

PRELIMINARY EXECUTIVE SUMMARY
TECTONICS PANEL MEETING

September 30 - October 2, 1985
Ocean Research Institute, Tokyo, Japan

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1) RECOMMENDATIONS FOR LEG 110 DRILLING ON BARBADOS RIDGE

We endorse the drilling plan submitted by Moore in a memo dated May 17, 1985. Specifically, most of the drilling time should be expended at LAF-1 to: a) drill through the décollement; b) measure in situ physical properties using a drill-string packer; and c) set drill-in casing if necessary. After LAF-1, sites LAF-2 and 3 should be drilled upslope to complete the transect begun on Leg 78A. We do not support drilling completely new sites, such as LAF-5, 6, or 7 in the Caribbean Working Group proposal, on this leg.

2) IN SITU FLUID PRESSURE MEASUREMENTS

In view of the importance of documenting in situ fluid pressures and fluid properties at convergent margins, we recommend:

- A) Immediately modifying the Barnes-Uyeda temperature probe so it can be used to measure in situ fluid pressures in the bottom of holes to be drilled on Leg 110;
- B) Proceeding with the engineering required to modify the TAM drill-string packer so it can be included in a rotating ("hole-making") drill string, preferably before Leg 110; and
- C) Developing a wire-line packer as soon as is technologically possible.

3) INDIAN OCEAN DRILLING

- A) From the Chinese menu of possible legs for May-June 1987, we recommend drilling the Southwest Indian Ridge fracture zone (SWIRFZ). As is clear from our earlier ranking, we think both SWIRFZ and Makran address thematic problems of global significance; our rationale is clearly explained in the minutes of our March 1985 meeting. Forced to choose between them, we now favor SWIRFZ. On balance, the panel (by a 5-4 vote) feels that new information concerning fracture-zone tectonics and structure is more important at this stage than additional drilling in an accretionary prism, especially because drilling is scheduled on Barbados Ridge and off Peru. Looking down the road (or strait), we plan to evaluate other prisms and trench slopes in the Pacific Ocean.

Regarding SWIRFZ, we insist on using at least 2 holes to study transverse variations in the fracture zone instead of placing all holes along the trend of the zone as proposed. Finally, the sites proposed for other items on the menu - Davie Ridge and Somali Basin - do not merit drilling from a tectonic standpoint.

- B) Kerguelen: Basement must be sampled on the north, central, and southern parts of the plateau. Of the existing proposed sites, we give highest priority to KHP-3, as a re-entry hole if necessary.
- C) Drilling into "basement" beneath the dipping reflectors off the Caird Coast of Antarctica is of high priority because of the non-conclusive results of Leg 104 concerning seismically equivalent rocks.

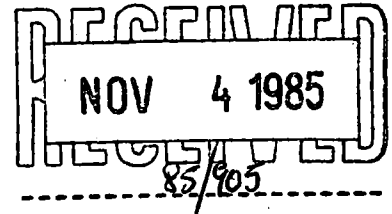
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4) WESTERN PACIFIC

From a thematic standpoint, drilling in the Western Pacific offers an outstanding opportunity to address these global tectonic problems:

- A) The evolution and constitution of arcs and fore-arc basement; the process of rifting in and near arcs; vertical tectonics in arcs
- B) The origin and evolution of back-arc basins, including nascent and more highly evolved examples
- C) The tectonics of collisions in the broad sense: The arrival of seamounts, aseismic ridges, plateaus, and continental plates and microplates at active convergent margins.

We plan to devise a drilling program aimed at these topics at our next meeting.



JOIDES Tectonics Panel Meeting
Ocean Research Institute, Tokyo, Japan
30 September - 2 October 1985

Panel members present: Darrel Cowan (USA), Chairman
Keir Becker (USA)
Rene Blanchet (France)
Karl Hinz (FRG)
David Howell (USA)
Bruce Marsh (USA)
Kazuaki Nakamura (Japan)
Robin Riddihough (Canada)
Jeff Weissel (USA)

In attendance: Christian Auroux (ODP)
K. Fujioka (Japan)
T. Ishii (Japan)
A. Taira (PCOM liaison; Japan)
T. Seno (Japan)
H. Tokuyama (Japan)

Absent: John Ewing
Peter Vogt

AGENDA

1. Minutes of previous meeting
2. Reports from liaisons: PCOM, ODP, CEPAC, WPAC, IOP, SOP
3. Report on drill-string and wire-line packers
4. Drilling plan for Leg 110, Barbados Ridge
5. Recommendations for specific drilling programs in Indian Ocean
6. Western Pacific thematic problems and drilling proposals
7. Report on Peru margin site survey
8. Next meeting

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MINUTES

The meeting began at 9:00 a.m.

1. MINUTES OF THE PREVIOUS MEETING

The minutes of the last meeting were approved without changes.

2. REPORTS FROM LIAISONS

2.1 PCOM

Taira (substituting for our new PCOM liaison, Hussong), briefly reviewed how the shortage of funds in ODP, caused by the lack of the fifth and sixth participants, is going to have an impact on operations. For example, hard-rock guidebases will only be available for Mid-Atlantic Ridge holes, and, as a result, site 504B will be drilled rather than new sites on the East Pacific Ridge.

2.2 ODP

Auroux reviewed drilling results so far on Leg 105 (Baffin Bay), and results from Leg 103 (Galicia) and Leg 104 (Norwegian Sea). The dipping reflectors consist of interlayered volcanic flows and tuff. Hinz noted that possible basement rocks below the dipping reflectors were insufficiently sampled, so seismically equivalent rocks off of Antarctica should be drilled on the appropriate Weddell Sea leg.

2.3 CEPAC

Cowan reported on the meeting just held near Seattle. The panel identified 22 drilling objectives in the region, and Cowan listed the six that were given highest priority in a preliminary ranking. Among these, the following address primarily tectonic problems: past and present convergence along the Aleutian system; accretion and transcurrent displacements along the British Columbia-Washington-Oregon margin, and the Chile triple junction.

2.4 WPAC

Nakamura distributed a list of 20 potential legs that the panel had identified at its August meeting in Santa Cruz. The panel also ranked these to show its drilling priorities. Some potential legs are regional; others are transects. The panel wants to meet in Miami next February to study proposals hole by hole. WPAC is very interested in the thematic priorities of TECP and we agreed to try to meet again just before WPAC.

Blanchet reported on a SW Pacific workshop just held in Suva, Fiji.

2.5 SOP & IOP

Weissel gave a detailed review of the sites recommended by the SOP. Of particular interest to TECP, SOP whittled down the N. Kerguelen drilling campaign to two holes, KHP-1 and 3. SOP asked for re-entry at KHP-3 to get through Upper Cretaceous into "basement". Weissel then presented a new Indian Ocean drilling plan that IOP formulated in response to the schedule PCOM adopted at its June meeting. He also distributed IOP's evaluation and recommendations for each of its proposed drilling projects. Weissel noted that the Makran was not among these. IOP tabled Makran because of concerns about safety, BSR, and the lack of adequate site surveys.

Our panel's discussion of Indian Ocean drilling is continued under item 5 below.

3. REPORT ON DRILL-STRING AND WIRE-LINE PACKERS

Becker gave a timely, detailed review of shipboard logging operations and packers - how they work and which kinds are available. Packers are devices with inflatable seals that can isolate fluids in part of the section penetrated by the drill. They are used to measure in situ pore pressure, and possibly permeability, and if properly equipped, for sampling formation fluids.

The wire-line packer isolates a 20 cm section of hole (it may eventually be able to isolate as much as 1-2 m) for measurements and sampling. It is an ideal device for these purposes, but is not yet available to ODP. Funding problems have impeded its development by Anderson at Lamont. Becker said it probably won't be ready for 2 years, and definitely not before Leg 110. Another type of packer is the drill-string packer. Rather than refurbish the old DSDP Lynes packer, Becker bought a new TAM packer. It measures fluid pressure over a long interval of hole, above the bottom of the hole. At present, the TAM packer must be introduced through a re-entry cone after drilling a hole has ceased, because the packer cannot be made part of a rotating, "hole-making" drill-string. Becker feels, however, that the TAM packer can be modified to be rotatable, thus saving a pipe trip and re-entry.

A third way of measuring fluid pressure in the bottom of the hole is by using the stinger on the Barnes-Uyeda probe. This probe also measures the bottom-hole temperature and can obtain fluid samples.

Several panel members commented that it is absolutely essential to obtain fluid pressures and samples from active

accretionary prisms. TECP therefore recommends that PCOM implement:

- A) An immediate modification of the Barnes-Uyeda temperature probe so it can be used to measure in situ fluid pressures in the bottom of holes to be drilled on Leg 110;
- B) The engineering required to modify the TAM drill-string packer so it can be included in a rotating ("hole-making") drill string, preferably before Leg 110; and
- C) The development of a wire-line packer as soon as is technologically possible.

4. DRILLING PLAN FOR LEG 110, BARBADOS RIDGE

PCOM had asked TECP to discuss the drilling program for Leg 110 in light of the fact that a wire-line packer will not be ready for the leg, nor are there likely to be any major modifications and improvements in the available drill-in casing. Cowan reviewed the recommendations that TECP reached at our September 1985 London meeting and located the sites as prioritized by the Caribbean working group. He also distributed a memo from Casey Moore dated May 17, 1985, which contains a detailed prospectus for drilling a transect comprising sites LAF-1, 2, and 3.

The panel weighed the potential drilling problems at these sites (difficulty or impossibility of penetrating the decollement) and the second-best equipment available for measuring fluid pressures against the alternative plan of completely new drilling in different parts of the Lesser Antilles forearc. Our consensus clearly is that drilling to complete the transect begun on Leg 78A has overwhelming priority. We feel that Moore is aware of the diverse drilling scenarios that depend on hole conditions and equipment, and we prefer to let the co-chief scientists alter their plans as they deem best on board the ship. Even drilling using available equipment should tell us much of scientific and engineering value that can be used in future campaigns on accretionary prisms.

TECP endorses the drilling plan submitted by Moore in a memo dated May 17, 1985. Specifically, most of the drilling time should be expended at LAF-1 to: a) Drill through the decollement; b) Measure in situ physical properties using a drill-string packer; and c) Set drill-in casing if necessary. After LAF-1, sites LAF-2 and 2 should be drilled upslope to complete the transect begun on Leg 78A. We do not support drilling completely new sites, such as LAF-5, 6, or 7 in the Caribbean working Group proposal, on this leg.

5. RECOMMENDATIONS FOR SPECIFIC DRILLING PROGRAMS IN INDIAN OCEAN

For this meeting, PCOM asked TECP to: A) Thematically prioritize the Chinese menu of possible legs for the May-June 1987 time slot; and B) Fine-tune specific drilling programs in diverse parts of the Indian Ocean, including Kerguelen, the Red Sea, and the central Indian Ocean, according to their potential for solving tectonic problems.

5.1 May-June 1987 Chinese Menu

The four potential legs we considered were: Makran, SW Indian Ridge fracture zone (SWIRFZ), Somali Basin (Tethyan sediments), and Davie Ridge. We reaffirmed our conclusion, expressed in the minutes of the Lamont meeting, that the sites proposed in the Somali Basin and on Davie Ridge are of distinctly lower priority than either Makran or SWIRFZ. Cowan read a letter from Ewing stating that a new proposal from Segoufin et al. for drilling on Davie Ridge deals mainly with ocean sediments rather than tectonic problems.

We began an intense discussion of the relative merits of the Makran and SWIRFZ. In our March 1985 rankings, Makran was first and SWIRFZ third. Cowan (watchdog for Makran) briefly reviewed Leggett's drilling proposal and highlighted the putative advantages of drilling at this particular active margin: Determining rates of uplift; tying together on-land and offshore studies; probing well-defined slope basins; drilling a thickly sedimented descending plate. Several panel members questioned the feasibility of determining uplift rates and why the Makran was particularly suited for this goal. Nakamura noted that the high sedimentation rate and abundance of imbricate slices promise good time resolution. Taira pointed out that slope basins are much better developed here than on other margins (e.g. Nankai, Barbados Ridge). Both the proponents and TECP recognize that more site survey data are required before any drilling campaign. Cowan read a telex from Leggett dated 12 Sept. 1985 reaffirming UK plans for an extensive site survey in November 1986, but some panel members noted that abundant geophysical and bathymetric data are already at hand for other margins such as Nankai and Barbados Ridge.

TECP is intensely interested in the structural fabric of fracture zones; we believe that information from the oceans can establish diagnostic criteria for interpreting the origin of ophiolitic complexes on land. The consensus of the panel is that the drilling proposed for SWIRFZ is potentially an important step in this direction (as noted in the Lamont minutes). In response to the question of whether SWIRFZ is the best fracture zone to drill, panel members noted that while there are undoubtedly other attractive drilling targets world-wide, we have a proposal in hand for a target that can be drilled soon.

With regard to specific sites in H. Dick's proposal, panel members noted that it calls for placing all of the holes along the strike of the fracture zone, in part to test for periodicity in magma chamber location. For comparison with ophiolites, we feel it is necessary to obtain samples in a profile transverse to the trend of the zone. We recommend that at least one of the "along-strike" sites be re-located within the fracture zone for this purpose.

In summary, as is clear from our earlier ranking, we think both SWIRFZ and Makran address thematic problems of global significance; our rationale is explained in the minutes of our March 1985 meeting. Because PCOM asked us to choose between them, Cowan called for a vote. We now favor (by a 5-4 vote) SWIRFZ.

- From the menu of possible legs for May-June 1987, we recommend drilling the Southwest Indian ridge fracture zone (SWIRFZ). TECP feels that new information concerning fracture-zone tectonics and structure is more important at this stage than additional drilling in an accretionary prism, especially in view of the fact that drilling is already scheduled on Barbados Ridge and off Peru.
- Regarding SWIRF, we insist on using at least 2 holes to study transverse variations in the fracture zone.
- The sites proposed for Davie Ridge and Somali Basin do not warrant drilling from a tectonic standpoint.

5.2 Kerguelen

Blanchet (watchdog for this area) reviewed the sites in proposal 136/C by Schlich et al. He also briefly summarized the drilling program in a new Australian proposal that Cowan brought to Tokyo. Weissenel noted again that SOP recommended that KHP-3 be a re-entry hole into basement. He also said that IOP recommends drilling into basement on the north, central, and southern parts of the plateau. TECP views the nature of basement in oceanic plateaus like Kerguelen as an outstanding tectonic problem that can only be addressed by drilling and we strongly endorse the recommendation of IOP. Of the sites in proposal 136/C, KHP-3 (re-entry) could reach basement. Perhaps other sites in the Australian proposal could as well, but we received the proposal too late for an adequate evaluation. Hinz pointed out that most of the holes in both proposals are designed to penetrate great thicknesses of sediment, but according to the seismic interpretations, sediments are much thinner on the flanks of the plateau. Drilling there might sample basement directly.

TECP's view is that basement must be sampled on the north, central, and southern parts of the plateau. Of the existing sites (proposal 136/B); we give highest priority to KHP-3, as a re-entry hole if necessary. Some additional sites should be re-located to assure basement penetration.

5.3 CAIRD COAST OF ANTARCTICA

Hinz emphasized that planned drilling in this region is of high priority in light of the findings of Leg 104 in the Norwegian Sea. An important tectonic problem at passive margins is the identity of basement below the seismically defined interval of dipping reflectors. Hinz noted that results from Leg 104 are inconclusive concerning the basement there. Weissel reported that site W-4 offers an opportunity to drill below the dipping reflectors on the margin of the Weddell Sea.

TECP views drilling into rocks beneath the dipping reflectors at site W-4 (or its equivalent) as a high-priority objective.

5.4 OTHER INDIAN OCEAN DRILLING PROGRAMS

Weissel distributed a list of program-by-program recommendations prepared at the last IOP meeting. We considered each program in turn after Weissel summarized the IOP recommendations.

5.4.1 Fossil Ridges

From a tectonic standpoint, the sites as proposed do not merit a drilling campaign at this time.

5.4.2 Laccadive-Maldives-Chagos-Mascarene Ridges

Hinz said that the existing proposal for drilling on the Mascarene Plateau is interesting, but the proponents failed to present alternative hypotheses in addition to the "hot spot" hypothesis. More geophysical data are required to formulate and test additional hypotheses.

5.4.3 Indus fan

The sites as proposed will satisfactorily address tectonic objectives (see minutes of March 1985 Lamont meeting).

5.4.4 Red Sea

Nakamura commented that drilling in the Mabahis and Charcot deeps may provide some results of tectonic interest. The main tectonic problem - the nature of transitional basement-

cannot really be addressed by drilling because of thick sediment cover (see Lamont minutes).

5.4.5 Broken Ridge

We endorse both sets of sites from the standpoint of our thematic interest in passive and conjugate margins.

5.4.6 Exmouth Plateau

Both sets of sites address the general problem of the evolution of passive margins.

6. WESTERN PACIFIC THEMATIC PROBLEMS AND DRILLING PROPOSALS

On Tuesday, October 1, we reviewed all of the Western Pacific proposals that the chairman had received up to about August 29th and distributed to the panel. At our March meeting, we appointed watchdogs for various regions in the Western Pacific, and each watchdog summarized the contents of relevant proposals and pointed out the important thematic problems addressed in his region. The following is a list of watchdogs and the topics that each covered

- Nakamura: New plate boundary between Eurasian and American plates along E side of Sea of Japan; paleomagnetically determined rotation of SW Japan; drilling proposals for Sea of Japan
- Riddihough: Japan trench and forearc; TTT triple junctions; Zenisu Ridge; Nankai trough and forearc
- Marsh: Izu-Bonin and Mariana arc-forearc systems; Amami Plateau and Daito Ridge
- Blanchet: Okinawa Basin
- Hinz: S. China Sea and Sulu Sea; geology of Palawan and environs
- Weissel: Lau Basin; Solomon region; Mussau and Manus trenches
- Howell: New Zealand ridges
- Hinz: S. Tasman Rise
- Cowan: Sunda-Banda arc; collision of Australia

At the end of the above presentations and discussions, Cowan prepared the following list that was meant to group existing proposals under preliminary thematic headings. This list was distributed at the end of Tuesday's meeting for evaluation and criticism by the panel (note that these are not listed in any rank order):

Back-arc basins: Sea of Japan; Lau/Valu Fa
 Nascent back-arc basin: Okinawa trough; Izu-Bonin
 Trench and accretionary prisms: Japan trench; Nankai
 trough; Mussau/Manus "new subduction"
 Forearc volcanism, structure, petrology: Manus, Izu-Bonin,
 Marianas
 Arc evolution: Izu-Bonin, Marianas
 Terrane accretion and collision: Palawan (proposal in
 preparation by Hinz
 Effect of collision by accretionary prism: Timor region
 Effect of collisions on sedimentary record: Sea of Japan;
 Toyama fan; Nankai trench
 T-T-T triple junction: NE Japan; Japan-Izu-Sagami; four-
 plate downhole experiments
 Deformation of descending plate: Zenisu Ridge
 Passive margin rifting: S. Tasman rise
 Dating of magnetic anomalies: Shikoku Basin; S. China Sea
 Finding out what it is by drilling: Amami Plateau/Daito
 Ridge; New Zealand ridges; crust in Sulu, Celebes, Banda
 Seas

On Wednesday morning, when we reconvened, Marsh and Riddiough commented that yesterday the panel had been educated about the marine geology and geophysics of the Western Pacific and that we had learned which problems of local, regional, or thematic interest drilling proponents deem interesting. Both panelists recommended that TECP make a clear statement about which thematic problems we see as the most important and that we focus our attention on these at the expense of others. Cowan asked each panelist in turn to identify his own selection of key thematic problems. In an effort to precipitate discussion and reach a consensus, Cowan listed the three broad thematic issues that are apparently of greatest interest to TECP (not in rank order):

- A) The evolution and constitution of arcs and fore-arc basement; the process of rifting in and near arcs; vertical tectonics in arcs;
- B) The origin and evolution of back-arc basins including nascent and more highly evolved examples; and
- C) The tectonics of collisions in the broad sense: The arrival of seamounts, aseismic ridges, plateaus, and continental plates and microplates at active convergent margins.

A spirited discussion followed on how TECP should offer advice to both PCOM and WPAC on scientific problems to be addressed in the Western Pacific. Marsh suggested that we adopt the list above and try to design the best drilling campaigns to address each problem, even if it means tackling, say, arc evolution in several systems rather than on a single transect in just one. Others supported Marsh's plan, which would basically prompt a radical change in the way TECP operates. Until now, we have simply ranked all the proposals we have been asked to review.

In the future, we would concentrate primarily on proposals that address problems in A, B, or C above. Hinz argued that we should not change our way of doing business but rather continue to evaluate all parts of the Western Pacific on the basis of a more comprehensive list of tectonic problems, not just those in the list above.

Cowan sensed that TECP desires to make a strong statement about which thematic problems we see as most important in the Western Pacific. In effect, we see drilling in the Western Pacific as an outstanding opportunity to shed light on the three problems listed above and feel that drilling should be devoted to these at the expense of other thematic issues. At our next meeting, we will further evaluate proposals falling into these categories and suggest some specific drilling targets. A start was made at designing 3 sub-committees of panel members that would each take primary responsibility for evaluating each group of proposals.

7. REPORT ON PERU MARGIN SITE SURVEY

In Hussong's absence, Cowan briefly summarized the results of the site survey in support of Leg 112 and displayed some copies of new multichannel lines Hussong had given him the week before.

8. NEXT MEETING

Nakamura said that WPAC plans to meet again in Miami February 17-19, or possibly the succeeding week. Cowan said that a check with the JOIDES office revealed the PCOM's spring meeting, to formulate a preliminary Western Pacific schedule, would probably be held in April. He wondered whether TECP's advice should be directed primarily to PCOM or WPAC. Blanchet, on behalf of France, kindly invited TECP to meet in Toulon, France between February 15-21, when the JOIDES RESOLUTION will be in Marseilles. The panel would finally be able to inspect the ship and also examine two French submersibles. Our meeting would just precede the WPAC meeting and Nakamura could report to them directly. Alternatively, we could meet in Miami, just before WPAC. Becker offered to make local arrangements if necessary.

The meeting was adjourned at noon on Wednesday, October 2.