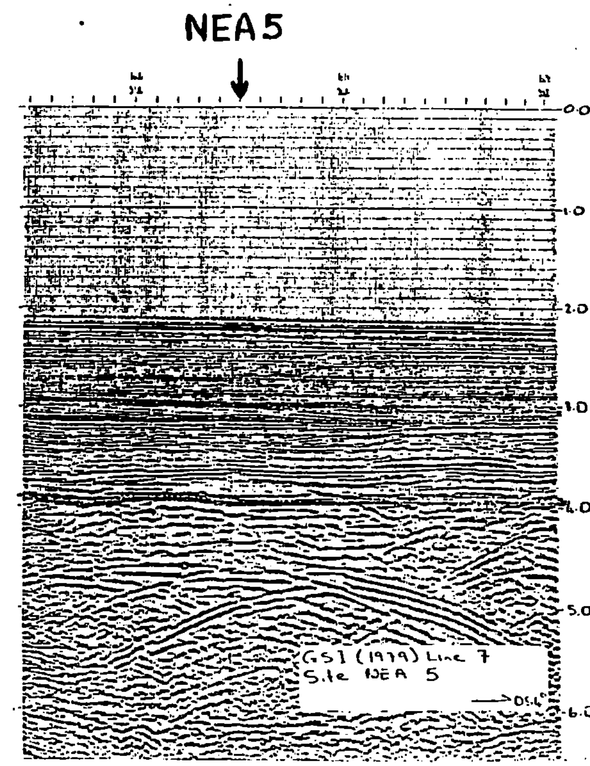
Interpretation of processed Gulf seismic profile: Grafton Passage transect. The major seismic sequences (A.B.C.D.E). and progradational phases (P1. P2. P3. P4) are labelled. WBFZ is the western boundary fault zone of the Queensland Trough rift basin.



Sparker profile at the eastern end of the Grafton Passage transect.
Amplitude-corrected. 12-fold stacked section. Shows prograding. mounded onlap (MO). sheet-drape (SD) and reef facies (R). Note the amount of shelf out-building and the relative positions of the present-day shelf hreak (SB) and the Pleistocene palaeoshelf break (PSB). Major seismic sequences (A. B) and progradational phases (P3. P4) are labelled. P4 has been subdivided into seismic facies units 4a and 4b. M is the first water-bottom multiple.


NEA9
NEA10
0
1
SEC.
2
BMR (1971) Line 13/71
Sites NEA 9 and 10


NEA12
SITE
NEA 12
SOUTHERN TOWNSVILLE
TROUGH
S
N
1.0
2.0
3.0
SECONDS (TWT)
5 km
BMR (1985) LINE 50/002
PRELIMINARY 24 FOLD STACK
SITE NEA 12 → N


NEA5
0.0
1.0
2.0
3.0
4.0
5.0
6.0
GSI (1979) Line 7
Site NEA 5

SUMMARY OF THE NEW HEBRIDES (VANUATU) DRILLING PROGRAM: REVISED JANUARY 1987

This summary presents the principal objectives selected by the West Pacific Panel from two separate proposals (Taylor, JOI, Inc. #187; Fisher et al., JOI, Inc. #190) concerning ODP drilling in the New Hebrides arc. To achieve these objectives the West Pacific Panel recommends a combined drilling and logging time of 72 days.

TECTONIC SETTING

During late Miocene through early Pliocene time the New Hebrides island arc apparently underwent a reversal in arc polarity, after which the Australia-India plate began to underthrust the arc from the west at a rate of at least 10 cm/yr. Since this polarity reversal, extensional back-arc troughs formed that probably are still in an early stage of rifting. The d'Entrecasteaux zone (DEZ) encompasses two east-trending aseismic ridges that tower over the Australia-India plate, and the rapid convergence between this plate and the arc carried the DEZ eastward to collide with the central arc. This collision appears to have exerted profound influence on arc evolution in that islands perched close to the trench rose at anomalously rapid rates. Furthermore, the collision occurs directly west of the intra-arc Aoba basin, which is much deeper than any other basin in this arc. The collision also locally deformed the forearc, suppressed back-arc rifting, and may have facilitated the eruption of picrite, a primitive lava restricted in outcrop to this collision zone. Clearly, much of the unusual morphology and structure of the central arc as well as the distribution and rates of vertical deformation and the historical seismicity pattern have been strongly influenced by the collision of the DEZ with the arc.

OBJECTIVES

The principal objectives of the proposed drilling include the study of arc processes involved in arc-ridge collision, back-arc rifting, subduction-polarity reversal, and the formation of intra-arc basins. A great advantage to drilling in the New Hebrides arc is that these wide ranging objectives can be investigated within a small geographic area by astutely chosen drill sites. The drill sites provide a transect completely across the arc, with one or more sites planned for each major tectonic subdivision of the arc. The transect will allow us to find out which tectonic events had arcwide consequences. Moreover, most proposed sites will contribute information concerning at least two of the four principal objectives.

Arc-Ridge collision

The DEZ-arc collision is the prime focus of our drilling proposal. Drill sites within the collision zone are designed to determine what influence ridge composition and structure exert on the style of accretion and type of arc structures produced during collision. Sites DEZ-1, DEZ-2, and DEZ-3 are located where the north ridge of the DEZ and arc collide. Site DEZ-1 will provide a critical reference section of north-ridge rocks so that we will be able to recognize these rocks in other drill holes. Site DEZ-2 will penetrate the lowermost accretionary wedge, the interplate thrust fault, and the north ridge itself. This site will show whether north-ridge rocks have been accreted onto the arc as well as the age and mechanical properties of rocks where, despite the great relief of the subducted ridge, the collision has

caused little forearc deformation. Site DEZ-3 is located on a bathymetric high just west of Espiritu Santo Island along the strike of the north ridge of the DEZ. The main purpose for drilling at this site is to test whether
1) the high is an uplifted horst of frontal arc material
or 2) large blocks of north-ridge rock have been accreted to the arc.

Drill sites DEZ-4 and DEZ-5 are located where a guyot has collided with the arc, causing considerable forearc deformation. Site DEZ-4 will penetrate imbricated arc rocks to test whether these rocks are part of an uplifted old accretionary wedge, recently accreted guyot rocks, or island-arc basement. Site DEZ-5 will show the lithology, age, paleobathymetry, and mechanical properties of the guyot. We will contrast the results obtained from drilling near the guyot with those obtained near the north ridge to determine why arc structures induced by the collision are so different. We want to determine the rate of uplift of the accretionary wedge and compare this rate to the rate at which onshore areas emerged. This emergence occurred synchronously with collision, and onshore areas rose at Holocene rates exceeding 5mm/yr.

Intra-Arc Basins

The purpose for drilling in the Aoba Basin is to investigate how arc-ridge collision affected the development of intra-arc basins and the evolution of the magmatic arc. In addition, volcanic ash within basin rocks may contain a record of the hypothesized reversal in arc polarity.

Site IAB-1 is located within the center of the Aoba Basin, which lies beneath significantly deeper water than does any other basin near the summit of this arc. Crucial information to be obtained at this site includes the age of a major unconformity that, we believe, correlates with the onset of arc-ridge collision and will provide one of the better estimates of when this onset occurred. The chemistry of Quaternary volcanic ashes may show whether the magmatic arc has been affected by subduction of the DEZ.

Site IAB-2a or IAB-2b will be located along the eastern flank of the Aoba Basin where basin rocks include two unconformities. The shallower one will show when the back-arc area was deformed, possibly as a direct result of the collision. The deeper unconformity lies along the top of the oldest basin rocks, and drilling at this site will show the late Cenozoic evolution of the magmatic arc. We want to determine whether the chemistry of volcanic ash shows that the magmatic arc was affected by the arc polarity change.

Back-arc troughs

The purpose of drilling in the back-arc troughs is to show the range in chemical composition and eruptive sequence of volcanic rocks that fill grabens that are in an early stage of development.

Although the back-arc troughs lie east of the present volcanic line, fresh basalt and volcanic glass have been dredged from the bottom of the troughs, suggesting that these features are young. The chemical composition of dreged samples shows that the rocks are intermediate between arc basalt and back-arc basin basalt. We propose to drill where the chemistry and volcanic stratigraphy in an incipient rift can be determined. We will drill only one of the three sites listed in Table 1 (BAT-1a, 1b, or 2). The choice will be made after more seismic reflection and chemical data are available.

SITE SURVEY DATA: EXISTING AND PLANNED

A large data base, assembled by the USGS and ORSTOM, includes single-channel and multichannel seismic sections, refraction profiles, as well as magnetic, gravity, dredge, bathymetric, and onshore geologic and geophysical data. Migrated multichannel seismic data have been used to locate proposed drill sites in the collision zone and Aoba basin. Seabeam, single-channel seismic, and dredge data collected aboard the R/V J. Charcot in late 1985 provide excellent bathymetric control for choosing sites within the collision zone and the back-arc troughs. In 1986, ORSTOM and the University of Texas conducted OBS refraction surveys over these troughs and the Aoba basin. In April, 1987, ORSTOM will conduct a multichannel seismic survey in the New Hebrides arc to aid site selection.

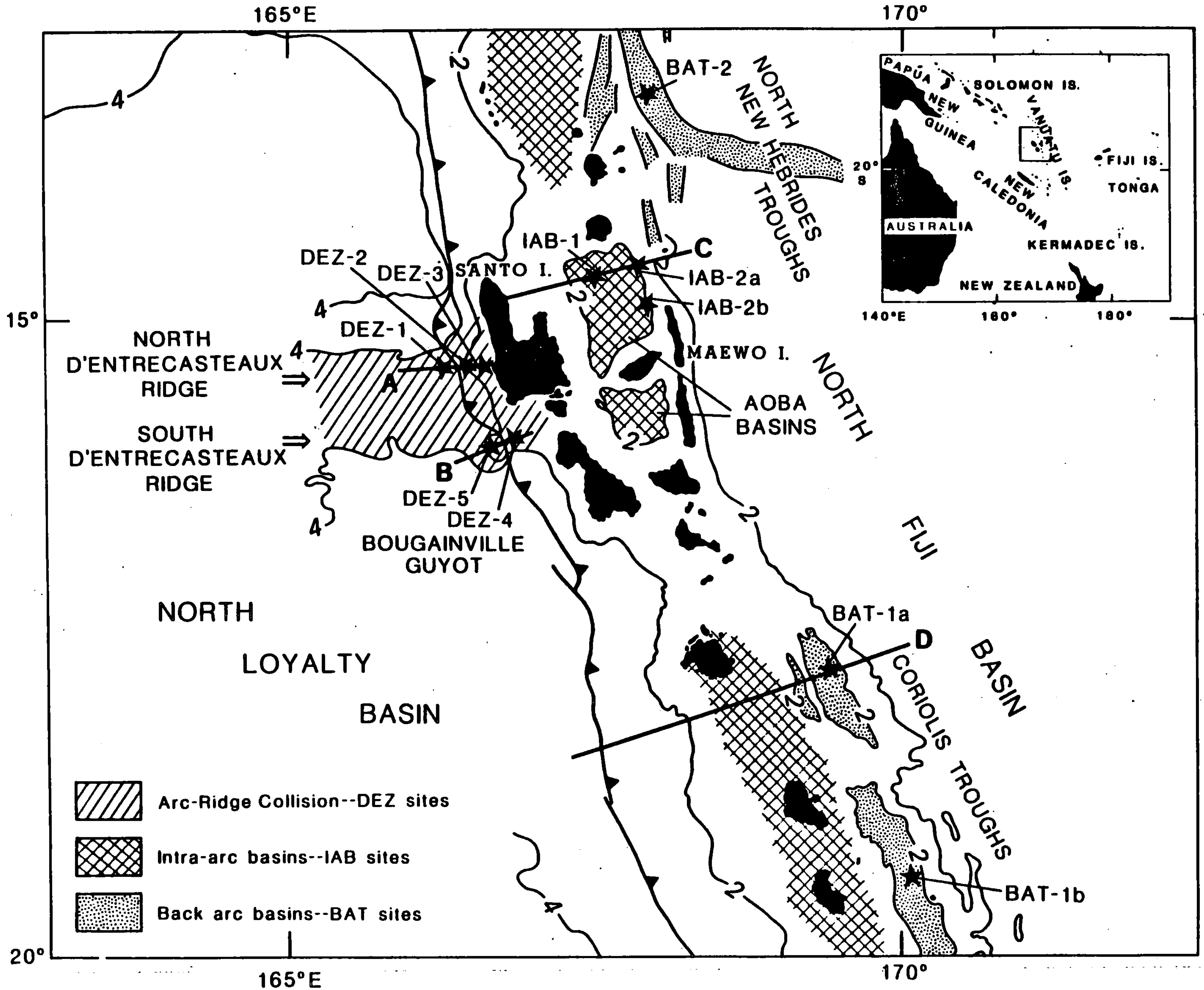
Site #	LAT (°S)	LON (°E)	Water Depth (m)	Penetration Sediment (m)	Penetration Basement (m)	Drilling Time (Days)**	Logging Time (Days)***
DEZ-1	15°20.5'	166°16.5'	2500	200	100	3.0	1.3
DEZ-2	15°19.2'	166°21.7'	2130	900	100	9.0	2.2
DEZ-3	15°20.7'	166°30.5'	500	800	0	4.7	1.7
DEZ-4	15°57'	166°47.5'	900	1000	0	7.2	2.0
DEZ-5	16°01'	166°40.5'	1100	700	50	4.3	1.7
BAT-1a	17°49.8'	169°20.5'	2600				
* BAT-1b	19°44.8'	170°11.3'	3300	600	100	7.0	1.9
BAT-2	13°15'	167°57'	2550				
IAB-1a	14°47.5'	167°35'	3075	1000	0	10.4	2.3
* IAB-2a	14°38.3'	167°55'	2600	1000	0		
IAB-2b	14°50.2'	167°55.5'	2400	1000	0	9.6	2.2
					Total:	55.2	15.3

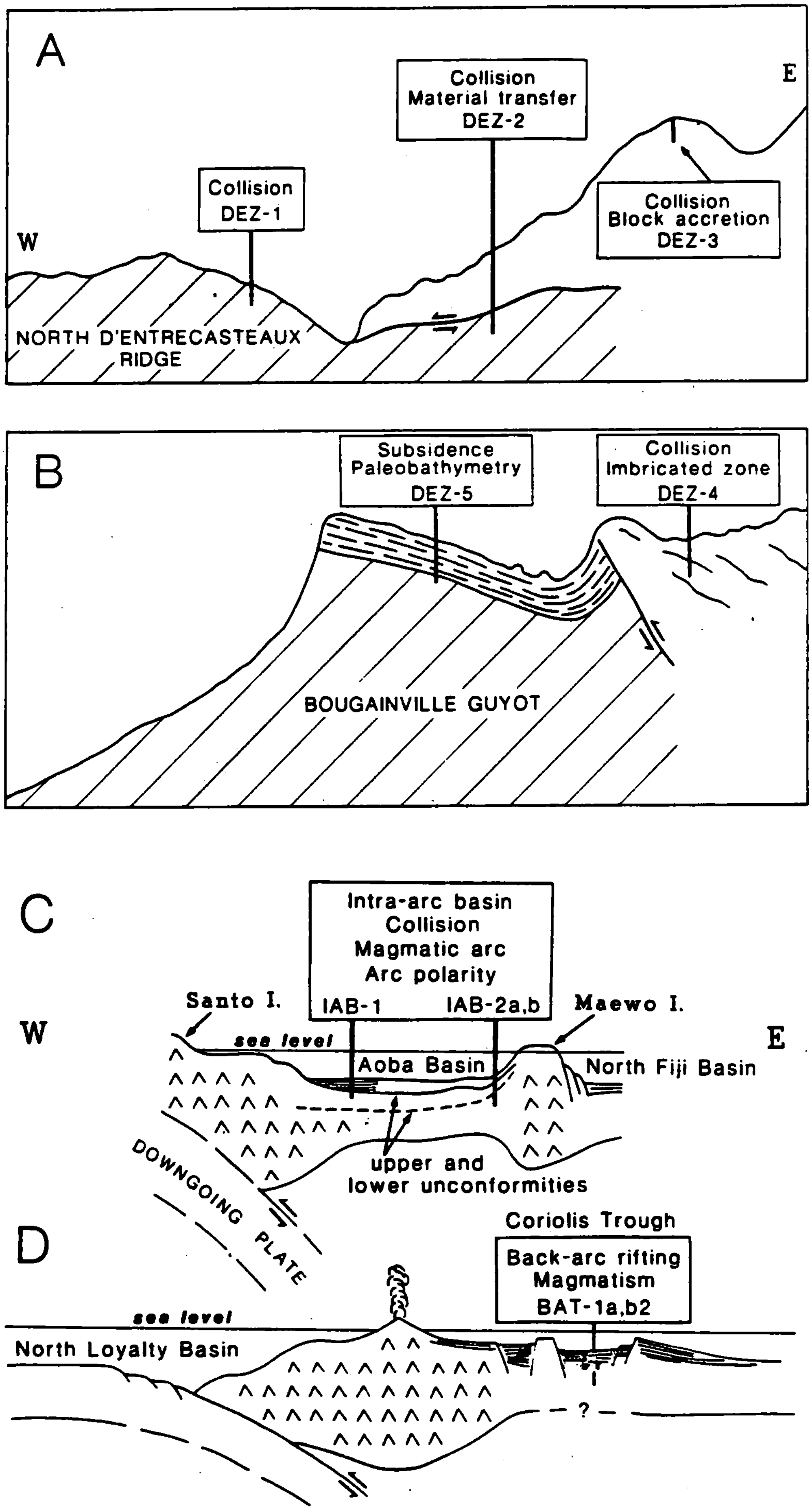
Total transit time Noumea to Fiji: 5.5

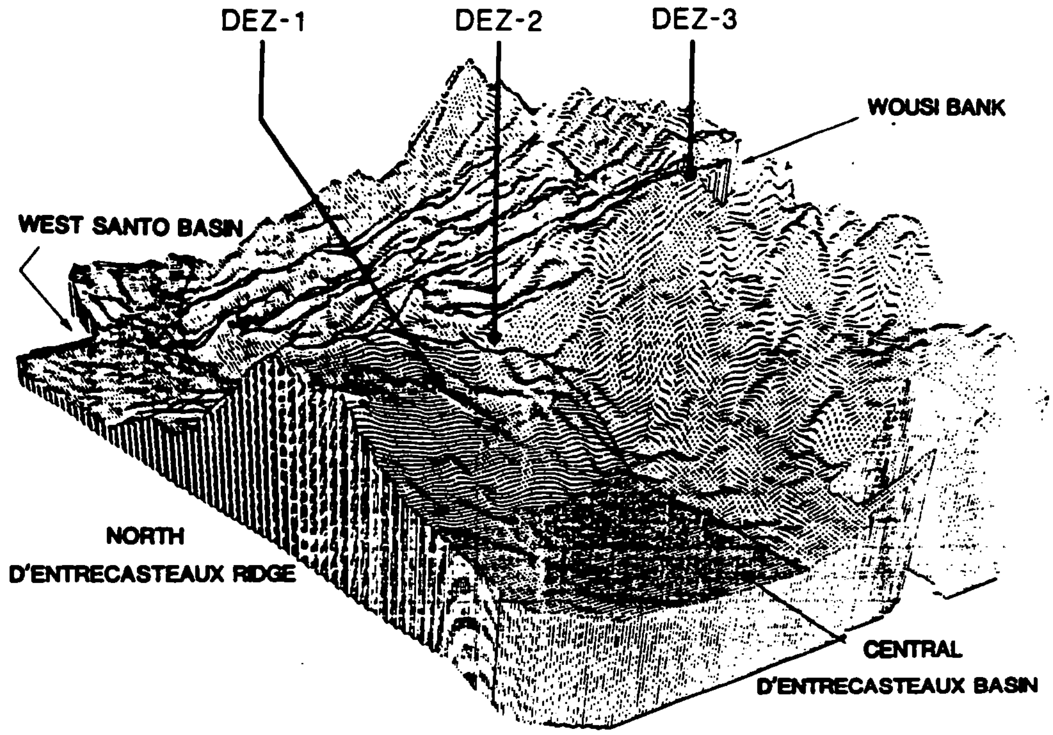
* Only one site will be drilled. GRAND TOTAL: 76 days

** Drilling time estimates are based on Preliminary Time Estimates For Coring Operations, ODP Technical Note n. 1, December, 1986, and on discussion with Roland von Huene about drilling in accretionary wedges.

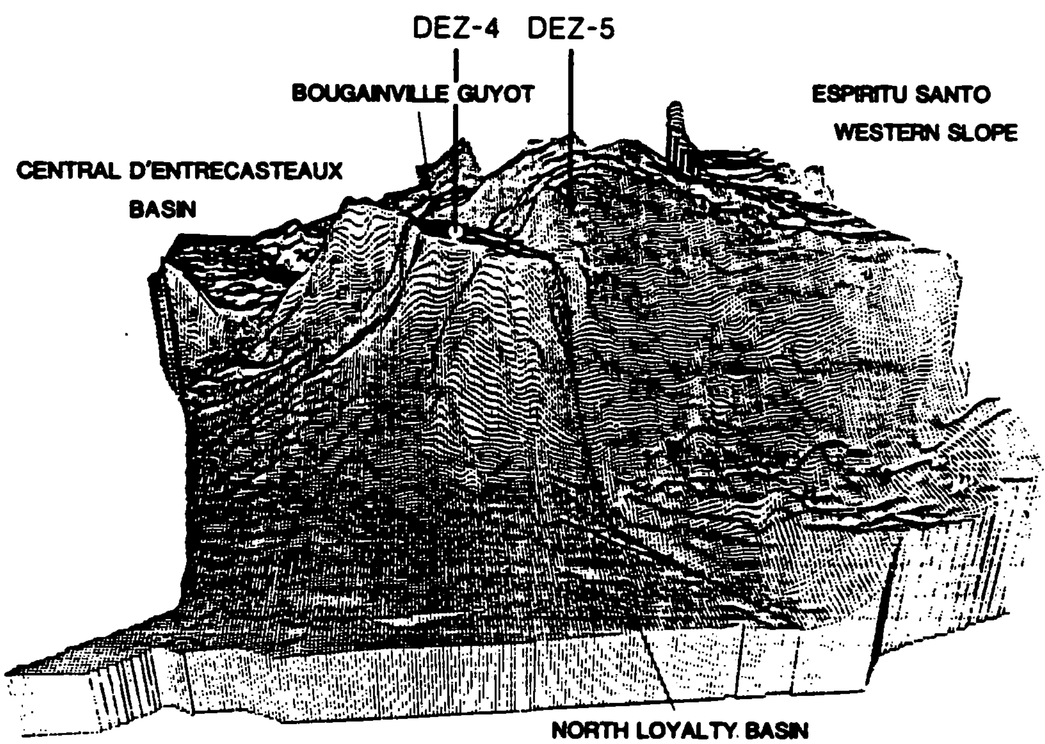
*** Logging time includes time for seismic stratigraphic/geochemical combination, lithoporosity, and borehole televiewer.


165°E
170°
15°
20°
BAT-2
NORTH NEW HEBRIDES TROUGHS
PAPUA NEW GUINEA
SOLOMON IS.
VANUATU IS.
FIJI IS.
TONGA
NEW CALEDONIA
AUSTRALIA
KERMADEC IS.
NEW ZEALAND
20° S
140°E
160°
180°
IAB-1
C
IAB-2a
IAB-2b
DEZ-2
DEZ-3
SANTO I.
DEZ-1
NORTH D'ENTRECASTEAUX RIDGE
A
SOUTH D'ENTRECASTEAUX RIDGE
B
DEZ-5
DEZ-4
BOUGAINVILLE GUYOT
MAEWO I.
AOBA BASINS
NORTH FIJI BASIN
NORTH LOYALTY BASIN
BAT-1a
D
CORIOLIS TROUGHS
BAT-1b
Arc-Ridge Collision--DEZ sites
Intra-arc basins--IAB sites
Back arc basins--BAT sites


A
W
E
Collision
DEZ-1
Collision
Material transfer
DEZ-2
Collision
Block accretion
DEZ-3
NORTH D'ENTRECASTEAUX
RIDGE
B
Subsidence
Paleobathymetry
DEZ-5
Collision
Imbricated zone
DEZ-4
BOUGAINVILLE GUYOT
C
W
E
Intra-arc basin
Collision
Magmatic arc
Arc polarity
IAB-1
IAB-2a,b
Santo I.
Maewo I.
sea level
Aoba Basin
North Fiji Basin
upper and
lower unconformities
DOWNGOING PLATE
D
Coriolis Trough
Back-arc rifting
Magmatism
BAT-1a,b2
sea level
North Loyalty Basin
?



Seabeam data over the North d'Entrecasteaux Ridge-arc collision zone



Seabeam data over the Bougainville Guyot-arc collision zone

LAU BASIN-TONGA

The Lau Basin is an actively spreading backarc basin behind the Tonga Arc. It was the first such basin to be recognized some two decades ago, yet has continued to yield valuable perspectives into the diverse processes of crustal formation at oceanic convergent plate boundaries because it has been studied recently by researchers from five ODP member nations. This drilling program is the result of collaboration between these national groups, and is their unanimous recommendation.

The central Lau basin currently produces N-MORB-type basalts at an intermediate spreading rate (5-6 cm/yr^{-1}), which locally are overlain by sediments in which the accumulation rate of hydrothermally-derived elements is as high as near the East Pacific Rise. In contrast, the basin's western margin is underlain by older basalts which, although more similar in composition to those of island arcs, are less so than the basalts which were erupted on the adjacent remnant arc during or just before the initial opening of the basin 3 to 5 Ma ago. Recent accumulation rates of hydrothermal metals in sediments near the margin are only about 25% of those near the spreading axis. Farther south, the present spreading axis lies only 50 km behind the volcanic arc, and is characterized by a 200 km-long volcanic ridge (Valu Fa) which is made of basic to acid andesites and underlain at some 3.5 km by a seismically-identified magma chamber.

The six-hole Lau Basin drilling program provides opportunity to investigate a mature backarc basin which is well enough known that fundamental processes of crustal generation can be studied in detail. These processes include changes in the composition of both basement basalt and overlying sediment during opening of a backarc basin, and the relationship of each to the basin's tectonic history; the time-transgressive character of basin opening and its relationship to the magmatic evolution and vertical tectonic history of the adjacent arc; the geochemically distinctive and widespread volcanism which forms the basement of oceanic island arcs; and the petrologic, metallogenic, and hydrothermal character of one of the largest and most differentiated active volcanic features known on the seafloor, Valu Fa Ridge.

Four of the sites (LG2,3,6,7) constitute a half-leg core program. The scientific justification of the other two (LG1 in MORB-like basalts in the central basin, and LG4 on or near Valu Fa Ridge) is just as strong as for the core program, but although neither is a bare-rock site both require drilling in young volcanic rocks. Because of the technical problems of core recovery at such sites, and because site survey work at both is continuing during the first half of 1987, we defer judgment about whether to drill at both sites or just one. Under favorable conditions, it may be posible to answer the first-order questions posed below, and to leave a re-entry cone for future re-investigations, at both sites in the other half of one leg.

1. Petrological evolution of the basin

Temporal variation in the composition of basement basalts is one objective of sites LG1, LG2, and LG7 located on crust expected to be 0.5-1.0 to 3-5 Ma old along a common flow-line at about 19°S. Basalts dredged from the LG1 area, just west of the present spreading axis, are N-MORB-types (Figs. 1, 2). In contrast, basalts from the LG2 area in the western basin margin are more like those of island arcs in general, but less so than the coeval basalts of the Lau Ridge in particular. That is, they are like Mariana Trough basalts in composition. If the basement at the LG2 site is older than 3 Ma, then it formed at the same time as arc-type volcanism on the Lau Ridge. Site LG7 lies between these areas of known difference in basement basalt type. This difference, together with the tight stratigraphic and geochemical control on volcanism of the now-remnant arc, is what makes the LG1-7-2 transect a unique drilling target because such control is not available for any other backarc basin. Comparison of the volcanic stratigraphy between the sites will test whether basalt heterogeneity is as great in one place as is the apparent difference between sites of different age, and will test whether the change from arc-like to N-MORB chemistry is sharp, gradational, or cyclical. This, in turn, will inform dynamical models of the evolution of the mantle wedge during arc rifting, and models of geochemical recycling through arc-backarc couples. Site LG1 also is designed as a reference re-entry hole in a backarc basin suitable for long-term downhole experiments and deep drilling in <1 Ma-old basaltic crust.

2. Geodynamics of arc rifting and backarc basin formation

Geodynamic aspects of backarc basin formation which can be studied only by drilling include the age of basin inception, the vertical motions of the arc before and after rifting, and the extent to which volcanism is synchronous in both arc and backarc. These are the objectives of sites LG2, 7, 3, and 6. The magnetic anomaly patterns in the basin have too little long-range order to yield firm estimates of the age(s) of, or rate fluctuations during, its opening. Current estimates are that the basin began to be floored by oceanic crust 3 to 5 MA ago, perhaps propogating southward. The four sites listed have been designed to determine the age of opening at two latitudes 400 km apart by using the age of the oldest sediment on the earliest crust (LG2 ± 7) and the age of uplift of the proto-arc (LG 3 ± LG6) (Fig. 3a). The rates of differential uplift and subsidence of the arc and basin also can be evaluated at these sites, thanks to the good local biostratigraphic control which is available for Upper Miocene to Pleistocene sediments; this may test stretching versus detachment models of basin formation. Finally, the age of inception and the subsequent history of Tofua Arc volcanism can be evaluated at proximal site LG3 (Fig. 3a), and distal sites LG2, 7, and 6, and compared to the history inferred for the basin.

3. Relationships between magmatism, tectonics, and hydrothermal metal accumulation

Accumulation rates of hydrothermal metals in recent sediments in the central Lau Basin are comparable to those near the East Pacific Rise, but drop off exponentially toward the basin's margins. The LG1-7-2 transect is designed to evaluate how these rates change with time (i.e., as a site moves away from the spreading center), and whether perturbations in rates can be correlated between sites and, hence, to basinal tectonic history. Studies of East Pacific Rise cores (DSDP 92) have demonstrated on the basis of sediment chemistry that there have been several periods of anomalously high hydrothermal activity during the last 30 Ma which are thought to be related to periods of enhanced volcanic activity due to reorganization of plate boundaries. Similar results for Lau will contribute to the geodynamic objectives discussed above, and to the hydrothermal mineralization studies at Valu Fa discussed below.

4. Basement and Tectonic history of the forearc

The pre-Lau Basin volcanic basement and/or lower crust of the Tonga forearc is one objective of site LG6, located on the trench-slope break (Fig. 3b,c). In addition to offering a distal sedimentary record of the arc's response to basin formation, and of the preceding arc volcanism, this hole will explore the nature and latitude of origin of the Eocene basement which is common to most western Pacific arcs. Tholeiitic to boninitic basement rocks crop out in Tonga and Fiji and have been dredged on the Tongan forearc. They are scarce, and less is known about them than about those of the Bonin and Mariana forearcs to which they will be compared. The age and composition of basement rocks not only are important for understanding the crucial early processes of crustal formation in oceanic island arcs, but also for predicting the effects of crustal interaction during initial marginal basin magmatism (item 1 above).

5. Petrology, metallogenesis, and hydrothermal effects of a large active differentiated submarine volcano

Site LG4 investigates one of the largest active submarine volcanic edifices known: Valu Fa Ridge (Fig. 4). This portion of the basin's current spreading center lies only about 50 km behind the volcanic arc. It is characterized by fresh andesite for almost 200 km along strike and by a seismically-visible magma chamber at 3.5 km below the seafloor for at least half this distance. Discovery of this feature is especially important in light of the ubiquity of silicic rocks in modern backarc basins (e.g., near site BON1) and in many ophiolites, and their potential relationship to metallic ore deposits. Phanerozoic volcanogenic massive sulfide deposits in silicic rocks, including some of the world's largest Cu-Zn-Pb-Ag-Au ore bodies (e.g., Rio Tinto, Bathurst), are thought to have formed in such environments. Drilling will permit study of the petrological evolution of the uppermost part of the volcano, study of the relationships between depth and style of hydrothermal mineralization which is known to exist from dredging, and preliminary study of the heat and fluid flow in porous volcanic rocks above a differentiated magma chamber of known depth. This site is an oceanic equivalent of the drilling projects in continental rhyolites of the USA, comparisons to which will clarify differences in metallogeny between submarine and subaerial environments. Also, it is a felsic analogue to the drilling planned at zero-age spreading centers in the eastern Pacific, permitting comparison of the effects of different wall-rocks and magmatic volatile budgets on hydrothermal fluid geochemistry and mineral paragenesis.

Additional survey work is necessary for sites LG1,2,4, and 7. This will be done during 1987-88 cruises of the Sonne, Charcot, and Darwin.

Site#	Type	Lat.(°N)	Long.(°W)	W.D.(m)	Penetration(m) Sed*	Bsmt	Time(d) Drill	Log
LG1	APC/RCB (re-entry)	18°45′	176°45′	2400	100	120	12	2
LG2	APC/RCB	18°45′	177°45′	2600	300	50	6	1
LG3	APC	22°10	175°42′	750	500	--	4	1
LG4	APC/RCB (re-entry)	22°22′	176°39′	2400	100	120	12	2
LG6	APC/RCB	22°00′	174°30′	4500	500	50	8	1
LG7	APC/RCB	18°45′	177°10′	2400	150	50	3	1
							45	+ 8

* Sediments are hemipelagics and volcaniclastics

= 53d

Transit Time (Suva-Pago Pago) = 3d

TOTAL TIME: = 56d

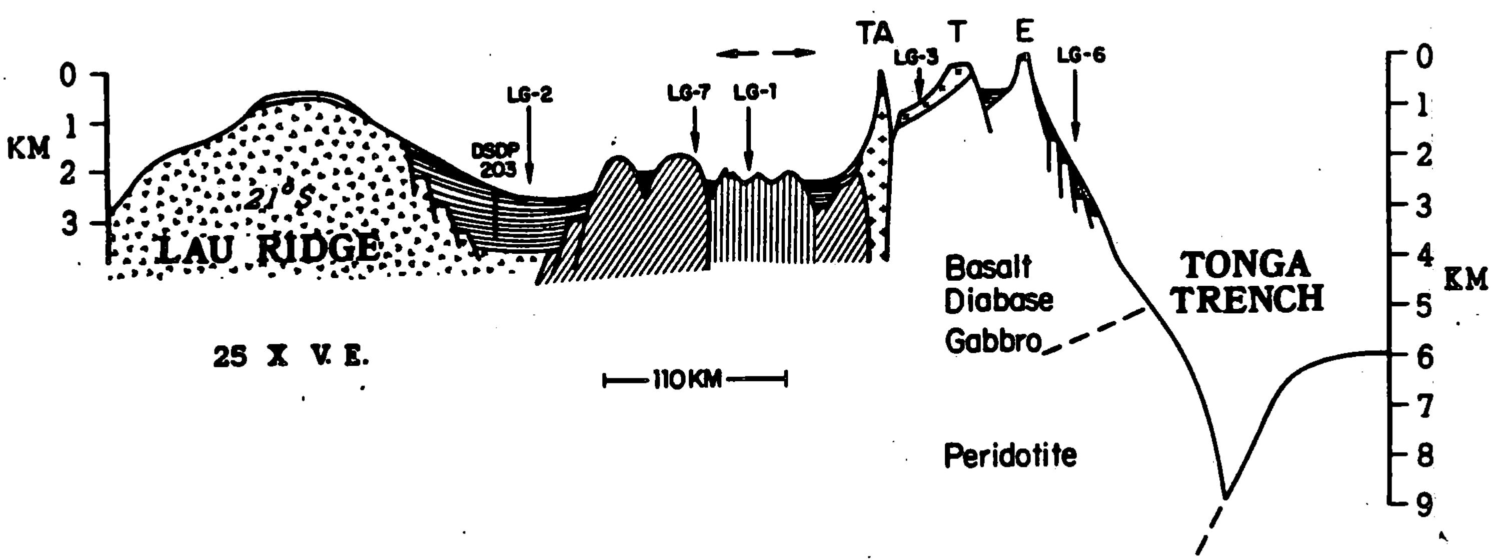


Fig. 1a. Cross-section sketch of Lau Basin and Tonga Trench showing distribution of rock types and morphology. Proposed drill sites, and DSDP site 203, are projected onto this section.

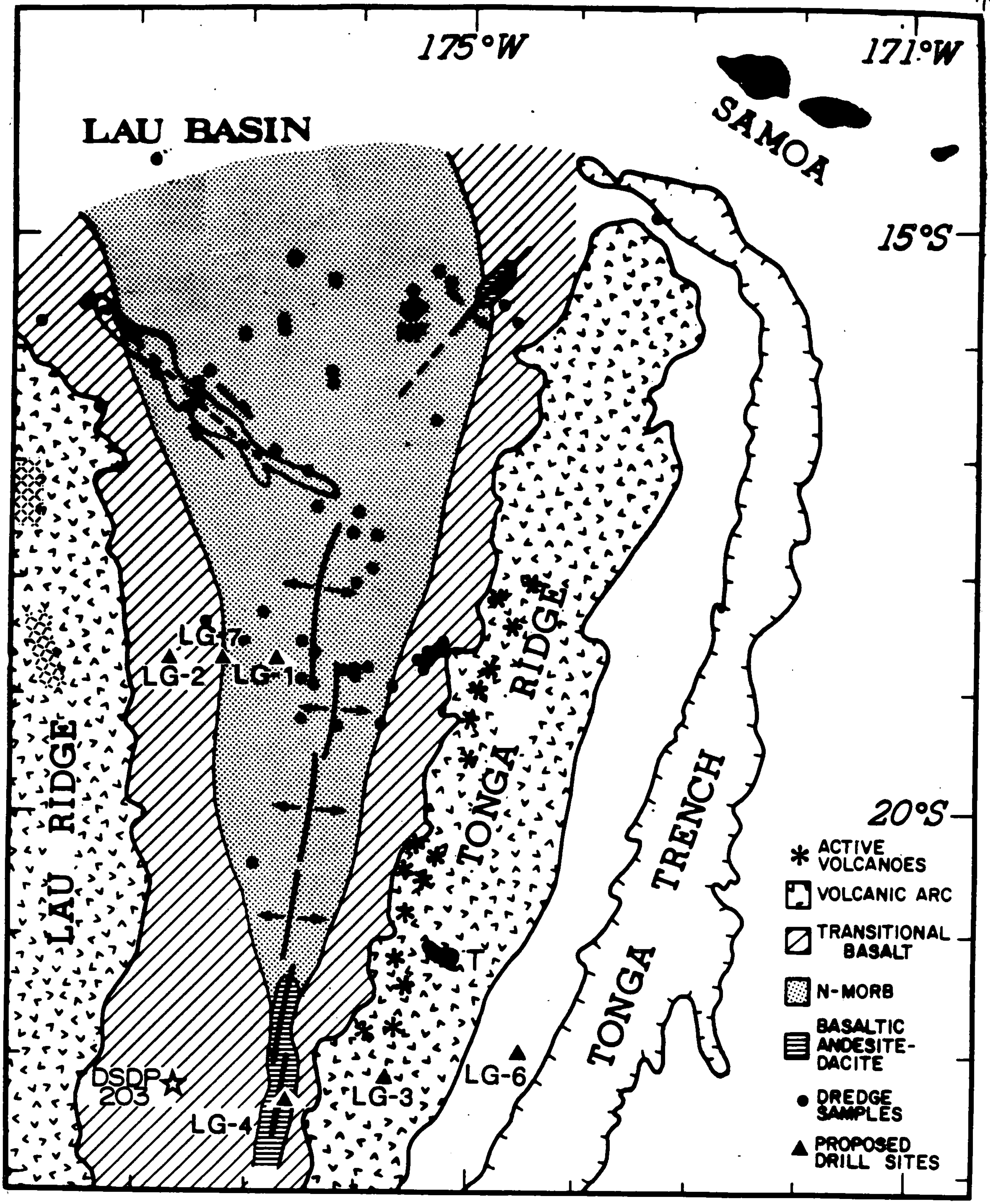
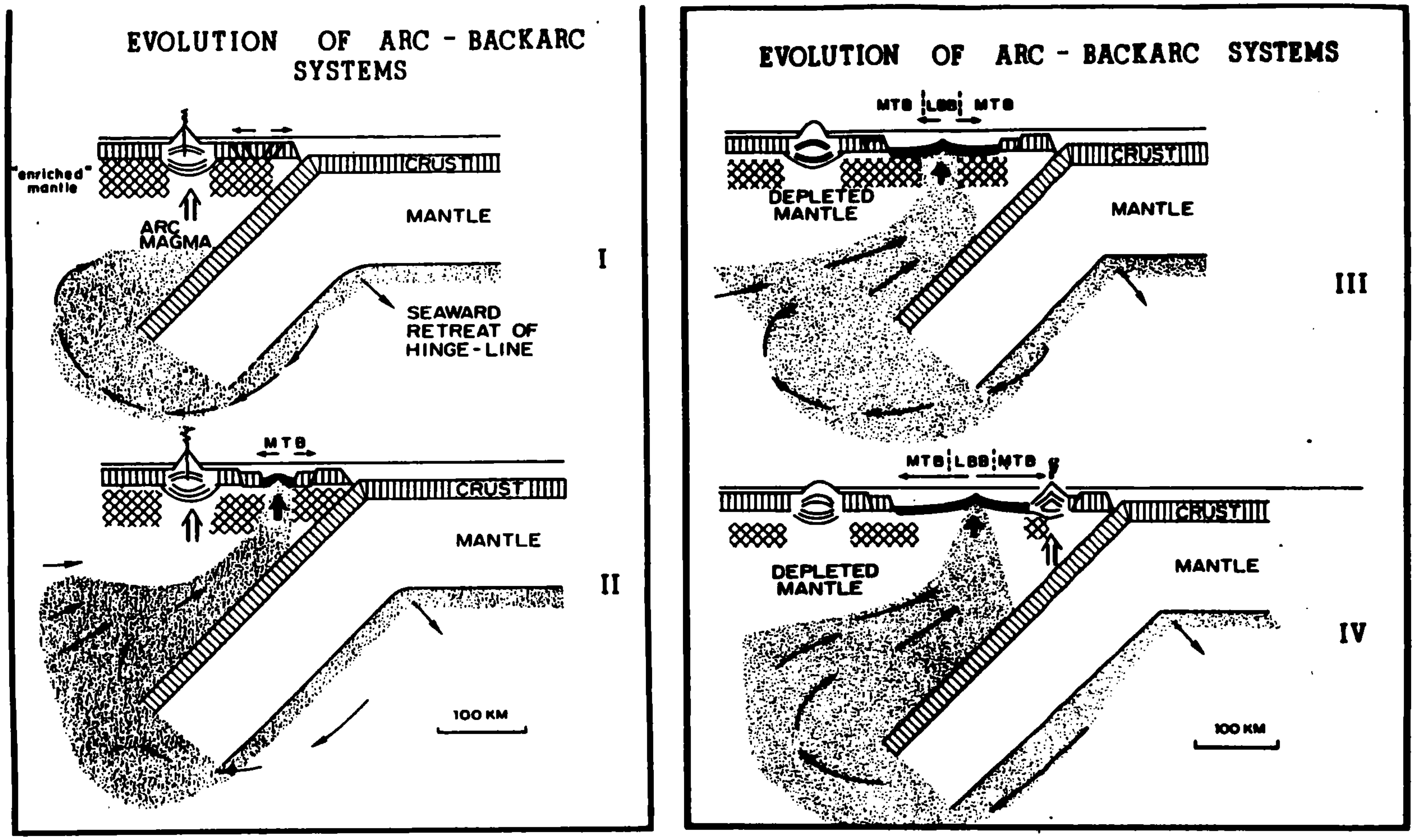


Fig. 1b. Sketch map of Lau Basin showing distribution of rock types and dredge sites. DSDP site 203 is shown as a star and proposed drill sites LG-1 to LG-7 are shown as triangles. Areas on Lau Ridge with 3-5 Ma basalts are shown in hatched pattern. The transitional basalts resemble Mariana Trough basalt and are enriched in alkalis, alkaline earths and water relative to MORB.



Model to explain the evolution of back arc basins and the compositional zonation of back arc basin crust. (I) Initial stage of evolution showing the convergent plate margin, the active volcanic arc, and the forearc. The forearc is under extensional stress due to the "rollback" of the trench hingeline. The cross-hatched area under the arc and forearc represents mantle that has been partly depleted in its "basaltic" components but variably enriched in water and large ionic-radius lithophile (LIL) elements derived from subducted oceanic crust. The stippled pattern and the curved arrows represent deep mantle convective flow driven by the seaward retreat of the subducted plate. The mantle counterflow causes thermal upwelling in the forearc and causes the forearc extension. Heavy lines in the forearc crust represent normal fault planes that form half-grabens as the forearc is dilated. (II) This view represents a more advanced stage of forearc extension. Rising mantle diapirs (solid arrow) have partly melted to form MORB-like basalt in the rifted region. These melts have been modified by zone-refining processes that enrich them in water and LIL components derived from the enriched upper mantle. The basalt is comparable to the Mariana Trough-type basalt (MTB). (III) Continued extension of the forearc causes new ocean crust to form due to fractional melting of the rising mantle diapir. Inflow of "new" mantle, and eruption of basalt through upper mantle and deep crust depleted in the enriched material, allows eruption of basalt more like normal MORB, e.g., Lau Basin-type basalt (LBB). The volcanic island arc has become inactive because the geometry of the subduction system has been changed due to the seaward retreat of the subduction zone. Note that this model requires that there is a break in arc volcanism during the early stages of "back arc" basin evolution. (IV) A new volcanic arc has formed on the outer edges of the zone of extension. It is superposed on, or replaces, part of the back arc basin crust. The active arc is not a fragment split off from the older (remnant) arc. The configuration shown here is similar to the Lau Basin in which the back arc crust is zoned from MTB to LBB basalt. In the Mariana Trough the new arc formed at a stage equivalent to stage II above. The geometric arrangement of arcs and the new oceanic crust make the latter a true "back arc" basin. A more detailed explanation of the model for tectonic evolution shown here, and the field evidence to support it, is given by *Hawkins* (1984).

from Hawkins and Melchior, 1985.

FIG.

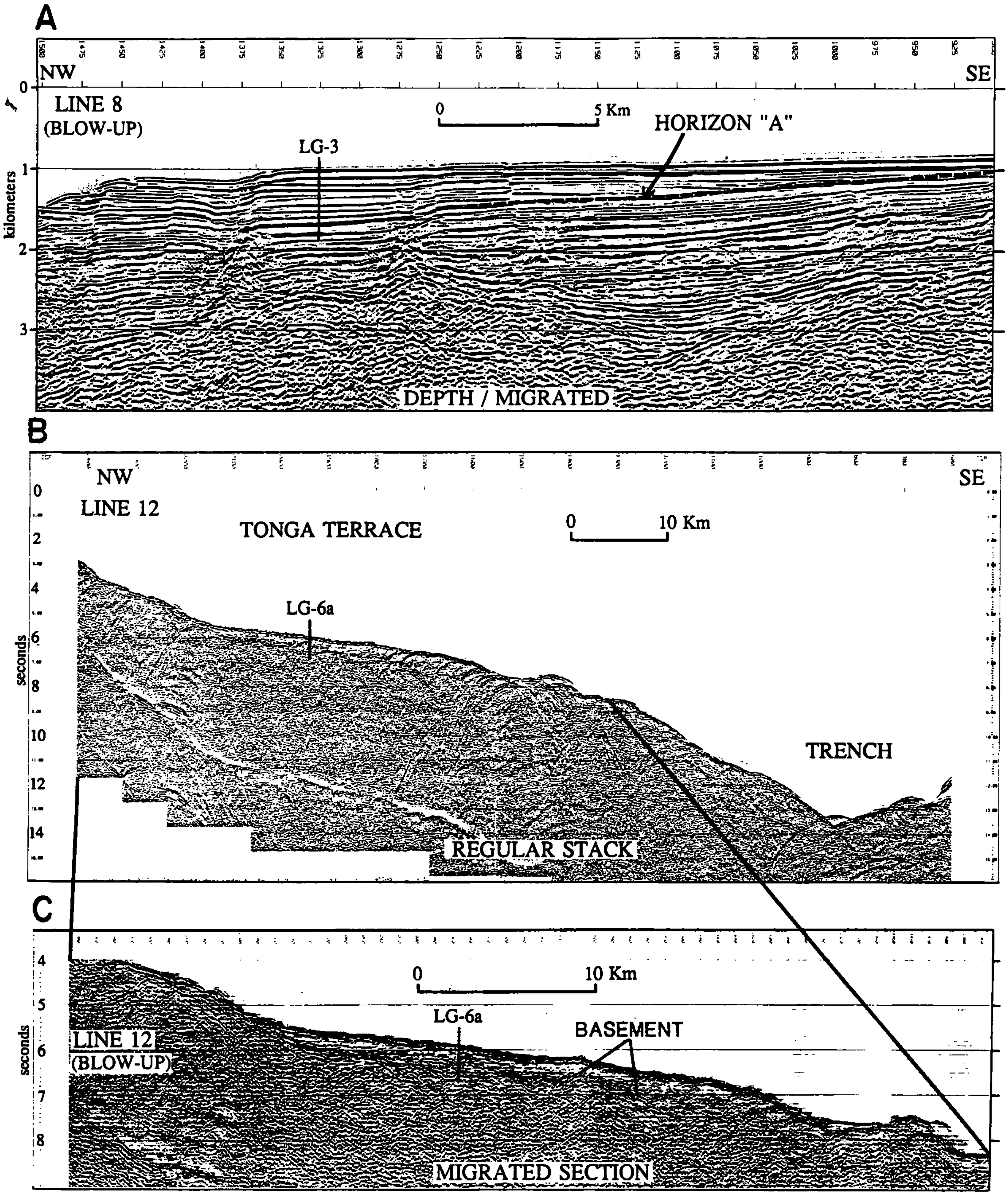


Figure 3. (A) Depth migrated MCS line (USGS line 8) at a possible site for LG-3. Horizon "A" is the unconformity interpreted as reflecting arc inflation before initial rifting. Sediment above it record initiation of post-rifting arc volcanism. (B) Regular stack of MCS line (USGS line 12) at a possible site of LG-6. "Basement" is interpreted as Eocene tholeiitic and boninitic lavas and dikes. (C) Migrated time section blow-up of the above.

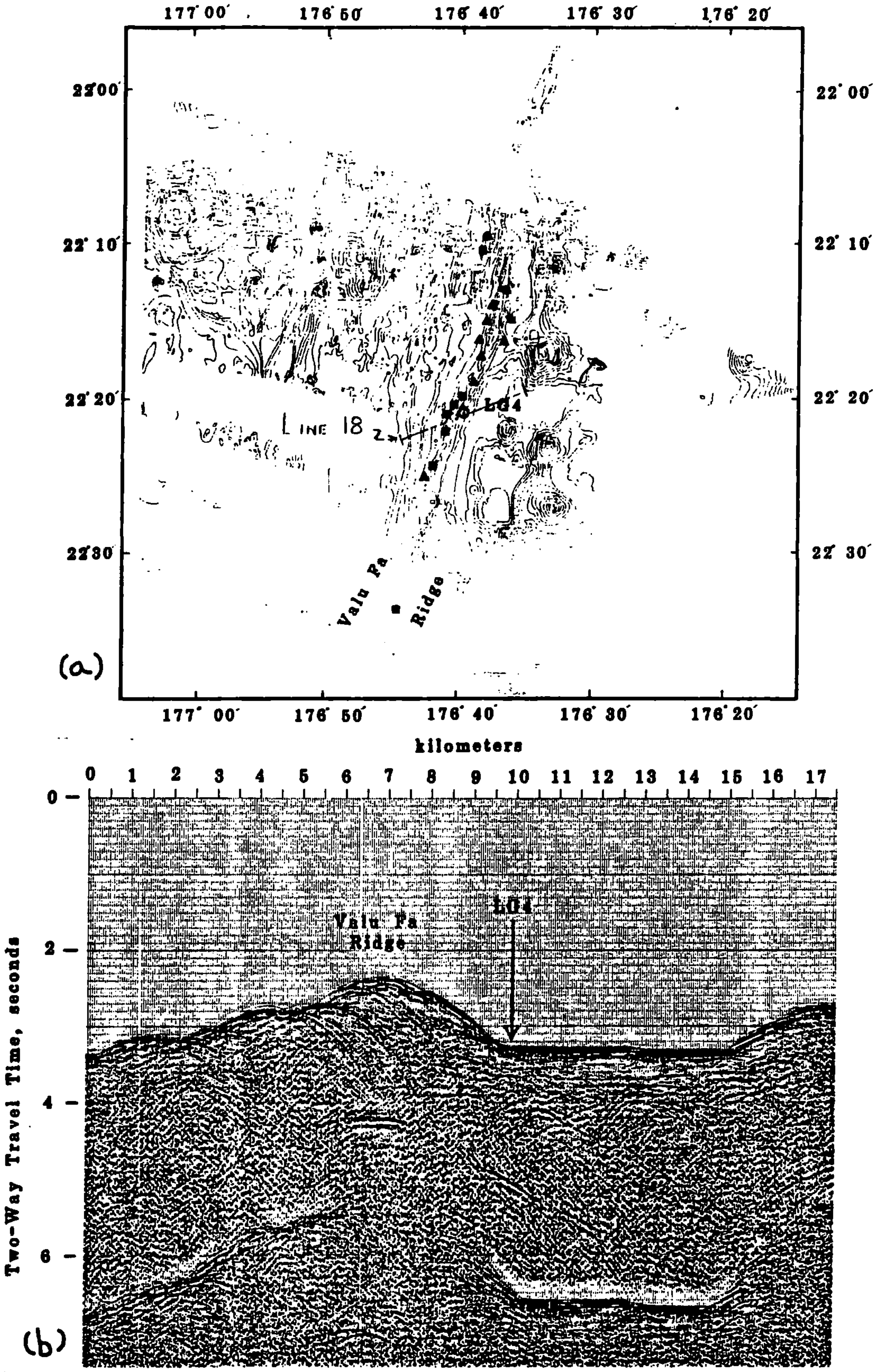


Figure 4. (a) Seabeam map and (b) MCS line (USGS line 18) showing a possible site of LG4 adjacent to Valu Fa Ridge. On (a), the location of dredged tholeiitic basalt is shown by circles, basic andesite (53-57% SiO_2) by squares, and acid andesites (57-63% SiO_2) by triangles. On (b), the bright reflector about 1.4 sec beneath the ridge crest is interpreted as the magma chamber roof. The site will be in sufficiently thick sediment as close to the ridge crest as possible.