

JOIDES Tectonics Panel Meeting
Celerina, Switzerland
27-28 September 1987

87-687
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Panel members present: Darrel Cowan (USA), Chairman
Ian Dalziel (USA)
Dan Davis (USA)
Karl Hinz (FRG)
David Howell (USA)
Ken Hsü (ESF)
Robin Riddihough (Canada)
François Roure (France)
Peter Vogt (USA)
Tony Watts (USA)
Graham Westbrook (UK)

In attendance: Olav Eldholm (PCOM)
Greg Moore (WPAC)
Jean-Claude Sibuet (ARP)
Dave Scholl (CEPAC)
Kensaku Tamaki (temporary replacement for
Nakamura)

Members absent: Bruce Marsh (USA)

AGENDA

1. Minutes of previous meeting
2. Reports from liaisons (I)
3. Central and Eastern Pacific
4. Reports from liaisons (II)
5. Western Pacific
6. Membership changes
7. Next meeting

EXECUTIVE SUMMARY
TECTONICS PANEL MEETING
27-28 September 1987
Celerina, Switzerland

1. CENTRAL & EASTERN PACIFIC

TECP establishes three prioritized groups of themes (programs).

- (A) Highest priority; clearly supported by a majority of the panel at this mee
- M-series dating and calibration of anomalies in old crust
 - Flexure of oceanic lithosphere
 - Ridge-trench interactions
 - Pre-70 Ma absolute motion
 - Deformation in accretionary prisms
- (B) Intermediate priority; some can be addressed in combination with other programs
- Cretaceous quiet zone
 - Cretaceous intraplate volcanism
 - Comparative geochemistry of arc magmas and descending crust
 - Rates of deformation at the toe of accretionary prisms
 - Cenozoic absolute motion
 - Subsidence history and sea-level changes
- (C) Distinctly lowest priority; little support at this meeting
- Absolute subduction rate
 - Gulf of California
 - Oceanic plateaus
 - Structures in oceanic crust

2. WESTERN PACIFIC

- (A) **BONIN - MARIANAS:** TECP recommends drilling two holes on Conical Seamount in the Marianas (~ site MAR - 3) to study the fabric, fluid regime, and history of an active serpentinite diapir. We assign a lower priority to drilling one hole at BON - 7, largely because the origin of the seamount there is obscure.
- (B) **NANKAI:** We support the general themes of fluid flow and compositions in accretionary prisms and forearcs. There is as yet no formal proposal addressing these problems at Nankai, but we will review such a proposal, if one is submitted, and compare it to 233/E (fluids in Cascadia prism).
- (C) **LAU BASIN:** Because there are so many unresolved questions about the spreading history in the Lau basin, we are not able to discern how proposed backarc drilling will solve general or specific tectonic problems related to backarc-arc evolution. LG - 3 and 6 will help establish the nature of basement in the arc and forearc, but a more extensive, multi-site drilling program is probably required to get at fundamental tectonic problems.
- (D) **SUNDA:** Our position regarding this program hasn't changed. We recognize that collision-related processes are important, but are unsure of the best drilling strategy. We still have doubts that the information that would be provided by the Sunda drilling program, in its present form or even if supported by new geophysical data, will uniquely resolve fundamental questions about arc-continent collisions.
- (E) **S. CHINA SEA:** Our interest in some form of drilling program on the margins of the S. China Sea -- to address the early rifting and subsidence history of a marginal basin formed by rifting near the edge of a continent -- is growing. We would like to be presented with a revised proposal that is more regional in scope and more attentive to alternative models for extension and how they would be tested by drilling.

MINUTES

SUNDAY, 27 SEPTEMBER

The meeting began at 0830

Cowan welcomed Olav Eldholm, one of our liasons from PCOM, and Kensaku Tamaki, who is temporarily Japan's representative, replacing Kazuaki Nakamura. Robin Riddihough generously volunteered to serve as Secretary during the meeting.

1. MINUTES OF THE PREVIOUS MEETING

Graham Westbrook noted that, in section 4.2.1., "basin" should read "basic." With this change the minutes were approved.

2. REPORTS FROM LIASONS (I)

Cowan asked for reports form PCOM and CEPAC first, so that the panel would begin and complete its discussion of the C. and E. Pacific the first day. Dave Scholl will travel to Paris the next day to present the results at CEPAC.

2.1 PCOM

Eldholm reviewed some retrenchments in the publications budget, particularly as they affect Part B of the leg reports. PCOM approved a deep (300m) basement hole in the Argo abyssal plain. Regarding the W. Pacific, PCOM chose 9 programs from the WPAC prospectus of 12; these 9 would require about 12 legs. SSP has already pointed out potential deficiencies in site surveys; PCOM anticipates jurisdictional problems. PCOM has asked thematic panels for input [requests to TECP were detailed on the second day of the meeting]. A suggested program for Fiscal Year (FY) 1989 -- the final program will be approved at the December PCOM meeting -- comprises: (1) Banda-Sulu-S. China Sea; (2) Bonin 1; (3) Bonin 2; (4) Nankai; (5) Japan Sea 1; (b) Japan Sea 2. Some of these programs constitute only part of a leg. At its December meeting, PCOM also needs to identify technical/engineering needs and expenditures for FY 89 drilling.

Regarding the C. & E. Pacific, PCOM expects to consider a final prospectus from CEPAC at its Spring meeting. PCOM has specifically asked TECP to provide its six most highly ranked programs, and somehow to group existing proposals within them [more details were provided by Eldholm and Cowan later in the meeting].

Eldholm then summarized PCOM's desire to achieve a stronger thematic input to the planning process -- to achieve a more thematically driven program. Toward this end, PCOM has established a sub-committee to review the panel structure; meanwhile, it adopted an interim "proposal review process," encapsulated in a form which Cowan distributed to all present. A long discussion ensued, and Cowan offered to bring before the upcoming Panel Chairmen's meeting some of the points raised. Howell was concerned that a short "keyword" evaluation on the form would be too brief. Hsü wondered how to deal with proposals that rank "medium" in two or more thematic panels, but that might in reality be strengthened because of broad-based support. Hsü and Scholl suggested adding some sort of "multi-thematic" rating to the form. Vogt wondered about the fate of topics and areas that are not addressed by

proposals. Eldholm encouraged the thematic panels to be alert for these and flag them somehow. Vogt also requested that copies of white papers from thematic panels be made available to proponents. Watts asked if PCOM had considered how to coordinate a response to a proposal using the form with panel meetings. Eldholm encouraged the panels to provide feedback to PCOM concerning the new system.

2.2 CEPAC

Scholl mentioned that CEPAC hadn't met since our last meeting, and he emphasized again the importance of thematic input from TECP at this juncture. CEPAC has received several new proposals since they last met, and their upcoming meeting in Paris is being held jointly with LITHP.

3. CENTRAL & EASTERN PACIFIC

Eldholm and Cowan reiterated the instructions from PCOM: to provide a group of our most highly ranked six programs. Cowan distributed a list of the thematic issues identified in the TECP White Paper; each topic was followed by the number of the relevant proposals. He asked the panel to identify the top-priority programs, and to provide specific comments on the scientific content of as many of the proposals as possible.

Hsü then asked whether the numbers of legs in both W. and C. & E. Pacific were fixed at 9 (i.e., 1 1/2 years drilling in each region). Eldholm replied that PCOM is in principle no longer committed to a second circum-navigation; in fact, holes in a particular area can be staggered over time, rather than be drilled all in one leg. Moreover, the "9-leg" scenarios are for "planning purposes." They may change depending on thematic priorities, technological progress, and the like.

The following summary is organized by thematic problems, in the order in which they were discussed by TECP.

3.1 PLATE KINEMATICS

3.1.1 Absolute rate of subduction

No proposals have been submitted for this topic, so TECP postponed discussion.

3.1.2 Dating and calibration of anomalies in old oceanic crust

Relevant proposals: 261E, 285/E, 287/E

After Vogt briefly reviewed the content of his proposals (285/E and 287/E), there was an early consensus, summarized by Hsü, that dating the M-series anomalies is an important goal; the Jurassic history of part of the Pacific basin is a fundamental, but only partly resolved, problem. Further discussion focused on the merits of the three proposals, and particularly on 261/E. Although 261/E is designed to sample both Jurassic crust and overlying Cretaceous basalt, there was general concern that the Cretaceous flows may be too thick to guarantee

penetration of older crust. Cowan noted that there are really two different themes addressed by 261/E: old (Jurassic) crust, and Cretaceous intraplate volcanism. Several panel members emphasized the importance of the latter. There are unresolved questions about the origin of these volcanics; how widespread this and similar events (e.g. in the Venezuelan Basin) were, and why; and the duration of the Pacific event. Systematic drilling to address these problems in the Pacific is a worthwhile objective, but TECP would like to see more information (i.e. more geophysics) to place such a proposed drilling program in a better understood regional context.

In summary, TECP reaffirms its interest in a drilling program in Jurassic crust, as proposed in 285/E and 287/E. It also recognizes that the nature and origin of Pacific Cretaceous intraplate volcanism are fundamental problems, deserving of a systematic drilling program based on extensive geophysical data. 261/E alone addresses neither problem satisfactorily. It should be revised as a wholly "intraplate volcanism" proposal.

3.1.3 Cretaceous quiet zone

Relevant proposal: 231/E

Scholl emphasized how the resolution of conflicting models for the evolution of the N.Pacific awaits better dating of crust in the quiet zone. TECP recognized that this proposal and theme address not so much a process as a regional kinematic problem with probable wider significance for events along the plate margins. The distinction among the models, and exactly how the models will be tested by drilling, need to be explained more fully in a revised 231/E.

3.1.4 Hotspot traces and absolute plate motions

Relevant proposals: 202/E, 203/E, 247/E, 280/E, 282/E, 283/E

In a general discussion of this theme and these proposals, TECP recognized that three separate issues were actually involved: (1) pre-70 Ma absolute motions (280/E; 203/E); (2) post-70 Ma absolute motions (247/E, 282/E, 283/E); and (3) subsidence history and sea-level changes (202/E, 203/E). Proposal 280/E is specifically designed to document the age progression of mid-Cretaceous Geisha seamounts. The only criticism offered was the question of whether these seamounts actually define a trend.

282/E is designed to address the post-bend motion of the Hawaiian hot-spot. The general goal of testing whether there are short-term variations in plate motion is important, but TECP felt that the 282/E program would be unlikely to achieve the expected resolution of ages to an accuracy of < 2 m.y. 247/E is of only marginal interest with regard to

this theme, because penetration of basement is not a prime objective. 283/E is only incidentally designed to address tectonic questions. TECP questions the principle of using sedimentary facies to address tectonic questions as proposed by 283/E; the resolving power of expected facies is too small.

202/E and 203/E primarily address a tectonic problem that was not included in the TECP White Paper: sea-level changes and the subsidence history of oceanic crust. Opinions were expressed about whether the best information concerning sea-level change will come from continental margins or islands. A general concern is whether we can establish the age of sediments on the banks and islands to an accuracy of 5 m.y. or less in the Cretaceous. Even this resolution, however, may be useful in some analyses of subsidence history. Dolomitization of sediments is a problem that could potentially interfere with establishing the age of sediments and the depth at which they were deposited. In summary, TECP is concerned that the resolution of ages and the depth indicators that will be provided by the drilling proposed in 202/E and 203/E may prove to be too crude to satisfactorily address tectonic problems. These proposals fall largely in the realm of SOHP.

3.2 COMPARATIVE GEOCHEMISTRY OF ARC MAGMAS AND DESCENDING CRUST

Relevant proposals: 285/E, 287/E (both contribute to the topic)

There are yet no proposals in the CEPAC list that deal primarily with this high-priority thematic issue. If holes are drilled as proposed in 285/E and 287/E, some useful data on the geochemistry of old crust could be obtained. Eldholm said that PCOM recognizes the need for a drilling strategy that will satisfactorily address the problem. BON-8 (deep reference hole) is a case in point; it will certainly provide geochemical data on the crust, but the relevance of these data from just one site to arc magmatism isn't totally clear. Points brought out in TECP discussion included: how to deal with the "time-delay" problem (crust descending now may not be representative of what has contributed to magmas; the need for a very well-understood kinematic context, how crust has been moving relative to the arc during magmatic periods in question).

The consensus of TECP is still that a concerted program of several holes in front of a well-studied arc will be more useful than "sites of opportunity" that are basically designed to penetrate deeply into oceanic crust. TECP concluded that such a custom-designed proposal should be solicited, although the mechanisms for such a solicitation aren't clear.

3.3 RIDGE-TRENCH INTERACTIONS

Relevant proposal: 8/E

TECP still is interested in a drilling program at and near the intersection of the Chile rise and Chile trench. The thermal history of ridge-trench interactions and attendant vertical displacements are topically of great interest (see TECP White Paper). We understand that further site surveying will be undertaken soon, so we expect that 8/E, which has been on the books for some time, will be updated and revised. TECP will postpone further review of 8/E until the new data (and proposal) are available.

3.4 DEFORMATION WITHIN ACCRETIONARY PRISMS

Relevant proposals: 37/E, 233/E, 237/E, 277/E

Cowan briefly summarized the existing proposals and noted that TECP identified deep drilling in a clastic-dominated prism as a high-priority theme in our White Paper. CEPAC has included both deep drilling (237/E) and a suite of shallow, fluid-oriented holes (233/E) in their Cascadia program. A new proposal (277/E) nominally addresses the question of aseismic vs. seismic slip on the Cascadia decollement.

Several specific criticisms of 277/E were offered. Although the tiltmeter to measure deformation is to be placed in a prominent fold upslope from the toe of the accretionary prism, this particular structure may not be actively growing if slip (aseismic or seismic) is transferred oceanward along a decollement to other structures at the actual deformation front. In other words, a negative result -- no measurable deformation of the major fold during the monitoring period -- may not indicate "locked" behavior. It would be difficult in principle to pinpoint the active structures with seismic profiles, especially if they are very recent. Also, it was felt that more reflection coverage of the area is needed to put the proposed sites into a proper regional context. The basic problem posed -- slip behavior and consequent seismic risk -- is a good one, but the proposal seems more suited to address another separate issue which we can identify as a new theme: deformation rates at the leading edge of an accretionary prism. TECP agreed that this problem is also important, but felt that 277/E should be modified to include a wider net of instruments placed in a more tightly constrained structural framework.

We then discussed the Cascadia drilling program in general as encompassed by 233/E and 237/E. A question repeatedly raised was whether deep Cascadia drilling off Vancouver Island would be advisable or valuable if drilling at Nankai -- NKT-1 and 2, and geotechnical -- were successful. The need for subdecollement drilling, to establish fluid compositions and processes, temperatures, and the like, is clear; the debate concerns how many holes are needed, to what depth, and whether both Nankai and Cascadia need be drilled. The panel seemed split on the latter issue, it didn't reach a consensus. [Shallow "hydrogeologic" drilling at Nankai was discussed the following day].

3.5 FLEXURE OF OCEANIC LITHOSPHERE

Relevant proposal: 3/E

Watts said that he had written LITHP addressing their concerns about the suitability of the sediments for biostratigraphic dating. TECP discussed the issue at its last meeting, but didn't receive a copy of Watt's letter. Watts further noted that a high-resolution site survey, with close line spacing, will take place soon.

3.6 OCEANIC PLATEAUS

Relevant proposal: 222/E + addendum

In the addendum, site 6, originally a "collisional" objective, is dropped, and sites 1 and 2 are proposed to be deepened to sample basement of the Ontong-Java plateau. TECP reiterated the same criticisms it raised in its White Paper: there are as yet not enough geophysical data to locate the most advantageous sites for drilling, or to interpret drilling results even if they become available. Extensive multichannel seismic, and perhaps aeromagnetic data, are needed. Sites 1 and 2 have some value as reconnaissance holes.

TECP recognizes that the origin of plateaus is a good problem, and would like to encourage further proposals based on more extensive geophysics.

3.7 STRUCTURES IN OCEANIC CRUST

Relevant proposals: 224/E, 278/E

These proposals were brought up for discussion because the general theme was included in the TECP White Paper, where it was rated "immature." The panel concluded these proposals should be properly evaluated by LITHP.

3.8 GULF OF CALIFORNIA

Relevant proposal: 275/E

Although not strictly a "theme," the drilling in the G of C proposed in the omnibus 275/E constitutes a program. This proposal was first considered by TECP at this meeting. The panel criticized several aspects of 275/E and the program in general. The Manzanillo rift program is ill-conceived; geophysical data presented in support of drilling are of poor quality; the relevance of the drilling or the rift itself to the origin of the Gulf or of rifted margins in general is not substantiated. By far the bulk of the proposed drilling would address petrologic and geochemical processes in active rifts, and the history of sedimentation within them. TECP didn't identify any specific or general tectonic

problems that would be addressed by sites in 275/E. Some useful information about subsidence would probably be obtained, if data from earlier drilling on Legs 64 and 65 were worked up, but this possibility wasn't raised in 275/E. The consensus of TECP was that the G of C is not a good analog for early stages of rifting of classic passive margins; rather, it is in a separate class and may serve as an example of a "transform-rift" marked by long stretches of transforms and small pull-apart basins.

After completing its review of major thematic issues, TECP discussed how best to present its prioritized grouping or ranking of these issues, or "programs," to PCOM and CEPAC. The panel decided to vote on all of the thematic issues raised during the preceding, day-long discussion; some issues were newly identified and were not singled out in the White Paper. TECP decided not to rank-order individual proposals, but rather hoped that its discussion of their scientific merit as summarized in these minutes would constitute a useful review. The voting procedure adopted was to allow each panel member to list up to six of his most highly ranked themes.

MONDAY, 28 SEPTEMBER

TECP began its second day with a lengthy discussion of how to report the results of its vote. Opinion was divided on whether to report the actual votes, or rather just two or three groups of issues.

TECP MOTION: Thematic issues (programs) are to be reported in three groups: a top-ranked group of five; followed by an intermediate group of 6; followed by the lowest group of four, which had either no support (votes) or was supported by only one panel member

MOVED: Hsü

SECONDED: Westbrook

10 in favor

1 against

1 abstain

MOTION PASSED

The groups, and relevant proposals, are:

(I) HIGHEST PRIORITY, CLEARLY SUPPORTED BY A MAJORITY OF THE PANEL AT THIS MEETING:

- M-series dating and calibration of anomalies in old oceanic crust 285/E, 287/E, 261/E (partial)
Comments: see criticisms of 261/E above under 3.1.2
- Flexure of oceanic lithosphere
3/E
- Ridge-trench interactions
8/E
- Pre-70 Ma absolute motion
280/E, 203/E (partial)
Comments: see remarks about 203/E above under 3.1.4
- Deformation in accretionary prisms
37/E, 233/E, 237/E

Comments: topic broadened from White paper to include shallow, in addition to deep, drilling; deformation-rate program appears below.

(II) INTERMEDIATE PRIORITY; some of these topics can be secondarily addressed in combination with other programs; lower priority may partly reflect deficiencies in existing proposals or lack of proposals

- Cretaceous quiet-zone
231/E
- Cretaceous intra-plate volcanism
261/E (partial)
- Comparative geochemistry of arc magmas and descending crust
285/E, 287/E (contributing)
- Rates of deformation at the toe of accretionary prisms
277/E
- Cenozoic absolute motion
247/E, 282/E, 283/E
- Subsidence history and sea-level changes
202/E, 203/E (partial)

(III) DISTINCTLY LOWEST PRIORITY; LITTLE SUPPORT AT THIS MEETING

- Absolute subduction rate
No proposals
- Gulf of California
275/E
- Oceanic plateaus
222/E + addendum
- Structures in oceanic crust
278/E

4. REPORTS FROM LIAISONS (II)

4.1 WPAC

Moore and Tamaki noted that WPAC hadn't met since the last TECP meeting. Tamaki said that some new proposals for drilling on Zenisu Ridge, in Sea of Japan, and concerning ^{10}Be near the Japanese Islands, had recently been submitted.

4.2 ARP

Jean-Claude Sibuet reported that ARP is trying to develop many drilling programs and targets well in advance of the ship's next visit to the Atlantic. One in a series of workshops devoted to this development has already been held; future workshops concern the Caribbean, Mediterranean, central Atlantic, and Arctic. A white paper is also planned. Hinz emphasized the necessity to

explore different types of rifted margins, characterized by the presence or absence of volcanics; many of the targets are very deep. Watts noted that segmentation of margins is a major theme which he hopes will be highlighted in the white paper.

Hsü asked the important question about whether TECP should soon begin weighing the merits of diverse drilling programs in the Atlantic and circum-Atlantic basins against those of staying in the Pacific. Cowan encouraged the panel to adopt a long-term, global perspective. Eldholm again noted that a second circum-navigation is not obligatory; concern about transit time should not predominate over scientific questions, and the ship could in principle go back and forth from Atlantic to E. Pacific, rather than steam in one general direction.

5. WESTERN PACIFIC

Eldholm presented a list of six W. Pacific legs that were tentatively approved for drilling in 1988-1989 at the last PCOM meeting. He emphasized that these had not yet been formally approved, but PCOM plans to do this at its December meeting. The six legs are: Leg 1: Banda-Sulu-SCS Basins (BNDA-1, SUL-5, SCS-5, SCS-9); Leg 2: BONIN-1 (BON-1, BON-2, BON-5A + B); Leg 3: BONIN-11 (BON-6, + diapir or forearc terrace); Leg 4: Nankai (NKI-1, NKI-2); Leg 5: Japan Sea-1 (J-1b, J-1d, J-1e, J-3a); Leg 6: Japan Sea-11 (J-2a, JS-2). Programs for which further information or justification has been requested from various panels include: Nankai geotechnical and Zenisu (considered as a single program); Bonin reference site; Sunda; NE Australian margin; Vanautu; and Lau basin.

Cowan and Eldholm noted again that PCOM, at its last meeting, had asked TECP to review again several W. Pacific drilling programs and, in some cases, provide a further justification for drilling. Cowan reported that Nick Piasias had told him that PCOM requires an "enthusiastic" and "strong" recommendation from our panel if certain programs (e.g. Sunda, S. China Sea) are to be considered for drilling beyond FY89. Piasias also told him that our strong support for one of the "still-under-review programs" should not be construed as bumping another program off the drilling plan.

Cowan proposed to proceed systematically through the questions and requests for information that Piasias transmitted from PCOM. Cowan read the relevant sections of a letter from Piasias dated 2 September 1987.

5.1 BONIN-MARIANA

PCOM asked TECP to provide scientific justification for diapir and/or forearc-terrace drilling in the Bonins. Cowan proposed that TECP should also discuss MAR-3, the serpentinite diapir in the Mariana forearc, because we strongly advocated this site at our last meeting. Cowan also read excerpts from a memo from Brian Taylor and P. Fryer that he had received on 17 September; it described, among other things, results from Alvin dives this summer at MAR-3. Tamaki summarized the results of very successful Japanese dredging in the vicinity of BON-7. Exciting results from MAR-3 included evidence for active venting of fluids at Conical Seamount.

TECP then addressed at length two questions: why and how should a serpentinite diapir be drilled; and are the features at both MAR-3 and BON-7 diapirs? Several strategies for diapir drilling were discussed. A hole near the center of the diapir would be assured of penetrating the main mass, sampling in situ fluids, measuring T and possible fluid pressures, and obtaining samples with in situ fabric. A hole on the flanks, drilled in layered sediment resolved by seismic profiles would be assured of penetrating at least some sediment that could be used to date deformational events (tilting) possibly related to emplacement of the diapir. Such a hole would also determine the frequency and age of serpentinite debris flows supplied by the diapir. It could also give some indication of the subsurface geometry of the diapir; e.g. are its flanks steep, or do they flare outward. There was general agreement that studying the fluids that are known to be actively vented from a diapir is important; these results would complement findings from Legs 110 and 112 concerning fluids in forearcs.

TECP unanimously agreed that Conical Seamount (MAR-3) is a diapir. Its opinion was divided on whether the feature at BON-7 is a diapir. Moore displayed a bathymetric map and seismic profile. It was noted that the BON-7 seamount is one of a series of roughly aligned bathymetric highs. Perhaps it is part of an intricate thrust slice striking parallel to the trench. In TECP's opinion, available geophysical data and sampling have not conclusively established that the feature is an active, venting diapir; future studies may do so. In contrast, Conical Seamount is known to be active, and has higher priority. Drilling BON-7 would enhance the transect aspect of the Bonin program, and at the same time would probe an interesting topographic feature in the Bonin forearc.

TECP CONSENSUS:

We strongly and enthusiastically recommend drilling two holes on Conical Seamount in the Marianas to study the fabric, fluid regime, and history of an active serpentinite diapir: one hole near the center, and one near the diapir in sediment ponded on its flanks. We assign a lower priority to drilling one hole at BON-7, largely because the origin of the seamount is obscure or controversial.

5.2 NANKAI

PCOM approved drilling at NKT-1 and 2, and it will consider a second leg beyond Fiscal Year 1989 that could include geotechnical studies and drilling at Zenisu Ridge. Meanwhile, PCOM asked TECP to examine sites NKT-3 and 7 as part of a possible program devoted to hydrologic processes in the prism. There was of course general agreement that the topic -- fluids in accretionary prisms and forearcs -- is a highly visible and promising field of investigation. One question that could be addressed at upslope sites on the Nankai prism is the nature of fluid flow along presumably out-of-sequence thrusts. Although TECP supports the general theme, there is already a proposal -- 233/E -- that addresses the hydrogeology of the Cascadia prism off Oregon. As yet, there is

no formal proposal addressing hydrologic problems per se in the Nankai prism, but TECP would be pleased to review any that become available.

TECP CONSENSUS:

We support the general themes of fluid flow and composition in accretionary prisms and forearcs. There is as yet no formal proposal specifically addressing these problems at Nankai, but we will review such a proposal if one is submitted, and compare it to 233/E.

5.3 LAU BASIN

PCOM asked TECP for its views on tectonic objectives to be addressed in the Lau backarc. The drilling program as presently envisaged by PCOM will focus on backarc processes; proposed forearc sites (LG-3, 6) in the WPAC prospectus aren't included. TECP first tried to define tectonic problems concerning backarc basins that could in theory be addressed in the Lau-Tonga system. Possibilities include: where does back-arc rifting initiate (in the arc, at its rear margin); the nature and symmetry of early spreading. Existing bathymetric and magnetic data are very complex and difficult to interpret in terms of spreading history; spreading may have been characteristically diffuse. The clear TECP consensus was that the backarc sites as proposed exclusively address lithospheric (ocean crust and hydrothermal) problems. From available data, we can't put these sites into a tectonic context, nor can we formulate specific questions to be tested by drilling.

Concerning the forearc sites, Moore said that WPAC would like our support for LG-6 in particular. However, TECP finds it difficult to put these forearc sites into a proper tectonic framework. We view LG-6 as a reconnaissance-style hole to "see what's there"; in its favor is its likelihood of sampling the basement of the forearc. A better approach would be a systematic drilling program, designed to test specific models of arc-backarc evolution.

TECP CONSENSUS:

Because there are so many unresolved questions about the spreading history in the Lau basin, we are not able to discern how proposed backarc drilling will solve general or specific tectonic problems related to backarc-arc evolution. LG - 3 and 6 will help establish the nature of basement in the arc and forearc, but a more extensive, multi-site drilling program is probably required to get at fundamental tectonic problems.

5.4 SUNDA

PCOM may consider this program for drilling after FY 1989, if TECP can strongly and enthusiastically recommend it. Silver submitted a revised 242/D that attempted to address some of the criticisms we raised at our last meeting. Cowan distributed copies of the revised 242/D at the meeting. Sites S1, S2,

S3, T1, and T2 were shifted to second priority in favor of four new sites that are better supported with geophysical data. Silver is currently (during this meeting) in the Indonesian region attempting to obtain additional site-survey data. Brian Taylor notified Cowan by phone on 17 September that Indonesia had denied Silver permission to operate in her waters, jeopardizing the entire survey and possibly drilling; a rumor surfaced at the meeting that Indonesia had finally relented.

As is clear from the record, TECP has long supported drilling to address the nature of collisions, and it was pointed out that this is the only proposal (other than Vanuatu) designed around collisional objectives in the program at this time. TECP had a long discussion centered around *how* collisional problems can be addressed by drilling, and whether 242/D satisfactorily does so. Key points raised during the discussion are summarized as follows. The approach taken by the revised drilling program is to determine the history of vertical motion in three parts of the system (Sumba Ridge, Flores backarc, Wetar Strait). These data may provide evidence for how collision-related deformation is distributed and possibly linked across the arc, from forearc to backarc. TECP concluded that evidence concerning the timing of vertical movements will be the main outcome of the drilling program.

Several panel members did not believe, however, that this information can uniquely or adequately test diverse hypotheses regarding "rapid vs. slow underplating," "deformation of the backstop," "links . . . between backthrusting and backarc thrusting," and the like. They pointed out the myriad variables -- changing velocities of convergence, the known existence of continental fragments like Timor and Sumba, for example -- whose effects on these processes can't be readily evaluated, with or without additional seismic data or drilling. In other words, evidence from drilling can be used to erect diverse hypotheses; it cannot prove one or another model, as is implied in the proposal. Other panelists either disagreed or argued that the information supplied by drilling would be interesting and novel in its own right, even if it did provide non-unique solutions.

Howell noted that COSOD-II was unable to establish how best to address collision-related problems using the drill. He wondered if the drill was indeed the best or even an appropriate tool with which to attack the problem. Some panel members wondered with him whether the data that would be obtained from the Sunda drilling would help us understand the general process of arc-continent collision; would the interpretations be applicable elsewhere? There was also general, but not unanimous, agreement that the new site-survey data won't make our reservations about drilling in Sunda, or at collisional margins in general, go away. The overall drilling strategy and kinds of information to be obtained won't change.

In light of these concerns, Hsü proposed that a workshop be convened on how to address collisions with the drillship. Such a workshop should include geoscientists with diverse backgrounds, who work on land and in the marine realm. Its goal would be to devise a drilling strategy.

TECP MOTION: TECP supports convening a workshop to develop a drilling strategy designed to address collision-related problems.
 MOVED: Hsü
 SECONDED: Howell
 12 in favor
 0 against
 0 abstain MOTION PASSED

TECP CONSENSUS:

Our position regarding this program hasn't changed. We recognize that collision-related processes are important, but are unsure of the best drilling strategy. We still have doubts that the information that would be provided by the Sunda drilling program, in its present form or even if supported by new geophysical data, will uniquely resolve fundamental questions about arc-continent collisions.

5.5 SOUTH CHINA SEA (N. MARGIN TRANSECT)

In mid-September, D. Hayes notified Pias and Cowan that he had worked up new geophysical data for this program. A revised proposal will be submitted shortly, but he asked, and Pias and Cowan agreed, that TECP re-evaluate the program, at least in a preliminary fashion, at this meeting. The geophysical data were hand carried by Davis to Switzerland. Hsü asked if our endorsement of the program would result in the replacement of a program in the list Eldholm presented earlier [see introduction to section 5 of these minutes]. Eldholm replied that it is up to WPAC to justify an extension to the drilling already planned for the Banda-Sulu-S. China seas program, but TECP must strongly endorse the plan.

Cowan read excerpts from Hayes' letter, while the panel scrutinized the seismic profiles and their interpretation. Hayes pointed out that: basement is imaged and reachable by drilling; deeper crustal reflectors (structures) are imaged; heat flow is determined, and is high; stratigraphic information from industry wells will be available soon. He feels that there is excellent geophysical coverage now, and all that is needed is drilling to obtain primary stratigraphic information.

Cowan asked that, if possible, TECP provide constructive criticism on the scientific rationale of the drilling program. The lengthy discussion that followed centered on two main questions: can drilling on this margin contribute new and original insights on a global thematic problem; and, if so, is the proposed drilling plan well designed for such a goal. There was general agreement that the new data are of high quality though some doubts were raised about the identification of certain events, especially basement (blue). The latter is significant because some holes are projected to penetrate basement. A consensus emerged that it will be possible to penetrate the syn-rift section,

which is essential if the early subsidence history is to be determined. There was also a general recognition that this margin is indeed an attractive place to get at the important problem of early subsidence history. Another attraction is that drilling would supplement the information that will accrue from the Japan Sea, and provide a more complete view of how marginal seas opened and evolved along the eastern margin of Asia.

Several aspects of the proposed drilling program, however, were criticized. (1) TECP doesn't think it is appropriate to call this an "Atlantic-type" margin, because it didn't form by central rifting of a huge continent. It is, rather, an example of small ocean basins that form when marginal fragments of continents rift away. It may have even formed as a large pull-apart basin in concert with slip on transcurrent faults in SE Asia and the adjacent SW Pacific. The potential information on early rift history is not devalued by the debates over its geotectonic setting, however. (2) The proposed program may still be too "one-sided." To properly evaluate models for the origin (extension) in the basin, it will probably be necessary to obtain data from the other margins of the S. China Sea. (3) TECP isn't convinced that a simple transect of several holes is needed to obtain the desired information about subsidence history. Perhaps a better approach in a revised proposal would be to present several possible hypotheses for the extensional development of the basin, and show how a proposed site or sites could test them. The deep reflector imaged suggests the possibility for a Wernicke-style geometry rather than a McKenzie "pure shear" extension. (4) The proposed transect appears to cross a transform fault that can be inferred from offset magnetic anomalies. Sites should be repositioned if necessary to avoid this complication.

Finally, Hsü noted that there is a Chinese "South China Sea Working Group," which has information that can be made available through the Ministry of Geology, especially if there is heightened interest on the part of JOIDES and ODP.

In summary TECP offers the following criticisms, guidelines, and recommendations:

- (A) TECP would like to see a new proposal that is more regional (basin-wide) in scope, that more thoroughly explores diverse models for extension, and that shows how perhaps fewer sites (or even one or two, e.g. one near CDP 5200 on MCS 70) could test these.
- (B) Proponents should liase with other groups interested in or working in the area and aim for a more comprehensive approach. Hsü noted that a workshop on rifted margins held in November may provide useful input.
- (C) Proponents should abandon the analogy with "Atlantic-type" margins.
- (D) At the least, proposed transect should not cross an interpreted transform.

- (E) PRC should be encouraged to release stratigraphic data from exploratory wells.

TECP CONSENSUS:

Our interest in some form of drilling program on the margins of the S. China Sea -- to address the early rifting and subsidence history of a marginal basin formed by rifting near the edge of a continent -- is growing. We would like to be presented with a revised proposal that is more regional in scope and more attentive to alternative models for extension and how they would be tested by drilling.

5.6 SULU SEA & CELEBES SEA

Hinz said that BGR has prepared two new proposals for sites in these basins. He briefly summarized results of his recent cruises in the region and explained how drilling would determine the age of crust in these basins. Although TECP has not yet been presented with these proposals, it reiterated its support for a hole in the Celebes Sea as expressed in the minutes of its last meeting.

6. MEMBERSHIP CHANGES

Cowan noted that the following people are scheduled to rotate off the panel at the end of this calendar year: Cowan (as member and chairman); Vogt; Marsh; and Howell. Riddihough announced that he will be replaced by Srivastava, but that both would attend the next TECP meeting. Cowan said that he must step down as a member of TECP because the University of Washington has nominated him as its next PCOM representative. He asked for names of potential new members of TECP to replace those leaving. He particularly encouraged names of people who are new to the JOIDES advisory structure and who are experts in fields that are likely to be discussed in the next couple of years. Eldholm cautioned us not to recommend people who are already on other JOIDES panels.

Because such a large group of members is leaving at once, someone suggested that we ask PCOM if Vogt, Howell, and Marsh could serve a few months past their scheduled retirements and attend one more meeting of the panel. Their presence at the next meeting would ease the transition into a significantly reconstituted panel. Howell and Vogt agreed to serve. [Marsh declined in a post-meeting phone conversation with Cowan].

TECP REQUEST TO PCOM:

We ask that Howell and Vogt be allowed to serve as members through the next TECP meeting, which they would attend together with their replacements. Howell and Vogt have agreed to serve.

TECP RECOMMENDATIONS FOR PANEL MEMBERS TO REPLACE RETIREMENTS:

The following names are roughly grouped into fields of expertise; they are not limited to US scientists.

Plate kinematics and history of ocean basins:

D. Engebretson, D. Clague, Zonenshain, T. Atwater, B. Luyendyk,
R. Carlson (A & M).

Structures in oceanic crust (plus kinematics and history):

K. Macdonald, J. Fox

Igneous petrology, geochemistry, isotopes:

R. Carlson (Carnegie Inst.)

General marine geology and tectonics:

S. Cande

Physical properties and fluids:

B. Carson

Mechanical Models:

R. Buck

7. NEXT MEETING

Karl Hinz kindly offered to host the next meeting in Hannover, FRG. The latter part of the first week in June, 1988, suited the members present.

The meeting adjourned at 1800 Monday evening.