IOP MEETING
20-22 March 1985
Miami, Florida

SUMMARY

IOP has reordered priorities for the projects it proposes for drilling in the Indian Ocean as follows, with scores of the voting, endorsement by thematic panels, and estimated drilling legs.

		Score	Thematic	Legs
1.	Kerguelen-Gaussberg, first leg	9.50	TS	1
2.	Ninetyeast Ridge	8.25	TSL	1
3.	Neogene Package	8.00	S	1
4.	Red Sea	7.63	TL	1
5.	SEIR	7.38		< ½
6.	Broken Ridge	6.88	T	½
7.	Kerguelen, second leg	6.75	TS	< 1
8.	Argo AP & Exmouth Pl.	6.75	S	1
9.	Cent. Ind. Basin & Distal Bengal F.	6.25	T	1
10.	Davie Ridge	5.00		< ½
11.	SWIR F.Z.	4.88	TL	< ½ - 1
12.	Chagos-Laccadive-Mascarene	4.63	TSL	< ½
13.	Makran	4.50	T	½ - 1
14.	Agulhas Pl., 1 site	3.50		< ½
15.	Rodriguez T.J.	2.88	L	½ - 1
16.	Fossil Ridges	2.25	L	< ½ - 1
17.	Cold spot	1.75	L	½?
18.	Agulhas Pl., 2nd site	1.25		< ½
19.	W. S. Australia	1.13	T	< 1
20.	N. Somali Basin	0.63	S	1+

Estimated drilling times may, in many cases, be variable, and some of the top priorities could be accomplished in partial legs arranged in a logistically feasible ship's track.

Arranging these top-priority projects into a schedule is constrained by severe weather limitations, especially for the Kerguelen-Gaussberg (1 and 7) and northern Arabian Sea projects (3 and 13). Two sample "strawman" schedules are shown, but many others were discussed and are considered in the full minutes of the meeting:

Sample "Strawman" Schedules

19 Month

87	M	Davie
	A	Neogene
	M	
	J	Red Sea
	J	
	A	Makran
	S	Cent. Ind. B.
	O	Chagos-Lacc.
	N	SWIR
	D	Kerguelen
88	J	
	F	Kerguelen
	M	½ SEIR
	A	½ SEIR
	M	Broken R.
	J	Ninetyeast R.
	J	
	A	NW Austr.
	S	

24 Month

87	M	Agulhas Pl.
	A	Davie R.
	M	½ Neogene
	J	½ Red Sea
	J	½ Red Sea
	A	½ Makran
	S	½ Neogene
	O	Cent. Ind. B.
	N	Chagos-Lacc.
	D	Fossil-Mascarene
88	J	Kerguelen
	F	
	M	SWIR
	A	
	M	Rodriguez T.J.
	J	
	J	SEIR
	A	Broken R.
	S	NW Austr.
	O	
	N	Ninetyeast
	D	Fossil-Wharton
89	J	Kerguelen
	F	

ATTENDEES

Panel Members

Cochran
Curray
Gradstein
Honnorez - PCOM
Prell
Schlich
Sclater - LITHP
Tauxe - SOHP
von Rad
Weissel - TECP (21,22 March)

Guests

Brass - NSF (21,22 March)
Brenner - SSP
Clement - ODD
Larson - PCOM

Visitors

Biju - Duval - EXCOM (20 March)
Peterson - RSMAS (21,22 March)

Missing

Falvey (and alt. Packham)
Herb
Leggett
White

REPORTS

EXCOM and PCOM - Larson and Honnorez

The U.K., E.S.F., and Australia have not yet come in as members. EXCOM has decided that they will accept the U.K. only as a full member and not as a part of a consortium. E.S.F. and Australia may come in later this year as a consortium. Another possibility is that Canada could switch its membership to a consortium with E.S.F. As a result of obtaining only three full members, rather than the assumed four full members, the project is now $2.2 M short. Budgets are therefore very tight, but no major disasters are anticipated. There have been some discussions with the U.S.S.R. and reports are that they may be prepared to join if such action would be blessed by the U.S. Security Council.

Because of the failure of E.S.F. and the U.K. to come in at the present time, panel memberships are short. The plan, however, is to play with the short membership and not start replacing in April, in hopes that it will later be possible to readmit our U.K. and E.S.F. panel members. In the discussion, the reality of national interest programs was recognized. Some programs we had previously considered may very well drop in priority because of lack of a strong proponent present. We should, however, continue to endeavor to pick the best science, ignoring political considerations, and leave the politics to others.

The relationship between regional and thematic panels was again discussed. Larson emphasized that there is no hierarchy. Thematic and regional panel recommendations will be considered equally by PCOM in planning the program.

PCOM is now seriously considering an 18-month program in the Indian Ocean, to include Kerguelen and Red Sea. We are directed, therefore, to recommend to PCOM our priorities, with realistic and logistically feasible schedules for such an 18-month program. This program would probably start in Cape Town or Durban in March 1987, following drilling in the Waddell Sea.

The present PCOM plans for advisory panel member rotation is that all new appointments will be for 3-year terms, and a rotation schedule will be set up optimally to rotate one-third of the members each year. Some of us who were appointed for a two-year period at the beginning of 1984 may be reappointed for continuity, and also to permit us to see some of the fruits of our labors with at least start of the drilling program in the Indian Ocean.

ODP - Clement

Leg 100 was the shakedown cruise to train personnel and test the equipment, followed by Leg 101, the first real science cruise, which ended only a few days before this meeting. All appears to be well with the crew and the ship. The ship is more stable, more powerful, more responsive, and has better positioning than Glomar Challenger. HPC coring was accomplished in the Gulf of Mexico in 18-foot, short-period seas. The laboratories are incredible, and the equipment is good. The quarters and the food appear to be satisfactory, although with some remaining minor problems. Drilling thus far is slower than on Glomar Challenger, but this partially reflects lack of experience of the drilling crew and the fact that the iron roughneck is slower but safer than human roughnecks. SEDCO appears to be performing well, although they were obviously not accustomed to rapid moving from one site to another.

The plans for bare rock drilling are progressing satisfactorily. Andy Anderson is the staff scientist at ODP assigned to this project.

SOHP - Tauxe

SOHP met in Cambridge in February and reviewed and revised their priorities, which are in order:

1. Amery Margin, south Kerguelen
2. Neogene Package
3. Deep Somali Basin
4. North Kerguelen
5. Exmouth Plateau, Argo Abyssal Plain
6. Chagos Laccadive Ridge, or Nineyteast Ridge

These projects all rank in higher priority than the sub-Antarctic traverse in the Atlantic.

LITHP - Sclater

The Lithosphere Panel met in February and revised its priorities as follows:

1. Red Sea
2. Ninetyeast, Broken Ridge, Southeast Indian Ridge, Kerguelen
3. South Australia/coldspot
4. SWIR FZ's
5. Triple Junction
6. Fossil Ridges

Number 2, the aseismic ridge/hotspot trace compares well with any Atlantic and Pacific ridge projects, but the panel was concerned because no formal proposal was yet in hand. The panel's objectives for this hotspot trace was not just ages, but was for better basalt petrology and geochemistry. Sclater contacted Fred Frey, MIT, after the meeting to solicit his interest. Frey responded by providing considerable input for our IOP Meeting. The Lithosphere Panel still likes the natural laboratory concept, so some suggestions will be made to consider the Indian Ocean triple junction as a site for an Indian Ocean natural laboratory. It is close to the major ports of Mauritius and La Reunion.

TECP - Weissel

Tectonics Panel met earlier this week, and Weissel came directly from that meeting to represent them on IOP. Their revised priorities are in order:

1. Makran
2. Intraplate Deformation
3. SWIR FZ; Bengal and Indus Distal Fans
5. Ninetyeast and Broken Ridge (Curray)
6. Broken Ridge (Weissel)
7. Kerguelen; North Somali Basin; Chagos Laccadive
10. Red Sea Package
11. South Australia Quiet Zone
12. Timor
13. South Australia Old Crust
14. Nias-Java

WPAC - Curray

Priorities of the Western Pacific Panel were reviewed from their minutes, only to determine impact on Indian Ocean Drilling plans, to determine for example the best exit route to plan from Indian Ocean. Their priorities are:

1. South China Sea
2. Nankai Trough
3. Banda Sea
4. Okinawa Trough
5. Sulu Sea
6. Japan Sea
7. Bonin Trench Toe
8. Sumba Region, Trench Toe; Bonin Trough
10. Coriolus Trough

Most of their high-priority targets are in the western Pacific, thus suggesting that we should plan an exit from the Indian Ocean to the northwest of Australia at the end of our drilling time, rather than around the south of Australia.

Red Sea W.G. - Cochran

The Red Sea Working Group met the previous week at Lamont and produced a lengthy report. They have summarized their objective into three principal themes:

1. Evolution of the lithosphere, as expressed by the nature of the igneous rocks produced through the transition from continental to oceanic rifting.

2. Hydrothermal activity and metallogenesis in a young rifted margin.

3. Sedimentary history of a young rifted margin.

They then proposed their strategy, with a shopping list of eleven items, as summarized in their report. The advisability of inviting somebody from the Red Sea Commission to become a member of the Working Group, or at least an observer, was discussed and strongly advised. We conclude that one leg would be about optimum for accomplishing the primary objectives in the Red Sea. Drilling through the thick evaporite section off the flank of the inner rift would be too time-consuming to consider at the present time.

SSP - Brenner

The Site Survey Panel has not met since November, and there is some serious concern about time growing short for organizing and conducting necessary site surveys for the Indian Ocean. Proponents are strongly advised to get mature proposals and other data submitted as soon as possible.

IOP DISCUSSIONS

Before the end of the first day of meeting, panel proponents were assigned for each of the projects which IOP chose to consider for review of priorities at this meeting. The proponents' responsibility was to lead the brief discussion on each of these projects and to prepare documentation on this project for the Appendix if that project rated high enough in our later voting to be considered for the drilling proposal.

We still have a serious problem of having many of our proposals in an immature stage. We had previously planned to consider only mature proposals at this meeting, but have had to reconsider this plan in view of the fact that the meeting schedule was advanced by several months. Many of the projects we are considering consist of an amalgamation of several proposals in our long list. These must be gathered together and merged for the ultimate mature proposal, and in most cases it will be the responsibility of the panel proponent to do so.

At the next IOP Meeting, Summer 1985, only projects represented by mature proposals will be considered. It will be the responsibility of the panel proponent for each of these projects to prepare this mature proposal, as gathered together from the various sources and outside proponents, or to see that another outside proponent does so.

The entire second day of the meeting was spent discussing the various projects, objectives, arguments for priority, survey status, and probable drilling times. At the end of the day, a ballot was prepared for voting overnight for establishing priorities to be considered early in the meeting on the third day. Twenty projects were included in the ballot. Each voting member had 100 points total to assign, grades to the individual projects ranging from 0 to 10. This assured that the mean of priorities for these 20 projects would be 5.00. In our voting, we cast separate votes for a first leg in Kerguelen versus a second leg in Kerguelen, which would also include other adjacent areas such as the Antarctic margin and/or part of the southeast Indian Ridge transect. Leg 1 in Kerguelen came out first in our voting; Leg 2 came out tied for 7th in our voting. Similarly, we cast separate votes for a first site on the Agulhas Plateau versus a second site on the Agulhas Plateau. The first site came out fourteenth in our priorities; the second site came out eighteenth.

Table 1 is a listing of the projects received by IOP to date. Table 2 includes the projects we are now considering, as rated by our voting. The two Kerguelen legs are combined for this table, which also includes the scores of our voting, the range of votes, the proposals considered, the panel proponent, endorsement by the thematic panels, survey status, and an estimate of drilling time.

The major breaks in our priority scores occur between the first leg in Kerguelen and Ninetyeast Ridge, between the central Indian basin and Davie Ridge, and between the Makran and one site on Agulhas Plateau. It is our belief that the principal objectives of some of these lower-priority projects could be accomplished in less than full drilling legs of work and could be added to the schedule to minimize deadhead transit time and optimize use of the drilling vessel. It is our hope, therefore, to be able to accomplish the major objectives through Project 13, and perhaps even picking up parts of subsequent projects. It is the strong belief of many members of the panel, for example, that with further study and a mature proposal, Project 16, fossil ridges, will advance in our subsequent ratings of priority.

The effect of absence of strong proponents at the panel meeting was obvious. Makran rated No. 6 in our priority list at our December 1984 Meeting, but in this listing has fallen to 13. Similarly, the South Australian projects suffered from not having a strong proponent present. We chose not to even vote on the eastern South Australian project until Falvey is present at our next meeting.

A brief review of each of the top 16 projects is included in the Appendix, combining for this purpose the first and second legs of drilling on Kerguelen.

Logistics for planning a logical sequence of cruise legs for these projects is difficult because of weather constraints. January and February are the best months for the Kerguelen area; December and March are marginal. June, July, and August are the worst months for the northern Arabian Sea because of high winds and high-amplitude, long-period swell. Our attempts at putting these projects together into logical programs therefore involved many compromises and necessitate somewhat more transit time than would be optimum.

Our first attempt was to propose a "strawman" 18-month plan for the Indian Ocean, to include Red Sea and two legs on Kerguelen and adjacent areas. In order to do this, it will be necessary to schedule back-to-back legs in the Kerguelen area, with resupply by Marion Defresne in Kerguelen. At best this is risky, because of marginal weather conditions in December and March. Our initial assumption was availability of the ship early March 1987 in Capetown or Durban. In order to come in phase with the weather window for Kerguelen, therefore, we had to insert a short one-month leg at the start, thereby making our plan a 19-month, rather than 18-month plan.

In our opinion, a better possibility of obtaining good results from Kerguelen would be legs in successive austral summers, thereby necessitating approximately a 24-month program. Chances of a total lost program, through the occurrence of one unusually bad austral summer, would be minimized, and the expense of chartering a supply vessel like Marion Defresne would be eliminated.

Several "strawman" schedules are suggested in Table 3, involving various combinations of hitting and avoiding weather windows, cutting some projects to half legs, and rearranging the routing.

Next IOP Meeting

The next meeting of IOP will be the week of 19 August. First choice for location of the meeting is Stavenger, Norway, in order to see the drilling vessel while it is in port. If this location is not approved because of cost to NSF, Roger Larson, Chairman of PCOM, will consider the relative cost of Bermuda or Iceland as alternatives. We wish to minimize the cost for both North American and Western European panel members.

APPENDIX

1. (and 7) Kerguelen-Gaussberg Ridge

The continental or oceanic nature of the Kerguelen-Gaussberg Ridge has long been a matter of controversy. Recent geological and geophysical studies favor an oceanic origin. Anomalies 17/18 of late Eocene age have been identified along the northeastern flank of the ridge; Anomalies 33 and 34 of late Cretaceous age have been observed to the northwest of the Kerguelen-Heard Plateau. Reconstructions generally preclude the hypothesis that the ridge is a continental fragment. However, the nature of the oceanic structure has not yet been determined: uplifted Cenozoic or Mesozoic ocean basin, mantle hot spot, or anomalous large-scale magma generation at or near an active spreading center. In petrological and geochemical studies on Kerguelen Island, igneous rocks show clear affinities with observations from other oceanic islands. The thickness of the crust apparently ranges from 15 to 20 km, and the seismic velocity versus depth distribution is similar to those of typical oceanic ridges.

The geological history of the northern part of Kerguelen-Gaussberg Ridge has been interpreted from seismic stratigraphy interpretations of multichannel seismic profiles and a lithostratigraphic model obtained for the eastern flank of the plateau.

The nature, the evolution, and the paleoenvironmental history of Kerguelen-Gaussberg Ridge can be determined by drilling a transect of sites from the northern end of the ridge to the Antarctic margin.

It is proposed to obtain a complete stratigraphic record from upper Cretaceous to Recent. The objectives include:

1. The nature and age of the different sedimentary sequences with the age of the oldest clastic deposits.

2. The shift of the polar front versus time.

3. The age of the major discordance, which dates the rifting between Kerguelen-Heard Plateau and Broken Ridge.

4. The pre-rifting and post-rifting subsidence history of the ridge.

5. The nature and age of the basement in the northern and southern part of the ridge.

Four sites have been located on the northern part of the ridge. One of these sites may be a re-entry site. The corresponding site survey work has been done. The southern sites will be selected from survey work conducted by the Australians in 1985 and 1986.

2. 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 formerly 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 was 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 dissolution-depth relations in the carbonate sediments.

From a geochemical point of view, the Indian Ocean is by far the most interesting for ocean floor drilling, because it is evident that MORB's dredged from Indian Ocean ridges are isotopically distinct from MORB's in the Pacific and Atlantic. This is an important result, because until recently it had been generally believed that all MORB's had a pervasive, nearly uniform depleted source, the only exceptions occurring in proximity to "hot spots." As a consequence, it is important that ODP obtain more samples in the Indian Ocean of MORB created at spreading centers and at hot spots.

Geochemically-based models for mantle heterogeneity have not evolved into end member models, which range from extreme upper mantle heterogeneity involving streaks and veins, e.g. the "paisley model" of Zindler et al. (1984), based on Pacific Ocean seamounts, to the traditional two-source model championed by Schilling et al. (1984). Present consensus is that the Kerguelen hot spot is responsible for Ninetyeast volcanism, but the current data set is very sketchy. Data based on DSDP Site 253 are especially unsatisfactory because of limited recovery; data based on the more northerly sites 214 and 216 are better because of better recovery; the basalts here have oceanic island affinities, but the two sides have very different isotopic characteristics. Without geochemical studies of oceanic crust in the southeast Indian Ocean, we will remain ignorant with respect to some very important geochemical tectonic problems: specifically, is there a southern hemisphere geochemical anomaly? What is the relationship of the Ninetyeast Ridge to various islands? How isotopically variable are lavas comprising the Ninetyeast Ridge, and are there alternatives to the hot spot explanation?

3. Neogene Package: Monsoons, Mountains, Man, and Milankovich

The Indian Ocean summer monsoon is a key component of the global climate system. Combined with the physiography of the Arabian Sea and uplift of the Himalayas, the monsoon circulation dominates the paleoenvironment-sediment history of the Arabian Sea and adjacent Africa and India.

This proposal investigates four separate but related aspects of this history: 1) the evolution of monsoonal upwelling, 2) the relationship of upwelling to anoxic sediments in the Oman margin oxygen minimum zone, 3) the long-term evolution of the Indus Fan in response to changes of climate and uplift rate of the Himalayas, 4) the tepheochronology of Africa rift sites related to hominid evolution.

A. Paleomonsoonal Upwelling

The Owen Ridge contains a section of pelagic sediments that record the strength of upwelling induced by SW monsoon winds. Previous work shows that upwelling faunas vary with solar radiation patterns and should be affected by the uplift of the Tibetan Plateau.

We propose to core two sites (double HPC) to at least 600 m to obtain the past 5 m.y. to 10 m.y. record of upwelling. Continuous recovery and complete sections are required to test existing ideas on the control of monsoon-induced upwelling. Approximately 20 days site time are required. Regional survey is adequate, but detailed site selection data (preferably water gun seismics) are required and proposed.

B. Anoxic Sediments and Paleoupwelling

The margin of Oman contains anoxic sediments in the upper slope oxygen minimum layer. These sediments record the proximal monsoon upwelling, the diagenesis of organic-rich sediments, and are high-resolution paleoclimate records.

We propose to obtain a transect of double 3 HPCS (200 m) across the O_2 minimum (500 m, 1000 m, 1500 m) along a spur of the Oman margin. Total site time about 18 days. Regional survey identifies problem, but a detailed survey is required to select sites.

C. Indus Fan

The distal Indus Fan should contain a record of the changes in fan sedimentation over long time intervals in contrast to the proximal fan. Because the Siwalik sedimentary basins at the base of the Himalayas are so well dated, the Indus Fan sediments offer the best chance to relate continental uplift and climate patterns to deep-sea terrigenous deposition patterns. Similar drilling in the distal Bengal Fan in the proposal for interplate deformation in the Central Indian Basin will also contribute to knowledge of uplift history of the Himalayas.

We propose to core two HPC cores to about 600 m to obtain high-quality sections for paleomagnetic, sedimentologic, and biostratigraphic studies. Site time about 16 days. Regional data exist, but need to be synthesized.

D. African Hominid Sites

We propose to core the deep-sea record complimentary to the East-African rift sequences 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).

4. Red Sea

The Red Sea Working Group identified three themes that can be uniquely addressed in the Red Sea. These are:

A. Evolution of the lithosphere during rifting, as expressed by the nature of the igneous rocks produced through the transition from continental to oceanic rifting. The geometry of rifting in the Red Sea, with seafloor spreading in the south passing through a transition zone of discontinuous deeps into continental rifting, allowing sampling of basalts generated 5 m.y. after initiation of spreading (dredging on active ridge), a few m.y. after beginning of spreading, during the transition and during late-stage continental young rifted margin. The Red Sea deeps present a north-south transit of holes (minimum of 3). These would be single bit holes through 50-100 m of sediment into basement.

B. Hydrothermal circulation and metallogenesis at a young rifted margin. The Red Sea hot brine deeps present a number of different hydrothermal and geochemical systems. The objectives of drilling would be to drill basement rocks and capture the hydrothermal fluids circulating in them to study the plumbing and circulation system, source of the fluids, alteration, leaching, and metallogenesis. A strategy would be to drill (probably) single bit holes into an active high-temperature (Atlantis II Deep) and low-temperature (Nereus Deep) system where basement is involved, and a small deep (Kebrit) without basement involvement. Because of probably altered basement, these sites should not double with those of the first theme.

C. Sedimentary history: It would be valuable to obtain continuous stratigraphic sequences of Pliocene-Holocene sediments to study the influences of climatic change on Red Sea circulation, productivity, and sedimentation. The major objective is the so-called Red Sea "saprapels," relatively organic carbon-rich layers reported but poorly sampled on Leg 23. A continuous sequence obtained by double HPC of the top 200-30 meters, relatively distal from the margin, would allow examination of possible correlations with East Mediterranean saprapels and with the monsoonal upwelling record obtained from drilling in the western Arabian Sea.

The Working Group proposed a set of 11 sites, composing about two legs of work. However, some of these can be considered as options or alternatives to each other to make a solid one-leg program. Detailed discussions of the sites, including estimated drilling and site survey status, are contained in the Working Group preliminary report.

5. Southeast Indian Ridge Transect

We propose drilling a transect of sites on one or both flanks of the Southeast Indian Ridge for several reasons. First, such a transect will provide long continuous sequences of Neogene sediments in high southern latitudes to allow comparison of the evolution of low- and high-latitude faunas and floras during the late Neogene. Second, the transect could be located so the sites cross the subtropical convergence and Antarctic Polar Front to record Neogene movement of these oceanographic boundaries and provide detailed information on climatic fluctuations in these latitudes.

In addition to the paleoceanographic objectives, this same transect of sites should 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 hotspots: Kerguelen and Amsterdam.

The measured progression of basement ages along the Ninetyeast Ridge (Duncan, 1978), paleomagnetic latitudes from basalts and overlying sediments (Pierce, 1978), and geochemical character of the basalts (Whitford and Duncan, 1978; Dosso _et al_., 1979; Dosso and Murthy, 1980; Mahoney _et al_., 1983) indicate that the Ninetyeast Ridge and adjoining Rajmahal Traps were formed over the Kerguelen hotspot. Following opening between Australia and Antarctica, the Southeast Indian Ridge rode northeastward over the Kerguelen hotspot, severing the connection to the Ninetyeast Ridge at about 38 m.y.B.P. (DSDP Site 254). Production of oceanic crust at the Southeast Indian spreading ridge in the wake of this separation results from the mixing of two distinct mantle source regions: the MORB source underlying the present spreading ridge and the Kerguelen hotspot. The hotspot influence should decrease with time (toward the spreading ridge). Young volcanism at Amsterdam/St. Paul is thought to reflect a recently initiated hotspot which is geochemically distinct from Kerguelen and which has not yet left a volcanic trail (Morgan, 1981; Duncan, 1981).

The Southeast Indian Ridge Transect should consist of three holes, one of which will be drilled as the deep slope site during drilling on the northern Kerguelen Plateau. The remaining two sites to be drilled during the Southeast Indian Ridge leg will be located in approximately 3000-3500 meters water depth. 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. Total drilling time for these sites would be about 25 days. Regional site surveys available in the area are sufficient; a site-specific survey will be necessary before actual drilling targets can be identified.

6. Broken Ridge

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 Antarctica. Prior to formation of the southeast Indian Ocean Ridge, they constituted a single ridge extending westward from the join between Antarctica 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 two-site transect could establish whether there is a younging to the west as predicted by the hot spot model.

The stratigraphy developed on Broken Ridge reflects the uplift/subsidence history that occurs in response to rifting. Broken Ridge, therefore, may be a good place to discriminate between the two end member models for rifting -- "active" versus "passive" processes. In active rifting, uplift precedes rifting (by at least a few tens of m.y.) due to convective thinning of the plate. In passive rifting, uplift either accompanies or is later than rifting. Subhorizontally-layered mid-Eocene littoral sands and gravels overlie a pre-rift limestone and chert sequence on Broken Ridge that was flexurally uplifted due to rifting and exposed to subaerial erosion. A N-S transect comprising two shallow ($\sim$ 400 m) holes is proposed to obtain sediment ages and paleodepths that will constrain the timing between rifting and uplift. Drilling objectives related to identifying rifting mechanisms may also be addressed during drilling on the northern part of Kerguelen-Gaussberg Ridge. However, the Broken Ridge sites may be more attractive, given the high competition for drilling time and the restricted weather window for Kerguelen.

7. Kerguelen Plateau, Second Leg, See Above Under 1

8. Argo Abyssal Plain and Exmouth Plateau Transect

Argo Abyssal Plain is a remnant of the Tethys superocean adjacent to one of the world's oldest starved passive continental margins. We suggest drilling one site with a penetration of 1250-1300 m to basement) in order to:

A. Study the nature and history of the oldest (Jurassic) part of the Indian Ocean in comparison with Tethys facies in the Atlantic, Mediterranean, and (?) Pacific.

B. Date the Indian Ocean M-Series (M 25/26 crust!).

C. Study the paleoceanography, paleobathymetry, paleoecology, and biostratigraphy, especially of the Callovian to late Cretaceous.

D. Infer the subsidence history.

About 12 days of drilling time are needed. Site survey data are sufficient, but will be supplemented by BMR site survey in March 1986.

The northern rim of the Exmouth Plateau is a unique example of a sediment-starved, very old stretched/transform passive margin with a very wide, subsided marginal plateau, which is extremely well surveyed by seismic surveys and dredges that can be correlated to numerous wells on the Northwest Shelf and Central Plateau. The existing commercial wells are no duplication of the planned ODP wells, since they are essentially uncored (only cuttings) and represent the central part of the plateau, which formed by rifting in the Neocomian and experienced a different -- more continent-influenced -- evolution during the Mesozoic. With single-bit drilling we can study pre-rift and rift-fill Triassic to mid-Jurassic sedimentation, as well as the post-breakup late Jurassic to Cenozoic development and subsidence history of a juvenile to mature ocean. Completion of an Argo Abyssal Plain-Exmouth Plateau transect will provide unique data on a 200 Ma record of margin sedimentation in response to sea level fluctuations, subsidence history, paleocirculation, climate and sediment supply. We suggest drilling two holes, one at the outer edge of the northern plateau (1800 m w.d.) with about 1300-1400 m penetration to Triassic rocks overlying continental crust, and one at the foot of the plateau (4050 m w.d.) with a penetration of about 800 m to mid-Mesozoic rift floor basement of continental or transitional crust. Both holes could be drilled in about 20 days. The area is one of the best surveyed passive margins of the world. This information will be supplemented by a funded joint site survey by BMR (Australia) and Lamont-Doherty Geological Observatory in February-April 1986.

9. Central Indian Ocean Basin and Lower Bengal Fan (Intraplate Deformation: A Response to the Himalayan Orogeny)

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 and non-linear temperature-depth profiles 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 and the history of deformation can be precisely delineated from drilling on the "back sides" of rotated fault blocks, while the problem of fluid flow may be resolvable 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.

10. The Davie Ridge 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 Basin 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.

The paleoceanographic record of opening of the Indian Ocean is, we believe, better displayed on the Davie Ridge than on Agulhas Plateau, partly because the Oligocene section is present. We estimate approximately 15 days drilling time for these two sites.

11. SWIR-F.Z.

Based on the working hypothesis that lithospheric structure in fracture zones is related to plate spreading rate, we propose to drill directly into unaltered mantle along the axis of the Melville Fracture Zone Valley (very slow spreading) to assess: 1) mantle and thinned crustal "stratigraphy", 2) to test the postulated "transform edge" or cooling effect on mantle melting, 3) to evaluate the ophiolite model for oceanic transform faults. We do not expect to find tectonized crustal material below the floor of the fracture zone valley.

The drilling rate and recovery are expected to be high because the material recovered by dredging the fracture zone is mainly massive peridotite and its serpentinized equivalent.

The Discovery II Fracture Zone could be used for a backup program (even though the influence of mantle hot spot here becomes part of the picture), and weather window is far less certain.

Both programs at the Melville and Discovery II Fracture Zones are single-bit series of four holes without bare rock spudding.

12. Chagos-Laccadive-Mascarene Ridge

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 of "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.

An E-W depth transect of cores would permit the same geochemical and paleomagnetic experiments as have been done successfully on the Ninetyeast Ridge, providing an opportunity to recover a complete suite of calcareous sections covering the entire Neogene. This transect will recover continuous Neogene sections, which will record vertical dissolution gradients in a small area, independent of productivity variations. Hence the carbonate budget of the ocean can be deduced in detail from these sediments.

13. Makran

This is a transect of relatively shallow (∿ 300 m) holes that provides an excellent opportunity to asses the distribution and rates of deformation across an accretionary prism. Previous drilling of accretionary prisms has been concentrated at the toe. Makran is a particularly favorable place for such drilling objectives, because (a) the deformation structures appear relatively simple in available seismic reflection records, (b) the prism is dominated by clastics, although sands are not present in piston cores, and (c) there is the opportunity to compare drilling results to an excellent exposed and well-mapped Plio-Quaternary record on land. The exposed drilling program of about seven holes incorporates sites on the abyssal plain, basal thrust, basal slope basin thrust, and a slope basin farther upslope.

14. Agulhas Plateau

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 sediment on the northern portion of the plateau 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 Westward Drift in a unique and latitudinally stationary setting. The area will provide the southernmost carbonate record obtainable for the Atlantic paleoclimatic transect.

Recent evidence of differentiated crust (oceanic to the north, continental to the south) on the plateau could be investigated further by drilling both a northern and southern hole to basement. The unknown tectonic subsidence history of the plateau could then be reconstructed from the overlying sedimentary record.

15. Rodriguez Triple Junction

The Rodriguez Triple Junction is a clear, well exposed RRR junction which has been controlling the evolution of the major part of the Indian Ocean since at least the late Cretaceous. 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 contrast, 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 RTJ offers the possibility of investigating the processes of time duration of magma chambers and possible evolution of degree of partial melting at the three ridges through the last hundred thousand years. Results on dredge samples around RTJ: Sr and Nd isotopic ratios, REE patterns strongly suggest the existence of separated magma chambers around the triple junction. SWIR basalts within the canyons are probably from narrower magma chambers erupting during stretching of the canyons.

Drilling at three sites near the RTJ will provide deep insight into the duration of magma chambers and possible variations with time of partial fusion degrees. Moreover, logging downhole measurements and oblique seismic profiling should allow description of the structure of the upper crust.

16. Fossil Ridges

Several fossil ridges have been identified in the Indian Ocean. The Western Somali Basin fossil ridge corresponds to an Early Cretaceous extinct spreading center (anomaly 70). The Mascarene fossil ridge corresponds to a Paleocene extinct spreading center (anomaly 28/27). The Wharton Basin fossil ridge corresponds to an Eocene extinct spreading center (anomaly 19/18).

Drilling at two fossil ridges of different ages, characterized by different spreading rates, should provide the possibility of studying how a magma chamber at a spreading center ceases its activity. Drilling at the fossil ridge axis should allow, in addition to accurately dating the end of spreading, investigation of the latest erupted basaltic products. Presently, no available information exists on what happens when the supply of juvenile magma into the magma chamber decreases progressively to zero. It is, however, expected that more differentiated liquids will be erupted at these fossil axes, as intensive fractional crystallization may continue.

In order to test this hypothesis, it is proposed to drill at least three holes at two of the fossil ridges. The first site should be located at the ridge crest; the second site should be close to the ridge axis, where spreading is slowing down; the third site should be far enough from the ridge crest to sample crust generated at full spreading rate. Drilling those sites in the Wharton Basin will provide the opportunity to record the not well known late Cenozoic history of the Eastern Indian Ocean.

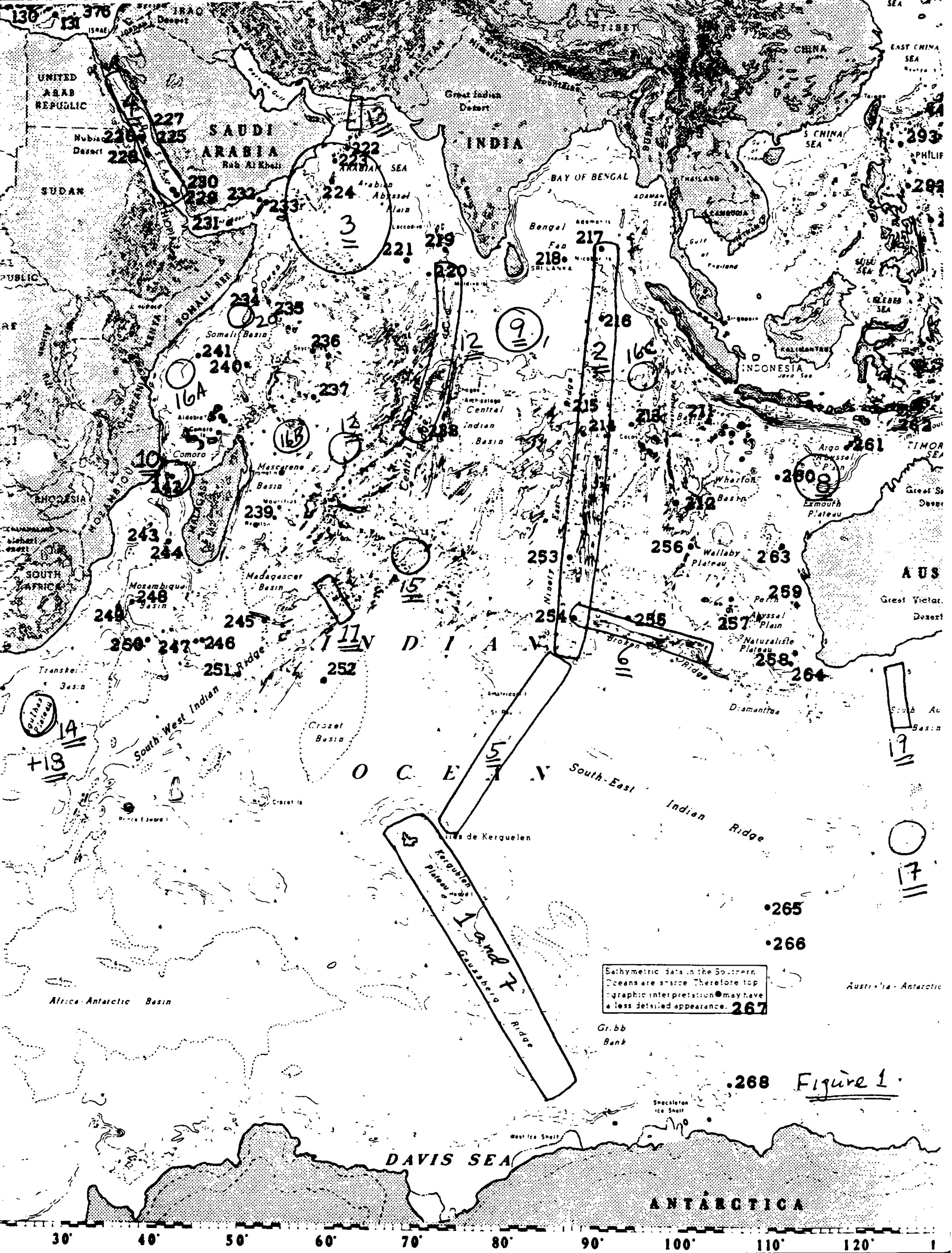
UNITED ARAB REPUBLIC
SAUDI ARABIA
Rub Al Khali
SUDAN
IRAQ
TIBET
CHINA
EAST CHINA SEA
INDIA
Great Indian Desert
Himalaya Mountains
PAKISTAN
Persian Gulf
ARABIAN SEA
Arabian Abyssal Plain
Laccadive
BAY OF BENGAL
Bengal Fan
SRI LANKA
ANDAMAN SEA
S CHINA SEA
THAILAND
CAMBODIA
Gulf of Thailand
SULU SEA
CELEBES SEA
INDONESIA
Java Sea
PHILIP
TIMOR SEA
Nubian Desert
SOMALI REP
KENYA
ETHIOPIA
RHODESIA
MOZAMBIQUE
SOUTH AFRICA
Somali Basin
Aldabra
Comoro Basin
MALAGASY
Mascarene Basin
Mauritius
Madagascar Basin
Mozambique Basin
Central Indian Basin
Argo Abyssal Plain
Wharton Basin
Exmouth Plateau
Wallaby Plateau
Perth Abyssal Plain
Naturaliste Plateau
Broken Ridge
Great Victoria Desert
AUS
INDIAN OCEAN
South West Indian Ridge
Transkei Basin
Crozet Basin
South-East Indian Ridge
Iles de Kerguelen
Kerguelen Plateau
Gaussberg Ridge
Africa-Antarctic Basin
Australia-Antarctic
Gribb Bank
Diamantina
DAVIS SEA
West Ice Shelf
Shackleton Ice Shelf
ANTARCTICA
Bathymetric data in the Southern Oceans are sparse. Therefore topographic interpretation may have a less detailed appearance.
1 and 7
2
3
5
6
8
9
10
11
12
13
14
+18
15
16A
16B
16C
17
19
20
130
131
376
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°

Figure 1

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

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, Recommendation, 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 #4 & 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. Tapponnier G. Jacquart	Andaman Sea	Andaman Sea tectonics	

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, Recommendation, 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, crustages, paleoposition of Madagascar	
14	17 Apr. 84	G. de Vries 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	Replaced by #81
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	

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, basements 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 Bowers, 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 previous 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
79	8 Jan 85	Crook, Falvey, & Packham, Editors	Site Proposals for Scientific Ocean Drilling in the Australasian Region	Consortium for Ocean Geosciences Publication No. 2	Overlap, duplicates, & supplement to #71, 72, 73, 74, etc

Proposal No.	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
80	21 Jan 85	Reed, Silver & Meyer	The Eastern Sunda Arc and NW Australia Collision: Accretionary Processes in a Sharp Transition Zone of Arc-Continent Collision	E. Sunda Arc & NW Australia	
81	4 March 85	Dick, & Natland	A Proposal for an Ocean Drilling Program Mantle-Heterogeneity Leg - Drilling on SW Indian Ridge Fracture Zones	SW Indian Ridge	Replaces L-4 #26
82	20 Mar 85	Weissel & Karner	Drilling on Broken Ridge To evaluate thermo-mechanical models for rifting	Broken Ridge	
83	20 Mar 85	Peterson	Variation of Neogene surface fertility and carbonate compensation in the equatorial Indian Ocean	Chagos-Laccadive-Mascarene on Ninetyeast Ridge	

Proposal No	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status, etc.
84	20 Mar 85	Schlich, Munschy, LeClaire, Froehlich	Proposal for oceanic drilling on the Kerguelen-Heard Plateau (Indian Ocean)		
85	20 Mar 85	Jacquart, Vincent	Proposal for oceanic drilling on the Agulhas Plateau, Southwest Indian Ocean		
86	"	Segoufin, Dumb - Clocchiatti, LeClaire	Proposal... on the Davie Ridge and Malagasy Margin (Mozambique Channel)		
87	"	Schlich, Royer, White-church, Clocchiatti	Proposal for ... at fossil ridges in the Indian Ocean		
88	"	Schlich, Munschy, Royer, Montigny, Whitechurch	Proposal ... at the Rodrigues Triple Junction		
89	"	Jacquart & LeClaire	Proposition de forage sur le Deep Sea Fan de l'Indus		

Proposal No	Date Rec'd	Proponent	Title	Area, Objectives, etc.	Status
90	8 Apr 85	Pautot & Guennoc	A proposal for deep drilling in the central and northern Red Sea axial areas		Replaces #7
91	8 Apr 85	Girdler	Proposal for ocean drilling in the Gulf of Aden		Replaces #15

Table 2 IOP Priorities 20-22 March 1985

Rank	Score	Project	Proposals	Thematic Panels T	Thematic Panels L	Thematic Panels S	Panel Proponents	Survey Status Regional	Survey Status Site	Legs
1 (and 7)	9.5 (7-10)	Kerguelen-Gaussberg Ridge	57, 58, 72, 84	7		1+4	Schlick Falvey	ok	under-way	1 and 1=2
2	8.25 (6-10)	Ninetyeast Ridge	15, 39, 35, 45, 78	5	2	6	Curray Sclater	fair	to be proposed	1
3	8.00 (0-10)	Neogene Package: Monsoons, Mountains, Milankovitch, and Man	30, 31, 32, 33, 43, 68, 89			2	Prell Tauxe	ok	proposed	1
4	7.63 (2-10)	Red Sea	7, 23, 52, 56, 76, 90	10	1		Cochran	ok	needed	1
5	7.38 (4-10)	SEIR	27, 37, 38		2		Prell Schlick	ok	needed	< 1/2
6	6.88 (4-10)	Broken Ridge	49, 82	5+6	2		Curray Weissel	ok	needed	1/2
8	6.75 (0-10)	Exmouth Plateau + Argo Abyssal Plain	71, 12, 79,			5	von Rad Falvey	ok	needed	1
9	6.25 (3-10)	Central Indian Basin, distal Bengal F.	33, 44, 14,	2			Weissel Curray	ok	needed	1
10	5.00 (2-10)	Davie Ridge	62, 69 86				Sclater Prell	ok	needed	< 1/2
11	4.88 (0-7)	SWIR - FZ	81	3	4		Honnorez	ok	needed	< 1/2 - 1
12	4.63 (2-8)	Chagos-Laccadive-Mascarene	20, 34	7		6	Prell	poor	needed	< 1/2
13	4.5 (0-8)	Makran	8	1			Weissel	ok	needed	1/2 - 1
1	3.5 (0-8)	Agulhas Plateau, 1 site	6, 36, 77 85				Schlick	ok	needed	< 1/2
15	2.88 (0-10)	Rodriguez Triple Junction	55, 75, 88		5		Schlick	ok	needed	1/2 - 1
16	2.25 (0-10)	Fossil Ridges	87		6		Schlick	ok	needed	< 1/2 - 1
17	1.75 (0-5)	Cold Spot	28, 73		3					
18	1.25 (0-8)	Agulhas Pl., 2nd site	6, 36, 77, 85				Schlick	ok	needed	
19	1.13 (0-5)	Western South Australia	48	11						
20	0.63 (0-2)	N. Somali Basin	21, 70			3				> 1

Table 3 Sample "Snowmen" Schedules – IOP 20-22 March 1985

		19 Mo	19 Mo	19 Mo	19 Mo.	20 Mo	20 Mo	21 Mo	22 Mo	23 Mo.	24 Mo.
1987	M	David	David	David	David	David	David	Agulhas	Agulhas	David	Agulhas
	A	Neogene	Neogene	Neogene	½ Neogene	½ Neogene	Neogene	David	David	Neogene	David
	M				Makran	Makran		Makran	Makran		½ Neogene
	J	RedSea	RedSea	RedSea	RedSea	RedSea	RedSea	RedSea	RedSea	RedSea	½ RedSea
	J										½ RedSea
	A	Makran	CentIndB	Makran	CentIndB	CentIndB	Makran	CentIndB	CentIndB	Makran RedSea	½ Makran
	S	CentIndB	C-L-M	CentIndB	½ Ninetyeast	C-L-M	C-L-M	C-L-M	C-L-M	Neogene	CentIndB
	O	C-L-M	SWIR	SWIR	½ Neogene	½ Neogene	SWIR	Neogene	Neogene	CentIndB	½ Neogene
	N	SWIR		C-L-M	C-L-M	FossilR				C-L-M	C-L-M
	D	Kerg.	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg.	Kerg.	FossilR.
1988	J										Kerg.
	F	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg	Kerg	
	M	½ SEIR	½ SEIR	½ SEIR	½ SEIR	½ SEIR	½ SEIR	½ SEIR	½ SEIR	½ SEIR	SWIR
	A	½ SEIR	½ SEIR	½ SEIR	SWIR	SWIR	½ SEIR	SWIR	Rodriguez TJ	SWIR	
	M	Broken	Broken	Broken	½ SEIR	½ SEIR	Broken	FossilR			Rodriguez
	J	Ninetyeast	Ninetyeast	Ninetyeast	Broken	Broken	Ninetyeast	½ SEIR	SWIR	Rodriguez TJ	TJ
	J				½ Ninetyeast	Ninetyeast		Broken	½ SEIR		SEIR
	A	NW Austr.	NW Austr.	NW Austr.	NW Austr.		CentIndB	Ninetyeast	Broken	NW Austr.	Broken
	S					NW Austr.	NW Austr.		Ninetyeast		NW Austr.
	O							NW Austr.		½ SEIR	
	N								NW Austr.	Broken	Ninetyeast
	D									Ninetyeast	FossilR
1989	J										Kerguelen
	F										