JOIDES Lithosphere Panel Meeting
Institut de Physique de Globe
Univ. Pierre et Marie Curie
Paris, France
29 Sept - 1 Oct 1987

EXECUTIVE SUMMARY

1.0 Top Six LITHP Themes in CEPAC and Related Proposals

Ranking	Theme	
1.	**Structure of the lower oceanic crust**	
	Return to 504B (286E)	(1-1 1/2 legs)
2.	**Magmatic and hydrothermal processes at sediment-free ridge crests**	
	East Pacific Rise (76E Revised)	(3 legs)
3.	**Magmatic and hydrothermal processes at sedimented ridge crests**	
	Juan de Fuca Ridge (232E)	(1-2 legs)
	Escanaba Trough (224E,284E)	
	Guayamas Basin (275E)	
4.	**Early magmatic evolution of hot spot volcanos**	
	Loihi (282E)	(1 leg)
	Marquesas (291E)	
5.	**Crustal structure and magmatic evolution of oceanic plateaus**	
	Ontong-Java Plateau (222E revised)	(1 leg)
6.	**Composition and magnetization of old crust**	
	Jurassic Quiet Zone (285E)	(1 leg)

Related recommendations:

In order to help achieve LITHP drilling objectives in CEPAC we make the following related recommendations:

1) A minimum of four hard rock guidebases will be required for LITHP drilling in CEPAC. Additional guidebases will be required if any near-axis seamount drilling is carried out.

2) An engineering test leg should be scheduled for sometime in the next 12-18 months to allow ODP engineers to field test their new hard rock drilling and coring systems prior to EPR or Loihi drilling.

3) One leg of young crustal drilling should be scheduled as early as possible in the CEPAC program to allow ODP engineers to evaluate their new systems and have time to made necessary modifications.

4) PCOM should establish a working group to develop a detailed drilling plan for EPR and Juan de Fuca Ridge/Escanaba Trough including strategies for hydrothermal fluid sampling, borehole logging and downhole geophysical experiments (including VSPs, crosshole seismic tomography etc.), as well as options for long-term instrumentation of the drill-holes.

2.0 LITHP Recommendations on WPAC drilling

2.1 Geochemical Reference Holes

LITHP believes a minimum drilling strategy for a reference hole program in the western Pacific is one deep hole outboard of the Bonins and three shallower holes near the Mariana transect of DSDP Legs 59 and 60. This program will require 1 1/2 legs of drilling.

2.2 Bonin diapir and forearc drilling

LITHP recommends a half-leg be devoted to drilling a forearc diapir and the adjacent forearc ridge in one arc, rather than drilling diapirs in two different arcs. The panel endorses drilling Conical seamount (MAR-3) and an adjacent forearc site in the Marianas as its highest priority.

2.3 Mississippi Valley Deposits Proposal (268D)

The Mississippi Valley deposits proposal addresses important scientific questions related to the formation of carbonate-hosted lead-zinc deposits. However, this program is not central to LITHP thematic objectives, either globally or in WPAC. We suggest additional efforts be made to integrate this work with SOHP objectives in the area, but in terms of an extra half-leg, reference hole drilling and forearc diapir drilling are higher priorities for LITHP.

2.4 Lau Basin

(1) LITHP recommends a 1-leg program concentrating on back-arc processes in the Lau Basin. The highest priority sites are LG-2 in the western Lau Basin which should be drilled to a least 200 m sub-basement, LG-3 on the Tonga platform which should be drilled to Unconformity A and LG-7 or LG-1. None of the sites require bare-rock drilling.

(2) A separate engineering development leg should be approved for Lau Basin to field test new hard-rock drilling and coring systems under development for CEPAC drilling. Final site selection should be based on engineering requirements, but LG-1 on- or near-axis between 18-19^{o}S would be our first choice, with LG-4B or LG-4C on Valu Fa ridge as potential alternative sites.

3.0 Other matters

3.1 Next LITHP Meeting scheduled for 1-3 March, 1988 in Hawaii

3.2 Nominations for new panel members:

D. Clague	B. Bryan
J. Natland	M. Perfit
N. Sleep	J. Orcutt

3.3 LITHP endorses acquisition of the Formation Microscanner by ODP

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Members present:

R. Detrick (URI), Chairman
R. Batiza (Northwestern)
K. Becker (RSMAS)
K. Bostrom (ESF)
H. Elderfield (UK)
T. Fujii (Japan)
J. Hawkins (SIO)
C. Langmuir (L-DGO)
J. Malpas (Canada)
M. McNutt (MIT)
C. Mevel (France)
J. Mutter (L-DGO)
J. Pearce (UK)
N. Peterson (Germany)
J. Sinton (HIG)

In attendance:

A. Adamson (TAMU)
E. Davis (CEPAC)
M. Fisk (SOP)
P. Robinson (PCOM)
S. Scott (WPAC)

Absent:

R. Duncan (IOP)
M. Kastner (PCOM)
K. Klitgord (ARP)

AGENDA

1. PCOM Report (both CEPAC/LITHP panels)
2. Reports from other liaisons
3. CEPAC proposals evaluation and ranking
4. LITHP CEPAC Drilling Themes
5. Joint CEPAC/LITHP meeting (Sept. 30th)
6. WPAC prospectus and PCOM evaluation
7. Other matters
   - Next meeting
   - Panel membership
   - Formation Microscanner

MINUTES

1.0 PCOM Report (both CEPAC/LITHP panels):

The meeting began at about 9:15 am with both the CEPAC and LITHP panels in a joint session to hear a report from R. Larson on the August PCOM meeting in Tokyo. He reviewed two major items of interest to the panels: (1) PCOM decisions on the ODP budget for FY 1988, and (2) proposed changes by PCOM in the panel mandates and the proposal review process.

1.1 FY 1988 ODP budget

The FY 1988 ODP budget will total about $36 million. PCOM has mandated that 3-4% of this budget (~$1.1-1.4 million) be reserved for special projects (eg. guidebases, ice support vessels, etc.).

In order to satisfy this requirement, and still stay within the current budget, PCOM approved $1,150,000 in cuts elsewhere in the TAMU budget. These include (budget savings in parentheses):

* Publication of only 1000 Part A & B volumes (with 1000 microfiche copies) ($50K)
* TAMU headquarters ($200K)
* Computer services ($100K)
* 5 TAMU grad. res. assts. ($50K)
* 2 database positions ($42K)
* Res. elec. eng., travel ($88K)
* Camera-ready Part B figures ($171K)
* Reduction of 3 staff scientists positions ($143K)
* Reductions in technician and laboratory support ($211K)

Larson answered several questions about the changes in publication policies. Part B of the Proceedings volumes will be retained. Part B will be type-set, but camera-ready figures must be supplied by the authors. Other changes include elimination of the color frontispiece from the Proceeding volumes and reducing the number of pages in the Part A volumes from 1000 to 800.

It was also noted that the XRF/XRD will remain aboard the drillship and TAMU is committed to operate these instruments on critical legs.

1.2 Changes in panel mandates and proposal review process

Larson reported that PCOM discussed the JOIDES advisory structure at its last meeting. They believe the ODP community would like to see a more thematically driven planning process, however PCOM feels that major changes in the panel structure should occur in "an evolutionary rather than a catastrophic fashion". PCOM has therefore appointed a subcommittee composed of four PCOM members (Asahiko Taira, Tim Francis, Marc Langseth, Margaret Leinen), plus Ross Heath of EXCOM, to provide recommendations on long-term changes in the panel structure.

In the interim, however, PCOM has adopted a new "proposal evaluation process" (see Appendix A). Under this plan, thematic panels are asked to

evaluate and rank proposals with respect to the major themes identified by the panel, and as to how well proposals address those themes. In the case of CEPAC, the thematic panels are requested to identify their six top thematic objectives. Regional panels are asked to evaluate only those proposals passed on by the thematic panels. They are to evaluate the proposals in terms of (1) maturity, (2) adequacy of documentation, and (3) probability of success, and construct a preliminary drilling prospectus. The thematic panels will review this prospectus to see how well the drilling program meets their thematic goals. Finally, all this information will be passed onto PCOM for formulation of the final ODP drilling schedule.

This new plan illicited a number of comments ranging from formal protest to outright support. One common concern was that the regional panel would be relegated to merely "bookkeeping" and would not retain a role in providing scientific input to the drilling plan.

After this brief airing of opinions, the two panel adjourned to separate rooms and continued their meetings.

2.0 Other liaison reports

2.1 IOP Report (C. Langmuir)

The IOP has not met since the last LITHP meeting so there was nothing new to report. C. Langmuir noted that he cannot attend next IOP meeting scheduled for late October in Rome. Detrick asked for volunteers to attend as LITHP liaison, but none were forthcoming. He therefore agreed to contact R. Schlich before their meeting to find out what, if any, LITHP input was required by IOP for this meeting (done; no reply).

2.2 WPAC Report (J. Hawkins)

WPAC also has not met since the last LITHP meeting. Their next meeting is Nov. 2-5 in London. Discussion of LITHP response to PCOM's evaluation of the 3rd WPAC prospectus was deferred to Thursday (agenda item 6).

2.3 TAMU (A. Adamson)

A. Adamson updated the panel on the status of the new mine coring system (MCS) and the preparations for Leg 118. TAMU now has two full-time engineers working on the MCS. Plans call for it to be tested on Leg 121. The NaviDrill will be available for use on Leg 118.

3.0 CEPAC Proposal Evaluation and Ranking

The review of specific CEPAC proposals, begun at the May LITHP meeting, continued with the discussion of fourteen new or revised proposals with significant lithospheric drilling objectives.

1.0 Ontong-Java Plateau (222E Revised)

This revised proposal clarifies the crustal basement objectives in the original OJP drilling proposal and modifies the drilling plan to make

both OJ1 and OJ2 basement re-entry holes, while eliminating OJ6 which addressed collisional processes on the western margin of the plateau.

- the panel felt this proposal addresses fundamental lithospheric problems, especially in terms of the crustal structure, petrogenesis and age relationships on oceanic plateaus. Since drilling is the only way to sample basement at OJP (and most other oceanic plateaus), this is a problem which ODP is well-suited to address.

- OJP is one of the largest oceanic plateaus, and relatively well-studied, making it a logical choice to focus a plateau drilling program.

- the panel felt one or two relatively deep holes (300-500 m into basement) were preferable to many shallow holes as a drilling strategy. The elimination of OJ6 was supported since the panel felt it is difficult to address collisional tectonic processes with drilling.

- deep-penetration MCS data would be useful for locating potential crustal holes, however the panel felt the lack of such data should not preclude drilling OJP at the present time. The proposed holes would at best only penetrate 1/60th of the 30+km thick plateau crust anyway and MCS data could be collected after the drilling. At this point, the panel felt any well-located, stratigraphically-controlled basement samples from this huge, virtually unknown feature would be valuable.

2.0 Blanco Transform (278E)

Five basement penetration holes are proposed in the Gorda Depression, Cascadia Depression and West Blanco Depression of the Blanco Fracture Zone to: (1) penetrate hydrothermally altered crust in the fault zone, (2) sample lower levels of the oceanic crust, and (3) sample basement in pull-apart basins within the fracture zone.

- this proposal addresses two important LITHP themes; water-rock interactions and the structure of the lower crust.
- though this area is relatively well-surveyed, insufficient site survey data is available to properly locate these drill holes; in this sense this is still an immature proposal.

- questions were raised about the objectives of the hydrothermal drilling at BEZ-1 - is this just a fishing expedition? What can be learned about hydrothermal systems here that can't be better studied elsewhere in the Juan de Fuca/Gorda/EPR ridge system?

- some of the proposed drilling objectives may be satisfied by a detailed submersible sampling program. The igneous and tectonic processes associated with small pull-apart basins, in particular, may be better studied at Garret, Clipperton or Siqueiros where they are not buried by sediment and may be directly accessed by the submersible.

3.0 Anatomy of a Seamount - Seamount 6 at EPR (279E)

A single 1200+m deep, bare-rock drill hole is proposed through a typical near-ridge, non-hot spot volcano in order to determine its internal composition and structure. These small seamounts are the most abundant volcanos on Earth and the proponents argue this drilling would provide important constraints on their growth and magmatic evolution, associated hydrothermal processes, and the tholeiitic to alkalic transition.

- as the most abundant volcanos on Earth, the structure and magmatic evolution of these seamounts are of major thematic interest to LITHP; seamount hydrothermal systems may differ from those at spreading centers and this is also of interest to LITHP.

- seamount 6 has been exhaustively studied and would make an ideal drilling target.

Two major concerns were raised about this proposal by the panel:

(1) The location of the drill hole in the caldera was questioned. The caldera will be structurally very complex with dikes, sills, and small plutons, plus hydrothermal stockworks and deposits. Successive intrusive events and episodic caldera collapse may result in an extremely complex vertical stratigraphy that may be almost undecipherable. The panel recommends the proponents consider the relative merits of a flank vs a caldera hole.

(2) The proposal does not really clearly state the key questions regarding seamount structure and evolution that drilling can answer. What hypotheses will be tested? What are the specific drilling objectives? What will we learn from this hole?

- the technical feasibility of this drilling (approximately equivalent to another 504B) was noted. The alternative of submersible sampling of a feature like Split Volcano was mentioned.

- the consensus of the panel was that this and other near-axis seamount proposals (see below) should continue to be developed. The panel also felt any seamount drilling program should be closely linked to investigations (including drilling) of the adjacent spreading center.

4.0 Axial Seamount (290E)

This proposal has very similar objectives to 279E. Three holes are proposed - two on Axial seamount and a third on Brown Bear Seamount on older crust west of the rise axis. The proposal has both magmatic and hydrothermal objectives that are of considerable interest to LITHP.

- Axial seamount is extremely well-studied; it is close to North American ports which is a logistical advantage, but the weather window is shorter than 13°N which is a disadvantage.

- as in the case of 279E, questions were raised about the usefulness of drilling in the summit caldera to investigate magmatic processes; ridge flank holes may yield a more complete and interpretable record. However, a caldera hole can be valuable for investigating seamount hydrothermalism.

- the relative merits of drilling Axial and Brown Bear seamounts were discussed. At Brown Bear seamount it will be possible to recover the whole sequence of lavas from the early to late stages of magmatism, This is not possible at Axial seamount. Thus if the primary objective is the magmatic history of this seamount, it is thus hard to justify drilling Axial seamount if Brown Bear is also drilled. On the other hand, if the main objective is hydrothermal then Axial seamount is a better target.

- as in the case of 279E the panel felt this proposal should be developed further. The proponents should clarify whether the highest priority objectives are magmatic or hydrothermal, and more specifically indicate the kind of information the proposed drilling will provide.

5.0 Geisha Seamounts (280E)

One and a half ODP legs are proposed for drilling the Geisha seamount chain in the western Pacific. The objectives of this drilling are not clearly stated, but appear to be: (1) determining the age progression along the seamount chain, (2) constraining absolute plate motions for >70 Ma, and (3) determining compositional differences with Hawaiian-Emperor seamounts.

- to the extent that samples from these seamounts provide a window into the geochemical evolution of the upper mantle this proposal is of interest to LITHP, but the age-dating and plate motion objectives are not high priority LITHP themes in the Pacific.

- the panel felt that many of stated drilling objectives could be achieved by a detailed dredging program (several of the sites are "bare-rock" holes).

- as written, the proposal provides little information on drilling strategy - why re-entry holes on some seamounts and not others; single-bit, "bare-rock" holes are proposed which seem hard to justify given the expense and time required to deploy a hard-rock guide base.

6.0 Tracing the Hawaiian Hotspot (282E)

The objective of this proposal is to drill sediments within the Hawaiian flexural moat to constrain the absolute motion of the Pacific plate with respect to the Hawaiian hot spot and define the relationship between plate motion and plate subduction. Serious questions were raised on the panel about the feasibility of this proposal:

- dating will be a problem in the moat sediments since deposition of widespread ash deposits is relatively rare.

- it is unclear how changes in absolute plate motions will be detected; the proposed method appears to require that volcanism be related to absolute plate motion which is not obvious.

- the proposed drilling could not be carried out as part of the Hawaiian flexure drilling (3E) since the holes for this project must be drilled along, rather than across, the moat.

- this proposal has serious deficiencies and we recommend it be dropped from further consideration.

7.0 Kuroshiro extension and Pacific plate motion (283E)

This drilling proposal is designed to test the hypothesis that the Kuroshiro Current has played an important role in controlling the sedimentation history of the northwest Pacific. In the process of testing this hypothesis the proponents also hope to study the interplay between the stability of the current and absolute Pacific plate motions.

- this proposal does not really address any major LITHP thematic objectives in the CEPAC area.

- this is not the best way to resolve absolute plate motions; there are just too many variables. Any drilling addressing this problem should be justified by the sedimentological or paleoceanographic objectives, not the lithospheric or tectonic objectives.

8.0 Escanaba Trough I (224E Revised)

The original version of this proposal was reviewed at the May LITHP meeting. It proposes drilling in the Escanaba Trough to determine the timing and compositional variability of magmatic activity on a 10,000-100,000 year time scale. The revised proposal addresses questions raised about this proposal by LITHP.

- this drilling clearly addresses problems of ridge crest magmatism of major interest to LITHP. The major problem with the program is the feasibility of dating the sediments with sufficient accuracy to construct a reliable chronology of eruptive events.

- LITHP supports efforts by the proponents to carry out a detailed piston coring program in this area. They must demonstrate the feasibility of stratigraphic mapping and dating in these sediments before a drilling program can proceed.

- if piston cores are successful in extending coverage to >30,000 yrs some questions were raised about how much more will be learned by drilling if it only extends the historical record back to 100,000 yrs. Could the infamous "Long Coring Facility" do this job more cost effectively?

- despite these questions, LITHP would like to see the proponents continue to develop this proposal as a potential component of a sedimented ridge crest drilling program.

9.0 Escanaba Trough II (284E)

This proposal, like 224E (Middle Valley, Juan de Fuca Ridge), is aimed at studying hydrothermal processes and ore genesis at a sedimented ridge crest. Holes are proposed in two areas of the Escanaba Trough in massive sulfide deposits, on top of uplifted sediment hills, and in sediments away from volcanic centers.

- this proposal addresses major COSOD and LITHP thematic objectives; drilling hydrothermal systems at sedimented ridge crests should be a high priority for the next phase of CEPAC drilling.

- this area is well-studied and on-going and planned surveys should provide a geological and geophysical database comparable to that available in Middle Valley. Logistically it is well-situated and the weather window might be slightly better than for Juan de Fuca Ridge.

- one major disadvantage to drilling this area is that the hydrothermal system is not apparently active. There was a consensus on LITHP that the highest priority is to drill the upflow zone of a major active vent system. As is pointed out in this proposal, there is also value in drilling a fossil system, but we believe it is a lower priority and should be done, if possible, in the same area where the active vent is drilled.

- as written, the proposal may be overambitious in trying to drill too many holes. LITHP would like to see fewer holes with at least one relatively deep (500 m) basement re-entry hole.

- LITHP encourages the proponents to continue to develop this proposal as a component of a lithospheric drilling program on sedimented ridge crests.

10.0 Jurassic Quiet Zone (285E)

One or more deep basement drill holes are proposed in the Jurassic Quiet Zone to: (1) determine the origin of the weak magnetization responsible for the magnetic quiet zone, (2) serve as a geochemical reference section for old Pacific crust, and (3) provide information on the paleoceanography of the middle/late Jurassic and early Cretaceous.

- the origin of the Jurassic quiet zone, the magnetic properties of oceanic crust, and the geochemical characteristics of old Pacific crust are all important lithospheric themes discussed in the LITHP White Paper.

- this is a good use of the drill ship; it is technically feasible (if the chert problem can be solved) and LITHP, TECP and SOHP objectives can all be addressed in a single hole.

- LITHP favors deep (ca. 500 m) holes; good MCS data is needed to properly locate potential sites.

11.0 Return to 504B (286E)

This proposal argues that despite the problems on Leg 111, Hole 504B still represents our best chance reach layer 3 in the foreseeable future. The proponents discuss several options for a return to 504B, but favor a plan to schedule an early engineering leg to clean and recase 504B and set one guidebase on the EPR before drilling 504B.

- thematically, this program represents one of LITHP's highest global priorities and is a goal that has been repeatedly endorsed by the larger scientific community at both the COSOD and COSOD II conferences.

- cleaning the junk left in the hole or deviating the hole around the junk are both feasible alternatives for deepening 504B. LITHP favors either of these options over abandoning 504B to drill (without coring) a new hole nearby.

- LITHP would strongly endorse a sidewall coring program in any return to 504B. In fact, some on the panel felt obtaining this systematic and uniform sampling from the existing hole was nearly as important as deepening 504B.

- one argument that has been raised against continuing to drill 504B is the "von Herzen" curve that appears to show an exponentially decreasing recovery rate. However, it was noted that this curve includes in the cumulative drilling time operations that did not involve drilling. In fact, some of the best penetration rates in Hole 504B were obtained at the beginning of Leg 111. Moreover, there is hope the new mine coring system will significantly improve penetration and recovery rates.

- since many of the problems in 504B are believed to be thermally related, the alternative of drilling an older site like Hole 418A was discussed. While this may be a sensible long-term alternative, the same technical problems will eventually be encountered in these holes as well (although possibly at greater depths). We believe it is best to concentrate on dealing with these known problems now in 504B, rather than gambling that another hole somewhere else will not encounter these, or other more intractable, problems.

In summary, LITHP's long-term objective is to get the technology to drill really deep into the lower oceanic crust or to Moho. While this drilling will ultimately be done elsewhere, Hole 504B represents our best chance to achieve the important short-term objective of reaching the top of layer 3 before COSOD III! Returning to 504B would also provide a clear thematic focus and deadline for the ODP engineering effort that will be necessary to achieve this top priority lithospheric drilling goal.

12.0 Drilling the M-Series, Western Pacific (287E)

Drilling is proposed to determine the nature of an apparent systematic along-strike variation in crustal magnetization in the M-series anomalies. A second simultaneous goal is to sample early Cretaceous sediments and to determine the geochemical character of the oceanic crust being subducted under the Bonin arc.

- this proposal includes drilling objectives of thematic interest to LITHP, particularly establishing a geochemical reference section seaward of the Bonin arc.

- the along-strike magnetic variations described in the proposal are intriguing, but need to be better constrained by a surface ship magnetic survey before they are adopted as a drilling target. In general, the panel felt the magnetic questions addressed in the Jurassic Quiet Zone proposal were of higher priority.

- in addition to a magnetic survey, deep reflection seismic data are needed to choose drilling sites.

13.0 Drilling of hydrothermal systems on the EPR (76E Revised)

This is a revision of the original EPR drilling proposal submitted several years ago. It is focussed primarily on drilling active and inactive hydrothermal systems on the rise axis near 12°50'N and on an adjacent off-axis volcano. Three bare-rock holes are proposed on the rise axis, 100 m apart, arranged in an L-shaped pattern. A fourth bare-rock site is proposed for drilling into the summit of a near-axis seamount.

- this proposal clearly addresses problems of magmatism and hydrothermal circulation at mid-ocean ridges that are of very high priority to LITHP and that were strongly endorsed by COSOD.

- the proposed drilling program is well-focussed for addressing the hydrothermal problem; drilling on a sediment-free ridge crest will complement drilling a sedimented hydrothermal system on the Juan de Fuca/ Gorda Ridge.

- the close spacing of the proposed axial drill holes is ideal for cross-hole seismic tomography and EM experiments.

- although thematically, LITHP rates this program very highly, the proposal itself was still considered inadequate. It needs a better developed drilling program (including drilling time estimates etc.), and more specific information on the associated logging, geochemical sampling and borehole geophysical experiments. LITHP recommends (see below) that an EPR Working Group be established with the appropriate expertise to develop a detailed drilling strategy.

14.0 Drilling the Marquesas Island Chain (291E)

This is a proposal to drill through the archipelagic apron into volcanic basement at several locations in the Marquesas volcanic chain. The drilling will address the development of the deep structure of the chain, the response of the lithosphere to volcanic loading, and the composition of lavas representing the early eruptive stages of the chain.

- this proposal addresses important LITHP drilling themes in the Pacific including hot spot volcanism and the thermal and mechanical response of the lithosphere to volcanic loading.

- the Marquesas are a different expression of hot spot volcanism than Hawaii that may be more typical of mid-plate volcanism.

- drilling and sampling the pedestal building stage of island formation would be very valuable.

- dating of sediments in the flexural moat may be easier than at Hawaii, however there is no evidence yet in the Marquesas for the well-developed moat stratigraphy documented at Hawaii.

- additional site survey data (especially MCS) are needed to define the deep pedestal structure of the islands and determine the stratigraphy within the flexural moat.

15.0 Rankings

Following the procedure begun at the May LITHP meeting, the proposals described above were divided into four groups. Group 1 are the proposals which have LITHP's highest ranking - they all are programs that address fundamental **global** lithospheric problems and, in our opinion, should be part of any Pacific drilling program. Group 2 proposals are ranked high by LITHP, but with certain qualifications mentioned above. We encourage the proponents to continue to develop these proposals. If these problems are resolved, or if higher ranked proposals prove technically or logistically unfeasible, they could potentially move into our Group 1 category. Group 3 proposals have important scientific objectives, but have limited lithospheric drilling objectives - we hope they get drilled, but they are not our highest priority in the Pacific. Group 4 proposals are either scientifically immature or have serious deficiencies - they are programs we recommend be dropped from further consideration. (The following list includes all CEPAC proposals reviewed by LITHP to date; within each grouping the proposals have not been prioritized).

Group 1 (Highest Ranking)

Juan de Fuca/sedimented ridge crest (232E)
Young hotspot volcano - Loihi (252E)
East Pacific Rise (76E Revised))
Return to 504B (286E)
Ontong-Java Plateau (222E Revised)
Jurassic Quiet Zone (285E)

Group 2 (High, but with qualifications)

Early continental rifting; Gulf of Calif. transect (275E)
Guayamas hydrothermal (275E)
Hawaiian flexure (3E)
Escanaba Trough (224E, 284E))
Old Pacific Crust (261E)
Axial Seamount (290E)
Seamounts 6 EPR (279E)
M-Series (287E)

Group 3 (Limited LITHP interest)

Atolls and guyots (202/203E)
Ontong-Java (248E)
Magnetic Quiet Zone (231E)
Geisha seamounts (279E)
Kuroshiro Extension (283E)

Group 4 (Immature/serious deficiencies)

Galapagos stockwork (258E)
Explorer Ridge (263E)
Manzanillo Rift (275E)
Blanco transform (278E)
Tracing Hawaiian hotspot (282E)

4.0 LITHP CEPAC Drilling Themes and Related Proposals

Following the PCOM directive to identify our panel's six highest priority thematic objectives in the CEPAC area, a list of thirteen drilling themes was constructed. (For a more detailed description of each theme see the LITHP White Paper). These thirteen themes were:

1. Magmatic and hydrothermal processes at sedimented ridge crests
2. Magmatic and hydrothermal processes at sediment-free ridge crests

3. Magmatic and hydrothermal processes at near-axis seamounts
4. Magmatic evolution of young hot spot volcanos
5. Structure of the lower oceanic crust
6. Crustal structure and magmatic history of oceanic plateaus
7. Composition and magnetization of old oceanic crust
8. Thermal and mechanical response of the lithosphere to volcanic loading
9. Development of young oceanic rifts
10. Along-strike segmentation of magmatic processes
11. Temporal variability of hot spot volcanism
12. Magmatic processes at convergent margins
13. Oceanic fracture zones

All of these themes can be addressed, in one fashion or another, in the CEPAC area (12 of the 13 themes are associated with at least one CEPAC proposal). The panel prioritized these themes using the following procedure: Each panel member listed their six highest priority themes from this list. Each theme was awarded one point for each vote it received. The six themes with the highest number of votes were then listed and the panel voted a second time to determine their relative priority - a first place vote was awarded six points, second place five points etc. The seven themes that did not make the initial cutoff were also prioritized in a similar fashion. The results are summarized in the accompanying table with a listing of each theme, their relative ranking, the associated CEPAC proposals that are rated highly by LITHP, as well as an approximate estimate of the drilling time required to achieve each drilling objective. Where more than one proposal is identified with a particular theme, they are listed in order of priority.

Two important points regarding these recommendations should be emphasized. The top four LITHP drilling themes in CEPAC require bare-rock drilling (EPR, Loihi), young crustal drilling (EPR, Juan de Fuca, Loihi) or high-temperature drilling (504B, EPR, Juan de Fuca, Loihi), none of which are technically feasible at the present time. <u>If the highest priority lithospheric drilling objectives in CEPAC are going to be addressed in this next round of drilling, a major improvement in crustal drilling technology must be achieved over the next 3-5 years.</u> This will require appropriate long-term planning by PCOM and a major commitment of manpower and resources by ODP/TAMU.

In addition to the development of new drilling technology, achieving <u>the highest priority LITHP drilling objectives in the CEPAC area will also require the commitment of substantial amounts of drilling time.</u> A realistic estimate of the drilling time required to address all six LITHP CEPAC drilling objectives is 8-10 1/2 drilling legs; just the top four drilling themes, which we consider a minimal lithospheric drilling program in CEPAC, will require <u>6-8 1/2 legs of drilling.</u> We believe devoting this amount of drilling time to LITHP objectives in CEPAC is justified because these are, and have been, our panel's highest global thematic priorities. Only 3 legs (106, 109 and 111) will have been devoted to these objectives in the first 5 years of ODP. This will, however, require a change in the present plan to devote only nine legs to CEPAC drilling since important SOHP and TECP objectives exist in this area as well.

LITHP CEPAC Drilling Themes

Ranking	Theme	Votes
1.	**Structure of the lower oceanic crust** Return to 504B (286E) (1-1 1/2 legs)	73
2.	**Magmatic and hydrothermal processes at sediment-free ridge crests** East Pacific Rise (76E Revised) (3 legs)	65
3.	**Magmatic and hydrothermal processes at sedimented ridge crests** Juan de Fuca Ridge (232E) (1-2 legs) Escanaba Trough (224E,284E) Guayamas Basin (275E)	54
4.	**Early magmatic evolution of hot spot volcanos** Loihi (282E) (1 leg) Marquesas (291E)	46
5.	**Crustal structure and magmatic evolution of oceanic plateaus** Ontong-Java Plateau (222E revised) (1 leg)	45
6.	**Composition and magnetization of old crust** Jurassic Quiet Zone (285E) (1 leg)	34
7.	Magmatic and hydrothermal processes at near-axis seamounts	
8.	Thermal and mechanical response of the lithosphere to volcanic loads	
9.	Temporal variability of hot spot volcanism	
10	Along-strike segmentation of magmatic processes	
11.	Development of young oceanic rifts	
12.	Oceanic fracture zones	
13.	Magmatic processes at convergent margins	

Related recommendations:

In order to help achieve LITHP drilling objectives in CEPAC we make the following related recommendations:

1) A minimum of four hard rock guidebases will be required for LITHP drilling in CEPAC. Additional guidebases will be required if any near-axis seamount drilling is carried out.

2) An engineering test leg should be scheduled for sometime in the next 12-18 months to allow ODP engineers to field test their new hard rock drilling and coring systems prior to EPR or Loihi drilling. A western Pacific back-arc basin (eg. Lau Basin) would be an ideal location for such a test, but it should be in addition to, and separate from, any scientific drilling in this same area (see related recommendations for Lau Basin drilling in section 6.4 of minutes).

3) It is desirable to attempt one leg of young crustal drilling as early as possible in the CEPAC program to allow ODP engineers to evaluate their new systems and have time to made necessary modifications. This might be done in conjunction with cleaning and recasing Hole 504B as suggested in proposal 286E.

4) We recommend PCOM establish a working group to develop a detailed drilling plan for EPR and Juan de Fuca Ridge/Escanaba Trough including strategies for hydrothermal fluid sampling, borehole logging and downhole geophysical experiments (including VSPs, crosshole seismic tomography etc.), as well as options for long-term instrumentation of the drillholes. The composition of the working group should be determined by the PCOM Chairman in consultation with the LITHP Chairman.

5.0 Joint LITHP/CEPAC Meeting (Sept. 30th)

The LITHP and CEPAC panels met jointly on the afternoon of September 30th. R. Detrick summarized for CEPAC the LITHP thematic objectives in the CEPAC area and the highest ranked related proposals. In the course of this presentation the following points were discussed:

- J. Francheteau raised the question of whether Hole 504B should be reoccupied or if deep crustal drilling should be attempted at another, older site (eg. Hole 418A). LITHP re-iterated its position that 504B is probably our only chance to reach layer 3 in a single leg of drilling in the next 5 years. It is LITHP's position that the drilling problems at 504B will eventually be encountered in any deep crustal hole. Since these problems must be solved to achieve our long-term objective of deep crustal drilling, we believe 504B is as a good place as any to do this, while at the same time achieving a long-standing goal of scientific ocean drilling - reaching oceanic layer 3.

- in reference to EPR drilling, E. Davis questioned how long it would take to complete the proposed program. It was noted that this very much depends on the drilling and coring technology, but a reasonable estimate is about 3 drilling legs (one leg per hole). It was noted that

it is not necessary or desirable to drill these as three consecutive legs

- CEPAC questioned whether adequate site survey data was available to choose sites for drilling on Ontong-Java Plateau. LITHP indicated that better sites survey information (especially deep reflection data) was clearly needed, but so little is known about the crust forming oceanic plateaus that a hole almost anywhere would be useful.

- E. Davis asked if LITHP was concerned with vertical tectonic motions (eg. sea level changes, thermal evolution of old lithosphere). LITHP indicated it was, but felt it was the primary responsibility of the TECP panel.

- R. Larson asked if either CEPAC or LITHP was interested in oceanic fracture zones. LITHP indicated it was, but did not rate this theme highly in the Pacific since it thought this problem was better addressed in the North Atlantic. It was also noted that fracture zones should be part of TECP's interests.

At the conclusion of the joint session, the panels resumed their separate meetings. The consensus was that the joint meeting had been useful.

6.0 WPAC Prospectus and PCOM evaluation

P. Robinson reviewed for LITHP the PCOM evaluation of the 3rd WPAC prospectus (see Appendix B). PCOM has asked for LITHP input on four questions: (1) Geochemical reference holes, (2) Bonin drilling, (3) Mississippi Valley Deposits proposal (Great Barrier Reef), and (4) Lau Basin.

6.1 Geochemical Reference Holes

PCOM has requested that LITHP provide the minimum strategy necessary for obtaining reference hole(s) for the Bonin system and a justification for the proposed drilling.

LITHP believes drilling crustal holes outboard of the arcs in the western Pacific can address a variety of objectives emphasized in the LITHP White Paper and by the COSOD II document. These objectives are:

(1) to determine the composition of sediment and igneous crust being circulated into the mantle at subduction zones;
(2) to test whether there is any correlation between the composition of the subducting plate and the compositions of neighboring arc volcanics;
(3) to investigate the temporal and spatial variations in the composition of the igneous crust;
(4) to compare the style of alteration and fossil hydrothermal activity in old fast-spreading with that observed in old slow-spreading crust, and inferred in young fast-spreading crust;

(5) to determine the physical processes responsible for the observed seismic velocity structure and magnetization of crust produced at a fast-spreading ridge.

The term, "geochemical reference holes," connotes objectives (1) and especially (2), but the priority LITHP places on such holes is based on the entire suite of objectives. To achieve these objectives it is necessary to drill at least one hole with deep (>200 m) basement penetration, and in addition to drill several shallower holes along the length of an arc system that shows substantial variation in chemistry. These holes should penetrate some tens of meters (preferably 50 m or more) into basement. Ideally, such drilling should take place in a variety of settings where different sediment types are involved, where the crust being subducted is of different ages (states of alteration), and was produced at different spreading rates. In this context, the western Pacific is of clear importance - it is old and fast spreading, and has a relatively thin veneer of old sediments. Drilling here would thus be a first step in achieving the longer-term objective of defining the global geochemical cycles associated with plate tectonics.

Why is it necessary to drill a deep hole?

There are three major reasons for obtaining reasonably deep holes into old ocean crust:

(1) **to obtain samples of the crust after it has undergone the full complement of high and low temperature alteration.** This is important for two main reasons. First, altered crust is likely to be an important source of incompatible elements in the down-going plate, and we need to know what the concentrations of the pertinent elements are and how they vary with depth in the crust. Because nonoxidative alteration can lead to K-poor alteration assemblages, a serious question exists concerning to what extent subducting crust is a source of LIL elements for arc magmas. Second, the composition of old crust provides an essential constraint on models of the chemical fluxes between ocean crust and seawater. Fluxes based on hot-spring data alone are insufficient to describe the total exchange between basalt and seawater because of the importance of low-temperature off-axis circulation. The petrographic, chemical and isotopic record contained in drill cores of mature ocean crust will provide the key to the timing, processes and chemical exchange in the oceanic crust.

(2) **to determine variations in initial crustal composition.** There is an increasing body of evidence that even "normal" ocean crust has mappable differences in composition from ocean basin to ocean basin that provides constraints on the temperature of the mantle from which it was formed. Ultimately, these variations in the composition of ocean crust will provide important constraints on mixing and convection in the mantle. Old Pacific basement is clearly an essential data point required for this kind of analysis. But it can only be obtained by drilling, and only by drilling deep enough into the crust that one can be sure basement has been reached and samples are obtained from below the upper, most altered zone.

(3) **to ground-truth the seismic and magnetic structure of fast-spreading crust.** This was a prime motivation for DSDP crustal drilling in the eastern Pacific which, with the exception of Hole 504B, has been largely unsuccessful. However, this objective remains important, especially with

recent advances in seismic acquisition and processing techniques which promise to significantly improve our ability to map structures within the crust. Drilling older crust, which has been altered and sealed by hydrothermal mineralization, may be a better place to attack these problems than young crust. In this sense, the holes we are proposing here tie in with the proposals to drill Mesozoic and Jurassic-aged crust in the western Pacific (285E, 287E).

Why is it necessary to drill more than one hole?

It has long been clear that the subduction of lithosphere is intimately connected to arc volcanism. What remains unclear is to what extent subducted crust is a chemical source of these volcanics. Some workers have suggested there is almost no input from the down-going plate; others maintain that the down-going plate is almost the only source; and still others suggest that the subducting plate contributes material only through metasomatic transport caused by dewatering of hydrous phases. If subducted crust and sediment contribute to arc volcanism, we would expect some correlation between the composition of the material being subducted and chemistry of the arc volcanics.

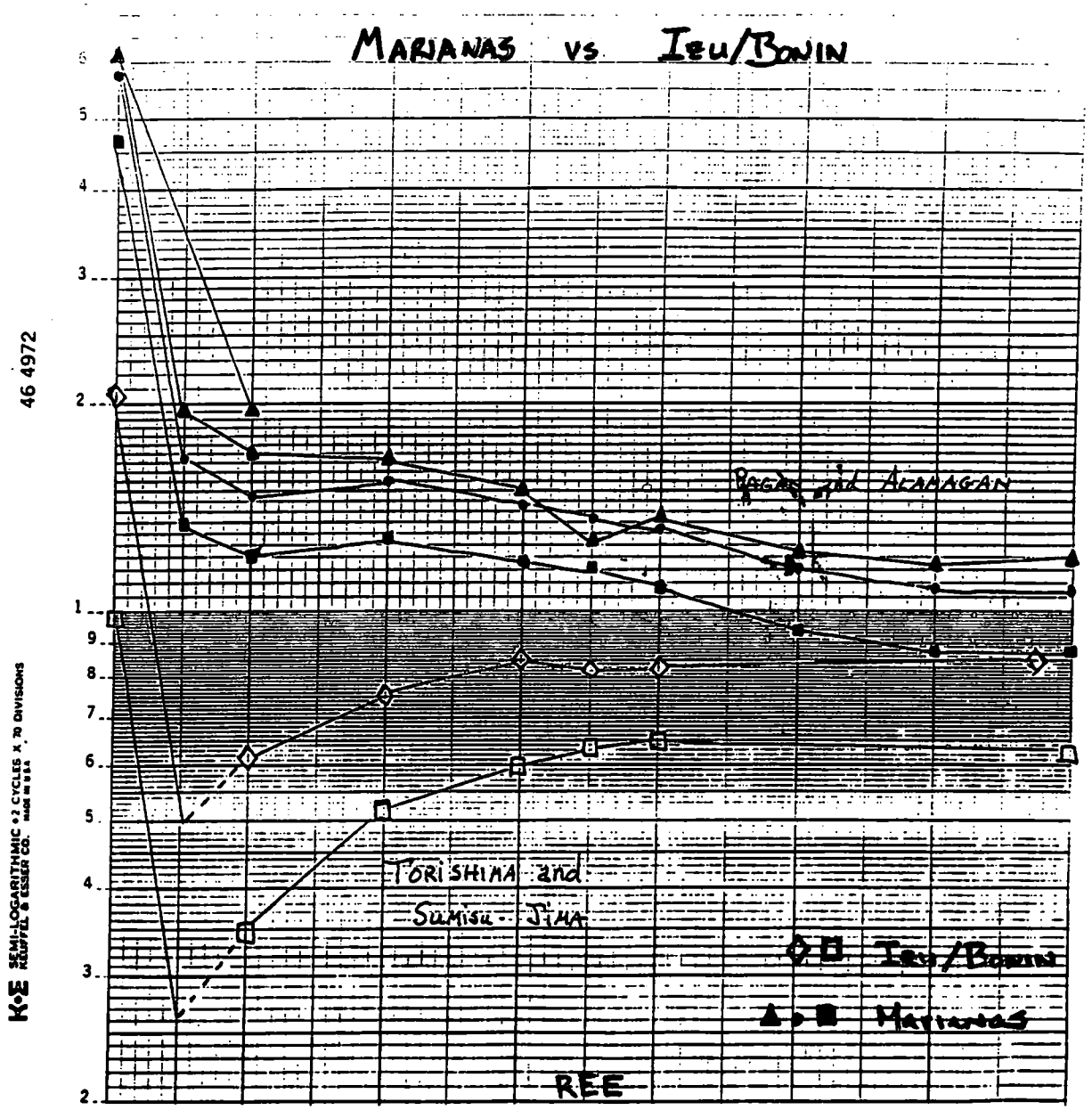
One approach to this problem (emphasized by TECP) is to choose an arc with substantial along-strike variations in arc chemistry and see if there are corresponding variations in the composition of the down-going plate. Because we can't drill the material immediately beneath the arc, the area chosen should display persistent differences in the subducting plate along the arc. The Bonin/Mariana arcs are just such a system. The islands in front of the Izu-Ogasawara arc consist of "island arc tholeiites" and their differentiates, rocks with very low concentrations of barium and potassium, and a marked depletion of the lightest rare earth elements. In contrast, the Mariana arc, which is the southern extension of this same system, have flat to enriched rare earth element patterns, and Ba contents are 100 ppm or greater (see attached figure).

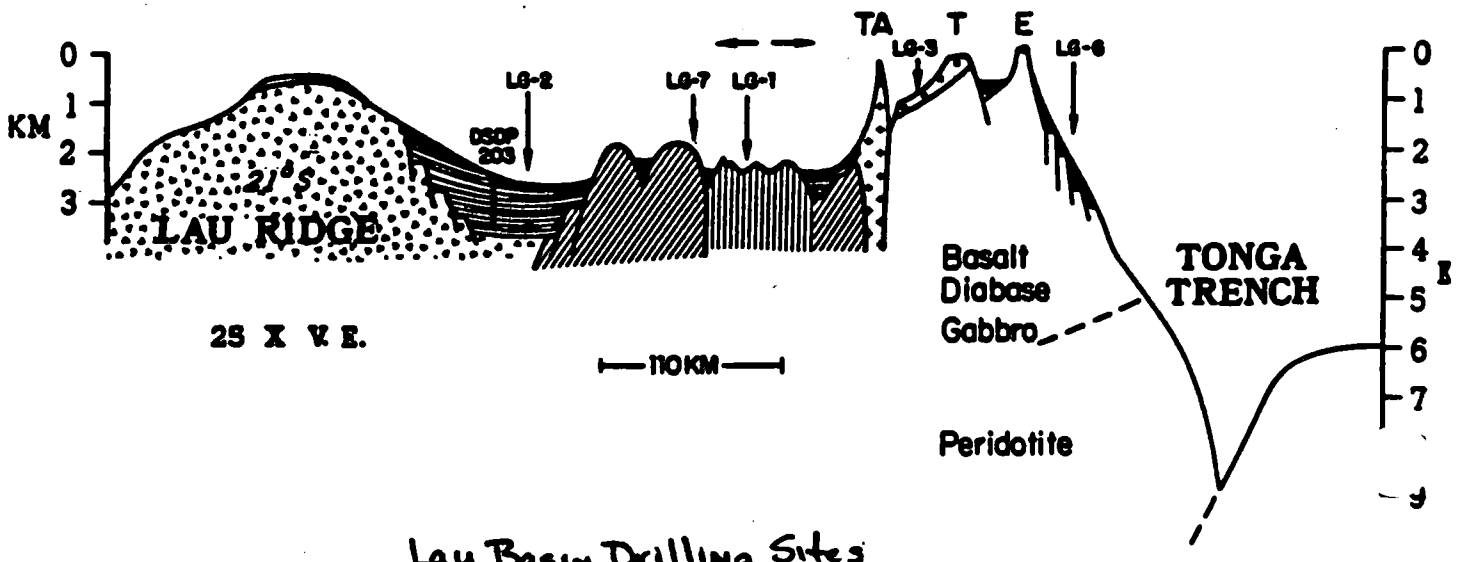
The distinctly different compositions of the Bonin and Mariana arc volcanics thus provide an ideal natural laboratory to investigate the role the composition of the subducting crust and lithosphere play in creating these differences (seamounts, for example, are much more common outboard of the Mariana arc than the Bonins). However, this requires holes in <u>both</u> arcs to sample the representative components of the subducting lithosphere in each area.

One argument apparently raised against investigating this problem in the Bonin/Mariana area is the supposed lack of sediment influence on the arc volcanics, as suggested by studies of radiogenic isotopes and ^{10}Be. The panel discussed this argument and concluded it was flawed for two reasons. First, post-Cretaceous sedimentation in this part of the western Pacific has been very low and the Mesozoic sediments contain no ^{10}Be. Thus the absence of ^{10}Be in the arc volcanics does not resolve the question of whether the sediments influence arc volcanism. Second, the isotopic characteristics of old Pacific crust is completely unknown so the lack of a ^{10}Be anomaly provides no constraint on the crustal contribution to arc volcanism.

Recommended drilling strategy

LITHP believes a minimum drilling strategy for a reference hole program in the western Pacific is one deep hole outboard of the Bonins and three shallower holes near the Mariana transect of legs 59 and 60.





Lau Basin Drilling Sites
(from WPAC Prospectus)

The deep hole, our highest priority, would be BON-8, on M-series anomalies (M-15) on the eastern end of the Bonin transect (the location of this hole could be adjusted to satisfy some of the requirements of the Handschumacher et al. proposal on the M-series lineations). This would be a re-entry site with the aim of at least 200 m of basement penetration. The three holes outboard of the Marianas are proposed for the area surveyed for DSDP Leg 60. Site MAR-4 would complete the transect of the Mariana arc carried out on Legs 59 and 60, and would be sited near Hole 452 on anomaly M-25. The objective of this hole is to sample the composition of the sediments entering the Mariana trench. MAR-5 would sample the distal portions of the volcanoclastic apron of the large seamount northeast of Hole 452, and hopefully penetrate into the oceanic crust below. MAR-6 would penetrate the summit region of the same seamount, or into a near-summit sediment bench, to sample shallow water sediments likely to be a significant component of thicker portions of the proximal sedimentary apron and Cretaceous ocean-island basalt beneath. The success of the program is critically dependent on solving the chert problem.

This program will require 1 1/2 legs of drilling. If only one leg were available for reference hole drilling, BON-8 followed by one of the Mariana holes would be our top priority.

6.2 Bonin forearc drilling

PCOM has approved a 1 1/2 leg Bonin I program consisting of sites BON 1, 2, 5a, 5b and 6. It has asked both LITHP and TECP for scientific objectives that can be addressed by an additional half leg of drilling in the Bonins, especially the question of drilling diapirs and/or the forearc terrace.

The panel discussed memos that Brian Taylor and Patricia Fryer had prepared on the scientific justification for drilling forearc diapirs in either the Marianas or Bonins. It was agreed that drilling a forearc diapir would provide unique information, not easily be obtained by surface sampling, on:

(1) the compositional variability of the fluids within the serpentinite matrix and their origin (dewatering of the down-going slab or compaction and desiccation of the sedimentary section).
(2) the compositional variability of the matrix material.
(3) the potential for ore deposition within the diapir.
(4) the mechanical properties and uplift history of the diapir.

The information obtained from this drilling will be important for understanding the geochemical mass fluxes associated with the subducting lithosphere and thus is closely tied to the "reference hole" drilling that has been strongly advocated by LITHP.

Although the value of drilling forearc diapirs is clear, the panel reiterated its earlier position that drilling the forearc terrace adjacent to these diapirs is of the same, if not greater, importance. The nature of the material comprising the forearc terrace is still very poorly understood and can only be sampled at depth by drilling. Its mechanical properties will provide an important control on forearc diapirism, and the unroofing history of the diapir recorded in its sediments

may provide better constraints on the uplift history of the diapirs than drilling directly into the diapir itself.

The panel next turned to considering whether this drilling should be carried out in the Bonins or Marianas, or in both areas. The best-studied diapirs are Conical and Pacman seamounts in the Marianas; it is not certain the domes seen in the Bonins are serpentinite diapirs, although dredge samples show evidence of hydration consistent with fluid invasion of the outer forearc. On the other hand, the structural setting of the outer Bonin arc is better known from MCS data. A final consideration was potential differences in the kind of diapirism in the two areas. The Bonin "diapirs" form on the lower slope terrace and are consistent with hydration of the outermost toe of the overriding plate by low P-T dewatering of the sedimentary section and possibly the upper portion of the oceanic crust in the down-going plate. The Mariana diapirs, on the other hand, are actively venting fluids that indicate they are derived from the subducting plate and/or mantle by massive segregation of serpentinite, and have risen through significant crustal and mantle overburden. Based on these considerations the panel made the following recommendation:

Recommendation

LITHP recommends a half-leg be devoted to drilling a forearc diapir and the adjacent forearc ridge in one arc, rather than drilling diapirs in two different arcs. The panel endorses drilling Conical seamount (MAR-3) and an adjacent forearc site in the Marianas as its highest priority. Diapirism is best documented at this site and drilling the adjacent forearc ridge will complete the Leg 59/60 Mariana transect. BON-7 is an important, but lower priority target, that should be drilled if time is available.

6.3 Evaluation of Mississippi Valley deposits proposal

LITHP has been asked to evaluate the Mississippi Valley Deposits proposal (268/D) for PCOM.

S. Scott summarized the proposal. Mississippi Valley-type deposits are carbonate-hosted lead-zinc deposits that are very important sources of base metals in North America and Europe. Northeast Australia appears to offer a close analogue to these deposits in a modern reef environment. The proponents argue that data from these holes could yield useful information regarding early carbonate diagenesis, chemistry of pore fluids, H_2S generation, chloride solutions, aquifer dynamics and metal source-sediment chemistry. Two of their proposed sites can be "piggy-backed" on SOHP proposed sites, but they require an additional half-leg to drill two additional sites.

- there was general agreement that this is a fundamental problem in ore genesis and that by drilling on the GBR much could be learned about the depositional history and early diagenesis of potential host rocks for these kinds of deposits.

- questions were raised about the lack of a true transect and what this would mean in terms of determining the aquifer dynamics and variations in fluid chemistry; also concern was expressed about what could be

learned about metal source-sediment chemistry if the ore deposits are not now actively forming.

- H. Elderfield noted that problems exists with present fluid sampling capabilities within ODP; significant improvement in pore fluid sampling techniques would be required for this program.

- J. Malpas commented that many of the objectives here are related to carbonate diagenesis and deposition and should be evaluated by SOHP.

- finally, there was discussion about the minimum drilling program needed to adequately address this problem - four holes?, three?; another attempt should be made to select sites that would satisfy this program as well as SOHPs other objectives in this area.

Recommendation

The Mississippi Valley deposits proposal addresses important scientific questions related to the formation of carbonate-hosted lead-zinc deposits. However, this program is not central to LITHP thematic objectives, either globally or in WPAC. We suggest additional efforts be made to integrate this work with SOHP objectives in the area, but in terms of an extra half-leg, reference hole drilling and forearc diapir drilling are higher priorities for LITHP.

6.4 Lau Basin

PCOM has asked LITHP to formulate two scenarios for a single leg of drilling in the Lau Basin, one with and without bare-rock drilling, and to describe the scientific objectives and relative merits of each.

Scenario 1 (without bare-rock drilling)

LG-2 is LITHP's highest priority in the Lau Basin in this scenario. Drilling at this site will: (1) document the basement age of the basin margin at 18°S, with implications for the age of initial basin formation and comparison with (coeval?) activity on the Lau Ridge, (2) provide a sediment section for evaluation of the rates of subsidence and hydrothermal input in the evolution of the basin margin, and (3) sample the oldest lavas erupted in the basin to test models of chemical heterogeneity in the development of the basin. A moderately deep, re-entry hole (>200 m) below basement is required to adequately address the heterogeneity question. Coring of the oldest sediments will satisfy the unreached objective of DSDP Hole 203, and provide the critical age data. Coring of the entire sediment section is necessary for a temporal analysis of arc and hydrothermal inputs.

Our next highest priority is LG-3 on the Tonga platform near 22°S. This hole has a clearly defined drilling target (Unconformity A) that will yield information on the age of inception of back-arc opening, as well as the vertical tectonic history of the arc prior to rifting. Comparison of the opening rates at LG-2 and LG-3 will provide information on the age progression, if any, in the opening of the basin from 18-22°S.

Sites LG-7 and LG-1 are nearly at the same latitude as LG-2 and would sample younger crust within the basin. Drilling at these sites will be useful in evaluating the local heterogeneity of basement lavas, and the nature of the transition from "Mariana Trough"-type to MORB

lavas. We would favor drilling one of these holes (probably LG-7) relatively deep (ie. as a re-entry hole), rather than two shallow holes, to document local heterogeneity which is a prime LITHP objective at these sites.

We have not included LG-6 in this scenario since PCOM has directed us to focus on back-arc processes. However, LITHP has consistently rated LG-6 highly, especially for the information it could potentially provide on the history of the arc and the composition of pre-Lau Basin volcanic basement in the forearc. We thus recommend LG-6 as a high-priority back-up site, especially if drilling young crust at LG-7 or LG-1 proves technically unfeasible.

Summary: In this scenario we endorse a one-leg program consisting of, in order of priority, LG-2, LG-3 and LG-7 or LG-1. LG-2 should be drilled at least 200 m sub-basement; LG-3 must be drilled to unconformity A. LG-6 is a high-priority back-up site. None of the holes require bare-rock drilling.

Scenario 2 (bare-rock drilling)

Presently, the best-documented spreading axis in the Lau Basin is between 18-19^{0}S, in the vicinity of LG-1, and if we had to recommend a bare-rock site it would be in this area (final site selection should await detailed surveys yet to be completed). Drilling at or near the rise axis in this region would provide samples from medium spreading (50-60 mm/yr) back-arc crust. Dredging indicates the surface lavas are normal MORB, but it is possible other lavas types with particular back-arc characteristics may be encountered at depth. Valu Fa is a potential alternative bare-rock site which would sample highly differentiated (andesitic to dacitic) lavas and related hydrothermal mineralization (von Stackelberg has proposed two sites: LG-4B and LG-4C). We, however, would favor LG-1 since the highly acidic, brittle Valu Fa lavas are likely to be extremely difficult to drill and the northern Lau Basin is more typical of back-arc magmatism.. It is conceivable that devoting one leg entirely to bare-rock drilling at either of these sites would yield no new information on back-arc magmatic processes. Therefore, in this scenario we recommend at least 1/2 leg be devoted to drilling at LG-2.

Summary: Top priority for bare-rock drilling should be on- or near-axis between 18-19^{0}S, however at least 1/2 leg should be devoted to drilling at LG-2.

Discussion

Of these two options, LITHP unanimously endorses the first scenario. At the present time, there is not, in our opinion, strong scientific justification for an extensive program of bare-rock drilling in the Lau Basin (nor has either LITHP, WPAC or the Lau Basin Working Group previously recommended bare-rock drilling in the Lau Basin). Drilling at LG-2, LG-3 and either LG-7 or LG-1 offer excellent opportunities for studying back-arc accretion and magmatic processes without bare-rock drilling. However, there is a strong engineering justification for field tests of the new hard-rock drilling systems, including a modified guidebase design, under development for EPR and other CEPAC drilling. The Lau Basin is an ideal site to test this equipment and LITHP strongly endorses an "engineering" leg devoted to this purpose. However, LITHP believes this

engineering testing should be separate from, and in addition to, one leg of scientific drilling in the Lau Basin.

We thus make the following recommendations:

Recommendations:

(1) A one-leg program of scientific drilling should be devoted to back-arc processes in the Lau Basin. The highest priority sites are LG-2 in the western Lau Basin which should be drilled to a least 200 m sub-basement, LG-3 on the Tonga platform which should be drilled to Unconformity A and LG-7 or LG-1. None of the sites require bare-rock drilling.

(2) A separate engineering development leg should be approved for Lau Basin to field test new hard-rock drilling and coring systems under development for CEPAC drilling. Final site selection should be based on engineering requirements, but sites on- or near-axis between 18-19°S would be our first choice, with LG-4B or LG-4C on Valu Fa ridge as potential alternative sites.

7.0 Other Matters

7.1 Next meeting

The next LITHP meeting was tentatively scheduled for March 1-3, 1988 in Hawaii with John Sinton serving as host. The meeting will be either held at Volcano House or on the Hilo campus of the University of Hawaii.

7.2 Panel Membership

The panel was pleased to welcome Harry Elderfield (the long awaited replacement for Margaret Leinen) to LITHP and was informed that Larry Cathles will join the panel in March as a replacement for John Delaney. Three U.S. LITHP members are rotating off the panel effective Jan. 1, 1988: John Sinton, Charlie Langmuir and Jim Hawkins. The panel felt at least two of the new replacements should be petrologists to maintain the panels strength in this area. Nominees were (in preference order): Dave Clague (USGS), Bill Bryan (WHOI), Jim Natland (SIO) and Mike Perfit (Florida). The third replacement could be a geophysicist and John Orcutt (SIO) and Norm Sleep (Stanford) were nominated. Jim Hawkins agreed to remain on the panel longer if necessary.

The Chairman thanks John, Charlie and Jim for their long and devoted service to LITHP. They will be hard to replace.

7.3 Formation Microscanner

J. Picard made a brief presentation to the panel on the Formation Microscanner (FMS), a new tool developed by Schlumberger which the Borehole Logging group would like to acquire for ODP. The FMS provides two-dimensional resistivity images of the borehole wall and has a resolution of about 0.1 cm. It can clearly define fractures, foliation planes, brecciated regions, breakouts, and contacts. Since its spatial orientation can be determined with 3-axis accelerometers and flux-gate magnetometers in the tool, it can record the strike and dip of these features. The current version of the tool is too large to be used in ODP; a slimmer

version of the tool would cost about $160,000 over two years. DMP has listed the FMS as its highest priority acquisition for 1988. Although originally designed for use in sediments, it appears that it will be valuable in crustal holes as well. Questions were raised as to whether the modified FMS tool will fit in the smaller diameter holes envisioned with the new mine coring system under development at ODP. Assured that the answer to this was yes, the panel gave its endorsement to the acquisition of this new tool.

* * * * *

The meeting officially adjourned at 3:10 pm on 1 Oct. The panel thanked Catherine Mevel and Jean Francheteau for hosting an enjoyable and productive meeting.