JOIDES Tectonics Panel Meeting
National Academy of Sciences
Washington, D. C.
5-7 January, 1984

DRAFT

Panel members present:
J. Leggett (United Kingdom), Chairman
R. Blanchet (France)
A. Bouma (USA)
D. Cowan (USA)
J. Ewing (USA)
K. Nakamura (Japan)
R. Riddihough (Canada) (not present 7 Jan.)
J. Weissel (USA)
M. Weidicke for K. Hinz (Germany)

In attendance:
L. Garrison (ODP)
S. Toye (NSF)
H. Zimmorman (NSF)

AGENDA

I. Mandate for the Tectonics Panel
II. Introductions of panel members
III. Report on Leg 96
IV. Report on ODP
V. Ocean by ocean review of specific drilling targets and thematic problems
VI. Report on riser drilling
VII. Additional tectonic problems and drilling targets
VIII. Propsective panel members
IX. Drilling program after Weddell Sea
X. Summary of important thematic problems
XI. Future panel meetings
XII. Discussion of approved and tentative ODP sites

MINUTES

The meeting began at 0915 on 5 January in Room 353 of the Joseph Henry Building, National Academy of Sciences.

I. MANDATE FOR THE TECTONICS PANEL

Leggett reviewed our general mandate as described in a June, 1983 JOIDES memorandum. Our panel is to consider important thematic problems concerning the history of ocean margins and the tectonics of lithospheric plates, including but not limited to topics such as: the early rifting at passive margins; history of island arcs, back-arc basins and marginal seas; and the dynamics of fore-arc evolution. Our specific brief for this meeting includes consideration of: riser-mode drilling beyond 1987; drilling program after the proposed leg in the Weddell Sea; and scientific objectives on the proposed Galicia leg.

II. INTRODUCTIONS OF PANEL MEMBERS

Each panel member and others in attendance gave a short summary of his background, research experience, and scientific interests.

III. REPORT ON LEG 96

Bouma reviewed the major results of this successful final leg of DSDP. Drilling at several sites on the Mississippi fan provided important information on the distribution of sand bodies in a passive-margin fan. These observations will be useful for comparisons with more numerous published descriptions of ancient fans formed at active margins. The Mississippi fan consists of many distinct lobes of sand which are apparently related to different canyons. A new finding contributed by this leg is the documentation of very high sedimentation rates, on the order of 12m per 1000 years, high enough to fill a submarine canyon in 7000 years. Bouma also summarized the operational aspects of the leg. He noted that it is very difficult to adequately sample unconsolidated sediments below about 80m, and 200-300m may be the maximum depth to which these sediments can be penetrated before encountering severe drilling problems such as stuck bits or pipe. He reviewed drilling targets formulated in light of results from leg 96, including sites southeast of 614 and 615 to sample sheet sands further out on the fan, and sites in the mid-fan area to establish the history of migratory and "jumping" channels. The whole problem of the role of slumps in generating sediment flows is important but as yet unresolved.

IV. REPORT ON THE OCEAN DRILLING PROGRAM (ODP)

Garrison presented an informative review of the structure and mission of ODP, the role of Texas A & M University (TAMU) and the status of negotiations concerning a drillship.

He first compared the prior DSDP organization, contracted to Scripps, with the new ODP organization administered by TAMU via a five-year subcontract from JOI. Using organization flow charts, he elucidated the scientific advisory structure at TAMU and emphasized the expanded, professional role to be played by staff scientists, who will now actively pursue their own research in addition to accompanying other scientists on board the ship. Garrison then brought us up to date on negotiations for the drillship with the "semifinalists" Nedrill, Sonat, and Sedco. Whichever ship is finally chosen, it will accommodate 40-50 scientists, be able to deploy a 30,000 ft. drillstring in up to 27,000 ft. of water, and be able to accommodate a 6,000 ft. riser. An ideal schedule would have a contract for the drillship awarded around the end of February, a design phase for actual conversion to a scientific-drillship mode, conversion, sea trials, such that actual drilling could begin in October or November of 1984.

Garrison mentioned that a new format for initial reports is being considered to alleviate the problem of official, single-volume "blue books" appearing up to three years after completion of a leg. Initial reports may, in the future, comprise: (a) a summary of shipboard results, equivalent to site summaries in the present format, to be published in about a year; and (b) subsequent, intermittent publication of research papers in a journal format, perhaps in a new journal designed specifically for this purpose.

At this point, we began a general discussion of the science advisory structure and particularly the JOIDES panels. Most panel members are unclear about how thematic and regional panels are supposed to interact: through shared membership, informative memoranda, representatives attending other panel meetings? Also, no one was sure about how drilling proposals would be formulated, to whom they should be submitted, and who will evaluate them. We discussed whether our own panel members could prepare and submit proposals. Zimmerman suggested that an appropriate procedure would be to submit proposals to Honnorez, who will then direct them to the proper planels for evaluation.

Request for Information from PCOM

The Tectonics Panel needs guidelines and general information on how our panel will interact with other thematic and regional panels, and how drilling proposals will be generated, submitted, and evaluated.

V. OCEAN BY OCEAN REVIEW OF SPECIFIC DRILLING TARGETS AND THEMATIC PROBLEMS

Leggett originally had intended for us, at this point, to compile a list of worthy future drilling targets based on our own individual expertise, the expertise of our closely-related colleagues, or the scientific interests of each participating country. Several panel members commented not only on specific targets but also on general, thematic tectonic problems that fall under the panel's mandate. Each panel member was asked in turn to make a short presentation. Copies of the minutes of the final meetings of the Active Margin and Passive Margin panels were available, as were a flurry of drilling proposals in various states of preparation.

A. Blanchet

Blanchet began by focusing on the Western Pacific. He pointed out that very little drilling had been done in marginal basins and emphasized the clear need for future drilling in this particular tectonic setting. He advocated more complete transects like those successfully completed across the Mariana arc system. Blanchet stressed that island arcs are an attractive target, especially since we know very little about the nature of the basement of volcanoes themselves. For example, what rock types are present, and what could they tell us about the general history of the arc massif before the first phase of major volcanism? The Mariana arc is obviously an attractive target, but so is the Lesser Antilles chain in the Caribbean. He is also interested in collision tectonics such as is occuring at present in the Mediterranean, and the influence of arc volcanism on sediments in active-margin settings.

Blanchet and Wiedicke briefly reviewed the geology and tectonic setting of the Sulu archipelago, Palawan, and the South China Sea. They suggested that the Western Pacific regional panel should review this area and perhaps prepare a proposal. A Marianas-type transect would reveal much about the history of this particular area, but it isn't clear whether this is the best area to study certain fundamental active-margin processes.

Blanchet reviewed upcoming cruises of the R/V Charcot, and Nakamura mentioned the joint Japanese-French Kaiko project which will soon get underway. Both of these programs will provide important new seismic or Seabeam data that can be used to formulate more specific proposals in the Western Pacific.

B. Bouma

Bouma reviewed the principal results and recommendations of the COMFAN meeting held in late 1982. This group, which discussed deep-water sands and tectonic influences on their deposition, identified several important sedimentologic problems that are relevant to the role that submarine fans play in the evolution of passive and active margins. Two topics of special importance addressed by the committee are the importance of channel levee complexes, and the details of how channels meander or are bypassed. COMFAN recommended three important targets for drilling: the Mississippi fan, the Rhone delta, and West Coast fans south of Astoria fan. Cowan suggested that since slope failures are known or suspected to be an important process on fans in general, drilling could be used to document the characteristics of slump deposits at all stages in their development.

Bouma briefly summarized a memo he and J. Coleman had prepared after Leg 96 was completed. The memo contains suggestions for further drilling on the lower fan (depositional lobes), lower middle fan (channel-levee complex), lower upper fan, and at other sites to analyze mass-movement processes.

C. Cowan

Cowan first considered the Barbados Ridge complex in the Lesser Antilles subduction system and summarized important findings from the Leg 78A transect. Reverse faulting just upslope from the deformation front was first

documented at Site 541. This hole also entered the main decollement, above which ocean-floor sediments are scraped off and accreted, but it was unable to penetrate the remainder of the section to oceanic basement because the hole deteriorated. Several attractive targets remain to be drilled at this active margin. Two informal proposals by Moore and Biju-Duval (re-submitted by Biju-Duval and A. Mascle), and G. Westbrook propose several sites along the Leg 78A transect, across the deformation front to the South, and on the east flanks of fore-arc basins west of Barbados Ridge.

Cowan then briefly outlined the tectonic setting of the Juan de Fuca plate offshore Washington and Oregon. This plate is being created at an active spreading system, which is being intensely studied by teams from USA and Canada. A deformation front developed in thick terrigenous sediments marks the lower slope where the Juan de Fuca plate begins to descend beneath the continental margin. There are many drilling targets on both the Juan de Fuca ridge system and associated fracture zones, and along the deformation front. Riddihough mentioned that he had a preliminary draft from the international Northeast Pacific Activities Consortium (INPAC) proposing an extensive, multi-leg drilling program in this area, and a workshop is being planned to discuss problems in more detail. The Oregon-Washington margin was exhaustively studied as a prime target area for the stillborn OMD program.

A wealth of data on the Mid-America trench has been provided by Leg 66, summarized by Cowan and Leggett, and Legs 67 and 84. The Leg 66 transect apparently showed that sandy trench deposits are being accreted to the lower trench-slope. Results from Legs 67 and 84 indicate, however, that the slope off Guatemala is underlain by Mesozoic ophiolitic basement overlain by a complex blanket of upper Cretaceous to recent sediments, and little if any ocean-floor material has been accreted along this part of the trench. Future drilling at the Mid-America trench would largely fill the gaps in our current knowledge about the evolution of this system, particularly offshore of Costa Rica.

D. Ewing

The discussion shifted again to problems at passive margins. Ewing first emphasized the importance of comparing the geologic histories of conjugate margins in the Atlantic. We need to know whether the continental margins that formed as continents initially rifted then spread apart developed similar structural styles and how these styles influenced sedimentation. Penetration of Jurassic sediments at appropriate sites on Atlantic margins is necessary to solve this problem. In this regard, drilling in the Bahama Basin has been interpreted by Sheridan to indicate very fast spreading in the Jurassic during the early stages of Atlantic evolution. Future drilling could be used to test such hypotheses.

Ewing feels that the nature of the "7.1 km/sec" layer is a major unsolved problem. He wondered whether it forms at particular types of spreading systems during the initial rifting stage in the evolution of passive margins. Offshore of the eastern USA, it has been mapped seismically westward to the East Coast magnetic anomaly. Although it is too deep to be reached by the drill there, he suggested that a deep hole in a very young spreading system, such as the Gulf of California or Red Sea, might shed some light on the relation of 7.1 km/sec crust and tectonic setting.

E. Wiedicke

Speaking for K. Hinz, Wiedicke summarized tectonic problems and drilling targets that have high priority at Bundesanstalt für Geowissenshaften und Rohstoffe. The nature of the "dipping reflectors" at one type of passive margin is an outstanding problem. We are still uncertain as to how they relate to the boundary between continental and oceanic crust. Wiedicke also presented a geological sketch of the continental margin offshore northwestern Africa, illustrating block faulting and "diapirs," some of which are clearly structural highs consisting of continental basement. Drilling beyond that proposed for the second year of ODP would be required to address questions left unanswered by Leg 79.

F. Leggett

Leggett first summarized important features of the ancient and modern active margin in southeast Japan. The Shimanto belt, exposed on Honshu, Shikoku, and Kyushu, is a late Mesozoic to mid-Tertiary accretionary complex. The Nankai trench is an active convergent plate boundary lying offshore from, and approximately parallel to, the Shimanto. He advocated continued coordinated studies of both onshore and offshore parts of this long-lived active margin. Drilling on DSDP Legs 31 and 87 could only penetrate to shallowest depths near the toe of the landward slope of the Nankai trough, so many objectives have not been reached. On both legs, drilling was plagued by equipment problems and severe weather. Excellent seismic reflection profiles obtained by the Japanese show that the Nankai fore-arc region is superb for future drilling directed toward fundamental topical problems such as the mechanisms of frontal accretion, and the tectonic evolution of fore-arc basins.

Leggett next turned to the Makran region of Iran and Pakistan, where he is engaged in field work. The Makran extends offshore to an active deformation front in the Gulf of Oman where thick sediments on the Arabian plate are being accreted to the Eurasian plate. Like the Shimanto-Nankai, the Makran-Gulf of Oman system offers an excellent opportunity for a long transect through both exposed and submarine parts of an active margin. He emphasized that on-land studies are still very preliminary, and only part of the seismic data offshore is public. White's reflection profiles show classic folds, parallel to the deformation front, that may be ramp anticlines forming above thrusts. Marathon has well over a thousand kilometers of high-quality multichannel seismic that is not yet public, but future cruises of GLORIA will add to the seismic data needed for the proposal and evaluation of drilling sites.

G. Nakamura

Nakamura outlined four major thematic problems that are also relevant to the tectonic evolution of the Western Pacific and the Japanese archipelago. First he discussed the tectonics of back-arc basins and noted that there are examples of important phases in the evolution of these basins in the Western Pacific: (1) initial rifting of arcs is a process occuring in the Okinawa archipelago and in the Izu-Bonin arc; (2) initial spreading is represented in

the Okinawa trough; (3) main spreading phase, and (4) initiation of closure and possible obduction can both be studied in the Sea of Japan. A second important problem is how changes in subduction direction might induce changes in the stress field, which in turn probably influences both tectonics in the trench and back-arc areas and also arc magnetism. Third, the general process of sediment accretion at active trenches, such as the Nankai and Japan trenches, needs further study, as do the processes of collision.

Nakamura presented seismic and other geophysical data from the Izu-Bonin arc, the Okinawa trough, and especially the Sea of Japan. He pointed out several sites in the Sea of Japan where drilling could penetrate acoustic basement. The timing and mechanism of opening of the Sea of Japan are long-recognized, outstanding problems, and Nakamura explained how drilling in the Japanese and Yamato Basins would add much to our understanding of this classic example of a marginal sea.

H. Riddihough

Emphasizing thematic problems, Riddihough noted that the tectonic style of active margins probably depends on a variety of kinematic factors including rate of convergence but, perhaps more importantly, absolute motion. For example, the "rollback velocity" of the trench with respect to the overriding plate could greatly affect the deformational styles within accretionary complexes accumulating at active margins. The degree of obliquity with which two plates converge may influence the degree to which stresses are transmitted across the convergent boundary, and hence, coupling. He used the offshore Washington-British Columbia region as an example of different styles, particularly of the "bacon slicing" effect where tectonic slivers are being removed from the continental margin off British Columbia in response to highly oblique convergence. Riddihough summarized by noting that before we drill, we should know as much as possible about relative and absolute plate motions so that results can be interpreted in a kinematic context.

I. Weissel

Regarding passive margins, Weissel said that one needs to study the early rifting stage when continental masses first begin to split apart. Drilling sites need to be selected with care to assure that a sedimentary section which accumulated at this stage is present and can be reached with the drill. Weissel also outlined the general problem of intraplate deformation and mentioned specific examples where drilling could provide some new data to test various models. In one case, the temporal evolution of the "Hawaiian welt" could be constrained if the subsidence history of the moat surrounding the islands were better understood. Thus, the problem of how the Pacific plate responded to a mid-plate volcanic pile would be approached by obtaining sediment cores from the moat. It has also been suggested that large plates of oceanic lithosphere might develop large-wavelength buckles as they are compressed. A possible place to study this type of mid-plate deformation is in the Indian Ocean, where patterns of sedimentation at the distal edge of the Bengal fan may have been influenced by mid-plate compressional structures.

After all panel members had made a presentation, Leggett asked that we each consider additional thematic and regional problems so that we could prepare a comprehensive list of priorities when we re-convened the next morning.

VI. REPORT ON RISER DRILLING

One of our briefs for this meeting was to consider riser-mode drilling beyond 1987, but it was apparent that most panel members knew little if anything about risers and their capabilities. Leggett asked Garrison to give us a brief seminar on risers.

Garrison noted that the main reason to employ a riser is so that blow-out prevention equipment can be installed in case of high gas or fluid pressure in the hole. However, since the riser is only 1886 m long, riser-mode drilling can take place only in water depths less than 1886 m (or 6000 ft.). Because of the 9000 m length of drillstring, however, very deep penetration is possible in this mode. Garrison noted the importance of adjusting mud weight so as not to fracture bottom sediments and cause lost circulation. He said that the operations of the ship in riser-mode are basically different than when in normal mode, especially since a great increase in drilling time is required in order to set casing. Since the ship will not routinely carry casing, riser holes must be identified far in advance so the ship can pick up casing prior to the leg. Zimmerman mentioned that two riser-drilling proposals had already been received: one in the Guaymas Basin (hydrothermal, deep ocean crust), and one off the East Coast of USA (evaluate early rift history of Mesozoic oceans). It is apparent that drilling a single hole may take up six months, and a different program of shipboard staffing must be developed.

We recognized that the restriction to water depths of less than 6000 feet clearly eliminates many active-margin targets near and at deep trenches. Leggett noted that there are still major tectonic problems of interest to our panel that can be approached in the riser-mode: tectonics of ridge crests and fracture zones; tectonic evolution of passive margins; and the evolution of fore-arc basins. Riddihough suggested that margins dominated by strike-slip tectonics are attractive targets; an example is a tectonic sliver at the margin off the Queen Charlotte Islands in Canada that is being transported northwestward.

Tentative recommendation

Based on our present understanding of riser-mode drilling, we suggest that the technique could most usefully be employed for:

1) drilling on passive margins, especially where deep holes are needed to reach early-rift stage sediments or acoustic basement

2) drilling in fore-arc regions to elucidate the uplift and subsidence history of fore-arc basins, sample basement beneath the sediment fill, and sample the basement of island arc volcanoes.

We emphasize that these are tentative recommendations, since we need more information on risers and their capabilities.

VII. ADDITIONAL TECTONIC PROBLEMS AND DRILLING TARGETS

Leggett asked each of us, again in turn, to identify any regions or thematic problems that were not discussed under agenda item V.

A. Weissel

Weissel presented a comprehensive list of major tectonic problems that are not only of interest to the panel but also approachable with the drill:

1. Passive margins:
   a. Dipping reflectors
   b. Early rifting history best studied at margins with significant syn-rifting sediments; examples are the northwest margin of Australia (Permo-Jurassic sequences), Exmouth Plateau, Perth Basin, southern margin of Australia to study Late Jurassic-Early Cretaceous sediments
   c. Post-rifting history of opposed ("conjugate") margins
   d. Submarine fans
2. Active margins
   a. Structural style and deformation within accretionary wedges
   b. Dewatering phenomena and diapirs, such as on Mariana trench slope
   c. Sites of collision and shortening, for example the Moluccas
   d. Composition of fore-arc basin basement (arc-related, ophiolitic?)
   e. Submarine fans
3. Mid-plate: mechanical response of lithosphere to an applied load
   a. Loading by seamounts, as at Hawaii
   b. Response to large lateral compression (Indian Ocean)

B. Riddihough

He again noted that: (1) Strike-slip margins are an important tectonic problem; the Andaman archipelago is a classic example of arc volcanism and rifting at a highly oblique boundary. (2) The Aleutians were not brought up in the earlier discussion. (3) Oceanic rises and plateaus should be drilled to find out more about their composition. Nur and others have suggested that these features are analogues for some of the accreted terranes of the North American Cordillera. Kerguelen, Ontong-Java, and Rio Grande Rise were mentioned as candidates.

C. Nakamura

He recalled that the Active Margin Panel had identified the Bering Sea as an opportune place to drill a trapped part of the Kula plate.

D. Wiedicke

He supported Weissel's proposal to drill offshore northwestern Australia, and also brought up the margin of east Greenland, opposite the Norwegian margin.

E. Ewing

Ewing mentioned several regions, omitted from the earlier discussion, where important data on the evolution of passive margins could be obtained: continental margin on or near Madagascar; continental margins in the South Atlantic, and particularly the Angola Basin.

F. Cowan

He noted two areas that were discussed at some length at the last and final meeting of the Active Margin Panel: the Manila trench and fore-arc basin west of Luzon, and the Scotia Sea. Cowan felt that Weissel's list included most of the important topical problems regarding active margins, but added that little is known about the structure of the middle and upper trench slopes because drilling there hasfailed to penetrate the blanket of slope sediments. The evolution and sedimentary history of slope basins is also problematical. Cowan mentioned that the influence of fluid pressures on styles of deformation in accretionary wedges is of great interest now and suggested that every effort be made to determine fluid pressures in situ. Finally, the nature and significance of gravitationally driven slumps and slides need to be explored, and he recommended drilling the slump-like features identified by Seabeam in the Sunda trench and at the foot of the Barbados Ridge.

G. Bouma

Bouma brought up a tool problem: the need to somehow be able to orient cores. He suggested that when drilling in terrigenous sediments, we should plan to drill several holes in order to provide as complete a picture as possible of the geometry of sediment bodies, their depositional structures, and the relation of sedimentation and tectonics. We need to drill a submarine fan offshore form a mountainous coast for comparison with exposed ancient examples and with recently obtained data from the Mississippi fan.

H. Blanchet

He pointed out the need for deeper drilling to allow us to penetrate basement in volcanic arcs, mid-plate and fore-arc settings, and at passive margins. Blanchet emphasized that the Caribbean plate has barely been drilled, but it is an excellent place to obtain data from a single, well-defined plate to compare with the on-land geologic record obtained all around its margins. He also reminded us that the Southwest Pacific (especially the South China Sea and Manila trench), the Red Sea, and the South Atlantic offer a number of regional and thematic objectives.

I. Leggett

Since the Indian Ocean had not figured prominently in our earlier discussion, Leggett suggested that the Ninety-east Ridge should be drilled to test whether it originated as a hot-spot track, or leaky transform. A target with wider implications for processes is the Indus cone.

VIII. PROSPECTIVE PANEL MEMBERS

Our panel presently consists of 9 members, but Leggett said that it is to be expanded to about 15. He prepared a map of the world and indicated on it the geographic regions in which the present members have some experience and expertise. He also presented a list of specialties that the Passive Margin Panel (PMP) felt should be represented on an "ideal" Tecotnics Panel. We thought that comprehensive geographical coverage was not critical because Regional Panels and Working Groups will be an integral part of the ODP science advisory structure. Using the PMP matrix, we put our names in their categories, and discussed several prospective members who would complement the expertise of the panel as it now stands. We sensed a particular need for members with expertise in magnetic processes and instrumentation, and also felt a wildcard member with extensive experience in industry is desirable.

In the table below, present panel members are listed opposite their PMP specialty, and our recommended members follow *in italics*:

. 2 wildcard generalists	BLANCHET, LEGGETT	*Scholl, Vallier, Cooper, Talwani*
. 2 geohistory analysts		*Van Hinte*
. 2 theoretical modelers	WEISSEL	*Sibouet, Keen*
. 4 global seismic interpreters	HINZ	*McMillen, Falvey*
. 1 refraction specialist	EWING	
. 1 magmatist		*Vallier*
. 2 sedimentologists	BOUMA, LEGGETT	
. 2 global geophysicists	NAKAMURA, RIDDHOUGH, (WEISSEL)	
. 1 structural geologist	COWAN, (NAKAMURA, BLANCHET)	

TECTONICS PANEL ADDITIONS:

. industry wildcard	*Bally, Lehner, Roberts*
. "instrument-oriented" tectonicist	*Hussong, Moos, Stephens*

Recommendation

We recommend that PCOM choose additional members for this panel from the names listed in italics above.

IX. DRILLING PROGRAM AFTER WEDDELL SEA

One of the specific charges to the panel for this meeting was to recommend a post-Weddell Sea (post-early 1987) drilling program--that is, whether the ship should steam into either the Indian Ocean, or the South Pacific after the Weddell Sea leg is completed. A lengthy discussion took place that involved a consideration of possible drilling targets in the Indian Ocean, but we realized that we need more information about regional and thematic problems in the Indian Ocean, and on the status of site surveys. An informal poll of panel members indicated that the Indian Ocean was slightly favored over the South Pacific. At this point, however, we decided that instead of trying to prioritize objectives in the Indian Ocean by designing actual legs, it was more important to consider major thematic problems on a world-wide basis, and where the ship could best drill to solve them.

X. SUMMARY OF IMPORTANT THEMATIC PROBLEMS

Leggett suggested we use Weissel's list of major thematic problems, introduced under agenda item VII, as a springboard for discussion. We added other topics that were discussed earlier. Cowan noted that several of the thematic problems will be addressed during the first two-year ODP drilling program (late 1984-early 1987) so that important problems remaining after the Weddell Sea leg influence our recommendation of where the ship should go.

The following list, based on our discussions up to this point, presents what this panel identified as first-order, thematic tectonic problems. An asterisk under the column headed "ODP, yrs 1-2" indicates that a problem will have probably been addressed during the first period of drilling. Under "Beyond 1986", we listed what are to us some attractive areas to address the remaining problems:

PROBLEM	ODP years 1-2	Beyond 1986
1. PASSIVE MARGINS		
. dipping reflectors	*	
. early rifting	*	
. conjugate margins	*?	
. submarine fans	*	
2. ACTIVE MARGINS		
. lower slope		
processes of deformation	*	
fluid pressures	*	
slope-basin evolution	*?	Japan
influence of oblique convergence		NE Pacific; Indonesia
role of slumping		Barbados; Indonesia
. diapirism; fate of seamounts		Marianas; Japan
. collision	*	
. arc basement; volcanic history		Marianas; Bonin
. back-arc basins: nascent, young mature		Japan; Bonin; Okinawa
. submarine fans		Japan
. fore-arc basin evolution	*?	Japan; Indonesia
3. MID-PLATE		
. mid-plate compression		Indian Ocean
. seamount loading		Pacific
. oceanic rises		

Recommendations to PCOM

On the basis of our discussions summarized in the table above, our consensus is:

A. Three of the major tectonic problems left to be addressed are (not prioritized): (1) all stages of evolution of back-arc basins; (2) the evolution of fore-arc basins, and the nature of their basement; and (3) mid-plate phenomena, including deformation, and the nature of oceanic rises and plateaus.

B. There are many attractive drilling targets, some of which have been presented in formal or informal proposals, in the western and southwestern Pacific.

C. The panel is leaning toward a route through the Indian Ocean after 1986.

XI. FUTURE PANEL MEETINGS

Leggett explained that we are expected to have at least two, and probably three, meetings each year, and that it would be best if our meetings just preceded PCOM meetings so that he could report our recommendations. Garrison noted that the next PCOM meeting is scheduled for late May. Wiessel suggested that we hold our meeting in conjunction with the Spring AGU meeting to be held in Cincinnati. We concluded that 17-19 May, at the end of AGU, are the best dates. Leggett also thought we will probably have to meet in late summer, before ODP drilling begins, and he suggested a late August meeting in Europe as a convenience to the many non-USA members of the panel.

Leggett also suggested that the goals of our future meetings should be: (1) to review proposals; (2) to monitor and discuss the state of the science regarding the tectonics of ocean margins; and (3) to make specific recommendations concerning ODP operations and shipboard scientific staffing. There were several questions regarding the entire process for submittal and review of proposals. Leggett's plan will be to distribute proposals to panel members and then choose a panel member or team of members to carefully review proposals in certain geographic regions. These committees will report on their review to the full panel. Cowan suggested that Leggett establish a dialogue with other regional and thematic panels. Bouma asked that Leggett send the panel members a short report on the upcoming PCOM meeting and summarize matters of particular concern to us.

XII. DISCUSSION OF APPROVED AND TENTATIVE ODP SITES

We began a discussion of each of the specific legs proposed for the first two-year program of ODP and concentrated on the Barbados and Galicia legs.

A. Gulf of Mexico

Bouma again reviewed several sites on the Mississippi fan that are proposed in the memo from Bouma and Coleman. He stressed the need to complete the picture emerging from the results of drilling on Leg 96 by drilling at sites: (1) on the lower fan to probe distal sheet sands (7-8 days); (2) on the mid-fan to examine channel jumping phenomena (6 days); (3) on the mid- and upper-fan to examine the distribution of sands with respect to overbank clays, and mass-movements (20-25 days). The entire topic of mass movements and where they begin probably deserves another leg. Bouma also summarized a proposal by Buffler and Bryant for sites: (1) on the Mexican Ridges (gravity ridges or diapirs?), but no site surveys are available yet; (2) on the Gulf of Mexico abyssal plain just west of the Mississippi fan, to obtain a representative stratigraphic section; and (3) in the Straits of Florida. We agreed that further drilling on the fan is definitely a worthy objective, and that more expansive objectives need to be further evaluated by a working group.

We next had a general discussion about drilling in the Caribbean, prompted in part by an informal proposal received from Mascle and Biju-Duval. Leggett pointed out that a comprehensive program in the Caribbean, though long advocated by France in well-documented proposals, had sort of fallen through the cracks in DSDP. Two of the proposed sites, CAR 2 and 7, are alternate

sites for Gulf of Mexico drilling. Blanchet said that complete, formal proposals are nearing completion and will soon be presented to JOIDES by France.

Summary and Recommendations:

(1) The panel agrees that completion of additional drilling on the Mississippi fan is an important priority; and (2) we strongly support the Caribbean Working Group's evaluation of the Caribbean area and we suggest that it consider one or more long transects to address important regional and topical problems.

B. Bahamas

Ewing summarized many of the problems that could be addressed by drilling in this area, particularly: (1) the identification of strong seismic reflectors to establish whether the mid-Cretaceous unconformity can be traced into the Gulf of Mexico; and (2) the details of how carbonate banks developed and how they were related to a mid-Cretaceous drowning event. Bouma mentioned that drilling could document major environmental changes in the Lower Cretaceous, the distribution of slope facies, and the origin of the Bahama escarpment. Ewing and Bouma both emphasized that an important objective of drilling in the area should be to evaluate the role of a megashear in the opening of the Gulf of Mexico, and Bouma suggested that a deep hole in the eastern Gulf would be needed to complement data from the Bahamas in this regard.

Summary and recommendations:

We recommend that the Atlantic Regional Panel consider tectonic questions, specifically the role of the megashear, as they formulate specific drilling proposals for the Bahamas.

C. Barbados

Leggett led a discussion of drilling targets centered on the Barbados Ridge complex. Two informal proposals, one by Biju-Duval and Mascle (modified from Moore and Biju-Duval), and one from Westbrook had been circulated at our meeting. Leggett reviewed again the major results from Leg 78A and noted that further drilling in this vicinity is promising because there are no thick sandstones to impede good recovery, the biostratigraphic zonation is excellent, and the sediments are very low in hydrocarbons. To drill more deeply at Site 541 will require a cased hole, and a packer is necessary to determine fluid pressure. Ewing thinks that a packer should be tried, and noted that it

is technically feasible to emplace casing, even though Leg 78A was plagued with mechanical problems. In view of other interesting physical data obtained on 78A (such as anomalously high temperatures in one hole), the panel felt that the Caribbean Working Group should evaluate other types of instrumentation besides the packer, including temperature probes and possibly strain gauges.

We next considered specific sites suggested in the three proposals on the table. Blanchet suggested drilling one deep hole through the decollement at Site 541. Rather than completing a transect upslope from 541 (Mascle and Biju-Duval 2a,b,c), Blanchet favors moving south to Westbrook 1 and 2, and then going north to the west flank of the Barbados Ridge where it borders the fore-arc basin to drill Mascle and Biju-Duval site 4. In other words, Blanchet recommends a "round-trip" rather than a transect. Bouma also favors a spread of sites in a north-south direction. Weissel thought that an important goal is to understand how physical properties determine why sediments are scraped off. Cowan suggested re-drilling at 541 as deep as possible and also drilling (possibly with HPC) the slump features identified by Seabeam at the deformation front. Ewing also favored deepening 541 through the decollement and felt it might be possible to get some information about basement rocks by drilling in the Tobago trough. Nakamura suggests deepening 541, using the HPC on slumps, and then drilling somewhere on the western flank of the Barbados Ridge. Leggett noted that the consensus is to drill 541 through the decollement and perhaps to basement and then drill on the western flank. Garrison anticipated possible safety problems on the west flank.

Summary and recommendations

1) A deep cased hole through the decollement at 541 is of highest priority, and the Caribbean working group should investigate instrumentation options beyond the packer; (2) the panel favors a round-trip mixture of sites, rather than a single transect at this stage; and (3) the working group should evaluate alternative sites proposed on the western flank of the Barbados Ridge.

D. Mid-Atlantic Ridge

We are unable to comment on this leg at this time.

E. Labrador Sea

It is premature for us to comment on this leg until we receive more information.

F. Norwegian Sea

Wiedicke summarized the geology of the proposed drilling area, pointing out that one of the main objectives is to drill west of the Voring Plateau escarpment through a series of reflectors to reflector K. The panel strongly supported this leg as an excellent opportunity to probe basement and study dipping reflectors. In response to a question from Garrison, Wiedicke said that new data are being digested in order to prepare a formal proposal.

G. Galicia

Blanchet reviewed a proposal submitted by A. Mauffret for drilling on this highly starved margin. Sites are proposed on oceanic crust, on a high presumed to be underlain by ultramafic rock (lherzolite), and in alternate locations designed to sample not only a pre-rift sequence but also possibly basement. Ewing felt this leg would be an excellent opportunity to sample an early, syn-rifting sedimentary sequence, and he wondered about the need for more modern seismic data or at least reprocessing of existing data. Weissel believes that the Galicia leg features enough important scientific objectives that it should be planned regardless of whether or not the Norwegian Sea leg is drilled.

Summary and recommendations:

The panel strongly supports drilling off Galicia as an excellent opportunity to address major tectonic problems related to the evolution of passive margins and to sample an unusually complete syn- and pre-rift sedimentary section.

F. Mediterranean

Blanchet summarized a proposal by J. Mascle for drilling outside of the Hellenic trench. From the general discussion that followed, it was clear that there are many targets in the Mediterranean that could easily justify two legs, one in the east and one in the west, on tectonic grounds alone. We agreed to await detailed proposals and the recommendations of the Mediterranean Working Group so we can evaluate specific tectonic problems in the area.

G. Northwest Africa

Wiedicke again reviewed some of the topics he covered under agenda item V. One goal of future drilling will be to elaborate on the findings of Leg 79. The panel agreed with Ewing that we must await new proposals before we can act.

H. Remaining Legs (after Northwest Africa)

Although we have essentially no details on these legs and specific targets, the panel agreed to support all of the legs as tentatively proposed. A variety of possible sites on the Costa Rica/Venezuela/Columbia leg were mentioned, but our evaluation must again await details. Cowan noted that the Peru trench and South Chile Rise triple junction were high-priority recommendations from the Active Margin Panel. Wiedicke mentioned that K. Hinz and P. Barker were going to meet to discuss Weddell targets, so we can expect more detailed proposals in this interesting area.

The meeting was adjourned at 12:05 p.m., 7 January