JOIDES Journal

Joint Oceanographic Institutions for Deep Earth Sampling
volume 21, number 2, June 1995

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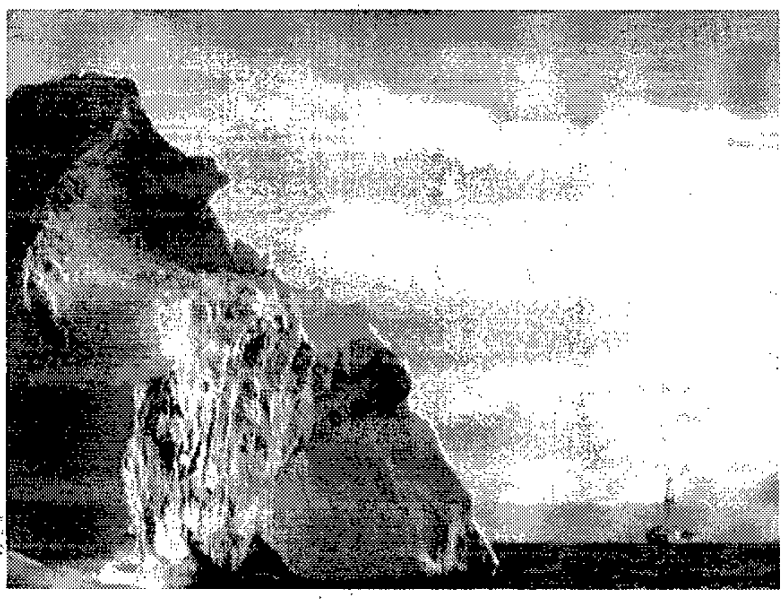
The 'Resolution' sails North



July - October 1995

COVER :
The JOIDES Resolution with an iceberg in the foreground. The picture was supplied by Aaron Woods at ODP-TAMU, and was taken during Leg 151. The ship will be working in Northern latitudes between July and October 1995 on the North Atlantic Arctic Gateways II and the S E Greenland Volcanic Rifted Margin II legs.

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JOIDES Journal

Joint Oceanographic Institutions for Deep Earth Sampling

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Woods Hole Oceanographic Institution

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Introduction

Since your February issue of JOIDES Journal, we at Cardiff have been through the cycle of finalisation of the FY96 Science Plan, a Planning Committee (PCOM) meeting in Japan, an Executive Committee (EXCOM) meeting and JOIDES Resolution port-call in Edinburgh, a new round of proposal inputs and numerous alterations of the Long Range Plan.

The latter is approaching its finalisation for presentation to the International Review of the Ocean Drilling Program which will begin at the Lamont Doherty Earth Observatory in September 1995. The various refinements that have been made, aided by input from throughout our JOIDES community and from our associated global geoscience programs have brought a real polish and focus to our vision into the 21st century.

EXCOM has taken some very positive steps that will allow much greater coordination with other programs including proposing ways to merge planning and management with the Nansen Arctic Drilling (NAD) program.

PCOM set a revised 4 year operational plan, based on highly ranked proposals, that will take the JOIDES Resolution from middle America at the end of 1996 to the north Atlantic, thence the South Atlantic and Indian Ocean, to the Western Pacific. This will provide exciting prospects for renewed Southern Ocean drilling before the end of the current phase (1998) and of new initiatives in establishing seafloor observatories and global borehole networks in the western Pacific.

This issue of the Journal was largely completed before the July EXCOM meeting, and a number of the issues alluded to above will be more fully explained in the October issue, the slight delay in publication was due to the finalisation of the Long Range Plan, a document that will prove crucial in the renewal process for the Program to continue into the 21st century, and yet another feature that will be detailed in the next issue of the Journal.

Robert B. Kidd

Robert B. Kidd
Chair, JOIDES Planning Committee

JOIDES Committee Reports

Planning Committee (PCOM)

Makuhari, Japan, 25 - 28 April 1995

The Tokyo meeting focused on the following: discussion of the latest version of the draft LRP, budget issues and their impact on science planning, discussion of its subcommittee's report on publications, consideration of non-DCS engineering development to allow prioritisation, and discussion of the thematic panel's new global rankings through to projection of the JOIDES Resolution's ship-track over the next 4-years. The PCOM Sub-committee Report on Publications is on pages 18 -20.

Scheduled Legs : 1995 and 1996 Program

The Caribbean Ocean History and Bahamas will stay as Legs 165 and 166, and they might want the St. Johns port call moved to Halifax as a public relations exercise. The loss of science time to transit on Leg 167 California Margin might be mitigated by the use of a western Mexico port call. PCOM asked ODP-TAMU to do the transit calculations and circulate them to the panels. After discussions of SGPP's Saanich Inlet proposal, PCOM asked ODP-TAMU to investigate the feasibility, recognising that there may be safety and environmental problems, and to report back to PCOM at the August 1995 meeting. PCOM were notified that the New Jersey Shallow Gas Hazard survey cruise will take place in June-July 1995.

4-Year Plan

After consideration of the thematic panel global rankings, PCOM turned to the 1997-98 area of operations. The rankings were considered to lead to a rather obvious extension of the track from Middle America through the Atlantic and Southern Ocean to the Western Pacific. PCOM outlined a proposed general ship track in that period, which will form a template for consideration of proposals for the 1997 Prospectus in August.

Publications

PCOM discussed the report of its subcommittee on publications, and there is a separate article on this on pp.18-20.

Budget Prioritisation

JOI wish to introduce project-based budgets, a paper will be presented to EXCOM, and if accepted, full implementation should take around two years. Given BCOM's report on the FY96 budget, and a projected level budget, PCOM tasked itself with identifying areas for savings at a level of $1M per year for 1996*, 97 and 98. (*This had been done this for FY96 based on PCOM's December prioritisation.). PCOM has advised JOI on their preferences, who will then work out budgets to fit with the PCOM priorities. PCOM agreed that the New Jersey engineering modifications would be necessary in FY96, if that leg was scheduled, and asked ODP-TAMU to report cost estimates and possible timelines for outfitting the JOIDES Resolution with the on-site safety measures at the August meeting.

In looking at the FY95 Re-Allocations, PCOM concentrated on the scheduled legs first, followed by operational items. The JOI liaison reported that he thought he could find $300-400K in total for possible re-allocation¶. He considered JOI had a mandate from BCOM to purchase the cryogenic magnetometer. After considerable discussion PCOM passed Motion 95-1-15 which outlined a possible budget re-allocation prioritisation of 1) absolutely critical replacement items in shipboard laboratories, 2) previously identified items in support of scientific activities during legs scheduled for FY95/96, and 3) non-DCS engineering development.

¶ Since the PCOM meeting in April, SEDCO/FOREX have insisted that an Ice-support vessel be used for Leg 163 E Greenland, and these 're-allocation' funds may now have to be used for this purpose, leaving little or nothing for non-DCS engineering development at ODP-TAMU in FY96.

Other Matters

Co-Chief Nomination Procedures

Following the December 1994 PCOM meeting there was some misunderstanding regarding the process of co-chief selection, largely due to a hiccup in communications between panels. To ensure misconceptions could not recur, and to make the process transparent to those outside the JOIDES advisory structure, PCOM reviewed the nomination process for both PCOM members and panel members, passed an additional guideline in Motion 95-1-19, which is - For PCOM to recommend to ODP-TAMU a member of a thematic panel, SSP or PCOM for consideration as a candidate for co-chief scientist, that candidate must also be a proponent of the relevant proposal(s). This was also discussed by OHP, see their report pp.3)

JANUS Working Group

PCOM authorised the setting up of an SMP Working Group to look at the problem of preservation of detailed core descriptions and structural information. See report on pp.23.

Thematic and Service Panel Meetings

The main business of the thematic panels in the Spring meetings are the Global rankings (see map on pp.33). They are presented here (by panel) along with some of the other major minuted topics of discussion. Panel recommendations, and where appropriate the PCOM responses are also given in this summary.

Lithosphere Panel (LITHP)

College Station, Texas, 22 - 25 February 1995

Caribbean Basement Drilling Leg

The Panel reviewed the decision not to schedule the basement drilling leg in the Caribbean. LITHP is concerned with the interface between the thematic panel review process and subsequent reviews by PCOM; they made the following recommendation:

- **LITHP recommends to PCOM that they explore ways to get complete copies of highly ranked proposals to PCOM watchdogs and panel liaisons earlier in the process, certainly before the Fall meetings at which the prospectus rankings are produced.**

PCOM said that communication channels were already clear and no further action was necessary.

LITHP think that PCOM should retain the option of not scheduling a highly ranked proposal when they feel they have adequate reason. However, they ask that PCOM recognise that such decisions can leave a strong negative impression in the scientific community and with the proponents, and therefore made the following recommendation:

- **LITHP recommends to PCOM that every effort be made in the review process to ensure that such decisions will not have to be made. In the event that they are, LITHP recommends that the reasons for that decision be clearly communicated, in writing, to the proponents by the relevant thematic panel chair and an appropriate member of PCOM.**

PCOM said that the PCOM liaison reports back to the panel and that such a procedure is already in place.

ODP-TAMU Engineering

Members of the ODP-TAMU Engineering Staff gave LITHP a review of the current operations in engineering, including offset-section drilling and DCS. LITHP have become concerned that the engineering department had more projects in front of it than they could reasonably expect to complete. Thus they made the following rec-

ommendation:

• **LITHP recommends to PCOM that they ask JOI to ask ODP-TAMU for a review of the manpower and time projections for current engineering projects, and for an evaluation of whether or not the engineering group is understaffed for that volume of work. If appropriate, LITHP recommends to PCOM that a prioritisation of engineering development needs be established, based on ODP-TAMU's response.**

This was dealt with by PCOM at their April meeting (see above).

Proposal Deadlines

LITHP also discussed the proposal deadlines and made the following recommendation:

• **LITHP recommends to PCOM that the winter proposal deadline date be moved to December 15th and that proposal guidelines be developed addressing, among other things, format, length, the inclusion of an abstract and location map in all versions and addenda, and specific responses to panel recommendations.**

PCOM said that the proponents can submit earlier if they wish, and that any changes in guidelines should be brought up at the annual Panel Chairs meeting.

Other Matters

LITHP also recommended that PCOM reconsider their recommendation for the possible elimination of 2 FTE of shipboard technical support, but this was already dealt with by ODP-TAMU by making all sea-going technician posts sea-going only positions.

LITHP still strongly endorses the proposal to CORK hole 395A (proposal 424) which would require 3-4 days of ship time, and urged PCOM to keep this project in mind, particularly if the ship moves back into the North Atlantic after its work in the eastern Pacific.

LITHP has also prepared a synopsis of their strategy and goals in drilling large igneous provinces with a summary of how current proposals in the system fit into that strategy (see pp.16-17).

Global Ranking

The Panel reviewed their list of active proposals and chose to globally rank proposals or letters-of-intent as in the table below.

LITHP Spring 1995 Global Rankings

Rank	Number	Short title	Score
1	300	Return to Site 735B	13.50
2	411	Caribbean basement drilling	11.21
3	448	Ontong-Java Plateau—LIP drilling	10.93
4	457	Kerguelan Plateau—LIP drilling	10.23
5	426	Antarctic-Australian Discordance	9.43
6	472 (435)	Izu/Mariana mass balance experiment	7.43
7	451	Tonga forearc drilling	7.38
8	420	Evolution of the oceanic crust	7.17
9	471 (435)	Nicaragua mass balance experiment	6.71
10	442	Northern Mariana Trough rifting	6.15
11	376	Vema offset-section drilling	5.79
12	438,469	Deep, dipping reflectors in ocean crust	4.50
13	470/LOI47	Red Sea drilling	4.27
14	431	Western Pacific Seismic Network	3.64
15	425	15°20'N offset section drilling	3.57

Ocean History Panel (OHP)

Miami, Florida, 2 - 4 March 1995

Co-Chief Nomination

OHP recognised the need to retain, and improve the process of Co-Chief nomination. They discussed possible amendments to the current process and noted that about 40 people had been involved in the nomination process though the final decision is the hands of TAMU. They recommended that

• **There be three categories of nominee, that would include:**
-all proponents and associated scientists involved in proposal writing or site survey,
-all other appropriate candidates, and
-appropriate candidates from thematic panels.

PCOM dealt with this matter at their April meeting (see above).

Southern Ocean Panel

PCOM had received a letter asking whether ODP would consider establishing a Southern Ocean Panel. PCOM was not in favour of the idea and asked OHP to respond. OHP has an interest in facilitating planning for Southern Ocean drilling, and a sub-committee will monitor interest and act as OHP's representatives in any planning initiatives in the area.

Drilling recovery in Tills

The panel noted a request to investigate techniques to improve recovery in tills. The panel recognised that ODP's record in this area was not good, but were not hopeful that breakthroughs would be forthcoming by ODP in light of the reduction in engineering expenditure suggested for 1996.

Global Ranking

The Panel reviewed their list of active proposals and made their global ranking as below.

OHP Spring 1995 Global Rankings

Rank	Number	Short title	Score
1	354-Add4	Benguela Current	.87
2	441	South West Pacific Gateway	.79
3	464	Southern Ocean Palaeoceanography	.78
4	404-rev2	Late Neogene Palaeoceanography	.74
5	462	Blake Plateau and Blake Nose	.63
6	465	SE Pacific Palaeoceanography	.63
7	348	New Jersey Margin	.55
8	367-rev2	Cenozoic Carbonates in the GAB	.53
9	449	Mesozoic Weddell Basin	.34
10	452-Rev	Antarctic Glacial History and SL change	.31
11	079	Mesozoic Somali Basin	.25
12	427	South Florida	.21
13	253	Ancestral Pacific	.21
14	444	Joban Margin	.13

Sedimentary and Geochemical Processes Panel (SGPP)

Boulder, Colorado, 2 - 4 March 1995

Special Report on CORKs

SGPP were given a special presentation by Bobb Carson, from Lehigh University, on the development and use of CORKs. He said that the CORK is intended to isolate the water in the hole and allow later measurements of temperature, pressure and sampling of the fluids. CORKing involves installation of a borehole seal, a data logger with thermistors or other sensors, and a fluid sampling manifold extending through the seal.

At Site 889, the CORKing was a total failure because of rough sea conditions. There was damage to the instrumentation, and it was impossible to get a complete seal due to heaving of the ship during emplacement. At Site 892, the weather was unexpectedly good and the seal sound. Sites 948 and 949 on the Barbados Accretionary Ridge were CORKed. Site 948 was cased but without a basal plug, and strong fluid pressures at the bottom of the hole caused the sediment to move up, greatly lessening the depth of hole available for the experiment. This CORK probably did not latch in. At Site, 949, the hole was plugged at bottom, and emplacement is thought to have been successful.

The length of time to set a CORK varies with conditions. At a minimum, the emplacement requires drilling a pilot hole and adds a minimum of three pipe trips to the site. The most rapid CORK deployment, was at Site 892; emplacement took just five days. Whereas at Site 949, emplacement required three weeks.

Plans for Leg 164 - Gas Hydrates

Because of changes in the schedule since the leg proposal was last reviewed, SGPP also received a special report on the status of the plans for Leg 164 (Gas Hydrates) by Charles Paull, the US co-chief, to look at the argument for casing a hole. The concept of casing a hole on Leg 164 was that many valuable downhole acoustic experiments could be conducted in a hydrate hole because of their odd velocity structure. Furthermore, it was noted that many experiments could be done in the future by wire line re-entry techniques. SGPP expressed its endorsement the new program, including the request for casing to be used if necessary.

PCOM noted this endorsement at their April meeting, and said that they had already passed their directives to JOI.

ODP Database

Following a report on the JANUS project, SGPP was concerned about the size of the proposed user-groups and the possible impact on finances. After discussion, SGPP passed the following resolution:

- **SGPP endorses the concept of obtaining advice from groups based on data types. Chairs of the groups should be ad hoc members of the steering committee. The groups should have a core membership no more than 2-4 in addition to the Chair authorised to travel to meetings if necessary, and as many corresponding members as may wish to be involved. The corresponding members would be kept abreast of activities by electronic and other communication and invited to test the developing products.**

At their April meeting PCOM noted this recommendation.

Publications

SGPP discussed the proposals for revision of ODP publications. After considerable deliberation, SGPP passed the following resolutions:

- **A) SGPP believes that the core photographs at present size are often of little value, and further reduction in size will make almost all of them useless. We suggest elimination of the core photographs, to be compensated by the availability of slides or B/W prints on request. We urge that the project ultimately move toward electronic capture of core images.**

- **B) The scientific value of the SR volumes should not be compromised.**

- **C) Full site chapters should be published in the IR. These should include some detailed photographs of the cores, as is current practice.**

PCOM noted these recommendations, which they dealt with during discussion of the Publications Report (see pp.18-20).

Global Rankings

After considering the active proposals, the Panel ranked order of proposals.

SGPP Spring 1995 Global Rankings

Rank	Number	Short Title	Score
1	473/LOI35	Saanich Inlet	19.82
2	Generic	Antarctic	16.45
3	348	New Jersey Margin	15.91
4	445	Deform'n/Fluid Flow, Nankai Trough	15.22
5	471 (435)	Crustal Fluxes to Mantle - Nicaragua	15.18
6	354	Benguela Current	15.00
7	367	Carbonates - Great Australian Bight	14.36
8	424	Cork for Hole 395A	13.82
9	467	SL Golfe de Lion, Ligurian Sea	13.77
10	355	Peru Margin	13.09
11	420	Evolution of Ocean Crust - Clipperton	12.90
12	455	Laurentide Ice Sheet	12.18
13	Generic	Red Sea	11.45
14	453	Bransfield Strait	11.18
15	LOI 48	LWD Middle America	10.68

TECTONICS PANEL (TECP)

Pasadena, California, 20 - 22 February 1995

Shipboard Structural Science

Structural data were now being collected effectively at sea and would be archived by adding a column to the Barrel Sheets and by publication of VCDs and other data (e.g. drawings) on CD-ROM. There is still a need to produce the "cook book" for use at sea, and a small group to finalise this had been included in the plan.

Computer database upgrade (JANUS)

TECP were very concerned that the upgrade may not proceed as smoothly as planned and that Group 4b data (structural data) might not be incorporated. Thus they made the following recommendation to PCOM;

- **TECP recommend to PCOM that PCOM recommends to JOI Inc and that JOI Inc direct TAMU to ensure that every possible step is taken to ensure that the computerisation of both structural and lithological data is fully implemented during the computer data base upgrade project (JANUS).**

PCOM noted this recommendation at their April meeting.

Study in situ physical properties

TECP considered that Logging While Drilling (LWD) was a spectacular advance to the program and offered great opportunities, and from the TECP viewpoint, LWD could be more valuable than recovery of additional core in already well studied accretionary settings. TECP noted that funding was clearly a problem, but suggested that ODP could take the bold and innovative step of sanctioning a LWD leg without coring in an already well drilled area. Thus they said;

- **TECP recommends to PCOM that PCOM recommend to JOI Inc that every effort be made to overcome funding constraints on further use of LWD. TECP further recommends to PCOM that PCOM recommend to JOI Inc that TAMU be directed to put in place arrangements to allow LWD to take place on a leg, if necessary, without coring, should TECP rank a suitable proposal for LWD work sufficiently highly to allow implementation (assuming funding is available).**

PCOM noted this recommendation, they have passed their priorities to JOI.

Monitoring Active Systems (i.e. Observatories)

TECP believes that the importance of developing integrated interdisciplinary observatories, for the study of long-term tectonic (and other) processes should be flagged. TECP believe that the use of "observatories" has great societal relevance and might command new, additional funding. TECP adopted the following recommendation:

- **TECP recommends to PCOM that the development of integrated multidisciplinary observatories as a means of monitoring and experimenting on fundamental tectonic (and other) processes be highlighted in the new Long Range Plan.**

PCOM noted this recommendation.

Land-Sea Integration

TECP believe that the solution of some fundamental tectonic problems require the integration of tectonic information between land and sea (e.g. subduction - accretion). They see the Continental Drilling Programs offering an opportunity for collaboration that could greatly increase the size of the Earth Science community with an interest in continental ocean drilling. They made the following recommendation:

- **TECP recommends to PCOM that the new LRP also highlights the future importance of continental land-sea drilling to help solve some fundamental tectonic processes (e.g. subduction/accretion).**

PCOM noted this recommendation.

Global Ranking

TECP decided to include in the global ranking only those that could reasonably be expected to be drillable by the end of the present phase of ODP - 1998.

TECP Spring 1995 Global Rankings

Rank	Number	Short Title	Score
1	447 Rev	Woodlark	11.9
2	461 Add	Iberia 2	11.6
3	471	Taiwan	11.1
4	468	Romanche	10.6
5	355 Rev	Peru Tectonic Erosion	10.1
6	442 Rev	Mariana Back Arc	9.8
7	445	Nankai deformation and fluids	9.6
8	451 Rev2	Tonga Forearc	9.5
9	LOI 48	Physical prop. LWD	8.4
10	466	S Australia Continental Margin	8.2
11	LOI 44	Japan trench borehole obs	7.4
12	334 Rev3	S'Reflector	7.0
13	LOI 41	Stress-strain obs	6.4
14	469	Dipping reflectors (Argo)	6.1
15	431 Add2	W Pacific Seismic Net	5.1

Site Survey Panel (SSP)

Dartmouth, Nova Scotia, 5 - 7 April 1995

PANCH/DRILLOPTS Report

SSP had a report on the December 1994 Drilling Operations (DRILLOPTS) and Panel Chairs (PANCH) meetings. They were reminded that DRILLOPTS represents an opportunity to air or resolve thorny issues concerning specific legs. Thematic Panel chairs agreed to take responsibility for communicating the nuances of their priorities for specific aspects of specific proposals direct to the SSP chair.

Another major point concerned the number of proposals that SSP have to consider (20 in April 1994; 24 in April 1995). At the July meetings, they have been looking at data from something like 12-15 programs. This reduction is primarily in response to PCOM's designation of an "area of operations" during their April PCOM meeting, and SSP said that it is absolutely crucial that an area of operations for 1997 is made at the April PCOM meeting. SSP is not capable of examining full data sets from 20-24 proposals in their July meeting.

Site Survey Data Bank

While SSP recognised that the Data Bank should be moving in the direction of handling most data in a digital format, of higher priority should be improvements to the methods of compiling navigation track charts and reproducing colour swath bathymetric plots, and upgrading the Data Bank's data tracking system. SSP advised the Data Bank communicate to JOI that SSP feels the additional funds recently made available will have more impact if used to better manage the existing paper data, and better handle navigation and swath bathymetric data, rather than to actively solicit new digital seismic records.

The rest of the meeting was taken up by reviewing the Site Survey implications of recently drilled legs and the Site Survey status of upcoming scheduled legs and potential future legs.

Shipboard Measurements Panel (SMP)

College Station, Texas, 8 - 10 March 1995

Cookbooks

SMP reviewed the "cook-book" situation on the JOIDES Resolution and made the following recommendation to PCOM;

- **During each cruise there should be a direct interaction between the Laboratory Officer, the appropriate Laboratory Specialist, and the participating Scientist(s) regarding potential changes and improvements of a cook-book. The most appropriate time for such interactions would be about half-way through the cruise. Any questions should be referred to the appropriate Staff Scientist of ODP-TAMU and/or appropriate SMP members.**

PCOM endorsed this recommendation and the ODP-TAMU liaison to PCOM said that it is in progress.

Explanatory Notes

SMP discussed the status of the "Explanatory Notes" and made the following recommendation:

- **SMP recommends that one set of Explanatory Notes be produced each year and that this set should be sent out to participating scientists in a floppy disc or hard copy format prior to the legs. During each leg participating scientists are required to record any changes in procedures made during the leg, so that a record is available on this for future reference.**

PCOM endorsed this recommendation and the ODP-TAMU liaison to PCOM said that it is in progress.

Shipboard Pycnometer

SMP also discussed the need for a smoother operation of the shipboard pycnometer and recommended:

- **SMP urges the update of the shipboard pycnometry through the introduction of computer pycnometer control. The costs of the system are relatively low, but the pay-off in much improved data will justify this purchase.**

PCOM endorsed this recommendation and the ODP-TAMU liaison to PCOM said that it is in progress.

Palaeomagnetic Equipment

SMP discussed replacing the Cryogenic Magnetometer by a new 2G system. SMP wished to draw PCOM's attention to its highest priority with the following recommendation:

- **SMP strongly recommends the replacement of the present aged Cryogenic Magnetometer by a modern new version of the 2G Cryogenic Magnetometer. This equipment will allow a much higher precision (by about 100 fold) in geomagnetic data and will allow a better integration of these data into the data base that underlies the data integration efforts currently underway in the Ocean Drilling Program.**

PCOM noted this recommendation, and it was dealt with at the April meeting.

Status of the WSTP

SMP considered that the WSTP needs updating through more accurate data logging devices. They made the following recommendation:

- **SMP recommends that the upgrading of the temperature recording devise in the current WSTP to a devise based on the ADARA temperature tool be executed in the near future. The importance of this project is especially geared to a more precise recording of in-situ temperatures during the sedimented ridge Leg 169.**

PCOM noted this recommendation, and it was dealt with in their April meeting.

Data Base Upgrade.

SMP discussed the progress of the Data Base Upgrade after a presentation during a joint session with IHP, noting the concerns of the Tectonics Panel. SMP consider that it will be important to discuss preservation of core descriptions and structural data in greater detail prior to establishing a "user group", and so SMP recommended:

- **SMP strongly recommends to PCOM/JOI that as soon as possible a working group on the problem of preservation of detailed core descriptions and structural information be formed. This group should consist of**
  - **2 Sedimentologists**
  - **2 Structural Geologists**
  - **1 Palaeoceanographer**
  - **1 SMP Representative**
  - **1 TAMU Representative**

The working group should meet for 2 days and during the latter part of the workshop should consult with a representative of TRACOR on the problem of compatibility with the data base.

PCOM agreed with this recommendation, and added 2 petrologists to the working group in the PCOM Consensus 95-1-20.

Future of Shipboard Measurements.
Recognising that economic necessities may force some reductions in shipboard measurements, SMP has requested ODP-TAMU to supply a list of all major equipment, emphasising the following: a) Life expectancy; b) Changes required for future use; c) Availability of spares; d) Software requirements; e) Necessary care or special requirements.

Data Integration (DICOM).
SMP discussed the consensus of PCOM regarding the establishment of a Data Integration Working Group (DICOM) to oversee development of a computer based data integration capability. The Core Description Working Group has now been formed as the first stage.

Other Items
SMP discussed the status of the X-Ray laboratory and reiterated that the present XRF and XRD equipment is ageing. SMP asked to go on record advising that serious consideration be given to the future purchase of a new XRD system.

Downhole Measurements Panel (DMP)

Leicester, United Kingdom, 8 - 10 March 1995

Downhole Measurements Program
Presentations concerning operations of the Borehole Research Group were made by members from Palisades, Leicester, and Marseilles. As a result of these presentations, the DMP wishes to make the following statements:

- The DMP acknowledges the work that the technical operations group put into the preparation and testing of the tools for TAG, and the logging-while-drilling tools for Barbados. The DMP appreciates these innovative efforts made on behalf of the ODP, and notes that they are necessary to the well-being of the program.
- The DMP acknowledges the efforts of the service centres charged with the dissemination and analysis of log data, and to making it available to the scientific community in a timely manner.
- The DMP acknowledges the scientific developments made with non-ODP funds, and the positive impact this work has on science within the ODP community.

Measurements at Juan de Fuca
Precise temperature measurements are necessary for the success of the Juan de Fuca operations, and these measurements must be made using either the WSTP or ADARA tools. An upgrade to the WSTP is in the proposal stage, and funding for this joint Canadian/German thrust is essential. The DMP strongly endorses this effort, and wishes to convey this position to funding institutions.

VSP Tools for Hydrate Quantification
While the DMP strongly supports the proposed VSP experiments on Leg 164, concern over the Woods Hole tool performance cannot be ignored. Thus, the DMP has initiated a review of the tool pursuant to the Third-Party-Tool Guidelines.

Information Handling Panel (IHP)

College Station, Texas, 8 - 10 March 1995

Request from the Smithsonian Institution
The Smithsonian Institution wants to create a plate tectonics exhibit including a few archive core-halves showing sediments and rocks through the crust. After discussion the IHP forwards the following Recommendation to PCOM:

- **The IHP recommends that PCOM permits the Smithsonian to display ODP samples in accordance with the stipulations that (1) the lendee return samples to ODP if needed for study and (2) that the lendee care for the samples using the same standards as ODP. Non-vital samples should be used where possible (out-of-context samples, wash cores, or triple hole APC cores where normal sampling rules don't apply).**

PCOM agreed with this request, with the provisos that the samples be returned if needed for study, and that the samples be treated with the same standards of care as at ODP.

Stratigraphic Database Centre (SDBC)
The GEOMAR Research Centre for Marine Geosciences in Kiel, has put forward a detailed proposal for the establishment of a Stratigraphic Database Centre (SDBC). IHP forwarded the following recommendation to PCOM:

- **The IHP requests that the PCOM more strongly endorse the establishment of a Stratigraphic Database Centre as the PCOM recommendation from the December meeting was too vague. The Establishment of a Stratigraphic Database Centre requires stronger statement of endorsement to find funding.**

PCOM noted this recommendation; they had endorsed this in December 1994.

PCOM Publications Subcommittee Report
IHP discussed the PCOM Publications Subcommittee report for a considerable time. Their recommendation can be found in the article on pp.18-20.

Technology and Engineering Development Committee (TEDCOM)

College Station, Texas, 20 - 21 March 1995

EDRC Report Implementation at ODP-TAMU
TEDCOM were not convinced that the current re-organisation at ODP-TAMU brought all major projects, such as DCS, under the Engineering Development Supervisor. Thus they made the following recommendation to PCOM:

- **TEDCOM recommends to PCOM, the recommendations of the EDRC report for the organisation of engineering and development projects, which is supported by TEDCOM, should be implemented at TAMU to meet the intent of the EDRC Report to ensure efficient and consistent engineering development projects.**

PCOM noted this recommendation, and it is in train by JOI.

Technology Review
TEDCOM suggested that ODP-TAMU take advantage of the expertise available in the membership of TEDCOM by forming small ad hoc committees to review specific projects. Thus they made the following recommendation to PCOM:

- **When warranted, PCOM allow one or two extra days of selected TEDCOM members to meet with identified ODP-TAMU engineers immediately before or after the scheduled TEDCOM meeting.**

PCOM endorsed this recommendation.

Joint Venture Engineering & Technology
At TEDCOM the issue of joint venture engineering technology development was raised, a concept initially explored within Europe by an "ODP Technology" ad-hoc working group under the auspices of E.S.F. It was recognised by TEDCOM that throughout ODP member nations there is a range of expertise and capital facilities which would assist ODP-TAMU in specific areas of development, and they made the following recommendation:

- **TEDCOM recommends to PCOM, the investigation of joint and co-funded Engineering & Technology Development Projects between ODP-TAMU and appropriate partners.**

PCOM recognised both the potential benefits and possible drawbacks, but overall they are in support of this idea, and will ask EXCOM and ODPC to look at modifying the Memorandum of Understanding in terms of intellectual property rights, to allow this to happen.

New Equipment Development
ODP-TAMU suggested that several new tools and concepts (for use in offset drilling areas) are tested during a dedicated engineering leg in 1997. Such a leg would be 48 days long with tool costs (over

and above normal vessel operation) of about $286K. TEDCOM supported this with the following recommendation to PCOM:

- **Given: (1) continued interest in Offset Drilling, and (2) limited success in drilling in this difficult environment, TEDCOM supports and recommends to PCOM, the development and testing of these improved concepts and tools, but with the reservation that this engineering test program should be broken into two or three more manageable and fundable parts, each of which should be attached to scientific legs of appropriate opportunity, and made a part of the formal plans thereof in each case. Alternately, a single combined scientific/engineering leg devoted to Offset Drilling in the specific Offset areas previously drilled, should be considered.**

PCOM agreed that this was a good idea, although it would not be straightforward to implement.

Project Based Management

TEDCOM discussed the merits of using project-based management for engineering and technology development at ODP-TAMU and passed the following to PCOM:

- **TEDCOM endorses the comments made by the budget committee recommending the full implementation of project based management across all aspects of ODP operations, management and science co-ordination by FY98.**

PCOM noted this recommendation. Project management will be looked at by EXCOM in July 1995.

Hard Rock Orientation, Sonic Core Monitor, Rig Instrumentation System

TEDCOM reviewed a number of non-DCS projects and asked PCOM for a prioritisation:

- **TEDCOM recommends PCOM establish priority for these projects from a cost and TAMU manpower point of view relative to Science objectives. If cost and manpower requirements cannot be justified, it is recommended these projects be removed from the active projects list.**

PCOM noted this recommendation during their discussion of Engineering Development in April.

Motor Driven Core Barrel (MDCB)

TEDCOM consider that ODP-TAMU should focus on eliminating the limitations of the present MDCB, and should also investigate the MDCB as an interim solution for DCS:

- **TEDCOM recommends to PCOM, ODP-TAMU Engineering perform a technical feasibility study on improving the coring effectiveness of the Motor Driven Core Barrel.**

PCOM noted this recommendation during their discussion of Engineering Development in April.

Future Role of TEDCOM

TEDCOM believe their greatest potential is to support engineering and technology development at ODP-TAMU. During discussions as to the possible future roles of TEDCOM, they outline the following as a way of satisfying many of the difficulties they see in the existing organisation of TEDCOM.

TEDCOM to be: proactive in seeking proposals for technology development in support of ODP, to rank (prioritise) such proposals, to form subcommittees to assist proponents in refining proposals, drawing on relevant experience, to present final proposals and rankings to PCOM at the annual meeting each year, and to have liaisons to the Thematic Panels.

Essentially TEDCOM wish to take on a role analogous to a Thematic Panel. They made the following recommendation to PCOM:

- **TEDCOM recommends to PCOM, the future role of TEDCOM should be discussed, the above outline should be discussed by PCOM members to determine if there is any interest to pursue the concept or determine if other concepts can be investigated to minimise the existing paradox.**

PCOM complied with this request and asked TEDCOM to submit a position paper.

Science Operator Report Leg 158

TAG Hydrothermal Field

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ABSTRACT

Leg 158 investigated the fluid flow, geochemical fluxes and associated alteration and mineralization, microbiological processes, and the subsurface nature of an active hydrothermal system on a slow-spreading sediment-free mid-ocean ridge. The active mound within the Trans-Atlantic Geotraverse (TAG) hydrothermal field at 26°N latitude on the Mid-Atlantic Ridge (MAR) is a large, mature deposit of varying mineralogy with emanating fluids displaying a wide range of temperatures and two distinct, but related, chemistries.

At Site 957, a northwest-southeast transect of holes in three major, distinct areas of the mound was drilled: the upper terrace east of the Black Smoker Complex (proposed TAG-1 area), the white smoker Kremlin area (proposed TAG-2 area), and the upper terrace west of the Black Smoker Complex (proposed TAG-4 area). In addition, holes were drilled on the south side of the lower terrace (proposed TAG-3 area) and on the northern edge of the upper terrace (proposed TAG-5 area) in an attempt to delineate lateral heterogeneity of the sulfide deposit, and the extent and nature of th e underlying stockwork zone. Breccias of various types dominate the stratigraphy of the entire mound, not only within the sulfide section but also extending into the upper part of the stockwork. Within the sulfide mound, these different types are distinguished primarily on the basis of the relative abundances of pyrite, anhydrite, and silica, and therefore reflect different degrees of brecciation, cementation, hydrothermal reworking, and replacement of pre-existing sulfides.

Based on the sequence of rock types recovered from each area, four major lithologic types can be distinguished, all of which may or may not be present at a given location. Massive pyrites and pyrite breccias dominate the upper 10-20 m. This is followed by an anhydrite-rich zone, which is composed of matrix-supported pyrite- anhydrite breccias and pyrite-anhydrite-silica breccias. At depths of about 40-45 mbsf, the amount of quartz-pyrite mineralization and quartz veining increases and represents the top of the quartz-sulfide stockwork zone, which typically includes pyrite-silica breccias overlying silicified wall-rock breccias. A quartz-chlorite stockwork zone was sampled at depths greater than 100 mbsf in Hole 957E. This complex assemblage of rock types is a product of the multistage development of the mound, and is reflected in the sequences of alteration and veining events that can be distinguished both in the sulfide breccias and in the silicified wall-rock and chloritized basalt breccias.

INTRODUCTION

Hydrothermal circulation is one of the fundamental processes associated with crustal accretion along oceanic spreading centers. Driven by heat from magmatic intrusion and emplacement of new crust, seawater circulates through the permeable portions of the crust and upper mantle, and discharges at the seafloor as both high- temperature (up to 400°C) focused and lower temperature (less than ~250°C) diffuse fluid flow. The circulating hydrothermal fluids interact with the oceanic basement in a complex series of water-rock reactions that not only influence the physical properties and composition of the crust, but also give rise to the development of seafloor mineral deposits. These reactions result in changes in the chemistry of the material recycled into the mantle by subduction and also play a role in regulating the chemical composition of seawater. However, the extent of alteration and its impact on global geochemical mass balances is still very poorly constrained.

Hydrothermal vent systems also provide unique habitats that support chemosynthetically based biological communities that are especially adapted to the physico-chemical environment and ephemeral nature of vents. Reduced gases in the discharging fluids are converted into biochemical energy through microbially mediated oxidation. Most noteworthy are the free-living sulfide oxidizers and the sulfide oxidizing endosymbionts associated with the vent invertebrates that obtain their energy through sulfide oxidation and their carbon through CO_2 fixation. These primary producers provide the basis of the trophic structure that supports the large biomass of macroinvertebrates endemic to deep-sea hydrothermal vents. Deep-sea hydrothermal vents also provide a unique environment for the study of the thermally restricted hyperthermophilic microorganisms (organisms that grow optimally above 80°C).

The surficial expression of submarine hydrothermal systems has now been investigated at fast-, intermediate-, and slow-spreading ridges, at intraplate volcanic centers, and in island arc settings, both in backarc basins and in forearc regions. However, our knowledge of the subsurface part of the hydrothermal system is indirect, and has been derived by combining studies of altered rocks recovered from oceanic spreading centers and from ophiolites, with experimental work and theoretical modeling. All of these approaches have been combined into simple conceptual models of the progression of alteration reactions that occur within the oceanic crust. However, many uncertainties remain about the nature of the subsurface part of an active system. These include (1) the permeability, pressure, and temperature structure within the upflow zone beneath an active hydrothermal system, (2) the nature of the chemical reactions between water and rock in both the upflow zone and the underlying reaction zone, (3) the mechanisms of sulfide precipitation and subsequent modification below the seafloor, (4) structural controls on the plumbing system within both the upflow and reaction zones, (5) the evolution of major black smoker systems, and (6) the existence, extent, and persistence of a subsurface biosphere. ODP Leg 158 was designed to address these issues by investigating fluid flow, alteration and mineralization and associated geochemical fluxes, microbiological processes, and the subsurface nature of an active hydrothermal system on a slow-spreading, sediment-free mid-ocean ridge. Hydrothermal systems on unsedimented ridge axes dominate global hydrothermal activity, and hence are an important contributor to global mass and energy fluxes. The site chosen for this study was the active TAG hydrothermal mound (26°N on the Mid-Atlantic Ridge) - a large, mature deposit composed of massive sulfides probably in excess of 5×10^6 tons, making it equivalent in size to some of the ophiolite deposits in Cyprus, Oman, and elsewhere.

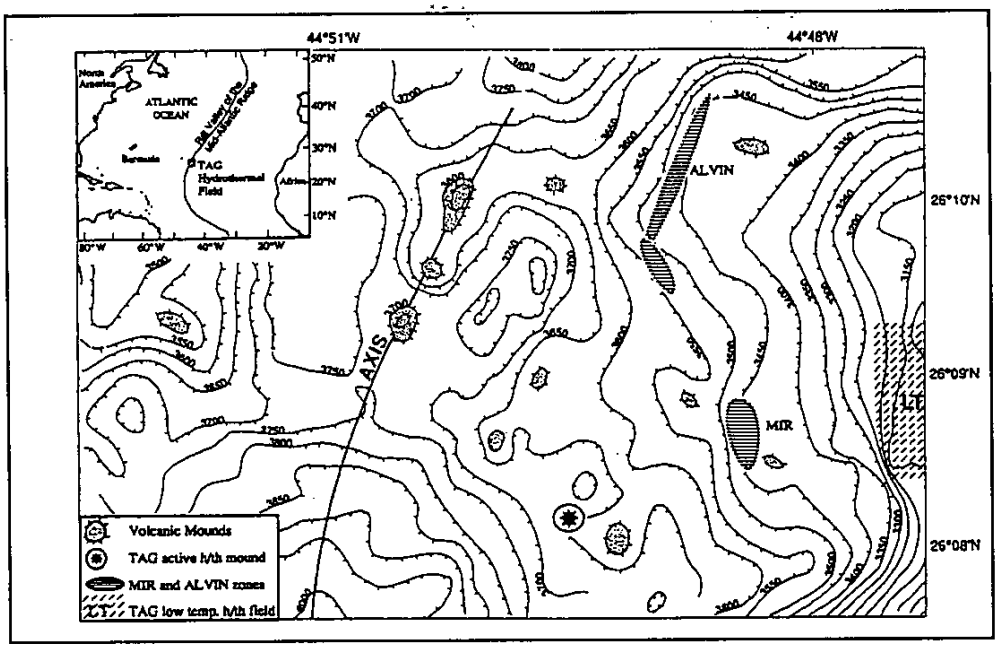

Figure 1. SeaBeam bathymetry (50m contour interval) of the TAG hydrothermal field, showing volcanic domes, the active TAG hydrothermal mound, the low temperature hydrothermal field up on the eastern rift-valley wall, and the ALVIN and MIR relict hydrothermal zones.

GEOLOGIC AND TECTONIC SETTING

The 40-km-long ridge segment in which the TAG hydrothermal field is located trends north-northeasterly, and is bounded by non- transform discontinuities to the south and north at 25°55'N and 26°17'N respectively. Seafloor spreading has been asymmetric over the last 10 m.y., with half spreading rates of 13 mm/yr to the east and 11 mm/yr to the west. At about 26°10'N (approximately the middle of the segment) the east wall forms a broad salient that reduces the width of the valley floor from about 9 to 6 km and rises from the valley floor, near 4000 m in depth, to a height of 2000 m through a series of steps formed by fault blocks.

The TAG hydrothermal field lies at the base of this salient and extends over an area of at least 5 x 5 km along the eastern median valley wall (Fig. 1). The field consists of presently active low- and high-temperature zones, as well as a number of relict deposits. The zone of low-temperature activity occurs between 2400 and 3100 m in depth on the east wall and includes massive, layered deposits of manganese oxide, amorphous iron oxide, and nontronite. The two large relict zones occur on the lower east wall to the north of the active mound, and are believed to be associated with volcanic domes. The 2 km long ALVIN hydrothermal zone lies between depths of 3400 and 3600 m and is composed of discontinuous sulfide deposits associated with several mound-like features with dimensions similar to those of the active mound, and separated by sediment and pillow-basalt flows. The MIR zone is south of the ALVIN zone on the lower east wall about 2 km east-northeast of the active mound between 3430 and 3575 m. It consists of inactive deposits in various stages of weathering, situated on normal fault blocks, as well as areas of numerous standing and toppled sulfide chimneys, some up to 25 m in length and up to 3 m in diameter.

The presently active black smoker system occurs at the juncture between the rift-valley floor and the east wall at approximately 26°08'N, 44°49'W, and at a depth of about 3620-3700 m (Fig. 1). The low-temperature field described above lies 3.7 km upslope to the east; the bathymetric axis of the rift valley is about 1.5-2 km to the west. The active high-temperature mound lies on oceanic crust at least 100,000 years old, based on present seafloor-spreading rates. Preliminary geochronological studies of samples recovered by dredging suggest that the mound is on the order of 40,000-50,000 years old. More detailed studies of samples collected by submersible suggest that activity has been intermittent over the past 20,000 years, with a periodicity of 5000-6000 years. Present activity commenced about 50 years ago after a hiatus of about 5000 years.

A recent bathymetric map confirms that the mound is distinctly circular and measures 200 m in diameter and about 50 m in height (Fig. 2). It exhibits two distinct, flat platforms at depths of about 3650 and 3644 m, which may represent two phases of active growth. The mound is surrounded by an apron dominated by carbonate and metalliferous sulfide-oxide sediment that ranges in width up to 100 m. A schematic cross section of the active TAG hydrothermal mound made during the 1990 ALVIN dive series, and the inferred flow pattern within the mound, are shown in Fig. 3. The mound is composed of massive sulfides and anhydrite, with distinct sample types being distributed from the inner to the outer parts of the mound. A cluster of chalcopyrite-anhydrite-rich black smoker chimneys emitting fluids up to 363°C is northwest of the center of the mound. This chimney cluster sits on the top of a 10-15 m high, 20-30 m diameter cone, the surface of which is covered by a 3-6 cm thick plate-like layer of massive chalcopyrite and marcasite, with interspersed blocks of corroded massive anhydrite with variable amounts of chalcopyrite and pyrite. The tops of both the upper and lower platforms of the mound are relatively flat with irregular surfaces. Samples of amorphous Fe oxyhydroxide and silica have been recovered from the west, south, and east rims of the mound, and bulbous mixed Zn, Fe, and Cu-Fe sulfides with cavities filled by amorphous silica were recovered from the northern rim and central parts of the mound. A complex of white smokers venting fluids from 260° to 300°C is located in the southeast quadrant of the mound approximately 70 m away from the Black Smoker Complex; these "Kremlin"-like spires are small (1-2 m) and are composed dominantly of low-Fe sphalerite with minor amounts of chalcopyrite, pyrite, and amorphous silica. Fluids from the white smokers have a very low pH (3 at 23°C) and lesser amounts of iron than the black smoker fluids. They are thought to be derived from the black smoker fluids by a combination of conductive cooling and mixing with seawater and precipitation of sulfides within the mound.

Mass-wasting of the edges of the inner mound results in steep outer slopes to the west, north, and east. Two sample types are exposed: (1) pyrite-rich blocks with trace amounts of late-stage amorphous silica, quartz, goethite and with outer oxidized layers that include atacamite; and (2) deep-red to orange-brown blocks of amorphous Fe oxide, goethite, hematite, and silica (as both amorphous silica and quartz). Analogs for these sample types are not found in other known seafloor vent sites but are present in massive sulfide deposits of Cyprus.

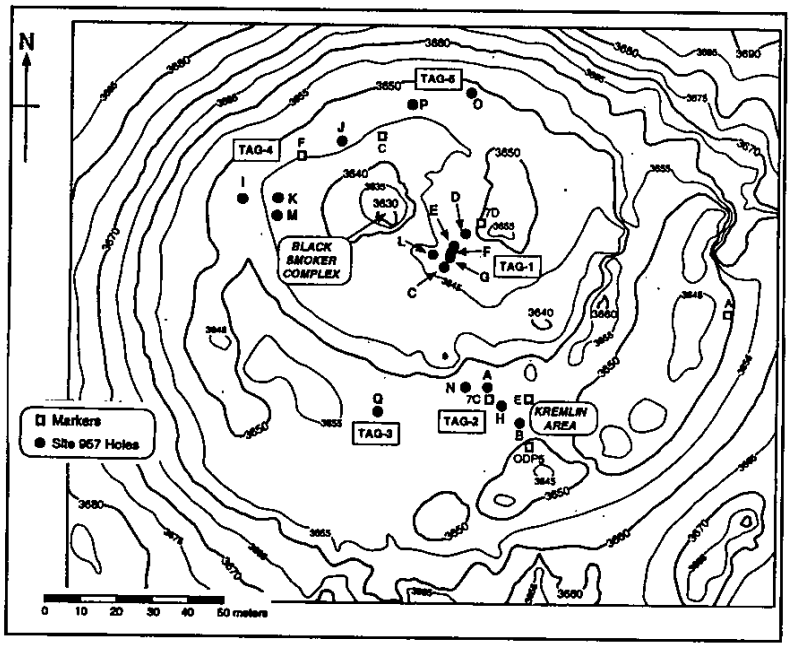

Figure 2. Bathymetry (5m contour) of the active TAG mound showing major morphologic features and the Leg 158 drill sites.

Hydrothermal activity on the active TAG mound supports a productive chemosynthetic-based benthic community. The most abundant organisms over much of the mound surface where diffuse fluid flow is present are anemones, together with smaller numbers of inconspicuous tube-dwelling polychaetes and buccinid snails. In the immediate vicinity of the active black smokers, however, swarming shrimp (Rimicaris exoculata) that reach densities up to 1500 per m^2 are dominant, with two other shrimp species, a brachyuran crab, and a zoarcid fish (at densities of only a few per m^2) also present.

RESULTS

The major objective of Leg 158 was to investigate the subsurface nature of the active TAG hydrothermal system on the Mid-Atlantic Ridge at about 26°N. Unlike most other ODP legs, drilling was concentrated on a feature only 200 m in diameter. Consequently, all drilling locations were considered as one site, although holes were grouped in specific areas, each of which had distinctive objectives. Several holes in one location were often attempted in order to recover as much of the stratigraphic section as possible. It was originally planned that a full logging program would be run at each location and a CORK would be emplaced in one hole; however, due to very difficult drilling conditions that included hole instability and cleaning problems, we were unable to accomplish these particular objectives. However, a northwest-southeast transect of three major, distinct areas of the mound was successfully completed, as well as some additional holes that attempted to delineate lateral heterogeneity of the sulfide deposit, and the extent and nature of the underlying stockwork zone.

PROPOSED TAG-1 AREA (E. of the Black Smoker Complex)

Holes 957C, 957E, 957F, and 957G were drilled on the upper terrace of the TAG active hydrothermal mound approximately 20 m southeast of the Black Smoker Complex. The objective of drilling at this location was to recover a stratigraphic section of hydrothermal deposits and underlying stockwork beneath the most active part of the mound. The two most complete sections through the mound were cored in Hole 957C (from 10 to 49 mbsf) and Hole 957E (from 30 to 125 mbsf) with recoveries of 44% and 4% respectively. The upper part of the section was cored in Hole 957F (from the surface to a depth of about 8 mbsf with recovery of 10.5%) and in Hole 957G (from 12 to 22 mbsf with recovery of 8.5%). Holes 957D and 957L were also drilled in this area, but had no recovery.

Since all the holes are within 10-15 m of each other, their stratigraphy is considered together to form a composite section through the hydrothermal mound and into the upper part of the stockwork zone (Fig. 4). Most of the sulfides occur in the upper part of the section, with pyrite making up between 50% and 80% of the rock by volume down to about 30 mbsf. Based on recovery from Holes 957F and 957G, the upper few meters of the section contains fragments of massive granular pyrite and chalcopyrite, which likely represent near-surface hydrothermal precipitates derived from sulfide crusts and chimney talus.

Massive pyrite breccias (from 0 to 15 mbsf) contain >75% pyrite and are largely clast-supported. These breccias consist of subrounded clasts of massive, granular pyrite in a porous, sandy pyrite matrix cemented by anhydrite. Clastic material in these breccias resembles porous and granular massive pyrite found in the sulfide talus from the surface of the mound. From 15 to 30 mbsf, a zone of pyrite-anhydrite-rich breccias, grades into pyrite-silica-anhydrite breccias that extend down to about 45 mbsf. These compose the bulk of the anhydrite-rich zone. The pyrite-anhydrite breccias typically consist of rounded pyrite clasts in a matrix of semi-massive anhydrite. The clasts (ranging in size from 0.5 to 2 cm) are composed of massive granular pyrite, but siliceous clasts, quartz-pyrite clasts, and altered basalt fragments become increasingly common with depth. The pyrite-silica-anhydrite breccias are intermediate in character between pyrite-anhydrite breccias above and pyrite-silica breccias below. Subangular to subrounded clasts consisting of siliceous pyritic material, quartz-pyrite aggregates, and massive granular pyrite, are cemented mainly by quartz, with most of the anhydrite in the form of crosscutting veins. The quartz appears dark gray due to inclusions of abundant, fine-grained disseminated pyrite.

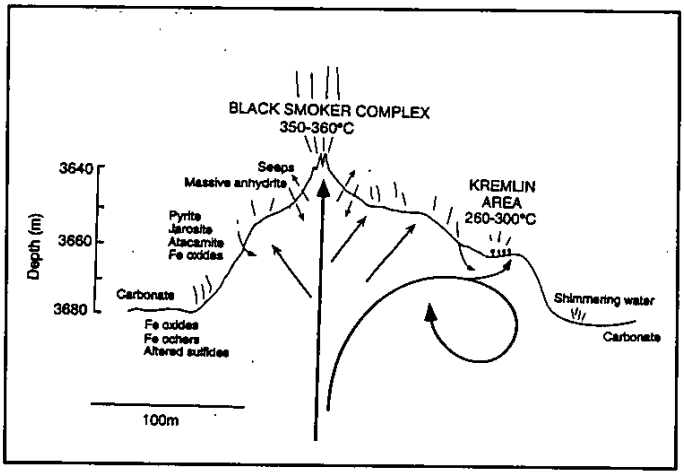

Figure 3. Schematic cross section of the active TAG mound from northwest to southeast. The flow patterns within the mound are derived from the mineralogy and chemistry of the deposits and the chemistry of white smoker and black smoker fluids.

Abundant quartz-pyrite mineralization and quartz veining immediately beneath the anhydrite-rich zone represent the top of the stockwork, suggesting that the thickness of the mound in this area is about 30 m. A quartz-rich zone composed mainly of pyrite-silica breccias near the top and silicified wall-rock breccias toward the bottom occurs between 45 and 100 mbsf. The pyrite-silica breccias consist of large (up to 10 cm) fragments of fine-grained, gray siliceous material and smaller fragments of quartz-pyrite set in a matrix of very fine-grained quartz. The gray siliceous clasts appear to be fragments of pre-existing mineralized and silicified wall rock similar to that occurring deeper in the section, but the clasts generally have more diffuse boundaries and are partially replaced by the quartz matrix.

The silicified wall-rock breccias differ from the overlying pyrite- silica breccias in that they are dominantly clast-supported and contain significantly less pyrite. They consist of angular siliceous basalt fragments that are identical to the silicified clasts that occur higher in the stratigraphic column. They are 1-5 cm in size, totally recrystallized to quartz, pyrite, and clay, but locally they contain relict igneous textures, and are veined and cemented by white to gray quartz and pyrite.

Below about 100 mbsf, this quartz-rich zone grades downward into a chloritic stockwork where chloritized and weakly mineralized basalt is the dominant lithology. The rocks range from gray chloritized basalt breccias to green chloritized basalt fragments and glass shards cemented by quartz. The gray chloritized basalt breccias consist of 1-5 cm clasts of altered basalt in a fine-grained matrix of intergrown white to gray quartz and pyrite. The altered basalt clasts are softer and less silicified than those in the overlying silicified wall-rock breccias, and are pervasively altered to chlorite + pyrite + quartz.

Anhydrite veining is abundant throughout the vertical extent of the section, but is best developed in the pyrite-anhydrite and pyrite-silica breccias (15 to 50 mbsf), where veins up to 45 cm in width are present. These veins comprise complex, multistage fracture fillings and cavity linings, some of which include disseminated, fine-grained pyrite and chalcopyrite, and trace amounts of hematite. The occurrence and size of veins decrease downward and correspond to an increase in the amount of quartz cement. In the chloritized basalt breccias, veins of pyrite, quartz, and quartz + pyrite commonly cut the basalt clasts, and appear to follow a sequence from early pyrite and quartz + pyrite veins to later quartz veins that cut the earlier veins. There is some evidence for small, late anhydrite veins that cut other vein types, and some anhydrite also occurs as the last mineral to form at the center of sulfide veins. Large ranges in the chemical compositions of different rock types reflect the extreme heterogeneity of the samples and the variable proportions of sulfides, anhydrite, and silica. The Fe contents of the samples range from 20.1 to 40.8 wt% and reflect the dominance of pyrite in the sulfide section. Cu contents are significantly lower, ranging from 0.01 to 6.0wt%, and Zn concentrations ar e also generally low (<700 ppm). The most striking feature of the sulfides in the proposed TAG-1 area is their very low concentrations of Pb, Ag, and Cd, which are close to their detection limits.

Physical properties of sulfide samples from the proposed TAG-1 area are typical for this type of material and yielded bulk densities from 2.85 to 4.51 g/cm^3 and porosities ranging between 2.4 and 16.2%. Compressional (P)-wave velocities are generally high (4.85-5.66 km/s), and electrical resistivities are low (0.11-2.01 Ω/m). Thermal conductivities generally range between 5.7 and 8.7 W/m K. In contrast, anhydrite samples have lower bulk densities (2.79 and 2.85 g/cm^3) and thermal conductivity (5.4 W/m K) and distinctly higher electrical resistivity (2.77 Ω/m) than the sulfides, but porosities (4.9% and 9.6%) are similar. Paleomagnetic measurements indicate that cores recovered from the upper part of the section (0 to 25 mbsf) have a low intensity of natural remanant magnetization, while those from depths of 30 to 35 mbsf have a stable component of magnetization consistent with the location of the TAG mound. Preliminary data from unblocking temperatures and coercivity determinations suggest that maghemite is the most likely magnetic carrier in these rocks. Fluid sampling in Hole 957C indicates that borehole fluids were dominated by surface seawater introduced during the drilling processes, and there was no evidence for upflow of hydrothermal fluids. However, elevated concentrations of magnesium, calcium, and sulfate in the sample suggested that dissolution of calcium and magnesium sulfate solids may be occurring. This was most likely an artifact of the drilling process but could also be the result of an ongoing process in the mound.

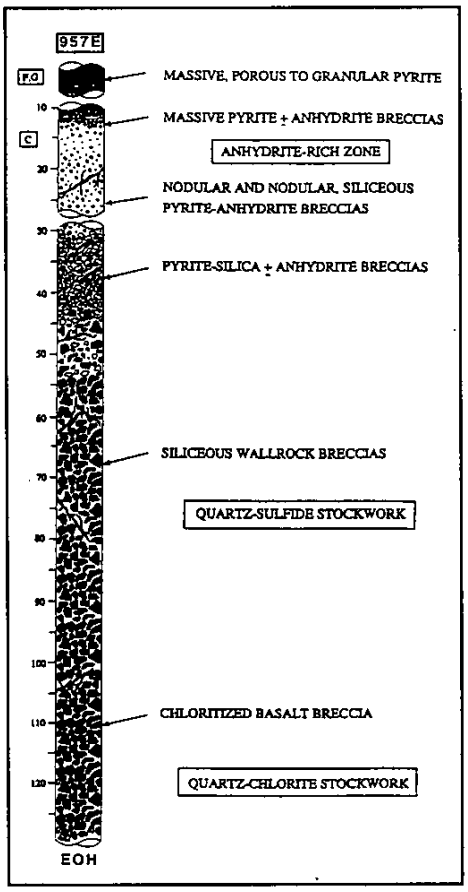

Figure 4. Schematic stratigraphic section of the mound in th eproposed TAG-1 area showing the distribution of the principal rock types in cores from Holes 957C, 957F, and 957G.

PROPOSED TAG-2 AREA ("Kremlin" White Smoker)

Holes 957A, 957B, 957H, and 957N are within about 10-15 m of each other on the lower terrace of the active TAG mound in an area of white smoker chimneys (the Kremlin, or proposed TAG-2 area). Objectives of drilling at this location were to sample a section of the mound where discharging fluids have chemistries distinct from those of the black smokers, and have undergone conductive cooling and mixing within the mound.

The most complete section cored was Hole 957H (from 8.7 to 54.3 mbsf) with a recovery of 11.0%. Hole 957A was located about 5 m northwest of Hole 957H and sampled the upper 15.0 m with recovery of 1.7%. Hole 957B was cored with recovery of 5% to a depth of 29.6 m about 8-10 m southeast of Hole 957H and recovered a thick section of massive sulfides, with the hole ending in partly altered basalt. A single wash core covering the interval 0-42.2 mbsf was recovered from Hole 957N to the west of Hole 957A.

The stratigraphy of the sulfide section in the Kremlin area is similar for all the holes down to about 20 mbsf. Drill cuttings from the very top of the section in Hole 957B consist of red-brown, sulfide-rich sand and mud with abundant chert clasts and a few small pieces of porous massive sphalerite and massive granular pyrite. The sulfide-rich sand and mud contains up to 16 wt% combined Cu and Zn (1-

3 wt% Zn and 8-13 wt% Cu), and may represent near-surface hydrothermal precipitates similar to those observed in Hole 957F east of the Black Smoker Complex (proposed TAG-1 area). A hard layer in the top few meters of each hole at the proposed TAG-2 area consists of mixed pyrite and chert clasts in a dominantly cherty matrix. Clasts of similar red and gray chert are also common in the underlying massive, porous pyrite to a depth of about 10 mbsf. Most of the sulfide material recovered from the proposed TAG-2 area occurs in the upper 20 m of the section as massive porous pyrite and porous, nodular pyrite breccias. These breccias have experienced less complex brecciation, cementation, and veining than similar rocks drilled in the other areas of the mound. The upper 10 m of the core in Holes 957A and 957H consists of massive, porous to granular pyrite with abundant red and gray chert. The massive pyrite is colloform-banded and exhibits primary depositional textures, with only limited replacement and local recrystallization to coarse, granular pyrite. Between 10 and 20 mbsf, a zone of massive, nodular pyrite breccias containing rounded clasts of pyrite in a sandy pyrite matrix is present. Although the breccias are dominantly matrix-supported, they contain only minor anhydrite cement.

Pyrite accounts for 80%-90% of the rock by volume in the upper 20m, and chalcopyrite is locally abundant in the upper 15 m of the core as disseminated grains and clasts in the sandy pyrite matrix, replacing the colloform pyrite, and locally associated with anhydrite veins. Sphalerite occurs mainly as coatings on massive colloform pyrite and in late cavities or fluid channelways in the upper 5 m of core. A sample of nodular pyrite breccia from about 10 mbsf contains close to 7 wt% Cu. Zn contents are low in samples from Hole 957H below about 8 mbsf (<0.02 wt% compared with 1-3 wt% from the uppermost samples recovered in this area). Between 20 and 30mbsf in Hole 957H, massive pyrite br eccias grade into pyrite-silica breccias, which consist of nodular clasts of quartz and pyrite in a quartz-rich matrix with anhydrite veining. Silicified wall-rock fragments and altered hyaloclastite first occur at a depth of 27 mbsf, and the wallrock fragments become increasingly abundant deeper in the core. Below 27 mbsf, the fragments in the pyrite-silica breccias become coarser and more angular and are interspersed with sections of brecciated and silicified wall rock. At about 40 mbsf, the pyrite-silica breccias grade into more massive silicified wall-rock breccias, and chloritized basalt fragments are present locally among the clasts. The silicified wall-rock breccias represent the upper part of the stockwork zone below the massive sulfides. This stratigraphic sequence suggests that the thickness of the sulfide mound beneath the Kremlin area is only about 25 m.

The silicified basalt clasts in the pyrite-silica breccias of Holes 957H and 957N, and in the silicified wall-rock breccias of Hole 957H, are gray to buff, 2 mm to 3 cm rounded to angular fragments in a fine-grained matrix of gray quartz plus pyrite. Pyrite in the matrix is present as 0.1-1 cm grains and rounded aggregates. The basalt clasts themselves are composed of a buff phyllosilicate plus quartz, and contain variable amounts of fine-grained pyrite replacing plagioclase microlites and disseminated in the groundmass. The clasts are replaced by quartz to varying extents, with gray portions that are more intensively silicified. The silicified hyaloclastite from Hole 957H consists of 1-5-mm angular fragments of altered basaltic glass in a matrix of fine-grained gray quartz. The glass fragments are altered to green chlorite and a white phyllosilicate, commonly in concentric bands.

Anhydrite veins are less abundant in the recovered rocks from the proposed TAG-2 area than in rocks recovered from the proposed TAG-1 area. Late anhydrite veins, up to several centimeters in width, occur in the pyrite-silica breccias in Hole 957H. Quartz veining is abundant in pyrite-silica breccias below the massive sulfides, and small quartz-pyrite veins (up to 1 cm) are the dominant vein type in the silicified wall-rock breccias to a depth of 45 mbsf. In Hole 957B, massive porous pyrite and pyrite breccias, similar in texture and mineralogy to those observed in Hole 957H, are present to a depth of about 20 mbsf. At the base of the massive sulfides in Hole 957B, a 30 cm section of pillow-rim breccia was recovered, which overlies partly altered basalt. This is interpreted to be the uppermost basement or a part of a basaltic flow. Centimeter-sized pieces of altered crystalline and glassy basalt occur in a matrix of red mud. The crystalline basalt fragments are grayish red and completely replaced by yellow phyllosilicates (smectite?) and iron oxides and/or oxyhydroxides. Basaltic glass fragments are blue and also completely altered to phyllosilicates (chlorite?). The strongly altered pillow-rim breccia at the contact between relatively fresh basalt and the base of the massive sulfides may indicate local hydrothermal flow along the contact or weathering of the basalts at the base of the sulfide breccias.

Fragments of red brown to dark gray, very fine-grained aphyric to sparsely phyric basalt occur in the lowermost part of Hole 957B. They exhibit rare olivine phenocrysts in a microcrystalline groundmass containing plagioclase microlites, and are slightly altered with olivine phenocrysts replaced by smectite and iron oxyhydroxides and/or oxides. Small rounded to elongated vesicles make up 1% to 2% of these samples.

Physical properties of sulfide specimens from the Kremlin area yielded a range of bulk densities from 2.61 to 4.33 g/cm^3 and porosities between 6.38% and 21.5%. Electrical resistivity measured on two sulfide minicores are low (0.07 and 0.58 Ω/m). Compressional (P-wave) velocities of minicores vary between 5.4 and 6.7 km/s, and thermal conductivities between 8.0 and 10.4 W/m K. High porosities (15.7% and 18.6%) and low wet bulk densities (2.25 and 2.43 g/cm^3) reflect their altered character. The cores recovered from Hole 957H displayed a multicomponent magnetization. The unstable viscous component is characterized by a higher magnetic susceptibility and a lower Koenigsberger ratio. This viscous magnetization can be removed by AF demagnetization. The downhole magnetic profile shows a trend of increasing intensity with depth, which coincides with the observed changes in lithology. No noticeable magnetic anisotropies were observed.

The core from the proposed TAG-2 area indicates that the massive sulfides at the eastern edge of the lower terrace comprise a 20 m thick talus pile on the flanks of the mound. This material was presumably derived from the erosion of sulfide chimneys on top of a former mound/stockwork complex. As these breccias are presently at the edge of the main upflow zone, they exhibit only minor replacement, veining, and cementation by quartz and anhydrite. The upper 10 m of sulfides consists of massive colloform pyrite with minor late sphalerite lining cavities and fluid channelways. This sphalerite is probably related to the current white smoker activity at the surface of the mound. Massive, nodular pyrite breccias beneath the white smoker complex may represent an earlier generation of sulfide talus that accumulated on the eastern flanks of the growing sulfide mound.

PROPOSED TAG-3 AREA (South of the Black Smoker Complex)

Hole 957Q was drilled on the lower terrace of the mound about 55m south of the Black Smoker Complex in a water depth of 3657 m. The objectives were to investigate the nature and degree of sulfide oxidation, and the vertical extent of the sulfide deposits in the southwestern quadrant of the mound. Hole 957Q was drilled to a total depth of 14.5 mbsf with 41% recovery.

The recovered cores consist of fine- to medium-grained drill cuttings and several small fragments of pyrite and chert. The drill cuttings are composed of silt- and sand-sized grains and fragments of pyrite, red chert, partially silicified Fe oxides, and trace amounts of chalcopyrite. Geochemical analyses of this material indicate that it is composed of 36.8 wt% S and 33.0 wt% Fe. It has a high Cu content (6.64 wt%), but low concentrations of Zn (0.42 wt%), Ag (5.1 ppm), and Cd (9.2 ppm). These drill cuttings are more pyrite-rich than those recovered from Hole 957B (proposed TAG-2 area - Kremlin area) about 40 m to the east, and are enriched in Fe oxides and chert but depleted in anhydrite relative to the drill cuttings from Hole 957P on the upper terrace to the north of the Black Smoker Complex.

Larger fragments of porous red chert, red and gray chert, and massive porous pyrite were recovered both embedded in the drill cuttings and stuck in the core catcher. Similar material was collected at all locations drilled on the mound, and corresponds to a hard layer of chert just beneath the seafloor. This most likely results from precipitation of silica from hydrothermal fluids diffusing through the mound and forming a silica cap. Physical properties measurements were made on four sections of drill cuttings. Bulk densities range between 2.8 and 3.2 g/cm^3, with the top section exhibiting more variable values and very high magnetic susceptibility values (1200 x 10^{-5} SI). One partially silicified Fe oxide fragment showed a high total porosity of 18.1% and a bulk density of 2.60 g/cm^3.

PROPOSED TAG-4 AREA (West of the Black Smoker Complex)
Holes 957I, 957J, 957K, and 957M were drilled on the upper terrace on the western side of the mound (proposed TAG-4 area). The objectives of drilling at this location were to recover a section through the sulfides and into the stockwork zone in an area of low conductive heat flow (<20 mW/m^2), and to determine the extent of the sulfides and the stockwork on the western side of the deposit. Holes 957I, 957K, and 957M were drilled about 20 m west of the Black Smoker Complex in a water depth of 3645 m. The most complete section was cored in Hole 957M (from 9.3 to 51.2 mbsf) with a recovery of 13.6%. Hole 957K was drilled approximately 5-8 m north of Hole 957M and sampled the section down to 20.0 mbsf with a recovery of 5.0%. Hole 957I was 10-15 m west of Hole 957K and drilled to 9.0 m before coring to 13.5 m with 17% recovery. Hole 957J was 25m northeast of Hole 957I in a water depth of 3647 m, and only one core was retrieved with 1.0% recovery.

Core recovered from the proposed TAG-4 area indicates that the western side of the upper terrace consists mainly of massive sulfide crusts and sulfide-cemented breccias. In addition, there are significantly higher amounts of sphalerite, marcasite, and amorphous silica and lower amounts of anhydrite than in samples drilled elsewhere on the mound. The upper 10 m of the mound consists of porous colloform pyrite + marcasite with red and gray chert, below which is a 10 m thick zone of massive pyrite and massive pyrite breccia with minor sphalerite. A few altered basalt clasts occur in this zone. Between 20 and 30 mbsf, massive pyrite grades downward into pyrite-silica breccia in which larger, silicified wall-rock fragments (up to 10 cm) are abundant. Silicified wall-rock breccias are the dominant lithology between 30 and 42 mbsf, followed by an abrupt transition into slightly to moderately altered basalt, which was drilled down to 51.2 mbsf.

In the top of Hole 957M, fine- to coarse-grained red-brown and orange Fe oxides and minor pyrite and silica were encountered as drill cuttings. Geochemical analyses of this material indicate high Fe contents (up to 52.4 wt%) but low S (4.7 wt%), Cu (up to 0.29 wt%) and Zn (0.28 wt%) contents compared with near-surface drill cuttings recovered from the proposed TAG-2 area indicative of the higher abundance of Fe oxides and Fe oxyhydroxides at the proposed TAG-4 location.

The dominant rock type in the upper 10 m of the section is porous massive pyrite that consists of variable proportions of pyrite + marcasite with colloform banded textures and a coarse vuggy porosity. The colloform texture commonly encloses zones of massive fine-grained pyrite and marcasite, or grades into dark gray pyrite-silica. Minor chalcopyrite occurs as 1-3 mm aggregates associated with silica-rich zones. Minor amounts of sphalerite are intergrown with pyrite and marcasite, and sphalerite is also present as overgrowths on the colloform pyrite. Geochemical analyses of four samples indicate high Fe (38.4-45.7 wt%) and S (41.0-50.8 wt%) contents. Zn concentrations range from 3.0 to 3.7 wt%, which are among the highest values determined, while Cu contents are only 0.05-0.13 wt%. The upper 10 m of core from Holes 957J, 957K, and 957M also contains clasts of red and gray chert, which consist of dark red Fe oxides intimately intergrown with silica, and are similar to those observed in the uppermost hard layer at other drilling locations.

Between 10 and 20 mbsf, porous massive pyrite and massive granular pyrite occur in Holes 957K and 957M. Massive granular pyrite consists almost entirely of granular aggregates of fine-grained pyrite with abundant colloform texture. This rock type seems to have formed by recrystallization of the porous massive marcasite + pyrite, but also incorporates pyritized silicified wall-rock fragments. This lithology grades down into a pyrite-silica breccia that contains numerous silicified wall-rock fragments, that increase in abundance and size between 30 and 40 mbsf until they comprise more than 50%(vol) of the rock. The pyrite-silica breccias are matrix-supported and consist of assemblages of different clasts derived from both surface hydrothermal processes (e.g., cherts) and subsurface alteration processes (e.g., silicified wall rock) in a dark gray pyrite-silica matrix.

Between 30 and 42 mbsf, silicified wall-rock breccias resemble those in the upper part of the quartz-rich stockwork in the proposed TAG-1 and TAG-2 areas, but are generally softer, have greater porosity, lack significant quartz veining, and contain greater quantities of massive pyrite. The breccias consist of angular to subrounded clasts of variably silicified and highly altered basalt enclosed in a matrix of pyrite-silica breccia or porous massive pyrite. The clasts are generally hard and silicified, and contain abundant pyrite disseminated in the matrix. The buff to gray color of the groundmass suggests replacement by chlorite. The siliceous wall-rock breccias are cut by several generations of quartz and pyrite veins. A few pieces of chloritized basalt breccia occur below 34 mbsf, where they are gradational from the silicified wall-rock breccias, and where there is less intensive silicification of the altered basalt material.

Below 42 mbsf, the silicified wall rock and chloritized basalt breccias are underlain by slightly to moderately altered basalts. These basalts are uniformly dark gray, but some have <1 mm red iron oxide/oxyhydroxide coatings on their outer surfaces or display various combinations of 1-5 mm wide, red, black, and green alteration halos around central parts of dark gray basalt. These sparsely olivine phyric basalts appear to be fragments of pillow basalts, as several of the pieces are rimmed with glassy rinds or are holohyaline. Textures range from intergranular to subvariolitic and variolitic. Olivine is partly altered to colorless to pale green to tan smectite, rarely with small amounts of accompanying red iron oxyhydroxide. The groundmass is composed of microcrystalline to cryptocrystalline plagioclase, clinopyroxene, small interstices of variably altered glass, and granular fine-grained titanomagnetite. Vesicles are filled with a light green smectite. Small (10 µm) veinlets of tan smectite are also present in some samples.

Physical properties measurements on sulfides from the proposed TAG-5 area indicate that the porous massive pyrites exhibit a narrow range of high values of bulk density (4.34-4.50 g/cm^3) combined with high values of porosity (8.22%-11.53%). Pyrite- silica breccias have lower bulk densities (3.46-4.38 g/cm^3), which are similar to those of silicified wall-rock breccias (3.51-4.65 g/cm^3). Porosities for these two rock types are in the range 2.86%- 9.09%. The slightly altered basalts have typical bulk densities of 2.88-2.90 g/cm^3, porosities of <2%, and compressional (P) -wave velocities of 6.09-6.13 km/s.

Paleomagnetic measurements were conducted on two basalt samples and indicated NRM intensities (~4 x 10^3 mA/m) much stronger than those typical of oceanic basalts. Based on the magnetic behavior during AF demagnetization, the magnetic carrier is speculated to be titanomagnetite. The stable component of magnetization for both samples has a much shallower inclination (14°) compared with the expected inclination (55°) at this site, suggesting that the magnetization is unlikely to have been acquired during cooling of the basalt but may be related to the pervasive hydrothermal alteration that has affected the TAG hydrothermal mound.

Core recovered from the proposed TAG-4 area indicates that the western side of the upper terrace consists mainly of massive sulfide crusts and sulfide-cemented breccias. Although abundant wall-rock

clasts were recovered, the framework-supported nature of the breccias, the absence of pervasive quartz and anhydrite cement, and the presence of relatively unaltered basaltic basement at the bottom of Hole 957M suggest that this is not part of the high-temperature stockwork. Instead, these breccias appear to be part of a thick talus pile adjacent to the main upflow zone. Measured from the basalt basement, the mineralized talus is at least 20 m thick and is capped by a 10- to 15-m-thick carapace of massive pyrite. This carapace may be either an in situ hydrothermal precipitate, composed mainly of porous and colloform pyrite-marcasite crusts, or primary precipitates that originate from the Black Smoker Complex.

PROPOSED TAG-5 AREA (Northeast of the Black Smoker Complex) Holes 957O and 957P are about 15 m apart and are near the margin of the upper terrace on the north side of the mound about 20-30 m north-northeast of the Black Smoker Complex (this area is designated as the proposed TAG-5 area). The objectives of drilling at this location were to determine the lateral heterogeneity of the sulfide mineralization and to delineate the northern extent of the underlying stockwork zone. The upper part of the section from 0 to 20.5mbsf was cored at Hole 957O, although material was recovered only from 7.9 to 20.5 mbsf. The overall recovery for the entire 20.5-m section was 6.2%; however, between 7.9 and 20.5 m, recovery of 10.1% was achieved. Hole 957P is 15 m west of Hole 957O, and was cored from 0 to 59.4 mbsf with a recovery of 12%.

The overall stratigraphy inferred from core recovered from Holes 957O and 957P is similar to that observed in Holes 957E, 957F, and 957G in the proposed TAG-1 area to the east of the Black Smoker Complex. Massive pyrite and semi-massive pyrite-anhydrite breccias make up the dominant lithology from the surface down to a depth of about 10 mbsf, below which there is a 20 m thick zone of massive granular and brecciated pyrite and massive pyrite-anhydrite breccias. Between 30 and 45 mbsf, this zone grades into pyrite-silica breccias that contain fragments of silicified basalt and extend down to about 55 m. Silicified wall-rock breccias make up the lower part of the cored section. The last two cores from Hole 957P consisted of sand-sized fragments of pyrite, quartz, anhydrite and Fe oxide, which represent drill cuttings. Embedded within them are large fragments of massive granular pyrite, pyrite- silica breccia, and silicified wall-rock breccia.

The upper part of the section is composed dominantly of nodular pyrite and pyrite-anhydrite breccia, similar to those in the anhydrite-rich zone in the proposed TAG-1 area. The hard, cherty layer encountered in the upper few meters in the other proposed areas (TAG-2, TAG-3, and TAG-4) was not recovered at the proposed TAG-5 area. Nodular pyrite breccias are composed of nodular pyrite clasts and angular aggregates about 1 cm in diameter in a matrix of fine sandy pyrite and anhydrite (up to 20 vol%). Geochemical analyses indicate S and Fe concentrations of 45.1 and 33.0 wt% respectively. The Cu content is high (3.7 wt%), but the Zn content is low (0.03wt%). The analyzed sample contains 4.5 ppm Ag, but the concentration of Cd was below the detection limit. The Fe, Zn, Cu, and S contents are within the range of similar samples of the proposed TAG-1 and TAG-2 areas. The pyrite-anhydrite breccias contain nodular to angular clasts of pyrite (as large as 2 cm in diameter) and smaller (<3 mm in diameter) aggregates of chalcopyrite in a matrix of fine- to medium-grained pyrite and anhydrite. Anhydrite composes up to 60 vol% of the rock and occurs in vugs as irregular veins and as matrix.

There is an increase in the proportion of anhydrite and vein-related mineralization below 10 mbsf. Vein-related pyrite-anhydrite breccias have a banded texture and are characterized by fine- to coarse-grained pyrite and chalcopyrite disseminated in anhydrite. Massive granular pyrite is also present associated with the anhydrite veining and pyrite-anhydrite breccias, and consists of pyrite as granular or crustiform banded aggregates and intergrown with chalcopyrite.

Below 30 mbsf, massive, coarse-grained granular pyrite is associated with the pyrite-silica breccias and contains significant amounts of silica. Remnant patches of chert, dark gray silica, and silicified altered basalt material are commonly included within the massive pyrite, suggesting that the rock formed by pyritization of an existing pyrite-silica or silicified wallrock breccia. The pyrite-silica breccia consists of coarse, poorly sorted pyrite aggregates in a matrix of fine-grained dark gray silica with coarse disseminated pyrite. Anhydrite is common, but is confined to vugs and late veining. These breccias contain clasts of an earlier generation of pale-gray, fine-grained pyrite-silica breccia, indicating at least two stages of brecciation.

In Hole 957P, 1 mm to 5 cm round to angular to irregularly shaped clasts of silicified wall rock occur in pyrite-silica breccias from 35mbsf to the bottom of the cor e at 59.4 mbsf. The clasts are replaced by quartz, gray chlorite(?), and 0.1-1 mm pyrite grains and aggregates, and they commonly have 0.5-3 mm rims of pyrite. The matrix is white to dark gray quartz + pyrite. Silicified basalt clasts are also common in massive pyrite matrix at depths greater than 45mbsf in Hole 957P. These basalt clasts are more intensively replaced by pyrite than those in the pyrite-silica breccias. The breccias and massive pyrite containing silicified basalt clasts in Hole 957P contain numerous veins, indicating multiple stages of veining, brecciation, and cementation.

Physical properties measurements were made on 11 sulfide samples from Holes 957O and 957P. Bulk densities range from 3.37 to 5.19 g/cm^3 and porosities from 3.8% to 11.2%, similar to the values measured on samples from the proposed TAG-1 and TAG-2 areas. Electrical resistivities measured on two sulfide minicores are low (0.13 and 0.19 Ω/m) and show the same inverse relationship to porosity as found in samples from the proposed TAG-1 and TAG-2 areas. Compressional (P)-wave velocities measured on the same minicores are 5.4 and 5.8 km/s. Thermal conductivities measured on half-round slabs are relatively high (10.2 and 10.5 W/m K) and comparable to similar measurements made on cores from the eastern side of the mound in the proposed TAG-1 and TAG-2 areas. Paleomagnetic measurements were completed on two pyrite-rich samples from Hole 957O. The NRM intensities of these two samples are comparable with those of samples recovered from the proposed TAG-1 and TAG-2 areas, although the Koenigsberger ratios and the initial magnetic susceptibilities are higher. The anisotropy of magnetic susceptibility (AMS) is similar to that of samples recovered from the proposed TAG-1 and TAG-2 areas as well as the basalt samples from the proposed TAG-4 area, suggesting no significant magnetic anisotropy in these samples.

Vertically directed, drilling-induced magnetization could be removed relatively easily from the nodular pyrite breccia by AF demagnetization. However, AF demagnetization was not sufficient to completely remove this overprint from the pyrite-anhydrite breccia. Similar examples of this behavior are also seen in samples from other TAG areas, and the more heavily overprinted samples are often associated with the presence of anhydrite and also come from relatively deeper sections in the mound. This suggests that the hydrothermal processes that have produced the entire TAG mound may have resulted in distinct zones where precipitates have their own characteristic magnetic properties. These zones are likely to reflect different mineralogical and chemical compositions and hence variable abilities to acquire and maintain magnetic overprints.

The section of the mound cored in Holes 957O and 957P most closely resembles that of Holes 957E, 957F, and 957G in the proposed TAG-1 area. Although the top of the stockwork could not be precisely determined from the core recovered in Hole 957P, the presence of numerous altered basalt clasts and silicified wall-rock fragments below 45 mbsf suggests that a part of the stockwork zone occurs at the bottom of the hole. This is close to the depth at the top of the quartz stockwork in Hole 957E, and suggests that the thickness of the mound beneath the northern part of the upper terrace may be similar to that in the proposed TAG-1 area. The abundance of pyrite as cement and vein material in the lower part of the section at the proposed TAG-5 area suggests that this part of the mound may be

underlain by pyritic stockwork and that the sulfide- rich portion of the stockwork zone extends at least to the northern edge of the upper terrace.

SUMMARY AND CONCLUSIONS

The complex assemblage of rock types that result in the overall stratigraphy of the sulfide mound is a product of its multistage development, and is reflected in the sequences of alteration and veining events that can be distinguished both in the sulfide breccias and in the silicified wall rock and chloritized basalt breccias. Sulfide breccias that are now at the base of the mound were formed at the seafloor during an earlier stage of deposit growth and have since been buried and overprinted by later hydrothermal events. The sulfide breccias likely accumulated at the seafloor through the collapse of large sulfide chimneys and by dissection of massive sulfides along active fault scarps. This debris has been overgrown by later generations of chimneys and progressively cemented or replaced by quartz, sulfides, and sulfates. The presence of altered basalt clasts from the base of the mound higher up in the section may indicate periodic dislocation and partial erosion of the mound/stockwork complex by faults during the growth of the deposit. Alternatively, the basalt clasts may be remnants of lava flows that partially buried the deposit early in its development, or relics of the original pillow talús on top of which the sulfides accumulated.

Results from drilling have enabled some constraints to be placed on the vertical and lateral extent of the stockwork beneath the TAG mound. Although the extent of the stockwork zone beneath the Kremlin area (proposed TAG-2 area) could not be determined, the presence of chloritized basalt fragments in the lower part of the core suggests proximity to a chloritic alteration zone at depth or at the outer margins of the quartz stockwork. On the western part of the mound (proposed TAG-4 area), the outer margin of the stockwork zone may be somewhere between this area and the Black Smoker Complex, and within about 5-10 m of the present high-temperature upflow. Despite their proximity to the present Black Smoker Complex, the wall-rock breccias in this area exhibit only minor replacement or veining by quartz and anhydrite, consistent with having been outside the main upflow zone throughout most of their history. In comparison to the breccias in the proposed TAG-1 area, where the original fragments of basalt have been almost completely replaced, the wall-rock fragments recovered in the proposed TAG-4 area are reasonably intact. However, abundant colloform pyrite and late-stage sphalerite in cavities and veins suggest that low- temperature upflow, possibly originating from beneath the present Black Smoker Complex, has occurred through the flanks of mound and was likely responsible for cementing the breccias in this area.

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JOIDES Lithosphere Panel
Oceanic Plateaus Position Paper

Large igneous provinces (LIPs), voluminous crustal emplacements of predominantly mafic extrusive and intrusive rock, represent a fundamental mode of mantle circulation that is commonly distinct from that which characterizes plate tectonics and sea floor spreading. LIPs are observed not only on Earth, but also on the Moon, Venus, and Mars. They include oceanic plateaus, submarine ridges, seamount groups, and ocean basin flood basalts, as well as volcanic passive margins and continental flood basalts. These intense episodes of igneous activity episodically alter the flux of solids, particulates, volatiles, and heat from the lithosphere to the hydrosphere and atmosphere, possibly altering their physical, chemical, and biological characteristics. Below we address scientific problems and drilling strategies for oceanic plateaus.

Scientific Problems

The major objective of oceanic plateau studies is to describe and understand upper crustal to upper mantle igneous and deformational processes related to LIP emplacement, how they relate to deeper mantle processes and dynamics, how these processes relate to plate tectonic processes, and how emplacements of LIPs relate to major events of global change. Age control is a fundamental prerequisite for addressing most of these issues associated with oceanic plateaus; ocean drilling samples offer opportunities to solve problems involving:

- Mantle behavior. Decompressional melting of mantle material, whether initiated by plumes originating at boundary layers within the earth, by lithospheric plate separation, or from extraterrestrial impacts, is required to produce LIPs. Parental magmas in these various models originate at different mantle depths and follow different time-temperature paths; thus petrological and geochemical studies of drill core samples and estimates of magma production rates will constrain the causes of anomalous melting. Emplacement environments for LIPs range from purely extensional (e.g., Iceland) to intraplate (e.g., Hawaii), and provide clues to their origin, but the original tectonic settings for many LIPs (including the two giants, Ontong Java and Kerguelen-Broken Ridge oceanic plateaus) remain uncertain.

- Lithospheric effects. Various models for the origin of LIPs predict different lithospheric uplift resulting from thermal and dynamic mantle upwelling, different amounts of crustal thinning, and different subsidence histories. Deep LIP basement (500-1000 m) and sedimentary equivalent (moat) samples, in conjunction with high-quality geophysical data, can constrain (i) overall timing of deformation, and (ii) relative timing of elastic response from which strain rate, effective elastic thickness of the lithosphere, flexural rigidity, relative importance of lithospheric reheating, and possible lateral flow of material at deeper levels can be determined.

- Timing of the entire LIP emplacement process. Models for LIP emplacement predict various durations of magmatism and associated lithospheric deformation. Drilling can provide a vertical stratigraphic record in both the volcanic succession and in syn-constructional sediment which constrains absolute and relative ages of uplift, magmatism, and subsidence during LIP emplacement and evolution. Reference holes on older normal oceanic crust will provide evidence for nature of the initial stages of volcanism. Accurate dating of LIPs, in particular their extrusive components, will provide input for correlations and for analysis of causal relationships among large-scale magmatism, changes in the Earth's magnetic field, true polar wander, and hydrospheric-atmospheric physical, chemical, and biological changes.

- Magma character, dimensions, and eruption parameters. Drilling can provide information for characterizing the petrology, geochemistry, and volumes of magmatism. Understanding of the duration, rate and episodicity of volcanism, and eruption style and environment can only be furthered by drilling. Full sampling of the sequence of volcanism by drilling a LIP and its sedimentary equivalents will provide critical information on the petrological and geochemical evolution of magmatism during emplacement, and by inference constrain the thermal and compositional evolution of the underlying mantle. Igneous basement samples can provide information on asthenosphere-lithosphere interactions. Complementary studies of continental flood basalts and submarine LIPs will enhance understanding of both.

- Flux of mass and heat from the lithosphere into the hydrosphere, atmosphere, and biosphere. Intense pulses of igneous activity associated with LIP emplacement affect the physical, chemical, and isotopic character of the oceans and atmosphere to an undetermined extent, with possibly significant effects on the biosphere. Tentative correlations of the pulses with changes in biota, paleoclimate, paleoceanography, paleoenvironment, paleogeography, and sea level require further analysis, to which drill core samples will be a key component, to examine for causal mechanisms. The relative temporal and spatial importances of off-axis hydrothermal circulation and ridge-crest hydrothermal activity need to be established. The thermal and permeability structure of old oceanic and transitional crust invaded by LIP heat sources likely differs from mid-ocean ridges. Therefore the products and consequences of hydrothermal activity in this setting may differ significantly. Oceanic crust underlying LIPs may be fundamentally altered by this hydrothermal activity and might contribute to the flux of seawater-derived components back into the mantle at subduction zones.

Drilling Strategies

Oceanic plateau drilling strategies, detailed in the accompanying table for individual plateaus, address the initiation, emplacement, and post-emplacement phases of their evolution, and the role of these provinces in crustal evolution and global change. Drilling of oceanic plateaus is still in an exploratory phase, and the diversity of plateaus globally suggests that all questions cannot be answered by drilling one or two such features. The two giant oceanic plateaus, Ontong Java and Kerguelen-Broken Ridge, are clear priorities for study because of their large size and potential to impact the physical and chemical characteristics of the Earth. Intermediate-sized oceanic plateaus, whether in relatively pristine (e.g., Wallaby, Manihiki, Hess, Shatsky) or tectonized (e.g., Caribbean) settings, are also of high priority because of their potential global impact. Our initial oceanic plateau drilling strategies focus on determining chronologies and geochemistries of plateau emplacements so that relationships to major events of global change can be examined.

Plateau crust is commonly buried under as much as 1.5 km of sediment; hence, drilling is in most cases the only method of recovering samples of basement rock. Paleontological evidence from the sediment deposited on the plateaus will provide important constraints on the age of these features and their long-term subsidence history. Plateau drilling may be complemented by holes on older oceanic crust away from the LIP; recovered sediment may provide important temporal brackets for igneous activity.

The principal drilling strategy for oceanic plateaus is based on transect sampling, supplemented by holes of opportunity. A drilling transect would normally consist of a series of holes sampling key igneous, sedimentary, and metamorphic rock units, tied to reference holes in normal oceanic crust. Moderately deep (500-1000 m) basement penetration should be achieved to establish the uppermost igneous stratigraphy. Wherever possible, advantageous exposure of deeper crustal sections via tectonic processes (e.g., Kerguelen, Broken Ridge, Manihiki, Caribbean) should be exploited. All drill holes should be continued at least 150 m into the igneous basement to constrain its age, petrology, and geochemistry, and to sample geomagnetic field behavior.

Oceanic Plateau Drilling Summary

	Kerguelen-Broken Ridge	Ontong Java	Caribbean	Shatsky
Type :	Giant Plateau	Giant Plateau	Intermediate-size Plateau	Intermediate-size Plateau
Size :	~2.3 x 10^6 km^2	~1.9 x 10^6 km^2	medium	medium-small
Age :	110-115/85	122/90	88	149?-138?
# Legs :	2	2	1	1
Goals :	age and composition array; deep hole by drilling or offset	age and compositionarray; deepen 807C (now 149 m)	age & compositional progression; deep hole by drilling	age & compositional progression
Characteristics :	continental contamination; original setting among Antarctica, India, and Australia	original tectonics? Malaita and Santa Isabel are uplifted plateau sections; models exist for links to Lousiville	original setting unknown; models link to Galapagos; tectonized, exposed edges; only hi-Mg rocks of any *in situ* oceanic plateau	end of tail? where is active hotspot ?
Drilling Strategy :	Longitudinal, latitudinal, and offset transects together with reference holes in the adjacent oceanic crust. At a minimum, this would involve one site per 100,000 km^2 (i.e. Iceland-size), with at least one site having basement penetration of about 1 km, to test for composition and age variations. The longitudinal transect would be drilled on the normal to magnetic lineations adjacent oceanic crust. Offset holes, drilled where rifts expose rocks from deeper crustal levels would allow construction of a composite igneous stratigraphy for the upper crust, and would help constrain the emplacement duration of volcanism.	same as for Kerguelen-Broken Ridge	Longitudinal and latitudinal transects together with reference holes in the adjacent oceanic crust. Minimal areal coverage should be the same as for the giant oceanic plateaus, resulting in about 5 sites, not including reference holes. Uplift and subsidence history could be addressed by drilling the oldest reef-capped volcanoes.	same as for Caribbean

PUBLICATIONS SUBCOMMITTEE REPORT

Introduction

Due to increasing fixed costs (subcontracts such as SEDCO/FOREX and Schlumberger, and other items such as fuel costs) and a level budget to FY98, in December 1994 PCOM decided that they had to look at ways of reducing expenditure. One of the first areas to be examined was ODP Publications. PCOM set up an ad-hoc subcommittee to examine this task and report back with a set of recommendations for Budget Committee consideration in March 1995 and PCOM in April 1995. The mandate, operation, recommendations and PCOM final actions are outlined below.

Committee Mandate

The ad-hoc subcommittee of PCOM was set up by motion at the 1994 Annual Meeting of PCOM and formally constituted in a letter from the PCOM chair to the individual members of the subcommittee, with the following formal charge:

The subcommittee's mandate is: to investigate various options for achieving an approximately one-third reduction ($600K) in the annual publications budget of ODP by FY98 while at the same time creatively restructuring ODP publications to expedite them and increase their scientific impact. The options are to take advantage of the increasing availability of electronic non-hard copy methods of publication. As much as possible within the time constraints for reporting the subcommittee should seek the advice of the wider JOIDES panel structure.

Executive Summary

Based on the community response to a questionnaire circulated to the JOIDES ODP advisory structure, the subcommittee recommends retaining the basic structure of ODP publications, but reducing both their size and the amount of editing by FY98.

The subcommittee believes that the scientific audience and the impact of ODP science can be substantially enhanced by taking steps to encourage earlier publication of scientific results in the outside literature, and that this should be done even at the cost of fewer and smaller contributions to the ODP Scientific Results volumes. In addition, the committee recommends that ODP underwrite (through salary support for editors) a thematic synthesis series, to be published by various professional societies. Such syntheses would not only reach a more targeted audience, with a commensurably greater impact, but would also demonstrate the effectiveness of the JOIDES planning structure in addressing major scientific themes.

The subcommittee does not recommend replacing ODP publications solely with electronic publication. At present there is only a small established readership for this media in the earth scientific community. On the other hand, it is clear that ODP can lead the way for the earth science community by utilising electronic publication and the distribution of the Initial Results and Scientific Results on CD-ROM to expand its readership and to provide greater accessibility to data. A preliminary investigation, reveals that the added costs for electronic publication, once the SR and IR are prepared for hard copy publication, are minimal.

Subcommittee Operation

A questionnaire to poll the scientific community, circulated via e-mail allowed easy distribution and rapid response. Responses from the panel structure, were sought in general, with additional responses solicited by individual members of the committee for the purpose of improving the total statistical representation of the community.

The questionnaire consisted of all possible options that the committee could think of. It was felt that there would be little purpose to respondents focusing on changes in the publications structure with little impact on cost savings, except where they relate to improving scientific impact. Accordingly the effect of potential changes in publication were roughly costed out, with their downstream impact by year. If current publication commitments are honoured, then cost

TABLE 1: Summary of Questionnaire Results

Total # of Responses: 55, Statistical Margin of Error: ?

	Yes	No
OPTIONS TO CUT PUBLICATIONS COSTS		
1) Shorten IR & SR by 50% with overflow in CD-ROMs	13	4
2) Shorten IR & SR by 50% with overflow in CD-ROMs, but eliminate most of TAMU IR and Barrel sheet edit	8	6
3) As in (2) but keep IR at present length	9	5
4) Abandon IR	0	7
5.1) Abandon SR, substitute a quarterly journal	11	1
5.2) Abandon SR, publish in outside literature	10	0
6) Publish Hole Summary off ship, publish SR later with Site Chapters	14	3
7) As above w/TAMU edit of barrel sheets	0	5
8) Significantly reduce post-cruise edit of barrel sheets	23	2
OPTIONS TO INCREASE SCIENTIFIC IMPACT		
9) Moratorium on publications change to 1 year post cruise with submission of a scientific results paper	14	2
10) Same as (8) without requirement of a submission to the scientific results	4	8
11) Eliminate synthesis papers and publish periodic thematic monographs through an AGU-like organisation	21	2
11.1) Same as (10) but retain some syntheses in SR volume	2	0
12) Publish a Synthesis Volume or Journal	7	0

savings effected by changes in the publications structure only appear incrementally, reaching their full impact in four years. Changes to the Initial Results have the most immediate impact, while changes in the Scientific Results largely only impact FY98 and FY99.

The questionnaire responses were collected by the subcommittee chair, and the results tabulated (Table 1). However, tabulation proved subjective, as respondents generally replied in essay form, and often only indirectly answered the questions posed.

ODP-TAMU Publications staff costed the impact of the recommendations, and presented the savings they potentially represented, their impact on staffing and likely impact on scientific operations at sea and post-cruise. Based on this and further discussion, the committee finalised its recommendations to PCOM.

Recommendations of the Subcommittee

At the outset, the cost savings which the committee needed to achieve were greatly reduced by ODP-TAMU proposing to bring composition of the SR and IR entirely in-house, and the indication that further annual savings would be effected beginning in 1998 with the retirement of a senior manager who would not be replaced.

While the recommendations often presented contradictory views, the perspective of the writers were taken into account and the contradictions pointed to places where flexibility was needed. Thus, in order to attain the savings desired, a single rigid structure for ODP publications was not recommended.

The committee concluded that electronic publication presents a mechanism for increasing the visibility and impact of ODP science. Once the IR and SR are produced in hard copy, the additional cost of going to electronic publication is minimal. Putting the IR and SR on the InterNet, once they are on CD-ROM is a minor cost, and both forms of publication would greatly facilitate global access to results and data. ODP could lead the way in earth science publication by using CD-ROM's and electronic publication to supplement the hard copy IR's and SR's. This also has potential for increasing the utility of data by making it accessible in digital format.

For scientific impact, shortening the moratorium on outside publications, could both raise the scientific profile in the outside literature, and reduce the size of the SR's. Retaining the SR is viewed as critical to the long term scientific impact of the program. Thematic synthesis volumes, with direct salary support for editing was also strongly supported. As regards the deadline for revised manuscripts, we strongly recommend that authors get 3 months from the time of initial receipt of their reviewed manuscript for revision.

Recommendations

The Publications Subcommittee recommends the following changes in Publications Strategy:

A) Related to Reducing Publications Costs

1) Continue with implementation of in-house composition of the IR and SR volumes through the use of newly acquired technology and termination of the external composition sub-contract.
2) Streamline the management structure of the Publication Section. Additional reductions in management should be achieved commensurate with progressive reduction in size and editing of the IR and SR volumes.
3) Reduce the editing at ODP-TAMU of the IR and drafting of barrel sheets and other prime data, requiring a greater percentage of author-produced copy from the ship.
4) More efficient formatting of barrel sheets, including reduction in size of core photos to reduce the number of printed pages by up to 50%.
5) Eliminate the distribution of the Preliminary Results in hard copy, substituting electronic distribution via MOSAIC and the InterNet.
6) Shorten the total length of the SR volumes by 1/3, achieving an average volume length of about 500 pages. This reduction should be achieved by an annual global page limit for SR volumes, with the length of individual volumes determined by negotiation with the Chief Scientists post-cruise and as a consequence of changing the moratorium on outside publications which will likely reduce the total number and length of submitted manuscripts.
7) Require author-produced copy for the SR in electronic format, with editing available at ODP-TAMU only for manuscripts submitted by authors without access to proper facilities for electronic preparation and submission.
8) Reduce the total print run of the IR and SR by providing copies to most panellists on CD-ROM rather than hard copy.
9) Reduce the total number of printed pages in the IR by 50% (to approximately 300 to 400 pages). This would include a maximum of approximately 100 pages of text, involving the printing of only the Co-Chief's leg summary, expanded site summaries with key data tables and figures, operations report, and core photos and barrel sheets. The full IR, including expanded site chapters, explanatory notes, underway geophysics and the engineering report would be included on CD-ROM.
10) If funds should be available, either through additional savings in publications costs at ODP-TAMU, or from other sources, the Subcommittee strongly recommends that the full site chapters be restored to the printed text of the IR.

B) Related to Increasing Scientific Impact

1) Shorten the moratorium on outside publication of scientific papers to 12 months post-cruise with prior submission of an original reviewable manuscript to the Scientific Results.
2) Expand the total circulation and availability of the IR and SR volumes by production of these volumes on CD-ROM in addition to the printed volumes.
3) Make the IR and SR fully available through the InterNet as soon as possible.
4) The production schedule, and flow of manuscripts, should be adjusted to permit authors 3 months after initial receipt of a reviewed manuscript for revision, even if in some cases this requires lengthening of the total production schedule by up to 2 months (38 rather than 36 months post-cruise.
5) Provide for allocation of funds to underwrite the production of two thematic synthesis volumes per year, with up to 3 months salary for the editors of a volume. These syntheses would be published outside ODP (AGU, G.Soc.Lon., AAPG, GSA, EUG and etc.). PCOM should establish an editorial board charged with identifying key themes and individual volume editors to accomplish this task.
6) Provide high resolution digital colour images of the core on CD-ROM as cost-effective technology becomes available, presumably before 1998.

Impact of Changes on the Initial Reports.

The committee's recommendations will reduce the IR to about 300-400 pages with about 100 pages of text. The entire IR, as it is presently constituted will be included on CD-ROM in the back jacket and for separate distribution as a disc or via the InterNet. Hard copy distribution will be as present, except that panellists will receive a CD-ROM unless they specifically request a hard copy for an individual leg. Members of IHP will receive hard copies of all volumes published during their tenure on that committee for review. The CDs will also be made available for purchase through appropriate publishing houses (e.g. NGDC, Boulder, AGU, AAPG, Geological Society of London). The Preliminary Report will no longer be published separately, but the contents of the Summary of the Leg will be made available on a world-wide network as soon as they have been edited. The full contents of CDs could also be made available on the network.

Contents of the Printed Volume:

Summary of the Leg: This will have the length and content of the present Preliminary Report, which will no longer be published separately, but will be available separately for electronic distribution following the leg.

Expanded Site Summaries: These will replace the Site Chapters, which will be placed in their expanded form on CD-ROM. The expanded site summary will include the operations report, the princi-

ple results, with a few key figures and plates.
Key Data Tables: These will contain the shipboard data without interpretation. The co-chief scientists, in consultation with the Shipboard Party, will decide which data should be published as hard copy.
Barrel Sheets and VCD's: We recommend halving the number of pages allocated to these by halving the size of the graphics. The final layout will be evaluated by IHP. In the case of VCD's, even greater reductions in space are possible, through reformatting text and layout.
Explanatory Notes, Site Survey (and other) Papers, and Engineering Report: All of these will be included only on the CD-ROM in their present form.

Time Scale of Implementation
Barrel sheet page reduction: the first IR after IHP/PCOM approval (April 1995). Reduction in Volume size and CD-ROM production to start with IR164. CD-ROM contents should be made available on the World Wide Web as soon as possible after IR164. Colour core photos in CD-ROM by 1998, or earlier if possible. Development of improved barrel sheet software be made an immediate priority for JANUS.

Editing
We recommend that the maximum of preparation is carried out on the ship: for many legs this will mean that the IR will be produced entirely in author-produced camera ready copy on the ship, including barrel sheets and VCD's. For other legs, the IR will be finished at an extended post-cruise meeting at ODP-TAMU by members of the Scientific Party without editorial assistance. Finally, it is recognised that the amount of work required for high-recovery legs is likely to require substantial editing beyond the capabilities of a post-cruise meeting. Additional editing of the prime data will therefore be completed at ODP-TAMU.

We note the following is implicit in our recommendations:
1. Figures and text should come camera-ready from the ship.
2. Until better software is available, barrel sheets should be prepared as camera-ready as possible on the ship (template + all lettering and numbering, but with graphics as overlays to be completed at ODP-TAMU).
3. All editing completed at post-cruise meeting (no galleys thereafter).
4. Immediate consideration should be given to improving barrel sheet software or production methodology.

Since high-recovery legs presently contribute disproportionately to the ODP-TAMU work load, we anticipate that the total work-load for editing for the IR can only be reduced by about 50% without sacrificing the integrity of the volume.

Cost Implications
Savings are made up of:
1. Shortening the IR volume:
2. Halving Barrel Sheet pages:
3. Reducing editorial commitments:
Additional relatively minor costs are made up of:
1. Producing CD-ROMs:

Implications for Impact on the Scientific Community
Positive
1. Greater availability of information.
2. Ability to download information.
3. More rapid dissemination of information.
4. Availability of core photographs in colour (from 1998).
5. Less shelf space for individuals.
Negative
1. Increased burden on shipboard party.
2. Removal of printed text may produce problems in long-term archival.
3. Reduced resolution of core photographs in the Volume.
4. CD-ROM publications may be less acceptable to authors than Volume publications (especially for Site Survey papers).

PCOM Discussion
PCOM discussion concerning the Scientific Results Volume was in favour of retention; it was generally acknowledged that its total value was greater than the sum of its parts. PCOM passed Motion 95-1-10, recommending retention of a modified Scientific Results volume.

PCOM Motion 95-1-10
PCOM recommends to JOI retaining a modified Scientific Results volume noting that the volume serves several essential roles within ODP, including:
- *It comprises a critical portion of the legacy of the drilling program.*
- *Production of the SR is part of the contractual relationship between ODP and the shipboard scientists, and serves as a vital management tool for co-chiefs in assembling a complete report within a reasonable period following the cruise.*
- *The SR is an essential part of the scientific visibility of ODP.*

PCOM were told that IHP basically agree with many of the publication subcommittee's recommendations and the panel re-iterated the "legacy" value of the volumes. However IHP are concerned about the recommendation to reduce post-cruise editing, currently standing at about $2\,^1/_2$ FTE effort per volume. ODP-TAMU confirmed that if PCOM endorsed electronic publication, they would implement this as soon as possible, although they suggested a step-wise move towards any changes since not all of the community have access to the InterNet.

PCOM decided that it would be appropriate for financial support for the editing of the recommended thematic synthesis volumes to come from national agencies rather than commingled funds, and the PCOM Chair has now written to those agencies outlining PCOM's position.

PCOM then passed on Motion 95-1-11, concerning the recommendations of the JOIDES PCOM Sub-committee on Publications Report. PCOM congratulated ODP-TAMU staff on the creative way that they had helped in this review

PCOM Motion 95-1-11
PCOM recommends to JOI that it advise ODP-TAMU to implement the recommendations of the JOIDES PCOM Sub-committee on Publications Report with the following provisos:
- *A) A stepwise implementation of the conversion to publication of both the Science Prospectus and the Preliminary Results in electronic form.*
- *B) That ODP-TAMU recommend to co-chief scientists that they should consider writing a Leg summary which addresses the Leg objectives, rather than a synthesis for the Scientific Results in order to save space for original scientific contributions related to the Leg.*
- *C) Only authors who require special English language assistance or who have no access to the medium for electronic publication should receive editorial support for the Scientific Results .*
- *D) That the period for revision of manuscripts for the Scientific Results will be 10 weeks, with only rare exceptions, at the discretion of the Manager of Science Services at ODP-TAMU.*
- *E) The resolution of digital core photos to be included on the CD ROM as specified in report item B6 should be negotiated between ODP-TAMU and IHP, with considerations given to reasonable and practicable costs and space.*
- *F) Editing of the Initial Reports at ODP-TAMU for VCD's and barrel sheets be retained, but otherwise require a greater percentage of author produced copy from the ship for tables, graphics and text.*
- *G) PCOM accepts the recommendation for thematic synthesis volumes, but recommends that non-commingled funds be used to support this activity from the appropriate national committees. PCOM recommends that these funds may be used either for salary support or for other costs related to the editing of the volumes.*

ODP WIRELINE LOGGING SERVICES

Borehole Research Group, Lamont-Doherty Earth Observatory, Palisades NY 10964

ODP WIRELINE LOG DATABASE

The ODP Wireline Log Database comprises data through Leg 160, including both original and processed data, conventional Schlumberger logs and speciality tools (borehole televiewer, multichannel sonic, and temperature), borehole images and sonic waveforms. The entire database is catalogued through a Macintosh-based system which is updated routinely and which allows for the information about the logs recorded at each hole to be easily accessed. In addition, the data management program contains information on over 1,200 data requests fulfilled to date.

WIRELINE LOG DATA DISTRIBUTION POLICY

Data distribution onboard. All of the logging data acquired on each ODP Leg are available onboard to each member of the scientific party. A form to request analog/digital data is distributed onboard or mailed to each scientist after the end of the Leg.

Currently, digital data is available onboard in two formats: DLIS or ASCII. The latter is available for conventional logs only, such as acoustic, nuclear, geochemical, and electrical logs. In addition, processed Formation Microscanner data are made available as soon as possible after preliminary processing. Starting with Leg 149 and the installation of MAXIS onboard, the DLIS format has replaced the LIS format; for those scientists who will not be able to read the new format, a conversion program is available at LDEO-BRG to perform the translation.

Data distribution on-shore. The original logging data is available at the well log data repository about 3 weeks after the end of the cruise. Each data request must be made using the appropriate form, specifying log type and format.

Schlumberger Data. Schlumberger digital data include conventional (acoustic, nuclear, geochemical, electrical) and Formation MicroScanner logs. The original, unshifted and unprocessed data is available in LIS/DLIS format. The processed conventional logs are available in LIS (on 4 mm DAT or 9-track magnetic tape) or ASCII format (on 3.5" floppy disk). Schlumberger sonic waveforms are available in LIS/DLIS or ASCII format (on 4 mm DAT or 9-track magnetic tape). Conventional logs are also available in analog form at the metric scale 1:500.

The processed Formation MicroScanner/Dipmeter data are available in LIS (on DAT tape; Legs 129-140 and 143 on), ASCII (Dipmeter data only; on 3.5" diskette, Legs L35-140 and Leg 143 on), and PBM formats (on DAT tape; Leg 139 and Leg 143 on). Formation Microscanner/Dipmeter data are also available in analog format at two different scales (metric 1:6 and 1:40).

Other Data. Multichannel Sonic data are available in BRG or binary format (on 4 mm DAT or 9-track magnetic tape). Analog Borehole Televiewer data are available in analog form only (Xerox copies of original Polaroid photographs); Digital Borehole Televiewer data are available on TK50 cartridges. Temperature data are available as ASCII files of temperature and pressure versus time or depth.

CD-ROM. Starting with Leg 143, the processed well log data is available on CD-ROM as well (a Leg 139 CD-ROM will be soon available as well). The ODP-BRG CD-ROM includes:

- processed FMS data in LIS (Log Information Standard) format (Leg 143 only)
- FMS image raster files in PBM (Programma -ble Bit Map)
- dipmeter data (ASCII format)

- conventional logs (ASCII format)
- sonic waveforms (ASCII format, Leg 152 on)
- BRG temperature tool data (ASCII format)
- text/documentation files (ASCII format)

Note that all of the above data are available free of charge to members of the scientific community. Any request, however, not conforming to the standards listed in the request form (ex. particular graphic presentation, multiple formats or media for the same dataset, etc.) will be subject to charge.

As of June 1, 1994, any initial data request must be accompanied by a statement of work explaining the intended use of well logs in that particular research. In addition, any subsequent request will have to be accompanied by documentation (such as a list of published papers) of any previous application of well logs.

The scientific community at large has access to the logging data a year after the end of each leg. Interested scientists, however, can obtain the logging data before the 1-year moratorium upon approval of the co-chiefs and the shipboard party; like the rest of the shipboard party these scientists will have the obligation of submitting a scientific or data report for the ODP Scientific Results volume.

Data can be requested at the address indicated above or through electronic mail. Scientists who request significant amounts of data are required to provide the medium (tapes, floppies etc.) necessary for the duplication.

Any request of data from commercial firms (ex. oil companies, consulting agencies etc.) should be addressed to the National Geophysical Data Center in Boulder, Colorado, where the unprocessed data are sent after the one-year moratorium.

WIRELINE LOG DATA REQUESTS AND COMMUNICATIONS VIA ELECTRONIC MAIL

The Borehole Research group can receive data requests and queries electronically over **InterNet**. Lamont-Doherty has a T3 class connection to the InterNet so data file transfer over the net is a practical option in addition to handling electronic mail. Data transfer via **ftp** can be arranged. The primary contact points for outsiders are the following:

- **borehole@ldeo.columbia.edu** (general purpose account)
- **chris@ldeo.columbia.edu** (Cristina Broglia, Data Services Supervisor, fordatabase and log analysis related questions)
- **barnes@ldeo.columbia.edu** (Deborah Barnes, Database Assistant and Information Services Coordinator, for CD-ROM and home page related questions)
- **beth@ldeo.columbia.edu** (Elizabeth Pratson, Senior Log Analyst, for log analysis related questions)
- **sbrower@ldeo.columbia.edu** (Susan Brower, Database Assistant).

JOIDES Journal Evolution

This article is to update you on the evolution of the JOIDES Journal, a process began by an effort to reduce the overall costs of the program. As readers will be aware, in the last issue we enclosed a postcard questionnaire to ask what information readers considered essential to receive in printed form and what you would like to see available electronically.

We plan to publicise the results of this survey in the October issue of the Journal. So far we have received just over 100 replies, from a Journal circulation of several thousand. So if you feel strongly about the evolution of the Journal, get your responses in by early September.

We have already made strides toward electronic publication of the Journal, it can be viewed on-line via the JOIDES Office World Wide Web home home page on

http://servant.geol.ac.uk

At present the home page is still under development, and many of the Journal figures are omitted because they were supplied to us on paper, if authors could use electronic format, we can then easily include them in the next issue. We do plan to scan the 'missing' images for insertion into the electronic Journal in time.

Core Descriptions Working Group

This Working Group evolved from a Shipboard Measurements Panel recommendation (95-6) after a joint meeting between this panel and the Information Handling Panel, and taking account of input from the thematic panel liaisons. The SMP decided that in order to lay the groundwork for the JANUS project user group concerned with Item 4b - "Sediment Description and Structural Description" it will be important to discuss this problem in greater detail prior to establishing a "user group".

The JOIDES Working Group on Core Sediment and Structural Descriptions will gather together a selected group of specialists at ODP-TAMU. There was a general recognition that this Working Group needed to be something more than a meeting of structural geologists to prepare a laboratory manual. There is the additional need for frequent communication with JANUS steering committee and TRACOR. The need for both TAMU and TRACOR representation made the venue of College Station most efficient.

The April PCOM motion (95-1-20) recommended to JOI the formation of the Working Group and spelt out it's desired composition of 2sedimentologists, 2str uctural geologists, 1palaeoceanographer, 1SMP representative, 1T AMU representative, and 2petr ologists. The Chair of the Working Group is Kevin Brown from Scripps, other members of the Working Group can be found on p.48.

The mandate of the group is to cover the whole issue of improved shipboard core description in ODP, including scanning techniques, with the Working Group paying particular attention to getting appropriate data into the JANUS database efficiently for the scientists at sea. In addition an outline manual for core descriptions (a "cook-book") should be recommended along with procedures and people identified to complete that job.

Specifically the working group has two production goals :

1) A Report that spells out recommendations for shipboard core description procedures, that can be endorsed by SMP and PCOM, and used as a template/advice for the JANUS Project;

2) A draft Core Descriptions Manual for shipboard use. This should at minimum include a detailed contents list, working group members responsible to complete the sections, and provide a timetable for finalisation.

The workshop will consult with a representative of TRACOR on the issues of compatibility with the database.

The JOIDES SMP and IHP expect to receive this report and a draft of the Manual at their September meetings, and copies will also be circulated to other panel chairs. PCOM will review the report and their input in December.

International News, Meetings and Announcements

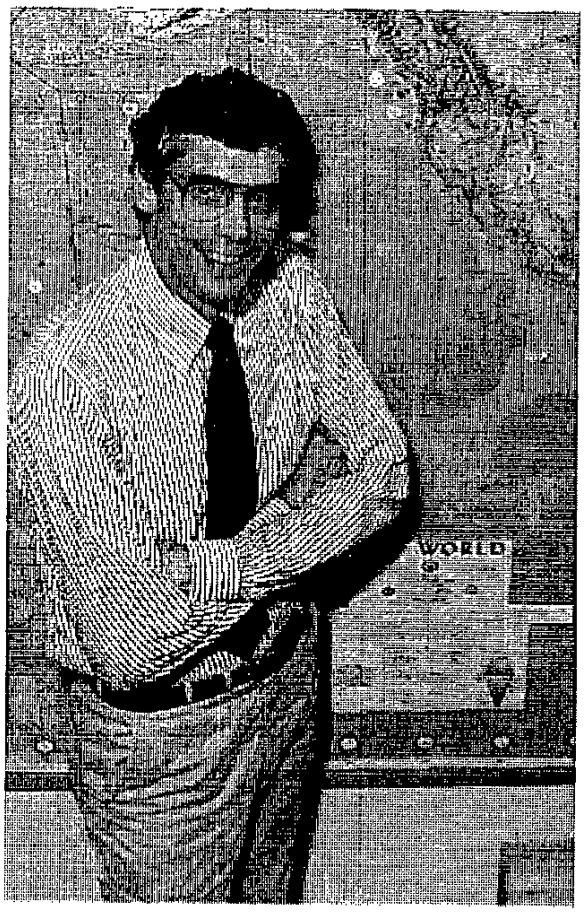
New Director at ODP-TAMU

Dr. P Jeff Fox has been appointed as the new Director of ODP-TAMU, College Station. He took up his new position with effect from 1 June 1995 after a very successful period in the Graduate School of Oceanography of the University of Rhode Island.

Jeff is well known through out the marine geoscience community, having begun his career in the mid 1960's at the then-named, Lamont-Doherty Geological Observatory, before moving on to the State University of New York at Albany between 1971 and 1981, after which he moved on to the University of Rhode Island.

His main research interests are the processes of oceanic lithosphere creation long mid-ocean ridges, using a wide variety of investigative techniques and equipment such as multibeam bathymetric mapping and sidescan sonar, underway geophysical sensors, and submersibles.

Jeff has a long history of involvement with ocean drilling, and was on the steering committee for COSOD II, and more recently a member of the ODP East Pacific Rise Detailed Planning Group (DPG), the ODP Deep Crustal Drilling DPG, and until he moved to ODP-TAMU, he was the URI member of the JOIDES Planning Committee.



Dr P Jeff Fox, the new Director of ODP-TAMU.

PORT CALL NEWS --- Napoli, Italy

The JOIDES Resolution was in Napoli, Italy, between ODP Leg 160 dedicated to the eastern Mediterranean, and Leg 161, dedicated to the western Mediterranean, May 3-6, 1995. This was the first port call ever in Italy since the beginning of the Deep Sea Drilling adventure and there was much expectation in the scientific community to have the opportunity to visit the ship, her equipment and laboratories.

The Italian Commission for ODP and the Committee for Earth Sciences of CNR (Consiglio Nazionale delle Ricerche), the funding agency, met in Napoli in occasion of the port call.

A press conference was organized on the ship on May 5, with presentations of the Program in general and of the Mediterranean scientific objectives in particular by B. D'Argenio, C. Panichi, M.B. Cita, and M. Comas. A rich buffet was offered on board the ship.

GEOMARE Sud organized a number of very successful visiting tours in the afternoon of May 5 and during the following day. Approximately 700 people visited the ship including Military Autorities (Navy, Army, NATO), Town Autorities, members of CNR-ODP Commission and CNR Earth Science Committee, professors and students from several Italian universities, researchers from Research Institutions, and high school students with their professors.

The last visitor was the Minister for University and Research, Prof. Giorgio Salvini, who made a long tour personally guided by Jack Baldauf acting as Deputy Director of the Program. Several articles reporting the ODP program were published in local, national and scientific press.

The End of a Successful Experiment

Jürgen Wohlenburg, RWTH, Aachen

The German Continental Deep Drilling Project (KTB) officially ended on 1 December, 1994. The main hole (KTB-HB) reached a final depth of 9101 m with an open hole section of 70 m. After the end of the drilling operations, a couple of major geophysical experiments were carried through, some of which involved the reopened 4001 m deep pilot hole (KTB-VB). An electrical dipole-dipole experiment was conducted with one dipole at a depth of 3950 m in KTB-VB and a second dipole simultaneously operating at a depth of 9050 m in KTB-HB. Radial surface profiles were observed at a distance up to 40 km. The successful experiment aimed to investigate the nature of a good electrical conductor which was identified already during the pre-site surveys of the KTB project. Highlight of the final downhole activities was a hydraulic fracture experiment to quantitatively determine the direction and magnitude of the in situ stress filed. During the fracture operations the induced seismic activity was recorded with a seismic array placed around the drill site and one geophone at a depth of 3860 m in the open hole section of the KTB-VB. More than 300 seismic events were recorded and are now being studied in detail.

There are no further experiments planned in 1995. Long term experiments in the twin boreholes are scheduled for 1996 in the frame of the down-hole observatory project.

The scientific research program which always ran parallel to the drilling- and downhole-operations which was sponsored mainly by the German Research Foundation (DFG) will be ending in 1996. Activities include about 50 geoscientific projects conducted at University Institutes and the KTB field laboratory at the drill site in Windscheschenbach.

It is hoped in the German geo-community that the KTB activities will end up as an integral part of an International Continental Deep-drilling Program (ICDP) to come.

CARDIFF goes on-line !

The JOIDES Office is Cardiff invites you to browse their World Wide Web home page

It is still under development, but can already be used to download Panel Minutes (as rtf files) and to view the JOIDES Journal Volume 21, No.1 (Feb 1995), and has links to ODP-TAMU.

Future plans are to link to all the main sub-contractors and to include all the JOIDES Directory information and the JOIDES Calendar, and active ODP proposal information.

Please visit our home page and send any comments to me by clicking on my name at the bottom right of the home page.

The home page of the JOIDES Office is available through the Department of Earth Sciences at the University of Wales server on

http://servant.geol.cf.ac.uk

German ODP Colloquium

ODP Germany continues to receive great attention as well as broad support from the earth science community in Germany. The German ODP Colloquium which was held from 1 - 3 March this year in Munich saw an attendance of 150. Representatives from the Federal Ministry BMBF, DFG, ODP Science Operator, researchers, students and news media saw 30 lectures, 32 posters and lively discussions. Reports came from DFG and BMBF, and ODP panel members.

Back to back with the colloquium the German InterRidge group (DeRidge) met in Munich in order to have a good co-ordination with the lithosphere and tectonics research projects within the DFG Priority Programme ODP / DSDP.

The next German ODP Colloquium will be held early March next year in Oldenburg, possibly as a Joint European ODP Colloquium.

Don't Forget....
The next Proposal Deadline is 1st Jan 1996

AVAILABLE NOW

DSDP / ODP RADIOLARIAN COLLECTION

Eight sets of DSDP/ODP strewn slides have been prepared from about 3,000 core samples chosen for radiolaria from important sites drilled during the Deep Sea Drilling Project. These have been made available to the scientific community at eight Micropaleontological Reference Centers (MRCs) geographically selected for world coverage.

To increase the usage of one of these sets, ODP proposes to offer it on loan to an institution that can show an expertise in the field of deep sea radiolaria. The proponent institution must demonstrate a willingness to curate and make available this collection to specialists from the scientific community and should provide space, microscopes, a computer, and a collection of DSDP/ODP volumes for the visitors to use. They should also suggest contributions that they can make towards the general improvement of the MRC collections. Possible contributions include: (1) play an active role in selecting additional samples to improve the coverage of the collections; (2) play an active role in development of image database(s) under the guidance of the JOIDES Information Handling Panel; and (3) contribute toward the preparation of the MRC samples.

Further information can be obtained from :

Brian T. Huber,
Smithsonian Institution, MRC 121,
Washington, D.C. 20560
phone: (202) 786-2658
fax: (202) 786-2832
e-mail: MNHPB007@SIVM.SI.EDU

AVAILABLE NOW

DSDP / ODP FORAMINIFERAL COLLECTION

Eight sets of DSDP/ODP foraminiferal sieved residues have been prepared from more than 4,000 core samples chosen from important sites drilled since the beginning of the Deep Sea Drilling Project. These have been made available to the scientific community at eight Micropaleontological Reference Centers (MRCs) that have been geographically selected for world coverage.

To increase the usage of one of these sets, ODP proposes to offer it on loan to an institution that can show an expertise in the field of deep sea foraminifera. The proponent institution must demonstrate a willingness to curate and make available this collection to specialists from the scientific community and should provide space, microscopes, a computer, and a collection of DSDP/ODP volumes for the visitors to use. They should also suggest contributions that they can make towards the general improvement of the MRC collections. Possible contributions include: (1) play an active role in selecting additional samples to improve the coverage of the collections; (2) play an active role in development of image database(s) under the guidance of the JOIDES Information Handling Panel; and (3) contribute toward the preparation of the MRC samples.

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phone: (202) 786-2658
fax: (202) 786-2832
e-mail: MNHPB007@SIVM.SI.EDU

MEETING ANNOUNCEMENT AND CALL FOR PAPERS

THE GEOLOGICAL EVOLUTION OF OCEAN BASINS RESULTS FROM THE OCEAN DRILLING PROGRAM
BURLINGTON HOUSE, LONDON, ENGLAND,UK
OCTOBER 18 - 19, 1995

Convenors: Drs. Adrian Cramp and Chris MacLeod (Dept. of Earth Sciences, UWCC) and Dr. John Jones (Dept. of Geological Sciences, UCL)

Sponsored by: Marine Studies Group, Geological Society London, Challenger Society

This meeting is designed to bring together a wide range of international geoscientists who have current, recent research interests in the geological evolution of ocean basins and climate fluctuation. The two day meeting will be arranged into thematic sessions each of which will be introduced by keynote speakers.

Expressions of interest and/or contribution abstracts (talk/poster) should be sent to Dr. Adrian Cramp, Marine Geosciences Research Group, Dept. of Earth Sciences, UWCC, PO. Box 914, Cardiff CF1, UK. Telephone: +44 (0) 1222 874335. FAX: +44 (0) 1222 874326. E-Mail: cramp@cf.ac.uk.

5TH INTERNATIONAL CONFERENCE ON PALEOCEANOGRAPHY

HALIFAX, NOVA SCOTIA, CANADA
OCTOBER 10 - 14, 1995

Convenors: Larry Mayer and Frank Rack, University of New Brunswick, and David J. W. Piper, Bedford Institute of Oceanography.

Sponsored by: The Geological Survey of Canada, Scientific Committee on Ocean Research (SCOR), and the Natural Sciences and Engineering Council of Canada (NSERC)

The International Conference on Paleoceanography (ICP) has, since its inception, been the premier forum for the presentation and discussion of exciting and timely topics in paleoceanography and paleoclimatology. The previous conferences have been held in Zurich (1983), Woods Hole (1986), Cambridge (1989), and Kiel (1992). These meetings have always attracted a large number of researchers and students representing all segments of the paleoceanographic community. The theme of the ICP-V will be LINKAGES - the role of paleoceanographic linkages in the global system. In keeping with ICP tradition each session comprises two or three invited overview talks and contributed poster sessions.

CONFERENCE THEME: LINKAGES

SESSION THEMES

ICE CORES - Atmosphere - Ocean - Climate Links. e.g. recent or past results from ice core studies on Greenland, Antarctica, or other regions (China, Peru, etc.); other interactions and linkages.

MODELLING - Links between past, present and future. e.g. ocean, ice, atmosphere, biogeochemical models, GCM's, sensitivity studies, climate simulations on varying timescales, sedimentary basin evolution and subsidence models (using downhole geophysical, seismic, or core data).

NEW TOOLS & PROXIES - Link between past and present processes. e.g. isotopic tools and proxies, biostratigraphic or palynologic tools and proxies, geochemical and biogeochemical tools and proxies, sedimentologic tools and proxies, geophysical (downhole) tools and proxies; data visualization and analysis tools.

OCEAN FLUXES - The up and down links. e.g. geochemical cycles and budgets, hydrothermal and ridge crest processes, sediment trap studies, JGOFS, and paleoproductivity.

TECTONIC & CLIMATIC LINKAGES. e.g. climatic or paleoceanographic responses to opening/closing of tectonic gateways, uplift/erosion of mountain ranges or tectonic blocks, linkages between seafloor spreading and/or mantle processes and climate.

LAND - OCEAN LINKAGES. e.g. glacial discharge to the oceans, studies of the hydrologic cycle, river fans and deltas, lake studies, varves and tree rings, palynology, land-ocean biogeochemical cycles and budgets.

TIMESCALES & STRATIGRAPHIES - The unifying link. e.g. magnetic polarity reversals, Milankovitch cycles, astronomic tuning and spectral analysis, isotopic and biostratigraphic timescales and stratigraphy.

ARCTIC & ANTARCTIC RECORDS & LINKAGES. e.g. Arctic or Antarctic geology and geophysics, bipolar comparisons, Arctic or Antarctic oceanography, ODP drilling, or results from other research activities in the Arctic or Antarctic regions.

HIGH & LOW LATITUDE RECORDS & LINKAGES. e.g. comparisons within individual ocean basins, between basins or interhemispheric comparisons, El Nino/Southern Oscillation, coral records, ocean-atmosphere teleconnections, tropical to polar linkages.

MEETING LOCATION

All meeting functions will be held on the campus of Dalhousie University in Halifax. Oral presentations will be given at the Rebecca Cohn Auditorium. Posters and Exhibits will be located in the Dalhousie Student Union Building, across the street from the auditorium. The conference will begin on Monday evening with a welcome reception at the Chateau Halifax Hotel. Pre-conference registration will be held Monday, October 9, at the Chateau Halifax Hotel from 1200 to 2100 h. On-site registration will be available at the Rebecca Cohn beginning at 0800 h daily. On Friday afternoon, there will be no formal sessions but a series of Field Trips are offered. The meeting will end at 1800 h on Saturday, October 14.

SUBMISSION OF REGISTRATIONS

Registrations will be accepted in both Canadian and US funds. The only credit card which will be accepted is Visa. Persons paying by Visa will be invoiced at the exchange rate at the time of processing. Attendees paying by check must use the amounts listed on the Registration form. Direct Bank Deposits (wire transfers) may be made to Lewis International Inc: Bank of Montreal, Halifax Main Branch, 5151 George Street, Halifax, NS, B3J 2M3 - Bank Transit # 00093 001 88045591. All Registrations will be acknowledged, when possible, by e.mail. A formal receipt will be given to all attendees in their registration packages.

Registration Fees

Registration fees after June 15, 1995 will be CAN$350 (US$290) for professional registrants, and CAN$125 (US$105) for students.

There will be a fee of CAN$60 (US$50) for persons wishing to withdraw abstracts or registrations after June15, 1995. Persons wishing to cancel must do so in writing. The registration fee is non-refundable unless request forms are postmarked before September 10, 1995.

POSTERS

Poster boards will be 2.4m horizontal x 1.4m vertical in size. Poster sessions will be held in the MacInnes Room and surrounding areas of the Dalhousie Student Union Building (SUB). Posters will remain on display for 48 to 72 hours depending on the number of posters submitted to the conference and available space.

All special requests (i.e., rental of VCR, TV, audio systems, computers, provision of power outlets, and tables, etc.) related to the presentation of individual posters should be made at the time that the abstract is submitted. Any costs will be billed to the abstract author.

EXHIBITS

Commercial exhibits will be set up on Monday, October 9 in the Dalhousie Student Union Building (SUB) Green Room. There will be an Exhibits Open House (open concession stand and no host bar) at the Dalhousie SUB on Tuesday, October 10, from 1730 to 1900 h. Exhibits will be taken down and removed on Saturday, October 14, after 1700 h.

EVENTS

Conference Dinner

There will be a traditional Maritime Lobster Dinner at Pier 22, in Halifax, on Wednesday, October 11, from 2000 to 2300 h. Cost is CAD$50 (US$40) / person. Attendees are asked to book in advance when submitting your registration.

Field Trips

A two day field trip on the glacial history of Nova Scotia, is scheduled for October 7 & 8, 1995. A one day field trip to see the Bay of Fundy Tides is scheduled for October 9 and 15. A two day Coastal Geology Kayak Trip is scheduled for October 5 & 6. On Friday afternoon, October 13th there will be no formal sessions and a number of field trips and special interest excursions have been planned, including: Cape Split Hike, Glacial history of Nova Scotia, Coastal geology and scenery, and Historic homes. Please see the enclosed details on the reverse of the registration form for all field trips. Registration and full payment for field trips should accompany your Meeting Registration Form.

Paleomusicology Concert
There will be the customary evening concert by participants in the conference and members of the local music community on Thursday evening at 2100 h at the Rebecca Cohn Auditorium. Admission is free. Those interested in participating in this concert should contact Keith Louden at: Phone: 902-494-3452, Fax: 902-494-3877 or e.mail: keith@papa.ocean.dal.ca.

Tourism Booth
An on-site booth will be present for those attendees wishing toplan special tours during their stay.

AIR TRAVEL & GROUND TRANSPORTATION

Special air fares and ground transportation to and from the Halifax International Airport and downtown Halifax hotels, have been arranged for attendees by Fraser & Hoyt Travel Agency.

Special air fares have been arranged through Air Canada, Continental and United Airlines. To receive conference rates please indicate the conference number, which is CV950488, when making reservations either through your local travel agency or contact Fraser & Hoyt Travel Agency.

There will be an ICP-V Information Booth located at the airport if you arrive at the airport on October 9th. Please report to this booth for instruction on ground transportation. Bus vouchers to the hotels will be sold at this booth. Persons arriving on other dates will find a Tourism Information booth located in the Baggage Claim area of the airport. Cost of bus fare to and from the airport and downtown hotels is approximately $10.

For reservations or additional information within Canada call Fraser & Hoyt Travel at 1-800-565-8747 or Air Canada at 1-800-361-7585. For International Delegates call Fraser & Hoyt Travel collect at 1-902-421-1113. Other Air Canada numbers: Frankfurt 25 01 31; Geneva 731 4980; London 081 7592636; Paris 1 43201200; Vienna 0222 5861909; and, Zurich 2110777.

Travel Awards
Limited travel awards from SCOR and other sources are available for active scientists from developing countries and the former Soviet Union. Requests for funding should be sent to Trudy D. Lewis at Lewis International (address on page 7).

Weather
Halifax in October is generally cool (15C) and sunny by day. Evenings tend to be somewhat cooler (0-10C). Be prepared for the possibility of heavy rain.

Banks
All Banks are closed on Saturday, October 7, Sunday, October 8, and Monday, October 9. There are INTERAC Banking Machines located at the Halifax International Airport, Dalhousie Student Union Building and at several downtown locations. There is a Foreign Exchange at the airport, open from 0600 to 2100 h.

OTHER MEETINGS

Organizations / companies / persons who intend to hold business meetings in conjunction with the ICP-V are requested to contact Trudy D. Lewis as soon as possible. In planning your travel, take note of the following meetings which will be taking place in Halifax around the same time as ICP-V. Canadian Coastal Conference - Oct 18-21, Glacial-Marine Sediment Workshop (Coldseis) - October 15-16, ODP Leg 154 Post Cruise Meeting October 7-9.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Trudy D. Lewis
Lewis International Inc
Richmond Terminal, Pier 9
3295 Barrington Street
Halifax, NS Canada B3K 5X8
Tel: 902-492-4988
Fax: 902-492-4781
Internet: ICPV@predator.ocean.dal.ca
Aussi disponible en francais

OR

Larry Mayer or Frank Rack
Ocean Mapping Group
Dept Geodesy & Geomatics Engineering
University of New Brunswick
Fredericton, NB Canada E3B 5A3
Tel: 506-453-4698
Fax: 506-453-4943
Internet: ICPV@predator.ocean.dal.ca

GENERAL SCHEDULE OF THE MEETING

Except as noted, sessions and events will take place at the Rebecca Cohn Auditorium and the student Union Building, Dalhousie University.

Monday October 9
1800-2100 Welcoming reception, Chateau Halifax

Tuesday October 10
0900-1200 Time scales and stratigraphies
1400-1700 New tools and proxies
1730-1900 Exhibits Open House

Wednesday October 11
0900-1200 Tectonic linkages
1400-1700 Land-ocean linkages
2000 Lobster Dinner, Pier 22

Thursday October 12
0900-1200 Ocean fluxes
1400-1700 Modelling
2100 Paleomusicology concert

Friday October 13
0900-1200 Arctic and Antarctic records and linkages
1200-1800 Field Trips

Saturday October 14
0900-1200 Ice cores
1400-1700 High and low lat. records and linkages

Field Trips
Field Trips have maximum and minimum capacities and may be canceled if minimum not met. Please register early.

#1 Cape Split Hike - Cape Split is a promontory of Triassic Basalts dividing the Minas Basin and Bay of Fundy. The 8-km-round-trip hike offers spectacular and rugged panoramas. The trail is moderately difficult and requires sturdy walking shoes. Half-day trip; lunch and transportation included. Cost is CAN$40 or US$35/person.

#2 Glacial History of Nova Scotia - This trip will go out to coastal exposures of drumlins at Lawrencetown, showing how sea-level rise has affected erosion of glacial deposits and evolution of beaches and lagoons. Half-day trip; lunch and transport included. Cost is CAN$40 or US$35/person.

#3 Coastal Scenery - St. Margaret's Bay and its coastal land forms are the focus of this trip. Starting at the scenic sandy beaches of Queensland and ending at the wave-swept granites of Peggy's Cove, this excursion provides access to some of Nova Scotia's beautiful coast. Half-day trip; lunch and transport included. Cost is CAN$40 or US$35/person.

#4 Historic Homes - Nova Scotia is blessed with many heritage properties. On this trip, four beautiful homes will be toured. Half-day trip; lunch and transport included. Cost is CAN$40 or US$35/person.

#5 Glacial History of Nova Scotia - This trip will examine coastal drumlin exposures. It will finish with a tour of stage 5e shorelines near scenic Arisaig. Two-and-a-half day trip from October 6 - 8; meals, lodging and transport included. Trip is limited to 30 people. Cost is CAN$250 or US$210/person.

#6 & #7 Bay of Fundy Tides - This 1-day trip will tour the shores of the Bay of Fundy, a stunning macrotidal estuary boasting the highest tidal range in the world. Erosional and depositional features related to the tides (cliffs, mudflats, sedimentary structures) will be examined, and the tidal range and dramatic tidal bore will be observed. One-day trip on October 9 and /or 15, depending on demand; lunch and transport included. Cost is CAN$66 or US$55/person.

#8 Coastal Geology Kayak Trip - This 2-day trip is planned for the ODP Leg 154 post cruise meeting participants. Space may be available for other conference participants. Please contact Kate Moran at moran@agc.bio.ns.ca if interested. Cost is CAN$150 or US$150/person.

ODP Proposal News

The way to get your ideas into the JOIDES/ODP system is by submitting either a Letter of Intent or a full drilling proposal. A Letter of Intent is a three to four page outline of your idea(s) for scientific ocean drilling. It may be submitted as an alternative to a full proposal and will be forwarded to the panels for comment. Based on panel response, the preparation of a formal proposal may be recommended.

A full drilling proposal must include an outline of thematic objectives and how drilling strategies will be integrated with other investigations in the proposed area, information on site survey data, and strategies for drilling, sampling, and downhole measurements. The scientific objectives of drilling proposals should be linked to COSOD, ODP Long Range Plan (LRP), or thematic panel White Paper themes (these documents are available from the JOIDES Office).

Ten hard copies of the entire proposal must be sent to the JOIDES Office. The JOIDES Office would also appreciate receiving a copy of the proposal via electronic mail or on floppy disk. Proposals received by the JOIDES Office are forwarded to the four thematic panels for review and appropriate service panels and the sub-contractors (ODP-TAMU, ODP-LDEO and the Site Surevy Data Bank).

Remember: Proposals must be updated every three years to remain on the active list.

JOIDES PROPOSAL REVIEW DEADLINES

While drilling proposals can be submitted at any time of year to the JOIDES Office, Thematic Panels review proposals twice a year, in Spring and Fall, following the JANUARY 1 and JULY 1 deadlines for submission. The JOIDES Office returns comments, recommendations, and data package requirements to proponents in April and October. Proposals submitted directly to thematic panels are not reviewed.

PROPOSAL PREPARATION AND FORMAT GUIDELINES

TARGET LENGTH: The main body of text of an ODP drilling proposal should be about 25 pages in length, and an ODP drilling proposal must contain an ABSTRACT (400 words or less).

All relevant FIGURES should be in the main body of the proposal or placed after the references. Proponents may submit additional foldouts, large maps, and full seismic sections with a master copy of a proposal to be retained on file in the JOIDES Office. Proponents should not expect these to be reduced by the JOIDES Office or Panel Chairs, and therefore they may not be distributed with proposals to the thematic panels for review (the panels conduct science reviews, not technical evaluations). Foldouts, large maps, and full seismic sections should be sent to the Site Survey Data Bank at LDEO as part of the Site Survey Data Package at such time as proponents are instructed by the JOIDES Office.

COLOUR FIGURES should be avoided as they often jam copy machines. They are not essential unless conveying the most complex information.

Do not attach REPRINTS to proposals. Proponents may submit these with the proposal to be kept on file in the JOIDES Office, but they will not be sent out with proposals to the panels for review.

All pages should be NUMBERED sequentially.

Use only staples for BINDING, please. Proposals are torn apart to facilitate copying.

MARGINS should be at least one inch all the way around regardless of paper size.

Completed ODP Site Summary Forms containing information on DRILLING SITES that are tied to the stated scientific objectives and justified by appropriate site survey data are required. Blank site summary forms are available from the JOIDES Office on disk or hard copy or can be downloaded from the anonymous ftp server (see pages 28 and 62).

For more information, please contact: *Dr. Kathy Ellins*
JOIDES OFFICE, Department of Earth Sciences, University of Wales, Cardiff, P.O. Box 914, Cardiff, CF1 3YE, United Kingdom
Tel: +44 1222 874541, Fax: +44 1222 874943, Internet: joides@cardiff.ac.uk

ODP Site Summary Form 693 Fill out one form for each proposed site and attach to proposal

Title of Proposal:	
Site-specific Objective(s) (List of general objectives must be inc. in proposal)	

	Proposed Site	Alternate Site
Site Name:		
Area:		
Lat./Long.:		
Water Depth:		
Sed. Thickness:		
Total penetration:		

	Sediments	Basement
Penetration:		
Lithology(ies):		
Coring (check):	1-2-3-APC VPC* XCB MDCB* PCS RCB DCS* Re-entry	
Downhole measurements:		

*Systems currently under development

Target(s) :(see Appendix of Proposal Submission Guidelines6/93) A B C D E F G (check)ß

Site Survey Information (see Appendix of Proposal Submission Guidelines6/93 for details and requirements):

		Check	Details of data available and data still to be collected
01	SCS deep penetration		
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		

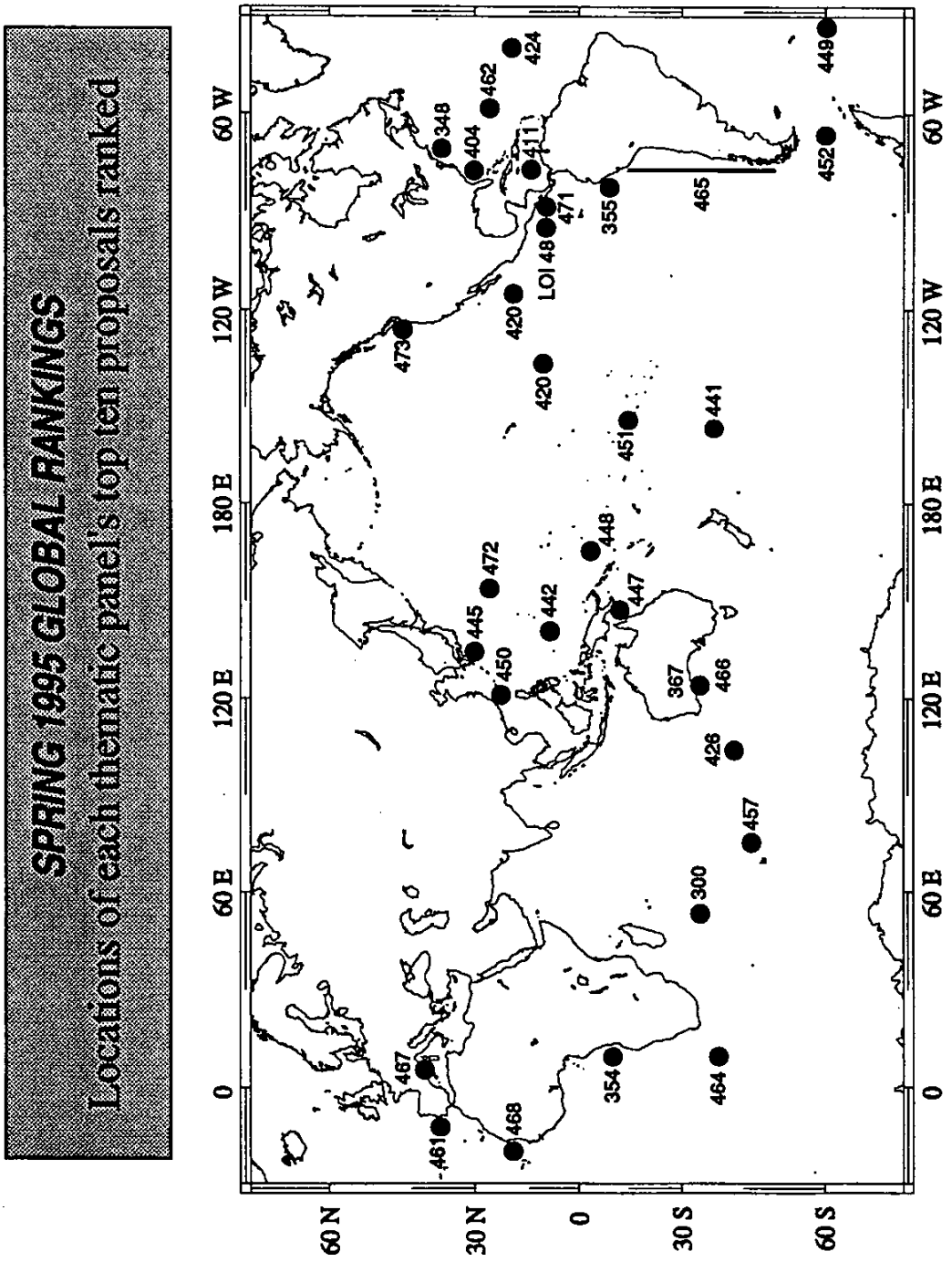
Weather, Ice, Surface Currents:

Territorial Jurisdiction:

Other Remarks:

	Name/Address	Phone/FAX/Email
Contact Proponent:		

Locations of each Thematic Panel's top ten ranked proposals Spring 1995



New and Revised Proposals in the ODP /JOIDES review system received: January to June 1995

(Proposals received for the July 1st 1995 deadline will be detailed in the next issue of the JOIDES Journal)

Proposal #	Date Rec'd	Abbreviated Title	Contact
473----	21/4/95	High Resolution Holocene Paleoenvironmental Record, Saanich Inlet,B.C.	Bornhold, B.D.
474----	2/5/95	Offset Driling Engineering Leg Proposal	Pettigrew, T.L.
473-Add	28/5/95	Saanich Inlet: A downhole temperature program	Nagihara, S.

DRILLING SITE DESIGNATIONS

A uniform system of designating proposed sites has been adopted by the JOIDES Office as directed by PCOM in December 1994. In accordance with this format each point on the seafloor considered for drilling will be known by one and only one name, and that name will never to be used for any other point on the seafloor. The new convention is:

AAAAAA- nnX

where

- AAAAAA is up to 6 alphanumeric characters indicating the area of the proposed drill site.
- nn is two numerals indicating the number of the site within that area
- X is one letter indicating variants (alternates or revisions) of that site.

The site designator should not attempt to encode information about the priority of the site (i.e. no "alt." designators). Because site priorities often change as the proposal passes through the advisory system, a site name that encodes priority may became obsolete or misleading by the time the site is drilled. The first time a site is proposed, X=A. If alternative sites are proposed in close geographic proximity and sharing scientific objectives, they will have X=A, X=B, X=C, etc.

What if a drill site is moved?

As a proposal moves through the advisory system, it occasionally becomes necessary or advisable to shift the position of a site in response to new data, new hypotheses, safety concerns, international clearance issues, or man-made seafloor hazards. Every time a site is moved, a new value of X will be used to identify the relocated site.

Why a new format?

The common practice of retaining the site designator when the position of a proposed site (as defined by latitude and longitude or shotpoint along a seismic line) is moved, causes great confusion for the JOIDES Office, SSP, PPSP, the Data Bank, and proposal reviewers. The new format is intended to alleviate such confusion and represents a uniform system of designating proposed sites, in which each point on the seafloor that has ever been considered for drilling is known by one and only one name.

SITE SURVEY DATA PACKAGE

Proponents of proposals that have been highly ranked will be asked by the JOIDES Office to submit a site survey data package to the ODP Data Bank at LDEO by a July or November deadline for review by the Site Survey Panel (SSP). The SSP review is based on identification of drilling target categories and site survey techniques that can provide the optimal data set for each target. The guidelines for submission of site survey data are available from the JOIDES Office at any time.

Status Report on the ODP Data Management System (JANUS Project)

The upgrade to the Ocean Drilling Data Management System (JANUS project) has been officially underway since February, 1995, when the statement of work contract was made final between the Ocean Drilling Program (ODP) and Tracor Applied Sciences Inc. (the company selected to develop the system). Since then, the Steering Committee who oversee the project has met on several occasions to discuss the progress of the project and Tracor has been working with some of the user groups who are defining their data models.

With this project, ODP hopes to acquire a leader among scientific databases. It requires that a new database system, hardware and software, be installed on the JOIDES Resolution drillship and at the ODP facilities in College Station. This system will be integrated into a heterogeneous computing environment at both sites and be usable by Unix, Macintosh, and MS Windows platforms, all currently in use on the ship.

It is expected that the data collected on the ship will be much better integrated. Any information entered in the laboratories will be immediately available to scientists in every other laboratory on board. The proceedures to access data, e.g. getting the depth of samples, will be greatly simplified. Data access and display would also become easier and more versatile - you would be able to display any combination of data types, e.g., GRAPE data with visual core descriptions. The data would be stored in well-defined Oracle tables in contrast to the current situation in which flat text files and other data files can be placed anywhere on disk.

At the end of a cruise, data that come back to shore will be efficiently merged with the previously collected data so that the database will be readily available. Also, all ODP data archived on shore will be available to the international community over the Internet. ODP also expects to provide data search capabilities over the Internet.

Project updates

Steering Committee: This group has the overall mandate to assist and make recommendations regarding the development of the ODP Data Management System to ensure that the project receives appropriate input from the final user community. The Committee has met on several occasions to discuss the overall status of the project. Their next meeting is scheduled for 14-15 November, 1995, when the Committee will evaluate the status of the applications ready for shipboard testing and upcoming applications.

List servers: These have been created so that the Steering Committee and each user group can access their own list server for members to communicate more efficiently.

JANUS Home page: The JANUS team at ODP/TAMU have created a Web home page for the project at "http://www-odp.tamu.edu/janus". It consists of the following topics.

- What's new - announces new project items and when they were last updated.
- System Description - contains an on-line view of the data model (downloadable) and a system overview document of the model.
- JOI Steering Committee - describes the Committee's mandate, contains minutes from past meetings and the statement of work, lists members of the Committee, and user group information.
- User Groups - describes their function, lists members of all groups, and displays the list server archives from each group.
- Tracor Reports - contains the current project timeline, monthly reports, and the current environment documents.

Demo/exhibition: A plan is underway to display a demo/exhibition of the Group 1 applications and Group 2 and 3 prototypes at the upcoming International Conference on Paleoceanography (Halifax, N.S., Oct. 10-14, 1995, see pp.27-30).

User Groups: Eight groups, consisting of people from the international user community, were selected to represent their expertise in a particular data area and to represent the wider scientific community's interests. They will provide support to the JANUS project by collecting, filtering, and reviewing the data that will aid in the definition of the data collected and the integration of all the applications. The groups will interact with Tracor and become involved in the testing and evaluation of the software application products.

User Group 1:
Corelog data, leg/site/hole,sample data, chemical samples, drilling data
Chair: Brad Julson, TAMU
Applications testing: 15 September, 1995 Ship testing: Leg 165
The group has met and will deliver the final version of their data model to Tracor on June 30. Tracor will deliver the application for testing in September.

User Group 2A:
Grape, p-wave, magnetic susceptibility, natural gamma, geochem and quad-combo logs, paleomagnetics, color reflectance
Chair: Nick Pisias, OSU
Applications testing: 15 November,1995 Ship testing: Legs 165 and 166
A meeting at the Tracor facilities in Austin has been tentatively scheduled for July 17, 1995.

User Group 2b:
Paleontology, ageprofile
Chair: Phil Weaver, IOS
Applications testing: 30 April, 1996 Ship testing: Leg 167
The paleontology model for this group is in it's finishing stages and is almost complete.

User Group 3:
Thermal conductivity,sonic velocity, shear strength, index properties, Adara, WSTP
Chair: Kate Moran, BIO
Applications testing: 15 November, 1995 Ship testing: Legs 165 and 167
A meeting in College Station has been tentatively scheduled for July 13-14, 1995.

User Group 4a:
Rock eval/Geofina, carbon/carbonate, gas chromatography,interstitial water, XRF/XRD
Chair: Kay Emeis, Warnemuende
Applications testing: unscheduled Ship testing: Leg 168

User Group 4b:
Sediment description,structural description, smearslide
Chair: Suzanne O'Connell, Wesleyan
Applications testing: unscheduled Ship testing: Leg 169

User Group 5:
Hard rock description, thin section description
Chair: Steve Hurst, Duke
Applications testing: unscheduled Ship testing: Leg 169

User Group 6:
Tensor/sonic core monitor, underway geophysics, seismic, core photos, FMS logs
Chair: Will Sager, TAMU
Applications testing: unscheduled Ship testing: Leg 169

Science Operator Prospectus Leg 162

North Atlantic Arctic Gateways II

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1000 Discovery Drive,
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A complete Scientific Prospectus for this leg is available from Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77845-9547, U.S.A.

ABSTRACT

Understanding the causes and consequences of global climatic and environmental change is an important challenge for humanity. The high northern latitude oceans are of great relevance to this task since they directly influence the global environment through the formation of permanent and seasonal ice-cover, transfer of sensible and latent heat to the atmosphere, and by deep-water formation and deep-ocean ventilation which control or influence both oceanic and atmospheric carbon chemistry. Thus, any serious attempt to model and understand the Cenozoic variability of global climate must take into account climate processes occurring in this region.

Leg 162 represents the second in a two-leg program designed to investigate three major geographic locations (the northern gateway region, the Greenland-Norway transect, and the southern gateway region) with the aim of reconstructing the temporal and spatial variability of the oceanic heat budget, the history of intermediate and deep water formation, and the history of glaciation on the surrounding land masses. Ultimately, we want to understand the role played by the high northern latitude seas in the global climate system on time scales ranging from decades (Heinrich/Daansgard-Oeschger Events) to millions of years. Leg 162 will provide sedimentary sequences containing records of biogenic fluxes($CaCO_3$, opal, and organic carbon), lithologic fluxes, and geochemical records which will be used to document oceanic processes on millennial, Milankovitch, and tectonic time scales. In combination with the Leg 151 sites, these sites are arrayed as broad north-south and east-west transects to monitor spatial paleoclimatic variability. In addition, a vertical array of sites in the North Atlantic will monitor water mass variability at intermediate water depths.

Lastly, deep drilling targets in the north should constrain the time of opening of the Fram Strait, and the inception of high northern latitude glaciation.

INTRODUCTION

The NAAG-DPG report (early 1991) constructed two legs of drilling in the North Atlantic-Arctic region. The first of these legs was completed in 1993 as Leg 151. Remaining high priority objectives, not addressed during Leg 151 are the timing and nature of the opening of the Northern Gateway (Fram Strait) and the history of glaciation on Svalbard/Barents Sea and on Greenland. These will be addressed by specific drilling targets during Leg 162 (Fig. 1).

In addition, the recognition that sub-Milankovitch climate signals such as those recently documented in the Greenland ice cores, can be recovered in North Atlantic and Nordic seas sediments is currently an exciting new area of paleoceanography. NAAG-II will provide an opportunity to recover high-resolution sedimentary sections allowing us to study the long term evolution of millennial-scale climate variability in the North Atlantic. In particular, we will be able to evaluate the amplitude and frequency of millennial-scale variability during intervals warmer than today.

The combination of earlier objectives outlined in the NAAG-DPG report with new objectives on high resolution paleoclimatology will guide drilling on Leg 162.

OCEANOGRAPHIC SETTING

The Nordic Seas, including the Norwegian and Iceland seas, the Greenland Sea, and the Arctic Ocean, form a series of interconnected basins containing a total volume of roughly 10×10^6 km^3, excluding the Amerasian Basin of the Arctic Ocean. This is about 0.7% of the volume of the world ocean with the Eurasian Basin of the Arctic Ocean making up nearly 60% of this volume. Despite the small volume of these areas, they nevertheless act as a primary source of a large portion of deep, ventilated waters in the world ocean. The idea that deep waters are formed in the Norwegian-Greenland seas, and that some of this newly formed water flows into the deep Atlantic across saddles on the Greenland-Scotland Ridge, was suggested a long time ago. Previous notions about the Arctic Ocean indicated that it has been a passive recipient of ventilated water from the south. In recent years, however, it has been demonstrated that the Arctic Ocean itself is an important contributor of deep waters which flow southward through the Fram Strait, and, after mixing with deep waters formed in the Greenland/Iceland seas, pass on into the world ocean. The processes leading to the formation of dense deep waters in the Arctic Ocean are thought to involve either intense cooling of Atlantic waters on the Barents Sea Shelf, or an increase in salinity through salt release during sea-ice formation on the large Arctic shelves, or maybe a combination of both processes.

The chief components of the surface water systems of the Nordic Seas involve the influx of warm and relatively high-salinity waters via the North Atlantic Current, which continues its northward flow as the Norwegian Current, and outflow via the cold and low-salinity East Greenland Current. The Norwegian Current is sufficiently cooled to allow deep water formation within the cyclonic gyre of the Greenland Sea. Another branch of this current continues along the western margin of Svalbard as the West Spitsbergen Current, before entering the Arctic Ocean. Within the Arctic this relatively warm water mass mixes with low-salinity surface waters, sinks and flows as an intermediate water mass counter-clockwise before being exported out of the Arctic via the Fram Strait along the Greenland Margin. The surface outflow from the Arctic Ocean sweeps the east margin of Greenland before entering the Irminger Sea of the North Atlantic via the Denmark Strait.

Some workers have concluded that nearly 50% of the water volume in the Nordic Seas, including the Amerasian Basin, is potentially in communication with the world ocean. The Nordic Seas might hence be characterised as the "lungs" of the present world ocean, implying that it is of fundamental importance to derive a detailed understanding of the timing and history of deep and shallow water exchange between the Nordic Seas and the remainder of the world ocean. The unique topographic constraints provided by a single deep, narrow passageway to the north (the Fram Strait), and a ma-

jor submarine ridge system to the south (Greenland-Scotland Ridge) make it pertinent to address the question of the Cenozoic paleoceanography of the Nordic Seas as a gateway problem.

SCIENTIFIC OBJECTIVES

The underlying rationale for this leg is to understand the role and importance of the Arctic and sub-Arctic regions to the global climate and ocean systems. This is a region where much of the world's deep waters are formed with associated large regional releases in sensible and latent heat. Likewise, major amplification of climate changes can occur in this region due to snow and ice albedo feedbacks. In addition, the Arctic and Nordic Seas may play a key active role in long-term evolution of global climate via linkages such as the effects of gateway openings on deep circulation, ocean alkalinity, and atmospheric CO_2. Linkages between deep-ocean circulation and atmospheric CO_2 have already been proposed for late Pleistocene changes at glacial-interglacial time scales. To address these fundamental long-term problems, the results of Leg 162 and its sister Leg 151 will fill large gaps of time over which we have no oceanic record of climate change at high northern latitudes. Our drilling strategy will focus on the three general scientific objectives discussed below.

Cenozoic Climate Evolution of the Arctic and Nordic Seas Region

The gateways in the north (Fram Strait) and south (Greenland-Scotland Ridge) are among the most important submarine topographic constrictions to global oceanic circulation. The opening of the Fram Strait and subsidence of the Greenland-Scotland Ridge below critical levels are necessary conditions for deep water exchange between the Nordic Seas and Atlantic Ocean. The history of these gateways is thus a key component in understanding the long-term evolution of both Northern Hemisphere climate and global thermohaline circulation.

The Fram Strait, with a present critical sill depth of 2600 m, represents the only deep connection between the Arctic Ocean and the global ocean. The initiation of this connection may have taken place as early as Anomaly 13 time, close to the Eocene/Oligocene boundary. The tectonic history of the Fram Strait area, however, is characterised by complex and, at present, vaguely understood processes, which might include stretching of the Svalbard continental crust and hotspot activity. When taking into account the strongly oblique opening of the Fram Strait and the nearness to surrounding land areas (Greenland and Svalbard), it seems possible that a truly deep Arctic Ocean/Greenland-Norwegian Sea connection became established considerably later than Anomaly 13 time, perhaps as late as Anomaly 6 time.

Likewise, few oceanic gateways can compete with the Greenland-Scotland Ridge in having such a profound influence on the present world hydrography. Overflow from northern sources occurs in the Faeroe-Shetland Channel, across the Iceland-Faeroe Ridge and in the Denmark Strait. Tracer studies indicate that the overflow waters originate from waters shallower than 1000-1200 m, probably to a large extent formed by deep convection in the Iceland Sea. Reconstructions of the subsidence history of the ridge system suggest that its eastern parts sank beneath sea level probably sometime during middle Eocene times, and during early to middle Miocene times in the Denmark Strait area. The distribution of shallow water benthic foraminifers, however, indicates that the Nordic Seas were effectively isolated from any "deep" Atlantic influence until middle Miocene times. The overflows have both influenced the Atlantic and global deep water masses through their contribution to North Atlantic Deep Water (NADW) production and to the formation of North Atlantic sedimentary records. Basic questions as to why and when NADW production was initiated, and how and why the chemical and physical signature of this major water mass has varied, remain to a large degree unanswered. The physical and chemical char-

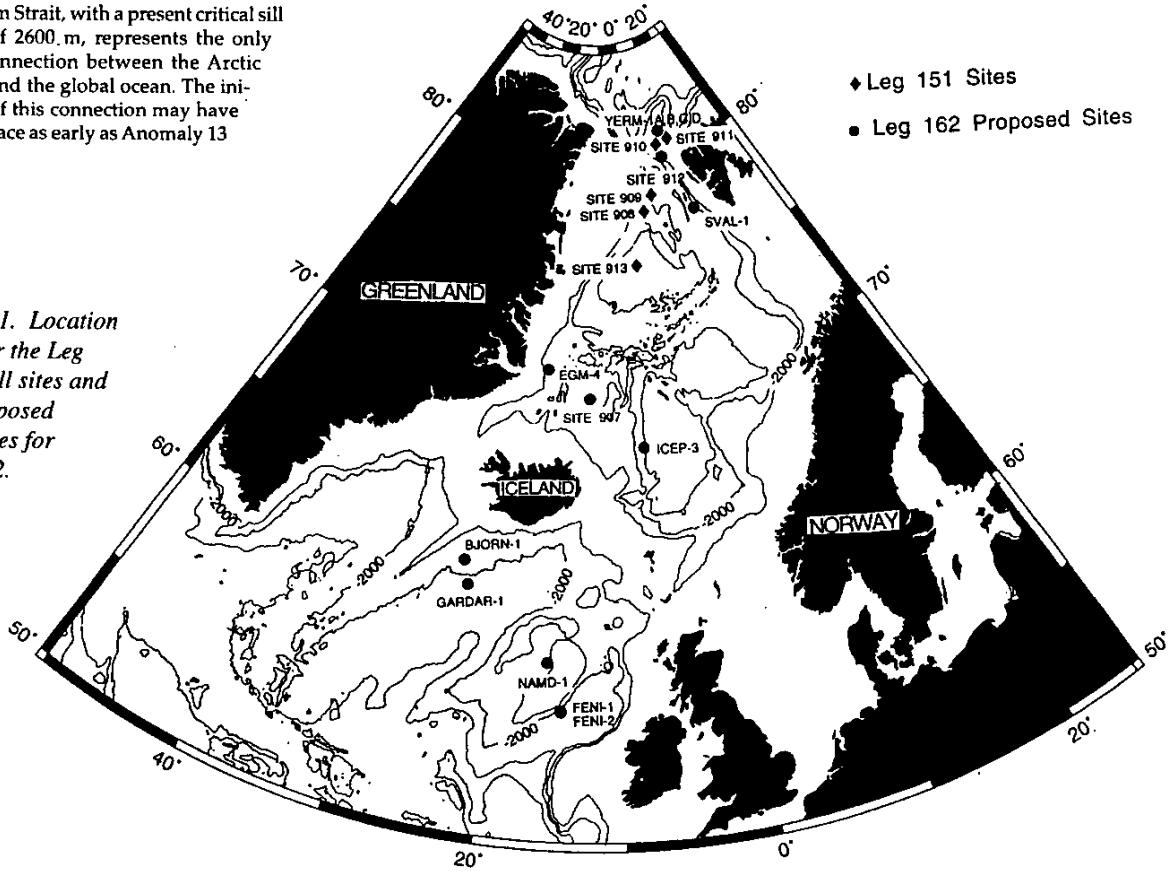


Figure 1. Location map for the Leg 151 drill sites and the proposed drill sites for Leg 162.

acterisation of surface and deep waters through time, in the main source regions and directly south of the ridge, will greatly improve the understanding of world ocean hydrography, global energy budgets, and North Atlantic patterns of sedimentation and erosion.

This drilling prospectus focuses on two key objectives not addressed in drilling prior to NAAG I and II: (1) constraining the tectonic history of the opening of these barriers, primarily by drilling to obtain basement ages; and (2) defining the subsequent history of surface and deep water exchange across these barriers, based on both proxy water-mass indicators and on current-sculpted features on the seafloor. Sites where the long-term evolution of these gateways will be studied include NAMD-1, EGM-4, SVAL-1B, and YERM-1.

We will also use these sites to address the Neogene history of glaciers and ice sheets around the Nordic Seas. Results from ODP Leg 104 trace the glacial history of the Fennoscandian Ice Sheet back to 2.57 Ma. Sporadic earlier occurrences of minor quantities of ice-rafted debris in various North Atlantic drill sites, including Legs 151 and 152, indicate an even earlier onset of glaciation around the Nordic Seas. However, both the location of the earlier ice sheets and the kind of glaciation remain uncertain. It is thus a primary drilling objective to obtain sediments from sites adjoining each of these earlier ice sheets to assess their glacial histories individually. Specific objectives are:

- To record and date the onset, and improve the general understanding of glaciations in the European high Arctic (YERM-1, SVAL-1B).
- To record and date the initiation and important phases in the glacial history of the Greenland Ice Sheet (EGM-4).
- To record and date important phases in the glacial history of the Svalbard-Barents Sea Ice Sheet, such as initiation of glaciations over the continental shelves, and the submergence of the Barents Sea platform and probable transition from a terrestrial to a marine based Barents Sea Ice Sheet (SVAL-1B).
- To investigate the nature of glacial continental margin sedimentary processes, with special emphasis on the processes of late Cenozoic uplift and erosion of the Svalbard-Barents Sea platform, and to calculate rates of glacial erosion and sediment fluxes in this type of environment (EGM-4, SVAL-1B, YERM-1).
- To investigate the nature of pre-glacial sediments, both in the deep sea, and on the outer shelf (ODP Site 907, SVAL-1B, YERM-1, EGM-4).

The Neogene evolution of sea ice cover in this region will also be examined. The present Arctic climate is strongly influenced by its sea ice cover, which greatly increases the regional albedo and reduces heat and gas exchange with the atmosphere. Very little is known about how this ice cover first developed and subsequently varied. JOIDES Resolution drilling along the present ice margins will provide better constraints on the history of sea-ice extent just north of a key Arctic gateway and southward into the Nordic Seas.

Finally, the long term history of surface, intermediate, and deep water chemistry and the exchange of these water masses across the northern and southern gateways will be an important scientific objective. Associated objectives are understanding the long-term history of biogenic fluxes in the region, in particular the bathymetric variability of the CCD and lysocline and the spatial and temporal history of silica preservation. Drilling on the Yermak Plateau (YERM-1) is designed for studying the Arctic intermediate water environments during and after the opening phase of the Northern gateway which enabled water mass exchange between the Arctic and the North Atlantic. Drilling in the North Atlaritic (NAMD-1) will obtain late Cenozoic sections for the documentation of North Atlantic water mass circulation at times when no North Atlantic Deep Water (NADW) is thought to exist, and document the transition to the modern type of ocean circulation.

Role of High Northern Latitudes in Orbital Forcing of Global Climate

Much of the natural variability in the Earth's environment on time scales less than a million years originates in the geometry of the Earth-Sun orbital system. It is likely that the sensitivity of the Earth's climate to orbital forcing increased during the late Cenozoic because of the increased extent of snow and ice, with particularly high sensitivity in the last million years. Obtaining records that document the development of these climatically sensitive latitudes is critical for elucidating how, why, and when enhanced sensitivity evolved and for improving our understanding of the mechanisms by which orbital insolation variations have forced Cenozoic climatic change.

The northern North Atlantic is an important source region for deep-ocean ventilation. North Atlantic Deep Water is composed of water masses forming in the Norwegian-Greenland Seas, the Irminger Sea south of Iceland, and the Labrador Sea. Surface water salinity's are high in these areas, and thus winter time cooling increases surface densities to an extent that deep convection occurs. Because of their rapid formation and short residence times, these deep waters are rich in O_2 but poor in CO_2 and nutrients. The deep water which spills over the Greenland-Scotland Ridge mixes with warmer North Atlantic waters to form southward-flowing NADW. North Atlantic Deep Water helps to oxygenate the deep ocean and transfers heat and salt to the Antarctic. Glacial/interglacial changes in deep-water formation in the Nordic Seas are implicated as the key driving force in conceptual models of atmospheric CO_2 variations and global climate change. ODP drilling in the Nordic Seas will improve our understanding of deep-water evolution north of the Southern Gateway by providing spatial and vertical transects that constrain the development of physical/chemical gradients in deep water and their response on Milankovitch time scales. Drilling south of the gateway will provide sorely needed shallow and intermediate water depth end members for Atlantic-scale studies of thermohaline circulation. This will enable reconstruction of water mass behaviour in the North Atlantic on glacial-interglacial time scales of the Plio/Pleistocene with special emphasis on the formation of Glacial North Atlantic Intermediate Water (GNAIW) and the links to surface water conditions.

Millennial Scale Climate Variability in High Northern Latitudes

Sites on the North Atlantic sediment drifts (FENI-1, GARDAR-1, and BJORN-1) will address several questions relating to climatic variability on a range of time scales. As a result of recent investigations on high sedimentation rate marine cores, it is evident that rapid oscillations such as those observed in temperature and dustiness in Greenland ice cores (Dansgaard/ Oeschger events) also exist in the marine record. They can be seen as changes in surface fauna (sea surface temperature), carbonate, color, and deep ocean chemistry. The transitions between cold epochs and warm epochs in ice cores are abrupt: warming occurred in as little as 50 years and fourfold drops in dust content in as little as 20 years.

One possibility is that millennial scale climate variations in ice cores are related to the strength of the thermohaline 'conveyor belt.' In addition to examining this hypothesis, we will use the long, high sedimentation rate cores to determine whether these oscillations characterised the marine record during earlier, warmer climatic regimes of the past 3 million years.

Also found in the marine record are events with longer characteristic repeat times (~10,000 years), which are related to surges of the eastern Laurentian ice sheet.

Determining the geographic distribution of these Heinrich events, their long-term character, and the timing of their first occurrence is a main objective of drilling at FENI, GARDAR, and BJORN. For instance, are they restricted to the '100kyr world' of the Brunhes characterised by the largest continental ice sheets? By studying sedimentation patterns, surface water properties, and deep-water variability on sub-orbital time scales and relating these observations to ice cores, we hope to better understand the forcing and dynamics

of decadal to millennial climate variability in the North Atlantic-Arctic region.

LEG 151 PRELIMINARY RESULTS

During the Arctic summer of 1993, JOIDES Resolution, recovered the first scientific drill cores from the eastern Arctic Ocean, including material which records the long history of glacial climate in the Arctic and evidence for massive ice caps on the Arctic Ocean margin during certain glaciations.

During ODP Leg 151 (see Fig. 1), drilling operations recovered over 3 km of core, which ranges in age from middle Eocene to Quaternary. Site 907 on the Iceland Plateau recovered a middle Miocene to Quaternary sequence overlying basement basalts with calcareous microfossils only in the upper Pliocene to Quaternary, but with a middle to upper Miocene biosiliceous-rich interval indicating high-productivity conditions. Site 908 in the Fram Strait documents a late Oligocene age for the biosiliceous-rich pre-rifted strata on the Hovgård Ridge micro-continent. Nearby Site 909 penetrated 1061.8 m into the Fram Strait basin, which acts as the corridor for deep-water flow between the Arctic Ocean and Norwegian-Greenland Sea, and recovered an upper Oligocene?/lower Miocene to Quaternary sequence high in organic matter and hydrocarbons but virtually devoid of calcareous and siliceous microfossils. Sites 910, 911, and 912 on the Yermak Plateau consist of Pliocene to Quaternary glacio-marine sediments with abundant dropstones and a high organic carbon content. Site 913 on the East Greenland Margin drilled a thick section of Pliocene to Quaternary glacio-marine sediments with abundant dropstones, overlying a middle Eocene to lower Oligocene and middle Miocene sequence of clays and silty clays. A biosiliceous-rich interval occurs in the upper Eocene to lower Oligocene.

The oldest sediments recovered, middle Eocene at Site 913, contain the highest abundance of terrigenous organic matter recovered during Leg 151 and indicate the close proximity of a continental source during this initial phase of seafloor spreading in the Greenland Basin. Episodes of laminated sediment deposition suggest a lack of infaunal activity and bioturbation during the middle Eocene. The dissolved-silica level is extremely low, suggesting an absence of biosiliceous deposition and hence indicates a restricted basin or basins receiving nutrient-depleted surface water over shallow sills, well above the mid-water nutrient maxima common in modern oceans. During this time, Fram Strait was closed to deep-water flow. Productivity increased throughout the middle Eocene, and Site 913 remained below the CCD.

At Site 913, there was a renewed influx of terrigenous organic carbon in the late Eocene, coinciding with the first appearance of preserved biogenic silica., the preservation and abundance of which increases up-section. The siliceous intervals were formed during times of high productivity, resulting in high sedimentation rates and a high abundance of marine organic carbon. Nevertheless, ventilation of the deep waters was poor, resulting in lamination and probably causing the accumulation of CO_2 in deep water, which dissolved carbonate.

The late Oligocene to earliest Miocene interval from Site 908 on the Hovgård Ridge suggests moderately well-mixed oceanic conditions in the Norwegian-Greenland Sea. Laminated-sediment intervals continued until about the middle/late Miocene boundary (Sites 907, 909, and 913) and provide evidence for restricted circulation in the early Miocene Greenland-Norwegian Sea. Leg 151 found no evidence for deep-water flow from the Arctic or modern type deep-water production in the Nordic Seas before this time.

The late Miocene is represented only at two sites. Site 909 is characterised by a paucity of microfossils, while Site 907 is rich in siliceous microfossils which appeared prior to the middle/late Miocene boundary but disappeared by about 7 Ma when true Norwegian-Greenland Sea deep water may have begun to form. The disappearance of anoxic indicators close to the middle late Miocene boundary at Site 909 marks the start of deep mixing in the Greenland Basin, while the presence of siliceous production on the Iceland Plateau shows that the southern part of the Nordic Seas still had net upward transfers of nutrients from deeper waters to the surface.

At all sites, the Pliocene and Quaternary interval is marked by evidence of ice. Significant quantities of dropstones appear near the late Miocene/Pliocene boundary and show a marked increase in abundance at about 2.75 Ma. Pliocene and Quaternary sediments on the Yermak Plateau at the southern edge of the Arctic Ocean are extremely thick, deposited either by the melting of sediment-laden pack ice transported to the region by Arctic surface circulation or by ice melted from a massive Barents Sea ice sheet or an ice cap centred on Svalbard. The former scenario seems more likely, because the melting ice edge now supports high productivity, which could cause the observed high levels of marine organic carbon deposition. The summer edge of Arctic pack ice would then have been near the Yermak Plateau for most of the Plio-Pleistocene interval.

Lastly, Site 910 was marked by a highly over-consolidated interval, beginning at about 25mbsf. No such interval was found at the deeper water Site 912 (south) or Site 911 (north). At Site 912, sedimentary evidence of an ice sheet was recorded for the same time interval. The consolidated interval was traced along the Yermak Plateau with seismic reflection profiles. This consolidation possibly indicates that an ice lobe of the Barents Ice Sheet reached well out to sea in the late Pleistocene and was grounded on the top of the Yermak Plateau. These event(s) may have occurred prior to the last glacial maximum at 18 kyr. Evidence for the extension of the Barents Ice Sheet westward will provide important constraints for Pleistocene ice models.

Leg 162 STUDY AREAS

Northern Gateway: the Yermak Plateau and Svalbard Margin
The Yermak Plateau is a topographic marginal high due north of Svalbard. The plan for Leg 162 is to drill YERM-1A or, in the event that this site is inaccessible due to ice cover, to drill alternate sites -1B, -1C or -1D, or a deepening of Site 912 (YERM-2A) from 200 to 550 m.

Site YERM-1 is located on the eastern flank of the Plateau and is a deep target site. This site has been proposed to document the subsidence history of the Yermak Plateau and its control on the water-mass exchange through the Arctic gateway, and to determine the age and nature of basement. Furthermore, it will provide records of surface and deep-water communication between the Arctic and the Norwegian Sea and the ice rifted debris (IRD) - sedimentation history of the Arctic. Lastly, with this site we hope to date the inception of glacial climate in the Arctic proper.

YERM-1A is our prime target since it is here that basement is most accessible. However, due to potential sea ice problems, a number of alternate sites which will address the same objectives are include d in our drilling prospectus (YERM-1B, -1C, -1D, Fig. 2). In the event that none of the YERM-1 sites are accessible, site YERM-2A (which is Site 912) could serve as a less desirable alternate site for YERM-1. YERM-2A is located deeper than site YERM-1 on the Southwest slope of the plateau. The thick sediment pile at this site prevents drilling to basement. This means that while we would be able to date the inception of glacial sedimentation in the region and look at the long-term history of North Atlantic surface water exchange with the Arctic, we would not be able to document the subsidence history of the Yermak Plateau.

We also expect to drill one site (SVAL-1B, Fig. 3) on the Svalbard margin to examine the onset of glaciation in the European Arctic and establish the history of the Barents Ice Shelf, including dating the transition from a terrestrial to marine based ice sheet. Svalbard is also believed to be the likely location for the initiation of Pliocene e glaciation in the European Arctic. This site will also address questions related to glacial fan development and will serve as an eastern

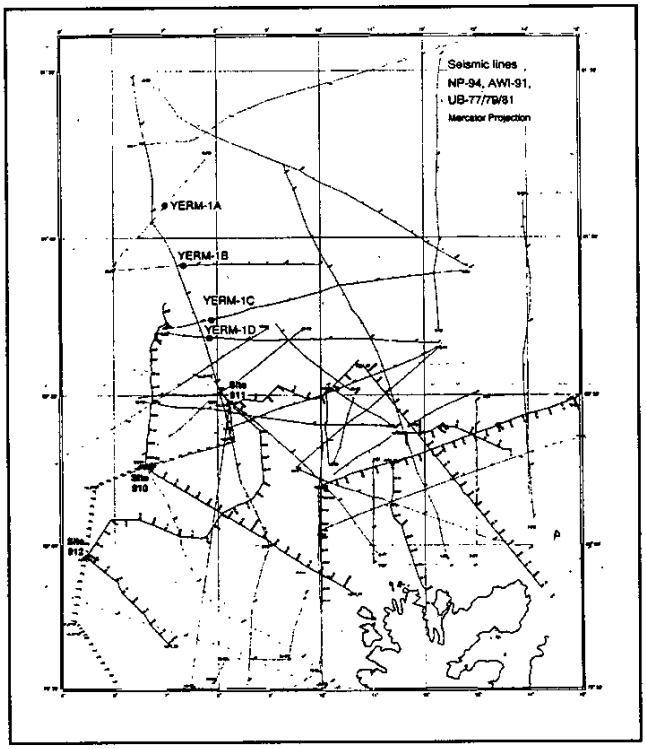


Figure 2. Shiptrack for proposed sites YERM-1A, -1B, -1C, and -1D.

counterpoint to EGM-4 located on the East Greenland Margin (see Fig. 1).

Nordic Seas Transect Sites on the Iceland Plateau and on the East Greenland Margin are designated to be parts of an east-west transect across the Nordic Seas from the present temperate waters in the east to the polar waters off Greenland in the west. The aim of the transect is to trace the evolution of environmental gradients across this region in the late Cenozoic. The sites drilled on the Vøring Plateau on Leg 104 form the eastern end member of the transect, the Iceland Plateau sites form the central element, and site EGM-4 on the East Greenland Margin forms the western end member of the transect.

ICEP-1 is located on top of the Iceland Plateau and is an open-ocean site isolated from continental marine influence on IRD records. This is also the location of Leg 151 Site 907 which, because of a medical evacuation, had only a single hole drilled. Leg 162 plans to re-drill this site to retrieve a complete section. This site is included to (1) monitor the history of oceanic and climatic fronts moving east and west across the Iceland Plateau, (2) derive an open-ocean record of IRD and carbonate, and (3) determine the history of northern-source deep water formation. While the first hole did not have abundant carbonate, an excellent record of siliceous microfossils extended back to the middle Miocene, and physical property time series from this hole record obvious Milankovitch scale cyclicity. Given that this site is likely to become a type section for the region, it was decided to drill two more offset holes (APC to 200 m).

Figure 3. Seismic profile for proposed site SVAL-1B.

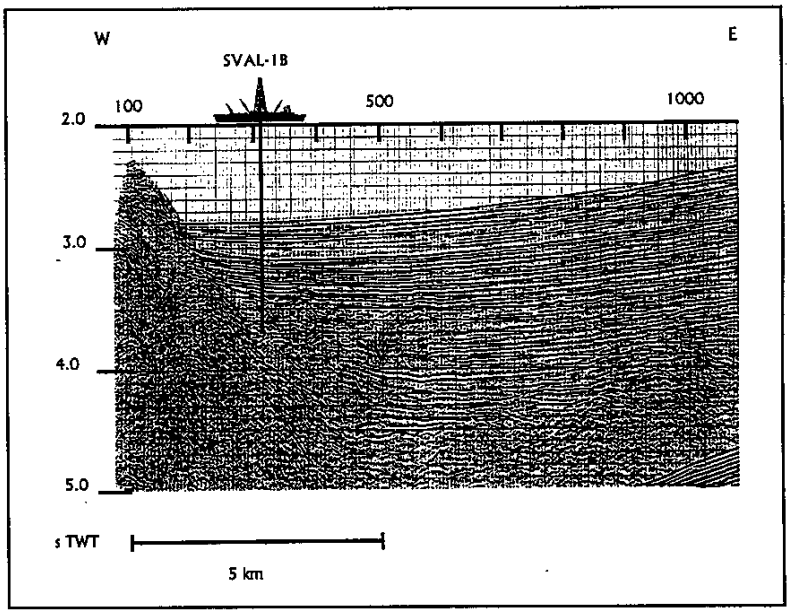
Site ICEP-3, located farther to the east, is a low priority alternate site chosen to study oceanic response to different stages in the opening of the Greenland-Scotland Gateway. This site could also provide a record of pelagic IRD input well away from the ice sheets, thereby avoiding strong continental influence. The more eastern location would also improve chances for recovering a carbonate biogenic record.

In order to document the history of the East Greenland Current (EGC), and of deep-water flow out of the Arctic downstream from Fram Strait, EGM-2 (Site 913) was drilled during Leg 151. Drilling encountered difficulties when coring the uppermost 400 m of sediment, core recovery was almost zero. In addition, the lack of carbonate at this site precluded many of the planned paleocirculation studies. Thus the plan is to drill EGM-4 situated on the lower slope of the trough-mouth fan at Scoresbysund. Piston cores recovered from this region indicate that this area is protected from the eroding deep water currents encountered farther north at EGM-2 (Site 913).

Likewise, the presence of carbonate in this region will allow paleochemical studies of the surface and deep waters of the Greenland Sea and allow studies of the evolution of the East Greenland Current. EGM-4 is also intended for high-resolution studies of the late Neogene history of IRD input from and evolution of the Greenland Ice Sheet and will serve as the Greenland counterpart to SVAL-1B.

Southern Gateway

The major objectives of these sites are related to Plio-Pleistocene water mass evolution and the role of thermohaline circulation in controlling the exchange of carbon between the ocean and atmosphere. In particular, these sites will address the character, causes, and consequences of Milankovitch and millennial scale climate variability with the goal of correlation to the ice core records for the Quaternary. We will also examine the question of when high frequency millennial to century scale climate variations began, and whether warmer periods in the past were characterised by such high frequency instabilities. The Greenland ice core records of interglacial stage 5e suggest that ice sheets are not necessarily a prerequisite for rapid oscillations in ocean-atmosphere circulation (although these records may be biased by ice deformation). The recovery of long, high sedimentation rate sedimentary sequences in the North Atlantic should establish whether this type of climate 'instability' was present during the early Pleistocene or prior to major Northern Hemisphere glaciation.



Two of the proposed sites are located on the Feni Drift in the eastern Atlantic (Fig. 4), perfectly situated to record the large north-south swings in surface water conditions (the polar front) which occur during glacial-interglacial, and potentially millennial, climate cycles. These sites, at 2157 m water depth, will also monitor Wyville-Thomson Ridge Overflow Waters as well as southern source deep water during times of minimal overflow. We expect to recover an approximately 100-m record of the Brunhes Chron (FENI-1) at sedimentation rates of between 11 and 20 cm/kyr. At FENI-2, located at the same depth but slightly to the Southeast, we expect to recover a 225 m late Pliocene to Pleistocene record of sedimentation, also at greater than 10 cm/kyr. These sites will be used to study mid-depth nutrient variability, deep water circulation, and surface-deep water links on both Milankovitch and millennial time scales.

BJORN-1 is located on the Bjorn-Gardar Drift on the eastern flank of the Reykjanes Ridge at a water depth of 1653 m. Sedimentation rates at this site are lower (~10 cm/kyr) although still high by open ocean pelagic standards. Here we hope to get continuous APC records extending to the Pliocene as well as an XCB record to the Miocene. In addition to extending farther back in time, this site will also allow us to assess east-west gradients in surface water conditions as well as monitor Norwegian-Greenland Sea overflows farther to the west. A nearby alternate site, GARDAR-1 (1977 m), is located at the depth of Glacial North Atlantic Intermediate Water during the last glaciation. Piston core results suggest that sedimentation rates as high as 13 cm/kyr would be found here, again providing an unprecedented record of both glacial-interglacial and millennial scale variations in thermohaline circulation, surface water temperatures, and ice-rafting history.

The last southern gateway site, NAMD-1 (1150 m water depth), is a re-occupation of DSDP Site 116. Information from this site, located on the top of the Rockall Plateau, will help reconstruct the water mass behaviour in the North Atlantic on glacial-interglacial time scales of the Plio/Pleistocene with special emphasis on the formation of Glacial North Atlantic Intermediate Water (GNAIW). In addition, we will be able to document the water mass structure in the North Atlantic during the late middle Miocene when the Iceland-Faeroe Ridge subsided to depths that allowed deep water exchange between the Nordic Seas and the North Atlantic.

Site 116 seems to be well suited for the proposed program in that a discontinuously drilled carbonate record back to the Oligocene has been recovered at this location. Its position on a structural high protects this site from turbidites, and its shallow depth greatly diminishes the risk of carbonate dissolution due to vertical fluctuations of the carbonate compensation depth. Furthermore, this site is in the flow path of the Iceland-Faeroe Ridge overflow waters which comprise a major constituent of NADW, and is in the area of potential glacial North Atlantic Intermediate Water formation.

SHIPBOARD SCIENCE AND DRILLING PLAN

Drilling Strategy

Most of the NAAG objectives require drilling rapidly deposited (>50 m/m.y.) sequences, with triple APC coring to refusal. This approach will permit the retrieval of continuous sections for high resolution analysis of the higher frequency (orbital- and millennial- scale) variations of the climate system. At the same time, it also provides sequences spanning millions of years, over which time the average climate state has evolved toward generally colder conditions and over which the spectral character of orbital-scale variations has changed dramatically. Composite sections representing continuous sedimentation records will be developed at each site during coring operations. These composites will be based on continuous data obtained by the multisensor track, logging, and spectral reflectance.

Triple APC cores are necessary to allow normal ODP sampling density guidelines to be exceeded for ultrahigh resolution paleoceanographic studies. In addition, triple coring will ensure that U-channel magnetic studies as well as geotechnical measurements on whole round samples can be done without sacrificing record continuity. If deemed necessary it may also be possible to preserve the cores from the third hole for X-ray imaging before sampling.

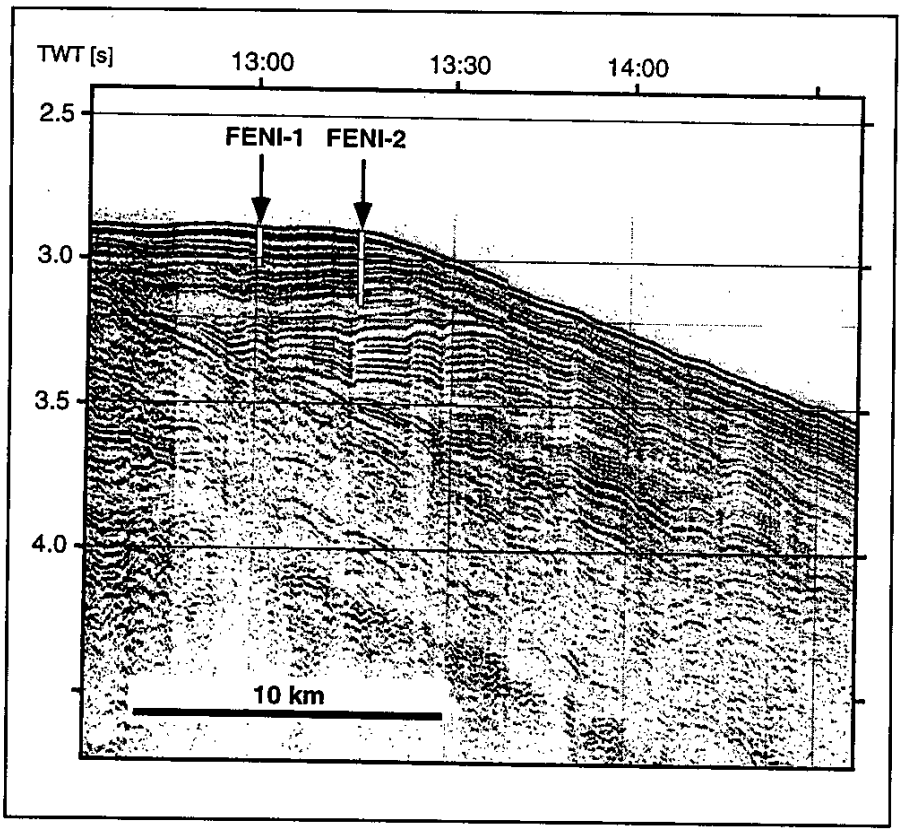


Figure 4. Seismic profile for proposed site s FENI-1 and FENI-2.

The drilling schedule outlines a 56-day leg with operations at eight sites. Drilling will begin on the sediment drifts south of Iceland (FENI-1 and -2), moving to the Rockall Plateau (NAMD-1). At NAMD-1 we currently plan to XCB to 500 m. If the recovered sediment looks continuous and undisturbed, a second XCB hole will be considered. If any time is gained by an early ship departure, and/or at operations on FENI-1 and -2, we plan to double XCB the B and C holes in hopes of generating continuous composite sequences through the Miocene. We will then move to BJORN-1, Site 907 (ICEP-1), and EGM-4, before moving to SVAL-1B. Time permitting, a third dedicated geotechnical hole will be drilled at Site 907 (APC to 220 m). At SVAL-1B a decision will be made as to

whether sea ice conditions will permit drilling at the Yermak Plateau sites. We will need to have 8 days of ice free conditions in the YERM area to complete operations. Ice conditions will be monitored weekly by satellite from the start of the leg and the monitoring frequency will increase if an ice window appears imminent. We will not transit to the drilling sites unless they are likely to be ice free for the duration of time needed to complete operations. If YERM-1 (A through D) are ice-covered or near the ice margin, we will move to YERM-2. If YERM-2 is also inaccessible we will transit to secondary site objectives ICEP-3 and GARDAR-1.

Downhole Temperature Measurements
We may elect to establish one or two in-situ temperature profiles across the upper 200 m sediment section to examine effects of upper ocean temperature changes during the Holocene on the geothermal gradient. We would use the APC temperature tool until APC refusal or critical overpull in some of the sites south of Iceland. This instrument is located within the cavity of the APC coring shoe and does not require a separate tool lowering.

Logging Strategy
The standard three tool strings, Quad-Combination, Geochemical, and the Formation MicroScanner, have been selected for Leg 162 holes drilled over 400 m. In holes less than 400 m, logging may occur where it assists in meeting the scientific objectives of the site.

Some of the benefits to be gained by logging during Leg 162 are direct core-log depth merging (to ensure that composite depths can be scaled back to true vertical depth), use of the spectral gamma ray (NGT) tool data for basic clay typing (mineralogy tied to changing climate), use of the geochemical logging tool for estimating bulk mineralogy, and integration of the Formation MicroScanner images (FMS) with the spherically focused log (SFL) data to resolve fine- scale (orbital) bedding cycles.

INVESTIGATIONS OF THE EAST GREENLAND VOLCANIC RIFTED MARGIN

Knowledge that will enhance our understanding of global geodynamics and the patterns of deep mantle flow is emerging from the study of volcanic rifted margins (VRMs) and large igneous provinces (LIPs). Large igneous provinces are exposed as flood basalts on continents or as massive, shallow plateaux on the seafloor. Evidence suggests that the development of large igneous provinces has influenced the pattern of continental breakup and the early stages of rifting in some cases, leading to the formation of ocean basins.

An optimum place to examine the processes involved in the generation of large igneous provinces and continental rifting is the North Atlantic region where unique exposures of Tertiary volcanic rocks occur along the margin of East Greenland. These consist of large gabbroic to syenitic intrusive complexes, sheeted dyke swarms and flood basalts. The flood basalts represent one of largest igneous provinces on Earth. A wedge of seaward dipping reflector sequences (SDRS) located about 50 km offshore of East Greenland is interpreted as lava flows that represent deeper parts of Earth's crust.

Ocean drilling on ODP Leg 163 (September-October, 1995) will provide an exciting opportunity to link the offshore record with the onshore record by drilling through the sparse sediment cover on the East Greenland continental shelf to sample the SDRS. Leg 163 drilling will sample the extensive wedge of seaward-dipping reflector sequences (SDRS) at two transects with different offset from the presumed mantle plume centre below the Iceland-Greenland Ridge. The main scientific objectives of the ODP drilling are to understand the origin, structure and emplacement history of hot asthenosphere during continental break-up, the accompanying weakening of the continental lithosphere, and the lithosphere - asthenosphere interaction leading to final breakup and seafloor spreading.

Leg 163 ODP drilling off SE Greenland is a follow-up to Leg 152 drilling (1993) and is is part of a larger international multi-disciplinary study of the early Tertiary break-up of the SE Greenland volcanic rifted margin. In addition to the ODP drilling, deep geophysical profiling across the margin and extensive field geological work within the onshore and exposed part of the rifted margin will be carried out. Plans for a deep continental drill hole are also under development.

The landward part of the northernmost of the Leg 163 ODP transects is close to the area where detailed fieldwork will be carried out onshore during the summer of 1995. The geologic field effort will concentrate on the continental volcanic history, emplacement of gabbros and dykes and associated deformation of the continental crust, and the lithosphere-asthenosphere interaction. Specifically, the research is intended to document the complete stratigraphy of the flood basalts, which may attain a thickness of more than 5 km; investigate the origin and emplacement history of the gabbros and dykes, and the associated tectonic deformation of the continental crust; and obtain a detailed geochronology (Ar/Ar dating) of the plutonic and volcanic history of East Greenland. The field program will receive logistical support from two helicopters operated from a base camp near the famous Skaergaard Intrusion.

In addition to the ODP drilling and the field geology program currently underway, seismic investigations (1994 and 1995/96) will complete multi-channel seismic (MCS) mapping of the distribution and structure of the SDRS along 1200 km of the volcanic rifted margin. The mapping will extend from the Iceland-Greenland Ridge in the north to south of Greenland (ICE project) and provide four deep crustal transects (SIGMA project) across the margin at different offsets from the Iceland Greenland Ridge (0, 300, 600 and 1100 km). The SIGMA project will involve the R/V Maurice Ewing and is a joint project between Woods Hole Oceanographic Institution and the Danish Lithosphere Center. Two of the SIGMA transects will follow the ODP drilling transects. The northernmost of these ODP-SIGMA transects will continue inland, crossing the coastal dyke swarm and other tectonic features associated with rifting. The seismic data together with the geological data will enable calculations of magmatic budgets and fluxes, and permit mapping of possible variations in margin structure and volcanism as a function of offset from the presumed plume centre.

Deep drilling on land, planned for 1998-2000, will explore the deep structure of the continent-ocean transition exposed along the outer coast in the area of the northern ODP transect and the offshore-onshore SIGMA line. A prime objective is to investigate the partitioning of strain between magmatic extension (dykes and gabbros) and tectonic extension (normal faults and crustal rotation) as a function of depth. An additional objective is the investigation of the paleotemperature depth profile.

The various research projects to investigate the East Greenland volcanic rifted margin are co-ordinated and funded in part by the Danish Lithosphere Centre (DLC). Strong interest by a number of US research institutions (Woods Hole Oceanographic Institution, Duke University, Oregon State University, University of California at Davis, Stanford University) is reflected in significant funding for parts of the planned work by the US National Science Foundation (NSF). Investigators from the Universities of Copenhagen and Aarhus, Denmark and University of Lund, Sweeden will participate in the studies of the onshore region.

The results of the investigation of the East Greenland volcanic rifted margin will help elucidate the different sub-lithospheric mantle components involved in magma generation in the North Atlantic, the melting and contamination (mantle lithosphere and crust) history of the magmatic melts, the configuration of the magmatic plumbing system through the continental lithosphere, and the processes involved in weakening and rifting the lithosphere. The results of the ODP drilling program will be highly relevant to other Earth science research initiatives, including the MARGINs and LIPs programmes.

JOIDES - ODP World Wide Web Servers

There are now three on-line JOIDES/OPD world wide web servers (though all are still under development) available for the marine geoscience community to browse. These are located at :

JOIDES Office, Cardiff at ***http://servant.geol.cf.ac.uk***
Currently you can look at Panel Minutes and an 'on-line' JOIDES Journal.

ODP-TAMU, Texas at ***http://www-odp.tamu.edu***
With an Overview of ODP (including the ship schedule), Publications and Curation, Science Operations, Engineering and Drilling Operations, General News and Information, International Participation and the JANUS project.

ODP-LDEO, New York at ***http://www.ldeo.columbia.edu/BRG/brg_home.html***
These pages contain an Introduction to the Borehole Research Group, and information on the Wirelline Logging Services and the ODP Logging database as well as connections to other ODP-related sites on the web.

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The JOIDES Office have data available from an anonymous ftp site.

The information includes a JOIDES calendar of meetings and a "Resolution" schedule, a directory of the JOIDES community as it will appear in the JOIDES Journal, containing names and addresses, and where known, telephone, fax and e-mail information. The files originated as Word 5.1 for Macintosh, and are stored as Macbinary Word files, RTF text files and unformatted text-only files.

The current usable directory tree is
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/pub/JOIDES/Directory
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/pub/JOIDES/Proposals
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Special Issue No. 1: Manual on Pollution Prevention and Safety, 1976 (Vol. II)
Special Issue No. 2: Initial Site Prospectus, Supplement One, April 1978 (Vol. III)
Special Issue No. 3: Initial Site Prospectus, Supplement Two, June 1980 (Vol. VI)
Special Issue No. 4: Guide to the Ocean Drilling Program, September 1985 (Vol. XI)
Special Issue No. 4: Guide to the Ocean Drilling Program, Suppl. One, June 1986 (Vol. XII)
Special Issue No. 5: Guidelines for Pollution Prevention and Safety, March 1986 (Vol. XII)
Special Issue No. 6: Guide to the Ocean Drilling Program, December 1988 (Vol. XIV)
Special Issue No. 7: Ocean Drilling Program Guidelines for Pollution Prevention and Safety, Oct., 1992 (Vol. 18)
Special Issue No. 8: Guide to the Ocean Drilling Program, June 1994 (Vol. 20)

JOIDES Meeting Schedule

Panel/ Committee	Dates	Location
PCOM	16 - 19 Aug '95	Portland, Oregon
PPSP	14 - 15 Sep '95	San Diego, California
* IHP	18 - 22 Sep '95	Kona, Hawaii
SGPP	26 - 28 Sep '95	Copenhagen, Denmark
DMP	26 - 28 Sep '95	College Station, Texas
SMP	27 - 29 Sep '95	Bremen, Germany
* OHP	6 - 8 Oct '95	Halifax, Nova Scotia
* LITHP	9 - 11 Oct '95	Japan or Cyprus
TECP	19 - 21 Oct '95	Antalya,Turkey
* SSP	6 - 8 Nov '95	Palisades, New York
* PPSP ¶	16 - 17 Nov '95	College Station, Texas
DRILLOPTS	3 Dec '95	San Diego, California
PANCH	4 Dec '95	San Diego, California
PCOM	5 - 9 Dec '95	San Diego, California
EXCOM/ODPC	29 Jan - 1 Feb '96	Washington, DC
* IHP	26 - 28 Feb '96	College Station, Texas
* LITHP	26 - 28 Feb '96	Corvallis, Oregon
* OHP	4 - 6 Mar '96	Hawaii
PCOM	22 - 25 Apr '96	Aix-en-Provence, France
* OHP	Oct '96	Strasbourg, France

* *meeting not yet formally requested or approved*
¶ *dedicated to the New Jersey Margin Proposal.*

JOIDES Resolution Operations Schedule

Leg	Destination	Cruise Dates	Port of Origin†		Total Days	Transit	On Site
162	Atlantic Arctic Gateways II	9 Jul - 3 Sep '95	Leith,	4 - 8 Jul '95	56	15	41
163	S E Greenland VRM	7 Sep - 28 Oct '95	Reykjavik,	3 - 6 Sep '95	51	9	42
164	Gas Hydrates	1 Nov - 19 Dec '95	Halifax,	28 - 31 Oct '95	48	6	42
165	Carib. Ocean History	24 Dec '95 - 18 Feb '96	Miami,	19 - 23 Dec '95	56	11	45
166	Bahamas	23 Feb - 1 1 Apr '96	San Juan,	18 - 22 Feb '96	48	8	40
166T	Transit	14 - 20 Apr '96	Panama *	11 -13 Apr '96	6	6	-
167	California Margin	21 Apr - 16 Jun '96	Acapulco,	20 Apr '96	56	11	45
168	Juan de Fuca Hydroth.	21 Jun - 16 Aug'96	San Francisco,	16 - 20 Jun '96	56	4	52
168S	Saanich Inlet Δ	17 - 18 Aug '96	Victoria,	16 Aug '96	2	-	2
169	Sedimented Ridges II	23 Aug - 18 Oct '96	Victoria,	18 - 22 Aug '96	56	6	50
170	Costa Rica Margin	23 Oct - 18 Dec '96	San Diego,	18 - 22 Oct '96	56	11	45
			Panama,	19-23 Dec '96			

† Although five day port calls are generally scheduled, the ship sails when ready.
* Leg 166 Scientists disembark in Panama.
Δ Subject to environmental and safety reviews.