# JOIDES PLANNING COMMITTEE SUMMER MEETING
## 11-13 August 1992
## Corner Brook, Newfoundland

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As of Wednesday, July 29, 1992

# JOIDES MEETING SCHEDULE

| Date | Place | Committee/Panel |
|---|---|---|
| **1992** | | |
| 4-6 August | Palisades, NY | SSP |
| 11-13 August | Newfoundland, Canada | PCOM |
| 9-11 September | Marseilles, France | IHP |
| 12-13 September | Victoria, B.C. | SMP |
| 23-25 September | Victoria, B.C. | DMP |
| 22-27 September | Grenada, Spain | TECP |
| 26-28 September | Kiel, Germany | SGPP |
| 30 Sept-2 Oct | Marseilles, France | OHP |
| 7-9 October | Cambridge, U.K. | TEDCOM |
| 14-16 October* | Paris, France | LITHP |
| 22-23 October* | London | PPSP |
| 1 December | Bermuda | Panel Chairs |
| 2-5 December | Bermuda | PCOM |
| **1993** | | |
| 27-28 January | Coff's Harbor, Australia | EXCOM |
| January* | College Station, TX | DMP |
| 26-28 April | Palisades, NY | PCOM |
| 22-24 June | College Station, TX | EXCOM |
| August | Australia | PCOM |

*Meeting not yet formally requested and/or approved

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# ODP OPERATIONS SCHEDULE

| Leg | | Port of Origin† | Cruise Dates | Days at Sea | Estimated Days Transit/OnSite |
|---|---|---|---|---|---|
| 144 | Atolls & Guyots B | Majuro Atoll 20-24 May | 25 May - 20 July 1992 | 56 | 12/44 |
| 145 | North Pacific Transect | Yokohama 20-24 July | 25 July - 21 September 1992 | 59 | 18/41 |
| 146 | Cascadia | Victoria 21-25 September | 26 September - 22 November 1992 | 57 | 6/51 |
| 147 | Hess Deep | San Diego 22-26 November | 27 November 1992 - 22 January 1993 | 56 | 14/42 |
| 148A | Hole 504B* | Panama 22-25 January | 26 January - 23 February 1993 | 28 | 4/24 |
| 148B | Hole 504B* | ⚓ Panama 23 February | 24 February - 15 March 1993 | 19 | 4/15 |
| 148C | Transit | Panama Canal 15 March | 15 March - 2 April 1993 | 18 | 18/0 |
| 149 | Iberian Abyssal Plain | Lisbon 2-6 April | 7 April - 29 May 1993 | 52 | 2/50 |
| 150 | New Jersey Sea Level | Lisbon 29 May-2 June | 3 June - 29 July 1993 | 56 | 16/40 |
| 151 | Atlantic Arctic Gateways | St. John's 29 July-2 August | 3 August - 28 Septemer 1993 | 56 | 14/42 |
| 152 | East Greenland Margin | Reykjavik 28 Sept.-2 Oct. | 3 October - 28 November 1993 | 56 | |

*Scientific Party on board for 148A&B. Sedco-Forex crew rotate on 23 February 1993

†Although 5 day port calls are generally scheduled, the ship sails when ready.

Revised 27 April 1992

# ODP FY1993

(November 1992 - November 1993)

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# JOIDES PLANNING COMMITTEE SUMMER MEETING
## 11-13 August 1992
## Corner Brook, Newfoundland

## AGENDA NOTES

**Tuesday 11 August 1991 (9:00 AM)**

**Item A.**
**Welcome and Introduction**

1. Welcome, and comments about meeting logistics (J. Malpas/S. Deveau).

2. Introduction of PCOM members/alternates, liaisons and guests.

**Item B.**
**Approval of Minutes**

1. The attached revised draft minutes of the 21-23 April 1992 PCOM Meeting at Oregon State University include corrections received at the JOIDES Office through 30 July 1992.

2. ACTION Call for corrections or additions; call for approval.

**Item C.**
**Approval of Agenda**

1. Comments about content of the meeting and organization of its agenda (J. Austin).

The primary purposes of the Summer Meeting are to: 1.) confer with liaison groups to other international global geoscience initiatives (**Agenda Items F. and H.**); 2.) make potential modifications to the near-term drilling program necessitated by a number of factors occurring since the Spring Meeting (**Agenda Item L.**); 3.) consider the future of DCS development (**Agenda Item G.**) and data management (**Agenda Item K.**) within ODP, and 4.) conduct routine JOIDES business (**Agenda Items D., E., G., N., and P.**).

In addition, PCOM will: 5.) hear summaries of the Atolls and Guyots program, legs 143/144, by one of the Co-Chiefs from each expedition (**Agenda Items I. and J.**); 6.) consider strategies for issuing RFP's for pore-fluid sampling and deep-drilling (**Agenda Item M.**) in light of the current fiscal situation; 7.) discuss format and content of the FY94 "Atlantic/eastern Pacific Prospectus" (to be prepared by the JOIDES Office and submitted to the thematic panels / SSP by late August), 8.) discuss outside-party use of ODP re-entry holes, and 9.) name a PANCHM Chair for the 1992 Annual Meeting (**Agenda Item O.**).

**2.** ACTION Call for additions to **Agenda Item O.**; call for other additions or revisions; call for agenda approval.

**Item D.**
**ODP Reports by Liaisons to PCOM**

**1. NSF** (P. Dauphin / B. Ambos, liaisons).

- Budget issues
- Reviews and renewal status
- ODP Council highlights
- Other

**2. JOI, Inc.** (T. Pyle, liaison).

- FY93 Program Plan
- Status of high-temperature tools
- Other

**3. Science Operator** (T. Francis / J. Baldauf, liaisons) (except engineering, including consideration of the future of DCS, **Agenda Item G.**).

- Operations of the *JOIDES Resolution* since the April 1992 PCOM meeting
- Preparation for future legs: 146 through 152
- Developments at ODP-TAMU:
  - Publications
  - Repositories (response to questionnaire)
  - Leg staffing

*Break 1000-1015 Coffee*

4. **Wireline Logging** (D. Goldberg, liaison) (except engineering, **Agenda Item G.**).

- Operations and results since the last PCOM meeting (legs 143 / 144)
- Personnel changes and other development
- Data distribution survey

5. ACTION Identification of action items from morning reports; take action or postpone (probably to **Agenda Item O.**) as appropriate.

**Item E.**
**JOIDES Reports by PCOM Liaisons / Chairs of Working Groups**

1. EXCOM (J. Austin, liaison).

The Executive Committee met in Washington, D.C. June 15 and 17 in executive session, and June 16 in conjunction with the ODP Council. This may have been the most complex (and chaotic) meeting in EXCOM history, but EXCOM is tackling some very complex issues in what the PCOM Chair feels is a responsible manner.

The main issues were: (1) approval of the FY93-FY96 Program Plan; (2) status of renewal (with emphasis on the 1993-1998 period); (3) the mix of subcontractors for that renewal period; (4) increasing internationalization of ODP, with particular emphasis on the site of the 1994-1996 JOIDES Office; and (5) external review of the JOIDES advisory structure.

EXCOM approved the four-year (FY93-FY96) Program Plan with little discussion, and did not seem concerned about the growing concentration of programs in the Atlantic and immediately adjacent oceans noted by PCOM. Regarding renewal, the U.K. (for five years) and Australia (for three years) have committed to a second phase of ODP participation, encouraging words were heard from ESF, Germany and Canada about their participation, and both France and Japan expressed (guarded) optimism about ongoing internal negotiations. *(Note: The PCOM Chair recently heard while in Yokohama that Japan has renewed its partnership in ODP.)* Without clearly stating their future intent, Russia appears to be out, effective 1 October 1992. This will obviously negatively affect the ODP budget, particularly for big ticket items like DCS, data handling, the "DataNet" concept, and all other engineering initiatives (additional platforms, pore fluid sampling, deep drilling, etc.). PCOM will discuss various aspects of this budgetary impact later on at this meeting (**Agenda Items G., K. and M.**)

EXCOM spent a great deal of time receiving and considering input from its subcommittees on "Long-Term Organization and Management of ODP (the "Briden Report") and subcontracting for the next phase of ODP (the "Dorman subcommittee"). To make a long story short *(Note: The PCOM Chair will have a complete set of EXCOM minutes at the meeting, if PCOM members desire to see them.)*, LDGO will (probably) manage routine logging through FY93, but such activities will be put out to bid for FY94 and beyond. Add-on downhole measurements activities (beyond the routine, day-to-day tasks, "DataNet" or some equivalent) will also be put out to international tender at some point, after input from panels / PCOM and BCOM. *(Note: Discussion of this at PCOM level will be postponed until DMP has had a chance to deal with this issue in September.)* The Site Survey Data Bank will not be put out to bid at this time, nor will the Science Operator subcontract (i.e., management of present core repositories, computing / data management *[including upgrades currently being envisioned, see **Agenda Item K.**]*, and staffing / running the *JOIDES Resolution*).

In terms of internationalizing ODP, EXCOM authorized a move of the JOIDES Office to a non-U.S. venue for the 1994-1996 period. JOI, Inc. will issue an RFP to the partners, and responses are due at JOI, Inc. ~1 October 1992. Bids will be evaluated by a panel of "uninvolved" EXCOM, PCOM and JOI, Inc. personnel, for a final decision by EXCOM at their next meeting in Australia in January 1993. EXCOM encouraged ODP-TAMU to increase its international staffing in College Station, a goal the Science Operator is already committed to achieving. Consideration of future core repository sites at locations other than those currently at LDGO, TAMU and SIO is also underway. *(Note: ODP-TAMU will report to PCOM at this meeting on a survey conducted at the request of EXCOM to assess community input on this issue, see **Agenda Item D.3.**)*

Finally, EXCOM mandated an external panel to review functioning of the JOIDES advisory structure, as recommended by both the Briden and PEC-III reports. Members of that panel are being invited this summer, and some/all may be at the Annual Meeting of PCOM with Panel Chairs in Bermuda in December 1992. A report from that group may be available for EXCOM perusal at their June 1993 meeting.

Regarding PCOM's letter response to recent EXCOM activities (copy attached to this Agenda Book), the EXCOM Chair has assured PCOM (see letter attached to this Agenda Book) that ODP will remain a fully consultative process (i.e., that PCOM will be consulted on all aspects of ongoing EXCOM deliberations prior to firm EXCOM action). That sentiment was oft reiterated by EXCOM members at the meeting itself. The PCOM Chair is confident that EXCOM will seek PCOM advice as needed (but PCOM is right to keep on eye on them!).

**2.** DMP (K. Becker, liaison).

DMP met 2-4 June at the KTB Visitor Center, Windischeschenbach, Germany. Draft minutes are attached to this Agenda Book.

PCOM should take particular note of DMP recommendations 92 / 4 (third party tool guidelines, see April PCOM mtg. minutes), 92 / 5 (endorsement of RFP for feasibility study for *in situ* sampling of pore fluids, see **Agenda Item M.**) and 92 / 6 (Leg 148, see **Agenda Item L.**).

PCOM might also take up the issue of a new Chair of DMP, effective in 1993. The DMP Chair has forwarded a nominee to the PCOM Chair (**Agenda Item N.**).

**3.** TEDCOM (K. Becker / B. Lewis, liaisons)

TEDCOM met 7-8 May in College Station. Draft minutes are attached to this Agenda Book.

The main item on the TEDCOM Agenda was review of DCS Phase IIB performance during Leg 142 and consideration of the future of DCS within ODP. TEDCOM also considered deep drilling. The PCOM Chair instructs liaisons to report on TEDCOM's stance on these issues; PCOM will take up DCS substantively as part of **Agenda Item G.** and the question of a deep drilling initiative (i.e., RFP) under **Agenda Items L.** (vis-à-vis Leg 149) **and M.**

**4.** OD-WG (B. Taylor, PCOM liaison; F. Vine, Chair)

The Offset Drilling WG held its third and presumably final meeting 18-20 May in Paris. The WG's final report is attached to this Agenda Book. The Chair of the WG will make a presentation to PCOM at this meeting, assisted if necessary by the PCOM liaison.

PCOM must either accept the OD-WG report and thank / disband the WG or direct the WG to continue it deliberations, under either the existing or modified mandate.

**5.** SL-WG (J. Watkins, PCOM liaison; T. Loutit, Co-Chair)

The Sea Level WG held its third and presumably final meeting 6-8 June in Snowbird, Utah. The final report is attached to this Agenda Book. The Co-Chair of the WG will make a presentation to PCOM at this meeting, assisted if necessary by the PCOM liaison.

PCOM must either accept the SL-WG report and thank / disband the WG or direct the WG to continue it deliberations, under either the existing or modified mandate.

*(Note: Because of anticipated scheduling at the time of writing of this Agenda Book, it is possible that the SL-WG report will instead be given as **Agenda Item H.**)*

**6.** ACTION Before recess: Identification of action items from morning reports; take action or postpone (probably to **Agenda Item O.)** as appropriate.

*Break 1200-1315 Lunch*

## Item F.
## Reports of Co-Chairs (or representatives) of Liaison Groups

**1.** Federation of Digital Seismic Networks (FDSN) [written report by G. M. Purdy, WHOI, liaison].

**Japan:** Although there is no formal funded program in Japan at this time to support the installation of further downhole seismometer experiments, there exists substantial activity directed towards the design, construction and installation of permanent ocean floor geophysical observatories. Prototype systems have been tested in shallow water and it is hoped that funding will be soon available to permit the installation of at least one of these observatories along TPC-1, the Japan to Guam telecommunications cable that is now jointly owned and operated by the Japanese and U.S. academic communities. The importance here is that a wealth of technological knowledge and experience of direct relevance to our efforts to build downhole seismological observatories will result from this work. We have excellent contact with Dr. J. Kasahara of the University of Tokyo who keeps us well informed of the progress being made.

**France:** Unfortunately at the time of writing I have not heard the specific details on the outcome of the NAUTILE-NADIA downhole operations at the existing DSDP Site 396B on the flank of the Mid-Atlantic Ridge that occurred a few weeks ago. This emplacement of a Guralp broadband sensor downhole will, of course, provide critically important data on the design of our permanent observatories.

A special session on the Ocean Seismic Network is part of the program for the major international seismological meeting in Paris this September organized by the French GEOSCOPE program.

**U.S.:** Substantial progress has occurred in the U.S. in recent months. NSF has agreed to support through IRIS a modest program planning office that will, in the short term, be located at JOI and be led by Dr. Ellen Kappel. This office will begin operation formally this fall. A joint Scripps/Woods Hole proposal to design and build a broadband downhole seismic system based around the Teledyne-Geotech sensor, and specifically intended for use for the OSN pilot experiments at the OSN-1 site off Oahu, has been funded by NSF. Successful tests of remote sensor burial systems (also an essential component of the pilot experiment activities) have recently been completed by Dr. T. Yamamoto of the University of Miami. The remote system for wireline reentry of ODP drill holes is approaching completion by Dr. Fred Spiess of Scripps and test activities are planned in OSN-1 later this year.

**Sites:** Obviously we were disappointed that the drilling proposal for OSN-2 in the Northwest Pacific was unsuccessful, but we understand the reason for PCOM's decision. It is a high priority for us to establish an overall siting plan for the network and plans are in place to proceed with this in a timely manner. Three specific activities are planned: a joint meeting between the U.S. OSN Steering Committee and representatives of the IRIS Global Seismic Network Committee is scheduled for mid-September. Secondary, observatory siting will be a key point of discussion at the OSN session during the GEOSCOPE meeting in Paris in late September and we hope to have specific recommendations for the endorsement of FDSN at the meeting in December. We cannot hope to finalize the siting for all 15 to 20 of our planned observatories at this early stage. Our tentative plan is to identify the five highest priority sites where prototype observatories could be installed without unreasonable logistical difficulties and from which data could be used to quickly confirm the unqualified importance of the recording of broadband data over oceanic lithosphere.

I hope these brief notes are helpful. As you can see, efforts to build OSN are in a healthy state. We look forward to working with PCOM over the next few years to achieve our ambitious and important objectives.

## 2. International Geosphere Biosphere Program / Global Sedimentary Geology Program (IGBP/GSGP) [written report by R. Ginsburg, U. Miami, for T. Bralower, University of north Carolina, liaison].

**Short Courses, Tunisia, January, 1992**

The Tunisian Committee, headed by PDC-Member Ali M'Rabet (see below), organized two Short Courses in January that were most successful and provided a model for future GSGP Training Courses. Dr. J.F. Sarg, formerly a Section Head for Exxon Research, gave a two-day Course on Sequence Stratigraphy and Professors Bruce Purser (University of Paris, Sud) and Ali M'Rabet joined me in giving a three-day course on Carbonate Platforms.

The two Courses were separated by a four-day field trip in Southern Tunisia to see Mesozoic carbonates.

The Courses attracted some 50 participants: university students and faculty, petroleum geologists from industry and government, and at least one consultant; most of them were from North Africa, but Hungary, Senegal, Spain, France and the U.K. were also represented.

The Tunisian Committee was most successful in raising funds to cover the travel costs of the Faculty and a substantial amount of the travel and living expenses for the non-professional students. They obtained funds from UNESCO, local governments and state oil companies as well as from international oil companies.

These Courses and the field trip were an unqualified success thanks to the excellent planning and arrangements by the Tunisian Committee. The participants were serious, committed geologists who were enthusiastic about the Courses. As one of the teachers and a participant in the excellent field trip, I consider the whole experience most rewarding.

This was the second GSGP-sponsored offering of short courses and I think it is a model of what can be done elsewhere. Through our Country Committees, I believe that GSGP can provide teachers on various topics in sedimentary geology and use the Tunisian experience as a guide for host groups. I know that Ali M'Rabet is willing to answer questions on the planning and execution of such courses.

**Changes in the Membership of the Program Development Committee**

| | |
|---|---|
| Bernard Beaudoin, Professor École des Mines | 1992 |
| Liu Baojun, Professor, Chengdu Institute | 1993 |
| Peter Cook, Director, Geological Survey of the UK | 1994 |
| Eric Flugel, Professor, Erlangen University | 1995 |
| Robert Ginsburg, Professor, University of Miami | 1995 |
| Victor Gostin, Professor, Adelaide University | 1994 |
| Victor Kurnosov, Professor, Russian Academy | 1995 |
| Ali M'Rabet, Senior Scientist, Tunisian Petroleum Co. | 1993 |
| Wolfgang Schlager, Professor, Amsterdam | 1995 |
| Luis Spalletti, La Plata University, Argentina | 1995 |

**PANGEA Workshop**

Co-Chairman George de V. Klein and Benoit Beauchamp did a splendid job of organizing the inaugural Workshop that was held May 23-27, 1992 at the University of Kansas. There were some 80 participants in the Workshop who participated in three days of intense discussions and planning. The summary reports of each of the five Working Groups is expected early in the fall of 1992.

**Albicore/Apticore Workshop**

In 1990, Working Group 3 of Project CRER [Cretaceous Resources, Events and Rhythms - see below] that is led by Dr. Alfred G. Fischer (University of Southern California) developed the idea of a research project to test the Milankovich interpretations of Albian carbonates. Subsequently, the ALBICORE initiative was combined with a program of research termed APTICORE on the possible influence of flood basalts on climate, sea level and anoxia that was developed by Roger Larson (University of Rhode Island). In parallel with this initiative, our European colleagues have organized a Greenhouse Coring Project.

A Workshop to plan research on both ALBICORE and APTICORE and to consider the Greenhouse Coring Project is scheduled for October 4-9, 1992 in Perugia, Italy. Support for this Workshop comes from USSAC and NSF.

**Activities in Research Project CRETACEOUS RESOURCES, EVENTS AND RHYTHMS**

A. Workshop on the K/T type section, El Kef Tunisia.

In April, 1992, 20 specialists on the K/T transition met in Tunisia with an equal number of colleagues from North Africa to discuss the state-of-the-art on the K/T and to examine and sample the newly-designated type section at El Kef. Two days of talks in Tunis were followed by two days studying sections that had been excavated by the Tunisian GSGP Committee. Samples were collected for a blind test to resolve difference in the interpretations of the pattern of microfossil extinctions across the boundary.

B. Atlas of Cretaceous Carbonate Platforms.

A collection of case histories of Cretaceous Carbonate Platforms is well on the way towards publication by Editors Toni Simo (Wisconsin) and Robert Scott (Amoco). Some 30 contributions have been received and it is expected that the volume will appear in 1993 as an AAPG publication.

C. Global Geology of Reefs and Carbonate Platforms.

A week-long Workshop on Carbonate Platforms is scheduled for August 26-29 in Tremp, Spain.

D. Albicore/Apticore Workshop (see above).

E. Western Interior Seaway Projects.

Project WIK continues active collection of basic data on the Cretaceous of the Western Interior Seaway. Initiated by Robert Weimer, this Project has been compiling reference sections and cross-sections for all the basins of the Seaway. The Project has presented posters at several national meetings and plans to publish its regional cross-sections and summaries of the geology in a Rocky Mountain Society Publication next year.

F. Cretaceous Shallow Drilling, Western Interior is a joint Project of the US Geological Survey (W. Dean) and Pennsylvania State University (M. Arthur) that involves the study of a transect of cores across the Western Interior Seaway that recover mid-Cretaceous deposits ranging from pelagic, carbon-rich sediments to nearshore coal-bearing units. The two core borings that will complete the transect will be recovered by the fall of 1992.

## 3. Joint Global Ocean Flux Study (JGOFS ) [written report by T. Pedersen, U. British Columbia, Vancouver, liaison].

The scientific goals of the JGOFS (Joint Global Ocean Flux Study) program are to:

- Determine and understand on a global scale the processes controlling the time-varying fluxes of carbon and associated biogenic elements in the ocean, and to evaluate the related exchanges with the atmosphere, sea floor and continental boundaries; and
- Develop a capacity to predict on a global scale the response of oceanic biogeochemical processes to anthropogenic perturbations, in particular those related to climate change.

The first of the above overlaps with one of the principal paleoceanographic objectives of the Ocean Drilling Program, which is to determine the history of climate on the planet using the sedimentary record. Therefore, to some degree JGOFS and ODP can be considered to be complementary initiatives. This very brief written report summarizes how JGOFS is proceeding, but makes no attempt to offer detail. The program continues to evolve, and indeed is still in its youth: many changes will occur over the next several years.

The scientific objectives of JGOFS will be attained through a combination of large scale surveys from satellites and ships, field studies of key processes, time series measurements over a number of years, and sedimentary record studies which will focus on the Late Quaternary. Data collection will follow specified, internationally-accepted measurement protocols, and a data management system will facilitate access to the information by the scientific community. A major program of synthesis and modeling is planned; where appropriate, model results will be used to plan further field studies directed toward verification or refutation of modeled phenomena.

Field work (process studies) began with the North Atlantic Bloom Experiment which ran from 1989 to 1991, and will continue until about 1997. Analysis of the data will continue for the rest of the decade. The North Atlantic work established an excellent precedent for subsequent JGOFS studies: the experiment was coordinated by the JGOFS Science Steering Committee through a committee of national representatives of the participating nations and the study itself was collaborative, international and multidisciplinary. Vessels from five nations (Canada, Germany, Netherlands, the U.K. and the U.S.) participated, a NASA aircraft and satellites were used for remote sensing, and moorings were deployed. Guided by this experience, JGOFS has set up mechanisms to ensure efficient planning and execution of upcoming process studies. The project continues to be coordinated by an international steering committee, and is run from the JGOFS Secretariat office in Kiel.

Process studies are planned or underway in the Equatorial Pacific (1992-94), the Southern Ocean (1992) and the Arabian Sea (1992-95). All such studies are multidisciplinary and will involve marine chemists, biologists, mathematical modelers, physical oceanographers, geologists and atmospheric scientists. The Equatorial Pacific is characterized by a large area and a large pool of unutilized nutrients. Primary production in this belt is reckoned to account for perhaps a third or more of the global oceanic total, but variability related to ENSO events complicates derivation of such estimates. The Southern Ocean is a complicated region where perturbation of the existing large fluxes or unused nutrient pool could have significant implications for climate. The Arabian Sea is on average highly productive, but it exhibits extreme seasonal contrasts related to the monsoon. Thus, it offers a wide spectrum of responses to physical forcing.

The process studies in these areas will provide inventories of key fluxes, insight into control mechanisms, and an understanding of forcing on time scales ranging from weeks to several years. Suites of "core" measurements will be or are being made in these studies; these are too numerous to list completely, but typically include total inorganic dissolved carbon, alkalinity, pH, $pCO_2$, dissolved organic carbon, primary productivity, chlorophyll and pigments, oxygen, nutrients, suspended (and benthic) particulate flux measurements using uranium-series decay products and moored and floating sediment traps, particulate organic C, $CaCO_3$, and N, stable C and N isotopes in particulate matter, temperature, wind and current speeds, and ocean surface color (from satellites). Time series stations exist near Bermuda and Hawaii (both commenced in 1989 and will continue until at least 1998), and are planned for Kerguelen Island (early 1993 through 1998) and the Canary Islands (mid-1993 through 1998); these are or will be sampled monthly. Shipboard observations and sediment trap results will be used to observe and interpret seasonal and interannual variability of fluxes over the whole water column. Satellite remote sensing is integral to the program; satellite measurements of surface winds and the surface wave field, sea-surface temperature, and sea ice distribution are expected to become routinely available this decade, and ocean color ("chlorophyll") data will be collected by the SeaWiFS mission starting in 1993.

By this time, JGOFS will have developed plans for validation, interpretation, and useful data products. Sedimentary record studies are underway in many areas including the North Atlantic and Pacific, the Equatorial Pacific, the northern Indian Ocean, the Northwest African Margin, and a number of coastal locations in Canada and elsewhere. These projects will provide information on the relationships among circulation, biological production and paleo-$CO_2$ fluxes through the determination of a wide range of isotopic and elemental analyses made on bulk samples and specific components.

ODP site survey information and cores will be extensively exploited in some of these studies. It is highly probable that ODP will see requests from JGOFS participants for samples from APC cores over the next few years. Efforts will also be made in the program to determine horizontal fluxes across the continental margins, work which will be coordinated jointly with the IGBP Core Project on Land-Ocean Interactions in the Coastal Zone. This particular aspect of JGOFS offers the possibility to involve many coastal states in global change research in the ocean.

JGOFS is not an open-ended project: the field phase will probably end in 1997 and the remainder of the decade will permit synthesis of the data and the filling of critical gaps in the global coverage. The results of the decade of effort will undoubtedly be of direct interest to a significant proportion of the ODP scientific constituency.

4. Nansen Arctic Drilling Program (NAD) (G. Brass, U. Miami, liaison).

5. InterRIDGE (J. Bender, University of North Carolina, Charlotte, liaison; written summary excerpted from *InterRIDGE News*, v. 1, no. 1, spring / summer 1992. A summary may be given by J. Delaney, InterRIDGE Office, U. Washington.).

**Second Formal InterRIDGE Meeting Held in York, March, 1992**

Representatives of ten InterRidge countries (Australia, Canada, France, Germany, Iceland, Japan, Portugal, Spain, United Kingdom and the United States) met in York, UK, on March 11-13, 1992. Representatives of other invited countries (Italy, Norway, CIS, India and South Korea) were unable to attend. N. Holm (Sweden; chair of SCOR WG91 on chemical evolution and origin of life in marine hydrothermal systems) participated as a SCOR scientific liaison, and J. Bender as an ODP liaison. The meeting was hosted by J. Cann of the University of Leeds.

The principal goal of the meeting was to reach agreement on a Program Plan for InterRidge, and to establish the framework for its implementation over the coming decade. Major items on the agenda were:

- Specific themes or projects, if any, on which InterRidge should concentrate its efforts during the first part of the decadal program;
- Levels of InterRidge coordination appropriate to these projects;
- Organization and administration of InterRidge; and
- Schedules for program development and implementation.

The supporting document for the meeting was an updated version of the InterRidge Draft Program Plan. A previous version was widely circulated for comments in December 1991, and a summary was published in *RIDGE Events* of Fall 1991.

Meeting participants agreed on three principal themes on which the program should focus during its active phase: global studies, meso-scale (regional) studies, and active processes. Working groups will be established around these themes to develop appropriate project plans and to coordinate actions as necessary.

The draft program plan was accepted by participants after discussion and incorporation of proposed amendments. This plan will be circulated to National Correspondents in June 1992; please contact the appropriate Correspondent for a copy *(Note: see list attached to this Agenda Book.)*.

Attendees agreed that a proactive, adequately supported InterRidge Office is essential to achievement of InterRidge goals. Functions that should be served by an InterRidge Office include creating an effective, broadly international context for ridge research, facilitating information exchange (including a data catalogue and cruise trackline/station information), and organizing general meetings and workshops. It was agreed that the InterRidge Office should remain at the University of Washington for 12-18 months, and then move to the home institution of a non-US InterRidge Co-Chair.

Copies of the full meeting report may be obtained from the InterRidge Office, from National Correspondents, or from Steering Group members *(Note: see list attached to this Agenda Book.)*.

*Break (approximately 1500) Coffee*

## Item G.
## Engineering Reports

**1.** Science Operator (T. Francis / M. Storms, liaisons).

- Status report: Analysis of DCS (Phase II) operations on Leg 142
- Future plans for DCS development

*(Note: ODP-TAMU will be handing out a report detailing future development plans for DCS at this meeting.)*

PCOM must consider continued DCS development in the context of ODP's overall budget, and should also keep in mind that discussion re: data handling will occur as **Agenda Item K.** and other RFP's currently under development / consideration will occur as **Agenda Item M.**

Any PCOM action(s) on the DCS must take the form of one or more motions.

- Progress on (other) prioritized engineering projects (see April PCOM mtg. minutes, attached to this Agenda Book)

2. Wireline Logging (D. Goldberg, liaison).

- Status of engineering / tool preparations for future legs

3. ACTION Identification of action items from engineering reports; take action or postpone (probably to **Agenda Item O.**) as appropriate.

**Item H.**
**JOIDES Reports by PCOM Liaisons / Chairs of Working Groups (cont.)**

1. SL-WG (see **Agenda Item E. 5.** above).

**Wednesday 12 August 1991 (8:30 AM)**

**Item I.**
**Scientific Reports of Recent Drilling**

1. Leg 143 - Atolls and Guyots I (J. Winterer, Co-Chief Scientist).

*(Note: This report to PCOM has been scheduled as the first item of the second day, but depending upon progress one or both (see **Agenda Item J.**) of the Atolls & Guyots reports may take place late on Tuesday.)*

**Item J.**
**Scientific Reports of Recent Drilling**

1. Leg 144 - Atolls & Guyots II (J. Haggerty / I. Premoli-Silva, Co-Chief Scientists).

**Item K.**
**Report of the DH-WG Steering Committee: the Future of Data Base Management in ODP.**

1. Introduction and background (J. Austin).

PCOM will remember that at its April 1992 meeting, I. Gibson, Chair of the Data Handling WG, presented a report (see April 1992 PCOM minutes, attached to this Agenda Book). The thrust of the DH-WG's recommendations was that a major upgrade of both shorebased and shipboard computing / data base management schemes within ODP should be implemented over the next two years.

In response to this input, PCOM took the following action:

*PCOM endorses the DH-WG recommendations, as contained in DH-WG's minutes of 5-6 March 1992, and requests of I. Gibson a list of possible candidates for a steering committee that will continue to work with ODP-TAMU on this issue. ODP-TAMU and the steering committee should jointly prepare a report for PCOM outlining the likely costs and implementation schedule to achieve the recommendations of the DH-WG. This report should be presented at the August 1992 PCOM meeting.*

Subsequently, Gibson presented a suitable list of candidates to the PCOM Chair. Since April, the DH-WG Steering Committee has met twice: June 22-23 in College Station and July 27-28 in Toronto. Minutes of the June DH-WG meeting are attached to this Agenda Book, as is an Executive Summary of the July meeting.

2. **Report of the DH-WG Steering Committee** (I. Gibson, Chair / J. Baldauf, ODP-TAMU).

The Chair of the Committee will present its report to PCOM at this meeting. J. Baldauf, ODP-TAMU, will then present a joint DH-WG Steering Committee / ODP-TAMU "ODIN" (Ocean Drilling Information Network) proposal for PCOM action. *(Note: The ODP-TAMU "ODIN" proposal is included with this Agenda Book to give PCOM members a chance to familiarize themselves with this complex topic prior to the meeting. Please do so. Additional material related to the attached proposal may also be handed out at the meeting.)*

**3.** **ACTION** Any PCOM decision(s) made on Data Handling should be in the form of one or more motions. PCOM must consider upgrades in computing and data base management in the context of ODP's overall budget. Bear in mind that once PCOM commits to ODIN, ODP must maintain that commitment to the tune of ~$800 K in Yr. 1, ~$900K in Yr. 2 and ~$600K in year 3. PCOM should also keep in mind that discussion re: other RFP's currently under development / consideration will occur as **Agenda Item M.**

*Break (approximately 1015) Coffee*

**Item L.**
**Adjustments to the Near-Term Program**

**1.** Introduction and background (J. Austin).

In light of any and all recent events, including engineering developments (**Agenda Item G.**), panel recommendations, and other reports / communications included with this Agenda Book, PCOM must decide if any additional adjustments are required in the FY93 program (i.e., legs 148-152). How will any such adjustments affect scheduling? cruise staffing? continued engineering development?

PCOM discussion is required at this meeting concerning legs 146 (i.e., Santa Barbara Basin drilling), 148 (proposed CORK / VSP experiments and testing of high-temperature borehole instrumentation at Hole 504B), 149 (site order, Iberia Abyssal Plain ) and 150 (possible involvement of the U.S. Office of Naval Research in the New Jersey / Middle Atlantic Transect).

**2.** Leg 146 - Santa Barbara Basin drilling / Cascadia.

PCOM will remember that this issue was discussed at the April meeting. At that time, PCOM took the following action (see internal p. 55, April PCOM minutes):

*PCOM views the Santa Barbara Basin site as an exceptional scientific opportunity to obtain an important climatic record at a logistically-convenient time. PCOM, therefore, approves the addition of a total of 24 hours to Leg 146 to allow drilling of this site at the end of this leg, contingent upon passing safety review. To maintain the schedule of subsequent Atlantic drilling, which is weather-dependent, Leg 148 will be shortened by 24 hours. PCOM nevertheless expresses strong concern about the lateness of the OHP request to drill this site and notes that, in the future, such requests normally will not be considered later than one year pre-cruise.*

The PCOM Chair subsequently charged the OHP Chair with the task of coordinating preparation of this site for drilling, with a deadline of 1 August. A proposal funded through JOI-USSAC allowed high-resolution seismic profiles to be collected *(Note: These have been submitted to the Site Survey Data Bank at LDGO.)*, PPSP has been consulted through the mails *(Note: PPSP has declared the site "reasonably" safe to drill for APC/XCB operations to ~200 m, although the panel will review the data* *again formally at their scheduled meeting in October.)*, and a site for PCOM consideration is attached to this Agenda Book.

PCOM should briefly review the package as presented and associated PPSP input, and either confirm its April action to proceed with Santa Barbara Basin drilling or specify any outstanding requirements.

3. Leg 148 - proposed experiments at Hole 504B.

At its last meeting, PCOM decided to make Leg 148 a return to Hole 504B in lieu of further at-sea testing of Phase IIB of DCS (see internal p. 33, April PCOM minutes attached to this Agenda Book).

Over the last two months, the JOIDES Office has received several proposals to conduct a variety of operations at Hole 504B (all of which are attached to this Agenda Book): a VSP (by WHOI investigators), a CORK / thermal monitoring experiment (by K. Becker, U. Miami / E. Davis, PGC, Canada), and a request to test new high-temperature logging instrumentation (by WHOI investigators).

Potential commitments of time are as follows: VSP - 45 hrs., CORK / thermal monitoring - 30-36 hrs., high-T logging - 8-10 hrs. (The PCOM Chair reminds PCOM that Leg 148 currently involves ~39 days on-site at Hole 504B).

Because of their nature, a decision on both VSP and logging experiments could be deferred by PCOM until the December 1992 meeting *(Note: Leg 148 is scheduled to depart 26 January 1993.)*, in order to get further feedback from panels at their fall meetings. However, the CORK / thermal monitoring experiment will require an immediate (philosophical and fiscal) commitment from ODP, as necessary fabrication (see the proposal) may require several months lead-time and could cost ~$15K (or more).

The PCOM Chair has consulted the chairs of LITHP, TECP and DMP on the CORK / VSP issues, along with the Co-Chiefs. *(Available responses are included in this Agenda Book.)*. PCOM is referred specifically to feedback from both the DMP Chair and one of the Leg 148 Co-Chiefs, both of whom give primary importance to deepening Hole 504B during Leg 148. Both also question the timing of the CORK / VSP proposals, though not their technical merit. The TECP Chair is similarly disposed, preferring not to see any experiments at this time which could jeopardize the integrity of Hole 504B. LITHP, too, wants Hole 504B deepened 300-500 m before any downhole experiments are considered. At that point, LITHP is in favor of conducting the VSP, and is against the CORK / thermal monitoring experiment.

PCOM should take particular note of the letter from T. Francis re: the CORK experiment, which suggests strongly that there is money but insufficient ODP-TAMU engineering staff time to gear up for that activity properly in time for Leg 148.

PCOM must debate the pros and cons of add-on experiments at this stage of Hole 504B, and propose one or more courses of action.

**4.** Leg 149 - Site order / Iberia Abyssal Plain, NARM non-volcanic I.

Leg 149 is the first of a series of non-volcanic North Atlantic Rifted Margin (NARM) drilling legs mandated by the NARM-DPG and endorsed by PCOM in December 1991. PCOM will remember that the issue of site order on this leg was brought up at the last meeting, leading to the following action (see internal p. 57, April PCOM minutes attached to this Agenda Book):

*PCOM moves that the primary objective of Leg 149 be a deep hole at Site IAP-1.*

In June, the Leg 149 Co-Chiefs responded to this action by suggesting a number of alternatives *(see correspondence attached to this Agenda Book).* The PCOM Chair decided to seek pre-meeting advice from PCOM members and thematic Panel Chairs on this increasingly complicated issue; all responses received are included with this Agenda Book.

At the risk of oversimplifying the ideas involved, the PCOM Chair summarizes (below) what he feels are the important perspectives re: Leg 149 site order based upon those responses, while reminding PCOM members to bear in mind that PCOM's <u>philosophical</u> commitment to NARM science expressed in December should not be affected by this issue, however divisive to the body politic it may become.

Some arguments for and against retaining the April 1992 PCOM decision regarding Leg 149 site order, as stated above:

Arguments in favor of the deep hole, Site IAP-1, first:

*Science* (no priority order implied)

- sedimentary history (especially syn-rift) will be more completely addressed (see responses by Delaney / OHP, McKenzie / SGPP).
- more complete approach to early crustal processes / history by which thinned continental / transitional crust develops.
- drilling basement highs not necessarily the way to study a complicated ocean-continent transition, particularly with only 100 m basement penetrations (see responses by Duncan / PCOM and B. Taylor / PCOM - "A 100-m section of basalt flows or serpentine may OR MAY NOT indicate the nature of basement beneath.").
- potentially contentious stand by Co-Chiefs to wash IAP sedimentary section(s) will not be an issue (see responses by Delaney / OHP and McKenzie / SGPP). Continuous coring will be observed.

*Engineering*

- non-routine, but tractable (but see comments by Becker, PCOM).
- potential excitement generated from a deep-drilling effort, whether or not basement is reached at IAP-1 in a single leg. (Better chance of return to IAP for another leg? - see comments by McKenzie / SGPP).
- Co-Chiefs' drilling time estimates for IAP-1 supplied by ODP-TAMU may be too conservative (see comments by Cita-Sironi / former PCOM), making ambitious plans for drilling a deep hole during Leg 149 seem more reasonable.

*Geopolitics*

- for ODP, another in a growing series of transitions to multi-leg scientific objectives (other e.g., Hole 504B, NAAG, OD).
- consistent with April 1992 PCOM action (The "Charge of the Light Brigade" justification?).

Arguments in favor of the originally proposed NARM transect [sites IAP-2, IAP-3, IAP-4], perhaps with one or more variations as suggested by the Leg 149 Co-Chiefs:

*Science* (no priority order implied)

- supports NARM-DPG input / Co-Chiefs' plan(s) of action:

- allowing optimal siting of deep hole "Site IAP-1 is not mature" (Larsen / PCOM) .
- allowing optimal drilling strategy for deep hole.
- learning along-strike extent of peridotite exposures.
- ascertaining crustal nature of complex ocean-continent transition (assumption: basement highs representative of basement as a whole, Moores / TECP - "...complexity should not be used as a reason not to obtain samples.").

*Engineering*

- routine, and most probably successful.
- community boredom could set in if syn-rift section / basement not penetrated at Site IAP-1 during Leg 149. (Which engineering scenario is better for NARM science in the long run?)

*Geopolitics*

- "Finally, on a point of principle, I am unhappy about altering the scientific goals of a leg after the co-chiefs have been appointed...Finishing a hole to basement is intellectually very satisfactory...Pragmatically the Planning Committee should be aware of what constitutes a scientifically attractive leg, both for co-chiefs and scientific staff" (Jenkyns / PCOM).

Well, those are most (some) of the highlights of opinions expressed. The PCOM Chair apologizes if not all points-of-view are detailed above, but the rest (and undoubtedly some new ones) will surely come out as part of discussion at this meeting.

On balance, a majority of PCOM members responding (14, present and former) felt that the April 1992 decision re: Leg 149 site order should be preserved, i.e., drill Site IAP-1 first, even if basement there cannot be reached in a single leg. (The PCOM Chair read the vote 8 for the deep hole, 4 against, with two equivocals. If acknowledged NARM proponents are excluded, the vote is 6 for the deep hole, 3 against, two equivocals, and 3 abstentions.) Why? Mostly aspects of excitement and the "get on with it" rationale re: deep drilling. However, both the TECP and LITHP Chairs favor the transect approach, for reasons described in their responses. So much for unanimity.

If PCOM decides to reverse its April decision, i.e., to reinstate the multi-site transect as Leg 149's primary objective, PCOM might consider possible new instructions to the Leg 149 Co-Chiefs re: the advisability of washing IAP section(s) and NARM-DPG stipulated 100-m penetrations in basement, potential inadequacies of which have come to light as a consequence of the extensive (and enlightening) feedback this issue has generated.

Any PCOM action(s) on Leg 149, whether they involve site order specifically or NARM science in more general terms, must take the form of one or more motions.

*Break 1200 - 1315 Lunch*

**5.** Leg 150 - possible U.S. Office of Naval Research involvement - New Jersey / Middle Atlantic Transect

ODP-TAMU and PCOM have been approached by the U.S. Office of Naval Research about the possibility of casing and instrumenting one or more holes of the New Jersey / Middle Atlantic Transect off New Jersey *(see correspondence and proposal from T. Yamamoto, U. Miami, to ONR attached to this Agenda Book).* They may also want to drill an offset (by 500 m) hole at one site (probably MAT-8) to ~200 m depth for tomographic studies. ONR has offerred to reimburse ODP for the necessary shipboard operations, but because of the nature of North Atlantic / FY93 scheduling (i.e., weather window for Leg 151), any operations of this kind <u>will</u> impact the present science plan for Leg 150.

PCOM must consider the ONR offer. The letter from T. Francis to the PCOM Chair *(attached to this Agenda Book)* summarizes the important questions to be addressed: "Is it appropriate for ODP to support this type of research in general? If so, is it appropriate for ODP-TAMU to seek reimbursement from ONR for the work carried out? *(<u>Note</u>: The PCOM Chair has discussed the financial side with ONR in a preliminary way. They are prepared to set aside up to $100k / hole for this work.)* The time pressures on Leg 150 are already great. There is no room to lengthen the time on site because of the substantial program on Leg 149 and the ice window for Leg 151. Does PCOM want to abbreviate the New Jersey Sea Level science to allow room for this work?" *(<u>Note</u>: The Leg 150 Co-Chiefs are already upset that their original time-on-site has been abbreviated to augment Leg 149.)*

The PCOM Chair is reluctant to discuss pressure on Leg 150's on-site time until the MAT sites have gone through safety review in late October. (This leg may have significant safety problems.) Therefore, one possibility is to defer PCOM discussion on ONR involvement until the Annual Meeting, which would allow panels to comment on the issue at their fall meetings. In the meantime, ONR could prepare a formal proposal to ODP.

Any and all PCOM actions re: Leg 150 must take the form of a motion or motions.

**6.** ACTION Identify PCOM action items in reference to the above. All actions should detail specific instructions to Co-Chiefs, panels, Science Operator, Wireline Logging, etc. All PCOM actions re: the FY93 schedule should be in the form of one or more motions, preferably referencing action on a leg-by-leg basis.

*Break (approximately 1500) Coffee*

**Item M.**
**Old Business; Continuing Issues**

**1.** *In situ* Pore-Fluid Sampling - fate of the "feasibility" RFP (J. Austin / K. Becker, liaison).

At its December 1991 meeting, PCOM established a steering group to examine the issue of feasibility of design / fabrication of a new tool or tools for *in situ* pore-fluid sampling with the following motion:

*PCOM authorizes the formation of a steering group for in-situ fluid sampling, to be constituted as a subset of DMP effective at its January, 1992, meeting. PCOM approves the mandate and membership of the group as described in DMP recommendation 91 / 17* (see below), *and urges that it meet in conjunction with normally-scheduled DMP meetings.*

DMP recommendation 91 / 17: *A steering group should be formed to direct the implementation of the Working Group on In-situ Pore Fluid Sampling. The Steering Group should comprise representatives of LDGO, TAMU, DMP and SGPP, with a PCOM liaison. The group should properly represent the areas of geochemistry, downhole measurements, and drilling and tool engineering. The steering group should meet as soon as (OPCOM) funds become available in order to progress the initiative and to contribute to the design of a request for proposals for a feasibility study. It should meet again to evaluate and decide upon the resulting bids. The group should meet a third time to review the output of the feasibility study.*

The steering group met in early April 1992 in College Station and had a preliminary version of the RFP ready for PCOM at its April meeting. At that time, PCOM took no action, in large part because the status of OPCOM funds was unknown. Since that time, an RFP has been finalized *(attached to this Agenda Book)*, and recent correspondence (7 / 20 letter from Gieskes to Worthington, attached to this Agenda Book) suggests a modified timetable for issuance of the RFP. Unfortunately, the financial situation has not gotten any clearer.

The PCOM Chair asks the PCOM liaison to this group to summarize the status of this RFP briefly, then PCOM must decide how to proceed, in light of current budget projections, which include (likely) commitments to other engineering (e.g., DCS) and non-engineering (e.g., data base management) initiatives. Options are to issue the RFP as it stands (in which case a dollar value must be attached by PCOM), or defer its circulation until other FY93 financial commitments are more precisely known.

**2.** Deep-drilling RFP (J. Austin).

At its December 1991 meeting, PCOM commissioned development of this RFP with the following motion:

*PCOM confirms the necessity of carrying out feasibility studies for deep drilling as soon as possible. PCOM asks ODP-TAMU to draft a RFP, in consultation with the PCOM chair, for the hiring of one or more consultants, to carry out such studies, using candidate sites recommended by thematic panels as a basis. The draft RFP will need to be reviewed by TEDCOM at its next meeting in [May] 1992.*

TEDCOM reviewed the draft RFP in May and made suggestions for revision *(see minutes attached to this Agenda Book)*. Presumably, the revised RFP will be considered again by TEDCOM at their next meeting in October, and may then be ready for action. Given that eventuality, PCOM should now discuss the fate of this RFP.

Some personnel at ODP-TAMU have expressed the view that no such RFP is needed if Leg 149 concentrates on the deep hole, Site IAP-1. The PCOM Chair is sympathetic to that perspective. However, if PCOM changes Leg 149 back to a shallow(er) transect, the issue of a deep hole likely to come before PCOM for FY94 drilling (that proposed for the Newfoundland Basin, NARM non-volcanic II) could receive insufficient ODP-TAMU engineering attention, and ODP may continue to defer the issue of maximizing capabilities of the *JOIDES Resolution* far into the future. The

PCOM Chair is <u>not</u> sympathetic to avoiding the issue of deep-drilling indefinitely.

3. ACTION Any PCOM actions on either or both of the draft RFPs must take the form of a motion or motions.

**Thursday 13 August 1990 (8:30 AM)**

**Item N.**
**Membership and Personnel Actions**

1. Panels and Panel Chairs.

The panels have in general (excepting DMP, see below) not made any nominations for replacements; therefore, appointments need not be made at this PCOM meeting. PCOM should, however, consider disciplinary balance on panels that are affected by the following impending changes in membership. PCOM may also wish to specify areas for which appointments will be made at the 1992 Annual Meeting.

- LITHP

No action required. The CAN-AUS replacement for J. Franklin is not yet known.

- OHP

No action required.

- SGPP

No action required.

- TECP

C. Beaumont (CAN, rifted margins expertise) declined to join the panel. PCOM may want to nominate TECP's #2 choice, M. Steckler (LDGO), at this meeting to give the panel the required disciplinary balance before its fall meeting.

- DMP

G. Fryer (SOEST, U. Hawaii) has been nominated to replace R. Wilkins.

P. Worthington, DMP Chair, will step down after the 1992 Annual Meeting of PCOM with Panel Chairs. He has forwarded several possible replacements to the PCOM Chair. PCOM may want to make a decision on the future DMP Chair at this meeting.

- IHP

No action required.

- PPSP

No action required.

- SMP

SMP would like a sedimentologist to replace A. Richards (ESF), who has rotated off the panel to join IHP. *(PCOM member from ESF, please take note.)*

- SSP

K. Kastens (LDGO) will take over as Chair when Kidd takes over from Jenkyns on PCOM in 1993. Kidd's U.K. replacement will be M. Sinha.

The PCOM Chair is waiting for France to replace G. Pautot (Lancelot is on record that he would attempt to find a person with high-resolution seismics expertise.) and for CAN-AUS to replace K. Louden, as suggested by the responsible PCOM members at the April meeting.

- TEDCOM

C. Sparks, TEDCOM Chair, was reelected unanimously at the last meeting, through the end of the current phase of ODP (September 1993).

No other action required.

**2.** Detailed Planning Groups and Working Groups.

- Offset Drilling Working Group had its third (final?) meeting in May 1992 in Paris. PCOM should thank and disband the OD-WG at this meeting, if PCOM considers their mandate fulfilled.

- Sea Level Working Group had its final(?) meeting in June 1992 in Utah. PCOM should thank and disband the SL-WG at this meeting, if PCOM considers their mandate fulfilled.

*Break 1000 Coffee*

3. PCOM membership and liaison work.

- Any general change of PCOM liaison responsibilities, other than those shown (see table)?

| | EXCOM | LITHP | OHP | SGPP | TECP | DMP | IHP | PPSP | SMP | SSP | TEDCOM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| J. Austin | *1 | | | | | | | *2 | | | |
| K. Becker | | | | | | * | | | | | * |
| W. Berger | | | | * | | | | | | | |
| H. Dick ? | | | | | | | | | | | |
| R. Duncan | | | * | | | | | | | | |
| J. Fox | | | | | | | | | * | | |
| H. Jenkyns | | | * | | | | | | | | |
| Y. Lancelot | | | | | | | * | | | | |
| H.-C. Larsen | | | | | *? | | | | | | |
| B. Lewis | * | *? | *? | *? | *? | *? | | * | | | |
| J. Malpas | | * | | | | | | | | | |
| J. Mutter | | * | | | | | | | | | |
| A. Taira | | | | | * | | | | | | |
| B. Taylor | | | | | * | | | | | | |
| U. von Rad | | | | * | | | | | | | |
| J. Watkins | | | | | | | | | | * | |

[1]Austin will attend January 1993 EXCOM to overlap with Lewis.
[2]Austin will attend October 1993 PPSP meeting if thematic panel attendance schedule prevents Lewis from doing so.

Other PCOM member notes:

- J. Austin will rotate off as Chair as of October 1, but will stay on PCOM through August 1993.

- R. Duncan and J. Watkins intend to rotate off PCOM at the end of 1992. Y. Lancelot will "probably" rotate off then, too. A. Mix will replace Duncan. Replacements for Watkins from TAMU and for Lancelot from France?

- A. Sharaskin / PCOM status after 1 October 1992?

4. Co-Chief Scientists.

Co-Chiefs have been nominated and acceptances received through Leg 152, as per 7 / 8 correspondence from T. Francis to PCOM members.

No other action is required on this subject at the moment.

5. ACTION Acceptance of slates of members. It will be easiest if PCOM incorporates all personnel changes in a single motion. Any other instructions to Panel Chairs should be in the form of separate motions aimed at specific panels.

**Item O.**
**New Business**

1. Content and format of FY94 "Atlantic / eastern Pacific Prospectus" (J. Austin / J. Watkins - P. Blum, liaisons to SSP).

"FY94" extends from 28 November, 1993 (the conclusion of Leg 152) to September 30, 1993. Legs 149 through 152 will all be conducted in the North Atlantic, and present four-year planning dictates operation in the "Atlantic" (i.e., including adjacent seas) through April 1994 (~Leg 155), when the ship could return to the eastern Pacific. Therefore, at the 1992 Annual Meeting of PCOM with Panel Chairs, ~10 months in the Atlantic (and adjacent seas) and the eastern Pacific must be scheduled. PCOM must fill that time either with ~5 legs for science, or ~4 legs for science and an engineering leg.

Based upon global rankings conducted by thematic panels at their spring 1992 meetings (see included summary put together by the JOIDES Office for the April 1992 meeting), the JOIDES Office plans to put ~10-12 programs into a "North Atlantic / eastern Pacific Prospectus" for consideration and re-ranking by thematic panels in fall 1992. The "Atlantic / eastern Pacific Prospectus" will include all revisions or addenda to selected ranked programs received by the JOIDES Office by the announced proposal deadline of 1 August, 1992. Final selection of prospectus programs will be made by PCOM at this meeting, following a final assessment of "drillability" to be made by SSP at their early August meeting at LDGO. The PCOM Chair asks that the SSP liaisons be prepared to summarize that assessment for PCOM at this meeting.

Programs will be included, probably in either alphabetical or numerical order, along with a cover letter from the PCOM Chair explaining the

# JOIDES Global Ranking 1992

Compiled from thematic panels' ranking lists

| Rank | LITHP | OHP | SGPP | TECP |
|---|---|---|---|---|
| 1 | 410----<br>Deepening 504B | 388---- (NAP)<br>Ceara Rise | * GENERIC<br>* Gas hydrates | NARM-DPG (NAP)<br>Non-volc. margins II |
| 2 | 387-Rev/Leg147<br>Hess Deep II | NAAG-DPG (NAP)<br>NAAG II | 414----<br>N Barbados Ridge | 346-Rev2 (NAP)<br>E eq. Atl. transform |
| 3 | 369-Rev/Add (NAP)<br>MARK lithosphere | 415----/403-Rev<br>KT-boundary | 405----<br>Amazon fan | NARM-DPG (NAP)<br>Volcanic margins II |
| 4 | 361-Rev (NAP)<br>TAG hydro | 354-Rev<br>Benguela Current | 391---- (NAP)<br>Med. sapropels | 323-Rev/399---- (NAP)<br>Alboran Sea |
| 5 | TIE} GENERIC<br>I Return to 735B | * 253-Rev<br>* Pac. black shales | 059-Rev3<br>MAP/Sed. instability | * 265----/265-Add<br>* Woodlark Basin |
| 6 | I SR-DPG<br>TIE} Sed. Ridges II | 386-Rev<br>California Current | 409----<br>Santa Barbara Basin | 410----<br>Deepening 504B |
| 7 | * EPR-DPG<br>* E Pac. Rise II | 404----/406----<br>NW Atl. drifts/climate | 330----/Add (NAP)<br>Med. Ridge | 400----<br>Costa Rica acc. wedge |
| 8 | 376-Rev (NAP)<br>Vema FZ: Layer 2/3 | * 412----<br>* Bahamas transect | 388---- (NAP)<br>Ceara Rise | 330----/Add (NAP)<br>Med. Ridge I (shallow) |
| 9 | NARM-DPG (NAP)<br>Volcanic margins II | Bering (CEPAC/391)<br>Bering Sea history | 354-Rev<br>Benguela Current | 414----<br>N Barbados Ridge |
| 10 | GENERIC<br>Galapagos hydro. | * 337----<br>* New Zealand sea level | * SR-DPG<br>* Sed. Ridges II | 369-Rev (NAP)<br>MARK lithosphere |
| 11 | TIE} 407----<br>I 15°20'N MAR | * 347----<br>* South-eq. Atl. paleo. | 404----<br>NW Atl. sed. drifts | 330----/Add (NAP)<br>Med. Ridge II (deep) |
| 12 | I * 413----<br>TIE} * Reykjanes Ridge | 363-Add<br>Grand Banks paleo. | * 361-Rev (NAP)<br>* TAG hydro. | 333----<br>Cayman Trough |
| 13 | 325----<br>Endeavour Ridge | * 345---<br>* W Florida sea level | * 412----<br>* Bahamas sea level | NARM-DPG (NAP)<br>Non-volc. margins III |
| 14 | 368----<br>Hole 801C return | * 338----<br>* Marion Pl. sea level | * Cascadia-DPG<br>* Cascadia margin II | * 411----/415----<br>* Carib./KT-boundary |
| 15 | * 374----<br>* Oceanographer FZ | | * 337----<br>* New Zealand sea level | * 375----/results Leg147<br>* Hess Deep II |
| 16 | | | * 360----<br>* Valu Fa hydro. | 376-Rev<br>Vema FZ: layer 2/3 |
| 17 | | | | * 362-Rev3/Leg 141<br>* CTJ II |
| 18 | | | | 363----<br>GB-Iberia plume volc. |
| 19 | | | | 361-Rev (NAP)<br>TAG hydro. |
| 20 | | | | 403-Rev<br>KT bound., G/Mexico |
| 21 | | | | 368----<br>Hole 801C return |

* Proposals not considered drillable in FY 1994 at the time of the meetings

NAP: North Atlantic Prospectus 1991

genesis and evolution of the document. At the same time, instructions for re-review and re-ranking will be given to thematic panels.

The Prospectus will be mailed to all members of PCOM, SSP and thematic panels, other Panel Chairs, and to all subcontractors and relevant liaisons by late August(!).

**PCOM members are solicited for input on both stated content and format of this Prospectus.**

- PCOM Watchdogs: "North Atlantic / eastern Pacific Prospectus" Programs

Once the content of the FY94 Prospectus is determined, PCOM may wish to assign watchdogs for those highly-ranked Atlantic / eastern Pacific programs under consideration for drilling in FY94 which do not yet have one.

At the moment, possible candidates for inclusion and their known watchdogs are:

| | |
|---|---|
| Ceara Rise | ~~J. Watkins~~ |
| Eq. Atl. Transform | J. Mutter |
| NARM | B. Duncan (volcanic) / U. von Rad (non-volcanic) |
| OD | B. Taylor |
| TAG | K. Becker |
| VICAP Gran Canaria* | J. Malpas |

*(now merged with Madeira Abyssal Plain)

**2.** Use of hole OSN-1 for wireline re-entry tests (J. Austin).

Attached to this Agenda Book is a 10 July 1992 letter from F. Spiess (SIO) to the EXCOM Chair detailing plans to conduct tests of a wireline re-entry system at Hole OSN-1, drilled by ODP for FDSN during Leg 136. The letter does not ask permission to use the hole, but merely informs ODP about the activity. (FDSN is aware of the activity, and has endorsed it in this case.)

The PCOM Chair suspects that this letter was generated in response to his (negative) reaction during a June 1992 JOI-USSAC meeting, where he

1993. The host should feel free to provide any further details at this meeting.

The 1993 Summer PCOM meeting will probably meet in Australia during the second or third week of August, 1993. The Australian ODP Secretariat is now at the University of New England (R. Arculus). Exact dates and venue could be arranged at this meeting.

**Item Q.**
**Adjournment**

discovered this impending activity only because funding for the project had been sought and received from that body.

PCOM should reexamine the issue of use of ODP holes by outside parties, and remind the international scientific community (perhaps through the *JOIDES Journal*) that permission must be sought from PCOM before such activities can / should take place.

**3.** PANCHM Chair, 1992 Annual Meeting of PCOM with Panel Chairs.

At this meeting, PCOM must choose the next PANCHM Chair, who is responsible for holding a 1-day meeting in advance of the PCOM meeting in December 1992 (i.e., on December 1). At PANCHM, Panel Chairs can get acquainted and then prepare a coherent agenda of items of concern to PCOM for discussion / action.

Recent PANCHM Chairs have been D. Cowan (1987), R. Detrick (1988), T. Moore (1989), R. Kidd (1990) and S. Humphris (1991). Panel Chairs that might be nominated are P. Delaney (OHP), J. McKenzie (SGPP), E. Moores (TECP) and K. Moran (SMP).

ACTION Any and all actions arising from new business items should take the form either of a consensus or a motion.

**Item P.**
**Future Meetings**

The 1992 PCOM Annual Meeting will be held at the Bermuda Biological Station (BBS). Participant forms and supplementary information are included with this Agenda Book. A cost of $130/day will include accommodation and meals (see the forms for details). Austin (still PCOM, but ex-Chair) will host the meeting. The University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, which was to have hosted this Annual Meeting, will host a subsequent meeting in Miami. PANCHM will meet on Tuesday, 1 December, 1992, with PCOM meeting on 2-5 December, 1992. *(Note: The AGU Fall Meeting is 7-11 December.)* A field trip is being arranged (by a former student of Austin's, who used to work at BBS), either prior to or during the meeting. Details will be forthcoming by mail. A deposit of $100 / person required by BBS four months in advance of the meeting is being ~~paid~~ by JOI, Inc.

The 1993 Spring PCOM meeting will be hosted by J. Mutter at Columbia University, Lamont-Doherty Geological Observatory, on 26-28 April,

# JOIDES PLANNING COMMITTEE SPRING MEETING
**21 - 23 April 1992**
**Oregon State University**
**Corvallis, Oregon**

## REVISED DRAFT MINUTES
**(27 July 1992)**

### Planning Committee (PCOM)

J. Austin, Chairperson - University of Texas at Austin, Institute for Geophysics
K. Becker - University of Miami, Rosenstiel School of Marine and Atmospheric Science
H. Beiersdorf (for U. von Rad) - Bundesanstalt für Geowissenschaften und Rohstoffe (Germany)
W. Berger - University of California, San Diego, Scripps Institution of Oceanography
M. Cita-Sironi - University of Milan (ESF Consortium)
R. Duncan - Oregon State University, College of Oceanography
J. Fox - University of Rhode Island, Graduate School of Oceanography
R. Kidd (for H. Jenkyns) - University of Wales, Cardiff (United Kingdom)
Y. Lancelot - Université Pierre et Marie Curie, Paris (France)
M. Langseth (for J. Mutter) - Columbia University, Lamont-Doherty Geological Observatory
B. Lewis - University of Washington, College of Ocean and Fishery Sciences
J. Malpas - Memorial University (Canada-Australia Consortium)
A. Sharaskin - Geological Institute, Moscow (Russia)
A. Taira (absent, no alternate) - Ocean Research Institute (Japan)
B. Taylor - University of Hawaii, School of Ocean and Earth Science and Technology
B. Tucholke - Woods Hole Oceanographic Institution
J. Watkins - Texas A&M University, College of Geosciences

### Liaisons

T. Francis and M. Storms - Science Operator (ODP-TAMU)
M. Lyle - Wireline Logging Services (ODP-LDGO)
B. Malfait - National Science Foundation
T. Pyle - Joint Oceanographic Institutions, Inc.

### Guests and Observers

R. Arculus - University of New England (Canada-Australia Consortium)
R. Batiza - University of Hawaii, School of Ocean and Earth Science and Technology (Co-Chief, Leg 142)
J. Byrne - Oregon State University, College of Oceanography
I. Gibson - University of Waterloo (DH-WG Chair)
S. Lewis - US Geological Survey, Menlo Park, California (Co-Chief, Leg 141)

### JOIDES Office (University of Texas at Austin, Institute for Geophysics)

P. Blum - Executive Assistant and non-US Liaison
C. Fulthorpe - Science Coordinator

# SELECTED ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AGU | American Geophysical Union |
| AMC | axial magma chamber |
| ARC | Australian Research Council |
| BGR | Bundesanstalt für Geowissenschaften und Rohstoffe |
| BGS | British Geological Survey |
| BHA | bottom-hole assembly |
| BHTV | borehole televiewer |
| BIRPS | British Institutions Reflection Profiling Syndicate |
| BMR | Bureau of Mineral Resources |
| BRGM | Bureau de Recherches Géologiques et Minières |
| BSR | bottom-simulating reflector |
| CSDP | Continental Scientific Drilling Program |
| CSG | Computer Services Group (ODP) |
| CY | calendar year |
| DCB | diamond core barrel |
| DCS | diamond coring system |
| DEA | Drilling Engineering Association |
| DFG | Deutsche Forschungsgemeinschaft |
| DI-BHA | drill-in bottom-hole assembly |
| DOE | Department of Energy |
| DP | dynamic positioning |
| DPG | Detailed Planning Group |
| ECOD | European (ESF) Consortium for Ocean Drilling |
| ECR | East Coast Repository |
| EEZ | Exclusive Economic Zone |
| EIS | environmental impact statement |
| ETH | Eidgenössiches Technische Hochschule, (Zürich) |
| FDSN | Federation of Digital Seismic Networks |
| FMS | formation microscanner |
| FY | fiscal year |
| GCR | Gulf Coast Repository |
| GSC | Geological Survey of Canada |
| GSGP | Global Sedimentary Geology Program |
| HRB | hard rock guide base |
| HRO | hard rock orientation |
| IDAS | isothermal decompression analysis system |
| IFREMER | Institut Français de Recherche pour l'Exploitation de la Mer |
| IGBP(/PAGES) | International Geosphere/Biosphere Program (/Past Global Changes) |
| ILP | International Lithosphere Program |
| IOC | Intergovernmental Oceanographic Commission |
| IPR | intellectual property rights |
| IRIS | Incorporated Research Institutions for Seismology |
| JAMSTEC | Japan Marine Science and Technology Center |
| JAPEX | Japan Petroleum Exploration Company |
| JGOFS | Joint Global Ocean Flux Studies |
| JOI-BOG | JOI Board of Governors |
| KTB | Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland |
| LANL | Los Alamos National Laboratory |
| LAST | lateral stress tool |
| LBL | Lawrence Berkeley Laboratory |
| LIPS | large igneous provinces |
| LRP | Long Range Plan |
| mbsf | meters below seafloor |
| MCS | multi-channel seismic |
| MDCB | motor-driven core barrel |
| MOU | memorandum of understanding |
| MRC | Micropaleontological Reference Center |
| MST | multi-sensor track |
| NADP | Nansen Arctic Drilling Program |
| NAS | National Academy of Sciences |
| NERC | Natural Environment Research Council |
| NGDC | National Geophysical Data Center |
| NRC | National Research Council |
| NSB | National Science Board |
| NSERC | National Science and Engineering Research Council (Canada) |
| OBS | ocean bottom seismometer |
| ODPC | ODP Council |
| OG | organic geochemistry |
| ONR | Office of Naval Research |
| OSN | Ocean Seismic Network |
| PCS | pressure core sampler |
| PDC | poly-crystalline diamond compact (drilling bit) |
| PEC | Performance Evaluation Committee |
| PPI | Producer Price Index |
| RFP | request for proposals |
| RFQ | request for quotes |
| RIDGE, InterRIDGE | Ridge Inter-Disciplinary Global Experiments (US and International) |
| SCM | sonic core monitor |
| SES | sidewall-entry sub |
| SNL | Sandia National Laboratory |
| SOE | Special Operating Expense |
| SOW | Statement of Work |
| STA | Science and Technology Agency (of Japan) |
| TAMRF | Texas A&M Research Foundation |
| UDI | Underseas Drilling, Incorporated |
| USSAC | US Scientific Advisory Committee |
| USSSP | US Science Support Program |
| VPC | vibra-percussive corer |
| VSP | vertical seismic profile |
| WCR | West Coast Repository |
| WCRP | World Climate Research Program |

*[Continued on next page]*

| | | | |
|---|---|---|---|
| WG | Working Group | WSTP | water sampler, temperature, pressure (downhole tool) |
| WOCE | World Ocean Circulation Experiment | | |

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## JOIDES Committees and Panels:

| | |
|---|---|
| BCOM | Budget Committee |
| DMP | Downhole Measurements Panel |
| EXCOM | Executive Committee |
| IHP | Information Handling Panel |
| LITHP | Lithosphere Panel |
| OHP | Ocean History Panel |
| OPCOM | Opportunity Committee (disbanded) |
| PANCHM | Panel Chairs Meeting |
| PCOM | Planning Committee |
| PPSP | Pollution Prevention and Safety Panel |
| SGPP | Sedimentary and Geochemical Processes Panel |
| SMP | Shipboard Mearurements Panel |
| SSP | Site Survey Panel |
| STRATCOM | Strategy Committee (disbanded) |
| TECP | Tectonics Panel |
| TEDCOM | Technology and Engineering Development Committee |

## Detailed Planning Groups (DPG) and Working Groups (WG):

| | |
|---|---|
| A&G-DPG | Atolls and Guyots DPG (disbanded) |
| DH-WG | Data-Handling WG |
| NAAG-DPG | North Atlantic-Arctic Gateways DPG (disbanded) |
| NARM-DPG | North Atlantic Rifted Margins DPG (disbanded) |
| OD-WG | Offset Drilling WG |
| SL-WG | Sea-Level WG |

## FY93 Programs:

| | |
|---|---|
| NAAG-I | North Atlantic Arctic Gateways, first leg (Leg 151) |
| NARM non-volcanic-I | North Atlantic Rifted Margins non-volcanic, first leg (Leg 149) |
| NARM volcanic-I | North Atlantic Rifted Margins volcanic, first leg (Leg 152) |
| NJ/MAT | New Jersey / Middle Atlantic Transect (Leg 150) |
| 504B | (deepening) Hole 504B (Leg 148) |

## FY92 Programs:

| | |
|---|---|
| A&G | Atolls and Guyots (legs 143/144) |
| CA | Cascadia margin (Leg 146) |
| CTJ | Chile Triple Junction (Leg 141) |
| EPR | East Pacific Rise (Leg 142) |
| HD | Hess Deep (Leg 147) |
| NPT | North Pacific Transect (Leg 145) |
| 504B | (deepening) Hole 504B (Leg 140) |

# JOIDES PLANNING COMMITTEE SPRING MEETING
## 21 - 23 April 1992
## Oregon State University
## Corvallis, Oregon

## EXECUTIVE SUMMARY

### PCOM Motions

PCOM approves the minutes of the 4 - 7 December 1991 PCOM meeting. (p. 6.)

PCOM adopts the agenda for the 21 - 23 April 1992 PCOM meeting. (p. 7.)

In view of the results of Leg 142 and to allow for their proper evaluation, PCOM confirms: 1) a postponement of further engineering test legs of DCS on *JOIDES Resolution*, and 2) that Leg 148 will be a return to Hole 504B in order to deepen that hole and carry out attendant logging operations. (p. 33.)

PCOM, recognizing the need to develop a high-recovery system for coring difficult formations, requests ODP-TAMU to prepare for the August 1992 PCOM meeting a detailed plan to bring the diamond coring system (DCS) to operational status. This plan should include an analysis of previous work as well as an estimate of future costs. PCOM will use this information to decide the future of DCS development in ODP. (p. 34.)

Based upon advice by ODP-TAMU engineers, PCOM considers the following tools now operational: CORK, PCS I and MDCB. Their use should be encouraged by the Science Operator and the appropriate panels, with care that appropriate financial planning is in place.
PCOM now prioritizes engineering developments as follows:

1) System developments:
   - a) DCS evaluation and improvements.
   - b) Engineering developments for core-log integration, including TOTCO, core orientation and sonic core monitoring.
   - c) Deep drilling system/capability.
   - d) Improvements in existing coring techniques, i.e., APC , XCB and RCB.
2) Leg-specific developments:
   - a) Vibra-percussive corer in preparation for legs 146 and 150. (p. 39.)

PCOM supports the DataNet concept as outlined in the White Paper prepared by ODP-LDGO, Wireline Logging Services Operator, to improve real-time core-log integration and data reduction, interpretation, archiving and dissemination. (p. 43.)

PCOM endorses the DH-WG recommendations, as contained in DH-WG's minutes of 5 - 6 March 1992, and requests of I. Gibson a list of possible candidates for a steering committee that will continue to work with ODP-TAMU on this issue. ODP-TAMU and the steering committee should jointly prepare a report for PCOM outlining the likely costs and implementation schedule to achieve the recommendations of DH-WG. This report should be presented at the August 1992 PCOM meeting. (p. 46.)

PCOM commends the panels for prioritizing their needs regarding non-engineering items and recommends to JOI, Inc. to take appropriate action contingent upon availability of funds. As some of the items require but modest investment it is anticipated that corresponding needs can be met in a timely manner. (p. 47.)

PCOM sets the direction of the drilling vessel for the next four years as follows:

1) In the remainder of FY92, confirmed as is in the current Program Plan.

2) In FY93, and beyond to November 1993, confirmed as is in the Program Plan approved at its December 1991 meeting in Austin, Texas, through Leg 152, East Greenland Margin, ending on or about 28 November 1993.

3) In the remainder of FY94 through April 1996, in the Atlantic Ocean and adjacent seas* and the eastern Pacific. FY94 program to be finalized in December 1992 at the Annual Meeting of PCOM with Panel Chairs.

PCOM reaffirms its stand that at its Spring 1993 meeting, and at subsequent meetings, it will evaluate again the state of panel recommendations, technological developments, and the overall state of ODP, and again set the general direction of the drilling vessel for the subsequent four years, with a relatively firm early track and a relatively flexible later direction.

* Defined as Caribbean, Gulf of Mexico, Mediterranean, Norwegian (including near-Arctic Ocean), Labrador, Red Sea. (p. 51.)

PCOM views the Santa Barbara Basin site as an exceptional scientific opportunity to obtain an important climate record at a logistically-convenient time. PCOM, therefore, approves the addition of a total of 24 hours to Leg 146 to allow drilling of this site at the end of this leg, contingent upon passing safety review. To maintain the schedule of subsequent Atlantic drilling, which is weather-dependent, Leg 148 will be shortened by 24 hours. PCOM nevertheless expresses strong concern about the lateness of the OHP request to drill this site and notes that, in the future, such requests normally will not be considered later than one year pre-cruise. (p. 55.)

PCOM moves that the primary objective of Leg 149 be a deep hole at Site IAP-1. (p. 57.)

PCOM endorses the DMP guidelines for third-party tools, except that the wording on page 4, paragraph (iii) be changed to read:
"If DMP proposes and PCOM endorses the Mature Tool Proposal, the Science Operator or Logging Contractor will progress the acquisition of the tool for ODP provided funds are available." (p. 68.)

## PCOM Consensuses

PCOM endorses the proposal by designated Leg 150 Co-Chiefs that core to be collected as part of a proposed land drilling effort extending the NJ/MAT transect be treated as one with Leg 150 cores. (p. 57.)

PCOM endorses all personnel actions taken at the 1992 Spring Meeting. (p. 63.)

**Spring Meeting JOIDES PCOM**
**Tuesday, 21 April 1992**

## 941. Welcome and Introduction

Austin called the 1992 Spring Meeting of JOIDES PCOM to order at 9:00 AM. Duncan introduced J. Byrne, President of Oregon State University.

Byrne recalled being at NSF when the first DSDP leg had drilled the Sigsbee Knolls, with Maurice Ewing as co-chief scientist. That the project had lasted almost 25 years, first as DSDP and later as ODP, was a tribute to the scientists involved. Byrne commended PCOM and expressed the hope that ODP would continue long into the future. He concluded by welcoming PCOM to Oregon State University.

Duncan explained meeting logistics. Austin explained that Taira, Japanese PCOM member, had been unable to attend the meeting and had expressed his regrets. Austin called for introductions.

## 942. Approval of Minutes of 4 - 7 December 1991 PCOM Meeting

Austin called for comments, corrections and approval of the minutes of the 4 - 7 December 1991 PCOM Meeting held at the University of Texas at Austin. The minutes included modifications received by the JOIDES Office through 10 April 1992.

PCOM Motion

**PCOM approves the minutes of the 4 - 7 December 1991 PCOM meeting.**
Motion Taylor, second Langseth Vote: for 15; against 0; abstain 1; absent 1

## 943. Approval of Agenda

Austin stated that the main purpose of the Spring Meeting was to plan the general direction of *JOIDES Resolution* for the next four years. Other important, but subordinate, purposes were: to decide matters related to various reports from liaisons to PCOM, from PCOM liaisons to thematic/service panels and to existing WGs (except DH-WG; see below), to hear recent scientific results from drilling off Chile (Leg 141) and scientific/engineering results from DCS IIB testing on the East Pacific Rise (Leg 142), particularly as Leg 142 bears on the fate of Leg 148, presently scheduled as a further test of DCS IIB, to review PCOM's 1991 prioritization of engineering systems (particularly in light of Leg 142) and incorporate advisory panel input on non-engineering equipment needs, to hear a report from the DH-WG and discuss/take action on its recommendations, to make any adjustments in the planning structure necessary to prepare for the next four years in general and for Fiscal Year 1994 (FY94) in particular (~ late November, 1993 - late September, 1994), and to conduct routine PCOM business. Austin noted that, unlike the previous year's Spring Meeting, engineering prioritization would be discussed prior to setting the four-year general ship direction, because engineering developments would be particularly relevant to ship scheduling for FY94 and beyond.

Austin called for any additions to the agenda. Beiersdorf asked to be allowed to introduce results of work on the German high-temperature magnetometer. Austin replied that the presentation could be given after the DMP report. Cita-Sironi requested permission to brief PCOM on progress in coordinating Mediterranean drilling proposals. Taylor asked that discussion of Leg 149 (NARM non-volcanic I) objectives be added to the agenda. Austin agreed to include these items under Old Business; Continuing Issues. He called for adoption of the agenda.

PCOM Motion

**PCOM adopts the agenda for the 21 - 23 April 1992 PCOM meeting.**
Motion Malpas, second Duncan Vote: for 16; against 0; abstain 0; absent 1

## 944. ODP Reports by Liaisons to PCOM

### EXCOM

Austin reported that EXCOM had last met on 14-16 January 1992 in Bonn, Germany. The main item of discussion had been the report of the EXCOM *ad hoc* Committee on Long-Term Organization and Management of ODP, by J. Briden (Agenda Book, white pages 89-104). Austin outlined the recommendations of the report (Appendix 1 and Agenda Book, white pages 102-104). EXCOM had asked that PCOM provide input on the holding of regular and open scientific conferences on ODP and how to feed results of such conferences back into the JOIDES advisory structure [recommendation (i)]. Discussions underway concerning internationalization of JOI, Inc. [recommendation (iv)] and internationalization of the JOIDES Office [recommendation (v)] would be discussed by EXCOM at its meeting in June 1992. EXCOM had formed a subcommittee, comprising C. Dorman, D. Falvey and H. Dürbaum, to consider existing subcontracts, their possible modification, and to assess interest among JOIDES members in bidding for subcontracts [recommendations (vi), (vii), (viii) and (ix)]. The subcommittee would also consider incorporation of new drilling vessels [recommendations (xiii) and (xv)]. Reports on new drilling vessels had been presented in Bonn by French, Japanese and Russian representatives, but funding situations remained cloudy. PCOM would address specific bids, provided by SEDCO, for use of additional platforms for NJ/MAT (Leg 150) and on MIT Guyot in the Western Pacific (A&G). JOI, Inc. and EXCOM were also setting up a group, analogous to PEC, to review the JOIDES science advisory structure [recommendations (x), (xi) and (xii)]. The group would meet later in 1992. Lancelot noted that the French evaluation committee had made a parallel recommendation, i.e., splitting PCOM into committees for planning the ship schedule and for science. He wondered where that recommendation might be discussed. Austin replied that the setting up of the EXCOM group was moving slowly. Its report would go first to EXCOM, then to JOI, Inc. and the international partners. Implementation had not yet been discussed.

Francis noted that the Briden Report (on Agenda Book, white page 91) stated that ODP was focused on a single facility which took up about 50% of total funds annually. Francis pointed out that the true figure was 75%, adding that it was important not to be misled and overly optimistic about the money available for additional platforms. Austin informed PCOM that a proposal for a study of additional platforms had been requested and received from a consultant, H. Zaremba. The proposal discussed dependent and independent options and had received mixed reviews. The SEDCO bids for additional platforms (Agenda Book, white pages 394-396) were for separate, independent facilities.

Austin went on to report that EXCOM had heard latest estimates on renewal. UK had committed to renewal, as had Australia, and efforts were underway elsewhere. Decisions were expected during the spring and summer.

*Discussion*

Malpas registered concern about the Dorman subcommittee request for interest in bidding for subcontracts. The Canadian ODP Secretariat had received the request only three working days before expressions of interest were due. There had been no warning that the requests were coming and it had not been clear whether they were for expressions of interest (which was the case) or for formal proposals (RFP). Malpas said that some organizations had had prior knowledge of the requests and that some US institutions had received their requests two weeks before Canada. He felt that the initiative should have been brought before the service panels, in particular, and also before the thematic panels. Furthermore, PCOM had not seen the request. Malpas thought that the action brought into question the way ODP was run, adding that there should have been due consultation. Lewis stated that some of the points in the Briden Report required modification and that EXCOM should have asked PCOM to comment.

Austin responded that he represented PCOM at EXCOM and that he had endorsed EXCOM's activities. The intent had been to request statements of interest and not an RFP. EXCOM was now moving on these issues and Austin applauded that. The Briden Report had galvanized EXCOM. He would, however, take Malpas' complaint to EXCOM. PCOM would have the opportunity at this meeting to comment on the Briden Report (under New Business). Berger remarked that SIO had also been concerned about the short time allowed for a response to the Dorman subcommittee's request, though they had had longer than three days. Kidd agreed, adding that it had not been clear that the request had been for only a statement of interest. Austin replied that there had been some need for the Dorman subcommittee to "separate the wheat from the chaff" and to ensure that it received legitimate statements of interest and ability. Beiersdorf felt that the Dorman subcommittee's request represented an initial phase with the purpose of promoting discussion. He added that Lewis was correct, however, in stating that PCOM should be part of the discussion. Austin explained that it was intended to restrict the bidding process to countries and institutions already involved in ODP. Inclusion of outside institutions would require a formal RFP costing perhaps as much as ~$1M, according to JOI, Inc.

Kidd recommended that service panels be asked to comment on the reports from Briden and the Dorman subcommittee. Austin replied that all Panel Chairs had received the PCOM Agenda Book and would have the opportunity to comment. The Dorman subcommittee would report in June, but after that the timeframe for EXCOM action was not clear. Lewis suggested that PCOM also discuss the science advisory structure review panel. Austin replied that PCOM would return to the issue later in the meeting and could make a recommendation at that time.

Austin asked non-US PCOM members whether there were any comments on renewal issues. Lancelot replied that France had completed about six evaluations. They had been generally positive. The problem would be in getting a commitment to five years. Renewal for some period of between three and five years was likely. Malpas stated that Australia had committed to a three-year renewal. Canada had completed its evaluations and he hoped that a five-year commitment would be forthcoming within the next month. Cita-Sironi notified PCOM that a formal ESF meeting had been held in Strasbourg. Italy and Switzerland were increasing their contributions to ESF and the Netherlands was decreasing theirs, though remaining involved. No official renewal document had yet been written. Beiersdorf reported that DFG had sent an official letter to the Federal Ministry of Science and Technology inviting the ministry to rejoin ODP. He expected a positive reaction. Sharaskin had no information on Russian renewal. In the absence of the Japanese PCOM member, Austin stated that he had heard both positive and negative comments on renewal from Japan. Japan had been having recent difficulty getting members to panel meetings.

**BCOM**

Austin reported that BCOM had been instructed to consider scenarios involving both six and seven international partners. BCOM had made some comments regarding minimum and acceptable levels of funding. A commitment to engineering development would not be feasible with only six international partners and funds for computer upgrades would also be in jeopardy. Taylor asked about the permanence of OPCOM funds. Austin felt that such discussion should be deferred until after the NSF and JOI, Inc. reports.

**NSF**

Malfait outlined NSF's timetable (Appendix 2). NSF had officially invited the international partners to continue their participation in ODP, but had received very few responses. The UK had committed to renewal. IFREMER was considering a three-to-four-year commitment. Lancelot commented that France would not commit to a five-year renewal because of issues related to NEREIS. France just wished to ensure that NEREIS could be incorporated into ODP even if it was operational before 1998. Malfait reported that Canada had asked for a two-month delay. Nothing had been received from Japan (though unofficial comment had been positive), or from ESF and Russia. NSF intended a ten-year renewal, with an initial commitment to five years, during which the post-1998 program would be evaluated.

NAS review of the LRP had been completed and would be mailed to PCOM members. An NSF panel would meet during the week following PCOM to review the four-year program plan. The plan would then be taken to the NSB with a recommendation for extension of ODP and approval of the budget for the first three years.

The FY92 budget had been approved at \$41.4M and increased by \$0.15M to cover extra costs. Status of OPCOM funds remained uncertain. JOI, Inc. had requested the additional \$2.1M using the June 1991 OPCOM minutes as justification. Changes in ODP since the OPCOM meeting, however, had created inconsistencies, so NSF had told JOI, Inc. that further consideration of OPCOM's recommendations was warranted. Uncertainty over the eventual number of international partners also remained a problem. Malfait contrasted the estimated FY92 budget of \$41.5M to the LRP FY92 budget of \$43.6M. NSF was committed to maintaining the budget at \$41.5M whether there were six or seven international partners. If there were only six partners, NSF would have to come up with additional funds and an OPCOM increment would be doubtful. With six international partners, NSF could meet projected budgets for FY93 and FY94, but not LRP budget levels.

The FY93 NSF budget was under consideration by the US Congress (Appendix 2). A 17.6% total increase had been requested. This would include a 3.9% increase for ODP, designed to cover inflation.

*R/V Knorr* and *R/V Melville* were back in service after being stretched. *R/V Knorr* had already completed a cruise. *R/V Washington* was at sea, but would be retired in spring 1992. *R/V Nathaniel Palmer*, a new icebreaker, was now in Antarctic service. The FY93 budget included funds for an Arctic vessel. *R/V Knorr* was likely to replace *R/V Atlantis II* as *DSRV Alvin* support ship.

The NSF budget for ODP science activities was $11.2M (Appendix 2). This comprised $4.7M for USSSP/USSAC and $6.5M for grants (including $2.3M in ship operations costs). NSF/ODP and earth sciences programs were jointly considering proposals for an OSN pilot experiment and for New Jersey drilling related to NJ/MAT (Leg 150).

FY92 field programs, together with those already scheduled for FY93, are listed in Appendix 2. Proposals for additional FY93 projects were expected in May.

*Discussion*

Lancelot asked for information about the planned Arctic vessel. Malfait said that it would not be a high-Arctic icebreaker, but a multi-purpose ship capable of breaking ice 3-4 ft thick. There had not yet been a detailed design study. Langseth reported that a preliminary design study had begun and that he was on the committee. Responding to a question from Lewis, Malfait said that JOI, Inc. had submitted four-year plan budgets for scenarios of both six and seven international partners. The FY93 budget would be closer to the lower figure (not the LRP figure) if there were only six international partners. In reply to a question from Beiersdorf, Malfait stated that NSF wanted a commitment to renewal for a minimum of five years.

## JOI, INC.

Pyle announced that the four-year program plan (FY93-FY96) had been completed on March 17. It would be reviewed by NSF on 28-29 April and by the NSB in August. Four-year program plan budgets were prepared for scenarios involving both seven (LRP budget level) and six international partners (Appendix 3). The seven-partner budget contained a large amount of SOE money, but may be a "pipe dream". With six partners, flexibility was reduced. Computer services, shipboard scientific equipment and DCS III would drop out as FY93 SOEs (Appendix 3) if the budget was at the six-partner level. FY94-FY96 SOE estimates (Appendix 3) would remain speculative until real budgets were known. PCOM might also be faced with cutting additional items at its August 1992 meeting.

Little progress had been made in organizing a liaison group with IGBP/PAGES, but NSF (Atmospheric Sciences) had now expressed interest in promoting such a liaison. Pyle continued working with continental scientific drilling programs and had recently attended a related scientific symposium in Paris.

Pyle went on to discuss the status of high-temperature tools (criteria of Lysne, Worthington and Pyle, 1990, Scientific logging in high-temperature boreholes, *Scientific Drilling*, v. 1, p. 296-299). Water sampler: a proposal had been sent to DOE from Sandia for a downhole sampler; funding was probable in FY93; ODP was responsible for uphole components. In response to a question from Francis, Pyle said that the water sampler would be an improvement of the current sampler rather than a new tool. Temperature measurements: the Sandia tool had been used on Leg 139; precision pressure measurement (0.005%) was to be incorporated; the French (BRGM) tool and cable were to be tested. Independent of ODP money, some slimline, high-temperature modular memory tools were being developed at Sandia. These tools did not require an electrical connection to the surface. In about one year, a dewared computer would be ready, to which could be added various modules, initially spectral gamma (to measure Potassium-, Uranium- and Thorium-series elements) with radioactive gamma and neutron sources in the future.

Expressions of interest had been received in response to requests sent out by the Dorman EXCOM subcommittee. Members of the subcommittee had visited France on 11 April to discuss logging and Russia on 13-16 April to discuss drilling technology and logging.

No problems were envisaged in principle with the internationalization of JOI, Inc. Discussions were proceeding. Similarly, internationalization of the JOIDES Office was felt to be feasible, based in part on comments received from past JOIDES Office personnel. Austin asked when the first international JOIDES Office might be set up. Pyle replied that the next move of the JOIDES Office, to the University of Washington, would complete the circuit of US JOIDES institutions. Therefore, it would be appropriate to try an international JOIDES Office after the University of Washington.

JOI, Inc. badly needed PCOM advice on several items: a) the OPCOM situation, b) DCS future and timetable, and c) computing and databases, including impact of possible subcontracting recommendations.

In conclusion, Pyle noted the following JOI, Inc. personnel items: R. Smith would be leaving JOI, Inc. in late June and E. Kappel would be taking family leave ~1 July.

*Discussion*

In response to a question from Storms, Pyle said that the high-temperature tool being developed by R. von Herzen (WHOI) was funded by NSF. Austin noted that the OPCOM issue would come up again. People would be reluctant to provide further volunteer efforts for deep-drilling and pore-fluid sampling studies if money for implementation was not available. Taylor added that, in addition, certain drilling programs would not be possible if some technological developments had to be dropped. Austin concluded that PCOM would have to address the issue before considering the four-year schedule.

## SCIENCE OPERATOR (ODP-TAMU)

Francis recalled that the last PCOM meeting had occurred while Leg 141 (CTJ) was in progress. Leg 141 lost ~4 days as a result of two medical evacuations. MDCB had been successfully tested in Hole 863B (Appendix 4). It had behaved as expected and was ready to work with GEOPROPS. Also in Hole 863B, the pipe became stuck. A kink was put into the pipe ~50 m above the seafloor during attempts to free it. The pipe was straightened by pulling before the hole could be logged, but the pipe was severed after logging with the loss of $81,000 of equipment.

Leg 142 (Engineering/EPR; Appendix 4) required a great deal of equipment to be shipped to *JOIDES Resolution*, with the result that the leg began ~0.5 day late. DCS had been a disappointment; it would be discussed further later in the meeting. Leg 142 ended a day early.

Leg 143 (A&G I) sailed on 22 March. Clearance from the Marshall Islands was obtained on 24 March. RCB holes were being drilled before APC/XCB holes because deeper objectives were considered more important. At Allison-A (Appendix 4), recovery in rubbly lagoonal limestone, below the pelagic cap, was <1% during the course of 600 m of penetration. Recovery improved in the bottom 100 m. Nine days had been spent on the site. Logging had gone well. At Huevo Guyot (Appendix 4), basement had been encountered at 1620 mbsf, although it had been expected at 960 mbsf. Penetration had reached 1720 mbsf and recovery rate was 50-60% in basalt. Taylor noted that this would be the deepest hole drilled by ODP. Francis added that recovery rate had improved with depth at Huevo, being poor at shallow depths, but improving to 20-40%. The shipboard party had formally proposed to rename this guyot Resolution Guyot. A charter flight to Majuro would bring Leg 144 personnel and immediately remove Leg 143 personnel in order not to overload limited accommodations there.

Clearance from Japan was expected shortly for drilling on Seiko Guyot by Leg 144 (A&G II). In reply to a question from Taylor, Francis explained that late clearances were normal, even when member countries were involved. A US Navy installation on Seiko had been an extra complication.

Leg 145 (NPT; Appendix 4) had been discussed by PPSP. The prospectus had been published and staffing was essentially complete.

Most Leg 146 (CA) sites had been approved by PPSP. Leg 141 results had been helpful in that respect. Staffing was 85% completed. The large number of downhole tools and measurements on Leg 146 meant that it would be difficult to drill >6 sites. Drilling of even 6 sites will probably require elimination of the geochemical logging program. PCS, MDCB, GEOPROPS (which seemed to be on course for readiness in July) and CORKs (at two holes) would all be deployed. Austin drew PCOM's attention to a letter from B. Carson (Leg 146 co-chief) describing how Leg 146 would be impacted by the loss of 1.5 days required to replace the thermistor string at CORKed Hole 857D drilled on Leg 139.

Francis noted that K. Gillis and C. Mevel had been appointed co-chiefs for Leg 147 (HD). (A list of co-chiefs for upcoming legs is included in Appendix 4.) No staffing had yet taken place.

Leg 148, currently scheduled as Engineering DCS IIB with a back-up of Hole 504B, required a PCOM decision at this meeting.

Leg 149 (NARM non-volcanic I) co-chiefs were D. Sawyer and R. Whitmarsh. Concern that there would be insufficient time to drill the proposed three sites in 5000 m of water had led to some adjustments being made in the ship schedule.

PPSP had expressed some concern about the possibility of encountering shallow gas on Leg 150 (NJ/MAT). Shallow water over the sites compounded the problem. G. Mountain (Leg 150 co-chief) was trying to obtain all available high-resolution seismic data. Taylor asked whether an environmental impact statement (EIS) would be required. Francis replied that ODP did not file EISs for legs in US waters. ODP as a whole had an EIS. Austin commented that there was a lot of high-resolution seismic data available from the area and that Mountain had acquired it. Austin did not know whether it would prove sufficient to answer the safety concerns. Francis added that the concern was possible presence of gas in the upper 100-200 m. Austin pointed out that Leg 150 might be modified by PCOM, or perhaps even delayed, at the 1992 Annual Meeting if the problem had not been solved.

Francis went on to discuss Leg 151 (NAAG I). NADP, at a February meeting with ODP, had expressed the wish to push *JOIDES Resolution* as far north as possible (Appendix 4). SEDCO was deciding how much ice could be tolerated during drilling operations in the presence of an icebreaker. A RFP for a support ship would be required by December 1992. Austin pointed out that OHP had recommended an icebreaker, rather than simply an ice-support ship. PCOM would have to discuss that recommendation, which had fiscal impact. Francis said that some options had been discussed. *Oden*, a powerful Swedish icebreaker (Appendix 4), would cost $1.8M for 6 weeks or $1.4M for 4 weeks. Langseth asked whether a Russian icebreaker could be used. Francis replied that there were a number of possible vessels. Lancelot suggested consideration of the French ship *Astrolabe*, a less powerful icebreaker than *Oden*, as a compromise. Francis explained that the advantage of *Oden* was that it could create a channel wider than *JOIDES Resolution*. Austin, however, noted that BCOM had stated that a cheaper ship should be found to enable the money saved to be spent on computer systems, etc. PCOM, therefore, had a choice to make.

Francis presented a revised, draft ship schedule for the remainder of FY92 and FY93. It assumed that Leg 148 would be 504B, split into three "mini-legs": two to allow a change of SEDCO crew at Panama, and one comprising a transit to Lisbon. Leg 150 (NJ/MAT) would begin in Lisbon in order to provide extra on-site time to Leg 149 (NARM non-volcanic I). *JOIDES Resolution* would not be required to enter dry dock until after the start of FY93. 4. Austin added that Leg 150 could now expect 41-42 days on site. Francis noted that the changes to the schedule meant that Leg 151 (NAAG I) would slip by ~6 days. He did not wish it to slip further because of its limited weather window.

Francis informed PCOM that J. Baldauf had been appointed as the new Manager of Science Operations at ODP-TAMU. The organizational structure for shipboard technical support had been changed to increase the number of marine computer specialists (there were now six, two of whom would sail/leg on an A, B, C rotation; see Appendix 4). Fox asked whether that change involved additional training, or just juggling personnel. Francis replied that the A, B, C rotation would allow for more training. Technical support staff employment conditions had also been changed. Technical support staff could now choose to return to a home of their choice following cruises and not necessarily to College Station. They would then receive 12 months salary at a flat rate. Alternatively, they could choose to return to College Station and receive sea pay plus compensation time. This system would allow employment of technicians from international partner countries. Taylor commended ODP-TAMU for that change, adding that it was important for the morale of technical support staff. Francis reported that Computer Services and Data Bases were being combined under a single manager as the Department of Information Services (old and new organizational charts are included in Appendix 4). ODP-TAMU was in the process of recruiting the new Manager of Information Services (see advertisement in Appendix 4) and expected to fill the post in a couple of months.

In response to a question from Kidd, Francis estimated that ~15-20 technicians would choose to live away from College Station. Photographers, however, would be required to live in College Station. Replying to a question from Pyle, Francis said that Baldauf would be full time on ODP. In reply to Fox, Francis stated that two staff scientist positions were currently vacant.

Staffing of legs 144 and 145 was complete. Leg 146 was 85% staffed and staffing of Leg 147 would begin at the end of April. Staffing of legs 148-152 had not yet begun.

The proposed publication schedule is shown in Appendix 4. Initial Reports volume 134 and Scientific Results volume 122 were printed by a different printer. ODP-TAMU planned to evaluate a number of different printers over the next year and finally choose two.

Langseth asked for some quantitative information on the performance of MDCB. Francis replied that MDCB had cored claystone and siltstone on Leg 141, recovering 2.5 m and 1.5 m cores. Its recovery rate had been better than the XCB.

## WIRELINE LOGGING (ODP-LDGO)

Lyle noted that there had been a big increase in the number of logging strings run starting in 1989, coinciding with the introduction of FMS (Appendix 5). The number was now stabilizing at 70-80 strings/year. The number of data requests had increased dramatically in 1992 (Appendix 5).

Drilling had not recovered gas hydrates on Leg 141 (CTJ). Logging results suggested that the BSR was caused by free gas beneath hydrate (Appendix 5). The presence of hydrate was inferred partly from the presence of low salinity pore water and partly from high sonic velocities.

There had been no logging on Leg 142 (Engineering EPR). Leg 143 logging was especially important because of low recovery rates. Cyclicity had been observed (Appendix 5). The Japanese magnetometer had worked well operationally, but Lyle had not yet seen its results. Leg 144 logging would be similar to that on Leg 143, involving the standard logging suite (geophysical string, geochemical string, FMS), digital BHTV, Japanese magnetometer and, if Hole 801C was logged, packer (for permeability).

Leg 145 (NPT) logging would involve the standard logging suite together with the French magnetometer/susceptibility tool.

Leg 146 (CA) would have an extensive downhole program. All sites were to be logged with the standard suite (geophysical string, geochemical string, FMS), though Lyle felt that the geochemical string was the least important. R. Jarrard would be the logging scientist, and Lyle stated that he would defer to Jarrard on the issue of whether to run the geochemical string. Temperature measurement would involve both WSTP and logging temperature. For two re-entry sites, the Schlumberger VSP tool and the packer/flowmeter would be run. Also planned for one or more sites were the WHOI offset VSP, CORK/thermistor string emplacement, LAST II and GEOPROPS. It was possible that the digital BHTV and shear-source sonic tools would also be deployed. Fox said that SMP had been very concerned to learn that the pore-pressure portion of WSTP had been removed from *JOIDES Resolution* for calibration purposes and felt that it had to be back in time for Leg 146. Langseth said that there was a serious question as to whether WSTP pressure measurements were of value. That was one reason why WSTP had not been used for that purpose. Pressure measurements were, however, obtained from packer and long-term CORK experiments.

Lyle turned to FY93 logging. Possible new tool developments were a digital version of the high-temperature resistivity tool and a high-resolution magnetic susceptibility tool. The final decision on Leg 148 would influence testing of slimhole/high-temperature tools.

Wireline Logging Service was in a state of transition. ODP-LDGO did not intend to bid on standard shipboard data acquisition in FY94, i.e., supervision of Schlumberger data acquisition, staffing of shipboard logging personnel and downhole measurement laboratory maintenance. FY93 would be a transition period to the next shipboard logging operator.

Lyle concluded with a review of personnel changes. J. Schwartz (logging engineer) left in December 1991. Lyle (interim chief scientist) planned to leave in July 1992. A. Meltser (logging and tool development engineer) had joined ODP-LDGO from Ukraine. He has extensive experience, including logging of the Kola Deep Hole. F. Filice (assistant systems manager) had joined from ARCO. He also has extensive field experience and experience with log processing. B. Pratson (log analyst) was on family leave.

*Discussion*

Austin asked who Lyle's replacement would be. Lyle replied that that had not been determined. Lancelot commented that the French high-resolution susceptibility tool had a resolution of 1.5 mm in the laboratory and should be ready in late 1993. Berger asked how the amount of time on legs allotted to logging had changed. Lyle replied that the switch in 1988-89 from two to three strings added another ~$^1/_3$ to the time required for logging. At the same time, there were fewer failures, which saved time. On average, one day was spent logging for each 500 m of hole, resulting in a total of 6-8 days/leg, depending on the number of non-standard measurements.

## 945. JOIDES Reports by PCOM Liaisons to Panels

### DMP

Lewis stated that the DMP minutes (Agenda Book, white pages 113-140) were comprehensive. He highlighted three items. 1) Third-party tools: the objective was to produce a document describing rules and regulations. 2) DMP hoped to put out a public information brochure in May. 3) Processing, acquisition and distribution of log data. The full third-party tool document had not been included in the minutes. Austin stated that guidelines for the monitoring of third-party tools had been published in the *JOIDES Journal* (February,1991 issue). The parts that DMP wished to revise concerned how to ensure that the third party completed the task and how tools passed from the third party to ODP. Lewis said that DMP had produced a draft report and was recommending it to PCOM.

DMP felt that the PCOM decision to relegate logging objectives of Leg 142 (Engineering/EPR) to alternate status had been made too late. The logging scientist had not been made aware of the decision. Austin replied that PCOM had not given logging alternate status, but had stated that coring should be paramount. Lyle stated that he should have contacted Batiza (Leg 142 co-chief) about the matter.

Lewis reported that DMP felt that, in view of the growth in demand for logging data, sufficient personnel should be available to disseminate logging data. The possibility of computer access to a central archive of log data should be explored to facilitate acquisition of data by the community. Austin noted that PCOM would consider the ODP-LDGO white paper "ODP DataNet Services", already reviewed by selected panels, later in the meeting.

Beiersdorf presented information on the German high-temperature, dewared, three-component magnetometer (Appendix 6). It had been tested in the KTB borehole and run from 3 to 6 km, with corresponding temperatures of 90°-170°C. The magnetometer had been exposed to temperatures of between 130°C and 170°C for 5 hours and had worked well. The sensor package was at 80°C, while the external temperature was 170°C. It had previously been tested to an external temperature of 260°C; the corresponding internal sensor temperature was 125°C. By the end of 1992, a gyro for orientation and an inclinometer would be available on the tool.

Outer diameter of the tool was 88 mm. Beiersdorf felt that Leg 148, if that was Hole 504B, would be an ideal place to run the magnetometer.

## STEERING GROUP FOR *IN-SITU* PORE FLUID SAMPLING

Austin explained that the steering group had met to consider what would have to be done in order to get a RFP ready. P. Worthington had been unable to chair the meeting and J. Gieskes had filled in. (The report of the steering group was available as a handout.)

Becker, PCOM liaison, stated that the steering group had decided to write a narrowly-focused RFP for a feasibility study. Becker stressed that pore fluid sampling was distinct from borehole fluid sampling. The group had emphasized sampling of pore fluids from: 1) basement aquifers, and 2) low porosity (<30%) sediments. This was in contrast to pore fluid sampling from soft sediments, which could be done using WSTP or PCS. The immediate goal was to write a scientific justification and RFP for a feasibility study that was to be completed by Winter 1992-1993. Source of funds for the feasibility study, however, remained uncertain.

A scientific/operational issue was the level of formation pressure relative to hydrostatic pressure. The formation might be under-pressured, over-pressured or hydrostatic. Downhole flow had been observed most frequently, suggesting that under-pressured formations were the most common. This led to the following problems: 1) a formation permeable enough to sample would be invaded by drilling fluid; 2) a formation impermeable enough not to be invaded would not produce formation fluids; 3) a permeable formation that produces (which may be rare) could be sampled by a borehole sampler. As possible solutions to these problems, the main goal of the feasibility study might include revisiting sealed holes, packer technology, or other approaches.

The proposed schedule was: 21 April 1992, endorsement by PCOM; 21 May 1992, RFP submitted to JOI/NSF; 15 June 1992, RFP issued by JOI/NSF; 15 August 1992, responses to RFP due; 15 September 1992, evaluation of responses (DMP meeting); 30 September 1992, selection of bidder; 15 October 1992, contract issued; January 1993 DMP, oral report by contractor; 1 March 1993, written report due. The matter was urgent because after the written report there would have to be another round of proposals to build the device. A functioning tool might be delayed for two to three years beyond the written report. The following monitoring responsibilities were assigned: science issues, P. Swart and J. Gieskes; technical issues, D. Huey (ODP-TAMU).

### *Discussion*

In response to a question from Langseth, Becker stated that the feasibility study would produce a report which assessed the many possible options for recovering pore fluids. Langseth felt that it appeared that it might be more a matter of strategy, i.e., how to make fluids accessible for sampling. That might include how to drill and circulate and when to attempt sampling. In reply to a question from Berger, Becker said that the cost of the feasibility study was envisaged as being ~$100,000. Austin explained that OPCOM had allocated money to downhole fluid sampling, but that NSF viewed that justification inadequate for allocation of funds. Part of the steering group's work was to provide a scientific justification for NSF.

Taylor asked whether pore fluid sampling was feasible. Becker acknowledged that one outcome of the feasibility study might be that it was impossible. Austin noted that it was in part a question of how long *JOIDES Resolution* would be allowed to sit at a hole in order to recover uncontaminated fluid. In response to a question from Beiersdorf, Becker said that members of the steering group would be at the June 1992 DMP meeting in Germany. Austin added that the group would meet again in conjunction with DMP. Taylor said that he was reluctant to spend $100,000 to be told pore fluid sampling was impossible. He suggested that the feasibility study be done informally. Becker commented that revisiting sealed holes was one possibility. Langseth pointed out that that was expensive and asked whether pore fluid sampling could be done in real time. Taylor asked whether it would also produce better results than squeezing. Becker noted that squeezing would not work in all sections.

Austin stated that fluid sampling was the number one panel priority for non-engineering equipment. PCOM would return to the issue later in the meeting. PCOM must also endorse the timing of actions proposed by the steering group. Austin had asked the group to write a science discussion to obtain (OPCOM) funds from NSF.

## PPSP

Austin reported that PPSP had approved all Leg 145 (NPT) sites. Several Leg 146 (CA) sites had been disapproved because of proximity to structures and through-going faults. There were now three sites in each of the Vancouver Island and Oregon margin drilling areas.

PPSP also previewed Leg 150. A presentation was given by one of the designated co-chiefs. Leg 150 (NJ/MAT) had potential safety problems due to gas in the upper 100 - 200 m. Such occurrences of gas were known to occur on the New Jersey margin. PCOM might have to delay or modify Leg 150. This raised the issue of how to deal with site-related surveying. There was at present no easy way to get a high-resolution site survey for a leg that was on the schedule. There used to be facilities for doing that.

New pollution prevention and safety guidelines had been completed and would be published as a special issue of the *JOIDES Journal* later in 1992.

## SMP

Fox stated that SMP met in Honolulu during a port call by *JOIDES Resolution.* SMP members examined shipboard laboratories and equipment and held discussions with technicians.

SMP had listed seven laboratory requirements (Agenda Book, white page 343). Fox highlighted three of them: 1) need for technical staff to receive shorebased training and stay in a specific laboratory for at least eight legs; 2) programming software (preferably C) should be provided for Macintosh computers; 3) cryogenic software should be completed for use on Leg 145 (NPT).

SMP recommended that safety of AC fields aboard *JOIDES Resolution* be assessed as soon as possible. High intensity AC fields could be harmful. A meter should be made available for such assessment.

SMP recommended adoption of procedures for XRD sediment analysis. A new manual was in hand. SMP disagreed with removal of the pore pressure component of WSTP. SMP felt that

Leg 146 (CA) might be jeopardized without it, though Fox acknowledged that, based on what he had heard earlier at PCOM, that might not be the case.

In the area core-log integration, SMP stressed the importance of a real-time drilling parameters data acquisition system. It should become an engineering development goal. SMP also recommended acquisition of Corepac software as the shipboard core-log data correlation tool. The manual must, however, be updated to make it more user-friendly. In addition, training with Corepac should be provided for the sailing core-log data specialist.

SMP endorsed the recommendations of DH-WG (see below). SMP felt that the shipboard computing facility was a central capability. DH-WG recommendations should, therefore, be implemented under the direction of the Science Operator with input from a specialist JOIDES steering group.

SMP endorsed the overall direction of the ODP-LDGO proposal for DataNet Service because real-time shipboard data processing capacity had reached its limits in some laboratories. An increasing need for shore-based support was envisaged. The present proposal, however, did not define a functional relational database and needed further development.

Fox highlighted the first two items of SMP's equipment priority list: 1) core-log integration needs (natural gamma and MST upgrade, computer workstation and resistivity equipment for discreet core measurements), and 2) a color measurement instrument, e.g., a Minolta instrument at a cost of only a few thousand dollars.

SMP felt that the shipboard measurement process was working well.

*Discussion*

Arculus drew PCOM's attention to a remark in the SGPP minutes (on Agenda Book, white page 191) to the effect that the shipboard XRD was worthless. He noted that the SMP minutes used XRD when they meant XRF. Fox replied that the XRF was excellent. He could not comment on the status of XRD, except to say that a procedure had been drawn up for use of the XRD with sediments. Arculus stated that the procedure only allowed a bulk major and trace element analysis of sediments and did not provide, for instance, information on clay mineralogy. Fox did not think that SMP had discussed that issue. Taylor added that effectiveness of the XRD depended on the technicians who happened to be on a particular leg. Lancelot agreed. Austin commented that the message about technician training was being heard. Francis stated that it was important to cross-train technicians because technician availability was sometimes a problem. Arculus returned to SGPP's point. Austin stressed that it had only been the point of view of one SGPP member, rather than the entire panel's perspective. Kidd agreed that XRD data were of variable quality from leg to leg and depended on the technicians aboard and also the interest of members of the Scientific Party. Austin stressed that XRD procedures should be spelled out clearly and given to technicians. Taylor pointed out that interpretation was involved. Lancelot felt that technicians should be trained to do it. Austin said that Francis could take that recommendation to ODP-TAMU.

Austin asked whether there were any gaps in the disciplinary balance of SMP. Fox replied that it was difficult for him to assess that, having attended only one meeting. Austin noted that SMP was smaller than most panels and could be augmented. Lancelot recalled that J. Natland had characterized SMP as sediment-oriented. Austin stated that PCOM could decide to augment SMP.

Becker asked whether the issue of making physical properties measurements under *in situ* conditions had arisen at SMP. This needed to be considered deeper in sections for ties to seismic data. Laboratory measurements became less useful with depth. Fox did not know whether it had been discussed. Francis explained that it used to be done on shore. Fox added that it was labor-intensive and that few measurements could be made. It might be impossible to get measurements in real time in order to assist with adjustments to drilling strategy.

## IHP

Berger explained that he had attended the IHP meeting for only one day. He referred PCOM to the IHP minutes (Agenda Book, white pages 283-324), where specific recommendations were listed. Berger said that he would present his personal impression of what IHP had considered important, noting that IHP Chair Gibson would be present later in the meeting.

Berger's impression had been one of general panic at the flood of data. IHP felt somewhat abandoned by the system. Data volume had increased, but the attention paid to it had not. IHP was very concerned about the shipboard computing system, both hardware and software. Estimated cost of improvements was of the order of several hundred thousand dollars. Good progress was being made on data handling; a demonstration was given of the CD-ROM ODP dataset, which contains data up to Leg 139.

*Discussion*

Austin asked whether Berger felt misplaced as liaison to IHP. Berger answered that he felt that he could only "sit and listen." Lancelot said that there was a learning curve for a liaison and that IHP had integrated itself into ODP a great deal.

## SSP

Watkins explained that SSP had reviewed Atlantic data and made initial assessments of 94 potential drill sites. Data were often available, but often had not been interpreted by proponents. (Watkins' summary of SSP's assessment of scheduled and potential drilling drilling programs is presented in Appendix 7.)

SSP would meet again at LDGO in early August to prepare recommendations for the August PCOM meeting. SSP recommended a four-year term for Kastens, who they had proposed as the next Chair. ODP-TAMU should investigate government approval necessary for drilling NJ/MAT (Leg 150). SSP planned to develop guidelines for offset drilling and invited OD-WG input. SSP expressed concern about the possibility of transferring the Site Survey Data Bank from LDGO. The present operation was excellent; a transfer would disrupt operations and possibly result in reduced efficiency. Furthermore, the Data Bank relied on LDGO's database. SSP proposed an August 1 deadline for getting data on drill sites to the Site Survey Data Bank, except for known cases involving data being collected.

*Discussion*

Kidd felt that PCOM should be aware that as many as 25 proposals could have data in the Data Bank by August 1. SSP, therefore, wanted to provide input to the August PCOM meeting to assist with selection of proposals for the FY94 prospectus. Austin stated that SSP would recommend to the JOIDES Office a subset comprising those proposals that were most ready for drilling. The JOIDES Office would then send the list, with an assessment of drillability, to PCOM in advance of the August PCOM Agenda Book and try to get a preliminary assessment of what subset should go into the FY94 prospectus. The JOIDES Office was trying to get an early start on this in order to give thematic panels more time to consider programs for ranking in the fall, i.e., late September through mid-October 1992. Austin applauded SSP's actions and their decision to meet at LDGO.

Duncan asked what SSP had meant by requesting that more effort be put into compiling data for Santa Barbara Basin (SBB) drilling. Watkins replied that it was related to potential safety problems. Kidd added that there were two concerns: gas and location in shipping lanes. Austin stated that OHP wanted a portion of Leg 147 to spend 1.5 days drilling in SBB. He reminded PCOM that the SBB site had initiated the entire 1991 "supplemental science" issue, but that a proposal had not materialized in time for consideration during those discussions.

## TEDCOM

Austin noted that TEDCOM had not met since the last PCOM meeting. TEDCOM's next meeting would address DCS planning and perform a preliminary review of a deep drilling RFP. The latter was another OPCOM recommendation and a feasibility effort. OPCOM had allocated $100,000 for a deep drilling study, but no commitment had yet been made to issue a RFP. Austin commented that, after nominating consultant H. Zaremba to examine the issue of additional platforms, TEDCOM had given his proposal a negative review.

## OHP

Duncan began his report by commending M. Delaney, the new Chair of OHP.

Poor attendance had resulted in inadequate representation and limited expertise. International partners should ensure that alternates are notified and can attend.

OHP strongly recommended pursuing DCS development with adequate shorebased resources and testing and ship time to ensure a fully-operable system as rapidly as possible. OHP saw the need for DCS for drilling sediments (e.g., chert/chalk sequences).

OHP recommended APC/XCB developments for upcoming legs 145, 150 and 151. Work was needed on: a) real-time hole-to-hole and core-to-log correlations, b) minimizing stretching and distortion with APC, and c) improving recovery with XCB.

OHP recommended that a single site in SBB (multiple APC to ~100 m; ultra-high resolution upwelling in the Quaternary) be added to Leg 147. OHP was aware of potential safety problems and had assigned watchdogs. Issues of available site surveys and refinement of site selection would be pursued by watchdogs with proponents. Austin noted that PCOM would return to this issue under Old Business. He added that J. Kennett (SBB proponent) had offered to fund a launch to take personnel out to *JOIDES Resolution* to work on SBB cores and then leave again. PCOM had expressed support for <1 leg science in 1991, but had stipulated that it be incorporated into legs at an "early stage". PCOM would now have to decide what constituted "early". In response to a question from Cita-Sironi, Duncan said that OHP understood what PCOM had decided about supplemental science. OHP felt, however, that SBB drilling would yield exciting science and that the probability that Leg 148 would no longer be an engineering leg opened up sufficient flexibility in the schedule to insert SBB. Austin, however, pointed out that SBB drilling would have to be either at the end of Leg 146 or at the beginning of Leg 147.

Duncan continued his report, noting that OHP recommended that PCOM form a DPG for NAAG II in 1993, for drilling in 1994. NAAG II-DPG would extend NAAG II and integrate new proposals. OHP also recommended formation of a DPG to integrate highly-ranked Caribbean proposals into common-interest sites and develop a drilling strategy (Neogene, Paleogene and Cretaceous issues, plus tectonic histories).

OHP recommended that an icebreaker operate in tandem with *JOIDES Resolution* for the highest-latitude sites of NAAG I (Leg 151), YERM-1 and ARC-2A. OHP considered those sites the chief objectives of NAAG I, but drilling them would involve penetrating into partially ice-covered waters.

OHP had provided a description of a deep-drilling target in the Somali Basin for TEDCOM. OHP would meet next in Marseille on 30 September - 2 October.

*Discussion*

Kidd asked what OHP felt had been achieved relative to their plan to begin with study of the Neogene and work back to the Paleogene. Duncan answered that Ceara Rise would constitute the final element of Neogene work. In addition, the composition of OHP was changing with the inclusion of members interested in older sections.

## SGPP

Cita-Sironi noted that the SGPP meeting had overlapped with that of OHP. Liaisons between the panels had, therefore, been absent for part of SGPP's meeting. Cita-Sironi characterized SGPP as an active panel with strong geochemical and sedimentary expertise, the former being dominant. Members from Japan, Russia and UK were absent.

Leg 141 (CTJ) geochemistry was discussed. PCS had been used 12 times, failing on 6 of those attempts. PCS was complex and required improvement. SGPP recommended that two working PCS units be available for Leg 146 (CA). In addition, T. Pettigrew (ODP-TAMU and PCS expert) should be invited to participate in Leg 146.

In spite of the presence of a strong BSR, no gas hydrate was recovered on Leg 141. A possible future strategy would be to rapidly drill and log (sonic and resistivity) a pilot hole to plan a gas hydrate drilling strategy in real time, then rotary drill a second hole as fast as possible for specific hydrate targets. Austin pointed out that only 25% of pore space need be filled with gas hydrate to create a BSR. It would, therefore, be possible simply to miss the hydrate during drilling.

Cita-Sironi reported that SGPP's new proposal reviews involved careful work. Each went to >1 watchdog. Watchdog names, however, were not given to proponents. Cita-Sironi felt that should be done.

Part of SGPP's meeting had been devoted to a scientific discussion. Three themes were discussed: 1) Gas hydrates (strategy and possible drilling areas, as well as how to combine gas hydrate objectives with existing proposals); 2) Sapropels (discussion led by Cita-Sironi); 3) Sediment drifts (Faro Drift and drifts off Brazil). SGPP was considering creating new proposals to address these themes, or supporting existing proposals.

Cita-Sironi commented that both OHP and SGPP had recently changed their Chairs, but still seemed unable to communicate effectively. Austin said that he had advised OHP and SGPP to meet jointly. A joint meeting should take place by spring, 1993. Cita-Sironi explained that J. McKenzie, SGPP Chair, had decided to meet in Kiel in September 1992, where a paleoceanography meeting was to be held, in the hope of meeting jointly with OHP. OHP was, however, meeting elsewhere. OHP's liaison to SGPP had only been present on the last day of the SGPP meeting.

SGPP was not supportive of DCS, since it was not a priority of SGPP. SGPP proposed that one co-chief for NARM volcanic I (Leg 152) should be a geophysicist and one a petrologist/geochemist. Proponents left the room during discussion of proposals. Austin remarked that SGPP were the only thematic panel to make proponents leave during discussion. PANCHM had decided in December 1991 that such decisions were up to the Chair.

*Discussion*

Kidd asked whether there was anyone on SGPP who would look at current proposals to drill drifts. Austin responded that there had been no nominations for replacement members. PCOM could examine SGPP's membership and make additions. Austin asked about SGPP's attitude to DCS. Cita-Sironi replied that SGPP thought it a waste of money and ship time. Blum added that he thought that SGPP had no enthusiasm for DCS, rather than being against it. SGPP simply felt that there were other things to do.

## LITHP

Malpas reported that LITHP strongly supported continued DCS development because: a) DCS might perform better in other than ridge-crest lithologies, and b) little money had been spent on DCS in comparison with what industry would spend on such a project. If Leg 148 was not to be an engineering leg, LITHP recommended that it be a return to Hole 504B, which was LITHP's highest-ranked program globally. LITHP opposed inclusion of SBB drilling in either Leg 148 or Leg 147. If Leg 148 was to be an engineering leg, LITHP recommended that DCS be tested in a less-hostile environment that zero-age crust., e.g., Vema Fracture Zone transverse ridge site or Galapagos extinct hydrothermal mound.

LITHP reiterated the importance of deep drilling. LITHP also endorsed DMP's efforts to use *JOIDES Resolution* in an experimental mode and was prepared to issue a joint RFP, with DMP, on the subject of lithosphere characterization. The objective would be to examine scales of variation in oceanic crust. LITHP also expressed interest in receiving proposals to drill in large igneous provinces (LIPs) and the Red Sea.

LITHP reemphasized that PCS was a high priority. LITHP's non-engineering priorities were: 1) sidewall coring tool, 2) computer hardware and software for core-log integration, 3) *in situ* fluid sampling and measurement of pore-water pressure and permeability, and 4) CatScan or X-radiography of whole cores.

LITHP planned to rewrite its White Paper to reflect changes in emphasis. LITHP also planned to issue a RFP for drilling proposals addressing its high-priority thematic objectives in any ocean, including the Red Sea.

*Discussion*

Francis, noting that PCS could only be run through XCB, expressed surprise at LITHP's interest. Austin believed that it indicated a growing effort to develop inter-panel solidarity. Thematic panels felt that they would get further if they spoke together. He added that LITHP was moving away from ridge crest drilling to offset drilling. In response to a question from Lancelot, Austin said that there was a Galapagos extinct hydrothermal mound proposal, but that the sites were in deep water. The Vema option would be better in that respect for a DCS test. Tucholke asked whether lithosphere characterization could be integrated with the offset drilling concept. Malpas replied that that had not been discussed directly and that lithosphere characterization was a generic concept. No proposals existed. It was talked of in terms of geochemical reference holes. Becker asked the meaning of a joint RFP for lithosphere characterization and asked why somebody did not just write a proposal. Malpas responded that LITHP wanted to write a proposal in concert with DMP's philosophy, which was to understand what a single hole can reveal about subsurface geology, what kind of area was covered, etc. He agreed that one way would be to write a proposal. Lewis doubted that a RFP would be required. He felt that there were enough proponents out there. Austin stated that he felt that the term RFP, in this case, was used in the context of SGPP's recent advertisement in the *JOIDES Journal* for gas hydrate proposals. Taylor added that it was more a call for proposals than a RFP in the formal sense.

Beiersdorf asked whether any estimate existed of what was still needed to develop DCS, versus what industry might spend to reach that goal. Austin replied that TEDCOM had discussed that issue. The estimate was $20M, including ship time (four engineering legs). $3M to $4M of that would be spent ashore. Industry might spend 2 - 10 times that amount.

Lancelot suggested that, if Red Sea drilling was possible politically, it might be time for a workshop on the subject. Austin stressed that such a workshop would have to be devoted to young ocean basins, not just the Red Sea. Blum pointed out that TECP had ranked a generic Red Sea program in 1991 and 1992. Furthermore, there had already been a Red Sea WG. Austin added that the Red Sea WG had been in ~1985 and that a drilling strategy existed. Lancelot said that there were many Red Sea proposals which could be reactivated, adding that the French might run some surveys in the Red Sea in 1993. Francis stated that ODP needed to make contacts with scientists in Saudi Arabia. Austin recalled that the original stumbling block had been that bordering countries had wanted to keep the core. Francis added that communications with Saudi Arabia had also been difficult.

## TECP

Tucholke explained that TECP had conducted an interim review of offset drilling. TECP was concerned that the concept of offset drilling was too geared toward recovering sections of oceanic crust without regard to tectonic setting. Two kinds of tectonic setting existed: 1) where tectonics was an incidental feature that had exposed crust (e.g., HD), and 2) where tectonic setting had been ultimately responsible for creating crust (e.g., detachments on slow-spreading oceanic crust). OD-WG did not seem to be developing tectonic hypotheses to be tested. There had been some miscommunication because TECP's liaison to OD-WG had been unable to attend the entire meeting.

TECP re-emphasized strong support for deep drilling and felt that the best way to explore its feasibility was to try it.

TECP had discussed how to include structural information in visual core descriptions. This had been done on Leg 141 and should be set up as a standard procedure. It should be included in the computer database and structural barrel sheets produced. Structural information should not be missed.

TECP also expressed interest in Red Sea drilling.

*Discussion*

Malpas said that he had brought up the issue of offset drilling strategy and tectonics at LITHP. LITHP had been split: 50% agreed with TECP, but the remainder did not care whether one part of a composite crustal section was from the Atlantic and another from the Pacific. Austin felt that the lack of a TECP liaison might have been part of the problem. In response to a question from Cita-Sironi, Tucholke said that balanced cross-sections were a goal and that TECP recognized that they will not be clearly defined in most cases. Providing three or four options, however, would place some constraints on the system.

## OD-WG

Taylor referred PCOM to the report on OD-WG in the Agenda Book (blue pages 12-14; OD-WG minutes were also included, on white pages 141-151). Offset drilling was a strategy to understand the processes of oceanic lithosphere formation by drilling key partial sections of crustal and upper mantle rocks exposed in tectonic windows (e.g., propagating rifts, fracture zones and median valley master faults). Offset drilling sections were ready to drill immediately with existing technology and where temperature is not a problem. The existing global database comprised Hole 504B (long section of Layer 2), Hole 735B (gabbro) and Site 395 (ultramafics). The plan is to circumvent the need to drill Layer 2 to get at Layer 3 and mantle rocks.

As previously noted, TECP's liaison had not been present for the entire meeting. OD-WG progressed further with discussion of tectonic processes than the TECP liaison saw, so that TECP's negative feelings were not justified.

OD-WG strategy would involve drilling of composite sections originating from fast- and slow-spreading ridges and from areas influenced by hotspots, as well as areas outside hotspot influence. A matrix of OD-WG site-survey requirements was included in the Agenda Book (blue page 13).

*Discussion*

Kidd agreed with the site-survey requirements for the time being, but noted that the September MCS cruise by *R/V Sonne* was an experiment. Requirements might change depending on its results. Austin added that K. Kastens presence as SSP liaison to OD-WG had been essential and generated a good dialog. Taylor pointed out that transitions (dike/gabbro and gabbro/ultramafics) were not well-characterized in 3-D and that, therefore, advancing Hole 504B into gabbro was a high priority. The emphasis was on long sections of gabbro and ultramafics, where 3-D geometry and depth of transitions could be determined, because of the need to provide additional characterization of transition zones.

Austin stated that OD-WG felt that recovery of a complete crustal and upper-mantle section by offset drilling should be carried out at a single drilling area if possible. Such a location had not, however, been defined. Therefore, OD-WG had backed off and considered what was feasible at present. Fox, however, felt that the OD-WG minutes indicated a consensus that did not yet exist. He felt it important to understand a single area as much as possible. Taylor explained that some of LITHP's concerns were related to not knowing how a leg devoted to drilling peridotite would turn out. ODP had little experience drilling peridotite. Malpas felt that the term offset drilling implied that the composite section would be from a single area and suggested changing the name to cover the option of constructing composite sections from widely-spaced sites. Kidd noted that Kastens had used the term tectonic windows, rather than offset drilling. Good seismics, however, would still be required regardless of the approach.

Tucholke felt that TECP's concerns had still not been addressed. One model of slow-spreading crust predicted that there might be no transition, but only faults. It was necessary to understand detachments well away from the rift valley. Fox cautioned that the geophysical tools to do that might not exist. MCS did not show the disturbance effects seen with *in situ* sampling. Taylor explained that OD-WG was frustrated that SSP felt that there was insufficient survey data even for the well-surveyed MARK area. Even there, 3-D characterization had not been achieved. Tucholke said that all of the MARK surveys had been along-axis and that little off-axis work had been done. In spite of all the survey work, it had not been carried out in such a way as to allow hypothesis testing. Sharaskin noted that there were many examples of pillow lavas overlying gabbros and even peridotites. Kidd said that SSP would like to encourage those interested in tectonic windows to get together and compile data.

Austin stated that PCOM could mandate OD-WG as a DPG or synthesis group. He was, however, reluctant to do that until it determined an offset drilling strategy after the third meeting. It would be problematic, however, if that strategy was not satisfactory to the panels. OD-WG needed advice because LITHP and TECP were reacting. Fox said that some of the issues would have to be resolved at the next OD-WG meeting. Out of that meeting would come a sense of whether to constitute a group to synthesize data. Lewis suggested renaming OD-WG. Austin agreed that OD-WG might have defined their goal differently from what PCOM had originally envisaged. Malpas did not care what the WG was called. The important points were that LITHP was split and that TECP had concerns. Austin pointed out that LITHP was moving away from ridge crest drilling to offset drilling and, therefore, would rank offset drilling proposals highly. TECP, however, would rank them poorly if it disagreed with OD-WG's overall approach. Malpas stated that LITHP was moving away from drilling continuous sections. If PCOM did not address what OD-WG was doing, however, ODP would be back in the position of having to drill a continuous hole to provide a framework on which to hang bits and pieces of crustal recovery from elsewhere. Tectonic processes had to be understood so that it would be clear where drilled sections lay in relation to crustal sections. Berger recalled that Sharaskin had highlighted variability from place to place. Berger, therefore, suggested using P/T diagrams to place sections in a crustal setting, rather than a stratigraphic approach. Batiza reemphasized the frustration of LITHP over the paucity of rocks on which to work. Much could be learned from the relative positions of rocks, even if they had not been placed within a total crustal section. The attitude that there would be no drilling unless everything possible could be learned had paralyzed LITHP. Arculus, returning to Berger's point, felt that a P/T approach was insufficient and that ties to seismics were essential.

Taylor noted that OD-WG had defined their approach (Agenda Book, blue pages 12-14) as the drilling of partial sections. In an ideal world, partial sections would be spatially located and characterized, but that might not be achievable within the next year. He asked whether this was the right approach. If not, PCOM must make it clear to OD-WG. Taylor added that part of the impetus for offset drilling had come from EXCOM. Malpas stressed that a composite section could not be constructed if component sections could not be hung together. It was, therefore, essential to drill transition zones. Taylor responded that OD-WG would also prefer that. Austin added that OD-WG could not presently define a location where a transition was well-constrained enough to be sure of drilling it. Lewis suggested changing the wording of OD-WG's definition to involve drilling of key petrologies (rather than partial sections) exposed in tectonic windows.

Austin suggested that someone needed to summarize PCOM's feelings to redirect OD-WG in the light of LITHP's and TECP's comments. OD-WG must define a strategy. PCOM might state that no offset drilling would occur unless a place where crustal stratigraphy was offset in one location could be identified. Taylor responded that HD was such a place, but that it had not yet been characterized in 3-D.

Austin stated that the OD-WG Chair would receive the PCOM minutes and that TECP and LITHP would have liaisons at OD-WG. Malpas said that he would be happier if the purpose was simply to sample lithologies (to study magmatic processes, etc.), but that the strategy broke down when the composite section idea was introduced. He suggested that that idea be dropped if sections comprising the composite were to be an ocean apart. That would not stand in place of a complete crustal section in one place. Fox doubted that TECP would support dropping the composite section approach. Providing some sense of PCOM's philosophy to OD-WG would be useful. Malpas felt that drilling lithologies addressed magmatic and tectonic processes, but that it did not substitute for a single hole. Austin said that LITHP and TECP liaisons would be at OD-WG and could hash it out. He asked again what PCOM should say on the subject.

Cita-Sironi announced that she had a copy of a revised Vema proposal, which had a LITHP approach and strong sensitivity to TECP's problems. Austin responded that OD-WG thought the data at Vema were insufficient. Taylor added that there was no 3-D control. Tucholke doubted whether TECP would be supportive because it was uncertain how the Vema ridge had formed; there was no hypothesis to test. Furthermore, MARK was simpler.

Malpas felt that OD-WG's approach was reasonable. OD-WG should address LITHP/TECP input. He suggested that OD-WG drop the composite section approach. Austin stated that Taylor should take that message back to OD-WG. PCOM accepted LITHP's and TECP's advice. OD-WG should also consider what to do next, e.g., continue as a DPG, or as something else, or turn work over to proponents.

### SL-WG

Watkins stated that SL-WG had not met since the last PCOM meeting. The next SL-WG meeting would be on 6-8 June 1992 at Snowbird, Utah, to finalize its report.

## 946. Scientific Results of Recent Drilling

### Leg 141: Chile Triple Junction

S. Lewis explained that Leg 141 studied spreading ridge subduction. Objectives were to address subduction accretion and erosion as well as thermal aspects. Pre-collision, post-collision and collision sites had been proposed originally. Leg 141 focussed on the collision zone, drilling 5 sites: 859, 860 and 861 forming an E-W transect across the forearc, Site 862 on Taitao Ridge, and Site 863 above the subducted ridge landward of the trench slope (Appendix 8).

The transect had been successful. Site 859 provided good information on thermal structure at the toe of slope. Plio-Pleistocene rocks are heavily tectonized, but younger sediments are not deformed. Sediment in the trench is, therefore, being neither accreted nor heavily eroded, indicating a mass balance. Temperature profiles indicate cooler temperatures further from the subducting young oceanic crust.

Only 20 m of sediment was penetrated on Taitao Ridge. Basement rocks contain either ~50% silica or 75-80% silica, with no intermediate compositions. Taitao Ridge is not, therefore, an offshore extension of the Taitao Ophiolite. It may have been formed by volcanism associated with stresses along the Taitao Fracture Zone.

BSRs and gas hydrates had not been primary objectives of Leg 141, but were addressed. PCS was deployed twelve times and WSTP measurements made. No clathrate was recovered, but proxy indicators suggested its presence. Two models of gas hydrate occurrence existed: 1) gas hydrate as a sheet-like seal (Von Huene model), and 2) spotty, permeable occurrence (Hyndman model). The second type appeared more likely at CTJ ("snow rather than ice"). Lewis estimated that ~25% of pore space was filled with hydrate, permitting gas migration through the hydrate layer.

Much organic matter, almost liquid, was found coming from high-temperature zones. This had raised some concerns during drilling. Organics being drilled were not, however, mature. Gas came from deep in the forearc and, in the absence of seals, was not a problem. Francis noted that communications between ship and shore had been good throughout and that PPSP had been satisfied.

S. Lewis went on to report that Site 859 recovered "gumbo", mud which gummed up drill bits and clogged roller cones. In reply to a question from Fox, S. Lewis said that the average recovery rate for the whole leg was 45%. Chlorine levels dipped near the BSR (Appendix 8), probably because melted hydrate had released fresh water into the hole. Temperature profiles show a positive anomaly, which appeared to be real, near the bottom of Hole 859 (Appendix 8). A zone of hot fluid at that level was hypothesized.

No age gradient was noted between broken formations at the bottoms of holes at sites 860 and 859. Methane content was high at shallow depths at Site 860 (Appendix 8). Inorganic chemistry was the same as at Site 859. Amplitude of the BSR at Site 860 was weaker chemically, but not seismically. At all three sites on the transect, porosity decreased with depth faster than average, indicating overcompaction (Appendix 8). WSTP temperature gradient at Site 860 (~60°/km) had been lower than at Site 859.

A medical evacuation meant that target depth was not reached at Site 861. The objective was to determine whether a major subsidence episode had occurred in response to removal of material during subduction. Inorganic geochemistry trends (Appendix 8), however, were such as to reach fluids in contact with continental crust by the target depth, so that pre-cruise hypotheses were probably correct.

Three holes were drilled at Site 862 on Taitao Ridge ~100 m apart (Appendix 8). Recovery below the sedimentary cover was ~10%.

Site 863 was drilled above the subducted spreading ridge, but was not the hottest site. A thick section of approximately vertical bedding was drilled (Appendix 8).

*Discussion*

Taylor asked about the tectonic picture and accretionary processes revealed by Leg 141 drilling. S. Lewis replied that the spatial scale of the transition from subduction accretion in the pre-collision zone to collision zone extensional tectonism implied that material had been removed. Subduction erosion was, therefore, a result of ridge subduction. The transition from mass balance to subduction erosion took place within 30 km, less than half of the predicted 80 km.

**Wednesday, 22 April 1992**

**Leg 142: EPR/Engineering**

Batiza reported that Leg 142 drilled three holes at Site 864 (Appendix 9). Site 864 was in a very well-surveyed area. Holes 864A-C were drilled in a ponded flow ~3.5 m thick, as estimated from an *Alvin* site survey. The two HRBs deployed were left at holes 864A and 864C.

Scientific results were based on recovery of ~20 kg of rock from Hole 864A (15 m penetration) and ~10 kg from Hole 864B (7 m penetration). Two igneous units were identified in normal MORB. Unit 2 contained gabbroic inclusions (Appendix 9). Hole 864B recovered only Unit 1. Most rocks were not recovered as drilled core, but in junk baskets and jammed into drill bits. One cylindrical piece was recovered by DCB. Rocks were essentially normal MORB, though the two units were distinguishable (Appendix 9). Thumbnail-sized crystal inclusions, rare at mid-ocean ridges, were of interest. They might give information about the underlying magma chamber.

In response to a question from Becker, Batiza explained that the original plan had been to drill ~1 km off-axis, but that the site had been moved on-axis because seismic velocities there were higher and there was, therefore, presumably less rubble. Leg 142 drilling did not penetrate deep enough to encounter rubble and verify the seismic interpretation. Tucholke asked whether TV images of the site had been obtained. Batiza replied that abundant data from four *Alvin* dives had shown that the ponded flow was flat, with some superficial cracking. This was in contrast to many rocks in the axial region, which were highly porous and unstable. A camera on the end of the drill string gave the same information. Austin asked which of the two guidebases Batiza would choose to reoccupy. Batiza answered that it probably did not matter; both were ready. Responding to a question from Malfait, Batiza said that the question of whether to move to an off-axis site during Leg 142 had been considered, but that the decision had been made to stay on-axis. Storms added that they had not wanted to spend time looking for an off-axis site.

Batiza went on to consider requirements for ridge crest/hostile environment drilling: 1) ability to spud hole on hard rock (guidebases, a Leg 132 problem), 2) ability to penetrate and case off rubble (i.e., bits that will not wear out, DI-BHA), and 3) ability to drill and core ahead (i.e., DCS). Only the last (DCS) was lacking. Failure of the DCS secondary heave compensator involved both software and hardware (bent feed cylinder? load cell problems?), but the reason was not entirely clear. It had apparently worked on Leg 132, so that failure had been unexpected. DCS failure had been unrelated to Site 864 rocks. As to the future of DCS, Batiza felt that it was too early to abandon DCS. Continued DCS development, however, would require a new look at secondary heave compensation and careful testing (bench, on-land and perhaps shallow water nearshore).

## 947. Preparation for the FY93 Program and Beyond

### DCS Progress and Prospects: Leg 142/DCS Status Report and Fate of Leg 148

(Overheads which accompanied Storms' report were available at the meeting as a handout.) Storms acknowledged that Leg 142 had been disappointing in that no DCS core was recovered. Problems with the secondary heave compensator had been unexpected. Systems that had given problems on Leg 132, however, had worked well on Leg 142.

The goals of Leg 142 had been to: 1) to maximize DCS coring time, 2) achieve a minimum penetration of 100 mbsf, 3) achieve >50% recovery of fractured rock, 4) deploy the new three-leg/hexagonal-sided HRB, 5) evaluate feasibility of reaming 3.96" DCS hole to 7.25", and 6) evaluate second-stage DI-BHA with 7.25" bit.

Highlights of Leg 142 were: 1) all Leg 132 HRB deficiencies were corrected, though clearance in the moonpool remained tight; 2) hexagonal HRB performed exceptionally well and numerous reentries were made in ~15 minutes or less; 3) all deficiencies in the back-off system were corrected; 4) value of nested DI-BHA was demonstrated, achieving a 15 m cased hole, though bit life was a problem (only 10-15 m penetration/bit was achieved); 5) DI-BHA diamond bits demonstrated potential for operational use in drilling ridge crest environments (the single-cone, center bit appears to be the problem); 6) DCB demonstrated potential as a future effective coring system; 7) ruggedness of modified XCB latch, casing advancer latch and 4", 2-cone center bit was demonstrated; 8) prototype bit guide deployment/center bit recovery system and break-away safety joint was demonstrated; 9) all Leg 132 platform-mounted DCS drill rig deficiencies were corrected (NB: secondary heave compensator was functional on Leg 132); 10) much was learned about EPR formations, drilling conditions and possible future drilling techniques.

The biggest disappointment of Leg 142 was failure to recover any DCS core (see handout). Penetration was only 15 m and recovery comprised fragments jammed in core barrel or bit. Secondary heave compensation software did not function correctly. The secondary heave compensator (hardware and software) did not work even when Leg 132 software was used. Reason were not clear, but it was not just a software problem. In reply to a question from Pyle, Storms explained that the software had been changed after Leg 132 because it had been written aboard *JOIDES Resolution* and needed to be cleaned up for Leg 142. It was possible that Leg 132 secondary heave compensation did not work as well as was thought and that Leg 132 had simply been lucky. That was being evaluated. Sea conditions on Leg 142 (usually 1-2 m swell, >3 m on occasion) were worse than on Leg 132. Occasional rogue swells might have pushed the secondary heave compensator to its maximum operating limit. The system, however, needed to work in the type of weather encountered on Leg 142. In reply to a question from Kidd, Storms said that the secondary heave compensator was designed to cope with ±12" of residual heave (heave left after primary heave compensation) on a 6 s period. A DCS review meeting at College Station on 6 April gave ODP-TAMU some different concepts to consider for secondary heave compensation. For example, the use of an accelerometer system might be eliminated.

Other disappointments (see handout) included failure of small-diameter cones on 6-cone DI-BHA bits. The failures cost time early in the leg. Five out of six cones were lost on the first bit. The sixth cone remained in good condition after 24 hors rotation, implying that failure was due to dynamic loads. It was necessary to use light bit weights when spudding hard rock holes and the slightest heave would lift the bit and then slam it down, leading to failure. It had been possible to drill with tri-cone bits, clean the hole and make progress. That had not been possible in the Atlantic (Leg 106). It should, therefore, be possible to use larger bit sizes for initial runs, rather than minimizing bit size as Leg 106 results suggested. In addition, diamond bits should be an effective option once the center bit problem had been corrected (single cone center bits would not drill effectively). Finally, J-slots and C-ring grooves in the casing hanger were damaged, possibly from rotation of hard-faced stabilizer blades.

Berger asked whether ODP-TAMU could now go back to Site 864 and place more casing. Storms replied that reoccupying Site 864 would require only 4" mills to grind up bit matrix left in the holes. Coring could then proceed. By grinding down J-dogs, access to casing hangers was achieved.

HRBs performed well and reentries were rapid. The electronic tilt beacon and mechanical "bulls eye" slope indicators performed flawlessly, (see handout for proposed action items).

Regarding the nested DI-BHA (see handout), fusing problems between back-off nut and landing seat were eliminated. All three back-off attempts were successful. It was difficult to know when the system was backed off (it had always been possible to tell on Leg 132). The difficulty was related to hostile drilling conditions at EPR. Perhaps the system should have been tested in a less-hostile environment, but if that had been done, many of the problems that were discovered would remain unknown. Taylor asked whether water depth was part of the problem. Storms replied that he thought that the problem was due only to the formation.

In reply to a question from Lancelot, Storms said that he doubted that failure of the secondary heave compensator had been related to the formation. Lancelot felt that failure of the secondary heave compensation system had prevented an effective ridge-crest test of DCS. Austin thought that LITHP was more comfortable about supporting DCS because it was tested at EPR rather than elsewhere. Storms added that DCS was a complex system, all elements of which had to work before the system functioned.

In response to a question from Berger, Storms explained that center bits were part of the nested DI-BHA system (see handout). The center bit plugs the 11.25" diamond bit during initial drilling. The center bit is removed so that the second string can be deployed. Single-cone and 2-cone center bits were tried. The single-cone center bit looked stronger than the 2-cone option. When tried, however, the single-cone bit made no new hole. The diamond bits were in good condition when they were pulled out and might have been simply pivoting about the single cone. Tests were being run by ODP-TAMU. Bits and center bits were needed that would hold up. Drilling results with the 2-cone center bit were encouraging. The bit was pulled out early, but was in good condition, suggesting that the single-cone bit was the problem.

Problems with the DCB (see handout) were related to fill in the holes. Flow ports were designed for small cuttings, not large rubble, and could not remove fill. They would be redesigned. In addition, stabilizer pads might have caused problems in getting full weight on bit. Some slick-walled barrels would be built.

Storms reported that the DCS secondary heave compensation system would undergo a complete reevaluation (see handout). Software and hardware would be reviewed. Feed cylinders would be repaired and modified. A full-scale test of the secondary heave compensation system was proposed, with heave induced with a suspension test cylinder. Redundancy of the secondary heave compensation was felt to be important. One approach was the present accelerometer system. A new concept was to use load variation of the drilling string itself. Tensile load fluctuates with heave. The concept was to monitor tension to determine the heave that was to be compensated. This would be an easier system to test on land than the accelerometer system. A third option was an entirely passive secondary heave compensation system (like the primary heave compensator). ODP-TAMU was not yet sure, however, that a passive system was possible. On the next DCS engineering test, ODP-TAMU would like to sail with more than one method of secondary heave compensation. In response to a question from Austin, Storms said that the time needed was ~18 months.

It must be kept in mind that many systems were included under DCS that had relevance to other operations, e.g., HRB, DI/BHA and bit development, DCB and modifications to top drive and mud pump control systems. Much progress had been made with the capabilities required for ridge crest drilling (see handout). A secondary heave compensation system was the last major requirement.

Leg 148 was felt by ODP-TAMU to be too early for redeployment of DCS. More time was needed to generate a second or third type of secondary heave compensation system and to allow development and testing of improved cutting structures for DI-BHA bits. The earliest appropriate leg for DCS testing was Leg 153 or later, possibly on the Mid-Atlantic Ridge in the MARK or TAG areas, ~18 months away.

*Discussion*

Pyle asked whether DCS III would be ready in 1995. Storms replied that ODP-TAMU felt that DCS III should be delayed until DCS II was operational. Pyle noted that that would push DCS III to around the next renewal time (e.g., if France renewed for 3 years at the upcoming renewal). Tucholke asked whether the secondary heave compensation system had been modelled. Storms thought that it might not have been correctly modelled. ODP-TAMU was considering new companies who might do a better job. Beiersdorf asked whether the 18-month delay before the next sea test assumed a stable budget. Storms replied that the cost of a land test was uncertain. It might not cost more than the slingshot test ($150,000) and should cost less, since no risk to equipment was involved with a heave test (in contrast to the slingshot test). Austin informed PCOM that, at the 6 April DCS meeting, testing on a platform other than *JOIDES Resolution* was again discussed. TEDCOM mambers felt that DCS testing must use *JOIDES Resolution.* He added that the land test was primarily a simulation for software. Storms, however, pointed out that the load fluctuation concept, if adopted, would be more conducive to land testing. Langseth questioned TEDCOM's attitude that *JOIDES Resolution* was essential for DCS testing. Austin replied that TEDCOM had endorsed elements of testing ashore, but was not sure whether it would be viable or cost effective. Langseth asked whether there were components of DCS which could be tested on another vessel. Austin replied that TEDCOM thought not. Storms added that drill bits and DI-BHA could be tested on a different vessel, but not the secondary heave compensator. Langseth felt that even testing subsystems on other platforms would help. Francis, however, noted that bids for additional platforms had been expensive. Langseth asked whether enough money was being devoted to DCS. Austin agreed that that was an issue that PCOM should address. In reply to a question from Duncan, Storms said that the drilling system worked and that there was no need to replace the top drive with a bottom drive.

Austin suggested dealing first with the fate of Leg 148. PCOM must decide on a program for Leg 148 if it was not to be an engineering leg. Hole 504B had been scheduled as a back-up at the Annual Meeting, but there had been some differences of opinion since then. Austin first asked whether any PCOM members felt that Leg 148 should still be an engineering leg. All supported a scientific (non-engineering) Leg 148. Austin then asked whether PCOM favored Hole 504B as Leg 148. Its advantages were that it was ready for drilling, no site survey was needed and it was potentially exciting science.

Lancelot felt that, if the decision to make Hole 504B the back-up was to be reconsidered, it must be on the basis of new information. Austin replied that there was none, just dissenting opinion. Cita-Sironi stated that the decision to assign Hole 504B as Leg 148 back-up had been made on the basis of information available at that time. Meanwhile, new rankings had been produced and OD-WG had also met again. She suggested two options: 1) the new Barbados proposal (414), which was an advanced experiment ranked very highly by SGPP, or 2) the revised Vema proposal, which was more advanced than HD. Kidd noted that it depended on the objectives at Vema. The new proposal was a major change. Langseth informed PCOM that he had been given strong comments by N. Christie-Blick (SGPP), who felt that the Hole 504B decision had been hasty and that the panels should be called in. Furthermore, Barbados was ready. Christie-Blick had asked whether Hole 504B science outweighed the opportunity of a new leg. In addition, would existing technology allow deepening of Hole 504B?

Malpas noted that LITHP had ranked Hole 504B top in its global ranking, ahead of Vema. Austin added that ODP-TAMU engineers believed that Hole 504B could be advanced, perhaps by 1-2 km. Tucholke recalled that, at the Annual Meeting, Storms had said that ODP-TAMU would like to return to Hole 504B as a stepping stone to deep holes on continental margins.

Francis raised the issue of operational problems. Vema was too far south to allow adequate days on site and Barbados needed much instrumentation. ODP-TAMU could not be ready for Barbados in 6 months. Austin added that a Barbados 3-D survey was scheduled for June 1992 and the data would not be ready for another year. The Barbados proponents would like those data. In reply to a question from Fox, Francis said that 15 m/day average penetration could be achieved at Hole 504B, or about 450 m in a leg. Austin stated that H. Dick , Leg 140 (504B) co-chief, thought that, based on geochemistry, Hole 504B had already reached the Layer 2/3 transition. Becker added that there was also some evidence of a geophysical transition. Duncan said that he had felt that the decision in favor of Hole 504B at the Annual Meeting had been hasty, but that there now seemed to be a basis for choosing Hole 504B. Austin noted that none of the panels had come up with eloquent opposition, though they had had the opportunity. PCOM passed the following motion.

PCOM Motion

**In view of the results of Leg 142 and to allow for their proper evaluation, PCOM confirms: 1) a postponement of further engineering test legs of DCS on *JOIDES Resolution*, and 2) that Leg 148 will be a return to Hole 504B in order to deepen that hole and carry out attendant logging operations.**

Motion Malpas, second Duncan — Vote: for 15; against 0; abstain 1; absent 1

Austin pointed out that this motion meant that Francis' draft ship schedule would come into effect. PCOM still needed to consider the status and future of DCS. ODP-TAMU engineers wanted to delay the next DCS test until Leg 153 at the earliest. Legs 150 - 152 could not be changed because of weather windows.

Fox asked about cost. Austin replied that ODP-TAMU had estimated the cost of a Leg 148 DCS IIB test as ~$1M. BCOM had been able to make that available. Francis stated that it was too early to be specific about cost. The most important task was to perform an evaluation of the secondary heave compensation system. That would be done by an outside consultant and would take several months. Austin commented that BCOM might have to revisit the issue. $1M had been allocated for FY93. Beiersdorf asked what Leg 154 would be if Leg 153 was a DCS test. Austin replied that many programs were available. Beiersdorf suggested postponing the DCS test to later than Leg 153. That would release some pressure on the budget. Austin agreed, but cautioned against too great a delay, which might result in a loss of community support. Taylor proposed dissociating the decision about timing of the next DCS test from an expression of support for DCS development. The question of timing could be left to the 1992 Annual Meeting. Austin agreed, but said that he would prefer to insert a place-holder in the FY94 schedule (legs 153-158). Taylor suggested allowing DCS to compete with other science. Austin, however, responded that to leave DCS to compete with other science would be to make a statement indicating lack of PCOM support for DCS.

Langseth expressed concern about trying to incorporate a major engineering development (DCS) within an operational program (ODP). He asked whether DCS development should be separated from the operational science and given a separate budget. He felt that DCS was underfunded, lacked sufficient personnel, and had been under-assessed from a management (PCOM) point of view. Austin observed that industry was moving toward slimhole coring for some environments and ODP needed to drill those environments. There seemed to be no way to separate operational and development costs. Lancelot agreed with Langseth. He asked whether, in addition, engineering developments impacted the four-year schedule, which PCOM would be discussing at this meeting. Lancelot did not feel that PCOM had enough information to say yes or no about DCS. A test of DCS's ability to drill in hostile environments had not been made. It was, therefore, too early to consider dropping DCS. Austin felt that, if PCOM did not continue to endorse DCS development, DCS would disappear. Taylor said that the scientific basis for DCS was good, but a development plan was needed. PCOM needed to know what would be done differently in future and on what schedule. Austin asked whether ODP-TAMU could provide that by the August PCOM. Francis answered that it could. Consultant evaluation was involved. He could not provide PCOM with enough information for the present meeting. Lewis stressed that cost estimates would also be needed. Austin agreed. Beiersdorf pointed out that the issue also involved the slimhole logging program.

Austin stated that PCOM needed to provide a philosophical endorsement. Langseth added that PCOM needed to say that it could not decide whether or not to proceed with DCS without sufficient information. Lancelot suggested that ODP-TAMU be asked to exert every effort to devise a plan and review the failure on Leg 142 before the August PCOM meeting. In response to a question from Kidd, Austin said that PCOM was not yet in a position to put a DCS place-holder in the FY94 schedule. A draft motion was presented by Taylor for discussion. Austin commented that PCOM needed a detailed development plan plus cost estimates by August. Lancelot suggested stating, in order to add urgency, that PCOM would decide on whether or not to proceed with DCS in August. Francis said that evaluation of Leg 142 should be included in the motion. Austin stated that ODP-TAMU should include shore and at-sea elements, though that need not be included in the motion. Kidd suggested keeping the motion short because PCOM was not sure whether the problems encountered on Leg 142 were big or small. PCOM should not send a message to funding agencies that the problems were major if they were not. Lancelot again advocated a preamble stating that the purpose of ODP-TAMU's work was to enable PCOM to make a decision on the future of DCS in August. Austin noted that shallow-water carbonates should be included as a lithology for which DCS was required. Lewis felt that DCS would improve coring in all environments. Francis, however, noted that DCS would not replace other techniques. He added that ODP-TAMU was planning evaluation by outside consultants and a cost of ~$50,000 was envisaged. Normally, ODP-TAMU would have to approach the international partners to enable international consultants to bid. Since time was short, however, Francis requested permission to use a local consultant. Austin replied that results were needed by August no matter how they were achieved. Francis said that ODP-TAMU would send out an RFP to the international partners, but he wished to alert them that it was probable that the deadline for responses would be past by the time the RFP arrived. There were no objections from the international members of PCOM. Malpas stressed that ODP-TAMU must provide to PCOM in August a plan to bring DCS to operational status. PCOM passed the following motion.

<u>PCOM Motion</u>

**PCOM, recognizing the need to develop a high-recovery system for coring difficult formations, requests ODP-TAMU to prepare for the August 1992 PCOM meeting a detailed plan to bring the diamond coring system (DCS) to operational status. This plan should include an analysis of previous work as well as an estimate of future costs. PCOM will use this information to decide the future of DCS development in ODP.**

Motion Taylor, second Lancelot — Vote: for 16; against 0; abstain 0; absent 1

## NON-DCS ENGINEERING DEVELOPMENTS

Austin recalled that PCOM had prioritized engineering developments at its April 1991 meeting. The objective had been to enable ODP-TAMU to cut items from the bottom of the list when funds or personnel were not available. PCOM would revise its prioritization following a review of non-DCS developments by Storms.

Storms reminded PCOM of its April 1991 prioritized list: 1) DCS, 2) XCB, 3) Leg 139 preparations (CORK, PCS, high temperatures - $H_2S$), 4) Leg 141 core orientation needs (HRO/SCM/electronic multishot), 5) VPC, and 6) MDCB (for GEOPROPS). Storms summarized the status of these developments (also see handout).

The XCB flow control concept had been designed, computer modelled and tested on Leg 141. Recovery decreased, rather than increasing, relative to basic XCB. Testing was abandoned due to severe erosion of the BHA wall. Second generation design had begun to allow for variable flow rate control to cutting shoes and protection from destructive erosion effects on BHA hardware. The next possible sea trial was Leg 146 (CA). Lancelot asked whether recovery of alternating hard/soft lithologies was being evaluated. Storms replied that ODP-TAMU had focused on general lithologies, because XCB was the most commonly used coring system. The cutting shoe jets tended to become plugged on the existing XCB. In reply to a question from Austin, Storms said that the ODP-TAMU engineers responsible for XCB work were Huey and Reinhardt.

The CORK system worked well on Leg 139 and two additional CORK assemblies were being prepared for Leg 146 (CA). Some modifications were being made, associated with HRB compatibility and flexibility of the system with different casing hanger designs. Malfait asked whether interested scientists were being informed of the design changes. Storms replied that they were, but that such changes would not affect them.

PCS was deployed 12 times on Leg 141. No solid hydrates were encountered. PCS Phase I (PCS I) was operational with some minor design problems remaining. PCS was complex and the operators were on a learning curve. Out of 22 runs, 6 had been fully successful (see handout). The track record would not reach 100%, but should improve. Francis informed PCOM that ODP-TAMU engineers Huey and Pettigrew had produced a good report on PCS (report was available at the meeting). The report stated that a gap existed between ODP-TAMU's responsibilities concerning PCS and the wishes of the scientific community. Extraction of fluids had not been properly addressed. Beiersdorf asked who wanted to use PCS and would take care of it. Francis replied that SGPP was the most interested panel and there were many other individual scientists interested in the capability.

Hard rock orientation (HRO) involved three elements (see handout): SCM (which logged core as it entered the core barrel), scribers and magnetic electronic multishot. SCM was deployed on Leg 141 in XCB mode, though it was now compatible with RCB and XCB. There had been some minor software problems, but SCM was basically operational. Results from Leg 141 were included in the handout. The ultimate goal was to get SCM measurements in real time so that the driller was aware of recovery as it was happening. In response to a question from Fox, Storms agreed that SMP wanted SCM for core-log integration. Electronic multishot was also working well.

APC core barrel parts modified for VPC use on Leg 133 had been cleaned and refurbished. VPC was on hold, partly because T. Pettigrew had been working on CORKs and also while awaiting evaluation of Novatec modifications. The latter had been completed (see handout) and the changes would be incorporated in ODP-TAMU's VPC. A laboratory test would be carried out in May and two VPC tools were scheduled for deployment on Leg 146 (CA). Francis added that Leg 146 would be the last opportunity to test VPC before Leg 150 (NJ/MAT). Austin asked whether Leg 146 Co-Chiefs recognized the need for a test. Francis acknowledged that it might be useful for PCOM to insist on a VPC test on Leg 146. Storms noted that VPC had to be tested in an unconsolidated section. There was no point in testing it in other sections. In reply to a question from Lancelot, Storms said that if an appropriate formation was not encountered on Leg 146, a test there would be up to the Co-Chiefs. They should not be forced to test VPC in an inappropriate formation. Kidd agreed that Leg 150 would need VPC, but added that unconsolidated sediments would also be encountered on Leg 149 (NARM non-volcanic I). Francis responded that, if VPC was tested on Leg 149, there would be no time for modifications in time for Leg 150. Austin commented that it was sometimes necessary to test a tool on a leg that needed it.

Storms reported that MDCB was considered operational. Minor design improvements were to continue during 1992.

At the 1991 Annual Meeting, PCOM had asked about the capability to drill beep NARM non-volcanic sites. ODP-TAMU had prepared a draft report on current ODP deep drilling capabilities, which was ready for review with TEDCOM in May. Both IAP-1 and NB-4A were considered drillable with existing technology. Penetration of 2500-3000 m could be achieved within one to two legs (60-80 on-site days), depending on the number and depth of casing strings required and weather (see handout).

Storms concluded his review with consideration of a possible future engineering development project: deep water and/or deep-penetration drilling operations. A number of hardware and equipment items would require upgrades or modifications to achieve deep drilling goals (see handout). Upcoming NARM legs meant that all needed to be looked at and should be included in PCOM's prioritization. A draft RFP for potential future ultra-deep drilling had been prepared and was ready for review with TEDCOM in May. The drilling parameter monitoring system (TOTCO, TOTCO alternative, DCS) was being furthered on a time-available basis. It was important for core-log integration. Langseth felt that the drilling parameter monitoring system should be higher on the list.

### ENGINEERING PRIORITIZATION

Austin felt that PCOM might not wish to include DCS in the prioritization list, as it was the focus of a separate motion. Taylor, however, noted that DCS would automatically be top of the list because ODP-TAMU must respond to PCOM about its development by August. Austin recalled that the April 1991 prioritization had listed DCS, XCB, followed by leg-related developments. PCS was needed for Leg 150. After Leg 146, CORKs would not be needed until FY94. HRO was required for legs 149/152 and 147/148. VPC was needed for Leg 150 and a test on Leg 146 was possible. MDCB was needed for Leg 146, after which it would not be required until FY94 at the earliest. Storms, however, pointed out that MDCB could be used for getting a few basement cores without tripping XCB and might, therefore, be useful for, e.g., Leg 145. Austin added that PCOM must also consider deep drilling and the drilling parameter monitoring system.

Francis commented that it would be helpful to have some idea of costs and level of commitment. Austin responded that PCOM had heard in April 1991 that ~50% of ODP-TAMU engineering time was required for DCS. Francis added that availability of personnel was the limiting factor, rather than money, except with DCS.

In reply to a question from Langseth, Storms said that MDCB no longer required an engineer now that it was operational. Langseth expressed interest in seeing MDCB used more to assess its capabilities. Storms agreed, highlighting the need to deploy it in different environments. Langseth, therefore, suggested taking MDCB off the prioritization list, but encouraging its use. Lancelot suggested testing MDCB in hard carbonates. Storms, however, explained that formations in which MDCB was used had to be drillable with XCB.

Berger asked whether ODP-TAMU engineers were satisfied that soft, gas-rich sediments could be recovered. Storms replied that that was done using standard APC. Austin, citing Leg 138, noted that even triple APC coring left gaps. Berger suggested that coring of soft, gas-rich sediment be added to the list. Taylor, however, pointed out that that was done well already compared to other things. Beiersdorf felt that the list should be revised, since some objectives had been partially achieved. Malpas thought that SCM should not be considered leg-specific, because it was related to core-log integration.

Francis explained that ODP-TAMU wanted clarification about where its responsibilities with regard to PCS ended. PCS I was finished, but the interface with laboratory equipment needed work. Austin thought that M. Kastner and G. Brass were working on that. He asked whether any feedback had been received from them. Francis pointed out that they were not working on PCS I. Austin stated that, in his opinion, ODP-TAMU should include extra steps, i.e., measurments on the PCS core recovered. Storms countered that that had not been the original plan. Extra development had been a third-party matter. ODP-TAMU had no plans to make changes to PCS I. Tucholke suggested getting the message to SGPP to move on this issue. Francis responded that the Huey/Pettigrew memo did that. Lyle remarked that SGPP felt that PCS needed to be run to gain experience. Austin added that SGPP had also recommended a third PCS device. PCS was in a separate category: it was not a development tool, but its use was to be encouraged. Becker asked for clarification of remarks on Agenda Book blue pages 18-19, which indicated that some items had been taken over by engineering. Francis answered that that was incorrect. Kidd felt that it would be insufficient to simply encourage use of PCS. PCS had been around for a long time. Kidd felt that PCS sampling should be ODP-TAMU's responsibility. Pyle, however, asked why ODP-TAMU should develop the system if nobody outside was prepared to take it up. Austin agreed.

Storms stated that some items on the list had advanced during the last year and required a lower-level effort. In general, the list should be kept as short as possible. Any extra time gained should go to DCS and deep drilling. In response to a question from Taylor, Storms said that XCB work had not been completed and XCB was, therefore, still a list item. There was a constant effort to refine APC, XCB and RCB. Taylor suggested that, in that event, XCB should not be on the list. Ongoing development was always needed. Austin cautioned that, if PCOM did not mention XCB, it implied PCOM did not consider it important.

Lyle recalled that a manifold for use with PCS had been on Leg 142. It had not been the best system, but it could be used. There was, however, no way to handle solids. Francis stated that extracting solids under pressure would require PCS II. There was also a feeling that, even if PCS I held pressure, the capability to extract gases and fluids was insufficient. Lyle reiterated that that could already be done. Francis felt that the problem was related to contamination. The existing manifold could not be flushed. Storms added that the manifold had been built onboard *JOIDES Resolution*. Francis said that much money had been spent on PCS and yet the extraction system was inadequate. Austin felt that, if the system was to work, it must be developed in-house. Becker noted that M. Kastner would be on Leg 146, but Francis stressed that her work involved PCS II and extraction of cores.

Francis argued against placing deep drilling too high on the list. It was theoretical and not planned for any leg, whereas VPC was needed for Leg 150. Austin countered that deep drilling would be needed for Leg 149. Francis, however, said that it was his impression that Leg 149 could be drilled with existing technology. Storms stated that he would rather develop tools based on perceived future needs, rather than for specific legs. Francis reiterated that Leg 149 sites, even the ambitious ones which were not yet scheduled, could be drilled with existing technology and questioned the need to place deep drilling high on the list. Becker replied that thematic panels had highlighted the importance of deep drilling. Austin added that it would send a signal that PCOM considered deep drilling important. Tucholke recalled that, at the 1991 Annual Meeting, ODP-TAMU had claimed not to be ready for deep drilling and now seemed to be reversing its position. He supported including deep drilling on the list. Francis reminded PCOM that it had said, in April 1991, that development should respond to scheduled legs. Austin said that short-term goals were still needed. Langseth stated that it was the specific engineering tasks associated with deep drilling which should be on the list. Austin responded that deep drilling was a scientific objective and it was up to ODP-TAMU to tell PCOM what was needed. Storms agreed that it was best not to put every item on the list.

Francis highlighted the importance of a drilling parameter monitoring system (e.g., TOTCO) and advocated placing it on the list. Storms explained that the TOTCO system was not working for two parameters (total depth and rate of penetration). This was critical because those parameters were harder to estimate without a riser. Francis said TOTCO seemed not to work for a number of parameters. Lancelot added that, in addition, the data were not available to the Scientific Party in real time. Malpas suggested adding to the list engineering priorities for core-log integration. That would include core orientation and TOTCO.

Austin asked whether there were any leg-specific goals, e.g., extra PCS I units, or a move to PCS II. Lancelot suggested testing of MDCB on Leg 144 in hard carbonates. Storms responded that Leg 144 drilling would primarily involve RCB and, therefore, MDCB could not be used. Lancelot suggested testing MDCB in B and C holes and making the Co-Chiefs aware that it could be tested. Storms felt that it might be worthwhile to make the statement on XCB more generic, i.e., to include further development of RCB and APC. Austin asked whether a generic statement would be sufficiently helpful to ODP-TAMU. Storms said that the rotary drilling system would be used a lot in the future for Hole 504B and deep NARM sites and should perhaps be included. Austin agreed, but felt that it should be included as a separate item on the list. Beiersdorf suggested inclusion of a study of stretching of APC cores, as highlighted by OHP. Francis felt that that would be fine tuning of APC and perhaps less important than the coarser problems with other technologies. Austin agreed that it was probably not necessary to focus on APC. Taylor asserted that APC, XCB and RCB were not of the same order of importance as DCS, HRO, etc. Austin, therefore, agreed to group the former "bread and butter" drilling systems under a single item. Kidd noted that PCOM was assuming that MDCB was operational. Austin responded that more information about MDCB would be available after the major test on Leg 146. PCOM could not say more now.

Austin noted that uncertainty remained about what was meant by PCS, i.e., PCS I or PCS II, and what ODP-TAMU's responsibilities were. He did not envisage a third party coming forward. He proposed that PCOM tell ODP-TAMU to make PCS part of a long-term effort.

Watkins asked how much effort would be involved. Francis replied that PCS II was a major system. ODP-TAMU was only talking about PCS I.

Austin stated that the minutes would reflect that PCOM discussed PCS II, but that ODP-TAMU was working on PCS I. PCOM's motion should include a statement to the effect that MDCB was operational. Francis noted that CORKs could not simply be considered operational, because a new CORK had to be built for every deployment. Taylor observed that PCS was also operational. Austin agreed, but noted that SGPP had wanted a third PCS. That was not an engineering development, but it required effort. Blum stated that SGPP suggested two complete PCSs for Leg 146 (CA). Only one PCS had been available on Leg 141. Cita-Sironi agreed. Austin agreed that PCS could be placed in the same category as MDCB, i.e., that PCOM wanted to see them both used. Arculus referred to the SGPP minutes (Agenda Book, white page 183). He read that SGPP had requested "a second, if not even a third," PCS for Leg 146. Austin reiterated that PCS and MDCB should be left use-related. Becker asked, as a third-party involved with CORK, whether the implication was that CORK was now a development tool and not a third-party tool. Austin replied that CORK could remain a third-party tool. PCOM passed the following motion.

PCOM Motion

**Based upon advice by ODP-TAMU engineers, PCOM considers the following tools now operational: CORK, PCS I and MDCB. Their use should be encouraged by the Science Operator and the appropriate panels, with care that appropriate financial planning is in place.**

**PCOM now prioritizes engineering developments as follows:**

**1) System developments:**

**a) DCS evaluation and improvements.**

**b) Engineering developments for core-log integration, including TOTCO, core orientation and sonic core monitoring.**

**c) Deep drilling system/capability.**

**d) Improvements in existing coring techniques, i.e., APC, XCB and RCB.**

**2) Leg-specific developments:**

**a) Vibra-percussive corer in preparation for legs 146 and 150.**

Motion Beiersdorf, second Langseth — Vote: for 15; against 0; abstain 0; absent 2

## PRIORITIES FOR DOWNHOLE MEASUREMENTS

Lyle reported that the FMS tools had received extensive maintenance after Leg 140 and the caliper problems, which led to junk in Hole 504B on Leg 140, had been rectified. Shipboard FMS processing continued to be a success, but there were logistical difficulties involving shared ODP-LDGO/ODP-TAMU technicians. Turnover of shipboard personnel was too rapid. A permanent solution had not yet been achieved. Francis commented that the problem had been a result of making some of the technicians into extra computer systems people.

Lyle informed PCOM that the Japanese magnetometer had been successfully deployed at Site 865 on Leg 143 on its first ODP trial. No news on data quality had yet been received.

The high-temperature (350°C) logging cable test (Gable) was not tested in a 300°C geothermal well in the Mojave Desert in February, as originally planned, because of logistical problems. That well has since been reopened, but a logging tool was lost in the well by the geothermal company (wireline broke because of fluid-induced corrosion). The casing may also have collapsed. The current plan was to test the high-temperature cable in the summer in coordination with Peter Lysne (DOE).

The high-temperature resistivity tool was being developed by Camborne School of Mines, UK. A field test of electrode array configuration in February was successful. Electronic and thermal systems design was complete and prototypes were being constructed. The tool was on schedule for autumn delivery.

The shear source tool (D. Goldberg, ODP-LDGO) prototype was in the final stages of assembly. An on-land field test was planned for May.

Lyle went on to address logging data distribution. Based upon results of a survey and IHP recommendation, ODP-LDGO planned to discontinue the only remaining microfiche inserts (FMS data), contained in envelopes in the backs of Initial Reports, in May 1992 (after Leg 140 volume) and rechannel related funds to production of CD-ROMs with all logging data for each leg. CD-ROMs would either accompany the leg volume or be sent separately to the same mailing list. In response to a question from Berger, Lyle said that there were no plans to produce CD-ROMs retroactively with present funds. Replying to a question from Pyle, Lyle said that standard logging illustrations would still be included in Initial Reports, so that access to a CD-ROM reader would not be essential. Berger stated that many people were interested in Leg 138 logging results, but noted that they would not be available on CD-ROM. Lyle responded that N. Pisias (Leg 138 co-chief) was independently making a CD-ROM of all Leg 138 shipboard and logging data except FMS.

ODP-LDGO wanted to test ways of getting logging data to the scientific community. ODP-LDGO planned to place a subset of the logging data on-line in FY92 to test electronic data distribution concepts (e.g., ease of access, ways to record data receipts, ease of educating scientists in on-line use).

*ODP DataNet*

ODP-LDGO had decided to be proactive and propose a DataNet system (see white paper on ODP DataNet Services, Agenda Book, white pages 367-389). It was planned that DataNet would be active at least by the end of the next four-year Program Plan. All components were already in existence. NASA was already operating such a system. DataNet would formalize many informal links that already existed within ODP.

DataNet was proposed for a number of reasons. Only minimal processing was currently possible, e.g., FMS images were produced, but were not being analyzed, sonic waveforms were not processed, geochemical logs received minimal interpretation, temperature data were not systematically examined and integration of core and log physical properties was at a rudimentary stage. In addition, a new generation of logging tools was appearing, e.g., MAXIS for use with very high data flow/imaging tools. ODP-LDGO could not afford to upgrade within the existing budget. Also, the ODP data stream had increased dramatically, but the data distribution scheme was not being changed. That was true for both logging and laboratory data. Finally, the existence of "orphan facilities", e.g., permeability/fluid flow and specialty logging tool development, mandated changes.

(Shipboard and land-based DataNet components are listed in Appendix 10, which also lists institutions that have expressed interest in providing each component.) The shipboard computing environment needed to be updated to allow real-time access to data. Shipboard logging needed MAXIS for use with the next generation of imaging tools. Other downhole measurements should be performed, e.g., hydrogeological experiments and downhole seismics. Fast ship-to-shore communications were needed. At present, shipboard data took about one month to get back to ODP-LDGO and data were often missing and had to be rewritten onboard *JOIDES Resolution*. A real-time connection was required. Processing rate could only be increased by adding processors at sea, and thereby displacing scientists, or by passing data faster to processors onshore. This would also allow real-time trouble shooting and the possibility of shore-based leg participants.

On-land (Appendix 10), ODP-LDGO would remain the hub for data, including raw logging data archive and distribution, quality control, processed data archive and on-line access to all ODP digital data. Distributed processing nodes would be located in UK, France (which was willing to commit funds external to ODP), Germany and Canada/US (for core-log integration).

*Discussion*

Austin explained that DataNet had been proposed to EXCOM in January 1992. It would cost ~$5M more than the existing logging budget (~$9M versus ~$4M). EXCOM decided to have the concept reviewed by the panels, who had endorsed the concept without considering cost. PCOM could do the same, bearing in mind that some subcontractors might change. Lancelot noted that Lyle had presented a mixture of the original ODP-LDGO DataNet proposal and subsequent actions. PCOM could not go into details regarding subcontractors, but could endorse the concept as an improvement to the system.

Austin said that EXCOM had wanted to examine community feeling about data flow to see whether EXCOM needed to come up with extra money. Fox characterized the DataNet concept as "a vision" that outlined a real need. SMP had flagged it as important. Fox did not feel that ODP-LDGO's plan was yet mature, adding that that would require input from others outside ODP-LDGO. It provided a catalyst to get people thinking, however. Lyle agreed that it was a vision. It did not all have to go into place at once. Duncan felt that it was an exciting idea. ODP would have to move in that direction. It had huge implications for how the shipboard Scientific Party was defined. He asked how the Shipboard Party could be guaranteed priority with the data. Austin replied that ODP-LDGO had felt, in January, that protection could be provided.

Austin stated that he would like to be able to tell EXCOM that PCOM had considered the DataNet concept, the specifics of which might change, and thought it useful. Berger asked whether there was any sense of who would use the data and whether it would be used. Lyle responded that DataNet would allow others to process log data, e.g., to use the sonic waveform. Berger asked whether there was any projection of the importance of particular data and their usage. Austin explained that FMS had started this move. The concept resulted both from the problem of limited personnel at ODP-LDGO and increasing post-cruise success. Taylor said that it was not currently possible to get real-time analysis of FMS and geochemical tool data even with the right people present. Arculus suggested that ODP-LDGO promote ease of access by remote users. Lyle replied that ODP-LDGO wanted that, because data distribution was a large part of ODP-LDGO's workload. Francis commented that that involved land-to-land access. He was more concerned about data transfer from ship to shore and back to the ship again. That would be expensive. People would have to be found onshore to do the work. Lewis said that a technology revolution was underway. It would be necessary to address both how to take advantage of that and how to acquaint the community with procedures for data access. Francis expressed concern about costs of data transmission. Beiersdorf asked whether any non-US institutions involved would be paid from ODP funds, or be expected to get money from other sources. Lyle replied that some commingled funds and some extra, outside funds would be involved. Austin added that more money would unavoidably be required. In response to a question from Lewis, Francis said that telephone time to the ship cost $10/minute. Lewis noted that there were alternative satellite systems and that, with heavy use, rates might fall. Beiersdorf said that he would feel more comfortable if all of the money came from a single source. Langseth felt that it might be useful for ODP-LDGO to put together a proposal focusing on the pilot program that Lyle had mentioned. Arculus commented that geochemistry data was little used at present and that was worrying. That was where the pilot program should focus.

Lancelot stressed that PCOM should stick to consideration of the concept, because the funding aspect was wide open at present. It was premature to discuss details, even those of the pilot program. Austin agreed. He asked whether there was any dissent from the idea that PCOM would like to improve on the *status quo*. Kidd felt that PCOM would have to make it clear that additional costs would be involved. Lyle stated that DataNet would cost <$9M. Austin said that the cost would depend on how much was absorbed by new operators. Lancelot agreed, adding that it might cost ODP no more than at present. Kidd raised the issue of access to shipboard data and rights of the Scientific Party. Austin responded that policies would not be changed. Watkins was reluctant to support the concept. He said it showed promise, but needed more work. Gibson said that the DataNet database (GeoBase) was more of a geographical browser system. SMP had got it right. Gibson quoted from the SMP minutes (Agenda Book, white page 345): "The database specifically proposed (GeoBase) is not truly a database, but a database browser specific for geographic information. The 'proposal' does not address the real requirement of a functional relational database which is an essential requirement for both shipboard and shore-based science. The panel encourages submission of a more detailed proposal for review." Lyle responded that the first-order problem was to get a subset of the data out, then get the database organized. Taylor noted that DMP had recommended that it was important to allocate appropriate personnel to data distribution and that computer access to a central archive of log data should be explored with a view to its potential adoption (Agenda Book, white page 114). Austin stated that all panels had supported the DataNet concept. Lancelot added that the ODP was now producing numerical data in large quantities. Because of that, ODP had to face the need to change its approach. It could not continue with the *status quo*.

Austin asked whether ODP-LDGO needed help from PCOM with prioritization of logging tool development. Lyle replied that ODP-LDGO felt that a magnetic susceptibility tool was a high priority. It might be good to hear a statement from PCOM on that. Austin said that PCOM input at this stage seemed unnecessary and that, in any case, PCOM would have to return to the issue of slimhole logging when it discussed DCS in August. He suggested delaying further consideration of logging prioritization until August. Taylor asked whether ODP-LDGO needed guidance on nothing but slimhole logging, i.e., that the only tools ODP-LDGO was looking to acquire were high-temperature and/or slimhole tools which were guided by DCS considerations. Lyle replied that there were others that were third-party tools, e.g., high-temperature resistivity tool, and high-resolution susceptibility, which ODP-LDGO would like to follow up, though PCOM could tell ODP-LDGO not to do so. Fluid sampling tools would have to be deferred for now. PCOM passed the following motion.

PCOM Motion

**PCOM supports the DataNet concept as outlined in the White Paper prepared by ODP-LDGO, Wireline Logging Services Operator, to improve real-time core-log integration and data reduction, interpretation, archiving and dissemination.**

Motion Malpas, second Cita-Sironi Vote: for 11; against 1; abstain 4; absent 1

**DH-WG**

Austin stated that, before discussing prioritization of non-engineering equipment needs, which Panel Chairs had been asked to provide, he was calling upon Gibson to report on DH-WG and its recommendations. Those recommendations were relevant to non-engineering equipment needs.

Gibson reported that DH-WG had been charged to evaluate computing in ODP and make recommendations. DH-WG included representatives from selected JOIDES institutions and international partners, SMP, IHP and DMP.

DH-WG believed that changes in the shipboard computer system were required immediately for the following reasons. 1) The work of shipboard scientists was being seriously hampered by the shipboard computing environment. 2) Integration of logging results with core data was also essentially impossible within the confines of the present shipboard computing environment. 3) Ship-to-shore data communications were poor, making real-time shore-based interaction with ongoing drilling difficult (being addressed by ODP-TAMU). 4) Presently installed VMS-based S1032 database system was totally inadequate and unfriendly. It could not handle large datasets (e.g., GRAPE). As a result, ODP was unable to archive shipboard data rationally for post-cruise and subsequent study. 5) Access to ODP data needed to be improved (e.g., as suggested by ODP-LDGO).

DH-WG proposed the following changes. 1) A large, UNIX-based online database in a client-server configuration. A UNIX computer should be dedicated to the database function. 2) A network of client PC-386 and MAC data-acquisition modules feeding data into the online database. 3) Powerful IBM-PC, MAC and UNIX workstations for data retrieval and interpretation. Many of the computers required for recommendations 2 and 3, except for UNIX workstations, were already onboard *JOIDES Resolution*. 4) A parallel shore-based system, accessible over Internet, to house the ODP multi-leg database, and linked to the ship by improved satellite communications for update, perhaps to be done weekly.

DH-WG also considered how the proposed changes should be made. 1) Development of new hardware and software configuration must proceed in parallel with ongoing shipboard activity, which must not be disrupted. 2) Changes should be viewed as an "add-on" package of hardware and software that can be developed onshore and then added to the shipboard environment. 3) Installation could be accomplished at a North American port call. 4) Each laboratory could then be moved to the new environment during the following leg(s). 5) Benefits of the new system would only be realized when the majority of data were stored in the new environment. As a result, changes should be made soon and duration of any transition phase should be minimized.

The proposed changes would bring the following benefits: 1) core-log integration during legs; 2) core-core correlation in real-time (as on Leg 138), and hence an ability to dictate drilling on the basis of an evaluation of core recovered; 3) greatly improved onboard access to shipboard data, and hence better interpretation of data and improved shipboard science.

(A diagram illustrating differences between the existing and proposed shipboard computing systems is shown in Appendix 11.)

Gibson explained that DH-WG had not felt that it had been within its mandate to suggest how to implement its proposed changes, should PCOM accept them. Nevertheless, Gibson presented three possible alternatives for PCOM. 1) Advise ODP-TAMU to adopt the DH-WG report. 2) Advise ODP-TAMU to adopt the DH-WG report and to subcontract work to outside groups. 3) Advise JOI, Inc. to contract work suggested in the DH-WG report to an outside group which would liaise with ODP-TAMU. Alternatives 2 and 3 would best be carried out in cooperation with a steering committee comprising a subset of DH-WG.

Gibson felt that PCOM might prefer alternatives 2 and 3, because the Dorman subcommittee of EXCOM had already asked for interest in bidding on computing. Such bidders could be asked to bid in the new system. Furthermore, ODP-TAMU had little experience in UNIX systems or in client-server database systems.

*Discussion*

Lancelot commented that the DH-WG meeting had been efficient and short, thanks to Gibson, and its conclusions had been virtually unanimous, with no dissent on fundamental aspects. Malpas stressed the need to act quickly, as the problem was building and impacted both engineering and non-engineering items.

Austin noted that the panels had included elements of the DH-WG recommendations in their non-engineering prioritization, under core-log integration (workstation and software) and capital replacement equipment (computer and software replacement for data handling). PCOM should discuss whether to endorse DH-WG's recommendations in whole or in part and then consider implementation. PCOM should remember that endorsement would have a financial impact on other items in the non-engineering wish list not related to DH-WG. The recommendations would cost an estimated $300,000 - $400,000, mostly for software.

Malpas felt that there was no other direction to take. Kidd noted that the emphasis was on what could be done onboard *JOIDES Resolution*, but the system was unfriendly for shorebased workers too. Lewis stated that PCOM would be endorsing what was in the DH-WG report. In response to a question from Berger, Gibson replied that DH-WG would like to have use of UNIX included in any endorsement, as it was ideally structured for multiple access.

Austin stated that implementation would be linked to endorsement in PCOM's motion. A steering committee was needed to consider details. Malpas asked what ODP-TAMU thought about Gibson's three scenarios. Francis replied that, if the work was given to outside contractors, ODP-TAMU would still have to learn about UNIX. There was a lot to be said, therefore, for having ODP-TAMU involved. ODP-TAMU might decide to use subcontractors in any case. Francis supported Gibson's implementation alternative 2, adding that ODP-TAMU would be glad to work with a steering committee. He felt that the effort required for implementation might have been underestimated. Two systems managers were needed for the existing system, but a third might be needed with the new system.

Malpas asked if outside interest could be explored, as the Dorman subcommittee had done. Austin replied that that could not be done before the June EXCOM meeting. Taylor stated that the University of Hawaii had responded to the Dorman subcommittee request by expressing interest in the computer database. A database demonstration had been given to SMP in Hawaii. The cost estimate was $600,000. Taylor added that there was information before PCOM already. Francis expressed concern about PCOM deciding on a method of implementation when there were people around the table representing institutions putting in competing bids. Austin said that Hawaii's response was just a statement of interest. ODP had subcontractors now and new subcontractors would have little involvement in changes to be made in the next two years. Malpas asked for an updated cost estimate from ODP-TAMU, noting that ODP-TAMU's estimate of $350,000 had been made some time ago, and some comments on feasibility, i.e., in-house expertise versus consultants. Austin said that the money would not exist if there were to be only six international partners, unless DCS was dropped. Lewis agreed with Malpas that ODP-TAMU should provide a cost estimate. In reply to a question from Austin, Francis said that ODP-TAMU could provide such information by the August PCOM. That was one reason that ODP-TAMU had reorganized computing and database departments. SOE money would be required, implying seven international partners (see BCOM report). Malpas asked whether the steering committee could be asked to report by August, having considered the views of ODP-TAMU and also of other interested parties (e.g., Hawaii). Gibson stated that IHP had been very aware of how stressed all ODP-TAMU groups were. They must not be overloaded. Francis, however, thought that if implementation alternative 3 was chosen, the outside group would come straight to ODP-TAMU and overload it.

Austin concluded that the steering committee must work with ODP-TAMU and report back to PCOM in August. Francis felt that the steering committee should focus on technical aspects. Austin said that the steering committee would not communicate with the community to solicit bids. Lancelot, noting that DH-WG had discussed the matter at length, asked which implementation alternative DH-WG would prefer. Gibson replied that DH-WG would prefer an outside perspective on the cost of the change, rather than going straight to ODP-TAMU. Francis felt that the steering committee could provide that. Gibson agreed that it could, provided it was given enough freedom.

Austin nominated Gibson to chair the steering committee. Malpas asked whether the steering committee would report in conjunction with ODP-TAMU. Austin replied that the steering committee could take the lead, so long as ODP-TAMU was in the loop. Pyle assumed that the steering committee would be advising ODP-TAMU. Malpas said that ODP-TAMU had to be involved, but that there were also other interested parties. They should be identified and considered. Francis said that those other interests were expressed in the context of the Dorman subcommittee report and that this matter had nothing to do with the Dorman subcommittee. Malpas agreed, but stressed that the steering committee should be free to explore the possibility of other interests (e.g., perhaps different from those replying to the Dorman subcommittee). Those interests could be subcontracted through ODP-TAMU. Francis had no objection to that. Austin said that PCOM would need to empower Gibson and the steering group to take action before August. Francis and Kidd did not feel that this had anything to do with Dorman subcommittee activities. PCOM would get a report and subcontracting would be decided elsewhere. Arculus asked whether the steering group would have time to do the chasing around involved in implementation or whether it would just advise ODP-TAMU. Francis agreed that that was a good point and expressed the opinion that the donkey work would be done by ODP-

TAMU because volunteers would not do it. Gibson agreed, but said that he would like the freedom to examine outside interests. Lancelot suggested that the steering committee, which had UNIX expertise, could provide intellectual leadership. That would help ODP-TAMU, which lacked that expertise. Malpas questioned, with regard to implementation alternative 2, what type of work would be subcontracted. He noted that alternative 2 implied that ODP-TAMU would be required to enlist subcontractors, not that subcontracting was optional. He felt that alternative 2 needed to be rewritten.

Austin suggested that the steering committee should not contain more than three to four members, all prepared to be substantively involved before August. Gibson could provide him with names which Austin would approve. Francis noted that the steering committee would have to exist for two years to guide the process of change. Austin responded that the steering committee would remain, though its membership might change. In response to a question from Taylor, Gibson said that the steering committee could not simply be drawn from IHP members. Taylor wondered whether, in that case, the membership of IHP should change. Gibson answered that that was under consideration.

Austin said that DH-WG would not be disbanded yet, because the steering committee would continue. PCOM passed the following motion.

PCOM Motion

**PCOM endorses the DH-WG recommendations, as contained in DH-WG's minutes of 5 - 6 March 1992, and requests of I. Gibson a list of possible candidates for a steering committee that will continue to work with ODP-TAMU on this issue. ODP-TAMU and the steering committee should jointly prepare a report for PCOM outlining the likely costs and implementation schedule to achieve the recommendations of DH-WG. This report should be presented at the August 1992 PCOM meeting.**

Motion Lewis, second Kidd Vote: for 16; against 0; abstain 0; absent 1

### NON-ENGINEERING EQUIPMENT NEEDS

Austin questioned whether PCOM would want to consider items other than those at the top in each category of the panels' prioritized non-engineering wish list (Agenda Book, blue page 18). Those categories were: core-log integration, capital replacement equipment and new/improved equipment (Agenda Book, blue page 18). Austin added that he would like to return to the issue in August after PCOM had some information on costs. Berger thought that that would be acceptable as long as the list was not just ignored. Austin noted that, in any case, most panels would not meet again before August. The list would, therefore, still be the same in August and PCOM would have a better idea about costs. Becker agreed, unless any equipment was vital for upcoming legs.

In reply, Francis gave the SMP equipment status report. Under core-log integration: the natural gamma system had been defined and an RFQ would be going out in a month, software and MST upgrade and also resistivity equipment were under review, and the workstation was on hold. Real-time navigation was in progress, as was the reference slide collection for shipboard use. The color scan system was on hold; A. Mix's system would not be on Leg 145, but it was planned to purchase a Minolta color gun. Work on the bar code system for cores was in progress. An off-the-shelf carbonate auto sampler (on hold) would be bought this year, if funds permitted. The seismic workstation was on hold. The auto titration system and LAS data handling were under review.

Austin noted that many of those items were in the panels' wish list. He asked whether PCOM wanted to take further action. Pyle said that requests for purchases tended to dribble in. He had, therefore, asked PCOM to coordinate requests. If PCOM did not act, it would be saying, in effect, that it did not wish to purchase anything. PCOM should be sure that there was nothing on the wish list that was needed for upcoming legs. Austin replied that the perception was that no money was available, but acknowledged that Pyle was right. Taylor stated that everything on the wish list was a priority to have made it that far. Berger suggested purchasing everything that cost <$10,000. Austin stressed that the list was a guide to JOI, Inc. Pyle said that, therefore, PCOM should endorse it. Austin replied that PCOM had already endorsed the top priorities and asked whether PCOM wanted to do more. Kidd supported Berger's plan. Austin suggested that PCOM endorse the wish list, enabling JOI, Inc. to purchase as resources became available. Gibson asked whether PCOM was happy with how the list was arrived at. SMP had responsibility for advising on purchases, then the ball was thrown to all panels, which voted. Austin added that K. Moran (SMP Chair) had worked with S. Humphris (LITHP Chair) on the short list. He was happy with how it was done. PCOM passed the following motion.

<u>PCOM Motion</u>

**PCOM commends the panels for prioritizing their needs regarding non-engineering items and recommends to JOI, Inc. to take appropriate action contingent upon availability of funds. As some of the items require but modest investment it is anticipated that corresponding needs can be met in a timely manner.**

Motion Berger, second Malpas — Vote: for 16; against 0; abstain 0; absent 1

## 948. Thematic Rankings of Programs

### LITHP

Malpas reported that LITHP identified 27 proposals addressing LITHP themes and introduced three new themes not addressed by proposals (lithosphere characterization, LIPs and the Red Sea [young oceans]). LITHP decided to rank the top 15 proposals. Proponents were present for information only. Each proposal was presented by a reviewer and ranking was by written votes. The top five of LITHP's ranking were: 1) Hole 504B, 2) HD II, 3) MARK, 4) TAG, and 5) Hole 735B and SR II (see also Agenda Book, blue page 22). Hole 504B was by far the highest-ranked proposal. Drillability was also assessed. A return to HD would depend on success of Leg 147. There was also a significant break in priority between ranks 4 and 5.

EPR II fell from 4 to 7 and NARM volcanic II fell from 4 to 12 relative to 1991 global rankings. LITHP had changed its philosophy and EPR II had been supplanted by offset drilling. Galapagos rose, partly because it was a potential DCS test location and partly because of some eloquent support by a panel member.

*Discussion*

Taylor noted that the top-ranked subset focussed on ridge processes and hydrothermalism. Austin stressed that that was partly a consequence of proposals available. Malpas added that LITHP had recognized that some themes were not addressed by proposals and had also added three new themes. Taylor wondered, therefore, how useful the ranking would be for developing the four-year ship schedule. Becker pointed out that LITHP's ranking was consistent with past rankings, with the addition of offset drilling. Taylor felt that LITHP also had other themes. Austin noted that LITHP had, in the past, had regional panels to direct it toward certain proposals. Austin stated that, at some point, PCOM would have to decide whether to schedule SR II based on an old DPG report. Someone would have to be found to prepare a new document. The panels generally recognized that, however.

## OHP

Duncan explained that OHP had considered 14 proposals. Voting had been conducted in a similar way to LITHP's. Proponents had been present, but for information only, and were not allowed to vote on their own proposals. Voting scores were normalized. OHP also assessed drillability. The top three were: 1) Ceara Rise, 2) NAAG II (including possible additions), and 3) K/T boundary (two proposals). (See Agenda Book, blue page 22, for remainder of ranking.) OHP recommended formation of a Caribbean DPG; OHP expected more Caribbean proposals. Austin reminded PCOM that the purpose of drillability assessment was to enable SSP to contact proponents to encourage them to submit data, in a timely fashion, to the Site Survey Data Bank at LDGO..

*Discussion*

Cita-Sironi asked why Santa Barbara Basin (SBB) had not been ranked. Duncan replied that the site would be included in the California Current proposal if it was not drilled on Leg 146 or Leg 147. Kidd, however, pointed out that SBB was not in the California Current proposal that SSP received. Cita-Sironi observed that OHP had not ranked any Mediterranean proposals. She asked why it had not ranked Mediterranean sapropels (391), which fell within three of OHP's four themes (Note: Cita Sironi is a proponent). Duncan answered that OHP had felt that that proposal was too immature. Blum stated that the OHP liaison to SGPP had said that OHP did not give Mediterranean sapropels full attention. Austin said that that was because OHP was not very interested in the proposal. Austin noted that some panels had decided to rank concepts, but that others had not. It was up to individual panels. Taylor asked how ready for drilling Benguela Current (354-Rev) was. Kidd responded that the panels had considered readiness and SSP had seen available data. Some proposals were unlikely to have data submitted by August. Benguela Current was one of those. Taylor said that he had asked because Benguela Current was located on one path out of the Atlantic. Austin reminded PCOM that it would have to decide on content of the FY94 prospectus in August.

## SGPP

Cita-Sironi reported that new proposals had been presented by watchdogs. SGPP reduced a list of 44 to 25, on which SGPP voted, and flagged those drillable in FY94. Proponents left the room during discussion.

Blum explained that a straw vote had been taken and the list reduced to 16 by consensus. SGPP had re-voted on those 16. Blum felt that SGPP's procedure had been good. Votes were almost identical to those in the straw vote, adding to the level of confidence. SGPP was a heterogeneous panel, with both sedimentary- and geochemistry-oriented membership. Such consistency in ranking as was achieved by LITHP and OHP should not, therefore, be expected. The top five rankings were: 1) Generic gas hydrates, 2) N. Barbados Ridge, 3) Amazon fan, 4) Mediterranean Sapropels, and 5) Madeira Abyssal Plain/sediment instability (see also Agenda Book, blue page 22). Below the top rank, rankings differed from 1991 global rankings. Cita-Sironi added that another reason for inconsistency had been that a number of new proposals had been received. Most had been from the Atlantic and adjacent seas.

*Discussion*

Austin recalled that PCOM had left it up to Panel Chairs as to how to deal with proponents during ranking. Only SGPP had kept proponents out of the room. In reply to a question from Berger, Blum said that excluding proponents had not influenced ranking consistency. Austin added that new proposals had been the main cause of 1991 to 1992 inconsistency.

### TECP

Tucholke stated that proponents had remained in the room during TECP's discussion, but for information only. Each panel member had been allowed to vote for ten proposals (not to include their own). The top six were: 1) NARM non-volcanic II (Newfoundland Basin), 2) African Equatorial Transect, 3) NARM volcanic II, 4) Alboran Sea (combined proposals), 5) Woodlark Basin, and 6) Hole 504B (see also Agenda Book, blue page 22).

## 949. Setting the General Direction of the Drilling Vessel to Spring 1996

Austin explained that PCOM had heard the panels' global rankings and the engineering discussion and must now put together a general motion to cover the four-year ship track. The FY93 schedule was fixed, FY94 was less fixed, FY95 and FY96 were flexible. He compared the FY91 and FY92 global ranking maps, on display at the meeting, which showed that the highest-ranked proposals were tending to become centered on the Atlantic. In the past, it had been assumed that the drillship would travel around the world and regional panels had existed. There were worrying implications of the present Atlantic focus. Austin then called for discussion.

Malpas felt that it was nice to see a focus, though it was worrying if the perception was that drilling would only be carried out in the North Atlantic and eastern Pacific. PCOM should recognize the development of a focus, which might be a consequence of the 1991 four-year ship track, and call for proposals elsewhere, e.g., Red Sea. It should be stressed that ODP was still a global program, but also that proposals must be thematic. Taylor felt that outlying (i.e., non-Atlantic) proposals that remained were there because they represented top panel priorities. Lower-ranked outlying proposals had fallen off. In addition, PCOM had drawn the line at rank 6 for the FY93 prospectus. That had sent a signal to thematic panels that if a panel wants a proposal in the FY94 prospectus, it must be in the top 6 of its global ranking. Austin agreed that thematic panels did respond to the four-year ship track. They knew where *JOIDES Resolution* was going to be and were, therefore, reluctant to rank globally and waste a rank. Ranking of generic proposals, e.g., gas hydrates, addressed the issue to some extent. Malpas expressed concern about the lack of proposals in the Southern Ocean and Indian Ocean, noting that there had been time to consider the last round of results. Austin said that PCOM must recognize that if it pointed the drillship in a particular direction, highly-ranked proposals would appear there. Lewis, therefore, questioned the need for a four-year ship track. Austin replied that it was required because lead time was needed to get site surveys organized.

Tucholke felt that PCOM should examine its general philosophy concerning the four-year ship track. PCOM had discussed making a commitment to deep holes and a focus was needed. It was not necessarily good to keep pushing around the world. Malpas agreed. He suggested that PCOM specify the Indian Ocean for the fourth year and see what proposals were received. There might be none. Beiersdorf pointed out that site surveys had absorbed the time of many investigators. He expected proposals from other areas to come in soon. Austin stated that commitment to long-range programs required a lot of supporting data and there was a lot of data from the Atlantic. There was also pent-up demand for Atlantic drilling because *JOIDES Resolution* had just completed its ~7-year circumnavigation.

Tucholke suggested asking thematic panels to make two lists: a theme ranking list and a proposal ranking list. Blum responded that, in effect, that was already happening. SGPP had been instructed that it could include generic proposals in its global ranking without restricting its fall ranking. Blum added that SGPP and TECP ended up ranking proposals which had already been highly ranked by other thematic panels. TECP looked at proposals which did not have tectonic themes as main objectives. Lancelot supported Tucholke. Panels should conduct a primary ranking of themes, then rank proposals. If some themes were not covered by proposals, the thematic panels could write proposals or issue RFPs. Austin commented that there would still be a lag time. Lancelot responded that it would, however, tell PCOM that some themes could be developed where the ship happened to be located. Malpas observed that thematic panels had ranked themes when they wrote their White Papers. Taylor pointed out that thematic panels might ask PCOM to rank themes. Austin noted that STRATCOM had suggested that PCOM be more proactive. He was not averse to having PCOM rank themes. Perhaps it would be best for thematic panels to continue to produce a single global ranking list. Austin was still concerned about Atlantic focus. Tucholke stressed that that was why themes should be ranked. Then, if proposals in the direction PCOM was driving the drillship did not address panel themes, PCOM should drive the drillship in a different direction. Berger felt that themes would change. Lancelot responded that they could be reevaluated each year. Malpas felt that another year would make a difference to the distribution of globally-ranked proposals. There was a finite number of drilling targets in the North Atlantic. Austin, however, stressed that PCOM was committing itself to a potentially four-year NARM program and a many-leg offset drilling program in the Atlantic.

Watkins recalled that there had been no Atlantic proposals three years ago and PCOM had walked away from some good Pacific proposals. He felt PCOM was stuck with the Atlantic for now. Arculus stated that, because of that, there was a relaxed attitude among proponents in other regions. Austin feared that, unless the rest of the scientific community was given some help, it might not be able to overcome the bigger Atlantic community. Taylor commented that PCOM got little information about surveys carried out by international partner countries (analogous to the information that was given as part of the NSF report). That could be a good long-term indication of where international interests lay. Austin agreed that it would be useful for international PCOM members to bring such information to future PCOM meetings. Lancelot announced that France was sending *R/V Atalante* across the Atlantic for a year. Taylor, however, added that *Atalante* would be in the westernPacific in 1993.

Malpas felt that there was nothing wrong with what was happening, or spending four years in the Atlantic to tackle top programs. Meanwhile, thematic panels should be asked to tell PCOM the best places to tackle particular themes. He did not think it worth worrying about drillship circumnavigation. Austin said he would have thematic panels do that at their fall meetings. The message to site-survey funding agencies was that ODP had an Atlantic focus for the time being.

Austin showed a sample motion outlining the four-year ship track (Agenda Book, blue pages 23-24). Watkins suggested including the Red Sea along with the Mediterranean. Austin asked whether *JOIDES Resolution* could pass through the Suez Canal. Francis was not sure, but Lancelot said that it could. Austin agreed, in that case, to include the Red Sea. Malpas suggested simply extending item 3 in the sample motion to cover the period up to April 1996. Duncan proposed adding the Indian Ocean. Austin said that the southwest Indian Ocean could be added. He commented that, if the 1993 global ranking map showed an even tighter focus on the Atlantic than in 1992, PCOM might have to reconsider its procedures in light of the interests of Japanese and Australian partners. Highly-ranked proposals were needed. Malpas suggested that, rather than for PCOM to take action, thematic panels should put out RFPs for other areas (e.g., LITHP's Red Sea initiative). Austin said that he would write to Panel Chairs and summarize PCOM's discussion. He would ask them, at their next meeting, to look hard at their themes, priotitize them, and give PCOM some examples of where they would like to see those themes pursued. Taylor pointed out that, though North Atlantic rifted margins were made the focus of a DPG, TECP had never been asked where the best place was to drill rifted margins globally. Austin said that TECP had been asked. Taylor recalled that TECP had listed several places. It might not be desirable to spend an eight-leg commitment entirely in the North Atlantic. Austin responded that the NARM program would be reevaluated after the FY93 initial approach. It was not certain that eight legs would be scheduled, as originally proposed by NARM-DPG. PCOM passed the following motion.

<u>PCOM Motion</u>

**PCOM sets the direction of the drilling vessel for the next four years as follows:**

**1) In the remainder of FY92, confirmed as is in the current Program Plan.**

**2) In FY93, and beyond to November 1993, confirmed as is in the Program Plan approved at its December 1991 meeting in Austin, Texas, through Leg 152, East Greenland Margin, ending on or about 28 November 1993.**

**3) In the remainder of FY94 through April 1996, in the Atlantic Ocean and adjacent seas* and the eastern Pacific. FY94 program to be finalized in December 1992 at the Annual Meeting of PCOM with Panel Chairs.**

**PCOM reaffirms its stand that at its Spring 1993 meeting, and at subsequent meetings, it will evaluate again the state of panel recommendations, technological developments, and the overall state of ODP, and again set the general direction of the drilling vessel for the subsequent four years, with a relatively firm early track and a relatively flexible later direction.**

*** Defined as Caribbean, Gulf of Mexico, Mediterranean, Norwegian (including near-Arctic Ocean), Labrador, Red Sea.**

Motion Tucholke, second Duncan — Vote: for 16; against 0; abstain 0; absent 1

## 950. New Detailed Planning Groups and Working Groups

Austin noted that OHP had recommended a Caribbean DPG and a NAAG II-DPG, the latter not to meet until 1993. Austin felt that, at present, there were insufficient Caribbean proposals and that those existing were not highly-ranked enough. His inclination was to allow proponents to work on them for a while. SL-WG and OD-WG would meet once more each. DH-WG (steering committee) would exist for about two more years. Austin reminded PCOM that it should avoid an excessive number of DPGs and WGs.

Taylor raised the issue of the importance of NAAG II versus SR II. He asked whether SR II had stopped because it lacked a DPG. Duncan responded that OHP felt that a NAAG II-DPG was needed because it was uncertain whether NAAG I would be able to reach the northernmost high-priority sites, and also because there were some new NAAG proposals. That was not the case for SR II. Taylor felt that there was no need for a NAAG II-DPG. Austin agreed that it was premature. The new proposals would first have to be highly ranked. NAAG I (Leg 151) would start with the northernmost sites and work south. He agreed that a NAAG II-DPG was not needed yet.

Malpas asked about a TAG-DPG. Austin replied that LITHP still felt TAG to be in the hands of proponents. A site-survey proposal had been turned down. A TAG-DPG had been rejected by PCOM in December 1991. Kidd stated that there was a lot of TAG data, but that nobody was synthesizing it. Beiersdorf noted that the Briden Report had recommended that thematic panels be more proactive. Austin responded that thematic panels were nominating watchdogs to contact proponents. PCOM had also told thematic panels that they could solicit proponents to write proposals or write proposals themselves if they had a theme that was not covered. Taylor proposed that no new DPGs or WGs be created. Austin concurred; there was no dissent.

**Thursday, 23 April 1992**

## 951. Old Business; Continuing Issues

### SANTA BARBARA BASIN (SBB) DRILLING

Austin recalled that OHP wanted to drill SBB on Leg 147 (they had said Leg 148, but that was not logistically possible). N. Shackleton, then OHP Chair, had raised the issue of Supplemental Science in 1991 using SBB as a basis. A SBB proposal did not, however, appear at that time. The single site now proposed was part of the California Current proposal (386-Rev). PCOM must respond to OHP. Austin stated that when PCOM ended Supplemental Science it endorsed less-than-one-leg science, if it could be incorporated into a leg early in planning. Austin felt that it was now too late to incorporate SBB into Leg 147.

In response to a question from Malpas, Francis said that the Leg 146 prospectus had been written and the Leg 147 prospectus would be written soon. Austin suggested that PCOM discuss what constituted an early stage of planning. In response to a further question from Malpas, Francis said that drilling SBB on Leg 147 would require 1.5 days plus 1 day of transit. No transit time would be required if SBB was drilled on Leg 146. Austin objected, saying that the Leg 146 prospectus had already been written and that Leg 146 had already been impacted by the need to replace a CORK thermistor string. Lancelot pointed out that SBB had not been ranked as a separate proposal, although it could have been during global rankings. OHP should have taken a stand and made SBB its first priority objective.

Malpas asked about staffing implications. Austin replied that J. Kennett, SBB proponent, was ready to fund a launch to take staff out to *JOIDES Resolution.* SBB would be an APC site on a RCB leg. Taylor suggested that PCOM turn down SBB. *JOIDES Resolution* would be back in that area and the site was incorporated within the California Current proposal. Berger, however, argued in favor of SBB. PCOM should not get bogged down with procedures, but must decide whether SBB was worth drilling. He suggested that most on PCOM believed that "a short core of diorite is better than a whole truck load of stinking mud." There was a large community, however, that felt that SBB represented a unique opportunity. SBB would provide foreknowledge for future California Current drilling. SBB was highly-ranked by OHP and SGPP and the atmospheric community was interested. There was a potential for good headlines. It would only require ~20 hours, including 3 hours steaming and ~16 hours drilling. Francis pointed out that that implied conducting SBB operations on Leg 146. Berger wanted to defer consideration of specific legs. Austin, however, stressed that PCOM had to consider those specifics now. Berger suggested that Leg 146 could shut down 10 hours early and Leg 147 could start 10 hours late. Austin felt that that would set a bad precedent because there could be demands to insert that sort of "hot item" into every cruise. Where would PCOM draw the line about putting late items into the schedule? Watkins felt that SBB was a good program.

Becker took exception to OHP's opinion that two days would not affect the scheduled leg. Austin cautioned that SBB would probably not take 20 hours, but longer.To involve only 3 hours transit time, SBB would have to be drilled on Leg 146 and that prospectus was already written. If PCOM put SBB on Leg 147, transit time would be >20 hours. SBB also involved possible safety problems. Kidd felt that SBB would have to be on Leg 147, not Leg 146. He added that SBB's site survey data were in as good shape as HD's. Malpas asked how long SBB drilling would take. Leg 147 had two objectives: a long section of gabbro and the gabbro/mantle transition. Three days could be critical to Leg 147 if it missed the transition as a result. Austin replied that the transit from San Diego to SBB was 8-12 hours. With extra transit time back to the south on the way to HD, the total additional transit time would be ~1 day. Berger suggested simply coming in from Leg 146 a day late. Francis stressed that the schedule was locked in down the line by the Leg 151 (NAAG I) weather window.

Austin returned to the issue of philosophy. Was SBB too late or still early enough for incorporation of less-than-one-leg science? Malpas felt that it was too late when Co-Chiefs had been chosen and the leg basically staffed. It was not too late if the leg had only been scheduled. Taylor suggested that the issue be discussed at the Annual Meeting. Duncan emphasized that OHP saw an opportunity when Hole 504B was replacing an engineering leg. OHP proposed making Leg 147 Hole 504B and Leg 148 HD. Austin stated that that could not be done. Scientific Parties had set their schedules and could not be expected to make a 2-month change. Lancelot agreed that that was out of the question, but added that PCOM should be looking for opportunities. Precedent alone was not a serious problem. PCOM had to react to opportunity and should not go on record as saying that was impossible. Austin, however, expressed concern that SBB would have to be put on Leg 146 for efficiency and staffing and that leg was already overcommitted. Taylor pointed out that SBB science had been around for years and could have been drilled on Leg 138 if the proposal had been submitted. He was not sympathetic. Austin added that SBB would be ranked highly in the future by OHP as part of the California Current proposal. Lancelot countered that, if the SBB proposal had come in earlier, PCOM would have found time on Leg 146.

Berger felt that it would set a bad precedent in the community if SBB was not scheduled. He suggested lengthening Leg 146 and shortening later leg(s). Lancelot wondered whether SBB could be accomplished simply by lengthening Leg 146 and shortening the subsequent port call, which had the advantage of being in San Diego. Francis replied that it was impossible to predict how smoothly the port call might go. Lancelot favored including SBB in Leg 146 and lengthening the leg by 1 day. SBB was high-priority science. PCOM had been vague to the thematic panels about restrictions on inclusion of less-than-one-leg science and should set a clear policy as to timing. The extra day could be taken out of Leg 148. Austin agreed that that solved part of the problem, since Leg 148 Co-Chiefs had not yet been chosen and it would avoid impacting the critical Leg 151 weather window. He stated that he was in favor of that scenario, as long as PCOM was specific about how this issue would be dealt with in future. Beiersdorf asked how the California Current proposal would be dealt with. Austin said that SBB proponents had excerpted SBB from California Current. He was concerned about safety. Kidd noted that SBB was of interest to both OHP and SGPP, but that SGPP would not push California Current as strongly.

Lancelot felt that PCOM must give its reasons for including SBB, that it was only because of the unique opportunity, but should not establish precedents and guidelines. Austin noted, however, that OHP had other, similar items in the Atlantic. Lancelot thought that OHP would have been warned to prepare far in advance. Duncan agreed. OHP was very aware of future requirements. They saw a special opportunity here related to the change to Leg 148 from engineering to Hole 504B. Austin was concerned about pleasing OHP at the expense of LITHP, adding that superposition favored OHP. Duncan noted that OHP had favored Leg 145 basement drilling. Fox felt that the proposed solution was good, but asked whether the time estimate of 20 hours was reliable. Austin, in addition, raised the issue of who would work the SBB cores, who would pay post-cruise money, and what would Leg 146 Co-Chief responsibilities be? Berger suggested that inclusion of SBB be looked upon as a medical emergency. Lancelot proposed allowing SBB 24 hours only, with no possibility of extra time. Kidd suggested that the work be done by the Leg 146 Scientific Party; there would be no SBB proponent aboard. Francis was reluctant to add a day to Leg 146. He had consistently argued to shorten legs. Lengthening legs was bad for morale. ODP's health also depended on technicians. Becker recalled that 5 days of paleoceanographic work had been incorporated in Leg 111; it could be handled. Taylor noted that if a day was added to Leg 146 and subtracted from Leg 148, it would affect the same crew. Austin said that PCOM was sensitive to problems of leg length, but that only one day was involved. Francis stated that Leg 146 was a very busy leg. Austin agreed and felt that the Leg 146 Co-Chiefs would not understand why PCOM would not give them, rather than SBB, an extra day.

Austin feared that the issue of what constituted an early stage in leg planning (i.e., for the inclusion of less-than-one-leg science) would be a continuing issue at every PCOM meeting. Lancelot disagreed. He felt, however, that there would be cases where PCOM would have to take advantage of opportunities. Taylor did not dispute that, but reiterated that SBB science had been around for 3 years. Austin commented that he had never understood why the SBB proposal had not been submitted earlier. Beiersdorf added that SBB did not rank very highly. Austin responded that OHP had made a tactical error. OHP should have ranked SBB higher, but that he could not blame OHP for that. Francis pointed out that *JOIDES Resolution* would sail on Leg 146 before safety approval had been obtained for SBB. Austin responded that Kidd would have to contact Kennett for data. Kidd stated that he had asked M. Ball, PPSP Chair, to look at SBB safety early. Austin did not think that there would be a problem with safety review procedures in this case.

Malpas asked what controls existed on the 24 hour time period. Austin replied that the Co-Chiefs would have ultimate control. SBB proponents would get what they could get in 24 hours. Storms remarked that the pre-cruise meeting for Leg 146 had just been held and had involved some severe cutting of days. The Leg 146 Co-Chiefs would be irate over inclusion of SBB. Austin acknowledged that they already had complaints (e.g., thermistor string replacement at Hole 857D, GEOPROPS testing). He felt that Leg 146 might have been given too much to do by being required by CA-DPG to drill at two locations (Vancouver Island and Oregon Margin).

Tucholke read a draft motion on SBB drilling. Fox stressed that PCOM should enforce the limit of 24 hours, and only 24 hours, on SBB drilling. Austin replied that the Leg 146 Co-Chiefs would do that. Duncan cautioned about being too inflexible about requiring similar requests to be submitted at least one year pre-cruise. Kidd suggested that PCOM should make the point that the return to Hole 504B had provided flexibility in the schedule that would not be there in future. Austin did not, however, wish to link the decision to drill SBB to Hole 504B. Taylor noted that SBB was not logistically convenient to Leg 146. Austin said that he would explain that to the Leg 146 Co-Chiefs. In response to a question from Kidd, Francis said that if SBB failed its safety review, Leg 146 would keep the extra day. Austin agreed. PCOM passed the following motion.

<u>PCOM Motion</u>

**PCOM views the Santa Barbara Basin site as an exceptional scientific opportunity to obtain an important climate record at a logistically-convenient time. PCOM, therefore, approves the addition of a total of 24 hours to Leg 146 to allow drilling of this site at the end of this leg, contingent upon passing safety review. To maintain the schedule of subsequent Atlantic drilling, which is weather-dependent, Leg 148 will be shortened by 24 hours. PCOM nevertheless expresses strong concern about the lateness of the OHP request to drill this site and notes that, in the future, such requests normally will not be considered later than one year pre-cruise.**

Motion Tucholke, second Lancelot — Vote: for 12; against 4; abstain 0; absent 1

### LEG 148 (HOLE 504B)

Austin noted that PCOM had already decided that Leg 148 would be Hole 504B. The decision to add an extra day to Leg 146 meant that Leg 148 would have 39 days on site instead of 40.

### LEG 149 (NARM NON-VOLCANIC I)

Austin informed PCOM that Taylor wished to express concerns about the ordering of sites on Leg 149.

Taylor stated that he had become concerned about Leg 149 science following the 1991 Annual Meeting. Leg 149 was built around locating the continent-ocean boundary (COB). Taylor argued that that was a fallacious concept and that chances of accomplishing that goal were small. He felt that the real questions involved the nature of the transition zone and differences between high-standing Flemish Cap and Galicia Bank and the stretched zones. Taylor drew an analogy between the early rifting history of the North Atlantic and the Afar region. He asked where drilling sites should be located in Afar to find COB. Results of drilling there would be alternating continental and oceanic rocks from successive sites because the settings were mixed. Furthermore, all three planned drill sites on Leg 149 at Iberian Abyssal Plain (IAP) were on basement highs. Only late post-rift sediments would be drilled. Drilling of three basement highs would not help define the COB. The syn-rift history must be known in order to determine how IAP evolved into its present configuration. In addition, the paleoceanographc community was interested in Aptian/Albian black shales. Taylor proposed, therefore, that Leg 149 focus on a single deep site, IAP-1, in ~5200 m water depth and with ~2500 m penetration. Drilling could be accomplished in a single leg. There was no need to wait an extra year before attempting a deep site (i.e., in Newfoundland Basin on NARM non-volcanic II). IAP-1 was estimated to require about the time available on Leg 149, whereas it might not be possible to drill the presently scheduled three sites in a single leg.

Lancelot stated that his perception of the plan for Leg 149 had been different from that presently scheduled. He had felt that IAP-3B ranked as a contingency with respect to GAL-1, based on a letter from H.-C. Larsen to G. Boillot before the 1991 Annual PCOM Meeting. Based on that, some seismic processing had been done in France related to GAL-1. Lancelot, therefore, felt that the choice should be between Taylor's scenario and GAL-1. Taylor responded that PCOM had discussed GAL-1 and that the problem was that the S-reflector was ambiguous there. Lancelot, however, believed that new data documented continuity of the S-reflector to GAL-1. The thickness of the (post-S-reflector) "enigmatic terrane" had been mapped and there was continuity. Both the enigmatic terrane and S-reflector could be drilled at GAL-1. Taylor noted that the problem was that the S-reflector was defined elsewhere as an intra-basement reflector. Further west, the enigmatic terrane occured and the candidate S-reflector was no longer intra-basement. Drilling would not get at the postulated intra-basement detachment (S-reflector).

Austin asked whether PCOM wanted to go back on its endorsement of NARM-DPG's strategy, by changing the ordering of sites. PCOM had discussed the issue in December 1991 and ODP-TAMU had not wanted to drill the deep hole (IAP-1) first. Watkins supported IAP-1, but expressed concern about second-guessing NARM-DPG. Kidd asked whether NARM-DPG's response had been based on ODP-TAMU's reluctance to attempt deep drilling on NARM non-volcanic I. Tucholke replied that he had not been at the final NARM-DPG meeting, but that he believed that NARM-DPG's decision to drill IAP-1 late was a response to ODP-TAMU's concern. He added that, as a proponent of NARM drilling, he was in an awkward position, but felt that Taylor had made a valid point. Kidd recalled that the Atlantic Regional Panel had wanted to drill deep holes first. Austin, noting that he was also a NARM proponent, stated that there was a need to drill deep. Duncan felt that Taylor had called into question the scientific rationale for drilling highs and questioned whether sites on highs should even follow IAP-1, if that was drilled first. Austin commented that it would always be difficult to know whether crust was continental or oceanic based on a 9" hole. Lewis asked for confirmation that NARM-DPG had wanted to drill the deep hole first, but that ODP-TAMU's objections had influenced it to delay deep drilling. Francis said that ODP-TAMU had updated drilling time estimates for IAP-1 in January: 53.8 days plus 4 contingency days, exclusive of logging. Austin asked whether ODP-TAMU was comfortable with drilling IAP-1. Francis answered that it could be done, but questioned how long it would take. Austin acknowledged that, with 2500 m penetration, a single leg might not reach basement. Storms explained that ODP-TAMU's analysis since the December 1991 PCOM meeting was that IAP-1 could be drilled with existing equipment in 50-60 days. That included 16" casing to 800 m. This was deeper and larger-diameter casing than usual. It would allow casing to still greater depths if problems were encountered.

Fox noted that a commitment of ODP was to solve first-order scientific problems. If IAP-1 was the key hole, it did not matter if it took more than a single leg. *JOIDES Resolution* would be in the Atlantic for some time. He added that basement highs had been drilled before. Lewis agreed, but felt that it might be necessary to ask proponents if IAP-1 was the site they would choose if drilling technology was not a problem. Austin responded that PCOM already had NARM-DPG's report. They had wanted to drill IAP-1, but had been cautious about engineering considerations. Lancelot felt that IAP-1 was needed. Little would be learned from the shallow sites. The transect could be drilled later. Austin agreed that the transect of shallower sites remained and would need to be drilled later. In addition, TECP wanted to get started on deep drilling. PCOM was not changing its endorsement of NARM-DPG, just the order of sites. PCOM passed the following motion.

PCOM Motion

**PCOM moves that the primary objective of Leg 149 be a deep hole at Site IAP-1.**

Motion Taylor, second Malpas — Vote: for 13; against 0; abstain 3; absent 1

### LEG 150 (NJ/MAT)

Austin explained that the Leg 150 Co-Chiefs had requested PCOM endorsement of a plan to treat cores from their proposed land-drilling on the New Jersey Coastal Plain as Leg 150 cores for archiving and sampling (Agenda Book, white page 399). Austin was in favor of the plan, so long as it was not viewed as setting a precedent.

Becker asked whether that would imply a commitment for USSAC to fund post-cruise work. Austin was not sure. Malfait stated that there would be no such commitment and that funding would be separate. Becker asked about publication. Austin responded that the Shipboard Party could work the land core and, since land drilling would take place before Leg 150, publication would not be delayed. Lewis asked whether there would be a problem with storage space at the East Coast Repository (ECR). Austin replied that space was a problem at ECR, but that that was not a consideration. Lancelot welcomed the proposition, characterizing it as "a freebie". Austin took it as a consensus that PCOM endorsed the plan, adding that it should help the land drilling to get funded.

PCOM Consensus

**PCOM endorses the proposal by designated Leg 150 Co-Chiefs that core to be collected as part of a proposed land drilling effort extending the NJ/MAT transect be treated as one with Leg 150 cores.**

Taylor noted that ODP-TAMU's revised drilling schedule took days away from Leg 150 and asked whether that would affect Leg 150 science. Austin replied that the old schedule had given NJ/MAT more days than its proponents had originally proposed.

### Leg 151 (NAAG I)

Austin stated that OHP had requested that an icebreaker, not simply an ice-support ship, be available for Leg 151. That would cost more than was currently budgeted.

Lancelot was not sure that it need cost more. *R/V Astrolabe* or its sister ship were cheaper icebreakers, though less powerful than *Oden*, e.g., they would not be able to tow *JOIDES Resolution*. They were, however, research vessels and could take 35 m piston cores. Partial French funding was possible. Austin explained that $1.1M had been budgeted for an ice-support vessel, but that BCOM had felt that that was too much and had asked that it be cut and the money used for other things. To reach the northernmost sites, however, it would be necessary to break ice. Taylor asked about the possibility of using a Russian vessel. Sharaskin replied that that might be possible. Russia was now looking for the cheapest and most appropriate vessel. Francis said that he had given Sharaskin Wadham's ice study. Sharaskin should provide ODP-TAMU with ship specifications. ODP-TAMU would also need *Astrolabe's* specifications. Lancelot replied that *Astrolabe* could break 2 m-thick ice. Francis pointed out that it would also be necessary to convince SEDCO-FOREX about the advisability of entering ice. In response to Taylor, Francis stated that insurance had been discussed. Austin felt that PCOM should not go on record as stating that the Science Operator must get an icebreaker. The ship chosen would be needed, as an ice-support vessel, for the whole leg. Berger suggested *Polarstern*. Beiersdorf noted that *Polarstern* could not tow *JOIDES Resolution*. Francis stated that *Polarstern* would be in the vicinity, but was fully committed. More than an ability to tow *JOIDES Resolution* was needed. It was necessary to maintain clear water around *JOIDES Resolution* so that it could use dynamic positioning (DP). Otherwise, drilling in DP mode would probably be impossible if the ice cover was >50%.

Taylor raised the philosophical issue that the important scientific results were to be achieved at the northernmost sites. That might not happen until NAAG II, but PCOM would have to think about how to accommodate that science during the next four years. Without *Oden*, the primary sites would be undrillable. If that was not to be done now, PCOM would have to think about how to guarantee that ARC-2A would be drilled on NAAG II. Austin countered that, if it cost an extra $500,000 to drill a site, PCOM would have to consider whether it was worth it. Lancelot noted that ice conditions varied from year to year. He felt that the *Oden* deal was risky. If it turned out to be a bad ice year, NAAG I would have to be ready to drill fall-back sites. Taylor, however, felt that if PCOM did not provide the best icebreaker possible, NAAG goals would never be achieved.

Austin stressed the importance of balancing costs. Something else would be lost if too much was spent on NAAG. BCOM thought that $1.1M was too much and wanted a reduction of ~$500,000. The savings could go to DCS, DataNet, etc. Francis commented that the cheapest ice-support vessel to fulfill safety requirements would cost <$1.1M, whereas *Oden* would cost $1.8M. Lancelot felt that the proponents were not comfortable with using *Oden* on NAAG I. They were ready to attempt NAAG I drilling and hope for good ice conditions. They did not expect an all-out effort until NADP began in earnest. Austin felt that it was important to gain experience with NAAG I before committing to costly decisions. Storms, however, noted that the ice situation varied and it would be good to have an icebreaker ready if this was a good year. Austin agreed, but added that *Oden* would not be sitting at the dock waiting for the call. Storms stressed that drilling of the northernmost sites would broaden the support base of ODP. Funds from other sources might be attracted; it would be cheaper than a new program. Austin said that remained hypothetical and asked whether PCOM should commit to an icebreaker. Lewis felt that budgetary uncertainty forced PCOM's hand. If an icebreaker capable of the task could be obtained within the available budget, it should be used. Otherwise, it would have to be omitted. Austin stated that the minutes would reflect that as PCOM's decision. Francis added that enough time remained to discuss the matter again in August.

## 952. Membership on JOIDES Panels

PCOM reviewed membership on various JOIDES panels and took the following actions. (CVs of most newly-nominated members are available at the JOIDES Office.)

### DMP

DMP wanted to replace R. Wilkins with a "seismically numerate" member, but P. Worthington (DMP Chair) had not yet forwarded recommendations. Becker nominated G. Fryer. Austin noted that Worthington was no longer with BP and was grooming a replacement Chair. Fox added that Worthington would step down as Chair after the fall meeting and stay on DMP for one more year.

### PPSP

No action required.

### SMP

R. Whitmarsh was to be replaced by R. Brereton (BGS, UK). SMP would like a sedimentologist to replace A. Richards (ESF). Cita-Sironi asked whether SMP needed a petrologist. Austin replied that SMP had not done so, but that ESF could nominate whoever it chose. PCOM could return to the issue of SMP's membership. SMP was relatively under-staffed, but K. Moran (Chair) had no objections.

### IHP

I. Gibson (Chair) was not the C-A representative. That had been N. Rock. Malpas said that a new C-A representative would be appointed in mid-May.

### SSP

R. Kidd (Chair) would be rotating off SSP and onto PCOM. G. Mountain had declined to be Chair because of Leg 150 responsibilities. In December 1991, PCOM had not minded there being two members from LDGO, because K. Kastens had been rotating off. Now, however, Kastens had been proposed as Chair, which raised the issue again, though Austin felt that Kastens would be a good Chair.

Taylor recalled that Mountain had been put on SSP to be Chair. He noted that Mountain and Kastens had very different expertise and, since SSP was a service panel, he proposed allowing both to remain. Taylor added that he would take exception to that on a thematic panel. Austin stated that PCOM must add the caveat that it still frowned on multiple panel members from a single institution. Kidd stressed that service panels differed from thematic panels: expertise and the amount of work members did were important. Austin asked whether PCOM was concerned about the precedent. No objections were raised.

International partner PCOM representatives announced that K. Louden (C-A), B. Larsen (ESF) and G. Pautot (France) would be replaced in May. ~~Kidd noted that Pautot had not attended~~ a ~~meeting in three years~~. Austin asked whether Kidd had profiles of expertise for replacements. Kidd replied that SSP would like a high-resolution seismics person to replace Larsen. Lancelot said that he would look for a French representative with that expertise. Kidd agreed with Lancelot's plan. He announced that his own replacement would be M. Sinha, whose expertise was in deep-towed seismics. SSP would discuss expertise to be required of Louden's replacement.

## TEDCOM

No action required.

## OHP

International partner PCOM representatives announced that P. Davies (C-A), E. Jansen (ESF) and E. Vincent (France) would be replaced. Malpas announced that T. Loutit (EXXON) would be moving to Australia (BMR). Duncan stressed that Loutit was important for his seismic stratigraphic expertise. Lancelot stated that M.-P. Aubry would probably replace Vincent.

## SGPP

Lancelot stated that J. Boulègue (France) would be replaced later in 1992.

## LITHP

J. Phipps-Morgan and G. Smith had rotated and S. Cloetingh (ESF) and J. Franklin (C-A) would be replaced. Nominees to replace Phipps-Morgan were: D. Wilson (UCSB), D. Forsyth (Brown) and R. Buck (LDGO). Those to replace Smith were: J. Tarduno (SIO), R. Karlin (Nevada, Reno), B. Clement (Florida International) and P. Rochette (France). Nominees to provide augmentation in LIPs expertise were M. Coffin (UTIG), J. Mahoney (Hawaii) and R. White (UK).

Taylor nominated J. Mahoney (already a nominee) and J. Karstens, both of Hawaii. He expressed the opinion that there was a need for more Hawaii people on thematic panels in the long term.

PCOM accepted the nominations of Wilson, Tarduno and Coffin.

## TECP

D. Sawyer and G.M. Purdy had rotated off. TECP had provided nominations in three areas of expertise. Seismology: A. Tréhu (OSU, but already on SSP) and U. Ten Brink (USGS, Woods Hole); rifted margins: C. Beaumont (C-A), M. Steckler (LDGO), D. Hutchinson

(USGS, Woods Hole), M. Coffin (UTIG); ocean crust/microstructure: S. Agar (Northwestern), J. Karstens (Hawaii). Lancelot stated that J. Bourgois would be replaced by either a rifted margins person or an ophiolite person. He asked which TECP would prefer. Tucholke responded that TECP's preference would be for additional rifted margins expertise.

PCOM accepted the nominations of Ten Brink, Beaumont and Agar.

## PCOM Liaisons

Concernong panels meeting before the August PCOM meeting, Becker would attend TEDCOM and DMP. Becker had to attend all meetings related to pore fluid sampling. Austin would attend EXCOM and Taylor would attend OD-WG. Watkins would attend SSP and SL-WG, but would rotate off PCOM at the end of 1992.

Cita-Sironi and Tucholke were leaving PCOM. Taylor could attend future TECP meetings in place of Tucholke.

Duncan noted that he would leave PCOM at the end of 1992. His replacement would be A. Mix. Jenkyns would attend the next OHP. Mix would probably become OHP liaison.

Berger would probably become SGPP liaison with von Rad.

Lancelot stated that he could attend the next IHP meeting, but would probably rotate off at the end of 1992.

Malpas and Mutter would share LITHP.

Sharaskin would replace Lancelot as liaison to SSP after Lancelot had rotated off.

## WATCHDOGS

Austin explained that watchdogs would be required to give presentations on proposals at the PCOM Annual Meeting and keep in touch with proponents, mostly through panels.

Berger would take over Mediterranean Sapropels from Cita-Sironi and also take on California Current. H.-C. Larsen would take on Alboran Basin and Mediterranean Ridge from D. Cowan. Watkins would retain his interest in sea-level proposals and Taylor would retain his in offset-drilling proposals. Taylor asked that someone take on HD as a separate item from the rest of offset drilling. It was decided that Taylor would be watchdog for Atlantic and Indian Ocean offset drilling proposals and Malpas would be watchdog for Pacific offset drilling proposals.

Von Rad would take on K/T boundary proposals. Duncan would take gas hydrates and Barbados. Malpas would continue on VICAP. Austin would take Benguela Current, since he would no longer be Chair at the 1992 Annual PCOM Meeting.

Kidd noted that nobody was compiling existing data on Vema. The watchdog (Taylor) should consider that. Taylor responded that Bonatti had a cruise organized and Taylor would see him soon.

## Co-Chief Scientist Nominations

Austin reminded PCOM that it nominated Co-Chiefs to ODP-TAMU (in order of priority, though names appeared in alphabetical order in PCOM minutes). The final responsibility for Co-Chief selection lay with ODP-TAMU. ODP-TAMU did not inform nominees who were not chosen. Austin asked whether PCOM or ODP-TAMU should do so.

Lancelot felt that there should have been better communications in the case of Leg 149. G. Boillot had kept working on related projects, unaware until recently that he had not been selected. Taylor thought that it would be useful if ODP-TAMU told PCOM members when both Co-Chiefs had been selected. Francis was reluctant to communicate with nominees, but would tell PCOM. Lancelot agreed with that plan. Tucholke suggested keeping nominees confidential (excluding their names from PCOM minutes) to avoid the problem. Austin responded that that could be done. Langseth noted that some people contacted PCOM and asked to be put on the lists. Lancelot noted that proponents expected to be given priority. Quick communication would solve the problem, but confidentiality would not help because a grapevine existed. The lists should be open. Austin added that if nominees were not listed in the minutes, there would be no evidence about PCOM's wishes. Lancelot said that the Leg 149 situation had been a problem because a lot of time and money had been invested in leg-related work.

Austin stated that Co-Chief nominees would continue to appear in PCOM minutes in alphabetical order, with no order of preference implied. Francis added that he would inform PCOM members when selections had been made.

*Leg 148, Hole 504B*

US: J. Alt (Michigan)

International: J. Cann (UK), J. Honnorez (ESF), M. Salisbury (C-A)

Becker felt that a combination of a petrologist and a geophysicist were required in order to define the Layer 2/3 transition.

*Leg 151, NAAG I*

US: W. Ruddiman (Virginia), G. Brass (Miami)

International: E. Jansen (ESF), A Lisitsyn (Russia), J. Thiede (Germany)

*Leg 152, NARM volcanic I*

US: M. Coffin (UTIG)

International: B. Clark (C-A), O. Eldholm (ESF), H.-C. Larsen (ESF), C. Saemundsen (ESF), A. Saunders (UK), R. White (UK)

Duncan had been nominated, but withdrew because he was a PCOM member and was not a proponent. H.-C. Larsen would be coming onto PCOM, but since he was not involved in PCOM at the time of his nomination, PCOM judged that acceptable. Austin felt that an igneous petrologist would be useful.

PCOM Consensus

**PCOM endorses all personnel actions taken at the 1992 Spring Meeting.**

## 953. Future Meetings

The 1992 Summer PCOM meeting will be hosted by J. Malpas in Corner Brook, Newfoundland, Canada, on 11-13 August 1992. A 2-day field trip will precede the meeting on August 9-10 1992. The cost of the field trip will be ~$100/participant, to cover the cost of a helicopter.

The 1992 PCOM Annual Meeting will be held at the Bermuda Biological Station (BBS). A cost of $120/day will include accommodation and meals. Austin (the JOIDES Office) will host the meeting. The University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, which was to have hosted the Annual Meeting, will host a subsequent meeting in Miami. PANCHM will meet on Tuesday, 1 December 1992, with PCOM meeting on 2-5 December 1992. A field trip may be arranged. A deposit of $100 each will be required by BBS 4 months in advance of the meeting. Deposits should be sent to Austin. Double rooms will be available.

The 1993 Spring PCOM meeting will be hosted by J. Mutter at Columbia University, Lamont-Doherty Geological Observatory, on 26-28 April 1993.

The 1993 Summer PCOM meeting will be hosted by R. Arculus in Australia during the second or third week of August, 1993.

## 954. Other Business

### Additional Drilling Platforms

A quote had been provided by SEDCO for additional drilling platforms for shallow-water operations such as A&G and NJ/MAT (Agenda Book, white pages 393-396). Consultant H. Zaremba's proposal had focused on a dependent option. SEDCO offered to get cost information on independent options free of charge. The result was a cost estimate of $1.8M for NJ/MAT drilling, more for A&G. PCOM could go back to Zaremba and ask him to provide more information of this type. Austin asked whether PCOM should pursue the matter further, however, if it was apparent that the costs would be excessive.

Francis suggested not taking the Zaremba proposal further. The dependent platform, that was the subject of most of the proposal, was expensive and there was no space for it on *JOIDES Resolution.* As for independent platforms, PCOM had bids in hand. Austin added that bids provided by SEDCO were similar to one provided by NJ/MAT proponents. Furthermore, ODP's budget was likely to be below LRP levels. Malpas said that he had not seen Zaremba's proposal, but acknowledged that no further action should be taken in view of budget problems. PCOM should thank Zaremba, but not spend more. Austin pointed out that consideration of the additional platform issue was continuing, but asked whether PCOM should keep talking about it if there was no money in the budget for it. Malpas replied that PCOM could not discuss the issue until the budget situation became clear. Lewis stated that the budget had a LRP target figure, but did not take into account items such as additional platforms and Arctic drilling requirements. Such items would have to be taken into account by the budget.

Austin noted that he had been circumspect in dealing with additional platforms in the four-year science plan. NSF was not pushing international partners to get extra money into the system before 1994. Malpas stated that the Briden Report had suggested that PCOM look at that. Austin said that this discussion constituted such consideration. The minutes would show that PCOM understood the budget. Taylor felt that PCOM should also put pressure on the budget system. EXCOM should help PCOM. Austin responded that he would take the additional platform cost estimates to EXCOM. Francis explained that mobilization and demobilization of an additional platform constituted the biggest cost element. That demonstrated the advantages of long-term charter of *JOIDES Resolution*. Austin stated that the minutes would show that PCOM thanked SEDCO for getting the additional platform cost estimates.

### FUND FOR LEV ZONENSHAIN

Sharaskin explained that Zonenshain (LITHP member) was now in the US receiving medical treatment, but had no recent news on his condition. A copy of an advertisement from *Eos*, regarding a fund set up to cover living expenses for Zonenshain and his wife, was included in the Agenda Book (white page 405). Austin added that Zonenshain was in South Carolina. Individual contributions could be made, but Austin felt that an official ODP contribution might mean more. Contributions could be sent to Austin and he would put them together with an official mailing. Taylor stated that USGS had paid for Zonenshain's travel and his medical expenses were being covered.

### REPORT OF THE EXCOM *AD HOC* COMMITTEE ON LONG-TERM ORGANIZATION AND MANAGEMENT OF ODP (BRIDEN REPORT)

Austin stated that EXCOM had initially asked PCOM to consider the report's recommendation concerning the need for regular and open scientific conferences and how to feed information from them back into the JOIDES scientific planning structure. PCOM was now considering all of the report's recommendations.

Malpas felt that examination of the recommendations item by item would take too long. He explained that he had received a letter from D. Falvey (C-A, EXCOM) stating that internationalization of ODP had been the centerpoint of the January 1992 EXCOM meeting. The origins of the debate had lain in attempts by France and Russia to get financial support for their national drillship programs. EXCOM had been concerned that that might drive a wedge into ODP, with potential loss of two members. J. Briden (UK, EXCOM) had, therefore, been appointed to look at the future of ODP paying particular attention to other platforms. Briden's final report, however, contained much more. Only two items were highlighted by EXCOM for PCOM to discuss: 1) scientific conferences, and 2) legs using other platforms on an *ad hoc* basis. PCOM did not have time to discuss the entire Briden Report. Malpas suggested the following course of action for PCOM.

1) Commend EXCOM on its action to review ODP's management structure and program operations.
2) Commend J. Briden on his comprehensive and lucid report.

3) Note that the Briden subcommittee was initially set up to consider "management of a program with multiple platforms", e.g., French, Russian and Japanese drillships. It had, however, somehow become much more and probably, as such, was inappropriate for a one-person subcommittee.

   [Austin noted that the Briden Report had already been endorsed by EXCOM. Malpas replied that that had been done without PCOM consultation.]

4) Note that ODP has been consultative at all levels in the past.
5) Note the apparent lack of consultation in the Briden Report, particularly with international partners (i.e., the report represented one person's view).
6) Request that EXCOM have the full planning structure comment on implications of the Briden Report before taking action.
7) In this light, express concern over the actions, and indeed the setting up, of the Dorman subcommittee without due consultation.
8) Note that JOIDES members, particularly international partners, were put in the awkward position of having to reply to (apparently) formal RFPs without due background data, with little time, with no clear statement as to what was intended (it had not been clear that it was just a request for interest), etc. This had been a wholly unacceptable way to determine serious interest in participating in future management, etc., of ODP.
9) Recommend immediate discussion of the Briden Report and implications of the Dorman subcommittee by each international and US member of ODP (all members to provide a [nationally] considered position paper to EXCOM), and through the planning structure (because of implications for science planning [PCOM], service panels and Science Operator [ODP-TAMU]), noting particularly the implications of "internationalization".
10) Indicate that ODP should not be rushed into major program restructuring because of the necessity to deal with one or two subcontracts (e.g., logging).

Proposed PCOM action: review the Briden Report/Dorman subcommittee initiative in terms of implications for the science program ("internationalization" issue) and present a position paper to EXCOM for their January 1993 meeting.

Malpas felt that his proposals represented the proper way to handle the situation if it was indeed a watershed in ODP. Beiersdorf agreed. Austin responded that, like it or not, the matter was proceeding, though the timeframe was uncertain. PCOM could review the Briden Report, but might already be faced with more reports/EXCOM actions by the time its review was completed. Malpas noted that the Dorman report would be given to EXCOM in June, so that a timeframe existed.

Francis reiterated that the Briden Report stated that *JOIDES Resolution* took up about 50% of total ODP funds (Agenda Book, white page 91). In reality, it was more than that. The report was, therefore, unduly optimistic. Austin replied that he would inform EXCOM of that.

Langseth felt that PCOM should express its concerns about the Briden Report and Dorman subcommittee. Austin asked whether a PCOM subcommittee would review the issue for the August PCOM meeting. Malpas expressed concern that EXCOM might act in June in such a way as to make such effort a waste of time. Austin offered to incorporate a letter from Malpas and others, expressing PCOM concerns, in the EXCOM Agenda Book, if the rest of PCOM was comfortable with its content. Kidd stressed that Briden's report did not represent a UK report. Austin defended Briden. He had been handed a "hot potato" and had done a lot of work. His report had assisted thinking on these issues and EXCOM was now in motion. Lewis felt that EXCOM should consult. Austin replied that EXCOM's feeling was that there was little time to consult the advisory structure. Beiersdorf felt that the discussion went further back. He recalled that EXCOM had been put under pressure by France at EXCOM's October 1990 meeting. The Briden Report had been a "shock-absorber". Malpas added that after the June 1991 EXCOM meeting, the immediate pressure was relieved when it became clear that NEREIS was not being supported directly by the Europeans. Austin replied that the issue was broader and involved French renewal. He added that the French had been relieved that the Briden Report had been written, because it aired issues they felt needed to be aired. ODP could not afford to lose international partners. The issues were important. PCOM could write a letter and conduct a review, but PCOM should not kid itself: elements of this would go forward regardless. In response to Lewis, Austin stated that Briden's brief had been broader than just additional platforms. He asked PCOM to remember that the PEC III Draft Report recommended some of the same things, e.g., a review of the advisory structure. Malpas commended EXCOM and Briden, but felt that subsequent EXCOM action had been inappropriate. Austin felt that Malpas may have overreacted to the Dorman subcommittee's request. Austin agreed that wording of the request had been poor, but it had only been a request for interest and no timeframe had been assumed. Austin noted that he did not know how the Dorman committee issue would develop. He had been purposely kept out of it because he might have to evaluate some of the expressions of interest.

Langseth felt that the idea of a conference for presentation of scientific results should be preserved: not a COSOD, but analogous to lunar science conferences. Austin explained that the key was how it was funded, i.e., whether it was internal to ODP or attached to other meetings. If the latter, the issue became how to feed results back into the JOIDES advisory structure. Taylor stated that Fox (who had left the meeting) had asked him to point out that ODP sessions had been tried at AGU and had not been successful. They ended up preaching to the converted. It was better to have drilling results presented as part of other thematic sessions. Beiersdorf suggested maintaining COSOD-type meetings. They constituted the only way to discuss themes and make planning suggestions. Austin noted that COSODs were expensive. There had already been two and ODP was still not addressing all of their recommended scientific objectives. Pyle explained some background. Briden had initially suggested that IUGG have some sort of control over ODP: to run these meetings periodically and tell ODP what to do in some fashion. Pyle and others had felt that there were enough committees and enough advice, so what was finally included in the Briden Report was a compromise that did little, in Pyle's opinion. Austin felt that it represented ODP's continuing mania for self-examination.

Duncan stressed that it should be emphasized that activity was already underway on some fronts to extend communication of what was going on in ODP, e.g., *GSA Today* articles and synthesis volumes. These were attempts to reach a wider audience. Austin agreed. He added that PEC III had made the recommendation that Part B, *Scientific Results* volumes be discontinued and that the results be published in the open literature. Pyle noted that the PEC III Report was awaiting subcontractor responses.

Beiersdorf stated that COSOD meetings had perhaps been viewed as more successful outside the US. They had played a major role in planning. He asked whether ODP could live without that broad community support. ODP was viewed as a closed shop. Pyle informed PCOM that the continental scientific drilling program had been considering how to get together. Pyle had briefed them and they plan to have a continental COSOD. Austin agreed that, if Briden's suggestion for meetings was unworkable, a COSOD was needed. ODP was now at a watershed in the areas of additional platforms and technology issues. He felt that there was more justification for a COSOD at present than there had been for COSOD II. Berger supported Beiersdorf's idea. Austin stated that he would inform EXCOM that PCOM favored a COSOD. Beiersdorf stressed the need to spread the word at conferences, in addition. Taylor cautioned against special ODP sessions at those conferences. Austin felt that that was happening, but that

PCOM would have to stress a COSOD if it thought one was necessary, because it would be expensive.

Austin asked that the letter providing PCOM's response to the Briden Report and Dorman subcommittee issues be sent to him soon. He reiterated that Briden had been given a broad brief. Kidd felt that PCOM's main objection related to EXCOM's acting on the Briden Report without consultation. Malpas said that he did not object to Briden covering the issues if he had been given that mandate, but felt that it had been an inappropriate task for one person. Austin noted that, in a sense, PCOM had already received a concession in seeing the Briden Report at all. The Briden Report was an EXCOM document. Austin asked that he be provided with a letter (drafted by Malpas, Beiersdorf and Langseth) by mid-May. It would represent PCOM's response.

## PROGRESS REPORT ON MEDITERRANEAN DRILLING PROPOSALS

Cita-Sironi had requested permission to give a progress report on Mediterranean ODP proposals. Active Mediterranean proposals were: 324-Malta Escarpment, 323-Alboran Sea (ranked in 1991 and 1992), 330-Mediterranean Ridge (ranked in 1991 and 1992), 379-Mediterranean drilling, 383-Aegean Sea, 364-Sardinia/Africa Strait, 391-Mediterranean Sapropels (ranked in 1991 and 1992) and 399-Alboran Sea (Watts).

In response to thematic panel comments, 323 and 399 (Alboran Sea) were being revised and integrated. In addition 330, 379 and 383 (Mediterranean Ridge) had been discussed together at a meeting in Milan on 2 March 1992 (a short report of that meeting was available as a handout). All proponents invited had attended the Milan meeting. The strategy for Mediterranean Ridge drilling involved two stages and two legs. 1) Shallow, post-Messinian objectives, including tectonic, fluid flow and paleoceanography/productivity/sea level objectives. The first leg was drillable immediately; a site survey package would be submitted by the August deadline. 2) Deep, Messinian and pre-Messinian objectives, i.e., décollement zone(s), style of deformation of pre-evaporite sequence and deep fluid circulation. The second leg would be drillable after additional MCS, OBS and multibeam data had been acquired. An additional meeting was planned for 1992.

The ECOD workshop in Copenhagen would take place on 6-8 May 1992. The theme was ODP in the Atlantic and the objective was creation of a "second wave" of drilling proposals.

A roundtable discussion on "Focusing scientific objectives for deep drilling in the Mediterranean" would be held at the XXXIII Congress and Plenary Assembly of CIESM (International Commission for the Scientific Exploration of the Mediterranean Sea) in Trieste, Italy, 12-17 October 1992. Conveners were Cita-Sironi and M. Comas. (A list of contributors was available as a handout.)

The following new proposals were expected: Eratosthenes Seamount, Rhone Fan, reoccupation of DSDP Site 372 for bio-chrono-magnetostratigraphic purposes, Mediterranean Ridge-Phase 1 and Plio-Pleistocene transect (paleoceanography).

*Discussion*

Austin commented that the Mediterranean community had been active in response to panel input. A number of Mediterranean proposals, if they were revised according to panel input, would probably fare well in rankings. Kidd noted that the new proposals would be in addition to the 25 SSP was already charged to consider. They would not get the rigorous examination that other proposals had had. Austin stated that PCOM had talked in December 1991 about whether a new program that had not gone through a global ranking should get on the drilling schedule. PCOM did not put a new program on the FY93 schedule, but never answered that question. Austin thought that it was possible for a new program to shoot to the top of rankings and get drilled, but it had not yet happened. Cita-Sironi stated that the Rhone Fan proposal was ready before Leg 107 and that the stratigraphy proposal was a reoccupation of an old DSDP site, so plenty of information was available. In response to a question from Berger, Cita-Sironi explained that ECOD comprised 12 countries and stressed that the Mediterranean was not its only priority. ECOD had other objectives and was thematically oriented. The Trieste meeting would focus on the Mediterranean, but the Copenhagen meeting was broader in scope.

## THIRD-PARTY TOOLS

Austin explained that new third-party tool guidelines differed from previous guidelines, because DMP had taken on the issue of enforcement. DMP had addressed the degree to which the third party was serious about completion. DMP needed feedback on the revised guidelines (distributed to PCOM as a handout the previous day).

Lyle expressed concern that the guidelines seemed to require that all mature tools be bought by the Science Operator or Logging Contractor (handout, p. 4, paragraph (iii)). Francis suggested changing the guidelines to indicate that ODP would acquire the tool if PCOM thought it worthwhile. Austin stated that "resources permitting" would be added and stressed that PCOM would approve tool acquisition if it got to that stage. Watkins suggested replacing DMP with PCOM. Austin, however, recalled that PCOM had decided that DMP should be the panel to monitor third-party tools. DMP had always kept PCOM informed. Langseth suggested adding that ODP would acquire a mature tool "if DMP recommends and PCOM endorses." Austin reiterated that "resources permitting" would also be added.

Becker asked who would submit the mature tool proposal. Austin replied that when a tool went from outside to inside ODP, the proposal would come from inside, i.e., Science Operator or Logging Contractor. The third party would not propose that the tool be moved to ODP.

Austin asked whether PCOM felt comfortable with the language concerning enforcement. Francis stated that these were just guidelines and that they were acceptable with the changes of wording noted. Austin added that Becker should inform DMP that the appropriate operator (Science Operator or Logging Contractor) and PCOM should be involved at all levels. The revised guidelines would be published in the October *JOIDES Journal*. PCOM passed the following motion.

### PCOM Motion

**PCOM endorses the DMP guidelines for third-party tools, except that the wording on page 4, paragraph (iii) be changed to read:**
**"If DMP proposes and PCOM endorses the Mature Tool Proposal, the Science Operator or Logging Contractor will progress the acquisition of the tool for ODP provided funds are available."**
Motion Lewis, second Beiersdorf — Vote: for 13; against 0; abstain 0; absent 4

## PCOM WHITE PAPER

Austin stated that PEC III and the Briden Report discussed splitting PCOM into a science committee and a scheduling committee and also encouraged PCOM to be proactive. He noted that PCOM had never written a White Paper.

Pyle responded that the LRP was PCOM's White Paper. Austin said that he was thinking of a more "nuts and bolts" document. Pyle recalled that PCOM's mood at the time of the LRP had been one of wanting to be all things to all people. Malpas felt that a White Paper might not be useful; such a document would have to be flexible. Discussion, however, might be useful.

Austin explained that part of the motivation for a White Paper was the prospect of internationalization of the JOIDES Office. At present, there was no guidance on how PCOM worked. Malpas commented that he had seen PCOM operate in various forms. He was concerned about PCOM's lack of memory. Some issues were discussed unnecessarily and guidelines might help. Austin stated that it was up to the Chair to remind PCOM of what had happened at previous meetings and items could be forgotten. There were always alternates and new members present. Malpas thought that one item that tended to get recycled was the working relationship between PCOM and ODP-TAMU. He added that it was liaisons, from, e.g., ODP-TAMU and JOI, Inc., who were the ones with the longest memories of past PCOM discussions. Austin noted that the present rotation period for PCOM members was 4 years. Austin said he was uncertain about how to proceed with a written document. He noted that JOI, Inc. prepared a policy manual listing responsibilities of all people actually employed (e.g., JOI, Inc., JOIDES Office). That would be one type of document.

Malpas felt more than that was needed. He said that it would have to include the way PCOM related to the panels. Members tended to become familiar with that over a period of time. It was the philosophy of how the planning structure worked. That could be tackled by discussion, perhaps with a document. Beiersdorf asked about the rationale for splitting PCOM into two groups. Austin replied that there had been a feeling that PCOM's charge to schedule the drillship blinded it to science issues. Therefore, two PCOMs were proposed, one to consider themes and science and transfer those thoughts to a second group that worried about scheduling. Malpas disagreed that PCOM was blind to science. Berger commented that he had been told that PCOM took too much interest in science. Austin countered that PEC III and the Briden Report had both made similar recommendations. Beiersdorf said that there were already a lot of panels and links. He suggested having longer meetings. Austin recalled that STRATCOM had proposed focusing. He felt that that was happening anyway, with programs like NARM and offset drilling. Malpas pointed out that, while some PEC II members had sat in on PCOM meetings, no EXCOM members had done so. Perhaps some EXCOM members should come to PCOM and see what happened. Malpas suggested that PCOM should discuss these issues at one PCOM meeting each year. A White Paper would then probably be unnecessary.

Austin asked whether PCOM thought that it was now pursuing certain themes. There was general assent. Kidd commented that PCOM had been criticized for not being responsive to panels. He had seen, however, that PCOM was responsive and was operating well.

Francis felt that some changes in procedure might be necessary. For instance, the science of NJ/MAT had led to it being scheduled as Leg 150, but high-resolution seismics were not run. That might prevent the leg from taking place because of safety concerns related to the possible presence of shallow gas. Procedures might have to be changed, if there was to be a lot of shallow-water drilling. There was presently no way of funding site surveys, because they did not produce sufficient science. Austin agreed that PCOM might have to return to that issue and acknowledged that site-survey funding for Leg 150 was not available. Kidd commented that SSP might have to specify different site-survey data for shallow-water sites. Austin stated that the Leg 150 Co-Chiefs had all existing data, but that might not be enough. Francis stressed that surveys were needed for specific sites. Taylor did not feel that this issue affected how PCOM worked. Austin observed that if NJ/MAT was not drilled, it would be a signal that data must be gathered.

Langseth felt that PCOM spent insufficient time considering service panel input and that it sometimes also gave logging short shrift. Austin responded that SSP was now plugged into the flow of mature proposals. Kidd agreed that there had been a major improvement over the previous two years. SSP would have to examine site-survey requirements for new environments, e.g., offset drilling and shallow water. Austin admitted that PCOM might not have paid sufficient attention to logging. His view was that logging represented an industry-influenced "black box". ODP-LDGO had done a good job getting exposure for logging and the emphasis on logging might increase as ODP drilled deeper holes. Perhaps more logging experts were required on PCOM. PCOM had expressed concern about the provision of expertise on panels, but the same applied to PCOM. At the moment, PCOM was at the mercy of institution directors, though he had tried to educate EXCOM. Taylor felt that continuity of the DMP Chair had been helpful. Austin added that FMS had made a big impact. He would make time available for discussion at the August PCOM meeting. He suggested that Lewis (future PCOM Chair) continue to consider PCOM's disciplinary balance. In response to a request from Malpas, Austin said that he would invite one or two EXCOM members to PCOM in August.

## 940. Adjournment

Austin noted that two PCOM members were leaving: Cita-Sironi and Tucholke. They would be irreplaceable and, on behalf of PCOM, he wished them well. Austin thanked Duncan and Oregon State University for hosting the 1992 PCOM Spring Meeting. The meeting was adjourned at 1:45 PM.

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APPENDICES ATTACHED TO THE 21-23 APRIL 1992 PCOM SPRING MEETING

1. Recommendations of the Report of the EXCOM *ad hoc* Committee on Long-Term Organization and Management of ODP (Briden Report).
2. NSF report, supplemental information
3. JOI, Inc. report, supplemental information
4. Science Operator report, supplemental information
5. Wireline Logging report, supplemental information
6. BGR high-temperature, dewared, three-component magnetometer
7. SSP report, supplemental information
8. Leg 141 scientific report, supplemental information
9. Leg 142 scientific report, supplemental information
10. DataNet components
11. Schematic comparison of existing and proposed shipboard computer systems

HANDOUTS DISTRIBUTED AT THE 21-23 APRIL 1992 PCOM SPRING MEETING

1. Map showing 1992 thematic panel global rankings
2. Science Operator DCS and non-DCS engineering report, supplemental information
3. Memorandum: PCS—Current State of Development (by D. Huey and T. Pettigrew)
4. Report of the Steering Group for *In Situ* Pore-Fluid Sampling
5. Advertisement for ODP-TAMU Manager of Information Services
6. DMP: revised third-party tool guidelines

7. SSP minutes (1-3 April 1992)
8. Weekly Science Report from Leg 143 co-chiefs (11-18 April 1992)
9. Letter from K. Gillis to J. Austin re: HD site survey data
10. ESCO report of working session: Status and Future Perspectives of ODP Proposals on the Mediterranean Ridge (Milan, Italy, 2 March 1992)
11. Announcement and list of expected contributions to roundtable: Focusing Scientific Objectives for Deep Drilling in the Mediterranean (Trieste, Italy, 12-17 October 1992)
12. Ocean Seismic Network Newsletter, April 1992.

000072

# MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

**KTB Visitor Centre**
**Windischeschenbach**
**Germany**

**2-4 June 1992**

## EXECUTIVE SUMMARY

1. Key thrusts of the meeting were technology exchange with KTB, in situ pore fluid sampling, high-temperature logging technology, and public information aspects of downhole measurements.

2. Panel recommended that the revised version of the ODP guidelines for the development and deployment of third party tools should be adopted and promulgated. The guidelines should applied to two of the tools that are currently under development, the BGR Borehole Magnetometer and the CSM/LDGO High-Temperature Resistivity Tool. On the basis of this experience, consideration should be given to issuing a further version of the guidelines if necessary.

   **[DMP Recommendation 92/4: to ODP-LDGO, Tool P.I.s]**

3. Panel endorsed the Request for Proposals for a Feasibility Study for In Situ Sampling of Pore Fluids. Pore fluid sampling is to be the highest priority with the determination or monitoring of pore fluid pressure and permeability as secondary priorities. Panel reiterates its strong support for the development of an in situ pore fluid sampler.

   **[DMP Recommendation 92/5: to PCOM, JOI]**

4. Panel expects that the issue of the above RFP will be in accordance with the timetable specified by the Steering Group for In Situ Pore Fluid Sampling.

5. Panel concurred that Leg 148, the return to Hole 504B, should be dedicated to drilling. coring and logging as the top priorities. Other experiments, such as offset VSP, should be deferred until the hole has reached its target depth and possibly until a later visit. Before further drilling, the (LDGO-Gable) temperature tool should be run and borehole fluid sampling undertaken. After drilling, the standard logging suite and high-temperature BHTV should be run, packer-flowmeter experiments undertaken, and the German high-temperature magnetometer deployed over target intervals. Schlumberger hostile environment logging (HEL) tools should be on standby on board ship during this leg.

   **[DMP Recommendation 92/6: to PCOM, ODP-LDGO]**

6. Panel considered that the Principal Investigators associated with the return to Hole 504B should investigate oil-industry thermistor/pressure observatories in order to establish what is available as off-the-shelf technology.

   **[DMP Recommendation 92/7: to ODP-LDGO, 504B P.I.s]**

7. The public information booklet on ODP downhole measurements is scheduled for publication in late July / early August. The purpose is to inform the scientific community about the proven benefits of ODP's downhole measurements programme and to highlight the scientific opportunities created by the availability of this technology.

8. Excellent progress continues to be made in the development of high-temperature logging technology. The three priorities are temperature and resistivity measurement, and borehole fluid sampling.

9. Panel considered that each technology that is developed and declared operational by ODP should be described in an appropriate industry publication with the object of informing industry of these achievements.

**[DMP Recommendation 92/8: to ODP-LDGO, ODP-TAMU]**

10. The joint technology session with KTB emphasised once again the benefits that can be derived from inter-programme collaboration. This was the second such meeting: it is hoped to hold others in the future.

11. DMP Chairman is to step down at year end, although he is prepared to remain on the Panel for one further year in the interests of corporate memory, as is the DMP tradition. Nominations are being sought for a successor.

12. The next DMP meeting will take place in downtown Victoria, B.C., Canada, during the period 23-25 September 1992. The meeting will encompass a half-day joint session with SMP, a meeting of the JOIDES Steering Group for In Situ Pore Fluid Sampling, and a visit to the JOIDES Resolution.

PAUL F WORTHINGTON

23 June 1992

# MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

**KTB Visitor Centre**
**Windischeschenbach**
**Germany**

**2 - 4 June 1992**

**MINUTES**

**Present**

| | | |
|---|---|---|
| Chairman: | P F Worthington | (UK) |
| Members: | R Desbrandes | (USA) |
| | J Gieskes | (USA) |
| | S Hickman | (USA) |
| | P Lysne | (USA) |
| | R Morin | (USA) |
| | M Williams | (USA) |
| | H Crocker | (Canada/Australia) |
| | H Draxler | (FRG) |
| | J-P Foucher | (France) |
| | L Petersen | (ESF) |
| | M Yamano | (Japan) |
| Liaisons: | J Bahr | (SGPP) |
| | K Becker | (PCOM) |
| | P Demenocal | (ODP-LDGO) |
| | A Fisher | (ODP-TAMU) |
| | C Moore | (TECP) |
| Guests: | H Beiersdorf | (FRG) |
| | J Erzinger | (Giessen Univ) ** |
| | A Green | (CSM) |
| | M Manning | (CSM) |
| | T Nagao | (Japan) |
| | H Villinger | (FRG) |

**Apologies**

| | | |
|---|---|---|
| | M Hutchinson | (USA) |
| | O Kuznetzov | (Russia) |
| | J McClain | (LITHP) |

** Present for agenda items 12 - 14 only

000076

## 1. Welcome and Introductions

The meeting was called to order at 0830 hours on Tuesday 2 June 1992. This was the second DMP meeting of the year. A special welcome was extended to those attending for the first time and to returning guests: Laust Petersen (new ESF representative), Jean Bahr (SGPP Liaison), Peter Demenocal (LDGO Liaison), Casey Moore (TECP Liaison), and guests Helmut Beiersdorf (FRG), Heiner Villinger (FRG), Toshi Nagao (Japan), Andy Green (CSM) and Mike Manning (CSM). Another guest, Jorg Erzinger (University of Giessen), would be attending for part of the meeting.

Key thrusts of the meeting were the technology exchange with KTB, in situ pore-fluid sampling, high-temperature logging technology and public information aspects of downhole measurements.

### Review of Agenda

Four modifications were proposed:

(i) TEDCOM Liaison report [Item 4(v)];
(ii) Recent results from pore fluid sampling in oil wells [Item 7(ii)];
(iii) Agenda Item 12(i) to include future logging programme for Leg 148;
(iv) Agenda Item 22 to address recent changes in Australian ODP Secretariat.

With these modifications the precirculated agenda was adopted as a working document for the meeting.

## 2. Minutes of Previous DMP Meeting, Kailua Kona, Hawaii, 28-30 January 1992

The following modification was proposed: Page 18, Para 15(i), Line 2; delete "MgO insulated".

With this modification the minutes were adopted as a fair record.

### Matter Arising

Panel wished to express their appreciation to Schlumberger for expediting the delivery of spare parts for the FMS prior to Leg 141. Chairman undertook to write a letter of thanks to Claude Boyeldieu of Schlumberger, Paris.

**[ACTION: WORTHINGTON]**

## 3. PCOM Report

Becker reported on the PCOM meeting held in Corvallis, Oregon, during the period 21-23 April 1992. PCOM responses to specific DMP recommendations were as follows:

| Rec. No. | Description | PCOM Response |
|---|---|---|
| 92/01 | Guidelines for enforcement of third-party tool development | Accepted with Page 4, Para (iii) changed to read: "If DMP proposes and PCOM endorses the Mature Tool Proposal, the Science Operator or Logging Contractor will progress the acquisition of the tool for ODP provided funds are available". |

| | | |
|---|---|---|
| 92/02 | Logging priorities for Leg 142 | Unclear. The Logging Contractor acknowledged that the JOIDES Logging Scientist should have been informed. |
| 92/03 | Dissemination of log data | Deferred pending upgrade of computer system and progress on the ODP Datanet proposal. |

Other highlights were:

(i) The general ship direction through to 1996 will be; Atlantic Ocean, adjacent seas, and eastern Pacific.

(ii) TAMU is to prepare a detailed report on DCS status and forward plans for the August 1992 meeting of PCOM. The Chairman pointed out that a functioning DCS or an equivalent facility was essential if the goals of the ODP Long Range Plan were to be achieved.

(iii) The DCS will not be ready for further testing during Leg 148, which has been redefined as a return to 504B.

(iv) The August 1992 PCOM meeting will also make decisions concerning the shipboard computer upgrade and the RFP for deep drilling.

## 4. Liaison Reports

### (i) Shipboard Measurements Panel

The Chairman reported on the SMP meeting held in Honolulu, Hawaii, during the period 20-22 March 1992. Core-log integration was a major agenda item. SMP recommended that CORPAC should be acquired as the shipboard core-log data correlation tool. CORPAC is a software package for correlating any digital data series, e.g. MST natural gamma vs. log gamma. CORPAC would be especially effective if used in conjunction with the Sonic Core Monitor. SMP generally endorsed the report of the JOIDES Data Handling Working Group. The ODP Datanet concept was well received. Other featured topics included laboratory resistivity equipment, the accuracy of GRAPE density measurements, and the calibration of shipboard XRF equipment, which will be vital for validating the interpretation of the new generation of geochemical logging tools. There is strong support in SMP for continuing the close ties with DMP, especially while the issue of core-log integration continues to evolve rapidly.

### (ii) Lithosphere Panel

The Chairman read a report received from McClain on the LITHP meeting held in Davis, California, during the period 18-20 March 1992. Key points were: LITHP supports the continued development of the DCS but suggested easier test sites; LITHP strongly endorses PCOM's plan to return to Hole 504B during Leg 148; LITHP is supportive of the Lithosphere Characterization concept and is prepared to issue a joint RFP (with DMP) at the appropriate time; highest ranked drilling proposals are return to 504B and Hess Deep; McClain will attend only one more meeting as LITHP Liaison to DMP.

(iii) Sedimentary and Geochemical Processes Panel

Bahr reported on the SGPP meeting held in Miami, Florida, during the period 6-8 March 1992. SGPP's highest drilling priorities are a generic gas hydrates leg and a return to the Barbados accretionary prism. SGPP is strongly supportive of the in situ pore fluid sampling initiative and the moves by the Steering Group towards an RFP. SGPP favours a packer device for multiple sampling and for measurements of pore fluid pressure and permeability. SGPP sees the Pressure Core Barrel as a high priority for engineering development because of its potential application in gas hydrates.

(iv) Tectonics Panel

Moore gave the inaugural TECP Liaison report to the Panel. TECP needs information on fluid and hydrological properties, such as fluid pressure, permeability and specific storage, and on the distribution and orientation of structural fabrics. There are also requirements for the (workstation) integration of seismic, core and log data (note the planned introduction of a workstation with Landmark software on Leg 146), for the long-term monitoring of earth processes, e.g. borehole seals, and for stress measurements, e.g. using the LAST tool. TECP endorses the DMP drive towards in situ pore fluid sampling but supports the SGPP view that such a facility should also allow measurements of permeability and pore pressure. In addition to the fluid-sampling and data-integration needs, TECP has an urgent need for a means of locating core in the hole and for hardrock sidewall cores, especially where core recovery is poor. Another key issue is the relationship between seismic data and physical properties; for example, what is the effect of pressure?

In thanking Moore for his historic address the Chairman noted that the current drive to integrate core and log data was a subset of a much bigger problem, that of integrating all physical data from the pore to the surface geophysical scales. An important contributor will be the recently developed Sonic Core Monitor. Sondergeld offered a presentation for the next DMP meeting on the measurement and interpretation of physical properties of core plugs under simulated overburden conditions, illustrated by examples of real data. The Chairman welcomed and accepted this offer, and pointed out that the subject matter would also be of interest to SMP.

(v) Technology and Engineering Development Committee

Becker reported on the TEDCOM meeting held in College Station, Texas, during the period 7-8 May 1992. The principal agenda item was the DCS. It was still not clear why the DCS had failed to perform on Leg 142. Possible causes were software inadequacies, feedback sensor problems in the secondary heave compensator system, and errors in the models of drillpipe dynamics. TEDCOM's position is that to abandon the DCS now would be premature. TEDCOM made specific recommendations for resolving the problem. It was proposed that TAMU should engage a consultant as a matter of urgency. A key task is to carry out a detailed computer simulation of the secondary heave compensator system. It was also suggested that more land testing could be done. The DCS could be ready for further testing at sea by Leg 153. As regards other engineering tools, the Pressure Core Sampler, Motor-driven Core Barrel and Borehole Seal have been declared operational and their use should be encouraged.

## 5. Tool Monitor Reports

(i) Geoprops Probe

Fisher reported that the Geoprops Probe, a geomechanical tool for measuring temperature, pressure and permeability and for collecting water samples, should be ready for shipboard tests on Leg 146. Geoprops requires the Motor-driven Core Barrel, operational as of Leg 141 and possibly to be deployed on Leg 144. The feasibility study for the completion of Geoprops, undertaken by Scott McGrath of ODP-TAMU, has formed the basis for a contract let to Aumann Engineering in mid-

March. The contract is funded through the additional finance secured by Bobb Carson. The programme of work provides for modified sequencing valves, protective rubber "boots" over wiring, basic drawings, shock absorber, bench testing, calibration, readjustment of temperature circuit, spares, and an operating/maintenance manual. The work should be completed by mid-July, at which time Geoprops should be at the stage of an ODP Development Tool (ref. Item 6).

(ii) LAST

Crocker tabled a brief report from Moran. LAST-1 will be available for Leg 146. Moran will transfer the two LAST-1 tools to the ship at the Victoria port call. LAST-2 will have its final field test in Houston during the week of 15 June 1992. Moran will also receive technical training in the detailed operation of the tool during that week. If the field test is satisfactory, the tool will be transferred to ODP-TAMU for shipping to the Leg 146 port call.

(iii) BGR Borehole Magnetometer

Draxler reported that after modification, the tool is being deployed in the KTB hole (at 6000 m). BGR considers the tool to be operational. The tool is available to ODP and would be ideal for use at Hole 504B during Leg 148. Running the tool requires a dedicated scientist and possibly a technician. The Principal Investigator (Bosum) is submitting a formal proposal for the tool to become an ODP Certified Tool (ref. Item 6).

(iv) French Sediment Magnetometer

Foucher reported that the tool is likely to be deployed on Leg 145. A French scientist will be on board and the tool will be operated by the Schlumberger engineer who will be trained in its use later in June. The susceptibility tool will be run with the magnetometer as before.

(v) Japanese Borehole Magnetometer

Yamano reported that the tool was deployed during Leg 143 where it was run in three holes. The tool had not been subjected to a full land test. It is a 67-mm diameter memory tool but was run on the logging cable for depth counting. Very noisy results were obtained (e.g. at Site 869). Data degradation was attributed to tool rotation during sequential digitisation of the sensor data. Other Panel members ascribed the noisy data to internal tool problems. The tool should not be deployed at sea again until these difficulties have been resolved and the tool has performed satisfactorily during land tests. It was noted that the tool would not have satisfied the ODP guidelines for Third Party Tools (ref. Item 6).

(vi) Packer-Flowmeter

Morin reported that the tool was used successfully on Leg 139 after debugging on Leg 137. It is planned to deploy it again during Legs 146-148. The Packer-Flowmeter is an ODP Development Tool and is a candidate to become an ODP Certified Tool (ref. Item 6).

## 6. Third Party Tools

The Chairman introduced this item by recalling that DMP had been asked to strengthen the guidelines for the development and deployment of third party tools with a view to their enforcement. The previous DMP meeting had placed an action on the Chairman to prepare a revised set of guidelines in accordance with the stated views of the Panel. These guidelines had been prepared and circulated to Panel members for comment. No changes were notified by the deadline and the guidelines duly passed to PCOM for their consideration. As noted under Item 3, PCOM had adopted the new guidelines with one minor modification. PCOM had directed that these guidelines be published in the JOIDES Journal.

Panel observed that the development of guidelines such as these was an evolutionary process. To date, comparatively few tools have passed through the system but many proposals for tool development are now being received by ODP. The guidelines therefore need to be available to the community now, even though they might be modified in the future. Some of the tools that are currently under development should become test cases for the guidelines. In the light of that experience the guidelines could be revised as appropriate. The Chairman reminded the Panel that it was proposed to issue the guidelines in brochure form just as soon as the current efforts on the ODP Downhole Measurements booklet (ref. Item 14) had come to fruition. This would secure a wider circulation to prospective proponents than could be achieved through the JOIDES Journal alone.

**DMP Recommendation 92/4**

**"The revised version of the ODP guidelines for the development and deployment of third party tools should be adopted and promulgated. The guidelines should be applied to two of the tools that are currently under development, the BGR Borehole Magnetometer and the CSM/LDGO High-Temperature Resistivity Tool. On the basis of this experience, consideration should be given to issuing a further version of the guidelines if necessary."**

Green and Draxler agreed to apply the guidelines to these tools and to report back to the Panel with recommendations for improvement. At the same time ODP-LDGO will apply the guidelines from the ODP side and report on their experience.

**[ACTION: DEMENOCAL, DRAXLER, GREEN]**

Panel noted that an enforceable set of guidelines would allow proponents to demonstrate to their funding agencies that their tools had been accepted. The guidelines would therefore serve as an auditable measure of performance.

## 7. In Situ Pore Fluid Sampling

### (i) JOIDES Steering Group for In Situ Pore Fluid Sampling

Gieskes had chaired the inaugural meeting of this group in the unavoidable absence of the Chairman. He reported that the group had met in College Station on 2 April 1992. The required technology encompassed the sampling of pore fluids in sediments and in basement, compatibility with ODP operations, and a capability for some in situ monitoring (of the sample and, for example, of formation temperature, pressure and permeability). The group had prepared a request for proposals for a feasibility study for in situ sampling of pore fluids. The tasks of the appointed contractor would include: consultation with ODP, evaluation of hydrogeological settings, evaluation of sampling technologies, selection of best sampling technologies, and report to DMP. The envisaged schedule is:

| | | |
|---|---|---|
| 15 May 1992 | Forward RFP to JOI, Inc | (done) |
| 15 June 1992 | Issue of RFP | |
| 15 August | Deadline for responses | |
| 22 September 1992 | Evaluation of proposals | (by Steering Group) |
| 30 September 1992 | Selection of contractor | |
| 15 October 1992 | Issue of contract | |
| January 1993 | Oral report to DMP | (College Station) |
| March 1993 | Deadline for final report | |

The technology contact for this initiative is Dave Huey (ODP-TAMU) and the science contacts are Joris Gieskes (DMP) and Peter Swart (SGPP).

After broad discussion, during which the SGPP and TECP Liaisons strongly supported the secondary goals of pore pressure and permeability determination, Panel formulated the following recommendation.

**DMP Recommendation 92/5**

**"DMP endorses the Request for Proposals for a Feasibility Study for In Situ Sampling of Pore Fluids. Pore fluid sampling is to be the highest priority with the determination or monitoring of pore fluid pressure and permeability as secondary priorities. Panel reiterates its strong support for the development of an in situ pore fluid sampler."**

The Chairman thanked Gieskes and other members of the Steering Group for an outstanding contribution to ODP. He expressed the wish that bureaucracy would not detract from their technical achievements to date. Panel looked forward to reviewing progress at the next DMP meeting.

(ii) Recent Results from Pore Fluid Sampling in Oil Wells

Crocker reported on pore-fluid sampling experiences offshore Australia. The objective had been to obtain pristine pore fluid samples using downhole monitoring of sample resistivity for quality control. The time required to attain a constant fluid resistivity was six hours. This demonstrates that it is possible to obtain pristine fluid samples but that a substantial investment of time might be needed. If time limitations are severe, a dilution curve could be established through multiple sampling at one station. Short tests for a single sample cannot be expected to provide meaningful data.

## 8. JOIDES Data Handling Working Group

The Chairman reported on the meeting held in Toronto, Canada, on 5-6 March 1992. The group concurred that changes are urgently needed to the shipboard computer system because the work of the shipboard scientist is being hampered by the difficulty of retrieving current data and by a lack of sophisticated computing resources to manipulate those data. More specifically, the integration of the increasing amount of logging data with core data was perceived as essentially impossible within the confines of the present shipboard computing environment. The working group outlined a package of recommendations for a major overhaul of the shipboard computer system. The recommendations included the installation of a new shipboard relational database to accommodate all the digital and text data sets currently acquired during a leg. Further, new software is needed to support the collection of data from, inter alia, the following tools: multi-sensor track, magnetometer, WSTP, slimhole temperature tool, and core natural gamma. The existing computer hardware environment should be supplemented by dedicated workstations for core-log data correlation, downhole measurements laboratory, underway geophysics laboratory, and physical properties laboratory. The implementation of the recommendations should be monitored by a Data-Handling Steering Group. The group's recommendations have subsequently been endorsed by PCOM.

## 9. Operations Report

As reported under Item 4(v), the DCS was unsuccessful in cutting core during Leg 142. The new Hard-Rock Guidebase and Drill-In BHA worked well. Logging proved to be especially important on Leg 143 due to the very low (< 5%) core recovery over extensive intervals (> 100 m). The logging programme was comprehensive. This leg featured the deepest hole (866A: 1743.6 mbsf) to be drilled during a single ODP leg: here the overall core recovery was around 15%. Logging plans for the current leg (144) include geophysical, geochemical and FMS logs at all sites, and the BHTV at basement sites. Logging Holė 801C is an alternative during Leg 144.

## 10. Logging Contractor's Report

Demenocal reported that the LDGO temperature tool was now MAC-friendly: a third tool was being built. Other developments include a new depth counter and platform for third party tools. Discussions are proceeding with the French concerning the magnetometer/susceptibility tool. This tool is to be deployed on Leg 145. Draxler reported that the (alternative) University of Munich tool failed in the KTB hole at 120°C and will not be upgraded until year-end. On the computing side, Sun-3 systems are to be phased in over the next two years to replace the Masscomps. LDGO BRG is to be a test centre for the new Schlumberger data analysis package, CHARISMA,which is UNIX based and includes log evaluation and seismic packages. Roger Anderson has resigned as BRG Director. David Goldberg is Interim Director through to FY93. Two scientific positions are currently open.

## 11. Science Operator's Report

Fisher reported that the two big initiatives are the DCS and shipboard computing. The Sonic Core Monitor had several good runs on Leg 143 but there were some electronic/battery problems and one of the two units had now been brought back to shore. Graphic interactive software for analysing WSTP temperature data was introduced on Leg 144. For the FY93 budget the three highest priorities are the real-time navigation system, the computer system upgrade for the chemistry laboratory, and the core-log integration workstation(s). The Pressure Core Sampler (now declared operational), the Vibra-Percussive Core Barrel (for unconsolidated sand recovery), and two Cork systems (with thermistor chains, pressure sensors and sampling straw) are scheduled for deployment on Leg 146.

## 12. Future Logging Programme

### (i) Legs 145 - 148

Leg 145: North Pacific Neogene Transect

Fisher reported that the standard suite (geophysical, geochemical and FMS) is planned for four sites (NW-1A, DSM-1, DSM-4, PM-1A) and that the (French) magnetometer/susceptibility tools are proposed for DSM-1 (800 m sediment, 50 m basement). Secondary plans are to run the standard suite at six other sites, the BHTV at two others, and the magnetometer/susceptibility tools at all sites.

Leg 146: Cascadia Accretionary Margin

The pre-cruise meeting was held in April. Logging plans as per previous DMP Minutes.

Leg 147: Hess Deep

Logging plans as per previous DMP Minutes.

Leg 148: 504B

Becker outlined the plans for a return to Hole 504B. The aims are to deepen the hole by 300 - 500 m and to recover gabbro from seismic Layer 3. The logging programme need not be as extensive as on previous legs at 504B. After much discussion, Panel formulated the following recommendation.

DMP Recommendation 92/6

**"Leg 148, the return to ODP Hole 504B, should be dedicated to drilling, coring and logging as the top priorities. Other experiments, such as offset VSP, should be deferred until the hole has reached its target depth and possibly until a later visit. Before further drilling, the (LDGO-Gable) temperature tool should be run and borehole fluid sampling undertaken. After drilling, the standard logging suite and high-temperature BHTV should be run, packer-flowmeter experiments undertaken, and the German high-temperature magnetometer deployed over target intervals. Schlumberger hostile environment logging (HEL) tools should be on standby on board ship during this leg."**

Panel considered that the hole should not be sealed with a thermistor string in place because there is no proven string available and the hole would be put at risk. It was noted that long-term temperature measurements are made in drill-holes in the oil industry. It is possible that established technology is already available off-the-shelf.

DMP Recommendation 92/7

**"The Principal Investigators associated with the ~~return to Hole 504B~~ should investigate oil-industry thermistor/pressure observatories in order to establish what is available as off-the-shelf technology."**

Becker will report back to DMP.

[ACTION: BECKER]

Crocker will try to solicit an industry speaker on downhole monitoring for the next DMP meeting.

[ACTION: CROCKER]

(ii) North Atlantic

Fisher reported that there had been no developments as regards logging plans for Legs 149 - 152, which remain as outlined in the previous DMP Minutes. However, there had been a planning change for Leg 149 (North Atlantic Non-volcanic Rifted Margins, Iberian Abyssal Plain). PCOM had recommended drilling a single deep hole (IAP-1; over 2800 m sediment with 5200 m water depth - the operating limit of the JOIDES Resolution) instead of the four shallower holes originally proposed. This matter is still being debated.

## 13. Non-Engineering Wish List

The Chairman reviewed for Panel's information the priorities for non-engineering development proposed by the JOIDES advisory structure. These were as follows.

(i) Core-log integration

| | | |
|---|---|---|
| (1) | Workstation and software | (FY92) |
| (2) | Natural gamma and MST upgrade | (FY92) |
| (3) | Downhole magnetic susceptibility | (FY93) |
| (4) | Discrete core resistivity | (FY92) |

(ii) Capital Replacement Equipment

| | | |
|---|---|---|
| (1) | Computers & software for data handling | (FY92/93) |
| (2) | Seismic data acquisition/synthetic workstation | (FY93) |
| (3) | Auto titration | (FY93) |

(iii) New/Improved Equipment

| | | |
|---|---|---|
| (1) | Fluid sampling and permeability | (FY92) |
| (2) | Sidewall coring tool | (FY92) |
| (3) | Sediment colour scanner | (FY92) |
| (4) | Core barrel magnetometer | (FY92) |

**Becker noted that this list will be considered at the August meeting of PCOM. The Chairman reiterated the importance and visibility of the core-log integration initiative.**

**14. Public Information Booklet**

The Chairman informed Panel of progress on the production of a technical information booklet on ODP downhole measurements. The purpose is to inform the scientific community about the proven benefits of ODP's downhole measurements programme and to highlight the scientific opportunities created through the availability of this technology. The initiative is being driven through a subcommittee comprising the Chairman, Golovchenko (ODP-LDGO), Fisher and Riedel (ODP-TAMU). The subject matter has been reviewed by referees from DMP and elsewhere in ODP. The final versions of text and artwork have been agreed and the booklet is currently at the graphics design stage. Page proofs will be available around the end of June 1992. Publication date is estimated as late July / early August. The booklet will be distributed to Panel members before the next meeting of DMP.

**15. High-Temperature Logging Technology**

(i) Temperature Tool & Cable

Demenocal reported that the tool and cablehead are robust and deliberately overdesigned: therefore the cable is the primary test target. Money is available for one test only. LDGO have not been able to identify a suitable site. Lysne offered to investigate other opportunities for test sites, noting that the cost of testing can be similar to the cost of manufacture. Draxler reported that KTB had reviewed possible high-temperature test sites. The Russians have a 300°C autoclave in Perm and Schlumberger (Paris) will have a facility for tests at equivalent temperatures under simulated operating conditions. The hottest place in Europe is in northern Italy and it might be worth approaching the Italian geothermal agency to see if a hole is available: in the past the Kuster sampler has been run there.

(ii) Resistivity

Manning reported on progress in building two tools on behalf of LDGO and the UK Dept of Energy who will receive one tool which would be available for loan to ODP. Temperature specification is 350°C for four hours and pressure rating is 100 MPa. Minimum weight is 50 kg. All electronics are rated to 200°C. Tool diameter is 48 mm. It comprises 3 x 3 m sections housing probes, dewared electronics and an extension piece. The tool comprises short and long normal configurations and a short focussed electrode configuration. Focussing technology is being input by consultants (UK BGS). There is also a capability for measuring borehole fluid resistivity. Resistivity ranges are 0.02 - 0.2 Ωm (borehole fluid) and 0.1 - 1000 Ω m (formation). Draxler commented that the latter range is sufficient for fracture detection but it may not be sufficient for lithology identification in crystalline rocks. Development began on 1 January 1992 and the tool is scheduled for completion by 1 September 1992. By that date testing will have been confined to a 250°C autoclave. Environmental testing will be completed in the USA, possibly at Los Alamos or the Salton Sea.

(iii) Fluid Sampling

Lysne reported that DoE had approved the proposal to build a high-temperature borehole fluid sampler. Funds will be available from 1 October 1992. Sample requirements had been specified by a committee chaired by John Edmond (MIT). The tool will be rated to 400°C for a few hours. Tool diameter will be 50 mm. The Chairman proposed inviting John Edmond to the next DMP meeting to brief Panel on the output from his committee.

**[ACTION: WORTHINGTON]**

(iv) Gamma Spectral Tool

Lysne also reported on progress towards developing a high-temperature natural gamma spectral tool. This was on the original list of priorities of DMP and LITHP but was not one of the top three. Geophysical Research Corporation in Tulsa are building the tool on behalf of Sandia Labs. Delivery is expected in September 1992, after which the tool will be tested and calibrated in DoE test pits near Albuquerque, N.M. Lysne concluded by emphasising the further need to understand what these (high-temperature) data mean. This is a prerequisite for meaningful interpretation.

## 16. Technology Review - Oilfield Petrophysics

The Chairman briefly reviewed the current status of petrophysics in the oil industry. There were two key issues. First, with the progressive integration of traditionally separate geoscience subdisciplines, the petrophysical subject area was being redefined to include not just core analysis and well logging but also aspects of borehole geophysics and engineering applications. Second, recent advances in data acquisition technology had placed our ability to measure ahead of our ability to understand the data and how they might best be used. Therefore the present thrust was one of developing new interpretation methods which made use of the available technology in a way that is not confined by classical subject boundaries. This is an important message for ODP because the need for sophisticated downhole technology for fluid sampling, high-temperature logging, etc., is not going to be met by current drives in industry, whose present focus is elsewhere. The Chairman requested that this message be borne to mind in the future, when identifying ODP technology needs and how these might be met.

## 17. ODP Downhole Measurements - Publicity Opportunities

The Chairman reminded Panel members that the last DMP meeting had been attended by the ODP Public Information Coordinator, Karen Riedel. Since the Panel had been debating for some time how to expand its promotion of downhole measurements to the scientific community, the Chairman had asked the Public Information Coordinator to use the opportunity to evaluate the Panel's culture and to suggest ways in which the Panel might best achieve its public information goals. The fruits of her deliberations were contained in a briefing note circulated to the Panel. The Chairman summarised its contents.

Essentially three major thrusts were proposed: print media (e.g. the booklet that is currently in preparation, targeted news releases, and trade journals), electronic media (e.g. video releases, CNN news snippets), and exhibits (e.g. permanent museum feature, travelling poster display). Much spirited discussion followed. Draxler showed Panel a KTB video that had been prepared for public dissemination. The Panel concurred with the Public Information Coordinator that industry was often unaware of the technology achievements of ODP in the logging area. This was seen as a major problem. Several suggestions were made for taking the initiative further. The following recommendation was formulated.

**DMP Recommendation 92/8**

**"Each technology that is developed and declared operational by ODP should be described in an appropriate industry publication with the object of informing industry of these achievements."**

The Chairman asked Panel Members to study the briefing note carefully and then to formulate suggestions for addressing the issues raised. These would be considered at the next DMP meeting when a plan of action would be drawn up.

**[ACTION: PANEL]**

Crocker observed that Ms Riedel had put in a good deal of effort on the Panel's behalf over the past few months. He proposed a vote of thanks. The Chairman noted that Ms Riedel's contribution was much appreciated by the Panel. He undertook to convey this message on Panel's behalf.

**[ACTION: WORTHINGTON]**

## 18. Shipboard Integration of Core and Log Data

Fisher reported that Science Operations, ODP-TAMU, is purchasing several copies of software for the development of custom data-merging tools. A request has been submitted to JOI for RISC-based workstations. Efforts are being made to obtain a Sun SPARC station for Leg 145: this would use similar correlation software to that used on Leg 138. Janecek and possibly Coyne are to sail on Leg 138, which should see the next major shipboard thrust towards core-log integration. The MST upgrade, including the addition of the natural spectral gamma system, is targeted for Leg 149. The downhole tools laboratory has been added to the shipboard ethernet. ODP-TAMU is preparing a four-year computer plan for consideration at the August PCOM. Overall the initiative is contingent upon money and the availability of people.

The Chairman reiterated that the core-log integration initiative is fundamental to data acquisition and handling in ODP. It was gratifying to see that there was now widespread support within the programme. The importance of continued dialogue with SMP could not be overstated.

## 19. Panel Membership

The Chairman announced that he would be stepping down at year end, after the 1992 annual meeting of PCOM with panel chairs. In 1990 the Chairman had been asked to extend his tenure until ODP renewal. It seemed that renewal issues would be clarified by the end of 1992, and that would be the most logical time for a change. The Chairman invited Panel members to consider whether they would be prepared to serve as Panel chair and, if so, to inform him within the next few weeks. He would pass these names on to the PCOM Chairman who would take the matter further.

No further nominations had been received to replace Roy Wilkens and therefore the Chairman proposed to forward to PCOM the single name that Panel had identified at the previous DMP meeting. In accordance with PCOM directives this name is not being minuted, although PCOM minutes do not reflect the same adherence to this protocol.

Sondergeld announced that he would be rotating off the Panel after the next DMP meeting. The Chairman commented that Panel would have to seek a replacement from industry if the technical balance is to be maintained: that might not be easy at the present time.

20. **Next DMP Meetings**

The Chairman stated that there were emerging difficulties associated with holding the next DMP meeting in Sante Fe, New Mexico, as originally planned. There were clashes with the Victoria port call, with the Leg 139 post-cruise meeting (also on Vancouver Island), and with the SMP meeting (also scheduled for Vancouver Island during the port-call week). A head count showed that up to seven panel members and liaisons would have conflicts during that week if DMP met anywhere other than Victoria. Lysne confirmed that the Sante Fe meeting could not be shifted by a week because of hotel-room shortages due to tourist events: DMP was already in a very tight accommodation window. Lysne noted that if it was decided to change venue, the prebooked accommodation in Sante Fe could be cancelled without difficulty. The Chairman added that a major additional concern was the need to secure a quorum for the In Situ Pore Fluid Sampling Steering Group which would meet as an extension of the next DMP meeting. A quorum would not be reached with the present arrangements. All in all, it seemed that there was little choice but to relocate the next DMP meeting to Victoria, B.C. Such a move would also allow a joint session with SMP, to continue the dialogue on core-log integration. Further, several Panel members had not yet seen the JOIDES Resolution. A Victoria meeting would encompass a ship tour.

After further discussion it was decided to hold the next DMP meeting in downtown Victoria, B.C., during the period 23-25 September 1992. The In Situ Pore Fluid Sampling Steering Group would meet at 1700 hours on Tuesday 22 September 1992. A joint session with SMP would be targeted for the afternoon of Wednesday 23 September. The ship tour would be arranged for Thursday 24 September. Fisher agreed to make the necessary arrangements for the ship tour.

**[ACTION: FISHER]**

The Chairman said that Kate Moran had offered to be a host for the meeting but she would no doubt be supported by someone from her own organisation based in the area. The Chairman apologised to Lysne for this late change in the arrangements, which had been brought about by circumstances beyond Panel's control.

The subsequent DMP meeting would be the first under the new Chair. However, it was important to make arrangements now. It is quite some time since Panel has met at ODP-TAMU and therefore the January 1993 meeting of DMP would take place in College Station, Texas. The Chairman will investigate suitable dates and report back to Panel.

**[ACTION: WORTHINGTON]**

21. **Joint Technology Session with KTB**

This aspect of the meeting had been co-chaired by Peter Lysne on behalf of DMP. The aim was to air technology and exchange views in areas of mutual interest. The session also included a review of German ODP activity and a KTB status report. Results from the KTB main hole were featured. Scheduled reports on tool development and performance included borehole magnetometry, VSP surveys, Sonic Core Monitor, Packer-Flowmeter, high-temperature tools (resistivity, fluid samplers, magnetometer), cross-hole seismic experiments, and data handling (ODP Datanet, KTB Databank). The session concluded with visits to the KTB drilling rig and field laboratory. It was hoped that this type of joint meeting would become a regular occurrence, perhaps at 2-3 year intervals.

22. **Other Business**

Crocker informed Panel of changes to the Australian ODP Secretariat. These are not as projected at the previous DMP meeting. The Secretariat moved on 1 April 1992 to the Geology and Geophysics Department, University of New England, Armidale, New South Wales. The new director is Richard Arculus. The functions of the Secretariat are essentially unchanged.

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## 23. Close of Meeting

The Chairman thanked Panel Members, Liaisons and Guests for their contribution to the meeting, KTB for their kind hospitality, and Hans Draxler for his gracious hosting. The meeting closed at 1505 hours on Thursday 4 June 1992.

PAUL F WORTHINGTON

23 June 1992

# Joint Meeting DMP/KTB

KTB Information Center
Windischeschenbach, June 2nd 1992

**Protocol:**

The Downhole Measurements Panel (DMP) of the Ocean Drilling Programme (ODP) met for the second meeting of the year 1992 at the KTB drilling site in Windischeschenbach, Germany.

To foster cooperation between the DMP and KTB a one day joint meeting was organized on June 2nd 1992. The goal was to convey results from the KTB operation, discuss common problems on formation evaluation techniques, downhole sampling, logging operations and high temperature tool development.

The meeting was chaired by K. Bram of KTB and co-chaired by P. Lysne, DMP and J. Draxler, DMP/KTB. The Agenda of the meeting is enclosed (Ref. 1).

**Participants:**

**Downhole Measurements Panel:**
**Members:**

| | |
|---|---|
| H. Crocker | Canada/Australia |
| R. Desbrandes | USA |
| J. Draxler | Germany (KTB) |
| J. Gieskes | USA |
| S. Hickman | USA |
| P. Lysne | USA |
| R. Morin | USA |
| L. Petersen | Scandinavia |
| C. Sondergeld | USA |
| M. Williams | USA |
| M. Yamano | Japan |

**Liasons:**

| | |
|---|---|
| K. Becker | (PCOM) USA |
| A. Fischer | (ODP-TAMU) USA |
| P. De Menocal | (LDGO-BRG) USA |
| J. Bahr | (SGGP) USA |
| C. Moore | (TECP) USA |

**Guests:**

| | |
|---|---|
| A. Green | (CSM) UK |
| M. Manning | (CSM) UK |

| | |
|---|---|
| H. Beiersdorf | (BGR) Germany |
| H. Villinger | (Uni.-Bremen) Germany |
| W. Bosum | (BGR) Germany |
| H. Gatto | (Cons. KTB) Germany |
| F. Fieberg | (Uni.-Braunschweig) Germany |

**KTB-Projet Management (KTB-PL) and Fieldlaboratory (KTB-FL):**

| | |
|---|---|
| K. Bram | KTB-PL |
| C. Bücker | KTB-FL |
| C. Chur | KTB-PL *) |
| H.-G. Dietrich | KTB-FL |
| W. Dorn | KTB-PL *) |
| M. Heinisch | KTB-FL *) |
| P. Kehrer | KTB-PL *) |
| W. Kessels | KTB-PL |
| J. Kück | KTB-PL |
| S. Lich | KTB-FL |
| S. Rust | KTB-FL |
| G. Zoth | KTB-PL |

*) Could not attend full day.

## 1. Welcome and Introduction

K. Bram opened the joint meeting at 8.30 and gave a special welcome to the members, liaisons of the DMP, the guests of DMP/KTB and the participants from KTB.

After a short briefing of the Agenda, the Agenda was accepted as a schedule for the meeting.

## 2. Review of German ODP Activity

Helmut Beiersdorf, the coordinator of the German activities in ODP, welcomed the participants of the Joint Meeting on behalf of Dr. Maronde of Deutsche Forschungsgemeinschaft (Bonn), which is the main sponsor of the German ODP participation. Deutsche Forschungsgemeinschaft, it is the equivalent to the U.S. National Science Foundation, made some funds available to the meeting and the field trip.

H.B. mentioned that the negotiations on the continuation of Germany's ODP participation beyond 1993, came to a successful end despite of serious financial constraints. The Bundesministerium für Forschung und Technologie (Federal Ministry of Research and Technology) has sent a letter to Deutsche Forschungsgemeinschaft in which its intent was expressend to continue financial support in form of the other half of the initial contribution of which the first half comes from Deutsche Forschungsgemeinschaft. The only obstacle before the signing of the ODP Memorandum of Understanding (MOU) is the "Intellectual Properties" clause of the MOU. But it is hoped that this can be removed soon.

The German ODP community is far from being tired of ODP, and has recently, at the German Annual ODP Colloquium, again expressed its great interest in the continuation of the program.

H.B. also pointed out that he sees with great sympathy the close cooperation between ODP and KTB in the field of engineering including downhole measurements, and wished the meeting good success.

**3. Status Report KTB-Oberpfalz HB**

Peter Kehrer welcomed the perticipants on behalf of the KTB Project Management. He gave a brief summary of the status of the project. Current depth of the KTB superdeep well is 6200,7 m with a deviation of only 0,2° and is drilling ahead. 8000 m should be reached at the end of 1992 and the target depth of 10 00 m and a range of 300 °C is planned for February 1994. Deepening of the well below 10 000 m is under discussion. The projekt has undergone an intensive planning period during the last months concerning budget, time schedule and evaluation of scientific results.

The excellent cooperation between ODP and KTB in logging and drilling technologies was emphasized. This is also expressed by the fact that this is already the second DMP-Meeting at the drillsite in Windischeschenbach. There is much discussion in the International Geoscientific Community about the forming of an "International Continental Deep Drilling Programme". Meetings toward this goal were held at an International Symposium in Paris in April 1992, discussions will be continued at the International Geological Congress in Kyoto in August/September 1992. A special International Conference for this subject will be held in Germany in spring of next year which will be organized by the "Geoforschungszentrum Postsdam" a new geoscientific research institute.

**4. Results: KTB-Oberpfalz HB, 0 - 6000 m**
**a) Drilling Operation (Chur)**

A specific drilling strategy with new technology was developed to drill the KTB ultra deep borehole.

In particular for

- vertical drilling
- casing program
- coring.

Engineering calculations as well as drilling experiences from the KTB pilot hole, the Russian Kola well and other drilling operations worldwide have shown the need for a straigth borehole to reduce torque and drag between the drill string and the borehole wall to a minimum.

The vertical borehole is also necessary for running the special clearance 16" and 13 3/8" casing strings.

To achieve that, Vertical Drilling Systems (VDS) were developed. The latest design VDS-5 has an external steering system where hydraulicaly actuated pistons push expanding stabilizer ribs against the borehole wall. The borehole inclination is continuously measured by two inclination sensors. If the inclination deviates from verticality, the pressure in the respective hydraulic cylinder is released and the bit corrects the deviation.

Using the vertical drilling systems, it was possible to maintain an average borehole inclination less than 0.5°. The horizontal displacement at 6000 m is only 8.5 m (Ref. 2).

The verticality of the borehole is also a major requirement for the casing programme with extrem narrow clearances. The well was drilled down to 3003 m with 17 1/2" bit size. After the 16" casing was run to 3000.5 m and cemented, the well was drilled with 14 3/4" bit size to 6018 m. After a three weeks logging programme a combined 13 3/8" and 13 5/8" casing string was run to 6013,5 m and cemented. Both casing strings required special couplings to realize a maximum clearance to the nominal borehole diameter of only 15 mm.

The well now will be drilled with 12 1/4" bit size to 10 km.

For coring new technology was also developed. Whereas the coring in the 14 3/4" drilling phase was done with roller cone core bits and a 8" x 4" core barrel, the majority of the core drilling in the 12 1/4" drilling phase will be done with a Large Diameter Coring System (LDCS). This system drills with a 12 1/4" thin kerf diamond core bit a 334,6 mm core. The LDCS drills not only in one single core run a rock volume five times more than the standard coring system, but also increases the core recovery from slightly over 40 % up to 90 %.

**b) Logging Operations and Evaluations**
**- Highlights: New Logging Tools (Draxler)**

After reaching the depth of 6020,0 m on March 13th 1992 an extensive logging programm was run after the borehole had been cooled by additional circulation for 48 hrs. The programme was split in two segments: the first included temperature sensitive tools (like Magnetometer - Uni. Braunschweig, GLT) and the tools requiring the MAXIS 500 (FMI, DSI and the prototype ALAT). In addition 6 temperature surveys were run to record the temperature increase with time. In 188 hrs the increase was 48 °C. The maximum recorded reached 162 °C.

After reconditioning the borehole the second segment of services was run under reduced hydrostatic pressure (51 bar), due to a lowering of the mud level by 500 m. The goal was to locate producing zones by provoking inflow.

New tools run:
Formation Micro Imager (FMI) was used in the KTB-HB since the depth of 720 m with good results. In 17 1/2" borehole the tool covers 36 % of the circumference and in 14 3/4" hole 43 % (see Ref. 3 in appendix). The Dipole Sonic Imager (DSI) was run as of 3000 m depth. The detection of the shear velocity is improved due to direct shear wave propagation. The recorded Stoneley-wave showed clear enhancement with strong chevron signatures at fractured zones (see Ref. 4 in appendix).

Schlumberger offered a new prototype tool the Azimuthal Laterolog. We recorded the interval from 6000 - 3000 m with this tool. It provides the standard Dual Laterolog plus 12 additional Laterolog curves from an array of electrodes arranged on the circumference of the sonde in sectors of 30 degrees. As the tool is run in combination with an orientation and deviation tool (GPIT), the Array Laterolog resistivities can be oriented in space.

As the Laterolog system provides "deep" investigation resistivities, confirmation of "open" fractures or fracture systems can be detected. In addition, this tool might bring information about anisotropy.

Tool specification and one log example are given as Ref. 5 and 6 in the appendix.

**- Correlation of GLT with XRF/XRD (Gatto)**

As in the KTB-pilot hole the GLT was run in the KTB-deep hole from 6000 - 3000 m. The large borehole diameter of 14 3/4" required a recalibration of the results. The elements evaluated from the GLT have been crosscorrelated with the X-ray fluorescence analysis made on rock samples in the KTB-field laboratory. The samples are collected at 2 m depth intervals.

A comparison of the two methods in a paragneiss and amphibolite section shows good agreement (Ref. 7 and 8). Due to the denser sampling rate of 0,1524 m, the log shows more details.

A quantitative analysis was performed using the ELAN programme. Each of the two predominant rock types found in the KTB-pilot hole and as well in the KTB-deep hole, gneisses and amphibolites are composed of at least 10 minerals. The availability of a continuous X-ray diffraction analysis (XRD) done in the KTB field laboratory made it possible to select a suitable compromise model for the evaluation. Comparing ELAN results to XRD, good agreement was observed in gneisses (Ref. 9) and to a lesser degree in amphibolites (Ref. 10).

**- Borehole Stability - Break-outs (Kück)**

Especially in the lower portion of the borehole between 5500 and 6000 m a rather fast development of breakouts has been observed, shortly after drilling ovalisation of the borehole is measured. Repeated caliper logs show this increase in diameter immediately after drilling with a complete stabilisation later on.

The minimum diameter remains at bit size (see Ref. 11). Further confirmation of the fast-development of break-outs is the increase of borehole deviation even with the Vertical Drilling System (VDS4) in the borehole (5800 - 5843 m). If the rock remains stable while being drilled, the deviation is corrected and remains around zero degree (5843 - 5890 m).

The break-out orientation between 3400 - 6000 m is between 80 - 90 degrees, corresponding to the interval from 5900 - 6023 m shown on Ref. 12.

**- Geothermic: Temperature Evaluation (Zoth)**

To a depth of about 4000 m the temperature is rather well defined as temperature measurements have been made in the KTB pilot well one year after drilling has stopped.

The temperature estimation for the KTB-deep borehole is still problematic due to the disturbance caused by the drilling operation.

During the last logging series at 6000 m, six temperature logs have been recorded over a period of 188 hrs. With these data an estimation of the bottom hole temperature was made using different algorithms. The calculated average temperature gradient is 27.3 K/km. Down to a depth of 6000 m no change in this gradient has been observed. If there is no change the limit of 300 °C will be reached at 10.700 m depth (see Ref. 13).

**- Geohydraulic: Testing and Sampling, Hydrofrac Experiment (Kessels)**

Hydraulic experiments in the KTB boreholes followed the intention to determine the hydraulic parameters of the fractured zones and to recover formation fluids as uncontaminated as possible. The selection of the fractured zones for testing was done by an intensive log interpretation. A drawdown and injection test, six packer tests and a pump test were carried out in the 4000 m deep pilot hole. Prominent inflows were found between 480 m and 800 m and in the deepest part of the hole. In the upper part low salinity fluid with a negligible gas content was produced. From the deepest part highly saline fluids with a high gas content of 0,8 $m^3$/1 $m^3$ were recovered. The 30 % $CH_4$ fraction in the gas was also remarkable.

In the main hole between 3000 m and 6000 m four fractured zones were investigated during a test. The mud level in the borehole was lowered by 500 m and inflow was observed. The intervalls detected by temperature and mud resistivity (salinity) logging were tested by taking fluid samples (Ref. 14). The analysis confirmed high salinity and gas content.

Two additional interesting observations have been made. During the inflow test (drawdown test) in the deep hole the fluid level in the pilot hole decreased and when the casing was cemented the level increased. This clearly shows that hydraulic communication exists between the KTB pilot hole and deep hole at 200 meters distance. A permeable fracture system exists in the deeper crystalline rock (Ref. 15).

**- Magnetic: Report on Tool Performance and Evaluation (Bosum/Fieberg)**

The Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) in Hannover/Germany has developed a high resolution/high temperature 3-axis borehole magnetometer. The system consists of 3 ringcore fluxgates, perpendicular to each other, installed in a Dewar-housing with heat shield and heat-sinks, for temperature regulation, which is put in a titanium-housing for high pressure protection.

After a temperature test (Ref. 16) the borehole magnetometer has successfully been applied in the KTB borehole during the last logging phase till 6000 m depth, corresponding, to an environmental temperature of 170 °C (Ref. 17). The accurary of the tool in the stationary mode proved to 0,1 nT, in the (running) logging mode to 1 nT, for further specifications see Ref. 17. - Ref. 18 shows a field plot of the Magnetic-Log (vertical component) between 3350 m and 3700 m, in correlation with the lithology and the GAMMA-Log. The borehole magnetometer is constructed for temperatures up to 300 °C. Presently a gyro-system, giving reference for the magnetic field vector, is being integrated.

Due to the still missing heat protection system for the magnetometer sonde of the University of Braunschweig, the tool could only be run in the borehole when it was cooled. The interval between 6000 and 3000 m was logged successfully. The tool responded according to expectations. Due to the excellent calibration facilities available at Braunschweig the tool reaches a very high accuracy. A small temperatur effect was recognized and corrected for.

**- Seismic: VSP and ISO 89-3D Survey (Bram)**

In close co-operation between DEKORP and KTB a comprehensiv seismic survey was conducted in 1989 with the KTB drilling site in the centre.

Routine processing of the 3D-reflection seismic survey, the first ever carried out over crystalline rocks, failed due to the very complex reflectivity pattern, due to strong velocity anisotropy (up to 15 %) and the complex geology.

Performing a envelope-stacking technique the summed up energy of reflecting elements a first idea on the structural situation appeared governed by stepply dipping reflectors (50° and more!). The most prominent one, the so-called SE1 will be intersected at a depth of about 7000 m (after migration).

A recently shot VSP in the KTB-main hole from 6000 m to 3000 m confirms a lot of the observed reflectors, their interpretation despite having some of them already drilled through, remains however uncertain (Ref. 19).

The final results from this VSP are not available yet.

## 5. Sampling/Coring Innovations

**- Sonic Core Monitor (Fisher)**
**Status of ODP Hard Rock Orientation (HRO) System**

The ODP Hard Rock Orientation (HRO) System consists of the following components: core sciber, sonic core monitor, electronic multishot, bit-depth indicator. Each of these components is operational, but some individual software and hardware bugs remain. The full system is presently compatible with RCB operations only, although individual components are compatible with APC and XCB operations as well.

The core sciber marks the orientation of each piece of core relative to the core barrel, as the material enters through the core-catcher. The sciber does not impede the movement of the core into the barrel, but rotation of the barrel relative to the formation (due to torquing between the barrel and the BHA) can cause the core pieces to become 'lathed' by the sciber. The barrel latch system is now being redesigned to eliminate core barrel rotation. The sonic core monitor worked well during Leg 143, accurately recording the progress of cored materials as it filled the barrel. There were some minor electronic and power-supply problems, which have been fixed. Data from the monitor are presently dumped to a PC for analysis.

The electronic multishot replaces the photographic instrument used both for HRO applications and paleomagnetic investigations. The multishot must be run inside a non-magnetic drill collar, meaning that its use must be planned well in advance. The tool is operated like conventional survey instruments; data are downloaded to a PC. The final component of the HRO System is a means of recording the relative progress of the bit as it penetrates the formation. This is presently done manually with the assistance of the driller; automated recording of bit-depth information should be available soon.

Although each of the four HRO System components is operational, a great challenge remains in providing a software/hardware system for combining data from these different sources so that complete interpretations can be made. This development is difficult because the data presently come in very different forms. Two data sets are digital (sonic core monitor and electronic multishot) while two are analog (core scriber and bit-depth indicator). Core-Sciber data will probably remain analog for some time, as these data require the most basic interpretation; each piece of core must be examined by hand.

**- Automatic Sampling System (Heinisch)**

The representative routine sampling procedure in intervals of 1 m in connection with gaining of additional solid and fluid samples allows the realization of an extensive geoscientific program. To ensure reproducible analysis data, constant sampling quality is of great importance. Therefore suitable systems for represantative sampling of solids, mud and gases extracted from the mud are integrated into the circulation system of the drilling rig:

- An automatic sampling system (Ref. 20) located in a partial mud stream, which is controlled by rate of penetration and pump rate, collects constant amounts of cuttings, centrifuge material and mud <u>over the full length of a sample interval</u>.

- An additional partial stream of mud uncontaminated by air, is continuously degassed (Ref. 21), so that fluid inflows of gasrich fluids from the formation into the drilling mud can be detected, depth correlated and quantified.

A visit to the automatic sampling system is planned.

**- Sedimentation Sub-Evaluation (Lich/Rust)**

The sedimentation sub (also 'junk basket') is a tool that is normally used to bring lost pieces of tools from the borehole bottom to the surface (fishing operations).

In the KTB pilot-hole a junk basket was used a few times to get bigger rock samples than the usual cuttings. This tool was quite difficult to handle and was an instability within the drilling string. Therefore a new junk basket, (called 'cutting-sampler' (CS)), has been constructed for the KTB main hole by modifying a normal drill-collar. The new CS with 3 pockets is generally positioned a few meters above the bit and collects material from the borehole bottom (coming up with the mudflow) as well as breakout material from cavings.

Material from the CS enables investigations that require large sample sizes:

- fabric-oriented thinsections
- analysis of microfabrics or structures larger than a few mm
- rock-mechanical analysis.

When we started to analyse the cutting-sampler material, the central question was, wether it would be possible to distinguish samples coming from the bit (from borehole bottom) or from breakouts higher up the borehole.

Criteria for a discrimination of caving material against the 'fresh/just drilled' material are:

- Lithology (relative amount of components, degree of alteration, cataclasis - in comparison to the routine-cuttings lithoprofile)
- Size of the samples
- Shape of samples (grade of roundness/flatness, bit-influences).

In general caving-material can be identified:

- by mixtures of different lithologies or high amounts of lithologies that have not been drilled during the current run
- by their bigger size
- by their rather flat form
- and by concave surfaces with bit traces (directly representing the borehole wall).

Based on these data we correlate the CS samples with the existing cutting-profile, also considering borehole measurements (e.g. gamma-rey, caliper, Formation Micro Imager and BoreHole TeleViewer). Dip of foliation or faults can be measured directly on pieces from the borehole wall. Comparing these measurements with FMI-BHTV data, it is possible to get confirmation about the origin of this caving material (within a range of only few meters).

The correlation yields detailled information about:

GEOLOGY

- petrology (fabric, ...)
- structures (foliation, folds, fractures ...)
- small intercalations of different lithologies (eg. in the KTB instrusive dikes, meta-ultramafitites) which are hardly detected in the usual cuttings
- open fissures, joints and pores.

DRILLING

- developement of breakout areas eg. with respect to
- recent stress field configuration (rock mechanics) and
- microcracking.

The experiences with the CS have shown that the tool is completely filled after the first 5-10 meters of drilling, respectively reaming or short time of circulation. First data have shown, that the correlation of CS samples with borehole areas works quite well.

**- Gamma Spectroscopy on Cores and Cuttings (Bücker)**

A comparison of the borehole and the laboratory measurements of natural gamma ray activity showed a very good agreement between both for the depth section down to 6000 m of the KTB-HB. The laboratory measurements have been realized using cuttings and germanium detector. Cores are measured in a special apparatus with three independent NaJ scintillation counters positioned at 90° to each other which measure K, Th, U spectra separately.

Furthermore the RYBACH-relation between the gamma ray (GR) and the heat production (A, from NGS) has been tested and confirmed. It could be shown, that the correlation between A and GR depends an the Th/U-ratio and the K/U-ratio respectively. With increasing Th/U- and K/U-ratio the slope of the GR-A correlation increases. For a given Th/U- and K/U-ratio, the GR-A correlation holds for all borehole measurements if the GR is given in absolute API-units. That means that a meaningful information of the heat production can be derived only using the normal GR.

Integrating the heat production over depth yields a heat flow due to the radionuclides of about 6 mW/2 down to 6000 m. The contribution of the heat production to the total heat flow at the earth's surface is about 10 %.

**6. HT-Tool Development and Tool Performance:**

**- Packer Flowmeter (Morin)**

The tool was used on Leg 139 and logs were recorded successfully. The problems encountered on Leg 137 were solved.

The tool uncludes a flowmeter and a pressure transducer allowing an evaluation of the hydraulic conductivity and distribution in the borehole.

Permeability estimation, detection of fracture zones and calculation of the specific storage coefficient is possible.

The logs from leg 139 showed underpressured zones in well 857D.

**- HT-Resistivity Tool Development CSM (Manning)**

The Camborne School of Mines is building two HT resistivity tools, one for ODP and one for the UK Department of Energy. The tool should operate up to 350 °C for 4 hrs and measure the resistivity range between 0.1 and 1000 Ohm m.

The resistivity systems consist of: 16" and 64" Normal and Short Lateral.

The outside diameter of the tool must be samll enough to be used in boreholes drilled by the DCS (tool OD = 40 mm).

Technical details: electronic circuitry temperature rating 200 °C, Dewar-system internal temperature limit 170 °C. Thermo-syphons and heat pipes will help to distribute the heat evenly and avoid hot spots. The tool will have a Gearhart head cormection.

The first autoclave test will be made at Bochum (MESY) up to 250 °C in September, followed by field tests in Los Alamos or at Salton Sea.

**- HT-Fluid Sampler/-Sensors SANDIA (Lysne)**
**Downhole Memory-Logging Tools**

Logging technologies developed for hydrocarbon resource evaluation have not migrated into geothermal applications even though data so obtained would strengthen reservoir characterization efforts. Two causative issues have impeded progress: (i) there is a general lack of vetted, high-temperature instrumentation, and (ii) the interpretation of log data generated in a geothermal formation is in its infancy. Memory-logging tools provide a path around the first obstacle by providing quality data at a low cost. There tools feature on-board computers that process and store data, and newer systems may be programmed to make "decisions". Since memory tools are completely self-contained, they are readily deployed using the slick line found on most drilling locations. They have proven to be rugged, and a minimum training program is required for operator personnel. Present tools measure properties such as temperature and pressure, and the development of noise, deviation, and fluid conductivity logs based on existing hardware is relatively easy. A more complex geochemical tool aimed at a quantitative analysis of potassium, uranium and thorium will be available in about one year, and it is expandable into all nuclear measurements common in the hydrocarbon industry. A second tool designed to sample fluids at conditions exceeding 400 °C (752° F) is in the proposal stage. Partnerships are being formed between the geothermal industry, scientific drilling programs, and the national laboratories to define and develop inversion algorithms relating raw tool data to more pertinent information.

- HT-Magnetometer BGR (Bosum)
  See above under Magnetic.

- HT-Tool Status KTB (Bram)
  Ref. 22 gives a complete list of the tools presently under development for HT-environment. The BGT-upgrade will be done by KTB, while the other tools will be done by Schlumberger or different institutes. At the moment no test has been performed for 300 °C.

**- Deep Hole Operation: Capstan, Cable (Zoth)**

Due to the very high day rate for the drilling rig an installation for the logging system was designed to cut out rig-up and rig-down time completely. The logging cable is guided through a subsurface tunnel from the unit to the derrick and run over two sheave wheels in to the rig. It remains in the rig permanetely. Logging tools are prepared and calibrated while the drill pipes are still pulled. After the last pipe is out - the top sheave is placed over the borehole by a moveable arm and logging operation starts without delay (Ref. 23).

End of May 1992 the Capstan Unit - needed for operations in deeper holes - was installed. It is a new design including a compensating device. The Capstan will take the pull on line via two friction wheels with 5 wraps of cable each. The wheels are driven by hydraulic motors and have a diameter of 1.15 m.

Synchroneous motion of winch and capstan is reached by close control from the hydraulic system (Ref. 24).

The logging operations in the pilot well and down to 6000 m in the deep hole were performed using a VECTOR 7-46 V cable. A total of 1940 km of cable movement has been recorded without problems. With the installation of the capstan a longer cable with larger outer diameter (5000 m 7-52 V with 4100 m of 7-52 NA) was mounted on the larger drum of the winch. With this cable operations down to 8500 m will be handled. For the interval from 8500 - 10.000 m a piece of 2000 m length of smaller cable (7-39 TFE) will be spliced by a quick joint to the 7-52 VNA cable. This smaller cable will be run from a separate winch.

If the 7-39 TFE cable will cause problems due to temperature an alternative would be the mineral-isolated cable from BICC. A cable head for this type of cable is under development.

## 7. Crosshole Experiments:

**- Interwell Seismic CSM (Green)**

Surface and single hole seismic surveys have provided a wealth of information for the earth scientist including the following:

- Imaging boundaries.
- Physical rock properties.
- Calibration of surface seismics.
- Wave propagation studies.

Cross-hole seismic surveys provide all this information but fill a gap in the seismic spectrum. Surface reflection and refraction surveys operate at frequencies of up to 100 Hz and are limited by surface operation. Higher resolution single hole methods such as sonic and BHTV logs operate at more than 1 kHz but suffer lack of penetration and the effects of the borehole itself. Cross-hole seismics provides high resolution information between 0.1-1 kHz in the undisturbed region between boreholes.

Cross-hole surveys are now routine in some areas such as engineering and geothermal investigations. There are a variety of source and receivers existing that enable surveys to take place at depth of up to 3 km with interwell distances of 500 metres with the main choice being between clamped and unclamped tools. The tools used, however, must be determinded by the end use. Wave propagation studies would require a clamped 3 component receiver but velocity attenuation tomography is porbably more cost effectively carried out using hydrophones.

It is recommended that consideration of cross-well surveys by ODP should go through the following definition studies:

| | | |
|---|---|---|
| Phase 1: | Define objectives | (physical properties, boundary imaging etc). |
| Phase 2: | Define constraints | (borehole diameter, temperature etc). |
| Phase 3: | Define hardware | (clamped/unclamped etc. |

**8. ODP-Data Net Vision (De Menocal)**

The Borehole Research Group (Lamont) is planning to implement a new program, called DataNet, which will significantly broaden the ODP logging operations and provide an internationally-available database resource. The DataNet concept is a management structure as well as a product. The essence of DataNet is that it provides the means to address three growing concerns within ODP: 1) increased international participation, 2) rapid, global accessibility of ODP log and core data, and 3) integration of log and core data. Lamont will remain the managerial hub of logging operations, but an intrinsic part of DataNet is to gradually distribute some of the logging contractor's responsibilities over to other DataNet-affiliated institutions. Thus, DataNet will enhance international cooperation, and produce a larger resource base since the affiliate institutions bring with them added expertise and experience. We plan to retain a single JOI contract for logging operations and DataNet; subcontracts to DataNet affiliates will be managed from Lamont.

Implementation of the DataNet structure will proceed in four phases. The first phase is business-as-usual until the end of FY92, with the renewal phase planning for the implementation of a full-scale DataNet proposal to JOI as a target goal. Phase II (FY93) marks the beginning of any real changes; we plan to develop and pilot-test essential software components of the DataNet database, and shipboard technical support and core-log data integration centers will be phased-in at IMT (Marseille) and URI (Rhode Island). Some of the critical routines required for the DataNet database have been developed at Lamont already (GeoBase, Sybase, GMT, and CORPAC programs) on-line. During Phase III (FY94) we plan to expand database development and testing and have a core-log data integration center in-place at Lamont

The beginning of Phase IV (FY95) marks the full implemantation of DataNet management and products. We plan to have the DataNet software package on-line and available for global access through internet by the beginning of FY95. Shipboard logging operations will be managed by IMT (Marseille) through an annual subcontract from Lamont. Core-log integration workstations will be installed at Lamont, URI (University of Rhode Island), TAMU (Texas A & M University), UNB (University of New Brunswick), and the ship; log analysis centers will be installed at Lamont, IMT, Leicester, and Karlsruhe. Phase IV marks the official end of business-as-usual operations and marks the beginning of a new international logging resource base whereby ODP core and log data are rapidly accessible through internet, and powerful computational tools are available to analyze, integrate, and extract these data.

The DataNet plan is our response to the evolving needs of the ODP community. We also hope to include the KTB program and its data within the DataNet environment. Merely repackaging the standard BRG logging service in this renewal phase is neither an efficient nor effective way to promote growth for the ODP program as a whole. DataNet is a forward-looking project, and we would like to include these features in the renewal proposal.

**- SEL Software (Draxler for Sturmeit)**

KTB has developed over the last four years a comprehensive software package for handling and manipulating data from different sources like drilling, logging, core analysis. The data can be in digital or analog from, numerical or continuous, fixed or variable sampling rate. In addition graphic display possibilities have been created to produce any kind of plot and combine data from these different sources. The package is called SEL from "SELECT".

For the data processing at the logging center additional software from CSN (Compagnie de Services Numériques, Paris) and Schlumberger (Formation Evaluation Package) is evailable.

These software packages run on the Micro VAX III installed at the logging center and is linked to the main frame VAX at the field laboratory. A data link to Hannover exists (9600 bauds). The evaluation of the Formation Micro Imager is done on a MAC II with software from Stanford University, modified and upgraded by Karlsruhe University.

Via the link to the field laboratory logging data (for ex. the reference Gamma Ray Log) is transfered to and constantly updated at the KTBase the KTB operational data base.

To support operational decisions fast "Quick Look" data outputs can be produced - like horizontal or vertical projections of the borehole trajectory. At the same time, formation evaluation studies are made exploiting data from logs, drilling and sample analysis.

The SEL package is the easy and fast manipulation device of the systam (Ref. 25 and 26).

## 9. Visits

After the meeting visits were made to the field laboratory, the drilling rig the automatic sampling system and the logging center.

The processing of sample material (cores, cuttings, drilling, powder, mud, gases) was explained by H.-G. Dietrich while visiting the individual sectors of the field laboratory.

The drilling rig and the associated installations were explaned by Tran Viet (KTB drilling engineer) and J. Draxler. The operation of the pipe handling equipment could be seen during a round trip operation.

Heinisch explained the automatic sampling system, but could not demonstrate it, as installation is not complete yet.

The tour through the logging center was guided by J. Draxler. The operation of the capstan and the logging system installation was explained. A visit to the data processing center closed the tour of the KTB drilling site.

## 10. Remarks

This protocol was compiled from abstracts of the presentations provided by the participants. If abstracts had not arrived in time, a short summary was written from notes taken during the meeting.

The KTB Projekt Management likes to thank the participants for their valued contributions to this second joint meeting.

J. Draxler

Hannover, July 9th 1992

Appendix: Ref. 1 - 24

000106

# Joint Meeting DMP/KTB

## Windischeschenbach, June 2nd 1992
## KTB Oberpfalz HB
## Agenda

| | | |
|---|---|---|
| 8.30 | Welcome and Introductions, Discussion / Adoption of Agenda | (Bram) |
| 8.45 | Review of German ODP Activity | (Beiersdorf) |
| 9.00 | Status Report KTB-Oberpfalz HB | (Kehrer) |
| 9.15 | Results: KTB-Oberpfalz HB, 0 - 6000 m | |
| | Drilling Operation: | (Chur) |
| | Vertical Drilling Technology | |
| | Large Diameter Coring | |
| | Casing Scheme and Application | |
| | Cementation 16" and 13 3/8" Strings | |
| | Logging Operations and Evaluations | (Draxler) |
| | Highlights New Logging Tools (FMI, DSI, ALAT, GLT) | |
| | Correlation GLT with XRF/XRD | (Gatto) |
| | Borehole Stability (Break-outs) | (Kück) |
| | Geothermic: Temperature Evaluation | (Zoth) |
| | Geohydraulic: Testing and Sampling | (Kessels) |
| | Hydrofrac Experiment | |
| 10.30 Break | | |
| 10.45 | Magnetic: Report on Tool Performance and Evaluation | (Bosum/ Fieberg) |
| | Seismic: VSP and ISO 89 (3-D Survey) | (Bram) |
| 11.15 | Sampling / Coring Innovations: | |
| | Sonic Core Monitor | (Fisher) |
| | Automatic Sampling System | (Heinisch) |
| | Sedimentation Sub - Evaluation | (Lich/Rust) |
| | Gamma Spectroscopy on Cores and Cuttings | (Bücker) |
| 12.00 | HT-Tool Development and Tool Performance: | |
| | New Tool Performance Report LDGO | (DeMenocal) |
| | Packer Flowmeter | (Morin) |
| 12.30 Lunch | | |
| 14.00 | HT-Resistivity Tool Development CSM | (Manning) |
| | HT-Fluid Sampler / -Sensors SANDIA | (Lysne) |
| | HT-Magnetometer BGR | (Bosum) |
| | HT-Tool Status KTB | (Bram) |
| | Deep Hole Operation: Capstan, Cable | (Zoth) |

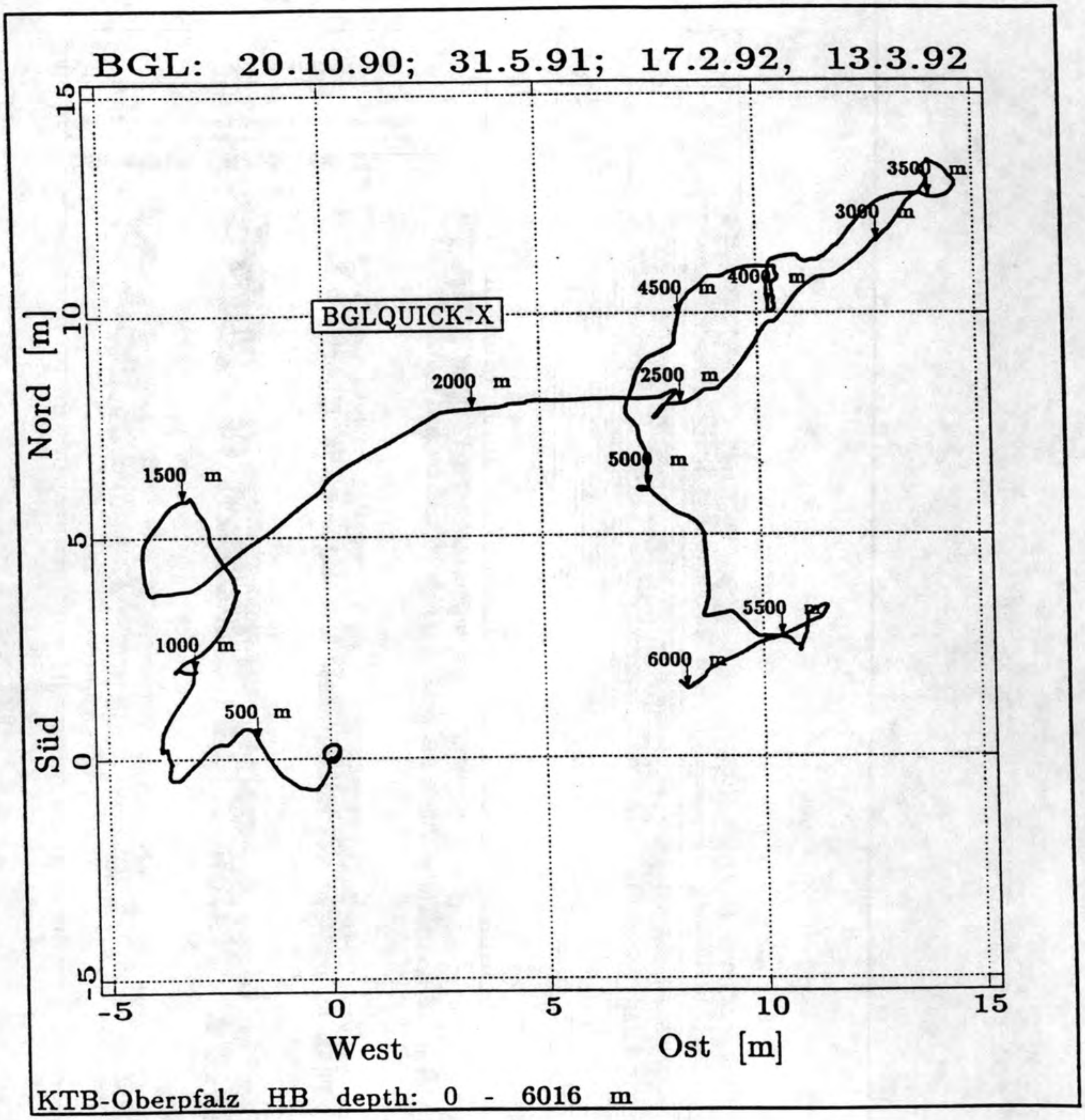
000108

| | | |
|---|---|---|
| 15.15 | Crosshole Experiments:<br>Interwell Seismic CSM | (Green) |
| 15.45 | ODP Data-Net Vision<br>SEL Software | (DeMenocal)<br>(Sturmeit) |
| 16.30 | Visits: KTB Logging Centre<br>Drilling Rig<br>Field Laboratory | (Bram/Draxler)<br>(Chur/Tran Viet)<br>(Dietrich). |

J.Draxler
Hannover, May 29th 1992

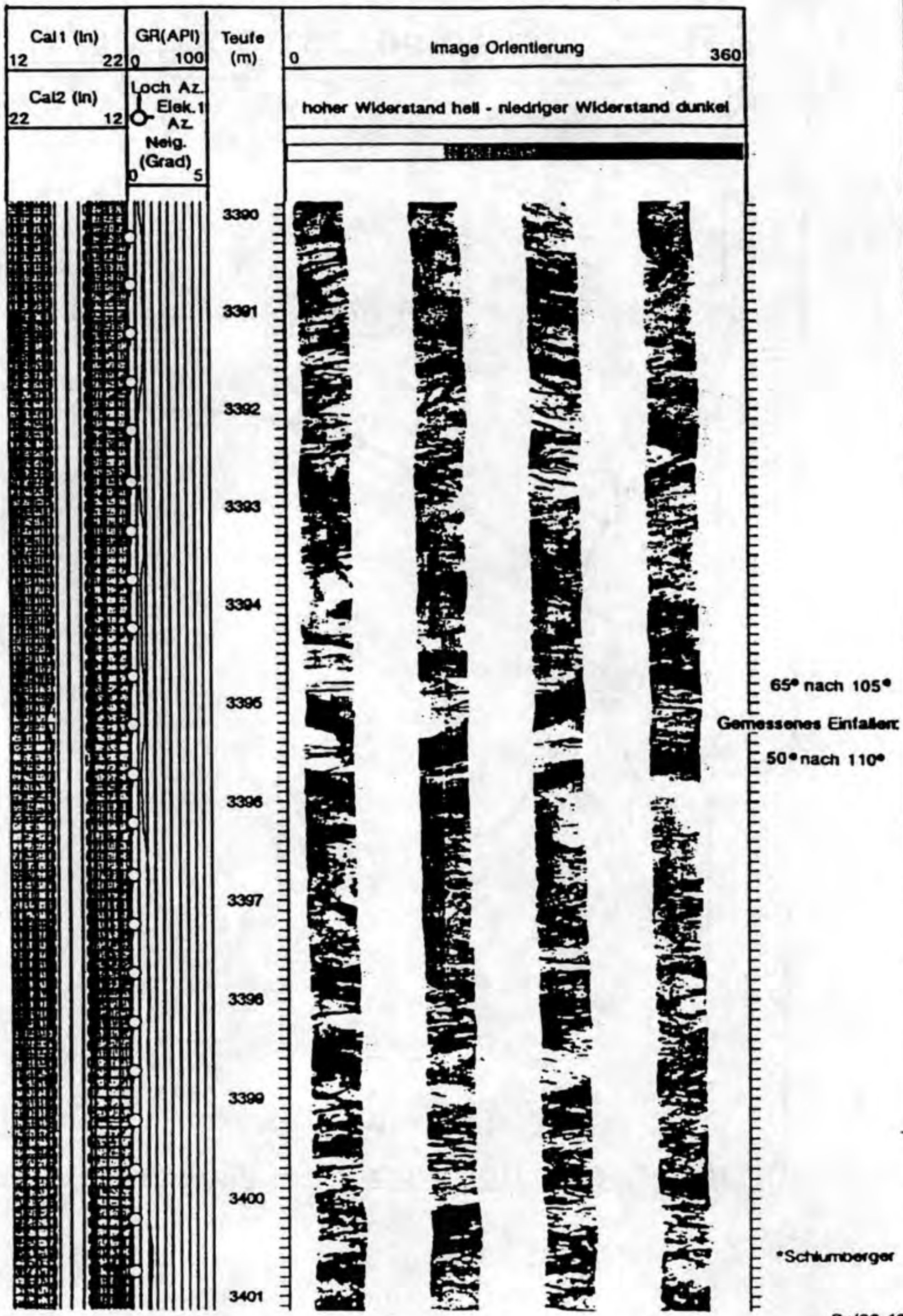
Ref.2

# KTB-Oberpfalz HB
# Horizontal Projection



Ref.3

# FORMATION MICROIMAGER (FMI)*
## Fracture Detection




*Schlumberger

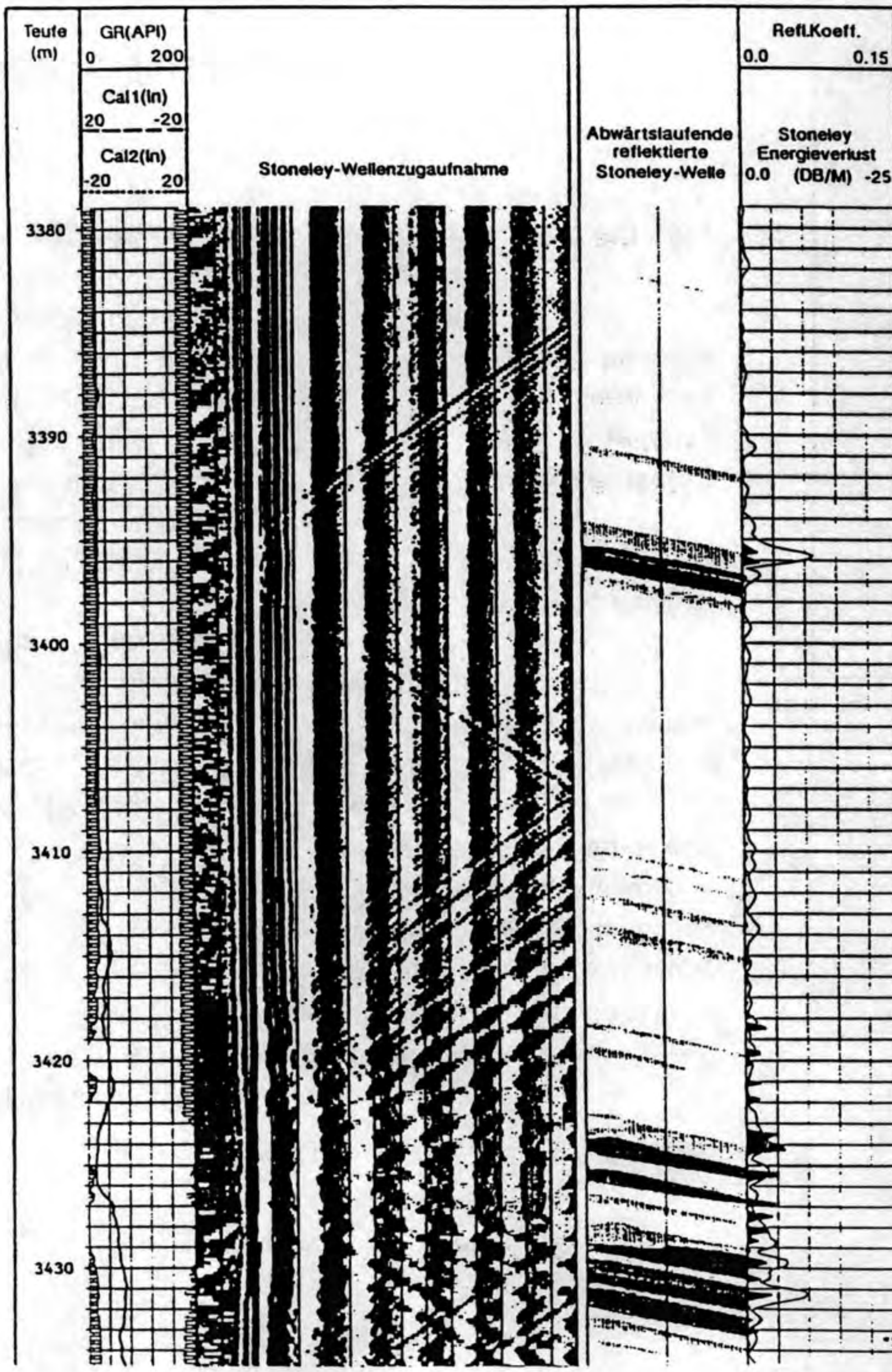
Dx/92-13

000111

Ref.4

# DIPOLE SONIC IMAGER (DSI)*

## Fracture Detection




*Schlumberger

Dx/92-12

# AZIMUTHAL ARRAY IMAGER (ALAT)

## PRELIMINARY SPECIFICATIONS

| | | |
|---|---|---|
| Tool Diameter | (small sub) | 3 5/8" (4 7/8" with stand-offs) |
| | (medium sub) | 6" (7 1/4" with stand-offs) |
| | (large sub) | 9" (10 1/4" with stand-offs) |
| Make-up Length | | 33.75 ft (11.02 m) |
| Tool Weight | | 556 lbs (252 kg) |
| Telemetry Type | | DTS (with DTB through-wiring) |
| Combinability | | Anywhere in the DTS string |
| | | GPIT needed for oriented images |
| | | With FBST, (FBCC housing is A 2) |
| Logging Speed | (high.azim.res.) | 1800 ft/h 0.5" sampling |
| | | 3600 ft/h 1.0" effective sampling |
| | (DLL only) | 7200 ft/h |
| Azimuthal Resolution | | 60 deg. fractures (1" stand-off) |
| Instrumental Accuracy | | 5% (1 < Ra < 2000) |
| | | 10% (2000 < Ra < 5000) |
| Maximum Temperature | | 350 °F (175 °C) |
| Maximum Pressure | | 20,000 psi (140 MPa) |
| Maximum Borehole Diameter | | 21" |
| Minimum Borehole Diameter | | 4 1/2" |

Resistivity Range (Azimuthal Mode);

Formation Resistivity: 0.2 - 40,000 Ohmm

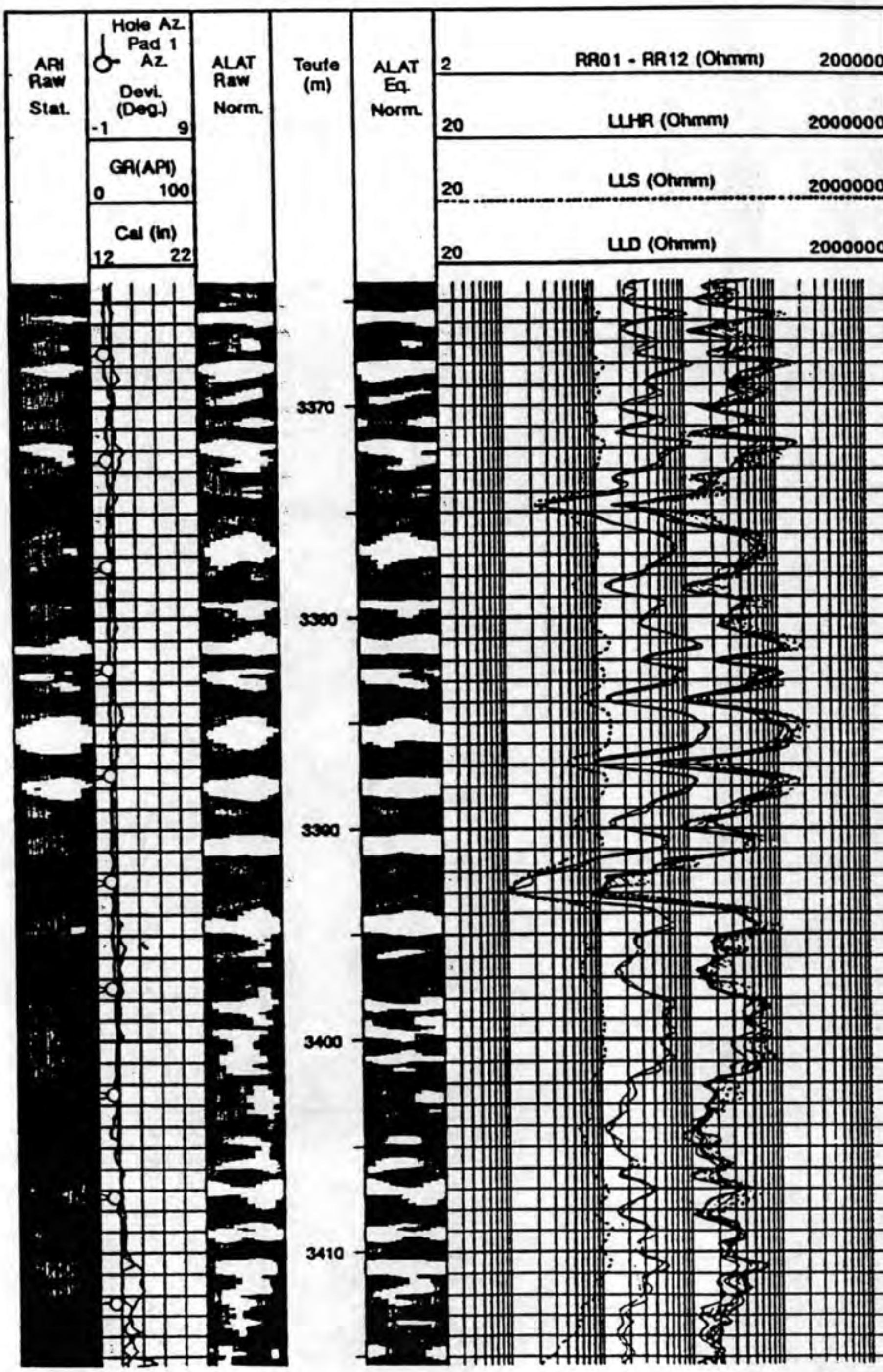
Mud Resistivity (conduct. muds only) up to 2 Ohmm

000113

Ref.6

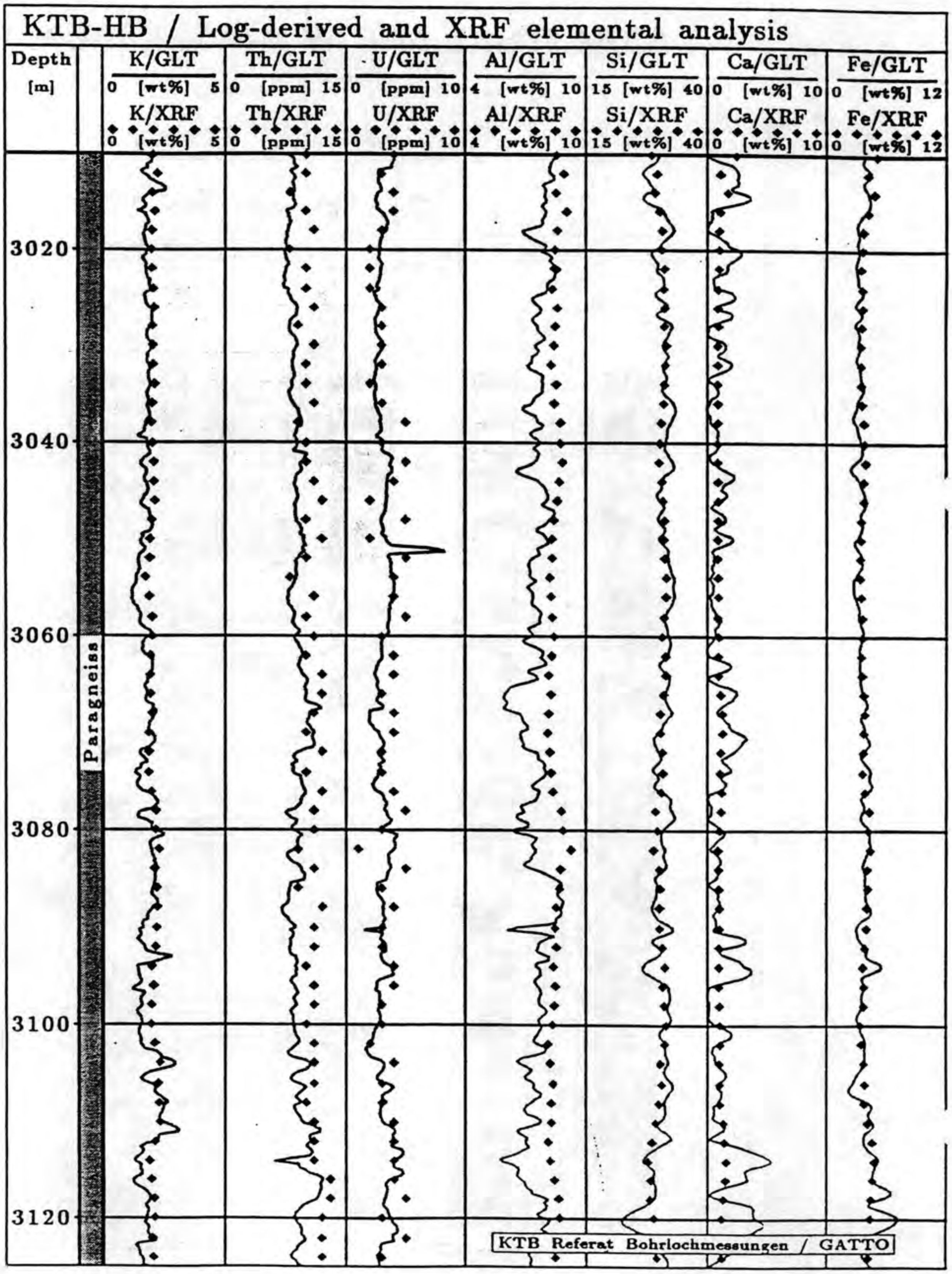
# AZIMUTHAL ARRAY IMAGER (ALAT)*

**(Prototyp)**



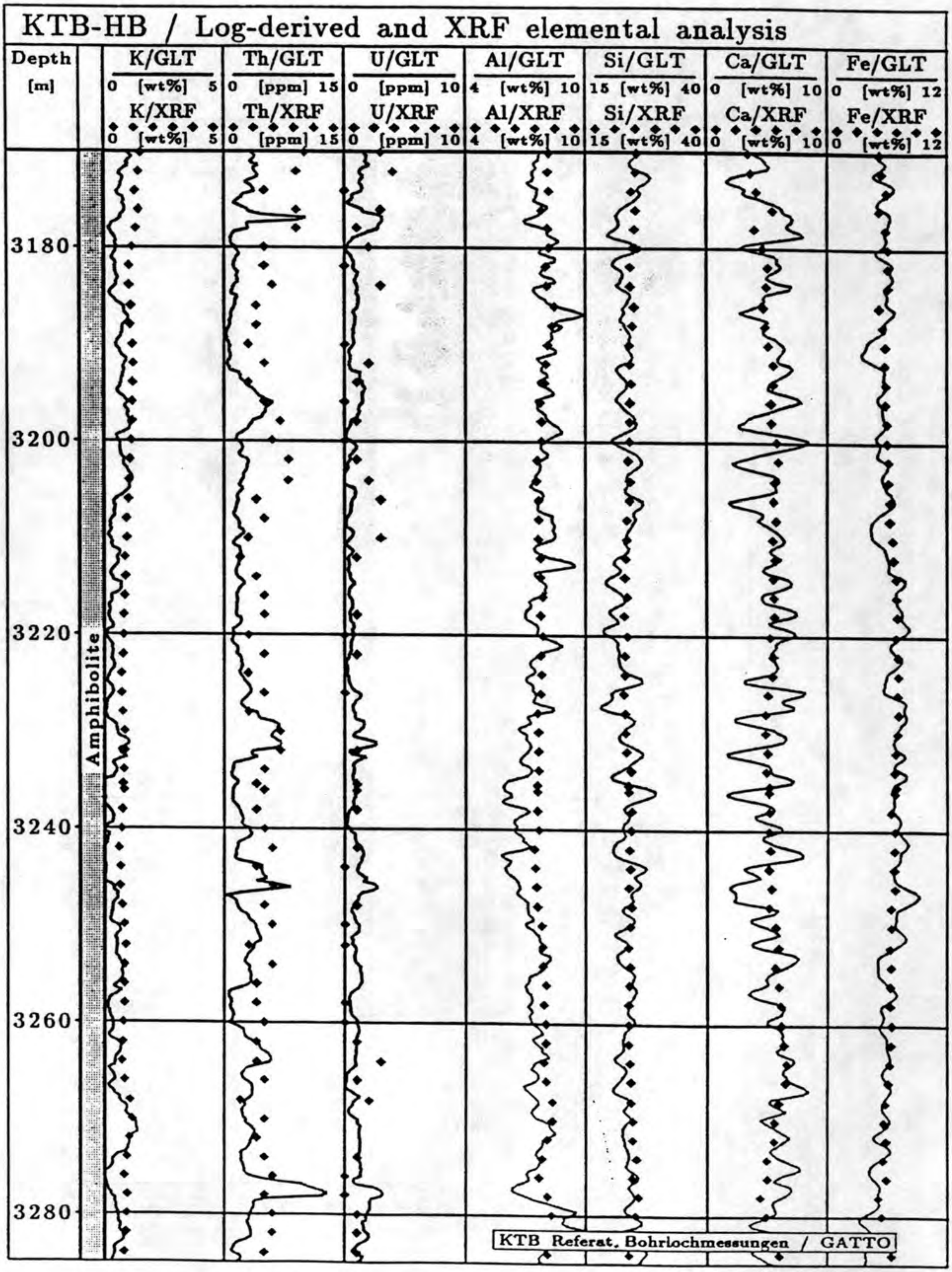
000114

Ref.7



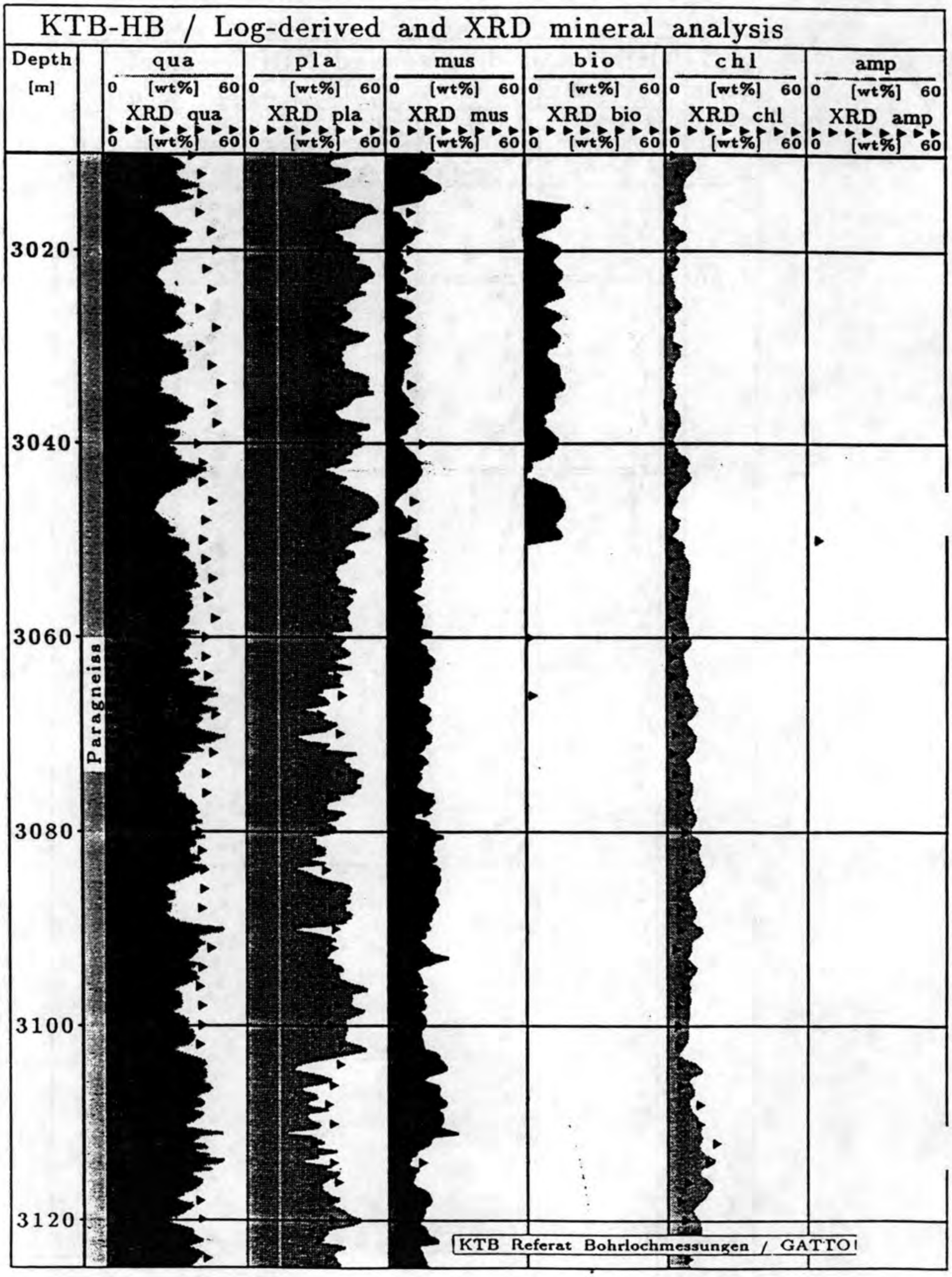
KTB-HB / Log-derived and XRF elemental analysis
Depth [m]
K/GLT 0 [wt%] 5
K/XRF 0 [wt%] 5
Th/GLT 0 [ppm] 15
Th/XRF 0 [ppm] 15
U/GLT 0 [ppm] 10
U/XRF 0 [ppm] 10
Al/GLT 4 [wt%] 10
Al/XRF 4 [wt%] 10
Si/GLT 15 [wt%] 40
Si/XRF 15 [wt%] 40
Ca/GLT 0 [wt%] 10
Ca/XRF 0 [wt%] 10
Fe/GLT 0 [wt%] 12
Fe/XRF 0 [wt%] 12
3020
3040
3060
3080
3100
3120
Paragneiss
KTB Referat Bohrlochmessungen / GATTO

Ref.8

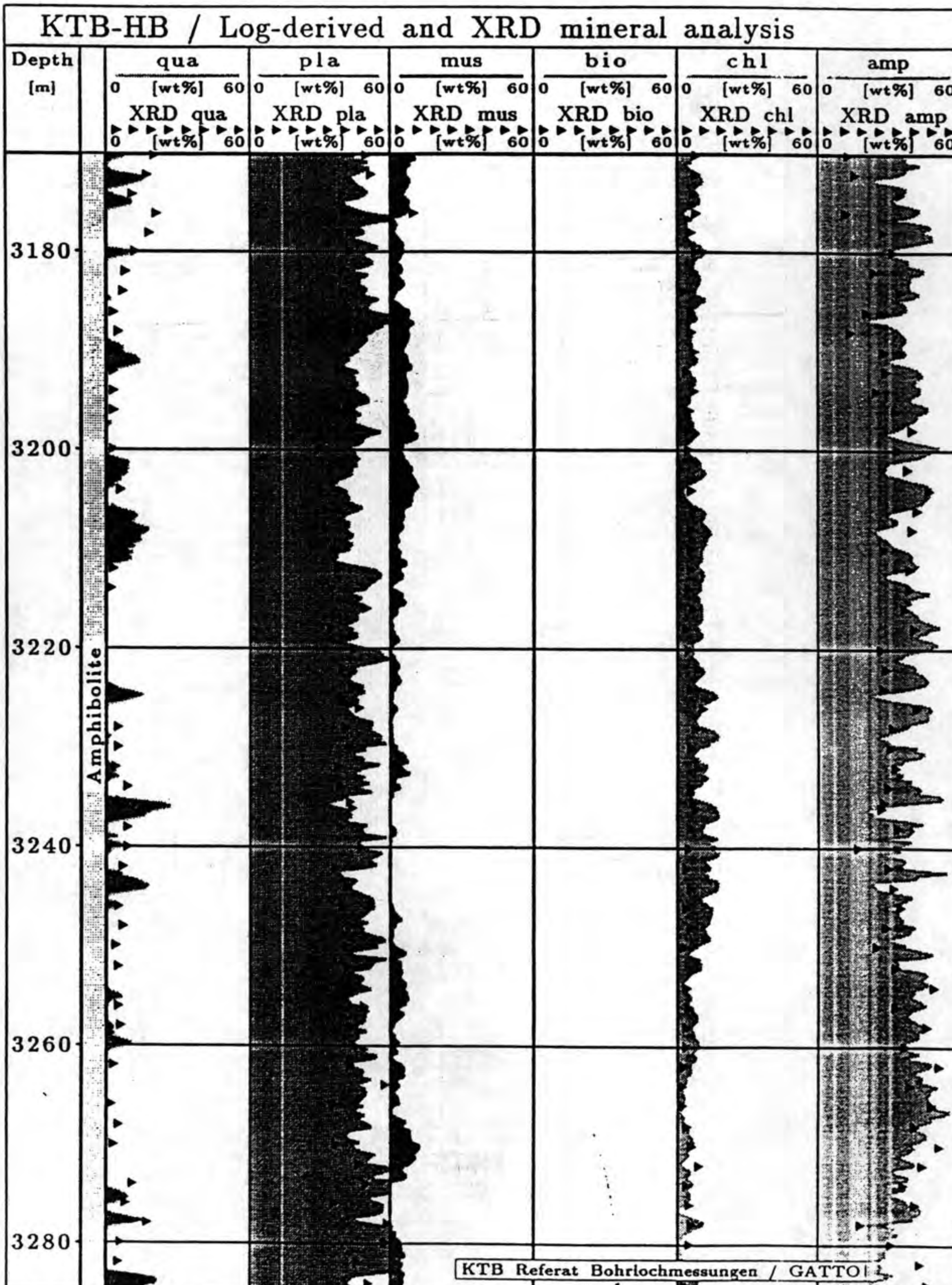

KTB-HB / Log-derived and XRF elemental analysis
Depth [m]
K/GLT 0 [wt%] 5
K/XRF 0 [wt%] 5
Th/GLT 0 [ppm] 15
Th/XRF 0 [ppm] 15
U/GLT 0 [ppm] 10
U/XRF 0 [ppm] 10
Al/GLT 4 [wt%] 10
Al/XRF 4 [wt%] 10
Si/GLT 15 [wt%] 40
Si/XRF 15 [wt%] 40
Ca/GLT 0 [wt%] 10
Ca/XRF 0 [wt%] 10
Fe/GLT 0 [wt%] 12
Fe/XRF 0 [wt%] 12
3180
3200
3220
3240
3260
3280
Amphibolite
KTB Referat, Bohrlochmessungen / GATTO

000116

Ref.9

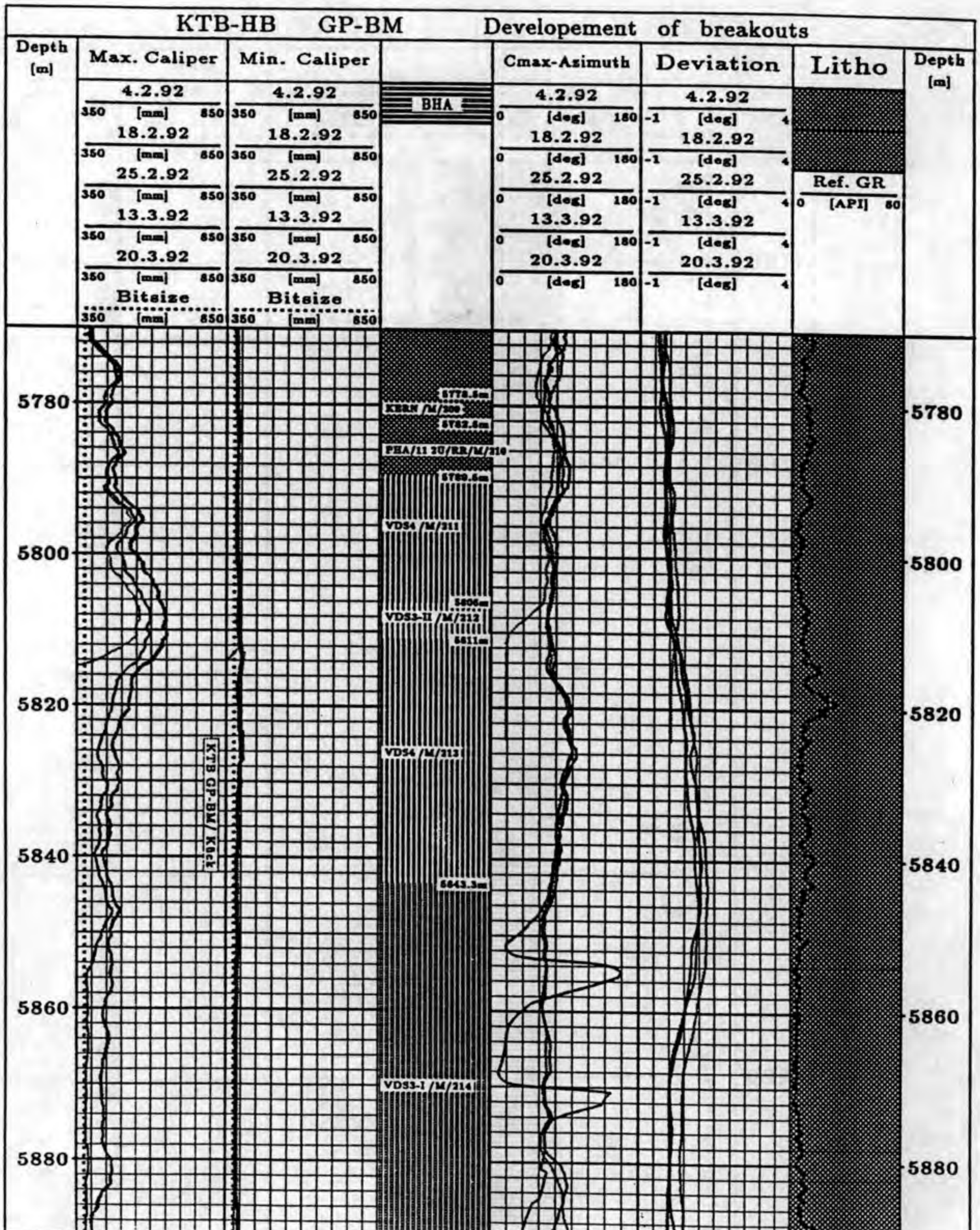


KTB-HB / Log-derived and XRD mineral analysis
Depth [m]
qua 0 [wt%] 60
XRD qua 0 [wt%] 60
pla 0 [wt%] 60
XRD pla 0 [wt%] 60
mus 0 [wt%] 60
XRD mus 0 [wt%] 60
bio 0 [wt%] 60
XRD bio 0 [wt%] 60
chl 0 [wt%] 60
XRD chl 0 [wt%] 60
amp 0 [wt%] 60
XRD amp 0 [wt%] 60
3020
3040
3060
3080
3100
3120
Paragneiss
KTB Referat Bohrlochmessungen / GATTO


KTB-HB / Log-derived and XRD mineral analysis
Depth [m]
qua
pla
mus
bio
chl
amp
0 [wt%] 60
XRD qua
XRD pla
XRD mus
XRD bio
XRD chl
XRD amp
3180
3200
3220
3240
3260
3280
Amphibolite
KTB Referat Bohrlochmessungen / GATTO

000118

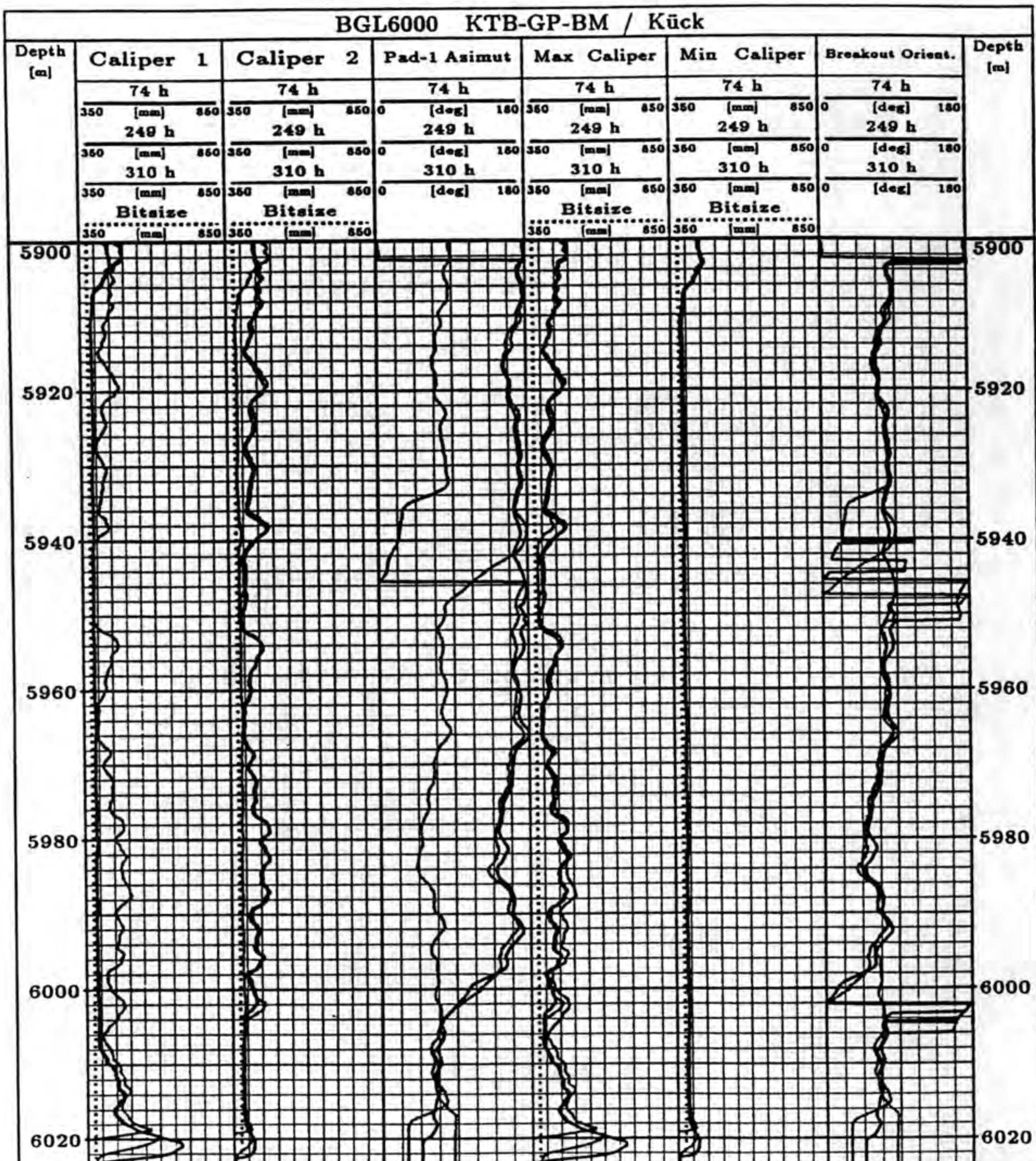
Ref.11




3-JUN-1992 11:37 / KTB-HB Referat Bohrlochmessungen / Kück

000119

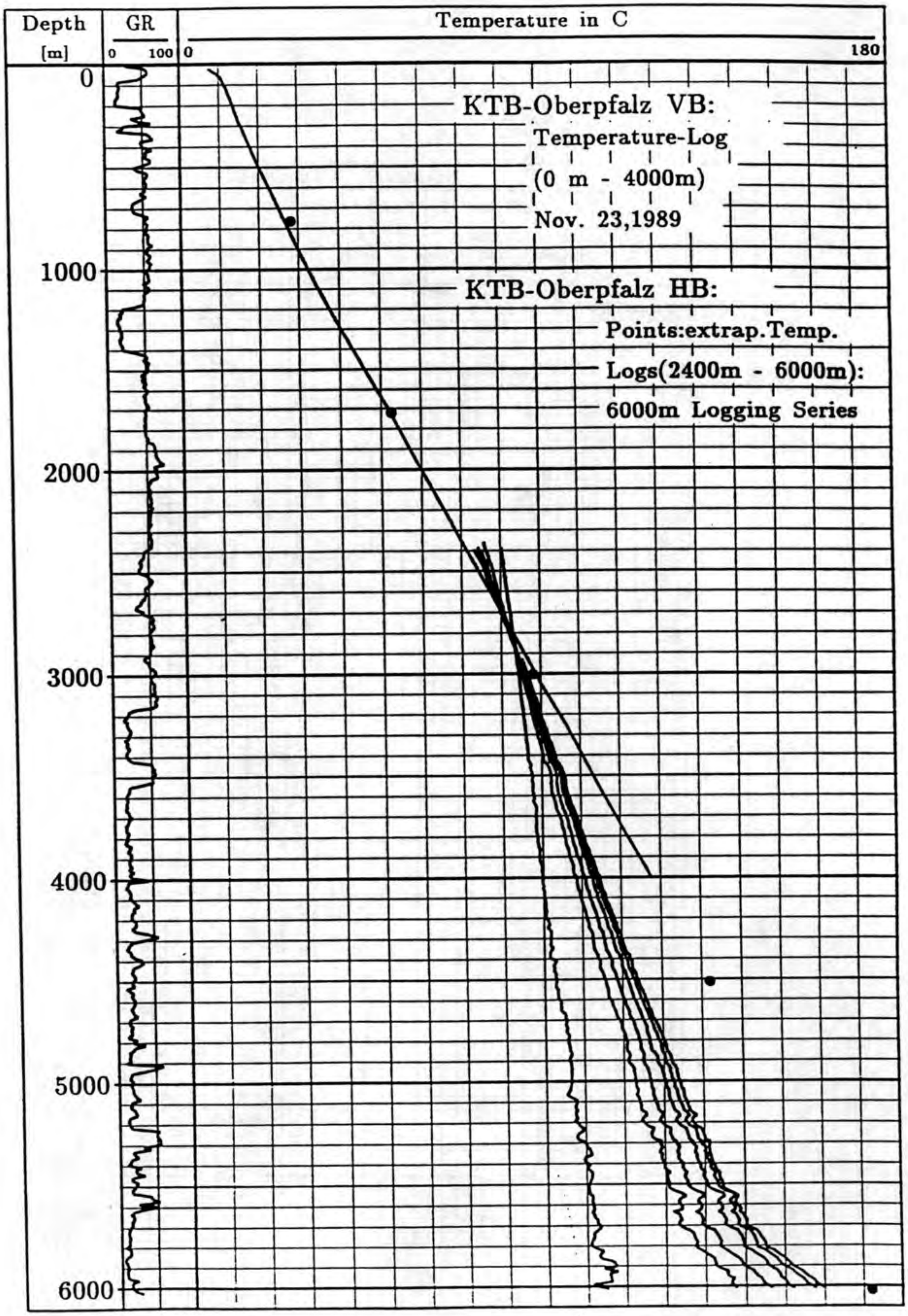
Ref.12




3-JUN-1992 10:37 / KUECK

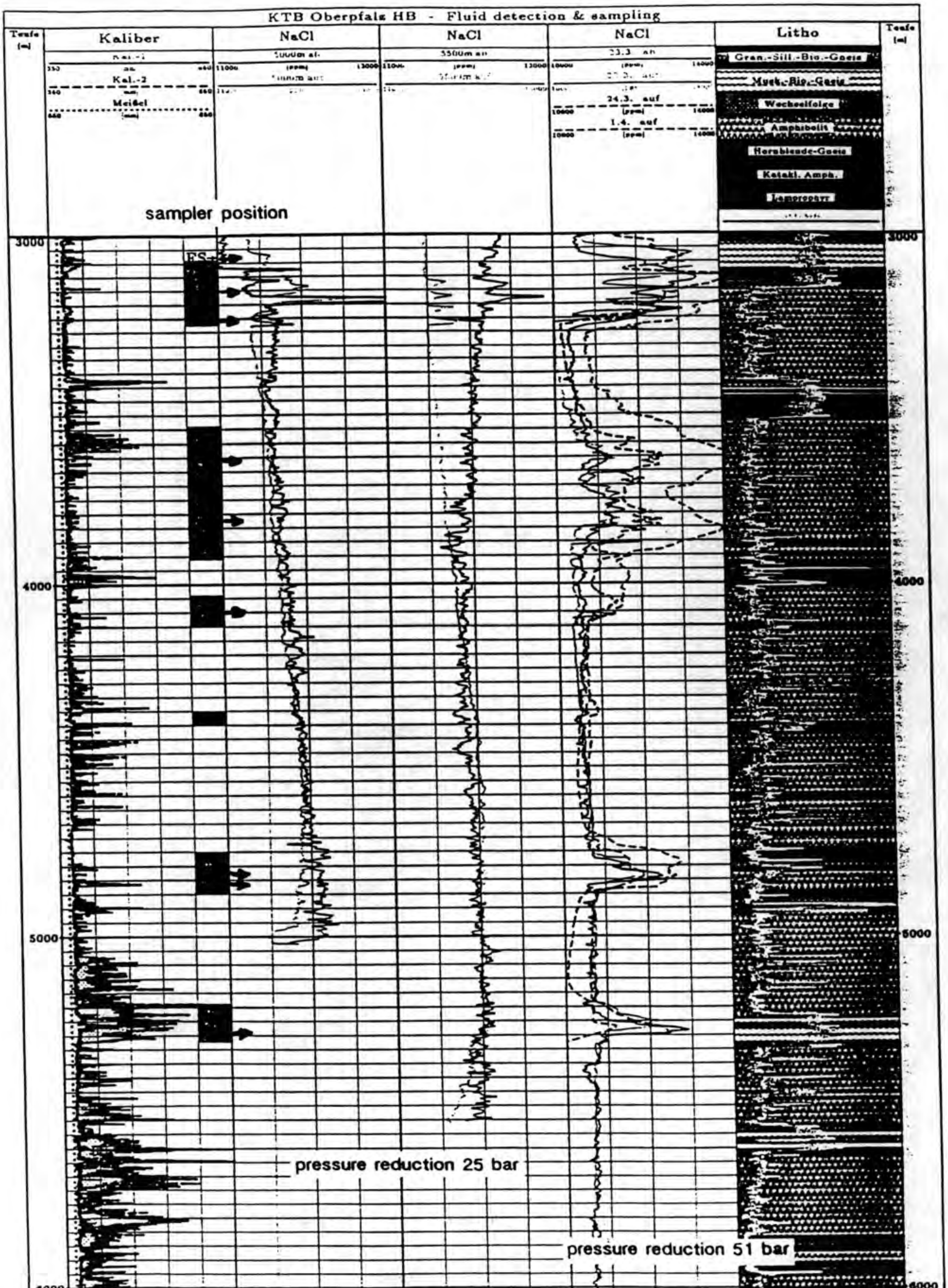
000120

Ref.13




8-JUL-1992 08:33 / ZOTH

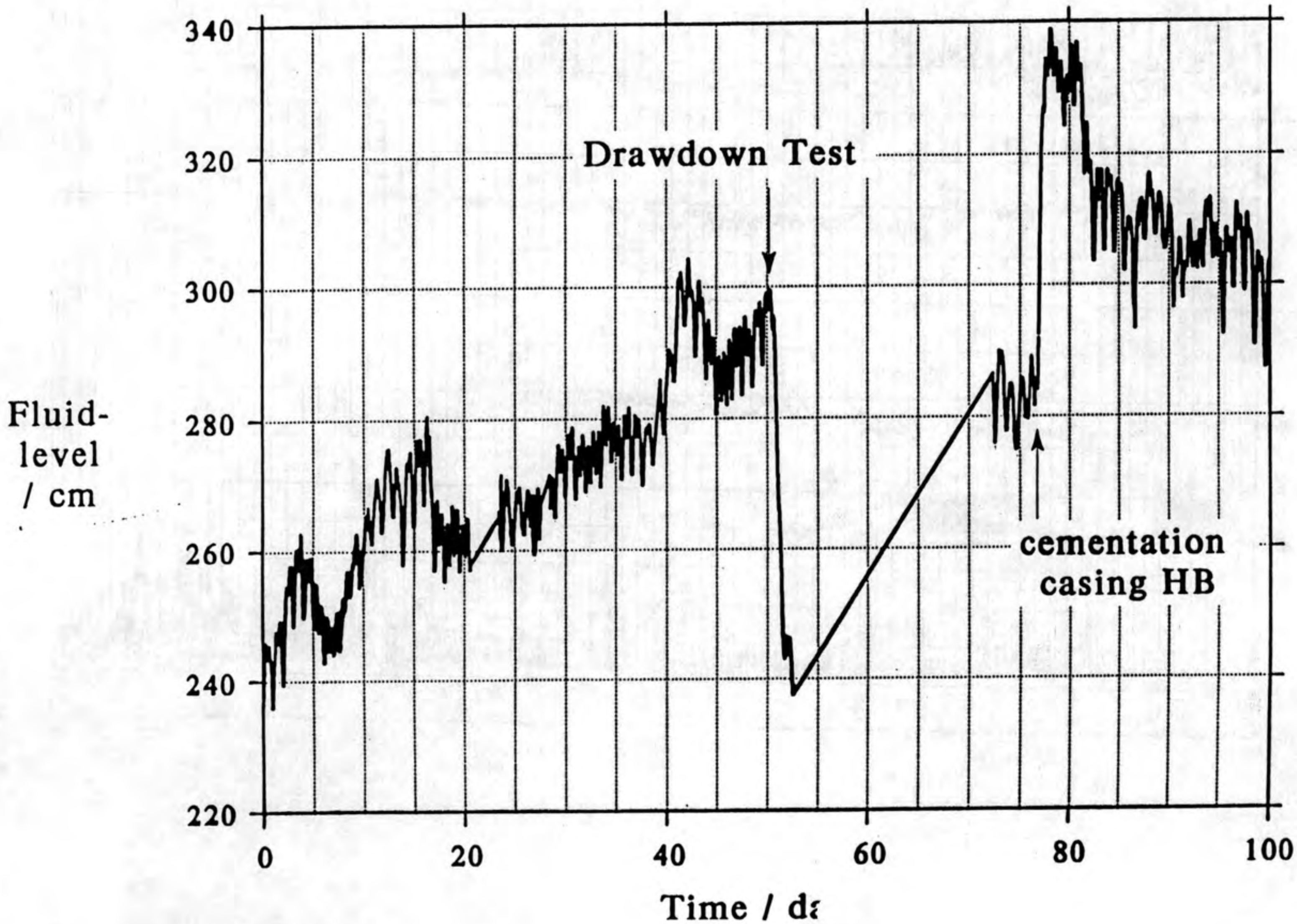
Ref.14




26-MAY-1992 12:44 / KTB-HB Referat Bohrlochmessungen / Kück

## KTB Oberpfalz VB

## Monitoring of the fluid level

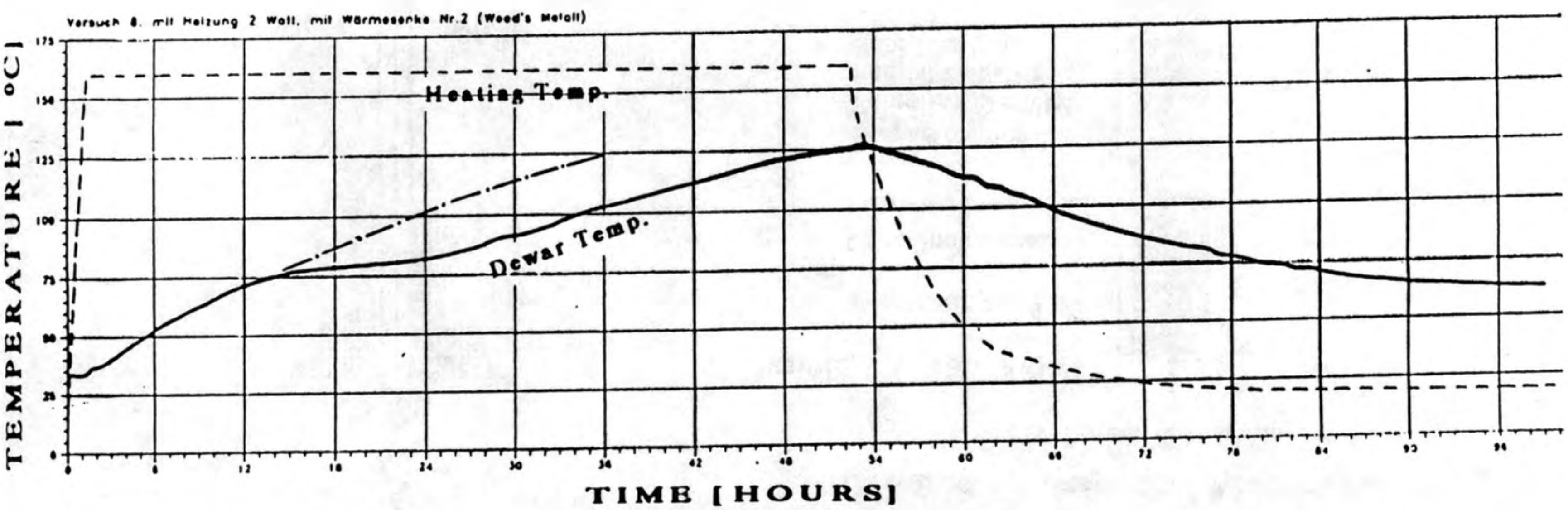



000122

Ref.15

# BGR

## 3-Component Borehole Magnetometer

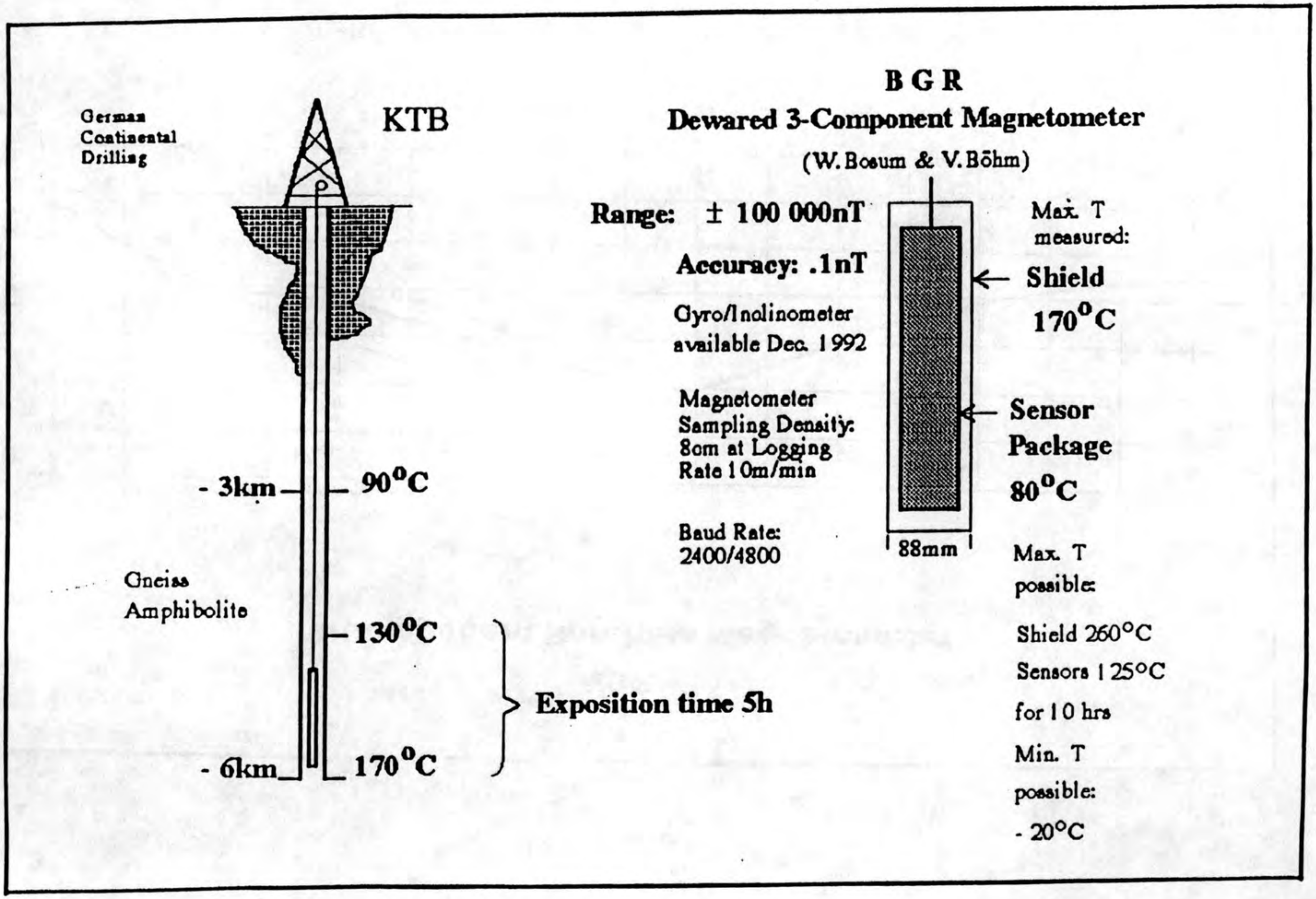



Laboratory Test of Heat Protection System

(December 1991)

000123

Ref.16

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Ref.17

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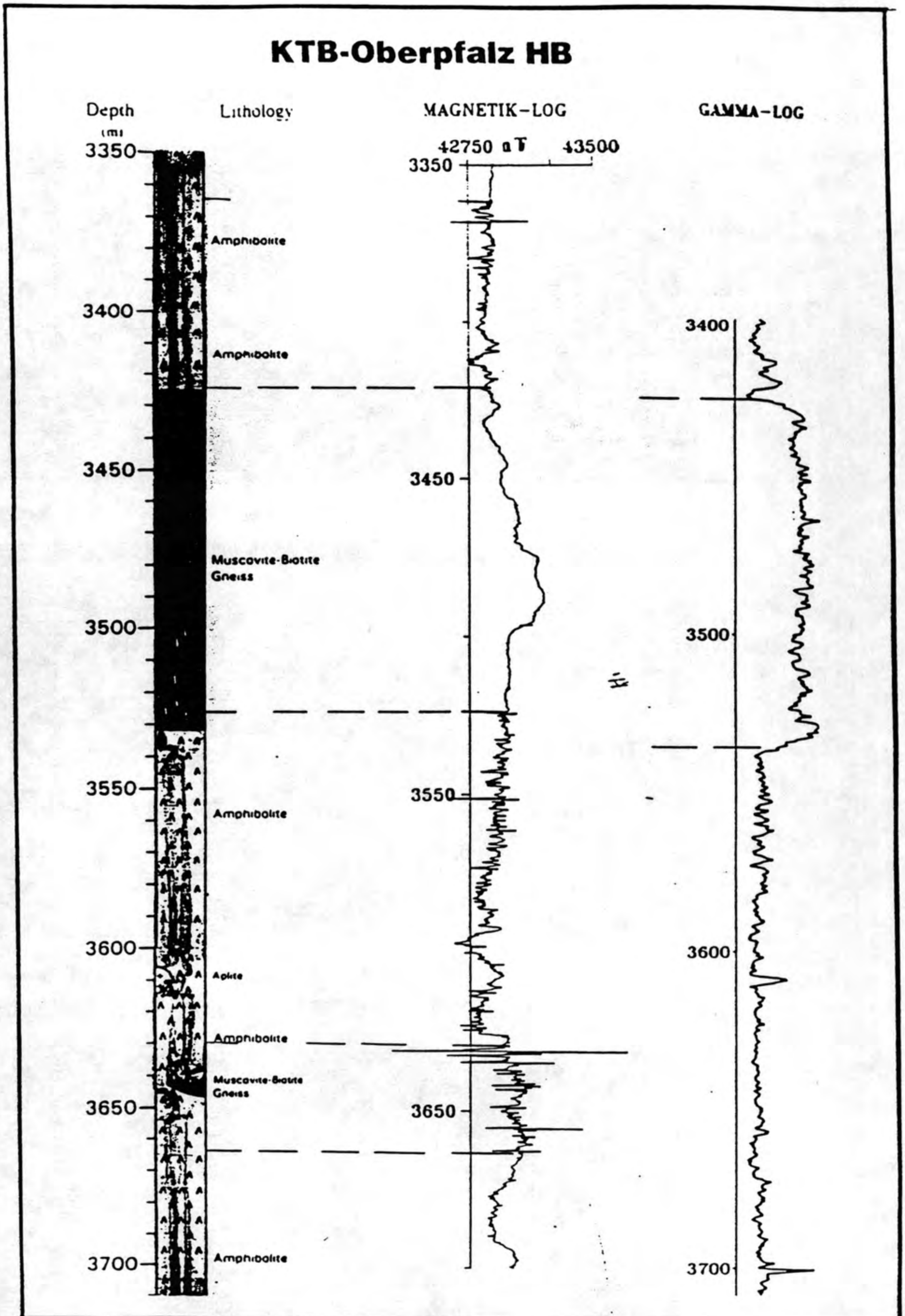
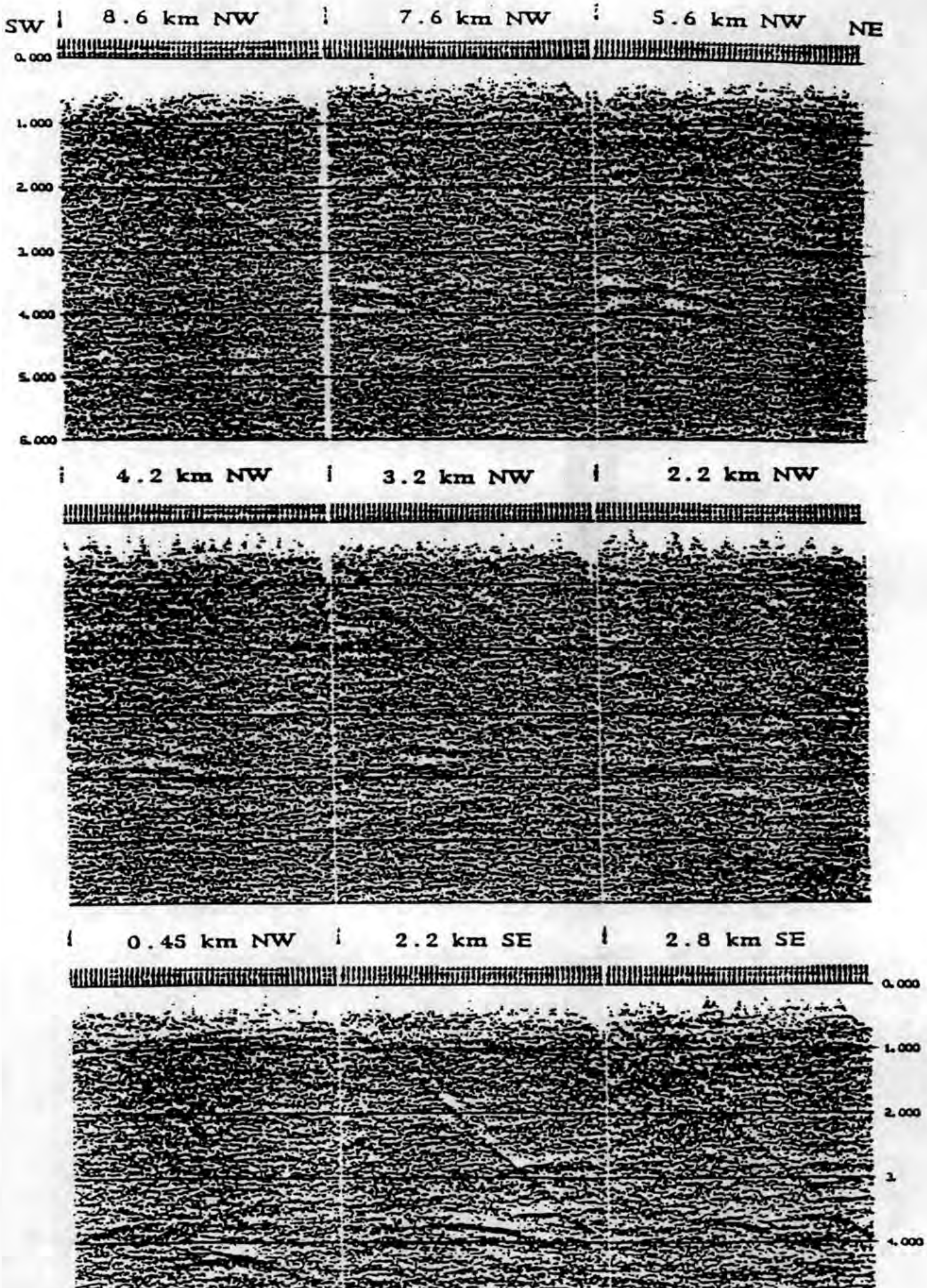
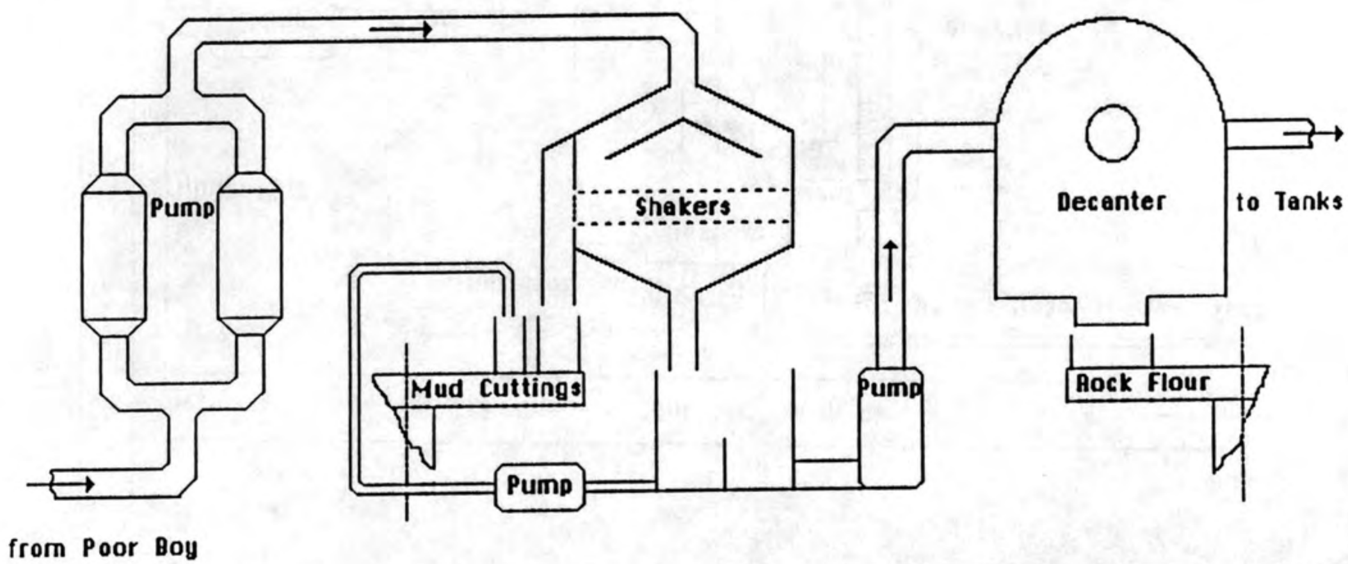
Ref.18






<u>Abb. 3a:</u> Inline-Ausspielungen. Entfernungsangaben über jedem



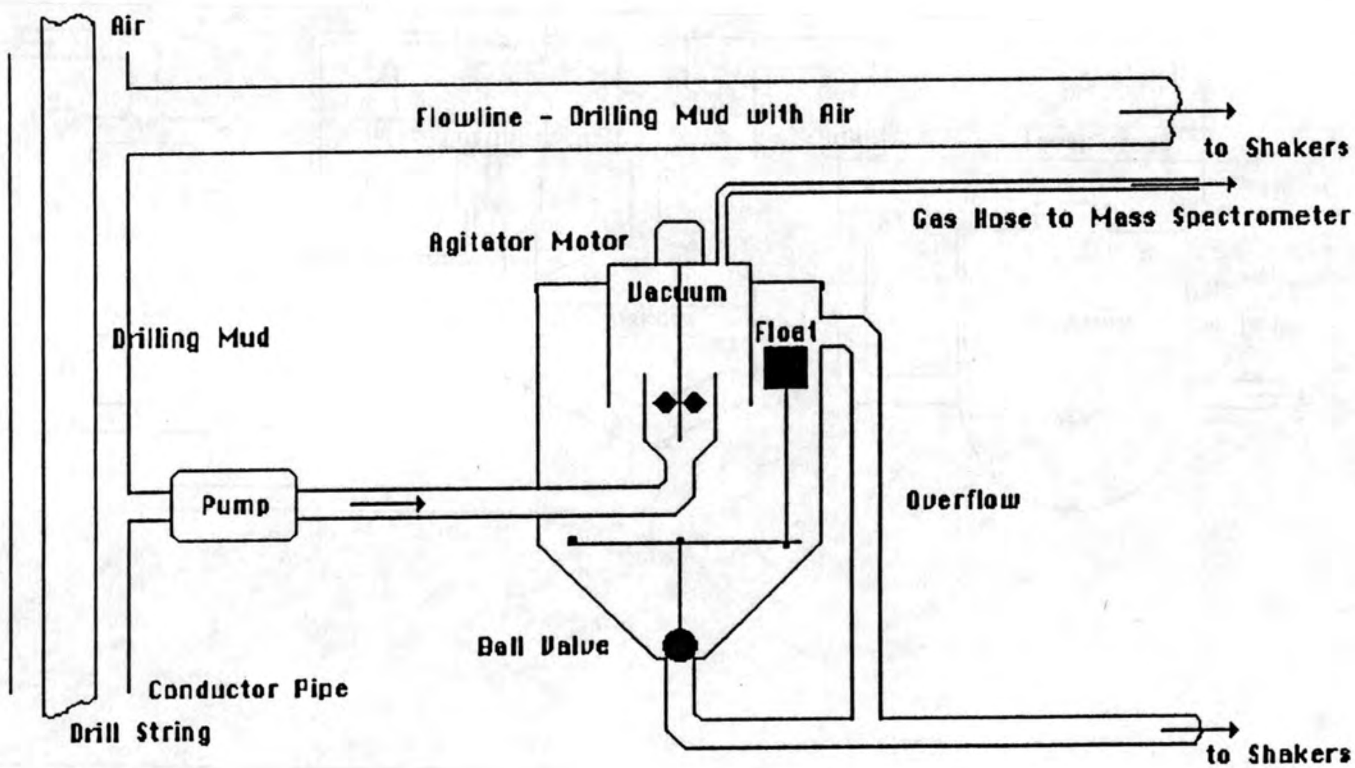

Automatic Sampling System for Cuttings, Mud and Rock Flour

KTB

Niedersächsisches Landesamt für Bodenforschung

Ref.20

000127




Degassing System for Air-uncontaminated Drilling Mud

KTB

Ref.21

Niedersächsisches Landesamt für Bodenforschung

| Tools | Company | Remarks |
|---|---|---|
| Cable head | Thetys/KTB | 300 °C for mineral insulated cable |
| BGT | NLFB-KTB | 200 °C, improvement to 225 °C in progress |
| AMS | Schlumberger | 260 / 300 °C under development |
| BGT/GPIT | Schlumberger | 260 / 300 °C under development |
| FMST | Schlumberger | 260 °C under development |
| SIT | Schlumberger | 260 °C under development |
| FS | Leutert | evaluation above 175 °C underway |
| SP-Redox | Univ. F | evaluation above 175 °C underway |
| Magnetometer | Univ. BS | 125 °C, waiting for appropriate dewar flask |
| Magnetometer | BGR | 175 °C succesfully tested |
| Magnetic Susc. | Univ. M | 125 °C, waiting for appropriate dewar flask |
| BHTV | DMT | 235 °C succesfully tested |

K T B - HEL/VHEL Logging Tool Status

Joint meeting DMP/KTB, June 2nd, 1992

KTB

Niedersächsisches Landesamt für Bodenforschung

000129

Ref.22

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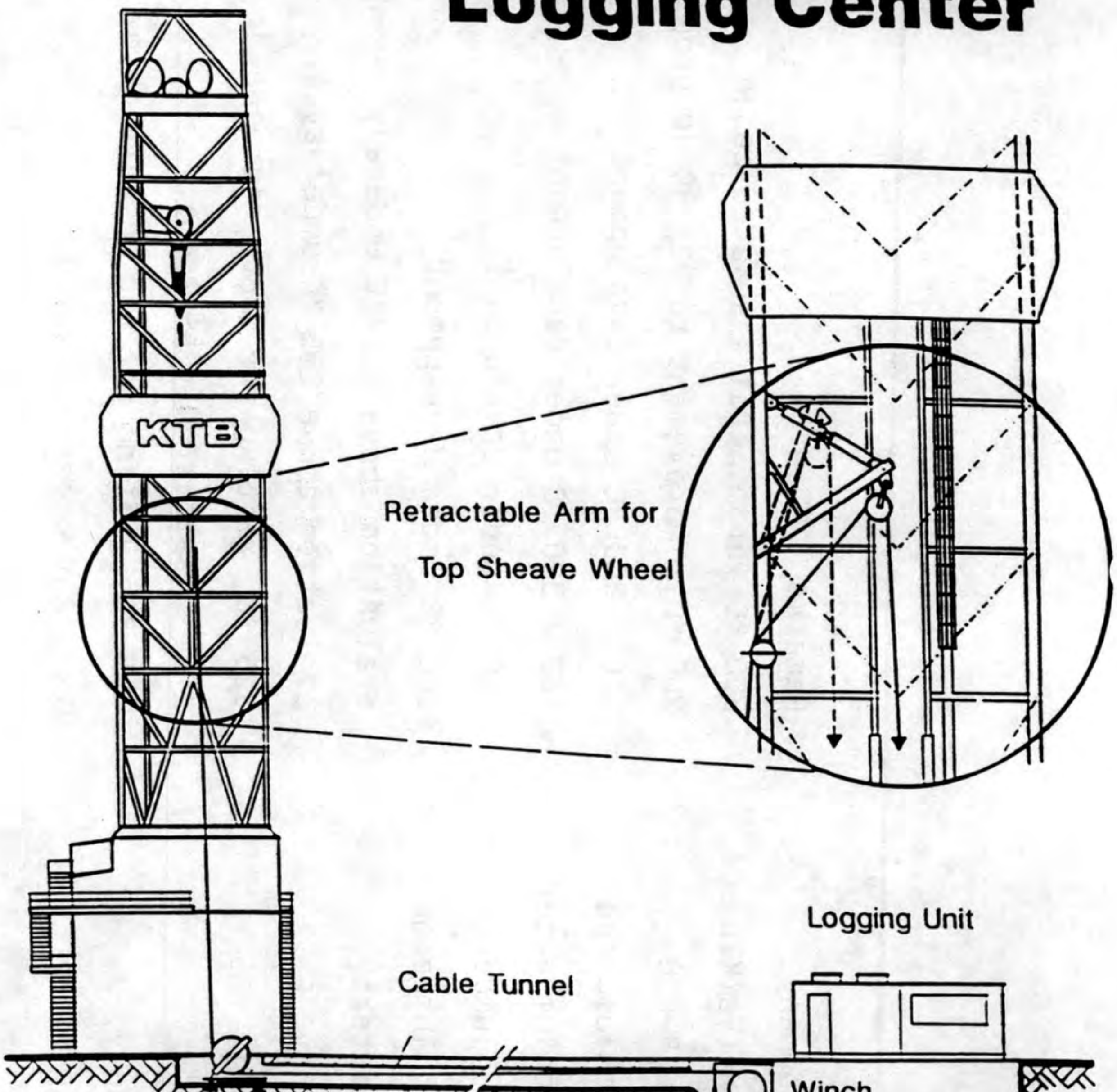
Ref.23

# Logging Center

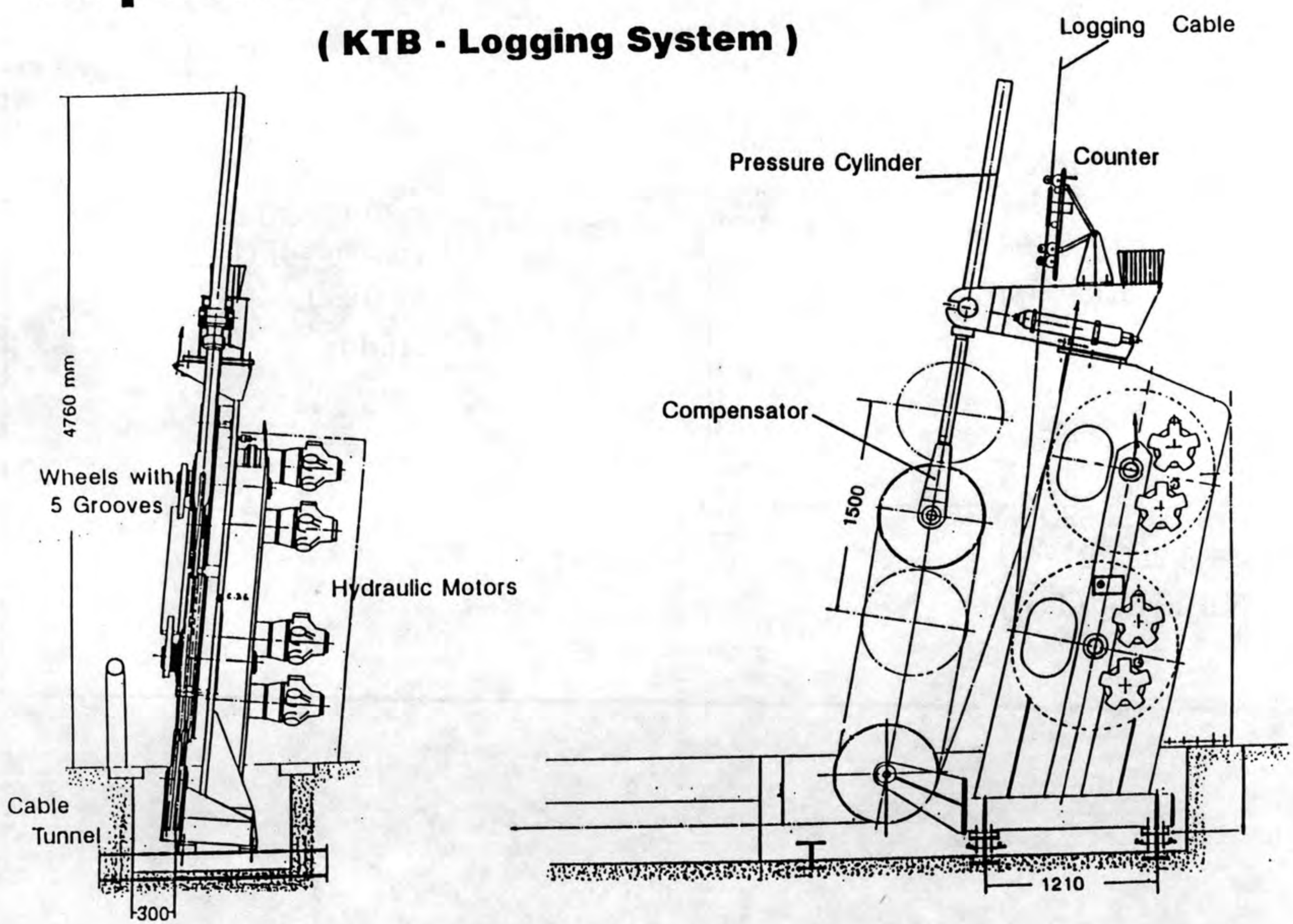



## KTB - Logging System

## Installation for Cable Guidance

# Capstan Unit

## ( KTB - Logging System )

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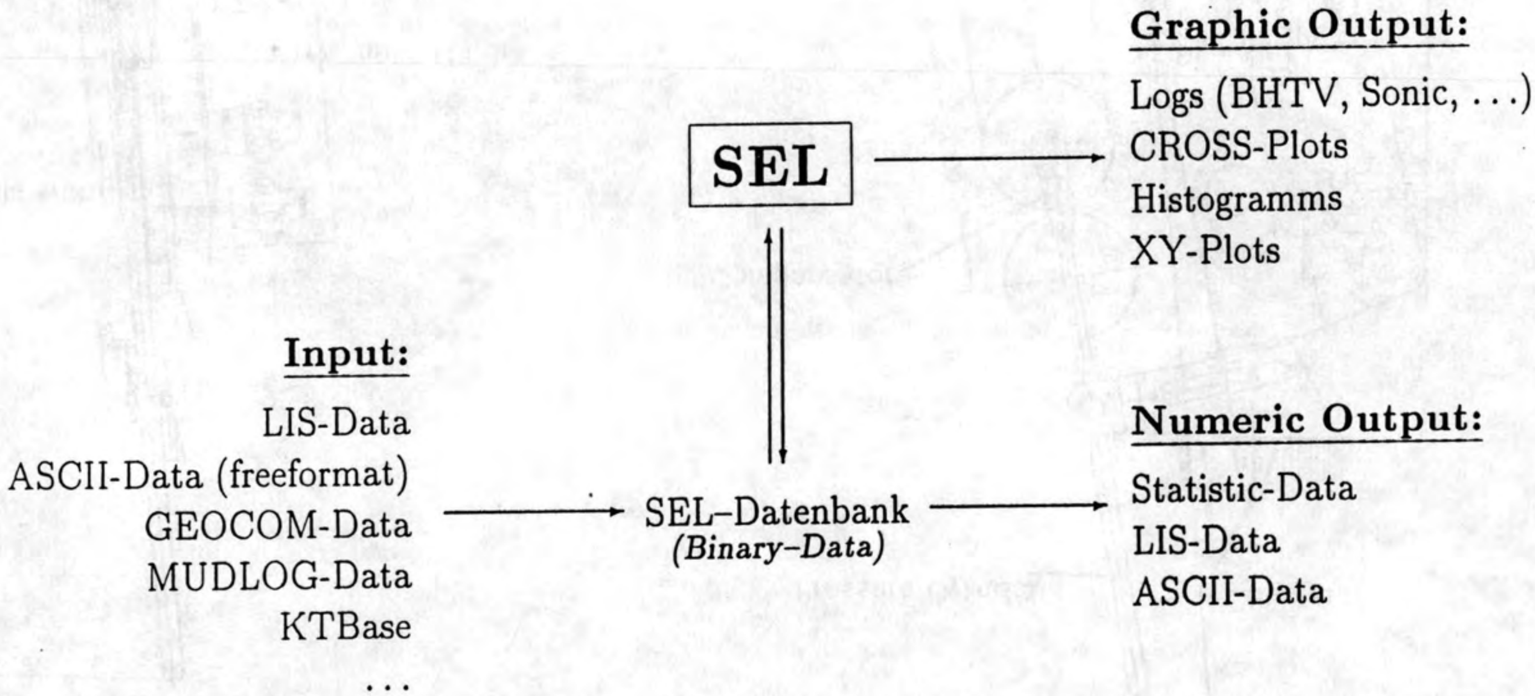


# SEL Overview

KTB

Ref.25

Niedersächsisches Landesamt für Bodenforschung

## SEL:

Commandlanguage (VAX/VMS)
Datahandler (Curves called by name)
Memoryhandler (50 Mbyte)
GKS–Plotsoftware

## Sub–Programms (selection)

ASCII (Ascii Output)
CLUSTER - Analysis
COMPUTE (arith./logical operations)
CONSTANT
CROSS (Cross plot)
DEFINE (Tables)
DEPTH - Matching
EDIT (Data edit)
FILL (Fill Gaps)
FILTER
GET (read Data from Disk)
PLOT
PUT (write Data to Disk)
SET (set Parameter)
SHOW (show Parameter)

# SEL Functions

KTB

Niedersächsisches Landesamt für Bodenforschung

Ref.26

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INSTITUT FRANÇAIS DU PÉTROLE
Division "Exploitation en Mer"
RE.20 ChS/jn N° 92/43

3rd June 1992

# ELEVENTH MEETING OF THE JOIDES TECHNOLOGY AND ENGINEERING DEVELOPMENT COMMITTEE (TEDCOM)

***College Station, Texas***
***7th-8th May 1992***

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Ch. SPARKS

***Note*** : In future if you can/cannot attend a TEDCOM meeting, you should keep the following informed by fax:

| | | |
|---|---|---|
| Allison BURNS (JOI) | fax | (202) 232 8203 |
| Charles SPARKS | fax | (33) 1 47 52 70 02 |
| Mike STORMS | fax | (409) 845 2308. |

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## EXECUTIVE SUMMARY

The TEDCOM met principally to discuss the following:

- results of Leg 142
- the future of DCS development
- deep drilling.

After much discussion of the first two subjects, the TEDCOM made the following recommendations with respect to DCS development:

1) DCS development should be continued despite the disappointing results of Leg 142, since the technical problems encountered should be solvable if the effort is pursued.

2) A computer simulation study of the DCS system should be done by an outside consultant based on the "Proposed DCS Feasibility Review" (see Appendix C) by Howard SHATTO.

3) Howard SHATTO should be used as a paid consultant to assist TAMU in the definition of the scope of work of the above simulation study and in following the work concerned.

4) Tests should be done on the JOIDES RESOLUTION as soon as possible to determine:

   - the mechanical characteristics of the main heave compensator
   - to record accelerations and stress fluctuations at the top of the API string (and at other points if possible), when anchored to the seabed by an HRB and tensioned back to the main heave compensator.
     The test should preferably be done in deep water/moderate weather. Redundancy should be added to the instrumentation system.
     [Note: this test could take 2-3 days and could impact science plans on Legs concerned].

5) The DCS should be modified to allow an easy means for manual intervention.

6) Extensive land testing of the DCS will be desirable before next deployment on the JOIDES RESOLUTION.

7) Russian retractable bit technology should be studied in more detail. It would allow spud in on hard rock without the HRB. It has the potential to simplify the installation of DCS seafloor hardware and to avoid rubble below the (present) DI-BHA. Mikhail GELFGAT will provide TAMU with details of operational experience.

8) TAMU should contact the Bureau of Mines and pursue studies of retractable mining bits for the DCS to speed up bit change. This technology has been developed under the auspices of the Bureau of Mines en 1977-79.

The TEDCOM noted that deep drilling studies (to be done by an outside consultant) were now on hold; since OPCOM funds had not yet been released. They considered the time available should be used to do the following:

1) The deep drilling sites should be reduced to the LITHP hole and TECP hole GI-A. The study of these holes should be obligatory (not optional).

2) A literature seach on deep drilling should be done by TAMU on MOHO/OMDP documents (NSF has them). A summary report should be requested.

3) The document "Engineering for deep sea drilling for scientific purposes" should be distributed to PCOM, thematic panel chairmen and TEDCOM members.

4) Realistic specifications/well programs for the LITHP/TECP holes should be defined by a small working group (comprising TAMU, TEDCOM, LITHP/TECP) at the next TEDCOM meeting.

5) The RFP must be revised and a clear summary of objectives added.

The next meeting will take place in Cambridge (U.K.) on October 7-9, 1992. It will be hosted by the Schlumberger Cambridge Research Centre.

## LIST OF ATTENDEES

TEDCOM members:

| | | |
|---|---|---|
| Charles | SPARKS, chairman | IFP |
| Mikhail | GELFGAT | VNIIBT |
| Keith | MANCHESTER | AGC, Canada |
| Gary | MARSH | Shell Offshore |
| Earl | SHANKS | Mobil MEPSI |
| Howard | SHATTO | Shatto Eng. |
| Alister | SKINNER | BGS |
| Walter | SVENDSEN | Longyear |
| Sverrir | THORHALLSSON | NEA, Iceland |

TEDCOM liaisons:

| | | |
|---|---|---|
| Jeff | ALT | SGPP |
| Keir | BECKER | PCOM |
| Dan | MOOS | LITHP |

Guests:

| | | |
|---|---|---|
| Brian | LEWIS | PCOM chairman elect |
| Shohei | KATO | Japon Drilling Co. |
| Shinichi | TAKAGAWA | JAMSTEC |
| Tetsuya | YASUDA | IHI |
| Masayasu | YOSHITAKE | MES |
| Duke | ZINKGRAF | SEDCO FOREX |

TAMU staff:

| | |
|---|---|
| Jim | BRIGGS |
| Leon | HOLLOWAY |
| Dave | HUEY |
| Roland | LAWRENCE |
| Dan | REUDELHUBER |
| Mike | STORMS |

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Excused and absent members and liaisons:

| | | |
|---|---|---|
| Hiromi | FUJIMOTO | Univ. of Tokyo |
| Claus | MARX | ITE |
| Keith | MILLHEIM | AMOCO |
| Heinrich | RISCHMULLER | KTB |
| Alex | SUMMEROUR | CHEVRON |
| Dale | SAWYER | TECP |
| Michel | TEXIER | ELF |
| Paul | WORTHINGON | DMP |

# TEDCOM AGENDA

7th-8th May, 1992

1. Introduction
2. Leg 142. Trial of DCS II B
3. DCS secondary compensator
4. DCS III reports
5. Russian technology proposed for ODP
6. Retractable mining bits
7. TEDCOM recommendations with respect to DCS
8. Development of the MDCB
9. Offset drilling working group (ODWG)
10. Deep drilling. TAMU studies
11. Deep drilling. Request for proposals (RFP)
12. TEDCOM recommendations for improving the deep drilling RFP
13. Hole 504 B
14. Vibra-percussive corer (VPC)
15. Japanese Deep Sea Drilling Vessel System
16. TEDCOM closed session
17. Next meeting.

## 1. Introduction

Charles SPARKS opened the meeting by welcoming new member Gary MARSH from Shell Offshore and by mentioning that Alex SUMMEROUR had taken over as the Chevron member of the panel, although absent from the meeting.

SPARKS went on to present the agenda. He stressed that the future of the DCS was the most important topic and that it would be treated in depth even at the expense of other topics. Given the disappointing results of Leg 142, clear recommendations on the subject were required from the TEDCOM, both for PCOM and for TAMU.

SPARKS mentioned that the wish for the TEDCOM to play a more active role in ODP had been clearly expressed from a number of sources including the members themselves, who felt their combined experience, was insufficiently exploited by ODP at present. Changes had taken place in TAMU to allow this evolution in the TEDCOM's role to happen. There was no reason to hesitate any longer. The way to implement the change was to get TEDCOM involved in engineering details.

## 2. Leg 142. Trial of DCS II B

Mike STORMS gave a brief overview of the DCS system and of Leg 142 highlights and disappointments (see section A of agenda.book). Much of the seabed hardware and in particular the new mini-HRB worked satisfactorily and was a big improvement on Leg 132. However difficulties were encountered with the drill-in BHAs (see section B of agenda book). Dynamic loads, when compensating only with the principal compensator, caused failure of small cones on six cone bits. They had trouble reaching the bottom of pre-drilled holes, which tended to fill with rubble. It is probable that J-slots and C-ring grooves in the casing hanger were damaged by stabilizer blades during the hard rock spud in.

Before the performance of the secondary heave compensator was discussed Charles SPARKS presented some highly simplified calculations (see Appendix A attached) to illustrated the order of magnitude of the stretch in the API string resulting from the stiffness of the main heave compensator.

The calculation also shows how very precisely the length of the DCS string has to be kept constant in order to maintain W.O.B. to within +/- 500 lbs. In 1000 m of water the corresponding allowable stretch in the steel mining string is only +/- 6 mm. As Howard SHATTO pointed out, this could be improved by using a more elastic mining string made from aluminium, for example. SPARKS also presented simplified calculations (see appendix B attached) for the Bucentaur type DCS, which go some way to explaining why WOB can be controlled on that ship without secondary compensation.

### 3. DCS secondary compensator

Dan REUDELHUBER then spoke about the performance of the secondary heave compensator on Leg 142 (see section C of agenda book). This had been the big disappointment of the leg, since it had plainly not even worked as well as on Leg 132 Furthermore the data logger failed, which meant no post cruise analysis of the data could be carried out.. REUDELHUBER explained the two modes of operation of the secondary heave compensator: "standby mode" based on signals from accelerometers, when the DCS bit is off bottom ; "auto mode" based on accelerometer signals and load cell signals (W.O.B.). Neither of these modes had worked satisfactorily on leg 142, although both had worked on Leg 132. Several factors may have contributed (see section C of agenda book). Sea conditions were more severe (on Leg 142). One of the feed cylinders was discovered to be bent. The measured load variation was found to depend on the mean position of the feed cylinders. The secondary heave compensator did not even work with the old soft ware, which had worked on Leg 132.

Howard SHATTO then read his letter and DCS Review Proposal (see attached appendic C), which he had prepared following the DCS review meeting of April 6th, that he had attended along with Frank SCHUH and Earl SHANKS, on behalf of the TEDCOM. The letter and review proposal summarized the points of view of the TEDCOM engineers who had attended the meeting. It called for a computer simulation program to be written (or adapted) and used to study the theroretical behavior of the DCS system. The work would have to be done by an outside consultant and the program could be handed over to TAMU once completed, for continual improvement. Such a simulation study should indicate the best way of controlling secondary motion compensation.

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SPARKS proposed that such a simulation study should to done by an outside consultant. He also proposed that Howard SHATTO should be used as a paid consultant to assist TAMU in defining the contents of the study and in following the work.

Earl SHANKS thought there could be a conflict of interests if TEDCOM members were to be used as paid consultants. SPARKS reminded that the question of using TEDCOM members as paid consultatns had been raised at the Dec.'91 PCOM meeting and Jamie AUSTIN (PCOM chair) had approved the idea. There were several advantages in using SHATTO: the subject falls in his field of competence; being a self employed consultant he can do the work ; being in Houston he is situated conveniently close to Houston; SPARKS added that he thought assistance with the definition and follow up of the simulation study would make demands on SHATTO's time in excess of what could reasonably be expected on an unpaid basis.

The simulation study would only be as good as the information put into it. It was therefore essential that the characteristics of the compensators and present control systems should be simulated as accurately as possible.

Duke ZINKGRAF said tests must be done on the main compensator first, since its real stiffness/friction characteristics are at present unknown. These could be established fairly simply by means of static tests during a port call.

Charles SPARKS suggested further tests should be carried out with the API string tensioned between the main compensator and the HRB. If the string were instrumented at the top end with both accelerometers and strain gauges (with plenty of redundancy) and all data recorded, this would provide valuable data about the real movement at the top of the API string for which DCS secondary heave compensation was required. Earl SHANKS added it would be preferable also to acquire stress data at the string bottom end and may be mid-point as well if possible. TAMU engineers estimated that such a test would take 2-3 days and could be fitted into Leg 146.

SHANKS mentioned that high speed rotation of the DCS string, friction between the two strings and lateral motion of the strings may have a big effect on DCS WOB. He thought the ODP system probably gives the best compensation available. He considered the only way the improve on it radically would be to provide compensation at the seabed. He went on to show sketches of such a system that had been worked on by Mobil.

**4. DCS III Reports**

Two studies on tensioning systems for the DCS III (version without secondary platform) had been done by Stress Engineering Services (SES) and Earl & Wright (E & W) in 1991. Extracts of reports had been sent to all TEDCOM members. SPARKS said the status of DCS III was now academic given the situation of DCS II B and ODP funding problems. However he said it was still of interest to go through the reports briefly.

SPARKS said that both studies had been done by very reputable consultants and yet they were both disappointing in that they only adressed tensioning hardware problems and left the question of how to operate the DCS system in such a case completely unanswered.

SES had studied a tensioning system with a "bottom mounted slip joint" using pressure balancing and clump weights/pulleys to transmit tension between the upper and lower parts of the joint. Since the API string would be hung from the ship (and would heave with it) and the DCS would be motionless with respect to the seabed, there would be continual movement between the two. Friction might be large, because of lateral bowing of the string (resulting from current), which would lead to fluctuating WOB. With this system there would be no reference point at ship level, any where near stationary with respect to the seabed. It is therefore hard to see how it would be possible to compensate the stretch of the DCS string with the millimetric accuracy required (see above). Maybe a seabed compensator (see SHANKS above) would be the only solution.

E & W had studied a tensioner system incorporated in the API string below the guide horn. The study had concentrated on defining the principles of the hardware and checking that stress levels in the string conformed with API requirements; Some computer analyses had been done, which added little to what could be obtained by static hand calculations. It was not clear where bending stresses were calculated, or whether there was contact between the string and the guide horn for the conditions simulated.

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The consultants would almost certainly have given reports of greater value if TAMU engineers had had time to control their work more closely.

## 5. Russian technology proposed for ODP

Mikhail GELGAT presented the russian technology which had been developed in the course of their on-land super deep drilling program (see Appendix D attached). He explained how it could benefit ODP (see Appendix E attached). Some of the technology used by the russians is simular to that of ODP. This includes rotary drilling with wireline core barrels, downhole motors, diamond coring systems.

The innovative technology related to retrievable downhole motors with retractable drill bits. This technology had been used to drill several hundred metres on the russian deep holes Kola SG3 and the Keivoy Rog pilot holes. It had also been used offshore on the "Bavenit" - a small drillship simular in size to the "Bucentaur". During the campaign on the "Bavenit", retrievable tools were used on 29 holes to drill to a total depth of 260 m. They demonstrated their ability to spud in on hard rock, without an HRB.

GELFGAT suggested the retrievable tool technology should be used by ODP as a drill-in BHA to avoid problems experienced (by ODP) with rubble while trying to seat the DCS drill-in BHA.

GELFGAT thought it would be simple to try the technology on the JOIDES RESOLUTION. It would only be necessary to change part of the drillstring (the russian string is 6 5/8" diameter) and associated equipment on the pipe rack.

ODP engineers were not convinced the change over would be that easy. TEDCOM thought that the merits of the russian technology should be looked at in more detail. GELFGAT should provide TAMU with the detailed experience of the russian use of this technology, which should be assessed seriously in the context ot the long term future of ODP.

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### 6. Retractable mining bits

Wally SVENDSEN showed a short film about small diameter (3") diamond mining bits that could be lowered down the drillstring. A special tool was used for running them which allowed the bits to be lowered through the lower extremity of the string, turned through two right angles (about mutually perpendicular axes) and pulled back onto the face. The bits were quasi-rectangular in plan and hence did not cover the whole of the drilling face; SVENDSEN said this led to a more event distribution of wear between the inclined parts and the flat end part, when compared with normal bits; The system had been developed in 1977-79 with the Bureau of Mines, for drilling 3"Ø holes and taking 1 3/4"Ø cores using 2 3/4" x 2 3/8" tubings. It would have to be scaled up for ODP.

Alister SKINNER added that such a system would be of interest for deep penetration holes, in deep water using the DCS II system, since it would avoid all the time wasted when pulling the DCS string to change the bit. This could make the development of DCS III much less urgent. He added that such bits are of no interest for short penetration holes in shallow water. BGS try and improve bits so that they last the hole life.

### 7. TEDCOM recommendations with respect to DCS

Following the discussion of Leg 142 and DCS development, the TEDCOM formulated the following recommendations for PCOM and TAMU:

1) DCS development should be continued despite the disappointing results of Leg 142 since the technical problems encountered should be solvable if the effort is pursued.

2) A computer simulation study of the DCS system should be done by an outside consultant based on the "Proposed DCS Feasibility Review" (see Appendix C) by Howard SHATTO.

3) Howard SHATTO should be used as a paid consultant to assist TAMU in the definition of the scope of work of the above simulation study and in following the work concerned.

4) Tests should be done on the JOIDES RESOLUTION as soon as possible to determine:

   - the mechanical characteristics of the main heave compensator

   - to record accelerations and stress fluctuations at the top of the API string (and at other points if possible), when anchored to the seabed by an HRB and tensioned back to the main heave compensator.
     The test should preferably be done in deep water/moderate weather. Redundancy should be added to the instrumentation system. [Note: this test could take 2-3 days and could impact science plans on Legs concerned].

5) The DCS should be modified to allow an easy means for manual intervention.

6) Extensive land testing of the DCS will be desirable before next deployment on the JOIDES RESOLUTION.

7) Russian retractable bit technology should be studied in more detail. It would allow spud in on hard rock without the HRB. It has the potential to simplify the installation of DCS seafloor hardware and to avoid rubble below the (present) DI-BHA. Mikhail GELFGAT will provide TAMU with details of operational experience.

8) TAMU should contact the Bureau of Mines and pursue studies of retractable mining bits for the DCS to speed up bit change. This technology has been developed under the auspices of the Bureau of Mines in 1977-79.

**8. Development of the MDCB**

The motor driven core barrel (see section E of the agenda book) has been under development by ODP for many years and had encountered many problems which had seemed to be inherent, given that fluid pressure controls both the thrust on the bit and the applied torque.

Dave HUEY said the tool had been retried on Leg 141 and had finally given satisfactory results. Two cores were cut on Hole 863B and yielded much higher recovery that had been obtained with the XCB immediately before and after. The MDCB has now been declared operational although work on minor improvements will continue.

**9. Offset Drilling Working Group (ODWG)**

Earl SHANKS reported on the three day meeting (see section F of agenda book) that he had attended on behalf of the TEDCOM.

The group debated at length what was meant by offset drilling. They finally defined it as follows:

*"offset drilling is a strategy to deal with a complex, laterally heterogeneous ocean crust and shallow mantle by drilling key, partial sections in tectonic windows into crustal and mantle rocks".*

The group considered for a moment dropping the term "offset drilling" in favour of "composite section drilling". The group endorsed four classes of objectives:

- sections through dike/gabbro transitions
- long sections of gabbroic crust
- sections through the gabbro/mantle transition
- long sections of upper mantle.

Participants talked of an 11 ou 12 Leg program to obtain composite sections of slow and fast spreading crust.

**10. Deep drilling. TAMU studies**

Mike STORMS gave a brief presentation of TAMU recent deep drilling studies (see section H of agenda book). He mentioned that the NARM site on the Iberia Abyssal Plain (IAP-1) had already been scheduled for Lef 149. A second NARM site in the Newfoundland basin (NB-4A) was also planned. These sites called for 2.5 km penetration (mainly in sediments) in 5 km and 4 km water depths respectively. They were expected to require 60-80 days each and should push the capabilities of the JOIDES RESOLUTION to the limit.

## 11. Deep drilling. Request for proposals (RFP)

Charles SPARKS mentioned that OPCOM funds had not been made available as expected, hence the deepdrilling studies the TEDCOM had been recommending for some time were on hold. There was thus time to modify the RFP (see section I of agenda book).

TEDCOM members thought several changes should be made in the RFP. They noted the thematic panel sites (RFP page 8) are not actually referred to in the text, although their study may be implied in the optional section (RFP page 5). This should be changed. The thematic panel sites must be studied, but the TECP sites and SGPP sites should be redefined. TECP sites (IAP-I and NB-4A) have already been scheduled (and the SGPP sites are easier!) Jeff ALT suggested that the deep sites be reduced to two: the LITHP 10.5 km hole and the TECP site G 1-A (3.5 km penetration in 5.2 km of water). ALT said SGPP would forgo defining a third site. The TEDCOM said the well programs for the two holes must be defined in detail otherwise the study basis would be so imprecise that it would be of little value. TEDCOM members would assist in this task at the next meeting. Once the document had been revised in this way, it should be completed with an initial summary in which the object of the proposed study is clearly defined in a few lines. Bidders should also be required to provide qualification statements.

The TEDCOM also suggested that a literature seach on MOHO and OMDP studies should be carried out. During the discussion a promising document entitled "Engineering for Deep Sea Drilling for Scientific Purposes" was discovered in TAMU archives. It looked to be the summary document that should be essential reading for all interested in ultra deep drilling in the ocean!

Finally TEDCOM formulated the following recommendations:

## 12. TEDCOM recommendations for improving the deep drilling RFP

1) The deep drilling sites should be reduced to the LITHP hole and TECP hole GI-A. The study of these holes should be obligatory (not optional).

2) A literature seach on deep drilling should be done by TAMU on MOHO/OMDP documents (NSF has them). A summary report should be requested.

3) The document "Engineering for deep sea drilling for scientific purposes" should be distributed to PCOM, thematic panel chairmen and TEDCOM members.

4) Realistic specifications/well programs for the LITHP/TECP holes should be defined by a small working group (comprising TAMU, TEDCOM, LITHP/TECP) at the next TEDCOM meeting.

5) The RFP must be revised and a clear summary of objectives added.

## 13. Hole 504B

Ron GROUT gave a brief summary of the drilling of hole 504B, which was taken down to 2000.4 m penetration (in 3460 m of water) on Leg 140. Of this, 1726 m has been drilled in basement. The hole is scheduled to be revisited on Leg 148 during which ROP and core recovery are expected to improve from the mean values (1.3 m/hr and 12.6% respectively), obtained on Leg 140.

## 14. Vibra-percussive corer (VPC)

Alister SKINNER asked for news about the development of the VPC. He was told that the tool was being worked on by the manufacturers, who had found faults in a large hammer being developed for Shell Canada. Improvements made on that tool would be incorporated in the ODP one. These relate to corrosion and stalling problems.

## 15. Japanese Deep Sea Drilling Vessel System

Shinichi TAKAGAWA presented the above system (see Appendix F) based on japanese resources and technology.

## 16. TEDCOM closed session

During a closed session TEDCOM members discussed ways of improving the action of the committee. It was suggested that the future meetings should be preceded by a 'working day' during which small groups would work together with TAMU engineers on specific topics/problems.

The TEDCOM discussed the chairmanship of the committee following which an election was held. Charles Sparks was reelected unanimously and asked to stay on at least until the end of the present phase of ODP (autumn 1993).

## 17. Next meeting

It was decided to hold the next TEDCOM meeting on October 7-9, 1992 at SCHLUMBERGER, Cambridge (U.K.). Duke ZINKGRAFF offered to set up the necessary contacts.

The present plan is to divide the meeting as follows:

Oct. 7th Meeting of 2-3 working groups (5-6 people each) devoted perhaps to:
- DCS simulation study
- Deep drilling RFP
- Evaluation of russian technology.

Oct. 8th Full TEDCOM meeting with liaisons, guests etc.

Oct. 9th Visit of Schlumberger's facilities.

The chairman will consult with TEDCOM members and TAMU before deciding on participants in the Oct. 7th working groups.

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# JOIDES RESOLUTION - DCS

## STRING CHARACTERISTICS

| | API | DCS |
|---|---|---|
| O.D. - I.D. | 5″ - 4.276″ | $3\frac{1}{2}$″ - 2.992″ |
| Sectional Area ($A$) | 5.27 $in^2$ | 2.59 $in^2$ |

## STRETCH OF API STRING

| | | |
|---|---|---|
| Assumed string length ($L$) | 40,000″ | (1,000 m) |
| Assumed ship heave | ± 3.3 ft | (± 1 m) |
| Compensator capacity ($F_{max}$) | 800 kips | |
| Compensator stiffness (assume 1% $F_{max}$ per ft) | ?? 8 kips/ft | (120 kN/m) |
| Resulting force fluctuation ($F$) | ± 26.4 kips | (± 120 kN) |
| Stretch of API string ($FL/EA$) $\left(\frac{26.4 \times 40{,}000}{30 \times 10^3 \times 5.27}\right)$ | ± 7″ | (± 17 cm) |

## DCS - REQUIRED CONTROL

| | | |
|---|---|---|
| WOB | ± 500 lbs | |
| Stress $\sigma$ $(= \frac{500}{2.59})$ | ± 193 psi | (± 1.4 MPa) |
| Strain per 1000 m ($\sigma L/E$) $\left(\frac{193 \times 40{,}000}{30 \times 10^6}\right)$ | ± 0.27″ | (± 6.4 mm) |

C.Sparks, April 1992.

# BUCENTAUR - DCS

## STRING CHARACTERISTICS (assumed)

| | API | DCS |
|---|---|---|
| O.D. - I.D. | 5″ - 4.276″ | $3\frac{1}{2}''$ - 2.992″ |
| Sectional Area ($A$) | 5.27 $in^2$ | 2.59 $in^2$ |

## STRETCH OF STRINGS (API plus DCS)

| | | |
|---|---|---|
| String length ($L$) | 20,000″ | (5000 m) |
| Assumed ship heave | ± 3.3 ft | (± 1 m) |
| Compensator capacity ($F_{max}$) | 100 kips | |
| Compensator stiffness (assume 0.5% $F_{max}$ per ft) | ?? 0.5 kips/ft | (7.5 kN/m) |
| Resulting force fluctuation ($F$) | ± 1.67 kips | (± 7.5 kN) |
| Stretch of strings ($FL/EA$) $\left(\frac{1.67\times 20{,}000}{30\times 10^3\times 7.86}\right)$ | ± 0.14″ | (± 3.6 mm) |

## DCS - REQUIRED CONTROL

| | | |
|---|---|---|
| WOB | ± 500 lbs | |
| Stress $\sigma$ $(= \frac{500}{2.59})$ | ± 193 psi | (± 1.4 MPa) |
| Strain per 500 m ($\sigma L/E$) $\left(\frac{193\times 20{,}000}{30\times 10^6}\right)$ | ± 0.13″ | (± 3.3 mm) |

C.Sparks, April 1992.

To: Charles Sparks
Chairman TEDCOM

April 15, 1992

cc: Mike Storms
TAMU

ODP Meeting at TAMU
April 6, 1992

From: Howard Shatto

The ODP meeting on April 6th was a good one, I thought. The engineers back from leg 142 reviewed the successes and problems. Just about everything went well except DCS coring which was prevented by failure of the secondary heave compensation system. They had already developed a good list of action items, and we all discussed alternatives to solve the problems.

Prior to the meeting I had talked with Tim Francis about my suggestion that riser top tension be used to calculate its position as the input for secondary compensation instead of using riser top acceleration to calculate position. He agreed to invest in a day or so of my time to track down some people with expertise in mathematical modeling of longitudinal riser dynamics and an understanding of control systems; people who might be able to do use such modelling to study and compare the merits of various alternative configurations for secondary heave compensation (including accelerometer integration), and perhaps to participate in implementing the best. After some long discussions with several contacts, I felt even more that top tension is a candidate worthy of deeper study.

At the meeting Dan Reudelhuber suggested that DCS drill string top tension might also be a good candidate for control of secondary compensation. My first reaction was negative, but it may be workable. It is basically an automatic bit weight control. While it might work well alone, it might work best in conjunction with an accurate calculation of riser top position. I guess the reason it appeared not to work on leg 142 was that calculation of vessel heave by accelerometer was too inaccurate. Hopefully the simulation study will tell.

Another approach that should be considered is to use the secondary system simply as another passive compensator, or otherwise to provide compliance in the DCS drillstring to reduce its stiffness and the large variation in bit weight that occurs with a small change in top position. Earl Shanks and Frank Shuh thought the passive system might work.

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Delegates to the meeting, including the ODP engineers, appeared fairly unanimous in their support for a serious mathematical simulation study. Some called it a fresh look. The biggest problem seemed to be that it would take time to prepare specifications and a bid request which may have to be circulated through the many countries which support ODP. Results would not be available for forthcoming meetings of PCOM and TEDCOM, and worse, it seemed very unlikely that a redesigned system could be ready for the next engineering leg 148 in January of 1993.

Jamie Austin said he thought money could be made available and was reminded of Keith Millheim's admonition that this system should be tested aboard ship. Jamie wondered if another ship would do. My first reaction again was negative (I used the word "insane"), but on further reflection, it perhaps should be looked at seriously if we are otherwise faced with an intolerable delay. It has the potential saving of not having the whole scientific crew and facilities wasted while compensation systems are tested.

Maybe the simulation study will show the extent of need for land or offshore testing of the system selected. It will probably show that surge and sway and pitch and roll introduce considerable error into measurement by accelerometer integration. These effects would be difficult to test on land. On the other hand, they may not be a factor in measurement of top tension. This may mean that such a system could be rather thoroughly tested to full "water depth" in land wells by dealing only with the vertical forces and motions.

I look forward to seeing you at the meeting on May 7.

Best regards,

Howard

Encl: DCS Feasibility Review--2 pages.

Comments on Proposed
DCS FEASIBILITY REVIEW

Howard Shatto
April 18, 1992

As a result of the failure of the secondary compensation system, it is prudent to review the feasibility of its present design approach and to compare it with attractive alternative configurations. The quickest and most economical way to do this is probably to use a time domain mathematical model simulation. I have learned that time domain programs have been developed which model the vertical or longitudinal behavior of risers and drillpipe and which can form the basis for this feasibility review. If it is found desirable these programs can also be used to model the pipe strings as a part of the secondary compensation control.

The objectives of the study are:
1. To determine whether any of the compensation configurations is able to accomplish the high degree of accuracy and performance needed to ensure successful DCS coring, and if so, which is best.
2. To provide a solid framework for development, design, implementation and testing of the best configuration.
3. To allow development of accuracy requirements for sensors, the sensitivity of the result to sensor error, and the control system gains and stability margins.
4. To help determine the system parameters which should be recorded in real time aboard the vessel to allow rational trouble shooting, analysis of performance and verification of the design.
5. To indicate any of those parameters which should be recorded early as part of the design study.

To be comprehensive the model for this feasibility review should include all significant elements of the system:
1. The control algorithms and actuators.
2. The main passive compensator with its Coulomb friction. "stiction", hydraulic drag and non-linear air spring.

3. The distributed mass and spring of the riser and drill tubing, and the mass of the DCS platform.
4. A real or simulated sea state and vessel response.
5. The effect of accelerometer errors introduced by surge, sway, pitch and roll on the existing design.

The configurations to be modeled and compared should include the following:
1. The existing system using an accelerometer on the vessel to determine heave, then subtracting passive compensator stroke to obtain riser stretch for control of the DCS drill string position. Combining that with measurement and control of bit weight while the bit is on bottom. (See also item 5 above)
2. Measurement of riser top tension which is input to a real time mathematical model of the vertical dynamics of the riser and drill tubing to determine the position of the top of the riser and use of that position (equal and opposite) to control the secondary compensator.
3. When the bit is on bottom, blend or average the control as in the previous item with the present automatic bit weight control, or use the automatic bit weight control alone if for any reason it should be better.
4. Try using the secondary compensation pistons purely as passive compensation; a lighter weight, softer spring system in series with the main passive compensator. Piston friction alone may eliminate this prospect.
5. To improve the feasibility of any of these configurations it may be necessary to add a little spring compliance in series with the drill tubing to relieve the brittle requirement for extremely (maybe prohibitively) precise position control.

Howard Shatto

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# IADC/SPE

## IADC/SPE 23912

# Technology and Technique for Scientific Drilling in Crystalline Rocks: Experience and Perspectives

A.V. Mnatsakanov, M.Y. Gelfgat, and R.S. Alikin, VNIIBT

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ABSTRACT

Continental and offshore scientific drilling is one of the most effective methods of earth investigation. The experience of realization of such wells drilling programs obtained in the last few years points to the fact that there are a number of problems, particularly when drilling crystalline rocks. Simultaneous analysis of deep water and continental drilling results allows to draw up general principles of drilling and coring technology.

In the paper there are given the results of tests and field use of coring technology and technique in crystalline rocks without pulling out the drill string, developed by VNIIBT. Onshore drilling strategy consisted in coring with retrievable tool and research of the pilot slim hole for one drill string running, and then drilling the main borehole with minimum vertical deviations.

In offshore drilling without re-entry equipment with retrievable down hole motors and retractable bits it was possible to spud and core the well on the sea floor into bare rocks. On the paper the information about the characteristics of technical means for the technology realization is given. From the onshore and offshore drilling of more than two thousand meters with retrievable down hole motors and core barrels in crystalline rocks there are shown the advantages and perspectives of using drilling technology without pulling out drill string in different conditions.

References and illustration at end of paper

## INTRODUCTION

For the past 20 years drilling of special wells with the aim of earth's crust investigation (research wells) gained recognition all over the world as one of the effective method of the planet comprehension.

The achievements in the field of drilling technique and technology made possible the realization of deep water drilling programs as well as onshore drilling of deep and ultradeep research wells.

Of these wells, wells drilling crystalline rocks should be particularly picked out. Mining drilling practice in such rocks to the depths of 2-3 km, with borehole diameter being less then 130 mm (5 1/8"), cannot favor, to a great extent, the development of research wells drilling technique and technology with oil tools range. The available experience of drilling such wells in crystalline rocks - more than 100 km drilled - indicates that there are serious technical problems limiting the depth of penetration into the earth's crust basement. The main of them are: (1) borehole walls instability; (2) borehole deviation; (3) destruction of core; (4) hardness of formations. These problems have also detrimental effect of the well construction cost and rates.

It is expedient to look for technical solutions by both deep water and onshore drilling results analysis and development of general basic regulations of drilling and coring technology.

## BRIEF ANALYSIS OF SCIENTIFIC DRILLING EXPERIENCE

### Ocean drilling

Scientific drilling has started at the end of fifties with "Mohol" project. But this project turned out to be impracticable because of the discrepancy of the scientific purpose and technical possibilities of those years.

Nevertheless, in 1966 it was transformed into very successful program of deep water drilling (DSDP) from DV "Glomar Challenger". This project was technically based on: (1) drill ship with dynamic positioning system; (2) drilling technology with power swivel; (3) wire line core barrels for coring in different formations; (4) roller-cutter core insert heads with sealed bearings; (5) system for re-entry operations.

After some years of the program development the scientists requirements for deep ocean crust strata investigations began gradually to be met. This was assisted by the improvement of the above drilling means, which allowed for coring in great depth including basement. When drilling hard rocks of basalt type with the conventional core barrel being used, the results were much worse as compared to operations in sediments, sticking of tools often took place. In analyses 141 DSDP wells drilled in the basement, 7140 meters were drilled in hard rocks, core recovery was 31 % compared with 58 % DSDP total. The results of 15 years work on DSDP promoted continuation of investigations in ocean since 1985 according to ODP from DV " JOIDES Resolution ". The main object of ODP is more extended studies of basalt bed mantle, including penetration into the ocean crust up to 2-4 km. The attempts to run into such depths were made primarily in available wells: in 504B - the depth of 2000 m was achieved. But the experience of drilling basalts showed that the solution of the scientific problems presented some serious difficulties. Instability of crystalline rocks, including upper strata, makes well drilling difficult, results in tool sticking, necessity of intense flushings, borehole reaming, running of additional casings. With these conditions core recovery is decreased. Hardness of formations results in penetration rate decrease and rapid bit wear. It is precisely this fact that gre attention is paid to the improvement of core recovery and drilling technique in crystalline rocks when realizing ODP: Diamond coring system, Motor driven core barrel, new types of core heads and etc. For now, it is difficult to say what drilling strategy and what means will allow best to solve the problems in hand.

In the USSR the deep water drilling program has begun developed at the beginning of eighties. The principle drilling technology of research wells was based on the experience of operations on board of "Glomar Challenger". At the first stage the achievements of DSDP in the field of drilling sediments should be repeated. But in the field of drilling crystalline rocks would be useful to use the experience of continental scientific drilling.

### Continental drilling

The program of studies the deep bowels of earth by means of superdeep drilling in the USSR appeared simultaneously with "Mohol" project. On 1970, when first attempts of drilling ocean young basalts were made from "Glomar Challenger", in Kola peninsula drilling of superdeep well SG-3 was begun with the aim of penetration into the old rocks of Baltic shield to the depth of 15 km. It is quite natural, that for th technical aspects of this project grea. attention was paid, as they influenced, in many respects, on the research strategy.

The basic of the last is: (1) drilling with continuous coring of pilot hole of 214 mm (8 7/16") diameter to the maximum attainable depth without running casing; (2) use of aluminum drill pipes (ADP) and down hole motors;(3) well reaming and running of casing in case of insurmountable technological problems; (4) protection of previous casing from wear by temporary casing. Taking into consideration the complications and new technical problems occurring with depth, the well "Sputnik SG-3" (1300 m depth) was drilled in 1974-1979 at the distance of 50 m from the main hole with the aim of testing new drilling technique.

The first stage of drilling Kola well SG-3 was completed by drilling 7263 m by means of standard rig with load capacity of 200 tn. It was necessary to run one casing of 324 mm ( 12 3/4 ") diameter to the depth of 2000 m. After mounting new rig "Uralmash 15000" with the load capacity 400 tn the well was deepened to 12066 m, the bottom hole deflection angle was above 23 degrees. After reaming the hole, casing of 244.5 mm (9 5/8") diameter was run to the depth of 8770 m and the well was drilled to 12260 m.

"Insurmountable" problems, requiring borehole reaming and running of the casing or sidetracking, consisted in BHA sticking and abandonment of it in the hole, because it was impossible to pull it. The reason of it was intensive hole enlargement or deviation.

Subsequent to the Kola well, superdeep Saatlinskaya well began to be drilled in the southeast of the Caucasus. Here crystalline rocks were covered by the sediments of 3.5 km thickness. Drilling of a pilot hole to 6260 m depth with the aim of refinement the geological conditions and selection of technical means for the main bore hole preceded drilling of this well. The main hole was drilled with rig "Uralmash 15000" and sedimentary formations were cased. Further the strategy was similar to that of Kola SG-3 well. After a number of failures when drilling very hard formations, Saatlinskaya well was suspended at the depth of 8324 m.

The depths attained with the first wells and scientific results obtained, favored the development of onshore drilling program in the USSR and other countries. In 1984 in accordance with the extended program of scientific drilling three wells in crystalline rocks began to be drilled: Ural (Russia), Krivoy Rog (Ukrain) and Muruntauss (Uzbekistan). The experience of the first two wells was taken into consideration in technical projects, but the problems arisen showed that this was not enough. New technical solutions were required for (1) borehole deviation control in intervals of 1000-3000 m and (2) for intensive borehole enlargement and caving-in control in intervals of 3000-4000 m. The development and use of new methods and means of drilling made it positive to attain the depth of 5 km with good possibilities of it is deepening to 8-10 km.

Krivoy Rog well was distinguished by the fact, that in this well, for the first time the technology of drilling without pulling out the drill pipes was field tested and began to be used.

The experience of drilling the crystalline rocks is not limited by the above program. When studying oil and gas content of Arcean basement of Russian platform, some wells were drilled in crystalline rocks. The most interesting is the experience of Minnibaevskaya well of 5088 m depth (over the basement - 3200 m). Here, for the first time, methods of the crystalline rocks falls control in the interval of 2700-3100 m were used.

In 1987 Germany program of continental superdeep drilling (KTB) began to be run. The operations strategy consisted in the following: (1) drilling of 3-5 km depth pilot hole with continuous coring; (2) drilling of main borehole in vertical direction without coring in pilot hole interval; (3) successive running of casing string so that the length of open hole was not above 3000 m. In 1989, at the depth of 4000 m the drilling of the pilot hole was completed. This allowed in 1990-1991 to successfully drill the main borehole to the same depth. The base for the fulfillment of scientific tasks at hand was laid, but problems connected with high bottom hole temperature and coring at great depth in unknown section, are still ahead.

Prospecting hole in Siljan crater (Sweden) was drilled in crystalline rocks to the depth of about 7000 m. However, because of serious borehole deviation problems and low core recovery the well did not meet the task, and a new well is planned to be drilled in this region.

In research well in Kanyon-Pass (USA) of 3510 m depth there were also problems with hole deviation. A new borehole was sidetracked at the depth of 2533 m. It was necessary to run 3 casing strings. The combination of oil and mine coring technique allowed to obtain good recovery - 74% with total footage being 177 meters for 54 runs.

So, this analysis confirmed mentioned above problems.

## DRILLING AND CORING STRATEGY

The purposes and objects of drilling wells in crystalline rocks predetermine the necessity of so called "double" drilling. The rejection of preliminary geological and technical estimation can result in substantial time and cost losses.

The first variant of such strategy is drilling of pilot borehole of maximum possible length. This method was used in drilling Kola SG-3, Ural well to 4000 m depth, first borehole of Krivoy Rog well, Muruntausskaya well. In all cases the borehole diameter was 214-217 mm (8 7/16 - 8 9/16"). The major problem was borehole deviation control with high requirements to core at the same time. In some intervals of SG-3 well this caused very low core recovery (less than 30%) or sidetracking. As a result in all above wells the pilot hole was reamed or a new borehole of large diameter was drilled for running casing to the depth of about 2-4 km.

Offshore as well as onshore the second variant of drilling strategy is drilling initially test pilot hole ("Sputnik"). This well depth in each particular case is determinated from geological and economical considerations. The depth of Saatlinskaya pilot well was obviously to much. It was sufficient to determine the boundary of basement, at is to drill the well to 4 km depth but not to 6.2 km. The depth of Krivoy

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Rog well- sputnik (1000 m) turned out to be not enough, practically 217 mm (8 1/2") borehole drilled at the interval of 1000-2400 m (before entering the granitoids) was a pilot hole. It is precisely this fact that allowed to reject expensive operations on deviation control. The borehole was drilled as crooked one, but with good core recovery - about 60%.

The most successful experience of such strategy for to-day is KTB project. Effect was achieved by drilling the pilot hole following the mining drilling technology - by diamond bits with wire line core barrels of "intellectual" type.

Offshore drilling of pilot wells (type A) is a common practice at all sites. Drilling of deep re-entry holes requires preliminary to determine the depth of crystalline rock bedding. However, with sedimentary layer being absent, it is often impossible to spud wells of A type by traditional for DSDP and ODP rotary method. The mounting HRB type guide base without preliminary drilling can result in problems, when drilling the first meters, and necessitate running of casings before attaining the total depth .

The third variant of double drilling strategy is based on the use of drilling method without pulling out drill pipes by retrievable down hole motors (RDM). This method allows for drilling pilot slim hole up to 134 mm (5 1/4"), 35 m plus length for one drill string run. The deviation of the pilot slim hole does not influence on the drilling technology of main borehole. This permits to concentrate only on the coring efficiency. The analysis of core obtained and logging results allows to make corrections in drilling technology of the main borehole if some problems arise. The main borehole is drilled subsequently with BHA, providing it verticality and preventing problems. Thus, the necessary separation of coring and drilling operations is achieved. This variant of double drilling strategy is the most adaptable and promising both offshore and onshore. Onshore it is expedient to combine this variant with the second one-drilling of well-sputnik.

The offshore use of RDM allow to drill a hole of A type in hard formations with sedimentary layer being absent.

## STRATEGY AND TECHNOLOGICAL SCHEMES OF CORING

Three variant of coring strategy in research wells can be considered: (1) continuous coring; (2) partial coring; (3) spot coring. Obviously, the first variant is the most informative but is the most expensive. Examples: research wells in the USSR, DSDP and ODP holes. The second variant, as a rule, is used with oth information systems being available continuous analysis of cuttings, drilling fluid, logging as well as drilling of rather homogeneous sections. This variant is planned to be used in KTB well. Spot coring is also used together with other research methods. This method is preferred for economical reasons. Technological limitations are often the reason - coring according to the traditional technology is difficult to be combined with operations on problems control and prevention. Depending on the strategy accepted it is possible to chose suitable technique and methods - the technological scheme of coring.

There are seven technological schemes.

(1) Rotary drilling with wire line core barrel. This is the conventional scheme widely used in oil well drilling to the depth of 5-7 km and in mining drilling -to 2-3 km depth. The scientific drilling on DSDP, ODP, KTB-pilot hole projects is based on this scheme.

(2) Rotary drilling or drilling with a down hole motor with dual core barrel (without wire line). This scheme with a down hole motor as a drive is widely used, when the continental scientific drilling programs being realized. In the last few years it is used in oil well drilling.

Rotary drilling according to this scheme is used for spot coring in oil well drilling and more seldom in scientif continental drilling.

(3) Drilling with a down hole motor with a hollow or retrievable shaft with a wire line core barrel. In the USSR, core turbodrills used for this scheme realization, are steadily used in oil exploration drilling. PDM with a hollow shaft are being tested within the frames of scientific drilling programs.

(4) Coring according to the scheme (1) with internal drill-string in the pilot slim hole and subsequent reaming of borehole, with main (external) drill string being rotated. This variant of coring (DCS) has been developed for the ODP program. Sometimes, this scheme is used in mining drilling.

Common to all these scheme (1)...(4) is the fact that in order to replace the used bit it is necessary to pull the drill sting.

The main distinguishing feature of the following schemes (5)...(7) is that the replacement of the bit is made without pulling out the drill string (Fig.1).

(5) Coring is made in the pilot slim hole with RDM and core barrel; the reaming of pilot hole is carried out by drill string rotation. Technical means for this scheme realization are being tested according to deep water drilling programs.

(6) Coring is made in the pilot slim

hole, is according to the scheme ..., with simultaneous or subsequent reaming of it by a retrievable tool. This scheme differs in that the replacement of BHA for coring, reaming, drilling is made without pulling out the drill pipes. The tests were carried out on the program of scientific continental and offshore drilling in the USSR.

(7) Coring in crooked pilot slim hole, as in the schemes (5)...(6); reaming of cored interval with a BHA, including the down hole motor and bit, run-in on drill string to obtain vertical borehole. This method is used in drilling the superdeep well in Krivoy Rog.

The schemes (5)...(7) from the analysis of the data on their use, are the most rational in drilling research wells in crystalline rocks with continuous or partial coring.

The main advantage of pilot coring with RDM is the possibility of prompt replacement of coring tool and responding to the well situation change. This problems in the pilot borehole do not influence on safety of main hole drilling.

## TECHNICAL MEANS FOR REALIZATION OF OPTIMUM DRILLING TECHNOLOGY

### Drill string

Types, sizes and characteristics of pipes, making up the drill string is tabulated in table 1. The main feature of all pipes is internal flush of 146 mm (5 3/4") diameter for passing the retrievable tool inside the string.

In offshore drilling, in the upper part of the drill string special steel pipes with protective bulges (SBTPU) are used. When operating with power slips, steel extension nipple are fixed per each stand of ADP.

### BHA components for coring and drilling without pulling out drill pipes

BHA's consist of the body part rigidly connected to the drill string and retrievable part.

There are used down hole motors (Fig.2).

(1) TVR-198T - turbodrill with a retrievable rotor: the housing of the turbodrill including stator, landing shoulder and alignment bearing housing; retrievable part - rotor and a thrust bearing assembly.

(2) TRV-142 - turbodrill with reducing gear: housing part includes landing shoulder and keys for fixing the turbodrill in axial and radial directions. Retrievable part includes reducing gear with thrust bearing assembly, turbine section and a torque [illegible] assembly.

(3) RVT-142 - the housing part is the same as that of TRV, retrievable part includes PDM instead of turbine with reducing gears.

The motors provide a wide range of drilling and coring practices (see table 2).

There are used conventional dual core barrels with different types of core bits:

(1) ISM type: 132/52 S and T, 132/67T-cutting structure is equipped with inserts of composite material with impregnated diamonds layer;

(2) Cone core bits of 132/52 TKZ type with hard alloy wedge-shaped inserts;

(3) Standard and special diamond core heads.

For drilling pilot bore hole without coring cone bits are used.

Retractable reamers and bits are used: RVA reamer (Fig.3) - three-blade one with ISM type cutting structure; two-cone or three-cone retractable bits with hard alloy inserts (Fig.4). For changing a retractable tool transporting position into working one hydraulic method is used under a manifold pressure control and for back change - mechanical method is use.

There are also used some special tools:

(1) Thruster mechanism (bumper sub) is mounted between down hole motor shaft and core barrel.

(2) Drilling fluid flow divider is mounted, if it is necessary to direct only part of the drilling fluid flow into the core barrel.

(3) Extension fitting pipe is mounted between the core barrel and RDM shaft as the pilot borehole is deepened.

(4) Magnetic bit extractor of high load capacity as well as taper taps, bell sockets, junk mills run for carrying out emergency operations in the pilot borehole without pulling out drill string.

The running -in of a retrievable tools made by dropping the tool together with pumping the drilling fluid. In onshore holes for lifting of tools the reverse mud circulation is used. Both in onshore and offshore holes lifting with a wire line can be used.

### BHA elements for reaming pilot bore hole and drilling the main one

For reaming pilot borehole reamers of ISM and cone-types are used. They can be mounted above the bottom part of RDM housing.

For drilling main borehole bits, stabilizers, conventional down hole motors of different type are used (see table 2).

For borehole deviation control special devices of passive and active types are used. The most effective means for drilling boreholes of 375 mm (17 3/4") diameter and more is RTB - rotary-turbine drill (table 3 and Fig.5).

When drilling, the bits are rotated by turbines, and the whole RTB system is rotated by a rotor. As a result of complex bit movement, much less teeth are simultaneously in contact with the formation as compared to conventional drilling, and high contact stresses necessary for effective destruction of formation are obtained with less much bit weights as compared to usual ones. There is a lot of experience with RTB when research wells drilling (Saatlinskaya, Ural, Krivoy Rog and other).

### Control systems

For drilling process control there are used:

(1) telemetric system consisting of a down hole rpm sensor-generator and surface equipment;

(2) throwing down single-shot inclinometer;

(3) acoustic control system of the retrievable tool position;

(4) wire line control system;

(5) vibrations measuring complex for the bit rpm control, determination of rocks drillability change, precise core reference to the depth, the moment of the tool sticking and other specific situations in the process of drilling.

## THE RESULTS OF TESTS AND FIELD USE

### Onshore tests

Tests of technical means and coring technology without pulling out the pipes in crystalline rocks for 217 mm (8 9/16") wells were carried out in "Sputnik SG-3" well and first borehole of Krivoy Rog well. All Types of BHA with RDM were worked out in different and fairly complicated geological conditions. The footage drilled was 800 m in "Sputnik SG-3" well and more than 400 m in Krivoy Rog pilot hole. Data obtained confirmed the promise for the use of this method of coring in crystalline rocks.

As compared to conventional coring, in similar conditions footage per run was 40-80 % and ROP from 80 to 200 %; time consumed for trips was several times less. The calculations made on the base of obtained results defined the field of effective use of the coring technology with RDM. With drill string length being above 3 km, any technological scheme of coring with RDM's provide advantage drilling time by 20-60% with the total footage with coring by 50% and more.

### Offshore tests

In March-June of 1991 the trip of DV "Bavenit" to the region of Azores-Gibraltar zone of fractures in the North-East part of Atlantic ocean took place. The main goal of this expedition was the tests of deep water research wells drilling technique and technology developed for the SDV "Nauka" built according to the order of the USSR Academy of Sciences.

Objects of work: Gorringe bank, Amper and Josephine Mountains. The conditions were characterized by high degree of hard pyrogenic and soft poorly consolidated formations alternation. Hard formations had a lot of zones of different disturbances.

There were drilled totally 29 holes; the total footage was 260.3 m for 76 wire line trips, in hard formations - 207.2 m. There were 53 attempts to make coring, 49 trips with 146.9 m of penetration were successful. Core recovery was 35.23 m (24%) from all types of rocks. 65% of footage was drilled in the five deepest wells (table 4).

According to the developed deep water research drilling technology two methods of drilling were tested: (1) conventional one - rotary drilling with the retrievable core barrel and (2) RDM with dual core barrel, took aboard without pulling out the drill string. All three variants of coring with RDM were realized (see Fig.1).

(1) Coring of the pilot slim hole wi the simultaneous reaming by retrievab. RVA1-217 reamer was used in the well 5 along with the scheme with the subsequent reaming.

(2) Coring of the pilot slim hole with the subsequent reaming by the 3DR-217K bit was most successful in the wells 4E (DVO-142 was used) and 5 (TRV-142 ).

(3) Coring of the pilot slim hole with the subsequent reaming by ISM 217/136T reamer on the drill string shoe. Typical example is the well 2E (DVO-142 PDM).

To test the sea floor upper bed lithology 9.5 m depth pilot slim holes were drilled. Core recovery was up to 40%, in spite of the complicated conditions of spudding.

Test results of the retrievable bits and reamers at all objects are given in table 5.

### Drilling of the main borehole of Krivoy Rog SG-8 well

Krivoy Rog SG-8 pilot hole provided enough information for correcting the region geological model and further research project. The vertical 850-1000 m of the pilot hole was reamed by means of RTB-480 drill and a new main borehole was sidetracked. The borehole of 480 mm (18 7/8") diameter was drilled to 2808 depth without deviation, 426 mm (16 3/4") casing was run and cemented. Drilling was continued with RTB-394 (15 1/2") drill to the depth of 3210 m, then the borehole of 295.3 mm (11 5/8") diameter was drilled (Fig.6). The change-over to the less borehole diameter was caused by economical reasons. From 3703 m depth the continuous coring began. At 3703-4975 m interval 630 m were cored with the retrievable tool. Altogether, 32 pilot slim holes were drilled, the total number of the retrievable tool trips was 219. The length of the pilot slim hole was determined by the coring program, well problems and technical reasons. Maximum length of 32 m was limited by the derrick height. The main object of each pilot slim hole drilling is maximum speedy obtaining of average core recovery sufficient for necessary investigations. For Krivoy Rog SG-8 well this level is 60%.

By variation of the tool types and trip length this average statistical core recovery level was constantly maintained. Penetration rate of each interval depending on the right choice of BHA type and drilling practices. With optimum conditions 50-60 hours were required to drill the pilot slim hole of 25-30 m length. In the pilot slim hole without pulling out the drill string there was the possibility of logging. When reaming the pilot slim hole there was used BHA that should provide for the vertical well drilling with maximum ROP. Here the major problem was to ensure effective bit operation conditions with low bit weight (up to 40 kN). With the turbodrill rotational speed of 500-600 rpm, the life of the unsealed bearing insert bit was 15-18 h. Footage per bit was 14-16 m.

Up to 3840 m depth the vertical borehole direction was possible to be preserved by using simple BHA with stabilizers. But after drilling thick trouble zone, where the large diameter cave was formed, the deviation began which was possible to be stabilized at the angle of 3.5-4 degrees. After drilling the next trouble zone from the depth of 4470 m the borehole began to deviate again. To stabilize the hole direction different BHA of passive type were used, but only with the angle being equal to 7.5 degrees the hole direction managed to be stabilized.

When well drilling, the zones of baddy tectonic faultings were penetrated, where the intensive hole enlargement, cavings, stickings of tools were observed.

The average hole diameter was increased up to 300-600 mm, the ellipsoidal section with axes lengths ratio of 1.3...1.5 was formed. At the interval of 3800-3840 m the cave size was not possible to be measured. The bottom hole was cleaned by means of the reverse circulation. The samples of rock of more than 2 kg weight with typical 100-140 mm sizes were lifted through the internal flush drill pipes. Several cubic meters of rocks were removed. This zones penetrated by plugging up the well and redrilling.

To decrease the negative effects accompanying drilling in troubles zones, the mud of 1050-1100 kg/cu. m density from the depth of 3840 m was replaced by peat-humate mud of 1100-1150 kg/cu.m density with higher viscosity and lower water loss. This replacement was useful and reduced time consumed by solution of drilling problems. When drilling with the reducing gear turbodrill TRV-142 during one running drill string the pilot slim hole in average 27 m length is formed for 7-10 trips of a retrievable tool. The ROP with TRV-142 turbodrill is 1 m/h, with TVR-198T turbodrill - 0.7 m/h, with the tool tripping requiring 35-40 minutes.

As compared to drilling igneous rocks at the 3.8-5 km interval of Kola SG-3 well, in Krivoy Rog well the drilling time of 295.3 (11 5/8") borehole was decreased by 30%. Therewith, the core recovery and quality was higher: in average 60% all over the intervals of operations in Krivoy Rog and from 60 to 20% (in average 41 %) in Kola SG-3 well.

**THE CONCLUSION**

(1) The drilling of pilot slim holes for one running of drill string with it's subsequent reaming by optimum BHA allows to solve the problems of 240-640 mm diameter wells drilling in crystalline rocks with different aims in complicated geological conditions.

(2) The use of well drilling with RDM and a retractable drilling tools in sea floor expands greatly the possibilities and increases the drilling and coring efficiency in crystalline rocks. .

(3) The internal flush drill string of increased diameter provides a number of advantages:

- optimum hydraulic program;
- high longitudinal stability;
- high carrying capacity of aluminum pipes with steel tool joints;
- the retrievable core bits diameter of 132 mm instead of 100.6 mm allows to increase their life and to use not only diamond but cone core bits as well;
- the RDM's diameter of 142 mm instead of 95 mm provides the increase of power and possibility to use not only the PDM but the turbodrill as well; this allows to develop the heat resistant motor;
- the possibility to drill wells of 217 mm diameter with the retractable

tool without pulling out the drill pipes;

- while rotary drilling with wire line core barrels the diameter of core is 90-100 mm instead of [illegible] mm;
- the possibility of logging in the pilot borehole.

(4) The technology of drilling with the retrievable tool provides the intensive borehole cooling by means of continuous drilling mud circulation in the cycle: running-in-drilling-lifting, and this provides the possibility of operation in "hot" wells.

(5) The available experience and the above technical advantages are indicative of the promise of the above drilling technology and technique in crystalline rocks to be used in the following fields:

- scientific deep and ultradeep continental drilling;
- geothermal drilling;
- drilling of wells for burying toxic wastes;
- scientific drilling of deep (2-4 km) wells in ocean from DV of "JOIDES Resolution" type;
- offshore drilling to the depth of up to 500 m in crystalline rocks without mounting the re-entry equipment from platforms and ships of different types as well as from the drift ice.


## ACKNOWLEDGEMENT

The authors highly appreciate the work of VNIIBT collaborators T.A. Andreeva, R.L. Babayan, M.V. Mischenko in the managing and test results handling of the drilling technology with RDM; Yu.S. Zmojin - in the carrying research with vibration measuring complex, A.A. Rybalka - in adaptation of RTB systems to operations in crystalline rocks. Without their participation as well as without technical assistance of L.I. Konstantiniva and M.M. Piskunov, the preparation of this paper would have been difficult. The authors also would like to acknowledge all specialists of "NEDRA" amalgamation, DV "Bavenit" team as well, which provided the use of developed in VNIIBT technique and technology in drilling research wells.


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Table 1 Characteristics of the Drill String Elements

| | Drill pipes | | Drill collars (UBTS) | Special drill pipes | Bumper sub KPBK | Extension nipple NT-195 |
|---|---|---|---|---|---|---|
| | aluminium | steel | | | | |
| Diameter, mm:<br>- pipe body<br>- tool joint<br>- protective swelling | 164,168,172<br>195<br>182 | 168<br>195,212<br>- | 197,229,240 | 186<br>229<br>229 | 260<br>240 | 170<br>195<br>- |
| Wall thickness of the main pipe body, mm | 9,11,13 | 9,11 | 25.5;42.5;<br>47.5 | 20 | | 12 |
| Length, m | 9.0 | 9.0 | 9.0 | 8.95 | 7.284 | 2.15 |
| Weight, kg | 176, 197<br>216 | 313, 440 | 961, 1726<br>2000 | 977 | 1510 | 115 |

Table 2 Characteristics of the Down-hole Motors

| Name | Water flow rate, l/sec | rpm of the motor shaft, 1/s | Max. work. torque k Nm | Differ press., MPa | Length m | Weight, kg | Weight of retriv. part, kg |
|---|---|---|---|---|---|---|---|
| Retriviable: | | | | | | | |
| Turbodrill TVR-198T (300 pieces of turbines) | 25 | 14.1 | 2.0 | 8.0 | 34.0 | 6500 | 2850 |
| Turbodrill TRV-142 with 1 reducing gear | 20..25 | 6.2..7.8 | 1.3..<br>..2.0 | 3.3..<br>..5.2 | 10.8 | 2100 | 900 |
| Turbodrill TRV-142 with 2 reducing gear | 20 | 1.6 | 5.0 | 3.3 | 10.8 | 2100 | 900 |
| PDM DVO-142 | 20 | 3.2 | 2.5 | 7.0 | 6.5 | 1700 | 800 |
| Conventional | | | | | | | |
| Turbodrill A9Sh | 45 | 16.1 | 6.1 | 4.0 | 16.5 | 4400 | - |
| PDM D1-240 | 34 | 3.0 | 7.0 | 5.0 | 8.5 | 2000 | - |

Table 3 Basic parameters and dimensions of rotary-turbine drills

| Drill type | Well diameter, mm | Bit diameter, mm | Turbo-drills diameter, mm | Drilling fluid flow rate, l/s | The largest cross sectional dimension, mm | Drill mass, kg |
|---|---|---|---|---|---|---|
| RTB-375 | 375 | 181.0 | 145 | 35..50 | 362 | 6800 |
| RTB-394 | 394 | 190.5 | 172 | 50..56 | 382 | 8200 |
| RTB-445 | 445 | 215.9 | 195 | 60..70 | 435 | 10800 |
| RTB-490 | 490<br>519<br>545 | 215.9<br>244.5<br>269.9 | 195 | 60..70 | 480 | 12000 |
| RTB-590 | 590<br>616 | 269.9<br>295.3 | 195 | 60..70 | 576 | 15800 |
| RTB-640 | 640<br>665 | 295.3<br>320.0 | 195 | 60..70 | 624 | 17000 |

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Table 4 Results of drilling by retrievable downhole motors during DV "Bavenit" leg in the Azoro-Gibralatar zone of fractures.

| Hole location | Water depth m | Penetration, m | | Num. of wire line trips | Time on hole, h | Rate of coring m/h | Core recovery | | Reason to stop drilling |
|---|---|---|---|---|---|---|---|---|---|
| | | total | during coring | | | | m | % | |
| 2B, m.Jozephine | 206 | 32.0 | 17.4 | 10 | 53.3 | 1.9 | 2.8 | 16.3 | BHA sticked |
| 2E, m.Jozephine | 212 | 22.0 | 17.5 | 5 | 24.4 | 2.8 | 5.0 | 28.5 | Weather conditions |
| 4E, Gorrindge Getesberg | 106 | 24.0 | 8.5 | 5 | 24.0 | 1.3 | 3.4 | 40.2 | BHA plugged |
| 5, Gorrindge Getesberg | 87 | 50.0 | 25.0 | 17 | 82.5 | 2.1 | 7.9 | 31.5 | According to leg program |
| 7, m.Amper | 121 | 42.0 | 20.5 | 5 | 52.5 | 3.5 | 6.0 | 29.1 | SDP failure |
| Total | | 170.5 | 88.9 | 42 | 212.7 | 2.4 | 25.1 | 28.2 | |

Table 5 Results of drilling with retrievable tools

| Tool | Well "Sputnik SG-3" | | | Krivoy Rog well SG-8 (pilot hole) | | | DV "Bavenit" | | |
|---|---|---|---|---|---|---|---|---|---|
| | Penetrat. | Life | | Penetrat. | Life | | Penetrat. | Life | |
| | m | m | h | m | m | h | m | m | h |
| Core heads: | | | | | | | | | |
| 24K-132/52 TKZ | 92.0 | 3.8 | 4.2 | 21.2 | 1.6 | 2.8 | 119.2 | 8.0 | 2.6 |
| ISM 132/52C | 305.3 | 20.4 | 20.0 | 233.5 | 27.3 | 34.1 | 18.5 | - | - |
| Retractable bit 3DR-217K | 130.5 | 6.9 | 4.2 | 29.9 | 4.8 | 3.3 | 147.4 | 36.4 | 10.6 |
| Retractable reamer RVA1-217 | 190.6 | 14.7 | 13.9 | 121.8 | 8.2 | 6.3 | 21.4 | 10.7 | 4.2 |

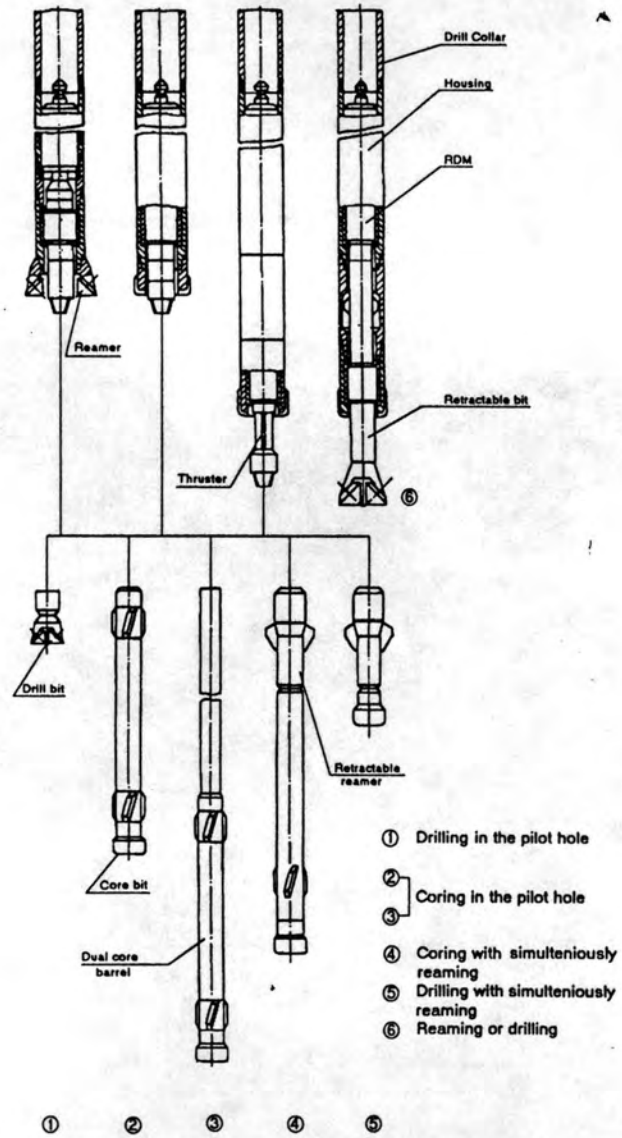


Fig. 1 Technological schemes of drilling with retrievable down hole motors

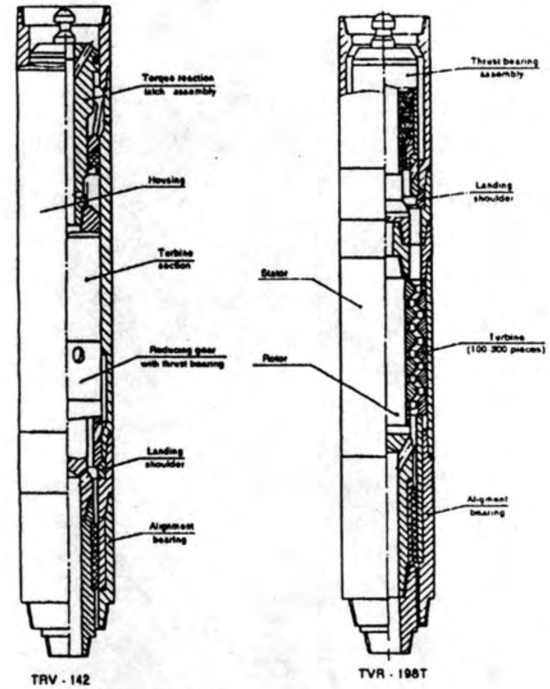


Fig. 2 Retrievable down hole motors (RDM)

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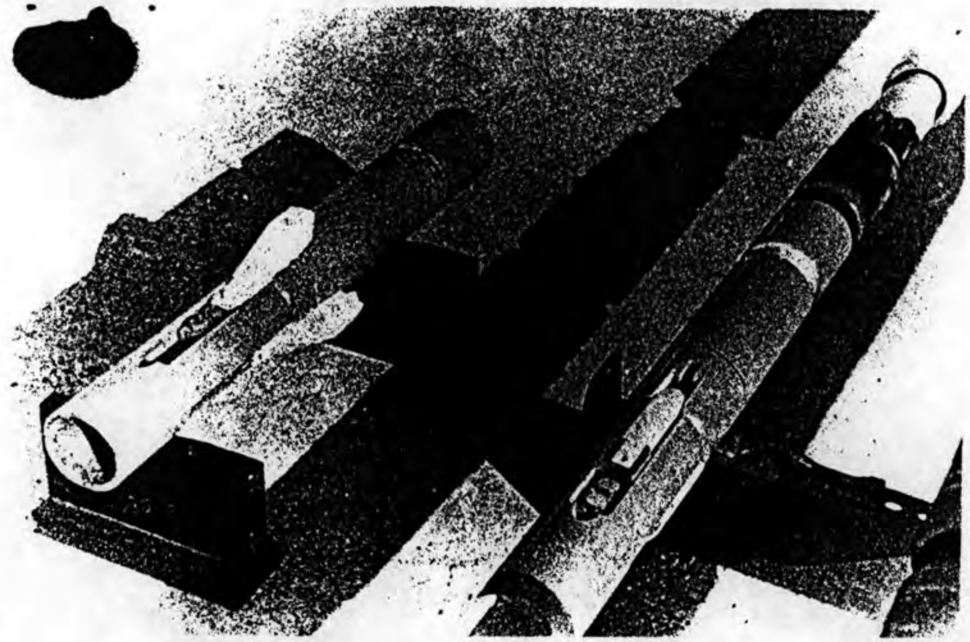

Fig. 3—Retractable reamer RVA1-217.

Fig. 4—Retractable bit 3DR-217K.

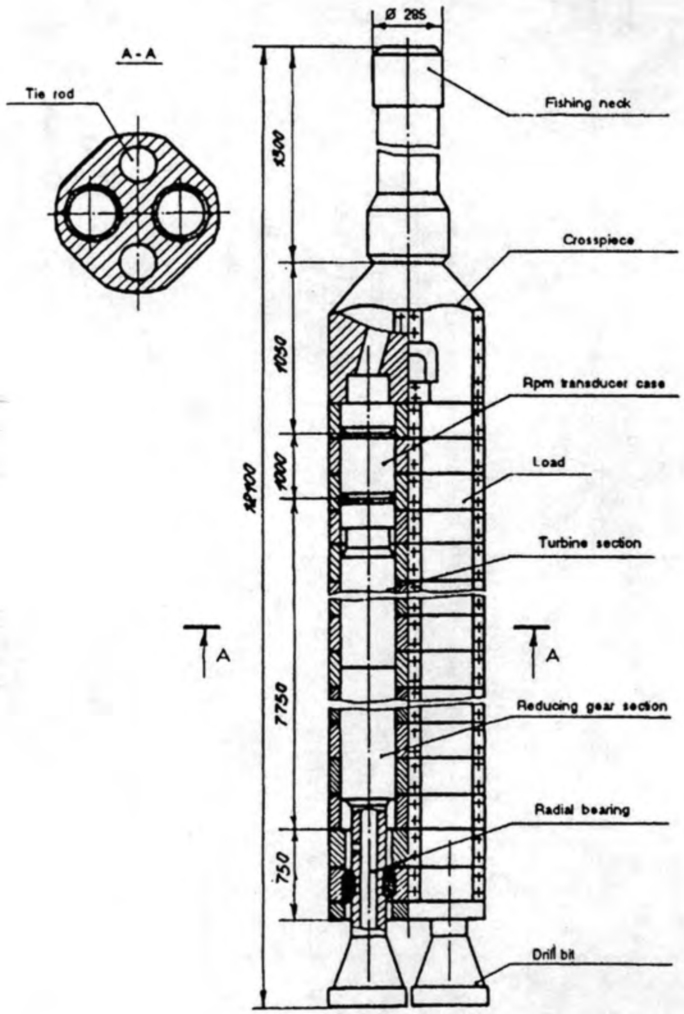


Fig. 5 Rotary-turbine drill system

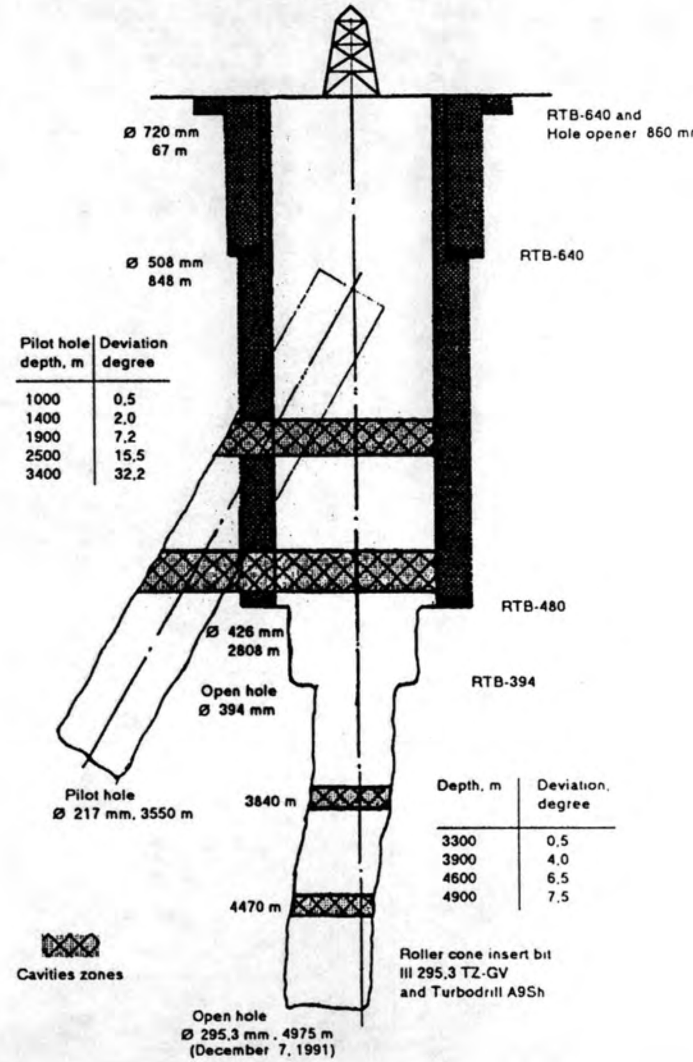


Fig. 6 History of Krivoy Rog hole system



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# PROPOSALS

on the test of deepwater drilling technology#0
developed for the use on SDV "Nauka"#0
of the Russia Academy of Sciences#0
while carrying out the Ocean Drilling Program
on the SDV "Joides Resolution"#0

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April 1992

## 1. Technical description of the technology and equipment.

### 1.1. General.

The technology comprises several technological schemes, where two drilling methods are used:

(1) rotary drilling with wireline core barrel;

(2) drilling with retrievable downhole motors (RDM) and core barrels delivered on board a ship without pulling out the string. The possibility of a drilling tool re-entry into a well with the help of a special equipment is also allowed.

The technology provides for:

- spudding a well on the ocean bottom even in bare rocks; coring and logging without pulling out the drill string on board a ship;
- resumption of separate wells drilling and logging after pulling out the drill string on board a ship, if it is necessary or in case of a well conservation for a long period (years).

The technology was developed with due regars for the possibility of drilling in different geological conditions, except the regions with potential intensive oil and gas showings.

### 1.2. Types of BHA.

For the above technology realisation there are used BHA with a housing rigidly attached to the drill string, and the retrievable part delivered on board a ship without pulling out the drill string.

Rotary drilling is performed by BHA standart for the ODP.

When drilling with a RDM the BHA housing part includes assemblies for fixing the motor in axial and radial directions. If necessary the housing includes a reamer and(or) stabilizers.

The retrievable part of the assembly consists of a rock destruction tool, core barrel and a downhole motor.

1.3. Technological schemes of drilling with RDM.

Proposed technological schemes (Fig.1) are mainly specified by the replacement of a coring tool without pulling out the drill string.

(1) Coring in a slim pilot borehole 132mm(5-1/4") diameter by a RDM and core barrel with simultaneous or subsequent reaming up to 250...394mm(9-7/8"...14-7/8") by a drill string rotation.

(2) Coring in a slim pilot borehole as in the scheme (1) with simultaneous or subsequent reaming up to 217mm by a retractable tool.

(3) Coring in a slim pilot borehole as in schemes (1) and (2); re-entry for the interval reaming and drilling by a standart BHA.

Schemes (1)-(3), on the basis of data analysis of their use represent the most suitable methods of scientific well drilling in crystalline rocks with continuous or interval coring.

The main advantage of the pilot coring with retrievable motors is a possible prompt core barrel replacement and a quick responce to well situation changes. The problems in a pilot borehole do not influence the reliability of the main well drilling.

1.4. Spudding and drilling of pilot (test) wells (type "A").

When sediments are present the spudding of such wells is carried out in accordance with traditional for the ODP scheme, namely with piston-type core barrels.Spudding can also be performed by washing-out without coring followed by the drilling according to (1) or (2) schemes.

In bare rocks well spudding and drilling is performed in accordance with schemes (1) or (2).

1.5. Well drilling when the re-entry equipment was installed (type "B").

When drilling diameter 250...394mm(9-7/8"...14-7/8") wells coring is carried out in a diameter 132mm(5-1/4") pilot borehole by a retrievable tool; then the well is reamed to a required diameter by the drill string rotation (scheme 1), or by a standart downhole assembly after the re-entry (scheme 3).

217mm diameter hole can be drilled according to scheme (2) without coring tool replacement through re-entry.

## 2. Brief characteristic of technical means for realization of the technology

2.1. Drill string

Types, sizes and characteristics of pipes making up the drill string are tabulated in Table 1. The main feature of all pipes is internal flush of 146mm (5 3/4") diameter for running the retrievable tool inside the string.

In the upper part of the string special steel pipes with protective bulges (SBTPU) - "knobbies" are used.

Table 1. Characteristics of the Drill String Elements

| | Drill pipes | | Drill collars (UBTS) | Special pipes (SBTPU) | Bumper sub KPBK |
|---|---|---|---|---|---|
| | aluminium | steel | | | |
| Diameter, mm: | | | | | |
| - pipe body | 164,168,172 | 168 | 197,229,240 | 186 | 260 |
| - tool joint | 195 | 195,212 | | 229 | 240 |
| - protective swelling | 182 | - | | 229 | |
| Wall thickness (pipe body),mm | 9,11,13 | 9,11 | 25,5; 42,5; 47,5 | 20 | |
| Length,m | 9,0 | 9,0 | 9,0 | 9,0 | 7,3 |
| Weigth,kg | 176,197,216 | 313,440 | 961, 1726, 2000 | 977 | 1510 |

2.2. Retrievable downhole motors (Fig.2)

TVR-198T - a turbodrill with a retrievable rotor: the housing of the turbodrill includs a stator, a landing shoulder and alignment bearings housinge; the retrievable part - a rotor and a thrust bearing assembly.

TRV-142 - a turbodrill with reducing gear: the housing part



includes a landing shoulder and keys for fixing the turbodrill in axial and radial directions. The retrievable part includes the reducing gear with thrust bearing assembly, turbine section and a torque reaction latch.

DVO-142 - a positive displacement motor: the housing part is the same as that of the TRV, the retrievable part includes the PDM instead of the turbine with a reducing gear.

The motors provide a wide range of drilling and coring practices (see Table 2). In the retrievable part of the DVO-142 the standart 4-3/4" Dyna-Drill motor can be used.

Table 2. Characteristics of the Retrievable Downhole Motors

| Name | Water flow rate, l/sec | rpm of the motor l/s | Max. work. torque k Nm | Differ press., MPa | Length m | Weigth, kg | Weigt of retriv. part, kg |
|---|---|---|---|---|---|---|---|
| Turbodrill TVR-198T (300 sets of turbines | 25 | 14,1 | 2,0 | 8,0 | 34,0 | 6500 | 2850 |
| Turbodrill TRV-142 | | | | | | | |
| - 1 gear | 20..25 | 6,2..7,8 | 1,3..2,0 | 3,3..5,2 | 10,8 | 2100 | 900 |
| - 2 gears | 20 | 1,6 | 5,0 | 3,3 | 10,8 | 2100 | 900 |
| PDM DVO-142 | 20 | 3,2 | 2,5 | 7,0 | 6,5 | 1700 | 800 |

Diameter: housing - 197mm; retrievable part - 142mm, no more.

2.3. Core barrels.

(1) Dual core barrels including outer barrel with two stabilizers and inner barrel. Inner barrel of 3...6 meters length includes the assembly of two core catchers, plastic or metal with chromium plated inside surface pipe and a bearing hanger.

SKV-122-132/52(67) core barrels are used with core bits of different types:

- ISM type: 132/52 S and T, 132/67T - cutting structure is equipment with inserts of composite material with an impregnated diamonds layer;

- cone type: K132/52 TKZ with hard alloy wedge-shaped inserts; standard ODP core diameter is available if necessary.

(2) standart core barrel sets of "Christensen","Diamond Boart" etc. of 4-3/4" OD size. Core bit diameter shouldn`t be above 5-1/4".

2.4. Retractable drilling tools.

3DR-217K retractable three-cone bit; cutting structure - hard alloy inserts (Fig.3).

RVA-217T retractable reamer (Fig.4) - a three blade one with the ISM type cutting structure.

Retractable rock destruction tool is transported to the bottom hole inside the drill string in the retracted position and then it is converted into the operating position. For changing a retractable tool transporting position into an operating one the hydraulic method is used with manifold pressure control, and for back change the mechanical method is used.

2.5. The reamer on the RDM housing shoe.

For reaming the pilot borehole 217/136T and 293/136T ISM type reamers and 393/136TKZ cone type ones are used. Another size both types reamers can be manufactured if necessary.

2.6. Special tools.

(1) Thruster mechanism (bumper sub) is mounted between the RDM shaft and core barrel.

(2) Drilling fluid flow divider is mounted above the core barrel, if it is necessary to direct only a part of the fluid flow into it.

(3) Extension fitting pipe is mounted between the core barrel and RDM shaft as the pilot borehole is deepened.

(4) Magnetic bit extractor of high load capacity as well as taper taps, bell sockets, junk mills run for carrying out emergency operations in the pilot borehole without pulling out drill string.

2.7. Control systems:

(1) telemetric system consisting of a down hole rpm sensor-generator and surface equipment;

(2) throwing down single-shot inclinometer;

(3) acoustic control system of the retrievable tool position;

(4) wire line control system;

(5) vibrations measuring complex for the bit rpm control, determination of rocks drillability change, precise core reference to the depth, the moment of the tool sticking and other specific situations in the process of drilling.

## 3. Service operations with a deepwater manned submersibles (Sub) and a ROV.

When testing the drilling technology it is expedient to use the subs and the ROV to control the carried out operations and necessary services.

3.1. The use of the Subs.

a) In operation to the depths up to 4000m the sub "Rift" can be used (in case the financing is offered, the apparatus can be launched in 1,5 years). The joint participation in these operations is proposed.

b) To control the drilling process and service operations in the depths up to 6000m the use of sub "Mir-1" and "Mir-2" belonding to the Russia Academy of Sciences is proposed.

c) For operations in the depths above 6000m the building of the titanic submersible with operating depth of 9000m and weight up to 25tns is proposed.

There is an official support of specialized industrial enterprizes concerning the possibility of all "Sub-9000" components development.

3.2. The use of the ROV.

To carry out service operations in hard-to-reach and dangerous places as well as for the subsequent geophysical survey of drilled before wells, the joint development, building and subsequent operations of the following equipment is proposed:

a) special device for wells geophisical surveys: after the device docking on the bottom it is controlled from the sub board; the device is used with Sub "Mir", "Rift" and "Sub-9000";

b) ROV used for two variants of installation:

- basing on boards of Sub "Mir", "Rift" and "Sub-9000" (Fig.5);

- basing on the "garage", run in outside the drill string and used instead of the wire-line TV camera. In this case the ROV released from the "garage" will provide services with the downhole drill string assemblies, wellhead and in a definite region within the point of the well spudding. The area of this region depends on the cable floating part length (Fig.6).

4. Modification of "SEDCO / BP 471" drilling complex.

The amount of the drilling complex modification depends on the targets of the engineering leg.

We think that it is necessary to modificate two 5" diameter drill pipes holders of Pipe Racking System (port and star sides) in order to keep there 4500 m of 168 mm (6-5/8") diameter aluminium drill pipes. The modification will be consisted in the replacement of the arms of the Pipe Racking System. In case of necessity to use combined drill string ( 5", 5-1/2" and 6-5/8" aluminium DP) it is reasonable to manufacture proper cross over pipes.

6-5/8" knobbies which are under manufacturing now for third stage of DCS can be adapted for VNIIBT drill string and tested during the next engineering leg in case of their inside diameter is not less than 146 mm (5-3/4").

In order to make round trips with VNIIBT drill string three 6-5/8" elevators, propersizes of drill collars slips, clamps and dies should be prepared. Enough place to keep spare aluminiun single pipes, drill collars, down hole motors, BHA and retrievable tools should be provided.

5. The program of operations.

| | | |
|---|---|---|
| 1) Drawing up of documentation for the above technology and technical means on the "JOIDES Resolution" | - | May 1992 |
| 2) Demonstration of technical means and technology for the TAMU/ODP specialists in GGP (State Geological Company) "Nedra", Krivoy Rog town (Ukrain) while drilling Krivorozhskaya SG-8 well | - | June 1992 |
| 3) Coordination of preparation and test program with TAMU/ODP | - | July 1992 |
| 4) Technical studies for SEDCO/BP 471 drilling crew members in GGP "Nedra" | - | August 1992 |
| 5) Preparation of technical means and necessary documentation for testing | - | November 1992 |
| 6) Test of the technology | - | Leg 148 |

6. Expected results.

6.1. While drilling "A" type wells.

In bare rocks well spudding and drilling with continuous coring can be performed to 100m plus depth without the HRB mounting. Results of this drilling and coring will help to select: the best conditions to deploy HRB, casing program and the method of the deep hole drilling including DCS drilling.

6.2. While a deep well drilling.

Core recovery increase and the optimization of conditions for drilling problems solution. Cost reduction and the drilling process reliability increase.

6.3. Determination of the proposed technology application promises, as well as of some of its components or equipment while realising the ODP.

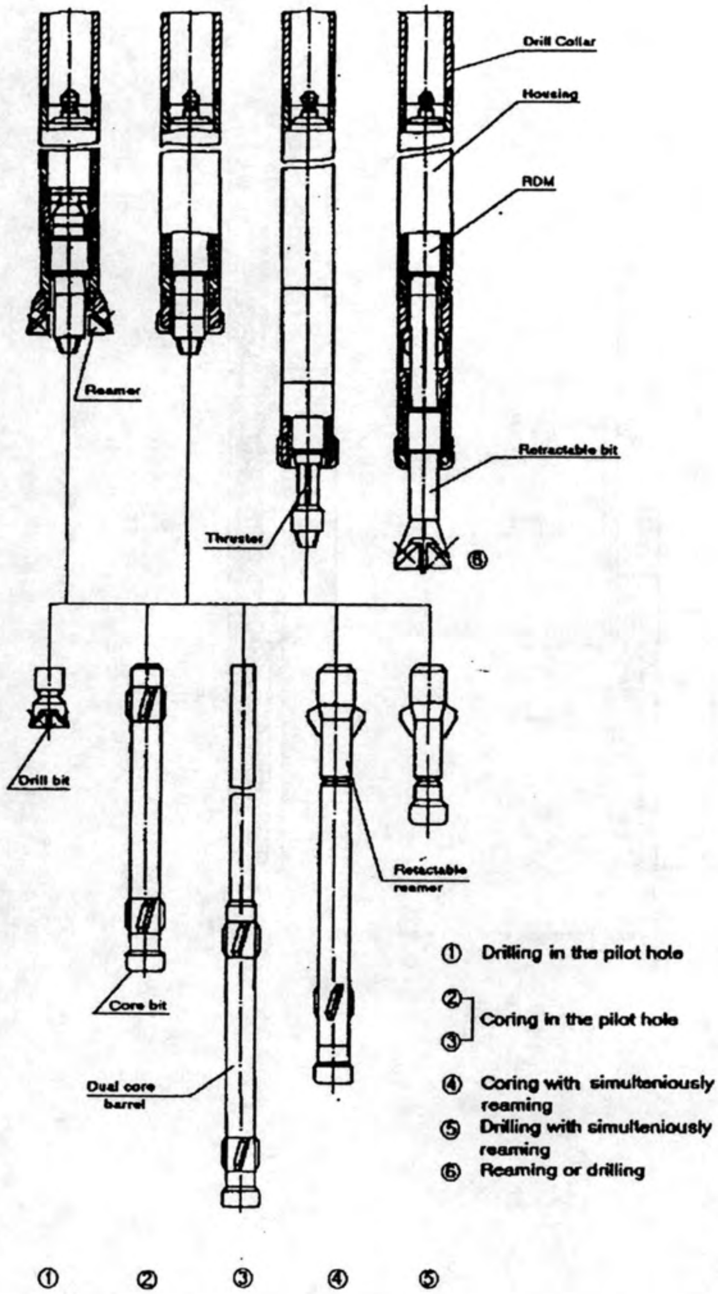


Fig. 1 Technological schemes of drilling with retrievable down hole motors

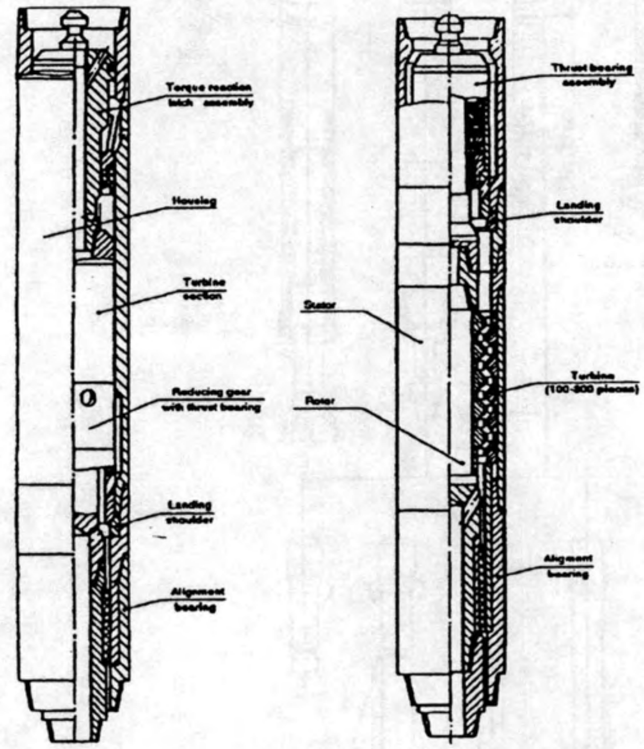


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Fig. 2 Retrievable down hole motors (RDM)

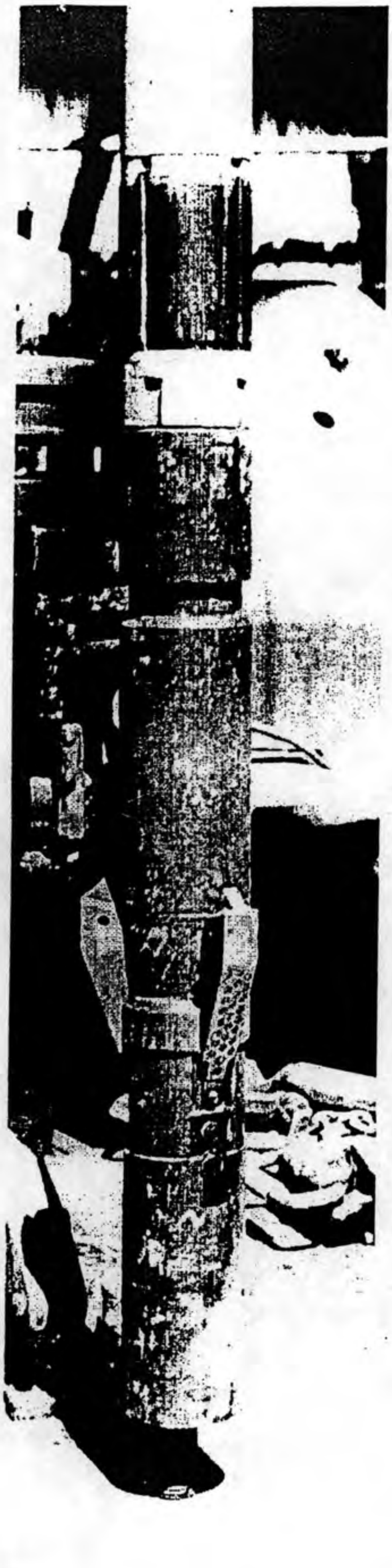

Fig. 3

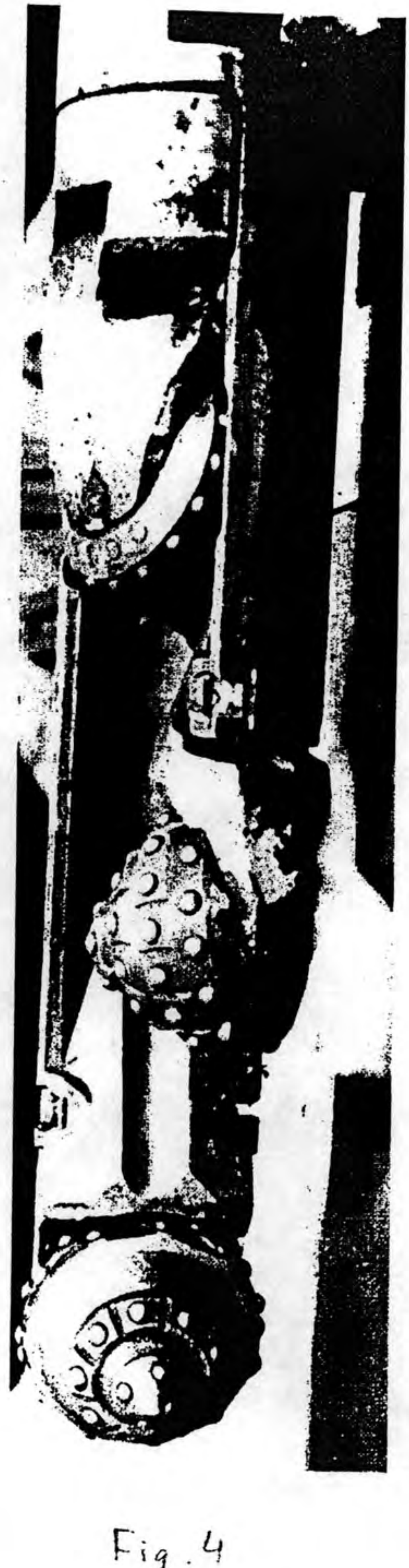

Fig. 4

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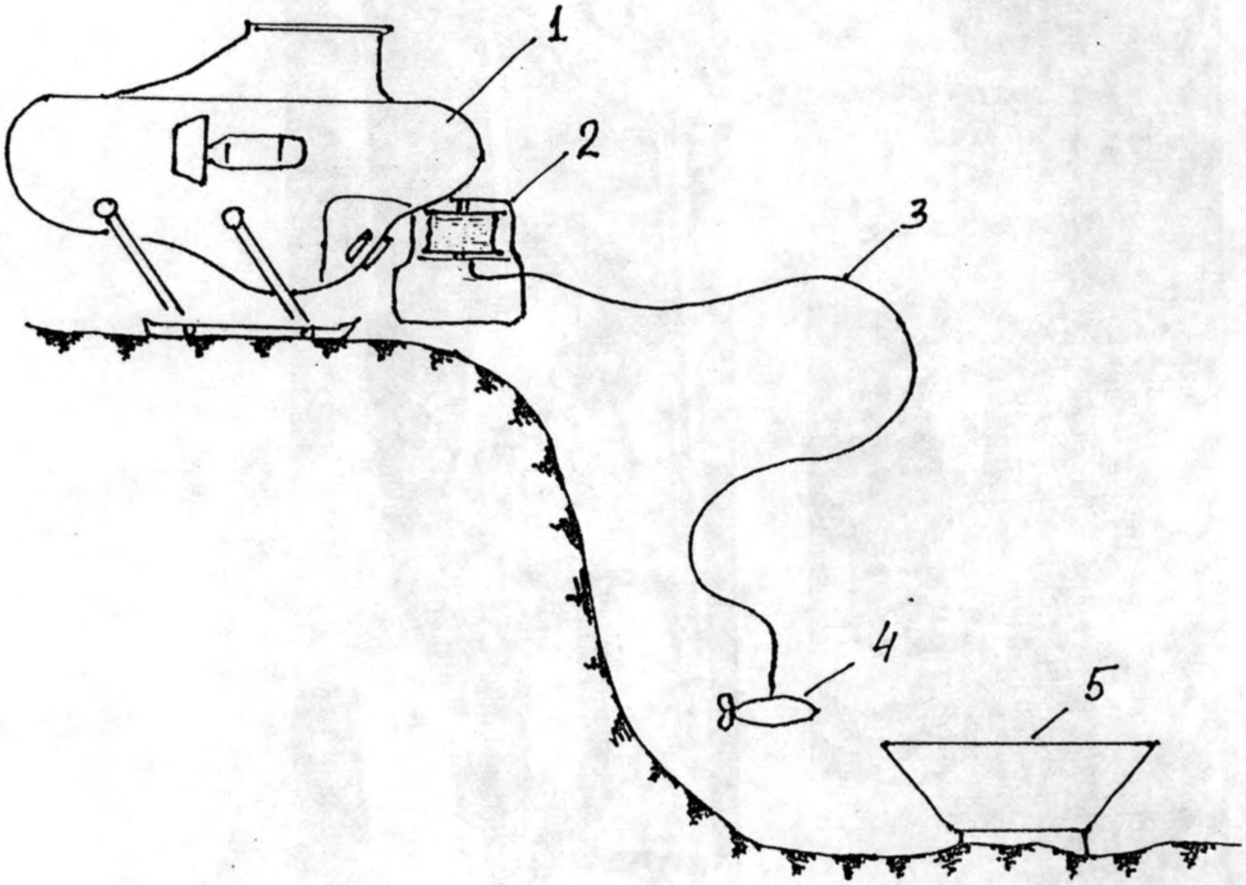


Fig 5

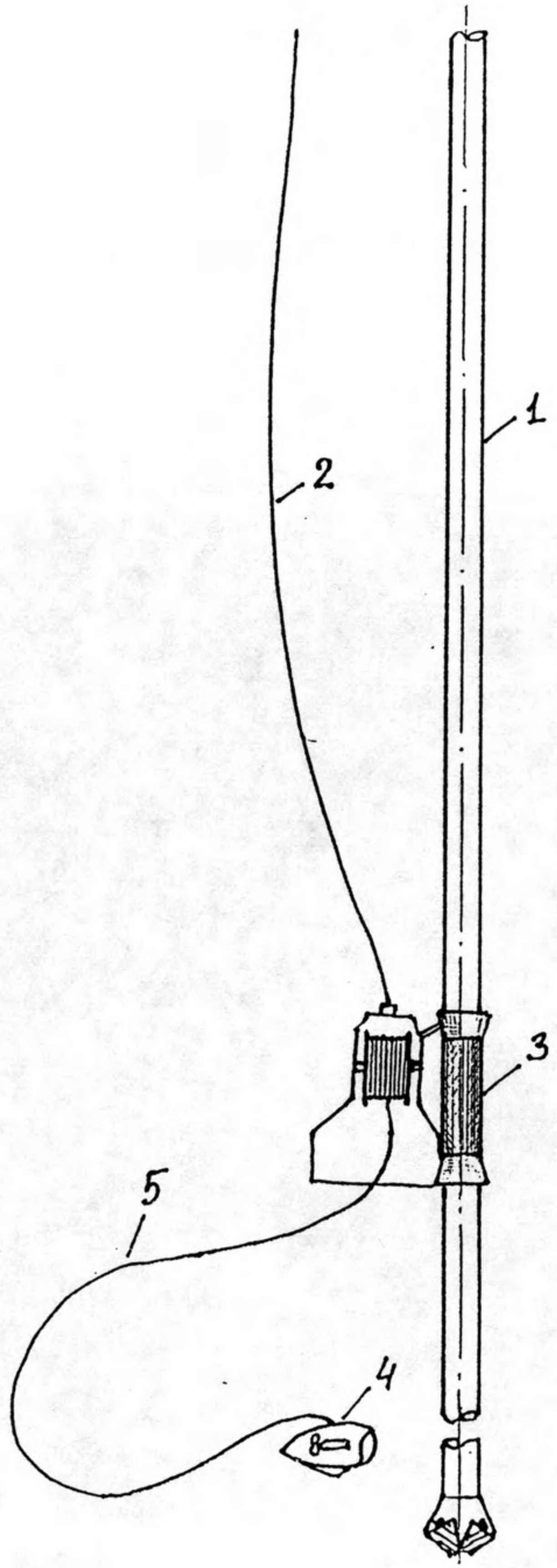


Fig 6

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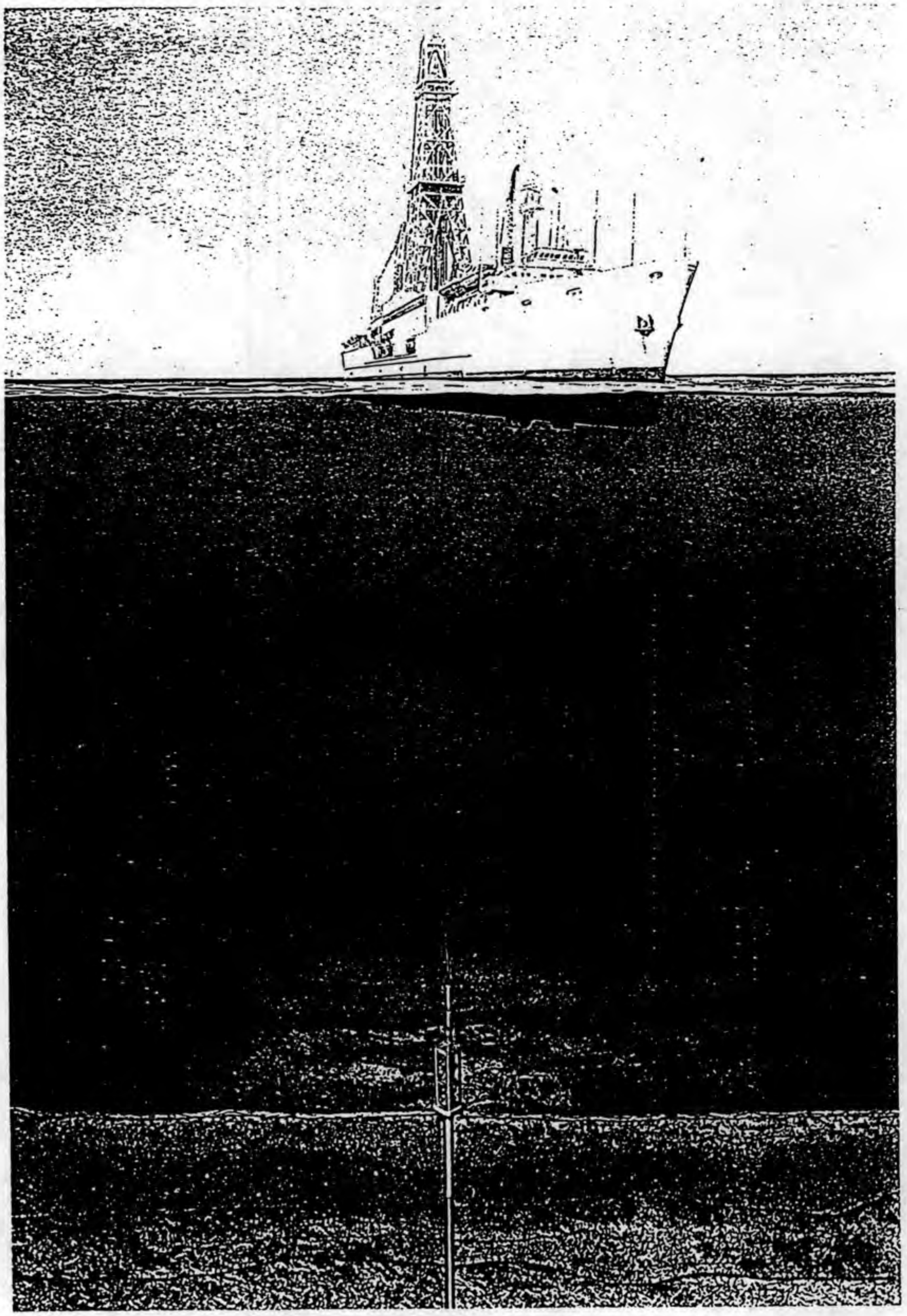
- For the dramatic advances and the international contribution on the earth and ocean science and technologies -

# DEEP SEA DRILLING VESSEL SYSTEM



Science and Technology Agency (STA)
Japan Marine Science and Technology Center (JAMSTEC)
*- Tentative Translation from the Japanese Edition -*

# Why the Deep Sea Drilling Vessel System is required?

Today, with issues of the global environment looming larger, the necessity of understanding the solid earth itself is more stressed than ever before. From the view point of earthquake prediction and disaster pre-vention and others, scientific knowledge of the earth's process is urgently needed. The development and utilization of the **Deep Sea Drilling Vessel System** is expected not only to help bring dramatic advances in research field mentioned above, but also to become the tool for big sciences to provide human beings with broad scientific knowledges about the entire planet.

Researches by deep sea drilling until now has been performed centering on the United States. From now on, however, Japan considers it appropriate to promote its basic scientific researches like these ones powerfully, taking its responsibilities to the world in minds.

**A Key is hidden in the deep sea to understand the history and evolution of the earth.**

**"Thin crust"**

- ***The average thickness of the oceanic crust is about 4 to 10km*** and it is very thin compared with the continental crust which is about 20 to 60km.
- It is easier at the ocean to survey the structure of the crust and is more possible to reach to the interface between the crust and the mantle (Moho-surface) than at the continent.

**"Moving oceanic plates"**

- The movement of the oceanic plates has produced present topology of the earth.
- Many of the plate spreading zones (Mid Oceanic Ridge), plate subduction zones (Trench), opening zones behind island arcs (Back arc basins) etc. ***which are difficult to survey on land*** exist in the deep sea.

**"Thick sediment accumulated in 2 hundred million years"**

- ***Fossils and sediments accumulated in 2 hundred million years in maximum*** exist in the deep sea floor without any erosion or weathering.
- It accumulates the ***history of environmental changes of the earth*** for several thousands to several tens of million years and has quite many informations to solve the mechanics of the changes.

**"Various resources in the deep sea floor"**

- ***Abundant resources such as petroleum, natural gasses and hydro-thermal deposit,*** exist in the deep sea.
- To understand the formation mechanism and the distribution of the deep sea resouces are very important for the human beings on a view point of long-term security of resources.

**"Enormous movement inside the crust"**

- Heat and material inside the earth appear to the ocean via the crust, and strain in the crust induces large scale earthquake.
- To grasp the strain, heat transfer, material transfer etc. in the crust is very important for the ***earthquake prediction and for understanding the environmental changes.***

## Dramatic Advances expected on Earth and Ocean Science and Technology (Basic Scientific Research)

Science and technology on the earth and the ocean, as well as the global environmental issues, are areas which should be expecially strengthened in the '90s. It is necessary for Japan to fill up, to strengthen, and to expand the facilities and personels of these areas because Japan lags considerably behind the world level. Research by deep sea drilling can be a turning point for Japan's science and technology.

## Establishment of Large Scale and High Level Research Method (Center of Excellence)

For the promotion of science and technology on the earth and the ocean, it is of paramount importance to have large and state-of-the-art research tools. Good example is "SHINKAI 6500" submersible system which has the deepest diving capability in the world at present. Hence the development of the core system (i.e. the **Deep Sea Drilling Vessel System** proposed here) for what could develop into a big science is indispensable utilizing Japanese resources and splendid technologies.

## Promotion of International Contribution and International Cooperation

Currently the world's only and now rather aged deep sea drill ship "Joides Resolution" is in service for the Ocean Drilling Program (ODP) under the leadership of the United States. However, the vessel alone cannot possibly meet the scale and level of modern research in demand today, and the program is requested to expand to respond the ever growing needs around the world. On the other hand, the development of a large scale system of this kind is also necessary for Japan in view of its responsibility to the world.

The **Deep Sea Drilling Vessel System**, after development, has to be operated under internationally open system with international joint efforts and offering research opportunities to researchers around the world as a part of Japan's contribution to the world in the field of basic researches.

# OUTLINE OF THE DEEP SEA DRILLING VESSEL SYSTEM

The Deep Sea Drilling Vessel System is a ***comprehensive research platform built for studying the earth and the ocean using the most advanced technologies available*** on shipbuilding, drilling, resource survey, instrumentation, automation (robotics), data processing, and so on. It consists of a large and specially featured ship body and an advanced drilling system.

After its completion, the system is expected to ***cruise to different oceanic spots around the world*** for large volumes of core samples from under the sea bottom, and for other observation data on the earth's processes which are beneficial to the progress of the science and technology on the earth and the ocean.

The development of the **deep sea drilling vessel system** will serve these purposes:

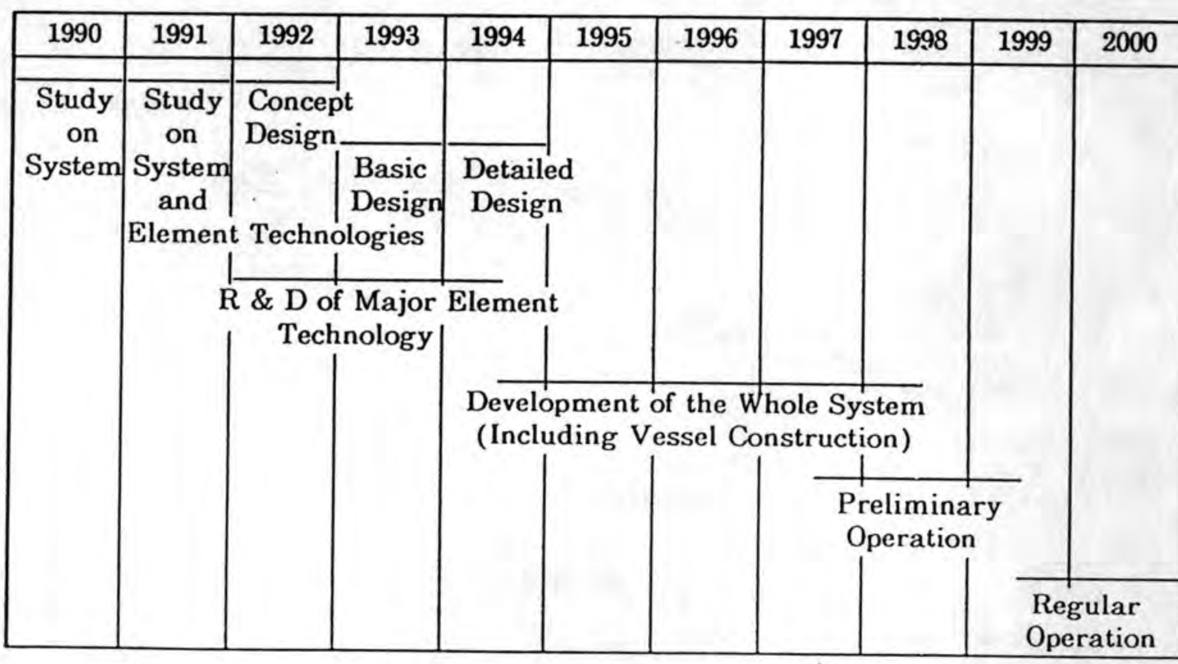
- Comprehensive promotion of R & D efforts for frontier technologies and systems
- Realization of a **deep sea drilling vessel system** capable of fulfilling investigation needs in seas around Japan and in major oceans of the world
- Role of a "Center of Excellence", a floating integrated research center equipped with various kinds of modern experiment and analyzing equipment and computers
- Main features of the proposed **deep sea drilling vessel system** (goals):

| | |
|---|---|
| Maximum operating water depth | 7,000m |
| Drilling via fluid circulation | |
| Maximum water depth at drilling point | 4,000m |
| Maximum drilling depth under sea bottom | 3,500m |
| Maximum temperature in the hole | |
| while drilling | 400℃ |
| while measuring | 300℃ |

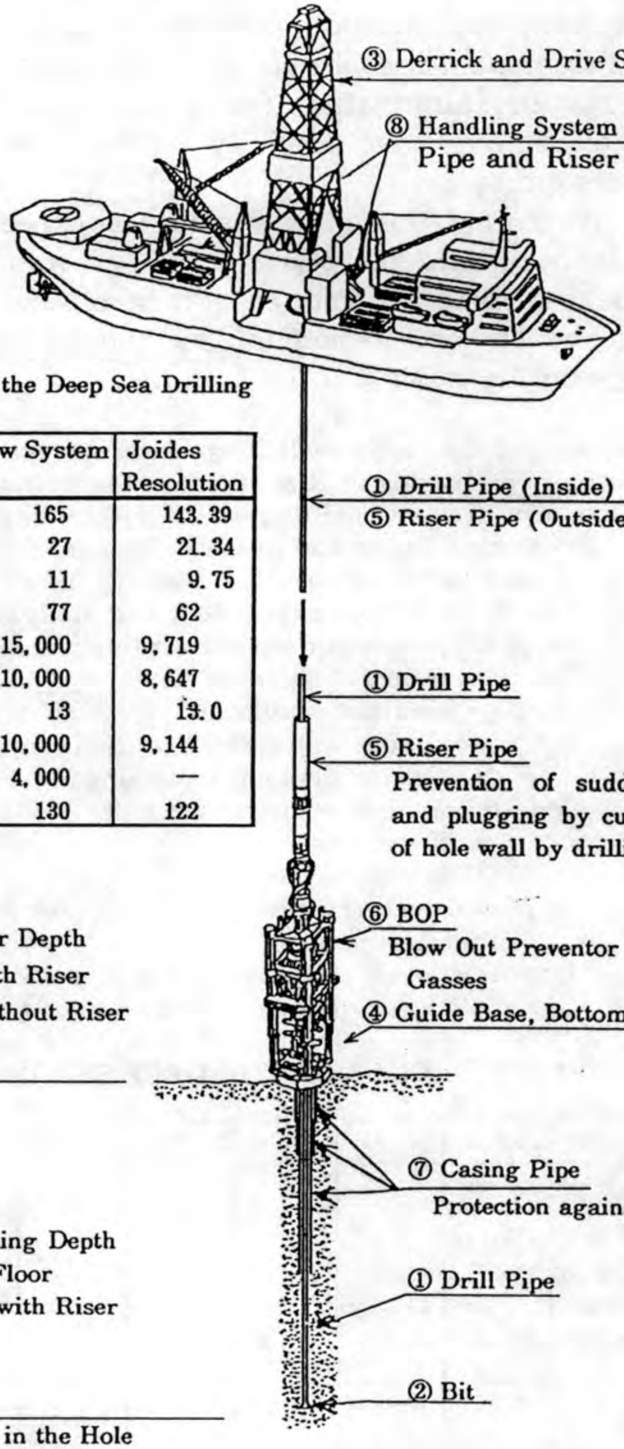
Improved recovery rate of core samples while retaining in-situ conditions

Improved work efficiency and safety and maximized automation for drilling processes throughout

DEVELOPMENT SCHEDULE OF THE **DEEP SEA DRILLING VESSEL SYSTEM**



# CONCEPT DRAWING OF THE DEEP SEA DRILLING VESSEL SYSTEM




Principal Particulars of the Deep Sea Drilling Vessel System

| Item | New System | Joides Resolution |
|---|---|---|
| Length Overall (m) | 165 | 143.39 |
| Breadth Molded (m) | 27 | 21.34 |
| Depth Molded (m) | 11 | 9.75 |
| Derrick Height (m) | 77 | 62 |
| Gross Tonnage (mt) | 15,000 | 9,719 |
| Dead Weight (mt) | 10,000 | 8,647 |
| Speed (kt) | 13 | 13.0 |
| DrillPipe Length (m) | 10,000 | 9,144 |
| Riser Length (m) | 4,000 | — |
| Accommodation | 130 | 122 |

# EXPECTED RESULTS



(1) Analysis of the Oceanic Crust Structure

- Direct sampling and analysis of the ocean floor sediment and rock give us knowledges on structure of the crust covering the earth surface and show the era of the crust formation. Sampling of materials of the lower part of oceanic crust and also of the upper mantle is expected by proper selection of the drilling position, and such sampling is very beneficial for the study on the lowest part of oceanic crust and the interface between the crust and the mantle (Moho surface).

- Measurement in the drilled hole gives us knowledges on mechanical structure of the crust and heat/material transfer coming up from inside of the earth.

**(2) Analisys on Plate Dynamics and Earthquake Prediction**

- Mid ocean ridge which is a diverging zone of mantle convection and where the oceanic plate is formed, and trench which is a subduction zone where the plate sinks back to the mantle after very long trip from the ridge, are the places of the most dynamic plate activities on the earth. Researches by the **Deep Sea Drilling Vessel System** at mid ocean ridges will unveil the structures and composition of the crust, the relation between the material of mantle and the rocks consisting the crust, and the plate formation processes.

- Researches at subduction zones such as trenches will also unveil the plate subduction processes and the formation processes of the sliding surface and the faults etc. Moreover, the in-situ measurement in the drilled hole will contribute to the analysis and prediction of the earthquake or volcanic activities.

- Researches will unveil the inside structure and the history of development of sea mounts.

- Sea floor spreadings similar to the mid ocean ridge are seen in various places behind the chain islands in volcanic zones, and new sea floors are formed there. Mechanism of spreading of the back arc basin (Japan Sea and other back arc basins) and geological history of island arc such as the Japan islands will be unveiled by the researches.

(3) Analysis of Environmental Change on the Earth

- Continuous sampling of the deep sea floor sediment accumulated during this 2 hundred million years and the analysis of the fossils and others contained in the sediment will unveil the paleoenvironment and paleoclimate of the earth, and the analysis of them will give us knowledges on the changes and its mechanisms of the earth's environment.

(4) Promotion of the Basic Study on Deep Sea Mineral Resources

- The vessel can be used for the promotion of the basic study on the formation mechanisms and the distribution of the deep sea mineral resources.

(5) Deployment of the Advanced Ocean Observation Network and Earth Diagnosis Network

- Deployment of observation network covering wide area with continuous monitoring of dynamic fluctuations in the crust such as earthquake or strains can be realized utilizing the drilled holes for the measurement spots where noise levels are quite small and very good data can be easily obtained. This network can be extended to the global observation/monitoring system.

**Where and What kind of drilling survey will be carried out?**

☆Mid Ocean Ridge
(East Pacific Rise, Mid Atlantic Ridge, Central Indian Ridge, etc.)
- Detection of the crust structure, its composition, sedimentaly structure etc. at plate spreading zone
- Analysis of plate creation processes

☆Subduction Zone
(Japan Trench, Nankai Trough, Izu-Bonin Trench, etc.)
- Detection and analysis of the structure of accretion zone, condition of the fault or sliding surfaces etc. and their formation processes
- Detection of the internal stresses and fluid circulation in the plate

☆Seamount, Seamount Chain
(Kyushu-Palau Ridge, Hawaiian Ridge, etc.)
- Analysis of the internal structure and the history of development/subsidence of the seamounts

☆Back Arc Basin
(Japan Sea, Ogasawara Trough, North Fiji Basin, etc.)
- Analysis of the structure, the formation mechanism, and the spreading pattern of the back arc basin
- Analysis of the geological history of the island arcs such as the Japan Islands

☆Abyssal Plain and Trough
(Shikoku Basin, East Mariana Basin, North Pacific Abyssal Plain, etc.)
- Detection of the structure, internal stresses, heat transfer, etc. of the typical oceanic crust
- Analysis of the environmental changes using abyssal deposits

## History of Deep Sea Drilling Survey in the World

- 1961 Mohole Project (USA) **CUSS I**
  Nearly 170m core sample was collected at the depth of 3,560m off California.

- 1968 JOIDES Project (USA) **Caldrill I**
  513m core samples were collected at 6 points of the depth of 25m to 1,032m off Florida.

- 1968~75 Deep Sea Drilling Project, DSDP (USA) **Glomer Challenger**

- 1975~84 International Phase of Ocean Drilling, IPOD (USA, Japan, France, UK, West Germany, USSR) **Glomer Challenger**
  Nearly 170km core samples were collected at 624 points of all over the world through DSDP and IPOD.

- 1985~ Ocean Drilling Program, ODP (USA, Japan, France, UK, Germany, Canada, Australia and other nations and organizations) **Joides Resolution**
  Nearly 80km core samples were collected until March 1991 at about 450 points of the world. This project continues until 1993, but further extension is sought and is now under discussion.

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JOI/ODP

# OFFSET-SECTION DRILLING

## AN EXECUTIVE SUMMARY OF THE FINAL REPORT OF THE OFFSET DRILLING WORKING GROUP (OD-WG)

### Background and Thematic Objectives

The oceanic lithosphere underlies approximately 60% of the Earth's surface. Its uppermost part, the seismically-defined crust, is typically no more than 6 or 7 km thick, and yet to date less than half of the oceanic crustal section has been drilled. Thus, although the plate tectonic paradigm has provided a first-order picture and model for the formation of oceanic lithosphere at accretionary plate boundaries, we are still remarkably ignorant of the nature of the lower crust, and the upper mantle from which it is derived, and the chemical and physical processes which take place at these depths.

Models for the nature of the lower oceanic crust are constrained by seismic studies and direct sampling of the ocean floor, and by the analogy with ophiolites. However, most ophiolites have a supra-subduction zone origin and contain abundant wehrlitic accumulates, rock types only rarely sampled in the oceans. Seismic structure may be more a reflection of the porosity and alteration of the crust and uppermost mantle than its igneous lithology.

Major developments in techniques, data and ideas within the past decade or so raise numerous new questions regarding the processes occurring in the uppermost oceanic lithosphere. How does melt form and migrate in the mantle? To what extent does it react with the mantle? Earlier ideas of 'batch' melting have been challenged by the concept of continuous melt formation and removal. Melt modification by wall-rock interaction is as yet a complete unknown.

How is melt production and removal related to local tectonic environment, notably ridge segmentation? To what extent is there focussing of mantle flow? Are these effects essentially a function of spreading rate? What are the relations between magmatism, tectonism and hydrothermal activity? Does magma aggregate into magma chambers, and if so what are the internal dynamics of magma chambers? The latest evidence for very small bodies of magma beneath fast-spreading ridge crests, and large volumes of crystal mush will, if verified, necessitate a major revision of many earlier ideas.

Basement topography and crustal structure appear to relate to spreading rate and plume/spreading centre interactions. However, the precise nature of these variations and what governs the transition from, for example, magmatic to amagmatic extension episodes is essentially unknown.

What role does serpentinisation play in ocean crust creation? How is serpentinite generated, and what is its relationship to faulting? What role does the lower crust have in the origin of the oceanic linear magnetic anomalies? What is the regional state of stress at accretionary plate boundaries?

This myriad of questions, many of which could not have been posed ten or fifteen years ago, can be most expeditiously addressed at the present time by the strategy of offset-section drilling of the oceanic lower crust and uppermost mantle.

Strategy

The primary scientific objective of lithospheric drilling is to investigate the complex magmatic, tectonic and hydrothermal processes involved in the formation and evolution of oceanic crust. Offset-section drilling is a strategy to obtain long sections of crust and upper mantle and to construct composite sections at a limited number of localities where testable models can be identified.

Key partial sections of crustal and upper mantle rocks are exposed in tectonic windows provided by propagating rifts, fracture zone walls, transverse ridges and median valley master faults. Partial sections will yield the most useful information when they can be linked together by either seismic or lithologic transitions. However long sections of oceanic gabbro and peridotite can yield valuable information on magmatic and tectonic processes even when their stratigraphic positions are not precisely constrained.

A minimum drilling programme to address the major objectives outlined above would be as follows:

1. The gross structure of the ocean crust can be determined by obtaining composite sections of crust formed at fast- and slow-spreading ridges.

2. The processes of melt formation and migration in the mantle can be addressed by sampling long peridotite sections, preferably in tectonically constrained plume and non-plume environments.

3. Melt production can be related to local tectonic environments by sampling lower crustal and upper mantle sections near the centre and at the end of a magmatic cell, preferably in a slow-spreading environment.

4. Relationships between magmatic, tectonic and hydrothermal activity can be addressed by sampling the dike-gabbro transition in slow-spreading crust. Several holes would be needed to constrain the lateral and depth variations.

5. Magma chamber processes can best be studied in long sections of gabbro from fast- and slow spreading crust where the original spatial relations can be reconstructed.

6. Investigation of the relationship between crustal dynamics and spreading rate will require compilation of composite sections in fast-spreading, slow-spreading and plume-related environments.

7. The role of serpentinisation in the creation of oceanic crust can best be addressed by a number of relatively short holes ($\approx$ 500m) in a number of environments such as diapirs, rift valley walls, and detachment surfaces, where peridotite is exposed.

8. Long sections of gabbro and peridotite in magnetically constrained environments will provide data on the contribution of lower crustal and upper mantle rocks to magnetic anomalies.

9. Understanding the state of stress in oceanic crust will require deep holes (greater than 500m) in areas where the tectonic environment is well defined.

Given the undoubtedly limited amount of shiptime available for basement drilling, the following objectives for offset-section drilling are considered the highest priority:

1. To obtain composite sections of crust formed at fast- and slow-spreading ridges.

2. To obtain sections which constrain the variability in the crust and upper mantle that occurs between geochemically enriched and depleted areas, and the lateral (spatial and temporal) variations that occur within magmatic segments of spreading systems.

The construction of the ocean crust has first order variations between slow- and fast-spreading ridges. Any strategy to test models for the evolution of ocean crust must include sampling sections in both kinds of crust. Most models for crustal formation are either spreading-rate specific; eg. detachment faulting or so-called "amagmatic" extension at slow-spreading ridges, or include end-member cases for fast- and slow-spreading environments, as in the magma chamber models of Sinton and Detrick (1992). Thus, if we are to reach any reasonable understanding of crustal genesis, by an offset-section strategy, sampling of fast- and slow-spreading crust must proceed in concert.

Models for fast-spreading crust suggest that the higher magma supply rates and more laterally continuous melt horizons of fast-spreading ridges produce, to a first order, more homogeneous crust than is generated at slow-spreading ridges. In contrast, many models for the evolution of slow-spread crust emphasise along axis discontinuities in time and space, and strong interactions between tectonic and magmatic processes. The testing of models for crustal generation consequently, will require that more time be spent characterising the slow-spreading case, because the apparent complexity of the crust requires a larger number of sites.

Second order crustal variations occur between geochemically enriched versus depleted areas of the mid-ocean ridge system and systematically within magmatic segments of all spreading systems. Establishing the nature of these variations will be the second priority.

The programme envisioned here would last 8-10 years and involve about 12 two-month legs in the hope of drilling a total of 15-18 holes. Each hole would typically be 1000 ± 500m in depth depending on scientific objectives, drilling conditions, and logistic considerations.

A notional allocation of legs to our primary objectives might be as follows:

1. Composite section of fast-spreading crust: 4 legs

2. Composite section of slow-spreading crust: 6 legs
   This would include an array of holes distributed along a magmatic segment isochron and a flow line because of the apparent 3-D complexity of slow-spread crust.

3. Near plume crustal sections: 2 legs
   The characterisation of the difference in crustal construction due to plume proximity can be addressed, at a first order, by recovery of "representative" long sections of gabbroic and ultramafic rocks from near plume sites. This characterisation assumes that similar sections will exist from "non-plume" slow- and fast-spread crust for comparison.

This programme will produce a first order picture of the oceanic crust in its end member varieties. It should be viewed as the initial phase of a longer-term, multidisciplinary, approach to understanding what is clearly a temporally and spatially variable oceanic lithosphere.

Target areas for this first offset drilling programme should be within the main ocean basins, with the aim of establishing the lithospheric section and processes associated with mature, mid-ocean ridges. Should the results show that the sections exposed in ophiolites are not relevant to the main ocean basins, then a second programme of offset-section drilling might be proposed in which the primary targets would be in marginal seas, and back-arc and fore-arc basins with the objective of making the ophiolite connection.

## Site Survey and Proposal Requirements

The suggested site survey requirements in terms of the Site Survey Panel's listing and guidelines are given below:

| | | |
|---|---|---|
| 1. | Deep Penetration SCS | No |
| 2. | High-resolution SCS | May be required [1] |
| 3. | Multichannel Seismic | Recommended [2]<br>May be required [9] |
| 4. | Grid of Seismic lines | See data type [3] |
| 5a.<br>5b. | Refraction (surface source)<br>Refraction (near bottom source & receiver) | Recommended [2]<br>May be required [9]<br>May be useful [3] |
| 6a.<br>6b. | 3.5 kHz echo sounder or equivalent<br>12 kHz echo sounder | May be required [1]<br>No |
| 7. | Swath bathymetry | Required |
| 8a.<br>8b. | Side-looking Sonar (shallow-towed)<br>Side-looking Sonar (near-bottom towed) | Recommended<br>Recommended |
| 9. | Photography/video | Required [4] |
| 10. | Heat flow | No |
| 11a.<br>11b. | Magnetics<br>Gravity | Required [5]<br>Recommended [3] |
| 12a.<br>12b. | Cores analysed for paleoenvironment<br>Cores analysed for geotechnical properties | No<br>No |
| 13. | Rock sampling | Required [6] |
| 14. | Water current data | May be required [7] |
| 15. | OBS microseismicity | May be useful [8] |

1. Shallow penetration, high-resolution single-channel seismic and 3.5 kHz data will be required if sites are proposed to spud into sediment pockets.

2. A regional MCS or OBS-refraction survey is recommended to determine the regional crustal structure before dismemberment. It is not necessary to have crossing seismic lines exactly over the proposed site. Site specific reflection or refraction surveys may be required in some cases, but it is recognised that in many offset drilling settings such surveys may not provide useful subsurface information.
3. Near-bottom source/near-bottom receiver seismic refraction and near-bottom gravity are new experimental techniques that hold great promise as a site survey tool for tectonic windows. SSP is following the development of this technology with great interest, and may upgrade this data type at a future date.
4. Visual observations (submersible, towed still camera, towed video camera) are required to determine the detailed geological setting of the site, and to select a site for emplacing a bare-rock drilling guidebase.
5. A regional magnetic survey is required to determine the age of the oceanic crust and the plate kinematic history of the site, and the surface magnetic field associated with the section to be drilled. Near-bottom is desirable.
6. A closely-spaced, precisely positioned suite of samples is required in the immediate vicinity of the drillsites, as well as a less-dense suite of samples over a broader region. Samples must be analysed for geochemical/petrological and structural characteristics.
7. Data on water currents will be required for sites in shallow water or wherever swift (>1 knot) currents are anticipated.
8. Microseismicity determined from ocean bottom seismometers is useful in regions where the faults that form the tectonic window are still active.
9. Some combination of 3, 5a and 9 is required to determine the 3-D geology.

---

Offset section drilling seeks to determine the relationships between the lithologies, structures, and physical properties of ocean lithosphere. Site surveys need to establish both the local and regional, geological and geophysical, context of offset drilling targets. The age, tectonic history, crustal structure, and potential fields associated with the region to be drilled should be determined. The 3-D local geology as well as the nature of the offset between sites that will form a composite section need to be defined to the extent possible with available techniques.

In addition to the site survey requirements listed above, the OD-WG suggests the following as required elements for offset-section drilling proposals:

A. <u>A geologic map</u>:

All available surface data should be synthesised into one or more geologic map(s), as appropriate, interpreting the local and regional structure. Attempts should be made to interpolate contacts, faults, and other geologic features between survey observations. In cases of ambiguous or complex regions, more than one map should be constructed to depict the possible end member geologic models to be tested by drilling.

B. <u>Cross-Sections</u>:

The geologic map or maps should be accompanied by a best attempt at characterisation of the 3-D structure of the site(s) by construction, to the extent possible, of <u>true scale</u>, restorable (balanced) cross-sections. To the extent possible these sections should represent a viable geological model. Sections should be constructed through the sites parallel to the inferred spreading direction or perpendicular to major geologic features. It is recommended that an additional cross-section be constructed perpendicular to the first section to illustrate along-axis or along-strike variations. Uncertainties and ambiguities in the three-dimensional interpretation should be clearly spelled out, perhaps by construction of alternative sections depicting end-member geologic models.

C. Drill Site Prognosis:

Each proposed drill site should be located on the geologic map or maps and cross-section(s). Using all available information and a hypothesis-testing rationale, specific predictions should be made, to the extent possible, of the approximate depths, attitudes, and nature of important seismic and lithologic transitions, faults and other features. The consequences of particular predicted observations to the hypothesis or hypotheses being tested should be clearly stated as a justification for drilling.

The uncertainties in predictions for each hole should be clearly spelled out, in the light of the uncertainties of the map(s) and cross-section(s). As appropriate, alternate drilling predictions should be made, and the consequences of these alternate predictions for the model(s) being tested enumerated.

D. Comment:

It is expected that the map and cross-section construction, and drill site prognoses will be an interactive process. Thus the original proposal may contain a first attempt at map and cross-sectional constructions. These items should be updated and made more specific as new data are acquired.

**Technological requirements to implement the strategy**

One of the great attractions of an offset-section drilling strategy is that it does not require technological capabilities and developments beyond those which currently exist. However, having said this, the routine provision of some of the hardware development currently in hand could greatly enhance the degree of success achieved by an offset-section drilling programme.

The following technological capabilities are considered to be particularly relevant to offset-section drilling:

a) The 'Hard-rock' Guidebase, ideally modified to cope with slopes up to thirty degrees

b) The 'Hard-rock' Drill-in Casing, which might be invaluable, for example, on benches covered with up to 10 or 20m of talus

c) The 'Hard-rock' Spud-in with Downhole Mud Motor

d) A commandable on-off beacon with long-life batteries (eg. 5 years) and deployable by ROV

e) The Electronic Multishot Orientation Tool

f) In principle the Diamond Coring System could be useful for offset-section drilling but there is some concern that core orientation and certain crucial down-hole measurements, such as the Formation Micro Scanner, might not be available because of the narrower hole. If this were to be the case, then the Downhole Mud Motor, producing a full-size hole, would be preferred, as great importance is attached to obtaining oriented core and a full suite of downhole measurements.

Possible target areas

Initially twenty-two possible target areas were identified; eleven in crust formed at slow-spreading ridges, eleven in crust formed at fast-spreading ridges. Each of these areas was assessed according to the number of objectives that might be achieved at each location and the extent of existing and any pending site survey data. Clearly these assessments reflected in part the intrinsic potential of an area, and in part our current knowledge of the area based on existing survey information. Incorporation of the latter into the assessment seems entirely appropriate in that the site survey requirements for offset-section drilling are particularly stringent and it makes good sense therefore to capitalise on the very considerable sums of research funding already invested in certain areas.

Six areas scored very highly in this exercise but between them did not adequately cover the full range of objectives. A further six areas were added to achieve this coverage and again the resulting twelve areas were equally divided between lithosphere formed at high and low accretion rates. Following a detailed review of these twelve areas, a final short-list of eight areas was produced. Without the results of additional site surveys and preliminary drilling it is not considered possible to reduce this short-list further at this stage. As this additional information becomes available it will be necessary, ultimately, to identify just three or four 'natural laboratories' in which multiple offset-sections are to be drilled.

The short-listed areas may be summarised as follows:-

| | Rate | Comp | Segment |
|---|---|---|---|
| **Rifted Crust** | | | |
| Hess Deep (2°20'N:101°30'W) | F | N | N/A |
| Pito Deep (23°S:112°W) | F | N | N/A |
| Kings Trough (43°30'N:22°W) | I | E | T |
| **Transverse Ridge and Fracture Zone** | | | |
| Atlantis II (32°40'S:57°E) | S | N | T, S |
| Vema (10°40'N:43°30'W) | S | N | T |
| Oceanographer (35°N:36°W) | S | E | T, S (?) |
| **Median Valley** | | | |
| MARK (23°20'N:45°W) | S | N | T, S |
| 15-20 (15°20'N:45°W) | S | E (?) | T, S |

Rate: F = fast, S = slow, I = intermediate
Comp: N = normal MORB composition
E = enriched MORB composition
Segment: T = temporal variability in magmatic cells
S = spatial variability in magmatic cell
N/A = not applicable

Thus three environments have been identified for offset drilling where tectonic windows into gabbroic and ultramafic rocks are present. It is important to note that these three environments are not equally represented in slow- and fast-spreading crust, and that each has advantages and disadvantages.

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Rifted Crust:

Advantages:

1. In fast-spreading crust, rifted lithosphere regions appear to be the main sites where plutonic and ultramafic levels of the crust are exposed.

2. As these rifts generally cut non-transform crust, they may be more representative than tectonic windows in fast- or slow-spreading transforms.

3. These rifts can sometimes provide windows into crust of different ages and provide information on temporal variations and evolution of the crust.

Disadvantage:

These rifts are usually associated with propagating rifts which may superimpose structures and alteration and magmatic effects that will be difficult to discriminate from those associated with the formation of the crust at the ridge axis.

**Transverse ridges and fracture zone walls:**

Advantages:

1. These regions provide tectonic windows that may allow assessment of crustal and upper mantle stratigraphy and temporal evolution of the lithosphere.

2. Transverse ridges may allow spatial sampling of magmatic cells over relatively short distances in both ridge-parallel and in flow-line directions.

3. Because a large portion of the crust generated at slow-spreading centres is transform affected, the study of these sections may be important in documenting the more varied crustal architecture at slow-spreading centres.

Disadvantages:

1. These regions are affected by transform tectonics which complicate reconstructions of crustal stratigraphy and create ambiguities in the nature of lithologic contacts.

2. As transforms represent the terminations of magmatic cells, there may be transform fault effects that control the thickness of units, the overall magmatic budgets and alteration processes. These factors may make sections unrepresentative of the bulk of the oceanic crust and upper mantle.

3. The tectonic and dynamic processes leading to the formation of transverse ridges are not well known.

Rift valley walls:

Advantages:

1. These sites lie outside the areas affected by transform tectonics, alteration, and effects imposed on magmatic budget and may make these sections more representative.

2. There is access to along axis variations in crustal stratigraphy.

3. Tectonic models of rift valley formation and unroofing of mafic and ultramafic exposures can be tested.

Disadvantages:

1. The possibility of obtaining temporal variations along a flow line is more limited when compared with transform valley walls.

2. The relief along rift valley walls is generally less than that observed along transform valley walls; so that the mafic plutonic and ultramafic stratigraphies exposed are more limited.

Conclusion

The conjunction of new data and ideas relating to the exposure of gabbros and ultramafic rocks in tectonic windows, and new models for the nature and spatial and temporal variability of the lower oceanic crust, makes the proposal for an offset-section drilling programme, to investigate the oceanic lower crust and upper mantle, timely and potentially very fruitful. Moreover, the nature and origin of these tectonic windows are also of first-order scientific interest. Offset-sections are ready to drill, using proven technology, and in temperature conditions that allow the deployment of the full suite of down-hole measurements.

The Working Group recommends therefore that a Detailed Planning Group be set up, early in 1993, to define a specific programme of offset-section drilling in the light of the results of Legs 147 and 148, and the responses to the OD-WG report from ODP panels and the scientific community.

Reference

Sinton, J.M. and Detrick, R.S. 1992 Mid-Ocean Ridge Magm a Chambers. J.Geophys.Res. 97, 197-216.

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OFFSET-SECTION DRILLING

The final report of the Offset Drilling Working Group (OD-WG) of the ODP, Paris, May 1992

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OFFSET-SECTION DRILLING

The final report of the Offset Drilling Working Group (OD-WG)

of the ODP, Paris, May 1992

**Definition:**

Offset-section drilling is a strategy to investigate the complex, laterally heterogeneous ocean crust and shallow mantle by drilling key partial sections of crustal and mantle rocks in tectonic windows. Such windows are provided by propagating rifts, fracture zone walls and transverse ridges, and median valley master faults.

**Background and Thematic objectives**

The oceanic lithosphere underlies approximately 60% of the Earth's surface. Its uppermost part, the seismically-defined crust, is typically no more than 6 or 7 km thick, and yet to date less than half of the oceanic crustal section has been drilled. Thus, although the plate tectonic paradigm has provided a first-order picture and model for the formation of oceanic lithosphere at accretionary plate boundaries, we are still remarkably ignorant of the nature of the lower crust, the upper mantle from which it is derived, and the chemical and physical processes which take place at these depths.

The following nine sections discuss various aspects of the oceanic crust and upper mantle which are still poorly understood. These uncertainties can best, sometimes only, be resolved by drilling; hence these topics would form the major objectives of a program of offset-section drilling.

1. The structure of the oceanic crust

Even before the birth and development of the plate tectonic paradigm, the nature and composition of the oceanic crust was a question of fundamental interest. The first plans to drill through the oceanic crust to the mantle were probably spawned by the American Miscellaneous Society (AMSOC) in the convivial ambience of the Cosmos Club, Washington DC, in 1957. This initiative ultimately led to the ill-fated *Project Mohole* which finally foundered, due to lack of funding, in 1966, leaving the questions about the nature of the oceanic crust unanswered.

A major element of the plate tectonics paradigm is that oceanic crust is created by the emplacement of melts of basaltic composition along a narrow and dynamic interface defined by the axis of the world-encircling Mid-Oceanic Ridge system. The melts are derived by partial melting of a buoyant wedge of asthenosphere that rises beneath the ridge axis in the underlying upper mantle. Our understanding of the products of this process is constrained primarily by three observations: the seismically determined velocity structure of the oceanic crust, the rock types recovered from the ocean floor by a variety of sampling methods, and the investigation of assemblages of rocks, called opliolites, found along sutures in continental settings. The latter are interpreted to be fragments of oceanic crust and upper mantle created at a paleo-spreading centre and emplaced by tectonic processes as a consequence of the evolving plate mosaic.

Seismic data have shown that the velocity structure of the oceanic crust is remarkably similar at a global scale and is defined by two major velocity intervals: Layers 2 and 3. Layer 2 is characterised by material that exhibits steep velocity gradients in the upper few kilometres of the crust with velocity ranging from less than 4.0 km $s^{-1}$ at shallowest levels to 6.5 km $s^{-1}$ at deepest levels. Layer 3 is in the order of 4 km thick and exhibits more gentle velocity gradients, that range from 6.7 km $s^{-1}$ to 7.5 km $s^{-1}$. The Moho, the seismically determined boundary between crust and upper mantle, is spatially variable in seismic character, sometimes defined as a sharp velocity discontinuity between crustal velocities and upper mantle velocities (>8.0 km $s^{-1}$) and sometimes defined as a few thousand meter thick transitional interval.

The various sampling strategies have recovered a variety of basaltic (extrusive basalt, diabase and gabbro) and ultramafic lithologies (harzburgite, lherzolite) and their metamorphic equivalents (metamorphosed to greenschist and amphibolite facies) from a range of seafloor environments. Results from the last 20 years of ocean drilling at sites on the ridge flanks and ocean basins, as well as observations at localities along the Mid-Oceanic Ridge establish that extrusive lavas, with a high bulk porosity created by fissures and faults, routinely compose the upper portion (several hundred meters) of the oceanic crust. At one site (504B) on the flank of the Costa Rica Rift, a deep crustal hole has reached a depth of 1726 m into the crust and has established that at this site sheeted dikes underlie the extrusive basalts. A transition between these two lithologies occurs between 600 m and 800 m and metamorphic grade increases from zeolite facies at shallowest level at the top of the pillows to amphibolite facies at the bottom of the hole.

Along the slowly-spreading Mid-Atlantic Ridge observations and in-situ sampling made during submersible traverses at a number of localities, and an ODP site on the south-west Indian Ridge, document the exposure of gabbroic and ultramafic rocks along low-angle slopes that define the walls of the rift valley and on uplifted terrain that flanks the rift valley. Taken as a whole these data suggest a level of lithologic and structural complexity at a scale that has heretofore not been appreciated. These data have been interpreted to be manifestations of a magma-starved accretionary environment that may be characteristic, in some settings, of slowly-spreading (<2 cm/yr) limbs of the Mid-Oceanic Ridge system.

Apart from these constraints, the distribution of rock types vertically and laterally within the oceanic crust, and the nature of the contacts between lithologic units is unknown. In addition, the correlation between these oceanic rocks, and their spatial distribution, with the seismically determined velocity structure is not well understood, although laboratory-determined velocities of oceanic rocks under confining pressures thought to be representative of in-situ crustal conditions have been compared to seismic results. Such a comparison suggests that partially serpentinised ultramafic samples, gabbroic samples and some amphibolite facies metamorphic rocks (gabbroic and diabasic) are candidates for constituents of seismic layer 3. Diabase, basalt, their metamorphic equivalents and partially serpentinised ultramafic rocks could all be major constituents of seismic layer 2.

In-situ seismic velocities will also be a function of the porosity and fracturing of the crust particularly in the upper part of the section. There is a distinct possibility therefore that the velocity structure derived from seismic refraction experiments is more a reflection of porosity, faulting and alteration of the crust and uppermost mantle than its igneous lithology.

The investigation of ophiolites of variable age yields a distinctive lithologic organisation: extrusive lavas and shallow intrusives overlie sheeted dikes which in turn are underlain by a gabbroic sequence. At the base of this igneous sequence is a transition from magmatic cumulates of gabbroic and ultramafic rocks to residual ultramafic rocks. The first-order organisation of these igneous lithologies and the laboratory defined physical properties of these units correlate well with the seismically determined structure of oceanic crust. However, most ophiolites have a supra-subduction zone origin, as shown by lava geochemistry, and contain abundant wehrlitic cumulates, rock types only rarely sampled in the oceans. In detail therefore they may differ appreciably from oceanic lithosphere formed in the main ocean basins.

In addition the ophiolite model is a very generalised one and the thickness of the igneous units, their metamorphic history, the nature of the boundaries between them, whether they are controlled by igneous, metamorphic or structural processes, is variable within a given ophiolite and between ophiolites. These documented heterogeneities in the crustal architecture of ophiolite assemblages suggest that the interplay of magmatic, metamorphic and tectonic processes can be complex. Unfortunately, the crustal accretion characteristics that were operative at the time when a given architectural style for an ophiolite was created cannot be established. This ambiguity makes it impossible to correlate a given architectural characteristic exhibited by an ophiolite with a particular accretionary environment known to exist along the Mid-Oceanic Ridge. These documented variations, however, do suggest an inherent heterogeneity in oceanic crustal structure.

## 2. Melt formation and migration in the mantle

Ocean ridge magmatism is the primary manifestation of plate tectonics and seafloor spreading. While there is general agreement that magmas erupted at ocean ridges are the result of melting accompanying asthenospheric upwelling between the diverging plates, little is known about how melt forms, aggregates and migrates through the mantle, and what interactions exist between it and the shallow mantle as it ascends towards the crust. These are key questions. Mid-ocean ridge basalts, as the products of decompression melting, potentially provide a direct method for inferring the patterns of mantle flow beneath the ridges. Yet without answers to these questions, we cannot realistically invert basalt compositions to infer mantle dynamics.

Numerous detailed models, based largely on conjecture and poorly constrained by observations on mantle rocks, have been used to invert basalt compositions to infer mantle processes. For many years batch melting, in which mantle and melt have been held together throughout the melting process was favoured. More recently, another class of models, which can be best described as open system melting, where melt is continuously removed from the mantle as it forms, has gained sway. Additionally, there is a growing awareness that mantle melts may react at shallow depth with the mantle as it passes to the surface, which may substantially alter its composition, though it may not change the actual mass of melt produced. These different models are critically different in the amount and composition of magmas which they predict, yet cannot readily be resolved by the study of erupted basalts, which have been modified and homogenised in the crust.

The uppermost mantle preserves the integrated footprint of the melt generation process and shallow mantle flow, and can reveal the melting process unmasked by the numerous factors which modify the composition of ocean ridge basalt (magma mixing, crustal assimilation, fractional crystallisation). Large partially serpentinised mantle sections are exposed in tectonic windows on rift valley walls, the amagmatic extensions of propagating rifts and the walls of large oceanic transforms, which preserve relict mineralogy and texture. Dredge and submersible samples from isolated outcrops and debris flows, however, do not preserve the key internal stratigraphic relationships necessary to understand the melt migration process, and entirely lack orientation from which to interpolate patterns of shallow mantle flow. Moreover, detailed study of these rocks has been limited by lack of fresh samples due to surficial weathering and localised alteration associated with the faults on which the rocks are exposed, problems which can be overcome by drilling long continuous sections of mantle rock below the seafloor weathering zone and through the hydrothermal alteration associated with late-stage faults.

The shallow oceanic mantle is the complementary residue of the generation of ocean crust. As the principal component of the lithosphere, determining its composition and heterogeneity is critical in order to determine global fluxes in the Earth. Drilling is critical to evaluating the composition of the shallow mantle, as the vertical stratigraphy of this region of the Earth is unknown. It is likely that, both local and regional scale gradients in mineral, modal and chemical composition may exist related to the melting and mantle flow process whereby the mantle is emplaced to the base of the crust. In addition, there are likely to be important features in the shallow mantle stratigraphy, both lateral and vertical related to the aggregation and shallow transport of melt which also affect the mass balance.

Moreover, the shallow mantle section contains the last products of crystallisation and reaction of melt and mantle prior to intrusion to the crust. Studying these products can lead to direct inference of the composition, nature, and abundance of primary melts from which the crust is constructed. Short of drilling a representative suite of holes recovering intact total sections of a crustal segment, this is likely the only technique by which the overall composition of the ocean crust can be reconstructed.

3. <u>Relationship between melt production and tectonic environment</u>

There has been a growing appreciation of the complexity of the internal structure of the ocean crust - both igneous and tectonic - over the last decade. In part, this is due to new models for a segmented ocean crust (eg. Francheteau and Ballard, 1983; Whitehead et al, 1984; Crane, 1985, Schouten et al, 1985; Macdonald, 1987; Dick, 1989). These models view an ocean ridge as comprising a series of shield volcanoes overlying regularly spaced magmatic centres which undergo continuous extension to form ribbons of ocean crust. These models predict major lateral changes in crustal stratigraphy and composition from the central to the distal portion of a ridge segment. Implicit to these models are the underlying patterns of mantle flow, which require focusing of mantle flow, and therefore melt migration out of the mantle, beneath the magmatic centres at the midpoints of ridge segments. There is considerable controversy, however, as to whether these models can explain crustal structure at both fast and slow spreading ridges. Considerable sentiment for more uniform sheet-like flow of melt and mantle beneath fast spreading ridges exists. The latter models, in turn, imply a significantly different crustal structure as spreading rate varies.

Thus, a test of these models can be made by looking for patterns of compositional variation in mantle rocks exposed at and along the ocean ridges from which can be inferred gradients in melting or melt extraction beneath an ocean ridge segment or adjacent to a major ridge discontinuity. While, to some degree this can be done by dredging, the necessity of a representative sampling of the mantle at any point and determination of its local stratigraphy cannot. To the point, melt flow from the mantle is accompanied by the formation of dunites in the shallow section, which can be interpreted as the traces of shallow melt migration. A dredged dunite, without its stratigraphic relationship to the mantle preserved, however, may have formed in different ways, and it can be difficult to reliably infer its origin. Thus, a suite of holes in the shallow mantle at varying distances along a ridge segment can be used to obtain these key stratigraphic relationships and the distribution of dunites in the shallow mantle where this distribution would be expected to be strikingly different for focused as opposed to more uniform flow of mantle and melt beneath a ridge. Moreover, in-situ sampling in tectonic windows can obtain oriented samples preserving mineral fabrics allowing direct interpolation of patterns of mantle flow, where the orientation of mineral fabrics anticipated for focused diapiric mantle flow would contrast sharply to those for a more uniform sheet like flow anticipated beneath fast spreading ridges.

A major factor believed to affect crustal stratigraphy and structure is magma budget. High rates of magma supply are generally related to the absence of a deep rift valley at an ocean ridge and the presence of a long-lived magma chamber. This may be related to either spreading rate or proximity to mantle hot spot regions near ridges. Preliminary studies suggest that the composition of the shallow mantle peridotites directly relate to these variations, and may provide a guide to variations in the degree of melting on both the local scale of a ridge segment or fracture zone as well as on the scale of entire ridge systems which can be related to variations in the composition and structure of the crustal section. An essential component of evaluating any geodynamic model for generating crustal structure and composition on a local and regional scale is the ability to relate it to shallow mantle stratigraphy and composition. At present, this can be done only surficially, without any sense of the three dimensional character of the mantle section.

4. <u>Relationships between magmatism, tectonism and hydrothermal activity</u>

The primary agent of crustal construction at spreading centres is igneous activity, whether extrusive, forming different types of lava flow, or intrusive, forming dikes or sills at shallow levels and plutons at greater depth. However this activity is controlled and modified by hydrothermal and tectonic processes, which also affect the newly-formed crust. Models of these interactions are still at a preliminary stage, since there are clearly complex feedback mechanisms that operate to link all three types of process.

The general structure of interaction is considered to involve the relationship between a brittle carapace at the spreading axis which thickens with crustal age, and a plastic substrate. These are separated from each other by a narrow brittle-ductile transition zone. The ductile zone is maintained hot and hence ductile by magma rising through the underlying mantle. The mean flux of magma must be related closely to spreading rate, since overall crustal thickness is independent of spreading rate, but fluctuations in magma supply in space and the time must lead to variations in heat supply across the brittle-ductile transition and perhaps to vertical movements in the transition. The heat supply drives hydrothermal circulation through the brittle, cracked carapace, in which the permeability structure is largely created by faults generated by tectonic processes. The hydrothermal circulation cools and perhaps thickens the brittle carapace and thus controls the style of deformation adopted by the tectonics.

At a more specific level, the most common model envisages episodic supply of magma to the spreading axis, with periods of high supply corresponding to magma chamber creation or inflation and achievement of spreading by dike injection. During periods of low magma supply, extension is envisaged as being accommodated by normal faulting of the brittle lid, with little or no magmatic injection. Hydrothermal activity is not explicitly considered, but is implicitly taken either as constant or as in phase with the periodic changes in magmatism and tectonism.

Such models are likely to be considerable simplifications of the complexity of natural interactions. Thus faulting is likely to be enhanced at times of abundant magma supply because higher fluid pressures within magma systems at such times would act to decrease the effective normal stresses on fault surfaces. Then inflation of magma chambers would act to stretch the overlying lid, enhancing permeability and hydrothermal circulation at a time when the simple theory would predict a minimum. And hydrothermal circulation can, in many cases, remove heat from magma chambers far faster than steady state replenishment, as well as promoting chemical reactions, such as epidote formation, that enhance the permeability of the system, so that it too takes an active rather than a passive part in the feedbacks.

Important aspects of crustal creation likely to be strongly influenced by these interactions are:

(a) the location of the brittle-ductile transition, seen in ophiolites and perhaps in the ocean crust as an abrupt transition from sheeted dikes to gabbro;

(b) the size and longevity of crustal magma chambers, and especially the point at which the continuous, long-lived magma chambers considered characteristic of fast-spreading give way to the small chambers discontinuous in space and time that may typify slow-spreading;

(c) the character of crustal deformation and its partition between igneous and tectonic extensional processes;

(d) the depth of penetration and the characteristics of axial hydrothermal systems, especially the temperature of water-rock interaction and the energy flux of high-temperature systems.

The most sensitive location for investigating these interactions is close to the brittle-ductile transition as frozen into crust off axis. It is here that the effects of the complex feedbacks are likely to be amplified to their greatest extent and where new models can be tested as they are developed. In ophiolite complexes this horizon corresponds to the neighbourhood of the sheeted dike-gabbro boundary, where plutonic rocks are highly evolved and hydrated, where horizontal detachments have been found that may represent the soles of listric faults and where alteration of sheeted dikes to epidosite indicates the former presence of hydrothermal reaction zones. Spatial variation at this level is highly instructive, but there are some crucial differences here between ophiolites and ocean crust: the magmas are much richer in water than MORB, so that magmatic water may contribute strongly to hydrothermal alteration; the degree of alteration of the dikes is very different from that so far seen in the oceans; many of the structures seen may have been formed, or at least reactivated, during emplacement.

In order to evaluate oceanic processes properly, and to set them in an overall tectonic context as well as a local structural and stratigraphic context, penetration of the dike-gabbro boundary (or whatever other feature represents the axial brittle-ductile transition in the oceans) by a series of related drill holes is necessary. No other method can give the necessary truly oceanic context.

5. The role and nature of magma chambers

A recurrent theme in models of the ocean crust is the role of magma chambers in the formation of crustal structure. Magma chambers in general are considered to be places in the ocean crust where magma is retained or held where crystallisation of gabbroic rocks occurs and where crystallisation differentiation and magma mixing take place to greater or lesser degrees. Two classes of magma chamber models have been developed for the ocean crust, those for slowly spreading ridges with deeply rifted axial structures and those for fast spreading ridges with structurally positive axial relief. The models presume a greater rate of magma supply at the faster spreading ridges, and depend on seismic evidence that substantial bodies of melt are present along the East Pacific Rise whereas no such bodies of melt have been detected by similar experiments along the Mid-Atlantic Ridge.

More recent interpretations of geophysical evidence, however, indicate that melt bodies present beneath the axis of the East Pacific Rise are much smaller than previously thought. What was originally interpreted as a large magma body spanning the width of the axial topographic high, and the full thickness of the ocean crust beneath a carapace of extrusives and dikes has been reduced to a small melt lens only several hundred metres wide and perhaps no more than 50 metres thick, residing atop a body of crystal mush and hot but solid rock (Sinton and Detrick, 1992) - see Figure 1.

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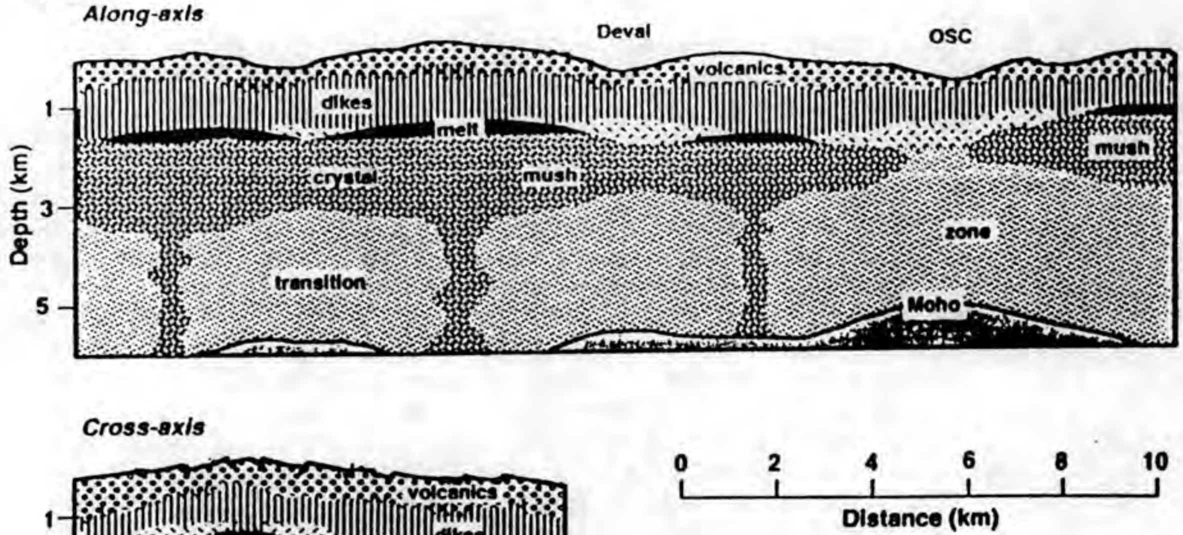


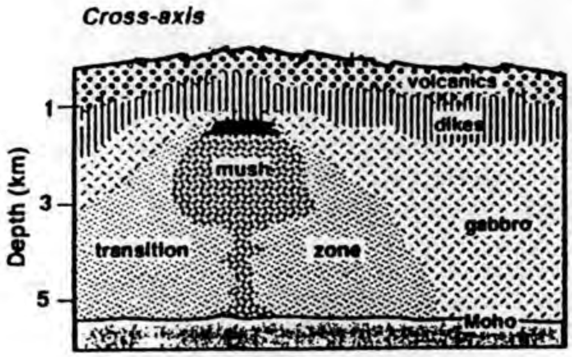


Figure 1(a) Interpretive model of the magma chamber beneath a fast-spreading (high magma supply rate) ridge crest such as that of the East Pacific Rise (after Sinton and Detrick, 1992). Note the narrow, sill-like body of melt 1-2 km below the ridge axis that grades downwards into a partially solidified crystal mush zone, which is in turn surrounded by a transition zone to the solidified, but still hot, surrounding rock. The relative volumes of melt and mush vary along the ridge axis, particularly near ridge axis discontinuities.

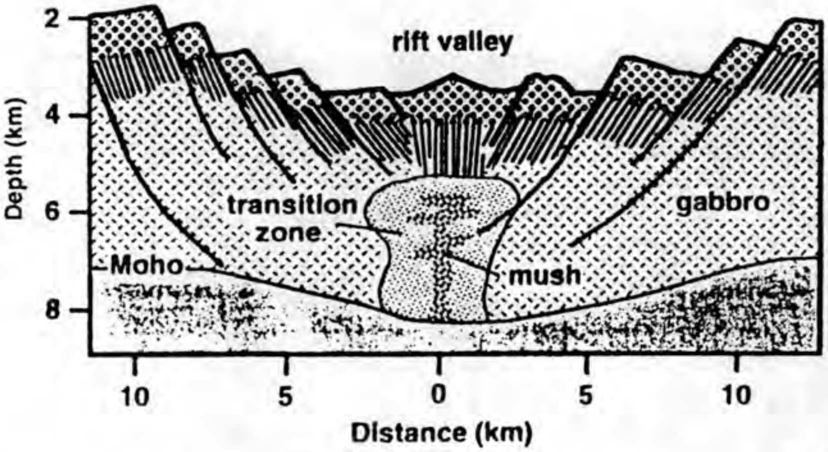


Figure 1(b) Interpretive model of the magma chamber beneath a slow-spreading (low magma supply rate) ridge crest such as that of the Mid-Atlantic Ridge (after Sinton and Detrick, 1992). Such ridges are unlikely to be underlain by a steady-state magma lens. Instead a dike-like mush zone is envisioned beneath the rift valley, and eruptions are thought to be closely coupled in time to injection events of new magma from the mantle.

These new seismic observations are very significant. An entire body of petrologic and geological observation, theory and doctrine can no longer be simply applied to spreading ridges. The gabbroic layer of the ocean crust is not merely an infinitely spread layered igneous intrusion. Fundamental questions, once thought to be at least partially answered, now have to be asked again. For instance, does magma aggregate at all (form sizable bodies) in magma chambers beneath spreading ridges? Or does it simply filter through a crystal mush? If so much of the zone between the mantle and the crust is a crystal mush, how does the magma get from the bottom to the top? How are magmas tapped from a crystal mush for eruption? Where does magmatic differentiation take place? How may thick gabbroic sections form?

To answer these questions, we now appeal to a spectrum of models which treat different aspects of the problem. The models are drawn from various sources and approaches including petrological study of igneous intrusions-layered or not, observations in ophiolites, and laboratory experiments. For the ocean crust, they are applied at present primarily to inferences from basalt compositions and mineralogy and to seismic observations at spreading ridges. They can really only be seriously tested by direct sampling of the gabbroic layer. The terms of the problem are bounded by models of large versus small magma chambers, the question of whether or not magma convects, the concept of gabbros as magmatic sediments, and the issue of gabbros as the product of crystallisation at the roofs of magma chambers in consequence of the typical steep thermal gradient in the crustal carapace at the ridge axis. Underlying all of this is the certainty that the processes are likely to be very different at slow and fast spreading ridges.

In this connection, we note that the one example of a long gabbroic section we have ever drilled, at Hole 735B, provided evidence for a process that has not even been a part of the literature and science of layered igneous intrusions. This is the process of simultaneous ductile deformation and igneous differentiation which produced sheared and foliated gabbro cross-cut by less deformed dikelets of differentiated material. The process had significant consequences on the efficiency and degree of melt migration throughout the entire body of rock, and led to the formation of oxide/sulphide concentrates from migrating late stage melts. The concentrates are perfectly capable of providing deep reflecting horizons in the ocean crust. This was a process that had not been deduced from dredge collections nor from study of ophiolites. It underscores the importance of continuous long sections of cored rock, carefully studied, from holes completely characterised by logging and downhole experiments.

6. Effect of spreading rate on crustal architecture

A large fraction of the total global mid-ocean ridge system can be assigned to one of two classes:

(a) crust formed at ridges spreading in general faster than 3 cm/yr, which has well developed magnetic anomalies, low topographic relief both laterally and longitudinally, and few exposures of plutonics, except in fracture zones. A median valley is characteristically absent, or present as a shallow graben a few hundred metres wide. Seismic evidence indicates a shallow crustal magma chamber over much of the spreading axis;

(b) crust formed at rates generally less than 3 cm/yr, in which magnetic anomalies tend to be irregular, topographic relief is high both along and at right angles to the axis, and exposures of plutonics frequent, even on median valley scarps away from offsets. Median valleys are normally deep, up to 1.5 kilometres, and tens of kilometres wide. There is no evidence for a major axial magma chamber.

Associated with this contrast is a marked difference in the style of volcanism as imaged by high-resolution side-scan sonar. The low-relief crust is characterised by flat smooth lava flows apparently erupted from long fissures, with few point-source constructions near the spreading axis, while the high relief crust shows a hummocky volcanic topography, and abundant small volcanic cones near the spreading axis.

Though the transition between the two styles of crust is gradational, it is relatively rapid at around a half spreading rate of 3 cm/yr. Small variations in spreading rate are not necessarily directly reflected in changes in crustal morphology. At the Costa Rica Rift, for example, there was a radical change from low-relief to high-relief crust four million years ago, with no marked change in spreading rate. Such abrupt changes suggest that the crust may exist in either of the two states, and feedback between processes maintaining one state until conditions allow a switch to the other.

As spreading centres approach mantle plumes, as happens most spectacularly along the Reykjanes Ridge south of Iceland, the character of the crust changes. On the Reykjanes Ridge, changes start about 700 km from Iceland, where the crustal relief decreases rapidly, so that the deep median valley is replaced by a median ridge, and the seafloor takes on the aspect of crust produced at fast-spreading rates, even though the spreading rate remains slow. Side-scan sonar images show that these changes are not reflected in the volcanic morphology, which remains typical of slow-spreading ridges, even when the broad bathymetric morphology is that of fast-spread crust. This evidence suggests that broad morphology and style of volcanism are controlled by two different processes, even though both change similarly on crust distant from plumes.

Models that address these observations are still being developed, especially since some of the crucial side-scan sonar images have been obtained only recently. The most popular models focus on the concept that flux of magma (and hence of energy) from the mantle is directly related to spreading rate, and that reduction in spreading rate leads to reduced overall flux rate and increased intervals between the arrival of a new batch of magma at any one place. Removal of energy by hydrothermal circulation is envisaged either as remaining constant or as increasing in effectiveness with decreased spreading rate. Tectonic fracturing of the upper crust is considered to increase as spreading rate decreases, because increased intervals between magma injection leads to periods of amagmatic extension which generate high relief by tectonic means. Magma supply rates are considered to increase at constant spreading rates as plumes are approached, causing near-plume crust to resemble fast-spread crust.

The observations of volcanic morphology are consistent with the view that at fast-spreading rates eruptions are copiously fed from fissures intersecting large continuous magma chambers, while at slow spreading rates, eruptions emerge, often through point sources, from small, short-lived chambers. It is not yet clear why volcanic morphology of the Reykjanes Ridge suggests small, intermittent magma chambers, while the bathymetric morphology suggests high magma flux.

The most sensitive test of these models, and the most fruitful ground for further critical observations is the plutonic section of the crust. Most predictions concur that at fast-spreading rates plutonic bodies should be large and relatively simple, with little deformation or hydrothermal alteration, while at slow-spreading rates the plutonic section is expected to be complex, with small plutonic bodies intersecting each other, with intense deformation and hydrothermal alteration. A section similar to that expected at slow-spreading rates was intersected in Hole 735B on the slow-spreading south-west Indian Ocean Ridge.

The structure of plutonic sections can be observed in ophiolites, but their spreading rates cannot be estimated even approximately. Any critical test must be made in crust which can be assigned a reasonably precise spreading rate, which in turn means in the oceans. Submersible observation cannot provide the detailed field context nexcessary for critical testing. Deep sea drilling of long, continuous sections of the plutonic section of the ocean crust from environments where spreading rate is known and plume influence can be estimated is thus essential if these crucial problems are to be addressed.

7. <u>The role of serpentinisation</u>

Wherever ultramafic rocks are exposed in the ocean crust, serpentine will be found. Whether serpentine is a greater or lesser component of the ocean crust cannot be resolved by seismic refraction techniques. Hess (1955, 1962) proposed a fundamental role for serpentine in the structure and tectonics of the ocean crust. Although opinions on this have varied through time, we now have dredged enough deeply faulted exposures in fracture zones and other tectonic windows in the ocean crust to know that serpentinisation of ultramafic rocks is common, and that we must understand its relation to faulting and fluid circulation if we are to improve our knowledge of the nature and lateral heterogeneity of oceanic crust.

There are three general questions we can pose about serpentinisation. First, what role does serpentinisation play in ocean crust accretion? We know for example, that serpentinised peridotite crops out both in fracture zones and in the walls of rift valleys. There is consequently no question that occurrence of serpentine corresponds to specific types of tectonic exposure. The leading question is whether serpentinite occurs at these places simply because the structure exists and allows water to transform peridotite, or whether serpentinisation itself was required for the structure to exist.

This leads to the second question, how is serpentinite created? There are both mineralogical and geochemical aspects of serpentinisation that can be used to specify conditions (P, T, $f(O_2)$, etc) of serpentinisation, and also the nature of fluids that accomplished the transformation. But these must be linked to structural aspects of the rocks (fabric deformation, veining) that are in turn closely linked to macroscopic understanding of the feature being studied (through submersible observations and sampling, etc).

Finally, the passive or active role of serpentinisation in the formation of structure, and the conditions of serpentinisation, can be addressed together by the question, what is the relation of serpentinisation to faulting and crustal accretion?

We have several models dealing with different aspects of serpentinisation to evaluate by drilling. The simplest is serpentinite diapirism. This holds that ultramafic rocks are often (perhaps always) exposed as screens between blocks of gabbroic/basaltic rock. The screens exist because hydration of peridotite to serpentine is accomplished by expansion, which is accommodated by vertical displacement of altered ultramafic material along faults in the manner of diapirs.

A second model with more general implications is that of Hess, previously cited, wherein faulting of the ocean crust particularly at deeply rifted segments of slowly spread ocean crust, allows water generally to pervade the upper mantle, with a consequent major influence on the seismic velocity of the lower ocean crust and the identity of Layer 3.

A third hypothesis is that serpentinisation is closely linked to the development of detachment faults with penetrating water serving both to weaken the upper mantle and to lubricate planar fault surfaces. In this guise serpentine may be a major agent in the unroofing of large tracts of plutonic exposures both near and away from transform faults.

Finally there is the hypothesis that exposures of gabbroic and ultramafic rocks reflect alternation of magmatic budgets into periods of strongly and weakly magmatic extension. The latter might correspond to intervals when upper mantle might be especially prone to serpentinisation, thus imposing a particular style to rift structures.

These questions can all be addressed by placement of holes or clusters of holes in carefully documented exposures of peridotite on the sea floor. Specific targets should include 1) gabbro/peridotite transitions; 2) serpentinised peridotite exposures at rift valley walls; 3) serpentinised peridotites at or near summits of transverse ridges, and 4) large tracts of peridotite now known to exist away from transform faults at certain spreading ridges.

8. <u>The origin of the linear magnetic anomalies</u>

Magnetic anomalies are conventionally ascribed to the presence of magnetic minerals in, and consequent high magnetisations of, rapidly quenched basaltic lavas on the sea floor. Although this was deduced by combining the detailed structure of magnetic anomalies with inferences from rock magnetic properties, drilling of the basaltic layer, particularly at slowly spreading ridges, casts doubt on the supposition that the basaltic layer is coherently magnetised. Both long intervals between eruptions, overlapping magnetic reversals, and faulting were suggested to wreak havoc on the magnetic structure of the uppermost ocean crust (Hall and Robinson, 1979). Clearer signatures predicted for the Pacific have not been possible to test by drilling, at least near the present day East Pacific Rise (eg. Rosendahl, Hekinian et al, 1980).

The only significant penetration of a lower ocean crust section of rock, at Hole 735B Southwest Indian Ridge, suggested that whereas the basaltic layer might have a confused magnetic signal, gabbroic rocks may be both sufficiently magnetised and structurally coherent to retain a coherent magnetic signal. We thus wish to test the hypothesis that the gabbroic layer contributes to, and may even explain, magnetic anomalies.

The basis of the hypothesis is twofold. First, gabbro cumulates are magnetic because they are altered, that is, transformation of olivine/pyroxenes to magnetite/serpentine and magnetite/amphibole assemblages produces the requisite magnetic minerals in otherwise weakly magnetic rocks. The second component of the hypothesis is that this occurs in the rift valley environment, in association with high-temperature hydrothermal flux, and within a short period of time after the magmatic emplacement of the gabbros. To test this hypothesis, the magnetised lower crustal rocks cannot have been structurally rotated or tilted significantly at any point after magnetisation took place.

This seems to have been the case at Hole 735B (Kilerwa and Pariso, 1991) where coherent magnetic anomalies have been mapped across the transverse ridge structure to the walls of the fracture zone where basalts no longer are present (Dick et al, 1991). A coring programme into gabbros and peridotites in diverse tectonic environments which carefully characterised local and regional magnetic structure will contribute significantly to understanding of the origin of magnetic stripes in the ocean basins.

9. The state of stress in oceanic crust

If we are to progress beyond the kinematic description of plate evolution to a better understanding of the dynamics of plate motions it is essential to measure the internal state of stress in the oceanic crust. Numerous in-situ stress measurements in continental areas make it possible to define regional stress regimes in an increasing number of land areas. Inevitably to date there is a relative dearth of data from oceanic areas although such data are crucial in attempting to determine the relative importance of different plate driving forces. In addition the definition of the local stress regimes in the vicinity of transform faults, ridge crests and ridge-transform intersections would provide important constraints on dynamic models for the mechanical, thermal and rheological processes in these settings. The relatively deep holes of an offset-section drilling program, sited in areas which are well-constrained tectonically, would provide ideal opportunities to measure the orientation of the principal horizontal stresses and hence to tackle these fundamental problems.

## Strategy

The primary scientific objective of lithospheric drilling is to investigate the complex magmatic, tectonic and hydrothermal processes involved in the formation and evolution of oceanic crust. Offset-section drilling is a strategy to obtain long sections of crust and upper mantle and to construct composite sections at a limited number of localities where testable models can be identified.

Key partial sections of crustal and upper mantle rocks are exposed in tectonic windows provided by propagating rifts, fracture zone walls, transverse ridges and median valley master faults. Partial sections will yield the most useful information when they can be linked together by either seismic or lithologic transitions. However long sections of oceanic gabbro and peridotite can yield valuable information on magmatic and tectonic processes even when their stratigraphic positions are not precisely constrained.

A minimum drilling programme to address the major objectives outlined above would be as follows:

1. The gross structure of the ocean crust can be determined by obtaining composite sections of crust formed at fast- and slow-spreading ridges.

2. The processes of melt formation and migration in the mantle can be addressed by sampling long peridotite sections, preferably in tectonically constrained plume and non-plume environments.

3. Melt production can be related to local tectonic environments by sampling lower crustal and upper mantle sections near the centre and at the end of a magmatic cell, preferably in a slow-spreading environment.

4. Relationships between magmatic, tectonic and hydrothermal activity can be addressed by sampling the dike-gabbro transition in slow spreading crust. Several holes would be needed to constrain the lateral and depth variations.

5. Magma chamber processes can best be studied in long sections of gabbro from fast- and slow spreading crust where the original spatial relations can be reconstructed.

6. Investigation of the relationship between crustal dynamics and spreading rate will require compilation of composite sections in fast-spreading, slow-spreading and plume-related environments.

7. The role of serpentinisation in the creation of oceanic crust can best be addressed by a number of relatively short holes (~ 500m) in a number of environments such as diapirs, rift valley walls, and detachment surfaces, where peridotite is exposed.

8. Long sections of gabbro and peridotite in magnetically constrained environments will provide data on the contribution of lower crustal and upper mantle rocks to magnetic anomalies.

9. Understanding the state of stress in oceanic crust will require deep holes (greater than 500m) in areas where the tectonic environment is well defined.

Given the undoubtedly limited amount of shiptime available for basement drilling, the following objectives for offset-section drilling are considered the highest priority:

1. To obtain composite sections of crust formed at fast- and slow-spreading ridges. Some tactical approaches to drilling these sections are outlined below. The completion of these sections should be the highest priority and their constituent parts should be drilled as expeditiously as ship scheduling allows.

2. To obtain sections which constrain the variability in the crust and upper mantle that occurs between geochemically enriched and depleted areas and the lateral (spatial and temporal) variations that occur within magmatic segments of spreading systems.

To date less than half of an oceanic crustal section has been drilled in any kind of setting.

Hole 504B has contributed to our knowledge of the upper 2 km of a median-rate spreading centre and continued drilling at 504B will provide an important reference section for comparison with upper crustal sections drilled in an offset-section approach. The only other significant drilling targeted at understanding the origin of the ocean crust was Hole 735B, which recovered 500m of gabbro from a very slow-spreading environment. The lack of recovery of lithologies characteristic of the lower ocean crust in a variety of environments has seriously limited our ability to answer the thematic questions posed above regarding the origin of oceanic crust. It is in this light that the completion of at least two composite sections is regarded as the highest priority for drilling.

The construction of the ocean crust has first order variations between slow- and fast-spreading ridges. Any strategy to test models for the evolution of ocean crust must include sampling sections in both kinds of crust. Most models for crustal formation are either spreading-rate specific; eg. detachment faulting or so-called "amagmatic" extension at slow-spreading ridges, or include end-member cases for fast- and slow-spreading environments, as in the magma chamber models of Sinton and Detrick (1992). Thus, if we are to reach any reasonable understanding of crustal genesis, by an offset-section strategy, sampling of fast- and slow-spreading crust must proceed in concert.

The first order variations between slow- and fast-spreading crust, and the models which have been erected to explain those variations require that a somewhat different approach be taken to offset-section drilling in each. Models for fast-spreading crust suggest that the higher magma supply rates and more laterally continuous melt horizons of fast-spreading ridges produce, <u>to a first order</u>, more homogeneous crust than is generated at slow-spreading ridges. In contrast, many models for the evolution of slow-spread crust emphasise along axis discontinuities in time and space, and strong interactions between tectonic and magmatic processes. The testing of models for crustal generation consequently, will require that more time be spent characterising the slow-spreading case, because the apparent complexity of the crust requires a larger number of sites. We emphasise that this strategy is aimed at obtaining a <u>first order</u> picture of the crust in its end member varieties. It will not, and is not intended to, constrain all of the variability that we recognise exists along both slow- and fast-spreading ridges.

The construction of these composite cross-sections in both environments will require groups of holes sited in specific lithologies or lithologic transitions which can be tied together into a stratigraphic or "pseudo" stratigraphic entity. Ideally, these holes will be sited within small geographic areas and will be related in a straightforward manner. The review of potential target areas, however, suggests that it may not be possible to complete all parts of the composite sections in a single area. Well-constrained transitions from dikes to gabbros and from gabbros to the mantle may be particularly difficult to find; exposure and opportunity may dictate the choice of sites. If such is the case, it is essential that the parts of a section be drilled in similar crust (in terms of spreading rate) and that their relative positions in the local geologic setting be clearly established by correlation to regional seismic stratigraphies, to clearly defined geologic cross-sections, or by correlation to an obvious crustal transition. Such partial sections, if in a well located and "ideal" setting, can be as, or more, valuable than total composite sections drilled in a poorly understood area for answering the specific problems posed above.

Second order crustal variations occur between geochemically enriched versus depleted areas of the mid-ocean ridge system and systematically within magmatic segments of all spreading systems. Establishing the nature of these variations will be the second priority.

The programme envisioned here would last 8-10 years and involve about 12 two-month legs in the hope of drilling a total of 15-18 holes. Each hole would typically be 1000 ± 500m in depth depending on scientific objectives, drilling conditions, and logistic considerations.

A notional allocation of legs to our primary objectives might be as follows:

1. **Composite section of fast-spreading crust: 4 legs**

   This composite would include: the nature of the dike/ gabbro transition, long sections in the gabbroic section, the nature of the mafic/ultramafic transition and long sections within the ultramafic section.

   These sections would provide a first order picture of fast-spread crust and would allow evaluation of ophiolite - and seismic-type models for the crust. The section would ideally be constructed in a small area, but the realities of exposures may require tying together sites from different pieces of fast-spread crust. It should be kept in mind that this is likely to be an evolutionary approach; sites that provide initially useful information may prove, on further examination not to be suitable to complete all parts of the section. We should be prepared to characterise any site sufficiently so that its relative position in the crust can be established.

2. **Composite section of slow-spreading crust: 6 legs**

   This would include an array of holes distributed along a magmatic segment isochron and a flow line because of the apparent 3-D complexity of slow-spread crust; among the objectives that should be met with these holes are:

   long sections of the principal lithologies exposed at slow-spread crust;
   the transitions, structural or magmatic, between those lithologies;
   the nature of the hypothesised median valley master fault, and
   the emplacement mechanism of serpentinite blocks in the median valley and transverse ridges.

As in the case of fast-spread ridges, this section ideally would be constructed within a small geographic area. However, both the complexity of the crust and the vagaries of exposure are likely to require examination of sites in more than one slow-spreading segment. Again, it is important that each site be placed, relatively in its geologic cross-section, so that a reasonable composite section can be constructed.

3. **Near plume crustal sections: 2 legs**

The characterisation of the difference in crustal construction due to plume proximity can be addressed, at a first order, by recovery of "representative" long sections of gabbroic and ultramafic rocks from near plume sites. This characterisation assumes that similar sections will exist from "non-plume" slow- and fast-spread crust for comparison. The primary questions about plume effects can be addressed by single holes in particular lithologies at appropriate sites.

This programme will produce a first order picture of the oceanic crust in its end member varieties. It should be viewed as the initial phase of a longer-term, multidisciplinary, approach to understanding what is clearly a temporally and spatially variable oceanic lithosphere.

Target areas for this first offset drilling programme should be within the main ocean basins, with the aim of establishing the lithospheric section and processes associated with mature, mid-ocean ridges. Should the results show that the sections exposed in ophiolites are not relevant to the main ocean basins, then a second programme of offset-section drilling might be proposed in which the primary targets would be in marginal seas, and back-arc and fore-arc basins with the objective of making the ophiolite connection.

## Site Survey and Proposal Requirements

Offset section drilling seeks to determine the relationships between the lithologies, structures, and physical properties of ocean lithosphere. Site surveys need to establish both the local and regional, geological and geophysical, context of offset drilling targets. The age, tectonic history, crustal structure, and potential fields associated with the region to be drilled should be determined. The 3-D local geology as well as the nature of the offset between sites that will form a composite section need to be defined to the extent possible with available techniques.

The suggested site survey requirements in terms of the Site Survey Panel's listing and guidelines are given below:

| | | |
|---|---|---|
| 1. | Deep Penetration SCS | No |
| 2. | High-resolution SCS | May be required [1] |
| 3. | Multichannel Seismic | Recommended [2]<br>May be required [9] |
| 4. | Grid of Seismic lines | See data type [3] |
| 5a. | Refraction (surface source) | Recommended [2]<br>May be required [9] |
| 5b. | Refraction (near bottom source & receiver) | May be useful [3] |
| 6a. | 3.5 kHz echo sounder or equivalent | May be required [1] |
| 6b. | 12 kHz echo sounder | No |
| 7. | Swath bathymetry | Required |
| 8a. | Side-looking Sonar (shallow-towed) | Recommended |
| 8b. | Side-looking Sonar (near-bottom towed) | Recommended |
| 9. | Photography/video | Required [4] |
| 10. | Heat flow | No |
| 11a. | Magnetics | Required [5] |
| 11b. | Gravity | Recommended [3] |
| 12a. | Cores analysed for paleoenvironment | No |
| 12b. | Cores analysed for geotechnical properties | No |
| 13. | Rock sampling | Required [6] |
| 14. | Water current data | May be required [7] |
| 15. | OBS microseismicity | May be useful [8] |

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1 Shallow penetration, high-resolution single-channel seismic and 3.5 kHz data will be required if sites are proposed to spud into sediment pockets.

2 A regional MCS or OBS-refraction survey is recommended to determine the regional crustal structure before dismemberment. It is not necessary to have crossing seismic lines exactly over the proposed site. Site specific reflection or refraction surveys may be required in some cases, but it is recognised that in many offset drilling settings such surveys may not provide useful subsurface information.

3. Near-bottom source/near-bottom receiver seismic refraction and near-bottom gravity are new experimental techniques that hold great promise as a site survey tool for tectonic windows. SSP is following the development of this technology with great interest, and may upgrade this data type at a future date.

4. Visual observations (submersible, towed still camera, towed video camera) are required to determine the detailed geological setting of the site, and to select a site for emplacing a bare-rock drilling guidebase.

5. A regional magnetic survey is required to determine the age of the oceanic crust and the plate kinematic history of the site, and the surface magnetic field associated with the section to be drilled. Near-bottom is desirable.

6. A closely-spaced, precisely positioned suite of samples is required in the immediate vicinity of the drillsites, as well as a less-dense suite of samples over a broader region. Samples must be analysed for geochemical/petrological and structural characteristics.

7. Data on water currents will be required for sites in shallow water or wherever swift (>1 knot) currents are anticipated.

8. Microseismicity determined from ocean bottom seismometers is useful in regions where the faults that form the tectonic window are still active.

9. Some combination of 3, 5a and 9 is required to determine the 3-D geology.

In addition to the site survey requirements listed above, the ODWG suggests the following as required elements for offset-section drilling proposals:

A. <u>A geologic map</u>:

All available surface data should be synthesised into one or more geologic map(s), as appropriate, interpreting the local and regional structure. Attempts should be made to interpolate contacts, faults, and other geologic features between survey observations. In cases of ambiguous or complex regions, more than one map should be constructed to depict the possible end member geologic models to be tested by drilling.

B. <u>Cross-Sections</u>:

The geologic map or maps should be accompanied by a best attempt at characterisation of the 3-D structure of the site(s) by construction, to the extent possible, of <u>true scale</u>, restorable (balanced) cross-sections. To the extent possible these sections should represent a viable geological model. Sections should be constructed through the sites parallel to the inferred spreading direction or perpendicular to major geologic features. It is recommended that an additional cross-section be constructed perpendicular to the first section to illustrate along-axis or along-strike variations. Uncertainties and ambiguities in the three-dimensional interpretation should be clearly spelled out, perhaps by construction of alternative sections depicting end-member geologic models.

C. Drill Site Prognosis:

Each proposed drill site should be located on the geologic map or maps and cross-section(s). Using all available information and a hypothesis-testing rationale, specific predictions should be made, to the extent possible, of the approximate depths, attitudes, and nature of important seismic and lithologic transitions, faults and other features. The consequences of particular predicted observations to the hypothesis or hypotheses being tested should be clearly stated as a justification for drilling.

The uncertainties in predictions for each hole should be clearly spelled out, in the light of the uncertainties of the map(s) and cross-section(s). As appropriate, alternate drilling predictions should be made, and the consequences of these alternate predictions for the model(s) being tested enumerated.

D. Comment:

It is expected that the map and cross-section construction, and drill site prognoses will be an interactive process. Thus the original proposal may contain a first attempt at map and cross-sectional constructions. These items should be updated and made more specific as new data are acquired.

On Seismic Transitions at Offset Sections

At some of the places we are proposing to drill sequences of basalts, dikes and gabbros, and of gabbros and peridotites are offered by proponents as the lithologic counter parts of the seismic layer 2-3 and layer 3-mantle transitions. The extent to which this can be evaluated by drilling offset sections depends on three factors: (1) the degree to which an appropriate regional seismic standard is established; (2) the extent to which the seismic standard can be interpolated to the hole or holes drilled, and (3) the extent to which the original in-situ conditions of the section drilled can be restored. The latter may represent the most serious difficulty inasmuch as any exposure of deep seated rocks entails that they are no longer in their original environment, particularly with respect to microfracture porosity, and the rocks are likely to have experienced some degree of alteration (eg. serpentinisation) which will have significantly modified their physical properties. It is equally true that seismic techniques are not yet sufficiently refined to carry a detailed seismic velocity profile from a location corresponding to a regional standard directly to an outcrop.

This is not to say that virtually unmodified mantle and lower crust may not come very close to the sea floor at some locations, and thus be accessible to the drill. However, we as yet know of no location where this is unequivocally true. Nor is it to say that seismic experiments cannot be designed to show this. However, such experiments have not yet been devised.

As a means of working towards this dual objective, we recommend the following sequence of drilling and geophysical experiments in any region selected for multi-leg evaluation of a major crustal transition:

1. preliminary drilling to establish the feasibility of drilling in the specific environments and locales under study, and to provide information pertinent to the three-dimensional structural configuration of the transition;

2. geophysical studies to establish a regional seismic standard as close to the identified drill sites as possible, the particular seismic characteristics in the immediate vicinity of the sites, and whatever can be determined between the two;

3. continued drilling (as necessary) to complete coring of the lithological transition or transitions; and

4. careful integration of core log information, physical properties, downhole measurements and downhole seismic experiments for comparison to the regional geophysical standard and the local seismic profile.

**Technological requirements to implement the strategy**

One of the great attractions of an offset-section drilling strategy is that it does not require technological capabilities and developments beyond those which currently exist. However, having said this, the routine provision of some of the hardware development currently in hand could greatly enhance the degree of success achieved by an offset-section drilling programme.

The following technological capabilities are considered to be particularly relevant to offset-section drilling:

a) The 'Hard-rock' Guidebase, ideally modified to cope with slopes up to thirty degrees

b) The 'Hard-rock' Drill-in Casing, which might be invaluable, for example, on benches covered with up to 10 or 20m of talus

c) The 'Hard-rock' Spud-in with Downhole Mud Motor

d) A commandable on-off beacon with long-life batteries (eg. 5 years) and deployable by ROV

e) The Electronic Multishot Orientation Tool

f) In principle the Diamond Coring System could be useful for offset-section drilling but there is some concern that core orientation and certain crucial down-hole measurements, such as the Formation Micro Scanner, might not be available because of the narrower hole. If this were to be the case, then the Downhole Mud Motor, producing a full-size hole, would be preferred, as great importance is attached to obtaining oriented core and a full suite of downhole measurements.

Possible target areas

Initially twenty-two possible target areas were identified; eleven in crust formed at slow-spreading ridges, eleven in crust formed at fast-spreading ridges:

1. Slow-spreading Ridges

(a) Sections exposed on Transverse Ridges formed within the inside or transform corner of ridge-transform intersections

| | | |
|---|---|---|
| 1. | Atlantis II FZ SW Indian Ocean | 32°40'S |
| 2. | Vema FZ Mid-Atlantic Ridge | 10°40'N |
| 3. | Kane FZ Mid-Atlantic Ridge | 23°45'N |
| 4. | Hayes FZ Mid-Atlantic Ridge | 33°30'N |
| 5. | Oceanographer FZ Mid-Atlantic Ridge | 35°N |
| 6. | Kurchatov FZ Mid-Atlantic Ridge | 40°40N |

(b) Sites within the Median Valley

| | | |
|---|---|---|
| 7. | 15°20'N on the Mid-Atlantic Ridge | |
| 8. | MARK (Mid-Atlantic Ridge near Kane) | 23°20'N |
| 9. | 45°N on the Mid-Atlantic Ridge | |

(c) Section exposed by extension of pre-existing crust

| | | |
|---|---|---|
| 10. | Kings Trough, NE Atlantic | 43°30'N |

(d) Section exposed by thrusting of pre-existing crust

| | | |
|---|---|---|
| 11. | Gorringe Bank, Azores-Gibralter Ridge | 36°30'N |

2. Fast spreading ridges

(a) Exposures associated with Fracture Zones

| | | |
|---|---|---|
| 12. | Blanco FZ NE Pacific | 44°20'N |
| 13. | Siqueiros FZ E Central Pacific | 8°30'N |
| 14. | Garrett FZ E Central Pacific | 13°S |
| 15. | Eltanin FZ S Pacific | 54°S |
| 16. | Udintsev FZ S Pacific | 56°30'S |
| 17. | Nova Trough W Pacific (1°S; 168°W) extension of Clipperton FZ? | |

(b) Sections exposed by crustal extension ahead of propagating ridges

18. Hess Deep E Central Pacific 2°20'N near Triple Junction
19. Pito Deep SE Pacific (23°S) NE margin of Easter Microplate
20. Endeavour Deep SE Pacific (33°S) NE margin of Juan Fernandez Microplate

(c) Section exposed by late-stage extension on an abandoned ridge crest

21. Mathematicians Ridge E Central Pacific 15°N 111°W

(d) Section exposed by thrusting of pre-existing crust

22. Mussau Trough W Pacific 1°N 149°E

Each of these areas was assessed according to the number of objectives that might be achieved at each location and the extent of existing and any pending site survey data.

Clearly these assessments reflected in part the intrinsic potential of an area, and in part our current knowledge of the area based on existing survey information. Incorporation of the latter into the assessment seems entirely appropriate in that the site survey requirements for offset-section drilling are particularly stringent and it makes good sense therefore to capitalise on the very considerable sums of research funding already invested in certain areas.

Six areas scored very highly in this exercise but between them did not adequately cover the full range of objectives. A further six areas were added to achieve this coverage and again the resulting twelve areas were equally divided between lithosphere formed at high and low accretion rates. Following a detailed review of these twelve areas a final short-list of eight areas was produced. Without the results of additional site surveys and preliminary drilling it is not considered possible to reduce this short-list further at this stage. As this additional information becomes available it will be necessary, ultimately, to identify just three or four 'natural laboratories' in which multiple offset-sections are to be drilled.

Short-listed areas

The short-listed areas may be summarised as follows:-

| | Rate | Comp | Segment |
|---|---|---|---|
| **Rifted Crust** | | | |
| Hess Deep | F | N | N/A |
| Pito | F | N | N/A |
| Kings Trough | I | E | T |
| **Transverse Ridge and Fracture Zone** | | | |
| Atlantis II | S | N | T, S |
| Vema | S | N | T |
| Oceanographer | S | E | T, S (?) |
| **Median Valley** | | | |
| MARK | S | N | T, S |
| 15-20 | S | E (?) | T, S |

Key: Rate: F = fast, S = slow, I = intermediate
Comp: N = normal MORB composition,
E = enriched MORB composition

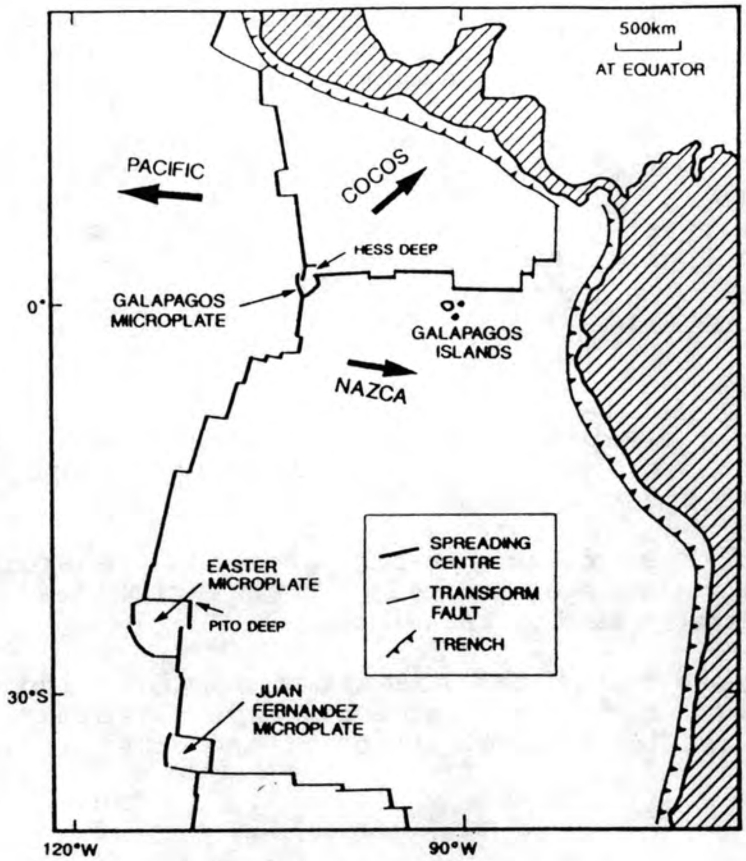



Figure 2. Location of Hess and Pito Deeps in the context of plate and microplate boundaries in the eastern Pacific.

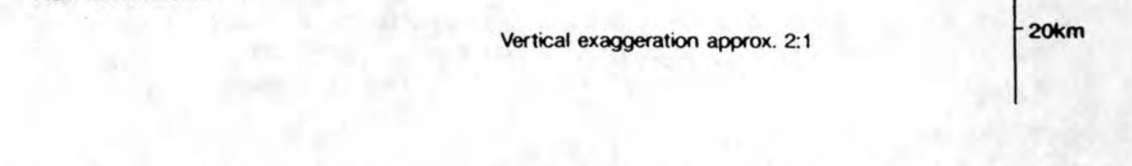



Figure 3. Schematic tectonic interpretation of the Pito Rift showing inferred block structures and asymmetric lithospheric thinning. (After Martinez et al., 1992).

Segment: T = temporal variability in magmatic cells,
S = spatial variability in magmatic cell,
N/A = not applicable

Thus three environments have been identified for offset drilling where tectonic windows into gabbroic and ultramafic rocks are present. It is important to note that these three environments are not equally represented in slow and fast spreading crust, and that each has advantages and disadvantages.

**Rifted Crust:**

Advantages:

1. In fast-spreading crust, rifted lithosphere regions appear to be the main sites where plutonic and ultramafic levels of the crust are exposed.

2. As these rifts generally cut non-transform crust, they may be more representative than tectonic windows in fast- or slow-spreading transforms.

3. These rifts can sometimes provide windows into crust of different ages and provide information on temporal variations and evolution of the crust.

Disadvantage:

These rifts are usually associated with propagating rifts which may superimpose structures and alteration and magmatic effects that will be difficult to discriminate from those associated with the formation of the crust at the ridge axis.

**Transverse ridges and fracture zone walls:**

Advantages:

1. These regions provide tectonic windows that may allow assessment of crustal and upper mantle stratigraphy and temporal evolution of the lithosphere.

2. Transverse ridges may allow spatial sampling of magmatic cells over relatively short distances in both ridge-parallel and in flow-line directions.

3. Because a large portion of the crust generated at slow-spreading centres is transform affected, the study of these sections may be important in documenting the more varied crustal architecture at slow-spreading centres.

Disadvantages:

1. These regions are affected by transform tectonics which complicate reconstructions of crustal stratigraphy and create ambiguities in the nature of lithologic contacts.

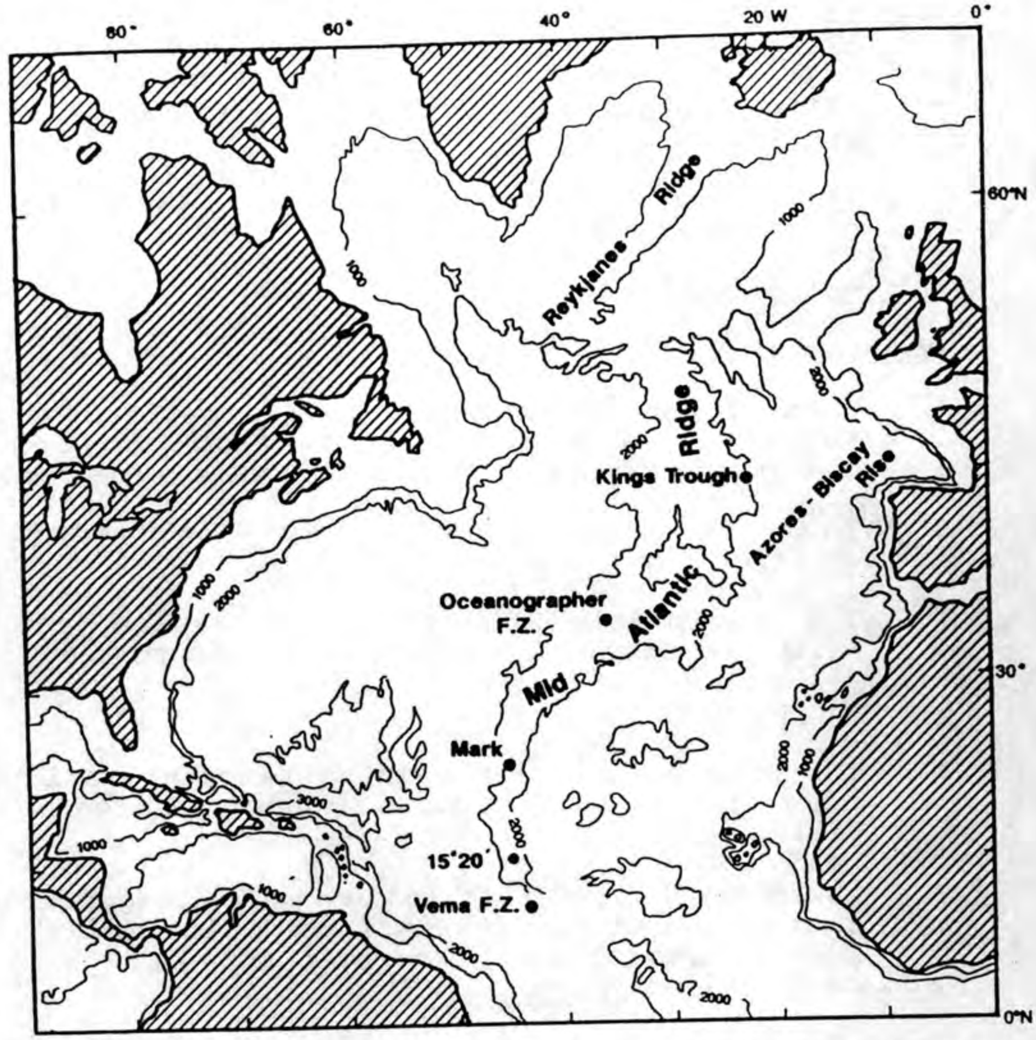
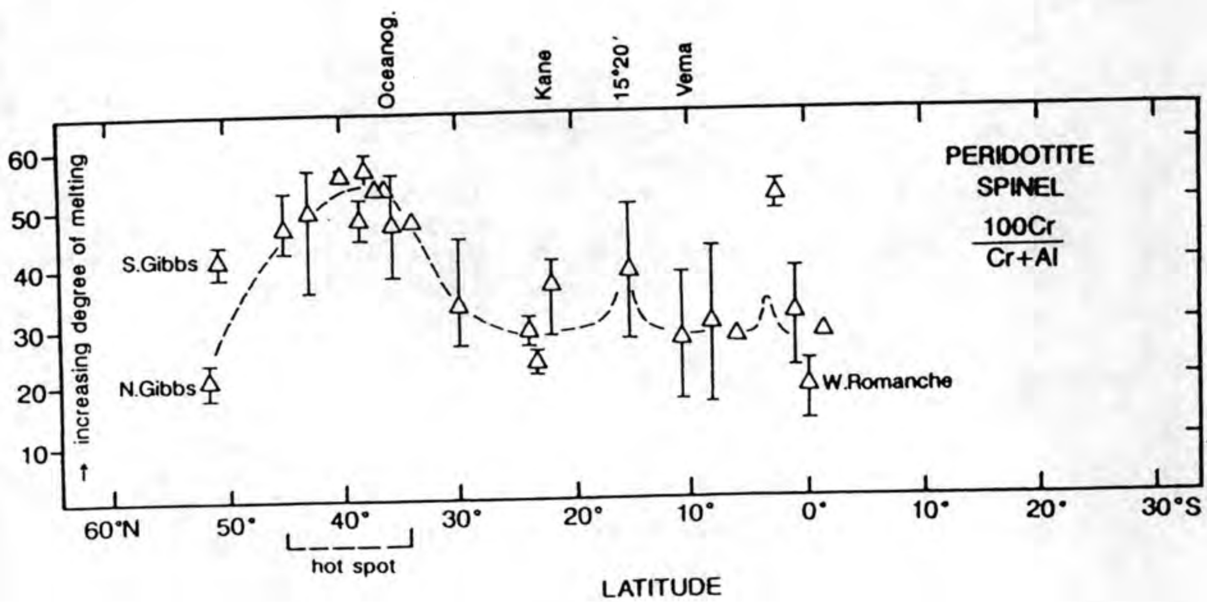



Figure 4. Location of the five short-listed target areas that are in the North Atlantic.



2. As transforms represent the terminations of magmatic cells, there may be transform fault effects that control the thickness of units, the overall magmatic budgets and alteration processes. These factors may make sections unrepresentative of the bulk of the oceanic crust and upper mantle.

3. The tectonic and dynamic processes leading to the formation of transverse ridges are not well known.

Rift valley walls:

Advantages:

1. These sites lie outside the areas affected by transform tectonics, alteration, and effects imposed on magmatic budget and may make these sections more representative.

2. There is access to along axis variations in crustal stratigraphy.

3. Tectonic models of rift valley formation and unroofing of mafic and ultramafic exposures can be tested.

Disadvantages:

1. The possibility of obtaining temporal variations along a flow line is more limited when compared with transform valley walls.

2. The relief along rift valley walls is generally less than that observed along transform valley walls; so that the mafic plutonic and ultramafic stratigraphies exposed are more limited.

Brief details of the known potential of each of the short listed areas are given below:

Hess Deep

The Hess Deep is at the tip of a propagating rift in the Cocos-Nazca plate and exposes relatively young crust generated at the East Pacific Rise (EPR). Topography is very rugged and geology is complex. The area has been surveyed and sampled during two dive programmes. Upper level gabbros, a dike complex and pillow basalts are exposed on the north wall of the rift. Peridotites, cumulate and non-cumulate gabbros as well as basalts and dolerites are exposed on the intra-rift ridge. There is some difficulty in distinguishing what is EPR crust and what is new Cocos-Nazca crust. Geochemical data and petrographic descriptions are not well developed as yet. Structural relationships are also poorly known and the connectivity between major zones of outcrops is not yet well documented. Some hydrothermal activity on the lower south-facing slope of the intrarift ridge may be related to the rift opening.

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Figure 5. (Opposite) 100 Cr/(Cr + Al) in spinel of mantle-derived peridotites from the northern Mid-Atlantic Ridge. The ratio increases with the degree of melting undergone by the upper mantle peridotites. (After Bonatti, 1990).

Pito Deep

As with Hess Deep this deep is formed by rift propagation into young, fast-spreading crust. Pito is about 6 km deep with 25 degree slopes on walls. Gabbros have been recovered from 5500 m level on wall. Expect to find significant crustal thinning associated with the Deep. There will be a dive programme in April 1993 and detailed sampling will be undertaken at that time. Pito is currently viewed as a viable alternative to Hess Deep but it needs additional study.

Kings Trough

Kings Trough is a failed rift that exposes old oceanic crust formed at approximately anomaly 25 time in the North Atlantic. The spreading rate at anomaly 25 was about 6 cm/yr and the area lies within the influence of a plume. The rift is part of the system that separated Iberia from Europe. The trough has steep walls and a sedimented floor. Good exposures of sheeted dikes occur along the base of the walls and are up to 1 km thick. Two dives in the area recovered gabbro overlain by diabase overlain by basalt. Very few survey data exist for the area and multibeam coverage is needed as well as more dives before this becomes a mature target.

Atlantis II Fracture Zone

A wide and high-standing transverse ridge is developed against this slow slipping (0.8 cm/yr half rate) transform fault, on the S W Indian Ocean Ridge, and exposes gabbro and ultramafics. Linear magnetic anomalies are traceable across both rock types, and Hole 735B was drilled on a shallow, wave-cut platform beneath anomaly 5 (ie. approximately 10 Ma). On the non-transform side of the ridge-transform intersection volcanics appear to overlie unextended crust. The transverse ridge provides ideal sites for further long gabbro sections, ultramafic sections, and, hopefully, the gabbro/ultramafic transition

Vema Fracture Zone

The Vema is located at 11°N on the MAR and has 320 km of offset. At this locality the MAR has a spreading rate of 1.2-1.6 cm/yr. It has a transverse ridge which is a continuous high ie. unlike the Atlantis II. Submersible dives surveyed and sampled two sections where all the major units of the oceanic upper lithosphere are represented, ie. from base to top:- mantle peridotite, gabbro, dike complex, basalts. Ferrogabbros apparently occur directly above mantle peridotites.

The Vema appears to be a good target for offset drilling of mantle and lower crustal sections. In addition, drilling on shallow water limestones on the summit of the transverse ridge will address a tectonic objective, ie. the origin of the transverse ridge and the processes responsible for exposure of the lithospheric sections. More survey work will better constrain the kinematic and tectonic settings of potential drill sites

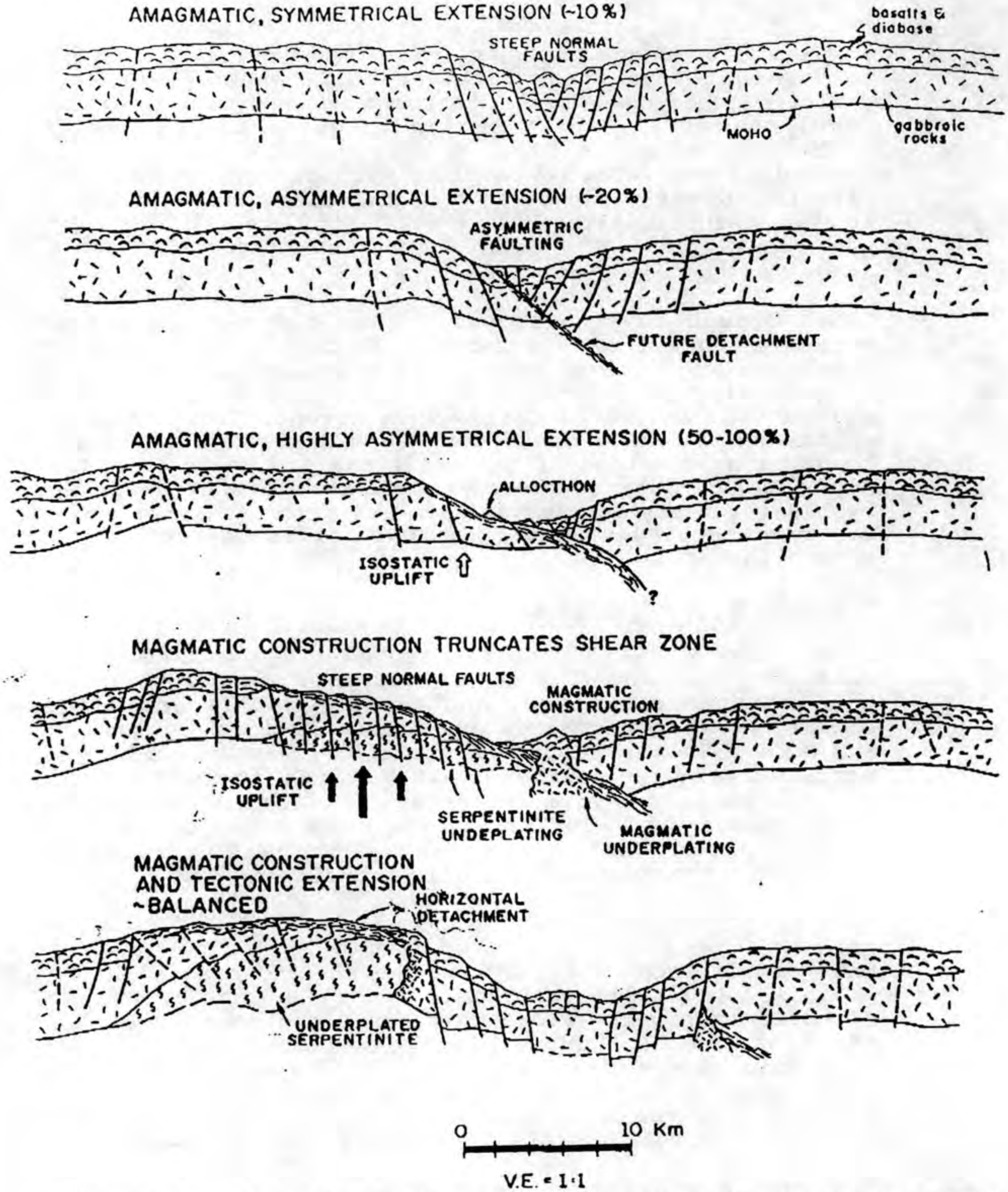


Figure 6. Sequence of cross-sections showing the possible evolution of the MARK area during alternating episodes of largely magmatic and amagmatic extension. Note that during the later stages of a lengthy period of amagmatic extension, highly asymmetrical extension results from the development of a major detachment, or "master" fault. (after J.A. Karson).

## Oceanographer Transform Fault

The Oceanographer offsets the MAR by about 100 km and is adjacent to the Azores hotspot so it has a relatively high magma supply rate. Relief is on the order of 2500 m, and the crust appears to thin to about 2 km in the axis of the transform. There are mostly breccias exposed on the walls with some sheeted dikes and peridotite exposed on the inner wall of the spreading ridge. Harzburgite and lherzolite have been recovered from the north wall of the transform. Ultramafic rocks and gabbros occur on the south wall where they are overlain by pillow lavas.

## MARK Area

The MARK area is one of the best studied and best known targets available at the present time. It has been very well surveyed and sampled and its geology is well known. Ultramafic rocks are exposed on the west wall of the ridge segment where they are overlain by basalt. The nature of the peridotite/basalt contact is unknown. Apparently the ultramafic rocks were exposed by detachment faulting during a period of low magmatic activity. The basalts may have extruded directly on top of the unroofed peridotite or may be part of an allochthonous block transferred from the hanging wall block to the footwall block. The ultramafic rocks appear to outcrop in a region of thin crust based on mantle Bouguer anomalies. The ultramafics could also, in part, be exposed by diapiric mechanisms.

Gabbroic rocks are also well exposed on the western rift valley wall closer to the transform inner corner high. They are also exposed on the south wall of the transform in the same region. Submersible work has documented over three kilometres of exposure of gabbroic rocks and this is the thickest section yet documented on the sea floor. The gabbro is overlain by basaltic rocks, but the transition from gabbro to basalt is obscured and there appears to be no well-documented sheeted dike section. Slickensides on gabbroic surfaces parallel surface slopes and suggest that the western rift valley wall may represent a single detachment surface.

## 15 20 Fracture Zone

The Fifteen Twenty Fracture Zone is located north of the Vema on the MAR. It is similar in many ways to the Vema but its attraction is its proximity to the end of a magmatic cell. Dunite and harzburgite are present, apparently unroofed by detachment faulting. Dredged rocks show some effects of low-temperature hydrothermal alteration. The rocks in the area have the geochemical signature of a hotspot although no known hotspots occur in the vicinity.

## Conclusion

The conjunction of new data and ideas relating to the exposure of gabbros and ultramafic rocks in tectonic windows, and new models of the nature and spatial and temporal variability of the lower oceanic crust, makes the proposal for an offset-section drilling program, to investigate the oceanic lower crust and upper mantle, timely and potentially very fruitful. Moreover the nature and origin of these tectonic windows are also of first-order scientific interest. Offset-sections are ready to drill, using proven technology, and in temperature conditions that allow the deployment of the full suite of downhole measurements.

**The Working Group recommends therefore that a Detailed Planning Group be set up, early in 1993, to define a specific programme of offset-section drilling in the light of the results of Legs 147 and 148, and the responses to the OD-WG report from ODP panels and the scientific community.**

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# APPENDIX

## The Working Group's Mandate and Membership, and attendance at meetings.

1. **Mandate**

PCOM's charge to the OD-WG was to:

i) establish and set into priority scientific objectives and a drilling strategy for a program to drill offset-sections of oceanic crust and upper mantle

ii) identify target areas where specific objectives can be addressed

iii) identify other survey information necessary to establish the geologic context of an offset drilling program and

iv) identify the technological requirements to implement the strategy.

2. **Membership and attendance at meetings**

Ernesto Abbate 1
Enrico Bonatti 2, 3
Joe Cann 3
John Casey 1, 2, 3
Henry Dick 1, 2, 3
Jeffrey Fox 2, 3
Karl Hinz 2
Catherine Mével 1, 2, 3
James Natland 1, 2, 3
Kazuhito Ozawa 1
Paul Robinson 2, 3
Robert Varga 3
Fred Vine (Chair) 1, 2, 3
Lev Zonenshain

Liaisons:

Sherman Bloomer (LITHP) 2, 3
Jacques Boulègue (SGPP) 3
Jeffrey Karson (TECP)
Kim Kastens (SSP) 2
Eldridge Moores (TECP) 1, 3
Jason Phipps-Morgan (LITHP) 1
Dale Sawyer (TECP) 2
Earl Shanks (TEDCOM) 2
Brian Taylor (PCOM) 1, 2, 3

Guests/observers:

James Austin (Chair, PCOM) 2
Gene Pollard (TAMU/ODP) 1, 2
Alex Sobolev 1

Key to meetings:

1. Woods Hole, 12-15 August 1991
2. Miami, 3-6 February 1992
3. Paris, 18-20 May 1992

# Sea Level Working Group (SLWG) Report

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## I. Summary


The strategy defined by the Sea Level working Group (SLWG) involves a **global** drilling program that will require a minimum of one sea-level leg/year for the next decade. A Sea-Level Program should be established to oversee the coordination of sea level research within the Ocean Drilling Program (ODP). The nature of the research will require a concerted, coordinated effort focussed on specific time intervals, at a number of locations, by geoscientists from a wide variety of disciplines. As the program evolves it will be important to frequently review the criteria presented here and update where necessary.

The success of the program is contingent upon global coverage in a variety of tectonic (passive, convergent, intra-oceanic), sedimentary (siliciclastic, carbonate, mixed), climatic (Icehouse, Doubthouse, Hothouse), and oceanographic (low and high latitudes). The strategy is based on the successful application of the scientific and technical objectives to address sea-level issues outlined by the SLWG:

- **dating sea-level-related stratigraphic events**
- **establishing the stratigraphic response to sea-level oscillations, and**
- **estimating the magnitudes and rates of sea-level change through time.**

A fourth issue, **understanding the mechanisms of sea-level change,** is addressed but the SLWG believes that the **JOIDES Resolution** will play a lesser, although important role in increasing our understanding of the mechanisms of sea-level change. In fact, resolution of the first three issues listed above will be fundamental to the success of sea-level mechanism research.

The **JOIDES Resolution** is an appropriate platform for all three issues. Indeed, the Ocean Drilling Program, because of the nature of the research proposed, is in the enviable position of being able to significantly contribute to the integration of continental margin, platform, deep ocean and earth-process related research. ODP-based sea-level research will focus the activities and coordinate the utilization of information between a multitude of onshore, continental margin and deep-sea geoscientists. The result is a unique sharing of concepts, information and technology, that can not be addressed by any other group of geoscientists, and a better understanding of one of the key issues in sedimentary geology and global change research.

In addition to the scientific coordination issues there are a number of **technical issues** that will control the success of the program. The first involves the ability of the **JOIDES Resolution** to maintain station and drill in shallow water depths (<50m). A test of the capabilities of the Resolution to stay on station in shallow water (38m) in Anewetak Lagoon was undertaken

during Leg 143. Although the test stopped early the ship was able to maintain station, with variable winds and currents. A supplementary platform will be required to complete the transect begun during Leg 150 and investigations are underway to find a suitable platform.

Sediment recovery from sands and alternating hard/soft units is still a major concern for proponents of sea-level proposals. The Diamond Coring System is still regarded as a critical component of the program.

An additional technical issue that the SLWG regards as critical is the development/application of an Integrated Stratigraphic Analysis System. The tool/system would integrate seismic stratigraphic tools (seismic interpretation/seismic-log calibration), log analysis/interpretation tools (including the Core/Log integration package endorsed by SMP and DMP, correlation and cross-section generation tools, etc.), backstripping software, etc. In order to effectively address sea-level issues it is important that the methodology and tools used for each approach are available to the general scientific community.

It is also imperative that a Data/Information Management System be constructed to store, display and distribute the information necessary to define the age, position and character of stratigraphic units and surfaces, document stratigraphic event correlations, estimate magnitudes of sea-level oscillations, and eventually begin to coordinate the information necessary to understand the wide variety of mechanisms controlling sea-level.

## II. Introduction

The JOI/USSAC Workshop held in El Paso, Texas from October 24-26, 1988 laid the foundation for the role of ODP in the investigation of global changes of sea level. The workshop stimulated a number of investigations of the stratigraphic response to eustatic changes on a number of margins of the world.

The SLWG, commissioned in 1991, was charged with the task to reassess the strategy for sea-level-related research, to encourage proposal writing and to establish further criteria for proponents.

**The mission is to formulate a global ocean-drilling strategy for**

**1) estimating the timing, magnitude and rate of eustatic changes as they are recorded in sediments and sedimentary rocks,**

**2) investigating the stratigraphic response to sea-level oscillations, and**

**3) determining mechanisms of eustatic change.**

The SLWG agrees that the **JOIDES Resolution** does offer an excellent platform to address sea-level issues, but the most important result is the recognition that it is going to require a *coordinated, concerted* effort on a number of margins around the world to achieve all of the tests conceived in the El Paso workshop and presented here. Coordination of ODP related sea-level research is at present handled jointly by the Ocean History Panel and Sedimentary and Geochemical Processes Panel. In future, the coordination will have to be integrated even further.

Eustatic fluctuations are inferred to constitute an important control on the stratigraphic record that should be addressed by the Ocean Drilling Program. However, neither the timing and amplitudes nor the causes of eustatic change are well known. For instance, possible relations between eustasy, tectonics, climate, the origin and deposition of siliciclastic versus carbonate sediments, ocean chemistry and circulation, and organic evolution are largely a matter of speculation. Similarly, little is known about feedbacks between sedimentary, climatic, tectonic, or eustatic phenomena or the possible offsets in leads and lags between them (Watts, 1982; Pitman and Golovchenko, 1991; Christie-Blick, 1991; Schlager, 1991). Understanding the rates and effects of sea-level related processes and their interaction with other Earth system processes is a fundamental component of the US Global Change Program.

Despite the interest in and understanding of sea-level issues (synchrony, magnitudes, rates, shape of curve) developed at the El Paso workshop, very few of the proposals submitted to ODP specifically to test eustatic concepts have been drilled. In general, previous legs have not been able to provide an adequate test of the concept (by concept we mean all aspects of stratigraphy that are influenced by eustatic oscillations). Recent legs, and a number scheduled for 1993 may well contribute significantly to solving certain aspects of sea level issues mentioned above. After an initial flurry of proposals there has been a steady decrease in the number of proposals to the point that there is only one mature sea level proposal in the North Atlantic Prospectus. A number of immature sea-level proposals in the southwest Pacific have been submitted. There are many tests of sea-level concepts that are appropriate for the **JOIDES Resolution** and it is imperative that we alert and encourage potential proponents. There is a significant opportunity to coordinate onshore, continental shelf and slope, and deep sea geological activities to resolve some key, topical, geological questions.

In the following sections, four distinct sea level research issues involving the **JOIDES Resolution** are discussed. The discussions include a number of strategies and criteria for proposals. It is important that clear tests of various aspects of sea level be proposed and that there is understanding and consistency among proponents of legs on different margins or areas of the world. It is apparent that there are still significant gaps in understanding of the terms used in sequence stratigraphy, the methods employed to generate eustatic cycle charts by Vail and his colleagues, and possible mechanisms for changing relative sea level. The discussions below address some of these gaps and will hopefully generate better insights into sea level research, resulting in new ODP proposals.

## III. Strategy

The strategy defined by the SLWG involves a global drilling program that will require a minimum of 1 SL leg/year for the next decade. The success of the program is contingent upon global coverage in a variety of tectonic (passive, convergent, intra-oceanic) sedimentary (siliciclastic, carbonate, mixed), climatic (Icehouse, Doubthouse, Hothouse), and oceanographic (low and high latitudes). The strategy is based on the successful application of the scientific and technical objectives to address sea level issues outlined by the SLWG: dating stratigraphic events, establishing the stratigraphic response to sea-level oscillations and estimating the magnitudes and rates of sea-level change through time.

An additional, but important, component of this strategy is geared toward stimulating potential proponents to write specific sea-level related proposals to meet the objectives outlined by the SLWG. Watchdogs for potential areas have been named amongst SLWG members and potential proponents will be contacted to obtain an initial estimate of whether the respective areas may meet the requirements for the sea level program.

The strategy is divided into short and long term components to take advantage of the drilling schedule in the Atlantic. Although the emphasis is initially on the Neogene Icehouse, for reasons outlined below, sea level objectives in the Paleogene "Doubthouse" and Cretaceous "Hothouse" are regarded as critical components of the program.

Potential Drilling Targets for Sea-level Program

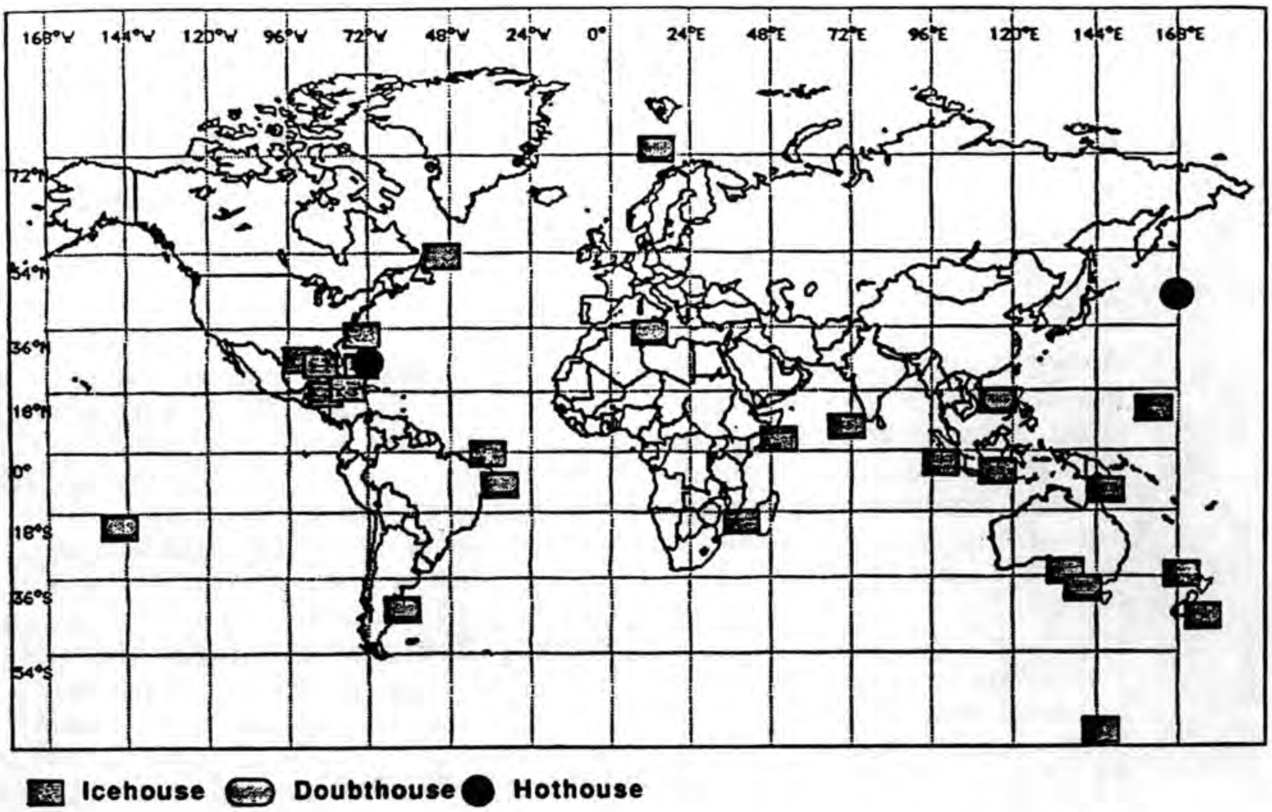


Fig. 1. Areas suggested by members of the SLWG as potential targets for a sea level program. Brief descriptions of the areas, including names of SLWG watchdogs and potential proponents, are contained in Appendix A of this report.

Short Term

The SLWG recommends that an integrated sea level program should begin by testing the synchrony of stratigraphic events in the Neogene where optimum age control and a calibrated signature of sea level are best constrained. Leg 150 on the New Jersey margin represents the first step in the program. The transect design on the NJ margin is focussed on establishing the age of several Miocene sequences. Secondary objectives of Leg 150 include estimating the magnitudes of sea level oscillations and understanding the stratigraphic response to sea level changes. It is important *to note that* Site locations required to achieve the latter objectives would be significantly different from those designed for dating stratigraphic surfaces on Leg 150.

Leg 150 will establish a control point that could be tested by another leg in the Atlantic within the next 2 years. The SLWG believes that an appropriate next test would be to drill the Neogene of the Bahamas because it offers a geographically close test of the ability to correlate stratigraphic events between two areas of contrasting sedimentary settings. In an effort to solicit other potential tests in the Atlantic the SLWG has undertaken an initial evaluation of potential locations and initiated communication with possible sea-level leg proponents (see Appendix A). It is also important to remember that following the completion of Leg 150 the strategy outlined here may change. The stratigraphic framework developed during Leg 150 could form the basis for locating additional sites to better constrain sea-level magnitude estimates and improve understanding of the processes controlling the distribution of sediment across the margin.

Long Term

An essential component of the sea-level program is to demonstrate the degree of synchrony of sea-level related stratigraphic events between a number of continents. After an initial assessment of possible candidate locations, the SLWG believes that proposals for the southern Australian and eastern New Zealand Neogene may provide an adequate test. The SLWG is also encouraging proponents to submit proposals for other potential Neogene test locations (see Appendix A). The targets in Australia and New Zealand also include Paleogene strata, as does Leg 150. Adequate testing of the synchrony of sea-level related events in the Neogene (Icehouse) will provide the confidence, and understanding of the methods, required to investigate sea-level-related processes and effects in the Paleogene and Cretaceous. To begin to understand the stratigraphic response to sea-level oscillations the SLWG believes that it will require 6 legs; 3 siliciclastic settings, 3 carbonate settings (including 2 platforms of different ages and 1 atolls/guyots) in different time-slices.

## IV. Target Intervals

The working group suggests that proponents focus on specific time-intervals with the greatest chronologic resolution, so that the "global" nature of events can be tested within a reasonable period of time. With a limited number of legs available it is imperative that there be a **coordinated effort among groups of researchers on selected target intervals.** In addition, there are a number of advantages to selecting intervals that are **associated with second order sea-level rises and highstands**. Many classic, intensely studied, outcrop sections span the climatic intervals targeted. They represent sediments deposited during major transgressions related to the second- and third-order relative sea-level rises (Haq et al., 1987. It is important to take advantage of as many land-based studies as possible in order to formulate the questions that can be addressed by the **JOIDES Resolution**.

For intervals of established eustatic change (e.g. , the Icehouse earth discussed below) both the estimation of size of sea-level excursions and the sediment response (e.g. leads and lags), with respect to forcing mechanisms in depositional systems can be evaluated. For intervals of uncertain eustatic signals, the relative effects of eustasy, tectonics, and sediment supply can be evaluated by comparison of sequences on different margins (for further discussions see "Determining the Stratigraphic Response to Sea-Level

Change").

The intervals suggested during the El Paso workshop are:

**Oligocene - Recent "Icehouse" Earth**

There is compelling evidence that major glacio-eustatic fluctuations occurred throughout this interval. These particular eustatic signals should be resolvable and globally correlatable because of their magnitude. They can be compared among deep ocean, carbonate plateau and continental margin stratigraphic sequences to delineate the response of different sedimentary regimes. Dating can be further strengthened by comparing stratigraphic (e.g., biostratigraphic, magnetostratigraphic and magnetic susceptibility records) and carbonate diagenetic markers with oxygen isotope markers at the beginning and end of the glacial cycles. These are presumed to coincide with the beginning and end of the sea-level cycles.

*Late Miocene - Recent*

Intensively studied upper Miocene to Recent strata indicate the availability of high-resolution chronologic control (at Milankovitch orbital frequencies) providing an opportunity to date and correlate high-frequency sequences. In addition, the calibrated signature of sea level provided by oxygen isotope records provides an opportunity to quantify the effect of known sea-level oscillations on the stratigraphic record. Transects that target the late Miocene to Recent should avoid areas that are strongly influenced by glacial-isostatic effects and should try to locate sites to enhance correlations between open-ocean and margin or platform sites.

Drilling efforts for this interval require stratigraphic successions with high sedimentation rates (100-1000m/my) to provide high chronologic resolution (5-50ky). (Carter and/or Suter figures)

*Late Oligocene-Middle Miocene.*

This interval contains evidence, derived from outcrop and subsurface studies, of the effects of high and low sea-level oscillations. A high rate of change in $^{87}Sr/^{86}Sr$ of ocean waters results in Sr-based dating with a resolution of 0.5 to 1.0 m.y., and the interval includes significant stable isotope excursions that have been correlated with sea level events (Miller et al. 1989). Magnetobiostratigraphic resolution is high.

Investigation of this interval will also permit us to assess relative amplitudes of eustatic and local pulses of sea-level change. The glacial component of the signal should be truly eustatic and present at all sites, whereas local effects from sedimentation, compaction, and local tectonics will be restricted to specific sites, and should thus be separable from the eustatic signal if evidence of eustatic signal and sea-level amplitudes are determined at enough sites. This will yield an estimate of the magnitude of local effects, a value for which we have few data at the present time.

## Paleogene "Doubthouse" Earth

*Latest Paleocene-Middle Eocene.*

"Doubthouse" time is non-glacial to some but glacial to others; study of this interval would test that controversy. Furthermore, this period represents the transition from a warmer, perhaps ice-free climate of the Cretaceous to the ice-dominated climate of the Neogene. Inferred sea-level excursions include widely observed, high-amplitude events (Haq et al., 1987). The only established mechanism for these large, rapid sea-level changes is glacio-eustasy (Pitman and Golovchenko, 1983). Investigation of these inferred sea-level events allows us to evaluate synchrony, to measure amplitudes and rates and to test their similarity with both non-glacial ("Hothouse") and glacial ("Icehouse") events. Because these events occur during periods of relatively frequent magnetic polarity changes and excellent biostratigraphic control, they can be dated with an accuracy of about 0.1 to 0.5 m.y.

This interval covers at least two widely recognized, unconformity-generating events at approximately 55 and 49 Ma (time-scale of Berggren et al., 1985). Magnetobiostratigraphy has excellent potential for trans-latitudinal correlations because of the wide distribution of biozonal markers.

## Cretaceous "Hothouse" Earth

*Aptian-Coniacian.*

This "mid-Cretaceous" interval recorded the warmest climatic conditions of the past 200 m.y. with presumably "ice-free" conditions and the highest sea level. Despite the lack of a known mechanism for eustatic variations, many large, rapid, sea level fluctuations have been inferred (Haq et al., 1987). Studies of this "Hothouse" world provides an important test of the timing, amplitude and rate of sea-level changes with respect to possible causal mechanisms.

Although magneto-polarity stratigraphic techniques (susceptibility techniques can be used) cannot be used directly, because this interval is within the Cretaceous Normal Superchron, biostratigraphic resolution is adequate. The Global Sedimentary Geology Program has selected this period of "ultra-thermal earth," a time characterized by the accumulation of thick black shales, as its first subject of international study on land.

## V. Sea-level Research Issues

Four sea level issues can be addressed by the **JOIDES Resolution** during the next few years. Three of them were discussed at the El Paso workshop:

- testing the synchrony of sea-level events,
- estimating the amplitude and rates of sea-level changes, and
- understanding the mechanisms of sea-level change.

The fourth issue that could be studied by the Ocean Drilling Program is:

- understanding stratigraphic response(s) to sea-level oscillations

Outlined below are some criteria for selecting margins suitable for tackling each issue. The criteria are generally similar with a number of exceptions specific to each approach. The success of the sea-level drilling program is contingent upon adherence to most of these criteria. It is important that each test of a sea-level-related problem be well formulated with every effort being made to constrain the parameters to be measured for sea-level estimation and correlation. Margins or areas that do not meet, or adequately address, the criteria should not be drilled solely for sea level related reasons. However, we realize that new tests of sea-level concepts will be developed as our understanding of the problems evolve and that we can not provide an exhaustive list of criteria that *must* be met. The criteria listed for each approach serve as a checklist to help establish some of the ground rules and to improve communication between proposal proponents and ODP thematic panels. The criteria checklist should be reviewed from time to time and updated accordingly. Responsibility for the evaluation of the criteria must rest with OHP and SGPP or a group commissioned to oversee a sea-level program.

### A. Dating Of Stratigraphic Events

#### 1. Introduction

To determine the timing of sea-level changes, major stratigraphic surfaces (sequence boundaries, flooding surfaces, down lap surfaces, etc.) must be dated and correlated among different regions to evaluate the synchrony of causal events. Drilling with the **JOIDES Resolution** is well suited to this task because it provides continuous cores tied to a seismic-stratigraphic framework, allowing the integration of magneto-, bio-, and chemo-stratigraphy with seismic sequence analysis. As suggested in the El Paso workshop, transects across continental margins and platforms are needed to date accurately stratigraphic surfaces and intervening sedimentary successions.

2. Strategy

The objective of this drilling strategy is to test the synchrony of sea-level related stratigraphic events in three selected time intervals characterized by different climatic regimes and potentially different sea-level signatures. Transects of marginal marine to deep basin environments are required in a variety of settings (such as passive continental margins, seamounts and perhaps basins in more complex settings associated with plate convergence). These settings should be characterized by stratigraphic sections with sufficient resolution to date surfaces in selected target intervals.

3. Criteria For Proposals

Ideally, a stratigraphic interpretation of the tectonic/sedimentary setting should be available prior to the generation of an ODP proposal, particularly of the on-land expression of the sequences to be drilled. Interpreted industry seismic and well data should strongly influence margin selection. In any case, site-survey seismic data should be of sufficient density and quality to allow detailed seismic stratigraphic interpretation to satisfy the criteria outlined below. Another important criteria is to look for areas where sequences of similar time periods are physically well expressed in the sedimentary record. Tectonic, climatic and oceanic processes all combine to accentuate or disguise the expression of sequence boundaries in a specific area. In other words, a "major" sequence boundary in one area may be expressed very discretely in another area.

Specific criteria relating to the dating of stratigraphic events are included in the sections on Transect Criteria and Technical Issues.

4. Summary

One of the primary products of ODP drilling of sea-level targets will be firm constraints on the ages of major stratigraphic surfaces, particularly unconformities (sequence boundaries). This will allow interregional correlations of sequence boundaries and provide a test (although potentially incomplete) of the synchrony of their cause(s). The ages of surfaces may be slightly different and the cause globally synchronous, but the stratigraphic response involves leads and lags of up to a quarter/cycle (approximately 400k.y. for a third order cycle of Haq et al., 1987: Christie-Blick 1991). In addition, ODP drilling will provide the chronologic control needed to compare sequence stratigraphic estimates with other proxies of sea-level change. Firm age constraints are also needed to estimate the rates of sea-level change and to evaluate causal mechanisms. In this, the close dating of sequence boundaries is the first step required to decipher the history of sea-level changes.

## B. Determining The Stratigraphic Response To Sea Level Changes

### 1. Introduction

The JOIDES Resolution is an appropriate platform for determining the stratigraphic response to sea-level changes. This is because it is possible to penetrate and sample sedimentary sequences of different water depths and depositional settings within a clearly defined geometrical framework. Seismic reflectors image surfaces and packages that can be followed from shallower to deep-water settings where they can be dated. Cores and logs ground truth the seismic data and provide higher stratigraphic resolution record to complement the lower resolution seismic records. More importantly, cored sediments contain a record of changing environments, sedimentary processes and information about the timing of events.

The sedimentary record is fundamentally discontinuous at a variety of scales as a result of secular changes in patterns of erosion, transport, in situ production, and accumulation of sediment. Stratigraphic discontinuities are expressed by breaks in lithofacies and/or changes of biotic successions and by the geometric patterns of stratal onlap and offlap. The recognition of discontinuities allows sedimentary successions to be subdivided into relatively conformable elements of genetic significance, and this is the essence of the techniques of seismic and sequence stratigraphy (Mitchum et al., 1977; Vail, 1988). However, in spite of existing terminology and the tendency to interpret unconformity-bounded depositional sequences in terms of eustatic change, seismic and sequence stratigraphy do not actually require any assumptions about the role of eustasy in sediment cyclicity ( Christie-Blick, 1991). Sequence stratigraphic techniques offer a framework within which lithology, faunal distribution, paleomagnetics, geochemistry can be objectively tied (Loutit et al., 1988). An essential component of the Sea Level Program will be to understand the stratigraphic response, in a variety of settings and climatic regimes, to inferred eustatic oscillations using sequence stratigraphy as a tool to provide a framework for observations. What role does eustasy play in the origin of sedimentary cyclicity? It is therefore important to select widely separated basins for which rates of subsidence and sediment supply and sequence geometry are similar, as well as basins in which they are different.

The sedimentary response may be different for siliciclastic and carbonate margins (Schlager, 1991). In end-members of the two settings the time of maximum sediment supply can be 180° out of phase. For example carbonate platforms may shed sediment during relative sea-level highstands while siliciclastic shelves shed during lowstands (Droxler and Schlager, 1985; Sarg, 1988; Van Wagoner, 1990). The result is that the internal architecture and geometry of carbonate versus siliciclastic sequences differ widely so that high quality data sets for both settings are necessary to calibrate their respective responses to relative sea-level changes. The emphasis should be on understanding the processes that control sedimentation in a variety of settings, not on descriptive comparisons of stratal geometry and tectonic/sedimentary setting.

Eustatic fluctuations may also effect the stratigraphic record of portions of the ocean far from continental margins. Responses in open-ocean sedimentation processes as a result of eustatic changes are not well documented and there is an opportunity to better quantify the nature and timing of the response to sea-level oscillations (Shackleton and Opdyke, 1973; Vincent et al.,1985;Mayer et al.,1986; Miller et al., 1987).

2. Strategy

We require marginal marine to deep basin transects in a variety of settings, such as such as passive continental margins, seamounts and perhaps basins in more complex settings associated with plate convergence. Targeted intervals must have a well-developed sedimentary cyclicity and well-defined sequences. The objective of this drilling strategy is to calibrate the sedimentary record and to document the variability of depositional sequences. This should allow us to quantify the influence of sea-level fluctuations on stratal geometry, lithofacies distribution, and other stratigraphic/lithologic attributes.

Two general approaches are suggested depending on the availability, or absence, of eustatic records.

(a) The first approach deal with cases where the eustatic record is already known with some degree of certainty based on other sea-level proxies (e.g., $\delta^{18}O$).

By comparing the stratigraphic response to sea-level changes on different margins in time intervals where there exists a reliable signal of sea level, one can understand the precise relationship between facies and sea-level change. In particular, it may be possible to identify leads and lags between sediment facies and a sea-level signal and to identify the processes responsible. Studies within the Neogene Icehouse period are most appropriate for this approach because of the existence of an eustatic ice-volume driven forcing mechanism. Neogene sections offer the possibility of directly correlating depositional sequences with the deep-sea record from which a number of eustatic proxies have been generated.

Eustatic records provide a model that can be used to formulate tests of the sequence stratigraphic approach. For example, how much of the stratal geometry on a specific margin can be explained by processes related to a specific eustatic history? On the basis of the available data, various stratigraphic models can be constructed which predict the facies, in both two and three dimensions, and their timing. The reliability of eustatic proxy records varies considerably, primarily as a function of the construction method, and this must be discussed by proponents. The most reliable eustatic records have been obtained from the last 3 m.y. Understanding the stratigraphic record of these events is important to understanding the sedimentary processes associated with sea-level change. While sea level fluctuations in this time period are often large and occur frequently, it must be recognized that this time interval is not characteristic of all of earth history.

(b) The second approach deals with cases where sea-level is not known with any precision, even by proxy. In these cases, eustasy constitutes an additional unknown which has to be inferred from the sedimentary record being studied.

It is essential to attempt to quantify the effects of processes that control sediment deposition and distribution during time intervals where a preexisting independent eustatic record is not available or mechanisms are unknown.

## 3. Criteria For Proposals

Proposals related to sea-level investigations may usefully be judged against the following criteria.

### a) Define whether time of known or unknown sea-level

Proposals must contain a clear statement of whether the targeted program applies to a time of known or uncertain sea-level change, of the type of geologic and sedimentary setting, and of whether the nominated sites fall within the Icehouse, Doubthouse, or Hothouse time periods. They must define the periodicity of sea-level oscillations thought to drive the stratigraphic response
Proponents should strongly consider taking advantage of areas and time periods (such as the Neogene) that have already been evaluated in detail by other sea-level legs. Such studies would reveal changes in lithologic response to similar sea-level forcing in different sedimentological and tectonic settings.

b) Clearly define the "test"

In order to develop a working hypothesis, the following steps are recommended:

Proponents should describe the model or working hypothesis that is being applied to predict sediment architecture (including facies patterns, unconformities etc.). In addition, a discussion should be included about the parameters that are utilized in the model and how these parameters relate and respond to sea-level fluctuations with particular emphasis on the leads and lags that may exist within the system. It is likely that reference to geometric modeling simulations would form part of such a discussion.

c) Status of existing data?

Summary of existing data and state of knowledge regarding the chosen site area(s), and a discussion as to how this provides the necessary background for a successful test of the working hypothesis. The data set needs to include a seismic grid that clearly defines the interval under discussion as well as the specific targets. Assessment of the likelihood that the critical data necessary for the test (e.g. chronologic resolution, facies information, subsidence history, etc.) will be available and/or of high quality at the proposed sites.

4. Summary

In summary, the strategy to understand stratigraphic response to sea-level oscillations should emphasize: 1) the need for precise dating to identify and quantify possible leads and lags; 2) comparisons between basins for which the rate of tectonic subsidence is different (and the mechanism known); and 3) comparisons between settings in which depositional geometry and sedimentation rates are different (including siliciclastic and carbonate settings).

## C. Estimating Magnitudes And Rates Of Sea Level Changes

1. Introduction

The **JOIDES Resolution** can be an effective component of an integrated effort to estimate the magnitudes and rates of sea-level fluctuations by selectively sampling environments ranging from shallow shelf to deep (open ocean) settings and by integrating all datasets and techniques utilized so far to quantify sea level. These estimates require the use of geological, geophysical and geochemical models. Drilling proposals addressing the sea-level magnitude and rate problem should make explicit the assumptions of the models being used and the links between the signatures and the values to be estimated.

Two fundamentally different approaches have been suggested for estimating the magnitude of sea-level change, and when integrated with appropriate geochronolgy, the rate of change. One approach is to analyze the subsidence history at a given site or transect, and to attempt to make corrections for variations in water depth through time, for compaction/lithification and the isostatic response of the lithosphere to loading and unloading, and for the tectonic component of the observed subsidence. In detail, the nature of the corrections depends to some extent on local geology (e.g., passive continental margins versus atolls) and different techniques have been employed to provide an approximation of changes in paleobathymetry (e.g., physical sedimentology and paleoecology, seismic geometry, evidence for subaerial exposure and freshwater diagenesis of sediments that accumulated close to sea level) A second approach is to attempt to gauge the glacio-eustatic component of the sea-level signal from the analysis of oxygen isotopic ratios in foraminifera.

The approaches include:

• Measurements of stratal geometry in siliciclastic, carbonate and mixed margins using seismic stratigraphic techniques as illustrated by: Vail and Todd (1981); Haq et al. (1987); Greenlee and Moore, (1988), Schlager (1991);and others;

• Measurements using geohistory analysis and "backstripping" techniques: Van Hinte (1978,1983); Hardenbol et al. (1981); Steckler and Watts (1982); Moore et al. (1987); Greenlee et l. (1988); and others;

• Forward modeling to simulate stratigraphic response to various forcing mechanisms, for example, from crustal movement to high-frequency orbital forcing, etc. (Reynolds et al., 1991)

• Combination of seismic stratigraphy and chemical methods on atolls/guyots ("dipstick" methods) and barrier reefs : Halley (1989); Davies et al. (1992); and

• Paleomagnetic measurements for high-resolution correlations of surfaces and depositional sequences and of diagenetically reset magnetic signatures; Aissaoui and Kirschvink (1991).

• Chemical proxies for ice volumes such as oxygen isotope ratios:

Fairbanks and Matthews (1978); Jansen and Sjoholm (1981); Miller et al. (1989); Fairbanks and Wright (1991); and others;

With the exception of the paleomagnetic technique most of the methods have been reviewed elsewhere (see El Paso workshop report and Fairbanks and Wright, 1991) and the advantages and disadvantages discussed. We do not feel that it is warranted to go over all of these techniques again, although some examples are presented below. The critical point here is to minimize the failings of each technique and to try and develop a coordinated attack on the problem.

Sea-level magnitude and rate estimates are inherently difficult because of the large number of variables that must be quantified and for this reason a number of researchers have questioned whether realistic estimates are possible. Most members of the SLWG are of the opinion that constraints can be placed on both amplitude, and rates of eustatic change by means of a coordinated drilling program utilizing the capabilities of the JOIDES Resolution, coupled with the analysis of seismic and existing borehole data and modeling. Computer simulations are useful for examining the sensitivity of the stratigraphic record to variations in the key parameters, even if the parameters themselves cannot be estimated uniquely from the geologic record (for a more complete discussion of computer simulations see Appendix B).

2. Strategy

The drilling strategy is to estimate magnitudes and rates of sea-level fluctuations using a variety of geological, geophysical and geochemical models. Best results can be expected to be achieved for known periods of well-defined sea-level excursions and regions of well-defined tectonic movement.

We need to drill selected marginal marine to basin transects in a variety of known sedimentary settings and environments with: 1) well-constrained tectonic behavior, and 2) sections of sufficient geometric, paleobathymetric, and time-stratigraphic resolution for selected target intervals to allow correlation to a geochronologic time scale.

3. Criteria For Proposals

a) Coordinate proposals with those selected to estimate synchrony of stratigraphic events

The drilling strategy for estimating the magnitude of sea-level change may differ from that employed to date and correlate stratigraphic events. However, accurate estimates of rates of sea level change require accurate dates of surfaces and depositional sequences produced by sea-level oscillations. It is critical that the efforts required for both approaches not be compromised. Coordination of effort within specific time-intervals and margins will result in a more efficient and successful use of the drill-ship.

b) Explain the appropriateness of the **JOIDES Resolution** (as a tool to estimate sea-level magnitudes) relative to other efforts (land-based, alternate platforms, other time periods, etc.)

The advantages of using the JOIDES Resolution for this task are not as obvious as in the other approaches and it is appropriate that proponents document these advantages, relative to other platforms and areas. For example, a good case can be made for modifying the technique used by Greenlee et al. (1988) and Greenlee and Moore (1988) to estimate eustatic change in the Neogene of the US mid-Atlantic margin, as well as for updating the basic stratigraphic constraints and assumptions. Many of the assumptions can be evaluated through the ability of the JOIDES Resolution to obtain samples from specific sites and depths. The US mid-Atlantic margin, because of these previous studies, provides a well-constrained "test" in contrast to many other areas that have been proposed for sea-level research.

c) Define the method, or array of methods to be used to estimate magnitudes of sea level changes

Two different approaches have been suggested for estimating the magnitude of sea-level change, one based on the analysis of subsidence history at a given site, or transect (Van Hinte, 1978, 1983;Steckler and Watts, 1982), and the other on the analysis of oxygen isotopic ratios in foraminifera. The former requires a range of constraints and assumptions about paleobathymetry, processes of compaction and lithification, the isostatic response of the lithosphere to loading and unloading and the tectonic component of subsidence. Proponents should therefore state explicitly how specific drilling will help constrain these parameters. One strategy at passive continental margins has been to attempt to use seismic geometry to constrain variations in water depth during the development of unconformity-bounded depositional sequences (Greenlee et al., 1988; Greenlee and Moore, 1988; Moore et al., 1987). This requires assumptions about the depth of water associated with observed breaks in slope such as the depositional shelf edge and about the water depth that corresponds with onlap along the depositional slope. It is also necessary to know or to assume the duration of the hiatus represented by the sequence boundary in the vicinity of the shelf edge. An alternative strategy is to focus not on the sequence boundaries themselves but on drilling relatively complete sections of each sequence. The rationale here is to simplify the backstripping procedure, and to recognize that backstripping is most successful when hiatuses are limited or absent. In either case, and as recognized in the El Paso report, uncertainties can be reduced by means of a transect of holes.

Carbonate platforms, atolls and guyots may offer the best constraints on variations in paleobathymetry because carbonate sediments tend to fill available accommodation to close to sea level. Facies patterns on carbonate platforms, especially on isolated platforms detached from the continents, are not comparable, directly, to those on clastic margins and the typical clastic, or mixed clastic/carbonate geometry is not developed. Instead, the essential feature of carbonate banks is that upward growth generally paces long-term tectonic subsidence, keeping depositional surfaces close to sea-level. In essence, they provide a "dipstick" to clock subsidence relative to ambient sea level. In healthy, low latitude systems, the upward growth rate can keep up with rapid sea-level rise. Platform drowning occurs when upward-growth is outpaced by sea level rise. On some platforms growth "catches-up" again with sea level but on others the drowning is permanent. Alternately, a relative fall of sea level exposes the platform to subaerial diagenesis and erosion. All these fluctuations of relative sea level are encoded in carbonate strata, in the language of lithologic and biotic changes, and in diagenetic overprints.

Recent drilling, during Leg 143, has raised some doubts concerning the viability of the "dipstick" method. The results suggest that tectonic subsidence in the Western Pacific mountains varied considerably during the middle Cretaceous. In fact, it appears that large areas of the Pacific may have gone up and down at remarkably fast rates, thereby making it difficult to unravel the ambient sea-level story.

The main failing of the "dipstick" method so far has been the inability to develop transects across target areas and to accurately define the position of the shoreline. Proponents who plan to study the geometric relationships of the above margins or platforms will need to consider how drilling, coupled to seismic, will determine the position of the coast for a particular sea-level high-stand event and how the vertical distance will be measured to the coastal position of the next sea-level low-stand event. Consideration should be given to: 1) accurate dating of the events; 2) an estimation of coastal paleobathymetry; 3) the completeness of the section (the absence of erosion, and or a certainty that the so called low-stand sediment response is in fact for the lowest position of those coastal sediments); 4) a reasonable tectonic model for the depositional setting; and 5) a well defined seismic velocity depth relationship. Multiple drill holes will be required across shelves. Multiple drill holes are also required on atolls, lagoons, and reef transects for testing the "dipstick" method of monitoring eustasy.

Also, proponents may wish to consider using a new method for estimating the magnitude of sea level falls in barrier reefs. The method is based on recognizing secondary magnetization produced during the subaerial diagenesis of barrier reefs, and may provide a reliable estimate of the magnitude of sea level falls. The area of study should be restricted to a carbonate section that remained in shallow water during deposition. The section to be drilled should be sampled with oriented cores. There should be well constrained subsidence histories available for the period of the formation of the section of the barrier reef or margin in question. The study requires optimum core recovery. To better constrain the solution determined from this method, a number of transects should be drilled, some close together and some a distance away, preferably in a different tectonic province or atoll.

The second principal approach measurement of the magnitude of sea level change is to attempt to gauge the glacio-eustatic component of sea-level signal from analyses of oxygen isotopic ratios in foraminifera. Composite oxygen isotope records have been calibrated to known changes in sea level and appear to represent the most reliable geochemical technique for estimating sea level, particularly for the last 35 million years ( Fairbanks, 1978, 1989). The oxygen isotopic content of sea water varies as a function of the volume of water in the sea. This variation can be measured from the oxygen isotopic content of foraminifera. Problems include: 1) how to separate ice-volume (a close monitor of sea level) from salinity and temperature effects; 2) understanding ice-sheet dynamics; and 3) estimating variability in the isotopic composition of ice sheets through time.

The criteria to obtain the most appropriate oxygen isotope records for estimating eustatic oscillations for discrete time periods have been discussed elsewhere (Miller et al., 1991; Fairbanks and Wright, 1991) and are only briefly mentioned here. The best strategy to minimize temperature effects is to obtain:

1) good surface-dwelling planktonic and bottom-dwelling benthic foraminiferal $\delta^{18}0$ records from tropical non-upwelling regions;

2) from sites well above the CCD;

3) at shallow burial depth (<400-500m); and

4) with the possibility of continuous recovery (double/triple coring) from relatively high sedimentation rate (>20-30m/m.y.) sections (to estimate single cycle oscillations). The isotopic records must be supported by an integrated magneto-, bio-, and

chemostratigraphic framework.

4. Summary

The estimation of magnitudes and rates of sea-level fluctuations will require a variety of geological, geophysical and geochemical models. The **JOIDES Resolution** can be an effective component of an integrated effort to estimate the magnitudes and rates of sea-level fluctuations by selectively sampling environments ranging from shallow shelf to deep (open ocean) settings. The importance of the **JOIDES Resolution** to a program to estimate sea-level magnitudes and rates cannot be overemphasized. The ship provides the ability, in suitable locations, to physically correlate chronostratigraphic units (depositional sequences) between the open ocean, where calibrated signatures of sea-level are available, and shallower environments where geometric and geochemical estimates of magnitudes and rates are traditionally estimated. The integration and calibration of the variety of methods currently available can be achieved via a coordinated effort by ODP sponsored research.

## D. Determining Mechanisms Of Sea Level Change

1. Introduction

Our understanding of sea-level forcing mechanisms ranges from fair to nil. Short-period (0.01-0.1 m.y.) sea-level cycles are probably the best documented. These changes have been shown to closely match orbital frequencies. Linkages between orbital perturbations and sea-level changes remain clouded, however. The next best understood part of the sea-level spectrum is that with periods ranging from approximately 0.1 to 1 m.y. Sea-level changes in this range appear to be mainly due to glacial removal of water from the world's oceans and subsequent restoration of the water. Although the basic mechanism is well known, much remains to be determined regarding the specifics of rates, durations and amplitudes of these cycles. Sea-level events with periods 1-10 m.y. are the most enigmatic. Many of these events have been reported from periods of geological time when glaciation is neither known nor likely. Although no mechanism has as yet been demonstrated to adequately account for cycles in this frequency range, several mechanisms have been suggested. A variety of mechanisms appears capable of explaining cycles with periods of 10-300 m.y. With the exception of changes in ocean basin volume due to changes in global spreading rates, the effectiveness of these mechanisms has not been demonstrated.

To fully understand the mechanics of sea-level change, we must:

- Test and confirm proposed mechanisms,
- Fully understand those mechanisms shown to be active,
- Discover unrecognized mechanisms, especially those responsible for changes of 1-10 m.y. duration, and finally
- Develop a strategy for attaining the above objectives.

In order to accomplish the above, we herein review known and potential mechanisms and summarize their salient features, including inferred polarity (rise, fall or both), duration, probable amplitudes and near- and far-field variation in signature. We then suggest steps that might be taken to clarify and define these mechanisms together with objectives of experiments that have the highest priorities in terms of understanding sea-level mechanisms.

Mechanisms

There are two families of mechanisms, one consisting of those mechanisms due to changes in the volume of water in the ocean basins, and the other due to changes in the volume of the world-ocean basin. In the first case, we know that the waxing/waning of ice sheets may cause rapid, large-amplitude changes in sea level. According to benthic foraminiferal $\delta^{18}O$ studies, ice sheets developed at least intermittently during the Oligocene to early Miocene. The calibration of the $\delta^{18}O$ record against a "known" eustatic record from terraces/atolls suggests that glacial mechanisms are capable of producing magnitude changes of about 30-120 m with cycles that range from a few tens of thousands of years to perhaps a few million years. No other mechanisms capable of significant changes in ocean water-volume over periods commiserate with sea-level changes are known.

Estimates of eustatic changes due to tectonic alteration of the volume of the world-ocean basin rely on model predictions, and as a result there is much controversy on the magnitude and periods of these mechanisms. However, some general patterns emerge. For example, Pitman (1978) and Kominz (1984) have shown that changes in the volume of the mid-ocean ridges can cause large amplitude sea-level rises and falls of up to 250 ± 50 m on a cycle scale of up to 70 m.y.

Mechanisms such as compressional and extensional tectonics, sediment loading, and volcanic loading appear capable of producing long frequency cycle changes. Results of recent seismic tomographic studies suggest that there may be bumps in the lithosphere-asthenosphere boundary due to temperature variations in the asthenosphere. Most of these variations in temperature appear associated with entombed segments of old subducted slabs, plumes, or mid-ocean spreading ridges. These bumps may be capable of changing global sea level as well as causing apparent sea level changes on a megaregional scale as the asthenosphere rotates relative to the lithosphere.

Preliminary analysis of ODP Leg 143 drilling and associated geophysical surveys in the Western Pacific suggest that vertical motion of the sea floor due to construction and subsidence of oceanic plateaus and seamount groups during the middle Cretaceous may have been of sufficient areal extent and vertical magnitude to displace volumes of water capable of causing rises and falls of sea level of 10-40 m on continental shelves. The time scale of these events appears to be in the range of 1-10 m.y.

Although eustatic variations are generally thought of as being of the same magnitude worldwide, observed magnitudes vary widely. Some variations are probably due to poor data or observational errors, but other variations may be inherent in the mechanism. For example, deglaciation models of a self-gravitating earth (Peltier, 1980) show several different fields in which the observed sea-level curves differ. Most prominent is the region of the ice sheets and their immediate surrounding which is uplifting from the post-glacial rebound which therefore sees a net sea level fall. This region constitutes a "near field" where the observed sea-level signal is significantly different from the rest of the world. In the "far field" and "near field" regions relative to ice sheet locus, the adjustment of the earth to the melting and redistribution of water will be different. Sea-level changes will be greater in the near field, and polarity will vary with distance from the ice sheet.

During movement of asthenospheric bumps across continental margins and desiccation of isolated basins, local observations of apparent sea-level change will also differ from distant observations. Similarly, near-field and far-field signatures will differ in the case of uplift of mid-plate swells. For other mechanisms such as changes in spreading rates there will only be a global far field signal caused by the volume change of the oceanic basins.

For a third class of mechanisms, there will be local or regional effects but no uniform global signal. These mechanisms, for example, in-plane stress and dynamic topography, are tectonic processes that produce "eustatic-like" signal in the near field but no uniform far field response. It has been proposed that they are capable of generating sequence boundaries that may be otherwise mistaken for eustatic events (Cloetingh et al., 1985; Gurnis, 1990).

2. Strategy

A detailed list of distinguishing features of many individual mechanisms, or the correlation of the timing of associated geologic and eustatic events is not appropriate at this time. For these processes the uncertainties in the magnitude and timing of sea-level response are still too large to define tests of the mechanisms. As new data enables refinement of their eustatic effects, tests will become feasible. We can, however, identify a suite of studies that will contribute to an improved understanding of many mechanisms. In this context, we would like to see studies that improve our understanding of:

a) Timing of inception, growth and decay of the ice sheets.

b) Timing and volume changes associated with additions of large thicknesses of sediments to the oceanic crust, especially deep sea fan deposits that form adjacent to rapidly eroding areas of the continents.

c) Timing and volume changes associated with additions of large thicknesses of volcanic material to the oceanic lithosphere through processes of deep water volcanism, underplating and the emplacement of seaward dipping reflector sequences.

d) Timing and volumes of formation of mid-plate oceanic swells or plateaus. This requires a systematic evaluation of the water-displacement volume and of timing of emplacement and subsidence of oceanic plateaus and swells and of deep-water flood basalts. This includes emplacement in both mid-plate (e.g., Ontong-Java Plateau, Cape Verde Rise) and ridge-crust (e.g., Iceland-Reykyanes Ridge, Easter microplate) settings.

e) Timing and volume changes associated with connection and/or isolation of individual basins (e.g., Mediterranean and Gulf of Mexico).

f) Time and magnitude of shortening (through compression) and lengthening (through extension) of the continental crust during orogeny and rifting.

In addition to improving determination of the contribution of different mechanisms to sea level fluctuations, it may be possible to distinguish the effects of individual components in the stratigraphic record. Some processes should yield distinctive stratigraphic signals that may be investigated via drilling. For example, it appears that the inception of large mid-plate swells is a geologically rapid event (refs Ontong Java drilling; Tardenov, Science, 1992; Leg 143 prelim. results). If so, they would produce a rapid sea level rise but only a slow fall as the lithosphere cools. When ODP dating of mid-ocean swells matures, one could examine the stratigraphic record of sea-level change for a rapid eustatic rises not coupled to a sea level fall that is coeval with the time of swell initiations.

3. Summary

Assuming that magnitudes of sea-level changes can be estimated from the stratigraphic record with an accuracy of ± 5 m or better, it should be possible to constrain current models of the causes of sea-level change. In formulating a drilling proposal we need therefore to be aware of the capability of the various mechanisms to contribute to sea-level changes by discussing whether they would produce a rise or fall, smooth or oscillatory changes and how they would be expressed in different parts of the world.

**We cannot overemphasize the necessity for accurate estimates of sea level change from widely distributed areas of the world. Good estimates of the magnitudes, durations, and rates of sea-level fluctuations are critical to constraining the mechanisms responsible for sea-level change.**

## VI. Transect Criteria

The topics discussed below summarize some of the transect requirements for sea-level research utilizing the capabilities of the **JOIDES Resolution.** Issues not discussed in detail, but that are of concern to proponents, include, tracking down licensing road-blocks, understanding territorial jurisdiction, locating potential aquifers, recognizing potential hazards that the **JOIDES Resolution** may pose to shipping or commercial ventures, and environmental concerns that may require special drilling muds and close-out procedures.

### A. Non-marine/marginal marine to "deep" basin transects

At the El Paso workshop, the need for drilling non-marine to "deep" basin transects was recognized because transects allow: 1) the dating of bounding unconformities of individual sequences; and 2) the estimation of the magnitude of sea-level events. In particular, there are two positions within depositional sequences that are critical for dating surfaces.

The first is associated with the "toes of clinoforms" within a sequence. Because sedimentation rates are generally lower than in the overlying and underlying systems tracts, microfossils tend to be found in greater abundance (condensed section of Loutit et al., 1988). Within a depositional sequence there may be two sites of significant downlap: 1) downlap at the base of the lowstand wedge near the basinward edge of a sequence (Fig. ), and 2) downlap at the base of highstand system tracts. The first, while physically most continuous and closer in time to the age of the sequence boundary, poses challenges in dating owing to downslope transport, scarcity of pelagic microfossils, and problems with sand recovery. The second significant downlap location, in the middle of the sequence and removed (in time) from the sequence boundary, may also provide good chronostratigraphic control. To estimate magnitudes of sea-level oscillations it will be important to date as many horizons as possible within a sequence, not just at specific locations such as condensed sections and unconformities.

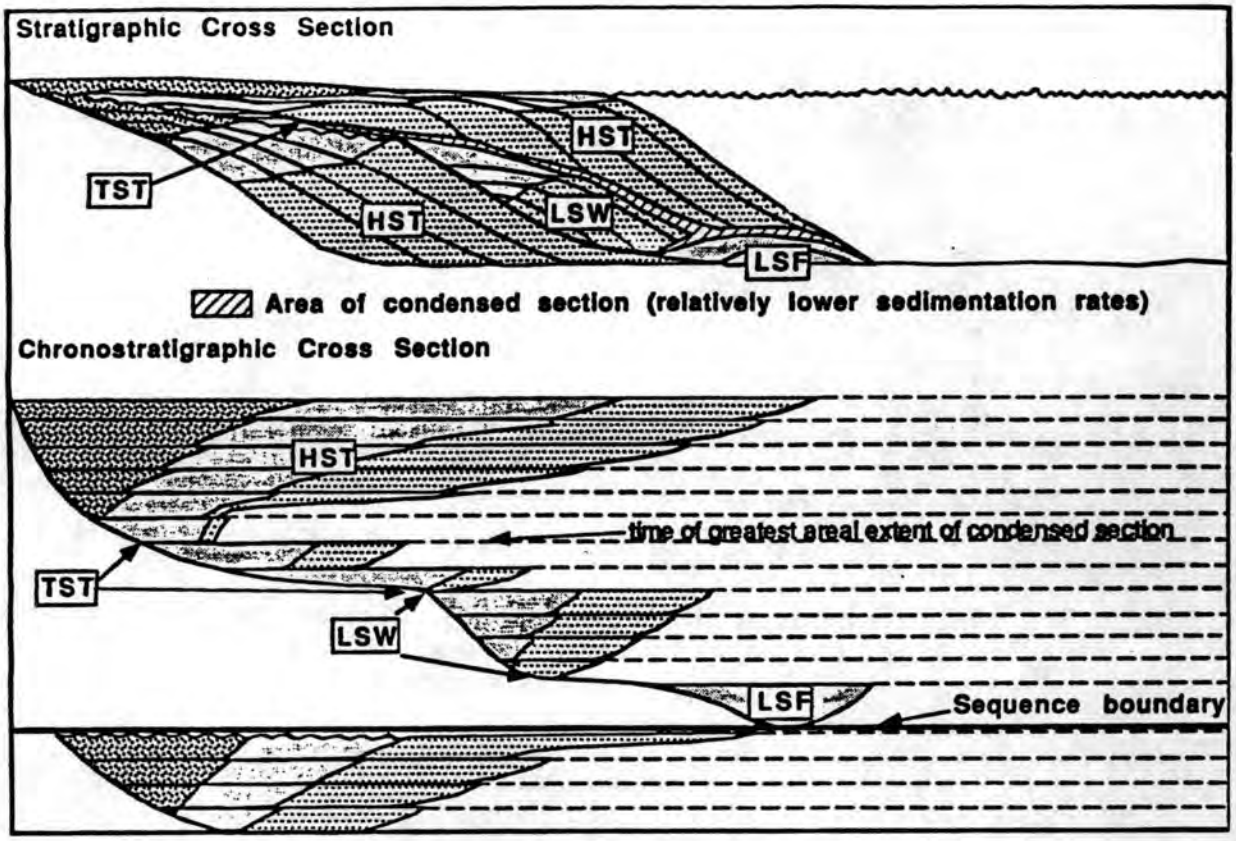


Fig. 2. Stratigraphic and chronostratigraphic cross section across a depositional sequence. Downlap of highstand and lowstand wedge systems tracts on to underlying systems tracts defines areas of relatively lower sedimentation rates where open-ocean microfossils may be concentrated. The details of the units within the lowstand systems tracts are not included in this figure because the focus is on the nature of sedimentation at the boundaries between system tracts.

The second critical area is in the open-ocean basin (Figs. 3 and 4). the deep (open-ocean) basin potentially contains more complete pelagic sections that are suitable for detailed magnetobiostratigraphy; typically the best sections are associated with paleodepths greater than 200m and often greater than 1000m. Even in the deep basins, it is critical to locate the most continuous section using high resolution seismic profiles.

Dating stratigraphic surfaces in margin and platform successions represents a major challenge. The key is to project the excellent age-control provided by open-ocen integrated chronostratigraphy into the more fragmented, but expanded section, on margins and platforms (Loutit et al., 1988)

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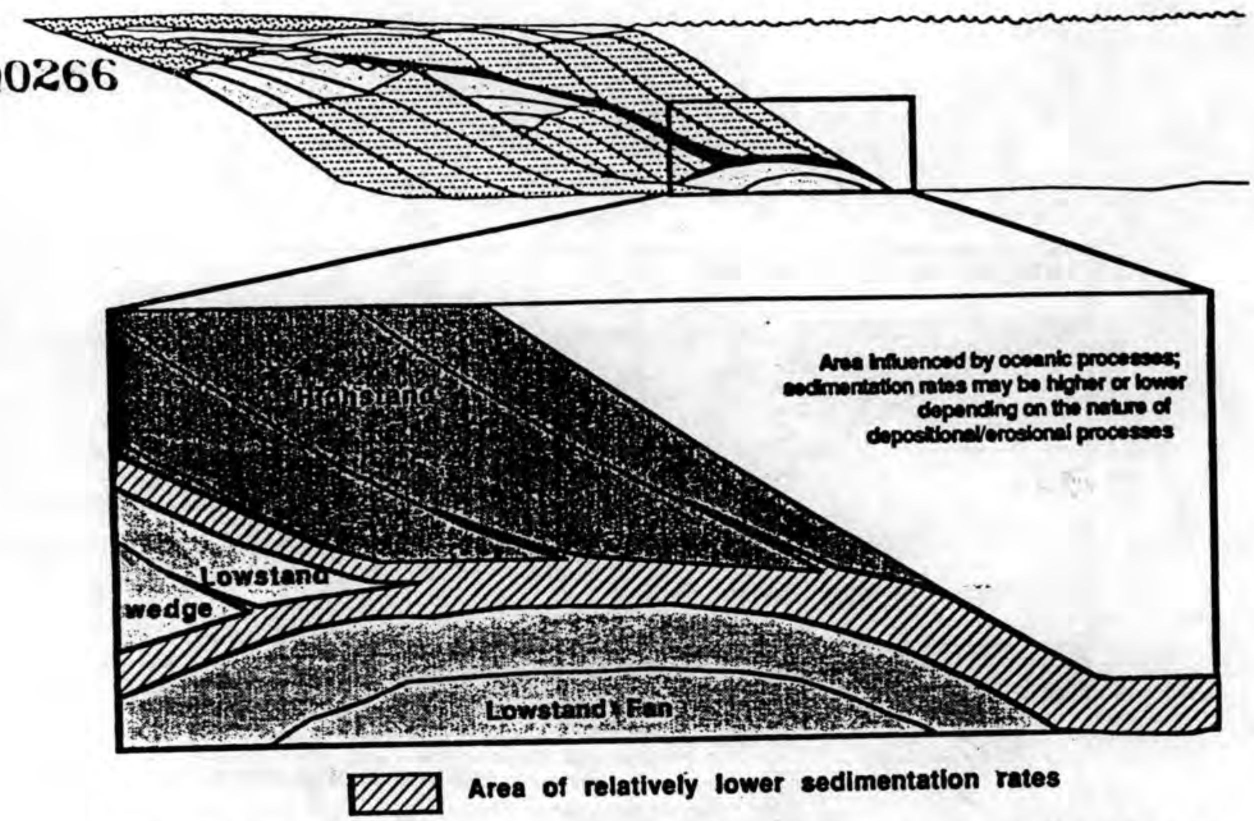


Fig. 3. Schematic illustrating the area of relatively lower sedimentation rates and the geometry of depositional surfaces in the distal portion of the depositional sequence shown in Figure 2.

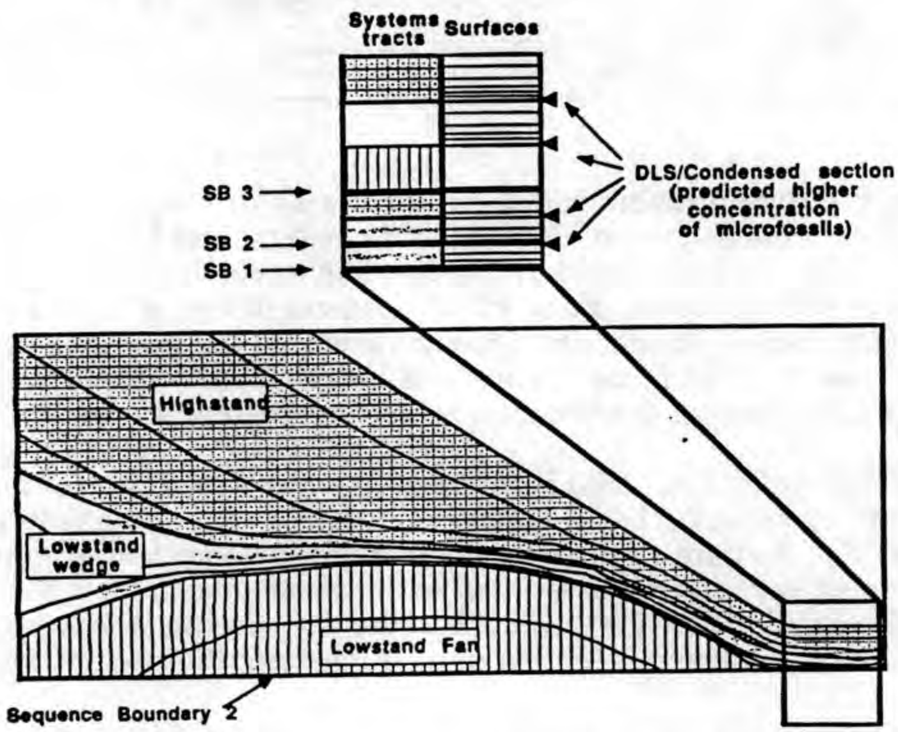


Fig. 4. Schematic illustrating stratal geometry in condensed section and a synthetic core through the hemipelagic deposits at the basinward end of the depositional sequence illustrated in Figure 2. The position of depositional surfaces, distribution of systems tracts, and key locations to

sample are illustrated, for three prograding sequences, in the expanded section at the top of the diagram. Black triangles represent relatively lower sedimentation rate locations to sample for microfossils.

## B. Age-control

It is important to demonstrate that the ages of stratigraphic events, delineated in a particular area, can be determined with the chronologic tools that have been or might be effective in the area. Industry results, data from nearby outcrop and/or deep-sea studies may all contribute to making an estimate of the degree of stratigraphic resolution attainable. For example, biostratigraphic information from industry wells, plotted with respect to sequence boundary positions ("biostratigraphic time-distance grids", Loutit, 1991) could provide a framework for more accurately establishing local biozone boundaries prior to designing specific transect locations (Loutit, 1991, 1992; see Fig. 5A and 5B). This step will be particularly important in some of the middle to higher latitude sites where paleobiogeographic effects may decrease resolution to the point that the ability to date individual sequences using biostratigraphic criteria is difficult. Chemo- and magneto-chronologic (e.g. strontium isotopes, magnetic susceptibility, etc.) tools, in addition to logging, will play an even more critical role in these areas.

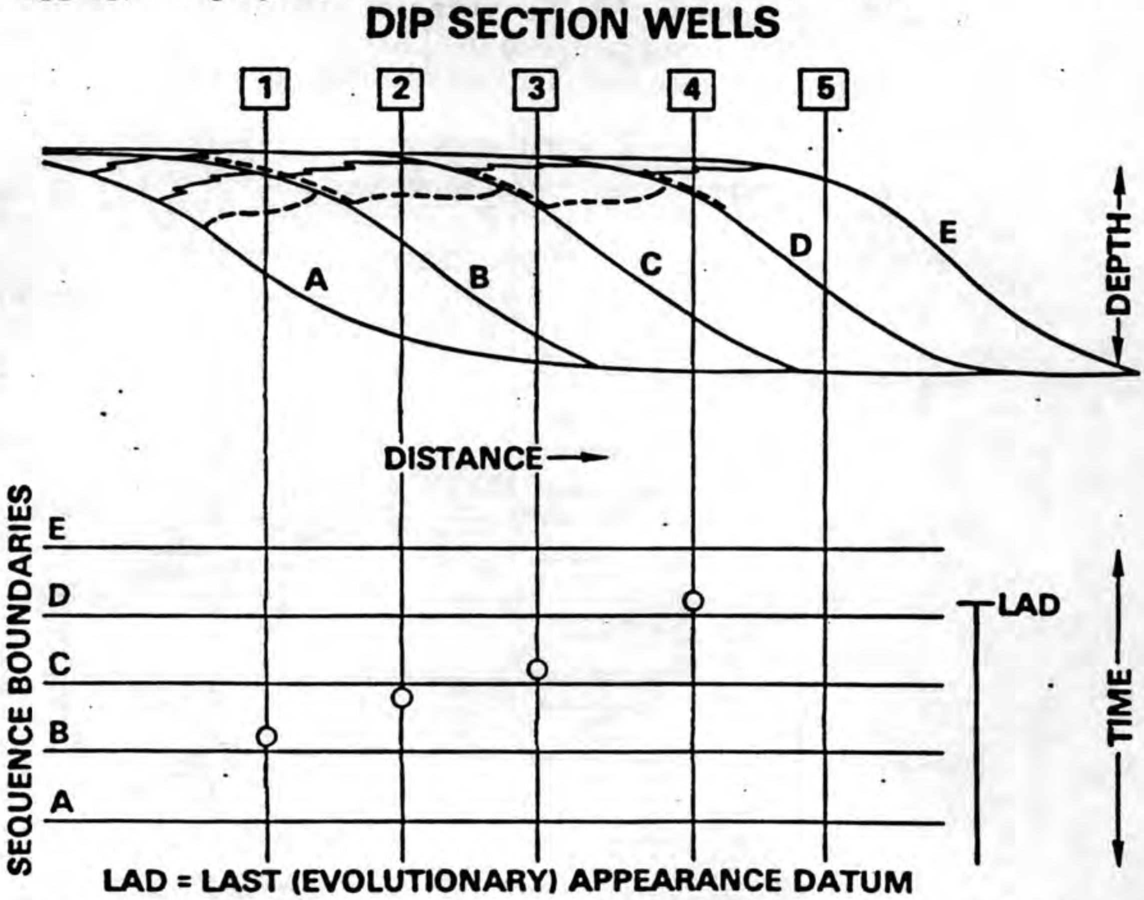


Fig. 5A and 5B. Schematic illustrating the distribution of microfossils and sequences in a biostratigraphic time-distance grid (Loutit, 1991)

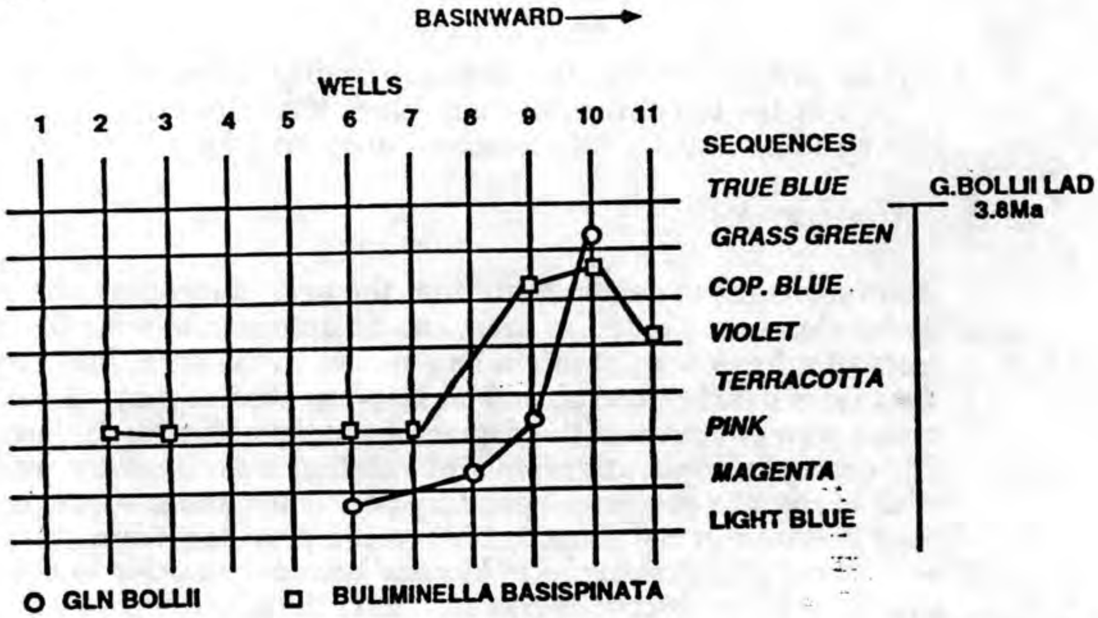


Fig. 6. Biostratigraphic time-distance grid illustrating the distribution of two age-diagnostic microfossils with respect to sequence boundaries, represented by the horizontal lines, and wells, represented by the vertical lines. The grids provide a simple display of the positions of microfossils relative to sequence boundaries and graphically highlight where correlation problems exist. The youngest basinward occurrence of G. bollii will be the closest in age to the LAD of G. bollii. Thus, the age of the Grass Green sequence boundary may be close to 3.8Ma.

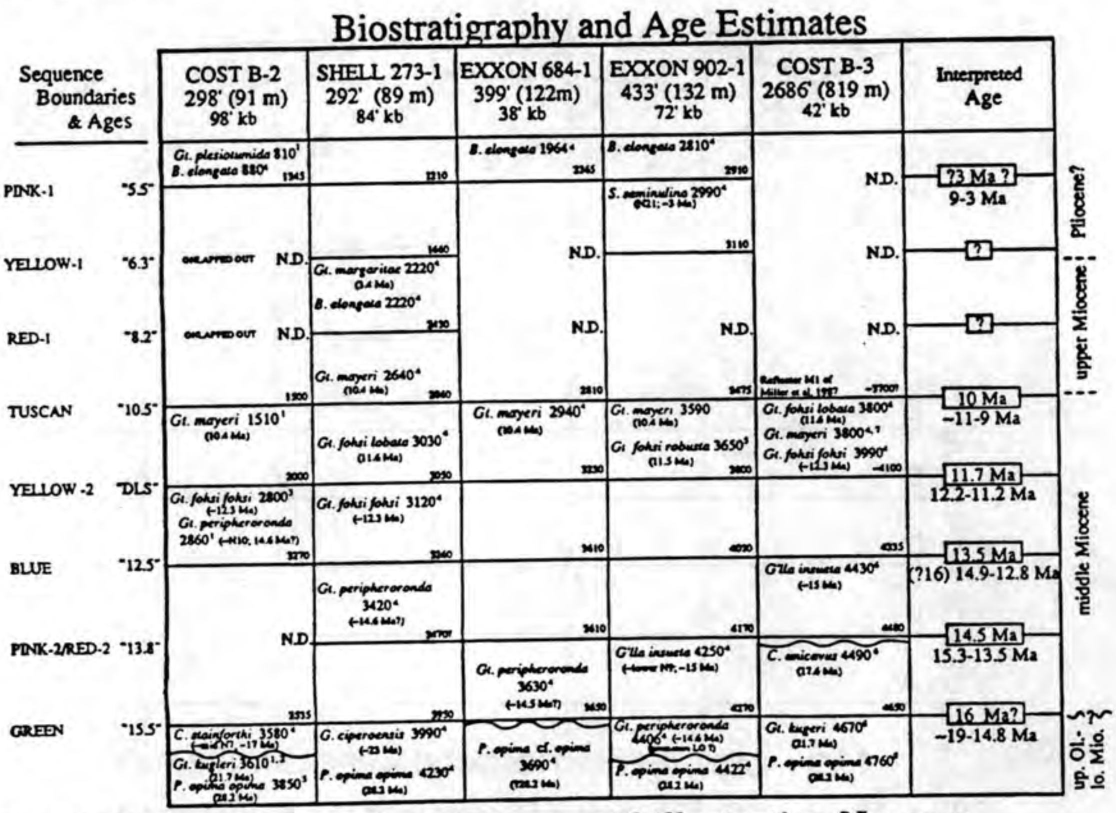


Fig. 7. Biostratigraphic time-distance grid illustrating Neogene

biostratigraphy and age estimates for five wells on the New Jerssy continental shelf and slope. All biostratigraphic data are last occurrences ("tops"). After Greenlee et al. (Geological Society of America Bulletin, in press).

## C. Tectonic/Sedimentary Setting

A complete test of the eustatic concept must involve the recognition, dating and correlation of surfaces on a variety of tectonic/sedimentary settings with both similar and differing tectonic history. The character of stratigraphic surfaces such as sequence boundaries, depends on a number of factors, but perhaps most significantly on the interplay between eustasy (position of sea surface) and tectonic subsidence (shape of container) through time. In areas with more complex subsidence histories it should be possible to recognize the eustatic component, if subsidence history is carefully documented using geohistory analysis (Van Hinte, 1979) and backstripping techniques (Watts and Steckler, 1981). The advantage of using the drill ship in complex tectonic settings again relates to the ability to design a sampling strategy that will precisely date surfaces that may coalesce or split due to the effects of multiple geologic processes.

## D. Geophysical Data Grid

A critical component in the effort to date stratigraphic events, represented by unconformities (e.g., sequence boundaries, etc.) is the ability to adequately resolve the target surfaces ahead of the drill. The term "adequately resolve" is difficult to define and may best be illustrated by the use of an example from the New Jersey margin (Greenlee and Moore, 1988; Miller et al., 1991; Greenlee et al., 1992). Key points to make here are the importance of acquiring seismic reflection profiles of sufficient resolution to image the target stratigraphic units, loop-tying around a regional seismic grid to define stratal and reflection termination patterns, calibrating seismic reflections to reflectors via synthetics and delineate the seismic facies of systems tracts within depositional sequences.

EW9009: Nov 1-22, 1990

Greg Mountain and Ken Miller
Co-Chief Scientists

11 days MCS - 2400 km

6 airgun array
    500, 305, 200, 140, 120 and 80 cu in guns
    1350 cu in total, fired at 2000 psi
    towed at 20 feet

1500 m digital streamer
- 120 channels
- 12.5 m group lengths
- depth controlled to tow at 20 ft

SEGY recording
- 1msec sampling
- 3 to 5 second recording window
- 5 knots ship speed
- 10 sec firing rate = 25 m between shots

9 dip lines
- 4 extend to lower slope
- 4 inboard to within 25 km of shoreline
- longest single line is 145 km
- ~ 7 km between each

18 strike lines
- focussed on clinoforms of potential drilling interest (Oligocene through Miocene) Oligocene, lower, middle and upper Miocene
- from 2 to 6m apart in these detailed grids
- from 20 to 70 km long

Table 1. Acquisition specifications and characteristics of multichannel seismic data, used to supplement published seismic, across the New Jersey margin, in preparation for ODP Leg 150.

Industry, government and academic studies of the New Jersey margin provide a comprehensive stratigraphic framework that will form the basis for sea-level related research on Leg 150. In order to improve stratigraphic resolution and to determine the best possible locations for drill sites on Leg 150 the proponents collected multichannel and single channel seismic to supplement the existing published data (Table 1 and Fig. 8). Seven middle to uppermost Miocene sequence boundaries were defined on previously published profiles and as many as eight additional sequences have been recognized on the newly acquired profiles (Fig. 9). The boreholes have been sited to target specific portions of a number of depositional sequences in order to obtain the best possible sections to date sequence boundaries. In this particular example, third- to fourth-order depositional sequences have been adequately resolved prior to designing the strategy for locating drill sites. The proponents of Leg 150 noted that the Ew9009 survey, in combination with the industry data provided a minimum degree of control for locating sites. They also suggested that industry specialist be involved in the interpretation and location of appropriate sites.

Another important function of the geophysical data grid is to help with the evaluation of safety hazards. The lack of shallow penetration SCS data along the proposed Leg 150 transect has made it difficult to demonstrate that there is no risk of shallow gas deposits.

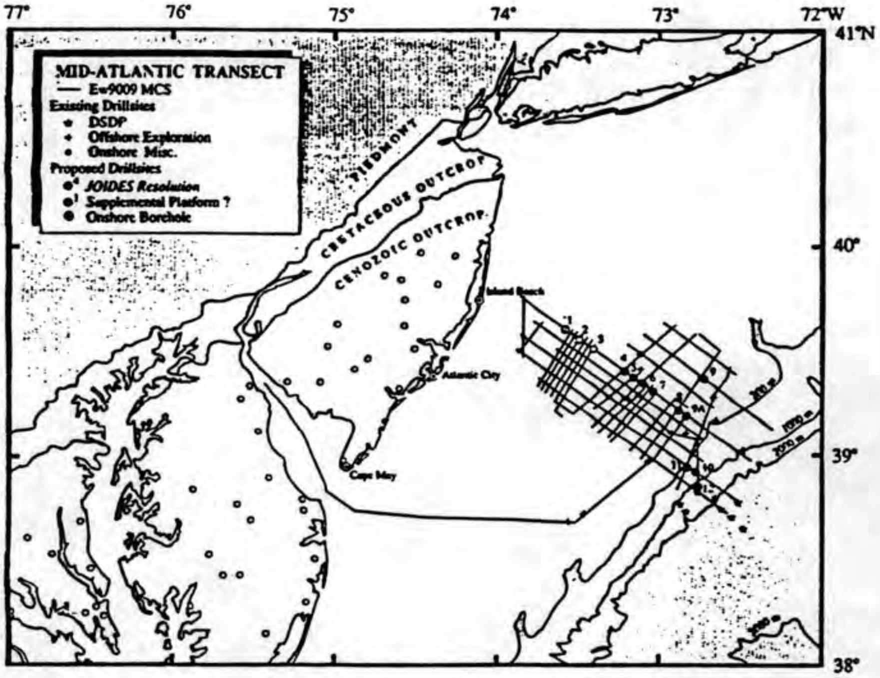


**Fig 8. Map of multi- and single channel profiles, proposed boreholes MAT 1-12 and proposed onshore boreholes.**

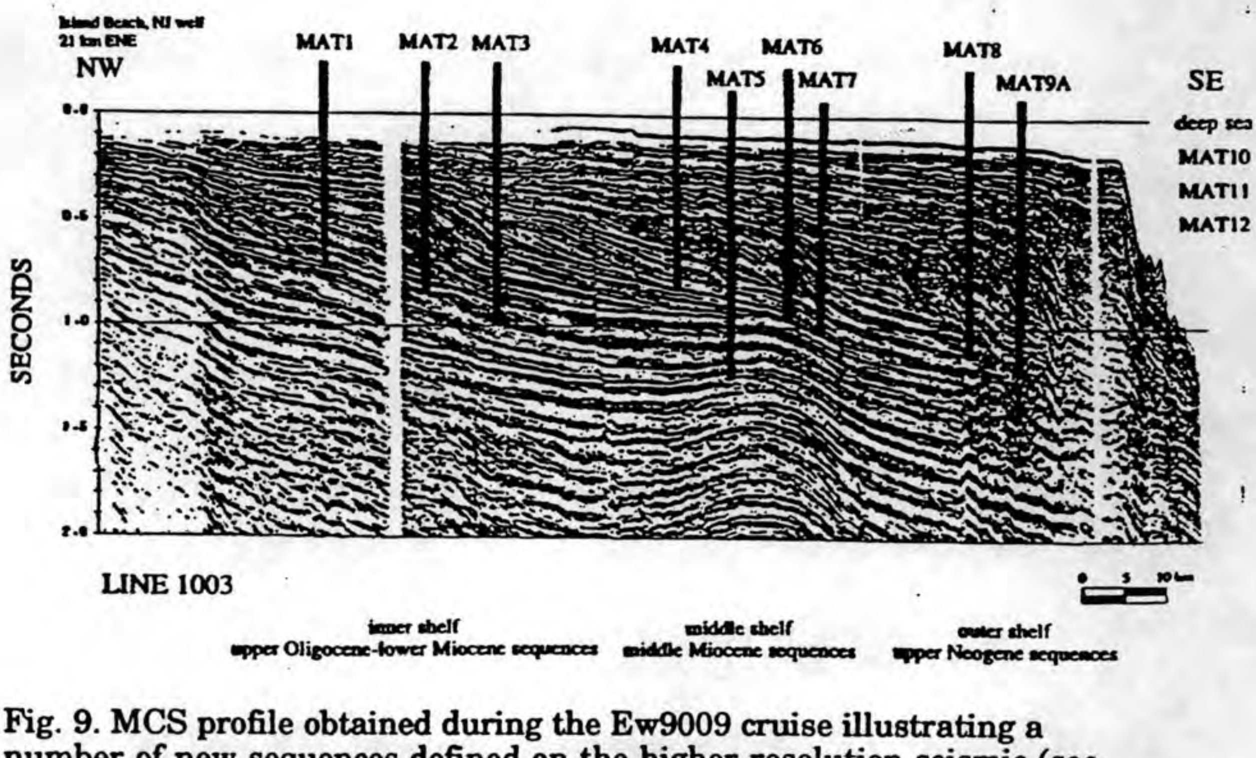


**Fig. 9. MCS profile obtained during the Ew9009 cruise illustrating a number of new sequences defined on the higher resolution seismic (see Table 1 for acquisition details).**

## E. Burial depth

Selection of target intervals, for the **JOIDES Resolution**, at moderate burial depths (<1000m or so) has significant implications for the efficiency of the drilling program, the frequency band-width of seismic reflection profiles (hence stratigraphic resolution), the success of chemostratigraphic dating techniques, preservation of microfossils and the construction of calibrated signatures of sea level.

## VII. Technical Issues

### A. Supplemental platform selection

Study of sea-level change requires drilling in all settings from onshore to the deep sea. One of the more critical and challenging settings is the nearshore (water depths 0-50 m). Although the **JOIDES Resolution** has documented the ability to dynamically position in water depths of 38 m (see note below), it is not clear that it can maintain position long enough to obtain significant penetration (100's m); also, it is not clear that it can recover the unconsolidated sands, particularly in the nearshore zone. In contrast, stable platforms such as jack-up rigs (Ginsburg et al., 1991) and anchored drillships (e.g., *Glomar Conception*, Hathaway et al., 1976) provide near-continuous recovery in the nearshore setting. Jack-up rigs are best in water depths less than 30 m, while anchored drillships' capability overlaps with dynamically positioned drilling (~30-400 m). Because adding anchoring capability to the **JOIDES Resolution** will be prohibitively expensive (~$5,000,000; T. Francis, personal communication, 1992), a supplementary platform will be required to meet all sea-level objective. JOIDES should consider funding options for supplementary platforms in these critical nearshore settings. For example, completion of two extant sea-level transects (New Jersey Sea Level/Mid-Atlantic Transect, Leg 150; the Bahamas Transect, proposal #412) may require supplementary platform drilling in 1994-1995. Future transects of continental margins, drilling on atolls and other shallow water drilling are expected to have similar requirements.

During Leg 143 there was a short test of the capability of the **JOIDES Resolution** to maintain position and to core in very shallow water. The vessel was positioned, using a "taut-wire" method, in 38m of water just inside the Enewetak lagoon for about 18 hours.Currents were as much as 1 knot and variable in direction, and winds varied from 12 to 18 knots. During the coring, to about 30mbsf, the ship remained within about 1m of the hole except for one excursion, which necessitated lifting the pipe out of the hole. Core recovery in the loose sand was very poor.

### B. Maximize sediment recovery

In order to resolve a number of sea level issues, we must maximize sediment recovery in a number of sediment types, some of which have proven difficult to recover with existing tools, thus technological improvements are paramount. A number of these issues were raised during the El Paso Workshop but have not yet been resolved. Failure to achieve high core recovery will seriously impact investigations of sea-level changes because both carbonates and unconsolidated clastic sediments will make up a high percentage of the sediments being investigated. Early correction of the core recovery problem is essential if planning is to proceed at a rate necessary for drilling on margin sites. Also, because hole stability often limits penetration and logging the

SLWG supports efforts to improve hole stability.

Sidewall coring may provide a tool to obtain key sediment targets, that may have been missed, after coring and logging operations have ceased.

1. Carbonates

   **First, we require far higher recovery rates in carbonate sequences than are currently obtained. Using XCB, RCB technology, ODP Legs 133,134, and 143 drilled shallow water carbonates of of ages ranging from Tertiary to Mesozoic. Recovery was typically low, less than about 5%, at shallow depths, with some improvement with greater depth and consolidation. Better results have been obtained in the Bahamas and in Anewetak Atoll using other coring tools. We believe high recovery rates can be achieved on the JOIDES Resolution. Fixed platform drilling of shallow carbonate banks has routinely recovered in excess of 80% of cores penetrated in contrast to about 10% averaged by the JOIDES Resolution. Core recovery can perhaps be improved through the use of alternate bits but the highest recovery will probably require diamond coring systems.**

   **So far, efforts with the Diamond Coring System(DCS) have not been successful. A recent test on Leg 142 obtained little core material. Full details of the test are not yet available, although the ability to maintain constant weight on the bit seems to be a major factor. It has been suggested that deploying the DCS from the sea floor might be an option. The SLWG strongly supports efforts to make the DCS operational.**

2. Sands

   We also require recovery of unconsolidated clastic sediments. Since the use of rubber-sleeve liners in the core barrel is impractical on the **JOIDES Resolution**, the **VPC** (vibra-percussive corer), currently under development, needs to be **finished** and put into operation **before** Leg 150.

3. Soft/hard alternations

   A method is required for recovering a high percentage of a section from alternating hard and soft layers, as, for example, cherts and chalks in the deep ocean (p 60., El Paso). Sediment recovery in alternating hard/soft layers is critical to the success of sea level efforts on carbonate margins, carbonate platforms and atolls and guyots. The best candidate for improving core recovery in this environment appears to be the DCS.

4. Deep sea sediments - be prepared to double APC to obtain required recovery

## C. Stratigraphic Analysis Tools

We believe that the efficiency of a global effort to investigate sea-level issues would be improved immensely by developing and integrating stratigraphic analysis tools and information management systems on the **JOIDES Resolution** and also making them available onshore for proponents developing proposals and cruise participants. Individual investigators have built many of the components of such a system and we recommend that every effort be made to coordinate/integrate the components into a loosely linked analysis scheme. The requirements of sea level investigators are varied, including seismic stratigraphic analysis, structural interpretation, well log analysis and stratigraphy, sedimentology, sequence biostratigraphy, low temperature geochemistry to name but a few disciplines. The goal of all the disciplines is to recognize and correlate (globally) stratigraphic events, such as depositional sequence boundaries, quantify the effects of sea level oscillations on the stratigraphic record and understand the processes that control sea-level oscillations. Thus a Sea-Level Program will require tremendous coordination, not just of the investigators, but of all of the methods and information in order to succeed. It will be important to make every effort to release, in a form that can be used, all of the information utilized by the sea-level program. The petroleum industry is often accused of withholding proprietary information required to support scientific findings. A similar situation could arise, for different reasons, if sea-level data, information, methods and tools are not available to the scientific community.

The stratigraphic analysis scheme would eventually evolve into a state of the art stratigraphic analysis tool that would dramatically improve shipboard operations. Recent efforts to generate a Core-Log Implementation Plan by DMP and SMP, as well as recent efforts to upgrade the **JOIDES Resolution** computer system, represent a critical step toward achieving the goal of an integrated system but there is still a long way to go.

1. Seismic/Core/Log integration

The calibration of seismic reflections to specific reflectors is a key step in seismic/sequence stratigraphic analysis and is crucial for part of the process to document the degree of synchrony of stratigraphic events on the continental margins of the world. The SLWG would like to see this capability on board the **JOIDES Resolution** in time for Leg 150 (May, 1993). Programs to generate synthetics and tie seismic to logs were used on Legs 130 and 138 by Larry Mayer and we would like to see similar capabilities, plus the ability to define/extract seismic wavelets, be added to the ship board facilities. Much of the calibration of survey or industry seismic is, of course, done prior to a drilling leg but the ability to select pulses (e.g. Ricker or sine wavelets), adjust frequencies, or extract pulses on-board ship, after logging runs to tie cores to seismic is important for sea-level related research and to guide co-chief scientist with operational decisions.

Core/log integration is a critical component of continental margin sub-surface studies recommended by the sea-level working group. We strongly support the implementation plan prepared by the DM (Downhole Measurements) and SMP (Shipboard Measurements) Panels during a joint meeting in October,1991. The core/log integration procedures, initiated during Leg 138, to correlate cores from multiple holes will need to be modified to handle the core/lithology/depth calibration in holes and sites. Recommendations to generate friendly, interactive graphics for curve matching and calibration and to create, for appropriate legs, a position of Data Correlation Specialist onboard ship are also strongly endorsed. In fact, for sea-level legs the position should be filled by a Sequence Stratigrapher (need two on board to handle daily tasks) to undertake sequence stratigraphic interpretation (and prediction) in real time as data becomes available.

2. Information Management/Database issues

The dating and correlation of stratigraphic events will require a coordinated program among scientists on a variety of margins around the globe. An important feature of this effort must be the ability to share all of the available data utilized on each margin between groups of researchers. At present, data/information sharing is restricted to data/information that is captured from the Initial Reports or by an informal process of digital data transfer. In addition, integration of analysis tools within the stratigraphic analysis process and linkages to official databases is not optimal.

ODP also has an opportunity, during the course of a Sea-Level Program to coordinate geological information from the continental margins of the world. At present, the seismic and well data bases required for the preliminary selection of sea-level study areas are poorly organized, with some exceptions due to specific government regulations requiring curation and publication of information. The SLWG recommends that the data/information required to support ODP sea-level legs become part of an evolving, coordinated (by ODP), package of information (digital/hardcopy) available for sea-level researchers.

a) Recognition/Description of events (Depositional sequences, unconformities, etc.) - physical stratigraphy database

**The SLWG suggests that a stratigraphic events database be constructed for capturing informaiton on the location and age of surfaces or markers encountered in ODP holes.**

b) Chronostratigraphic database

**The SLWG also recommends that a chronostratigraphic database be constructed to record the position, character and age of depositional sequences penetrated by ODP holes. The chronostratigraphic database represents an interpreted dataset that is derived from the raw data stored in the stratigraphic events database.**

c) Correlation of events, including graphic displays documenting precision and accuracy of the correlations.

**An important feature in the stratigraphic tools arsenal is the ability to graphically display the precision and accuracy of the ages of depositional sequences around the globe. Graphic correlation tools and displays should be attached to the databases mentioned above to allow rapid extraction and evaluation of chronologic data used to date chronostratigraphic units and surfaces.**

## D. Oriented cores

**High-resolution age determination in low latitudes requires oriented cores for determining magnetostratigraphic orientation. Characterization and orientation of sedimentary structures will be an important component of sea-level related research. Oriented XCB cores will be required. At present, there is no development of an orientation tool for XCB cores. An orientation system for RCB cores was tested on Leg 143, but had several flaws. Further development work is encouraged. An electronic orientation tool for APC (part of RCB too) was tested on Leg 143. The tool has potential, but computer hardware and software are needed to handle the several order-of-magnitude increase in data. Also, multiple orientation tools will be needed to speed up orientation operations. Orientation of cores may also be accomplished through correlations between recovered cores and logs such as the FMS.**

## E. Shipboard Core Analysis

**The SLWG encourages more detailed routine core description through the use of new technology, especially color scanners and whole-core X-ray. The SLWG also supports suggestions by the SMP to upgrade shipboard core analysis processes.**

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# - Appendix A: List of Potential Drilling Areas

## Clastic Margins

**Barents Margin** (NEO/PALEO)

The western continental margin of the Barents Shelf lies on the Senja transform zone bordering the northern Norwegian Sea to the east, which started to open about 55 Ma ago. Based on Norwegian seismic lines, the fault zone south of Bear Island was active until the Oligocene. Since then the tectonic setting was relatively calm. Both the deep shelf (up to >400m water depth) and the sediment fan to the west largely reflect a sedimentary regime controlled by river input from northeastern Europa via the Barents platform during most parts of the Cenozoic; during the last 3 Ma extensive glacial sediment supply became dominant.

Major Target Intervals: the "Icehouse Earth", possibly the "Doubthouse Earth".

Advantages of drilling in this basin include:

•extensive coverage with both industrial and academic seismic lines, forming a dense grid (produced by Norwegian, German and other colleagues); moreover, numerous industrial drill sites exist.

• detailed seismic geometry of sequence stratigraphy and links to Tertiary non-marine sediments on the Barents shelf (see Fig. 1) (coals on Svalbard).

• detailed knowledge of Quaternary sediment distribution patterns.

• undisturbed hemipelagic transect <800-2400m water depth at 72 degrees N, for the Pleistocene and ?Pliocene (down to 150m sediment depth).

• opportunity to trace sea level also during the "Doubthouse" Interval in high latitudes.

• direct linkage between the geometry of sequence stratigraphy and ice-related sediment signals (IRD from Greenland; benthic $\delta^{18}O$ records) prior to the late Pliocene glaciations, i.e., prior to isostatic downwarping of the shelf during Northern Hemisphere glaciation.

• direct ice volume/sea level signal contained in benthic $\delta^{18}O$ records below 600 m w.d. during the Pleistocene and upper Pliocene (lack of temperature variations according to the model of Labeyrie et al. 1987).

• excellent time resolution because of high sedimentations rates (8 - >100cm/ka over the last 150 ka).

• Abundant $CaCO_3$ fossils for biostratigraphy 10 to 3 Ma.

Disadvantages are:

• age control lacks $CaCO_3$ fossils prior to 10 Ma, especially below 500 m water depth; siliceous fossils, however, may be common. Pleistocene $CaCO_3$ dissolution common also on the Barents Shelf.

• local salt diapirism on the Barents Shelf east of 18 degrees E (Tromso Basin), however, not on the outer shelf, west of 18 degrees N.

• local problems of high burial depth must be circumvented by a greater number of sites.

• downwarping of Barents shelf by glaciations during the last 3 Ma.

Safety concerns exist, but may be sorted out in detail in cooperation with the Norsk Oil Directorate (ongoing oil exploration).

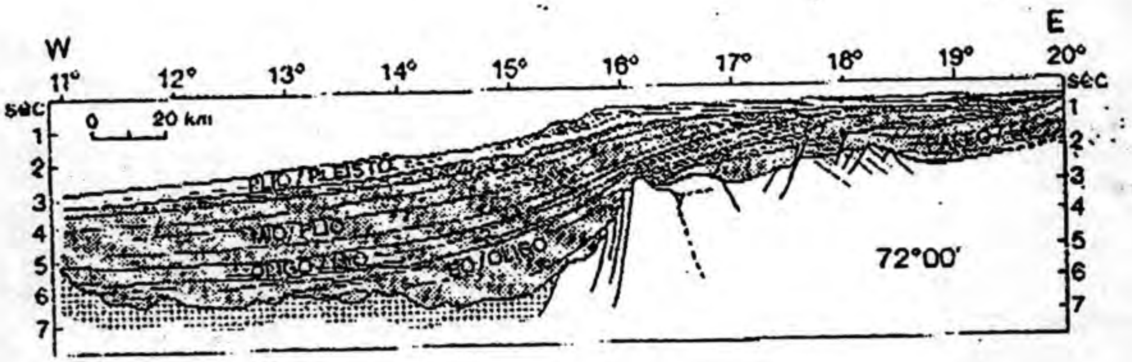


Fig. 1. Geoseismic W-E profile along 72°N (from Vorren et al. 1988)

Watchdog: Sarnthein
Potential proponents: M. Hald and T. Vorren (Tromso, N), K. Hinz (Hannover, D), M. Sarnthein (Kiel, D).

**North Atlantic**

Newfoundland (NEO/PALEO)

Modify existing leg.

**Mid Atlantic, USA NEO**

New Jersey upper Neogene

The New Jersey sea-level/Mid-Atlantic Transect (NJ/MAT) project includes both offshore and onshore (Leg 150) drilling that will primarily address the ages of sequence boundaries and amplitudes of relative sea-level changes for the late Oligocene to Miocene. By contrast, uppermost Miocene (?) through Recent seismic sequences are thickest in the northern part of the NJ/MAT seismic grid. The input of the Hudson River into this northern section has provided an expanded Plio-Pleistocene section that may resolve sea-level changes in unusual detail. Leg 150 will drill one site (MAT-9) in this area to provide a baseline for future drilling focused on post-Tortonian sequences. A drilling program designed to thoroughly evaluate this younger part of the glacio-eustatic record is beyond the scope of ODP Leg 150 for three reasons: 1) NJ/MAT chosen to focus on the interval best represented in the Exxon data and for which we have established that the requisite biostratigraphic control is available; 2) the post-middle Miocene section is not well represented or readily datable onshore; and 3) attaining requisite stratigraphic resolution of the many (>8) uppermost Miocene to Recent sequences may not be possible at this time. While oxygen isotope stratigraphy is the preferred correlation tool for the past few m.y., this ordinal technique is compromised by hiatuses, shallow water sections, and uncertain biostratigraphy. Biostratigraphic control may not be ideal for the uppermost Miocene to Recent in this region due to the absence of some low-latitude markers. Despite this somewhat pessimistic assessment, Site MAT9 should allow us to determine the suitability of the uppermost Miocene to Recent sequences for future studies. Two additional problems must be addressed before a "NJII sea-level" leg is proposed: 1 ) the problems of sand recovery must be addressed, because the Plio-Pleistocene section is very sand-prone; we will evaluate how feasible this is on Leg 150; and 2) late Pleistocene sea-level history (i.e., the past 900 k.y.). was influenced by the proximity to the Laurentide ice sheet; isostatic models must account for the loading effects of the ice sheet in order to obtain amplitude estimates. Nevertheless, the well-defined geometries, thick section, and importance of the Late Neogene to understanding response to known forcing make this a potentially attractive drilling target.

Watchdogs: Ken Miller, Greg Mountain
Potential proponents: David Krantz, U. DE, Lincoln Pratson, L-DGO

Norfolk Basin, offshore Virginia (NEO)

The Neogene sections thickens into the Salisbury Embayment of the Delmarva peninsula (Owens and Gohn, 1985). This region has a similar tectonic and sedimentary history as the NJ margin, although differences may exist due to differential movement on crustal blocks (Owens and Gohn, 1985). It seems unlikely that another Neogene Icehouse sea-level program will be mounted on the northeast U.S. continental margin in the next five years given the need for evaluating sea level on margins of difference sediments input and tectonics. Still, the Neogene section thins toward the Cape Fear arch, and Doubthouse sequences may be penetrated at a shallower depth off Virginia (<500 ms; Sheridan, personal communication, 1992) than off New Jersey. Further work is needed to evaluate the suitability of the offshore Virginia Doubthouse sequences. In particular, recent data obtained by the Edge project must be examined.

Watchdog: Ken Miller
Potential proponents: R. Sheridan, C.W. Poag

**Carolina/Georgia** (NEO)

Continental Shelf off North Carolina

Although the Neogene section is thin on the inner shelf of North Carolina between Cape Fear and Cape Lookout (<100 ms), it contains an excellent record of high-frequency sequences (Snyder, 1988 and references therein).These sequences have not been traced to the middle to outer shelf. Some published section of the latter region also show thin Neogene sequences (<150 ms), although isopach maps indicate Pleistocene thicknesses up to 600m Pliocene up to 300m, upper Miocene up to 1 00m, middle Miocene up to 200m, and lower Miocene up to 300m (Popenoe, 1985). Thus, the Neogene sections off the Carolinas might have considerable potential for ODP sea-level studies. The major limitation is that the Neogene sections on this shelf are often truncated by the Gulf Stream system; interaction of the Gulf Stream and sea-level changes adds and additional variable to isolating the effects of the latter. The potential of this margin for a Doubthouse Transect has not been evaluated, although the Eocene was dissected by the Gulf Stream, particularly on the inner-middle shelf (Popenoe, 1985).

Watchdog: Ken Miller
Potential proponents to contact: Steve Snyder, UNC; Pete Popenoe, USGS

Offshore Georgia-Florida

On the Blake Plateau (offshore Georgia-Florida), the Neogene section is thin. At the COST GE-1 well (Southeast Georgia Embayment, inner Blake Plateau), the Neogene is less than 300m thick; the Eocene is a thick carbonate platform sequence that may provide a record of Doubthouse sea-level changes (e.g., Dillon et al., 1985). However, due to truncation by currents, the Eocene section is not was well represented on the mid-outer Blake Plateau; this may preclude an Eocene transect, although further evaluation is needed before this area is eliminated as a target. The lower Cretaceous provides a record of Albian and older platform carbonate that was flooded in the Cenomanian, and may be useful in constraining Hothouse sea-level changes.

Watchdog: Ken Miller (Icehouse, Doubthouse; Jerry Winterer, Hothouse)
Potential proponents: USGS, Woods Hole

**Gulf of Mexico**

Paleogene And Neogene Offshore Florida And Alabama,
Northeastern Gulf Of Mexico (NEO/PALEO)

A thick succession of Paleogene and Neogene sediments occur in the Mississippi-Alabama-Florida (MAFLA) shelf region. The Mobil No. 1 well, located in Pensacola OCS Area Block 973, provides the control for interpretation of a multifold seismic reflection profile (Figure 1). Water depth is 31 m. The seismic section is slightly oblique to depositional dip. Both uninterpreted and interpreted sections are shown (Figure 2 and Figure 3). The top of the Eocene (arrow A, Figure 2) and the top of the Upper Cretaceous (arrow B, Figure 2) occur at 1234 m (1.05 seconds two-way travel time) and 1563 m (1.33 seconds two-way travel time), respectively.

000290

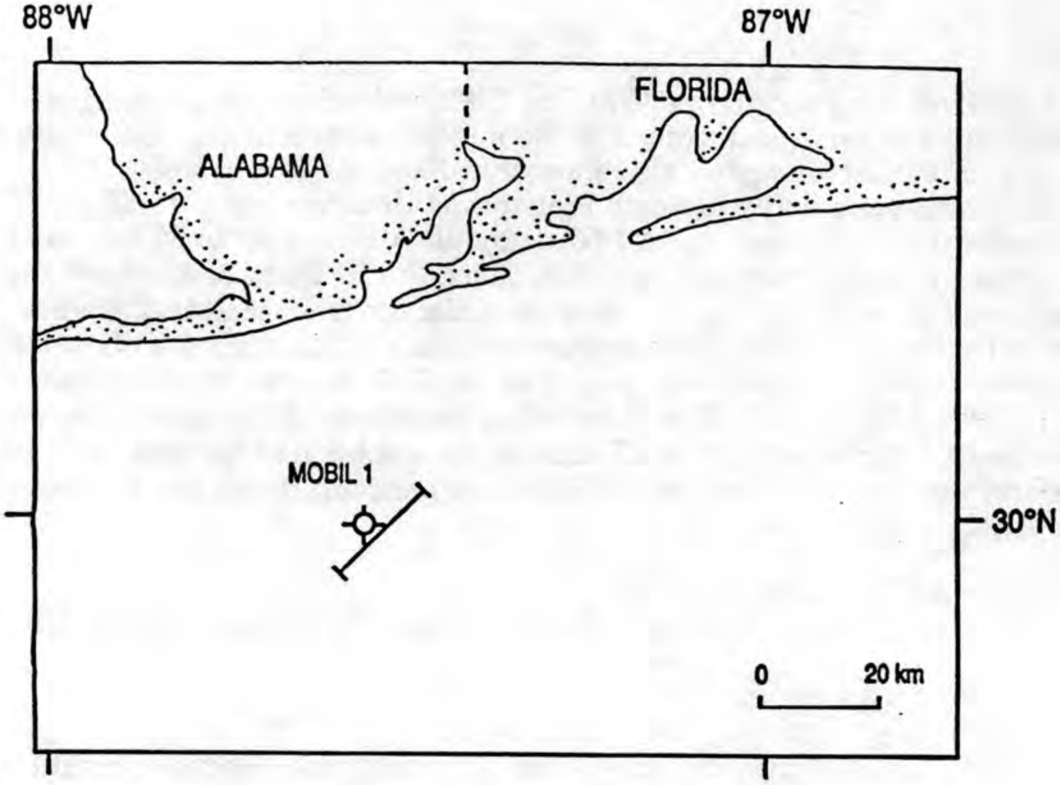


Fig. 1.

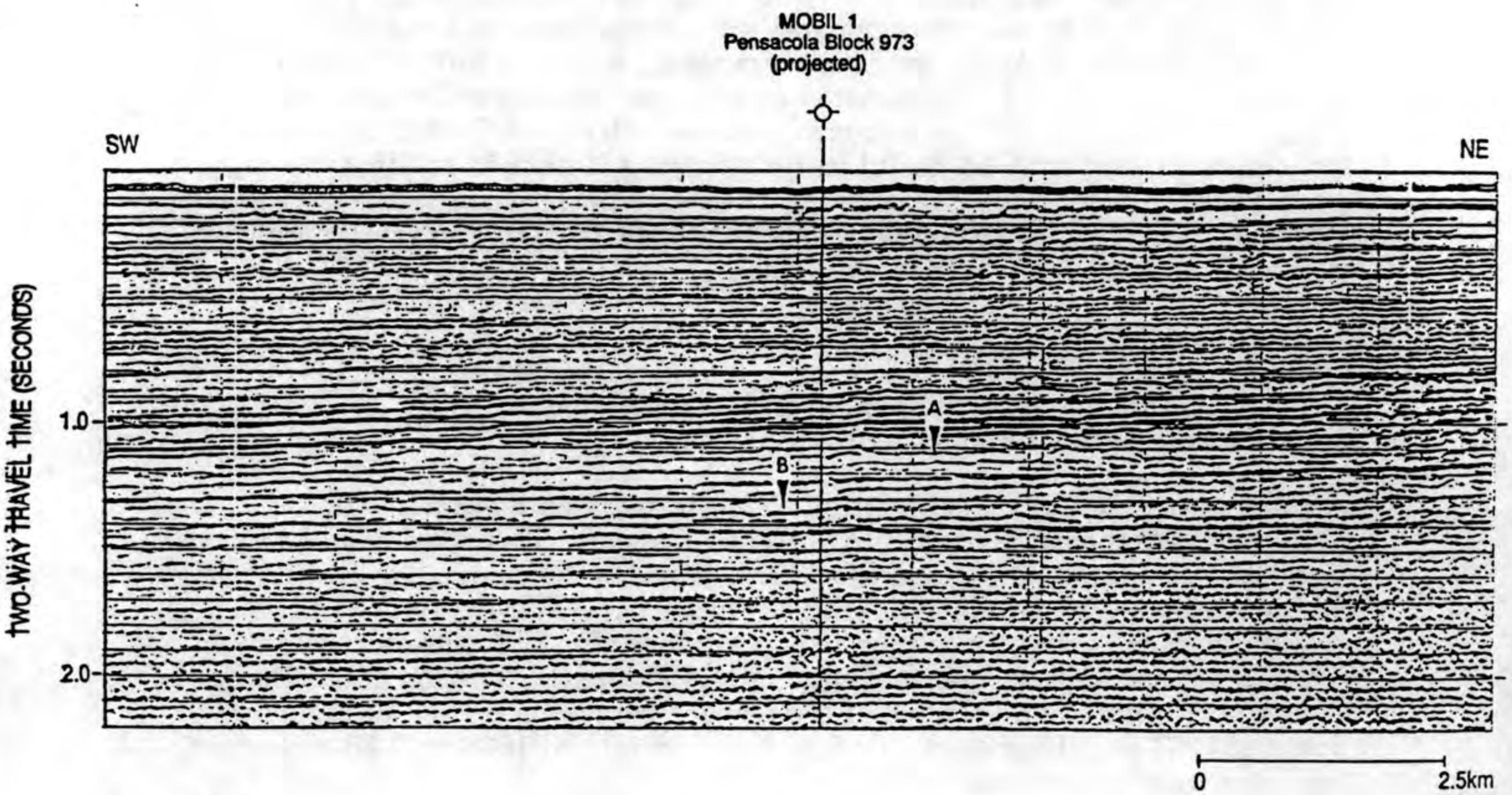


Fig. 2.

Appendix A:

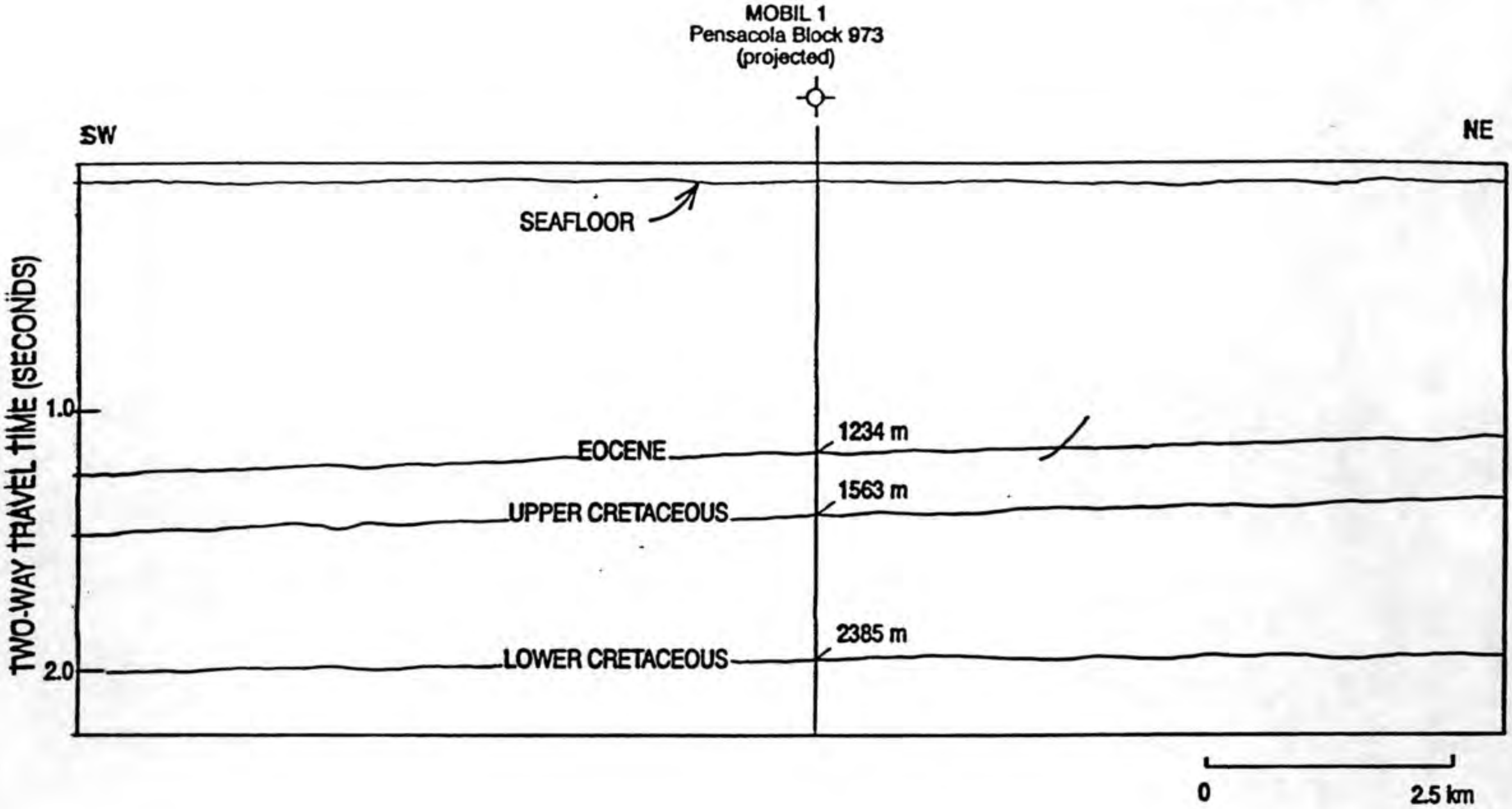


Fig. 3.

**JOIDES Resolution** Drilling in this area can extend the Atlantic/Gulf of Mexico sea level datum into the Upper Cretaceous, and provide a comparison with Neogene results from the New Jersey margin.

Watchdog: J. Watkins
Potential proponents: Buffler and Fulthorpe?

**South Atlantic Margins**

**Argentine Margin** (NEO/PALEO/CRET)

Dungeness Rise - Malvinas Basin
(Offshore Southern Argentina; Atlantic Ocean)

This area (Fig. 1) overlies a narrow wedge of rifted and stretched continental crust that extends eastward from Tierra del Fuego and Southern Argentina into the Atlantic Ocean (Kalkan, 1989). Both Neogene and Paleogene sections are accessible to **JOIDES Resolution** drilling at depths of 1 km or less (Fig. 2,3). Much of the upper Cretaceous is accessible at depths of less than 1.5 km. Ages of sediments are well constrained by a number of industry wells drilled in the area, and by good reconnaissance seismic data (Fig. 4,5).

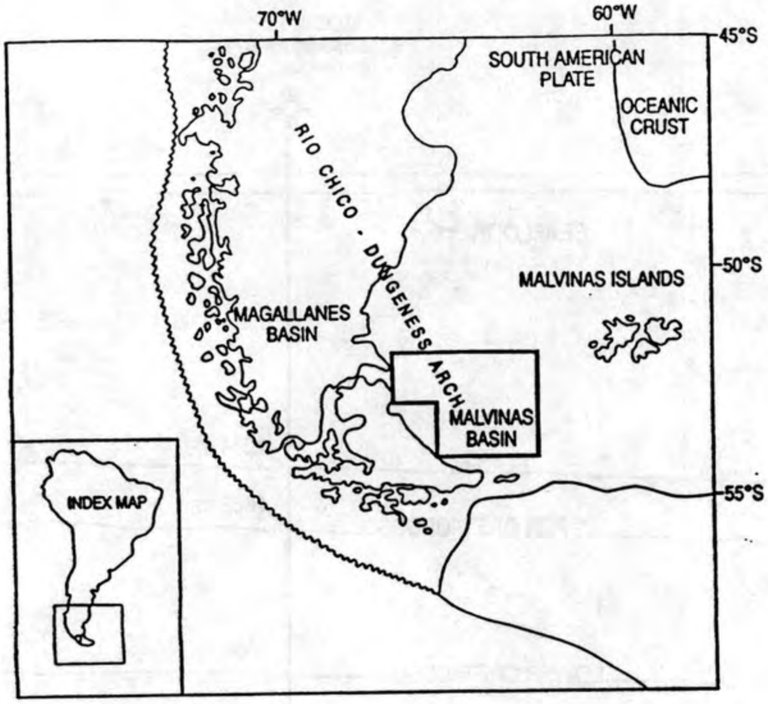
70°W
60°W
45°S
SOUTH AMERICAN PLATE
OCEANIC CRUST
RIO CHICO - DUNGENESS ARCH
50°S
MALVINAS ISLANDS
MAGALLANES BASIN
MALVINAS BASIN
INDEX MAP
55°S

Fig. 1.

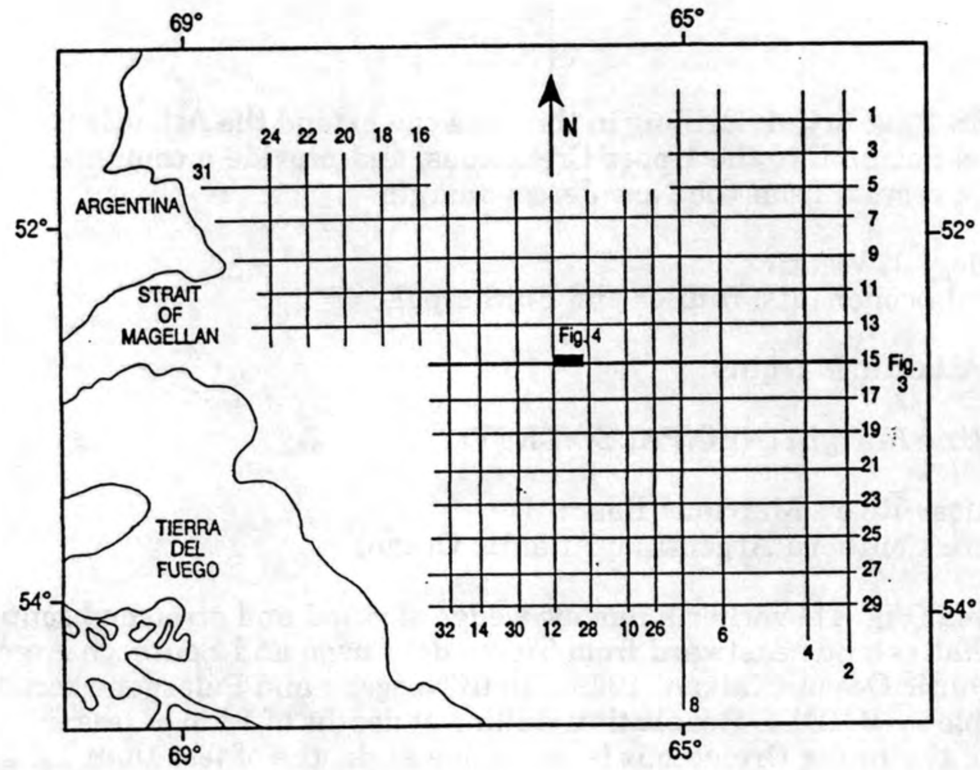
69°
65°
N
24 22 20 18 16
31
ARGENTINA
52°
STRAIT OF MAGELLAN
1
3
5
7
9
11
13
Fig.4
15
Fig. 3
17
19
21
23
25
27
29
TIERRA DEL FUEGO
54°
32 14 30 12 28 10 26
6
4
2
8

Fig. 2.

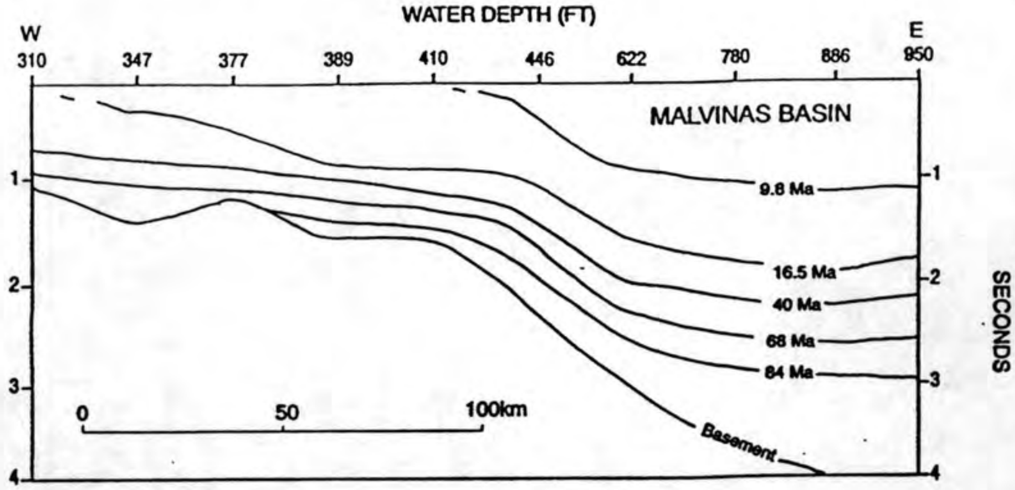
WATER DEPTH (FT)
W
E
310
347
377
389
410
446
622
780
886
950
MALVINAS BASIN
9.8 Ma
16.5 Ma
40 Ma
68 Ma
84 Ma
Basement
0
50
100km
1
2
3
4
SECONDS

Fig. 3.

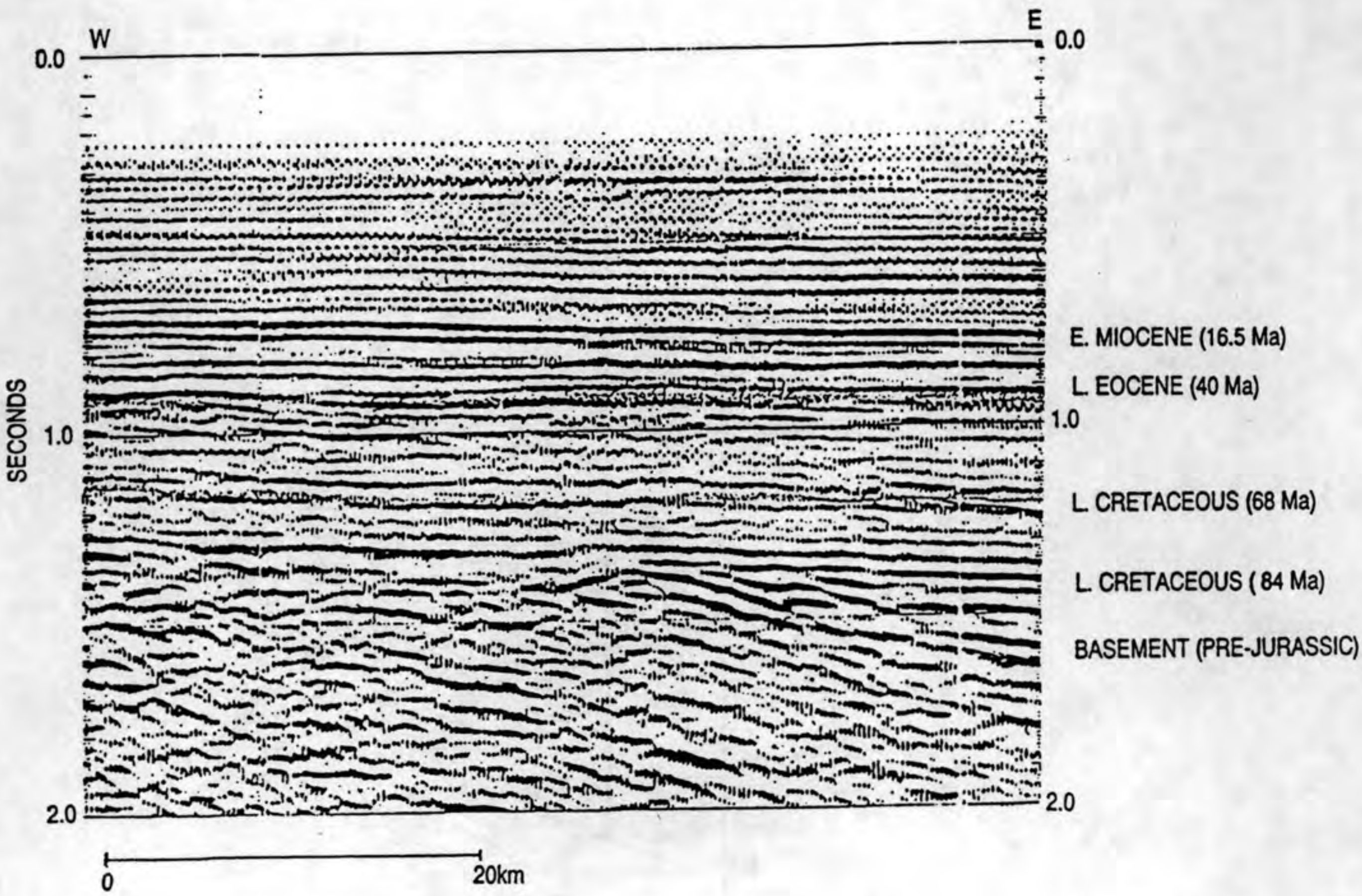
W
E
0.0
1.0
2.0
SECONDS
E. MIOCENE (16.5 Ma)
L. EOCENE (40 Ma)
L. CRETACEOUS (68 Ma)
L. CRETACEOUS ( 84 Ma)
BASEMENT (PRE-JURASSIC)
0
20km

Fig. 4.

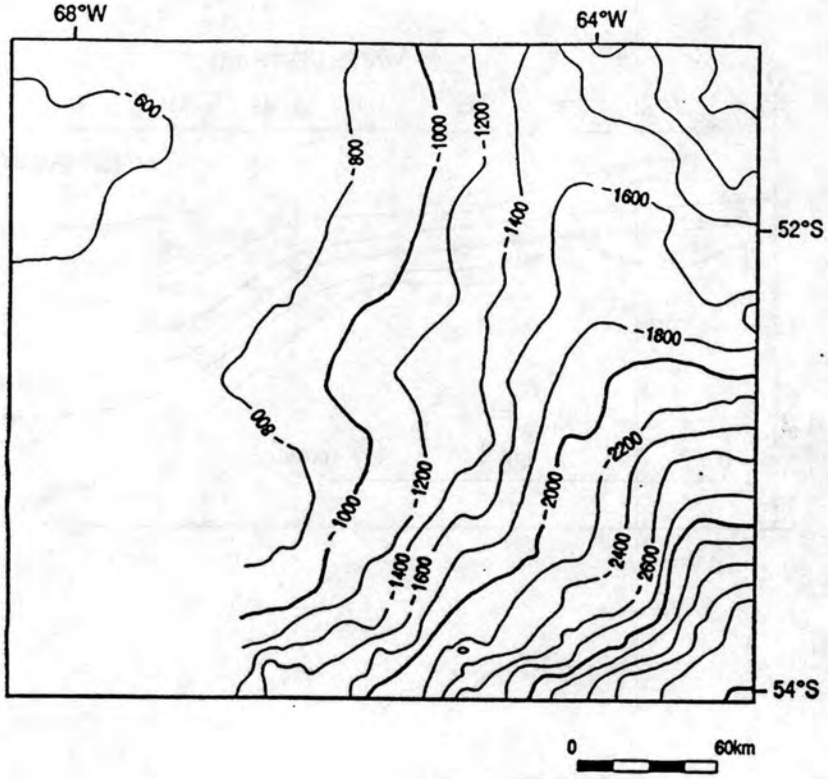
68°W
64°W
600
800
1000
1200
1400
1600
52°S
1800
2000
2200
2400
2600
54°S
0
60km

Fig. 5.

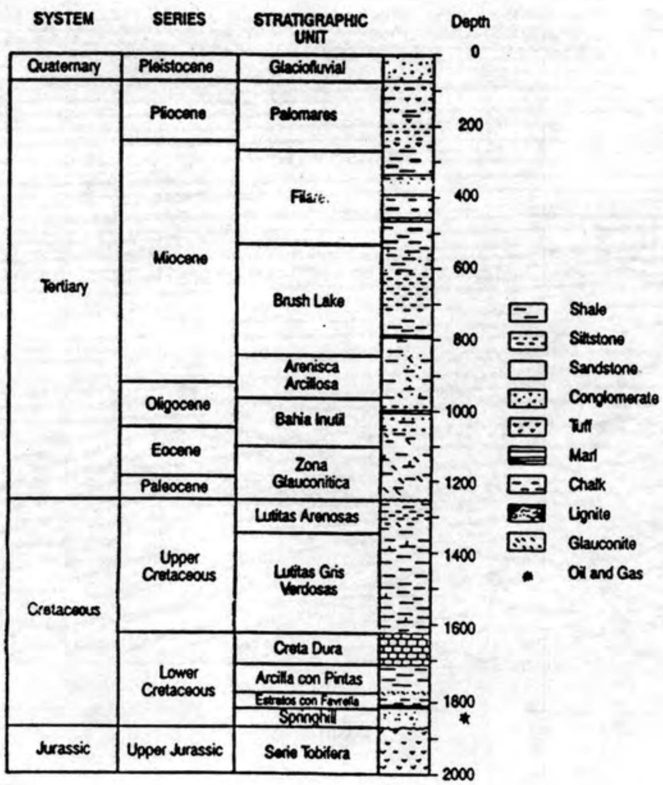
SYSTEM
SERIES
STRATIGRAPHIC UNIT
Depth
Quaternary
Pleistocene
Glaciofluvial
Tertiary
Pliocene
Palomares
Miocene
Brush Lake
Arenisca Arcillosa
Oligocene
Bahia Inutil
Eocene
Paleocene
Zona Glauconitica
Cretaceous
Upper Cretaceous
Lutitas Arenosas
Lutitas Gris Verdosas
Lower Cretaceous
Creta Dura
Arcilla con Pintas
Estratos con Favrella
Springhill
Jurassic
Upper Jurassic
Serie Tobifera
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Shale
Siltstone
Sandstone
Conglomerate
Tuff
Marl
Chalk
Lignite
Glauconite
Oil and Gas

Fig. 6.

Sediments encountered in the Cullen well (Fig. 6) located on the West flank of the Dungeness Arch were clastics except for Aptian-Albian marl (Olea and Davis, 1977). Some chalk was found in the Upper Cretaceous section. A number of dry holes have been drilled in the area.
This area is arguably the best location for calibration of sea-level change in southern latitudes.

**Mozambique/Dronning Maud Land Margins(NEO)**

General Statement
Regional seismic data show that the offshore Mozambique continental shelf is characterized by spectacular sedimentary geometries similar to those observed in the Main Pass area of the Gulf of Mexico, Exmouth Plateau of Australia, and Baltimore Canyon of the northeastern United States. As is the case for these other areas, the stratigraphy here is relatively unstructured. Preliminary studies have shown that the stratigraphy of offshore Mozambique can be correlated with other basins worldwide although there are some differences. Specific issues that an ODP transect would address include:

1) providing an independent test for the occurrence of globally-correlative sea level events. This depocenter lies outside to Atlantic basins that historically have provided most of the input to the development of global sea-level curves;

2) providing further evidence for or against the occurrence of forced regressions on passive continental margins;

3) providing further insight to the evolution of sequences and systems tracts on passive continental margins;

4) testing the concept of Milankovitch-driven 5th and 6th order sequences and how they stack to form 3rd and 4th order sequences;

5) determining not only frequency but also amplitudes of sea level changes for this stratigraphic section;

6) addressing specific sequences stratigraphic questions such as what is the timing of deposition of turbidite deposits (are they predominantly restricted to the lowstand systems tract)? Can significant mass movement and sediment gravity flow deposits characterize the transgressive systems tract? Do forced regressions occur and are they associated with zones of sedimentary bypass? How much erosion is associated with the transgressive surface (i.e., the ravinement surface)?

Timing of Rifting:
It is generally believed that rifting occurred before the late Jurassic and by the early Cretaceous open marine sedimentation began along the Mozambique margin (relevant literature: Norton and Sclater, 1979; DeBuyl and Flores, 1986; ENHM, 1986).

Stratigraphic Section:
Seismic stratigraphic analysis shows that numerous seismic sequences spanning the entire Cretaceous and Cenozoic can be identified. Kolla et al. (1991) have interpreted more than 25 depositional sequences within the Neogene

and the Quaternary section. This part of the section comprised the uppermost 1000 m of the stratigraphic succession. The stacking pattern of sequences within the early Miocene is characterized by aggradation, the middle Miocene progradation and the late Miocene-Pliocene aggradation. These analyses suggest that the continental margin prograded basinward 75-100 km primarily during sea-level lowstands. There are no major faults or other structural complications in the area. This margin comprised a true passive and stable continental margin.

Environments of Deposition:
The environments of deposition we anticipate encountering with an ODP transect penetrating Miocene to Recent deposits range from shelf-edge deltas to deepwater submarine fans. Deposits will likely include deltaic, nearshore (shelfal) marine, slope and basinal turbidite sediments as well as condensed section facies. These deposits will comprise each of the component parts of depositional sequences: i.e., lowstand, transgressive, and highstand systems tracts.

Availability of Age and Geophysical Controls:
Six wells with biostratigraphic data (data from two of which have been released) have been drilled by industry. In addition, comprehensive grids of multi-channel seismic data are available from GECO as well as Western Geophysical (23,568km industry data, 1981-1982; 1,100km acquired in 1983). Some data were collected also by the Lamont-Doherty Geological Observatory and the Marie and Pierre Curie Oceanographic Institute. The extent to which these data can be made available to ODP will determine the necessity of obtaining additional site survey data. About 1000km of seismic (Hinz and Krause, 1982) are available on the conjugate margin (Dronning Maud Land)

Watchdog: K. Miller
Potential proponents: H.W. Posamentier and V. Kolla

East African/Madagascan margins

The conjugate margins of East Africa (Somalia, Kenya and Tanzania) and Madagascar underwent nearly 150 m.y. of rifting before breakup in Late Jurassic time. Between the Late Jurassic and the Paleogene, these margins accumulated sediment and were not affected by tectonic deformation, although diapirs are observed on both (Coffin and Rabinowitz, 1988). Beginning in the Paleogene, however, parts of the Kenyan and Tanzanian margins have undergone extension (Okoth, 1981). The northern and western margins of Madagascar experienced volcanism in the Late Cretaceous and Tertiary. Thicknesses of Tertiary sediment offshore East Africa and Madagascar range from several hundred to several; thousand meters, and numerous wells have been drilled both offshore and onshore.

Data:
MCS: 3763 km industry data acquired from 1972 to 1979 in Kenya: 6000 km

lamont-Doherty data acquired in 1980 and 5000km industry data acquired during mid-1980's in Somalia; n x 1000 km industry data acquired in 70's and 80's in Tanzania; > 10000 km industry data acquired in 70's to 90's in Madagascar.

Offshore wells: Somalia at least 1; Kenya at least 4; Tanzania at least 3; Madagascar at least 10.

Watchdog: C. Fulthorpe
Potential Proponents:

**South Australian Margin**

Eucla Basin (NEO/PALEO)

The Eucla Platform is the carbonate cap to the rifted continental margin of southern Australia, deposited above a thick Mesozoic sequence of clastic sediments after the initial rifting of Antarctica and Australia during the Jurassic. The Platform comprises an onshore portion beneath the Nullarbor Plain, the offshore portion forming the continental shelf and several deep water (400 to lOOOm) terraces seaward of the shelf break. The steep, ?erosional, continental slope is fronted by a continental rise blanketed with carbonate sediments. The onshore exposures of Eocene-Miocene carbonates display an excellent, but unconformity- broken record of sedimentation in cool and warm-water settings.
Paleocene targets are shallow, generally less than 1000mbsf. Water depths for possible transects range from <100m to >4000m. Onshore exposure and control is good for much of the Paleogene. A number of BMR and industry multichannel seismic surveys and industry well data are available. The tectonic history is reasonably well understood and data for geohistory analysis are available.

Watchdog: T.S. Loutit
Potential proponents: N. James and Australian federal, state and academic geologists.

Otway Basin (NEO/PALEO)

The Otway Basin is an under explored Late Mesozoic to Recent sedimentary basin with BMR and industry multichannel seismic and well data. Part of the basin is onshore where Paleogene and Cretaceous targets are penetrated. Late Paleocene to Pliocene strata outcrop on the western side of the Otway ranges and upper Paleogene strata are exposed in the Torquay Embayment of the east side. Paleogene and Neogene nonmarine and marine strata are relatively shallow and drillable.

Watchdog: T.S. Loutit
Potential proponents: Australian federal, state and academic geologists.

## New Zealand Margin

Canterbury Basin (NEO)

The Canterbury basin lies on the eastern margin of the South Island of New Zealand, a passive continental margin that rifted from Antarctica at 80Ma. Prograding clinoforms characterize the Neogene of the Canterbury Basin, similar in geometry to those observed off New Jersey. Sediments are primarily silts with muds and fine to very fine sands.

An extensive grid of industry MCS data are available. Four exploration wells have been drilled in the Canterbury Basin, but are not well placed with regard to the best-defined sequences. Sequencs ages are, therefore, uncertain (probably middle to late Miocene, but possibly early Pliocene). Additional interpretation might resolve this uncertainty. Required depths of penetration are 1 to 1.5km. Neogene sediments are also exposed onshore.

Watchdog: C. Fulthorpe
Potential proponents: C. Fulthorpe, T. Loutit, New Zealand government and academic researchers

## Antarctic Margin

Prograding clinoforms have been identified at several locations along the Antarctic margins. In the eastern Ross Sea, Oligocene to Pleistocene prograding clinoforms have been identified in seismic profiles, and portions of these clinoforms have been sampled during DSDP Leg 28 drilling (Bartek et al.,1991). These clinoforms developed in a passive margin setting following Late Cretaceous rifting, although much of the sediment accumulation on the margin has occurred in the Neogene when continental glaciers developed on Antarctica. Seismic data in the area includes lines collected by US and foreign academic institutions and the USGS.

In the eastern Ross Sea, Neogene clinoforms are located at subbottom depths of less than 0.5 to about 1 second (approx. 0.5 to 1.0 km, with apparently conformable "deep-water" horizons at relatively deep subbottom depths of about 1.5 to 2 seconds (approx. 2 to 3 km). Similar cyclicity may be present on other portions of the Antarctic margin at shallower subbottom depths. Neogene stratigraphic resolution is based on diatoms and radiolaria. Resolution is relatively good in offshore areas, but more difficult in shelf and slope settings, although the stratigraphy and environmental analysis is improving as more material is analyzed.

The close proximity of the Antarctic margins to some of the glaciers that are thought to have driven the Icehouse sea-level changes makes this a potentially good area to understand the sedimentary response of a glaciated continental margin to sea-level changes and the effects of glacial loading on the sediment record. Understanding the magnitude and synchrony of glaciation from the proximal sediment record may be difficult because of the potentially poor stratigraphy very close to the ice sheet and the presence of an isostatic glacial load. Valuable information about the magnitude and timing of Neogene ice movements will come from more distally located holes.

Watchdog: R. Flood
Potential Proponents:

East Coast of Tunisia, Tertiary Clastics (NEO/PALEO)
Indonesia (NEO)

## Carbonate Margins

### Yucatan (NEO?PALEO)

Prograding clinoforms occur across offshore northern Yucatan (marked by arrows on attached Figure 2). Their age is inferred to be Neogene, but this has not been confirmed (see attached Figure 11, upper right, illustrating geometries and interpreted relative stratigraphic position).
Sequences comprise low-latitude carbonate sediments in passive margin tectonic setting. Burial depths are <1 km.
Geophysical data are limited at present, but a proposal has been submitted to NSF to collect a seismic grid across the area.
Outcrops of Oligocene to Pliocene rocks occur onshore in northern Yucatan and rocks of these ages have been penetrated by onshore wells.


Fig. 1. Map showing proposed MFS track on northern Campeche bank.

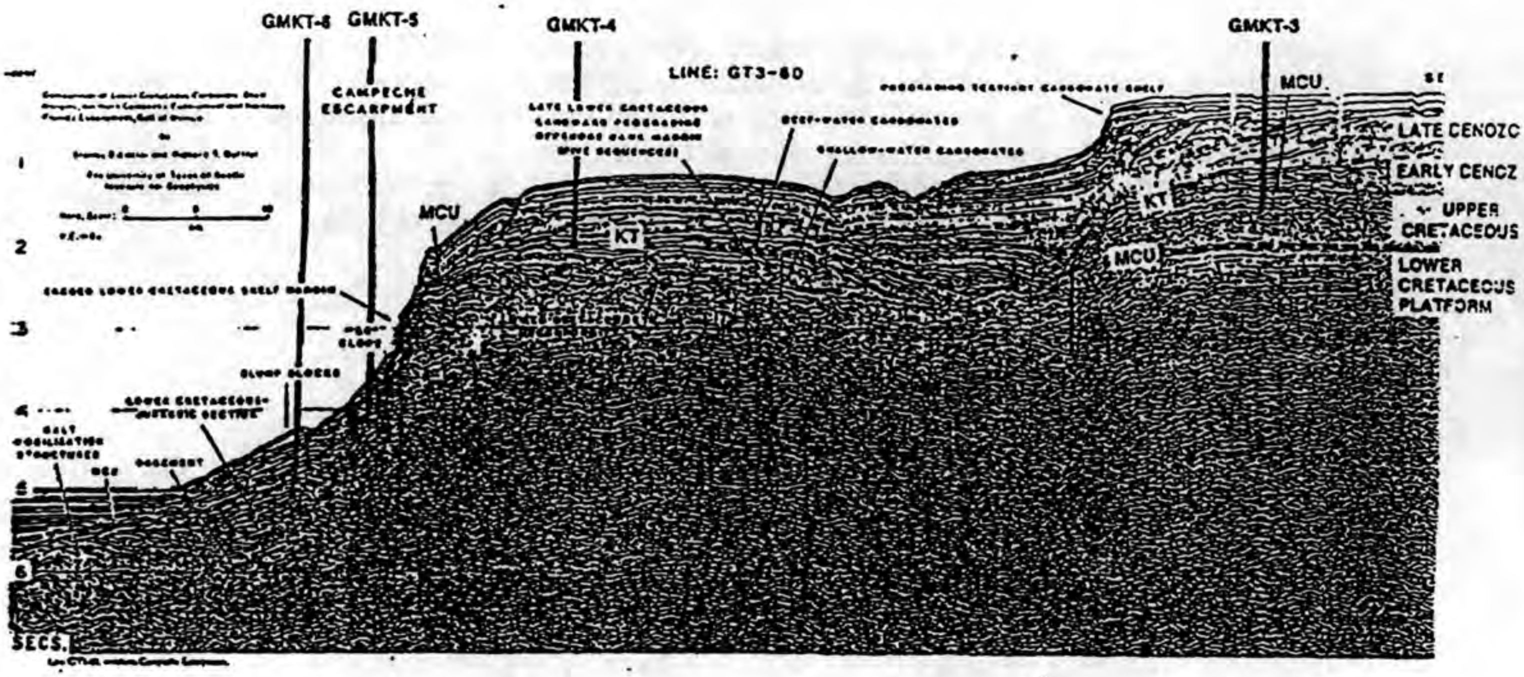


Fig. 2. Seismic line GT3-60 from Locker and Buffler (1983) showing location of proposed Sites.

**Seychelles margin** (NEO)

The southern margin of Seychelles formed when Madagascar and India (with Seychelles attached) separated during the Late Cretaceous. Karoo rifts have been identified on seismic and drilled. Tertiary sediment has been mostly ignored, but consists of > 1000m of limestone (Girling, 1992; Pasta, 1992; Wolden and Belle, 1992). No non-marine sediment is known in the Sechelles.

Data:
Seismic: 14000 km of industry MCS acquired between 1973 and 1983 and a further 5000 km industry data acquired in 1991 and 1992.

Wells:
Three wells with one presently drilling.

**Bahamas** (NEO)

Carbonate platforms and reef complexes, like those in the Bahamas that maintain their surfaces near sea level are sensitive archives of both timing and amplitude of sea level fluctuations. The prograding western Great Bahama Bank is especially suitable to evaluate global sea level change because laterally stacked prograding sequences with a high sedimentation rate provide a high resolution record of Neogene-Quaternary sea level fluctuations (Ginsburg, 1987, 1989). In 1990, two continuous holes through the Neogene Quaternary margin of

GBB were drilled and continuously cored along one of the existing multi-channel seismic lines. These two core borings from the shallow part of GBB make it possible to address the stratigraphic response of carbonate platform to sea-level changes, and in particular to 1) interpret depositional environments and modes of deposition in the proximal part of these carbonate sequences; 2) establish relation between seismic response, logs and lithology; 3) determine age and nature of seismic sequence boundaries; 4) characterize the diagenesis of these young limestones and dolomites.

These two cores are an excellent starting point for a complete platform/basin transect from the shallow top of GBB to the deep-water environment of the Straits of Florida. The completion of this transect with the JOIDES Resolution will produce a unique data set for attacking amplitude and timing of Neogene sea-level changes and documenting the sedimentary response of the carbonate environment from the shallow to the deep. The following important prerequisites to meet these objectives are in hand.

Predictable tectonic subsidence during the Neogene

The Bahamas archipelago developed on a passive continental margin and partially the adjacent oceanic crust (Sheridan et al., 1981) Along the southern portion, the archipelago experienced collisional tectonics during the Late Cretaceous and the Early Tertiary. Since the late Eocene, when the plate boundary jumped south of Cuba, the GBB is again a slowly subsiding continental margin (Williams et al., 1988, Leg 101 Scientific Party, 1988).

An excellent data set consisting of:

Seismic data: A grid of excellent commercial multichannel seismic profiles across the GBB (Eberli and Ginsburg, 1987, 1989) The seismic profiles revealed that GBB is not one huge vertically growing atoll-like platform but evolved from a series of smaller platforms that coalesced to form the modern edifice. Progradation is seen as a series of laterally stacked sequences with geometries similar to siliciclastic units. Within the prograding sequences, onlapping seismic reflection were used to reconstruct sea-level history and compared with the global sea-level changes of Haq et al.(1987). High resolution seismic data of the Quaternary section along the western side of GBB document high sedimentation rates on the leeward side of GBB (Wilber et al., 1990).

Cores drilled by alternative platform: two continuous holes through the Neogene-Quaternary section of GBB were drilled and continuously cored along one of the existing multichannel lines. Coring and logging of the two holes to depths of 442m and 662m respectively, were accomplished with a wire-line diamond drilling rig mounted on a self propelled jack-up barge. Recovery in both holes is approximately 80%. After coring, both holes were logged with downhole tools for density, sonic, velocity, natural gamma, neutron, caliper, inclination, and some shear wave velocities. A continuous vertical seismic profile (VSP) was shot for an accurate time/depth conversion and for checkshots for the other logs. In addition to these two holes, six shallow borings (30-75m) from the eastern part of GBB provide the record of platform flooding and are important for constraining the amplitude of highstand sea-level events (McNeil and Ginsburg, 1992).

Lithologic record: The excellent core recovery allows to document precisely lithologic changes and to interpret depositional environments and modes of deposition in the proximal part of these carbonate sequences. In the platform interior site (Unda) changes of sea level are indicated by exposures horizons, calcretes and black pebble horizons. Within the slope section of hole Clino, where the sediments consist predominantly (80%) of fine-grained skeletal and non-skeletal grains that are interrupted by some 10 intervals of coarse-grained skeletal sands, the inferred positions of the seismic sequence boundaries coincide with the most distinct interruptions, but also with changes in mineralogy produced by diagenesis. As a result, each seismic sequence consists of a characteristic mineralogical composition that is different from the other sequence.

Age control: The combination of biostratigraphy (foraminifera, nannoplankton, corals and bivalves), magnetostratigraphy, $^{87}Sr/^{86}Sr$ -dating provide accurate ages for the lithologic changes and for many of the sequence stratigraphic important surfaces. The base of the cores are dated as early late Miocene in hole Unda and late Miocene in hole Clino. As expected, dating is better in the upper slope sections of hole Clino and these ages are carried along seismic reflectors to the shallow-water site Unda.

Expected Results when drilled by ODP:
Within the existing data set in hand, the western side of GBB offers the unique opportunity for a complete transect from the shallow to the deep in the carbonate environment (Drilling Proposal by Eberli et al., 1992). In regards to the sea-level objective, this Bahamas transect has the potential to:

1) determine the stratigraphic response of the carbonate environment to sea-level changes,

2) provide the timing of the sea-level changes during the Neogene on GBB,

3) give information about the magnitude of these sea-level changes,

4) unravel the relationship between the Gulf Stream history and the sea-level fluctuations,

5) retrieve the low-latitude isotope signals of the Ice House World in the Neogene and Quaternary. The correlation of this high-resolution isotope stratigraphy with the seismic stratigraphy will make it possible to evaluate a causal link between eustatic sea-level changes as inferred from the $\delta^{18}O$ record and the drilled depositional sequences.

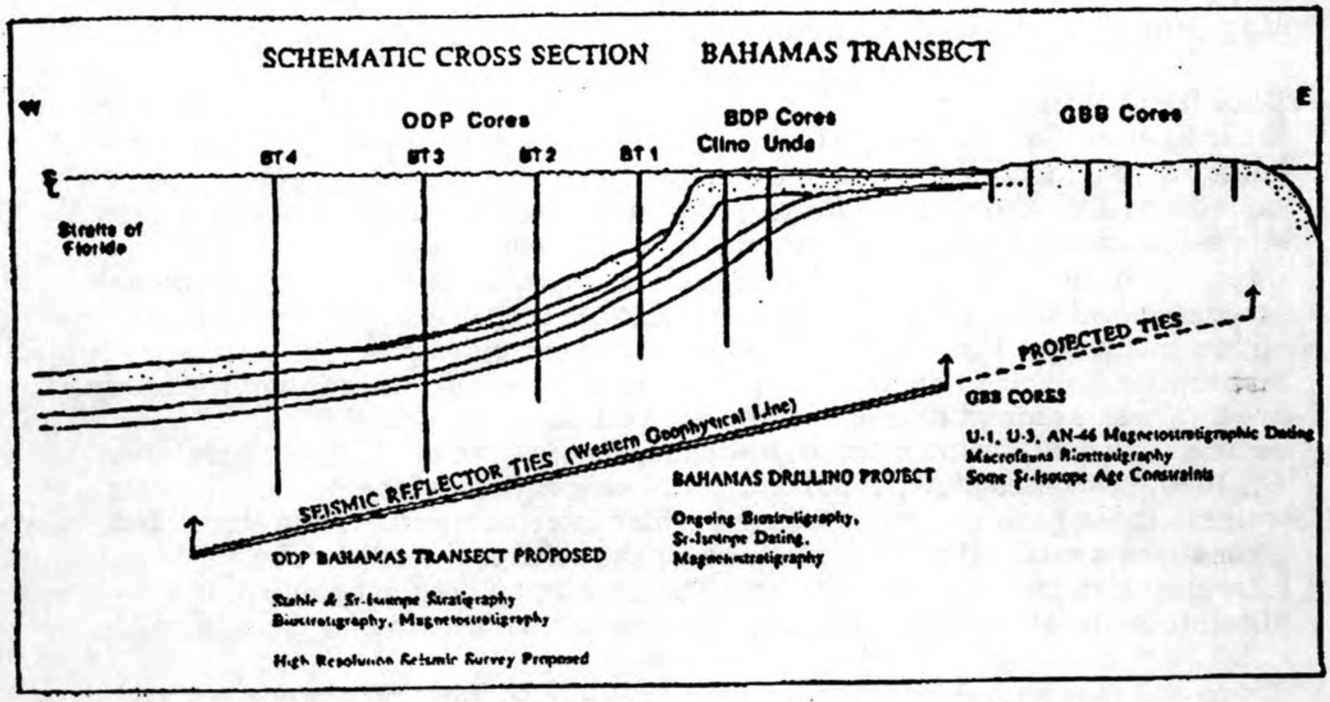


Fig. 1.

Watchdog: Eberli
Proponents: Eberli

Maldives (NEO/PALEO)

N.E. Australia (NEO)

Enewetak Atoll (PALEO/NEO)

Nicauragua Rise (NEO)

Northwest Pacific Guyots (CRET) (drill one of the atolls)

Tuamotus (PALEO/NEO) (drill one of the atolls)

West Florida Ramp (NEO)

Proposal has been submitted and is presently being rewritten.

Para-Maranhao Basin, Brazil (NEO/PALEO)

Blake Mesozoic (CRET)

## - Appendix B: The Significance Of Computer Simulations For Sea Level Magnitude And Rate Estimations

Data from seismic surveys will usually be the major sources of information for the drill site. For this reason the initial interpretation is often speculative and based more on models than on hard data. The test of the interpretation are sometimes only the costly drilling program. Computer simulation of the drill site sedimentary history is potentially a much cheaper initial test of the interpreted basin evolution. A successful simulation computer program can account for all the relevant parameters that are responsible for the observed strata geometry. The input parameters to the computer program are the assumptions about sedimentation processes and tectonic evolution of the study area. These assumptions should be based on currently accepted sedimentological, tectonic and eustatic models (Scaturo et al., 1989; Kendall et al., 1990; Lawrence et al., 1990) and not blind creations of the users. The user weights these parameters according to their interpretation. If the simulated geometries match with the geometries on the seismic lines then the interpretation is a possible solution. The simulation does not confirm the absolute truth of the interpretation but constrains it's boundary conditions.

There are many forward models which simulate sedimentary processes and lend themselves to testing the effects of variations in sea level and tectonic behaviour. Some are two dimensional mixed clastic and carbonate basin fill models (Aigner et al. 1987, Lawrence et al. 1987, Strobel et al. 1987, Lawrence 1988, Helland-Hansen et al 1989, Kendall et al. 1989a, Kendall et al. 1989b Kendall et al. 1989c, Nakayama and Kendall.,1989, Scaturo et al., 1989, Strobel et al. 1989a, Strobel et al. 1989b, Tang et al. 1989, Lawrence 1990, and French and Watney 1990). Others are two dimensional carbonate shelf models which respond to sea-level changes and erosion, allowing redeposition of sediment with user defined production functions (Graus et al. 1988, Demicco and Spencer 1988, Spencer and Demicco 1989, Bice 1988, Dromgoole et al. 1986, Lerche et al. 1987, Koerschner III and Read 1989, and Bosence and Waltham 1990a&b). Both the latter kinds of models respond to sea-level changes and erosion, allowing redeposition of sediment with user defined production functions. Other two dimensional simulations handle clastics alone and be used to: 1) create synthetic seismograms for sediment packages by modeling subsidence, sealevel, sediment supply and erosion (Turcotte and Willemann's 1983, Turcotte and Bernthal 1984); 2) use sediment compaction and tectonic movement to provide sedimentation rates for clastic fluvial systems (Bridge 1975 & 1979, Bridge and Leeder 1979); 3) simulate transport, deposition, erosion and compaction of clastic sediments emphasizing fluid velocity (Paola 1989, Pinter 1990, Bitzer and Harbaugh 1987). Other simulations one-dimensional and: 1) use defined third-order sea-level curves to infer the origin of peritidal cyclic carbonates (Read et al. 1986, Grotzinger 1986, Read and Goldhammer, 1988) ; 2) model the interdependence of sealevel, depth dependent carbonate accumulation and the flexural response of the earths crust (Cisne, et al. 1984, Cisne 1985); 3) handle diagenesis of carbonate as coupled to the eustatic record (Matthews and Frohlich, 1987, Quinn, 1989, and Humphrey and Quinn, 1989). Other simulations which might be considered are those of Angevine (1981), Jordan and Flemings (1989), Flemmings and Jordan (1990) and Slingerland and Furlong (1990) which model Foreland Basins settings in terms of sediment erosion and fill responding to depositional slope and relief, the rheology of the crust, plate tectonics and thermal subsidenc. Finally there are three dimensional process models (Tetzlaff 1986, Tetzlaff and Harbaugh 1989, Takao et al. 1990).

All these various simulations can be used to test responses to sea level variation, tectonic mechanisms that cause regional sea level variations, and whether changes in the regional stress field are sufficient to produce "apparent" eustatic sea level variations akin to those described by Cloetingh et al. (1985), Cloetingh and Wortel (1986) and Cloetingh (1986). In particular the mixed two dimensional clastic/carbonate simulations can be used to test the occurrence of eustatic sea level events and their effects, for instance confirming or denying that there may be errors in Exxon's coastal onlap charts, particularly the chronology of fluctuating sea levels since the Triassic described by Gradstein et al. (1987) .
Figure 1 illustrates an example of simulation of a seismic line from the Western Bahamas (Eberli et al 1990). The authers proposed that variations in eustatic sea level exerted an important control on the sedimentary sequences and they related pulses of progradation to these sea level events. They used a sequence stratigraphic approach to seismic interpretation and used a defined sea level chart (Haq et al 1987) to date the seismic reflectors (Eberli and Ginsburg, 1989). In the simulation of the seismic lines they took the sea-level curve of Haq et al (1987) as given, and varied such parameters as rates of carbonate accumulation and tectonic movement. These parameters are known to influence carbonate platform evolution, however, not all of them are quantitatively determined. The interactions of these parameters and the assumptions can be evaluated in the simulation. Because Eberli et al (1990) chose to use the Haq et al. curve as an input parameter for the sea level curve, the simulation of the GBB seismic lines not only tested their interpretation but also tested the sequence stratigraphy concept. They were able to test their model which proposed that third order sea-level fluctuations were responsible for the pulses of carbonate progradation. 60 my of carbonate deposition were simulated to reproduce sequence geometries seen on the seismic section.

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End of Simulation

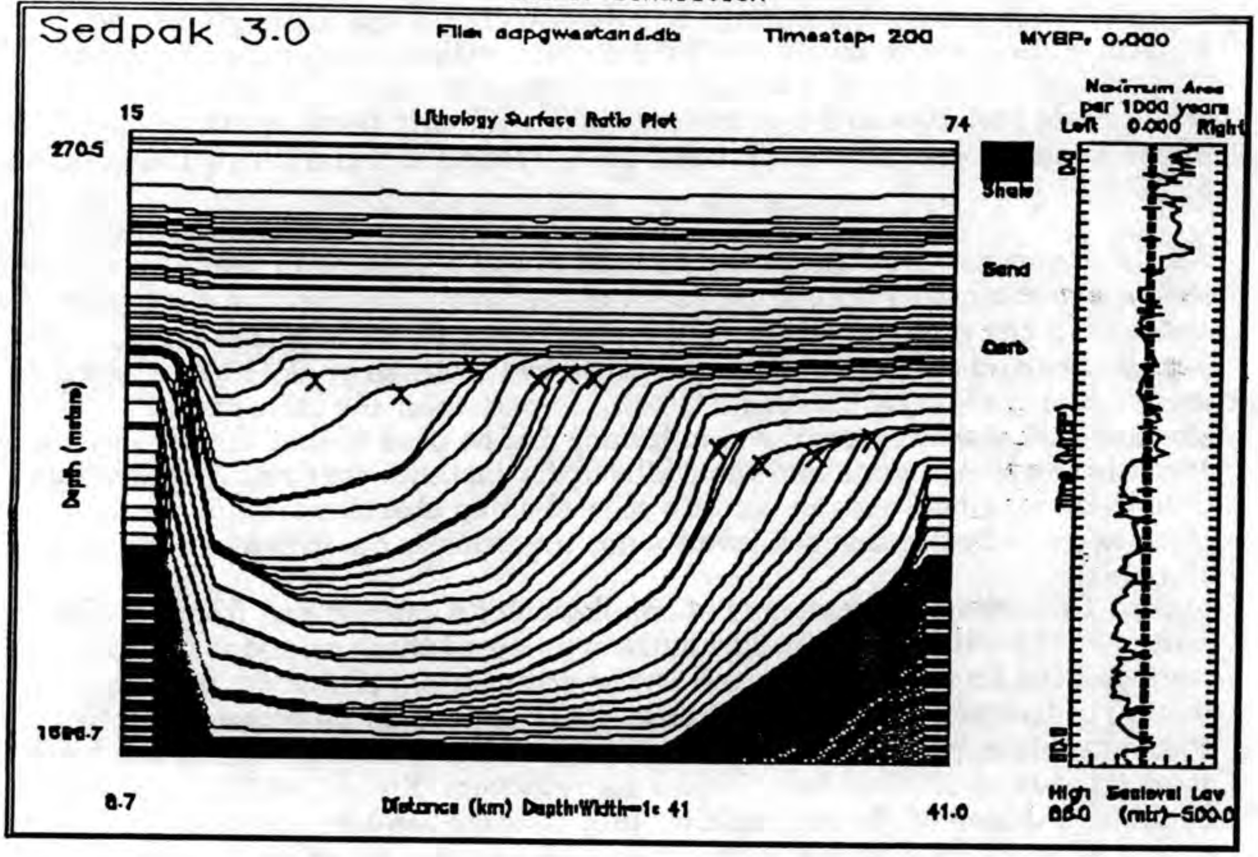


Fig. 1. Simulation of seismic line from Western Bahamas.

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# Data Handling Working Group Subcommittee
# College Station, June 22nd & 23rd, 1992

MINUTES

Membership

Ian L. Gibson, University of Waterloo, (Chairman)
Bob Bookbinder, Lamont-Doherty Geological Observatory
John Farrell, Brown University.
Volkhard Spiess, Universitat Bremen
Andy Sherin, Atlantic Geoscience Centre

Liaisons:

John Coyne, ODP/Texas A&M University.
Jack Foster, ODP/Texas A&M University.
Mary Reagan, Joint Oceanographic Institutions Incorporated
Peter Bloom, JOIDES office

Guests:

Jack Baldauf, ODP/Texas A&M University.
Russ Merrill, ODP/Texas A&M University.
Tim Francis, ODP/Texas A&M University.
James Allan, ODP/Texas A&M University.
Moses Sun, ODP/Texas A&M University.

The Chairman, in opening the meeting, commented that the mandate from PCOM was for the subcommittee to act as an advisory resource to help TAMU/ODP prepare a submission to the August 1992 PCOM meeting on the implementation of the March 1992 DHWG report. Secondly the subcommittee would act as a specialist advisory `panel' to PCOM on Data Handling matters. If the subcommittee operated as an independent body, it would be better able to fulfill both these rolls and, if appropriate, act as an advocate for the TAMU/ODP proposal.

Documentation provided by TAMU/ODP at the meeting indicated clearly that work was in progress to generate a long-range plan for computing within ODP for the period 1993-1998. The subcommittee emphasised that while such a long range outlook was useful, the PCOM mandate clearly requested that the proposal be particularly concerned with the implementation of the DHWG report. Under the circumstances, the subcommittee recommended that the detailed implementation plan contain:

* A statement about additional staff requirements and staff training.

* Information on what use might be made of subcontractors and how such work would be managed.

* Comments on the management structure to be adopted to facilitate implementation of the plan.

* Details of proposed equipment purchases.

* A detailed budget.

* Proposed time-frame with clearly indicated milestones.

* Information on how the ODP community is to be consulted during the planning stages.

It was stressed that all aspects of the proposal to implement the DHWG report should be clearly separated from proposals related to other computing at TAMU/ODP.

A wide ranging discussion followed and particular attention was paid to the following issues:

OPERATING SYSTEM ENVIRONMENT. The DHWG in Toronto clearly indicated in their report that the new database server should run under the Unix operating system. The subcommittee confirmed that they supported this view and considered that the short-term `pain' inflicted by such a change would be outweighed by that the long-term advantages of this arrangement.

DATASTRUCTURES. The DHWG in Toronto clearly indicated in their report that a relational database would be the central element in an initial implementation of the database system. The subcommittee supported this view and suggested that such a relational database might contain the majority of the `IHP sanctioned datatypes' as well as some important datasets being generated by new devices. It was recognized that some more specialized data types might require alternative datastructures.

TIME FRAME. It was agreed that every effort should be made to implement the DHWG recommendations over a two-year time frame starting in Oct. 1992 (The start of FY 1993). It was recognized that this required that the project be prosecuted in an aggressive fashion and that significant new personnel and financial resources would be required.

APPLICATION DEVELOPMENT. It was agreed that in order to accomplish the objectives within the two-year allotted time-frame it would be necessary to develop a relatively large number (15--20) quality data-input application modules essentially simultaneously. Whatever programming resources were utilized, this major effort would require significant management skills.

PRIORITY DATASETS. It was agreed that the `IHP sanctioned datatypes' would form the core of the priority datasets to be implemented in the initial 2-year phase of the project. IHP and SMP, at their September meetings, would be asked to review and revise this list. It was also agreed that if core-log integration was to become a reality, these priority datasets would have to include some data generated by the Logging Group.

SOFTWARE DEVELOPMENT. It was noted that TAMU/ODP had adopted the recommendations of the DHWG and was planning to purchase Unix work stations to assist in core/log integration. To minimize problems associated with systems integration, systems maintenance and perhaps to obtain favourable purchasing arrangements, it was suggested that the work-stations and Unix data-base server might be supplied by the same manufacturer and run the same operating system.

SOFTWARE FOR APPLICATION DEVELOPMENT. The subcommittee recognized that by industry standards the hardware environment on board the JOIDES Resolution was diverse and complex. To simplify application development, the subcommittee considered it appropriate initially to restrict all or most of the data-input applications to a particular hardware configuration (386/486 PCs). To further assist in this work, immediate attention should be paid to modern software development tools that are likely to be of use. Hopefully a homogeneous and modern software and hardware environment will ease development.

DATA-RETRIEVAL APPLICATIONS. Only if user scientists are able to readily retrieve information from the database will scientists assist in putting information into the system. The development of simple data-retrieval applications must therefore be part of the initial two-year database development. While some of these applications might be generic and form-based, applications that involve the use of Excel, a spreadsheet application that runs on both the PCs and Macs, should be given some priority. Certainly data-retrieval from the database server to scientists using all three types of client work stations (Macs, PCs and Unix) should be a simple, intuitive process.

DATA INTEGRITY. It was unclear as to the most effective way to control data integrity. Checks could be an integral part of the client work-station software, imposed by the database software, or carried out as a screening process on the completed database. Whatever the case, it was agreed that such data-verification should NOT impact unduly on the scientist.

In conclusion, the subcommittee noted that it was imperative that the various elements of the computing community at TAMU/ODP co-operate with vigour and enthusiasm to draft the proposal. Such cooperation must continue if the proposal is to have the far-reaching beneficial impact on the Scientific community that the DHWG sought and envisaged at the March Toronto meeting.

# Data Handling Working Group Subcommittee, Toronto, July 27th & 28th, 1992 Report

## Membership

Ian L. Gibson, University of Waterloo, (Chairman).
Bob Bookbinder, Lamont-Doherty Geological Observatory.
John Farrell, Brown University.
Volkhard Spiess, Fachbereich Geowissenschaften, Bremen.
Andy Sherin, Atlantic Geoscience Centre.

Jack Baldauf, ODP/Texas A&M University
John Coyne, ODP/Texas A&M University.
Russ Merrill, ODP/Texas A&M University.
Jack Foster, ODP/Texas A&M University.
Mary Reagan, Joint Oceanographic Institutions Incorporated.

## Introduction

The subcommittee's mandate from the April 1992 PCOM meeting was to work with the operatc to generate a proposal to implement the recommendations of the DHWG Report (March 1992). In adhering to this mandate the committee has met with the operator in June and July and the accompanying proposal is a result of these deliberations. While maintaining an 'arms-length', advisory relationship with the operator, the subcommittee has helped the operator by reviewing proposal drafts and providing general guidance on budgetary matters. The subcommittee enthusiastically endorses the ODIN proposal and urges PCOM to support it.

The comments below are provided to aid PCOM in assessing the proposal, with notes on technical aspects of the report, the budget, and the degree to which the proposal meets the DHWG March recommendations. Comments on the scientific impact of the proposal are included as accompanying letters from the Chairs of IHP and SMP.

## Comments on the TAMU/ODP ODIN Proposal

The present shipboard computing environment is characterized by an increasing amount of data being generated at an ever increasing rate, mainly as a result of improved and additional shipboard measurement systems. Major tasks such as data entry and archiving, data quality control and the application of sophisticated data analysis programs cannot be performed due to the limitations and low performance of the installed shipboard S1032 database system. In particular only a small proportion of data required for core-core and core-log integration is presently included in the database. This fact, and the lack of acceptance of data entry modules by the user community, has led to a precipitous decline in data organisation, homogeneity, quality and accessibility. Implementation of the ODIN proposal will resolve these major problems and the subcommittee noted with satisfaction that the proposal addresses the significant recommendation of the DHWG March Report. As such the proposal represents a major enhancement of the shipboard computing environment that would be of direct benefit to the on-board scientist. The following features of the proposal are of particular significance:

- **An ORACLE-7 relational database** will be established and implemented on the ship allowing ready access to data being generated on the current leg. This commercial database application allows the use of ancillary commercial software and user applications. The database design can accommodate multiple views of the data and allows for future expansion.

- **A second data base on shore** will provide scientists with similar data management and retrieval functionality for the entire ODP data set. This facility will make this important information accessible to the international scientific community via the Internet. The system will thus enhance ODP's publication function and preserve ODP's investment in the information.

- **New data acquisition software** will be written to ease the task of the shipboard scientist. The proposed use of modern software technologies, such as graphical user interfaces (GUI), will allow for much more efficient data entry and automated data acquisition systems. The work load on the shipboard scientist, which has increased due to the greater throughput during the drilling process, can thereby be brought back to an acceptable level. An important aspect of the proposal is the development of these applications in close interaction with selected experienced shipboard scientists and the JOIDES panels, to ensure the system meets the present user requirements.

- **New data-retrieval software** will be developed during implementation of the ODIN project to allow the users to retrieve data from the database more easily and quickly than in the past. This software will query the database via standard software packages (e.g. Microsoft Excel spreadsheets) and as ODP-specific GUI applications that will support ad hoc requests.

- **Unix work stations** will be integrated into the shipboard computing environment to allow the use and development of sophisticated analytical applications and work with newer larger datasets. These work stations will be particularly important in relation to core-core and core-log correlation, age-depth correlations and general work in the areas of downhole measurements and underway geophysics.

- **Ship/shore communication** will be critical during the shipboard installation and field testing of ODIN. During the next few months, ship/shore communication will improve dramatically due to a 25-fold increase in the transmission rate (from 2.4 to 56 Kbps). Communication via E-mail will continue to allow two-way discourse over internet in a timely and inexpensive manner.

- **The three-year timeframe** is supported here as being the most appropriate option when the urgency for renewal of the data base system is balanced with ODP budget constraints. PCOM is reminded of the Data Handling Working Group's recommendation that the new data base structure should be 'fully operational and on-board the JOIDES Resolution approximately two years from the start of the design phase.' By supporting the extended timeframe of three years, we are compromising this objective which has already been agreed by PCOM. The subcommittee, therefore, strongly recommends that the timeframe for completion of this project not be extended beyond three years. Any further extension will result in the unacceptable risk of loss of data and substantially impede the innovative analytical use of data.

- **subcontract and staff positions** within the ODIN program will be open to bids from the JOIDES community, allowing the international partners to benefit from participation in this work, as suggested by EXCOM.

- **A Data Handling Steering Committee (DHSC)** could continue to provide input into the ODIN program, advising and monitoring technical aspects of the work. It might also additionally take on the role of coordinating input from SMP, DMP, and IHP (two additional members would be required). The work of this steering committee might be achieved by visits to College Station at intervals during the duration of the project, by interaction via EMAIL, FAX and the telephone, and perhaps by visits to other sites where related developments are in progress. If the DHSC is to provide input, it is important that interaction takes places in such a way as to allow 'steering' and that the committee be not asked to simply approve ODIN decisions that have already been made.

In conclusion, while the subcommittee was charged with working only with the Operator to generate a response to the DHWG recommendation, we recognize that an alternative approach might result in lower costs by: the subcontractor subsidizing the work, the use of student labour, the use of minimal resources for quality assurance, reduced data verification, or the provision of limited documentation. The subcommittee was not asked to consider this 'straw-man' alternative but recognized that a reduced initial outlay might be deleteriously offset by the loss of data, data of lower integrity, and perhaps increased future costs for maintenance and enhancement.

000317

# Proposal for a New

# Ocean Drillimg Information Network

ODIN

Prepared by the

**Ocean Drilling Program**
**Texas A&M University**

College Station, Texas
28 July 1992

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## EXECUTIVE SUMMARY

Recent and anticipated near-future advances in computer analytical techniques and an increased need for manipulation of large data files onboard *JOIDES Resolution* dictate aggressive new approaches to data acquisition, data retrieval and database management both shipboard and shorebased. As such, high performance computing, data acquisition, data retrieval and high speed data communication networks have become essential to the scientific advancement of the Ocean Drilling Program (ODP). The Ocean Drilling Information Network (ODIN) proposal presented here represents a consensus reached during discussions between the Science Operator and the Data Handling Steering Committee (DHSC).

Essential to this new approach to ODP data management will be the installation of ODIN consisting of a shipboard data repository and a sister shore data repository to facilitate the accumulation, organization and accessibility of all data collected on each Leg. This new network will support: (1) the current ODP database in a new relational database management system consisting of ORACLE 7 running on a central server platform under the UNIX operating system; (2) prioritized IHP mandated datasets; (3) text, numbers, and digital images as appropriate; (4) UNIX, PC and Macintosh workstations; (5) data collection and data retrieval modules that interface with the new database management system; (6) graphical user interfaces; (7) core-core and core-log data integration applications; and (8) remote Internet access and the ODP Datanet concept.

In order to implement ODIN within three years, we will subcontract large pieces of the software development work to experienced database developers who have demonstrated their abilities to produce high quality work. In addition, we shall hire a temporary task force commissioned to complete the software design and development; data analysis and design; database administration; system and network management; and documentation. The temporary task force will include: Senior system analyst (1), System analyst (2), System manager (1), Database administrator (1), Documentation Manager (1) and Staff scientist (1). The ODIN task force will be managed by the Manager of Information Services. The Task Force will interact with experienced scientists selected from among the members of JOIDES Panels.These individuals will provide user input to system analysts and subcontractors working on the design and testing of ODIN.

The estimated cost for the proposed work is $828K during year 1; 877K during year 2; and 610K for year 3 for necessary salaries, supplies, services, equipment and software, communication, personnel, training, travel and subcontracts. Temporary Task Force personnel will be recruited and subcontractor bids will be solicited from ODP member countries.

## INTRODUCTION

Information needs have changed dramatically since the inception of the Ocean Drilling Program and will continue to evolve at an even greater pace in the near future. Recent advances in computer analytical techniques used on *JOIDES Resolution*, such as core-core integration, dictate the need for new approaches to database management in both ship and shore environments. In addition, increased international involvement such as future overseas repositories, the ODP Datanet, and cooperation with other international research programs, such as Global Change require immediate improvements in the current database to ensure maximum availability of ODP data to the international scientific community

Central to meeting this challenge will be the creation of the Ocean Drilling Information Network (ODIN), which will facilitate the accumulation, organization and accessibility of all data collected on each Leg. This new data system will consist of a relational database (equipped with a standard SQL interface) initially containing prioritized IHP sanctioned datasets. The heart of the new management system will be Oracle, running on a central server platform under the UNIX operating system. This server will support Sun and other UNIX, PC and Macintosh workstations.

It is clear from the magnitude of this undertaking that it will be essential to subcontract much of the design and programming work among several institutions having the expertise and experience needed to complete portions of the task. To accommodate the current financial climate, it is proposed that we develop, acquire and install ODIN over a period of three years. The development and acquisition of ODIN will be assigned to a temporary Task Force and subcontractors who will work in parallel with and separately from the daily activities of current ODP personnel. The ODIN task force will be responsible for building the new database system and its associated data collection and retrieval software, and for helping the permanent staff to migrate from the old system to the new.

Design and development of the system and data acquisition routines will require input from members of the JOIDES Panels. These individuals will provide advice and criticism to the staff scientists and to the ODIN development team concerning the user friendliness and functionality of the software during the design and development phase. It is conceivable that membership of the panels will require augmentation in order to ensure that scientists with the necessary shipboard experience will be available to supply this guidance

## FUNCTIONAL DESCRIPTION

Each segment below briefly describes the function and design philosophy for each component of ODIN.

**User Interface:** The success of ODIN as a next-generation database system relies heavily upon a friendly and intuitive user interface. Object-oriented Graphical User Interfaces (GUI) have become accepted as de facto standards in recent years. The interface for new programs will be based upon a modern GUI in order to make the user interface more intuitive and productive. Examples of successful GUI on the market today are: Macintosh, Microsoft Windows, Motif, and SUN's Open Look.

**Data Collection:** ODIN implements the following data collection methods: (1) automatic collection of data - where instrumentation aboard *JOIDES Resolution* permits data to be automatically collected, validated, processed, and stored in the databases for retrieval and analysis by users; (2) scannable bar-codes - scanning data into computer systems promotes efficient use of human time and decreases the chance of introducing error into the database; and (3) manual input by the user - many applications will continue to require the user to input data manually. The design and implementation of data input forms, employing

GUI and/or character-based data capture tools, will emphasize an easy, convenient way to make inputs. While some data validation checks, specified by SMP and IHP, must be made at the time of input, the new applications will make these checks less onerous than they are at present.

<u>Data Retrieval:</u> Data retrieval will be accomplished with applications running on client machines through transparent access (i.e., linking) to the database utilizing commercially available products such as the Microsoft EXCEL spreadsheet software or custom-developed GUI applications.

<u>Data Quality Control:</u> Quality control during data acquisition will be completed by one or all of the following methods: (1) performed by the scientists, (2) monitored through application programs at time of data entry, (3) checked and corrected when the data are dumped into the database, and (4) validated and corrected after data are already in the data base.

Input from IHP and SMP has indicated that data checking is required. However, assigning full responsibility for data validation to the scientist-user is unacceptable if that task distracts the scientist from performing his or her scientific role.

<u>Data Base Management:</u> The heart of ODIN's database is an Oracle 7 relational database management system (RDBMS) running under the UNIX operating system and supporting the client/server internet data access model. While the initial concern is for installation of the system aboard the *JOIDES Resolution* to archive current leg data, a shorebased system supporting data from all ODP cruises will also be acquired and installed.

This new, centralized data-repository aboard JOIDES *Resolution* will facilitate the accumulation and organization of large datasets collected on each Leg. It will support near real-time access to aid core-core and core-log correlation analysis.

<u>Data Analysis:</u> Recent advances in technology have provided additional tools for data analysis and correlation that were previously unavailable. These tools enable the scientist to perform more comprehensive analysis on the data being collected aboard *JOIDES Resolution.*

A set of analytical programs running on the various client machines will be provided for prioritized IHP-sanctioned applications. These programs will be provided by (1) in-house software development, (2) acquisition of existing applications from other university research environments, and (3) purchase of commercially available software that fulfills user requirements. Application-specific analytical programs will be designed and developed in-house at ODP or sub-contracted out based on resources available. The development environment of choice for new data analysis and retrieval applications will be UNIX. The shipboard network
and database servers will also accommodate equipment belonging to cruise participants.

<u>Data Publication:</u> Data will be distributed using media such as printed material, magnetic tapes, diskettes, CD-ROM, and networks. Additional distribution methods will be used as the technology and needs of the scientific community evolve.

<u>Computer Network and Satellite Communication:</u> The shipboard and shorebased computer network system will support 100 Mbps by project end. Satellite communication equipment will allow transmission rates up to 56 Kbps (kilobits/second). Advances in

modem technology (e.g., Codex V.FAST modem) may permit data rates exceeding 56 Kbps over normal voice-grade channels in the near future. Speeds of this magnitude will facilitate the implementation of the 'DataNet' concept to provide rapid and efficient data exchange between ship and shore installations.

Metadata: No database is complete without additional information describing the data that have been collected (eg., authorship, technique). The new database system will accommodate this type of information.

## PROJECT DESCRIPTION

There are four major groups which will assist the task force: the internal ODP/TAMU organizations, science user group, panels and committees, and subcontractors. The relationships among these groups are outlined in Figure 1. The ODIN task force will be responsible for managing the subcontracts (Fig. 2) and maintaining communications with the users, panels and committees, and must operate separately but in parallel with the existing Database and Computer Services groups. The project schedule is shown in Figure 3.

Tentatively, we have divided the task of preparing the new database system into six (6) sections. Five of these sections will be the subjects of individual subcontracts. The sixth, which includes databases like CORELOG and SAM, contains relatively small, but essential applications should be completed before subcontractors begin work, so that they will be available as prototypes and for use in testing subcontractor products. These applications will be handled entirely in house by the system analysts.

As soon as funds have been committed to the project, detailed planning will begin, using existing ODP/TAMU staff. Simultaneously, we shall commence the hiring process, seeking to have temporary positions filled as soon as possible after the beginning of the funding year in order to get a rapid start upon the complex planning and design process, and the acquisition of the hardware and commercial software needed to establish the new programming environment.

The first critical node will be the completion of the five requests for proposals (RFP's) describing the software development tasks for which we intend to subcontract development services. RFP's will be completed in a sequential fashion spanning nine months. The bid process will require an additional four months to complete, so contracts should be finalized and subcontractors should begin work approximately nine months after first funds become available. Individual science advisors will be extremely important during the first five or six months of the project.

We anticipate that preliminary versions of software modules will be delivered approximately three months after subcontractors begin work, and that the iterative testing and debugging process will consume most of the second and third years of the program. Science user groups will play major roles in final testing.

Quality Control: One of the early task force activities will be to design rigorous testing schemes for each new software module to be developed. Upon delivery, prior to acceptance, each module will be tested alone and working in concert with the rest of the system in a test environment which emulates the shipboard operating environment.

As applications are received and have met the acceptance criteria, it will be installed and field tested onboard *JOIDES Resolution*, where it will operate in parallel with the existing database system until it is reliable.

**BUDGET JUSTIFICATION**

The draft budget shown in Table 1 covers the three years which will be required to build ODIN. ODP/TAMU will accept the final version of ODIN, complete the migration from the old database to the new system, complete the operational training of its shipboard system managers, and phase out the temporary personnel and space acquired for the project during the last six months of the effort.

**Personnel task descriptions:** The ODIN Task Force will consist of temporary positions existing during the duration of the project with the exception of a system analyst who will continue to maintain ODIN. These positions will be advertised to the entire ODP community.

Senior system analyst -- This position supervises the work of the other system analysts, oversees quality control of all products, and will supervise one subcontract. This position carries primary responsibility for ensuring that all software produced is robust, well-tested, and meets ODIN standards.

System analysts -- There will be two system analyst positions during the first year, when the bulk of the RFP's are being prepared, and one during the second and third years, which will directly supervise three subcontractors, design and test subcontractor products, and will develop inhouse software to complement subcontractor efforts.

System manager -- Working closely with the network manager and the system manager in CSG, this position will be responsible for testing, tuning, capacity planning analysis and daily management of the workstation operating systems and the networks associated with ODIN. Additionally, this position will document the configuration of the ODIN development environment so that subcontractors will be able to reproduce that environment in their laboratories.

Database Administrator -- Working under the supervision of the Data Administrator in the DataBase Group, this position configures and maintains all database software; ensures that the databases themselves are correctly configured; documents database configurations for the use of system analysts and subcontractors; and carries out database maintenance and quality control activities during the project.

Documentation manager -- This position is responsible for tracking all versions of all software involved in or produced by the project, for ensuring that all documentation produced by system analysts and/or subcontractors meets the ODIN standard, and for preparing and/or overseeing preparation of user manuals for eventual use onboard ship. Quality of the user documentation will directly influence the success and ease-of-use of ODIN by cruise participants, once the system has been completed.

Staff scientist -- This additional staff scientist position will allow the ODP staff scientists as a group to provide essential guidance to the system analysts. Each staff scientist (at about a 15 percent level of effort) will coordinate the efforts of selected individual members of the science community who will supply user input to the design and testing phases of software development.

**Supplies**: Consumables required to support software development activities among the inhouse staff, as well as documentation and other exchanges with an international group of subcontractors.

**Services**: Hardware and software maintenance, shipping costs to send documentation and/or hardware between subcontractor and ODP/TAMU, and the cost of printing user manuals and other documentation are also included in this category.

**Equipment and Software**: These are estimates, because actual costs will be determined by bid. Most of this material will have to be acquired in the first year in order to support the task force activities, but purchase of material intended for deployment is on the ship can be postponed until the second year.

**Communications**: Peaking in the second year when the subcontractors are busiest, this category covers telephone costs. Ship/shore costs shown in the third year will be incurred during the field testing phase, when rapid communications with the ship will be essential. The use of electronic mail will be encouraged to save money.

**Training**: Covers training of task force and operational staff in aspects of the commercial and database software which will be specific to our needs.

**Travel**: Covers relocation for senior task force staff, attendance at task-related workshops and trade shows during the first year when equipment and software are being selected, and travel required to select, negotiate with, and supervise subcontractors. For purposes of this calculation, we have presumed that fifty percent of the subcontractors will be travelling to College Station from outside the U.S. We have presumed seven trips in connection with each subcontract (contract negotiation, initial briefing after contract is let, scheduled reports and consultations while work is underway, delivery and testing, and final work during field tests).

**Subcontracts and Subcontract Overhead**: Estimates, based upon experience, of the costs required to accomplish the tasks which will be subcontracted (Fig. 2). Actual costs will be determined by response to the RFP's.

In following years, there will be modest expenses associated with maintaining the new equipment and the new commercial and custom software; however, many of these expenses will be offset by savings on older hardware and software systems which can be abandoned upon completion of the ODIN project. Computer personnel will be increased relative to FY93 base budget by one system analyst, probably held over from the temporary task force staff, whose primary duties will be to ensure that the new database system evolves to accept the products of new instruments installed onboard the *JOIDES Resolution*, as well as to support new analytical software packages which may be required by future generations of cruise participants.

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# Table 1

**Draft Budget for ODIN in thousands of FY92 dollars**

| | | 1st Year | 2nd Year | 3rd Year |
|---|---|---|---|---|
| **Personnel** | | | | |
| | Senior System Analyst | 65 | 65 | 35 |
| | System Analyst (2 in 1st year) | 110 | 55 | 55 |
| | System Manager | 40 | 40 | 20 |
| | Database Administrator | 40 | 40 | 20 |
| | Documentation Manager | 0 | 50 | 50 |
| | Staff Scientist | 50 | 50 | 25 |
| **Supplies** | | 5 | 10 | 10 |
| **Services** | | | | |
| | Environmental | 36 | 36 | 17 |
| | Printing, Copying, Postage | 15 | 30 | 15 |
| | Maintenance (hardw, softw) | 13 | 20 | 20 |
| | Shipping | 2 | 5 | 1 |
| **Equipment**** | | | | |
| | Ship | 117 | 50 | 0 |
| | Shore | 50 | 0 | 0 |
| **Software** | | | | |
| | Ship | 0 | 21 | 0 |
| | Shore | 86 | 0 | 0 |
| **Communications** | | | | |
| | Network -- electronic mail | 7 | 7 | 7 |
| | Telephone | 10 | 20 | 12 |
| | Ship/Shore | 0 | 0 | 20 |
| **Training** | | 30 | 5 | 5 |
| **Travel** | | | | |
| | Exploratory | 4 | 0 | 0 |
| | Subcontract-related | 10 | 28 | 5 |
| | Relocation | 10 | 0 | 0 |
| **Subcontracts**** | | | | |
| | Applications | 85 | 230 | 195 |
| **Subcontract Overhead**** (rate = 50%) | | 42.5 | 115 | 97.5 |
| **Annual Totals** | | 827.5 | 877 | 609.5 |

**Estimates subject to modification during the bidding process

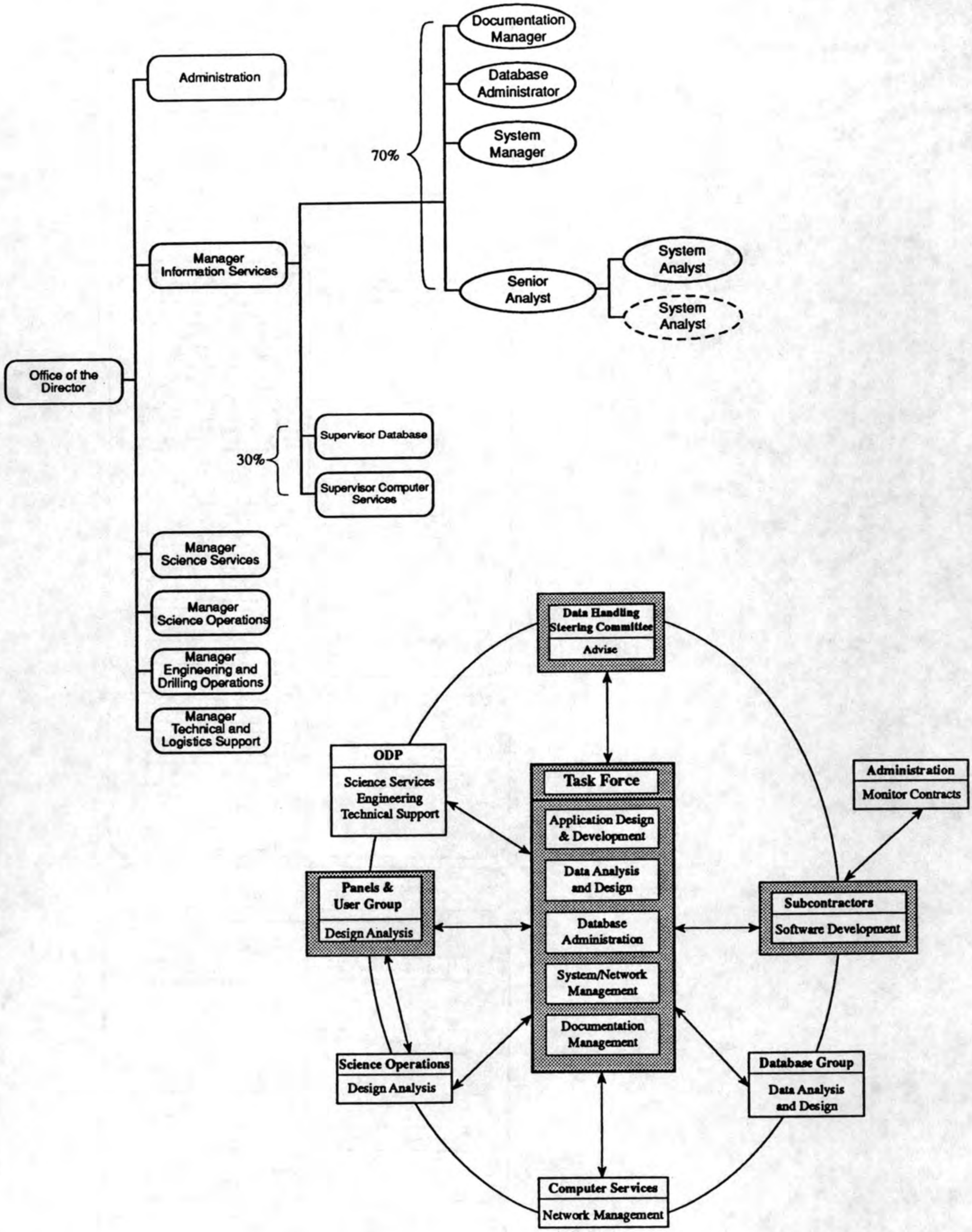


Figure 1: Task Force Organization and Functions

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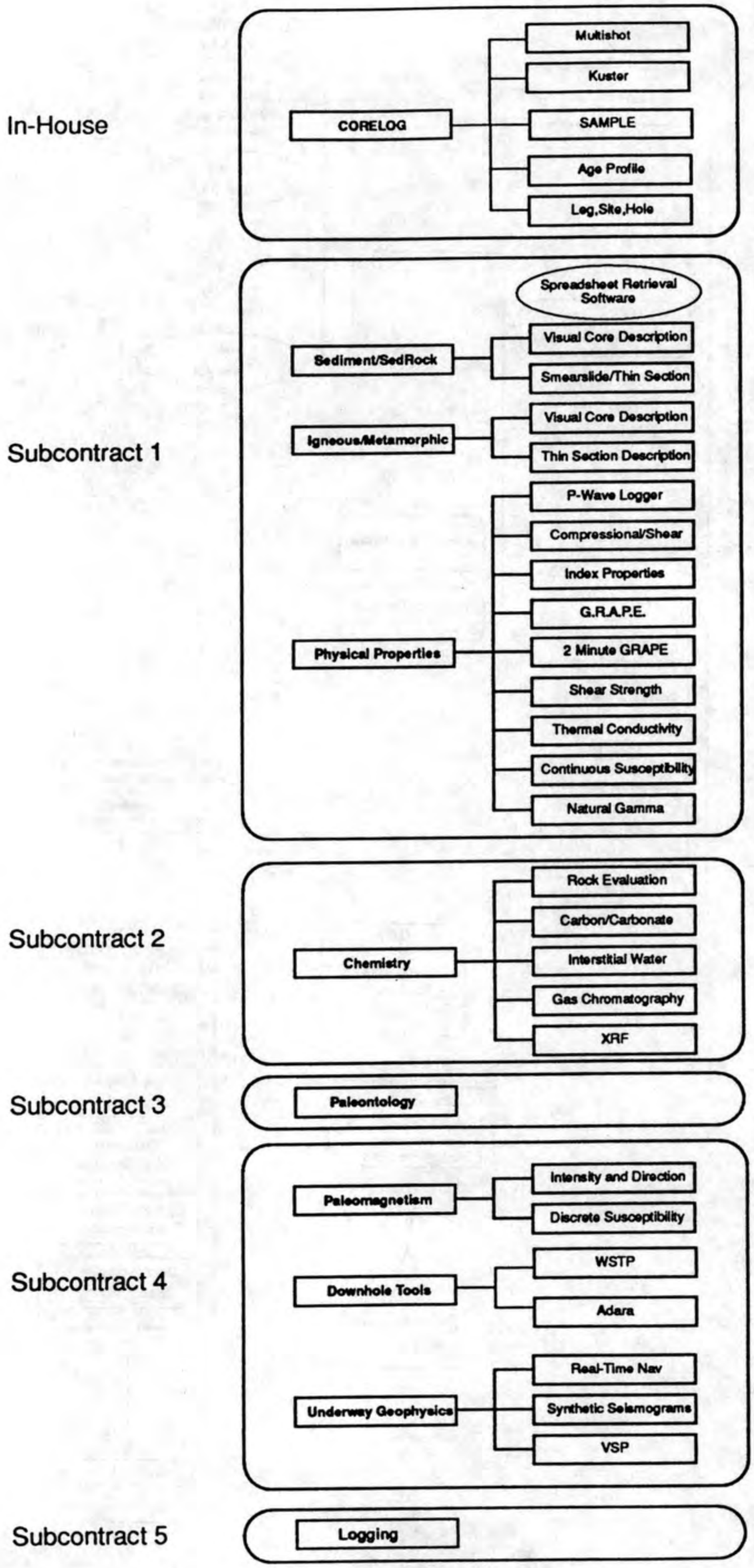


Figure 2: Prioritized IHP Sanctioned Data Types and Proposed Subcontracts

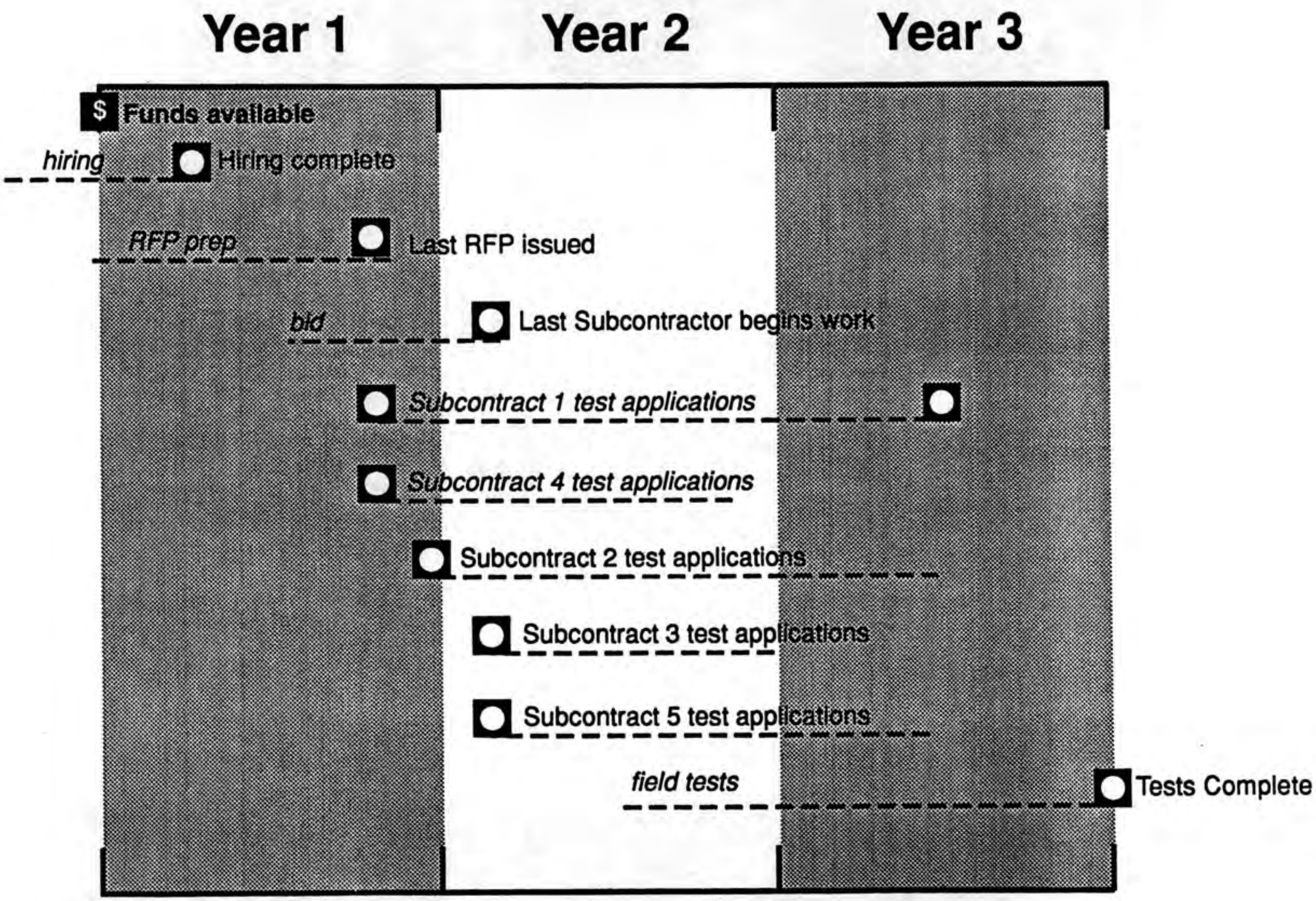


**Figure 3: Summary of Project Timelines**

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JUL 3 0 1992
Ans'd...........

July 29, 1992

Dr. James Austin, Chairman,
JOIDES Planning Committee, Institute for Geophysics,
University of Texas,
8701 Mopac Boulevard,
Austin, TX, 78759-8345, USA
FAX: 512-471-0999

Dear Jamie,

I am writing briefly, in my capacity as Chairman of IHP, to urge PCOM to support the ODIN proposal from the TAMU Operator to significantly revitalize the ODP computing environment. IHP wishes to stress that the upgrade will bring significant additional scientific benefits to the program, while a failure to act will represent an abandonment by PCOM of responsibility for the long-term organisation and stewardship of ODP data, impairing the work of future generations of earth scientists.

Although routine day-to-day scientific work on the JOIDES Resolution is continuing in the present computing environment, the work is significantly hampered by the difficulty of retrieving data related to the current leg, and by the lack of sophisticated resources to manipulate that data. Integrating logging and core data is also essentially impossible within the confines of the present shipboard environment. The ODIN proposal addresses these problems and the result should be a significant improvement in the diversity, quality and quantity of scientific work completed on board. The work of the scientist will be eased.

Although shipboard work continues, the rational organisation and archiving of ODP data during legs has almost collapsed because of a rejection by the scientific community of the out-dated, user-hostile, database environment presently in use on the JOIDES Resolution. A state of 'data-anarchy' is approaching. IHP views this as an intolerable situation. The speedy implementation of the ODIN proposal will address this problem and restore order to the organisation of ODP data by implementing a user-friendly data-acquisition / data-retrieval database environment. IHP will continue to monitor and advise as to how this improved database is used by the scientific community.

Again IHP urges support for the ODIN proposal. Delay or an implementation plan over an attenuated time-frame are not acceptable alternatives.

Yours sincerely

Ian L. Gibson,
Chairman IHP,
EMAIL: GUELPH2@Watdcs.UWaterloo.CA

000329

Dr. James A. Austin
JOIDES PCOM Chair
Institute for Geophysics
University of Texas at Austin
8701 N. Mopac Expressway
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transmitted via fax# 1-512-471-0999

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JUL 3 0 1992
Ans'd...........

Dear Jamie:

The proposal (ODIN), prepared by ODP/TAMU in cooperation with the Data Handling Steering Committee, for a new ODP computing system represents a major change in the shipboard and shore-based computing environments. As recommended by the DHWG, the proposal is an integrated approach which includes all aspects of the computing system, from data acquisition to current and future user interfaces. The program critically requires this new computing system. SMP has already reported to you that the ship is currently working under a computing environment which is at its limit. Many of data acquisition components and immediate processing systems are not efficient enough to allow for real-time core to core data correlation. Without core to core and hole to hole correlations, core-log data integration cannot be performed. In addition, the data processing for core-log data integration cannot be achieved without major changes to the computing environment as proposed.

Paleoceanographic drilling objectives, in particular, rely on core-to-core correlation for evaluation of the requirement for continuous core recovery in any one hole. Prior to Leg 138, this evaluation was never achieved and it is likely that even with many duplicate holes drilled, some core intervals were missed. Given the high priority of this requirement for paleoceanographic drilling, this situation is unacceptable, particularly where a real solution exists. On Leg 138, as you know, the computing system was boosted with two workstations brought on-board by the scientific party. In addition, on paleoceanographic legs, the scientific and technical staffs are severely overtaxed from the amount of core recovered. A more efficient data acquisition system will improve this situation considerably.

For other drilling objectives, the requirement for core-log data integration is essential. In most other environments, continuous core recovery is never achieved. Consequently, core data and log data must be used together to interpret the results. Core-log data integration cannot yet be performed on the ship. One of the restrictions is the existing computing environment. These restrictions in the existing system include: data are not currently captured or stored in a manner that allows for near real-time access; data processing software for depth matching is not available; and a graphics workstation does not exist.

When SMP considers future shipboard capabilities, almost all of these systems are computationally intensive. For example, the CATSCAN technology for replacement of discrete index property measurement; high resolution colour reflectance for measurement of core colour and as a paleoceanographic proxy record; and high resolution resistivity for structural geological interpretations, geochemical analyses, and physical property core mapping are systems that may soon be available for shipboard use. These technologies all require an improved shipboard computing system.

The ODIN proposal represents a major improvement to the ODP computing environment. Without it, our procedures for obtaining scientific data to meet program objectives are severely restricted. Given the level effort and time required to put this new system in place, we should not delay the initiation of this development. On behalf of SMP, I urge PCOM to proceed with this initiative. I also recommend that PCOM carefully consider the proposal in terms of the balance of the level effort. SMP recommended that this activity remain within the mandate of the prime contractor because computing is so central to the program. At the same time, SMP also suggested that major components of this development could be completed by sub-contract. Although the current proposal does include a significant sub-contract component, the balance is tipped to the operator. SMP recognizes that there are other groups with significant experience and talent within the JOIDES structure who could potentially participate in a more central role than could now be achieved under the existing proposal. For example, in the ODIN proposal, all of the detailed design specifications will be completed by TAMU and essentially the programming tasks will be completed under subcontract. This scenario of separation of the designer from the programmer is one which limits the development of innovative approaches, increases iterations, and complicates communication. An alternative approach might be for the lead contractor (TAMU) to define *performance* specifications of the major components and then allow organizations to produce bids for development and implementation which include the design component. This scenario would shift the balance to the sub-contracting side and perhaps allow the program to benefit from the expertise of the wider JOIDES community.

Sincerely,

Kate Moran
SMP Chair

fc: J. Fox, PCOM liaison to SMP
I. Gibson, Chair, DHSC

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MAY 26 1992
Ans'd............

# REPORT OF THE STEERING GROUP FOR IN SITU PORE FLUID SAMPLING

Conveners: Joris M. Gieskes (SIO) (substituting for Paul Worthington)

and Dave Huey (ODP/TAMU)

Held: April 2, 1992

Members present:

Keir Becker (PCOM)
Andy Fisher (ODP/TAMU)
Joris M. Gieskes (DMP)
Dave Huey (ODP/TAMU)
Erich Scholz (ODP/LDGO)
Peter K. Swart (SGPP)

Members absent:

Paul Worthington (DMP)
Robert Desbrandes (DMP)

The meeting was convened at ODP/TAMU at 8:30 am, April 2, 1992.

A first item of bussiness was a general review of the requirements of the Request For Proposals (RFP) for a feasibility study for the deployment of in situ pore fluid sampling equipment. In addition new conditions for the financing of this RFP have surfaced. Keir Becker (PCOM) informed the meeting of the necessary changes in the scope of the RFP proposal to meet these conditions, i.e., through a proposal to the National Science Foundation through the JOI Office.

Peter Swart (SGPP) reaffirmed the interest of SGPP in the sampling of pore fluids from formations that are characterised by sediments of low porosity or in basement rocks that show evidence of fracture porosity. Especially the sampling of potentially producing zones (aquifers) in the sediments/basalts is considered of high priority.

It was decided to subdivide the RFP into the following sections:

1. A more detailed scientific justification of the project;

2. The objectives of the required technology;

3. A description of specific measurements and conditions for the required sampling;

4. Technical beackground information;

5. Specific technical requirements for the RFP mandate;

6. Bidder qualifications and names;

7. Costs discussion;

8. Specific schedule of work (time table).

Points 1,2, and 3 will be submitted to PCOM before April 20 in the form of an agreed upon text. Points 4 - 6 will be written up before May 15, the delay caused in part by time schedules. However, an overview of the salient points will be made available to PCOM during its meeting in April, 1992.

The proposed time schedule for the feasibility study is as follows:

Outline to PCOM: April 20

Final RFP and coverletter to JOI: May 22

Discussion of potential funding between JOI & NSF and
issue of RFP: June 15

Responses to RFP: August 15

Evaluation of responses: September 12 - 15 (DMP meeting)

Bidder selection: September 30 (JOI)

Contract: October 15 or earlier

Oral report: DMP meeting January 1993

Written report: March 1, 1993

It was decided that the persons directly responsible for the follow trough (monitoring) on the RFP would be
Science proponent: Dr. Peter Swart (RASMAS Miami)
Technical contact: Mr. Dave Huey (ODP/TAMU)

However, the entire committee, including Dr. Paul Worthington, will be available for consultation when called upon by the above anchor persons.

The meeting closed at 3 pm, after the division of write up tasks.

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Ans'd............

# REQUEST FOR PROPOSALS FOR A FEASIBILITY STUDY FOR IN-SITU PORE FLUID SAMPLING

## INTRODUCTION

This request for proposals focuses on a feasibility study of sampling technologies appropriate for the sampling of fluids from sediments and/or basalts encountered in the Ocean Drilling Program (ODP). We outline below:

1. The nature of the Ocean Drilling Program;
2. The scientific justification for the project;
3. The proposed study of in-situ sampling options;
4. The description of existing equipment;
5. Required technologies;
6. Specific requirements;
7. Primary tasks of the successful contractor;
8. Bidder qualifications;
9. Schedule;
10. Bidders list.

## THE OCEAN DRILLING PROGRAM

The Ocean Drilling Program (ODP) is a long-term international partnership of scientists, oceanographic institutes and governments dedicated toward unlocking the history, evolution, and structure of the world ocean through the recovery of core samples and other measurements from beneath the ocean floor. The study of these cores, samples and measurements helps determine the history and evolution of the earth and it's climate. The science operator of the Ocean Drilling Program is Texas A&M University (ODP/TAMU). ODP is expected to last into the twenty-first century. The primary drilling platform is officially registered as the SEDCO/BP 471, but it is also referred to by the scientific community as the JOIDES Resolution (J/R). The former oil industry drillship was specially converted for scientific work in 1984 and is on an exclusive long term contract to ODP. Sedco-Forex is the drilling contractor.

ODP is the successor to the Deep Sea Drilling Project (DSDP) operated by Scripps Institution of Oceanography from 1968 to 1983 using the drillship Glomar Challenger. In the fifteen-year period, DSDP managed 96 scientific expeditions covering over 375,000 miles (600,003 kilometers) of ocean, and 1,092 holes were cored at 624 sites yielding more than 60 miles (96 kilometers) of deep ocean core. Since 1985, ODP has managed 42 scientific expeditions covering 118,000 miles (190,000 kilometers) of ocean and circumnavigated the globe. More than 590 holes have been cored at 244 sites, and 42 miles (68 kilometers) of deep ocean core have been recovered.

The core samples are collected by continuous wireline coring into the earth's crust (the present penetration record is 2000 meters (6562 feet) below sea floor) in water depths that have ranged thus far from 161 to 5714 meters (528 to 18,746 feet).

The SEDCO/BP 471 (J/R) is 143 meters (471 feet) long, 21 meters (70 feet) wide, and displaces 18,934 metric tons (18,636 long tons). The vessel has an ice-strengthened hull and is equipped with a dynamic positioning system using 12 thrusters capable of keeping the vessel within a radius of two percent of water depth in winds of 23 meters/second (45 knots), significant wave heights of five meters (16 feet), and surface currents of 1.3 meters/second (2.5 knots). The vessel has an operational endurance of 100 days with a fuel capacity of over one million gallons (3785 cubic meters). The SEDCO/BP 471 (J/R) can operate in water depths of 8,200 meters (26,900 feet) and can suspend a static load of 9,144 meters (30,000 feet) of drill pipe.

Table 1 - Vessel and Drill Rig Specifications

| | |
|---|---|
| Length | 470 ft |
| Beam | 70 ft |
| Draft | 24.5 ft |
| Displacement, maximum | 18600 sh.tons |
| Maximum complement | 122 persons |
| Cruising speed | 12 knots |
| Shaft horsepower, cruising | 9000 |
| Thruster horse power, (12 thrusters) | 9000 |
| Electrical generating capacity | 13.5 MW |
| Water distilling capacity | 650 bbl/day |
| Fuel storage | 4000 sh.tons |
| Drill water storage | 1500 sh.tons |
| Liquid mud storage | 4100 bbl |
| Bulk mud/cement storage | 13600 $ft^3$ |
| Scientific deck space | 14500 $ft^2$ |
| Drawworks | 2800 hp |
| Mud pumps (two pumps) | 1700 hp each |
| Rig Hoisting capacity | 600 tons |
| Maximum water depth, drilling ops. | 27000 ft |
| Maximum drill string length | 30000 ft |
| Maximum logging/reentry depth | 20000 ft |

The drilling equipment on board ensures that operations can be maintained in harsh environments and has been modified extensively for scientific, as opposed to oil and gas, drilling operations. The derrick is 62 meters (202 feet) tall, rated for 544,200 kilograms (1,200,000 pounds), and is equipped with a variable speed electric top drive. The traveling block drill string heave compensator is the largest in the world and is rated for 362,800 kg (800,000 lbs). The ship is also fitted with a Varco Iron Roughneck, dual elevator system and horizontal pipe racker for triple stands of 5 and 5-1/2 inch S-140 drill pipe.

Most sites are cored in open holes as deep as 1000 meters without any casing or reentry guide base, and wireline electric logs, fluid samplers (for use in soft sediments), and other special tools are run. Hole conditions range from benign carbonate oozes at 4°C to flowing sands, corals, boulders and swelling clays to rugose, fractured, altered basalts in 300° C hydrothermal vents.

A Reentry Cone and/or Guide Base can be run to the seafloor to support 16" and 11-3/4" casing in permanent or unstable holes where re-entry is required because of multi-bit runs, casing string requirements or later re-entry for scientific data. Reentry cones are 11 ft. - 6 inch diameter and are equipped with reflectors for sonar or TV-assisted re-entry, hanger for casing, diversion pipes for cleaning, and bottom plate to reduce settling. A full cementing unit is available for cementing casing and plugging open holes for abandonment.

The 9.5 meter (31.17 foot) long x 5.9 cm (2.3 inch) cores are retrieved by wireline through the 5 and 5-1/2 inch drill string (4-1/8 inch ID) without a riser or blowout preventer. Before drilling approval is granted at a site, a rigorous pre-drilling study and safety review is conducted to avoid areas of potential hydrocarbon accumulation or significant ecological risk. Sea water is circulated with occasional viscous gel pills (bentonite) to clean out cuttings, with returns to the sea floor.

Soft sediments are cored using an Advanced Hydraulic Piston Corer (APC)/ extended Core Barrel (XCB) bottom hole assembly with an 11-7/16" four-cone tungsten carbide insert rotary coring bit. Hard formations and basalt are cored using the Rotary Core Barrel (RCB) bottom hole assembly with a 9-7/8" four-cone tungsten carbide insert rotary coring bit. Diamond and PDC bits are also used in conjunction with Pressure Core Sampler (PCS), mud Motor Driven Core Barrels (MDCB) and numerous other coring tools now under engineering development. A narrow-kerf high-speed Diamond Coring System (DCS) using an active secondary heave compensator system is undergoing sea trials.

A wireline retrievable pore water sampler (WSTP) is deployed to gather pore fluid samples using a filtered probe that extends up to a meter ahead of the core bit into soft sediments. This tool cannot be used in indurated sediments or hard rock.

Cores barrels are retrieved through the drillstring using 1/2" wire rope "sandlines". Two redundant, electric, high speed sandline winches are available with depth capabilities up to 30,000 ft (9144m).

The electric-hydraulic logging unit provides a 30,000 foot (9144 m) capability for reentry, logging, explosive pipe severing and other electric wireline pipe severing and other electric wireline operations. Depending upon the activity in progress, the logging cable conductors may be connected to the Schlumberger "Cyber Service Unit" logging van, the dynamic positioning control room (atop the bridge), the downhole measurement lab (atop the laboratory stack), or the underway geophysics lab on the poop deck. A wireline motion compensator is installed adjacent to the logging winch. The active electric-hydraulic horizontal unit relies upon accelerometers as heave sensors. Such a system is required to decouple the vertical motion of the vessel from open-hole logging and seismic sondes, as there is no marine riser or other fixed link to the seafloor for reference.

Hydraulically and mechanically actuated bit releases allow 9-7/8" bits to be dropped so that the hole can be logged after the hole is drilled to total depth. This is important in holes drilled without re-entry tools as the drillpipe is the only connection with the wellbore since a riser is not used.

A third winch gives JOIDES Resolution an underwater television capability for reentry and other subsea work. The winch is also electric-hydraulic and holds 20,000 feet (6096m) of coaxial cable. It is located on the mezzanine deck below the rig floor and is rigged for deployment of the cable external to the drill string with both the underwater TV and a sonar tool mounted on a frame which rides down the outside of the drillpipe.

Logging and other downhole, electric wireline deployments can also be done using a custom-designed ODP side entry sub (CSES). This tool can be inserted anywhere in the drillstring and will carry full drillstring operating loads. Logging tools up to 3-3/4" diameter can be loaded into the CSES through the off-center side entry port. Inclusion of the CSES allows simultaneous axial movement of both wireline and drillstring without having to perform strip-over operations.

A variety of open-hole, casing, drill-in (rotatable) and wireline deployable packers have been used in ODP operations. However, only a non-rotatable, inflatable packer is currently in the ODP inventory. The "TAM" packer is 8-1/2" diameter as run and can be used to pack off open holes up to 12" diameter. It can be configured as a single or straddle packer and has multiple go-devil capabilities for accessing the various isolated zones for permeability testing. It has never been applied for acquiring in-situ formation fluid samples.

## SCIENTIFIC JUSTIFICATION

During the last 15 years interest in fluid circulation both in Layer I (sediments) and Layer II (basalts) of the oceanic crust has increased enormously, chiefly because of the realization of the importance of the role of fluids in driving crustal processes. Perhaps the most spectacular example is the role of hydrothermal processes in the creation and evolution of new oceanic crust, both at mid ocean ridge spreading centers and in back-arc basin spreading centers. In addition it is clear that off-axis fluid circulation in Layer II continues for long periods of time, evident from measured anomalies in heat flow, from geochemical evidence of continued alteration of the oceanic crust, as well as from pore water studies of the overlying Layer I sediments.

Drill holes penetrating Layer II at a relatively young age have shown that the upper part of Layer II is often characterised by zones of underpressure, causing substantial inflow of bottom waters into the formation. Sites 395, 396, and particularly Hole 504B are excellent examples for this phenomenon. There are also a few examples where the hole has been demonstrated to be producing. Also there is evidence that sea water of relatively recent origin has penetrated through Layer II below Layer I, thus influencing the pore fluids in the overlying sediments of Layer I.

In addition to the important implications of fluid flow in Layer II at mid ocean ridges and the implied continued flow in off axis situations, fluids also play a major role in sediments of carbonate platforms, where fluid flow has been surmised to be of importance (e.g., Bahamas,, Queensland Plateau, etc.). Of special interest also is fluid flow in sediments of continental margins. At passive margins fluid flow from either continental sources (meteoric waters) or resulting from lateral flow of fluids associated with sediment compaction and differential geothermal gradients has been observed. At active margins, especially those showing the formation of accretionary prisms, fluid flow as a result of compaction and sediment shortening, has been inferred on the basis of geophysical information, on the basis of hydrological modelling, and directly on the basis of observed alterations products associated with vein minerals and on geochemical anomalies in the pore fluid compositions. Indeed the geochemical evidence of anomalies in both fault zones and in potential aquifers associated with the zone of decollement of the accretionary complex, sets strong boundary conditions on any models attempting to explain hydrologic phenomena in accretionary complexes.

Notwithstanding the recognition of the importance of the fluid circulation associated with the above mentioned processes, recovery of fluids from actively circulating systems has hitherto been hampered by the lack of equipment capable of retrieving formation fluids in situ in the sediments and/or basalts. Most information obtained in the sediments is based on evidence obtained on pore fluids retrieved shipboard by extraction from retrieved sediments. Only for soft sediments is equipment available that can retrieve pore fluids and temperature/pressure information in-situ (WSTP-see below). However, especially in harder sediment sections (porosity < 30 %), but perhaps characterised by fracture porosity, and also in the upper part of Layer II, in situ recovery or any recovery of pore fluids has been difficult or imposible. Yet, especially in these situations, knowledge of the physico-chemical properties of the fluids (chemical composition, temperatures, pressures) is of importance in understanding hydro-geological processes.

## PROPOSED STUDY OF IN-SITU SAMPLING OPTIONS

In this proposal we suggest an analysis by a qualified consultant of the feasibilty of using in-situ methodologies aimed at gaining fluids from formations for physico-chemical characterisation. As mentioned above, the ODP has access to some equipment described below, but deployment as described herein has until now not been sucessful, despite the importance of obtaining samples and information.

The Ocean Drilling Program has presently access to two methodologies for in situ pore fluid retrieval:

1. Water Sampling-Temperature-Pressure Tool (WSTP)

An in situ pore fluid sampler was first deployed successfully during Leg 57A of the DSDP, and has since then been perfected with the addition of temperature and pressure measurement devices. In soft sediments this tool has provided important information both on in situ geochemical compositions of pore fluids and also on temperature anomalies associated with fluid flow in the sediments (e.g., Legs 110, 139, and 141 of ODP). In hard sediments this equipment fails as a result of failure of penetration or of cracking the formation with the tool.

2. Pressure core barrel

This equipment has been designed to retrieve sediments under pressure. Though this has been accomplished, methods still need to be worked out to retrieve both pore fluids and sediments under in situ conditions.

The above equipment, though representing important advances in technology for the retrieval of fluids under in situ conditions, is not appropriate for formations characterised by aquifers or by sediments/basalts that show fracture porosity. For this purpose it was envisioned to use the socalled wire line packer sampler, but this equipment failed during its first deployment during ODP Leg 133 (see Attachment 1).

The Downhole Measurements Panel (DMP) considered this problem of great importance and in August 1991 convened a working group consisting of various parties interested in the problem of in situ pore fluid retrieval. From the scientific side participants consisted of pore fluid geochemists and representatives of the SGPP and DMP panels. In addition the conference was attended by representatives of Industry. This work resulted in the issue of a working document (Attachment 2), but it was recommended and subsequently endorsed by DMP (October, 1991) that an advisory group should be constituted that would oversee an independent feasibility study concerning in situ pore water retrieval equipment for the above stated purposes. This group met at College Station on April 2, 1992 and drafted an RFP for this feasibility study. Below we present in detail the projected aims of this feasibility study.

## REQUIRED TECHNOLOGIES

The August 23 working group on in situ pore fluid sampling delineated several approaches that could be taken (section 6, Attachement 2), but agreed that an independent feasibilty study should be carried out.

Specifically the sampling apparatus should be able to achieve the following objectives:

1. The sampling of fluids from the formations in as pristine a fashion as possible emphasizing operiationability in: low porosity sediments; zones characterized by potential aquifers; fluids in Layer II of the oceanic crust, particularly those characterized by fracture porosity;

2. The apparatus should be compatible with ODP operations and should be characterised by simplicity and reliability and should be relatively easy to deploy;

3. The apparatus should provide some opportunity for in situ monitoring of the sampler (e.g., by conductivity measurements) and should, in principle, be accompanied by the possibility of monitoring formation temperature, pressure, and permeability.

## SPECIFIC REQUIREMENTS

Below some of the more specific requirements for the fluid sampling system are reviewed. This section is then followed by sections on: Technical Background; Specific Technical requirements for the RFP; Bidders and bidder requirements; Proposed Schedule.

1. Minimum requirements

The apparatus should be operable at temperatures of 100 °C or lower (higher temperatures, of course, would be of great use) and should obtain samples of a minimum size of 20 $cm^3$, with a capability of obtaining at least four samples at time intervals, thus allowing the posibility for extrapolation of geochemical information to in situ conditions.

2. Auxiliary information

Because of the desirability to obtain not only a water sample, but also information on formation properties - temperature, pressure, permeability - it will be of importance to obtain an evaluation of the feasibility of obtaining this information in a manner that does not compromise the fluid sampling.

3. The apparatus should possibly be equiped to verify sample identity, e.g., a conductivity device or other suitable, reliable detector.

4. Maximum acceptable pressure differential

Though limits are not known on maximum advisable pressure differentials, a minimum differential should be pursued - sufficient to allow fluid flow, but keeping the objective of minimum gas loss in mind.

5. Sample preservation

The apparatus should be designed to minimize contamination by apparatus (greases, etc.), and to minimize sample loss and in situ pressure loss.

6. Size of sampled zone

The minimum vertical packer spacing (if this is the option chosen) should be 1 - 5 meters, although methods based on packing of the lower portions of a hole should not be ruled out.

7. Depth resolution

The absolute depth of the sampling device downhole should be known to within 5 meters, so that correlations with logs remains possible.

8. Although it is not proposed to develop initially a sampler with maximized capabilities in terms of temperature limits, contamination, number of samples, the instrumentation should have the capability to be upgraded.

## PRIMARY TASKS TO BE COMPLETED BY THE CONTRACTOR

The contractor shall evaluate the methods and technologies available to the ODP to achieve the scientific objectives outined in the previous sections. A meeting of the ad-hoc working group on in situ pore fluid sampling on 23 August 1991 produced a list of five possibilities (see minutes, part 6 of Attachment 2). The contractor should consider these five options, as well as any additional options that are considered appropriate.

1. Consultation with ODP and other experts

The contractor shall consult with experts, as appropriate and necessary, who have experience unique to the ODP or to professions that have potential application to ODP operations. These experts may include ODP/TAMU engineering and operations personnel, experienced ODP scientists, members of the JOIDES and international partner communities, industrial scientists and engineers (from petroleum, geothermal, and hydrogeological bussinesses), and representatives of government and academic laboratories.

2. Evaluate hydrogeological setting

The contractor shall become familiar with DSDP and ODP experiences in oceanic boreholes. The contractor will complete a detailed analysis of the hydrogeological state of formations surrounding ODP drill holes in a variety of settings. This analysis should address the following fundamental question: *under what conditions is a formation likely to produce an appropriate fluid sample* ? The variables in this analysis should include formation properties (permeability, porosity, anisotropy, heterogeneity, and pore pressure - either under- or over-pressured, relative to a hydrostatic column) and operational parameters (borehole size, duration and rate of drilling, pumping rates and pressures). Particular attention should be paid to the problem of invasion into the formation of borehole fluids (seawater, drilling muds, and/or borehole cuttings). The relative volumes and probable radius from the borehole center of invasion fluids as well as their effect on the ability to gain access to in-situ uncontaminated fluids is of importance.

3. Evaluate sampling technologies

The contractor shall determine whether or not each of the proposed technologies and methods can be made to work in an appropriate ODP operating environment. Given a set of hydrogeological states, the likelihood of success of each of the techniques outlined previously should be evaluated. For each candidate technology, advantages and disadvantages should be listed and discussed. Some or all of the candidate technologies may be unlikely to succeed in gathering uncontaminated, in-situ fluid samples. Where this is the case it should be clearly stated along with the rationale for that judgement, based on documented results of actual similar experiences or comparable techniques. If documented cases cannot be found the opinions of experts in the field should be quoted, but labeled as opinion. The evaluation should concentrate on the ability of each technology to work under the conditions outlined through Item 2, above, and should address directly the following issues:

a. present state of development;

b. costs and time associated with additional development;

c. difficulty of operation (particularly for ODP personnel);

d. integration into standard ODP operations;

e. time required (shore and rig) to get a useful sample;

f. size of sampled zone;

g. method of disposal of "invaded" fluids;

h. time and difficulty of preparation for use, redressing, and maintenance;

i. probability of success;

j. quality of likely samples and data;

k. versatility, flexibility, and modification potential.

A summary of this evaluation might best be presented as a matrix, listing methods along one axis and the above issues along the other.

4. Choose the best candidate technology

Based on the above analyses, the contractor will recommend the best candidate for achieving the desired goals. The best candidate must meet the minimal scientific requirements outlined previously, but might not meet all the secondary (desirable) goals. The best candidate is not expected to be ideal in all catagories, but should represent a compromise of cost, performance, scientific quality, and likelihood of success. The contractor will provide a preliminary equipment/apparatus layout and an outline of a development plan (including estimated costs, time, and personnel).

5. Presentation of results

The contractor will make a preliminary oral presentation to the JOIDES Downhole Measurements Panel on the data shown in the Schedule section of this RFP and respond to questions. The contractor will provide a written report, at the date indicated on the Schedule, for distribution throughout the ODP community.

## BIDDER QUALIFICATIONS

Bidders must provide adequate statements of qualifications to be considered for award of this contract. Statements should include at least the following:

1. Engineering qualifications. Cite pertinent experience in: design and use of downhole sampling equipment (for oilfield, geothermal, geotechnical, or environmental monitoring), mechanical design in general, drilling/reservoir testing or completion work.

2. Hydro-geological qualifications. Cite pertinent experience in: reservoir analysis, including formations dominated by intergranular, vuggy and fracture porosity, formation invasion, analytical and numerical analysis methods, fluid analysis.

3. Past similar projects. Cite pertinent consulting experience or participation in projects involving design of downhole equipment, hydro-geological analyses, geotechnical surveys, etc.

4. Personnel/Resumés. Identify key individuals who would be assigned to critical roles in the feasibility study and provide resumés showing their experience and qualifications for the work. In particular, individuals for both mechanical design and hydro-geological evaluation must be named.

5. Teams. Those interested organizations that do not have individuals exactly suited to satisfy both mechanical engineering and hydro-geological expertise requirements are encouraged to form teams composed of critical personnel from various organizations capable of satisfying the qualification criteria. Team members must be identified with area of expertise and role/responsibility in the feasibility study explicitly stated. Team members must report through a single organization which will be awarded the contract for the study.

## SCHEDULE

| | |
|---|---|
| Issue of RFP (JOI/NSF): | September 1, 1992 |
| Responses to RFP: | November 1, 1992 |
| Evaluation of responses: | November 20, 1992 |
| Bidder selection: | November 30, 1992 |
| Contract: | December 15, 1992 or earlier |
| Oral report: | March 30, 1993 |
| Written report: | May 1, 1993 |

000342

## BIDDERS LIST

1. Foreign ODP offices

2. Woodward-Clyde
   900 - 4th Ave.
   Suite 3440
   Seattle, WA. 98164
   Attn.: Dr. Elliott Taylor
   Phone: (206) 343-7933

3. Stress Engineering Services, Inc.
   13800 Westfair East Dr.
   Houston, TX 77041-1101
   Attn.: Dr. Joe Fowler
   Phone: (713) 955-2900

4. Science Application International
   19062 Denver West Parkway, #200
   Golden, CO 80401
   Attn.: Dr. Dermot Ross-Brown
   Phone: (303) 279-7242

5. Madden Systems Inc.
   P.O. Box 3147
   Odessa, TX 79760
   Attn.: Raymond Madden
   Phone: (915) 363-8058

6. Halliburton Reservoir Services
   P.O. Box 721110
   Houston, TX 77272
   Attn.: Lance Rayne
   Phone: (713) 561-1450

7. Fugro-McClelland
   P.O. Box 740010
   Houston, TX 77274
   Attn.: Ron Boggess
   Phone: (713) 778-5501

8. Southern International
   4401 Northwest 4th St.
   Suite 121
   Oklahoma City, OK 73107
   Attn.: Terry Brittenham
   Phone: (405) 943-5288

9. Aumann & Associates
   5248 Pinehurst
   Suite B140

Murray, UT 84123
Attn.: Jim Aumann
Phone: (801) 261-3001

10. Schlumberger Testing Services
369 Tristar Drive
Webster, TX 77598
Attn.: Kieth Palmer
Phone: (713) 480-2000

11. Sandia National Laboratory
Geoscience Research Drilling Office
Division 6252
P.O. Box 5200
Albuquerque, NM 87185
Attn.: Dr. Peter Lysne
Phone: (505) 846-6328

12. New England Research
76 Olcott Drive
White River Junction, VT 05001
Attn.: Dr. Randy Martin
Phone: (802) 296-2401

13. Lawrence Berkeley Laboratory
Earth Sciences Division
1 Cyclotron Road
Berkeley, CA 94720
Attn.: Harold Wollenberg
Phone: (415) 486-5344

14. Los Alamos National Laboratory
J514, INC-7
Los Alamos, NM 87545
Attn.: Dave Janecky
Phone: (505) 667-0152, 665-4308

15. Gartner Lee, Inc.
105 Main Street
Niagara Falls, NY 14303
Attn.: Dave Slaine, Phone: (716) 285-5448
Attn.: Bob Leech, Phone: (416) 477-8400

16. Hydrogeologic
1165 Herndon Parkway
Suite 900
Herndon, VA 22070
Attn.: David Back
Phone: (703) 478-5186

17. Camp, Dresser and McKee
    One Cambridge Center
    Cambridge, MA 02142
    Attn.: Brent McArthy
    Phone: (617) 252-8259

18. GSEE Consultants
    599 Waldron Road
    Laverne, TN 37086
    Attn.: Mike Hicks
    Phone: (615) 793-5747

19. Stren Company
    10115 Sweetwater
    Houston, TX 77037
    Attn.: Donald May
    Phone: (713) 820-0202

20. Baker Oil Tools
    P.O. Box 3048
    Houston, TX 77253
    Attn.: Dodd Miller
    Phone: (713) 923-9557

21. TerraTek Drilling Research Laboratory
    University Research Park
    400 Wakara Way
    Salt Lake City, UT 84108
    Attn.: Craig Hyland
    Phone: (801) 584-2482

22. Geophysical Research Corporation
    Tulsa
    Oklahoma

000345

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SCRIPPS INSTITUTION OF OCEANOGRAPHY LA JOLLA, CALIFORNIA 92093

May 14,1992

Dr. Thomas Pyle
Joint Oceanographic Institutions Inc.
1755 Massachusetts Avenue, NW, Suite 800
Washington D.C. 20036-2102

Dear Tom:

As you probably know already, I was asked by Paul Worthington to act as chair of the small working group in charge of writing the Request for Proposals concerning a feasibility study for in situ fluid sampling in the Ocean Drilling Program.

I include the minutes of this meeting as well as the proposed text for the RFP with additional information, e.g., bidders list. As you will note, our proposed schedule called for us to submit the final RFP to you by May 22. I am happy to be in time and on schedule.

I understand from Keir Becker that PCOM has given its blessing to the RFP, at least in principle. The Downhole Measurements Panel considers this study of high priority and for these reasons we hope that the necessary funds can be allocated sothat the schedule as proposed can be followed.

I will be glad to furnish any other information that you may need, including a floppy disk with the RFP in Wordperfect 1.02.

Will you be in Windischeschenbach in June ? I hope we can get a positive response from your side before or at that time. I will leave for Europe on May 27.

Thank you very much,

Joris M. Gieskes

cc. A.Fisher ODP/TAMU
P.Worthington DMP
K. Becker PCOM
P.Swart SGPP

000346

UNIVERSITY OF
# Miami

RECEIVED
MAY 2 6 1992
Ans'd............

22 May, 1992

Dr. Jamie Austin
JOIDES OFFICE
Institute for Geophysics
University of Texas at Austin
8701 Mopac Boulevard
Austin, TX 78759-8345

Dear Jamie,

As we discussed on the phone, enclosed please find a copy of the draft RFP for fluid sampling. Joris recently mailed this to Tom Pyle, with my encouragement based on the last PCOM, and we will discuss it in 10 days at the DMP.

Note that I have not made you copies of the two lengthy attachments which Joris included, because these have already been distributed with previous DMP minutes and are presumably already in your files. These attachments are: first, the report on the wireline packer prepared by Erich Scholz for the February 1991 DMP, and second, the report of the Working Group on Fluid Sampling held in August 1991.

As promised, I will contact you by telemail, fax, or phone on June 11 or 12, to report on the DMP response to these documents, so that you can carry the matter on to EXCOM.

Best regards,

Keir

Keir Becker

Rosenstiel School of Marine and Atmospheric Science
Division of Marine Geology and Geophysics
4600 Rickenbacker Causeway
Miami, Florida 33149-1098
(305) 361-4663

FAX (305) 361-4632

000347

RECEIVED
JUN 1 0 1992
Ans'd............

28 May 1992

Dr. Joris Gieskes
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093

Dear Joris;

Thank you for sending me the proposed text for the RFP on *in situ* fluid sampling in ODP. I have two initial reactions: 1) shouldn't the name of the working group and the title of the document be modified to "*in situ* pore fluid sampling," emphasis on the pore? A separate effort on borehole fluid sampling is being led by an ad hoc committee chaired by John Edmond and working with Pete Lysne at Sandia. (Having 2 groups probably emphasizes the importance of fluid sampling. We should make the differences clear at the same time we ask people like yourself to work with both groups and foster coordination of efforts where possible.); 2) I am not prepared to consider this proposal until it has been reviewed by PCOM. Jamie Austin agrees and says that PCOM has always planned to consider the working group's report (in August) after the DMP makes its comments and recommendations (in June).

Since this RFP effort is not in the current budget and I anticipate budget cuts next year (probable loss of 1 partner), PCOM will probably have to make some tough recommendations on priorities at its August meeting. Have you estimated the cost of doing the work outlined in the RFP?

After writing the paragraphs above, I realize that I sound very negative. It may not be my preferred style but it's probably a realistic view of the technology development and budgetary situation in ODP.

Best regards to you and all of DMP.

Sincerely,

Dr. Thomas E. Pyle
Vice President and Director,
Ocean Drilling Programs

cc: J. Austin (PCOM)
~~K. Becker (PCOM)~~
P. Worthington (DMP)
P. Swart (SGPP)
A. Fisher (TAMU)
D. Goldberg (LDGO)

000348

RECEIVED
JUL 2 1 1992
Ans'd............

Charfield House
Woodlands Ride
Ascot
Berkshire SL5 9HP
United Kingdom

19 June 1992

Dr Jamie Austin
Institute for Geophysics
UT at Austin

**FAX to ++ 1 512 471 0999**

Dear Jamie

**JOIDES STEERING GROUP FOR IN-SITU PORE-FLUID SAMPLING**

Thank you for your FAX in connection with the above matter: this has been read to me by telephone. At the last DMP meeting, Panel decided to hold the second meeting of the Steering Group as an adjunct to the September 1992 DMP meeting, in accordance with the need to optimise travel costs. However, that decision was based on the assumption that matters would progress at the projected rate. This has not happened. First of all, PCOM did not debate the issue properly at their April meeting. The PCOM minutes do describe an inconclusive discussion, which was singularly lacking in profundity. At the end of that discussion, the minutes state that PCOM will return to the issue later in the meeting. I cannot find any further discussion of the matter. I suspect that PCOM were passing the buck to DMP on the grounds that DMP had not had the opportunity to endorse the RFP that PCOM were being asked to discuss, even though the RFP had been prepared by an approved sub-group of DMP. As a consequence, JOI are not prepared to progress the matter because it has not yet been approved by PCOM. The Steering Group will therefore not be in a position to review the response to the RFP at the September DMP meeting as originally planned, because there is now insufficient lead time.

PCOM now have the DMP endorsement and can move to accept the DMP recommendation so that the matter be progressed. JOI will then be able to issue the RFP if the funding situation looks favourable. The Steering Group should therefore be in a position to review responses to the RFP around the January 1993 DMP meeting, which is targeted for College Station. We will have lost four months. I therefore see little point in the Steering Group meeting as an adjunct to DMP in September, although the subject will be discussed by Panel as a whole. That is why I have not formally requested the Steering Group meeting. Of course, it is possible that things have moved on again. If so, and Joris feels comfortable, there could be merit in the Group meeting as such in September. Should this be the case, please advise me by FAX in Damascus, marking the FAX as follows:

Dr P F Worthington (GCA), c/o Dr R Raslan, FAX No. ++ 963 11 246006

I will be in Damascus until 30 July or so, when I will be back in the UK for a few days.

Kind regards

Paul

Paul F Worthington

cc Joris Gieskes
**FAX ++ 1 619 534 0784**

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RECEIVED
JUN 29 1992
Ans'd............

Dr. Thomas E. Pyle
Vice President and Director
Joint Oceanographic Instutions Inc.
Suite 800
1755 Massachusetts Ave NW
Washington DC 20036-2102

June 24,1992

**FAX 202-232-8203**

Dear Tom:

Thank you for your letter of 28 May 1992, which, unfortunately, arrived too late for a discussion at the Down Hole Measurements Meeting in Windischeschenbach. The postponement till August for a PCOM discussion and a subsequent prioritization will, of course, put a delay in the system and necessitate a shift in the schedule envisaged in the document. However, I do hope that shortly after the PCOM meeting we can get the ball rolling. Let me assure you that the DMP, and the panels most interested in this study (SGPP, Tectonics panel) are very strongly interested in this RFP and are of the opinion that this feasibility study is a high priority item, especially because there is an urgent need to obtain appropriate formation fluid samples and potential ancillary information on formation properties.

I am aware that Peter Lysne and I are also members of the high temperature borehole fluid sampling group, but the item being considered here is different, though perhaps complimentary. We are interested here in fluids from the formation, whereas in the bore hole sampling group we are targeting, in particular, high temperature fluid sampling in the borehole itself. There is a most important difference here. In fact we are looking for a sampler in formations less hot than the one considered by Lysne. However, some of the conclusions of this proposed feasibility study will have, without a doubt, a direct bearing on that project. Nonetheless there is no conflict.

During the DMP meeting both Jean Bahr (SGPP) and Casey Moore (Tectonics) strongly supported the idea of this feasibility study and the only complaint they offered was about the lesser emphasis on *in situ* temperature and permeability measurement possibilities. These items, of course, feature in the text under item 3. in "Required Technologies". I have slightly altered this part of the RFP for greater emphasis on a potential combination of such measurements in a possible tool. However, the emphasis remains on fluid sampling. Naturally we had set our hopes on an issue of the RFP prior to the August PCOM meeting, and indeed the September DMP meeting was supposed to have been preceeded by a meeting of our committee for an evaluation of the responses to the RFP. I hope that an RFP can be issued shortly after the PCOM meeting. This should make it possible to conclude the entire process by May 1993, rather than by March 1993.

Of course, you brought up the interesting problem of financing this project. It seems rather impractical to go the route of an official NSF proposal, but we need some guidance as to how to proceed. We omitted mention of funds on purpose, hoping for an unrestricted bidder option. On the other hand there should be some assurance available for the support of this project. We would appreciate your input into this matter, perhaps after discussion with Bruce Malfait. The urgency of the study requires that we should have pathways available other than just mere funds of opportunity such as OPCOM or available funds dependent on ODP partnership. We are willing to co-operate in this matter, but we need some guidance about how to approach this critical financing problem.

If the feasibility study comes to a negative conclusion this is of importance to the thematic panels, but if the result is positive, then the matter is even more urgent, because then proposals must be made to actually produce the proposed equipment. The feasibility study is, after all, intended to serve as a guideline to build (or not to build) equipment that will serve the ODP science community. We cannot act on proposals for this stage until the feasibility study has been carried out. The need to make maximum use of the ship for sampling purposes, of course, is an immediate problem.

Please let me know what I can do to help speed things up. DMP will, as always, try to serve the community to its best ability and the present item is considered of great importance in this respect.

I will forward under separate cover the slightly modified version of the RFP, the appendices are already in your hands. These modifications were in response to the discussions during the DMP meetings.

With best regards,

Joris M. Gieskes
Member DMP

cc. J.Austin (PCOM)
K.Becker (PCOM)
A.Fisher (TAMU)
P.Worthingtom (DMP)
D.Goldberg (LDGO)
P.Swart (SGPP)
J.Bahr (SGPP)
J.C.Moore (Tectonics Panel)
P.Lysne (DMP)

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Dr. James A. Austin
Institute for Geophysics
University of Texas at Austin
8701 Mopoc Boulevard
Austin TX 78759-8345

July 20,1992

FAX 512-471-0999

Dear James:

I include a Fax to Paul Worthington regarding the proposed meeting of the in situ Pore Fluids Sampling Committee. I guess you will agree with me that this meeting would be premature.

I do hope that you received my letter including the copy of my letter to Tom Pyle. I guess that the main problem is one that concerns funding. Let me assure you that we would like to get this study going as soon as possible and that I will do my best to get things going from the science and operations side. I have been assured of Andy Fisher's and Keir Becker's co-operation on this matter. A copy of the "final" version, including a new schedule will be sent separately.

With best wishes for a successful PCOM meeting.

Yours,

Joris M. Gieskes

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Dr. Thomas E. Pyle
Vice President and Director
Joint Oceanographic Institutions Inc.
Suite 800
1755 Massachusetts Ave NW
Washington DC 20036-2102

July 20,1992

FAX 202-232-8203

Dear Tom:

I include a FAX that I sent to Paul Worthington on July 20. I hope that you received my previous letter of June 24. I am looking forward to your response re the questions posed on the potential funding of this feasibility study. On my side I will do the best to get something going as soon as possible.

Please let me know and what I can do to get things on the way. The "final" version of the RFP is being mailed separately.

With best regards,

Joris

Joris M. Gieskes

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Dr. Paul Worthington
Charfield House
23 Woodslands Ride
Ascot
Berkshire SL5 9HP
England (UK)

July 20,1992

RECEIVED
JUL 2 0 1992
Ans'd...........

FAX 44-344-291-292

Dear Paul:

I received the FAX from James Austin re the DMP *in situ* pore fluid sampling meeting. I trust that you received my letter of June 26,1992

Under the circumstances I think that this meeting would be premature. The problem is simply that the original plans called for this meeting in conjunction with the September DMP meeting under the proviso that this meeting would be held in order to evaluate responses to the RFP. Unfortunately, of course, this will not be possible because we went under the (false) assumption that the RFP would be issued in May or June this year. Keir informed me that the decision re the RFP would be made during the August PCOM meeting. For these reasons the time schedule would have to slip and I propose the new schedule below:

## SCHEDULE

| | |
|---|---|
| Issue of RFP (JOI/NSF): | September 1, 1992 |
| Responses to RFP: | November 1, 1992 |
| Evaluation of responses: | November 20, 1992 |
| Bidder selection: | November 30, 1992 |
| Contract: | December 15, 1992 or earlier |
| Oral report: | March 30, 1993 |
| Written report: | May 1, 1993 |

Naturally, in order to keep things going we would need a separate meeting in College Station on November 20, but this ought not to be a major financial burden, two members being in College Station. Of course, sea going plans of Keir, Andy, etc., may interfere slightly with this, but probably not more than a few weeks. The main purpose would be to get going as soon as possible, definitely before the DMP meeting in January in College Station.

Please let me know your thoughts on these matters. I will forward a modified version of the proposal to James Austin and Keir Becker this week.

cc. J.Austin (PCOM)
K.Becker (PCOM)
A.Fisher (TAMU)
P.Swart (SGPP)
P.Lysne (DMP)
T.Pyle (JOI)

Joris

Joris M.Gieskes
FAX 619-534-2997 TEL 619-534-4257

000354

JOIDES Office
The University of Texas at Austin
Institute for Geophysics
8701 Mopac Boulevard
Austin, Texas 78759-8345

000355

Tel: (512) 471-0471 or 471-6156
Fax: (512) 471-0999
Telemail: JOIDES.UTIG
Telex: 7408994 JOID UC
Email: joides@utig.ig.utexas.edu

June 5, 1992

**MEMORANDUM**

**TO:** Brian T. R. Lewis

**FROM:** A. Maxwell, Chairman EXCOM

**SUBJECT:** PCOM comments on Briden report

Thank you for the comments concerning the Briden report. These will be presented to the EXCOM for discussion at its meeting in Washington DC in June. I appreciate PCOM's concern over this important report.

I would like to ensure PCOM is clear about certain aspects of the report and some of the subsequent actions. First, the Briden Committee was set up purposefully as a one person committee. This was done in order to have a single individual identify some problems that were facing EXCOM in connection with renewal of ODP. By so doing, nothing that was to come before EXCOM would be in concrete. In essence, it would only be the ideas of one member, which EXCOM could debate and approve each on its own merit. While Briden's initial concerns primarily involved multiple platforms, it was obvious to him, and EXCOM, that the future health of the program as an international endeavor required looking into other aspects as well. Briden did a superlative job in focussing the issues in his report.

Second, the Briden report was first discussed at the EXCOM meeting in Bonn in January. The general ideas of the report were approved by EXCOM with the reservation that many items required additional consideration before final action could be taken. At that time, some of the more easily resolved items were approved, others were referred to appropriate groups to study before further action was to be taken. In particular, a subcommittee consisting of Drs. Craig Dorman, Hans Dürbaum, and Dave Falvey was established to consider a number of items having to do with subcontracting and the incorporation of multiple ships into the program. NSF specifically requested actions on these items prior to the Joint ODP Council/JOIDES EXCOM meeting that is to be held on June 16. At the Bonn EXCOM meeting, a plan of action for the Dorman

OCEAN DRILLING PROGRAM

**Joint Oceanographic Institutions for Deep Earth Sampling**

• University of California, San Diego, Scripps Institution of Oceanography • Canada-Australia Consortium •
• Columbia University, Lamont-Doherty Geological Observatory •
• European Science Foundation: Belgium, Denmark, Finland, Greece, Iceland, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, and Turkey •
• France: Institut Francais de Recherche pour l'Exploitation de la Mer • Germany: Bundesanstalt für Geowissenschaften und Rohstoffe •
• University of Hawaii, School of Ocean and Earth Science and Technology • Japan: Ocean Research Institute, University of Tokyo •
• University of Miami, Rosenstiel School of Marine and Atmospheric Science • Oregon State University, College of Oceanography •
• University of Rhode Island, Graduate School of Oceanography • Texas A&M University, College of Geosciences •
• University of Texas at Austin, Institute for Geophysics • United Kingdom: Natural Environment Research Council •
• USSR: Institute of Lithosphere, USSR Academy of Sciences • University of Washington, College of Ocean and Fishery Sciences •
• Woods Hole Oceanographic Institution •

committee was approved that allowed for a fast-track approach to have the results by June. The Dorman committee has completed its work and its report will be discussed at a special meeting of the EXCOM just prior to the joint meeting with the ODP Council.

It is somewhat unfortunate that because of poor communications on my part, as well as Australia's, that all of the above information was not made available to Canada. Because of this, some of the Dorman committee's requests have been misinterpreted by some international partners. I regret this oversight, but it should not be blown out of proportion.

Lastly, I wish to emphasize, the Briden study and the subsequent Dorman study were fully sanctioned by the entire EXCOM and were undertaken in response to an urgent need to develop information requested by some member countries and NSF prior to agreeing to renewal of the long-term ODP contract. The reports of these studies, along with the PEC III report, all of which have some recommendations in common, have been or will be made available in their entireties to PCOM. Further, you will find that the Briden and Dorman committees along with EXCOM consider that PCOM and the other JOIDES advisory bodies should be involved in all appropriate decisions. EXCOM has involved PCOM in the past, and will continue in the future to keep it fully informed on all appropriate matters.

I hope these comments will allay some of the concerns expressed in your memo of May 21, 1992.

cc: EXCOM
PCOM
NSF
JOIDES Office
JOI,Inc.

000357

UNIVERSITY OF WASHINGTON CORRESPONDENCE

May 21, 1992

TO: J. Austin
FAX# (512) 471-0999

RECEIVED
MAY 2 1 1992
Ans'd............

FROM: Brian T.R. Lewis

Subject: PCOM comments on Briden report

The attached report reflects the imput of M. Langseth, J. Malpas & B. Lewis.

Dear EXCOM:

At our April 21-23 PCOM meeting, we reviewed the Briden report and discussed the recommendations made and the actions taken by EXCOM. Our immediate reaction is to applaud the lucid and comprehensive perspective on the scientific ocean drilling program that the Briden report presents. The report appears to have provided sufficient impetus to the Executive Committee for it to undertake a review of the management structure and program operations. Scientific ocean drilling is indeed approaching a watershed, and it is entirely appropriate to undertake such a review. EXCOM's prompt action is in line with this. However, the report also motivated EXCOM to implement, immediately, certain actions which we believe were made without due consideration. More importantly, without full scientific consideration.

The main theme of the Briden report is increased internationalization of the program. The report recommends a number of steps that might lead to an increased role for non-US partners in funding, planning and management, with a concomitant decrease in the role of the United States JOI institutions. Most of these steps will will clearly have a profound impact in the commitment of all partners. As a consequence, it is crucial that the recommendations be fully understood and fully evaluated at all levels in the program especially in light of potential benefits or possible detriments to the science that the science is designed to investigate.

We note that the Briden committee in the first instance was set up to examine possible modes of managing a program involving multiple platforms. That is, to respond to French, Russian and Japanese intentions to build deep-ocean drillships that might be used in such a program. This was probably appropriate for a one-man committee, but somehow the mandate became much more. As such, the report reflects one man's view of what a future internationalized ocean drilling program might look like. It has many singular perspectives that could be considered inappropriate. It likely requires extensive revision.

ODP has always been consultative at all levels in the past; however, in this case there was an apparent lack of consultation with other elements of ODP, particularly in that there was insufficient time for international partners to fully discuss the implications of the report. We therefore request that the Executive Committee ask the full planning structure to comment on the implications of the Briden recommendations before any further actions are taken. It is in this light that we express concern over the establishment of the Dorman committee and its precipitate actions without due consultation. JOIDES members, in particular some no-US partners, were put in an awkward position having to reply to apparently formal RFP's with neither the necessary background data, time, nor any clear statement as to what was intended by these RFP's. We viewed this as a wholly unacceptable way to determine serious interest in participation in the management and implementations of the program.

Our recommendation then is an immediate discussion of the Briden report and the implications of the Dorman committee by each of the partners in ODP and all elements of the planning and advisory structure. Each should provide a considered position paper on the Briden recommendations. These position papers should discuss the implications of the internationalization for science planning, service panels and the science operator. PCOM is concerned that we are being rushed into a major program restructuring perhaps because of the necessity of dealing with one or two changes in subcontracts, but most definitely without due consultation.

PCOM

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000360

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY · DAVIS · IRVINE · LOS ANGELES · RIVERSIDE · SAN DIEGO · SAN FRANCISCO | SANTA BARBARA · SANTA CRUZ

MARINE PHYSICAL LABORATORY, 0205
SCRIPPS INSTITUTION OF OCEANOGRAPHY

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0205

July 10, 1992

To: Chair, JOIDES Executive Committee

From: F. N. Spiess

Info: JOI (Kappel)
Co-Chairs, JOI/IRIS OSN Steering Committee
Chair, USSAC
Chair, JOIDES Planning Committee

Subj: Use of hole OSN-1

The purpose of this letter is to keep the community informed as to implementation of the in-hole testing of our wireline re-entry system within the framework of our contract, JOE-JSC2-89.

In response to a USSAC/JOI RFP my group was awarded a contract to build and operate a system that can be deployed from the larger UNOLS ships to do reconnaissance logging and support conduct of a wide range of experiments in DSDP/ODP holes. Our contract with JOI included a plan to test the resulting system in DSDP hole 534, using R/V Melville, in early 1991. As a result of delays in availability of Melville, and Knorr, the in-hole operations were repeatedly postponed.

During this period, hole OSN-1 was drilled in the Pacific Ocean floor near Hawaii to provide a test site for development of equipment, testing of operational procedures, and evaluation of the advantges of emplacement of low frequency seismometers in drill-holes rather than some other approach. At an OSN steering committee meeting, it was decided that it would be desirable to log that hole at an early time in order to determine the condition of the lower, uncased, portion. It was thus decided to investigate the financial and operational aspects of shifting our first in-hole test from 534 to OSN-1. As a result we have now scheduled this test operation, required and funded under our existing JOI contract, to take place in October, 1992, using R/V Moana Wave as the support ship.

It is our impression that this timing will not conflict with other operations at OSN-1. If further changes of plans occur, we will keep you informed.

The Biological Station is situated on a 15-acre property. Besides the main dormitory building's single and double rooms, a new dormitory consisting of 11 twin-bedded rooms, one-, two-, and three-bedroom apartments and cottages accommodate our visitors. As there is a wide variety of accommodation, space is allocated on an as needed and first come, first served basis. Some participants may be required to share rooms. Please be advised that we are a working field station and accommodations are basic but clean and comfortable. Three meals a day are provided cafeteria style in our Dining Hall.

The airport is approximately 5 minutes from the Biological Station and taxi fare is $7.00-$9.00. The US dollar is on par with the Bermuda dollar and both currencies are accepted. Participants must arrange their own taxi from the airport to the station, however, taxi's will be arranged for departure. Most tourists rent mopeds or bicycles while on the island because cars are not for hire. An adequate bus service and mini-bus service are also available The business centre, the City of Hamilton, is approximately 15 miles from BBSR and the village of St. George's is approximately 2 miles away.

The ODP Conference rate is $130 per participant, per day. Please refer to the participant information form for rates of guests and spouses. This conference rate includes the following facilities and services:

- room and board for each participant;
- the meeting room(s) or lab(s) your group uses;
- audio/visual equipment;
- photocopy machine use;
- office supplies (tablets and pens);
- coffee breaks (two per day);
- cocktail party on the day of arrival; and
- the services of our conference coordinator.

We will provide a "welcome packet" for you which will include information about BBSR, a map of Bermuda, a bus schedule, identification badges and the agenda for your meeting.

The Biological Station accepts cash, travelers cheques, personal cheques, Visa and Mastercard. We do not, however, accept American Express.

December weather is difficult to predict and can range from 55°-75°F. Bring a warm sweater, slacks or jeans, a pair of shorts, swimwear, rainwear and a jacket and tie or dress for any evening outings.

Should you require further information, or change your requirements, please do not hesitate to contact Isabella Pearson by facsimile at 809-297-8143, by telephone at 809-297-1880, or by telemail to I.PEARSON.

## BEFORE ARRIVAL

**SHIPPING**
When shipping equipment and/or chemicals to BBSR, consign all materials to:

Bermuda Biological Station for Research, Inc.
Ferry Reach GE 01
Bermuda
Attention: (your name here)

*Do not place your name at the top of the address or a wharfage fee will have to be paid.*

Please send an itemized list of all equipment and supplies together with value of same, with shipment to BBSR. It will be used as the invoice for Customs clearance. Without an invoice, goods cannot be released from the warehouse. Freight will be picked up from the airport or docks. A $38 minimum handling and trucking charge will be made for this service.

## ON ARRIVAL

1) Register at reception in Hanson Hall immediately on arrival.
2) Request an orientation tour of our facilities at the Operations Office.
3) Confirm lab, truck or boat bookings at the Operations Office.

## BEFORE DEPARTING

At least one day before leaving, please contact the Receptionist regarding the settlement of your bill. Payment may only be made in U.S. cash, personal check, Visa or MasterCard.

Outbound freight shipping: Advise the Operations Office of the number of boxes to be returned to your home institution and the airport to which they should be sent. Please ensure that al[illegible]ight is well packed and clearly addre[illegible]. A $53 minimum handling and trucking fee will be made for this service.

## IMPORTANT INFORMATION

**CHEMICALS**
A limited supply of chemicals is available at BBSR. Please check on your requirements in advance of arrival.

**RADIOACTIVE MATERIAL**
All potential users of radioisotopes must obtain permission from the BBSR Radiation Safety Officer before bringing radioactive material to Bermuda. See the research application form for details.

**TOXIC WASTE**
Visitors are personally responsible for the disposal of their toxic chemicals. We strongly encourage visitors to take waste material back to their home institution for disposal.

**INSURANCE**
As BBSR does not carry specific insurance to cover individual needs, we strongly suggest that you provide your own insurance for health, accident, equipment damage or loss. We require that all group leaders carry liability insurance, with BBSR as a named insured on the policy.

**PUBLICATIONS**
Field guides to Bermuda's biology, ecology and geology, plus other selected items are available at a small charge from our library.

**SCUBA**
BBSR is a member of the American Academy of Underwater Sciences (AAUS). AAUS accreditation and/or proof of certification and 12 logged dives within the previous 12 months are required. Regulation and waiver forms must be completed. Tanks, weights and belts are available. Visitors must supply their own regulator, b.c., etc. For further information, contact the Dive Safety Officer.

**PASSPORT/VISA RE[illegible]UIREMENTS**
Check with your trave[illegible]ent or government with regard to specific entry requirements

# THE BERMUDA BIOLOGICAL STATION FOR RESEARCH, INC.

000364

BERMUDA BIOLOGICAL STATION FOR RESEARCH INC. 1926

**SCHEDULE OF FEES**
(effective January 1, 1992)


| | |
|---|---|
| Address: | Bermuda Biological Station for Research, Inc. Ferry Reach GE01 BERMUDA |
| Telephone: | (809) 297-1880 |
| Fax: | (809) 297-8143 |
| Telemail: | BDA. Biostation |
| Telex: | BA 3246 |
| Cable: | Biostation, Bermuda |


Bermuda is on Atlantic Standard Time

PRICES ARE QUOTED IN U.S. DOLLARS AND ARE SUBJECT TO CHANGE WITHOUT NOTICE

## FEES F INDIVIDUALS

ACILITIES FEE
or all scientists, technicians and students.

| | |
|---|---|
| enior Investigators, ssistants, and Technicians: | $55/person/day |
| raduate Students: | $37/person/day |

or U.S. federally funded projects, a negotiable verhead rate applies; this may vary from the bove rates. Individuals planning to submit a roposal for a research project at BBSR to a ederal or other agency should contact the ssistant Director, Finance.

GRANTS-IN-AID
Small grants are available to help defray n-house costs, i.e. facilities fees and boat rental. Please contact the Education Office for more nformation and applications.

ACCOMMODATIONS AND MEALS

| Units with Kitchen | |
|---|---|
| 1 Bedroom | $85 /day |
| 2 Bedroom | $115 /day |
| 3 Bedroom | $140 /day |

| Rooms | |
|---|---|
| Single (single bed) | $58 /day |
| Double (double bed) | $75 /day |
| Twin (2 single beds) | $80 /day |

| Meals | |
|---|---|
| Breakfast | $6.50 |
| Lunch | $8.50 |
| Dinner | $13.50 |

## FEES FOR GROUPS

Fees include accommodation, meals and lab, lecture and library facilities.

| Educational Groups | For 1st Week | Thereafter |
|---|---|---|
| 10-14 people | $495/person | $71/day |
| 15-19 people | $479/person | $69/day |
| 20-30 people | $435/person | $67/day |

One educational group leader will be admitted free of charge for every 10 fee paying group members.

Discounts are available to groups staying for more than one month or who are in residence between December 1st and February 28th.

First-time groups are entitled to planning help from the BBSR Education Office and one free lecture from a BBSR staff member. Rates for staff assistance in lecturing and field-trip organization are $65 per lecture and $75 per half day for field or lab assistance.

CONFERENCES AND WORKSHOPS
The daily fee for conferences and workshops, including accommodation, meals and use of facilities, is $130 per person. Please contact the reservations office for more information.

## DEPOSITS

Reservations will not be confirmed until a non-refundable, non-transferable booking deposit is received:

| | | |
|---|---|---|
| Individuals: | (2 mo. in advance) | $150/person |
| Groups: | (4 mo. in advance) | $150/person |
| Conferences: | (2 mo. in advance) | $150/person |

## MARINE AND TRUCK

BOATS
*BBS II* or *Velella* with operator:

| | |
|---|---|
| 2 hour minimum | $70/hour |
| Overtime | $80/hour |
| Half-day rate 8 am-12 noon | $200/half-day |
| Half-day rate 1 pm-5 pm | $200/half-day |
| Half-day overtime rate | $250/half-day |

The reduced half-day rate only applies to trips which begin and end within the hours shown.

Please call the Assistant Director, Operations for *R/V Weatherbird II* rates.

SCUBA TANKS

| | |
|---|---|
| Includes use of tank, weight belt and weights | $7.50/fill |

TRUCK
Truck with driver (24 people max.):

| | |
|---|---|
| 1 hour minimum | $40/hour |
| Overtime | $55/hour |
| Half-day rate 8 am-12 noon | $120/half-day |
| Half-day rate 1 pm-5 pm | $120/half-day |
| Half-day rate - overtime | $160/half-day |

Truck is not available on Sundays or public holidays.

NOTE: Overtime rates apply to weekends, public holidays and weekdays before 8 a.m. and after 5 p.m. Long-term charter rates are negotiable. Contact the Assistant Director, Operations.

CANCELLATION CHARGES
If booked marine and truck services are not utilized, a cancellation fee will be charged. Cancellations must be made at least 24 hours in advance.

STORAGE
Space for scientific equipment storage is available at $0.33 per cubic foot per month.

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# Active ODP proposals, 30 July 1992

(List does not include ~12 new/updated proposals expected to arrive 31 July/1 Aug.)

| Ref.No | Received | Key Title | Contact | Re-viewed | * Globally Ranked | Drilled or Scheduled |
|---|---|---|---|---|---|---|
| 086-Rev2 | 07/27/92 | Red Sea | Bonatti, E. | IR | | |
| 142-Rev | 04/05/89 | Ontong Java Plateau | Mayer, L. | | 1991 | Leg 130 |
| 253-Rev | 06/19/91 | Pac. black shales | Sliter, W.V. | | 1992, 1991, 1990 | |
| 265---- | 12/04/86 | Woodlark Basin | Scott, S.D. | | 1992, 1991 | |
| 265-Add | 06/04/90 | Woodlark Basin | Scott, S.D. | | 1992, 1991 | |
| 271-Rev2 | 09/22/89 | California Current | Barron, J.A. | | 1990 | |
| 319---- | 02/21/89 | Extinct hydroth. | Jonasson, I.R. | • | | |
| 322---- | 03/28/89 | Ontong Java Kimberl. | Nixon, P.H. | • | | |
| 323-Rev | 02/11/91 | Alboran Sea/gateway | Comas, M.C. | | 1992, 1991, 1990 | |
| 324---- | 04/20/89 | Med tectonic evol. | Cita-Sironi, M.B. | • | | |
| 325---- | 05/09/89 | Endeavour Ridge | Johnson, H.P. | | 1992, 1991, 1990 | |
| 326---- | 05/11/89 | NW Africa margin | Hinz, K. | • | | |
| 327---- | 05/24/89 | Argentine cont. rise | Hinz, K. | | 1991 | |
| 329-Rev | 07/14/89 | Formation of Atlantic | Herbin, J.P. | • | | |
| 330---- | 07/17/89 | Med. Ridge | Cita-Sironi, M.B. | | 1992, 1991 | |
| 330-Add2 | 09/10/91 | Med. Ridge | Cita-Sironi, M.B. | | 1992, 1991 | |
| 331---- | 07/25/89 | Aegir Ridge | Whitmarsh, R.B. | • | | |
| 332-Rev3 | 02/04/92 | Florida Escarpment | Paull, C.K. | • | | |
| 333---- | 07/27/89 | Cayman Trough | Mann, P. | | 1992, 1991, 1990 | |
| 333-Add | 02/04/92 | Cayman Trough | Mann, P. | | 1992, 1991, 1990 | |
| 334-Rev2 | 07/27/92 | Galicia S reflector | Boillot, G._ | IR | | |
| 337---- | 07/31/89 | New Zealand sea level | Carter, R.M. | | 1992, 1991, 1990 | |
| 338---- | 08/03/89 | Marion Pl. sea level | Pigram, C.J. | | 1992 | |
| 338-Add | 07/13/92 | Marion Pl. sea level | Pigram, C.J. | | 1992 | |
| 340---- | 08/07/89 | N Australian margin | Symonds, P. | | 1991, 1990 | |
| 341---- | 08/08/89 | E Canada Wisc. climate | Syvitski, J.P.M. | • | | |
| 343---- | 08/08/89 | Caribbean crust | Mauffret, A. | | 1991, 1990 | |
| 344---- | 08/08/89 | NW Atl JMQZ | Sheridan, R.E. | • | | |
| 345---- | 08/11/89 | West Florida sea level | Joyce, J.E. | | 1992, 1991, 1990 | |
| 345-Add | 10/05/90 | W Florida sea level | Joyce, J.E. | | 1992, 1991, 1990 | |
| 346-Rev2 | 08/14/91 | E eq. Atl. transform | Mascle, J. | | 1992, 1991, 1990 | |
| 347---- | 08/15/89 | South-eq. Atl. paleo. | Wefer, G. | | 1992, 1991, 1990 | |
| 351---- | 09/06/89 | Bransfield Strait | Storey, B.C. | • | | |
| 352---- | 09/13/89 | Mathematician Ridge | Stakes, D.S. | • | | |
| 353-Rev | 09/13/89 | Antarctic Peninsula | Barker, P.F. | • | | |
| 354-Rev | 01/30/92 | Benguela Current | Wefer, G. | | 1992, 1991 | |
| 355-Rev2 | 08/30/90 | Gas hydrate | Von Huene, R. | | 1991 | |
| 356-Rev | 05/01/91 | NGS Paleo. | Smolka, P.P. | • | | |
| 360---- | 12/06/89 | Valu Fa hydro. | Von Stackelberg, U. | | 1992, 1991, 1990 | |
| 361-Rev | 03/01/91 | TAG hydro. | Thompson, G. | | 1992, 1991, 1990 | |
| 361-Add | 10/25/91 | TAG hydro. | Thompson, G. | | 1992, 1991, 1990 | |
| 362-Rev3 | 11/08/90 | Chile Triple Junction | Cande, S.C. | | 1992, 1991, 1990 | Leg 141 |
| 363---- | 01/18/90 | GB-Iberia plume volc. | Tucholke, B.E. | | 1992, 1991 | |
| 363-Add | 02/18/91 | Grand Banks paleo. | Tucholke, B.E. | | 1992, 1991 | |
| 364---- | 01/22/90 | Sardinian-African Str. | Torelli, L. | • | | |
| 365-Add2 | 03/20/92 | N Atl. geothermal | Louden, K.E. | IR | | |
| 367---- | 02/07/90 | S Australia margin | James, N.P. | | 1991 | |
| 368---- | 02/12/90 | Hole 801C return | Larson, R.L. | | 1992, 1991, 1990 | |
| 369-Rev | 09/09/91 | MARK lithosphere | Casey, J.F. | | 1992, 1991, 1990 | |
| 369-Add | 09/16/91 | MARK lithosphere | Mevel, C. | | 1992, 1991, 1990 | |

IR In review (for fall 1992 meetings)

* No. of globally ranked programs for 1990, 1991 and 1992, resp.:
LITHP 15, 20, 15; OHP 12, 12, 14; SGPP 14, 20, 16; TECP 15, 20, 21.

000368

# Active ODP proposals, 30 July 1992

JOIDES Office, UTIG

(List does not include ~12 new/updated proposals expected to arrive 31 July/1 Aug.)

| Ref.No | Received | Key Title | Contact | Re-viewed | * Globally Ranked | Drilled or Scheduled |
|---|---|---|---|---|---|---|
| 370---- | 02/22/90 | MAR magmatism | Dick, H.J.B. | • | | |
| 372---- | 02/26/90 | N Atl. paleo. | Zahn, R. | | 1991 | |
| 373---- | 03/01/90 | Site 505 Return | Zoback, M.D. | | 1991, 1990 | |
| 374---- | 03/06/90 | Oceanographer FZ | Dick, H.J.B. | | 1992, 1991 | |
| 376-Rev2 | 07/27/92 | Vema F.Z. | Bonatti, E. | | 1992, 1991, 1990 | |
| 378-Rev | 03/12/90 | Barbados acc. prism | Westbrook, G.K. | | 1991, 1990 | |
| 379---- | 03/12/90 | Med. drilling | Mascle, J. | | 1991 | |
| 380-Rev3 | 07/30/92 | VICAP-MAP | Schmincke, H.U. | | 1992, 1991, 1990 | |
| 381---- | 03/19/90 | Argentina shelf/slope | Huber, B.T. | • | | |
| 383---- | 05/22/90 | Aegean Sea | Kastens, K.A. | • | | |
| 384-Rev2 | 07/21/92 | Caribbean crust | Mauffret, A. | IR | | |
| 386-Rev2 | 02/10/92 | California margin | Lyle, M. | IR | 1992, 1991 | |
| 388---- | 10/01/90 | Ceara Rise | Curry, W.B. | | 1992, 1991 | |
| 388-Add | 09/06/91 | Ceara Rise | Curry, W.B. | | 1992, 1991 | |
| 389---- | 10/29/90 | SW Atl. traverse | Malmgren, B.A. | • | | |
| 390---- | 11/12/90 | Shirshov Ridge | Milanovsky, V.E. | | 1992, 1991 | |
| 391---- | 01/02/91 | Med. sapropels | Zahn, R. | | 1992, 1991 | |
| 391-Add | 09/12/91 | Med. sapropels | Zahn, R. | | 1992, 1991 | |
| 392---- | 01/29/91 | Labrador Sea volc. | Larsen, H.C. | | 1991 | |
| 394---- | 02/04/91 | N Atl. volc. margins | Kiørboe, L.V. | | 1991 | |
| 395---- | 02/11/91 | Volc. passive m. comp. | Boldreel, L.O. | | 1991 | |
| 397---- | 02/20/91 | N Atl. multiple rifting | Gudlaugsson, S.T. | • | | |
| 398---- | 02/22/91 | Grand Banks paleo. | Piper, D.J.W. | • | | |
| 399---- | 05/03/91 | Alboran Sea evolution | Watts, A.B. | | 1992 | |
| 400---- | 09/03/91 | Costa Rica acc. wedge | Silver, E.A. | | 1992 | |
| 400-Add | 07/20/92 | Costa Rica acc. wedge | Silver, E.A. | | 1992 | |
| 401---- | 09/05/91 | Jurassic Gulf of Mexico | Buffler, R.T. | • | | |
| 402---- | 09/09/91 | MAR basalts | Sobolev, A.V. | • | | |
| 403-Rev2 | 07/28/92 | KT bound., G/Mexico | Alvarez, W. | | 1992 | |
| 404---- | 09/11/91 | NW Atl. sed. drifts | Keigwin, L.D. | | 1992 | |
| 405---- | 09/12/91 | Amazon fan | Flood, R.D. | | 1992 | |
| 406---- | 09/16/91 | N Atl. climatic var. | Oppo, D. | | 1992 | |
| 407---- | 09/16/91 | 15°20'N shallow mantle | Dick, H.J.B. | | 1992 | |
| 408---- | 09/16/91 | N Nicaragua Rise | Droxler, A.W. | • | | |
| 411---- | 12/09/91 | Caribbean Basalt Prov. | Donnelly, T.W. | | 1992 | |
| 412---- | 01/28/92 | Bahamas transect | Eberli, G.P. | | 1992 | |
| 413---- | 02/03/92 | Reykjanes Ridge | Murton, B.J. | | 1992 | |
| 414---- | 02/03/92 | N Barbados Ridge | Moore, J.C. | | 1992 | |
| 415---- | 02/03/92 | K/T-boundary, Caribb. | Sigurdsson, H. | | 1992 | |
| 416---- | 03/11/92 | Svalbard margin | Solheim, A. | IR | | |
| 417---- | 06/30/92 | Okhotsk gas hydrate | Soloviev, V. | IR | | |
| 418---- | 07/27/92 | Menorca Rise strat. | Cita-Sironi, M.B. | IR | | |
| 419---- | 07/28/92 | Azores-Gibraltar plates | Zitellini, N. | IR | | |
| 420---- | 07/30/92 | Oceanic crust evol. | Purdy, G.M. | IR | | |
| 421---- | 07/30/92 | Volcano Trench | Vasiliev, B.I. | IR | | |
| Bering | 09/07/90 | Bering Sea history | CEPAC | | 1992, 1991, 1990 | |
| NAAG | 04/11/91 | N Atl./Arctic gateways | Ruddiman, W.F. | | 1992, 1991, 1990 | Leg 151 |
| NARM | 09/10/91 | N Atl. rifted margins | Larsen, H.C. | | 1992, 1991, 1990 | Legs 149/152 |

IR In review (for fall 1992 meetings)

* No. of globally ranked programs for 1990, 1991 and 1992, resp.:
LITHP 15, 20, 15; OHP 12, 12, 14; SGPP 14, 20, 16; TECP 15, 20, 21.

# ODP Proposal Log Sheet **386-Rev2** Proposal received: Feb 10, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## California Margin Drilling: Neogene Paleoceanography of the California Current, Coastal Upwelling, and Deformation of the Gorda Plate

M. Lyle, J. Barron, R. Jarrard, S. Halgedahl, J. Gardner, R. Karlin and J. Kennett

| Abbrev. Title: California margin drilling | Key: California margin | Area: N Pac |
|---|---|---|

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**Objectives:** Long Range Plan

1. Paleoceanography of the California Current (CC) [12/13]
   - Neogene fluctuations in strength of CC due to climate and tectonic reorganizations of the Pacific Basin
   - upwelling fluctuation through time along coastal California and relation to changes in CC strength
   - response of primary production to Neogene climate change
   - changes in calcium compensation depth in the NE Pacific
2. Carbon cycle [15]
   - preservation and depos. rates of terrestrial and marine organic carbon in cont. margin and hemipelagic sed
   - relation between org. carbon preservation and primary product., sedimentation rate, bottom water oxygen
   - interaction of carbon cycle and climate in the NE Pacific
   - high-resol. history of organic carbon burial as it relates to climate change (Santa Barbara Basin)
   - formation of gas hydrate and origin of a prominent BSR
3. Tectonic evolution of the Pacific margin of North America [ ]
   - extent and rates of deformation of the Gorda Plate during the Plio-Pleistocene
   - rates of N-ward motion of the Mendocino Triple Junction, bsmt. compos., rotation rates of poss. terranes
4. Geomagnetic secular variation and nature and timing of geomagnetic excursions < magnetic reversals [ ]

**Specific area:** California margin

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| CA-1 | 41°40'N; 125°00'W | 1500 | 400 | 0 | 400 | Climate-induced upwelling. |
| CA-10 | 34°16'N; 120°04'W | 570 | 200 | 0 | 200 | Upwelling history in Santa Barbara Basin. |
| CA-11A | 34°30'N; 122°05'W | 3750 | 350 | 0 | 350 | Paleo. rec. from mid-Miocene to Recent, Cape Conception. |
| CA-11B | 34°50'N; 122°25'W | 4000 | 400 | 0 | 400 | As CA-11A. |
| CA-11C | 35°40'N; 121°50'W | 3520 | 300 | 0 | 300 | As CA-11A. |
| CA-11D | 32°50'N; 120°50'W | 3800 | 350 | 0 | 350 | As CA-11A. |
| CA-12A | 34°00'N; 123°10'W | 4300 | 300 | 0 | 300 | Third site in Cape Conception transect. |
| CA-12B | 33°20'N; 122°40'W | 4200 | 250 | 0 | 250 | As CA-12A. |
| CA-12C | 34°30'N; 124°00'W | 0 | 0 | 0 | 0 | As CA-12A. |
| CA-13 | 32°50'N; 123°20'W | 4300 | 130 | 0 | 130 | Outermost site in Cape Conception transect. |
| CA-14 | 28°54'N; 117°31'W | 3549 | 163 | 0 | 163 | Paleo. record off Baja California. |
| CA-15 | 32°45'N; 119°55'W | 1125 | 600 | 0 | 600 | Upwelling history; translation and rotation of margin. |
| CA-2 | 39°58'N; 125°27'W | 2927 | 320 | 30 | 350 | Neogene paleo. record of climate change off N. Cal. |
| CA-3 | 41°38'N; 125°40'W | 3000 | 250 | 0 | 250 | Detailed Plio-Pleisto. paleo. record; Gorda Plate rotation. |
| CA-4 | 41°00'N; 126°45'W | 3150 | 190 | 0 | 190 | As CA-3. |
| CA-5 | 39°10'N; 127°50'W | 4200 | 450 | 0 | 450 | Paleo. record from near present core of CC. |
| CA-6 | 40°59'N; 130°07'W | 3273 | 115 | 0 | 115 | Paleo. record from seaward edge of the CC. |
| CA-7 | 38°25'N; 123°48'W | 1600 | 150 | 0 | 150 | Record of upwelling from central California coast. |
| CA-8 | 37°00'N; 123°20'W | 2575 | 250 | 0 | 250 | As CA-7. |

000370

**Specific area:** California margin

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| CA-9 | 35°15'N; 121°45'W | 1700 | 400 | 0 | 400 | Upwelling history, inshore site Cape Conception transect. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 02/24/92 | to: | Lyle, M. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI, SO, SSDB |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

**Proposal Reference No.:** 386-Rev2

**Title: "California Margin Drilling: Neogene Paleoceanography of The California Current, Coastal Upwelling, and Deformation of the Gorda 'Plate'"**

**Proponents:** M. Lyle, J. Barron, R. Jarrard, S. Halgedahl, J. Gardner, R. Karlin and J. Kennett

## Summary


The paleoceanographic (OHP) goals of the drilling program are to determine:

- the Neogene fluctuations in the strength of the California Current due to the interactions between climate and tectonic reorganizations of the Pacific Basin (both gateway formation/destruction and mountain building) and how the variability has affected heat and salt transport in the Pacific Ocean (All Proposed Sites).
- how upwelling along coastal California has fluctuated through time and how the fluctuations are related to changes in California Current Strength (Sites CA-1, CA-2, CA-7, CA-8, CA-9, CA-10, CA-14, CA-15).
- how primary productivity has responded to Neogene climate change in the California Current and in the coastal upwelling areas (All Proposed Sites).

and

- how calcite compensation depth has changed in the northeast Pacific, by means of depth transects (Sites CA-2, CA-3, CA-4, CA-5, CA-6; Sites CA-11, CA-12, CA-13, CA-14, CA-15).

The drilling will help to determine:

- how both terrestrial and marine organic carbon are preserved in continental margin and hemipelagic sediments, and how deposition rates change as a function of distance from shore (all Sites).
- how organic carbon preservation is related to primary productivity, sedimentation rate, and bottom water oxygen contact (all Sites).
- how climate and the carbon cycle have interacted; how have Neogene climate changes and the related growth of continental ice sheets in both the northern and southern hemispheres changed the burial of calcium carbonate, marine organic carbon, and terrestrial organic carbon in the northeast Pacific (all Sites).
- high resolution history of organic carbon burial as it relates to climate change, from ultra-high resolution Pleistocene records in the Santa Barbara Basin (CA-10) to more typical 10-100 cm/Kyr hemipelagic records (CA-1, CA-2, CA-3, CA-4, CA-7, CA-8, CA-9, CA-15).

Because of these considerations, California Margin Drilling has important secondary tectonic (TECP) goals to determine:

- extent and rates of deformation of the Gorda Plate during the Plio-Pleistocene (CA-3, CA-4).
- rates of northward movement of the Mendocino Triple Junction and to determine basement composition and rotation rates of possible terranes along coastal California (CA-2, CA-7, CA-8, CA-9, CA-15).

000371

# ODP Proposal Log Sheet **416----**

Proposal received: Mar 11, 1992

☒ **New proposal** ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

# Glacial History of the High European Arctic: Drill-Sites on the Svalbard Margin

A. Solheim and A. Elverhøi

| Abbrev. Title: Glacial history, Svalbard margin | Key: Svalbard margin | Area: Arctic |
|---|---|---|

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Long Range Plan 12/13

**Objectives:**

Glacial history fo the high Arctic, with special reference to the history of the Svalbard-Barents Sea Ice Sheet

- to record and date the onset of glaciations in the high European Arctic
- to record and date important phases in Svalbard-Barents Sea Ice Sheet history (initiation, terr./marine)
- nature of the uppermost presumably pre-glacial sediments beneath deep sea and outer shelf
- to understand formation of "trough mouth fans", which are typical on polar margins

**Specific area:** W Svalbard margin

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| SVAL-1 | 77°15.5'N; 009°05.5'E | 2120 | 600 | 0 | 600 | Onset of glaciations; nature of sequences; environm. evol. |
| SVAL-2A | 78°27.42'N; 009°04.33'E | 900 | 600 | 0 | 600 | Onset of glaciations; fan evolution and glacial history. |
| SVAL-2B | 78°26.13'N; 008°20.16'E | 1810 | 600 | 0 | 600 | As SVAL-2A. |
| SVAL-3 | 78°11.3'N; 010°01.66'E | 295 | 400 | 0 | 400 | Pre-glacial/glacial boundary; clinoforms; depos./erosion. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 04/08/92 | to: | Solheim, A. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI, SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000372

**Proposal Reference No.:** **416----**

**Title:** **"Glacial History of the High European Arctic: Drill-Sites on the Svalbard Margin"**

**Proponents:** A. Solheim and A. Elverhøi


## Abstract

Three drill sites on the western Svalbard margin in the eastern Greenland Sea are proposed. Two sites are located on the continental slope and rise, at 900 m and 2120 m water depth, respectively, while the third (and lowest priority) site is situated on the outer continental shelf, at 295 m water depth. The proposal is primarily based on a grid of high resolution single channel (sleeve gun) data, but with additional information from various types of MCS data as well as 3.5 kHz, side scan sonar and SeaMarkII data. Piston cores of 5-8 m length are recovered at or close to the proposed sites. Suggested drilling depths vary from 400 to 600 mbsf, and no drilling hazards are apparent from the site survey data.

The scientific objectives addressed in the proposal relate to the glacial history of the high Arctic, with special reference to the onset of northern hemisphere glaciations and the history of the Svalbard-Barents Sea Ice Sheet. Because of its high latitude and alpine relief, Svalbard is a likely location for the initiation of Pliocene glaciation in the European Arctic, and signals indicative of this are best sought relatively proximal to the ice sheet. Fast flowing ice streams probably formed the main drainage for ice and glacial sediments along the margins of the ice sheet. The ice streams were situated in the fjord systems of Svalbard and in the transverse shelf troughs forming the offshore continuation of the fjord systems. Extensive fans of presumably glacigenic sediments are presently found on the margin off the troughs west of Svalbard, as well as off the major troughs in the Barents Sea. These fans contain a major part of the glacial erosional products and the three proposed sites are situated near the Isfjorden fan off the largest fjord system of Svalbard. No sites are proposed on the fan proper, because small scale down-slope mass wasting seems to be an important sedimentary process on the fans throughout the glacial period. The proposed sites are adequate for meeting objectives both on the glacial history and the development of the large glacial fan. The sites will form important stratigraphic tie points for a regional grid of both high resolution and deeper seismic lines. The proposal is also closely related to the European program on "Late Cenozoic Evolution of the Polar North Atlantic Margins" (PONAM).

# ODP Proposal Log Sheet **365-Add2**

Proposal received: Mar 20, 1992

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

## Geothermal Measurements along the Newfoundland and Iberia Conjugate Passive Margin Transects

K.E. Louden, J.C. Mareschal and J.P. Foucher

| Abbrev. Title: Geothermal measurements, Newfoundland/Iberia transects | Key: N Atl. geothermal | Area: N Atl |
|---|---|---|

**Contact:**

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Long Range Plan: 7

**Objectives:**

Subsidence history, rifting process, and crustal composition through geothermal measurements

- direct measurement of crustal radiogenic heat production from basement samples at each site
- additional drilling time to measure temperature gradients down hole at approx. 5-10 positions
- site survey measurements of surface heat flow along each transect.

**Specific area:** Newfoundland and Iberia margins

**Proposed Sites:** Sites proposed by NARM-DPG

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| | | | | | | |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 04/08/92 | to: | Louden, K.E. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI, SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000374

**Proposal Reference No.:** **365-Add2**

**Title:** **"Geothermal Measurements Along the Newfoundland and Iberia Conjugate Passive Margin Transects"**

**Proponents:** K.E. Louden, J.-C. Mareschal, J.-P. Foucher and J.-C. Sibuet

## Summary

In this Addendum to ODP Proposal 365 Rev, we present a rationale for placing a high priority on the measurement of heat flow and crustal radiogenic heat production at the proposed drill sites along the conjugate margin transects across the Newfoundland and Iberia basins. Used in combination with other geophysical data, particularly the seismic crustal structures, we expect that the heat flow data will add significantly to the interpretation of the subsidence history, in helping to define the nature of the rifting process. They will also help interpret the nature of the crustal composition within the disputed region of the continent-to-ocean transition. The critical information that only drilling can offer comes from basement sampling which will allow the measurement of crustal radiogenic heat production. Using recent surface heat flow data across Goban Spur and Galicia Bank, we show why constraints on crustal heat production are necessary in order to limit possible models of the heat flow variation across old passive margins. Well-constrained downhole measurements of temperature and thermal conductivity should also be made on all boreholes in order to benchmark more numerous surface measurements across the margins. These surface heat flow data do not presently exist but surveys have or will soon be proposed to be conducted in these regions in 1993.

000375

# ODP Proposal Log Sheet **417----** Proposal received: Jun 30, 1992

☒ **New proposal** ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

## Gas Hydrate Formation and Distribution in the Vicinity of Gas Plume, the Okhotsk Sea

G. Ginsburg and V. Soloviev

| Abbrev. Title: Gas hydrate in vicinity of gas plume, Okhotsk Sea | Key: Okhotsk gas hydrate | Area: N Pac |
|---|---|---|

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Long Range Plan ☐

**Objectives:**

Gas hydrate formation

- distribution of submarine gas hydrate in vicinity of gas plume
- mechanisms of migration of hydrate forming gas, water and dissolved salts, and mass/energy balances
- paleoenvir. of gas discharge and hydrate formation (sed. rates, bottom water temp., carbonate concretions)
- evaluate permeability of gas hydrate-bearing sediments

**Specific area:** Sakhalin continental slope

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| OS-1 | 54°26.8'N; 144°04.8'E | 710 | 600 | 0 | 600 | Distr. and conditions of gas hydrate form., central plume. |
| OS-2 | 54°26.8'N; 144°04.9'E | 710 | 600 | 0 | 600 | Distr. and conditions of gas hydrate form., marginal plume. |
| OS-3 | 54°26.8'N; 144°05.0'E | 710 | 600 | 0 | 600 | Geochem. and theobaric conditions beyond plume. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/14/92 | to: | Soloviev, V. |
| Proposal forwarded for review: | Aug 3, 1992 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI, SO (ODP/TAMU), SSDB (LDGO |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

C00376

**Proposal Reference No.:** 417----

**Title:** "Gas Hydrate Formation and Distribution in the Vicinity of Gas Plume, the Okhotsk Sea"

**Proponents:** G. Ginsburg and V. Soloviev

## Abstract

Submarine gas hydrates are formed from gas: generated *in situ*, or entering hydrate stability zone in water-dissolved state, or surfacing in gaseous phase.

The goal of the present proposal is to study the formation of gas hydrate associated with large gas discharge in the Okhotsk Sea NE off Sakhalin Island. This discharge has been repeatedly recorded on echograms as a plume ca. 250 m across with the centre at 54°26'.782 N / 144°04'.858 E in water depth 710 m. Shallow coring undertaken in October 1991 confirmed the presence of gas hydrate bearing muds in the plume area at subbottom depths 0.3-1.2 m and indicated that the hydrated area may have larger dimensions. Gas hydrate extension depth was not established but it may reach 300-500 m subbottom according to geothermal data. Hydrate was observed in sediments mainly as isolated gently dipping interlayers and lenses.

In order to develop a three-dimensional model of gas hydrate system, we suggest to drill at three sites located at the centre, on the periphery, and beyond the limits of the plume. Before the position of drilling sites is finally defined, the boundaries of gas hydrate accumulation must be ascertained by means of seismic survey. The drilling depth 500-600 m required to exceed the thickness of hydrate stability zone.

The drilling goals are:

- To determined the distribution of submarine gas hydrate in the vicinity of the plume.
- To define the mechanisms of migration of hydrate-forming gas, water and water-dissolved salts; to understand the nature of subhorizontal layered structure of hydrated sediments; and to evaluate the present-day mass and energy balance in the process of hydrate formation/decomposition.
- To obtain data on sedimentation rates, bottom water paleotemperatures, and distribution and composition of carbonate concretions relevant to reconstruction of gas discharge and hydrate formation in the past.
- To evaluate permeability of gas hydrate-bearing sediments.

To solve these problems it is necessary to determine sediment porosity, permeability, gas hydrate contents, pore fluids composition, pore pressure and temperature by implementation of PCS, logging, packers and other techniques.

Pre-drilling investigations must include: high resolution SCS, MCS and velocity determination; free gas and carbonate concretions bottom sampling; additional shallow coring. A one month cruise of a research vessel equipped with submersible will be needed.

000377

# ODP Proposal Log Sheet **338----**

Proposal received: Aug 3, 1989

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

## Absolute Amplitude of Neogene Sea-level Fluctuations from Carbonate Platforms of the Marion Plateau, Northeast Australia

C.J. Pigram, P.J. Davies, D.A. Feary, P.A. Wymonds and G.C.H. Chapronier

| Abbrev. Title: Sea-level fluct., Marion carbonate plateau, NE Australia | Key: Marion Pl. sea level | Area: S Pac |
|---|---|---|

**Contact:**

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**Objectives:** Long Range Plan

1. Amplitudes of Neogene second and third order sea-level cycles [14]
   - sites with identical subsidence histories can be located within two phases of platform accretion
   - low relief of this carbonate bank - slope - basin system essential for comparison with Pacific atolls
   - subsidence can be eliminated
2. Evolution of the East Australian Current [13]
   - change of world's oceans from an equatorial to a gyral circulation pattern
   - effects on development of subtropical platforms

**Specific area:** Marion Plateau

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| MP 1 | 19°35.42'S; 151°51'E | 390 | 300 | 0 | 300 | Age, facies, cause of demise of late Early Mioc. acc. phase. |
| MP 2 | 19°29.4'S; 152°04.8'E | 340 | 200 | 0 | 200 | As MP 1. |
| MP 3 | 19°19.8'S; 152°50.4'E | 1100 | 600 | 0 | 600 | Paleo. record of change from equatorial to gyral circulation. |
| MP 4 | 21°03.54'S; 153°02.06'E | 300 | 400 | 0 | 400 | Age, fac. of L. Mioc.-Plio. platform init.; quantify lowstand |
| MP 5 | 21°07.12'S; 153°08.24'E | 337 | 500 | 0 | 500 | Age, facies of L. Mioc.-Plio. sea-level related downlap sequ. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 08/03/89 | to: | Pigram, C.J. |
| Proposal forwarded for review: | 08/03/89 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/89 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

**Proposal Reference No.:** **338----**

**Title: "Absolute Amplitude of Neogene Sea-Level Fluctuations from Carbonate Platforms of the Marion Plateau, Northeast Australia"**

**Proponents:** C.J. Pigram, P.J. Davies, D.A. Feary, P.A. Symonds and G.C.H. Chaproniere

## Summary

Absolute resolution of the amplitude of eustatic sea-level fluctuations in the Neogene (COSOD II; OHP White Paper, 1988), can be achieved by ODP drilling of the subtropical carbonate platforms of the Marion Plateau because they preserve a decipherable record of the absolute value of the composite Middle to Late Miocene eustatic fall as well as a record of Late Miocene and Pliocene third order cycles. The location is critical to determining absolute values for sea-level amplitude because subsidence effects can be eliminated. Drilling at this location will enable the calibration of Neogene sea-level change. Drilling will also provide excellent data on the establishment of the East Australian Current as a consequence of the change from an equatorial to a gyral circulation pattern in the Pacific Ocean and new information about the allocyclic controls on the processes operating within subtropical carbonate platforms.

000379

# ODP Proposal Log Sheet **338-Add**

Proposal received: Jul 13, 1992

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

## Sea Level Fluctuations - Marion Plateau carbonates, NE Australia

C.J. Pigram

| Abbrev. Title: Sea-level fluct., Marion carbonate plateau, NE Australia | Key: Marion Pl. sea level | Area: S Pac |
|---|---|---|


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**Objectives:** See proposal 338----.

Intention to submit revised proposal addressing timing and amplitude of sea level events in the Neogene

Long Range Plan: 14

**Specific area:** Marion Plateau

**Proposed Sites:** To be proposed in next version of proposal.

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| | | | | | | |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/23/92 | to: | Pigram, C.J. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI Inc., SO (ODP/TAMU), SSDB |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

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000381

# ODP Proposal Log Sheet **400-Add** Proposal received: Jul 20, 1992

☐ *New proposal* ☐ *Revised proposal* ☒ **Addendum to proposal** ☐ *Other*

## Proposal to NSF: Fluid Flow Paths in the Costa Rica Accretionary Wedge

E.A. Silver

| Abbrev. Title: NSF proposal: fluid paths in Costa Rica Acc. wedge | Key: Costa Rica acc. wedge | Area: N Pac |
|---|---|---|

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Long Range Plan: 11

**Objectives:**

Fluid pathways and budgets of the Costa Rica accretionary wedge

- rate of fluid expulsion from heat flow profiles and from gradients in pore water chemistry
- surface location of fluid vents from deep-towed side-scan sonar, bottom photogr., and heat flow transect
- subbottom imaging of fluid pathways through further analysis of 3D seismic data and modeling
- source of the fluids from pore-water chmistry from piston cores and diagenesis of sediments at vent sites

**Specific area:** Middle America Trench

**Proposed Sites:** See 400----

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| | | | | | | |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/22/92 | to: | Silver, E.A. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000382

**Proposal Reference No.:** **400-Add**

**Title: "Fluid Flow Paths in the Costa Rica Accretionary Wedge"**

**Proponents:** E.A. Silver, T.H. Shipley, M. Langseth, W. Ryan and J. Gieskes

## Summary

Fluid flow is one of the most important factors in determining the mechanical and chemical behavior of accretionary wedges. The excellent 2D and 3D seismic reflection data available for the Pacific margin of Costa Rica makes it arguably the most completely imaged accretionary margin on earth. This proposal is to determine the fluid pathways and budgets of the Costa Rica accretionary wedge, both as a primary scientific study and as a preparation for scientific ocean drilling. The rate of fluid expulsion will be estimated from detailed heat flow profiles, to compare advective and conductive heat flow through the continental slope, and from gradients in pore water chemistry. The surface location of fluid vents will be determined using deep towed side-scan sonar (such as Sea MARC I), bottom photography, and detailed heat flow transects. Careful subbottom imaging of the fluid pathways can be obtained by further analysis of the 3D seismic reflection grid and by 2D and 3D seismic modeling. The source of the fluids will be constrained by study of pore-water chemistry from piston cores and the diagenesis of sediments within vent sites. Further control of fluid chemistry will be possible with the proposed program of drilling.

# ODP Proposal Log Sheet 384-Rev2

Proposal received: Jul 21, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## The Connection Between the Pacific and Atlantic Oceans: the Venezuela Basin and Aruba Gap

A. Mauffret, A. Mascle and J. Diebold

| Abbrev. Title: Pacific-Atlantic connection, Venezuela basin, Aruba Gap | Key: Caribbean crust | Area: N Atl |
|---|---|---|

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**Objectives:** (Long Range Plan)

1. Caribbean tectonic history [6]
   - role of oceanic lithosphere of the Colombia and Venezuela basins
   - reconstruction of breakup of Pangea, if Caribbean crust is native
   - oblique rifting and divergence of North America and South America plates
   - history of the Farallon plate, if Caribbean crust is exotic
   - intraplate deformation
   - insertion tectonics
   - role of non-subductible plateau in development of allochthonous terranes
2. Magmatic evolution and petrologic variation with age of oceanic plateaus [3]
   - Cretaceous magmatic history of Farallon plate or Atlantic Ocean
3. Paleoceanography and faunal eolution of the Late Cretaceaous, Paleogene and Neogene [13/16]
   - Mesozoic pathways, if Caribbean crust is native
   - KT-boundary
   - Eocene chert
   - Neogene deep circulation, Panama closure

**Specific area:** Caribbean: Venezuela Basin, Aruba Gap

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| A 1 | 14°03'N; 072°30'W | 3950 | 1500 | 50 | 1550 | Paleoenv. of Jur.-Cret. series; nature and age of basement. |
| B 1 | 15°08'N; 072°02'W | 3200 | 525 | 25 | 550 | Top of probable pop-up structure; Horizon A"; paleomagn. |
| C 1 | 16°23'N; 067°15'W | 3750 | 500 | 25 | 525 | Last volc. Cret. event in the Carib.; recent volcanism; etc. |

| | | |
|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/22/92 | to: Mauffret, A. |
| Proposal forwarded for review: | 08/03/92 | to: LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: |

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**ODP Proposal Log Sheet** **086-Rev2** Proposal received: Jul 27, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

# A Proposal for ODP Drilling in the Red Sea

E. Bonatti

| Abbrev. Title: Drilling in the Red Sea | Key: Red Sea | Area: Ind |
|---|---|---|

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**Objectives:**

Long Range Plan: 2/7

Transition from continental to oceanic rift, initiation of sea floor spreading, and formation of passive margins

- nature of earliest oceanic crust in a continental rift that is in the process of splitting
- geometry of initial emplacement of oceanic crust, axial propagation from initial "hot points"?
- compositional evolution of crust in time and space during initial few million years of sea floor spreading
- nature of "intermediate" crust found in many passive margins
- petrological/geochemical nature of the upper mantle in an embryonic rift
- characteristics of hydrothermal activity and metallogenesis in embryonic, slow-spreading ridge

**Specific area:** Red Sea

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| RS-1a | 17°30'N; 040°20'E | 2500 | 50 | 150 | 200 | Drill ~5 my old basaltic crust. |
| RS-1b | 23°12'N; 037°14'E | 2500 | 30 | 170 | 200 | Drill ~2 my old basaltic crust. |
| RS-1c | 24°40'N; 036°35'E | 1500 | 200 | 200 | 400 | Drill in <1 my old basaltic crust. |
| RS-2 | 23°40'N; 036°15'E | 1100 | 200 | 200 | 400 | Drill basement off the Red Sea axis. |
| RS-3 | 23°35'N; 036°15'E | 800 | 100 | 400 | 500 | Drill a section of mantle peridotite. |

Proposal acknowledged by JOIDES Office: 07/28/92 to: Bonatti, E.
Proposal forwarded for review: 08/03/92 to: LITHP, OHP, SGPP, TECP
Proposal copies: 08/03/92 to: JOI Inc., SO (ODP/TAMU), SSDB (LDGO)
Proposal forwarded to DPG: 00/00/00 to:

000386

**Proposal Reference No.:** **086-Rev2**

**Title: "A Proposal for ODP Drilling in the Red Sea"**

**Proponents:** E. Bonatti

## Summary

The rationale for an ODP Red Sea effort is that drilling in the Red Sea could help in solving some fundamental geotectonic and petrological questions related to the transition from a continental to an oceanic rift, the initiation of sea floor spreading and the formation of passive margins. Some of these questions are: (a) What is the nature of the earliest oceanic crust emplaced in a continental rift that is in the process of splitting? (b) What is the geometry of the initial emplacement of oceanic crust? Does a linear accretionary plate boundary develop by axial propagation from initial "hot points" of oceanic crust emplacement? (c) How does the composition of the crust evolve in space and time during the initial few million years of sea floor spreading? (d) What is the nature of the Red Sea crust outside the "oceanic" axial trough, and, by inference, what is the nature of the "intermediate" crust found in many passive margins? (e) What is the petrological/geochemical nature of the upper mantle in an embryonic oceanic rift? (f) How do hydrothermal activity and metallogenesis differ in an embryonic, very slow spreading rift from full-fledged, slow to fast spreading oceanic ridges?

These questions will be addressed by a set of ODP holes outlined in this proposal. For several years to major marine geology and geophysics expeditions have taken place in the Red Sea, mostly because of the unstable political situation in the region, that has prevented also ODP from carrying out a drilling program there. However, the situation in the Red Sea area is now stable, and a drilling program can be carried out there.

I note that the present proposal does not address stratigraphic and paleo-oceanographic problems which could be tackled by drilling into the Red Sea sediment column, but is focused on lithospheric and tectonic objectives.

000387

# ODP Proposal Log Sheet **334-Rev2** Proposal received: Jul 27, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## Galicia Margin S Reflector

G. Boillot, M.O. Beslier, D. Rappin, E. Banda and M.C. Comas

| Abbrev. Title: Galicia margin S reflector | Key: Galicia S reflector | Area: N Atl |
|---|---|---|

**Contact:**

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**Objectives:** Long Range Plan

Sampling the terranes over, at the level of, and beneath S to constrain the models of passive margin formation [7]

A. Geological identification of terranes surrounding the S reflector [ ]
- terrane covering S mainly made of continental basement
- underlying terrane probably consists of serpentinized peridotite
- S being the tectonic, petrological Moho

B. Kinematics and dynamics of the deformation along the shear zone S [ ]
- relationship to nature of rocks
- location of deformations with respect to the detachment
- successive depths and temperatures where deformation occurred
- history and processes of lithospheric streching from petrostructure

C. Absolute timing of events (possible geochronological dating of minerals cristalized after partial melting etc.) [ ]

**Specific area:** Galicia margin

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| GAL 1 | 42°40'N; 012°48'W | 4500 | 600 | 1200 | 1800 | Sampling major Mesozoic syn-rift detachment fault. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/28/92 | to: | Boillot, G._ |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000388

**Proposal Reference No.:** **334-Rev2**

**Title: "Galicia Margin S Reflector"**

**Proponents:** G. Boillot, M.-O. Beslier, D. Rappin, E. Banda and M.C. Comas

## Summary

The S seismic reflector of the West Galicia margin is interpreted as the geophysical signature of a major, syn-rift detachment fault, which puts into contact terranes very different in nature. There is a general agreement to consider drilling through S as a very exciting and promising target for ODP.

We show in this up to date proposal that, in the northern part of the passive Galicia margin S is close from the seafloor, and becomes accessible to drilling with the current technology at the proposed Site GAL 1. Our demonstration is based on three different arguments:

1) Direct connection of S from the area where it was defined 15 years ago, at a depth of 3-4 km beneath the seafloor, to the proposed drill site GAL 1 where it is located at a depth of 1,6 km from the seafloor. This direct connection is made possible by the recent acquisition and processing of a grid of multichannel seismic lines, one of them avoiding the Cenozoic fault zone separating the northern, uplifted part of the margin from the southern part where S is deeply buried.
2) Measurements of the seismic velocities within terranes overlying S to the North and to the South of the Cenozoic fault zone. In both places, S is covered by a 5 km/s layer (enigmatic terrane), and by syn- and post-rift sediments where the seismic velocity is 2.5 km/s and 3.5 km/s, respectively. Enigmatic terrane includes continental basement sampled by diving with the French submersible Nautile in the southern area of the margin.
3) Amplitude attenuation of reflected seismic waves within terranes surrounding S. The respective amplitude attenuation of P waves, and thus the physical properties, within terranes over- and underlying S, are the same from the south where S was defined to the North where we propose to drill. Moreover, the seismic signal reflected by S is identical on both sides of the Cenozoic structure separating the northern and southern areas of the margin.

Our proposal consists to drill within the basement, beneath the thin local Cenozoic sedimentary cover (600 m). From the experience of Leg 103 (drilling in the serpentinized peridotite bounding the Galicia margin), we know that the basement rocks can contain crucial information about timing, pressure, temperature and kinematic conditions of their partial melting, metamorphism and deformation during the rifting stage of the margin. We think that sampling the terranes over, at the level of and beneath S can strongly constrain the models of passive margin formation. The expected results of drilling are:

- Geological identification of terranes surrounding S. Currently, we suspect that enigmatic terrane covering S is mainly made of continental basement, whereas underlying terrane consists probably of serpentinized peridotite, S being the tectonic, petrological Moho. However, this must be verified by drilling.
- Kinematics and dynamics of the deformation along the shear zone S. The style of deformations depend on the nature of the rocks, their location with respect to the detachment, and the successive depths and temperatures where the deformation occurred. Conversely, petrostructural studies of cored rocks can shed light considerably on the history and processes of the lithosphere stretching, and related uplift of crustal and mantle terranes involved in the stretching.
- Absolute timing of events, due to possible geochronological dating of minerals crystallized after partial melting, after ductile deformation and possibly after brittle deformation of the sampled rocks.

000389

# ODP Proposal Log Sheet **376-Rev2** Proposal received: Jul 27, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## Drilling at the Vema F.Z. in the Atlantic: (1) Upper Mantle; (2) Gabbro/Dyke Complex Boundary; (3) Limestone Cap on Transverse Ridge

E. Bonatti, J.M. Auzende and C. Mevel

| Abbrev. Title: Vema F.Z.: Upper mantle, gabbro/dyke, limestone cap | Key: Vema F.Z. | Area: N Atl |
|---|---|---|

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**Objectives:**

Long Range Plan

Reconstruct a complete section of upper oceanic lithosphere by offset section drilling [1/2]

A. Sampling in upper mantle section
- vertical variations of structure, geochemistry and petrology of the upper mantle beneath ocean basins
- understand mantle heterog. and processes of partial melting/melt extraction from formation of oceanic crust

B. Sampling the dyke complex/gabbro boundary
- drill through this boundary under a well-constrained structural framework
- determine whether this boundary is sharp or gradational
- clarify features of the upper part of the magma chamber and modes of magma transport to the surface
- determine depth reached by hydrothermal circulation, etc.

C. Vertical tectonic motions of blocks of oceanic lithosphere
- clarifying transform related vertical motions, particularly in low-slipping transform environments
- understand which processes have exposed the lithospheric section on the Vema Transverse Ridge

**Specific area:** Vema Fracture Zone

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| VE-1 | 10°41'N; 042°42'W | 4200 | 10 | 500 | 510 | Core mantle peridotite at least 500 m thick. |
| VE-2 | 10°39'N; 042°43'W | 3500 | 10 | 500 | 510 | Sample transition from gabbro to dike complex. |
| VE-3 | 10°45'N; 044°22'W | 600 | 250 | 250 | 500 | Drill through shallow water limestone unit capping ridge. |

Proposal acknowledged by JOIDES Office: 07/28/92 to: Bonatti, E.
Proposal forwarded for review: 08/03/92 to: LITHP, OHP, SGPP, TECP
Proposal copies: 08/03/92 to: JOI Inc., SO (ODP/TAMU), SSDB (LDGO)
Proposal forwarded to DPG: 00/00/00 to:

000390

**Proposal Reference No.:** **376-Rev2**

**Title: "Drilling at the Vema F.Z. in the Atlantic: (1) Upper Mantle; (2) Gabbro/Dyke Complex Boundary; (3) Limestone Cap on Transverse Ridge"**

**Proponents:** E. Bonatti, J.M. Auzende and C. Mevel


## Abstract

Three major objectives can be addressed with a drilling program in the Vema F.Z. area, equatorial Atlantic. One objective is to core a thick vertical section of upper mantle. This objective can be achieved by drilling the lower part of a relatively undisturbed upper lithospheric section (including a mantle peridotite unit, lower crustal gabbros, a dyke complex and pillow basalts) discovered by the submersible Nautile on the northern slope of the Vema transverse ridge. The second objective is to sample in the same lithospheric section the boundary between a well developed dyke complex and lower crustal gabbros. The third objective is to understand vertical motions of lithospheric blocks associated with slow-slipping transforms. This objective can be achieved by drilling through a reef limestone unit capping the summit of the Vema transverse ridge. The three objectives are conceptually related: understanding vertical motions would help interpret the mechanisms which have uplifted and exposed the lithospheric section: sampling upper mantle and lower crustal units in the same section would help understand petrological/geochemical relationships between the two. The lithospheric and tectonic objectives addressed by drilling at the Vema F.Z. are fully within those defined by the ODP offset drilling group. Additional site surveys will be carried out at the Vema F.Z. in 1992: a seismic multichannel survey in July - August, and a Hydrosweep/multibeam and side scan survey in December.

This proposal, submitted to ODP in July, 1992, revises and supersedes previous proposals submitted by Bonatti, Auzende, Mevel et al. for drilling at Vema F.Z.

000391

**ODP Proposal Log Sheet** | **418----** | Proposal received: Jul 27, 1992

☒ **New proposal** ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

# A Biomagnetostratigraphic Reference Section Representing a Marine Miocene Mid-Latitude Environment: Re-Occupation of DSDP Site 372 (Menorca Rise, Western Mediterranean)

M.B. Cita, A. Negri, C.G. Langereis and T.A.T. Mullender

| Abbrev. Title: Miocene biomagnetostrat. reference section, Menorca Rise | Key: Menorca Rise strat. | Area: N Atl |
|---|---|---|

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Long Range Plan: 13

**Objectives:**

Neogene bio-/magnetostratigraphy and western Mediterranean paleoceanography

- reference section for Miocene mid-latitude biostratigraphy and paleomagnetic stratigraphy
- response of the W. Med. deep-sea record to interruption of Indian Ocean - Atlantic gateway (Burdigalian)
- Plio.-Pleistoc. paleoclimatic/paleoceanographic record to test current reversal postulate for sapropel layers
- lithostrat. nature of the Messinian erosional surface and identification of additional intra-Messinian unconf.

**Specific area:** Menorca Rise, western Mediterranean

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| MR 1 | 40°01.86'N; 004°47.79'E | 2699 | 900 | 0 | 900 | Reference stratigraphy and paleoceanography. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/28/92 | to: | Cita-Sironi, M.B. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000392

**Proposal Reference No.:** **418----**

**Title: "A Biomagnetostratigraphic Reference Section Representing a Marine Miocene Mid-Latitude Environment: Re-occupation of DSDP Site 372 (Menorca Rise, Western Mediterranean)"**

**Proponents:** M.B. Cita, A. Negri, C.G. Langereis and T.A.T. Mullender


## Abstract

We propose the re-occupation of DSDP Site 372, which was cored discontinuously (continuously from 131.0 to 406.5 m subbottom) to the terminal depth of 885 m, in six days, from April 19 to 24, 1975. The site is located east of Menorca at a water depth of 2699 m.

Originally conceived as a transect of several holes, the site had the following objectives: 1) to investigate the age and nature of the pre-evaporitic formations to provide an age to the initial rifting of the Balearic Basin and to establish its subsidence history, 2) to determine the nature of pre-Messinian formations, just below the evaporites which would detail any change in environment just prior to the Messinian salinity crisis, and 3) to recover sediments from the upper contact of the Messinian evaporites to provide information on their pinch-out on the margin.

Although none of the above objectives was fully reached, drilling at Site 372 has been successful since it obtained a well developed, apparently continuous, richly fossiliferous open marine succession, which has the potential to become a standard reference section for the middle Miocene. Although entire drilling legs have been dedicated to investigate Neogene transects at low and high latitudes, no reliable paleomagnetic calibration is available yet for the middle Miocene. A pilot-study carried out in view of the present proposal on the magnetic susceptibility of old sediment samples from Site 372 gave promising results, whereas recent detailed investigations on the calcareous nannofloras demonstrated the excellence of the Miocene section, with special reference to the Langhian-Serravallian interval.

1) The recovery of the pre-Messinian succession is the major goal.
2) An important paleoceanographic event, that is the final closure of the seaway connecting the Indian Ocean with Mediterranean in Burdigalian times, should be detectable in the stratigraphic record, if fully recovered.
3) The post-Messinian succession is also very interesting for its paleoceanographic implications (current reversals related to sapropel deposition).

The present proposal has the following requirements: continuous coring with full recovery, obtained with APC, XCB, RCB used successively, with double coring for the first half of the hole.

The present drilling proposal requires approximately ten days to two weeks of drilling time; it may be combined with another Mediterranean proposal in one leg.

The present drilling proposal is strongly recommended by the Subcommission of Neogene Stratigraphy of the International Stratigraphic Commission.

# ODP Proposal Log Sheet **403-Rev2**

Proposal received: Jul 28, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## KT Boundary Drilling in the Gulf of Mexico and Its Relationship to an Integrated Study of Proximal Deposits Associated with the Chicxulub Impact Structure on Yucatan

W. Alvarez, R.T. Buffler, S.V. Margolis, A. Montanari, J. Smit, C. Fulthorpe, A.R. Hildebrand, M. Iturralde, and Mexican proponent(s)

| Abbrev. Title: KT Boundary Drilling in the Gulf of Mexico | Key: KT bound., G/Mexico | Area: N Atl |
|---|---|---|

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FAX: 1 (415) 643-9980

**Objectives:** (Long Range Plan)

1. Distribution and Characteristics of the proximal ejecta blanket related to the Chicxulub impact structure [16]
   - test whether Chicxulub structure is the large impact crater predicted by the KT mass extinction hypothesis
   - advance our knowledge about this impact site and event as well as impact events in general
   - sample directly and describe age, distribution and characteristics of predicted proximal KT ejecta deposits
   - - shock features, chemistry and petrography of ejecta for comparison with other KT deposits
   - - search for lithologies derived from lower crust/upper mantle
   - - subsidence, sedimentation, biostratigraphy and paleo. history before, during and after the KT event
   - - look for KT collapse breccias at the base of the Campeche escarpment and other giant wave indicators
2. Mid-Cretaceaous demise of carbonate platform [13/14]
3. Late Tertiary prograding sequences and sea level [14]

**Specific area:** Campeche Bank, Gulf of Mexico

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| GMKT-1 | 22°07'N; 089°54'W | 55 | 1000 | 0 | 1000 | Thick, proximal ejecta blanket; prox. Cenozoic clinoforms. |
| GMKT-2 | 22°36'N; 090°19'W | 150 | 1200 | 0 | 1200 | Intermed. ejecta blanket; Up. Cret. bank; Cenoz. clinof. |
| GMKT-3 | 22°56'N; 090°38'W | 900 | 900 | 0 | 900 | Outer edge of ejecta blanket; distal Cenozoic clinoforms. |
| GMKT-4 | 23°14'N; 089°59'W | 200 | 1200 | 0 | 1200 | Intermed.-outer ejecta blanket; Cenozoic clinoforms. |
| GMKT-5 | 22°18'N; 091°05'W | 120 | 1100 | 0 | 1100 | Outer edge and more distal ejecta; Cenozoic clinoforms. |
| GMKT-6 | 23°09'N; 090°46'W | 3150 | 750 | 0 | 750 | Sample and date possible KT slump block. |
| GMKT-7 | 24°00'N; 086°20'W | 1450 | 700 | 0 | 700 | Outer edge and more distal ejecta; Low. Cret. platform top. |
| GMKT-8 | 23°49.73'N; 084°22.25'W | 2926 | 350 | 0 | 350 | Full strat. sequence across KT bound. at DSDP Site 540. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | Jul 29, 1992 | to: | Alvarez, W. |
| Proposal forwarded for review: | Aug 3, 1992 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | Aug 3, 1992 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000394

**Proposal Reference No.:** **403-Rev2**

**Title: "KT Boundary Drilling in the Gulf of Mexico and Its Relationship to an Integrated Study of Proximal Deposits Associated with the Chicxulub Impact Structure on Yucatan"**

**Proponents:** W. Alvarez, R.T. Buffler, S.V. Margolis, A. Montanari, J. Smit, C. Fulthorpe, A.R. Hildebrand, M. Iturralde and Mexican proponents(s)

**Abstract**

The buried Chicxulub structure bisected by the northern coast of the Yucatan Peninsula, Mexico, has been identified as the largest known impact crater on earth and as a possible major KT impact site. This hypothesis is supported by geophysical data, samples from the crater itself, and detailed studies of nearby KT deposits in Mexico, Haiti, and the southeastern Gulf. To test this hypothesis five primary sites are proposed on the northern Campeche bank just north of the crater. Three nearby secondary or alternative sites are also suggested. This proposal is a revised and updated version of ODP #403 and #403(REV). It presents a full leg of drilling dedicated to sampling and studying in detail the 3-D distribution and characteristics of the proximal KT ejecta blanket related to the Chicxulub impact structure. These proximal sites located in a marine environment away from terrigenous influences should provide a well preserved and complete section of the proximal deposits and associated erosional and depositional features. Drilling these sites will be a key aspect of an integrated study of the KT impact site and related deposits currently ongoing in the Gulf region. Sampling these deposits near the major KT impact site offers an excellent opportunity to document and test the Chicxulub structure as a primary KT impact site. It also has the potential for advancing significantly our understanding of the KT event as well as impact events, in general. Important secondary scientific objectives are also reviewed, including the mid-Cretaceous demise of carbonate platforms, the rapid late Cenozoic progradation of a carbonate margin as a recorder of eustatic sea level changes, and the sampling the lower continental crust and upper mantle, which may be represented by blocks in the ejecta blanket. This proposal is being coordinated with proponents of the complementary Caribbean proposal (#415, Sigurdsson et al.), with whom we plan to cooperate and work closely as the programs develop. Because of the complexity and specific differences of the scientific objectives, however, and the distance between the areas, we have submitted separate site-survey proposals and are continuing to submit separate drilling proposals.

# ODP Proposal Log Sheet 419----

Proposal received: Jul 28, 1992

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

## Convergence of Oceanic Lithosphere at the Eastern End of the Azores - Gibraltar Plate Boundary

R. Sartori, L. Torelli, N. Zitellini, E. Lodolo and D. Peis

| Abbrev. Title: Convergence at Azores-Gibralter plate boundary | Key: Azores-Gibraltar plates | Area: N Atl |
|---|---|---|

**Contact:**

Dr. Nevio Zitellini
Instituto de Geologia Marina CNR
via Zamboni 65
40127 Bologna (I)
Tel: 39 (51) 244-004
FAX: 39 (51) 243-117

Long Range Plan 6/5

**Objectives:**

Interaction between major lithospheric plates

- directly study onset of convergence between Iberia-European and African oceanic lithospheres
- constrain plate kinematic reconstructions deduced by magnetic lineations in the Atlantic
- petrography and petrofabrics of oceanic layer 3 and mantle
- in situ fluid characters and mechanical properties along thrust surfaces involving oceanic bsmt. and mantle
- supplement reconstruction of North Atlantic non-volcanic passive margin history

**Specific area:** Horseshoe Abyssal Plain, Gorringe Bank, Tagus Abyssal Plain

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration | | | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| | | | Sed | Bsmt | Total | |
| GB 1 | 36°36.45'N; 011°18.54'W | 1081 | 900 | 100 | 1000 | Date uplift, start of convergence; petro. of gabbros/peridot. |
| TAP 1 | 37°04.33'N; 011°40.67'W | 5025 | 1000 | 100 | 1100 | Date olisthostrome, regional unconf.; nature of basement. |
| TAP 1A | 37°05.63'N; 011°41.67'W | 5025 | 1200 | 100 | 1300 | As TAP 1. |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | 07/28/92 | to: | Zitellini, N. |
| Proposal forwarded for review: | 08/03/92 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | 08/03/92 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000396

**Proposal Reference No.:** **419----**

**Title: "Convergence of Oceanic Lithosphere at the Eastern End of the Azores — Gibraltar Plate Boundary"**

**Proponents:** R. Sartori, L. Torelli, N. Zitellini, E. Lodolo and D. Peis

**Abstract**

We propose to drill a transect of relatively deep holes across the Horseshoe Abyssal Plain, the Gorringe Bank, and the Tagus Abyssal Plain. All these elements are located along the eastern termination of the Azores-Gibraltar boundary separating the Iberian (European) and African plates. This sector is presently undergoing convergence processes.

Available geophysical and drilling data have been implemented by a MCS leg just performed in the area (July 1992). A few Sites have been selected and are proposed to address important scientific themes such as: interaction between major Earth plates; tectonic objectives in the line of COSOD II recommendations; oceanic lithosphere and sediments.

000397

# ODP Proposal Log Sheet **380-Rev3** Proposal received: Jul 30, 1992

☐ *New proposal* ☒ **Revised proposal** ☐ *Addendum to proposal* ☐ *Other*

## Drilling into the Clastic Apron of Gran Canaria and the Madeira Abyssal Plain: Volcanic Island Evolution, Continental Margin Instability, Global Sealevel History and Basin Analysis

H.-U. Schmincke, P.P.E. Weaver, P.v.d. Bogaard, S. Cloetingh, R.E. Cranston, J.J. Dañobeitia, A. Freundt, H. Hirschleber, K. Hoernle, I. Jarvis, R.B. Kidd, R. Rihm, M. Schnaubelt, R.T.E. Schuttenhelm, K. Stattegger, H. Staudigel, J. Thompson, A.B. Watts, W. Weigel, G. Wissmann and R. Zahn

| Abbrev. Title: Clastic apron, Gran Canaria, and Madeira Abyssal Plain | Key: VICAP-MAP | Area: N Atl |
|---|---|---|

**Contact:**

Dr. H.U. Schmincke
GEOMAR
Christian-Albrechts-Universität zu Kiel
Wischhofstrasse 1-3
D-2300 Kiel 14 (G)

Tel: 49 (431) 7202-156
FAX: 49 (431) 725-391 or 650

**Objectives:**

Long Range Plan 1/3/14

Decompression evolution of intraplate mantle plume through clastic records of volcanic apron and abyssal plain

- mantle source evol. through isotope studies on clastics of non-exposed,unknown 95vol% of the island
- high-res. compositional, temporal, structural and sedimentological analysis of apron and abyssal plain
- 3D modelling of basin evolution, based on physical properties and ages (GRAPE, downhole measurments)
- response of lithosphere to loading and heating during magmatic activity and to enhanced levels of stress
- reconstruction of paleobathymetry and paleoceanography (dissolution interfaces, benthic org., isotopes)
- frequency, provenance, nanno-strat., distrib. and geochemistry of turbidties, calculation of sediment budgets
- effect of sea level fluctuation on basin sedimentation and deep sea record

**Specific area:** Canaria aprons and Madeira Abyssal Plain

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| MAP-1 | 31°09'N; 025°36.2'W | 5440 | 400 | 0 | 400 | Plio-Quat. high-res. turbidite strat.; diagenetic history. |
| MAP-2 | 31°56'N; 024°05'W | 5430 | 300 | 0 | 300 | As MAP-1. |
| MAP-3 | 30°47'N; 24°24'W | 5430 | 500 | 0 | 500 | As MAP-1. |
| MAP-4 | 31°59'N; 025°02'W | 5440 | 300 | 0 | 300 | As MAP-1. |
| VICAP-1 | 27°32'N; 016°09'W | 3500 | 1700 | 0 | 1700 | Most complete erosional stage deposits; prox. apron facies. |
| VICAP-2 | 27°27'N; 16°23'E | 3560 | 1700 | 0 | 1700 | Southern intermediate facies of apron; max. age volcanism. |
| VICAP-3 | 27°16'N; 16°42'E | 3620 | 1600 | 0 | 1600 | Distal facies of apron; max. age of volcanism. |
| VICAP-4 | 28°29'N; 15°00'E | 3400 | 1300 | 0 | 1300 | Northern proximal to intermediate facies of apron. |
| VICAP-5 | 28°48'N; 14°40'E | 3100 | 1900 | 0 | 1900 | Intermed. facies; Jurassic limestones; max. age volcanism. |

Proposal acknowledged by JOIDES Office: Jul 30, 1992 to: Schmincke, H.U.
Proposal forwarded for review: Aug 3, 1992 to: LITHP, OHP, SGPP, TECP
Proposal copies: Aug 3, 1992 to: JOI Inc., SO (ODP/TAMU), SSDB (LDGO)
Proposal forwarded to DPG: 00/00/00 to:

000398
**Proposal Reference No.:** **380Rev3**

**Title: "Drilling into the Clastic Apron of Gran Canaria and the Madeira Abyssal Plain: Volcanic Island Evolution, Continental Margin Sediment Instability, Global Sealevel History and Basin Analysis"**

**Proponents:** H.-U. Schmincke, P.P.E. Weaver, P.v.d. Bogaard, S. Cloetingh, R.E. Cranston, J.J. Dañobeitia, A. Freundt, H. Hirschleber, K. Hoernle, I. Jarvis, R.B. Kidd, R. Rihm, M. Schnaubelt, R.T.E. Schuttenhelm, K. Stattegger, H. Staudigel, J. Thomson, A.B. Watts, W. Weigel, G. Wissmann and R. Zahn

## Abstract

We proposed to study the development of the Canary Basin in terms of (1) the history of volcanic activity in the Canary hotspot, (2) the detailed evolution of the large volcanic oceanic islands of Gran Canaria and Tenerife (Canary Islands), and (3) the filling of the Madeira Abyssal Plain. This proposal represents the combination of two previous proposals (VICAP - Volcanic Island Clastic Apron Project - and MAP - Madeira Abyssal Plain) which addressed different aspects of the Canary Basin development.

VICAP concerns the physical and chemical evolution of the confined system "asthenosphere - lithosphere - seamount - volcanic island - clastic apron - sedimentary basin" by drilling into the proximal, medial and distal facies of a volcaniclastic wedge. The clastic apron is composed largely of material representing the evolution of the volcanic complex, including material no longer present on the island. Most importantly, it includes material from the unexposed and inaccessible submarine stages. The volcanic islands produce a large sediment supply with slopes that are at or near the critical angle of repose. They are prone to mass wasting, enhancing the probability that sea-level control vs. volcanic eruption and earthquake control can be distinguished. A major element of the program will be high precision single-crystal $^{40}Ar/^{39}Ar$ age dating with the aim of monitoring the island and basin evolution in detailed time slices as small as 100,000 years. The most distal sites on the Madeira Abyssal Plain will enable us to date major volcanogenic turbidites and hence large events in the Canary Island archipelago. We will achieve a quantitative analysis of a remarkably confined system. The magmatically governed sedimentary apron, which consists of material generated during more than 15 million years of volcanic and erosional activity, interfingers with nonvolcanic, continent-derived clastic and biogenic material.

The proposed drilling operation provides a case study of an intraplate volcanic system and its mantle source evolution in the sense of the JOIDES Lithosphere Panel long range Planning. It is accompanied by a massive land program, now underway, and is preceded by detailed geophysical pre-site monitoring. With VICAP, an attempt will be made to combine the temporal, spatial, compositional and volumetric evolution of the terrestrial-subaerial and submarine parts of a closely coupled geological system. The project is designed to provide a case history study and therefore a practical calibration system that will allow a more realistic assessment of the past volcanic, petrologic and plate tectonic environments of sedimentary basins adjacent to other productive volcanic source areas. This should serve as a model for the interpretation of many ancient marine sections as well as marine volcaniclastic successions drilled in the DSDP/ODP programs. This fundamental aspect of the proposal cannot, by definition, be solved by drilling on land. A pilot study of the cores from the distal facies of the apron (DSDP Sites 369, 397) has shown that the aims of the project proposed here are realistic (Schmincke and von Rad, 1979).

Madeira Abyssal Plain drilling is aimed at testing the hypothesis that ocean basin sedimentation is controlled by sealevel changes which affect the stability of sediments on continental margins including those on the flanks of volcanic islands. The products of mass wasting events accumulate on the continental slope and on the abyssal plains, but the abyssal plain is the only place where a complete record can be obtained in one drillsite. We predict that most sealevel changes, both rises and falls, will be associated with mass wasting events. Thus periods of oscillating sealevels, such as during the last 2.5 Ma, should be represented on the abyssal plains by sequences of turbidites, and periods of stable sealevels should be represented by continuous hemipelagic accumulation. Our evidence suggests that the abyssal plain is a young feature with the whole 350m thick turbidite sequence (20,000 $km^3$) being deposited in just a few million years. The drilling of 4 sites on the Madeira Abyssal Plain will allow mass balance calculations of sediment transported from the continental margins to the deep-sea, including mass balances for volcanogenic sediments derived from Madeira and the Canary Islands. The history of volcanogenic turbidites will be closely tied to the history of the volcanic islands and should provide information on the initiation of hotspot activity, on phases of increased volcanic activity and major island-flank collapse events. The frequency of turbidite input and composition of the units on the Madeira Abyssal Plain is ideal for studies of long term diagenesis and sediment burial. We will also be able to study the fate of unstable volcanic glass in the clastic aprons under varying heatflow regimes.

# ODP Proposal Log Sheet **420----**

Proposal received: Jul 30, 1992

☒ New proposal ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

## The Evolution of Oceanic Crust

G.M. Purdy, D. Abbott, K. Becker, N. Christensen, A. Fisher, G.J. Fryer, H.P. Johnson, J. Karson, J. Karsten, M. Kastner, M. Langseth, D. Lavoie, G. Thompson and R. Wilkens

| Abbrev. Title: The evolution of oceanic crust | Key: Oceanic crust evol. | Area: N Pac |
|---|---|---|

**Contact:**

Dr. G. Michael Purdy
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 (US)

Tel: 1 (508) 457-2000 x2826
FAX: 1 (508) 457-2187
Omnet: WHOI.Geol.Geoph

**Objectives:** (Long Range Plan)

1. Structural geology and seismic structureof the upper crust ☐
   - cores along flow line to reveal details of interplay between volc., tectonic and hydro. proc. beneath ridge axis
   - role of faults in sea floor spreading through unequivocal fault rock sample across an abyssal hill fault zone
   - upper crustal stratigraphy of crust created at fast spreading ridge
   - physical and geological nature of the lowermost boundary of the SLVL
   - correl. betw. geol. architecture and p/s-wave velocity and the magn./nature of porosity in uppermost crust
   - relationships between observed seismic velocity within SLVL and nature/extent of alteration in drill hole
2. Hydrogeology and rock-water interaction [10]

A. Mass and energy flux in the crust ☐
   - duration of geochem. and geothermally significant fluid flow through sediments and basalts of upper crust
   - role of sediment cover in the evolution of the hydrogeology of the uppermost crust
   - identify parameters that most strongly control intensity and geometry of seawater circulation in the crust
   - primary source and magn. of lateral/vertical pressure grad. in upper crust, role of isolated bsmt. outcrops
   - fracture permeability in crust after several tens of ma, role of faults in guiding/blocking fluid flow
   - chemical exchange with crust of moderate age, estimate how much change remains to take place
   - water-rock system near steady-state after tens of ma, or are there still active transient chem./thermal proc.

B. Alteration of the upper crust ☐
   - spatial scales of alteration type, vertical/lateral intensity
   - influence of crustal age, spreading rate and crustal morphology on regional spatial scales
   - influence on alteration of topography, rock type, sed. type, thickness and fissuring on local spatial scales
   - chemical fluxes into and out of crust
   - alteration-controlled seismic boundaries?
   - influence of mechanical evolution on alteration
   - geometry of off-axis hydrothermal systems, etc.

3. Rock physics ☐

**Specific area:** W flank EPR, N of Clipperton FZ

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| CREV-1 | 12°??'N; 118°??'W | 4500 | 90 | 500 | 590 | Trans. thermal regime; intersect bounding normal fault. |
| CREV-2 | 12°??'N; 118°??'W | 4500 | 90 | 500 | 590 | Trans. thermal regime; near bounding normal fault. |
| CREV-3 | 07°??'N; 147°??'W | 5300 | 250 | 500 | 750 | Sealed, conductive thermal regime; intersect normal fault. |
| CREV-4 | 07°??'N; 147°??'W | 5300 | 250 | 500 | 750 | Sealed, conductive thermal regime; near normal fault. |

Proposal acknowledged by JOIDES Office: Jul 30, 1992 to: Purdy, G.M.
Proposal forwarded for review: Aug 3, 1992 to: LITHP, OHP, SGPP, TECP
Proposal copies: Aug 3, 1992 to: JOI Inc., SO (ODP/TAMU), SSDB (LDGO)
Proposal forwarded to DPG: 00/00/00 to:

000400

**Proposal Reference No.:** **420----**

**Title: "The Evolution of Oceanic Crust"**

**Proponents:** G.M. Purdy, D. Abbott, K. Becker, N. Christensen, A. Fisher, G.J. Fryer, H.P. Johnson, J. Karson, J. Karsten, M. Kastern, M. Langseth, D. Lavoie, G. Thompson and R. Wilkens

**Abstract**

The primary research objective of this proposal is to understand the processes that control the evolution of the structure of the uppermost oceanic crust. We propose a two-leg drilling program on the western flank of the East Pacific Rise, in crust that was formed on the segment north of the Clipperton Fracture Zone. The first leg would drill and log a pair of holes about 500 m deep at a site where the thermal regime indicates a transition from convective to a conductive thermal regime. These we call the *Transition Sites*, CREV-1 and CREV-2. The second leg would drill and log a similar pair of holes in older crust (~60 my) with a conductive thermal regime, along a flow line from the first site. These we call the *Sealed Sites*, CREV-3 and CREV-4.

We know that profound changes occur in the physical and chemical characteristics of oceanic crust as it ages. The best known manifestation of these processes is the doubling of compressional wave velocities in the uppermost crust from ~2 km/s at zero age to over 4 dm/s beyond 60 my. Our knowledge of the structure of the uppermost crust and the processes that cause and control this evolution and alteration is inadequate: insufficient data exist to satisfactorily constrain quantitative models of the physical and chemical processes that produce these large and apparently systematic changes. Interdisciplinary work in geochemistry, sedimentology, seismology, tectonics, structural geology, dynamics of hydrothermal circulation and rock physics is required to explore the relationships between seismic structure and alteration history, to learn how the uppermost crust evolves, to determine how faults affect fluid circulation and hence alteration, and to investigate the effects of the sediment blanket. But the basic data for such work are still lacking and it is to the correction of this omission that this proposal is directed.

An essential characteristic of the proposed drilling strategy is to drill a *pair* of sites at each of the two locations. In order to make meaningful comparisons of results from sites separated in age by several tens of millions of years, it is extremely important to understand the range of variability which can occur in oceanic crustal structure at smaller spatial scales. Therefore we make the case that it is necessary to drill two adjacent ("paired") reentry sites, in order to meet the objectives of this project. In each case one hole would be located at the base of that same abyssal hill, positioned so as to penetrate the bounding normal fault structure a few hundred meters subseafloor.

Our ultimate goal - to understand the structure of oceanic crust and the processes that control its evolution - is ambitious. The drilling and associated programs described here will not fully achieve these objectives but will be a critical first step in a long-term program that is essential to the understanding of the processes that control the physical and chemical changes occurring in ~60% of the hard rock surface of the earth.

000401

# ODP Proposal Log Sheet **421----** Proposal received: Jul 30, 1992

☒ **New proposal** ☐ *Revised proposal* ☐ *Addendum to proposal* ☐ *Other*

## Alkali-Acidic Rocks of the Volcano Trench

B.I. Vasiliev

| Abbrev. Title: Alkali-acidic rocks of the Volcano Trench | Key: Volcano Trench | Area: N Pac |
|---|---|---|

**Contact:**


Dr. B.I. Vasiliev FAX: 7 (4232) 22-45-52
Pacific Ocean Institute
43 Baltiyskaya Str.
Vladivostok, 690032 (Russia)


Long Range Plan ☐

**Objectives:**

Geodynamic explanation of presence of Jurassic alcali-acidic subaerial rocks within ocean floor (7000m bsf)

- sampling alcalic-acidic rocks of the volcanogenic layer
- dating the volcanogenic layer by paleontological and radiometric methods (suggested: Middle-Late Jurassic)
- composition and age of underlying and superimposed rocks

**Specific area:** Volcano Trench

**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| VT | 24°08.3'N; 143°55.1'E | 6800 | 10 | 1500 | 1510 | Sample volc. acidic-alcalic rocks at ocean slope |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | Jul 31, 1992 | to: | Vasiliev, B.I. |
| Proposal forwarded for review: | Aug 3, 1992 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | Aug 3, 1992 | to: | JOI Inc., SO (ODP/TAMU), SSDB (LDGO) |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

000402

**Proposal Reference No.:** **421----**

**Title: "Alkali-Acidic Rocks of the Volcano Trench"**

**Proponents:** B.I. Vasiliev

## Abstract

In 1984 and 1986, during the cruises held by the Pacific Oceanological Institute (Vladivostok), interval dredging had been carried out in the Volcano trench. When dredging, rocks, not typical for the ocean floor, had been discovered. The rocks form continuous sodium series differentiated beginning from alkali and subalkali basalt up to pantellerite and trachyrhyolite contining 72% of $SiO_2$. The intermediate members of the series are as follows: hawaiite, mugearite, benmoreite, trachyte and trachydacite. In addition, there are melanocratic syenite-porphyrite (probably dykes and tuffaceous rocks bearing complex of foraminifera typical for Middle-Late Jurassic. It seems likely that the rocks form interbeds in the volcanogenic layer and in this way they mark the age of the layer as Jurassic. Macro-rublerocks such as tuff-breccia and tuff-lava (formed under subaerial conditions) dominated composition of the layer. It is agreed that the acid and subalkali rocks are typical for the areas with "mature" continental crust of great thickness. Therefore, the presence of such rocks at the ocean floor, beneath the "andesite line" hardly can be explained from the point of view of "the lithospheric plates tectonics" and requires detailed investigation which is possible only by deep-sea drilling.

Thus, the main scientific objectives of drilling the Volcano trench are as follows:

1. Studying the section of the volcanogenic layer of alkali-acid composition.
2. Dating the layer by paleontological and radioisotopic methods.
3. Studying the rocks underlying and superimposing the layer.

This will make possible carrying out the geodynamic model providing explanation for the presence of Jurassic subaerial rocks of alkali-acid composition within the ocean floor at the depth of 5400-7000 meters.

# Agenda Item L.

# Leg 146

## Santa Barbara Basin Drilling

000001

# Branch of Petroleum Geology
# U. S. Geological Survey

RECEIVED
JUL 30 1992
Ans'd............

**Date** 7-30-92

**Telefax No.:** 512-471-0999

**To:** Prof. James Austin
UTIG, P-COM Chair

**From:** M. Ball (phone- 303-236-5784)

**Telephone** 512-471-0450

**Telefax No.:303-236-8822**

**Re:** Preliminary mail review of Jim Kennett's proposed Santa Barbara sites.

I received input from:

| | |
|---|---|
| PPSP Members | |
| George Claypool: | Mobil |
| Claude Delas: | Total |
| Mimi [illegible]: | Canadian Oil & Gas Directorate |
| Louis Garrison: | Consultant |
| Ed Perry: | Consultant |
| ODP Safety Panel | |
| Kevin Burke: | Natl. Research Council |
| Thomas Thompson: | Consultant |
| Henk Wories: | Consultant |

Based on comments of the above, it is my impression that we will be able to select a reasonably safe site for a 200m piston core in the Santa Barbara basin.

Best regards,

Mahlon M. Ball
JOI-PPSP Chair

**PAGES TO FOLLOW:** 0

000002

DRILLING PROPOSAL
(UPDATE; JOIDES PROPOSAL #409)

# HIGH RESOLUTION LATE QUATERNARY PALEOCLIMATIC AND SEDIMENTARY RECORD, SANTA BARBARA BASIN, CALIFORNIA

RECEIVED
JUL 2 8 1992
Ans'd............

OCEAN DRILLING PROGRAM

From: James P. Kennett
Marine Science Institute
University of California
Santa Barbara, California 93106

## ABSTRACT

As the result of a recent successful site survey, this is an updated proposal to conduct double APC coring of the upper 200 m of sediments in the Santa Barbara Basin, California. The middle to late Neogene sediments of the Santa Barbara Basin and adjacent areas were deposited at high sedimentation rates in dysaerobic/anoxic conditions and contain diatoms, radiolarians, foraminifera and pollen in sufficient abundance, thus providing an important opportunity for ultra-high resolution paleoclimatic/paleoceanographic investigations in the late Quaternary. Stable isotopic, geochemical and micropaleontological studies will be of considerable value in providing critical information within the context of global climatic change and the role of the ocean in the global carbon cycle. The site should provide a maximum of data relative to a minimum use of drill-ship time.

The proposed site (SB-1) has been selected from near the center of the Santa Barbara Basin, based upon cross-lines of single channel seismic and 3.5 kHz data collected during a recent Farnella survey (May, 1992). The total 24 hours assigned to this project will allow double APC coring (XCB in lower part if necessary) to the maximum allowed depth of 200 m. The site survey shows that the sediments in the basin are flat-lying, structurally very simple, and pose no safety problems during the coring.

This site is proposed to be drilled at the end of the Cascadia Leg (ODP Leg 146), in late November, 1992.

## Value of the Basin Sequence

The Santa Barbara Basin site provides an unprecedented opportunity to obtain needed ultra-high resolution paleoclimatic records during the late Quaternary in western North America and the Northeast Pacific Ocean. Coring laminated sediments in the Santa Barbara Basin should provide a unique high-resolution record of paleoproductivity, climatic variations and oceanographic variations of the California Current during the late Quaternary. These areas are crucial to scientists working on the global carbon cycle. Annual layering of sediments will allow sampling of oceanographic variations, including El Niño episodes, at a frequency rarely accessible to earth scientists. In addition, results of Santa Barbara Basin coring may be integrated with tree-ring and other nearby continental climate reconstructions to understand coupled ocean-continent changes relevant to global environmental change.

This record will also allow high-resolution studies during the late Quaternary of current strength, productivity, and other variations due to sea level and global climatic change, including the effect of sun spot cycles (11 yr.) and other solar cycles. A tie-in to deep-sea stratigraphy would greatly enhance our knowledge about the history of coastal upwelling in the Milankovitch time scale. This knowledge is necessary to properly understand changes in the carbon dioxide content of the atmosphere as seen in ice cores. Due to the high organic carbon content of the sediment, the carbon isotopic record of carbonate can be directly compared to the carbon isotopic composition of individual biological markers on a lamina by lamina basis.

Valuable data related to the nature of organic carbon preservation, diagenesis of silica and phosphate, and fluid flow in borderland basins will also be provided by the Santa Barbara Basin coring. Santa Barbara Basin sediments may provide an analog for understanding hydrocarbon generation and diagenesis in older organic-rich siliceous deposits such as the Miocene Monterey Formation. Early diagenesis of sulfur-rich kerogen that generates petroleum at substantially lower temperatures than typical marine kerogen can also be traced. Study of the role of chemosynthetic communities in carbon cycling and storage may help to understand periods of ocean history when these organisms were more widespread.

## Geologic Setting

The Santa Barbara Basin is a tectonic depression that constitutes the submerged southwestern part of the Transverse Ranges Province. The area is commonly referred to as the Santa Barbara Channel, and the basin is up to 625 m deep. The basin itself consists of a very thick (>2000 m) uncomplicated flat-lying sequence of Quaternary sediments (Figure 1 and 2). The sill depth to the west of the basin is only 400 m deep, and within the oxygen minimum zone and hence waters in the deeper parts of the basin are dysaerobic leading to organic carbon preservation and to a general lack or reduction in bioturbation. Hence, in combination with high sedimentation rates, it is possible to resolve decadal paleoclimatic changes and even interannual to annual climatic change in parts of this sequence.

**Scientific Objectives**

To obtain a 200 m (double APC coring) sequence of late Quaternary sediments for ultra-high resolution studies of:

1. Paleoclimatic history.
2. Paleoceanographic history, including paleoproductivity.
3. Organic carbon production, preservation and diagenesis.
4. Silica and carbonate production, preservation and diagenesis.
5. Microfossil preservation and biostratigraphy.
6. Paleomagnetism.
7. Physical properties of sediments.
8. Sediment history in borderland basin.

The sequence will be correlated with detailed changes elsewhere, and interpreted within a global change context.

**Site Survey Information**

In May, 1992, a successful single channel and 3.5 kHz seismic site survey was conducted in the Santa Barbara Channel using the R. V. Farnella (Figures 3A,B), and funded by NSF via JOI/USSAC. The site survey data has been filed with the Site Survey Data Bank.

The proposed site (SB-1) has been selected from a total of four potential sites within the basin with cross-line data of both single channel and 3.5 kHz seismic data (Figures 4 and 5). The data from one of these four sites was less than satisfactory because of insufficient seismic penetration. Data for the other two sites (SB-1A and SB-1B) are shown in Appendix I, and were proposed as alternate sites to the Safety and Pollution Prevention Panel.

We propose to core SB-1 (Figures 3 to 5; Table 1). This site was selected amongst the three because it is the deepest (588 m) and closest to the center of the basin, in the area between the two shipping lanes, where the most useful Holocene piston cores have been obtained for ultra-high resolution stratigraphic studies. At this site the airgun record is well resolved to 300 m below the sea floor (Figure 4). This is a highly layered sequence. All layers are flat-lying and there is no sign of any structure. The 3.5 kHz record exhibits broad transparent zones with thin layers that are probably thin turbidite sands.

## Safety Considerations

Safety considerations are prominent in the proposed drilling operation. The site survey data shows that the drilling of site SB-1 (or the alternate locations) to 200 m depth should not encounter hydrocarbons. Sediment throughout the basin and at the sites themselves are flat-lying and exhibit no structure to the depth of penetration of the airgun (300 to 600 m). (See figures.) All sites have cross-lines for both the airgun and 3.5 kHz records. There are no apparent complications or anomalies in the records. This is a simple, flat stratigraphic sequence and is expected to be of late Quaternary age less than 130,000 years, and certainly less than 200,000 years older at maximum depth of coring (200 m).

According to Dr. Gregg Blake of UNOCAL, the "probability of hitting hydrocarbons in the upper 200 m is relatively small. Areas that contain hydrocarbons in shallow sediments, i.e., oil seeps, are located up on the margins of the basins or in areas with complex structure and faulting." Neither complex structure or faulting are exhibited at site SB-1 (nor the alternate locations). An Exxon exploratory well (OCS P-0353#1) in the eastern part of the basin encountered no hydrocarbons in the upper part of the well, according to Dr. Blake. Oil production platforms exist to the north of the basin on the continental shelf. The area is well known for its natural marine oil and gas seeps, but again only in shallow waters.

In summary, although the potential site is located in a region rich in hydrocarbon resources, we expect that no oil or gas will be encountered during the coring operation. Of course, continuous hydrocarbon monitoring is needed during coring.

Site SB-1 is located between and outside of the two shipping lanes that run through the channel (Fig. 3B). Many oceanographic expeditions, including piston coring, have previously been conducted between the two shipping lanes with no difficulty. The site survey was conducted so that all seismic cross-lines, and hence potential sites, are located outside of the shipping lanes. Alternate site SB-1A is to the north of the northern shipping lane, and SB-1B is to the south of the southern shipping lane. (Fig. 3B)

## Drilling Strategy

Site SB-1 is proposed to be drilled at the end of the Cascadia Leg (ODP Leg 146) in late November, 1992. If approved, a total of 24 hours on site has been assigned for the project. Site SB-1 is to be double APC cored to a maximum sub-bottom depth of 200 m. If the lower part of the hole is too consolidated for use of the APC, then the XCB is to be employed. The bottom of the hole is expected to be less than 130,000 years B.P. Double APC coring is needed to provide a complete, continuous sequence. Continuous hydrocarbon monitoring is required during the coring operations.

The cores will be cut into 1.5 m lengths on board the ship, capped, and stored unopened in the cold locker. The cores will not be split or sampled during Leg 146. The current plan is that the splitting, description, sampling and analysis of the cores will occur later at a shore-based facility.

**Time Requirement** (24 hours maximum)

| | | |
|---|---|---|
| Set up and leave site | | 6 hours |
| Drilling: 25 minutes/APC for 22 cores | | 9 hours |
| Second APC core | | 9 hours |
| | Total | 24 hours |

0000008

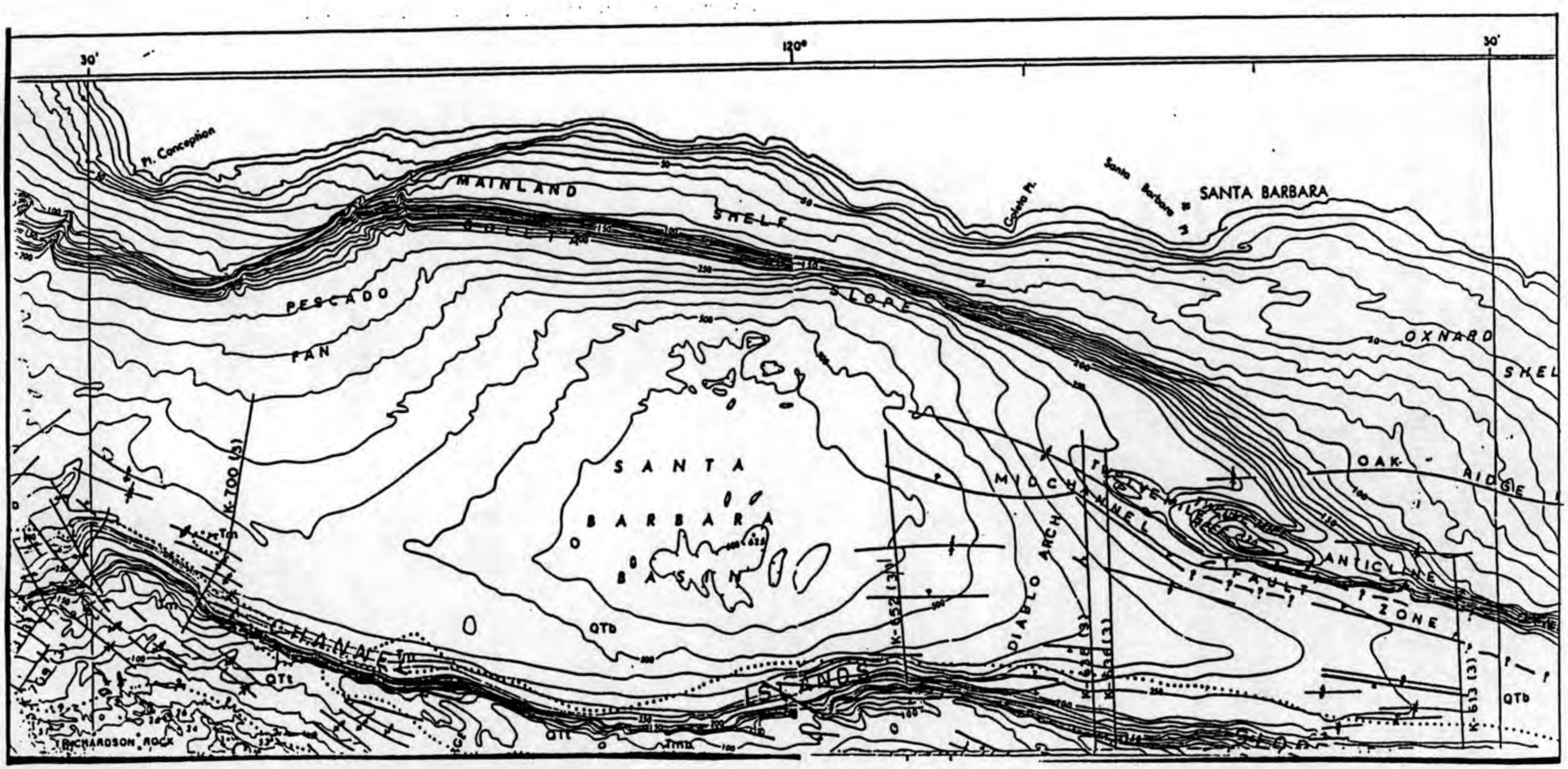



Figure 1. Location of seismic profile K-652 (north-south) at the eastern edge of the Santa Barbara Basin. (From Junger, 1979, Miscellaneous Field Studies, Map MF-991, U.S.G.S.)

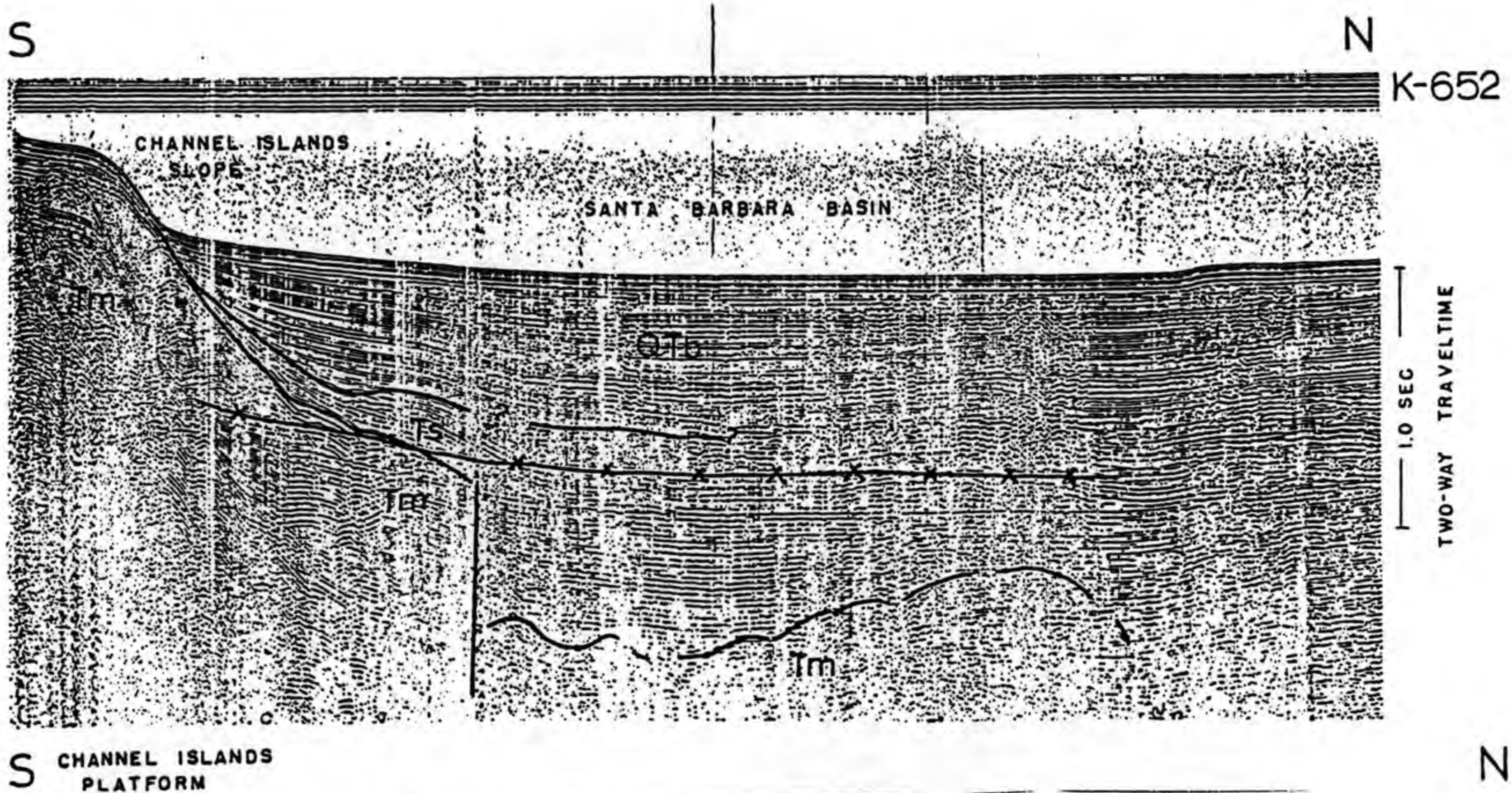



Figure 2. North to south seismic profile across the eastern edge of the Santa Barbara Basin. See Fig. 1 for location of profile. (From Junger, 1979, Miscellaneous Field Studies, Map MF-991, U.S.G.S.)

000009

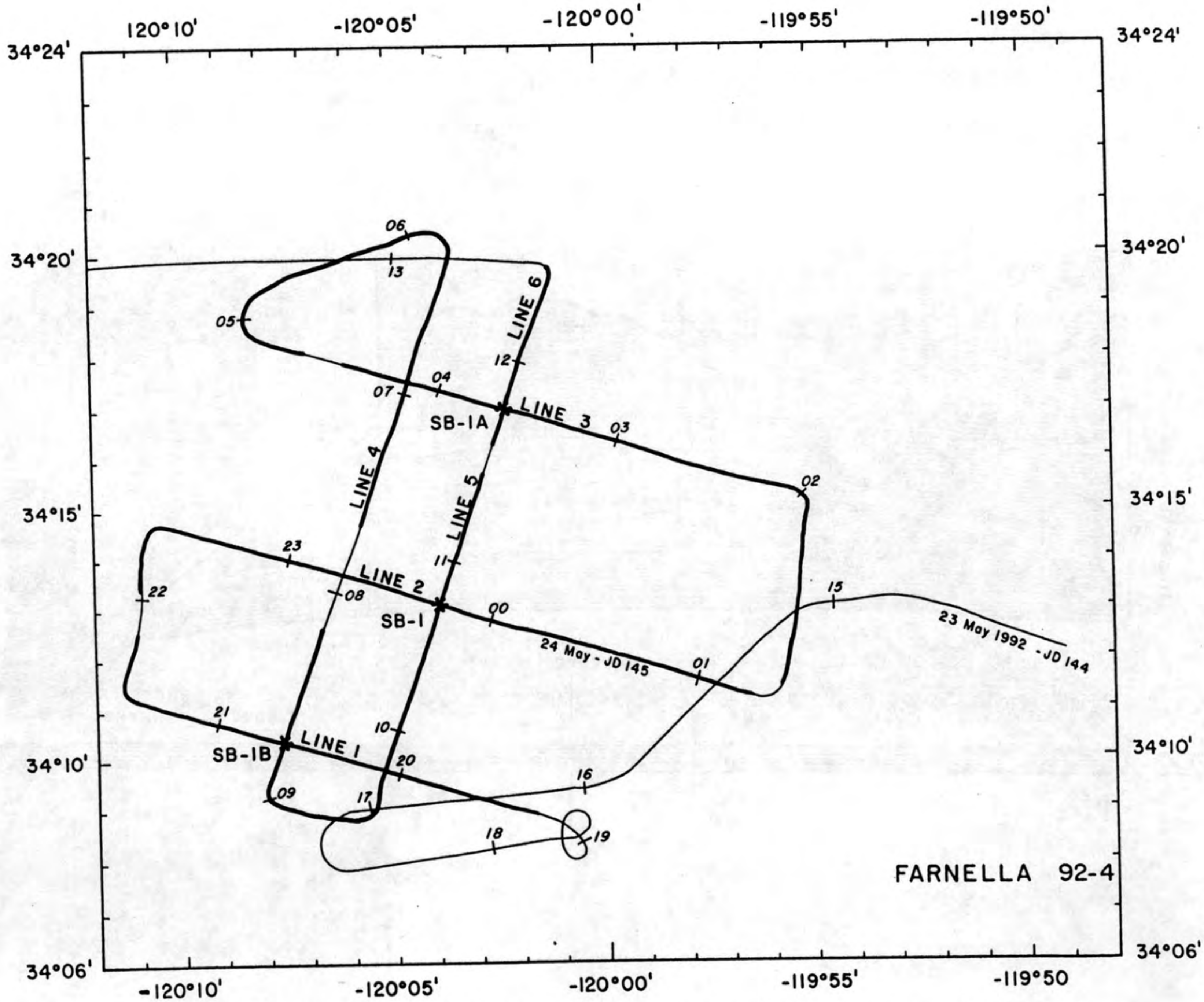



Figure 3A. Location of R. V. Farnella seismic survey profiles and proposed site SB-1 in the Santa Barbara Basin. Also shown are alternate sites SB-1A and SB-1B.

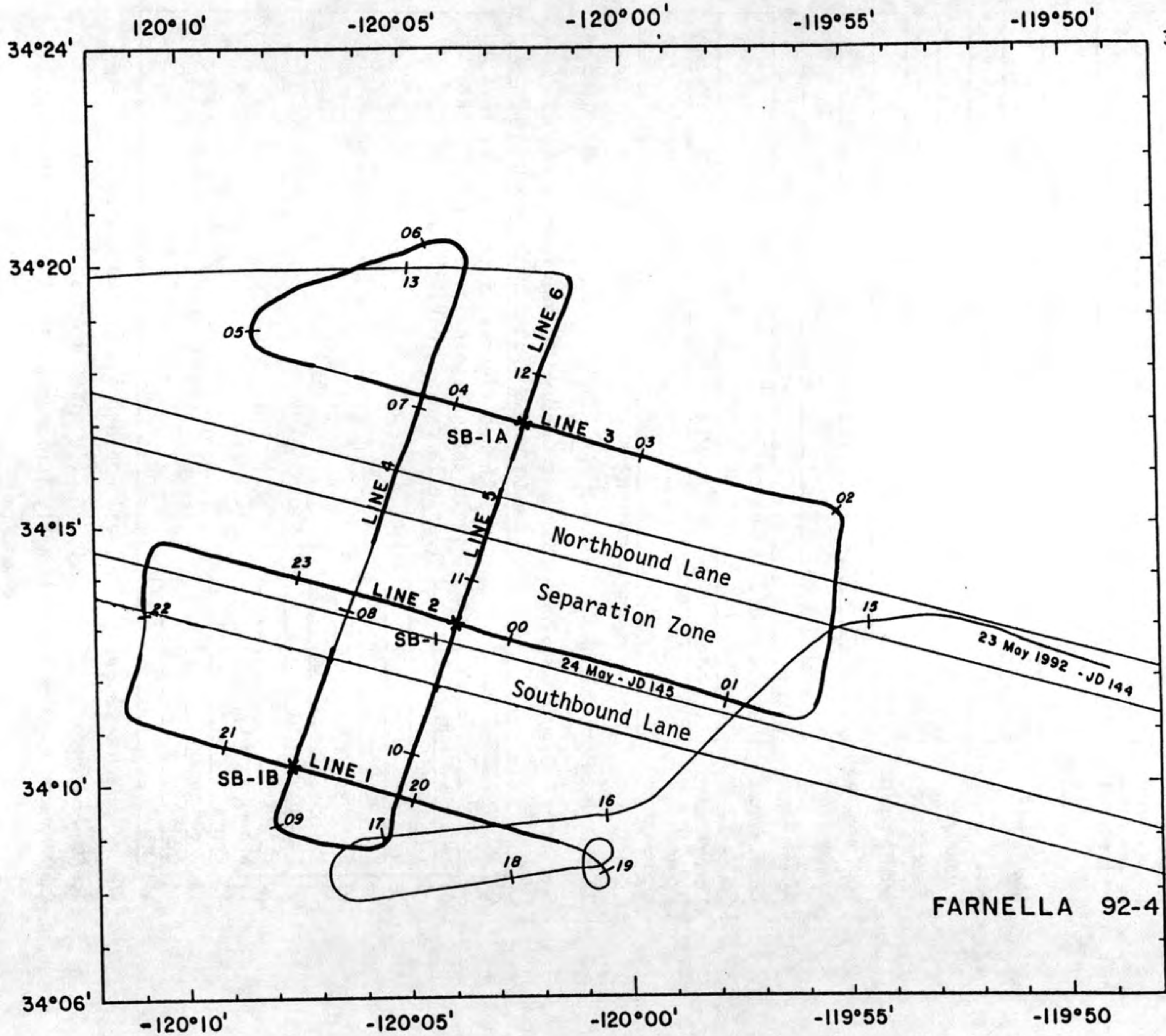



Figure 3B. Location of site (and alternates) in relation to shipping lanes

000011

000012 TABLE 1

# ODP Site Summary Form 6/91

Fill out one form for each proposed site and attach to proposal

| | |
|---|---|
| Title of Proposal: | High Resolution Late Quaternary Paleoclimatic and Sedimentary Record, Santa Barbara Basin, California |
| Site-specific Objective(s) (List of general objectives must be inc. in proposal) | High resolution paleoenvironmental (paleoclimatic/paleoceanographic/sediment/paleomagnetic) history of late Quaternary in Santa Barbara Basin anoxic/dysaerobic sediment sequence. |

| | Proposed Site | Alternate Site |
|---|---|---|
| Site Name: | SB-1 | SB-1A; SB-1B |
| Area: | Santa Barbara Basin | (See Appendix for data on alternate sites) |
| Lat./Long.: | $34^{o}13.1'N; 120^{o}03.9'W$ | |
| Water Depth: | 588 m | |
| Sed. Thickness: | 4,000 m+ | |
| Total penetration: | 200 m | |

| | Sediments | Basement |
|---|---|---|
| Penetration: | 200 m | No |
| Lithology(ies): | Anoxic muds, laminated in zones & thin turbidite sands. | |

Coring (check): 1-(2)-3-APC VPC* (XCB) MDCB* PCS RCB DCS* Re-entry

Downhole measurements: None

*Systems currently under development

**Target(s)** (see Proposal Submission Guidelines): (A) B C D E F G (check)

**Site Survey Information** (see Proposal Submission Guidelines for details and requirements):

| | | Check | Details of available data and data that is still to be collected |
|---|---|---|---|
| 01 | SCS deep penetration | | See attached figures of cross-lines for single channel seismics and 3.5 kHz data (Farnella cruise, May, 1992) |
| 02 | SCS High Resolution | ✓ | |
| 03 | MCS and velocity | | |
| 04 | Seismic grid | | |
| 05 | Refraction | | |
| 06 | 3.5 or 12 kHz | ✓ | |
| 07 | Swath bathymetry | | |
| 08 | H.-res side-looking sonar | | |
| 09 | Photography/video | | |
| 10 | Heat flow | | |
| 11 | Magnetics/gravity | | |
| 12 | Coring | ✓ | |
| 13 | Rock sampling | | |
| 14 | Current meter | | |
| 15 | Other | | |

Weather, Ice, Surface Currents: Ideal weather and sea conditions.

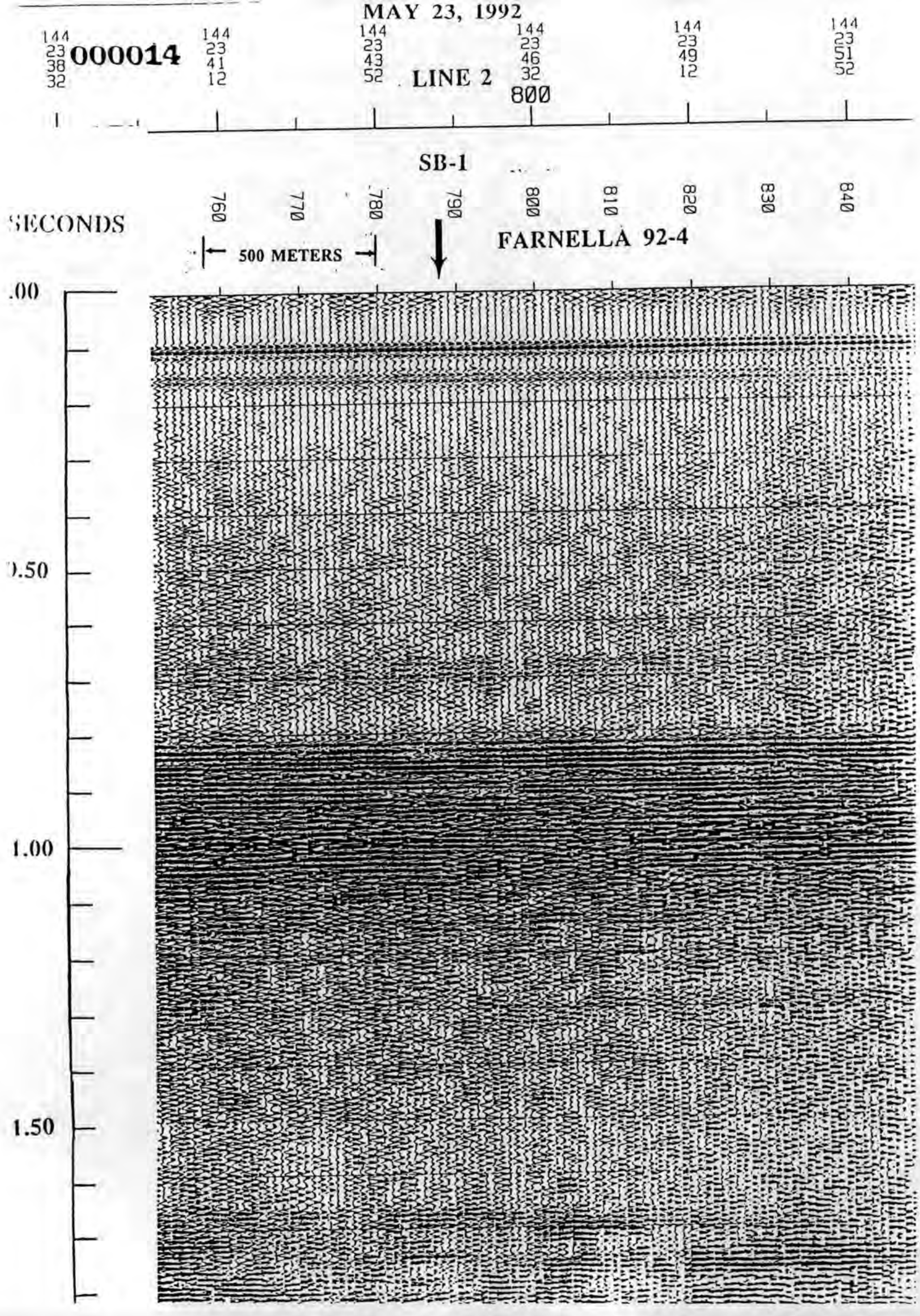
Territorial Jurisdiction: U.S.A. (18 miles from shore)

Other Remarks: Site located safely in zone between two shipping lanes.



| Contact Proponent | Name/Address | Phone/FAX/Email |
|---|---|---|
| | James Kennett<br>Marine Science Institute<br>University of California<br>Santa Barbara<br>Santa Barbara, CA 93106 | (805) 893-3764<br>(805) 893-8062 (FAX) |

Figure 4. Single channel seismic profiles for SB-1. Cross-lines are formed by Line 2 (west to east) and Line 5 (south to north)


MAY 23, 1992
000014
144 23 38 32
144 23 41 12
144 23 43 52
144 23 46 32
144 23 49 12
144 23 51 52
LINE 2
800
SB-1
760
770
780
790
800
810
820
830
840
SECONDS
FARNELLA 92-4
500 METERS
1.00
1.50

000015

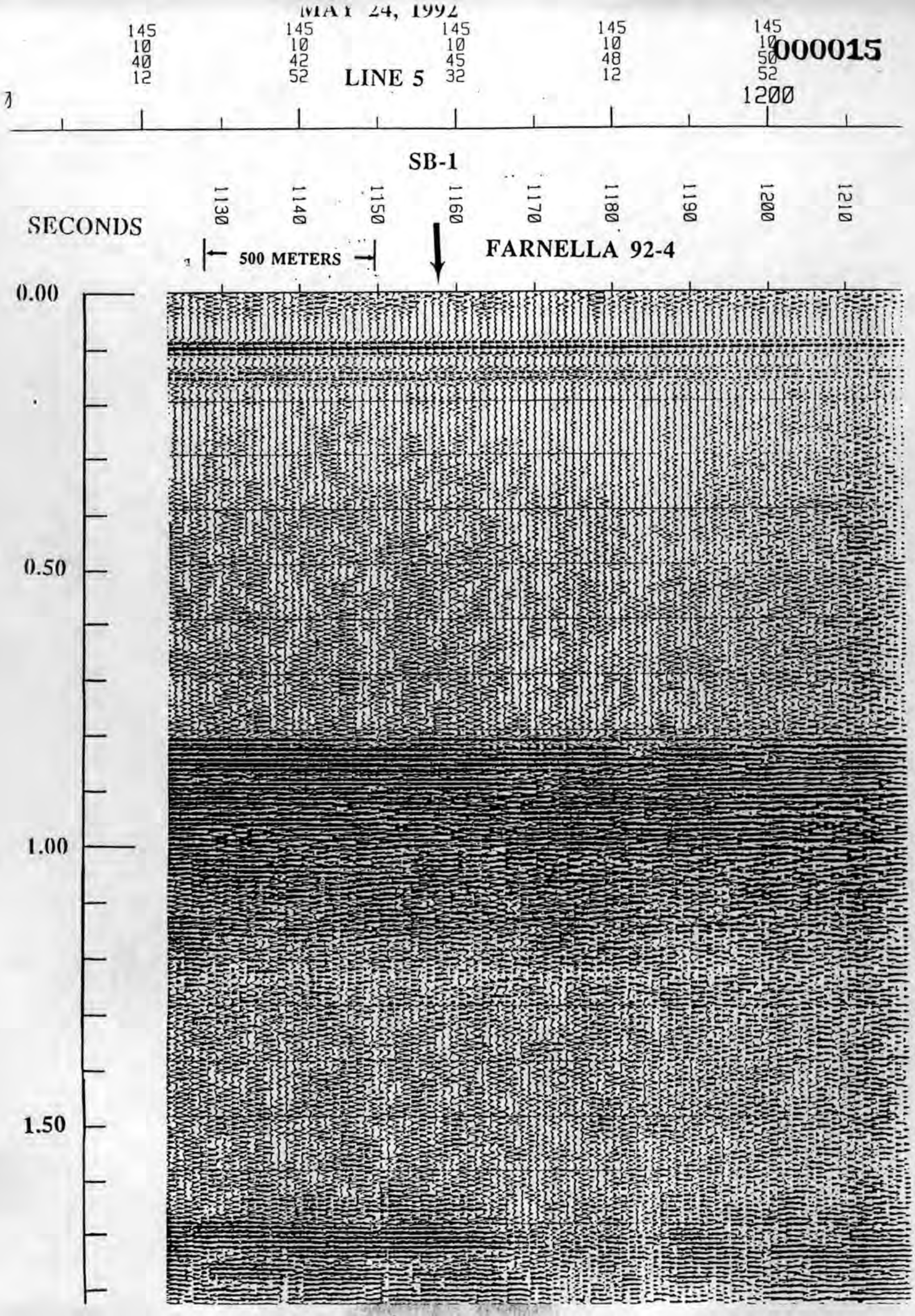
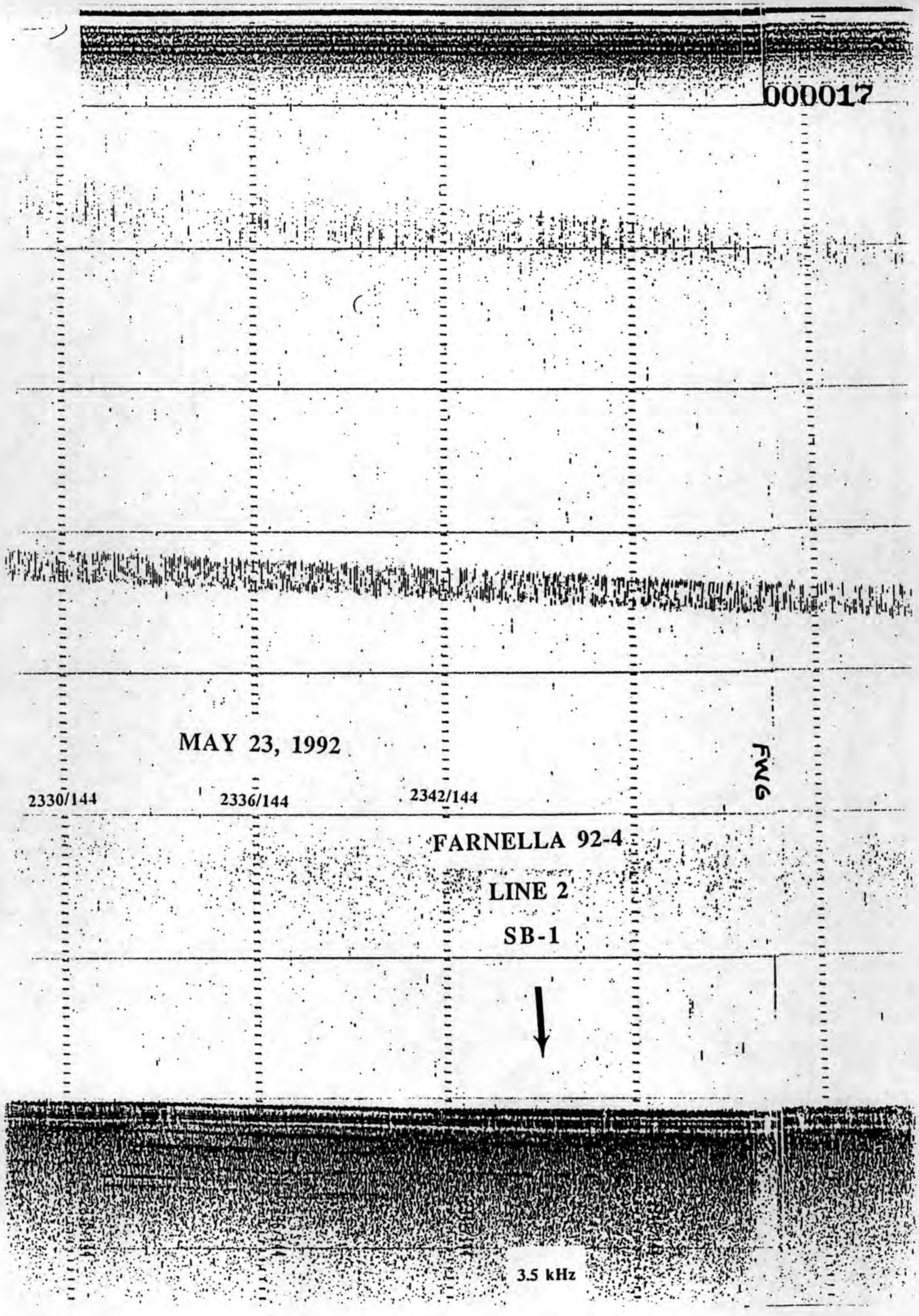
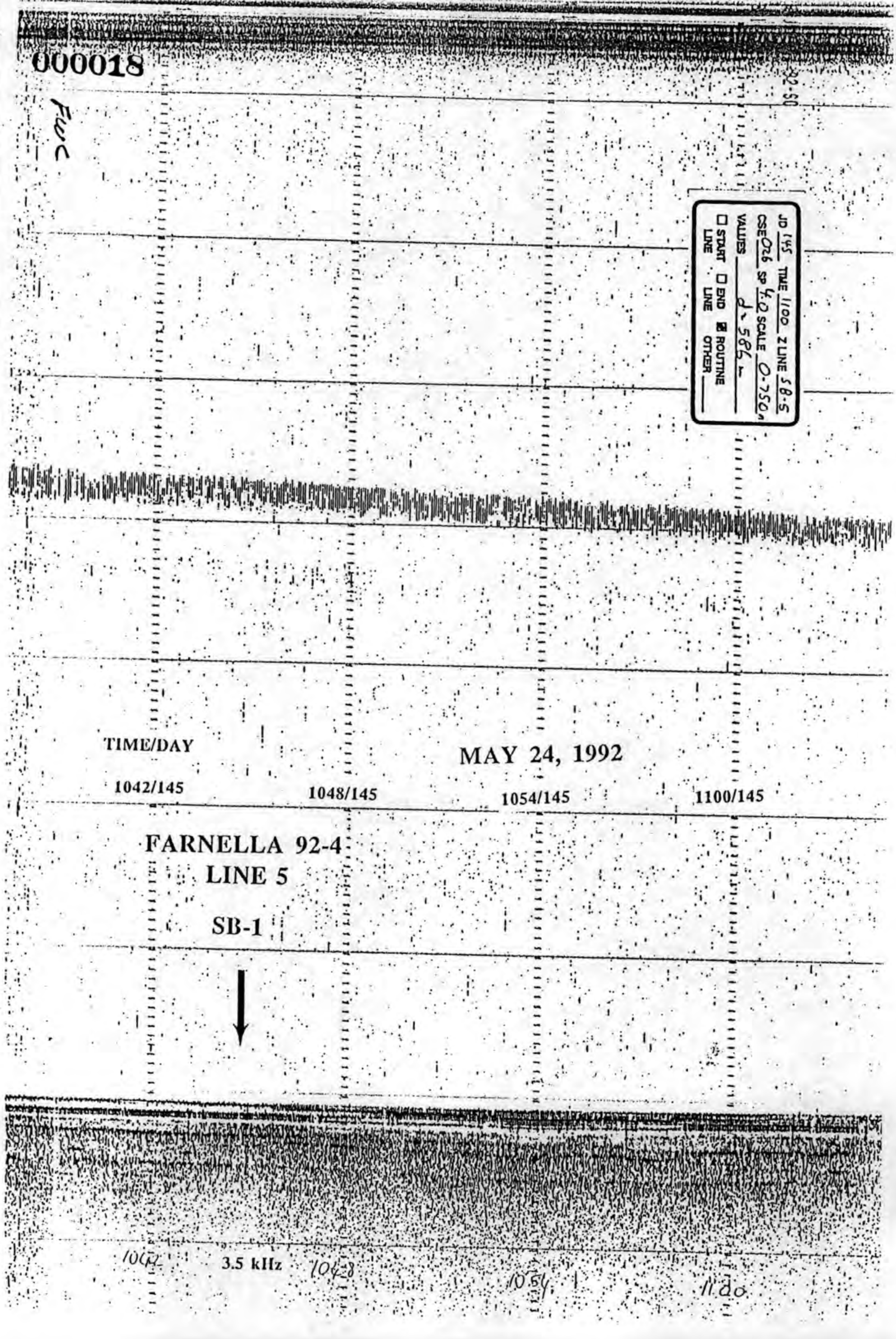

MAY 24, 1992
LINE 5
145 10 40 12
145 10 42 52
145 10 45 32
145 10 48 12
145 10 50 52
1200
SB-1
1130
1140
1150
1160
1170
1180
1190
1200
1210
SECONDS
500 METERS
FARNELLA 92-4
0.00
0.50
1.00
1.50

Figure 5. 3.5 kHz seismic profiles for SB-1. Cross-lines are formed by Line 2 (west to east) and Line 5 (south to north)

000017


MAY 23, 1992
2330/144
2336/144
2342/144
FWG
FARNELLA 92-4
LINE 2
SB-1
3.5 kHz

000018


FWC
JD 145 TIME 1100 Z LINE SB-5
CSE 026 SP 4.0 SCALE 0-750m
VALUES d~586m
☐ START LINE ☐ END LINE ☒ ROUTINE OTHER
TIME/DAY
MAY 24, 1992
1042/145
1048/145
1054/145
1100/145
FARNELLA 92-4
LINE 5
SB-1
3.5 kHz
1042
1048
1054
1100

# APPENDIX I

Data for alternate sites SB-1A and SB-1B.
For location of cross-line seismic profiles see Figure 3.

Revised January 1991

# SAFETY CHECK SHEET
# JOIDES POLLUTION PREVENTION AND SAFETY PANEL

*1) Basic site information.*

| | | | |
|---|---|---|---|
| *Leg:* 146 | *Site designation:* SB-1A | *Latitude:* 34°17.0'N | *Longitude:* 120°02.2'W |
| *Water Depth (m):* 577 | *Distance from land (n. mi.):* 17 | | *Jurisdiction:* USA |
| *General location or geomorphic province:* Santa Barbara Basin; flat plain | | | |
| *Probable thickness of sediments (m):* 4000m+ | | *Proposed total penetration (m):* 200 | |

*2) Upon what geophysical and/or geological data was this site selection made?*

| |
|---|
| *Seismic lines:* Cross lines of single channel and 3.5 kHz lines. |
| FA924 line 3 @ 0338 Z (SP 1052); |
| FA924 line 6 @ 1147 Z (SP 150). |
| *DSDP/ODP holes:* |
| *Piston cores:* Numerous piston cores to 10m - mostly laminated, unbioturbated. Holocene in age. |
| *Other:* |

*3) What is your proposed drilling program?*

Continuous double APC/XCB coring to 200m at one site. (Triple coring if time permits.)

*4) What is your proposed logging program?*

None.

*5) From previous DSDP/ODP drilling in this area, list all significant hydrocarbon occurrences. Give nature of show, age and depth of rock:*

No previous DSDP/ODP drilling.

*6) From available information, list all commercial drilling in this area that produced or yielded significant shows. Give depths and ages of hydrocarbon-bearing deposits:*

No report of shows in upper part of sequence of Exxon OCS P-0353#1 which was drilled in the Santa Barbara Basin. In areas peripheral to basin and in trap structures, oil production is as shallow as 1000m.

*7) Is there any indication of gas hydrates at this location?*

No.

*8) Is there any reason to expect any hydrocarbon accumulation at this site? If yes, please explain.*

No. Gas is not expected in these flat-lying sediments.

*9) What "special" precautions will be taken during drilling?*

Continuous hydrocarbon monitoring.

*10) What abandonment procedures do you plan to follow? (See JOIDES Journal Special Issue 5, March '86, p.25)*

Standard.

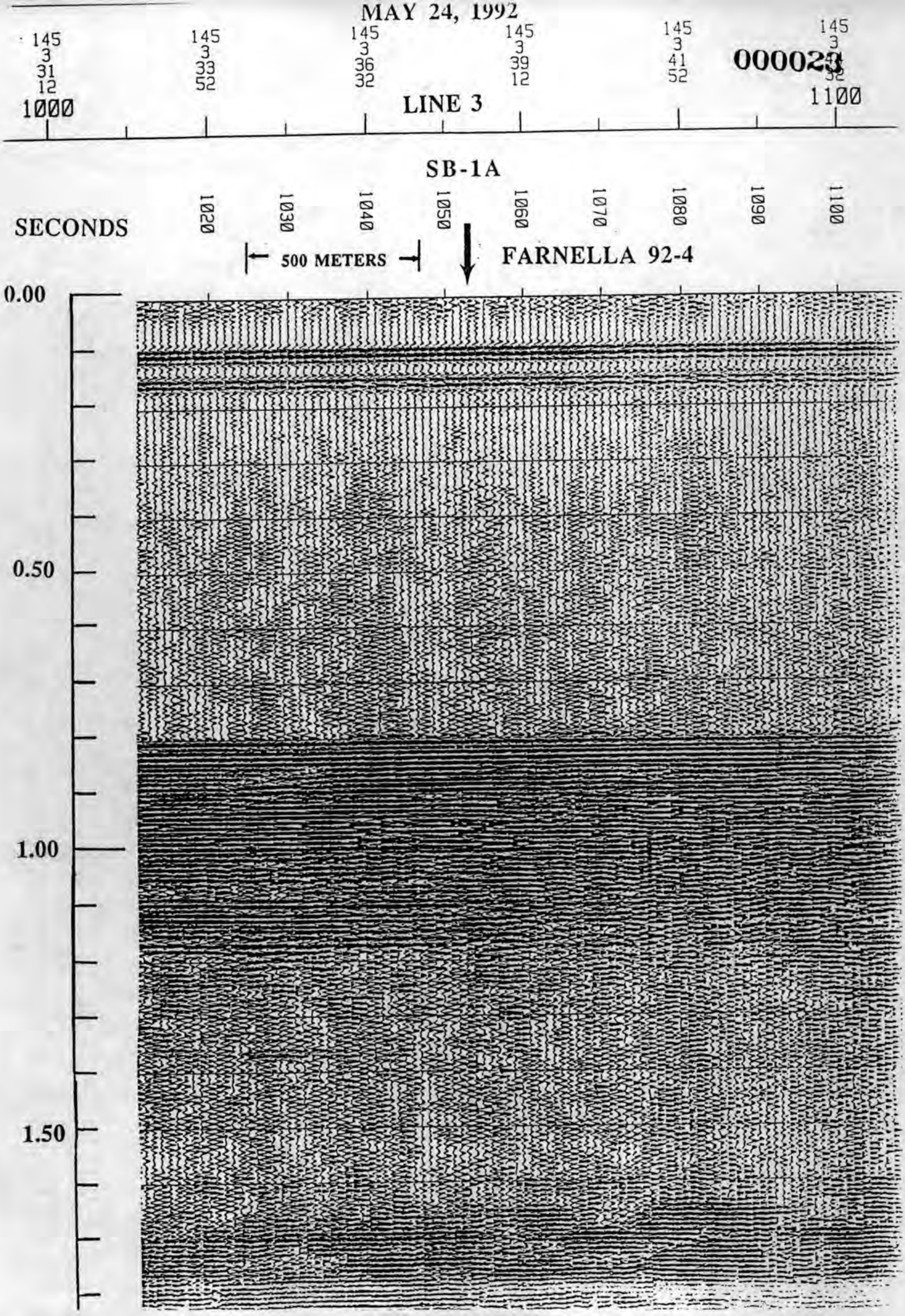
*Summary: What do you consider to be the major risks in drilling at this site?*

None. The site is located to avoid the shipping lanes through the Santa Barbara Channel.

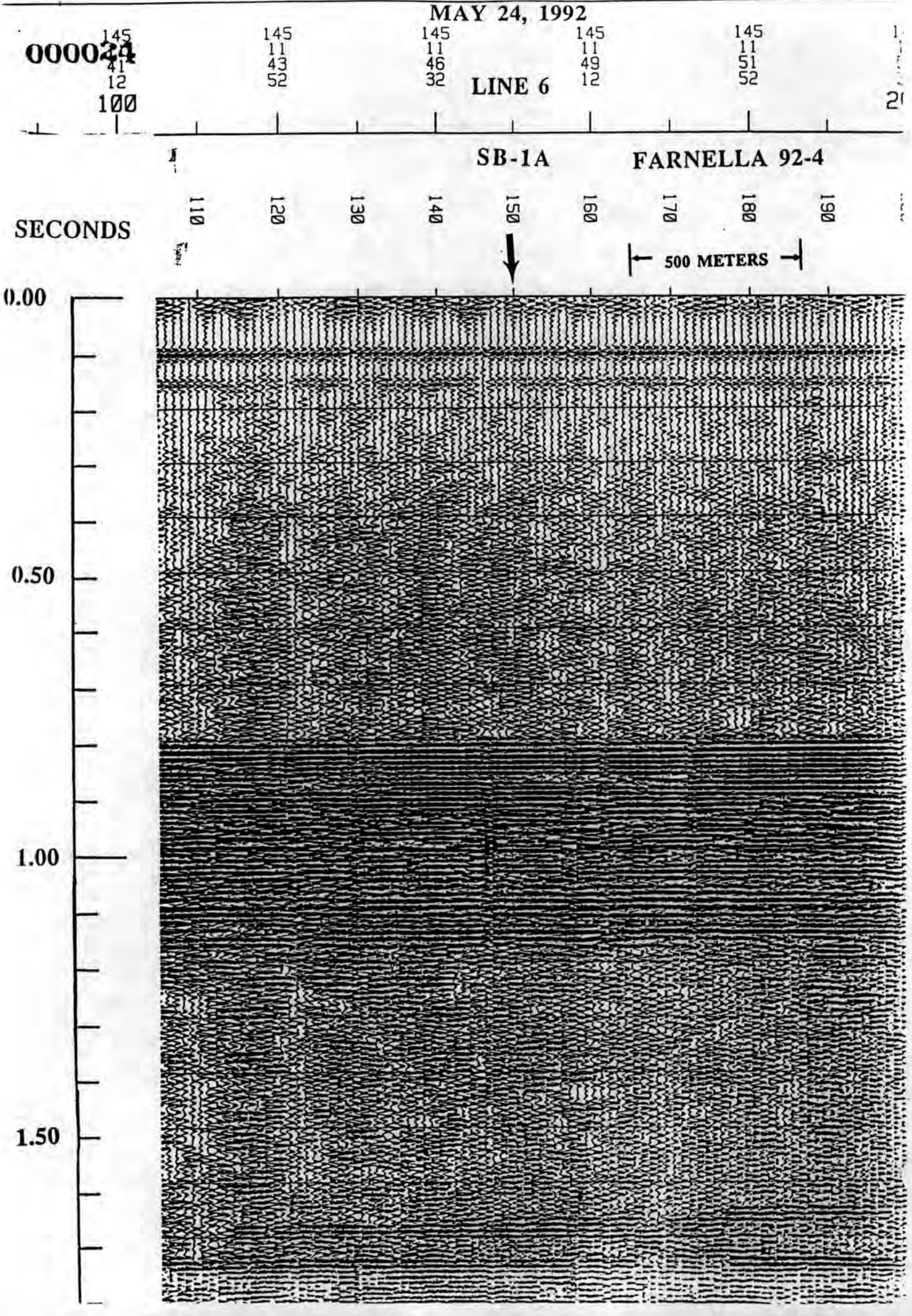
## GRAPHIC SUMMARY, <u>SITE SB-1A</u>

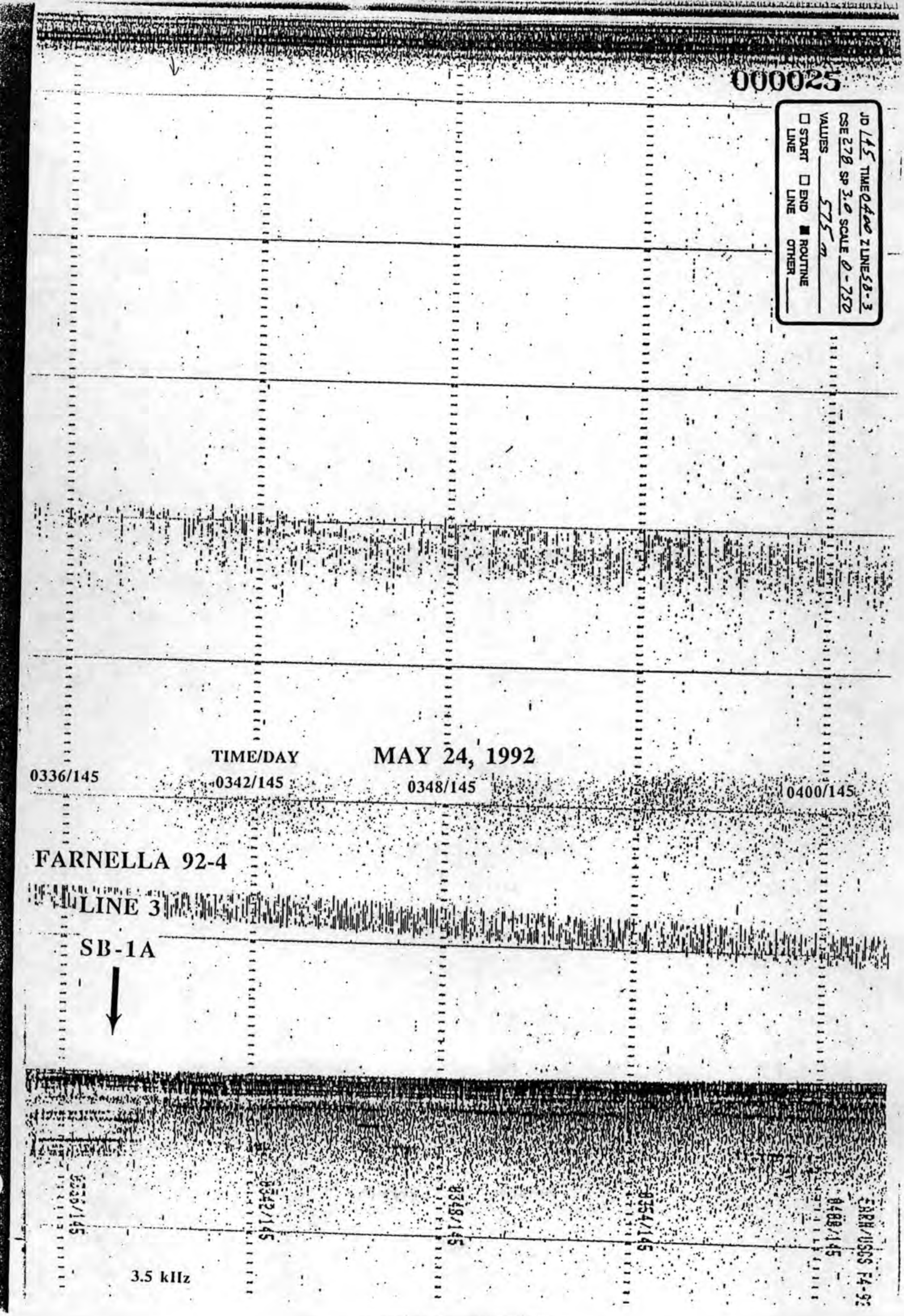
| *Sub-bottom depth (m)* | *Age* | *Assumed velocity (km/sec)* | *Lithology* | *Paleo-environment* | *Ave. rate of sediment accumulation* | *Comments* |
|---|---|---|---|---|---|---|
| 0-200m | Late Quaternary <130,000yrs. | 1.6km/sec | Muds, laminated in zones, and then turbidite sands. | Anoxic-Dysaerobic upper bathyal basin in California borderland. | Holocene <1m/1000yrs<br>Glacial <2m/1000yrs | 200m is maximum allowed penetration for this site. |

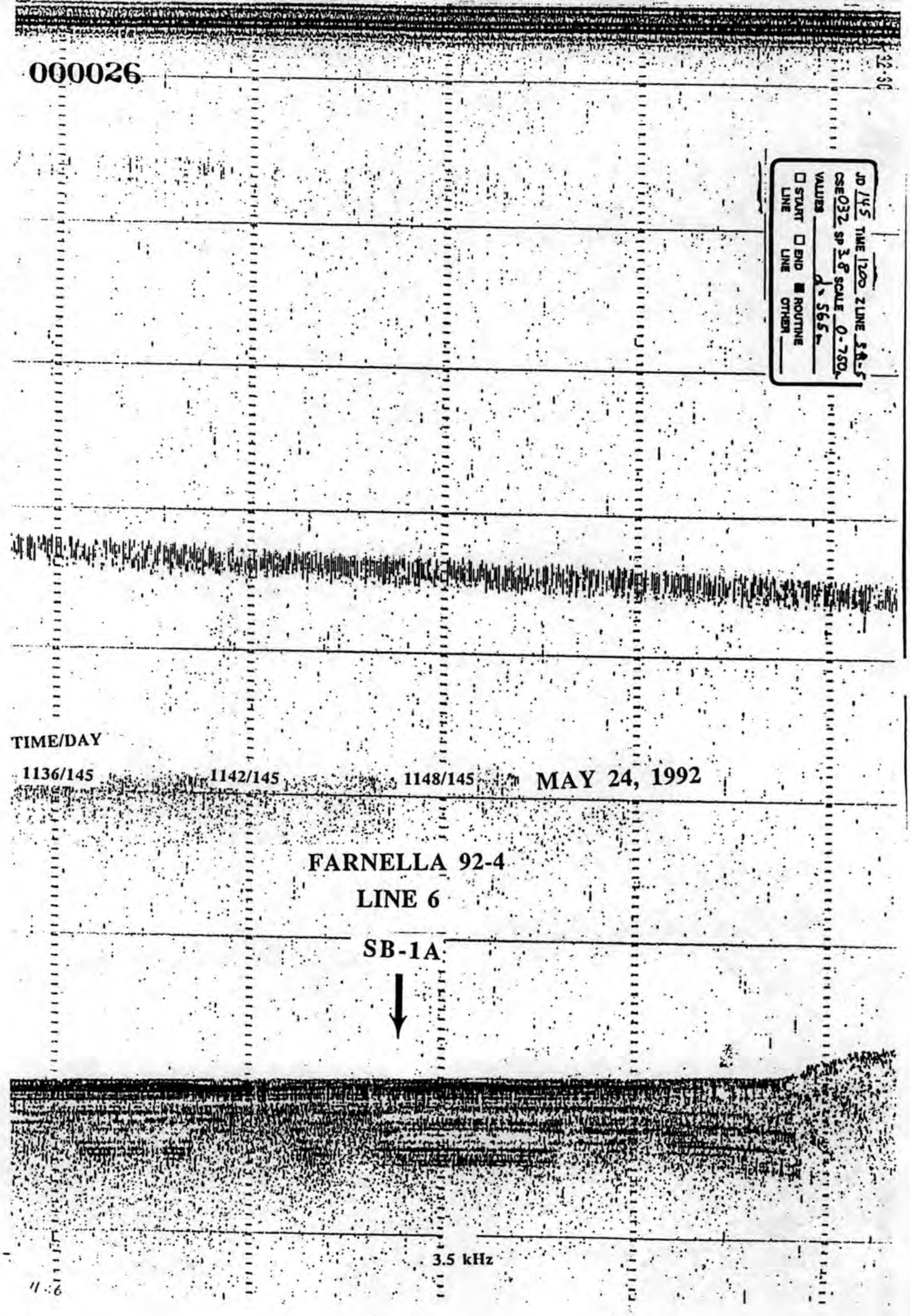
000022


MAY 24, 1992
145
3
31
12
145
3
33
52
145
3
36
32
145
3
39
12
145
3
41
52
1000
LINE 3
1100
SB-1A
1020
1030
1040
1050
1060
1070
1080
1090
1100
SECONDS
500 METERS
FARNELLA 92-4
0.00
0.50
1.00
1.50
000023

000024


MAY 24, 1992
LINE 6
145 41 12
145 11 43 52
145 11 46 32
145 11 49 12
145 11 51 52
100
SB-1A
FARNELLA 92-4
110
120
130
140
150
160
170
180
190
SECONDS
500 METERS
0.00
0.50
1.00
1.50


000025
JD 145 TIME 0400 Z LINE SB-3
CSE 278 SP 3.0 SCALE 0-750
VALUES 575 m
START LINE
END LINE
ROUTINE
OTHER
TIME/DAY
MAY 24, 1992
0336/145
0342/145
0348/145
0400/145
FARNELLA 92-4
LINE 3
SB-1A
0336/145
0342/145
0348/145
0354/145
0400/145
3.5 kHz


000026
TIME/DAY
1136/145
1142/145
1148/145
MAY 24, 1992
FARNELLA 92-4
LINE 6
SB-1A
3.5 kHz

Revised January 1991

000027

# SAFETY CHECK SHEET
# JOIDES POLLUTION PREVENTION AND SAFETY PANEL

*1) Basic site information.*

| | | | |
|---|---|---|---|
| *Leg:* 146 | *Site designation:* SB-1B | *Latitude:* 34°10.4'N | *Longitude:* 120°07.6'W |
| *Water Depth (m):* 513 | *Distance from land (n. mi.):* 20 | | *Jurisdiction:* USA |
| *General location or geomorphic province:* Santa Barbara Basin; south part on gentle southern slope. | | | |
| *Probable thickness of sediments (m):* 4000m+ | *Proposed total penetration (m):* 200m | | |

*2) Upon what geophysical and/or geological data was this site selection made?*

| |
|---|
| *Seismic lines:* Cross lines of single channel and 3.5 kHz lines. |
| FA924 line 1 @ 2038 Z (SP 614); |
| FA924 line 5 @ 0843 Z (SP 241). |
| *DSDP/ODP holes:* |
| *Piston cores:* Numerous piston cores to 10m; mostly laminated, unbioturbated, Holocene. |
| *Other:* |

*3) What is your proposed drilling program?*

Continuous double APC/XCB coring to 200m at one site. (Triple coring if time allows.)

*4) What is your proposed logging program?*

None.

*5) From previous DSDP/ODP drilling in this area, list all significant hydrocarbon occurrences. Give nature of show, age and depth of rock:*

No previous DSDP/ODP drilling.

*6) From available information, list all commercial drilling in this area that produced or yielded significant shows. Give depths and ages of hydrocarbon-bearing deposits:*

No report of shows in upper part of Exxon OCS P-0353#1 which is drilled in the Santa Barbara Basin. In areas peripheral to basin and in trap structures, oil production is as shallow as 1000m.

*7) Is there any indication of gas hydrates at this location?*

No.

*8) Is there any reason to expect any hydrocarbon accumulation at this site? If yes, please explain.*

No. Gas is not expected in the flat-lying sediments.

*9) What "special" precautions will be taken during drilling?*

Continuous hydrocarbon monitoring.

*10) What abandonment procedures do you plan to follow? (See JOIDES Journal Special Issue 5, March '86, p.25)*

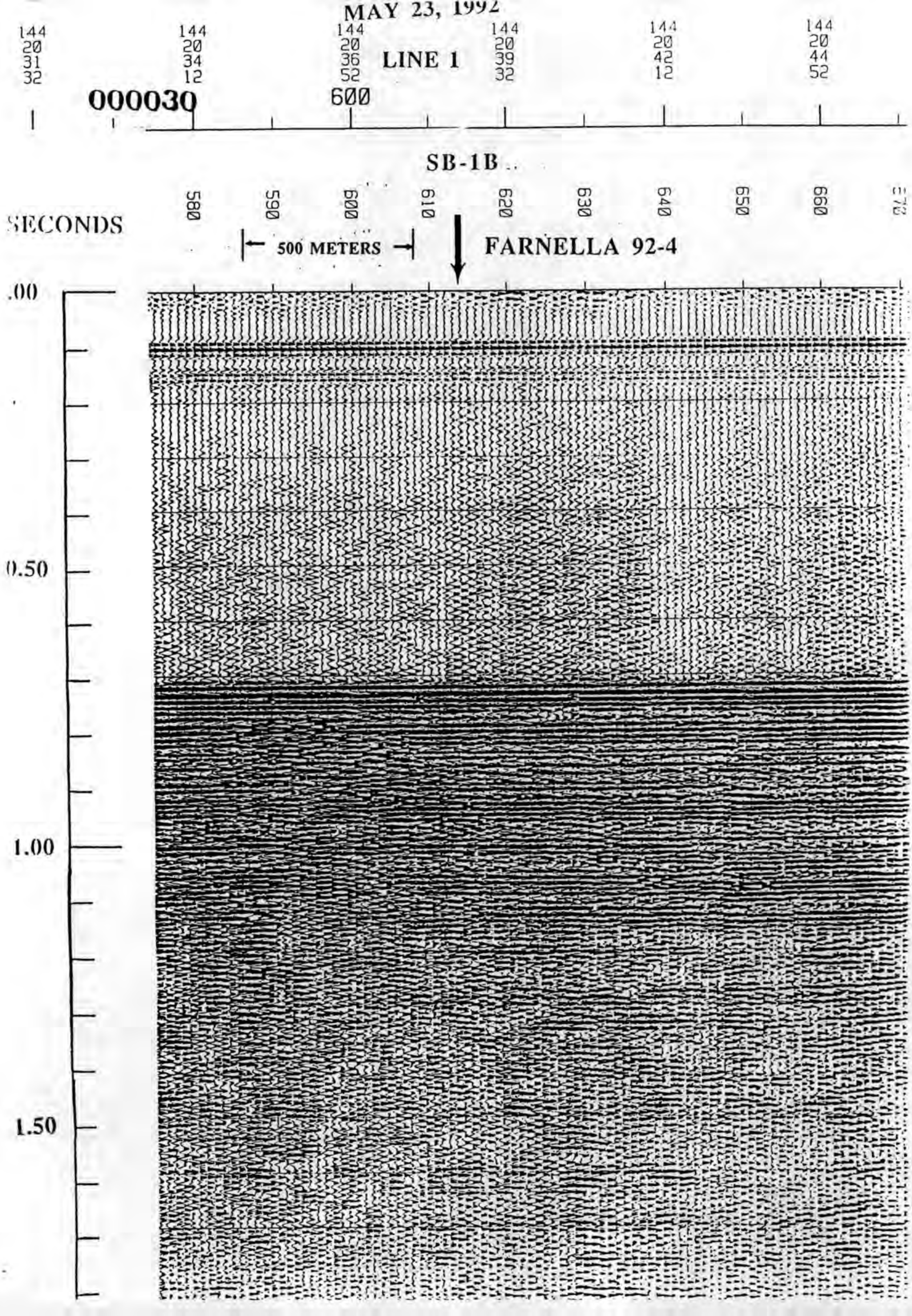
Standard.

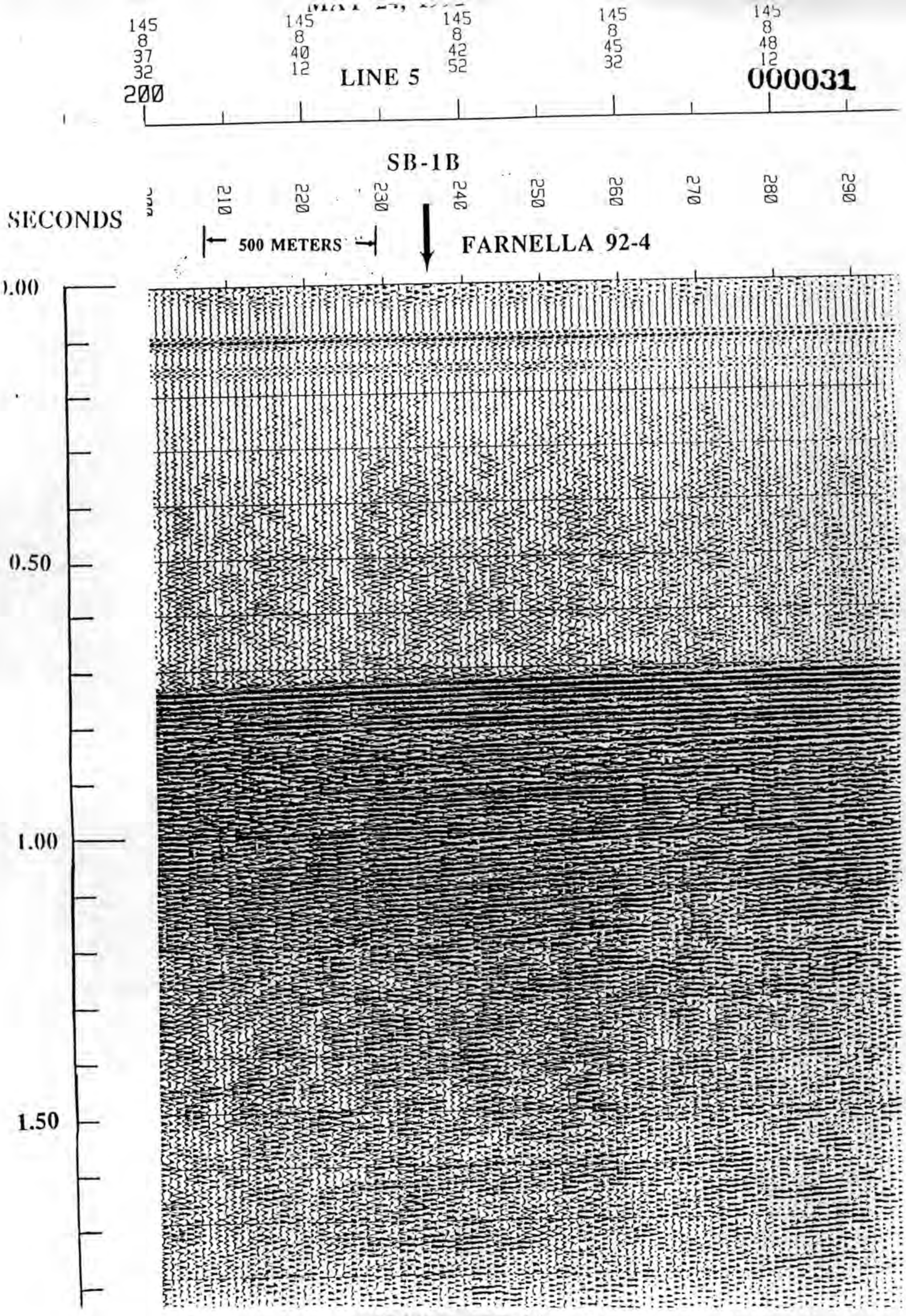
***Summary:** What do you consider to be the major risks in drilling at this site?*

None. The site is located outside of the shipping lanes through the Santa Barbara Channel.

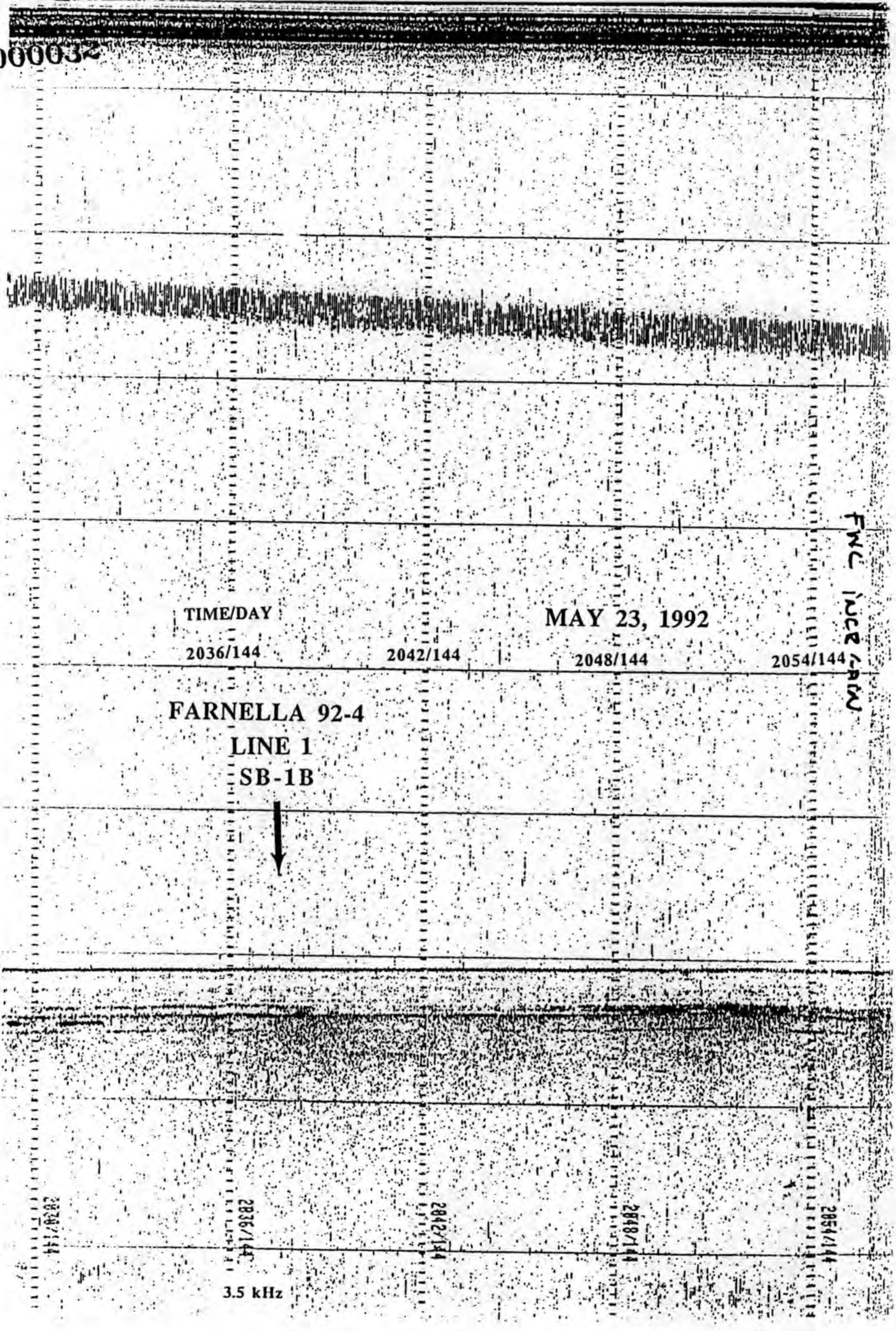
## GRAPHIC SUMMARY, SITE SB-1B

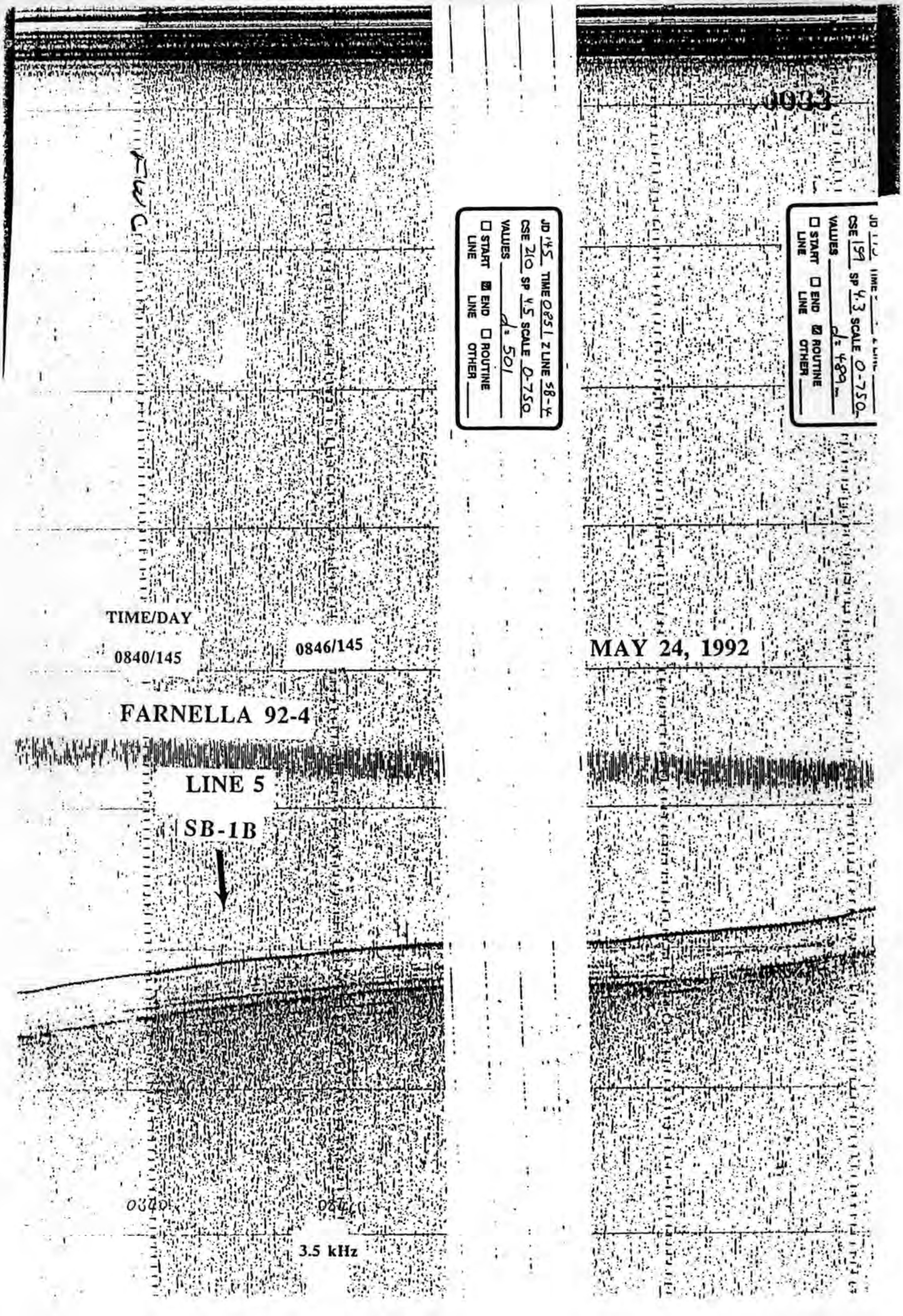
| *Sub-bottom depth (m)* | *Age* | *Assumed velocity (km/sec)* | *Lithology* | *Paleo-environment* | *Ave. rate of sediment accumulation* | *Comments* |
|---|---|---|---|---|---|---|
| 0-200m | Late Quaternary <130,000yrs. | 1.6km/sec. | Muds, laminated in zones, and then turbidite sands. | Anoxic-Dysaerobic upper bathyal basin in California borderland. | Holocene <1m/1000yrs<br>Glacial <2m/1000yrs | 200m is maximum allowed penetration for this site. |


MAY 23, 1992
LINE 1
144 20 31 32
144 20 34 12
144 20 36 52
144 20 39 32
144 20 42 12
144 20 44 52
000030
600
SB-1B
580
590
600
610
620
630
640
650
660
SECONDS
500 METERS
FARNELLA 92-4
.00
0.50
1.00
1.50



145 8 37 32
145 8 40 12
145 8 42 52
145 8 45 32
145 8 48 12
LINE 5
000031
200
SB-1B
210
220
230
240
250
260
270
280
290
SECONDS
500 METERS
FARNELLA 92-4
0.50
1.00
1.50


TIME/DAY
MAY 23, 1992
2036/144
2042/144
2048/144
2054/144
FARNELLA 92-4
LINE 1
SB-1B
FWC INCR GAIN
2030/144
3.5 kHz


0033
TIME/DAY
0840/145
0846/145
FARNELLA 92-4
LINE 5
SB-1B
3.5 kHz
MAY 24, 1992

# Agenda Item L.

# Leg 148

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543
Phone: (508) 457-2000
Fax: (508) 457-2187
Telex: 951679

Department of Geology and Geophysics

June 26, 1992

Dr. James A. Austin
c/o JOIDES Planning Office
Institute for Geophysics
University of Texas at Austin
8701 Mopac Blvd.
Austin, TX 78759-8345

RECEIVED
JUL 0 3 1992
Ans'd...........

Dear Dr. Austin:

This letter proposal requests two days of shiptime on the RESOLUTION to do a Vertical Seismic Profile (VSP) in Hole 504B on ODP Leg 148. In a letter dated March 22, 1992, we applied to ODP/TAMU for one or two scientific positions on Leg 148 for WHOI borehole seismologists (J. Collins, H. Hoskins, R. Stephen, S. Swift) to do the VSP.

We feel that significant scientific rewards would come from doing another VSP in Hole 504B. The last VSP was done at the end of Leg 111 when the total depth was ~5000 mbsl (~1500 mbsf). The attached figure (figure 2 in Collins et al., 1989b) shows that the layer 2 velocity gradient extends to ~5 km depth, so the leg 111 VSP could not unambiguously resolve the change in vertical velocity gradient that defines the boundary between seismic layers 2 and 3. Hole 504B was deepened ~60 m on Leg 137 and ~500 m on Leg 140. With the additional depth to be drilled on Leg 148, interval velocities determined from a VSP would have a depth range adequate to resolve the boundary. The lithostratigraphy at Hole 504B could then be placed unequivocally within the framework of the seismic structure of the ocean crust. Differences between seismic and sonic log velocities are well known (Stewart, et al., 1984), so sonic logs themselves are inadequate estimators of refraction velocities.

It is also a good time to determine attenuation on seismic length scales in Hole 504B. Wepfer and Christensen (1991) measured attenuation in ophiolite rocks and found that attenuation of diabase dikes varied by an order of magnitude at in-situ pressures (200 MPa) depending on the grade of metamorphism. They measured much higher attenuation in basalts and gabbro than in diabase. High attenuation in gabbros was also obtained at Hole 735B (ODP Leg 118) in laboratory measurements (Goldberg et al., 1989) and in analysis of the sonic log (Goldberg, 1992). Our analysis of VSP seismograms obtained in Hole 735B verified that the attenuation of oceanic gabbros is high at seismic frequencies (Swift and Stephen, 1991, in press). It appears from this limited work so far that attenuation varies by over an order of magnitude over crustal depths of 0.5-6 km, whereas Vp and Vs vary by less than a factor of two. We have proposed that seismic attenuation will be a useful parameter to remotely determine the depth to lithologic and alteration boundaries. This important hypothesis needs an in-situ test. Leg 148 is a highly desirable opportunity to do a VSP to test this idea.

The WHOI borehole group is highly qualified and well-equipped to acquire the VSP data and to process and interpret the results. R. Stephen ran two successful borehole seismic experiments already at Hole 504B (Legs 70 and 92) and is very familiar with the velocity structure of the hole and the surrounding region (Stephen, 1983; Stephen, 1985, Little and Stephen, 1985, Stephen, 1988; Lowell and Stephen, 1991). J. Collins collected sonobuoy refraction data at the site and has published two studies of the velocity structure of the borehole (Collins et al., 1989a,b). Collins was a member of the Leg 136 scientific party. H. Hoskins and I have participated in or processed data from three borehole experiments: the Oblique Seismic Experiment (OSE) on Leg 102 at Site 418 (Swift et al., 1988; Swift and Stephen, 1989) and the VSPs on Legs 118 (Swift et al., 1991; Swift and Stephen, submitted) and 123 (Bolmer et al., in press). H. Hoskins, working with G. Moore of Univ. of Hawaii, will be the specialist in charge of the borehole equipment during the VSP/OSE on Leg 146 to the Cascadia Margin. Thus, we feel that we have the best experience in doing borehole seismometer work from the RESOLUTION and a solid track record of analyzing and publishing VSP data.

The experiment would be designed similar to our VSP's on Legs 118 and 123. We will use the Geospace three-component, Wall-Lock Borehole Seismometer, the ODP logging cable (with a high-temperature leader), and the recording system in the Underway Geophysical Laboratory. Both of our Geospace tools have been recently pressure tested for two days to 700 bars (6950 m). They are rated to 1000 bars. We will monitor the source signature with a hydrophone suspended on a cable from the ship. On past VSP's, we suspended the phone at ~250 mbsl from the starboard tautline mooring boom off the opposite side of the ship as the guns (port-aft crane). In this configuration, the monitor is at a angle of ~17° from the ray path between the guns and the borehole. The hydrophone data would be a more useful record of the out-going wavefield if the monitor were placed closer to the guns - preferably suspended from the same port-aft boom as the guns.

On Leg 118 H. Hoskins and I measured, as a function of frequency, the losses during signal transmission from the geophones in the seismometer through the logging cable and through the digitizer onto tape. With the geophone response curve provided by the manufacturer we can provide calibrated signal levels.

The high temperature at the base of Hole 504B is a concern for borehole instruments. In 1982, we purchased a high-temperature version of the Geospace borehole seismometer which was rated to 200°C. During the oblique seismic experiment on Leg 92 at Hole 504B, our tool functioned well at a depth of 667 m into basement (941 mbsf) at a temperature of about 140°C. Leg 137 measured an equilibrium temperature gradient which extrapolates to 165°C at 1500 mbsf and 190°C at 2000 mbsf. Because it is over ten years (and several deployments) since the high temperature tool was purchased, we want to check that it still meets the temperature specification. If this proposal is accepted, we will request funds from JOI/USSAC to test and up-grade the tool as necessary to assure reliable performance at 200°C.

Based on our past experience, we estimate the experiment would take about 45 hours. We would like to run the VSP at 10 m receiver spacings from the base of the section that is newly drilled on Leg 148 upwards to the base of the sediments (at ~200 mbsf). The 10 m spacing is desirable to avoid spatial aliasing problems during frequency-wavenumber filtering to isolate the down-going, reflected, and side-scattered wave fields. Estimating new penetration on Leg 148 to be 300 m, we would cover ~2100 m of borehole using ~210 stations. Conservatively, the time required to do each station should be about 10 minutes figuring that we will shoot 5-8 shots with both the 1000 $in^3$ airgun and the 400 $in^3$ watergun at 20 second intervals and use ~5 minutes to move and set the seismometer. The borehole portion of the experiment, thus, will require about 35 hours. At least 2-5 hours should be reserved as contingency for establishing gain levels at the start of the experiment and for repairing failures of guns and recording equipment. Trip time of the tool to and from the rigfloor (at 30 m/min below the seafloor and 40 m/min above) will add about 5 hours. Given the long duration of the proposed experiment, strong consideration should be given to staffing the science party with two people who have the knowledge and experience to run the experiment.

Thank you very much for your consideration. I look forward to hearing from you.

Very truly yours,

Stephen A. Swift

Stephen A. Swift

| | | |
|---|---|---|
| cc: | S. Humphries | Chair LITHP |
| | E. Moores | Chair TECP |
| | P. Worthington | Chair DMP |
| | H. Kinoshita | Co-chief Leg 148 |
| | J. Alt | Co-chief Leg 148 |
| | E. Kappel | JOI/USSAC |
| | B. Malfait | NSF |
| | J. Balbauf | TAMU/ODP |
| | Operations Manager | TAMU/ODP |
| | K. Becker | DMP |
| | D. Goldberg | BRG/LDGO |

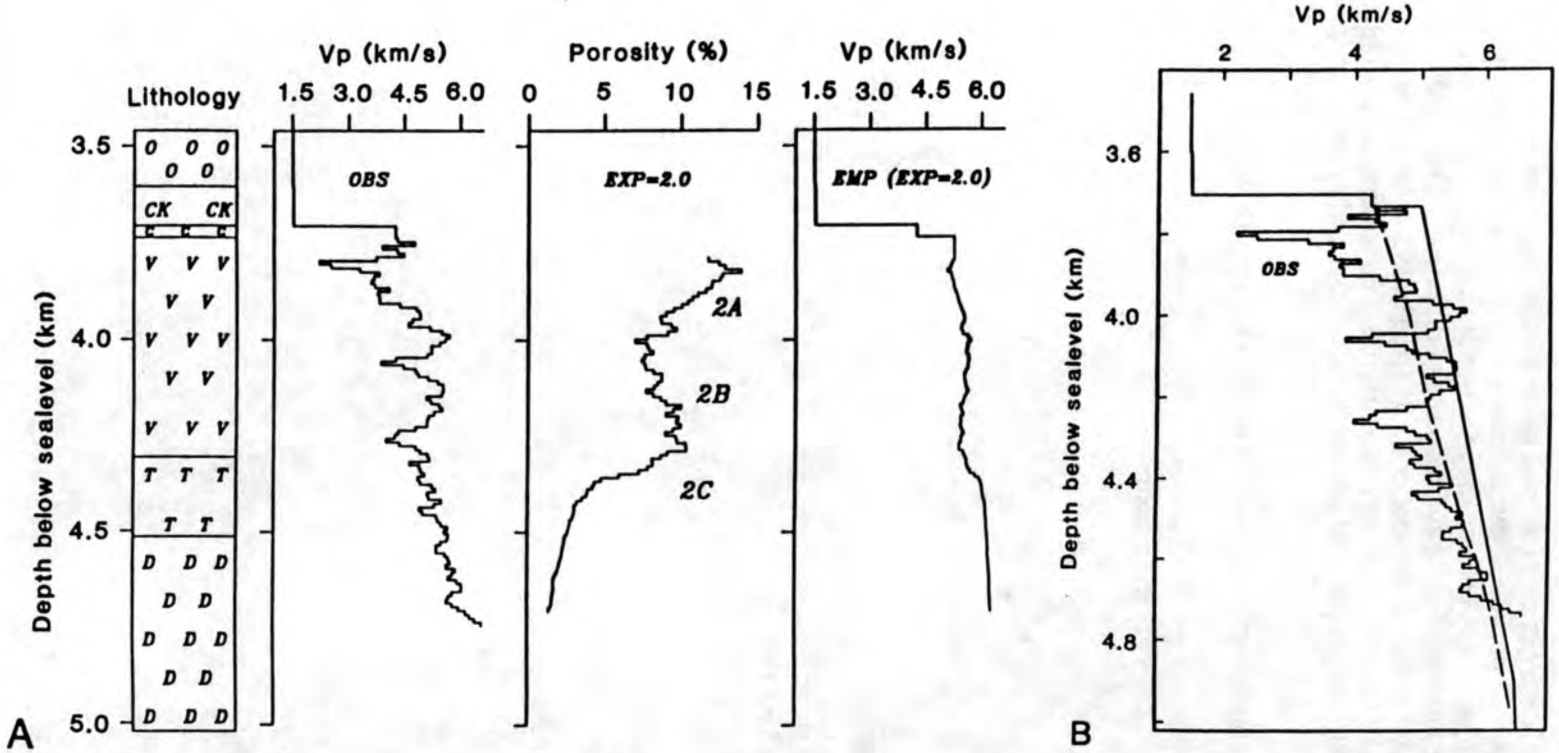



Figure 2. **A.** Schematic representation of the drilled sedimentary and igneous sequences at Hole 504B. Lithology: O = nannofossil ooze; CK = chalks; C = cherts; V = extrusive volcanics; T = volcanic/sheeted dike transition; D = sheeted dike sequence. The sonic velocity (model OBS) profile on the left was acquired on DSDP Leg 83 (Salisbury et al., 1985). Model OBS is the observed sonic velocity data averaged into 10-m-thick layers. The bulk porosity-depth model was calculated from a large-aperture resistivity log using an exponent of 2.0 for Archie's law (Becker, 1985). The velocity (EMP20) profile on the right was derived empirically from the bulk porosity model as described in the text. A possible subdivision into seismic Layers 2A, 2B, and 2C is indicated. **B.** The observed sonic velocity (model OBS) profile for Hole 504B plotted alongside the preferred velocity profiles of Little and Stephen (1985) (dashed line) and Collins (1989) (heavy solid line), based on borehole and sonobuoy seismic-refraction data, respectively.

000004

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000006

FACSIMILE FROM THE UNIVERSITY OF MIAMI
DIVISION OF MARINE GEOLOGY AND GEOPHYSICS

DATE: 10 July, 1992

TO: Jamie Austin, JOIDES Office

FROM: Keir Becker

I've finally reached Paul Worthington, and we've resolved to some degree our separate recollections of the DMP deliberations re the possibility of CORKing 504B. Paul will essentially stand by the draft minutes, although he has acknowledged that there was no intent to discourage the submission of a proposal. Therefore, I would like to request that you process the proposal which I FedEx'd to you earlier this week, so that, if there is a sense in the JOIDES structure that such an experiment should be done during Leg 148, a decision can be made at the August PCOM that would allow time for proper preparation. I will attempt to summarize the substance of my conversation with Paul in the following paragraph. If you think that it would be appropriate, please feel free to attach a copy of this fax to the proposal copies which you intend to distribute to appropriate Panel Chairs.

The DMP minutes contain a sentence that reads as follows: "Panel considered that the hole should not be sealed with a thermistor string in place because there is no proven string available and the hole would be put at risk." This would seem to be a blanket rejection of the possibilities outlined in our proposal, and also seems to contradict the report of the panel deliberations based on my recollection included within the text of the proposal. Despite the words cited above, Paul stated that the Panel did indeed encourage submission of a proper proposal like ours, although he wanted to see a full discussion of such a proposal plus the record of similar long-term monitoring experiments in industry at the next DMP. The concerns in the cited sentence arose because the initial CORK experiments have not been fully completed yet, so there is admittedly no record of success in such matters as collection of valid thermistor data and removal of a CORK from a hole. As evidenced by their recommendation 92/6, the DMP agreed with the point of view in the 504B drilling proposal that Leg 148 should emphasize drilling deeper as opposed to extensive downhole measurements. In this context, DMP endorsed only a limited suite of logs, and could not positively endorse more time-consuming experiments (such as offset VSP or CORK) for which there were no formal proposals at the time of the meeting.

Thus the only way to progress the issue is to proceed with the proposal submission and review. It is unfortunate that the late scheduling of Leg 148 in April has dictated that, if the proposed experiment is to be conducted on Leg 148, a decision is required by the August PCOM, before proper thematic panel discussion can occur. Earl and I both feel that there will never be a better time than Leg 148 to conduct our proposed experiment. Nevertheless, if you, the Panel Chairs, and/or PCOM consider that more extensive panel discussion and endorsement is essential, we will not be too discouraged, for we expect that there may be future opportunities at Hole 504B.

000007

# JOIDES PROPOSAL TO "CORK" HOLE 504B AT END OF LEG 148

K. Becker and E. Davis

RECEIVED
JUN 0 8 1992
Ans'd............

## SUMMARY

This is a letter proposal to emplace an instrumented borehole seal or "CORK", with thermistor cable and pressure sensor, in Hole 504B as the last operation of Leg 148. The scientific rationale involves addressing questions about the hydrogeology of the upper oceanic crust raised by the unexpected character of temperature logs taken during Legs 137 and 140 in 1991. Two options are discussed: either a full seal installation with 700-m thermistor cable, or suspending a 500-m thermistor cable without actually sealing the hole. In either case, the deployment would require about 30-36 hours at the end of Leg 148, inclusive of trip time.

## BACKGROUND AND OBJECTIVES

Hole 504B is clearly one of our most important reference sites for understanding nearly all aspects of the upper oceanic crust, and this is particularly the case for the crustal hydrogeology. Numerous temperature logs, borehole fluid samples, and permeability measurements make Hole 504B perhaps the best documented of many cases in which ocean bottom water is known to be flowing down DSDP/ODP holes into young upper oceanic crust. These examples suggest that young upper oceanic crust under a sediment cover is generally permeable enough to support considerable flow of seawater, but we still barely understand the details of off-axis circulation and its control by the fine-scale permeability structure of the upper crust.

Since 1979, temperatures measured in Hole 504B through the 275-m cased section and into the upper 100 m of basement have been depressed below the conductive values in the thick sediments at the site (Figure 1), indicating that ocean bottom water has flowed down the hole and into the upper levels of permeable basement ever since basement was first penetrated. The temperature data collected from the upper part of Hole 504B from 1979-1986 were less and less depressed with time relative to the conductive profile in the surrounding sediments (Figure 1a), suggesting that the downhole flow steadily diminished to less than 1% of the original rate. Based on this trend, it was predicted that a conductive profile would be measured when the hole was revisited in 1991, but the temperature logs contradicted this prediction (Figure 1b). Temperatures logged at the beginning of Leg 137 were again depressed, indicating that the downhole flow had revived. Perhaps even more surprising, temperatures measured only six months later during Leg 140 had rebounded considerably towards the conductive profile, suggesting that the revived downhole flow had once again diminished to a low rate.

Figure 2 shows the history of inferred downhole flow rates in Hole 504B, and also raises a basic dilemma: Do the temperature data indicate a discrete hydrologic event about the time of Leg 137, or have there been many such variations in flow rates and temperature profiles that have simply not been sampled at the very sparse rate of revisits by the drillships? The answer can only come from a more rapidly sampled, long-term time series, as would be provided by the deployment of an instrumented borehole seal.

Moreover, a well-designed instrumented borehole experiment in Hole 504B could provide much more than simply the full record of the actual variations in downhole temperatures and inferred flow rates. Such downhole flow requires both a pressure differential and sufficient formation permeability; in fact, information about the formation pressure and permeability structure are the real keys to understanding the crustal hydrogeology. For example, is the apparent variation in downhole flow rates in 504B due to changes in formation pressure or permeability? Careful inspection of the inflection points of the temperature data (Figures 1a and 1b) suggests that the downhole flow during the first seven years was probably directed into the zone below the impermeable massive flow, Unit 2D, whereas the flow suggested in 1991 seems to be directed into the formation above this unit. If so, is this due to changes in permeability structure and/or the pressure field above and below the massive unit? And why did such changes occur? Are they related to tectonic or hydrothermal processes? Or to hydrologic interference from other holes at the site, or some other artefact of man's interference with the natural system by drilling?

A carefully designed long-term borehole experiment would provide answers to questions like these, which otherwise will probably go unresolved. There are at least two options for such an experiment which should be considered for deployment in Hole 504B at the end of Leg 148:

(1) A fully-configured CORK to seal the hole, plus a thermistor string and pressure sensor in the sealed section. (An actual mechanical latch to hold the CORK in the cone would not be necessary, as the slight formation underpressure will hold the seal in place.) Such an installation would allow a long-term record of (a) the rebound of temperatures towards formation conditions after the emplacement of the seal, and (b) pressure variations, which would be the primary manifestation in a sealed hole of changes in formation hydrologic conditions. For this option, we would propose a 700-m cable, with ten thermistors spaced to span the lower sediments, permeable upper extrusives, and upper part of the less permeable lower extrusives. The data logger and sensor string could probably be pulled out of the hole without the drillship, if necessary, but the CORK hardware would require the drillship for removal.

(2) A non-sealing installation, with a suspended thermistor cable and flow sensor in the hole, allowing the formation to communicate hydrologically with the ocean bottom water via the hole, as has occurred for the last 13 years. Variations in downhole flow and temperatures could be monitored at a fast sampling rate (1 hour), and with proper thermistor spacing details of the permeability structure of the upper basement could be inferred. For this option, we would propose a cable 500-m long, with ten thermistors spanning the lower sediment section and permeable upper extrusives, at a spacing of about 25 m. If necessary, the entire apparatus could probably be pulled out the hole without the drillship, e.g. by submersible or wireline device.

For either option, the deployment sequence would be very similar to that required for deployment of the CORK already emplaced during Leg 139 and planned for Leg 146. A pipe trip would be required, plus about 6-8 hours to run in the cable and release the installation from the bottom of the pipe. Based on the Leg 139 experience, a deployment in Hole 504B would probably require about 30 hours; we request 36 hours, including contingency time which is probably necessary for planning purposes, given the greater inherent inflexibility at the very end of a leg with a short transit to port.

GEOPOLITICAL AND LOGISTICAL CONSIDERATIONS

The two options above were briefly discussed at the June 1992 DMP. In general, there was a somewhat lukewarm and jet-lagged reaction to either option, partly because of a reluctance to make an exclusive commitment to a long-term experiment with any perceived risk to such an important hole. Nevertheless, the panel agreed that a decision should be made based on a more careful consideration of the scientific benefits stimulated by a proper JOIDES proposal, and this document is intended to spur that consideration. The initial DMP reaction was perhaps more in favor of the second option than the first, for the following reasons:

(a) The hydrologists leaned towards leaving the hole open to flow as it has been for the last 13 years, arguing that it would be very difficult to reestablish formation conditions by sealing after such a long unsealed period. We note that the latter is probably, but not necessarily, correct, but more important, that observation of undisturbed conditions is basically not our goal. We are interested primarily in the causes of the inferred temporal variations of flow, with the simplest goal being to establish whether these are associated with changes in formation pressure or permeability.

(b) There was some opposition by fluid chemistry interests and others to fully sealing the hole, as this would represent an exclusive commitment of the hole until the next revisit by the drillship (possibly preventing use of the hole by wireline reentry or submersible, although no such experiments have been proposed for 504B). We would note that the experiment would probably run no longer than the next return of the drillship to the Pacific, and the seal might actually result in better fluid samples by preventing some of the contamination by mixing of bottom water that has been evident in most samples taken from deep in the hole.

Should the JOIDES structure approve the installation of either option described here for the end of Leg 148, the equipment could be configured mostly with spares that will be available from the 1991 and 1992 CORK installations, with the exception of the cable and a possible flow sensor. The cable would cost about $15k, depending on whether a 500- or 700-m cable were desired, and would require about three months to be manufactured. Similarly, TAMU engineering would require several months to assemble a non-latching or perhaps non-sealing version of the CORK hardware. Given the schedule of Leg 148, a favorable decision would be required no later than the August PCOM to allow sufficient lead time for preparation of the proposed long-term instrumented borehole experiments. One of us (KB) has already applied to sail on Leg 148 to conduct other experiments, and would assume responsibility for the proposed CORK deployment if it is approved.

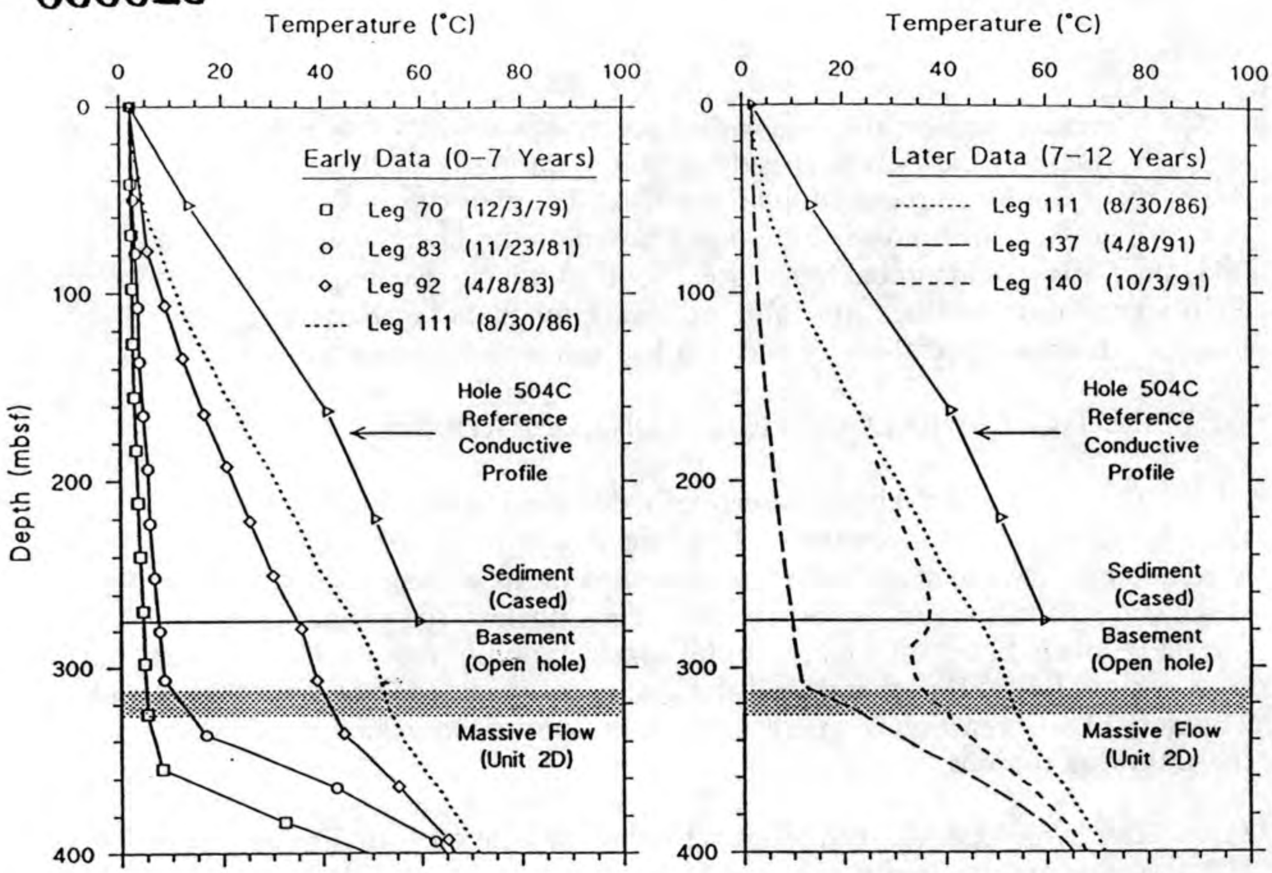
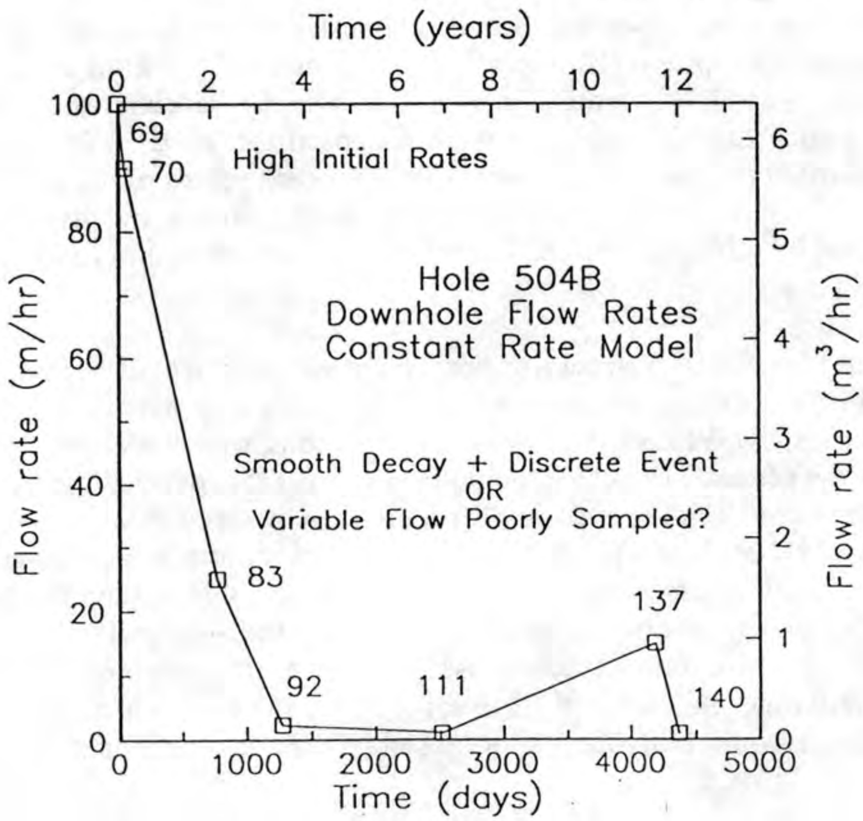



**Figure 1 (above). Equilibrium temperatures measured in Hole 504B. (a) Early data, 1979–1986. (b) Later data, 1986–1991.**

**Figure 2 (below). Inferred history of downhole flow in Hole 504B.**



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23 July 1992

Dr. James A. Austin, PCOM Chair
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University of Texas at Austin
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Austin, TX 78759-8397

RECEIVED
JUL 24 1992
Ans'd............

Dear Jamie:

This is to inform you and others in ODP about our progress in developing new high temperature logging instrumentation with NSF support, and to propose a scenario to introduce it to ODP operations. Unlike other single parameter high temperature tools, the High Temperature Borehole Instrumentation (HTBI) includes a multi-parameter logging tool with multiplexed data returned to the ship via the logging cable in real time, and/or recorded internally in memory. The borehole parameters to be measured include: temperature, pressure, axial fluid velocity, fluid electrical conductivity, and hole caliper. In addition, the axial acceleration and internal temperature of the tool will be measured, and a collar locator is included, to allow meaningful data reduction and relate the data to geometric and engineering characteristics of any borehole. It is designed to operate in 350 or more deg C environment for up to 12 hours (before the electronics become too hot). It has an overall diameter of 2-1/8 in. and a length of about 12-13 ft. (not fixed yet), and is thereby capable of being used with either the ODP standard rotary or DCS systems.

The design of the HTBI is nearly complete, and we are in the process of acquiring and testing components and sub-assemblies. When the downhole tool is together, we intend to test it in a hot land borehole, following the DMP guidelines for third party tools. This will probably occur during October 1992 in the western U.S., and we expect to correct any deficiencies as a result of that testing.

The original motivation for developing the HTBI was to monitor the recovery of a borehole after drilling in a hydrothermal upwelling region, to better understand the hydrology and physical parameters of these enigmatic features, particularly in the third (depth) dimension. With the disappointing recent performance of the DCS on the E. Pacific rise, it seems that objective may be somewhat in the future, at least until 1994. Of course, the instrumentation may be useful for measurements in other hot hole environments of the ODP. Apparently the only one scheduled for drilling before 1994 is at 504B (Leg 148), where we propose here to utilize the instrumentation after a successful land borehole test.

I have briefly discussed the use of the HTBI on Leg 148 with Tim Francis of TAMU, Jeff Alt at Michigan (co-chief scientist), and Keir Becker. I believe that there is some concensus that the instrumentation would be useful for the scientific objectives of this leg, although of course with the usual caveat that other uses of drilling ship time must be considered. It may also reduce requirements for overall logging time, considering its multi-parameter measurement capabilities. I estimate that a complete log of Hole 504B with the HTBI at a logging speed of 1 m/s would require only about 3-4 hours of ship time, assuming that everything worked as expected. Of course, even with pre-testing that usually doesn't happen the first use at sea, so I suggest that 9-10 hours total for the leg would give us enough time for several tries. We would be interested to have an engineer/technician or a student familiar with the instrumentation accompany it at sea on its first use, at least for either of the half-Legs 148. If possible, we request that this be considered at the upcoming PCOM meeting, where we understand that the activities for some legs may be firmed up. We believe that this instrumentation may prove useful for holes like 504B and as a general logging tool, and especially for sites targeted to investigate hydrothermal upwelling.

As the DMP is apparently not aware of the HTBI development status, I am copying their chairman and others to bring the relevant community up to date. We hope that the request may be considered favorably, and I welcome any questions that may arise.

Sincerely,

Dick

R. P. Von Herzen

cc: J. Cann, T. Francis, P. Worthington, J. Alt, H. Kinoshita, K. Becker, H. Dick, B. Malfait, R. Koehler

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6 July 1992

000013

Dr. Susan Humphris
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Dr. Paul Worthington
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UNITED KINGDOM

Dear Panel Chairs:

By now, you will have received a letter proposal from Steve Swift at Woods Hole to conduct a (another) VSP at Hole 504B as part of Leg 148. I would like your (written) input on this proposal prior to the end of this month, so that I can transmit your feelings to Planning Commitee in August. I feel that the proposal is reasonable, but remember that we have already trimmed Leg 148 by a day to accommodate Santa Barbara Basin drilling, and that any/all downhole measurements on the existing hole (presumably this VSP would precede further deepening?) will cut into deepening time.

Feel free to consult with panel members/others as you see fit, but please remember the time constraint. Thanks in advance - this August meeting is shaping up to be an interesting one!

Sincerely,

Jamie

James A. Austin, Jr.
Senior Research Scientist
Chair, JOIDES Planning Committee

JAA/km

xc: T. Pyle (with VSP proposal), A. Maxwell (with VSP proposal)

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• University of Hawaii, School of Ocean and Earth Science and Technology • Japan: Ocean Research Institute, University of Tokyo •
• University of Miami, Rosenstiel School of Marine and Atmospheric Science • Oregon State University, College of Oceanography •
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• University of Texas at Austin, Institute for Geophysics • United Kingdom: Natural Environment Research Council •
• USSR: Institute of Lithosphere, USSR Academy of Sciences • University of Washington, College of Ocean and Fishery Sciences •
• Woods Hole Oceanographic Institution •

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10 July 1992

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Dr. Paul Worthington
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Dear Panel Chairs:

As if you have not heard enough from me recently, I enclose a letter proposal from Keir Beker and Earl Davis to conduct a 1.5 day post-drilling CORK/un-CORK thermal monitoring experiment at Hole 504B as part of Leg 148. I would like your (written) input on this proposal prior to the end of this month, so that I can transmit your feelings to the Planning Commitee in August. I feel that the proposal is reasonable, perhaps even warranted, but remember that we have already trimmed Leg 148 by 1 day to accommodate Santa Barbara Basin drilling during Leg 146, PCOM may schedule a 2-day VSP at this site (see my previous mailing to you) and that any/all downhole measurements on the existing hole will cut into deepening time. By the way, DMP was lukewarm on this idea (refer to their recent minutes), because emplacing a thermistor string in Hole 504B (CORKed or unCORKed) possibly jeopardizes the hole's integrity.

Feel free to consult with panel members/others as you see fit, but please remember the time constraint. Thanks in advance - again!

Sincerely,

Jamie

James A. Austin, Jr.
Senior Research Scientist
Chair, JOIDES Planning Committee

OCEAN DRILLING PROGRAM

JAA/km
xc: T. Pyle (with CORK proposal)
A. Maxwell (with CORK proposal)

000015

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Department of Geology and Geophysics

28 July 1992

Dr. Jamie A. Austin
JOIDES Planning Office
Institute for Geophysics
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8701 Mopac Boulevard
Austin, TX 78759-8397

Dear Jamie:

I am writing concerning your request for input from the Lithosphere Panel regarding the letter proposals from Stephen Swift and Keir Becker for work to be included in Leg 148. I distributed these two proposals to a group of Panel members and, in this letter, summarize our recommendations.

LITHP strongly believes that the top priority of Leg 148 must be to continue to drill another 300-500m, with the hope of sampling the transition from sheeted dikes to gabbros (which may or may not coincide with the seismic transition from Layer 2 to Layer 3). Consequently, preservation of drilling time is critical to achieve this goal. LITHP is not pleased that a day has already been removed from Leg 148 in order to accommodate the Santa Barbara Basin drilling on Leg 146. It is not clear how this proposal which, in the thematic panels' April rankings, made it into the top six of only one panel (SGPP) and did not even appear in OHP's rankings, made it into the schedule.

Although drilling time needs to be preserved, consideration must be given to logging and downhole experiments, especially when recovery rates are not likely to be particularly high. Our interpretation of the structure of much of the oceanic crust is based largely on seismic data and its possible relations to different rock types. We need to investigate how realistic these interpretations really are on a number of different spatial scales. Results from the German drillhole have suggested that seismic structure does not correlate with the downhole lithologic stratigraphy, but with porosity/ fracture/ fault boundaries. If this is shown to be the case in oceanic basement, it would have profound implications for oceanic crustal structure. The VSP experiment proposed by Swift will provide intermediate-scale data between the sonic velocities measured on the cores and the seismic refraction and reflection data for the area, and would allow the lithostratigraphy of Hole 504B to be placed within the framework of the seismic structure.

I have also talked with Ralph Stephen about the questions raised by Jeff Alt (in his letter to you of 13 July) concerning changes in the proposed work. The main reason that they are proposing to conduct the VSP experiment along the whole section is a question of consistency of the data set. The equipment that will be used will be different (the Leg 111 data were collected by Joe Phillips, I believe), and relating data from the two runs might be difficult. In terms of wireline reentry, running a VSP experiment using the French submersible or Fred Spicss's wireline reentry system is theoretically possible, but has not yet been accomplished. Doing this would require more development work and an additional cruise, so would not be likely to happen in the near future. Ralph also mentioned that they would plan to coordinate their experiment with the packer deployment in terms of when it would be scheduled during the leg.

In view of all this, **LITHP feels that addition of the VSP experiment to Leg 148 would provide valuable information in interpreting the relation between lithologic and seismic stratigraphy in the oceanic crust, and consequently recommends that it be included in the planning of the downhole work at Hole 504B.**

With regard to the proposal by Keir Becker and Earl Davis to conduct a CORK/un-CORK thermal monitoring experiment at Hole 504B, there is some concern that this will not address a fundamental process, but rather an anomaly related to the presence of the drillhole. In the case of the fully-configured CORK, the proposal does not clearly indicate what fundamental problems could be addressed using records of the rebound of temperatures towards formation conditions and the pressure variations, after the hydrologic system has been perturbed for thirteen years. In addition, it is likely that a mechanical latch would be needed if the flow rates shown in Figure 2, which on occasion have dropped close to zero, are correct. In the case of the non-sealing installation, measurement of the variations in downhole flow and temperatures could provide information on the permeability structure of the upper basement, which would be extremely valuable. The other advantage is that this could be removed by submersible or wireline reentry, and would probably be less likely to damage the hole or the reentry cone and casing, which are concerns expressed by DMP. However, the question arises as to whether this non-sealed installation could be deployed by submersible or wireline reentry, rather than take time away from drilling.

LITHP has tried to carefully weigh the potential results from this experiment, which would be to gain information on the permeability of the upper extrusives, against the 1.5 days of drilling that would be lost from Leg 148. Given that we believe the top priority must be drilling to the dike-gabbro boundary, **LITHP recommends that the thermal monitoring experiment not be included in the plans for Leg 148.**

Please let me know if you have any further questions.

Sincerely,

Susan

Susan E. Humphris

UNIVERSITY OF CALIFORNIA, DAVIS

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DEPARTMENT OF GEOLOGY DAVIS, CALIFORNIA 95616

RECEIVED
JUL 27 1992
Ans'd............

July 27, 1992

Dr. James A. Austin, Jr.
JOIDES Office
Institute of Geophysics
University of Texas at Austin
8701 Mopac Blvd
Austin, Texas 78759-8345

Dear Jamie:

I write in response to your requests of July 6 and 10 for TECP input on the proposals for 1) a 2-day VSP at Hole 504B and 2) a 1.5 day post-drilling CORK/un-CORK thermal monitoring experiment, both as part of Leg 148. Regarding 504B, TECP views as its top priorities the following:

1. To resolve the issue of the correlation between lithology and seismic velocity structure;

2. To deepen the hole as much as possible; and

3. To maintain the integrity of the hole

Given these priorities, TECP's reactions to these proposals are mixed. We can see positive aspects and drawbacks to both. TECP believes that the current VSP data is not good, but then neither, apparently, is the MCS data, in that the postulated layer 2/3 boundary is not imaged well near the hole. Accordingly the question is raised whether another VSP experiment will contribute enough to our picture to merit the time required. Perhaps it would be better to spend the time drilling and strive to obtain good standard borehole geophysics. Only if a full waveform sonic log is impossible at the expected temperatures and VSP is the only way to get borehole seismic velocities should VSP be employed

In a similar vein, TECP would like to see the temperature and fluid flow data from the CORK/un-CORK experiment, but only if it does not compromise the integrity of the hole.

Sincerely

Eldridge Moores
TECP Chair

000018

Charfield House
Woodlands Ride
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Berkshire SL5 9HP
United Kingdom

15 July 1992

Dr J Austin
Chair, JOIDES PCOM
UT at Austin

RECEIVED
JUL 2 2 1992
Ans'd............

Dear Jamie

**DOWNHOLE MEASUREMENTS AT HOLE 504B**

I am responding to your request for advice on (i) the VSP proposal and (ii) the CORK proposal relating to 504B during Leg 148. At its recent meeting DMP discussed Hole 504B at considerable length and straddling both days. Recommendations and decisions were formulated in the early morning of Day 2, when Panel members were at their freshest. Although several Panel members had to travel considerable distances to attend, there is no doubt that the deliberations were not affected adversely by travel-related syndromes. It should be noted that Panel did not have access to either proposal at the time of their June meeting.

**VSP**

One of the outcomes of the 504B discussion led by Keir Becker at DMP was a general accedence to Keir's suggestion that peripheral downhole measurements of a time-consuming nature should not be squeezed into Leg 148, where the main emphasis should be on deepening, coring and logging the hole. These views were encapsulated in DMP Recommendation 92/6, which proposes the deferral of other downhole experiments. This recommendation preempts not only the VSP proposal but also the CORK proposal. I reiterate that the emphasis was on the impact of the time required for additional work and the DMP view in no way reflects on the technical merit of the proposal, which Panel have not seen. Indeed, if 504B is deepened successfully, there would be a strong case for a future leg dedicated to downhole experiments there. DMP does not therefore support VSP work during Leg 148. Panel is more concerned that the logging programme be properly executed, especially if downhole temperatures require deployment of the more failure-prone Schlumberger hostile environment logging (HEL) tools.

**Thermistor String**

For some time now, concern has been expressed at Panel meetings that off-the-shelf technology used by industry for downhole temperature and pressure monitoring is not being accessed by ODP. Panel were informed that there is no proven thermistor string available (within the scientific community). It is with the object of resolving this situation that an industry speaker on the subject is being sought as a guest for the next DMP meeting. Therefore, from the DMP standpoint, the Becker/Davis proposal is premature. Again, there is no doubt that the proposal has great scientific merit. DMP's concern is that a functioning facility is deployed without risk to the hole, which, I am sure, will be deepened again after Leg 148. This concern is especially poignant in view of the high profile being accorded to the protocol of third-party tool deployment. The technology of downhole monitoring of temperature and pressure will hopefully be featured at the next DMP meeting. If, as a result of those expositions, Panel can be convinced that (i) the best available technology is to be used, (ii) the thermistor deployment would have a negligible time impact on drilling, coring and logging operations, and (iii) the string can be deployed in the (uncorked) hole without the hole being put at risk [an issue of concern at the December 1991 meeting of PCOM], DMP might wish to make a further statement on the subject. If the proponents are confident that these three conditions can be met, they may wish to go ahead with preparations. But if DMP subsequently perceives that the conditions are not being met, Panel might recommend that the scheme be aborted. Your requested deadline for a response is two months too early for DMP. Such an important matter, with all its implications, ought to be debated fully by Panel. Even so, I fear that this proposal is affected equally by DMP Recommendation 92/6, which, ironically, Keir was instrumental in stimulating. At the present time, this proposal does not have DMP support for Leg 148.

I trust that these comments will enable you to take a position. I have not consulted other Panel members in view of the fact that we are currently between two closely-spaced meetings. If you require further insight into DMP's position, please refer to the minutes of our last two meetings. Should you still require further input, you may contact me by FAX in Damascus, Syria, on ++963 11 246006, marked "For Dr P F Worthington (GCA), c/o Dr R Raslan, Commerce and Engineering Consultants".

Kind regards

Paul F Worthington

Paul F Worthington
Chairman
JOIDES Downhole Measurements Panel

000020

# The University of Michigan

DEPARTMENT OF GEOLOGICAL SCIENCES

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RECEIVED
JUL 2 2 1992
Ans'd.........

13 July, 1992

Dear Dr. Austin,

As co-chief for Leg 148, I have received copies of two letter proposals for experiments to be undertaken on the leg. Because of the timing of the leg the proposals will not go through the normal panel reviews, and I understand they will be discussed at the upcoming PCOM meeting. Following are my views on the two proposals.

The top priorities of the leg are to penetrate and sample the transition from layer 2 to layer 3 and the transition from dikes to gabbros, plus determine how these two are related. A VSP would be a good complement to the core and seismic refraction data across this important boundary, consistent with the leg's main goals. There are some points that need to be addressed in the discussion about the Leg 148 VSP experiment, however. A VSP was run in Hole 504B on Leg 111, so why does this section need to be repeated on Leg 148? I realize that there were some problems with the source on Leg 111, but the main area of interest will be the Leg 140 and newly drilled Leg 148 sections, where the layer 2-3 transition is thought to occur. Cutting out the upper part of the section (1500 m) could cut the time for the experiment approximately in half, allowing time for other experiments or drilling. A second consideration is that there is always the risk of losing equipment in the hole and jeopardizing the hole for future drilling any time that something is clamped in the borehole. Finally, can such a VSP experiment be carried out via wireline reentry? The VSP measurements are important and will contribute to achieving the leg's major goals, plus past VSP experiments have been successful, suggesting that the risk and time involved are warranted.

The second borehole experiment proposed presents two possibilities: (1) to seal the hole with a CORK and deploy a downhole thermistor array and pressure sensors; and (2) to leave the borehole open and insert a thermistor array. I question the first alternative for several reasons. I'm not sure of the advantage of sealing the already perturbed hydrologic system. The sealed system would measure thermal re-equilibration and pressure variations, with the pressure variations giving an idea of underpressures. This is essentially the same information that temperature measurements give for the open system (the rate of drawdown of bottom seawater). If the pressure measurements are much more efficient and precise than the temperature measurements, then sealing the hole may be a better way to estimate underpressures and water drawdown. As far as I know, a borehole water sample is obtainable from only one depth using the CORK system. This is a disadvantage for borehole water sampling given the likelihood of residual compositional gradients within the hole, which could not be evaluated, so a single sample could not be put into perspective. The proposal suggests that a mechanical latch will not be required for the CORK because the underpressure in the borehole will hold the CORK in place. Temperature measurements have shown, however, that underpressures have varied and the drawdown of water into the hole nearly ceased at least at one point, suggesting the possibility that underpressuring may decay and may not be relied upon to hold the seal in place. Finally, there is always the possibility of damaging the reentry cone or casing during sealing of the hole: this equipment will be 13 years old and will have seen 8 DSDP/ODP legs by the end of Leg 148.

The second alternative of deploying a thermistor array in the open hole could provide data on variations in drawdown of water into the hole with time, and whether past temperature profiles are representative. As pointed out in the proposal, such a system could conceivably be retrieved without the drillship, leaving the hole open for other experiments. This leads to the question of whether the drillship is required to deploy the thermistor array. The French have successfully deployed thermistor arrays in and sampled fluids from several boreholes in the Atlantic using a submersible. Perhaps a similar or other wireline technique could be used at Site 504. These proposed measurements are also secondary to the leg's main goal, that is to drill and sample the transition from layer 2-3 and from dikes to gabbros. Temperature measurements and water sampling prior to drilling are already scheduled, and a suite of standard logs plus packer/flowmeter, magnetometer, and BHTV will be run following drilling, the VSP experiment may take up to 2 days, and the hole will likely be flushed with NaBr as a tracer for future fluid sampling. Consideration must be given to how many experiments can be added to the leg without detracting from achieving its main goal of penetrating the layer 2-3 boundary.

Sincerely,

Jeff Alt

Jeffrey C. Alt

cc: S. Swift
K. Becker
E. Davis
H. Kinoshita
T. Francis
P. Worthington
S. Humphris
J. Baldauf

000022

July 29, 1992

Dr. James A. Austin, Jr.
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Austin, TX 78759-8345

RECEIVED
JUL 3 0 1992
Ans'd............

Dear Jamie:

"CORK" Proposal for Hole 504B, Leg 148

Several experiments have been proposed for Leg 148 and will be discussed at the upcoming PCOM meeting. The CORK proposal of Keir Becker and Earl Davis differs from the rest in that it makes demands on our money and engineering staff time over the next few months in order to succeed. We have had an internal meeting here at TAMU in order to decide whether we can respond to this proposal. Our conclusions at this meeting were as follows:

1. CORKing Hole 504B is feasible, because the hole is likely to remain underpressured. The CORK design needs to be modified, with no provision required for latching or fluid sampling and a new type of seal. Whether a sealing or a non-sealing installation is required, a similar amount of engineering design time is needed.

2. The CORK could be prepared in one of two ways:

   (a) The back-up CORK for Leg 146 could be modified, stripping out the titanium plumbing, fitting new seals, etc. at a cost of about $5K.

   (b) A new modified CORK could be built at a cost of about $15K.

   Although our budget is getting very tight at the moment, we could live with this unforeseen expenditure.

3. The real crunch comes with the availability of engineering staff time. All the engineering design work on CORKs to date has been done by Tom Pettigrew. In order for us to provide a CORK for Leg 148, Tom would have to devote a week of his time in the next month or so, just when he is up to his neck preparing for Leg 146. His responsibilities on Leg 146 include CORKs, PCS, VPC and running Geoprops. Once Leg 146 started, another engineer would need to "bird-dog" the Leg 148 CORK in Tom's absence.

In the interests of preparing thoroughly for Leg 146, I regret to say that we are unable to support the CORK proposal for Leg 148.

Yours sincerely,

Tim

Timothy J.G. Francis
Deputy Director

OCEAN DRILLING PROGRAM

TJGF:hk

xc: Dr. Keir Becker
Dr. Earl Davis
Mr. Mike Storms, ODP
Dr. Jack Baldauf, ODP

Ocean Drilling Program
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# Agenda Item L.

# Leg 149

RICE UNIVERSITY
DEPARTMENT OF GEOLOGY & GEOPHYSICS

*Dale S. Sawyer*

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16 June 1992

RECEIVED
JUN 17 1992
Ans'd............

Dr. James A. Austin, Jr.
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Austin, TX 78759-8345

Dear Jamie,

The attached document is our formal reply to PCOM's April 1992 decision to fundamentally alter the objectives of Leg 149 by requiring drilling of the single deep site IAP-1 on that leg. As you know we found this decision extremely disappointing. We believe, on the basis of the minutes we have seen, that PCOM reached this decision, in the absence of consultation with either the NARM-DPG or ourselves due, at least in part, to misconceptions about the scientific background, objectives and logistics of the 3 basement ocean-continent transition sites. We have briefly restated these objectives and outlined some new, exciting and highly relevant scientific developments, since the NARM DPG Report was written, in the attached document. We have also carefully scrutinized the drilling times for a number of Leg 149 scenarios with members of the ODP Operations Group and have proposed a pair of alternate scenarios which we hope will meet with PCOM's approval.

Should you feel that it would be advantageous to PCOM for either one or both of us to be available at the August PCOM Meeting in Newfoundland, to provide further information if required, we would be happy to do so.

We will also be glad to discuss Leg 149 and Iberia drilling with you or other PCOM members before the upcoming meeting.

Yours sincerely,

Dale S. Sawyer
Co-Chief Scientist, Leg 149

Robert B Whitmarsh
DSS

Robert B. Whitmarsh
Co-Chief Scientist, Leg 149

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RECEIVED
JUN 1 7 1992
Ans'd............

# Leg 149
# Non-volcanic Rifted Margin Drilling at the Iberia Abyssal Plain

## RECENT SITE SURVEY AND SCIENTIFIC DEVELOPMENTS SINCE THE NARM DPG REPORT

1. A multichannel seismic reflection survey over all the IAP sites was completed by R.V. Sonne in November 1991. Excellent data were acquired which are now being processed in Germany and the UK and will be available to the SSP in August 1992. The survey revealed two important new facts.
   a) a drill site (IAP-3C) exists adjacent to IAP-3B at which the sediment section is about 200 meters thinner. Throughout this document we will base our drilling time estimates on Site IAP-3C.
   b) site IAP-1 (originally chosen from an unprocessed Lusigal MCS profile with an ambiguous basement reflector) should ideally be relocated in order to have the potential to sample the most complete sequence of syn-rift sediments. At such a new site the basement depth is approximately 2800 m (300 m deeper than previously). We have not included drilling time estimates for this new site because the estimates for IAP-1 with 2500 m of sediment already exceed one leg of drilling and because such a site would be close to the physical limit of the ship in calm water.
2. A deep-tow (TOBI) magnetic profile was obtained over Sites IAP-3, IAP-2, IAP-1 and IAP-5 in December, 1991. Preliminary modeling of the profile and other data indicate that sea-floor spreading began to produce thin oceanic crust at about anomaly M4 time at the longitude of Site IAP-4, that this thin crust extends west of IAP-3C, that highly magnetized transitional crust exists between Sites IAP-4 and IAP-2 and that weakly magnetized crust exists east of Site IAP-2 (Figure 1).

## SCIENTIFIC OBJECTIVES OF THE OCT (OCEAN-CONTINENT TRANSITION) SITES (IAP-2, IAP-3C, 1AP-4)

The OCT at a non-volcanic rifted margin has never been drilled before. Drilling an OCT will enable us to study the thermal, petrological and structural processes which accompany the end of rifting, continental break-up and the initiation of sea-floor spreading at such margins. We stress that the Iberia margin is an excellent, and currently probably unique, location at which to address the nature of the OCT. A comprehensive set of geophysical data exists there and the sediments are not too thick to prevent drilling of the 3 basement targets within a single leg. The objectives of the individual sites are briefly recalled below in the context of research conducted since the NARM DPG Report was written (see Figure 1).

**Site IAP-2.** Sample continental basement and Eocene to Recent post-rift sediments. This site lies at a point where the acoustic basement no longer has the strong N-S fabric, seen up to and west of IAP-4, but still exhibits relatively high magnetization which cannot be explained by a sea-floor spreading model. Such highly magnetized transitional basement is characteristic of the OCT in both the Iberia and Tagus Abyssal Plains (and in the Newfoundland Basin too).

**Site IAP-4.** Test for the presence of a serpentinized peridotite basement ridge at a point where modeling of deep-tow (TOBI) magnetics predicts the onset of sea-floor spreading (albeit with an abnormally thin crust). East-west seismic transmission in the lower crust across the OCT is also poor at this point; the same phenomenon is associated with the OCT in the northern Bay of Biscay.

**Site IAP-3C.** Date the oldest oceanic crust at a point at which sea-floor spreading has begun, but has not yet reached a steady state, i.e. where the oceanic crust is abnormally thin (ca. 4 km thick), and determine its petrological nature. Also sample the most complete Oligocene to Recent turbidite section of all the OCT sites (unconformities exist at Sites IAP-2 and 4), thereby allowing the possibility of relating the history of turbidite sedimentation to changes in sea-level. These most distal, and therefore least sandy, turbidites are likely to be easiest to drill and core.

WHY WE BELIEVE THAT THE OCT SITES SHOULD BE DRILLED BEFORE IAP-1

Current engineering evaluation of drilling time for IAP-1 suggests that it is highly unlikely that basement can be reached in one leg of drilling (see attached Drilling Time Estimates). We estimate that about 1930 m of IAP-1 can be drilled during Leg 149. This drilling is likely, even in the most optimistic scenario, to fall short of sampling syn-rift sediments. Syn-rift sediments are estimated to lie possibly at 2030 mbsf but most likely at 2350 mbsf.

It makes more sense to drill the OCT sites first because it is possible that knowledge gained from the OCT drilling will influence the siting of IAP-1. For example if the geophysical predictions about the character of the OCT in the Iberia Abyssal Plain prove to be wildly wrong, the current proposed site for IAP-1 may no longer be appropriate. If we drill the OCT sites first, we will be able to evaluate this. If IAP-1 is drilled first, not only will we be unsure that it is optimally sited before drilling, but even after spending Leg 149 drilling part of the IAP-1 section we will know no more about the setting of the well with respect to the underlying basement than we know now!

Further, we do not see any way that information obtained in such a leg will help us at all in improving the siting of the OCT holes.

Until the April 1992 PCOM Meeting, the ODP Operations and Engineering groups had stressed to us the importance of building up to a deep hole such as IAP-1 by drilling shallower holes nearby. Although the nearby OCT holes will provide some useful information about the superficial sediments, they are all sufficiently shallow that there is still a 1700 m gap between the deepest of them (850 mbsf) and the TD of IAP-1 (2550 mbsf). Our real concern is that we do not think it wise to devote the whole of Leg 149 to beginning IAP-1 purely to satisfy the wish to make a start on a deep hole when the scientific returns from such a leg are likely to be very slight (as spelled out in the previous paragraph).

## REPLIES TO SPECIFIC ASSERTIONS IN THE APRIL 1992 PCOM MINUTES

### Assertion 1. Samples from basement highs are not representative of the underlying or adjacent basement.

We suggest that, if these highs were tectonically uplifted (probably as tilted fault blocks) after their formation, they will not be significantly different in composition than the basement under low areas. If anything, some smooth highly reflective basement reflectors in lows may be syn-rift sills or flows, and hence be unrepresentative of the underlying basement. Sites on highs were chosen by the NARM-DPG simply to maximize the number of basement-penetrating holes which could be drilled in one leg. We acknowledge that we are not collecting information about the syn-rift sedimentary section, but we feel that will be best addressed at a single deep hole (Site IAP-1). There are always problems of extrapolating from a 4-inch basement core to a wider region. The same criticism can be made of almost all ocean crust drilling, but this criticism does not invalidate the use and value of crustal samples.

### Assertion 2. That the OCT sites have the objective of sampling the ocean-continent BOUNDARY in a simplistic way.

This is not our intention. The geophysical observations suggest that there is a transitional region (the OCT) within which the nature of the crust changes systematically from thinned weakly magnetized continental crust, to thinned but highly magnetized transitional crust, to thin oceanic crust, to normal oceanic crust (Figure 1). Thus any basement samples from within the OCT will aid our understanding of the geological nature of the transition. The OCT zone represents the processes which accompany the change from final continental stretching to steady state sea-floor spreading. Therefore we agree with Brian Taylor who stated that "the real question involved the nature of the transition zone..." (p. 55 in the April 1992 PCOM Minutes).

In the NARM-DPG Report the flow chart showing a strategy for drilling the OCT sites was oversimplified in that it implied a binary oceanic/continental decision tree. As we have stated here, we view the problem as one of studying, using a combination of geophysical and drilling observations, the transition from continent to ocean in all its complexity. In retrospect, including that flow chart was a poor decision as it implied a more simplistic concept of the nature of the ocean-continent transition than any of us on the NARM-DPG actually had.

<u>Assertion 3. That the syn-rift history must be known in order to determine how the IAP evolved into its present configuration.</u>

We agree that the syn-rift sediments will be critical in determining important aspects of how the IAP margin evolved. We do not maintain that the deep hole, IAP-1, should not be drilled, but only that the OCT sites should be drilled before IAP-1 for the reasons given above.

<u>Assertion 4. That IAP-1 can be drilled in a single leg and that the 3 OCT sites cannot be drilled in a single leg.</u>

It is now highly probable that IAP-1 requires, even with good weather and no drilling problems, substantially more than the 50 days of drilling available to Leg 149. On the other hand, sites IAP-2, 3C, and 4 can, with reasonable weather and minimal drilling problems, be drilled in the 50 days available to Leg 149 (see Drilling Time Estimates attached).

<u>Assertion 5. That the NARM-DPG really wanted to drill IAP-1 first but was influenced to delay deep drilling by ODP-TAMU engineers.</u>

The view of NARM-DPG regarding the order of drilling IAP sites was clearly expressed by H.C. Larsen at the December 1991 PCOM meeting. The minutes of that meeting (p. 69) say "In response to a question from Austin, Larsen said that even without ODP-TAMU's engineering warnings, NARM-DPG would not have chosen deep sites for non-volcanic leg 1 because it wanted to be sure to reach basement." The NARM-DPG Report (p. 53) also says "Site IAP-1 should be drilled after the first group of IAP sites. The shallower wells will provide useful information about shallow sediments that may make IAP-1 easier or faster to drill."

ALTERNATE SCENARIOS (see page 10 for details)

Our objective in proposing the following alternate scenarios is to make a start on drilling IAP-1 at the end of Leg 149 (see Drilling Time Estimates on page 9). Since IAP-1, as proposed, will take more than one leg to drill, and the OCT sites, as proposed, will take a full leg to drill, the IAP program, as proposed, cannot be completed in two legs. However, if we can set casing to 800 meters at IAP-1 at the end of Leg 149, then it is quite reasonable to expect that a second leg could come back and finish it (we estimate it will take a further 45.3 days to finish). Critical to both of these scenarios is obtaining PCOM and PPSP permission to wash down 500-800 m in one or two of the holes in the Iberia Abyssal Plain and/or to set casing to 800 mbsf in IAP-1 without first drilling an APC/XCB hole there. In his letter to us reporting the April 1992 PCOM decision to drill IAP-1, Jamie Austin indicated that the repeated drilling of the same shallow sedimentary section would not be very interesting. Our alternate scenarios avoid some of that repetition.

<u>Alternate Scenario D (see page 10 for time estimates)</u>

In this scenario we propose first to RCB IAP-3C from the seafloor to TD. Of the three OCT sites, IAP-3C looks to have the most complete shallow sedimentary section. We would then go to IAP-1 and APC/XCB the A hole to 800 mbsf. This will provide information (both scientific and safety related) about the shallow sediments at both ends of the transect. We would then go to sites IAP-4 and IAP-2 and at each site, wash to 100 m above basement and RCB to 100 m into basement. We would end Leg 149 by setting 80 m of 20" casing and 800 m of 16" casing at IAP-1. This would leave IAP-1 ready to re-enter on a second leg and we estimate that 45.3 days of further drilling would be required to reach TD at 2550 mbsf. This is possible in one additional leg.

<u>Alternate Scenario E (see page 10 for time estimates)</u>

In this scenario we propose first to RCB IAP-3C and IAP-2, from the seafloor to TD. Of the three OCT sites, IAP-3C looks to have the most complete shallow sedimentary section. IAP-2 is located between IAP-4 and IAP-1 (35 and 16 km away, respectively) and will constrain the shallow sediments in that area. We would then go to site IAP-4, wash to 100 m above basement, and RCB to 100 m into basement. We would end Leg 149 by setting 80 m of 20" casing and 800 m of 16" casing at IAP-1. This would leave IAP-1 ready to re-enter on a second leg and we estimate that 45.3 days of further drilling would be required to reach TD at 2550 mbsf. This is possible in one additional leg.

If during Leg 149, results from the OCT sites indicate that IAP-1 is mislocated, then we propose to drill an alternate but stratigraphically equally deep site in the next half-graben to the east. If results come to light after Leg 149 which indicate IAP-1 was mislocated, then at most 14.6 days of drilling will have been lost.

## RECOMMENDATION

We strongly endorse the recommendation of NARM-DPG in its Report of September 1991 that the OCT sites, IAP-2, IAP-3B (now 3C), and IAP-4, be drilled during the first leg of non-volcanic rifted margin drilling. We recognize that IAP-1 is an important target, both to the NARM-DPG and to PCOM. We have proposed two scenarios (Alternate Scenarios D and E, page 10) for Leg 149 that, in our opinion, meet the objectives of the OCT sites and also allow a significant start on the drilling of IAP-1. We urge PCOM to assign highest priority to one of these two scenarios for Leg 149.

| | |
|---|---|
| Robert Whitmarsh | Dale S. Sawyer |
| Co-Chief Scientist Leg 149 | Co-Chief Scientist Leg 149 |

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*reprints available from R.B. Whitmarsh

## Generic IAP Site Drilling Plans

These plans will be components of the site Drilling Time Estimates and Leg 149 Scenarios which follow.

IAP-2, 3C, and 4 Plans

Plan 1. RCB to TD with bit change.
*RCB from seafloor to TD, 100 m into basement, with a bit change at the basement interface. A free-fall-funnel will be deployed for the bit change. APC/XCB to basement can be substituted for RCB and will take about the same length of time.*

Plan 2. RCB to TD without bit change.
*RCB from seafloor to TD, 100 m into basement, without bit change (but bit may wear out before reaching TD).*

Plan 3. Wash down, RCB 100 m sediment and 100 m basement.
*Wash to 100 m above basement. RCB from there to TD, 100 m into basement.*

IAP-1 Plans

Plan 4. APC/XCB hole A, RCB hole B to 2550 mbsf.
*APC to 200 mbsf in A hole. XCB to 800 mbsf in A hole. Set 80 m of 20" casing in B hole. Set 800 m of 16" casing in B hole. RCB to TD, 2550 mbsf.*

Plan 5. APC/XCB hole A, case hole B to 800 mbsf.
*APC to 200 mbsf in A hole. XCB to 800 mbsf in A hole. Set 80 m of 20" casing in B hole. Set 800 m of 16" casing in B hole. Leave hole for future drilling.*

Plan 6. Case to 800 mbsf, no APC/XCB hole.
*Set 80 m of 20" casing in A hole. Set 800 m of 16" casing in A hole. Leave hole for future drilling. Note that this is like Plan 5 without the APC/XCB hole drilled first. This would be contingent on complete coring of the shallow section at nearby Site IAP-2.*

Plan 7. APC/XCB hole A, RCB hole B to 1928 mbsf.
*APC to 200 mbsf in A hole. XCB to 800 mbsf in A hole. Set 80 m of 20" casing in B hole. Set 800 m of 16" casing in B hole. RCB to 1928 mbsf. This plan represents 43.8 days of drilling. If 10% extra time for drilling problems and 2 days for weather delays are added, the total becomes 50 days, which is the drilling time available for Leg 149.*

000010

## Drilling Time Estimates

These estimates **include logging** but **do not include** time for weather delays or drilling problems. The ODP Operations Group has estimated that we can expect up to 2 days of weather delay on Leg 149 and that we should allow 10% extra time for drilling problems. The "plans" were described on the previous page. Leg 149 "scenarios" are shown on the following pages.

| IAP-1 | Days |
|---|---|
| Plan 4 (APC/XCB hole A, RCB hole B to 2550 mbsf) | 59.8 |
| Plan 5 (APC/XCB hole A, case hole B to 800 mbsf) | 14.6 |
| Plan 6 (Case to 800 mbsf, no APC/XCB hole) | 5.9 |
| Plan 7 (APC/XCB hole A, RCB hole B to 1928 mbsf) | 43.8 |

| IAP-2 | Days |
|---|---|
| Plan 1 (RCB to TD with bit change) | 17.7 |
| Plan 2 (RCB to TD without bit change) | 16.5 |
| Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 |

| IAP-3C | Days |
|---|---|
| Plan 1 (RCB to TD with bit change) | 15.6 |
| Plan 2 (RCB to TD without bit change) | 14.5 |
| Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 |

| IAP-4 | Days |
|---|---|
| Plan 1 (RCB to TD with bit change) | 16.3 |
| Plan 2 (RCB to TD without bit change) | 15.2 |
| Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 |

## Proposed Drilling at IAP Sites

| Site | Water Depth (m) | Sediment Thickness (m) | Basement Penetration (m) | Total Penetration (m) |
|---|---|---|---|---|
| IAP-1 | 5200 | 2500 | 50 | 2550 |
| IAP-2 | 5250 | 850 | 100 | 950 |
| IAP-3 | 5500 | 830 | 100 | 930 |
| IAP-3B | 5500 | 800 | 100 | 900 |
| IAP-3C | 5500 | 680 | 100 | 780 |
| IAP-4 | 5450 | 680 | 100 | 780 |
| IAP-5 | 5100 | 760 | 100 | 860 |

**Estimated Drilling Time for Various Leg 149 Scenarios**
**(The activities are not listed in order)**

**A) PCOM Mandated Scenario to Drill IAP-1 on Leg 149**

| | |
|---|---|
| Site IAP-1 Plan 4 (APC/XCB hole A, RCB hole B to 2550 mbsf) | 59.8 days |
| 10% contingency for drilling problems | 6.0 days |
| 2 days for weather | 2.0 days |
| **Total for Leg 149** | **67.8 days** |

**B) Scenario for the Portion of IAP-1 that Can Realistically be Drilled on Leg 149**

| | |
|---|---|
| Site IAP-1 Plan 7 (APC/XCB hole A, RCB hole B to 1928 mbsf) | 43.8 days |
| 10% contingency for drilling problems | 4.4 days |
| 2 days for weather | 2.0 days |
| **Total for Leg 149** | **50.2 days** |

**C) NARM-DPG Scenario to Drill IAP-2, IAP-4, and IAP-3C on Leg 149**

| | |
|---|---|
| Site IAP-2 Plan 2 (RCB to TD without bit change) | 16.5 days |
| Site IAP-3C Plan 2 (RCB to TD without bit change) | 14.5 days |
| Site IAP-4 Plan 2 (RCB to TD without bit change) | 15.2 days |
| 10% contingency for drilling problems | 4.6 days |
| 2 days for weather | 2.0 days |
| **Total for Leg 149** | **52.8 days** |

**D) Proposed Alternate Scenario for Leg 149 Drilling**

| | |
|---|---|
| Site IAP-2 Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 days |
| Site IAP-3C Plan 1 (RCB to TD with bit change) | 15.6 days |
| Site IAP-4 Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 days |
| Site IAP-1 Plan 5 (Drill APC/XCB hole A, case hole B to 800 mbsf) | 14.6 days |
| 10% contingency for drilling problems | 4.5 days |
| 2 days for weather | 2.0 days |
| **Total for Leg 149** | **51.5 days** |

**E) Proposed Alternate Scenario for Leg 149 Drilling**

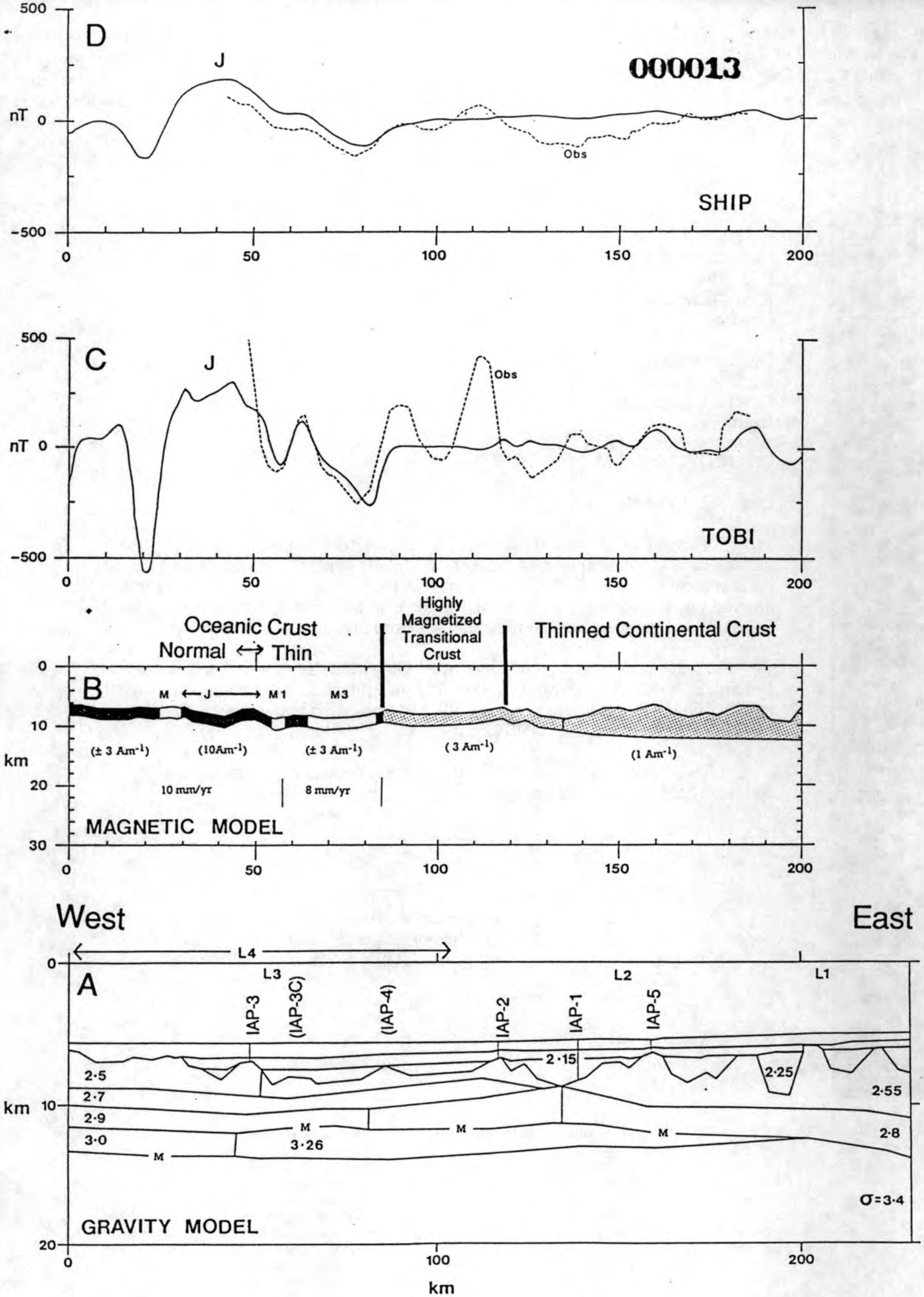
| | |
|---|---|
| Site IAP-2 Plan 1 (RCB to TD with bit change) | 17.7 days |
| Site IAP-3C Plan 1 (RCB to TD with bit change) | 15.6 days |
| Site IAP-4 Plan 3 (Wash down, RCB 100 m sediment and 100 m basement) | 7.4 days |
| Site IAP-1 Plan 6 (Case to 800 mbsf, no APC/XCB hole) | 5.9 days |
| 10% contingency for drilling problems | 4.6 days |
| 2 days for weather | 2.0 days |
| **Total for Leg 149** | **53.2 days** |

000012

Figure 1.

A. Gravity model along 40° 40' N in the Iberia Abyssal Plain constrained by seismic refraction measurements made along Lines L1, L2 and L3 (normal to the profile) and Line L4 (along the profile). M - petrological crust-mantle boundary. The model shows oceanic crust thinning from west to east (from about 45 to 80 km in the model) with a transitional region from 45 to over 150 km underlain by a layer corresponding to the 7.6 km/sec material (serpentinized peridotite?) widely observed over the whole western Iberia margin. Sites IAP-3, 2, 1, and 5 are located on this profile; sites IAP-3B and 4 lie 11 and 17 km further north, respectively.

B. Sea-floor spreading magnetic anomaly model which explains the deep-towed (C) and surface (D) magnetic profiles measured along the same track as the gravity model. J indicates magnetic anomaly J. Note that sea-floor spreading cannot explain the anomalies observed east of 85 km. Thus the two large peaks between 85 and 120 km appear to be caused by highly magnetized continental crust. Weakly magnetized continental crust appears to exist east of 120 km (the magnetic model is preliminary and incomplete and was prepared under time constraints for the information of PCOM).



D
J
000013
nT
Obs
SHIP
500
0
-500
0 50 100 150 200
C
J
Obs
TOBI
Highly Magnetized Transitional Crust
Oceanic Crust
Normal ↔ Thin
Thinned Continental Crust
B
M ← J → M1
M3
(± 3 Am-1)
(10Am-1)
(± 3 Am-1)
(3 Am-1)
(1 Am-1)
10 mm/yr
8 mm/yr
km
MAGNETIC MODEL
West
East
L4
L3
L2
L1
A
IAP-3
(IAP-3C)
(IAP-4)
IAP-2
IAP-1
IAP-5
2·15
2·25
2·5
2·7
2·9
3·0
3·26
2·55
2·8
M
σ=3·4
GRAVITY MODEL
km

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1 July 1992

Dr. Dale Sawyer
Department of Geology and Geophysics
P.O. Box 1892
Rice University
Houston, TX 77251

Dr. Bob Whitmarsh
Institute of Oceanographic Sciences
Deacon Laboratory
Brook Rd.
Wormley, Surrey GU8 5UB
UNITED KINGDOM

Dear Dale and Bob:

Thank you for your recent input on Leg 149 drilling scenarios. For your information, I have sent your packet off to thematic panel chairs and PCOM members for comments prior to the August meeting, where you ideas will be given a full and fair hearing. At this moment, I see no reason for your attendance, but I will keep you fully informed as I get feedback from the advisory structure.

Please believe that I, on behalf of PCOM, want the very best science to come from inaugural NARM drilling. You will know immediately following the August meeting where PCOM stands on Leg 149, and I trust that you will then lead the expedition to the Iberia Abyssal Plain in exemplary fashion.

Thanks again, and please do not hesitate to contact me at any time with additional comments or information.

Sincerely,

Jamie

James A. Austin, Jr.
Senior Research Scientist
Chair, JOIDES Planning Committee

JAA/km

xc: A. Maxwell
T. Francis
T. Pyle

OCEAN DRILLING PROGRAM

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000015

OCEAN DRILLING PROGRAM

2 July 1992

To: K. Becker, W. Berger, M. Cita/H.-C. Larsen, B. Duncan, J. Fox, H. Jenkyns/R. Kidd, Y. Lancelot, B. Lewis, J. Malpas/R. Arculus, J. Mutter/M. Langseth, A. Sharaskin, A. Taira, B. Taylor, B. Tucholke/H. Dick, U. von Rad/H. Beiersdorf, J. Watkins

Dear PCOM member:

Greetings! Sorry to disturb your summer activities, but I enclose a document on which I would like feedback prior to the 11-13 August meeting of PCOM: an "official" response from the designated Leg 149 Co-Chief Scientists to PCOM's change of site priority for Leg 149.

As you will remember (particularly if you were there), PCOM last April decided to make Site IAP-1, the "deep hole" on the Iberia Abyssal Plain, the top priority for drilling on Leg 149, in place of the 3-hole transect favored by the NARM-DPG. (Refer to your copies of the April PCOM minutes and the NARM-DPG report for relevant background.) The Co-Chiefs would like PCOM to modify that stance, and reinstate a transect in some form as Leg 149. They propose a number of alternatives.

PCOM will certainly have to revisit the Leg 149 issue in August. In my opinion, despite the complexities inherent in the various alternatives proposed by the Co-Chiefs, the issue remains relatively simple: stay with the deep hole as a primary objective, acknowledging the very real possibility that we will not complete it to basement by the end of Leg 149, or go with some form of transect (perhaps including a start on IAP-1, perhaps not).

Please consider the issue and give me a response, preferably by 15 July, but certainly before the end of this month. I have my own opinions, but I am a NARM-DPG proponent, so I will keep still for the moment. However, some questions to think about are: Which scenario serves the overall scientific objectives of NARM drilling best? Should PCOM begin to worry less about "leg" science, and concentrate instead on the long-term science goals (e.g., 504B)? Is drilling through ~2 km of post-rift sediment (most of which is already known from previous drilling during DSDP Leg 47 and ODP Leg 103) just to find out the nature of basement [highs] (the transect approach), as laudable as that basement goal may be in the vicinity of a complex ocean-continent transition, an efficient way to use the drillship? Should the advantages of learning how to drill deeply into passive margin sections (or anywhere alse, for that matter) be hit a glancing blow (as the Co-Chiefs want to do) or be approached by frontal assault (the PCOM approach).

Feel free to consult others about this, but remember the time constraint. Call me, too, if you would like to discuss this further, but I ask ultimately for some form of written response which I can incorporate into the agenda notes of the August PCOM Agenda Book. A little advance work by all of you now could/should considerably shorten our discussions in Newfoundland. For your information, I am also asking for input from the thematic panel chairs.

As always, thanks for your efforts in advance. I know you are cursing me for this extra work right now, but I do not want anyone to say that PCOM did not fully consider Leg 149 drilling in all its inherent complexity. The future of NARM drilling may depend on that.

Sincerely,

Jamie

James A. Austin, Jr.
Senior Research Scientist
Chair, JOIDES Planning Committee

Enclosure
JAA/km

xc: A. Maxwell
T. Francis
T. Pyle

**FACSIMILE** FROM THE UNIVERSITY OF MIAMI
DIVISION OF MARINE GEOLOGY AND GEOPHYSICS
FAX: 305-361-4632

DATE: 15 July, 1992

TO: Jamie Austin, JOIDES Office

FROM: Keir Becker

RE: Leg 149 Matters

# PAGES INCLUDING THIS: 2

**RECEIVED**
**JUL 15 1992**
**Ans'd............**

Jamie -

You asked for some feedback re the Leg 149 co-chief letter before the August PCOM. I spent the better part of yesterday going back through all the relevant documents in my files, starting with the massive proposal 365A. I have to admit that this is much more preparation than I had done prior to the last annual meeting or the spring meeting when Brian Taylor revisited the priorities of the leg. Having read all the relevant documents, I find myself in sympathy with the position expressed by the co-chief scientists, and I'm inclined to support their Alternate Scenario D or E. I can cite a number of reasons for this:

(1) I now understand the rationale for the OCT transect much better. Given the geophysical information, the purpose of this transect (as expressed on p. 50 of the NARM-DPG report) seems quite reasonable - to sample basement in transitional sections that are well-characterized geophysically, in effect to provide "ground-truth" for geophysical interpretations at this and other margins. I see providing such ground-truth for characteristic geophysical signatures as one of the most important roles of drilling. This purpose is somewhat different from the impression that I was left with by the discussion at the April PCOM, which led me to believe that the purpose was a flawed attempt to somehow find and map the OCT with the drill.

(2) There has indeed been some confusion regarding the engineering strategy for achieving a deep penetration at IAP-1 or NB-4A, and also confusion as to the role of the engineering input in the NARM-DPG prioritization of sites. Again in contrast to the impression I had at the April PCOM, it seems that engineering had nothing to do with the DPG's desire to drill the transect first, which instead was based on valid reasons like that above.

(3) I think the co-chiefs' response demonstrates both a good understanding of the purposes of the program, as well as a significant accomodation of the very high priority (shared by PCOM as well as the NARM-DPG) assigned to ultimately penetrating deep in IAP-1 and NB-4A. The co-chiefs' argument that the results of the transect might result in a repositioning of IAP-1 might very well

be true. Every drilling leg brings great surprises; if we were good enough to predict the results of a leg, we wouldn't need to be drilling! As a former co-chief and participant on countless legs, I've seen too many instances where PCOM pre-leg decisions, no matter how well-intentioned, have resulted in shipboard inflexibility which in turn sometimes produces poor science or wasted drillship time. Thus, I'm sympathetic to the arguments of the co-chief scientists, who are after all experts on the scientific problems to be addressed.

(4) One of the typical "surprises" of a leg is often that actual depths to basement or reflectors are significantly greater than depths predicted using seismic. Given the engineering challenge of designing a casing program for the deep penetration at IAP-1, I see some advantage to first drilling the OCT transect because it will provide important calibration for the travel-time to drilling depth conversion - calibration that may be essential to success at IAP-1.

(5) Finally, and probably the most important of my reasons, I think that the proposed Alternate Scenarios may actually offer a better operational approach to ultimately achieving the deep penetration in IAP-1 than the approach embodied in the PCOM April motion. All are in agreement that penetrating basement in IAP-1 is a top priority that will require more than one leg. The PCOM approach of devoting all of Leg 149 will at best result in a hole that is partially cased, with some unpredictable amount of deep open hole being left for at least a year. I seriously doubt whether any open-hole section can be expected to remain open for this amount of time, so that the next leg will almost certainly have to start with hole cleaning or conditioning or re-drilling, i.e., wasted time. On the other hand, installing the primary casing on Leg 149 would set a clean and ready stage for the achievement of the deep penetration on a subsequent normal length leg; good open-hole conditions would be required only during the duration of this subsequent leg, which would of course be maximizing the time with the drillstring and bit in the hole and therefore the chances of maintaining good hole conditions. In other words, I think that the proper way to end the first of the two legs is with a completely cased hole with a calibrated prediction of the ultimate drilling depth, as the Alternate Scenarios would provide.

Thus I think the Alternate Scenarios are quite sensible (and I probably favor D over E). They would attack the essence of the OCT transect, which does indeed have some valid justification, plus they would set an operationally strong stage for the deep penetration. Given that IAP-1 is a 1+ leg problem, PCOM may actually have little to gain, and a lot to lose (operationally, politically, and/or scientifically) by insisting that all of Leg 149 be devoted to it simply because it is the ultimate top priority. Instead, given that the deep penetration cannot be fully achieved until the second leg, it behooves us to plan the two-leg attack in the most efficient manner operationally.

BUNDESANSTALT FÜR
GEOWISSENSCHAFTEN UND ROHSTOFFE

Hannover, July 8, 1992

A.Z.: B 3.31 - 222/04 - Bei/Br

BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE
Alfred-Bentz-Haus · Postfach 51 01 53 · 3000 Hannover 51

RECEIVED
JUL 17 1992
Ans'd............

Dr. James A. Austin
JOIDES OFFICE
The University of Texas at Austin
Institute for Geophysics
8701 Mopac Boulevard
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Dear Jamie,

From the April PCOM discussion on the Leg 149 plans it was my believe that IAP-1 can be drilled to TD in a single Leg. What Dale Sawyer and Bob Whitmarsh have turned out now has convinced me that it can not. This is disappointing of course. On the other hand in April it was not as clear that IAP-1 may have been sited in the wrong place.

After having read the comments of both Co-Chiefs I favor their scenario E now with the stipulation that IAP-1 will be finished by another Leg including the APC/XCB Hole.

Sincerely,

Ursula Röhl

(Dr. U. Röhl for
Dr. H. Beiersdorf)

000020

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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SCRIPPS INSTITUTION OF OCEANOGRAPHY
GEOLOGICAL RESEARCH DIVISION

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July 7 1992

RECEIVED
JUL 1 3 1992
Ans'd............

Dear Jamie,

it would be unfair for me to express a strong preference one way or the other, regarding the Leg 149 issues, since I don't really understand them very well. Perhaps Sawyer & Whitmarsh (or one of them) should make the case at the meeting. I remember that at the meeting I thought we came up with the correct solution, given the arguments at the time.

Best regards Wolf B. (Berger)

000021

UNIVERSITA' DEGLI STUDI DI MILANO

*Dipartimento*
*di*
*Scienze della Terra*

Milano, July 22, 1992

RECEIVED
JUL 2 2 1992
Ans'd............

Dr. James Austin
PCOM Chairman
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FAX: 001-512-471 0999

Dear Jamie,

I am pleased to be given the opportunity to express my position vis à vis the problem of the Iberian Margin drilling (Leg 149).

As you may remember, I have always been in favour of starting the new phase of drilling in the Atlantic with a DEEP HOLE. Specifically, the best known passive margins on Earth are the ideal target for testing the real capabilities of the drillship which is now at its best, with several years of ocean drilling experience. And all this happens in a critical time for the most successfull scientific program ever.

Consequently, I was very disappointed, during the annual 1991 PCOM Meeting, to see the NARM DPG propose a drilling program for the Iberian margin consisting of a series of holes located on top of the basement highs, where already known post-rift sediments could be cored. This seemed to me a very old fashioned approach, style DSDP of the seventies.

I was also surprised, and disappointed, by the attitude of ODP officers, who seemed to consider risky and premature the DEEP DEEP DRILLING adventure.

Ulrich and I pointed out that over fifteen (now sixteen) years ago, we continuously cored in less than three weeks (17 days), without re-entery capability, IPOD Site 397 to the terminal depth of 1000 m, followed by 397A down to 1453 m subbottom. This was the Atlantic passive margin off Cape Bojador. The following half-Leg 47B, always with recordman Bill Ryan as co-chief, with re-entery capability, reached a depth in excess of 1600 m in the Iberian margin (Vigo Seamount).

So what? We were surprised, with so much more experience and a better technology, with a multi-leg program already approved, to see so much hesitation to finally start the deep penetration adventure in sedimentary rocks.

Reluctantly, I voted for the drilling program proposed by the NARM DPG, just because the ODP Headquarters apparently were not ready.

Consequently, I was very happy when last April Brian Taylor brought again the problem to the stage and was so persuasive with his argumentations that he succeeded to make PCOM change its former decision.

Also changed was in April ODP Officer's attitude towards the deep penetration adventure, that they were now ready to start.....

Jamie, I do hope you will not be frightened or intimidated by the position of the appointed co-chief scientists, and will not let PCOM go back to the previous decision.

The single deep hole is the best solution for Leg 149 in order to start something different from "MORE OF THE SAME". Let big science win, with all its risk.

I wish I could help you

Sincerely

Maria Bianca Cita

000022

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Woods Hole, Massachusetts 02543
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Department of Geology and Geophysics

June 7, 1992

Dr. James Austin
JOIDES Office
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Austin, TX 78759-8345

RECEIVED
JUL 1 3 1992
Ans'd............

Dear Jamie,

I read the Leg 149 Co-chief's letter and discussed its contents with Brian Tucholke who is far more aware of what has gone into the PCOM's decision to drill a single deep hole on this leg than I. He is also more attuned to the science than I. Basically, while sympathetic to the plaint of the Co-Chief's, I concur with the decision to drill a single deep hole largely on the basis of the discussion with Brian which can be summarized by the comment that "it is time to get on with it and drill a deep hole at a non-volcanic rifted margin". While I am sure that the three proposed basement penetrations would lead to some interesting science - probably of more interest to me personally, it is clearly evident that many community objectives are going to require multi-leg efforts. If the proposed hole bombs out, they can always move on to one or the other of their sites as a backup, but starting and pursuing the deep hole as far as possible seems the best strategy if we are to unambiguously recover the full record of such a margin (at least to this uneducated ridge petrologist). Brian has promised to elaborate on this in a telephone call to you.

Sorry you missed me in Woods Hole. I'm sure the conversation would have been both enlightening and entertaining. Next time you're here why don't you plan on staying at our new house - we have a smashing visiting oceanographer's suite.

Best Wishes,

Henry Dick
Senior Scientist
Henry Dick

cc: B. Tucholke
W. Curry
GM Purdy

000023

COLLEGE OF OCEANOGRAPHY

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Oceanography Administration Building 104 · Corvallis, Oregon 97331-5503
Telephone 503·737·3504 Fax 503·737·2064

15 July, 1992

Dear Jamie,

I'm getting this to you in a hurry because I leave early tomorrow for a cruise to the EPR with Rodey Batiza and the Melville. Marty Fisk will cover for me at the August PCOM, and I have briefed him on some of the current issues.

After reading the latest submission from the co-chiefs for Leg 149 I don't think the situation has changed enough to alter the PCOM decision in April. We still have to decide whether to go for the top priority of the program (a deep hole through the syn-rift sediments) or a secondary priority (locating and describing the ocean-continent transition). Brian Taylor convinced me that the whole strategy of drilling basement highs is suspect, and I still don't see that sampling basement rocks at 3 locations is going to add much to what is essentially a remote sensing problem. I recommend sticking with our plan to go with IAP-1 first, having picked the best location with the latest MCS survey.

I would be interested in discussing ways to save drilling time at IAP-1 by, for instance, washing through sections already recovered during DSDP Leg 47 and ODP Leg 103.

Sorry to miss you in Corner Brook.

Best regards,

Bob Duncan

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000024
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Dr. H.C. Jenkyns
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RECEIVED
JUL 1 7 1992
Ans'd............

9 July 1992

Jamie Austin,
JOIDES Office,
Institute for Geophysics,
University of Texas at Austin,
8701 Mopac Blvd., Room 300,
Austin,
Texas 78759-8345,
USA.

Dear Jamie,

Leg 149

Thanks for your letter about this. As you know I was absent for the Oregon PCOM meeting, so I am unaware of the "chemistry" of the discussion. However, a number of points disturb me. From reading the minutes it is clear that a number of PCOM members were concerned about going against the NARM DPG recommendations. The recommendations are clear from the December PCOM minutes and the DPG Report: namely that basement is a first-order objective and IAP1 should be drilled later, not sooner. If PCOM wishes to cross the DPG in this way, it must deem itself better informed and the scientific case to be, if not overwhelming, extremely persuasive. Is this the case? Surely investigating the nature of the ocean-continent boundary in a non-volcanic margin is a global problem; sampling a thick syn-rift section at IAP1 could be construed as more local in dimension. I do not think that sampling more Aptian-Albian black shales is really particularly important in this stage of the game. I guess what is worrying me is that the desire to drill deep, just because we can, is apparently overwhelming a carefully thought-out strategy put forward by a DPG. Is this the technological tail wagging the scientific dog? Why is it so important to drill IAP1 first?

Finally, on a point of principle, I am unhappy about altering the scientific goals of a leg after the co-chiefs have been appointed. Although the Planning Committee, rightly, wishes to view more science in a multi-leg mode, there is no doubt that leg participants like to feel that what they do has some thematic unity. Finishing a hole in basement is intellectually very satisfactory, as I have recently rediscovered on Leg 143. And, as you say yourself, if IAP1 is drilled in Leg 149 the section may be entirely sedimentary. Pragmatically the Planning Committee should be aware of what constitutes a scientifically attractive leg, both for co-chiefs and scientific staff.

On balance, therefore, I believe PCOM should follow the original recommendations of the DPG and drill the transect first.

Yours sincerely,

Hugh

Hugh Jenkyns

Posted: Tue, Jul 7, 1992 ( .:36 AM EDT    Msg: ( . JC-5299-3041
From: Y.LANCELOT
To: JOIDES.UTIG (REC)

000025

Attention Jamie Austin
Dear Jamie,
Thanks for your letter regarding leg 149 plans. First of all you should not apologize for asking that we do contribute. It is our duty and that's what Pcom is about. Second, contrary to what you say, I do think that the advice of ALL the proponents, and not only that of the two 149 co-chiefs should be taken into consideration. In fact your opinion there is as important as that of each of the NARM DPG members and, in my view, can help educate PCOM members. Give your opinion and don't vote and I don't think that anybody could complain, both on efficiency and ethical grounds.
Now, on the crux of the matter, it is not easy to decide. True we have been seduced, maybe to quickly, by Brian Taylor's dynamic presentation last time. But the argumentation against the deep hole is not very convincing either. It leaves me a bit skeptical abour priorities established by the DPG for an 8-leg program. My feeling was that all the priorities presented on existing data were about equal and that the order in which we would drill the holes was after all of secondary importance. I will look a bit more into the matter and read carefully the documents. I will also ask for other opinions but, frankly your opinion as expert, independantly from your position on PCOM, is an important one. So is the opinion of Brian Tucholke. If you want to lobby here it is fine, it will not be acceptable when we meet though... So please tell me what you think. In any case this is only my preliminary gut's reaction and I will be in touch soon with possibly a better educated opinion.
Cheers,
Yves Lancelot

000026

RECEIVED
JUL 3 0 1992
Ans'd............

Dr. James A. Austin, Jr.
JOIDES Office
The University of Texas at Austin
Institute for Geophysics
8701 Mopac Boulevard
Austin, Texas 78759-8345

Dear Jamie:

I am sorry for my late response to your request of July 2nd for comments on the question of the optimum Leg 149 drilling strategy, but I have been out of office most of July. My comments below should be read on the background that I, together with one of the appointed Co-Chiefs for Leg 149, chaired the NARM-DPG. Hence, I have the responsibility for the NARM-DPG proposed order of drilling as well as I am technically a proponent of Leg 149. However, since I am primarely involved in the volcanic margin drilling (appointed Co Chief for Leg 152), I do not feel in any way biased in questions related to Leg 149 drilling or later non-volcanic margin drilling for that matter. In fact, since the Co-Chiefs for Leg 149 not are invited to the PCOM meeting, I feel within PCOM a special responsibility for this subject. I will be prepared for discussions at the PCOM meeting, but my immediate respons is given below.

Perhaps one of the most important things for me to stress is that the NARM-DPG strategy of a transect of relatively shallow, basement penetrating holes close to the COT was our first priority choice for scientific reasons and not for technical reasons. We all agreed on that within the DPG, and I am quite sure that the DPG would not change its opinion on this subject if it was told to re-examine the subject without considering technical problems or the need to produce "final and visible" results in the first leg. We allways assumed that there would be several legs of drilling and we were actively thinking in terms of a multi-leg program. It is, however, correct that we stressed that the scientific priority we established as a bonus implies some lead-in time before the more difficult sites.

The only option we gave up for technical reasons, and only as a short term goal, was the idea of the very deep basement drilling required in order to penetrate the S-reflector where it is clearly developed. However, this was not only a technically hesitation. We also felt that better seismic imaging and some shallower drilling would be required in order to scientifically mature deep S-reflector drilling, though it is my feeling that the NARM-DPG might have recommended a more frontal approach on the S-reflector subject if PCOM had expressed commitment to very deep drilling at an earlier stage in the NARM planning. At an very early stage of the DPG work we also gave up ideas about ultra deep sites on the Newfoundland - Flemish Cap margin where landward dipping reflectors occur at large depth.

**In summary, it is therefore simply incorrect that the NARM-DPG were driven by "technology" in the question about delaying the deep Iberia drill site. Technology, however, kept us away from proposing very deep drilling in order to recover deep crustal reflectors.** This of course does not leave out the possibility that our scientific priorities were wrong. I will return to that later.

My second, and almost equally important, comment is that although the NARM-DPG suggested a four leg non-volcanic rifted margin program, the later legs obviously are not as scientifically or technically mature as the first leg. This fact was explained in detail by myself in the presentations to both thematic panels and to PCOM. It was because of that we "only" asked for one non-volcanic leg in 1993, a condition that was stressed by the PCOM chair during earlier PCOM discussions. Furthermore, the NARM-DPG recommended a break of one year between the first two legs of non-volcanic margin drilling and possible subsequent legs. This recommandation reflected the, in my opinion realistic expectation, that the first drilling results would produce very valuable results that should be used in the further planning of margin drilling. **PCOM must be aware of this declining level of maturity within the proposed four legs of non-volcanic margin drilling. In particular, PCOM must realise that they, by their proposal to drill site IAP-1 on Leg 149, have selected drilling that the NARM-DPG following detailed work and discussions only would consider scientifically mature following about two legs of drilling and a digestion period of minimum one year possibly including new planning.**

Personally, I never expected IAP-1 to be drilled on the basis of the transect and site specific data presently available. May be that my concern best can be illustrated by a reference to the site survey data through site IAP-1 shown in figure 4.45 of the NARM-DPG report. I think it is very clear from this figure that the expected stratigraphic fanning of the syn-rift fill is not well developed, that the proposed site is extremely likely to bottom in pre-rift fill at the proposed 2550 m drilling depth with as much as perhaps one kilometer more down to basement. I note that the two Co-Chiefs based on new data have arrived at the same sort of concern. I appologize for the fact that this uncertaincy not was spelled out sufficiently strongly in the DPG report, but it was in fact indicated. **PCOM therefore must be aware that if basement recovery is made an important objective at site IAP-1, its present location is a generic location only.**

Well, so much about the NARM-DPG considerations. The important thing is to evaluate how the best science is carried out on Leg 149 given the more relaxed attitude to deep drilling recently expressed by TAMU.

If deep drilling down to minimum around 3.5 km is considered realistic, I would certainly re-examine the possibilities for deep drilling of the S-reflector or other deep crustal features at rifted margins. If "only" approximately 2.5 km penetration is at hand, I certainly would stay close the NARM-DPG proposal along the lines suggested by the two Co-Chiefs for Leg 149 and essentially for the reasons referred to by the two Co-Chiefs.

In case of the latter I believe that one of the most important tectonic drilling objectives on a margin like the Iberia margin, is along a transect to map out the nature of the basement replacing oceanic crust and presumed (tectonic) mantle exposure landwards of the COT. Such data are a prerequisite for describing this transitional zone and for any attempt to reconstruct the structural deformation history. To provide a first order controle on the basement lithofacies I think the "basement high" drilling is a good strategy and provide the safest and most economic way of sampling "true" basement and not only a misleading local basement cover. More dense sampling of basement nature between the highs may be required later. I would expect drilling in the low between the presumed peridotite ridge (IAP-4) and the presumed first "continental" fault block (IAP-2) could be required and perhaps actually in the future partly or wholly could replace IAP-1. I therefore strongly recommend site IAP-4 and 2 drilled more or less as proposed. It might be considered if site IAP-2 should be displaced slightly landwards (i.e. landward and down dip of the fault block crest) in order to recover possible pre-rift sediments and more effectively narrow down the timing of the rifting and the change in environment from pre-rift to post-rift time.

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Concerning the drilling of the early oceanic crust at site IAP-3/3B/3C I allways have been slightly worried about drilling a high and not the regular oceanic basement. My concern here is two-fold. Oceanic highs can be non-representative local off-axis developments and we are missing out the early postrift sequence that could constrain both the timing of break-up, the break-up environment and the early subsidence history. It should be noted here that we are not drilling site IAP-3 only to re-assure ourselves about the oceanic nature of this site, but certainly also to constrain the age and geochemical nature of this early and thin oceanic crust, its paleoenvironment and initial subsidence and eventually compare such data with data from the thick-crusted volcanic margins. However, since site IAP-3 can be located on a ridge parallel to the sea-floor spreading anomalies further seaward, it probably represents a fair and economic compromise, but it surely is a compromise between drilling time and scientific requirements. For this reason, the Galicia site GAL-1 was presented to TECP and LITHP at their joint fall meeting 1991 as an alternative to site IAP-3 on the first non-volcanic margin leg. The panel minutes are a bit unclear at this point and since I was not in the room during discussions (asked to leave being a proponent), I do not know the details, but it is my impression that the panels were in favour of the GAL-1 site.

Finally a few words about the need for sampling of the syn-rift fill. I agree with PCOM's desire to recover the synrift fill, but I disagree about the need to do it from the very start. We spent a good deal of time on this subject in the DPG. One proposal (Flemish Cap - Goban Spur conjugate margin drilling) was fairly strongly based on syn- and post-rift recovery in order to map out margin symmetry/asymmetry regarding rift environment and later subsidence. The overall goal was to be able to destinguish between different models of deformation and crustal rupture (basically pure versus simple shear). The NARM-DPG was, however, not convinced about the viability of this approach as a principal tectonic data source. This proposal was accordingly not included in the first priority NARM-drilling. Recovery of the syn-rift fill was maintained in the first priority transect Newfoundland - Iberia margins following initial drilling close to the COT. However, the first recovery of the break-up unconformity and underlying syn-rift fill was suggested to take place at the Newfoundland margin (NB-4) since the break-up unconformity seems very well developed here and could represent a peculiar sub-aerial exposure. Recovery of syn-rift on the Iberia site was not planned before leg 3 (IAP-1) the details of and the need for IAP-1 being dependant on the results of the first two legs. Personally, I would favour recovery of syn-rift, pre-rift and basement as close as possible to the COT on the Iberia margin in order to portray the environment and the different events during break-up directly within the rift segment in which the final crustal rupture took place and the first magmatic accretion of oceanic crust started. In this sense, I consider the present IAP-1 a generic site that eventually might be moved to the low between IAP-4 and IAP-2 following the first drilling. I am therefore not very keen on Leg 149 even spending time on preparing for drilling site IAP-1 at this early stage. I will strongly recommend not to attempt drilling IAP-1 at Leg 149.

In summary, the NARM-DPG delayed syn-rift recovery and drilling of IAP-1 for scientific reasons that I fully believe were and are valid, and Site IAP-1 is not mature and to some extent only a generic site which presently hardly can be finally located. Concern about deep drilling kept the NARM-DPG from considering in more detail deep crustal drilling (min. 3.5 km) in order to recover the S-reflector.

Hans Christian Larsen
ESCO Chairman

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No. of Pages 2 Today's Date 7/13/9 000029

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JUL 13 1992
Ans'd............

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July 13, 1992

Dr. James Austin
University of Texas @ Austin
Institute for Geophysics
8701 MoPac Blvd.
Austin, Texas 78759

Dear Jamie:

Because I did not attend the April PCOM meeting, I discussed the questions concerning Leg 149 with Marcus Langseth who did attend, Nick Christie-Blick who was involved with the DPG, and Greg Mountain.

What is of concern is the likely scientific return from drilling the deep site vs. the transect on 149, although there are real questions about these sites on any leg. Deep drilling is, of course, an extremely important issue in ODP's future science, but 149 is not an engineering leg to test deep drilling - it must be primarily science driven. There seems to be two problems with the science proposed for the deep site. One is that the location of the "breakup unconformity" in the relevant reflection data is not well constrained from a seismic stratigraphic point of view. Drilling would hopefully encounter a region where facies changed from inner to outer shelf. Since such an event can happen any time around the time of breakup, but not necessarily exactly at the time of breakup, it is not clear what will be learned from this.

The second problem is that a subsidence curve constructed from data obtained from the deep hole would be very low resolution given the uncertainties of determining paleo-water depth from outer shelf fossils. Even very good subsidence curves do not uniquely constrain lithospheric processes. What could this one do?

On the other hand, I certainly appreciate the problems with the transect and it bothers me quite a bit to see the proponents say that the strategy as outlined in the DPG report was not particularly tight. In fact, planning for both the deep hole and the transect seem nowhere near as tight as we were led to believe by DPG proponents at the 1991 annual PCOM meeting when we voted NARM non-volcanic into the schedule. I think it is a little late to tell us that the continent-ocean transect strategy was immature.

000030

July 13, 1992

The idea of spending a whole leg trying to get an idea where the continent-ocean boundary might be within some very broad limits seems a waste of drilling time. For mine, the prime site in the whole plan is IAP-4 which has potential for recovering deformed upper mantle rocks that would tell us a great deal about the strain history of the margin. This would provide for more direct evidence on how the margin evolved than could be obtained from the highly non-unique modeling of very low-resolution subsidence data. The nature of the earliest formed oceanic crust is of critical important also since it tells us about the condition of the mantle at that time. I appreciate that we may not know exactly where the earliest formed crust is located, but if drilling encountered continental crust where all other indications suggested oceanic crust should be, then this, too, provides some critical constraints on margin evolution.

I have never felt that the continent-ocean transect idea was very strong if it was aimed at establishing the geometry of the boundary since it seems like it could not really achieve that goal. Drilling to learn about the deformation history of the deep crust and upper mantle is very worthwhile, however, and is more achievable than the science proposed for the deep hole.

See you in Corner Brook.

John C. Mutter

Date: Wed, 8 Jul 92 09:37:56 HST
From: taylor@elepaio.soest.hawaii.edu
To: jamie@utig.ig.utexas.edu
Subject: Leg 149

000031

Jamie,

Having read the Leg 149 co-chiefs letter, I remain convinced that PCOM made the right decision at its spring meeting. The new TOBI, and all other, data indicate that site IAP-1 is on the seaward edge of thinned continental and/or weakly magnetised transitional crust. The critical science to address relates to the processes and history by which this thinned/transitional crust develops. This will not be addressed by sampling a few basement highs beneath late post-rift sediments. A 100m section of basalt flows or serpentine protrusions may OR MAY NOT indicate the true nature of basement beneath. Also, as in the Afar region, continental blocks may be surrounded by 'oceanic' basalts covering transitional or oceanic crust.

The best record of the margin development is in the syn-rift sediments. This requires a deep site, so let's get started drilling it. Not only is the deep site the tectonically most important, it will provide significant OHP (Albian-Aptian anoxic events) and engineering lessons that the shallow sites will not. Go for the gold first!

Brian Taylor.

000032


# Texas A&M University
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Robert A. Duce, Dean
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JUL 0 9 1992
Ans'd.............


July 7, 1992

Jamie Austin
JOIDES Office
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Institute for Geophysics
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Austin, TX 78759-8345

Dear Jamie,

In an earlier reincarnation, I would have supported the Co-Chiefs and said that we should go for the OCT. But in this case, I say go for the deep hole. There are several reasons for this.

1) Drilling on tops of shallow tilted blocks tells us nothing about the early stages of rifting; we recover only the date of some time after the end of rifting and the beginning of submergence. Drilling a deep hole can tell all for the first time.

2) It is time the margin people did something different. We have "kissed" with the drill margins in many areas of the world. Let's take a real bite this time.

3) Finally, I would argue that the information from IAP-1 will help optimize the placement of later holes to get more information on the <u>total process</u> of rifting as opposed to information on a part of the process, <u>viz</u>. the OCT.

Regards.

Joel S. Watkins

JSW/mb

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000033

1 July 1992

OCEAN DRILLING PROGRAM

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Woods Hole, MA 02543

Dr. Judith A. McKenzie
Geologisches Institut
ETH - Zentrum
Sonneggstrasse 5
CH-8092 Zürich (CH)
SWITZERLAND

Dr. Eldridge M. Moores
Geology Department
University of California, Davis
Davis, CA 95616

Dear Thematic Panel Chairs:

Greetings! Sorry to disturb your summer activities, but I enclose a document on which I would like feedback prior to the 11-13 August meeting of PCOM: an "official" response from the designated Leg 149 Co-Chief Scientists to PCOM's change of site priority for Leg 149.

As you may remember, PCOM last April decided to make Site IAP-1, the "deep hole" on the Iberia Abyssal Plain, the top priority for drilling on Leg 149, in place of the 3-hole transect favored by the NARM-DPG. (Refer to your copies of the April PCOM minutes and the NARM-DPG report for relevant background.) The Co-Chiefs would like PCOM to modify that stance, and reinstate a transect in some form as Leg 149. They propose a number of alternatives.

PCOM will certainly have to revisit the Leg 149 issue in August. In my opinion, despite the complexities inherent in the various alternatives proposed by the Co-Chiefs, the issue remains relatively simple: stay with the deep hole as a primary objective, acknowledging the very real possibility that we will not complete it to basement by the end of Leg 149, or go with some form of transect (perhaps including a start on Site IAP-1, perhaps not).

Please consider the issue and give me a response, preferably by 15 July, but certainly before the end of this month. I have my own opinions, but I am a NARM-DPG proponent, so I will keep still for the moment. However, some questions to think about are: Which scenario serves the overall scientific objectives of NARM drilling best? Should we worry less about "leg" science, and concentrate instead on the long-term science goals (e.g., 504B)? Is drilling through ~2 km of post-rift sediment (most of which is already known from previous drilling during DSDP Leg 47 and ODP Leg 103) just to find out the nature of basement [highs] (the transect approach), as laudable as that basement goal may be in the vicinity of a complicated ocean-continent transition, an efficient way to use the drillship? Should the advantages of learning how to drill deeply into passive margin sections (or anywhere else, for that matter) be hit a glancing blow (as the Co-Chiefs want to do) or be approached by frontal assault (the PCOM approach). Other questions will occur to you, I'm sure.

Feel free to consult panel members about this, but remember the time constraint. Call me, too, if you would like to discuss this further, but I ask ultimately for a written response which can/will be included in the August PCOM Agenda Book.

As always, thanks for your efforts in advance. I know you are cursing me for this extra work right now, but I do not want anyone to say that PCOM did not fully consult the advisory structure concerning Leg 149.

Sincerely,

Jamie

James A. Austin, Jr.
Senior Research Scientist
Chair, JOIDES Planning Committee

Enclosure
JAA/km

xc: A. Maxwell
T. Francis
T. Pyle

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

000035

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SANTA CRUZ, CALIFORNIA 95064

20 July 1992

RECEIVED
JUL 24 1992
Ans'd............

Dr. James A. Austin, Jr.
Chair, JOIDES Planning Committee
University of Texas at Austin
8701 Mopac Blvd.
Austin, TX 78759-8345

Dear Jamie:

I write in response to your 1 July 1992 request for thematic panel comments on the Sawyer/Whitmarsh document about drilling plans for Leg 149, NARM non-volcanic rifted margins leg 1. I have reviewed the relevant documents and our past panel discussions, and have consulted with several panel members as well. The conclusion is that, from the OHP perspective, there is no strong preference for either the transect or the deep hole alternatives; the scientific objections of NARM should dictate the scheduling on this leg.

Given that, let me expand these comments slightly. Paleoceanographic interest in all of these sites is limited by their paleodepths and the likelihood of downslope transport; accordingly, sedimentary objectives have not been strongly developed for these sites. The transect approach, as given to fit time constraints, calls for washing of sediment at at least one, and possibly two sites to within 100 m of basement, diminishing any advantages of transect sampling for sedimentary objectives. As a general principle, I am not enthusiastic about washing through sedimentary sequences. As the record of syn-rift sedimentation is not likely to be well-developed at the transect sites, sedimentary history would be addressed more completely at the deep site (IAP-1). The existence of adjacent Hole 398D, in which an expanded Barremian-Albian record exists, lessens the interest in IAP1 for the Mesozoic. However, along with other panels, we are interested in observing the performance and potential of deep drilling in passive margin sequences.

I do not think this discussion of OHP interests in these sites points to either alternative as more strongly favored. I think this choice must rest on how best to achieve NARM scientific objectives and the advice of the thematic panels more closely involved. Thanks for the chance to comment and let me know if I can supply any further information.

Sincerely,

Peggy Delaney

Margaret Lois Delaney
OHP Chair

000036

From Judith A. McKenzie, SGPP Chair

For Dr. James Austin, PCOM Chair, JOIDES Office

Date: 27.07.92

RECEIVED
JUL 27 1992
Ans'd............

Re: Drilling strategy for Leg149 - SGPP input to PCOM

Dear Jamie,

As you are aware, two SGPP members, Nick Christie-Blick and Richard Hiscott, served as liaisons to the NARM-DPG and I have consulted with them concerning your request for SGPP input to PCOM about the drilling strategy for Leg 149. As Nick and Rick are undoubtedly the best informed SGPP members concerning the scientific objectives of this leg, I chose not to consult the full panel but propose to represent the panel with the following analysis:

For Leg 149 to be successful as scheduled (50 days) with a single deep hole (IAP-1) , it is essential (1) to sample a complete sequence of syn-rift sediments in order to constrain the subsidence history of the margin and (2) to drill into the oldest oceanic basement in order to acquire sufficient material to analyse and date. Based on new drilling estimates (Scenario B), a single deep hole (IAP-1) now seems unlikely to reach either of these two objectives within the allotted 50 days, which would apparently jeopardise the scientific integrity of Leg 149. Thus, if the deep hole drilling strategy is to be maintained by PCOM, Leg 149 must be viewed as the first of two or more legs. Longer-range scientific goals for NARM in the interest of the wider scientific community and, hence, staffing of Leg 149 must be viewed accordingly, as drilling will initially be confined to a thick sedimentary pile with important NARM-DPG objectives coming later. On the other hand, a return to the original 3-site program (Scenario C) also does not appear to be feasible for a 50-day leg and the crucial goal of reaching basement at at least one site would undoubtedly have to be sacrificed. Also, as none of the holes on the 3-site transect even approach the depth of IAP-1, little technical information would be gained to assist the engineers for a subsequent deep hole.

Alternatively, the Leg 149 co-chiefs are proposing an altered program which includes the drilling of a set of three sites to basement, plus making a start on the deep hole. In order to achieve this within a single 50-day leg, they are proposing to wash through most of the sedimentary sequences overlying basement. SGPP unconditionally <u>cannot</u> recommend or support this approach (Scenario D and E). Valuable sedimentary information may be lost by not coring these abyssal plain sequences. The study of such tubidites is an important SGPP objective towards a better understanding of sedimentary processes in the deep oceans. The sequences are not simply sedimentary overburden that has to be removed to reach basement objectives. In fact, SGPP highly ranks the drilling of Madeira abyssal plain turbidites (059Rev) and the Iberian abyssal plain may provide a complementary region to test proposed models.

SGPP recommends to PCOM that, in discussing the scientific priorities of Leg 149, they should return to the original NARM-DPG report and review the scientific rational and feasibility of the proposed objectives. Both SGPP liaisons to NARM-DPG were and remain uncomfortable with the strategy of NARM non-volcanic drilling. A summary of their concerns is as follows: The scientific emphasis is placed primarily on sampling basement and, if this goal is not achieved, the entire leg could be a complete scientific failure. Also, the goals of sampling both syn-rift and post-rift sediments to date the break-up unconformity and constrain the subsidence history of the margin are probably not achievable. There appears to be nothing in the stratal geometry identifiable on seismic profiles, such as evidence for tilting of fault blocks, that permits confident location of the "break-up" unconformity. Therefore, it is questionable whether the time of breakup of the conjugate margins can be obtained from the basin stratigraphy. Even if the supposed unconformity is sampled and dated, little useful information about the tectonic development of the margin will be obtained. Finally, the deep site is located on thin crust and would have subsided rapidly during middle to late Cretaceous time into water depths well in excess of what can be calibrated confidently. Therefore, attempts at backstripping will be controlled entirely by assumptions about water depth with enormous error bars. Thus, it will be virtually impossible to learn anything about the entire post-rift subsidence history.

In summary, SGPP does not support any drilling scenario that proposes to wash through the upper turbidite sequences. As important objectives of the scientific strategy appear to be unobtainable, SGPP questions the scientific rational for using the drill ship primarily as a tool to retrieve basement samples along a transect for the calibration of geophysical data. However, if, in the opinion of other thematic panels and PCOM, the ultimate goal of Iberian Margin drilling is to reach the oldest oceanic crust and to sample the most complete sequence of syn-rift sediments, SGPP recommends that the location of the site be re-evaluated in light of the recent site survey and that drilling of the deep hole be visualised as a 2-leg project beginning with Leg 149.

With best wishes,

Judith A. McKenzie
SGPP Chair

000038

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Department of Geology and Geophysics

29 July 1992

Dr. Jamie A. Austin
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8701 Mopac Boulevard
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RECEIVED
JUL 29 1992
Ans'd...........

Dear Jamie:

This letter concerns your recent request for input about the changes PCOM made to Leg 149 and the letter of response from the Co-Chiefs of that leg. I circulated the information to a group of LITHP members for their comment. I will first say that the reaction was mixed; however, I will present the general reaction of the majority and make a recommendation (that clearly would not be unanimous if LITHP were to vote on it)!

The NARM non-volcanic drilling has not been a very high priority for LITHP because many of the objectives are not of high priority to the Panel. The objective of most interest is the effort to *characterize* the OCT which, according to the NARM-DPG Report, is a primary goal of the Iberian Abyssal Plain drilling. It is not clear that the plans for Leg 149 were built around *locating* the OCT as suggested by Brian Taylor in his remarks to PCOM.

The objectives of IAP-1 are in many ways quite distinct from those of the transect, and are concerned with processes (recorded in the syn-rift and early post-rift sediments) rather than with structure (i.e.characterization of the OCT). The proposed transect includes a series of sites, each with 100m basement penetration across the OCT. Site IAP-2 is thought to be located on a continental tilted block and is a logical exploratory hole to drill for siting of IAP-1. If recovery is good at this site and washing without a pilot hole is therefore possible for the uppermost portions of IAP-1, then drilling the latter may be speeded up (it takes about 8 days to APC/XCB the 800m pilot hole). The Co-Chiefs propose this scenario in their letter. IAP-4 is planned to test whether the peridotite ridge sampled during Leg 103 extends across the Fracture Zone, and if so, it may indicate that such features are common in non-volcanic margins. The other two holes (IAP-2 and IAP-3C) are sited to penetrate, respectively, the westernmost continental and easternmost oceanic crust. As long as the transect holes reach basement, they will produce useful information for characterization of the OCT.

From the perspective of learning more about the evolution of oceanic lithosphere, therefore, the original plan of completing the transect during Leg 149 clearly offers the best chance to recover basement rocks and to begin to investigate the OCT, which is probably a very complex boundary. The Co-Chiefs' letter of 16 June seems to adequately answer the questions raised by the PCOM discussions, and they make a strong case for their original leg plan. In addition, they offer to make a start at drilling the deep hole. Of their proposed scenarios, LITHP would support one which maximizes basement penetration by minimizing duplicate recovery of sediments (e.g. Plan E, which also avoids having to drill a pilot for IAP-1). Basement penetration of 100m may not be enough for obtaining good magnetics data, for age dating, and for studying variations in geochemistry --300m would be preferable.

Overall, therefore, of the two scenarios, I would have to conclude that lithosphere interests would best be served by drilling the transect on Leg 149. **LITHP therefore recommends that Leg 149 drill the transect of holes on the Iberian Abyssal Plain.**

There are, of course the bigger questions concerning the need of the program to move away from single-leg science (and to get the community to buy into this) and to start learning how to drill deeply. The Co-Chiefs have made the argument (as did the NARM-DPG) that drilling the transect first would help site selection for the deep hole. In addition, the NARM-DPG proposed drilling the NB-4 deep site first. This suggests to me that IAP-1 may not be optimally located and additional information is needed. Perhaps Leg 149 should be left as originally planned with the next non-volcanic leg devoted to a deep hole.

Please call if you have further questions.

Sincerely,

Susan

Susan E. Humphris

000049 UNIVERSITY OF CALIFORNIA, DAVIS

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July 15, 1992

RECEIVED
JUL 15 1992
Ans'd............

James A. Austin, Jr.
Chair, JOIDES Planning Committee
JOIDES Office
University of Texas at Austin
8701 Mopac Boulevard
Austin, TX 78759-8345

Dear Jamie:

I strongly endorse the recommendations of the NARM-DPG and the co-chiefs of Leg 149, that Leg 149 be devoted to drilling a series of holes (IAP-2, 3, and 4, or alternates) across the ocean-continent transition (OCT) of the Iberia Abyssal Plain. This is the program that TECP had in mind when it gave first priority to "Non-Volcanic NARM Leg 1" drilling for the 1993 schedule.

There are two issues raised by PCOM's action and the Co-Chiefs' response: 1) the scientific rationale for drilling the Iberia Abyssal Plain transect; and 2) the question of drilling order of legs (deep after transect or vice versa). I discuss each of these issues in order.

1. Scientific rationale for drilling the Iberia Abyssal Plain transect:

There are several objectives that one can cite as a rationale for drilling a rifted margin: the nature of the ocean-crust transition, the age of oldest ocean crust, and the subsidence history. In the Atlantic non-volcanic rifted margin transect, there are several good scientific reasons to drill the series of holes across the OCT in the Iberia Abyssal Plain:

a. It is important to learn the extent along strike of the peridotite exposures. This will indicate whether they are a local phenomenon, off the Galicia Bank, or more regional in nature, and extend to at least the next margin segment. The whole issue of the tectonics of peridotite exposures bears not only on the origin of rifted margins, but also upon the nature of "Alpine-type" peridotites in formerly rifted, now collisional margins, such as the Alps or the Alboran Sea-Betic Cordillera region. As such they provide an important tie between the Ocean Drilling Project and land geology.

b. It is important to determine the nature, to the extent possible, of the OCT to serve as a model for other OCT's. To do so, it is important to confirm the geophysical observations of the OCT by sampling the basement at several sites. The combination of sampling by the drill followed by extrapolation away from the borehole using geophysical observations is the essential approach for understanding the tectonics of continental margins (and for that matter, of offset drilling sites). Geophysical data across this margin, like that across the conjugate Newfoundland basin, suggest that there is an unusually wide zone of highly extended continental crust. Drilling should be able to shed some light on that interpretation, or provide evidence for some intermediate crustal type. Like PCOM, TECP anticipates that the transition will be complicated, but this is the character of most tectonic targets, and complexity should not be used as a reason not to obtain samples, especially if the context of the complexity is optimally documented, as is the case here.

c. The PCOM minutes indicate that some PCOM members felt that there was no scientific value to drilling the basement highs in the Iberia Abyssal Plain. There was a suggestion that basement rocks sampled on highs were likely or certain to be unrepresentative of the adjacent or deeper rocks. I respectfully disagree. Basement highs in a faulted region owe their existence to elevation relative to the adjacent basement along faults. Thus they are almost certain to be representative of the adjacent and deeper basement rocks. There are numerous examples of this situation that could be cited from on-land exposures in normal-faulted terrains, such as the U.S. Basin and Range Province. Referring to the Afar example cited in the PCOM minutes, drilling the Danakil Alps and, say, other highs in the triangle itself would indeed tell you something about the nature of the rifting process, especially if you had no other way of penetrating the hypothetical sediments covering these features. In addition, drilling of the basement highs in IAP 3 or 3B should give information on the age of oldest magnetic ocean crust, an important factor in fixing the rift-drift transition in the evolution of the central Atlantic.

d. TECP acknowledges that none of the holes in the transect will sample any syn-rift sediments (unless IAP-5 is included). These sediments represent an important, but not the only, desired objective on this rifted margin. They will be sampled when IAP-1 is drilled, preferably in a few years.

2. The question of drilling order.

The reasons for drilling the series of holes across the OCT prior to drilling the deep stratigraphic hole (IAP-1) are scientific, not technological:

a. Proper siting of hole IAP 1 is crucial to its success. It is vital to establish the proper context for the deep hole; that context can be obtained only by drilling across the transition in the series of holes of the proposed transect. It is important, for example, to establish that the crust underlying the proposed the deep hole site is continental, as only in such a setting will the stratigraphic information about rifting obtained from the deep hole be of maximum value. That can be done only with the transect of holes. If it turns out that continental crust does not clearly underly the proposed site then re-siting will probably be necessary. Drilling the deep hole first is thus a high-risk strategy because it depends completely on the location of the proposed site.

b. As the NARM-DPG report pointed out, drilling the shallower wells first "...will provide useful information about shallow sediments that may make site IAP-1 easier or faster to drill." (p. 53) This knowledge could well help reduce the time necessary for successful completion of this hole, now estimated to be more than one leg (Co-chief scientists letter).

c. TECP concluded, as recorded in our March, 1992, minutes, that "the way to explore the feasibility of deep drilling is to try it". While we stand by that statement, it is important to be aware of its context. The statement was made specifically with the idea in mind of supporting the drilling of deep site NB-4 in the Newfoundland basin in 1994. At no time did TECP consider that statement in the context of re-thinking FY 1992 drilling, and I doubt it would have viewed such a reconsideration favorably if asked to do so.

In summary, if one accepts the necessity of both the transect and the deep hole, as argued by the NARM-DPG and stated in the April PCOM minutes (p. 57), then prudence would argue that to maximize the efficiency of the drilling effort, the transect of shorter holes should be drilled first to learn about the regional tectonic context, about the drilling conditions, and to be as sure as possible that the site for the deep hole is the proper one. This course of action should not be taken as a "glancing blow" at learning how to drill deeply, but as choosing the right moment for maximizing the effectiveness and chances for success of the deep drilling effort.

In conclusion, PCOM's action of April, 1992, to change the objectives of Leg 149 to the drilling of a single deep hole (IAP-1) is a much-appreciated, well-intentioned, and aggressive attempt to achieve TECP's desire to initiate deep drilling on passive continental margins. We recommend, however, that PCOM focus on scheduling 1994 drilling in the Newfoundland basin as the site for a foray into deep drilling. We believe that there are sound scientific reasons, outlined above and in the NARM-DPG report, why the OCT sites should be drilled before the deep hole in the Iberia Abyssal Plain, principally to maximize the possibility of success of the latter.

Thank you for the opportunity to comment on this important issue.

Respectfully yours,

Eldridge Moores
TECP Chair

# Agenda Item L.

# Leg 150

June 24, 1992

**000001**

RECEIVED
JUN 26 1992
Ans'd............

Dr. James A. Austin, Jr.
Chair, JOIDES PCOM
JOIDES Office
The University of Texas at Austin
8701 Mopac Blvd., Room 300
Austin, TX 78759-8345

Dear Jamie:

We have been approached by Dr. Tokuo Yamamoto of the University of Miami and by ONR (Dr. Marshall Orr) about establishing re-entry holes on Leg 150 (New Jersey Sea Level) for future use for ONR-funded acoustics experiments. I have explained to both Yamamoto and Orr the nature of ODP and that undertaking any work for ONR would require the support of JOIDES PCOM and of the Co-Chief Scientists of the leg. I also told them about the severe time pressures on this leg. I think that ONR would be prepared to pay for both additional ship time and material in establishing a cased re-entry hole.

I have now received a copy of Yamamoto's proposal, which I enclose. What he requires is that we make MAT-8 a re-entry hole and case it to 100 mbsf with a PVC pipe. The re-entry cone should be marked with a pair of wires (?)attached to a surface buoy. Technically, this is a job we can do. Discussions on the phone with Marshall Orr indicate that ONR might like 2 or 3 such re-entry holes at the MAT sites.

I think there are three issues here on which PCOM must come to a decision.

1. Is it appropriate for ODP to support this type of research in general?

2. If so, is it appropriate for ODP-TAMU to seek reimbursement from ONR for the work carried out?

3. The time pressures on Leg 150 are already great. There is no room to lengthen the time on site because of the substantial program on Leg 149 and the ice window for Leg 151. Does PCOM want to abbreviate the New Jersey Sea Level science to allow room for the ONR work?

I will come to PCOM with estimates of the time required and the cost of doing the ONR work.

Finally, please note that Dr. Bruce Rosendahl, Dean of RSMAS and an EXCOM member, is peripherally involved with this proposal (p. 1, 11 of proposal).

Yours sincerely,

Tim

Timothy J.G. Francis
Deputy Director

TJGF:hk

cc: Dr. Jack Baldauf, ODP
Mr. Ron Grout, ODP
Dr. Tom Janecek, ODP

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000002

RESEARCH PROPOSAL SUBMITTED TO
THE OFFICE OF NAVAL RESEARCH

FULL TITLE: Measurement and Modeling of Low Frequency Acoustic Wave Propagation and Scattering in Shallow Water with Comprehensive Subbottom Structure Measurement.

INSTITUTION: Rosenstiel School of Marine and Atmospheric Science University of Miami

PRINCIPAL INVESTIGATOR(s): Tokuo Yamamoto

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Date: June 10, 1992

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Miami, FL 33149
Phone: (305) 361-4635
Date: June 10, 1992

TOTAL COST: $503,210

PERFORMANCE PERIOD: 1 Oct 92 to 30 Sep 94

SUBMITTING DATE OF PROPOSAL:

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Abstract

In shallow water acoustic waves can not propagate very far without interacting with the bottom. The phase and amplitude fluctuation of acoustic waves propagating in shallow water is governed not only by frequency, range, ocean volume fluctuation but also by the acoustic characteristics of the bottom. Unfortunately, the physics of acoustic wave-bottom interaction is not completely understood at the present time. Consequently, the stochastic theory of phase and amplitude fluctuation of acoustic waves propagating in the shallow water simply does not exist at the present time. Therefore, in order to relate the oceanography of shallow water and acoustic measurements, the physics of acoustic wave interaction with the bottom must be fully understood first.

The shallow water sub-bottom geoacoustic structure is strongly heterogeneous, both vertically and horizontally. In order to quantitatively understand the physics of acoustic wave propagation and scattering in shallow water, accurate measurements of the bottom volume structure in three dimension and acoustic transmission of cw signals and pulses must be made at the same sites. This has not been accomplished so far and is the heart of this proposed research.

We propose an initial two year experimental and theoretical/numerical research program focused on low frequency acoustic wave propagation and forward scattering through shallow water overlying continental margin with thick unlithified sediment layers. We propose to conduct our experiments at the outer continental shelf area off New Jersey shown in Figure-4 which is a typical and ideal case of this type of shallow water province. The proposed experiments consist of an acoustic pulse transmission experiment and thorough sub-bottom structure measurements. An air gun array will be towed to generate a strong and sharp pulse at various range and azimuthal angles from a receiver array and the transient acoustic wave field propagating in the water column and within the sediment bottom will be measured with a bottom penetrating vertical hydrophone-geophone array and a horizontal hydrophone array in and near the ODP hole MAT-8.

A thorough sub-bottom structure determination along the acoustic transmission lines defined in Figure-7 will be made through a newly invented 3-D seismic system "Kite" survey (Task-1), the gravity wave bottom shear modulus profiler "BSMP"survey(Task-2), and a high resolution bore-hole to sea-floor seismic tomography experiment(Task-4). These sub-bottom surveys will produce the high resolution 3-D images of density, compressional wave velocity, shear wave velocity and attenuation with a spatial resolution of the order of 1 m for the sub-bottom volume of the bottom penetration up to 1 km x the width 200 m x the total length of acoustic transmission lines 350 km. The ODP holes MAT 1 through 12 will be used to ground truth the sub-bottom survey results.

Since it has been proven that the sediments of this area may

be effectively modeled as fluid (Rogers et. al., 1992), we can take a full advantage of the very powerful range dependent theories of acoustic wave propagation. A parabolic equation approximation (PE) model (Tappert, 1978) and a broad-band range dependent propagation model (MACH1) (Brown, 1992) will be used to make extensive and quantitative model-experiment comparisons. The deterministic aspect and the stochastic aspect of the acoustic wave propagation in shallow water will be thoroughly investigated and quantified through these model-experiment comparisons.

Objectives:

The long term objective of this proposed research is a quantitative understanding of the physics of propagation and scattering of low frequency acoustic pulses and cw signals in shallow water. The specific objectives of this funding period are to investigate and quantify the deterministic aspect and the stochastic aspect of the acoustic wave propagation in shallow water through model-experiment comparisons. The objectives of the experiments are to make spatio-temporal samplings of the transient wave fields propagating through the water column and the sub-bottom sediment using a bottom penetrating receiver array and to make comprehensive sub-bottom geoacoustic structure measurements of the same area. The objectives of the modeling study are to make physically consistent representation of the acoustic fields generated in the experiments using PE models and MACH1 models.

Key Word/Phrase Listing:

shallow water, low frequency, propagation, scattering, geoacoustics, range-dependent bottom, high resolution sub-bottom image, stochastic acoustics, acoustic transients, reverberation

A. Introduction and Background

To be specific, only the acoustic wave propagation in shallow water in the low frequency band ranging from 10 to 1000 Hz is considered in this proposal. Furthermore we will discuss the deterministic and stochastic aspect of propagation and scattering of acoustic cw signals and pulses.

Our understanding of acoustic wave propagation in the fluctuating ocean is mostly limited to the deep water condition where acoustic waves propagate with little or no interaction with the ocean bottom. Here, for example, the effects of fluctuating ocean volume caused by internal waves on the phase and amplitude of acoustic waves have been a major subject of ocean acoustic research (e.g., Flatté, et. al. 1979). The stochastic phase and amplitude fluctuation of acoustic wave in deep water is governed by the two nondimensional parameters $\Lambda$ and $\Phi$ which are combinations of frequency, range and ocean volume fluctuation characteristics. The fluctuations of acoustic waves due to volume fluctuation of the ocean is divided into the three regimes; unsaturated, partially saturated and fully saturated depending on $\Lambda$ and $\Phi$. For example, for low frequency- short range propagation ( frequency between 10 to 1000 Hz and range less than 200 km), the acoustic wave propagation between a source and a receiver is through a single path and its fluctuation falls into the regime called unsaturated geometric optics in which only the phase fluctuates while the amplitude remains constant. Acoustic ocean tomography has been successful also mainly because the acoustic waves propagate in deep oceans with little or no interactions with the bottom (e.g., Brown, 1982). The oceanography or the behavior of ocean can be and has been successfully measured by acoustic transmission experiments in deep water ( e.g., Dyson et.al. 1976, Ewart, 1976 and Ellinthope et. al., 1977).

In shallow water acoustic waves can not propagate very far without interacting with bottom. The phase and amplitude fluctuation of acoustic waves propagating in shallow water is governed not only by frequency, range, ocean volume fluctuation but also by the acoustic characteristics of the bottom. The strong attenuation, the strong volume fluctuation (10 to 100 times stronger than the water volume fluctuation), and the interface roughnesses of the bottom complicate the acoustic wave propagation in the shallow water. Consequently, the stochastic theory of phase and amplitude fluctuation of acoustic waves propagating in the shallow water simply does not exist at the present time. Some experimental attempts have been made to monitor the oceanographic behavior of the shallow oceans by acoustic transmission measurements ( e.g., DeFerrari, 1985; Ali et.al., 1985; Zhou et.al.,1991). If they were conducted in the deep oceans , because of the short ranges (less than 50 km) and the low frequencies (50-1500 Hz) used in these experiments, these propagation tests would be classified as geometric optics (unsaturated) regime where only the phase fluctuates but no amplitude fluctuation. To the contrary, the experimental results show strong amplitude fluctuation and inseparable multi-paths. No phase fluctuations were analyzed. In these studies, no bottom measurements were made and the bottom interaction was treated with extreme over simplification. The discrepancy between the stochastic theory of acoustic wave fluctuation and these shallow water observations is clearly due to the bottom interaction.

Therefore, in order to relate the oceanography of shallow water and acoustic measurements, the physics of acoustic wave interaction with bottom must be fully understood first. Unfortunately, the physics of acoustic wave-bottom interaction is not completely understood at the present time. In the following section, past shallow water acoustics research will be reviewed briefly in order to identify the specific problems that must be investigated.

The shallow water environment varies very much from one location to another. Consequently, shallow water acoustics has long been an empirical technology to predict transmission loss TL along a path using an empirical method developed from accumulated TL data and limited bottom data mostly surfacial sediments (Hamilton, 1980).

Since early 1980's NATO and ONR have directed the scientific community to investigate the basic physics associated with shallow water acoustics. Three NATO conferences focused on the bottom interacting acoustics and geoacoustics of the bottom have been held in 1980, 1985 and 1990 (Kuperman and Jensen, 1980; Akal and Berkson, 1985; and Hovem, Richardson and Stoll, 1990). ONR has supported a Shallow Water ARI from 1985 to 1989.

From the transmission tests using explosives conducted by the NATO ASW research center (SACLANTCEN), a frequency of least propagation loss has been found to exist between 200 to 400 Hz which is well above the shallow water cutoff frequency for the "sand" bottom site in the Mediterranean while TL monotonically increases with frequency thus no such optimum frequency exists for the "clay" bottom site (Akal, 1980). The NATO group concluded that the P-S conversion at the water-"sand" interface is responsible for existence of the optimum frequency of the "sand" bottom. However unreasonably high shear wave velocity for sand bottom of 900 m/s has to be assumed in the model calculations to support their conclusion (Ferla et. al., 1980). Later the NATO group admitted that the existence of optimum frequency is found only for this "sand" bottom (Kuperman, 1991). The writer suspects that the "sand" bottom is actually a hard limestone bottom underlying a thin layer of sediment, a common type in Mediterranean Sea.

Ironically the first ONR shallow water acoustics accelerated research initiative (ARI) was motivated by the experimental discovery of the "optimum frequency" and therefore placed an emphasis on measurements of the shear wave velocity structure of bottom sediments. Various methods of bottom shear property measurement have been developed (Ewing, et. al., 1992; Stoll,1989;

and Yamamoto, et.al.,1986,1989,1991,1992). Acoustic transmission experiment using a moving cw source was conducted successfully at an outer continental shelf site AMCOR 6010 off the coast of New Jersey by Carey (1988) but a pseudo-pulse transmission experiment at the same site by another investigator was not totally successful. The momentum of sub-bottom measurements continues to produce new methods to measure the high resolution 3-D structure of the subbottom such as the 3-D multi-channel high resolution seismic system "Kite" (Yamamoto et.al., 1991,1992 a and b), the high resolution sub-bottom cross-well tomography system (Yamamoto et.al., 1992) and the HUNTEC survey system (Milliman,et.al., 1990). Only one quantitative model-experiment comparison of cw TL vs. range using measured bottom properties at one location has so far been made by Rogers et. al. (1992). The following are the conclusions from the ARI important for future research:

* No optimum frequency of transmission exits for the sandy bottom of New Jersey outer shelf (Rogers et. al. 1992)

* The shear wave velocity of the sediment bottom (sand, silt and clay) within 200 m from the sea floor measured at New Jersey shelf, George's Bank and Florida Keys is less than 350 m/s. No sediment supports the high shear velocity of 900 m/s which had to be assumed for the "sand" bottom of NATO experiments. (Trevorrow et.al. 1991)

* The shear wave velocity structure of the sediment bed has very little effect on the modal structure of acoustic wave propagation and can be treated as an additional attenuation in the compressional wave velocity structure. In other words, a sediment bottom can be treated as a fluid bottom in the model studies. (Rogers et. al. 1992)

* The compressional wave velocity structure of the sediment bed plays the dominant role in the shallow water acoustics propagation. The low velocity (mud) layers act as subbottom wave guides which play an important role in acoustic wave-bottom interaction. (Rogers et.al. 1992)

* The sediment beds are highly heterogeneous in range and depth and future modeling must be based on the range dependent models. (Rogers et.al.1992; Ewing et. al. 1992; Yamamoto et.al., 1992)

* The energy loss due to the volume scattering within the sediment plays an important roll in acoustic transmission loss at 150 Hz or above (Rogers et.al. 1992).

The second wave of shallow water acoustics research emphasis recently came directly from the ASW fleet commanders of the U.S. Navy ( Naval Tactical Oceanography Workshop, 1991). Since the break up of the USSR, the emphasis of ASW is shifted to the threat of small shallow water submarines of the third world nations. The problem is that the shallow water targets can not be detected using the current USN sonar because of too many returns. The secretary of Navy has urged the immediate initiation of ONR research at all levels for the three objectives; Detection, Detection and Detection. (Symposium on Naval Warfare and Coastal Oceanography , Draft Report, 1991)

* The compressional wave velocity fluctuation within the sediment volume is very strong and of the order of 10 % compared to 0.1 % for volume fluctuation within the water column. This should be the major cause of the strong scattering in the shallow water (Yamamoto et.al. 1991). The recent shallow water reverberation tests by the U. S. Navy seem to support this prediction ( Dicus, 1992 and Carey, 1992). To demonstrate the point the forward scattered wave field measured within a mud bottom, generated by an acoustic pseudo-pulse one millisecond long, and received with a vertical hydrophone array located 122 m from the source is shown in Figure-1. The temporal-angular display of measured wave field obtained by beamforming the same data is shown in Figure-2. Very strong scattering, both in phase and amplitude, of the pulse by sediment volume fluctuation is shown. The compressional wave velocity cross-section of the mud bottom determined by cross-well tomography experiments by T. Yamamoto et.al. (1992) and its velocity fluctuation spectrum is shown in Figure-3.

  Systematic experiments to measure the acoustic propagation and scattering together with measurements of range dependent sub-bottom structure are needed to better understand the physics of the acoustic scattering in shallow water through model-experiment comparisons.

In summary, the shallow water sub-bottom geoacoustic structure is strongly heterogeneous,both vertically and horizontally. In order to quantitatively understand the physics of acoustic wave propagation and scattering in shallow water, accurate measurements of the bottom volume structure in three dimension and acoustic transmission of cw signals and pulses must be made at the same sites. This has not been accomplished so far and is the heart of this proposed research. Fully range dependent 2-D and 3-D models capable of modelling the acoustic wave propagation and scattering of the experimental conditions must be employed to quantitatively investigate the physics through comparisons with the experimental data.

B. Approach

The continental shelf off the coast of New Jersey is a strong candidate of the Natural Shallow Water Laboratories because it is a typical passive continental margin with several kilometers thick sediment layers which are most extensively surveyed. The area was the primary site of the past ONR Shallow Water ARI. Ocean Drilling Program (ODP) will drill thirteen ODP holes (MAT-1 through -12) across the shelf in 1993 as shown in Figures-4 and 5 (from Miller et.al. 1989). The positions and the specifications of the ODP holes are given in Table-1. We have requested to the co-PIs Dr. Ken Miller, Rutgers, SUNY and Dr. G.S. Mountain, LDGO as well as Dr. Tim Francis of ODP, Texas A&M U. to save ODP Hole MAT-8 for future instrumentation of the hole by us and others by placing a re-entry cone with a pair of wire lines and casing the top 100 m of the hole with a PVC pipe (see Figure 6). The request will be considered by the ODP panel based on the availability of time and scientific merit of this proposal. In the meantime, we assume that the hole would be cased so that we will be able to instrument the hole for this proposal.

We propose an initial two year's experimental and theoretical/numerical research program focused on low frequency acoustic wave propagation and forward scattering in a shallow water environment of continental margin with thick unlithefied sediment layers. We propose to conduct our experiments at the outer continental shelf area off New Jersey shown in Figure-4 which is a typical and ideal case of this type of shallow water province. The proposed experiments consist of an acoustic pulse transmission experiment and thorough sub-bottom structure measurements. An air gun array will be towed to generate a strong and sharp pulse at various range and azimuthal angles from a receiver array and the transient acoustic wave field propagating in the water column and within the sediment bottom will be measured with a bottom penetrating vertical hydrophone-geophone array and a horizontal hydrophone array in and near the ODP hole MAT-8 (Task-5) (see Figure 6). The proposed six radial and two concentric circular air gun transmission lines, Bill Carey's cw transmission lines and the ODP holes are shown in Figure-7.

A thorough sub-bottom structure determination along the acoustic transmission lines defined in Figure-7 will be made through a newly invented 3-D seismic system "Kite" survey (Task-1) ,the gravity wave bottom shear modulus profiler "BSMP"survey(Task-2), and a high resolution bore-hole to sea-floor seismic tomography experiment(Task-4). These sub-bottom surveys will produce the high resolution 3-D images of density, compressional wave velocity, shear wave velocity and attenuation with a spatial resolution of the order of 1 m for the sub-bottom volume of the bottom penetration up to 1 km x the width 200 m x the total length of acoustic transmission lines 350 km. The ODP holes MAT 1 through 12 will be used to ground truth the sub-bottom survey results.

Since it has been proven that the sediments of this area may be effectively modeled as fluid (Rogers et. al., 1992), we can take a full advantage of the very powerful range dependent theories of acoustic wave propagation. A parabolic equation approximation (PE) model (Tappert, 1978) and a broad-band range dependent propagation model (MACH1) (Brown, 1992) will be used to make extensive and quantitative model-experiment comparisons.

The following specific questions will be investigated through this proposed research:

1) Using the measured deterministic range dependent bottom/sub-bottom data as input to the PE model, calculate the model wave field generated by the 1988 cw experiments by Bill Carey and compare with the measured wave field. The comparisons will be made for both the deterministic part and the stochastic part of the wave field. Through model-experiment comparisons the contributions of the bottom roughness scattering and the sub-bottom volume scattering on amplitude and phase fluctuation will be investigated and determined.

2) Using the measured deterministic range dependent bottom/sub-bottom data as input to the MACH1 model, calculate the transient wave field generated by a shot by an air gun array. Examine the extent to which features (absolute sound pressure level, spatio/temporal/angular structure, relative amplitudes, relative phases) of the measured fields are predictable using deterministic range-dependent bottom/sub-bottom data. Does predictability vary as a function of receiver depth in water column/sub-bottom and/or vertical arrival angle?

3) Using MACH1 model and measured sub-bottom data, investigate wave field statistics in water column as well as within sediment. The ability of the receiver array configuration shown in Figure-6 to separate measured wave field features in time, vertical arrival angle, and azimuthal angle will make possible the distinction of deterministic from stochastic propagation. Example demonstration has been shown in Figure 2.

4) In many shallow water environments, we anticipate that out-of-plane scattering is important. The strong dipping of the sediment layers in east-west direction of the experiment site is evident from the MCS section shown in Figure-5. Strong out-of-plane scattering is expected from this sub-bottom feature during the pulse transmission tests using the air guns. Beamforming of the horizontal hydrophone array data should isolate the out-of-plane scattering fields. The proposed pulse transmission tests along six radial lines and two concentric circles are well suited to addressing this question. Through comparisons among 2-D and 3-D MACH1 models and measured fields, determine the extent to which the measured fields can be accounted for using a 2-D model.

5) Investigate the importance of sub-bottom scattering. Is the forward scattered energy primarily from the bottom roughness or from sub-bottom structure. The spatio-temporal sampling of the measured fields by the bottom penetrating receiver array used in the experiment shown in Figure-6 is well suited to addressing this question.

6) Investigate the shear wave generation by a water born acoustic pulse and its importance on acoustic wave fields. The three

orthogonal seismometers implanted within the sediment are capable of detecting the shear waves from the polarity of particle motion and well suited to addressing this question. As determined from the 2-D SAFARI model of the experimental site under cw propagation at 50-600 Hz by Rogers et. al. (1992), we anticipate that the shear wave generation is weak.

7) Investigate the backscattered wave field from the zero range air gun shot data. The spatio-temporal sampling of the measured fields by the vertical and horizontal receiver array will enable us to separate the backscattered energy according to the vertical angle and azimuthal angle of arrival and time, again in water column and in sediment. The scattering from rough bottom surface, the sediment volume scattering and the free surface scattering will be identified. We anticipate strong backscattered energy will come from the west because of the dip structure depicted in the MCS section shown in Figure-5. The PE reverberation model of Fred Tappert will be used to investigate the various backscattering mechanisms and their relative magnitudes. The "Kite" survey will provide the accurate bottom roughness spectra and the 3-D sub-bottom velocity fluctuation energy spectra. The bore hole to seafloor acoustic travel time tomography tests will provide a high resolution sub-bottom velocity image of the quality of Figure-3. These bottom and sub-bottom data will be used as input to the PE model. The proposed model-experiment comparisons will provide quantitative understanding of the physics of backscattering of the low frequency acoustic waves.

Experimental research which includes high resolution 3-D sub-bottom surveys and acoustic pulse transmission tests will be conducted by P.I. with four graduate students. The data processing of the 3-D seismic data will be conducted cooperatively with Bruce Rosendahl. Theoretical/numerical research in support of the experiments will be conducted cooperatively with Fred Tappert and Mike Brown. Bill Carey, DARPA will participate in this research as a thesis committee member and an advisor. His cw data will be compared with the range dependent modeling using the measured sub-bottom velocities from the proposed sub-bottom surveys (Task-3). Four students will do their Ph.D and M.S. theses based on various model-experiment comparisons.

The proposed two year research divided into the six tasks will be described in the following section in a chronological order.

Proposed Research for FY93

In the spring of 1993, an exhaustive bottom/sub-bottom survey along the paths of acoustic transmission experiments will be conducted in 6 days on board R/V Oceanus II using the 3-D seismic system "Kite" and three units of gravity wave bottom shear modulus profiler (BSMP) with radio transmitters. Both the two cw transmission paths of Bill Carey and the proposed five pulse transmission lines shown in Figure-7 will be surveyed. A numerical modelling study using a 2-D and 3-D PE codes will be initiated as soon as the bottom data along the Carey's cw paths are analyzed.

Task-1: High resolution 3-D bottom and sub-bottom survey using the 3-D multi-channel seismic system "Kite".

A "Kite" is a multi-channel seismic reflection system in which a horizontal hydrophone array axis is perpendicular to the ship's tow direction as shown in Figure-8. An oil filled hydrophone array with 24 receiver elements with a total spread of 46 m at a constant inter-element distance of 2 m is firmly attached to a rigid horizontal tow boom. An impulsive source - a 16 cubic inch air gun - is located at an end of the hydrophone array and another source, a programmable projector at the other end. The programmed projector is excited in a two cycle sine wave pulse at 3 k Hz. The two sources are fired at same time at a constant interval, usually 4 seconds, while the "Kite" is towed at a constant speed, usually at 4 knots, resulting 24 continuous sections of sub-bottom image at a constant interval, usually 1 m. The "Kite" data acquisition system is made of a VAX field station with four 400 kHz A/D board and an EXABYTE tape backup, capable of continuous 24-ch recording at 25 Khz. The 3-D processing of the "Kite" data produces a continuous 3-D compressional wave velocity image of bottom/sub-bottom with a width of 46 m at horizontal resolution of 1 m, depth resolution of a less than 1 m and depth penetration of approximately 1 km. Examples of raw data and processed "Kite" 3-D images are shown in Figures 9 and 10. Based on the assumption of normal consolidation of the sediment, the compressional wave velocity image is transformed into the density (porosity) and shear wave images. The porosity image then provides an attenuation image based on the improved Biot theory (Yamamoto and Turgut, 1989). Detailed experimental procedures and data processing of the "Kite" system is given in Yamamoto et. al. (1991, 1992 a and b).

The lines K1 and K6 will be surveyed four times so that the total width will be 184 m. The rest, lines K2, K3, K4, K5, C1, C2, WC1, and WC2 will be covered only once so that the width will be 46 m. The total of 350 km will be surveyed by "Kite". At a cruising speed of 4 knots, it will take 3 days to complete the "Kite" survey including transit time between lines.

Task-2: 3-D sub-bottom shear modulus structure survey using the Bottom Shear Modulus Profiler (BSMP).

A total of 22 BSMP measurements will be made along transmission lines Kl, K6, WCl, and WC2. Lines Kl and K2 will be surveyed at a 2.5 km interval and lines WCl and WC2 at 5 km. For a BSMP measurement, a 4 hour continuous measurement of bottom pressure and vertical acceleration induced by gravity waves is needed (Yamamoto, et.al., 1989). Using the three BSMPs with radio transmitters, it will take 3 days to cover the 22 BSMP sites.

The water depths of this area varies from 60 to 77 m. Therefore the vertical resolution of the BSMP inversion will be about 3 m and the penetration depth 200 m. From the shear modulus profile determined from the BSMP inversion, the density, shear wave velocity, compressional wave velocity profiles will be determined based on the normal consolidation assumption for the sediment (Trevorrow et. al., 1991). This will provide an excellent independent sub-bottom structure data to compare with the "Kite" data.

The BSMPs will also be used in FY94 experiments. The vector wave fields in the sediment generated by an impulsive acoustic source in the water column will be measured by the three orthogonal accelerometers of BSMP. The BSMP data will be analyzed to determine the directional spectra of ocean waves (Nye et.al., 1990). The data will be used as the surface roughness as input to PE models.

Task-3: PE-modeling using the 3-D bottom/sub-bottom data and comparisons with the Carey's cw-data and the backscattering data.

As soon as the sub-bottom data from the "Kite" and BSMP surveys are processed, the range-dependent modelling of the 1988 acoustic cw propagation experiments of Bill Carey along the two transmission paths shown as WCl and WC2 in Figure-6 will be carried out using the PE model. The questions 1) and 7) will be investigated.

Proposed Research for FY94

In the Fall of 1993, the seafloor to bore-hole travel time tomography experiments will be conducted on board R/V Oceanus II using a high frequency source and the 48 channel hydrophone array in the ODP bore-hole MAT-8 as shown in Figure-11. We also propose to conduct the main experiments of the shallow water acoustic pulse propagation and scattering on board R/V Oceanus II as shown in Figure-6. The MACHl model will be used to calculate the synthetic seismograms and compared with the measured seismograms to accomplish the scientific objectives 2) through 6). The PE reverberation model will be used to model the backscatter data in fulfillment of the scientific objective 7).

Task-4: High resolution seafloor to bore-hole tomography experiments.

R/V Oceanus II will be used to instrument the ODP hole MAT-8 with a 48 channel hydrophone array using the two wires attached to the re-entry cone. This is a standard technique of instrumenting a bore-hole by offshore petroleum engineers. Travel time seismic tomography experiments will be conducted with the 48 channel hydrophone array in the bore-hole ODP MAT-8 and a programmed projector on the seafloor as shown in Figure-11. The 200 dB ITC 6117 source will be used to generate pseudo-random binary sequence codes up to 4096 cycles at the carrier frequencies 1 to 8 kHz to obtain the high resolution as good as that of the example tomographic image shown in Figure-3. All the equipment and experiences needed for this task exist. The source will be moved along a radial path 100 m long on the seafloor at an constant interval of 1 m by pulling the power cable from the anchored source ship R/V Oceanus II. The signals from the 48 channel hydrophones will be digitally recorded at up to 64 kHz per channel by the "Kite" data acquisition system on board a small boat about 20 foot in length. The boat will be transported on board R/V Oceanus as a ship board equipment for this cruise. Four cross-sections at different orientations to the north, south, east and west, will be measured. The high resolution compressional wave velocity images of the sediment bed of this site are essential for investigation of the volume scattering of acoustic waves. The data will be used as input for PE models and MACH1 model for this purpose. This data is essential for investigating the questions 1) through 7).

Task-5: Acoustic pulse transmission experiments.

R/V Oceanus II will be used as a source ship to generate a strong and sharp acoustic pulse by an air gun array as shown in Figure-6. The existing 2, 16, 42 and 160 cubic-inch air guns will be combined to make a powerful and sharp acoustic pulse. The impulsive source is equivalent to a 1/4 lb TNT generating a pulse with a broad band frequency spectrum from 5 to 1000 Hz at peak pressure well over 240 dB which easily penetrates 20 km into the crust. The combination of the four different guns eliminates the undesirable bubble oscillations. The signals from the receiver array will be digitized at 10 kHz and recorded either by the VAX computer for "Kite" on board a small boat or by a self-contained recorder depending on the funding situation. The "Kite" data acquisition system exists but the selfcontained data acquisition system has to be built. Since the boat engine will be stopped and only a small generator will be used to power the "Kite" recorder, the noise radiated from the small boat will be negligible. The proposed six radial (K1 through K6) and two concentric circular (C1 an C2) air gun transmission lines relative to the ODP holes are shown in Figure-7. Along each radial line 25 km long, air guns will be shot at a constant interval of 100 m both as the guns are sailing away as well as sailing toward the receiver array at the ODP-hole MAT-8 to see the doppler effect. On the two concentric circles at ranges 1, and 10 km the air guns will be shot at a constat angular increment of 1 degree.

The temperature profile at the receiver array will be measured continuously using a thermometer array during the transmission experiments.

Task-6: MACH1 modeling of an acoustic pulse propagation and scattering through range and azimuth dependent environment and comparisons with the pulse transmission data from Task-5.

Synthetic seismograms along the airgun shot paths K1, through K6 and circular paths C1 and C2 will be calculated by MACH1 model and the sub-bottom data measured from the "Kite" survey (Task-1), BSMP survey (Task-2) and seafloor to bore-hole tomography survey (Task-5). Through comparisons with measured seismograms, we will investigate the scientific questions 2) through 6) regarding the effects of bottom/sub-bottom range dependent structure on the deterministic part and the stochastic part of the acoustic transient propagation through shallow water.

C. Expected New Understanding.

1) The extent to which feature (absolute sound pressure level, spatio/angular structure, relative amplitudes, relative phases) of the measured cw fields are predictable using deterministic range-dependent bottom/sub-bottom data as input to PE and MACH1 will be determined.

2) The extent to which features (absolute sound pressure level, spatio/temporal/angular structure, relative amplitudes, relative phases) of the measured transient fields are predictable using deterministic range-dependent bottom/sub-bottom data as input to MACH1 model. Predictability vary as a function of receiver depth in water column/sub-bottom and/or vertical arrival angle will be also determined.

3) The ability of the receiver array configuration shown in Figure-6 to separate measured wave field features in time,

vertical arrival angle, and azimuthal angle will aid in making the distinction between deterministic and stochastic propagation.

4) The out of plane scattering will be measured and its importance will determine the extent to which the measured fields can be accounted for using a 2-D model.

5) The contributions of the bottom roughness scattering and the sub-bottom volume scattering on amplitude and phase fluctuation will be determined.

6) The importance of the shear wave generation by a water born acoustic pulse and its importance on acoustic wave fields will be determined through measurements.

7) The physics of backscattering of the acoustic pulse in shallow water will be better understood. The spatio-temporal sampling of the measured fields by the vertical and horizontal receiver array will enable us to separate the backscattered energy according to the vertical angle and azimuthal angle of arrival and time, in water column and sediment. The scattering from rough bottom surface, the sediment volume scattering and the free surface scattering will be identified.

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Facilities Available

A. General Facilities Available

All the equipment necessary for the proposed experiments are available at RSMAS. If data storage by a selfcontained digitizer/recorder system for Task-5 is recommended by ONR, the system will be built at RSMAS with an budget increment of $120,000.

B. Special Support Requested from the Government

Ocean Drilling Program (ODP) will drill thirteen ODP holes (MAT-1 through -12) across the shelf in 1993 as shown in Figures-4 and 5 (from Miller et.al. 1989). The positions and the specifications of the ODP holes are given in Table-1. We have requested to the co-PIs Dr. Ken Miller, Rutgers, SUNY and Dr. G.S. Mountain, LDGO as well as Dr. Tim Francis of ODP, Texas A&M U. to save ODP Hole MAT-8 for future instrumentation of the hole by us and others by placing a re-entry cone with a pair of wire lines and casing the top 100 m of the hole with a PVC pipe (see Figure-6). The request will be considered by the ODP panel based on the availability of time and scientific merit of this proposal.

PROPOSED BUDGET

Overall Performance Dates: 1 October 92 - 30 September 94

Performance Period: 12 months: 1 October 92 - 30 September 93

| | Actual Man-Months | ONR-Funded Man-Months | $ |
|---|---|---|---|
| A. Salaries and Wages | | | |
| 1. Senior Personnel | | | |
| Tokuo Yamamoto - Principal Investigator | 6 | | 40,201 |
| 2. Post-Doctoral | | | 0 |
| 3. Graduate Students | | | |
| A. Rogers | 12 | | 17,000 |
| M. Kuru | 12 | | 17,000 |
| S. Theophanis | 12 | | 17,000 |
| W. Shi | 12 | | 14,000 |
| 4. Support Personnel | | | |
| TBN-Elect. Technician | 6 | | 15,000 |
| Secretary | .5 | | 1,000 |
| TOTAL SALARIES | | | $121,201 |
| B. FRINGE BENEFITS | | | |
| 29.5% of 1 | | | 11,859 |
| 33.5% of 4 | | | 5,360 |
| TOTAL FRINGE (B) | | | $17,219 |
| C. PERMANENT EQUIPMENT | | | |
| (1) 1 ADQ32 A/D Board(s) @ $2,339 | | | 2,339 |
| (2) A custom made Portable "Kite" frame | | | 2,765 |
| (3) 3 BSMP Boards @ $1,010 | | | 3,030 |
| TOTAL PERMANENT EQUIPMENT (C) | | | $8,134 |
| D. EXPENDABLE SUPPLIES AND EQUIPMENT | | | |
| (1) Kite System Supplies | | | 1,200 |
| (2) Misc. Lab Supplies | | | 1,800 |
| (3) Air Gun Supplies | | | 2,000 |
| TOTAL EXPENDABLE SUPPLIES AND EQUIPMENT (D) | | | $5,000 |

E. TRAVEL

| | |
|---|---|
| (1) Domestic | |
| 2 Round trips Professional Meetings @ 1,250 | 2,500 |
| 4 Round trips to WHOI @ 800 | 3,200 |
| TOTAL TRAVEL (E) | $5,700 |

F. DATA/PUBLICATION COSTS

| | |
|---|---|
| (1) 10 pp @ 100/page | 1,000 |
| TOTAL DATA/PUBLICATION COSTS (F) | $1,000 |

| | |
|---|---|
| G. COMPUTER AND PERIPHERAL CHARGES | 0 |

H. MISCELLANEOUS

| | |
|---|---|
| (1) Communication | 1,000 |
| (2) Printing | 200 |
| (3) Shipping equipment to WHOI | 3,000 |
| (4) E-Mail | 200 |
| TOTAL MISCELLANEOUS (H) | $4,400 |

I. SHIP/AIRCRAFT COSTS

TOTAL SHIP COSTS (I)

J. INDIRECT COSTS

| | |
|---|---|
| (1) 54.2% of A, B, & D thru H (154,520) | 83,750 |
| TOTAL INDIRECT COSTS (J) | $83,750 |

| | |
|---|---|
| K. TOTAL COSTS | $246,404 |

# PROPOSED BUDGET

Overall Performance Dates: 1 October 92 - 30 September 94

Performance Period: 12 months: 1 October 93 - 30 September 94

| | Actual Man-Months | ONR-Funded Man-Months | $ |
|---|---|---|---|
| A. Salaries and Wages | | | |
| 1. Senior Personnel | | | |
| Tokuo Yamamoto - Principal Investigator | 6 | | 44,221 |
| 2. Post-Doctoral | | | 0 |
| 3. Graduate Students | | | |
| A. Rogers | 12 | | 18,000 |
| M. Kuru | 12 | | 18,000 |
| S. Theophanis | 12 | | 18,000 |
| W. Shi | 12 | | 15,000 |
| 4. Support Personnel | | | |
| TBN-Elect. Technician | 6 | | 16,000 |
| Secretary | .5 | | 1,060 |
| TOTAL SALARIES | | | $130,281 |
| B. FRINGE BENEFITS | | | |
| 29.5% of 1 | | | 13,045 |
| 33.5 of 4 | | | 5,715 |
| TOTAL FRINGE (B) | | | $18,760 |
| C. PERMANENT EQUIPMENT | | | 0 |
| D. EXPENDABLE SUPPLIES AND EQUIPMENT | | | |
| (1) Kite System Supplies | | | 1,200 |
| (2) Misc. Lab Supplies | | | 1,800 |
| (3) Air Gun Supplies | | | 3,000 |
| TOTAL EXPENDABLE SUPPLIES AND EQUIPMENT (D) | | | $6,000 |

E. TRAVEL

| | |
|---|---|
| 2 Round trips to Professional Meetings @ $1,250 | 2,50 |
| 4 Round trips to WHOI @ $900 | 3,600 |
| TOTAL TRAVEL (E) | $6,100 |

F. DATA/PUBLICATION COSTS

| | |
|---|---|
| (1) 10 pp @ 100/page | 1,000 |
| TOTAL DATA/PUBLICATION COSTS (F) | $1,000 |

| | |
|---|---|
| G. COMPUTER AND PERIPHERAL CHARGES | 0 |

H. MISCELLANEOUS

| | |
|---|---|
| (1) Communication | 1,000 |
| (2) Printing | 200 |
| (3) Shipping equipment to WHOI | 3,000 |
| (4) E-Mail | 200 |
| TOTAL MISCELLANEOUS (H) | $4,400 |

| | |
|---|---|
| I. SHIP/AIRCRAFT COSTS | 0 |

J. INDIRECT COSTS

| | |
|---|---|
| (1) 54.2% of A, B & D thru H ($166,541) | 90,265 |
| TOTAL INDIRECT COSTS (J) | $90,265 |

| | |
|---|---|
| K. TOTAL COSTS | $256,806 |

Table 1. ODP Hole Position and Specification

000027

ODP Proposal Log Sheet **348-Add** Proposal received: Aug 30, 1991

☐ *New proposal* ☐ *Revised proposal* ☒ Addendum to proposal ☐ *"Supplemental Science" Proposal*

# Upper Paleogene to Neogene Depositional Sequences on the U.S. Middle Atlantic Margin: The Mid-Atlantic Transect

K.G. Miller, G.S. Mountain and N. Christie-Blick

| Abbrev. Title: Uppper Paleogen to Neogene U.S. mid-Atlantic transect | Key: New Jersey sea level | Area: N Atl |
|---|---|---|

**Contact:** Dr. Kenneth G. Miller
Department of Geological Sciences
Rutgers, The State University
New Brunswick, NJ 08903 (US)
Tel: 1 (908) 932-3622
FAX: 1 (908) 932-3374

**Objectives:** See preliminary proposal 348—- for general objectives

LRP

**General area:** North Atlantic
**Specific area:** U.S. Middle Atlantic margin
**Proposed Sites:**

| Site Name | Position | Water depth | Penetration Sed | Bsmt | Total | Brief site-specific objectives |
|---|---|---|---|---|---|---|
| MAT-1 | 39°37.60'N/73°36.52'W | 0029 | 0647 | | 0647 | Age/facies of up. Oligoc. to low. Mioc. (to ?30 Ma) |
| MAT-2 | 39°33.84'N/73°29.62'W | 0031 | 0778 | | 0778 | As MAT-1; amplitude of relative sea level (?17.2-?16 Ma) |
| MAT-3 | 39°31.15'N/73°24.66'W | 0031 | 0960 | | 0960 | As MAT-1; amplitude of relative sea level (?16-?15.5 Ma) |
| MAT-4 | 39°24.44'N/73°12.60'W | 0051 | 0745 | | 0745 | Age/facies of m. Mioc.(to 16 Ma); ampl. of rel. s. l. (14 Ma) |
| MAT-5 | 39°22.39'N/73°08.83'W | 0060 | 1202 | | 1202 | As MAT-4; plus Cenozoic subsidence history |
| MAT-6 | 39°20.18'N/73°05.08'W | 0060 | 0868 | | 0868 | Age/facies of m. Mioc.(to 16 Ma); ampl. of rel. s. l. (12 Ma) |
| MAT-7 | 39°18.15'N/73°02.17'W | 0063 | 0984 | | 0984 | As MAT-6 |
| MAT-8 | 39°13.01'N/72°53.04'W | 0077 | 1067 | | 1067 | Age/facies of m. Mioc.(to 14 Ma); ampl. of rel. s. l. (10 Ma) |
| MAT-9 | 39°21.34'N/72°42.59'W | 0090 | 1031 | | 1031 | Age/facies of m. Mioc.(to 14 Ma); ampl. of rel. s. l. (12 Ma) |
| MAT-9A | 39°11.26'N/72°49.67'W | 0084 | 1152 | | 1152 | As MAT-9 |
| MAT-10 | 38°55.93'N/72°46.05'W | 0806 | 0908 | | 0908 | Age of pelagic correl. to seq. boundaries 10-49.5 on shelf |
| MAT-11 | 38°56.22'N/72°49.00'W | 0430 | 0914 | | 0914 | Age of pelagic correl. to seq. boundaries 11.7-13.3 on shelf |
| MAT-12 | 38°50.00'N/72°45.98'W | 1298 | 0477 | | 0477 | Age of pelagic correl. to seq. boundaries 17.5-49.5 on shelf |

| | | | |
|---|---|---|---|
| Proposal acknowledged by JOIDES Office: | Sep 4, 1991 | to: | Miller, K.G. |
| Proposal forwarded for review: | Sep 16, 1991 | to: | LITHP, OHP, SGPP, TECP |
| Proposal copies: | Sep 16, 1991 | to: | JOI, SO, SSDB |
| Proposal forwarded to DPG: | 00/00/00 | to: | |

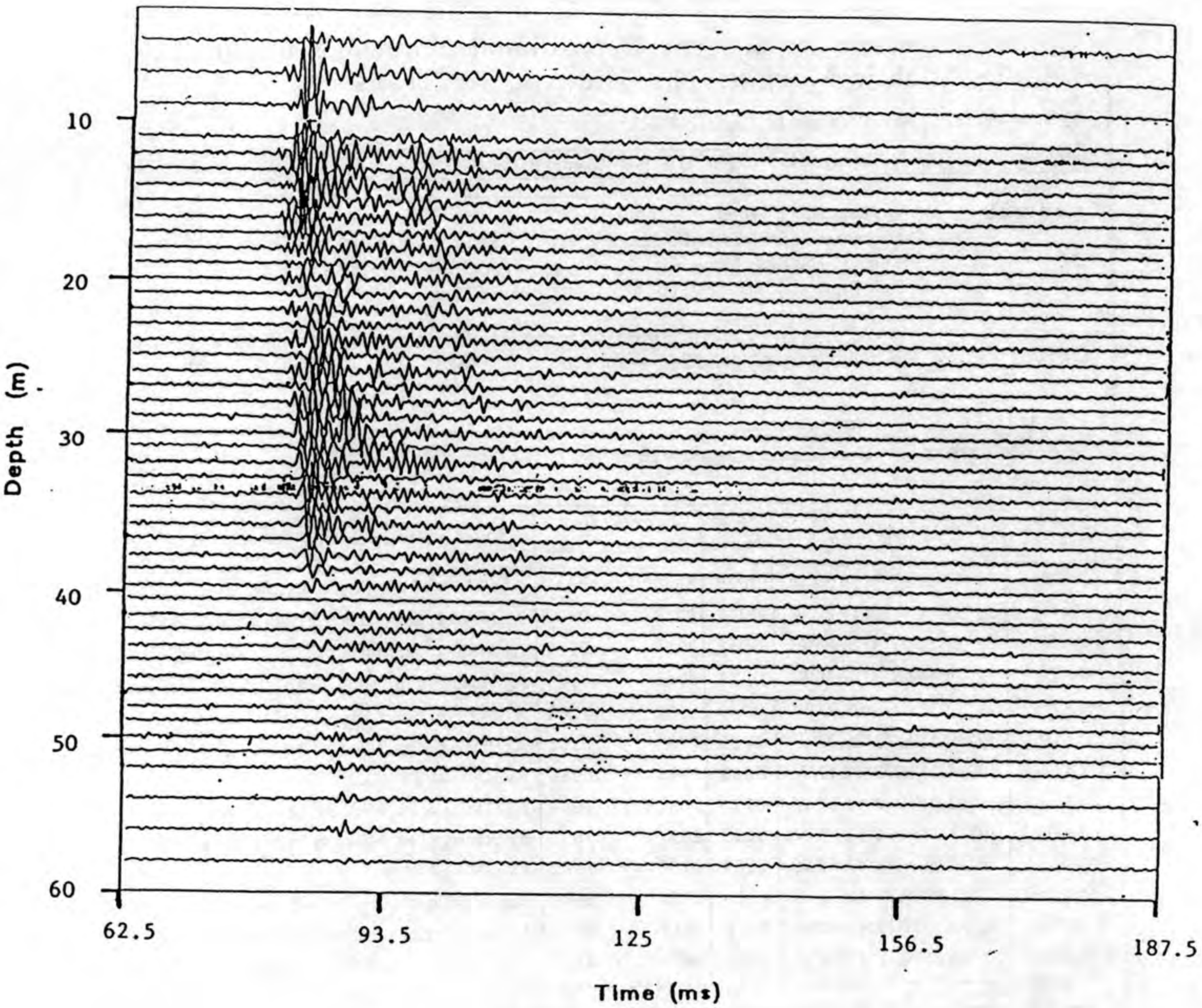



Figure 1. Spatio-temporal sampling of the wave field in a mud bed generated by a pseudo-pulse one millisecond long at 1 kHz, sampling made by a 24-channel hydrophone array, 122 m from the source, source depth 22.4 m.

000029

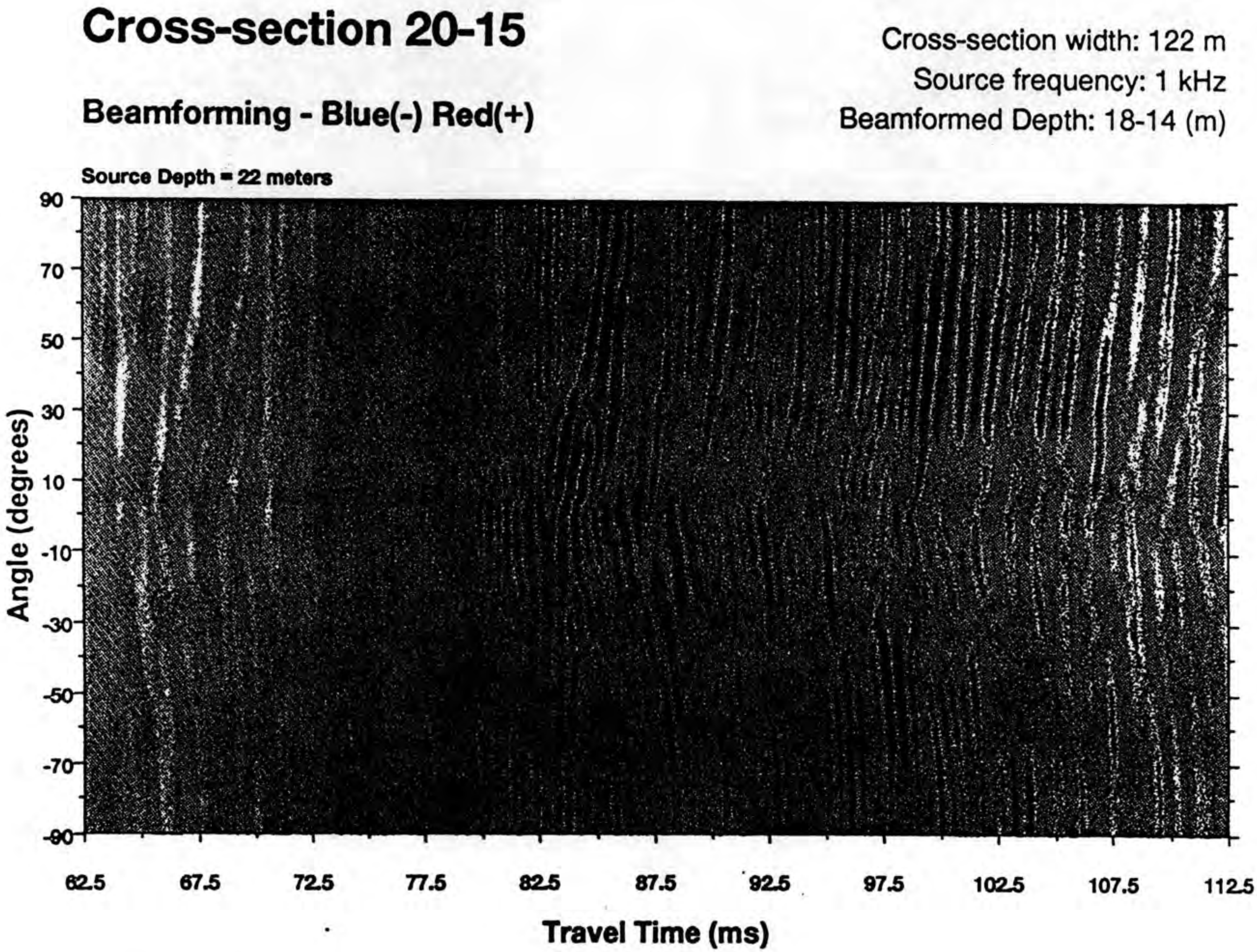
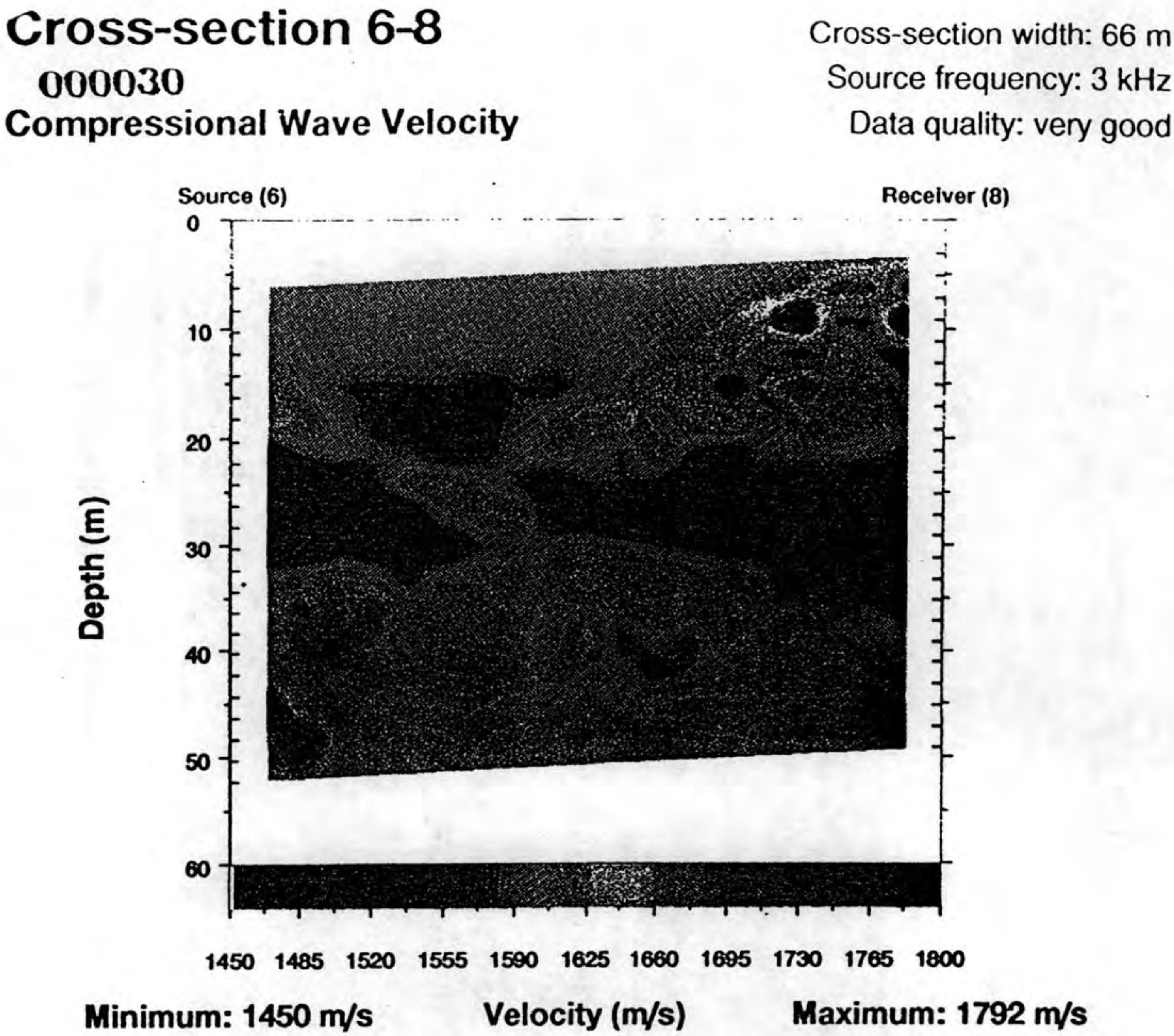



Figure 2. Temporal-angular plot of the wave form in a mud bed shown in Figure 1, beamforming applied to receiver depth from 14 to 18 m.




<u>2D-Fluctuation Spectrum</u>

$$S(\vec{k}) = A(|k_y|^2 + \alpha^2|k_x|^2)^{-\frac{(\beta+2)}{2}}$$

where $A = 0.001, \quad \alpha = 5.5, \quad \beta = 1.5$

Figure 3. The tomographic image of compressional wave velocity of a mud bottom and velocity fluctuation spectra from Yamamoto, Nye and Kuru (1992).

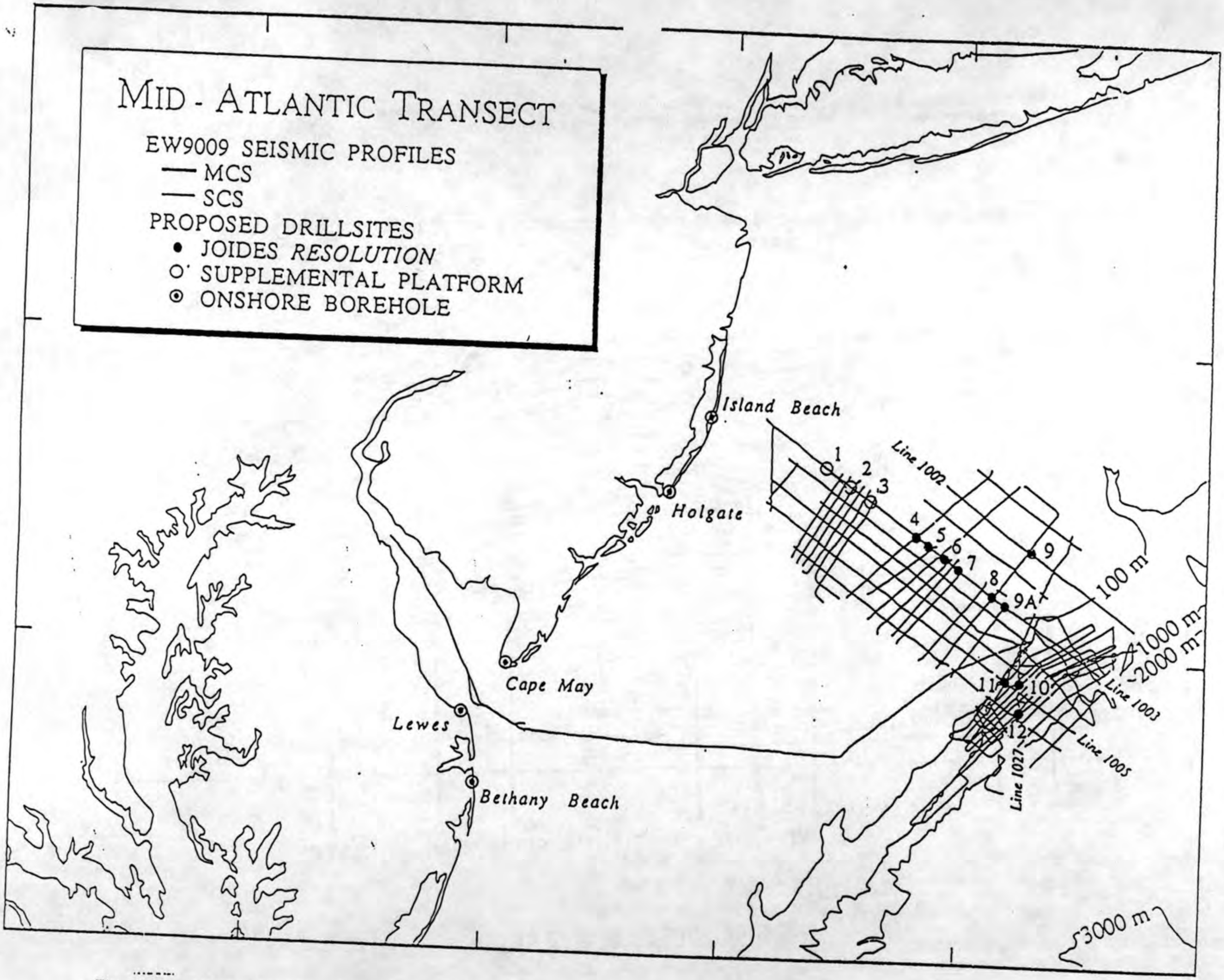



Fig. 4 Map showing the locations of Ew9009 MCS (heavy) and SCS (light) profiles, as well as proposed boreholes MAT 1-12 nd proposed onshore boreholes.



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# The Mid-Atlantic Transect

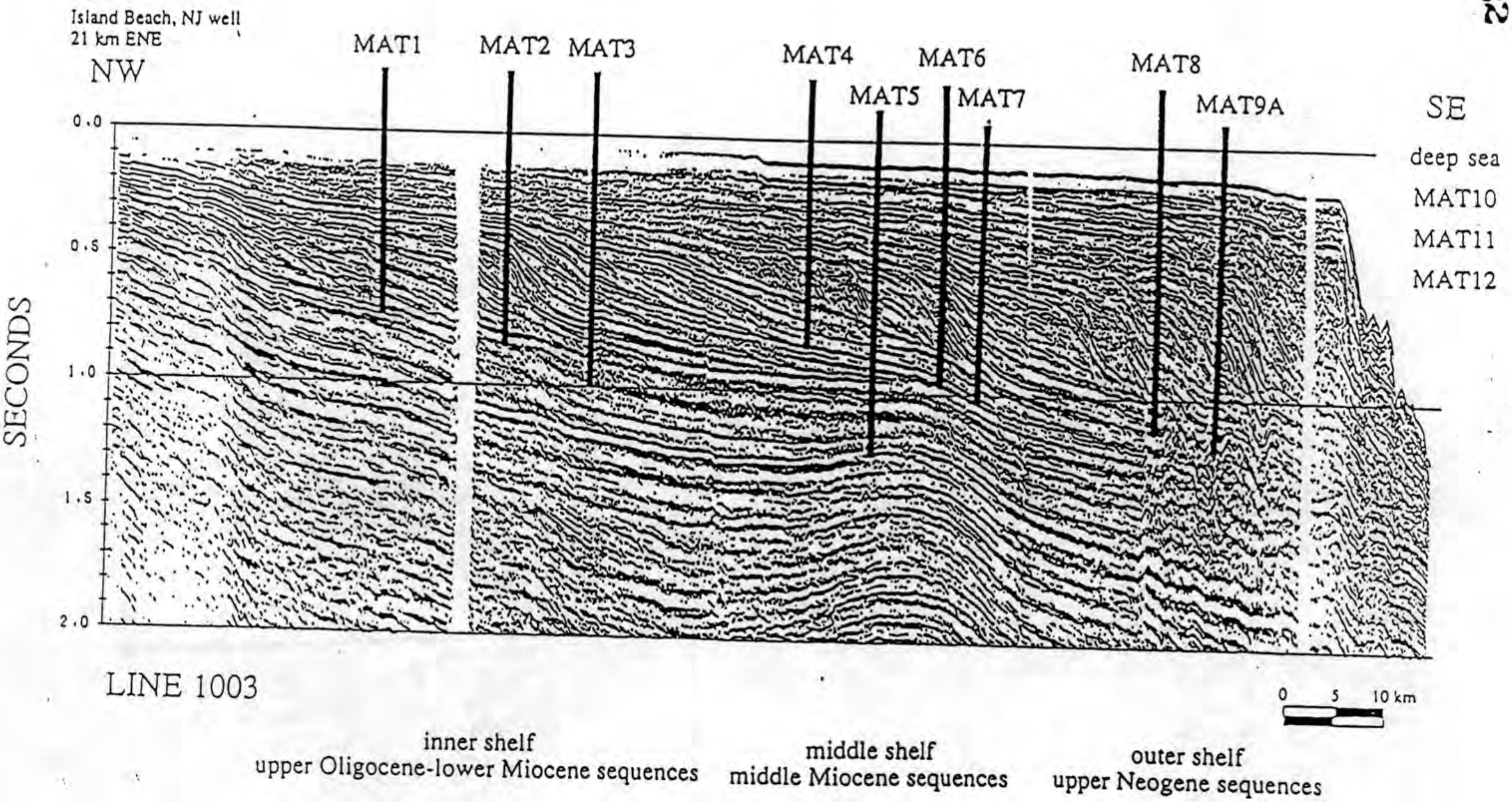


Fig. 5 Highly compressed Ew9009 Line 1003 showing locations of proposed ODP and supplementary platform boreholes MAT 1-12. This profile parallels Exxon Line 75-6/25 on which the original Transect was based (see Fig. 12 in original proposal).

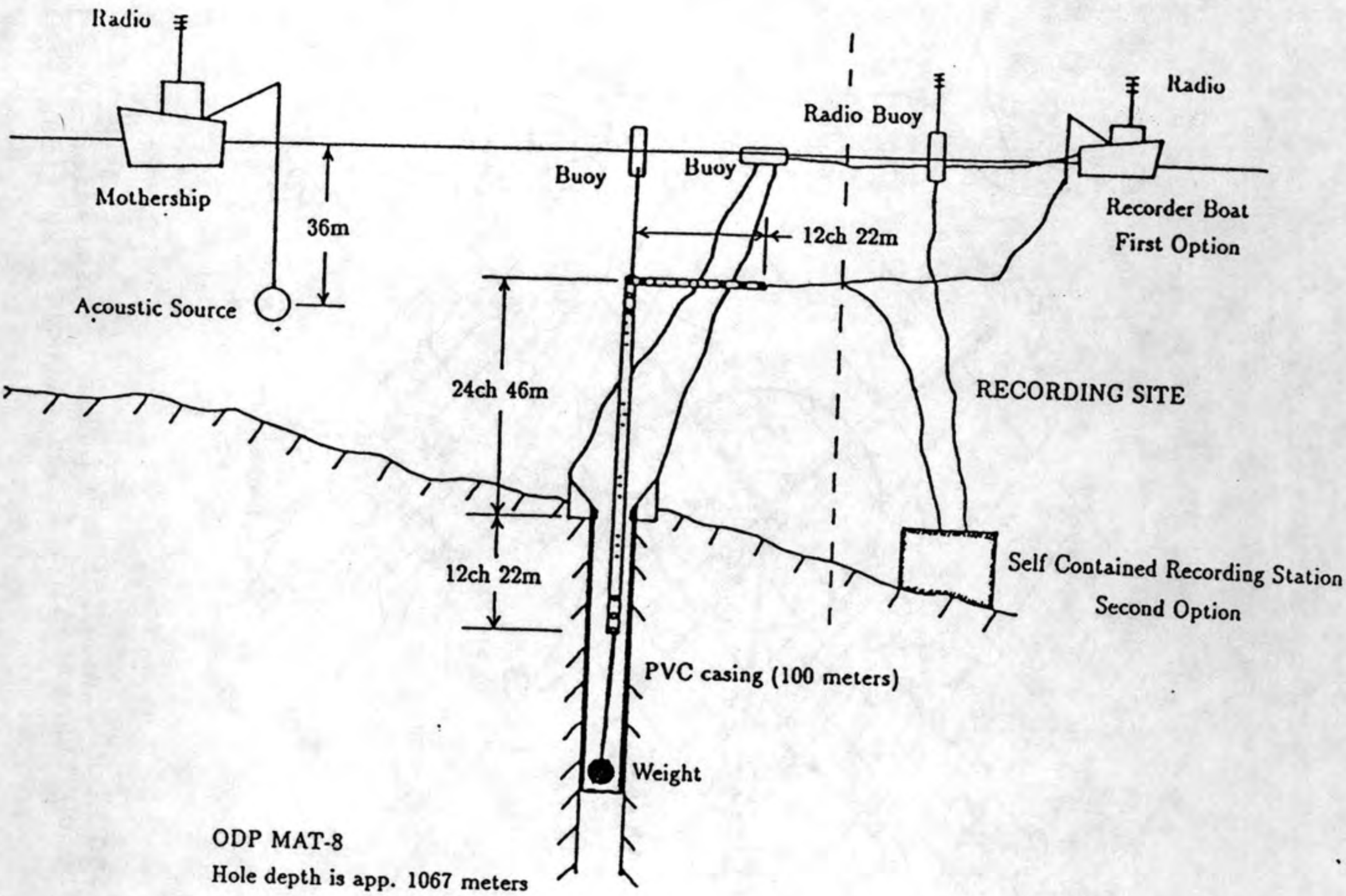


Figure 6. The ODP hole MAT-8 and requested re-entry cone, wirelines, and PVC casing for the top 100 m of the hole. The instrumentation is shown for the acoustic pulse transmission experiments using a 48-channel hydrophone array in the borehole as receivers and a towed air gun array as a source. The two options of data acquisition are shown for 1) real time recording on board a small boat, and 2) a self-contained recorder.

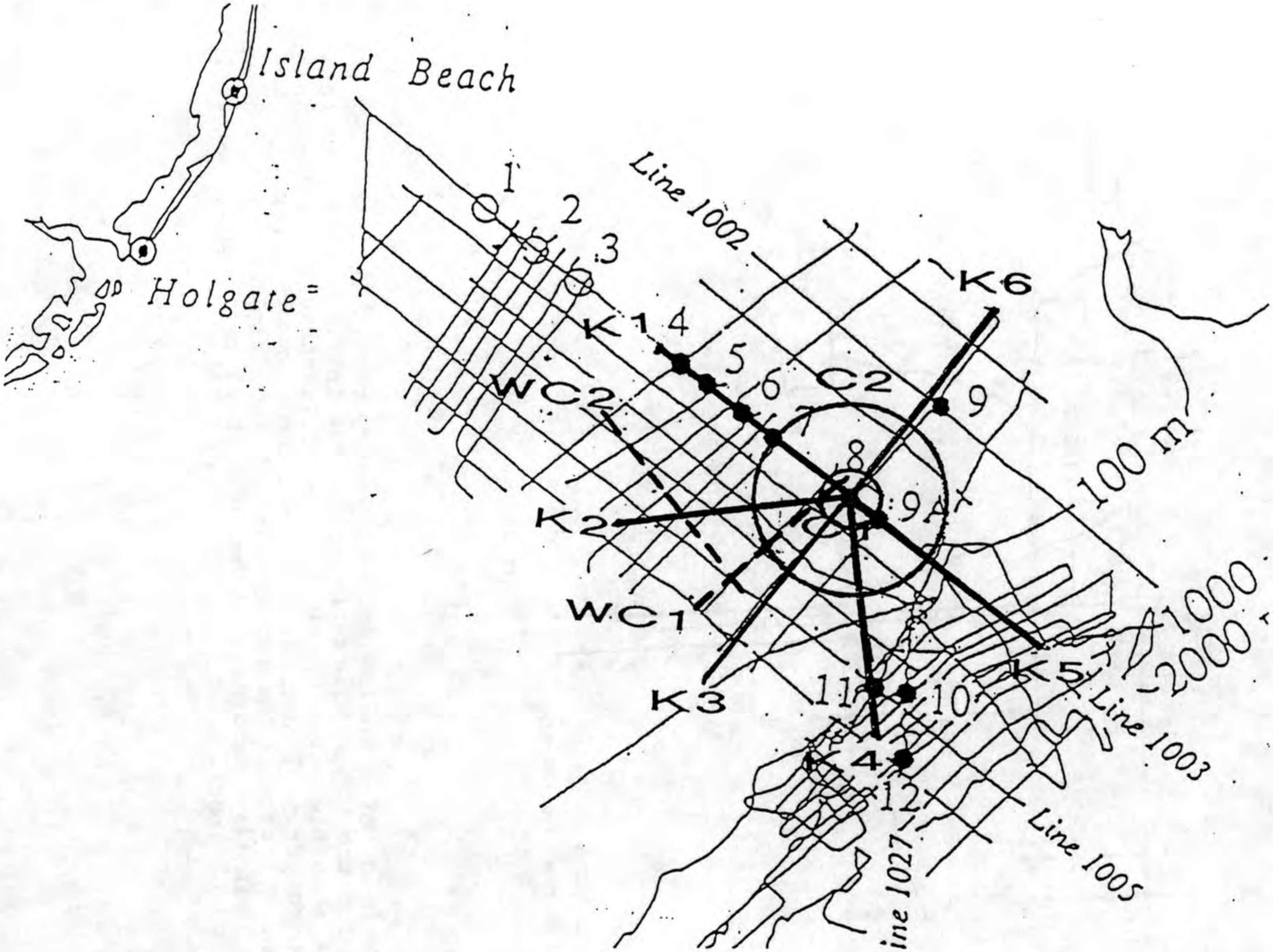


Figure 7. Proposed air gun shot lines for the pulse transmission experiments, WC1 and WC2 are cw transmission lines of W. Carey (1988).



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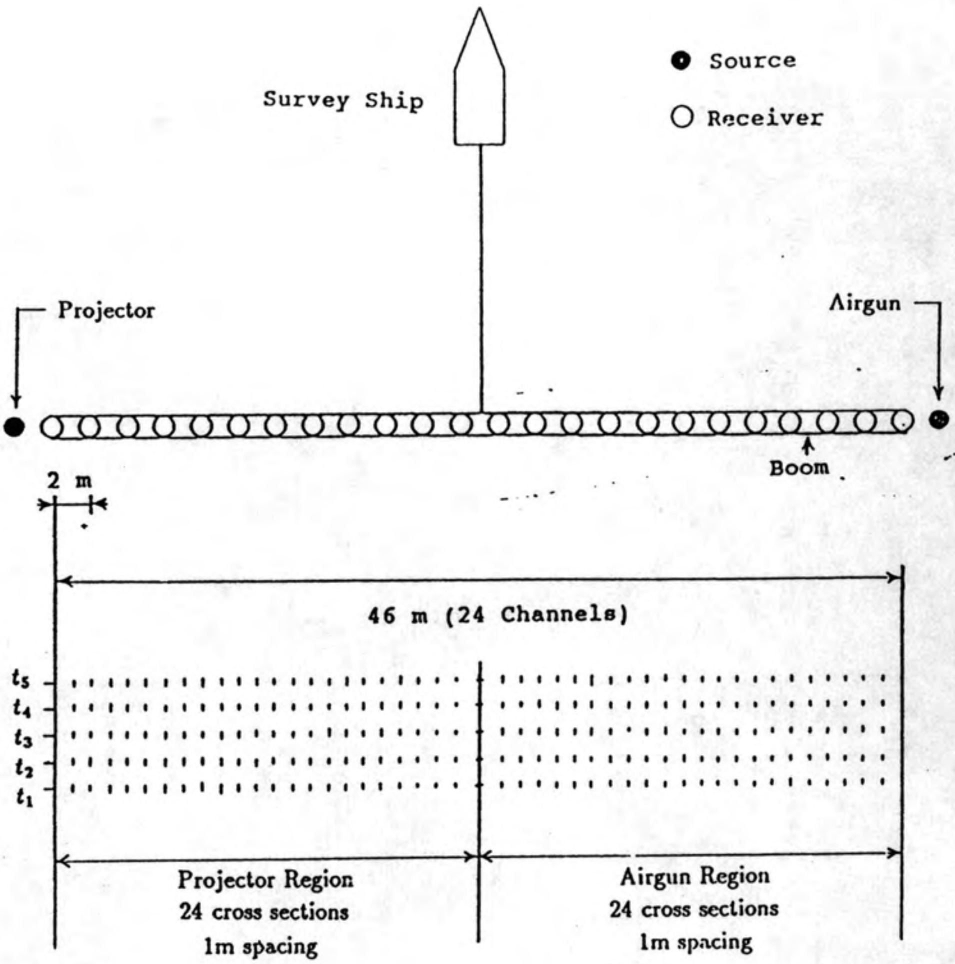


Figure 8. Schematics of the 3-D high resolution seismic system "Kite".

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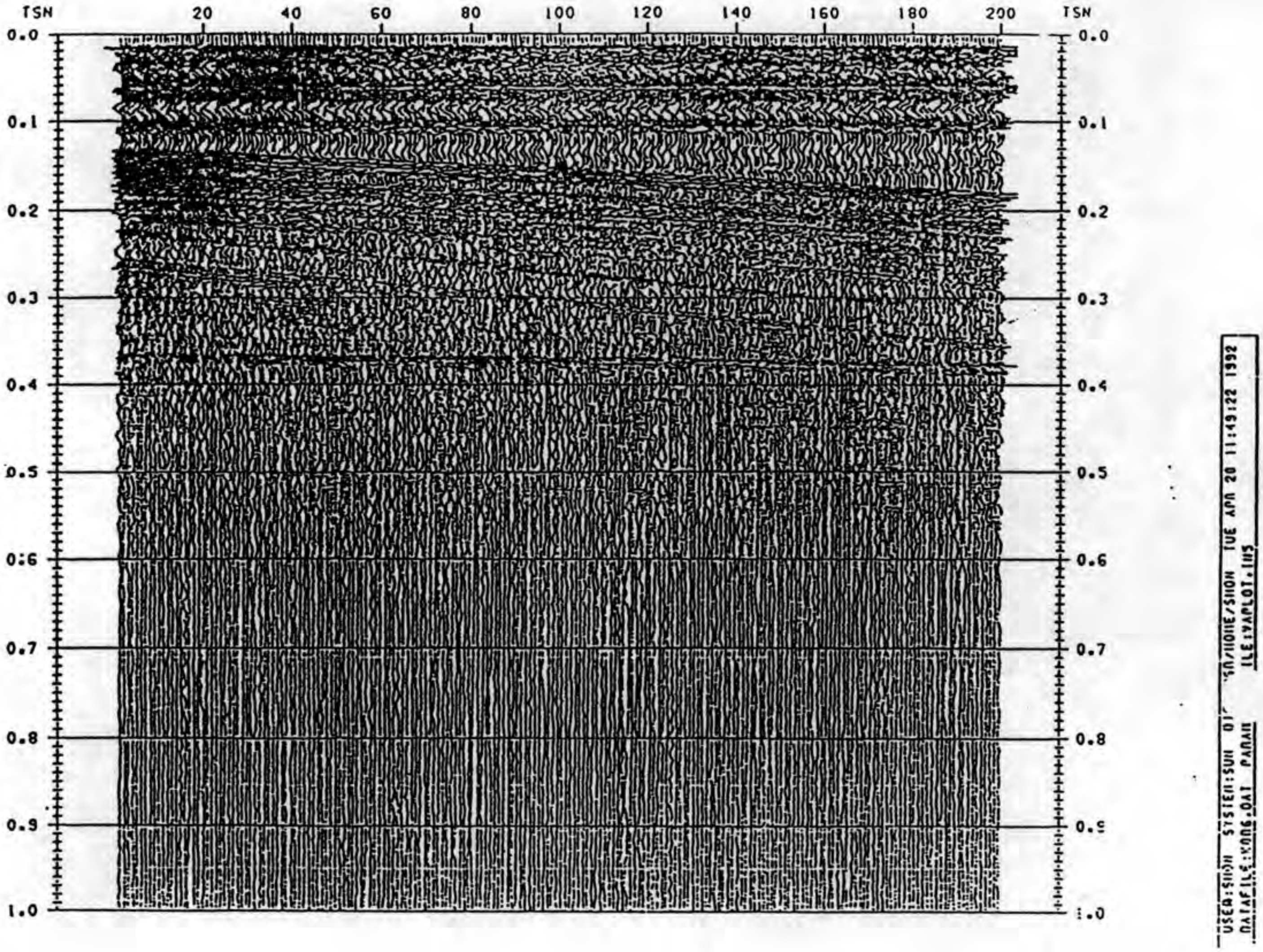


Figure 9. Raw seismic section (chan. 6) of "Kite", a 16 cubic inch air gun is used as a source.

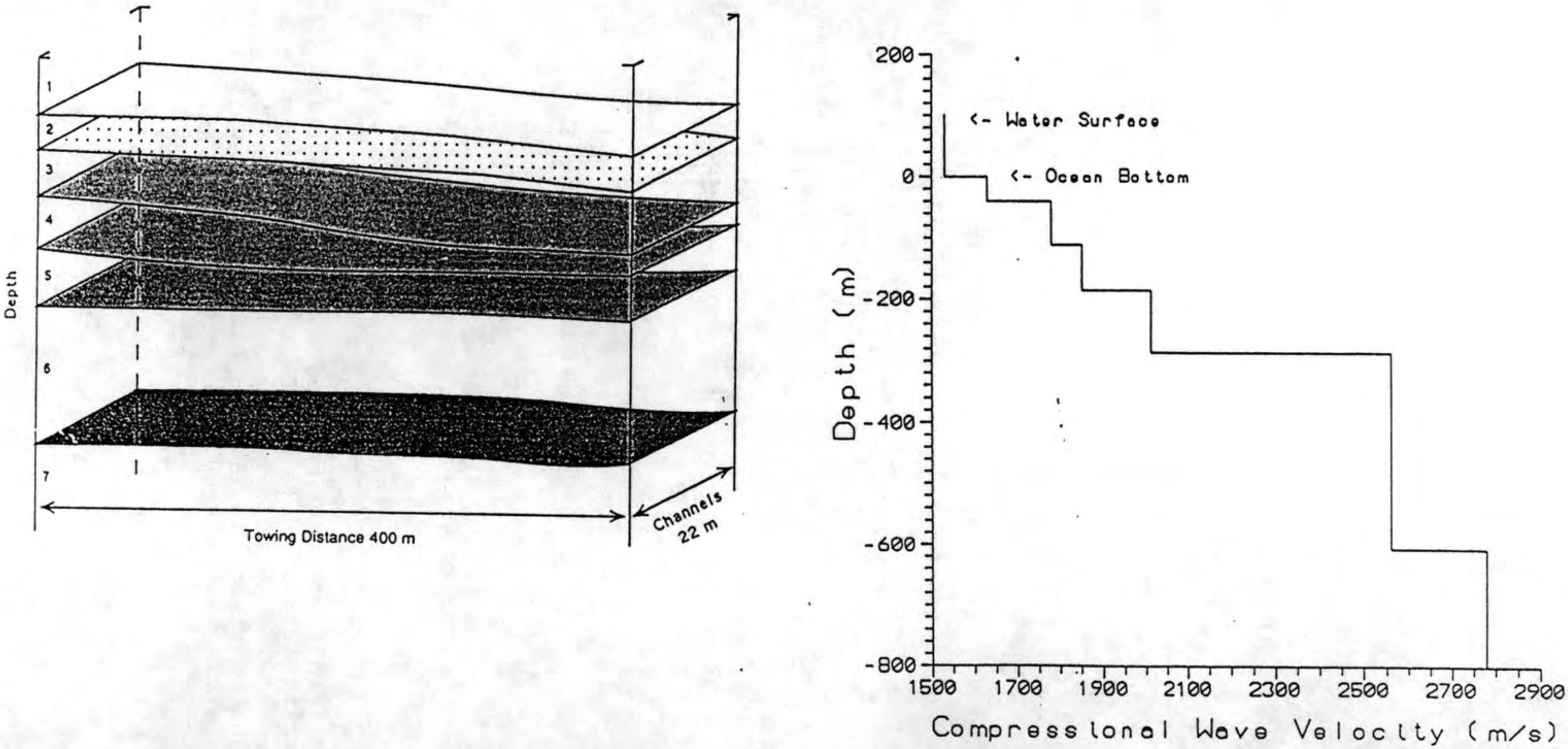


Figure 10. Example of processed "Kite" data: (a) 3-D image from "Kite" survey, (b) velocity profile of a, at the middle point. A 16 cubic inch air gun is used as a source.

000037

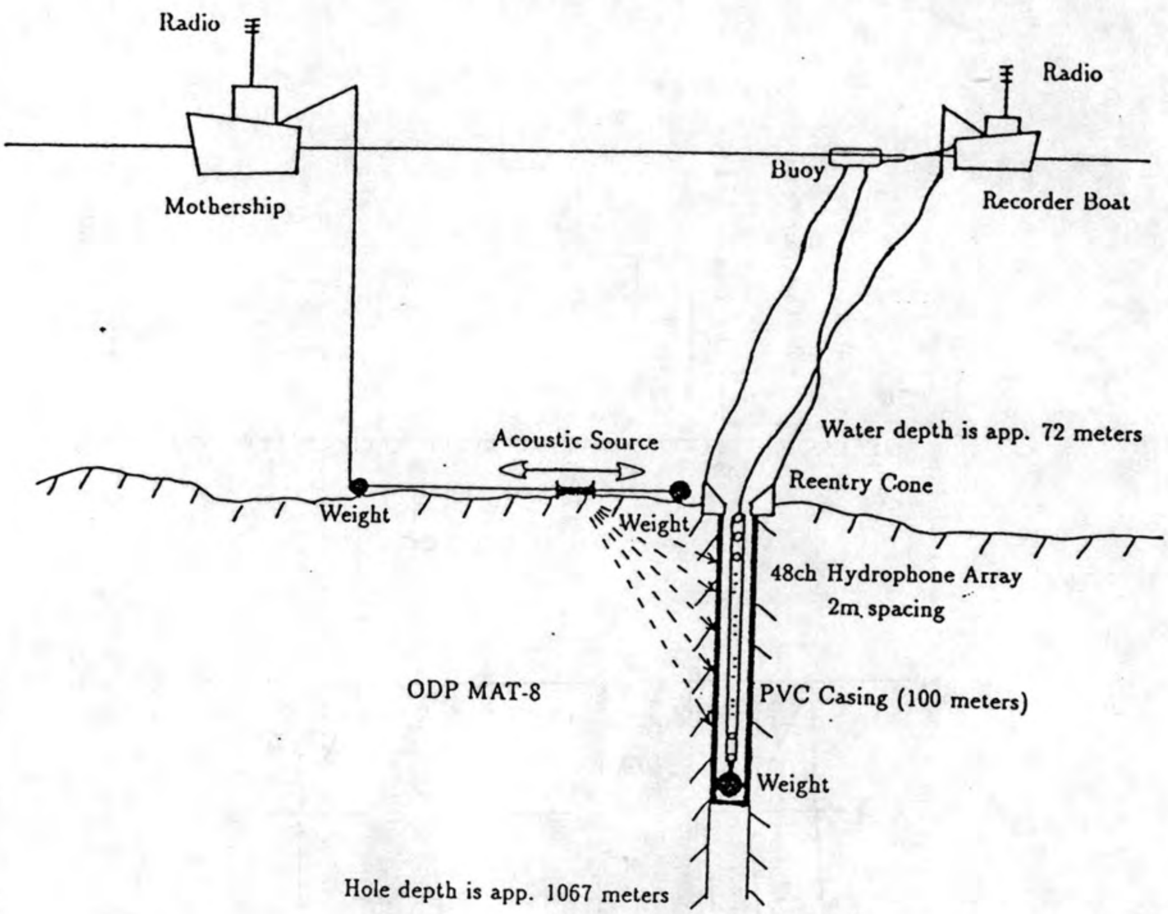


Figure 11. Experimental set up for seafloor to bore-hole seismic tomography experiments; ODP Hole MAT-8 is instrumented with a 100 m long 48-channel hydrophone array; 2 m inter-element spacing, a programmed projector source is dragged on the seafloor at 1 m interval; data acquisition is made by a VAX field station on board a small boat.

June 19, 1992 000039

Mr. Mahir Ibrahim
Regional Supervisor Resource Evaluation
Minerals Management Service
381 Elden Street, Suite 1109
Herndon, VA 22070

RECEIVED
JUN 22 1992
Ans'd............

Dear Mr. Ibrahim:

Ocean Drilling Program, Leg 150

We spoke on the phone on 17 June 1992 about the Ocean Drilling Program's (ODP) plans to drill on the New Jersey continental shelf and slope in 1993. Leg 150 is currently scheduled to take place there between 3 June and 29 July 1993.

The purpose of this letter is to acquaint you with the organization and nature of ODP. ODP is an international program funded by 20 countries through the U.S. National Science Foundation. The gross budget of the program in FY92 is approximately $41.5 million. Approximately 55% of that budget comes from the U.S. Government, the remaining 45% from all the international partners. Texas A&M University is the Science Operator of the program. We operate the drillship *JOIDES Resolution* (registered name SEDCO/BP 471) on a long term contract with Sedco-Forex. The seagoing phase of the program began in 1985 and we expect it to continue for many years.

The objective of the drilling is scientific. Scientists submit proposals to the JOIDES office (JOIDES stands for Joint Oceanographic Institutions for Deep Earth Sampling). The proposals are then reviewed by several JOIDES committees and the successful ones (a small proportion of the whole) get allocated time on the drillship. It is then our job as Science Operator to see that the proposal is carried out. We put together a team of scientists and technical support staff for the drilling leg, the former invited from all the participating countries in ODP, and assemble the necessary supplies and equipment.

This is the process that the New Jersey Sea Level program (Leg 150) is now going through. Two of the scientific proponents of the leg, Dr. Greg Mountain of Lamont-Doherty Geological Observatory and Dr. Ken Miller of Rutgers University, will be the Co-Chief Scientists of the leg and their job will be to ensure that the maximum scientific return is achieved from the drilling. I want to stress, however, that the Co-Chief Scientists are not in charge of the seagoing operation. Responsibility for drilling operations and safety rests with the ODP Operations Superintendent, who will be one of the very experienced Operations Superintendents on our staff.

The nature of our drilling is different from that used by industry to search for oil and gas offshore. We drill without a riser and for the most part with seawater as the drilling fluid. Slugs of mud are circulated when necessary to clean or condition the hole. Holes are continuously cored, except where previous hole(s) at a site have already been cored to a certain depth. Coring might then only start at that depth.

When ODP started it seagoing operations in 1985, an Environmental Impact Statement was prepared. This was published in November 1985 as the "Final Environmental Impact Statement for the Ocean Drilling Program" by the Division of Ocean Sciences, National Science Foundation. Copies of this document were sent to all relevant agencies of the Federal

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[illegible]ge Station, Texas 77845-9547 USA
[illegible] 345-8480
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FAX Number: (409) 845-1026

government and many environmental groups, including the Chief, Offshore Environmental Assessment Division, Minerals Management Service, Department of the Interior.

Enclosed with this letter is a copy of the "Guidelines for Pollution Prevention and Safety" in ODP, which was published as a special issue of the JOIDES Journal in 1986 (orange booklet). The principal hazard in ocean drilling is seen to be the release of oil and gas into the marine environment. We have a two-fold approach to avoiding this problem:

1. Drill sites are deliberately chosen to avoid structures which might contain hydrocarbons. In other words, our site selection procedure is the opposite of that used by the oil industry. To ensure that this is the case, the geophysical data of all sites are reviewed by the JOIDES Pollution Prevention and Safety Panel (PPSP), whose membership is drawn from experienced people in the oil industry and government. PPSP rejects sites which do not meet it's criteria. The safety review of the Leg 150 sites, for which Dr. Mountain is currently preparing, will take place at the next meeting of the PPSP scheduled to be held in London, England on 22-23 October 1992.

2. At sea, all the cores are routinely analyzed for the presence of hydrocarbons. The ship has a very well equipped chemistry laboratory including three gas chromatographs. If these tests indicate the presence of migrated hydrocarbons in significant quantities, drilling is terminated and the hole plugged. Out of the approximately 250 drill sites occupied by ODP since 1985, it has been necessary to stop drilling only 2 or 3 times because of indications of hydrocarbons. Never in the history of ODP, or of its predecessor program the Deep Sea Drilling Project (1968-83), has the drilling resulted in a blowout or uncontrolled release of oil or gas into the sea.

Finally, at the conclusion of our operations, holes are sealed with mud and/or cement according to prescribed abandonment procedures (see JOIDES Journal XII, 5, p. 25). We have not yet defined the precise operations which will take place off New Jersey. But it is possible that re-entry holes will be established at a couple of the sites. This means that there would be a re-entry cone sticking up above the bottom at each of these sites and a steel casing extending some hundreds of meters into the sea floor. The casing would be cemented to the sediment/rock and the bottom of the hole plugged with cement.

I enclose a copy of the scientific proposals on which the New Jersey leg is based (348 and 348-Add by Miller, Mountain and Christie-Blick), several brochures about ODP, our "Guidelines on Pollution Prevention and Safety" mentioned above, and a list of PPSP members.

I look forward to hearing your views on ODP Leg 150.

Yours sincerely,

Tim Francis

Timothy J.G. Francis
Deputy Director

TJGF:hk

xc: Dr. James Austin, Chair JOIDES PCOM
Dr. Mahlon Ball, Chair JOIDES PPSP
Dr. Ken Miller, Leg 150 Co-Chief
Dr. Greg Mountain, Leg 150 Co-Chief