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EXECUTIVE SUMMARY

Minutes, Indian Ocean Panel Meeting 10-12 Dec 84, La Jolla, CA

After hearing reports from PCOM, LITHP, TECP, SOHP, and SS-SP, the panel reviewed all proposals received to date, whether mature or immature, and reassigned priorities. Top priority projects are listed below in order, with notation of endorsement by thematic panels (T = Tectonics, L = Lithosphere, S = SOHP), and time estimates expressed in drilling legs.

1.	Kerguelen-Gaussberg: rifted hot spot trace model and high latitude paleocean. transect.	T,L,S,	1½-2
2.	Neogene Package: monsoons, mountains, Mikankovich and fossil man.	S	1+
3.	Argo Abyssal Plain: old, possibly Tethys, ocean crust.		< ½
4.	Red Sea: initiation of rifting.	T,L	1
5.	Broken Ridge: rifted hot spot trace model, conjugate to Kerguelen.		< ½
6.	Makran: distribution of deformation across an accretionary prism.	T	1
7.	Chagos-Laccadive-Mascarene Ridges: aseismic ridge, paleocean., carbonate history.	L	½
8.	S.E. Indian Ridge Transect: paleocean. transect and mantle heterogeneity.	L	½
9.	Ninetyeast Ridge: "aseismic ridge" and paleocean. transect.	L	½
10A.	North Somali Basin: old ocean, possible Tethys remnant.	S	1
10B.	Central Indian Basin & Distal Bengal Fan: intraplate deformation and Himalayan uplift record.	T	½
12.	West S. Australia & Antarctic Discordance: initiation of spreading and "cold spot" trace.	T	1
13.	Agulhas Plateau: S. Atlantic - Indian Ocean Gateway.		< ½
14.	Eastern S. Australia: starved block-faulted passive margin, slow spreading.		1
15A.	Exmouth Plateau: starved marginal plateau.	T	½
15B.	Fossil Ridges: Mascarene and Wharton Basins.		¾
17.	Sunda Arc: variation in deformation around an accretionary prism.	T	1
18.	Rodriguez Triple Junction.		1
19.	Davie Ridge: sheared margin.		¾
20.	Wallaby Plateau: epilith, volcanic passive margin.		1
21.	E. Gulf of Aden: rifting old ocean crust.		½

The projects considered and priorities reflect in part the fact that investigation of the Indian Ocean by both surveying and drilling is still in an exploratory stage, not as far advanced as most other major ocean areas. In addition, however, several thematic groups of projects have emerged based on features which are either unique to the Indian Ocean or are better displayed and can be studied better in the Indian Ocean than anywhere else. These include:

- Neogene Package (#2): a study in the NW Indian Ocean of paleoclimatology, monsoonal circulation, relation to uplift of the Himalayas, and correlation with East African hominid sites and the Siwaliks.

- Oceanic Plateaus and Aseismic Ridges (#1,5,7, and 9): Ninetyeast Ridge, Broken Ridge, Naturaliste Plateau, and Kerguelen-Gaussberg Ridge may have been formed by the same hot spot.

- N-S Paleoceanographic Transects (#9,5,8, and 1, or #7)

- Largest High Latitude Shoal Area (#1): Kerguelen-Gaussberg.

- Metallogenesis (#4): Red Sea.

- Old Ocean Crust (#3,10A): N. Somali Basin and Argo Abyssal Plain.

- Accretionary Prism Deformation (#6,17): Makran and Sunda.

- Passive Margin Evolution (#12,14,15A,20)

Action Items

- IOP requests appointment of a petrologist. First choice Duncan, second Frey.
- IOP requests appointment of a Red Sea W.G., with suggested membership: Cochran (Chairman), Coleman, Bäcker, Pautot, Arthur, Whitmarsh, Miller, Ewing, and one member from LITHP.

Minutes

Indian Ocean Panel (IOP)

10-12 Dec 1984

La Jolla, California

Members Present

Schlich
Gradstein
Falvey
Prell
Cochran
Leggett - TECP
Tauxe - SOHP
Sclater - LITHP
Curray (Chairman)

Guests and Alternatives

Honnorez (PCOM)
Brenner (SS-SP)
Clement (TAMU)
Thierstein (for Herb)
Whitmarsh (for White)

Not Represented

von Rad

Reports

PCOM - Honnorez

Honnorez reported on the last Planning Committee meeting held in Hawaii in September. Guidelines PCOM will follow in their planning include: 1) to follow panel recommendations whenever possible; 2) to seek innovative science rather than more of the same; 3) to make most efficient use of the ship, to optimize science and minimize dead-head transit runs. The presently planned schedule of legs is attached in Table 1 and shown in Fig.1.

IOP recommendations from our September meeting were presented to PCOM: our declared need for ten legs or two years, request for a Red Sea working group, request for a petrologist member, our overlap in interest with the Southern Oceans Panel (SO-RP), and our "straw man" suggested schedule. Our recommendations were considered, but none were accepted. New working groups will be appointed carefully as older working groups, e.g. the three Atlantic working groups, are disbanded. We should repeat our request for appointing a Red Sea working group. In view of a recent Langmuir memo suggesting the urgent need for petrologic expertise on IOP, we should repeat our request for appointment of a petrologist.

Sclater moved and Prell seconded that PCOM be asked to appoint first, Robert Duncan, or second, Fred Frey as a full member of IOP. The motion was carried unanimously.

The chairman was directed to coordinate closely with Kennett, chairman of SO-RP, for the next PCOM meeting to which panel chairmen will be invited, to avoid any contradiction and to reinforce requests for our mutual interests. SO-RP reportedly will request another south Atlantic leg after Weddell Sea. Another alternate plan discussed at PCOM was circumnavigation of Australia between two successive Kerguelen legs. We must, therefore, document and strengthen our proposals with the best possible scientific arguments.

There was considerable discussion about how to put priorities on our projects. One PCOM member had urged our panel to put our projects in priority order for presentation to PCOM.

The subject of foreign memberships was discussed. Honnorez suggested that after the drill ship sails on 22 January, the composition of all panels may change to eliminate automatic country membership in each panel. Scientists will instead be selected individually.

LITHP - Sclater

That panel began its discussion by reviewing what the Indian Ocean had to offer in terms of lithosphere objectives. The following objectives were considered to be important: aseismic ridges and oceanic plateaus, hot spot traces, residual depth anomalies and ultramafic variability, triple junctions, Australian-Antarctic discordance, rifting young ocean. The following were discounted because they believed that "comparable or better examples existed in more accessible places": major change in spreading direction, intermediate spreading rate ridge, and fossil spreading ridge.

The panel applied two grading schemes to Indian Ocean proposals which they considered: A,B, etc for non-lithosphere primary sites and 1,2,3, etc. for primary lithosphere sites. Highest in their primarily lithosphere objectives were Red Sea, SE Indian Ridge, Crozet Seismic Observatory, with lower ratings for SW Indian Ridge, Carlsburg Ridge Chagos-Mascarene, and SE Indian Ridge. Highest in the not primarily lithosphere objectives were Ninetyeast Ridge and Kerguelen, with SE Indian Ridge closely trailing.

TECP - Leggett

That panel's method of voting on scientific content of proposals was discussed and there was tentative agreement to attempt this within our panel. This system will be described later in these minutes. Projects in other oceans were rated at their September meeting, but because of timing they did not have our complete listing except as reported verbally by Meyer who attended both meetings. Their voting on Indian Ocean projects was, therefore, being conducted by post. Leggett had results of only six returns so far, so lithosphere panel priorities as reported in our Table 3 are preliminary. To date, their priorities are in order: 1) Makran, 2) Red Sea, 3) Intra-plate deformation, 4) Sunda Forearc, 5) South Australia (Western-South Australia in our terminology). During their meeting they had specifically discussed the following proposals: Somali Basin, Sunda and Banda arcs, Andaman Sea and Australian margins.

SOHP - Tauxe

Curray had attended one day of their recent meeting to brief their panel on Indian Ocean objectives and recommendations. All of our projects were, therefore, discussed and considered. After considerable discussion, their Indian Ocean priorities were, in order: 1) Kerguelen-Antarctic (Amery); 2) Oman-Owen Ridge Upwelling-Anoxic, Indus Fan; 3) Somali Basin; 4) SE Indian Ridge Transect; 5) Chagos-Laccadive Ridge, with one-hole Ninetyeast Ridge pick-up; 6) NW Australia, and an additional one-hole pick-up on Agulhas.

Their panel appointed individuals from within their panel to recommend a good location for deep North Somali Basin drilling, and to prepare a proposal for a K-T boundary site on Ninetyeast Ridge.

SS-SP - Brenner

The Site Survey Panel wants mature proposals and requests that proponents start complying with prescribed procedures as soon as possible to submit those proposals and accompanying survey data to the Data Bank at L-DGO. The Data Bank and SS-SP will act as a "trip-wire" for the PCOM to recommend where surveys, both regional and site specific, are needed and to suggest a priority order for funding or requesting such surveys. All panel members are requested to examine the specs for site surveys attached as Table 2.

General Discussion

Our continuing dilemma over consideration and discussion of immature vs. mature and illegitimate vs. legitimate proposals continued. We have been most strongly urged by PCOM chairmen to abandon our consideration of immature and illegitimate proposals and review only those which are submitted through formal JOIDES channels and are judged to be mature. The chairman reported that proponents are generally following our requests made as early as March 1984 to submit their proposals through formal JOIDES channels and that no more illegitimate proposals will be logged in. The consensus was, however, that in view of the very considerable interest, the flood of proposals we have and are continuing to receive, the short time-lag since the formation of our panel and announcement of plans to drill in the Indian Ocean, and the time-lead we still have for final site selection, we should continue to consider at this meeting all good science input whether or not it is reporesented by "mature" proposals. Following this meeting, however, the chairman is directed to send a form letter to all proponents who have submitted proposals informaing them that while we may have considered their proposals in immature form at this meeting, we will not continue to do so at our next meeting. All proposals must be submitted through formal JOIDES channels in a mature form or we will not continue to discuss them at our next meeting, to be held in the spring of 1985.

General discussion of our strategy in considering proposals was considered. We have been urged by the PCOM chairman to follow reasonable rules to avoid conflict of interest. Proponents, when members of the panel, may be requested to leave the room during parts of discussions or during parts of voting on priorities, if not conducted by secret ballot. We recognize however, that the mere process of selection of members of regional or thematic panels virtually assures that some conflict of interest problems will arise, and that qualified panel members will have not only interest but also expertise, experience and vested interests in the areas involved.

Consideration of Projects

All proposals which have been recieved to date, reported in Table 3, and all "super proposals" which we had considered in our September meeting (reported in Table 2 of that meeting) were further reviewed, discussed and reevaluated. The discussion especially considered any new input and rating or priorities assigned by the thematic panels. A panel proponent was appointed for discussion of each of these projects to review all of this new input overnight. We must stress here that new proposals were received even until the last day of our three day meeting, and that panel members did not have sufficient time to review all of this material before the discussion and subsequent voting.

Following the discussion of these proposals, "super proposals", and projects, a list of 21 highest priority "projects" was agreed upon for voting. This voting occurred as first item on the agenda for the third day of our meeting, 12 December 1984. The procedure to which we agreed was that each panel member filled out a secret ballot, evaluating his or her opinion of the scientific merit of each of the projects, on a scale of 0 to 10, 10 being the highest. We each attempted to make our individual means as close to 5 as possible. We then agreed to rank the projects in priority order by mean scores and also report the range of values.

Results of this voting, with score and order of priority, the project title, the individual proposals from Table 3 considered, the relative ratings put on these projects by the thematic panels, our IOP panel "watch dog", our evaluation of survey status, and time estimate are summarized in Table 4. Footnotes accompanying the table should be self explanatory. This listing includes only the projects which the panel agreed by consensus to rank as our top priority projects. Other projects, covering essentially all proposal input listed in Table 1, were also discussed during the second day of our meeting, but were eliminated as not being in our top priority list.

We do not assume much precision in our scores and ranking in this list, but we do assume that it represents a fair estimate of our relative priorities at the present time. The scores furthermore suggest that the "projects" we have considered at the present time fall into about six groups. Our lowest priority group includes the projects we discussed, but did not put into this ranking of 21 projects for voting.

The top group, number I, includes the Kerguelen project and our "Neogene Package". The former includes both tectonic aspects (basement type and age) and paleoceanography. The Neogene Package includes a suite of stratigraphic and paleoclimatologic objectives, including the history of monsoonal circulation, relation to uplift of the Himalayas, correlation with the tephrochronology of east African hominid sites, and correlation with the stratigraphy and vertebrate evolution record in the Siwaliks.

The second group includes Projects 3 through 10B, with scores of 7.00 to 6.00. The third group has scores ranging from 5.27 to 4.82, the fourth includes two projects scored at 3.82 and 3.36; and the fifth has scores of 2.09 and lower. We consider all of these to be valid and worthwhile projects, and still rank them above the many good projects we did not include in the voting.

The priority rankings may change as we receive additional input, especially from the thematic panels.

The 21 projects in Table 4 are described briefly in the Appendix. Approximate locations are shown in Fig.2.

Although the projects in Table 4 were discussed individually and generally in a regional context, they constitute several distinct, thematic objectives. In some cases the objectives could be accomplished by drilling only one of the areas in the suite, but in other cases an entire suite of problems should be drilled to accomplish the overall objective. A principle example of the latter is the relationship between the "aseismic" ridges and plateaus in the eastern Indian Ocean. By one published model (Morgan 1981) a single hot spot formed the conjugate and then attached Naturaliste-Broken Ridge and Kerguelen-Gaussberg Ridge, then the Ninetyeast Ridge from north to south, and subsequently re-emerged beneath Kerguelen and Heard Islands. This hypothesis may be testable by petrology and geochemistry of basement rocks. A secondary very important objective of this entire suite of aseismic ridges and plateaus is an essentially continuous, N-S transect from 10° N to the Antarctic continent by addition of the Project 8 transect of the SE Indian Ridge between Kerguelen and Broken Ridges. Thus Projects 1, 5,8, and 9 constitute a high priority package.

Other Business

The chairman was given advice by various panel members on how to present the IOP report and recommendations to PCOM in January 1985 and what should be included in the requested one-page summary of our minutes and recommendations.

A motion was made, seconded and passed unanimously: to endorse a proposal being submitted by Sclater and Schlich for NSF funding to compile all magnetics in the Indian Ocean. Work will be done at Texas, L-DGO, and in France.

Further endorsement by consensus was given to the panel request to PCOM to appoint Duncan as a member of our panel because of our high priorities on the problem of hot spot traces and "aseismic" ridges and plateaus in the Indian Ocean.

IOP again requests that PCOM appoint a Red Sea working group, with suggested membership as follows:

Cochran, Chairman	Arthur, SOHP
Coleman, USGS	Whitmarsh, Britain
Bäcker, Preussag	Miller, Exxon
Pautot, France	Ewing, TECP

one member from LITHP

The next panel meeting is scheduled to be 26-28 June in Bremerhaven at the time the drill ship will be in port. As an alternative, however, in case the chairman and PCOM liaison believe that there is urgency for a meeting to be held sooner, a schedule is tentatively set up for a meeting at Lamont on 17-19 April. If our next meeting will be held in Lamont, then we would plan to hold our subsequent meeting in August in Stavenger, Norway, to see the drill ship at that time.

APPENDIX

1. Kerguelen-Heard Plateau

Kerguelen Plateau extends in a NW-SE direction from about 46° S and 60° E to 63° S and 90° E. Although it is the world's largest mid-ocean plateau, little is known of its structure or origin.

The plateau can be divided structurally into two distinct areas: the southern and northern domains. A volcanic origin has been suggested for the northern part and possibly a continental origin for the southern part.

Alternative models of origin include a rifted hot spot trace and a rifted mid-ocean volcanic excrescence. Seismic multichannel reflection data obtained in the northern part of the plateau have shown thick sedimentary sequences reaching 3,000m. The oldest sediments cored are of Albian age.

Drilling on the Kerguelen Plateau (5 sites in the northern domain and 6 to 8 sites in the southern domain) will provide definite data to answer the question of nature and age of the basement underlying the plateau and will help to unravel the tectonic history of the plateau: subsidence, age of earliest rifting, relationship to Antarctic-Australian separation, etc. Drilling on this feature will also provide a unique record of the development, long-term northward migration and short-term fluctuations, of the Polar Front and the history of ice rafted debris.

2. Monsoons, Mountains, Milankovich, and Early Man

The development of the Indian Ocean monsson, driven by the uplift of the Himalayas, is an important component of the global trend toward climatic deterioration during the Neogene. Mammalism evolution, including the evolution of hominids, has been strongly affected by this climatic change. We propose to investigate four related aspects of this problem: 1) the evolution of monsoonal upwelling from two continuously cored HPC sites (300m) on the Owen Ridge, 2) the history of anoxic sediments from a transect of HPC holes across the O_2 minimum on the Oman margin, 3) the long-term evolution of the distal Indus fan in response to climatic change and the uplift of the Himalayas (two HPC sites), and 4) the deep-sea record complimentary to the East-African rift sequenses in order to provide a framework of tephrochronology, palynology and climatic change for studies on hominid evolution (one site in the Gulf of Aden and one in the Somali Basin).

3. Argo Abyssal Plain

This is a remnant of the Tethys superocean adjacent to one of the world's oldest starved passive continental margins. The site will provide Mesozoic/Cenozoic paleoceanography and paleobiogeography, date anomaly M-25, and provide a distal record of margin sedimentation and evolution.

4. Red Sea

The Red Sea represents a unique opportunity to study the very early stages of margin evolution and the initiation of seafloor spreading. The wide range, compl ity and inter-relationship of the problems that can be addressed in the Red Sea have led the panel to recommend the formation of a working group.

The Red Sea can be divided into three sections which appear to illustrate different stages in the development of a new ocean basin and continental margin. The southern Red Sea between 15° N and 21° N is characterized by a well-developed "axial trough" less than 50 km wide consisting of young oceanic crust. The nature of the crust underlying the shallower "main trough" is less clear because of the extremely thick sediment sequence. The axial trough becomes discontinuous about 21° N and the central part of the Red Sea is occupied by a sequence of deeps, quite often containing hot brine pools, alternating with shallower inter trough zones. The deeps are very similar to the axial trough in appearance, with steep sides, a rough basaltic bottom and large magnetic anomalies. In contrast, the inter trough zones are shallower, with gently sloping sides, no magnetic anomalies and the Miocene evaporites appear continuous across those regions.

An axial trough is not present north of 24° N, the northern limit of the large well-developed deeps, and there is no morphologically or geophysically identified feature that can be interpreted as a localized mid-ocean ridge spreading center. There is a series of deeps, which extend to the northern end, but they are shallower and less well-developed than those to the south.

The panel has received five separate proposals for drilling in the Red Sea and expects a revised proposal from the French group within a few months. A feature common to all of the proposals is an interest in the northern Red Sea and specifically in the deeps. The various problems proposed to be addressed include:

a) nature of earliest (pre-seafloor spreading and earliest oceanic) basalts and possible changes in composition as the axis develops. This is to be approached by a series of holes in a set of deeps which appear to become younger, smaller and less developed to north;

b) hydrothermal circulation and plumbing of hydrothermal cells: heat flow measurements in Conrad Deep show clear evidence of hydrothermal circulation in the sediments on its bottom;

c) metallogenesis. The deeps are characterized by hot brines and exotic metal deposits. All of the proposals address this question and one is completely devoted to it.

5. <u>Broken Ridge</u>

Broken Ridge and its eastward continuation, Naturaliste Ridge and Plateau, which extend to the southwest corner of Australia, are presumably conjugate to Kerguelen Plateau and Gaussberg Ridge, similarly extending to the Continental Margin of Antartica. Prior to formation of the southeast Indian Ocean Ridge they constituted a single ridge extending westward from the join between Antartica and Australia across pre-existing oceanic crust. Models of origin of these features have suggested a range of possibilities, including that they are underlain by continental crust, that they represent a volcanic pile overlying oceanic crust which formed as an intraoceanic rift system, or that together they constitute the trace of a hot spot. Morgan (1981) suggests that this hot spot subsequently formed the Ninetyeast Ridge and now underlies Kerguelen and Heard Islands.

DSDP 255 previously drilled on the Ridge penetrated only about 100 meters to Santonian-age limestone, with a considerable thickness of unsampled sediments remaining below the bottom of the hole and above basement. Recovery of a complete section will help establish age relationships, subsidence and uplift history of the Ridge, and paleo-oceanography of this part of the Indian Ocean. Drilling Broken Ridge to basement would establish the nature of the crust and with a 2-site transect could establish whether there is a younging to the west as predicted by the hot spot model.

Broken Ridge would constitute one part of a four part package, including Kerguelen, Ninetyeast Ridge, and the Southeast Indian Ridge transect. If Ninetyeast Ridge drilling is also done, the westernmost hole on Broken Ridge would be the southernmost hole on Ninetyeast Ridge.

6. Makran

A transect of seven holes, drilling the abyssal plain, basal thrust, basal slope basin thrusts, and a slope basin further upslope, would give a first opportunity to assess distribution of deformation across an accretionary prism. Previous drilling has been concentrated at the toe. The Makran prism is the place to do this because the structures are simple and well-expressed topographically. Furthermore, drilling conditions will be good - piston cores show lack of sands, and high velocities and lack of debris flows in 3.5 kH_2 records indicate well-consolidated strata in hangingwall anticlines. Targets such as sub-thrust strata and slope basin/hangingwall fold relationships can be reached above the gas hydrate layer. Finally, the drilled Plio-Quaternary record of the prism can be married with an excellently-exposed Plio-Quarternary record on the onland part of the prism: a unique opportunity.

7. Chagos-Laccadive Ridge and Mascarene Plateau

An equatorial bathymetric transect of HPC drill sites will provide a history of Neogene surface productivity and vertical dissolution gradients. High resolution bio- and magnetochronology can be used for timeseries analyses of the late Neogene variability in these climatically driven parameters. The addition of drill sites to the N and S. and the recovery of basement rocks on this aseismic ridge would determine its origin (hot spot or "leaky" transform fault?). Geochemical characteristics and radiometric dating of basement rocks would allow us to differentiate between the two modes of formation and document the transition from flood basalts in the Deccan to the discrete oceanic volcanoes at Reunion and Mauritius. Combined with paleomagnetic measurements of basalts and overlying sediments details of the true polar wander path throughout Tertiary time could be examined. New radiometric calibration points for the Cenozoic bio- and magnetostratigraphic time scales can be expected.

8. Southeast Indian Ridge Transect

We propose drilling a transect of multi-objective sites on the flanks of the Southeast Indian Ridge located so that the sites cross the subtropical convergence and Antarctic Polar Front. These fronts are best sampled in the southern Indian Ocean. The sites will record Neogene evolution of these oceanographic boundaries and faunas will provide detailed information on climatic fluctuations in these latitudes.

In addition to the paleoceanographic objectives, this transect of sites will provide appropriate sediments for the determination of historical hydrothermal activity along a moderate-rate spreading ridge, which is critical for long-term geochemical budget-balance studies. These results would be compared with those from DSDP Leg 92 across the southern East Pacific Rise to investigate the role spreading rate plays with hydrothermal flux. And finally, sampling of the basement will allow assessment of time variations of upper mantle geochemical homogeneities recorded in oceanic crust along plate motion flow lines away from two hot spots: Kerguelen and Amsterdam.

The Southeast Indian Ridge Transect should consist of at least three holes in addition to the northern Kerguelen Plateau. Each of these sites should be double-cored with an HPC/XCB. Penetration would be about 600 m of sediment and at least 50-100 m of basement. One hole at each of these two sites should be logged. Regional site surveys available in the area are sufficient; a site-specific survey will be necessary before actual drilling targets can be identified.

9. Ninetyeast Ridge

Ninetyeast Ridge is the longest "aseismic" ridge in the world, extending from at least 17° N, beneath the Bengal Fan, to over 30° S at the intersection with Broken Ridge. Previous drilling during DSDP established a probable trend in age from old at the north to young at the south and a hot spot model origin. Most models now suggest that it was formed by the hot spot which now underlies Kerguelen and Heard Islands. Some models suggest that this hot spot also formed the Rajmahal traps of the Bengal Basin of India, while another model suggests that that hot spot formed the formally adjacent conjugate ridges of Broken Ridge and Kerguelen Plateau.

This proposal is part of a four proposal package to understand the complex hot spot traces in the eastern Indian Ocean and also to establish a continuous N-S paleoceanographic transect from 10° N to the Antarctic margin.

Although several sites were drilled on Ninetyeast Ridge in 1972, none of them were adequately cored and basement recovery was minimal. Rather than diluting our efforts by proposing partial solution to another probable hot spot trace in the Indian Ocean, namely the Chagos-Laccadive-Mascarene Ridge, we propose giving high priority to completing the job only half done, of understanding the Ninetyeast Ridge and utilizing its high relief for paleoceanographic purposes.

We propose drilling a transect of perhaps as many as six single bit sites on the Ninetyeast Ridge with complete coring of the sediment section and maximum possible recovery of basement, and a short east-west transect from deep water to the crest of the Ridge to evaluate depth relations in the carbonate sediments.

9A. Northern Somali Basin

The Northern Somali Basin appears as a distinctive sub-basin in the Western Indian Ocean both on bathymetry and Seasat-derived free air gravity maps. There are unusually sharp offsets of approximately 0.5 seconds (located between 8.0 and 9.0 s two-way travel time) which appear on several seismic profiles in the area, which may indicate a "basin within a basin" structure. Additionally, the basin displays an unusually low free air gravity field and is surrounded by steep gravity gradients representing tectonic boundaries.

The age of the basement is uncertain, but the recent discovery of Mesozoic magnetic anomalies to the south of the basin and the presence of Triassic-Early Jurassic marine shales and sanstones sampled by drilling in the Ambilobe Basin of northeastern Madagascar support at least a Mesozoic age for the N. Somali Basin. Kent (1982) noted that marine transgression commenced in northern Madagascar in Permian time, and by the Middle Jurassic marine conditions persisted along the entire east coast of Africa, and the north and west coasts of Madagascar. This indicates that the transgression proceeded southward from the Northern Somali Basin. If so, the basin was a southern arm of Tethys, perhaps as old as Permian and in all liklihood no younger than Middle Jurassic.

The basin may contain the oldest <u>in situ</u> ocean crust, and drilling will address the possible relationship among the anomalously low gravity field, the age of the basin and the composition of the igneous crust. Additionally, the stratigraphy of southern Tethys should be preserved the the deep basin. World-wide phenomena such as the Mesozoic anoxic events and the terminal Cretaceous event should also be recorded in the sediments. Finally, Mesozoic magnetic stratigraphy should be preserved in the deeper portions of the basin where resedimentation is not a factor.

A single deep (1500-2000 m) hole with basement objectives will be located in the deep side of the basement offset in order to obtain as complete a Tethyan stratigraphy and magnetostratigraphy as possible. A site-specific survey will be necessary to provide a better regional context and to aid in avoiding unconformaties in the area.

10B. Central Indian Ocean Basin and Lower Bengal Fan

A remarkable example of intraplate deformation is found in the central Indian Ocean Basin south of India in the lower part of the Bengal Deep-Sea Fan. Oceanic crust and overlying sediments are deformed into long wave length (about 200 km) undulations and are disrupted by closely-spaced (about 5-10 km) faults showing reverse sense of motion. Gravity anomalies suggest that the surface of oceanic MOHO is deformed into undulations similar to those observed in the surface of the crust. This is also the site of intraplate earthquakes, whose foci lie beneath the oceanic crust, and of abnormally high heat flow suggestive of upward flow of water. The style deformation and focal mechanisms suggest that the Indo-Australian plate is deforming under N-S compression, probably dating from late Miocene time, as determined from a regional unconformity probably of that age correlated from earlier DSDP drilling farther to the north in the Bengal Fan.

Several important aspects of the nature and history of these phenomena can be resolved only by means of drilling. Specific objectives include determination of age of onset of the deformation and subsequent history of movement of individual fault blocks, and an understanding of the relationship of the fault zones to the upward water flow. Drilling in this part of the lower Bengal Fan can also help to resolve some questions about the tectonic history of uplift of the Himalayas and deposition of the fan.

The chronology of seismic stratigraphy throughout the Bengal Fan has been based largely on correlation of two regional unconformities throughout the entire Fan. The upper, preliminarily judged to be of late Miocene age from DSDP 218, occurs in these lower fan deformational hills, but can also be found farther to the north in the central part of the fan over the 85° E Ridge and along the flanks of the Ninetyeast Ridge. The lower unconformity, judged in a very tenuous way from DSDP 217 to be Paleocene-Eocene in age, occurs primarily along the flanks of the Ninetyeast Ridge and would also appear to represent some kind of intraplate deformation. Both unconformities appear to bear a possible relationship to tectonic events in the Himalayas related to the collision and uplift history.

About five to six sites are proposed, largely around the abyssal hills representing the upper Miocene unconformity and intraplate deformation. Age of the unconformity can be precisely delineated from drilling on the "back sides" of rotated fault blocks, while the problem of fluid flow may be resovable from drilling through the faults on the front sides of the hills. Careful selection of sites, plus a possible additional supplementary site along the flank of the Ninetyeast, may also help to resolve some problems of the tectonics of the Himalayas, and possibly also depositional processes of deep-sea fans.

12. Western South Australia and the Australian-Antactic Discordance

Formation of the Passive Continental Margin south of Australia and its conjugate on the Antarctic Margin occured as a final stage of fragmentation of the Gondwana Supercontinent. This margin is especially characterized geophysically by a broad magnetic quiet zone which extends along the margin of Australia for more than 2,000 km. Talwani et al. (1979) measured crustal columns, and suggested that the magnetic quiet zone was the floor of a deeply subsided Mesozoic intra-continental rift basin that developed prior to the commencement of sea floor spreading between Australia and the Antarctic. Some crustal columns suggest oceanic basement while other suggest thinned continental crust.

Breakup of this margin is now believed to have been at approximately anomaly 34, but sea floor spreading was extremely slow until about anomaly 19.

Two sites are proposed off the Australian Margin, one in the oldest part of the magnetic anomaly sequence to provide a minimum age for the inception of sea floor spreading, the second hole would be located on the seaward edge of the magnetic quiet zone where sedimentary cover is relatively thin and the character of the basement could be determined.

We propose that this two-hole transect be combined with examination of the Australian-Antarctic discordance, a prominent bathymetric low in the ocean ridge system. The AAD contains a high density of fracture zones and is bounded by two transform faults of large offset. Morphology of the ridge axis is symetrical about the AAD with a depth anomaly of up to 1,000 meters. Thus, the AAD appears to be a "cold spot".

Dredge samples suggest three important observations. First, basalts from the AAD are geochemically distinct from basalts from the ridge segments to the west and east. Second, basalts from the AAD have geochemical signatures similar to basalts from bathymetric highs over hot spots. And third, samples from the dredge closest to the propogating rift tip in the ridge segment to the east of the AAD show a different type of chemical anomaly than that observed near the propogating rift tips in the eastern Pacific.

Several questions of fundamental importance to the composition of the ocean crust, mantle heterogeneity and mantle dynamics can be addressed by drilling single bit holes in old crust formed in the southeast Indian Ridge. These sites could be important lithosphere sites to study a feature which is absolutely unique to this ocean.

13. <u>Agulhas Plateau</u>

Located strategically between the South Atlantic and the Indian Ocean, the Agulhas Plateau is draped by carbonate sediments of Mesozoic to Recent age at a relatively high southern latitude. Recovery of these sediments will allow reconstruction of the development of water exchange between the Cretaceous Indian Ocean and the nascent South Atlantic. The recovery of a Cenozoic HPC record from the plateau will provide a paleoclimatic cooling history of high mid-latitudes at the intersection of the tropical Agulhas Current and the cool Westwind Drift in a unique and latitudinally stationary setting. The area will provide the southernmost carbonate record obtainable for the Atlantic paleoclimatic transect.

Drilling the proposed hole into basement will establish the nature and the age of the underlying crust which is inferred to be of mixed oceanic and continental origin. The unknown tectonic subsidence history of the Agulhas Plateau will be reconstructed from the overlying sediment record.

14. <u>Eastern South Australian Passive Margin</u>

The southern Australian continental margin is one of the world's classic rifted passive margins. It also has very special characteristics which make it of unique importance in the study of general passive margin evolution. The structure and seismic stratigraphy of the margin from shelf to continent/ocean boundary is fairly well known. Industry data is available from the nearshore and onshore regions. Initial spreading rates from 90 mybp to 45 mybp were apparently very slow with subsidence dominated by a planer faulting. New research cruises are funded and scheduled by BMR-Australia and BGR-Germany during 1985. The four proposed sites would sample both pre and postbreakup sediments, look at sedimentation and subsidence through rifting and breakup and provide key data on sea level calibration. This margin is also on a rift-transform intersection where kinematics are fairly clear.

15A. Exmouth Plateau

The passive continental margin of the Eastern Indian Ocean is both very old (Jurassic) and sediment starved. It is also dominated by a unique and well established continental crustal feature - the Exmouth Plateau - which has subsided from shallow to bathyal water depths since breakup. The inner plateau and adjacent shelf of N.W. Australia have high quality industry well and seismic data available to augment ODP drilling on the outer plateau. Completion of an Exmouth Plateau/N.W. shelf transect will provide unique data on margin sedimentation and sealevel, subsidence and structural evolution, as well as thermal history for a long time after breakup. Both pre-rift and post-rift sediments are accessible to ODP drilling. The area is subject to a funded, joint and scheduled Lamont-Doherty/BMR-Australia research effort which will provide site data.

15B. Fossil Ridges

Several fossil ridges have been identified in the Indian Ocean. The western Somali Basin fossil ridge corresponds to an early Cretaceous (anamoly M-0) extinct spreading center. The Mascarene Basin fossil ridge corresponds to a Paleocene (anomaly 27) extinct spreading center. The Wharton Basin fossil ridge corresponds to an Eocene (anomaly 19) extinct spreading center. The spreading half rate of these fossil ridges are respectively 2 cm/yr for the smaller basin, 9 cm/yr for the Mascarene Basin and 5 cm/yr for the Wharton Basin. The extinct spreading centers correspond to clear topographic features which can be observed in several places along the fossil ridge crest which are covered by a thin sedimentary sequence.

Drilling at two different fossil spreading centers (Mascarene and Wharton Basins) will provide new and original data about processes of magma generation of dying spreading centers and will allow investigation of the characteristics of magma chambers in terms of age and spreading rates.

Two sites are proposed on each of these two fossil ridges, one on the axis and the second on either flank of the ridge. Penetration should be of the order of 100 m into the underlying basalt.

17. Sunda Arc

The Sunda Arc is one of the classic arc-trench systems in which all the tectonic elements are well expressed. A well-developed trench is backed by a series of accretionary ridges forming the outer-arc ridge, on which is exposed in a series of islands. The large forearc basin has been very extensively surveyed and drilled during the search of hydrocarbons. The region has been studied thoroughly during SEATAR transect studies off Sumatra and Java.

This arc is especially interesting for the variations around its length. Subduction is normal to the trench axis off Java at a rate of about 7 cm/yr. It is oblique off Sumatra and highly oblique farther to the west, off the Andaman and Nicobar Islands, with only a component of subduction normal to the trench axis of about 1 cm/yr. Similarly, sediment thickness on the subducting plate varies from several kilometers of sediment in the west to a few hundred meters off Java. Intensity of deformation varies from extremely intense off Java with no continuity of reflectors showing internal structure of the accretionary prism,to some continuity and folding off Sumatra,to gentle folds off the Andaman Islands similar to those exposed so well off the Makran.

A drilling program is proposed for understanding of subduction-accretion processes on the lower trench slope off Sumatra and Java. A principal objective would be to investigate the interaction of structural fabric and sedimentation on the trench slope and to quantify gradients in structural, physical and mechanical properties across the trench slope and downward from slope sediments into accreted trench sediments.

Another intriguing aspect of the Sunda Trench is the probable extension of the accretionary prism where the Sumatran Fault System passes out to sea at the Sunda Strait. It has been suggested that the Strait is a consequence of the north-westward motion of the southwestern Sumatra block (Andaman Plate). By this hypothesis the accretionary prism in front of the Strait would be submitted to north-south compression due to subduction and east-west extension. Scheduled French surveying will further evaluate this feature for the possibility of later proposal for drilling.

18. Rodriguez Triple Junction

The Rodriguez Triple Junction (25°30' S, 70° E) corresponds to the junction of three active ridges with different spreading rates. Drilling at this RRR junction offers the possibility of investigating processes of magma generation, mantle heterogeneities and crustal structure.

The Southeast Indian Ridge (SEIR) close to the triple junction, is a typical medium rate spreading ridge (2.95 cm/yr half rate). The rift valley is well delineated by the 3250 m isobath and is about 14 km wide. The Central Indian Ridge (CIR) aligns with the SEIR rift valley with a slight change of orientation. It is characterized by a greater depth (4000 m) and a smaller width (5 km). The spreading half rate is 2.73 cm/yr. In contast, the Southwest Indian Ridge (SWIR) is expressed by a deep canyon (5000 m) which abuts the southwestern flank of the SEIR and CIR. Interpretation indicates a slight instability of the geometrical configuration of the junction and a 5 km jump of the SEIR toward the northwest 0.5 m.y. ago. Close to the triple junction the SWIR may correspond to a stretched area within the southwest flanks of the SEIR and CIR.

Drilling at the three ridge axes will establish the origin and evolution of the erupted basalt, constrain the nature of the underlying mantle and the characteristics of the corresponding magma chamber and allow testing various geological and petrological models for three related spreading centers.

Three deep sites (300 to 500 m) are grouped close to the triple junction. The reference site is on the medium rate spreading SEIR. The second site is on the CIR which shows, compared to the SEIR, significant morphological differences. The third site is located in the SWIR canyon where the nature of the junction remains uncertain. The geographic location of these sites presents optimal conditions with respect to weather and distance to port.

19. The Davie Fracture Zone

An east-west transect of sites across the Davie Fracture Zone is proposed to examine the evolution of a sheared passive margin and also allows the nature of a rejuvenated Mesozoic fracture zone to be addressed. The Davie Fracture Zone formed during the separation of Madagascar from Africa between 165 and 130 Ma and is the site of current seismic activity. This drilling program proposes to test the concept of reactivation of "zones of weakness" in oceanic crust as well as addressing the tectonic and stratigraphic problems in the development of a sheared passive margin.

Two sites are proposed on the crest of the Davie Fracture Zone and on the Davie Fracture Zone secondary ridge to obtain stratigraphic records of ridge subsidence and rejuvenation as well as determining the nature of the crust. Downhole seismometers will be emplaced in holes to monitor seismic activity. One site will be drilled in the Comoros Bsin to provide control for the stratigraphic sections recovered in the other two holes. In addition, this hole is likely to recover a Mesozoic Tethyan section and will provide much needed constraints on the age of the crust in the basin.

20. Wallaby Plateau

The Wallaby Plateau and Saddle form a geographically compact area in which to address many of the basic questions concerning passive margin development characterized by exessive volcanism. It has been suggested that the plateau itself is a volcanic build-up (an epilith) similar to Iceland; the adjacent saddle, which separates the plateau from the west Australian continental shelf, is underlain by wedges of seaward dipping reflectors similar to those described beneath several of the world's continental margins. It has been recently suggested that they represent layered volcanics formed in a subareal evironment during rifting or the early stage of formation of oceanic crust. Drilling of three sites could attack and potentially solve some of these important problems.

21. Eastern Gulf of Aden

Drilling of one site is proposed through approximately 500 meters of sediment just outside of the Gulf of Aden, west of the Owen fracture zone in the "magnetic quiet zone" to the south of the ocean basin and north of 10myBP lithosphere of the Sheba Ridge. The purpose is to examine the early stages of the opening of the Gulf of Aden. During initiation of sea floor spreading at the Sheba Ridge old oceanic lithosphere was rifted. The similarities of features in the easternmost Gulf of Aden with those at rifted continental margins leads to the suggestion that the old oceanic lithosphere has been thinned during the opening of the Gulf by processes similar to those occuring during continental rifting rather than those during ridge crest jumps. We propose to test this hypothesis by drilling in the "quiet zone".

Table 1

OCEAN DRILLING PROGRAM
OPERATIONS SCHEDULE
1985-1986

	LEG	DEPARTS LOCATION	DATE	TRANSIT DAYS	OPERATIONAL DAYS	ARRIVES AT DESTINATION	DATE	IN PORT
BAHAMAS	101	Ft. Lauderdale, Florida	22 Jan	0.5	41	Ft. Lauderdale Florida	4 Mar	Feb 16-20
ENA3-418	102	Ft. Lauderdale, Florida	11 Mar	6	41	Norfolk, Virginia	25 Apr	Apr 9-13
GALICIA M.	103	Norfolk, Virginia	1 May	15	42	Bremerhaven, Germany	26 June	June 10-16
LABRADOR-BAFFIN BAY	104	Bremerhaven, Germany	3 July	6	41	Stavanger, Norway	19 Aug	Aug 4-8
NORWEGIAN S	105	Stavanger, Norway	25 Aug	16	42	St. Johns, Newfoundland	21 Oct	Oct 6-10
MARK I	106	St. Johns, Newfoundland	27 Oct	15	42	Malaga, Spain	23 Dec	Dec 8-12
MEDITERRANEAN	107	Malaga, Spain	29 Dec	4	42	Marseilles, France	11 Feb	Jan 27-Feb 1
N. AFRICA M.	108	Marseilles, France	18 Feb	6	43	Las Palmas, Canary Islands	07 Apr	March 23-27
MARK 2	109	Las Palmas, Canary Islands	13 Apr	11	42	Barbados, West INdies	4 June	May 20-24
BARBADOS N.	110	Barbados, West Indies	10 June	8	42	Panama	29 July	July 14-18
EPR 10-13°N	111	Panama	4 Aug	16	42	Callao, Peru	30 Sept	Sept 15-19
PERU-CHILE T	112	Callao, Peru	6 Oct	5	42	Valparaiso, Chile	22 Nov	Nov 7-12
CHILE 3 JCT	113	Valparaiso, Chile	29 Nov	11	43	Punta Arenas, Chile	20 Jan 1987	Jan
WEDDELL S.	114	Punta Arenas	26 Jan	5	--	------------	------	----

Table 2

ODP SITE SURVEY STANDARDS

ENVIRONMENTS

X = vital

(X) = desirable

(X)* = desirable, but may be required in some cases (e.g. bottom simulating reflectors)

TECHNIQUES	A PELAGIC (shallow penetration)	B SMALL BASIN/OPEN OCEAN (shallow penetration) subject to debris flow	C PASSIVE MARGIN single bit	D reentry	E FORE-ARC WEDGE	F SPREADING RIDGE zero or thin sediment cover	G OCEAN CRUST thick sediment cover	H HIGH TEMPERATURE ENVIRONMENT
1. Air Gun SCS	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
2. Water Gun SCS (or other high resolution system)	X	X	X	(X)	X		X or 5	X or
3. 3.5 KHz.	X	X	X	(X)	(X)		(X)	
4. Chirp Sonar	(X)					(X)		
5. MCS		(X)	X	X	X		X or 2	X or
6. Seismic Velocity Determinations			X	X	X	X	X	
7. Side Scan Sonar	(X)	X	(X)or (8)	(X)or (8)	(X)or(8)			
8. Seabeam Bathymetry	(X)		(X)or (7)	(X)or (7)	(X)or(7)	X		
9. Piston Cores	X	X	(X)*	(X)	(X)	(X)	(X)	X
10. Heat Flow			(X)*	(X)*	(X)*	(X)*	(X)	X
11. Magnetics/Gravity			(X)	(X)		X	X	X
12. Dredging and/or Bare Rock Drilling						X		
13. Photography (e.g. ANGUS)						X		(X)
14. Submersible						(X)		(X)
15. Current Meter (for bottom shear)			(X)*	(X)*	(X)			

TABLE 3: Proposals or Letters of Intent Received by ODP Indian Ocean Regional Panel

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, Recommendations, Action, Comments, etc.
~~1~~	19 March 84	J. Cochran	Memo	Priorities, guidelines, cont. margins, Makran, Red Sea, Cent. Ind. Basin, etc.	Superseded & removed. #52, #49, etc.
~~2~~	"	Curray, Thurston, Mackenzie, Mahoney	Broken Ridge	Basement, stratigraphy, geological history, paleoceanography	Superseded & removed. (#49)
~~3~~	"	C. Stein	African-Arabian Continental Margin	Cont. margin and adjacent oceanic lithosphere	Superseded by #42 + removed
~~4~~	"	M. Coffin	Potential ODP sites in western Ind. Oc.	Long list: cont. margins, ridges, basins, etc.	Superseded and removed.
~~5~~	"	H. Oberhänsli	Suggestions	Paleoceanography + biogeography latest Mesozoic + Cenozoic	Superseded & removed #53
~~6~~	"	von Rad & Hinz	Tentative ideas	S. China Sea, Banda/Arafura, N.W. Australia, S. Austr., W. Ind. margin, etc.	Wish list, and replaced by # 63
7	"	P. Guennoc	Red Sea	Red Sea	Also in Dec 83 IPOD France Scientific Committee Program p. 291
8	19 March 84 + 22 Aug 84	J. Leggett [+ R. White]	The Makran Fore-Arc, Pakistan	Tectonics of accretion	
~~9~~	19 Mar 84	J. Weissel	Intraplate Deformation, Central Ind. Oc.	Intraplate deformation	Superseded by # 44
10	"	G. Peltzer, P. Tapponier, G. Jacquart	Andaman Sea	Andaman Sea tectonics	

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, Recommendations, Action, Comments, etc.
11	19 Mar 84	P. Huchon	Sunda Strait	tectonics	
12	" 15 May 84	D. Falvey Willcox + Symonds	Suggested ocean drilling Detailed supplement.	Exmouth Pl., Wallaby Pl., S. Austr. margin, W. Tasmania	Supplemented by #63 but not replaced
13	17 Apr. 84 3 Sept 84	R. Scrutton "	Letter proposal — Supplement	Somali Basin, crustal ages, paleoposition of Madagascar	
~~14~~	17 Apr. 84	G. deVries Klein	Letter proposal	Bengal + Indus Fans, relation to uplift of Himalayas	Superseded by # 33
15	25 May 84	R. Girdler	Gulf of Aden	Tectonics, geol. history	
16	31 Aug 84	Zierenberg	Atlantis II Deep, Red Sea	Mainly hydrothermal	Replace by 76
17	21 Aug 84	Luyendyk	Letter proposal	Madagascar, Somali B., N.W. Austr., Ninetyeast Ridge	
18	20 Aug 84	Haq	Letter proposal	Indus Fan	
19	16 Aug 84	Y. Mart	Seychelles Bank + Amirante Trough	Tectonics, sed. hist.	
20	20 Aug 84	Kolla	Indus Fan	Seds, fan processes, uplift of Himalayas, etc.	

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
21	24 Aug 84	Coffin + Channell	Tethyan stratigraphy and ancient crust, Ind. Ocean	N. Somali Basin	
22	7 Aug 84	Wannesson	Site Forms	Antarctic Margin off Adelie Coast, S.E. Ind. Oc.	
23	13 Aug 84	Bonatti, Ross	L-1, in NSF-ODP Workshop	Crustal evolution of the Red Sea	
24	"	Natland	L-2 "	Petrologic changes due to changes in spreading rate and ridge-crest circ'n.	
25	"	Duncan	L-3 "	Geochemical heterogeneity of an aseismic ridge	
26	"	Dick, Natland	L-4 "	Mantle geochemistry and fracture zone tectonics	
27	"	Duncan	L-5 "	Mantle heterogeneity at the SE Indian Ridge	
28	"	Langmuir	L-6 "	Evolution of chemical discontinuities in the ocean crust	
29	"	Brocher	L-7 "	Crozet seismic observatory	
30	"	Prell	S-1 "	Evolution of Indian Ocean monsoon	
31	"	Prell	S-2 "	Neogene anoxic and upwelling sediments	

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Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
32	13 Aug 84	Cullen, Prell	S-3, in NSF-ODP Workshop	History of monsoon run off and salinity	
33	"	Curray, Klein	S-4 "	Evolution of deep-sea fans and Himalayan uplift	
34	"	Peterson	S-5 "	Variation of Neogene carbonate compensation	
35	"	Rea	S-6 "	Variation of Cenozoic atmospheric circulation	
36	"	Coulbourn	S-7 "	History of gyral circulation	
37	"	Hayes, Lazarus	S-8 "	Neogene evolution of mid-high latitude oceanic fronts	
38	"	Owen, Rea	S-9 "	Hydrothermal sediments	
~~39~~	"	Coffin, Matthias	T-1 "	Transform passive margins of Mozambique and Madagascar	Replaced by #69
40	"	Coffin	T-2 "	Rifted passive margins of Madagascar and East Africa	
41	"	Matthias	T-3 "	Somali Basin	
~~42~~	"	Stein	T-4 "	Early opening of the Gulf of Aden	Replaces # 3 Replaced by # 70

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
43	13 Aug 84	Heintzler	T-5, in NSF-ODP workshop	Northwest Indian Ocean	
44	"	Weissel, Stein, Forsyth, Anderson	T-6 "	Intraplate deformation in the central Indian Ocean	Replaces #9
45	"	Curray, Duncan	T-7 "	Ninetyeast Ridge	
~~46~~	"	Karig, Moore	T-8 "	Deformation of the Sunda Trench Forearc	Superseded by #66
~~47~~	"	Karig	T-9 "	Arc-continent collision	Superseded by #66
48	"	Cande, Mutter	T-10 "	Southern Australian margin	
49	"	Curray, Thierstein, Mackenzie, Mahoney	T-11 "	Broken Ridge	Replaces #2
50	"	Forsyth	T-12 "	Stress in oceanic lithosphere: SE Indian Ridge	
51	5 Sept 84	R. Kidd	Suggestions for Ocean Drilling in the Indian Ocean	Indus Fan	
52	" 10 Oct 84	Cochran + Hobart	A proposal for ocean drilling in the northern Red Sea	Red Sea Tectonics, seds, basement; Site Forms rec'd.	Replaces #1, in part
53	"	Herb + Oberhänsli	Prelim. proposal for Deep Sea Drilling on the....	Agulhas Plateau + adjacent basins	Replaces #5 in part

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
54	5 Sept 84	Oberhänsli + Herb	Prelim. Ocean Drilling Prop. N-S + E-W transects	Ninetyeast Ridge, paleoceanogr.	Replaces #5, in part.
55	"	Inst. de Physique du Globe de Strasbourg	ODP Site Proposal Forms	Rodriguez Triple Junction SE Indian Ridge Axis SW Indian Ridge Axis	
56	"	Pautot	ODP Site Forms and data	Red Sea	
57	"	Inst. Phys du Globe Strasbourg	Oceanic Plateaus	Kerguelen-Heard Plateau	
58	"	Lab. de Geol. du Mus. Nat. d'Hist. Nat.-LeClerc	Kerguelen-Gaussberg	Kerguelen-Gaussberg Plateau	
59	"	"	Crozet? - Enderby Basins		
60	"	"	Wharton Basin		
61	"	"	Central Indian Basin		
62	"	"	Davie Ridge		
~~63~~	7 Sept 84	von Rad + Falvey	Exmouth Pl., Argo A.P. Wallaby Pl.	[Oct 84 Supplement by Gradstein]	Replaces #6, in part by supplements, and #12 Replaced #71

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
64	Dec 83	M. Clocchiatti in IPOD France Scient. Comm. Report.	Deep Sea Drilling Proposals for the Indian Ocean	Davy Ridge, Kerguelen-Heard Pl.	-
~~65~~	April 81	Consortium for Ocean Geosciences	The Future of Scientific Ocean Drilling in the Australasian Region	Report of workshop; booklet, with description of several objectives in Indian Ocean	
66	30 Aug 84	Karig + Moore	Sunda and Banda Arc Drilling: A Study of Convergent Margin Processes	Fore arc, accretionary prism and arc-continent collision	Replaces #46 and #47 A revision
67	4 Sept 84	Jaquet	Ideas/Suggestions	1. Cementation + diagenesis of carb. sands 2. Iron-Manganese Micro-concretions 3. Mixed distal terrig-carbonate clastic deposits 4. Protoglobogerina-like fauna in Jur-L. Cret	
68	20 Nov 84	Kennett, Brown + Howell	Middle-late Cenozoic stratigraphy/chronology and paleoenvironmental history of East Africa: Correlation with hominid evolution sites	HPC + XCB sites close to East Africa	

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
69	5 Dec 84	Coffin, with Bowin, Channell + Scrutton	The Davie Fracture Zone: Reactivating Zone of Weakness	Davie Ridge	Replaces #39
70	5 Dec 84	Stein	Drilling to determine the history of the early opening of the Gulf of Aden resulting from rifting of old oceanic lithosphere	Easternmost Gulf of Aden	Replaces #42
71	6 Dec 84	von Rad, Exon, + Willcox	A proposal for ocean drilling on the Exmouth and Wallaby Plateaus and Argo Abyssal Plain, Eastern Indian Ocean	I	Replaces #63
72	6 Dec 84	Colwell	Kerguelen Plateau		Supplemented by preview report for a survey.... Supersede #65
73	6 Dec 84	Veevers + Branson	Australian-Antarctic Discordance and Depression		Supersede #65
74	6 Dec 84	Branson	Deep Sea Drilling Site Proposals: Northeast Tasmanian Margin		Supersede #65

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
75	10 Dec 84	Schlich	Rodriguez Triple Junction and associated spreading ridges		
76	10 Dec 84	Zierenberg	Proposal for oceanic drilling in the Atlantis II Deep, Red Sea		Replaces #16
77	11 Dec 84	Herb & Oberhänsli	Proposal for Deep Sea Drilling on the Agulhas Plateau and Adjacent Basins, off South Africa		Replaces #53
78	11 Dec 84	Oberhänsli & Herb	Comparative data on... Ninetyeast and... Chagos Laccadive Ridges for paleo-oceanographic purposes....		Supplement to #54

Table 4: IOP PROJECT PRIORITIES 12 December 1984

Group	Rank	Score[1]	Project	Proposals[2]	Thematic Panels[3] T	L	S	Panel watchdog(s)	Survey Status Regional	Site	Time[4]
Group I	1	8.91(7-10)	Kerguelen-Gaussberg: Rifted hotspot trace model and high latitude paleoceanographic transects	57, 68, 72	high	A	1	Schlich Falvey	ok	scheduled	1½ - legs
	2	8.36(2-10)	Neogene Package: Monsoons, mountains, Milankovich, and fossil man	30, 31, 32, 33, 43, 68	—	—	2*	Prell Tauxe	ok	to be proposed	1 leg
Group II	3	7.00(4-10)	Argo Abyssal Plain: old, possibly Tethys, ocean crust.	12, 71	—	—	—*	von Rad Falvey	ok	scheduled	15 da
	4	6.91(2-10)	Red Sea: Initiation of rifting.	7, 23, 52, 56, 76	2	1	low	Cochran	ok	scheduled + to be proposed	1 le
	5	6.73(4-10)	Broken Ridge: Rifted hotspot trace model, conjugate to Kerguelen	49	low	C	4*	Curray	poor	to be proposed	< ½ le
	6	6.65(2-9)	Makran: Distribution of deformation across an accretionary prism	8	1	—	—*	Leggett White	ok	scheduled	1 le
	7	6.55(2-9)	Chagos-Laccadive-Mascarene Ridges: Aseismic ridge, paleoceanography, carbonate history	25, 39	—	2	5	Herb	poor	needed	½ leg
	8	6.36(2-10)	S.E. Indian Ridge Transect: paleoceanogr. Transect and mantle heterogeneity	27, 37, 38	—	1, 2	4	Prell Schlich	ok	needed	½ leg
	9	6.18(2-9)	Ninetyeast Ridge: "Aseismic ridge" and paleoceanographic transect	25, 39, 35, 46, 78	moderate	A	—*	Curray Herb	ok	to be proposed	½ le
	10 A	6.00(2-9)	North Somali Basin: Old ocean, possible Tethys remnant	21, 70	—	—	3	Brenner	ok	needed	1 le
	10 B	6.00(1-8)	Central Indian Basin + Distal Bengal Fan: Intraplate deformation and Himalayan uplift record	33, 44	3	—	—*	Curray	ok	To be proposed	1/ leg
Group III	12	5.27(3-8)	West S. Australia + Antarctic Discordance: Initiation of spreading, cold spot trace	28, 48, 73	5	C	—	Falvey	ok	needed	1 leg
	13	5.18(0-8)	Agulhas Plateau: S. Atlantic - Indian Ocean Gateway	6, 36, 77	—	—	low	Herb	ok	needed	6 days Time
	14	5.09(0-10)	Eastern S. Australia: Starved block-faulted passive margin, slow spreading	74	—	C	—	Falvey	ok	scheduled	1 leg
	15A	4.82(1-8)	Exmouth Plateau: Starved marginal plateau	71	moderate	—	6	von Rad Falvey	ok	scheduled	½ leg
	15B	4.82(2-10)	Fossil Ridges: Mascarene and Wharton Basins	—	—	*	—	Schlich	ok	To be proposed	3/4 leg
Group IV	17	3.82(0-9)	Sunda Arc: Variation in deformation around an accretionary prism	11, 66	4	—	—	Curray	ok	scheduled + needed	1 leg
	18	3.36(0-10)	Rodriguez Triple Junction	55, 75	—	—	—	Schlich	ok	More needed	1 leg
Group V	19	2.09(0-8	Davie Ridge: Sheared margin	62, 69	—	—	—	Cochran	ok	ok?	3/4 le
	20	1.45(0-4)	Wallaby Plateau: Epilith, volcanic passive margin	71	—	—	—	von Rad	ok	needed	1 leg
	21	1.18(0-4)	E. Gulf of Aden: Rifting old ocean crust	70	—	—	—	Cochran	ok	needed	10 day

1/ Mean and range of scores of votes by panel members, scale of 0-10, by "scientific value".

2/ See Log of proposals received by IOP, Table 3.

3/ Ratings, if considered by thematic panels: T = TECP, preliminary rating by voting 1-5, and by consensus for other proposals; L = LITHP, on scale 1, 2, etc for primarily lithosphere sites, and A, B, etc for not primarily lithosphere sites; S = SOHP, first 6 priorit.

* = IOP requests review by SOHP or LITHP.

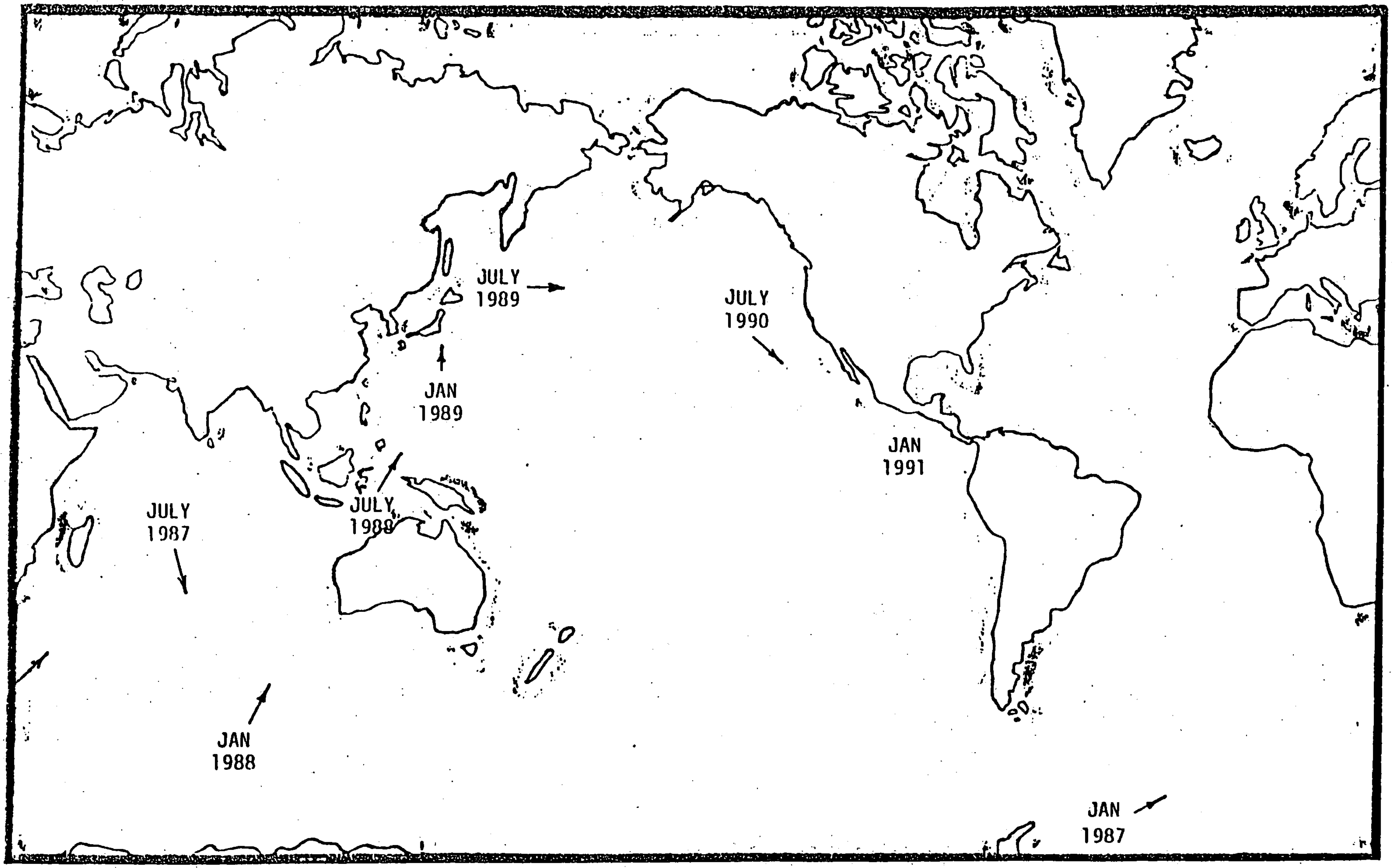
4/ Times in days are site time only, without Transit. Leg estimates include Transit.

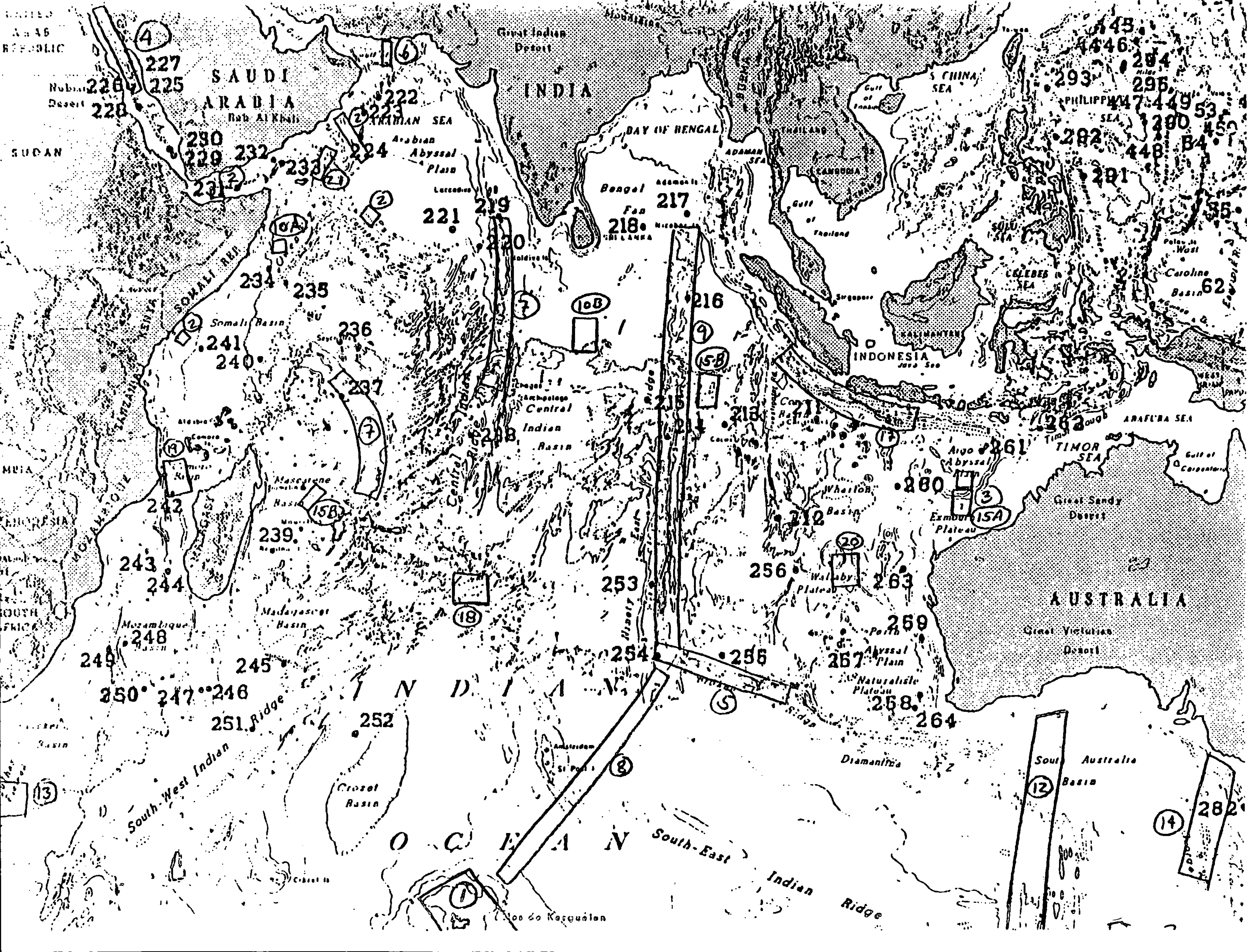
Fis. 1

OCEAN DR NG PROGRAM

Regions of Interest - 1987-1991

(Dates are tentative; shiptrack and drilling sites are not indicated.)

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Nubian Desert
SUDAN
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Somali Basin
ARABIAN SEA
Arabian Abyssal Plain
Great Indian Desert
INDIA
BAY OF BENGAL
Bengal Fan
SRI LANKA
ANDAMAN SEA
THAILAND
CAMBODIA
Gulf of Thailand
S CHINA SEA
PHILIPPINE SEA
SULU SEA
CELEBES SEA
Caroline Basin
INDONESIA
Java Sea
ARAFURA SEA
TIMOR SEA
Argo Abyssal Plain
Exmouth Plateau
Gulf of Carpentaria
Great Sandy Desert
AUSTRALIA
Great Victoria Desert
Central Indian Basin
Central Indian Ridge
Mascarene Basin
Madagascar Basin
Mozambique Basin
Wharton Basin
Wallaby Plateau
Perth Abyssal Plain
Naturaliste Plateau
Diamantina FZ
South Australia Basin
I N D I A N
O C E A N
South-West Indian Ridge
South-East Indian Ridge
Crozet Basin
Amsterdam
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