



JOIDES Tectonics Panel Meeting  
Rosenstiel School of Marine and Atmospheric Science  
University of Miami, Florida  
19-21 February 1986

Panel members present: Darrel Cowan (USA), Chairman  
Keir Becker (USA)  
Rene Blanchet (France)  
John Ewing (USA)  
David Howell (USA)  
Jeremy Leggett (UK)  
Bruce Marsh (USA)  
Kazuaki Nakamura (Japan)  
Robin Riddihough (Canada)  
Jeff Weissel (USA)

In attendance: G. Brass (NSF)  
D. Hussong (PCOM)  
R. Kidd (ODP)  
M. Max (for P. Vogt)  
J. Natland (WPAC liaison)

Absent: K. Hinz  
P. Vogt

AGENDA

1. Minutes of previous meeting
2. Reports from liaisons and guests
3. Appointment of liaison to April ARP meeting
4. Indian Ocean: alternate drilling targets
5. Leg 112 Peru margin
6. Western Pacific: thematic objectives and drilling plans
7. Thematic objectives in central and eastern Pacific
8. Next meeting
9. Panel membership and rotation

**EXECUTIVE SUMMARY  
TECTONICS PANEL MEETING**

19-21 February 1986  
University of Miami, Florida

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1) **INDIAN OCEAN DRILLING**

In the event that targets either in the Red Sea or on the SW Indian Ocean ridge fracture zone cannot be drilled as planned, TECP recommends the following:

- a) If the Red Sea cannot be drilled, we endorse drilling in the Makran accretionary prism.
- b) If the SW Indian Ocean ridge fracture zone cannot be drilled, we endorse drilling in fracture zones along the central Indian Ocean ridge (assuming that an appropriate proposal is forthcoming and that site-survey data are adequate).

2) **LEG 112 PERU MARGIN**

We endorse drilling proposed sites 3 and 6 or 7 along the southern (Lima Basin) transect, and sites 14 and 17 along the northern (Yaquina Basin) transect. Both sites 8 and 14 are designed to penetrate the apparent westernmost extent of continental basement. We recommend #14 because the top of basement is a strong reflector on seismic record Peru 2 and there is apparently no BSR. On the seismic record through #8, the top of basement may lie very near the BSR. We recommend logging all holes. The five shallow HPC sites proposed for both the northern and southern transects have no obvious interest from a tectonic standpoint. We encourage R. von Huene to prepare a back-up drilling plan along the "old" seismic line Peru-3 to the north.

3) **WESTERN PACIFIC THEMATIC ISSUES**

The major thematic problems we want to see addressed by Western Pacific drilling, and our suggestions for specific areas are:

- a) Arcs and forearcs: Structural and volcanic evolution  
. Best target areas: Izu-Bonin-Mariana arc systems; possibly Tonga
- b) Collision and accretion: If and how material is transferred from one plate to another  
. Best target areas: Ontong-Java; d'Entrecasteaux Ridge; Louisville Ridge; Okushiri Ridge (Japan Sea).
- c) Back-arc basins: Rifting of arc lithosphere  
. Best target areas: Bonin-Mariana systems; Coriolis trough; Lau basin

We estimate that 7-1/2 to 9 legs will be required to address these objectives satisfactorily.

## MINUTES

The meeting began at 9:45 a.m.

The panel welcomed the return of Jerry Leggett representing the United Kingdom, which recently rejoined ODP.

### 1. MINUTES OF THE PREVIOUS MEETING

The minutes of the last meeting were approved without changes.

### 2. REPORTS FROM GUESTS AND LIAISONS

#### 2.1 PCOM

Hussong reviewed the January PCOM meeting in La Jolla, where PCOM discussed the panel structure and proposed that COSOD-II be held in July 1987, probably in Europe. The likely target for Leg 111 is Site 504B. Indian Ocean drilling is in a state of flux largely due to the lack of required site surveys. PCOM asks that we consider alternate drilling plans, including an early departure from the Indian Ocean, in case one or more of the approved legs collapses.

#### 2.2 ODP

Kidd summarized recent results from Leg 107 (Tyrrhenian Sea). ODP asks that TECP be as specific as possible regarding upcoming drilling targets.

#### 2.3 NSF

Brass emphasized that site surveys should be proposed and completed with as much lead time as possible before drilling. In response to Cowan's concern that site surveys have an inordinate influence over what actually gets drilled, Brass answered that ideally there should be more areas surveyed than will be drilled so that we can select drilling targets from a larger group of surveyed areas than is presently typical. Brass will step down as program director in September and be replaced by Buffler.

#### 2.4 WPAC

Nakamura and Natland said that, for the meeting immediately following ours, WPAC wants our thematic priorities.

#### 2.5 Packers

Becker updated us on engineering developments concerning packers. A rotatable drill-string packer is being built and will be ready for Leg 110 (as will a conventional straddle packer that requires re-entry). AMOCO has slowed down their development of the wireline packer, and it appears that the first version to emerge will not be ideal in that it will require re-entry and an exclusive pipe trip for deployment.

### 3. APPOINTMENT OF LIAISON TO APRIL ARP MEETING

Cowan said that Jaime Austin, ARP chairman, has requested that TECP send a liaison to their upcoming meeting in Barbados on 21-23 April. After privately receiving expressions of interest from two panel members, Cowan decided to nominate Howell as a one-time liaison.

### 4. ALTERNATIVE DRILLING PLANS FOR THE INDIAN OCEAN

Cowan read excerpts from a letter from Roger Larson asking TECP to propose alternative drilling plans in case drilling in the Red Sea and on the SW Indian Ocean Ridge (SWIOR) is impossible due to either the lack of site surveys or political instability. The potential alternatives he listed were: a Somali Basin deep hole, Makran, a second Neogene leg, and an early departure from the Indian Ocean for the Pacific.

#### 4.1 Fracture zones

Cowan asked Natland, who is a proponent of drilling on SWIOR fracture zones, to review this drilling target and also to explain his belief that many of the same objectives could be achieved on the central Indian Ocean Ridge. In response to questions about why drilling is better than dredging, Natland replied that we need a section of crust that ideally would include both gabbro and ultramafic rocks so we could observe their contact relations. Natland pointed out that the Indian Ridge is an appropriate place to drill because it is a very slow spreading ridge and it appears from dredge hauls that gabbro and ultramafic rocks are abundant. He feels that drilling on the central ridge could be planned on the basis of geophysical surveys conducted for Leg 24; additional site surveys may not be necessary. He will prepare a proposal for this target only if the site survey for SWIOR is not funded.

#### 4.2 Makran

Leggett reviewed, once again, his proposal for drilling this accretionary prism. The major advantages include: an opportunity to determine the distribution of deformation across a margin and in slope basins using shallow (450 m maximum) holes; good drilling conditions in a section dominated by mudrock and at sites devoid of slumps; and a chance to tie into an on-land prism where he and Platt have documented Pliocene and younger deformation. A site survey cruise to acquire deep-tow seismic, piston cores, and refraction data, is planned for November 7 to December 7. Possible disadvantages include: the presence of gas hydrate; a concern that the Makran may not be representative of accretionary prisms in general because massive shortening occurs within the prism and not just at its toe; and the chance that sedimentation has been too rapid to allow adequate dating of deformation and uplift.

#### 4.3 Recommendations

We decided on Wednesday to postpone formulating an alternate plan until after we had discussed Western Pacific targets (agenda item 6) the following day. At that time, Brass reminded us that neither the

Red Sea nor SWIOR fracture zones had been eliminated yet, so our recommendations are cast as contingencies. We voted on the following alternatives: Makran, C. Indian Ocean fracture zones, or leave the Indian Ocean early for the Pacific. Cowan asked that Leggett and Natland not vote because they are active proponents.

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**RECOMMENDATIONS TO PCOM:**

A) If drilling proposed in the Red Sea cannot be carried out:

- 9 TECP members favor drilling Makran
- 0 favor leaving early for the Pacific

B) If drilling proposed in SWIOR fracture zones cannot be carried out:

- 6 TECP members favor drilling Central IOR fracture zones
- 3 favor Makran
- 0 favor leaving early for the Pacific

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A long discussion then ensued about the probability that our thematic objectives in the Western Pacific would in fact all be addressed by drilling. A motion was made stating in essence that if the Red Sea or SWIOFZ collapses, and if PCOM's forthcoming Western Pacific drilling plan did not adequately address our objectives, TECP would recommend leaving the Indian Ocean early. The motion was defeated.

**5. LEG 112 PERU MARGIN**

Larson asked TECP to recommend specific drill sites and drilling programs for this leg. Using seismic lines and SeaMARC II images, Hussong summarized the drilling proposed for Leg 112. Along the southern transect (Lima Basin); proposed sites include: (a) five shallow HPC sites on the shelf to address paleo-oceanographic objectives; (b) #3, a deepened HPC site; (c) #6 or 7 to determine stratigraphy, subsidence history, and nature of basement; (d) #8, to sample the westernmost metamorphic basement accessible with the drill. On the northern transect (Yaquina Basin), proposed sites are: (a) five additional HPC sites; (b) #14 into continental basement near its contact with an accretionary prism; and (c) #17 into landward-dipping reflectors within the prism.

Hussong noted that estimated drilling time for these sites exceeds the time presently allocated for the leg. In addition, he and Cowan mentioned that Roland von Huene has reprocessed line Peru 3 and feels that the boundary between the accretionary prism and continental crust is imaged better than on line 2 (where site #14 is located). Von Huene would like TECP to endorse his continued efforts to propose alternate sites (not completely new replacement sites) in case of drilling problems or unsatisfactory recovery from sites along Peru 2. Von Huene had notified

Cowan by phone that it would be extremely difficult for him to attend this meeting to explain his proposal, so he sent instead a brief write-up and copies of Peru 2 and 3 for each panel member.

After discussing the proposed drilling plans and objectives, TECP reached a consensus that the attraction of drilling along both the southern and northern transects is overwhelming, but at least one site (#8) and possibly several of the HPC sites could be deleted to assure that the remaining holes both reach their objectives and are properly logged.

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#### RECOMMENDATIONS AND ENDORSEMENTS:

- . We recommend drilling proposed sites #3 (deep), 6 or 7, 14, and 17. All holes should be logged as recommended by DMP.
- . Both sites #8 and 14 are designed to penetrate the westernmost continental crust as interpreted on seismic records. We recommend drilling #14, rather than 8, because the top of basement is much better imaged seismically (a strong reflector) on Peru 2. Also, the BSR may be only slightly deeper than top basement at #8.
- . We encourage von Huene to develop his alternate back-up sites along reprocessed Peru 3 and to obtain further site-survey data if possible.
- . The ten proposed HPC sites have no obvious importance from a tectonic standpoint.

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#### 6. WESTERN PACIFIC: THEMATIC OBJECTIVES AND DRILLING PLANS

On Wednesday, Cowan had distributed excerpts from a letter by Roger Larson dated February 4, 1986. This letter summarized the discussions at the January PCOM meeting concerning the panel structure and the interactions among thematic and regional panels and PCOM. In essence, TECP should concentrate on evaluating which thematic objectives can best be addressed in specific geographic areas, such as the Western Pacific. We should de-emphasize the numerical ranking and prioritization of individual proposals. The panel was happy about the new guidelines, especially since it had set sail on a more "thematic" course at its last meeting in Tokyo.

On Thursday morning, the panel divided into three groups to discuss thematic issues in the Western Pacific and to recommend specific drilling targets. Groups one and two met together and were joined occasionally by drifters from group three. Group one reviewed arcs and forearcs; two, processes of collision and accretion; and three reviewed marginal basins. The entire panel reconvened as a whole after lunch, whereupon Marsh, Howell, and Weissel summarized the morning's deliberations.

The following sections contain very brief summaries of not only the key thematic problems identified by each group, but also the best places to address them with the drill. A more complete presentation and justification will appear in a TECP Position Paper to appear before the May PCOM meeting.

### 6.1 Arcs and Forearcs

The "arc" group identified nine thematic problems in this general category. Those that can be attractively addressed by drilling in the Izu-Bonin-Marianas region are: (a) the structural and volcanic evolution of arcs, including the inception, timing, and periodicity of arc activity, and processes of magma transport; (b) the nature of the basement in the forearc; (c) the chemistry and budget of fluids; and (d) the dynamics of seamount offscraping and diapirs in the forearc.

### 6.2 Processes of Collision and Accretion

This group generated a list of types of collision (e.g. continent with volcanic arc) and boundary conditions (e.g. angle of convergence). Also, it specified six problems that could reasonably be solved with the drill: whether or not, and how, parts of a colliding mass are added to the upper plate (accreted); the timing of collision (read largely from the sedimentary record); changes in physical properties and strain attending collision and accretion; vertical tectonic response; larger-scale deformational effects; and thermal (diagenetic or metamorphic effects). Drilling targets are: Ontong-Java Plateau colliding with Solomons (we recognized that there is as yet no proposal satisfactorily addressing this target); d'Entrecasteaux Ridge; Louisville Ridge; and incipient obduction in Japan Sea (Okushiri Ridge).

### 6.3 Marginal Basins

This group noted that marginal basins are in different stages of development (rifting, early, mature) and different settings (back-arc, rifted continent, trapped crust). It also posed several fundamental thematic problems that in theory can be approached by drilling. For example, are arc lithosphere and continental lithosphere rifted by the same processes? How is the timing of spreading (inception and cessation) related to convergence and plate kinematics? The thermal regime and composition of crust of diverse ages are important parameters. Drilling in relatively simple systems to especially address early-stage rifting of arc lithosphere could profitably be targeted in the Bonins, Coriolis Trough, Mariana Trough, and the Lau Basin.

After each group presented its recommendations regarding thematic issues and drilling targets, the panel discussed how best to convey them to WPAC and PCOM. Several members expressed concern about important problems or targets that did not receive a group's endorsement. Leggett and Nakamura, for example, reminded us that the Nankai Trough offers an opportunity to drill an exceptionally well-surveyed accretionary prism dominated by terrigenous clastic, rather than pelagic sediments. Cowan

tried to elicit an endorsement for passive-margin problems in the South China Sea. Weissen raised the important question of whether we should justify at this time our negative decisions -- why we left Nankai, for example, off our list. In the spirit of PCOM's new guidelines on panel activities, we decided that the most significant information we could give now to WPAC and PCOM is a list of the global thematic objectives that we feel can be best addressed in the W. Pacific, accompanied by a list of what we feel are the best drilling targets.

We also made very approximate estimates of the number of legs we feel are necessary to address our objectives adequately. We realize that in many cases, one or more legs in a single arc system, for example, can address several objectives.

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**RECOMMENDATIONS TO PCOM & WPAC:**

Listed below are our principal thematic objectives in the W. Pacific, our suggestions as to appropriate drilling targets, and our estimates of required legs in an optimum drilling program:

. Arcs and forearcs

- 1) Izu-bonin-Mariana 2 legs
- 2) Tonga 1

. Collision and accretion

- 1) Ontong-Java (large plateau) 1-1/2
- 2) D'Entrecasteaux (aseismic ridge) 1-2
- 3) Louisville Ridge (seamount chain) <1-1
- 4) Japan Sea (obduction) <1-1

. Marginal basins

- 1) Bonin (included in above)
- 2) Mariana (included in above)
- 3) Lau Basin 1
- 4) Coriolis Trough (included in above)

TOTAL LEGS REQUIRED 7 to 9-1/2

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**7. THEMATIC OBJECTIVES IN CENTRAL & EASTERN PACIFIC**

Looking ahead, our next major task will be to specify our overall thematic objectives in this geographic area. In order to provide CEPAC with a very preliminary idea of our thematic interests from a global perspective, Cowan simply asked each panel member to identify key issues and, if known, places to drill:



- Nakamura: Age and origin of trapped crust in a marginal basin; Bering Sea
- Riddihough: Above, plus evolution of spreading systems and transforms in N. Central Pacific
- Weissel: Thermomechanical behavior of oceanic plates; evolution of the Hawaiian moats
- Howell: Transcurrent margins
- Natland: Fracture zones; E. Pacific and Nova Canton trough
- Marsh: Comparing geochemistry of sediments on descending plate with that of related arc; Aleutians
- Blanchet: Ridge-trench interactions; Chile triple junction
- Cowan: Factors responsible for seaward vs. landward vergence in accretionary prisms; Cascadia (British Columbia-Wash.-Ore.)

We estimate that about seven legs would be required to address these problems adequately.

#### 8. NEXT MEETING

We propose to meet next in Seattle at the University of Washington on Thursday and Friday, 5-6 June. Cowan will host the meeting and a one-day field trip in the San Juan Islands on 4 June.

#### 9. PANEL MEMBERSHIP & ROTATION

PCOM requested that panel members begin rotating off according to the guidelines in the official panel mandates (panel members are appointed for three years, and about one-third of the members should rotate off each year). Cowan distributed a form inquiring about each members plans for rotation and soliciting names of possible replacements. He will review the responses and forward recommendations to PCOM.

The meeting adjourned at 11:30 a.m. on Friday, 21 February.