JOIDES SCICOM Meeting

March 17th 2003
Austin, Texas

Cover Photograph "Texas Spring Flowers" by Kathy Ellins

Prepared by:
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LODGING ACCOMMODATIONS:
Inter-Continental Stephen F Austin
701 Congress Avenue
Austin, Texas 78701
Tel:˚ +1 512 457 8800
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http://www.austin.intercontinental.com/index.html

MAKING LODGING RESERVATIONS (Important Deadline Information): A block of rooms has been set aside for this meeting at a special rate of $119.00 USD per night (plus tax). Please email pia.Schmidt@6c.com **ON OR BEFORE February 23** and mention that a block of rooms has been reserved for JOI-Joint Oceanographic Institutions. If you email your request, be sure to put JOI reservation in the subject line. You will need to provide the hotel with a credit card number to hold your room and please let Pia know if you prefer a smoking room.

GROUND TRANSPORTATION:
From Austin International Airport to The hotel:
Austin-Bergstrom International Airport is served by all major airlines, through hubs in Chicago, Dallas, Denver, and Atlanta. It is less than 10 miles from downtown Austin and the hotel. Take either a taxi (~$25 U.S. one-way) or blue and yellow Super Shuttles (~$13 one-way, no need to make reservation).

AIR TRAVEL: Discounts available to non-USSSP sponsored travelers on United Airlines: If you are flying from a U.S. state or from Canada, you may use the United Airlines discount JOI has in place to lower your travel costs. Just give your travel agent or United Airlines agent the discount number: 549UC. This will save you a small percentage off already discounted fares, and a very large percent off non-Saturday night stay full fare economy. If your agent has difficulties applying the discount, have them contact me bchisholm@joiscience.org.

MEETING DATES & TIMES:
SCICOM
March 17
08:30 until 17:00
Capital Ballroom

IPC
March 18, 19 & 20
08:30 until 17:00
Capital Ballroom

PANCH
March 21
08:30 until 12:00
The Cloakroom

MEETING LOCATION:
All three meetings will take place at Intercontinental, Stephen F. Austin Hotel. The room names are listed above under the meeting time, but please check the posting boards at the hotel or your in-room television in case of last minute room changes.

MEETING HOST:
James A. Austin, Jr.
Senior Research Scientist
The University of Texas at Austin
Institute for Geophysics
4412 Spicewood Springs Road, Building 600, Austin, TX 78759-8500

Office: (512) 471-0450, Administrative Associate: Nancy Hard (512) 471-0471
fax: (512) 471-0999, WWW: http://www.ig.utexas.edu

SOCIAL FUNCTIONS:

March 15 - A gathering at Jamie Austin s house in NW Austin (12310 Hanging Valley Drive, my phone 336-7046) for those arriving early. Start time 6 PM. RSVP to Kathy Ellins kellins@utig.ig.utexas.edu on or before February 26.

March 17 — JOI hosted dinner, please leave your calendar free this evening for a dinner; details on location and time will come next month. RSVP to Kathy Ellins kellins@utig.ig.utexas.edu on or before February 26.

March 19 — UTIG and JOI hosted reception please leave your calendar free this evening for a reception; details on location and time will come next month. RSVP to Kathy Ellins kellins@utig.ig.utexas.edu on or before February 26.

FIELD TRIP:
Sunday, March 16
Austin area field trip, leader:˚ W.R. ("Bill) Muehlberger, Department of Geological Sciences, The University of Texas at Austin
View: (1) spectacular exposures of faulting within the Balcones fault system (the boundary between the "Southern" and "Western" United States) that overlies the edge of Iapetus North America and the inboard edge of the Late Paleozoic Ouachita orogenic belt.
(2) Pleistocene-Recent incision of the Cretaceous Edwards Plateau (carbonate platform) across the Balcones fault system.
(3) Early Laramide Cretaceous volcano (Pilot Knob) that erupted on the carbonate platform.

Dinner:˚ Salt Lick BBQ, a famous eatery south of Austin
Fee:˚ $75/person (includes transportation, box lunch and beer with BBQ)
RSVP to Kathy Ellins kellins@utig.ig.utexas.edu on or before February 26.

JOIDES SCIENCE COMMITTEE
March 17 2003
Institute for Geophysics
The University of Texas at Austin

ATTENDEES

SCICOM Members:

Jamie Austin	University of Texas, USA
Keir Becker (Chair)	RSMAS, University of Miami, USA
Sherm Bloomer	Department of Geosciences, Oregon State University, USA
Steve D'Hondt	Graduate School of Oceanography, University of Rhode Island, USA
Andrew Fisher	Dept. of Earth Sciences, University of California at Santa Cruz, USA
Peter Herzig	Freiburg University, Germany
Teruaki Ishii	Ocean Research Institute, University of Tokyo, Japan
Jeroen Kenter	Dept. of Sedimentary Geology, Vrije University, Netherlands (ECOD)
Larry Mayer	Center for Coastal and Ocean Mapping, Univ. of New Hampshire, USA
Chris MacLeod	Cardiff, University UK
Ted Moore*	Department of Geological Sciences, University of Michigan, USA
Warren Prell**	Brown University, USA
David Rea	Department of Geological Sciences, University of Michigan, USA
Will Sager	Texas A & M. University, USA

* One time replacement for Patricia Fryer
**Permanent replacement for Frederick Sarg

Associate Member Observers:

Benoît Ildefonse	Université de Montpellier, France
Matt Salisbury	Dalhousie Univ. & Bedford Inst. of Oceanography, Canada (PacRim)
Zuyi Zhou	Tongji University, Peoples Republic of China

Liaisons:

James Allan	NSF, National Science Foundation, USA
Jack Baldauf	ODP-TAMU Science Operator, USA
Tim Byrne	ISSEP, University of Connecticut, USA
Gilbert Camoin	ESSEP, CEREGE, France
George Claypool	PPSP, USA
Dave Goldberg	ODP-LDEO, Wireline Logging Services, USA
Nick Pisias	JOI, Joint Oceanographic Institutions, Inc., USA

Guests:

Steve Bohlen	JOI, Joint Oceanographic Institutions, Inc., USA
J. Paul Dauphin	NSF, National Science Foundation, USA
John Farrell	JOI, Joint Oceanographic Institutions, Inc., USA
Jeff Fox	ODP-TAMU, Science Operator, USA
Alan Mix	Co-Chief Leg 202, Oregon State University, USA
John Orcutt	Co-Chief Leg 203, Scripps Institution of Oceanography, USA
Frank Rack	JOI, Joint Oceanographic Institutions Inc., USA
Ann Trehu	Co-Chief Leg 204, Oregon State University, USA
Heinrich Villinger	Co-Chief Leg 205, Universitat Bremen, Germany

JOIDES Office:

Elspeth Urquhart	JOIDES International Liaison, RSMAS, University of Miami, USA

Guests from the iPC Meeting

Millard F. Coffin	iPC, Ocean Research Institute, University of Tokyo, Japan.
André Droxler	iSSP, Rice University, USA
Harry Doust	iILP, Vrije Universiteit, The Netherlands
Nobuhisa Eguchi	iSAS Office, JAMSTEC, Japan
Kathy Gillis	iPC, University of Victoria, Canada
John Hogg	iILP, EnCana, Canada
Hisao Ito	iPC, Geological Survey of Japan, Japan
Kenji Kato	iPC, Shinshu University, Japan
Barry Katz	iPPSP Chair, ChevronTexaco, USA
Yoshihisa Kawamura	CDEX, JAMSTEC, Japan.
Hajimu Kinoshita	iPC Co-Chair, JAMSTEC, Japan
Ulrich Harms	ICDP Liaison, GeoForschungsZentrum Potsdam, Germany
Yoshihiro Masuda	iTAP, Dept. of Geosystem Engineering, University of Tokyo, Japan.
Hitoshi Mikada	iSSEP Co-Chair, JAMSTEC, Japan
Yoshiro Miki	JAMSTEC International Liaison, Japan
Ted Moore	iPC Co-Chair, University of Michigan, USA
Kate Moran	iTAP Chair, University of Rhode Island
Rick Murray	iSciMP Co-Chair, Boston University, USA
Tomohisa Nawate	OD21, JAMSTEC, Japan
Delia Oppo	iPC, Woods Hole Oceanographic Institution, USA
JoAnne Reuss	University of Michigan, USA
Izumi Sakamoto	International Working Group Support Office (IWGSO), USA.
Jeffrey Schuffert	iSAS Office, JAMSTEC, Japan
Kiyoshi Suyehiro	iPC, JAMSTEC, Japan
Yoshiyuki Tatsumi	iPC, JAMSTEC/IFREE, Japan
Yasuo Yamada	OD21, JAMSTEC, Japan
Minoru Yamakawa	iSAS Office, JAMSTEC, Japan

1 JOIDES SCIENCE COMMITTEE AGENDA

March 17 with iPC and PANCH members welcome as observers

A.	Welcome and Introductions	Becker	
B.	Logistical Announcements	Austin	
C.	Approval of Agenda		
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E.	ODP Agency and Prime Contractor Reports		p. 21
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F.	ODP Operator Reports		p. 36
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	LDEO-BRG	Goldberg	p. 67
	Coffee break		
G.	Update on JOIDES panel matters	Becker	
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	Leg 201	D'Hondt	
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	Coffee Break		
K.	How well have we done? – input for EXCOM/PECVI		p. 76
L.	ODP legacy holes – status report		
M.	Motions thanking panels and members		
N.	Other matters, final business		
O.	Adjourn to traditional SCICOM wine tasting and then dinner		

D. Approval of August 2002 Minutes.

JOIDES SCIENCE COMMITTEE
26 August, 2002
Hosted by Ghent University at Het Pand, Ghent, Belgium

DRAFT MOTION AND CONSENSUS ITEMS

SCICOM Motion 02-02-01: SCICOM approves the meeting agenda.

Fryer moved, Rea seconded, all in favor.

SCICOM Motion 02-02-02: SCICOM approves the minutes of its March 2002 meeting in Yokohama.

Mayer moved, Sager seconded, 14 in favor, none opposed, 1 abstention (Brumsack).

SCICOM Consensus 02-02-03: SCICOM accepts the following SCIMP recommendations:

SCIMP recommendation 02-1-1 concerning the guidelines for digital seismic data submission
SCIMP recommendation 02-1-2 concerning the JANUS data model
SCIMP recommendation 02-1-3 concerning the petrologic results compiled by Kurnosov et al.
SCIMP recommendation 02-1-4 concerning metadata documentation in JANUS
SCIMP recommendation 02-1-5 concerning the FMS and digital line scan images
SCIMP recommendation 02-1-6 concerning conducting any future business only by email.

Preface to SCICOM Motion 02-2-4:

SCICOM applauds the proponents vision and is excited by the opportunities presented by a test hole connected to a high-bandwidth, high-power cable. This represents a tremendous opportunity.

However, SCICOM believes that there are scientific and technical issues that need review and discussion prior to a commitment to establishing such a test site. These issues include:

1) Is there a community consensus on the optimal technical requirements for such a site? Issues include hole diameter, seafloor landing structure, hole depths, and casing strategy.
2) How do the environmental and geological characteristics limit or enhance the prospects for instrument tests that might be done in the hole? Issues include porosity, formation pressures, lithologies, hydrocarbon potential, and so on.
3) How is community access to the site to be managed? Issues include interactions with MBARI and management of permitting issues within the sanctuary.
4) Should planning for the drilling operations include time for logging of the formation to establish adequate baseline characterization?

SCICOM Motion 02-02-04: SCICOM strongly encourages the proponents of APL-22 to submit a pre-proposal to the IODP interim Science Advisory Structure for a test hole in Monterey Bay as part of the MARS facility.

Bloomer moved, Austin seconded, all in favor.

SCICOM Consensus 02-02-05: SCICOM thanks Jean-Pierre Henriet and Marc Faure of Ghent University for wonderful arrangements in hosting this meeting in such a quintessentially European location. SCICOM also sincerely thanks ECOD and ODP-France for financial co-support for the meeting arrangements.

ATTENDEES

SCICOM Members:

Jamie Austin	University of Texas, USA
Keir Becker (Chair)	RSMAS, University of Miami, USA
Sherm Bloomer	Department of Geosciences, Oregon State University, USA
Steve D'Hondt	Graduate School of Oceanography, University of Rhode Island, USA
Andrew Fisher	Dept. of Earth Sciences, University of California at Santa Cruz, USA
Patricia Fryer	School of Ocean and Earth Science and Technology, University of Hawaii, USA
Hans Brumsack*	Institut für Chemie und Biologie des Meeres, Germany
Teruaki Ishii	Ocean Research Institute, University of Tokyo, Japan
Jeroen Kenter	Dept. of Sedimentary Geology, Vrije University, Netherlands (ECOD)
Larry Mayer	Center for Coastal and Ocean Mapping, Univ. of New Hampshire, USA
Chris MacLeod	Cardiff, University UK
Delia Oppo**	Woods Hole Oceanographic Institution, USA
David Rea	Department of Geological Sciences, University of Michigan, USA
Matt Salisbury	Dalhousie University and Bedford Inst. of Oceanography, Canada (PacRim)
Will Sager	Texas A & M. University, USA

*Alternate for Peter Herzig
**Alternate for Frederick Sarg

Associate Member Observers:

Philippe Pezard	ISTEEM (CNRS), Universite de Montpellier, France
Apologies: Zuyi Zhou	Tongji University, Peoples Republic of China

Liaisons:

Jamie Allan	SCIMP Co-Chair, Appalachian State University, USA
Jack Baldauf	ODP-TAMU Science Operator, USA
Tim Byrne	ISSEP, University of Connecticut, USA
Gilbert Camoin	ESSEP, IRD Centre de Noumea and CEREGE, France
J. Paul Dauphin	NSF, National Science Foundation, USA
Dave Goldberg	ODP-LDEO, Wireline Logging Services, USA
Alister Skinner	TEDCOM, British Geological Survey, UK
Nick Pisias	JOI, Joint Oceanographic Institutions, Inc., USA

Guests:

Steve Bohlen	JOI, Joint Oceanographic Institutions, Inc., USA
Brad Clement	NSF, National Science Foundation, USA
John Farrell	JOI, Joint Oceanographic Institutions, Inc., USA
Marc Faure	Ghent University, Belgium
Jeff Fox	ODP-TAMU, Science Operator, USA
Jean-Pierre Henriet	Ghent University, Belgium
Isabella Premoli-Silva	Leg 198 Co-Chief, University of Milan, Italy
Ralph Stephen	Leg 200 Co-Chief, Woods Hole Oceanographic Inst., USA
John Tarduno	Leg 197 Co-Chief, University of Rochester, USA
Paul Wilson	Leg 199 Co-Chief, Southampton Oceanography Centre, UK

JOIDES Office:

Aleksandra Janik	JOIDES Science Coordinator, RSMAS, University of Miami, USA
Elspeth Urquhart	JOIDES International Liaison, RSMAS, University of Miami, USA

Guests from the iPC Meeting

Andre Droxler	iSSP, Rice University, USA
Harry Doust	iILP, Vrije Universiteit, The Netherlands
Nobuhisa Eguchi	iSAS Office, JAMSTEC, Japan
Kathy Gillis	University of Victoria, Canada
Hisao Ito	iPC, Geological Survey of Japan, Japan
Kenji Kato	iPC, Shinshu University, Japan
Barry Katz	iPPSP Chair, ChevronTexaco, USA
Hajimu Kinoshita	iPC Co-Chair, JAMSTEC, Japan
Shin'ichi Kuramoto	iSSP Co-Chair, Geological Survey of Japan. Japan
Jörn Lauterjung	ICDP Liaison, GeoForschungsZentrum Potsdam, Germany
Hitoshi Mikada	iSSEP Co-Chair, JAMSTEC, Japan
Yoshiro Miki	JAMSTEC International Liaison, Japan
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Jeffrey Schuffert	iSAS Office, JAMSTEC, Japan
Kiyoshi Suyehiro	iPC, JAMSTEC, Japan
Ryuji Tada	iPC, University of Tokyo, Japan
Yoshiyuki Tatsumi	iPC, JAMSTEC/IFREE, Japan
Robert Whitmarsh	InterMARGINS, Southampton Oceanography Centre, UK
Minoru Yamakawa	iSAS Office, JAMSTEC, Japan
Yasuo Yamada	JAMSTEC, Japan

SCICOM Draft Minutes - August 26, 2002

A. Welcome and Introductions

Becker welcomed all attendees to the SCICOM meeting. He noted that Oppo and Brumsack were substituting on a one-time basis for Sarg and Herzig, respectively. Self introductions followed.

B. Logistical Announcements

Jean-Pierre Henriet welcomed the attendees on behalf of the meeting hosts and briefly outlined the meeting logistics.

C. Approval of Agenda

Becker noted one addition to the agenda, discussion of an APL, which was received at the JOIDES Office three days earlier. Copies were distributed and Becker asked that SCICOM be ready to discuss the APL in the afternoon. With that addition, the agenda was approved.

SCICOM Motion 02-02-01: SCICOM approves the meeting agenda.

Fryer moved, Rea seconded, all in favor.

D. Approval of March 2002 Minutes

SCICOM Motion 02-02-02: SCICOM approves the minutes of its March 2002 meeting in Yokohama.

Mayer moved, Sager seconded, 14 in favor, none opposed, 1 abstention (Brumsack).

E. ODP Agency and Prime Contractor Reports

NSF

Dauphin reported that since the SCICOM meeting in Yokohama, the Program Plan budget increased by $407,000 to $47,985,259 to account for the potential effect of September 11 events on insurance, day rates, travel expenses, etc. The FY03 target budget is $45.3M. The review panel for the FY03-07 Program Plan commended the FY03 plan as excellent, with only one major concern: that if IODP initiation is delayed, a contingency plan needs to be developed for ODP information services and core curation. The National Science Board (NSB) authorized the FY03-07 Program Plan including one year of operations and four years of phase-down activities. NSB was particularly concerned about legacy issues regarding data but JOI responded to these concerns.

Dauphin continued with an overview of the current membership levels, which for FY02 include Germany, Japan, UK, ESF, and PacRim as full members, and France (1/3 of full membership) and China (1/6 of the full membership) as associate members. Canada is currently seeking resources to bring PacRim back to 5/6 of the full membership level for FY03. EXCOM recommended associate membership level for PacRim in FY03, as only 76% of the annual contribution has been committed at present time.

Dauphin then informed SCICOM of the plans to establish the sixth Performance Evaluation Committee (PEC VI) in 2004 to evaluate the status and progress on the program phase-out activities.

Regarding the IODP non-riser vessel, Dauphin reported that NSF activities are well on track and an RFP will be released most likely in late November 2003. To help with the non-riser vessel acquisition, John Walter from NOAA was invited to NSF as a visiting science engineer, so the program could take advantage of his experience with government contracting and ship acquisitions issues.

Dauphin concluded by announcing that Dr. Jamie Allan from the Appalachian State University had accepted the second NSF/ODP Program Director position as of October 1, 2002.

JOI

Pisias reported that the FY03-07 Program Plan has just been approved by NSB. The review panel met in May 2002 and JOI received 11 primary recommendations, to which the response was sent to NSF on June 7, 2002. Among the panel concerns were creation and preservation of ODP legacy, e.g., ODP and DSDP data archives, having enough resources for continuous availability of ODP data, website and cores to the scientific community, publication of technology and engineering summary sheets, preservation of blueprints in hard copy and digital form, and inventory of legacy holes (reentry sites).

Documenting legacy sites has been undertaken by TAMU and a poster was displayed with examples of legacy site descriptions including technical details of reentry cone, observatory installations, and locations.

Pisias then briefly explained the contingency financial plan in case there is a delay in IODP commencement. JOI is addressing these issues by identifying the costs of projects like continuation of core repositories until the end of FY07 (estimated $675K/year), continuation of JANUS ($290K/year), scanning DSDP core photos ($418K) and migration of the micropaleontological database ($752K) in case the IODP start is delayed. Pisias also reminded SCICOM that all ODP phase-out activities post 2003 are to be financed entirely by NSF.

Regarding details of data archiving, Pisias noted that NGDC (Boulder, Colorado) will act as permanent repository for the flat ASCII files that will be readable forever. The data (flat ACSII tables) will be organized by Site and Hole and logging data will also be archived as ASCII tables (already available). In addition, technical notes, lab procedures and other metadata will be archived. The archive tables have been presented and discussed during the June 2002 SCIMP meeting. Subsequently, JOI formed a working group chaired by David Divins from NGDC to provide guidance regarding proper data archiving. Progress on the archiving efforts will be reviewed by PEC VI.

Pisias continued the JOI report with an update on prospects for post-ODP (2003-2004) charter use of the JOIDES Resolution (JR). He noted that a proposal is expected from a Canadian group to drill off the coast of Nova Scotia; that US Department of Energy has expressed interest in hydrates drilling in Gulf of Mexico; and JANOC is interested in JR use for hydrates drilling in the Nankai Trough. He emphasized that it is a good sign that interest in JR usage has increased because this may allow preservation of ship-related capabilities during the interim period. Pisias added that NSF owns the equipment onboard the drillship, so if the JR is to be used after September 2003 with its full complement of equipment, it will require NSF permission. Therefore, a set of principles has been articulated to ensure that operations would be performed in accordance with NSF requirements. Any such operation would be run in a fashion similar to ODP, with scientific results open to the community (open exchange of data after some proprietary period), and as a science-based activity that would involve participation of academic scientists. Any such operation would have to be at no cost to NSF, and insurance coverage for the vessel and the drilling operations would be the responsibility of the proposing organization. Sager expressed concern that the demobilization date is coming so quickly that any possible post-ODP charter plans need to set very soon. Pisias agreed, and added that although the negotiations were continuing, at the moment there are no firm commitments and the only certain date is the programmed demobilization (September 21-30, 2003).

Pisias then described the plans for PEC VI, which is scheduled to convene and report in FY04. The evaluation committee will be finalized in summer of 2003 at the time of the last EXCOM meeting, and the review is scheduled to start in the Fall of 2003. The PEC VI charge as outlined during the last EXCOM meeting is to asses how well the goals of the Long Range Plan have been achieved, to examine all the aspects of the phase-out of the program and its impact on the commencement of the new IODP program, and to evaluate the ODP legacy activities. The PEC VI charge also includes assessing the effectiveness of the JOI program management and JOIDES scientific advisory structure, to determine whether these are the most appropriate models for IODP.

Becker asked if JOI had formally adopted the version of the PEC mandate suggested by EXCOM at its meeting in Granada. Pisias confirmed as much, although he noted that the last charge, regarding evaluation of JOI and JOIDES as potential models for IODP, seems to be a bit late given the Fall 2004 timeline for PEC VI, so perhaps it will not be considered.

Finally Pisias reviewed recent personnel changes at JOI. These include hiring of the new Assistant Program Manager for USSSP, Bob Burger, and replacement of Brecht Donoghue, who left for graduate school, with Margo Cortes. JOI also has two new interns, Tony Goodman and Jennifer Anziano, and Frank Rack is now Director of DoE Programs, Associate Director of USSSP, and Assistant Director of ODP.

Farrell presented the second part of the JOI report about planning for Arctic drilling and revisions to the ODP Policy Manual. Farrell started with an update on the latest developments in the plans for Lomonosov Ridge drilling in the Arctic. He briefly summarized the steps taken to date starting with the August 2001 SCICOM motion endorsing the joint JOI/European initiative to establish an Arctic Project Management team. Subsequently in January 2002, IWG mandated iPC to rank MSP proposals in August 2002, and encouraged the funding organizations to move forward. This was followed by establishment of a contract between JOI and Swedish Polar Research Secretariat to conduct Arctic planning, together with JEODI cooperation. Many preparatory meetings took place and various planning activities are ongoing. Farrell diagramed a contract management structure including the major tasks of each unit, adding that it is a complicated program that requires considerable preparation. Farrell described the preferred four-vessel option for the operation, including one leading nuclear icebreaker, two other icebreakers (Terry Fox and Oden) and the drilling vessel Botnica. Farrell reported that a March meeting with the Botnica owners was very successful, and no liability issues were pointed out that could not be handled. It is planned that the operations would be headed by a European Science Operator with one qualified person as Armada Operations Manager. Farrell concluded that the total costs of the program is anticipated to be between $8-9M and, if everything goes well, IWG may decide in January 2003 if the expedition is ready to commence in summer 2004.

Farrell then reported on the progress made on updating the ODP Policy Manual, which NSF asked JOI to revise as it has not been updated since 1992. The final version is to be finalized in September and to be sent to NSF for approval soon after. The manual contains the general overview of the ODP policies and once approved, it will be distributed widely to the community.

F. ODP Operator Reports

ODP-TAMU

Baldauf started by reporting that the portcall between Legs 204 and 205 had just been rescheduled from San Diego to Victoria, Canada for the same reason the July port call had also been rescheduled to Victoria — uncertainties about the potential US west coast longshore workers strike. Then he briefly reported on the drilling operations for Legs 201 — 205.

<u>Leg 201 — Peru Biosphere</u>
- Very successful sampling for microbiology: out of total of 19,292 shipboard samples 10,732 taken for microbiological studies; samples had to be re-iced every two days but all samples successfully delivered to the institutions

<u>Leg 202 — SE Pacific Paleoceanography</u>
- Recovered more than 7,000 m of core with almost 100% of core recovery
- Very successful high resolution program with only two hiatuses

- Some weather problems at proposed primary site SEPAC-19A forced move to an alternate site

Leg 203 — Equatorial Pacific Ion
- Established cased reentry at the Hole 1243A for future multidisciplinary seafloor observatory, drilled to 224 mbsf and cased to 212 mbsf. This observatory is planned as part of DEOS (Dynamics of Earth and Ocean Systems).
- Hole 1243B drilled 600 m east off 1243A, RCB cored and logged
- Added 4 days to the transit due to portcall change from San Francisco to Victoria (to avoid potential longshoremen strike)

Leg 204 - Gas Hydrates (approximately one week remaining as of SCICOM meeting)
- 8 sites completed
- Very successful logging and measurements-while-drilling operations
- Extensive hydrate identified from 40-100 mbsf using high resistivity and RAB image anomalies
- Fugro Pressure Corer — good core but not able to maintain pressure
- HYACINTH Rotary Corer — good core with full to partial pressure
- Pressure Core Samples — good core with full to partial pressure
- About 40 pressurized samples recovered with HYACINTH and PCS (with DoE cooperation)
- HYACINTH transfer chamber successful — cores logged under pressure
- Portcall changed from San Diego to Victoria to avoid potential longshoremen strike
- 43 personnel were transferred on and off ship during the cruise

Leg 205 — Costa Rica
- Start portcall changed to Victoria to avoid potential longshoremen strike resulting in reducing operations by 2 days, so 3 top-priority sites will be completed, eliminating 4th lower-priority site
- Scientists to transfer to vessel in Acapulco and crew in Victoria

LDEO-BRG

Goldberg presented the logging highlights of recent and upcoming legs. He noted that for Legs 205-208, standard logging operations are scheduled, and a German magnetometer tool is planned to be added for Leg 206.

Leg 202 — SE Pacific Paleoceanography
- Standard logging and high-resolution gamma ray (3rd-party MGT)
- Core-log mapping critical because cyclicity in the sediments similar to the core length

Leg 203 — Equatorial Pacific Ion
- Standard logging and WST check shot
- Logs across sediment-basement contact show competent borehole conditions for downhole instrument emplacement
- NGR clearly shows two very different units within the basement

Leg 204 - Gas Hydrates
- Standard logging, VSP, offset VSP, density and imaging LWD, MWD, MRWD (Magnetic Resonance), RAB coring tool, HYACINTH (3rd-party) plus DSA
- Hydrates shown well in resistivity images (high resistivity - low water saturation)
- NMR-LWD and porosity log difference — indicators of high hydrate concentration
- Borehole breakouts clearly visible on the RAB images, probably related to stress and tectonics, but not yet well understood
- Successful RAB-while-coring tests at Site 1249 — 68% of recovery in first core, and 35% on average
- Drillstring acceleration tests performed for HYACINTH Rotary Corer and Fugro Pressure Corer

Next Goldberg updated SCICOM about logging-related legacy projects. He noted that 16 two-page technical summaries of ODP specialty, LWD, and third-party (certified) tools, as well as software, and related technologies are completed and can be accesses on the LDEO website at the following URL: http://www.ldeo.columbia.edu/BRG/ODP/legacy.html. Others are currently under development. He concluded his presentation with the diagrams illustrating the overall increase in logging database access as well as more activity coming from various foreign countries.

Ishii wondered about plans for improving of hard-rock recovery, but Baldauf said that at the moment no new developments are being done.

Becker referred to discussions at the March SCICOM meeting and asked whether the Leg 204 RAB-while-coring experiment was successful enough to warrant deployment on Leg 209. Goldberg confirmed that the RAB-while-coring tests on Leg 204 were successful, and noted that the possibility of use on Leg 209 depends on the availability of the tool.

G. EXCOM Report

Becker reported that during the last EXCOM meeting in Granada (25-26 June 2002), the main matters of interest to SCICOM were defining the charge of PEC VI and the discussion of membership issues. As was reported by Dauphin, EXCOM decided to class PacRim as associate member observer for FY03. The implication is that the PacRim representative will not have voting rights at the March 2003 SCICOM meeting. Becker added that EXCOM has one more meeting, scheduled for July 2003 in Bermuda to coincide with port call prior to Leg 210.

H. SSEPs Report

Camoin presented the status of the PPG Reports:

- *Arctic PPG* — Final report approved (excerpts published in spring 2001 JOIDES Journal).
- *Long Term Observatories* — Final report accepted (excerpts in fall 1999 JOIDES Journal).
- *Extreme Climates* — Final report accepted (excerpts in spring 2000 JOIDES Journal).
- *Hydrogeology PPG* — Final report submitted, reviewed, and recommended for acceptance.
- *The Architecture of the Oceanic Lithosphere PPG* — Final report submitted 02/2000 and reviewed, material from PPG minutes recommended by SSEPs to be added to final report.
- *Climate-Tectonics Links* — Report submitted 09/99 and reviewed.
- *Gas Hydrates PPG* — Report submitted 26/10/99 (excerpts in fall 2000 JOIDES Journal). SSEPs recommendation: needs revision.
- *Shallow Water Systems* — Report published in EOS but never submitted to SSEPs.
- *Deep Biosphere* — Nothing submitted to SSEPs. Final report requested (03/00).

SCICOM discussed those reports that have not yet been finalized in response to SSEPs reviews. Austin said that reaching closure on all the reports is a legacy issue. Fisher noted that considerable hydrate work has been completed since the Gas Hydrate PPG report was written, so although there may be value in cleaning up a final draft of the report, the scientific return for this effort may be modest. Sager said that because the Gas Hydrate PPG report had been written, it needs to be archived and can be a starting point for a further work within IODP. Allan noted that the PPG reporting procedures were unclear and the Gas Hydrates PPG members tried to do their best in preparing the report. One PPG goal was to ensure the availability of proposals addressing hydrates objectives; insofar as there were many hydrates proposals, the Gas Hydrates PPG was successful.

Austin stated that it is a SCICOM responsibility to assess any uncertainties and identify how PPGs should be used in future. Byrne suggested that formal guides should be prepared for each PPG like that prepared by former SSEPs chairs Lundberg and Morris for the Hydrogeology PPG.

Becker wondered about those PPG reports that the SSEPs recommend still need revision. Austin said that whatever the decision, it should now come from SCICOM. Becker suggested that, for Shallow Water Systems PPG, their EOS article might be acceptable as the final report. Pezard (former member of AOL-PPG) noted that there had been some conflicting views between the original guidelines from SCICOM and what the SSEPs wanted from the PPG; this confusion was probably caused by the change of the reporting requirements made after the PPG was formed.

Becker suggested that, for the PPG reports which have not been finalized, he would appoint SCICOM subcommittees to asses each situation and report at the March 2003 SCICOM meeting. These subcommittees would be charged both with finalizing or recommending a means to finalize the respective PPG reports as well as assessing the overall PPG process. [These subcommittee assignments were made in early September.]

I. Service Panel Reports

TEDCOM

Becker presented a brief TEDCOM report for Skinner, who was unable to attend that day. The last TEDCOM meeting took place in San Francisco in conjunction with the first iTAP meeting. The main purpose of that meeting was to ensure the orderly transfer of knowledge from TEDCOM to iTAP.

Becker then referred to the TEDCOM recommendation regarding plans for testing of ADCB for Leg 206 or 209. He noted that further testing and usage of the ADCB might address some of concerns expressed earlier about hard rock recovery. Baldauf explained that there is currently no formal plan to use the ADCB on either Leg 206 or 209 because the RCB is planned as the primary coring tool for both legs, and the costs of fielding the ADCB and supporting engineer for an entire leg are not justified for only a potential backup roll.

PPSP

Becker reported for Claypool who was currently on Leg 204. During its June meeting PPSP reviewed the sites for three final legs for FY03, approving all sites except one alternate site for Leg 210 that was viewed to pose a hydrocarbon risk. PPSP also reviewed APL 21 sites in the Santa Barbara Basin; after a long discussion, the majority of PPSP members did not support approval of those sites. PPSP also conducted two unofficial previews, one of a possible post-ODP JR charter project to drill near Newfoundland or Nova Scotia, the second for an NSF-funded Lake Malawi drilling program. D Hondt asked if the Lake Malawi preview had been at the request of the participants or NSF, and Becker replied that he understood it was a joint request. Becker concluded by noting that the June 2002 meeting was probably the final JOIDES PPSP meeting.

SCIMP

Allan reported that the Hard Rock Working Group (HRWG) meeting in May was very successful and noted that he would present the findings during the iPC segment of the joint meeting. He then briefly discussed the six recommendations to SCICOM from the June SCIMP meeting.

> SCIMP Recommendation 02-1-1
> The Digital Seismic Data Submission guidelines prepared by the ODP Databank and Borehole Research Group/Lamont should be used as a standard for all digital seismic data. The guidelines together with the data documentation sheets will be uploaded to the Borehole Research group WebPages.

SCIMP Recommendation 02-1-2
SCIMP recommends that the ODP Science Operator incorporate all regularly collected data in the JANUS data model and that appropriate data up-loaders are provided. SCIMP also recommends that the JANUS data queries are modified to allow all data in the JANUS database to be accessed. For example, in the case of magnetic susceptibility, instrument type needs to be added.

SCIMP Recommendation 02-1-3
SCIMP encourages ODP to consider publishing, as part of the peer-reviewed Technical Note series, the multi-leg petrologic results compiled by Kurnosov et al.

Allan said that this manuscript could be an important part of the ODP legacy documentation.

SCIMP Recommendation 02-1-4
SCIMP endorses the concept of comprehensive metadata documentation for each of the prime data types in the JANUS database. These documents should address issues relating to data collection, data archiving, and data quality. Metadata documentation files would accompany the ASCII data archive and be available through the JANUS system.

Allan added that a very good presentation dealing with the X-ray fluorescence data documentation was given at TAMU during the last SCIMP meeting

SCIMP Recommendation 02-1-5
SCIMP recommends that FMS and digital line scan image files be archived as depth-associated ASCII vector files.

The justification for this recommendation is the fact that the binary data format is not always readable, so SCIMP advised that ASCII format should be used for FMS archival.

SCIMP Recommendation 02-1-6
Given the reduced need for advice to the current ODP as it enters its last year of operation, the JOIDES SCIMP recommends that it meet electronically for the remainder of its existence.

Ishii made a suggestion concerning modification of the way hard-rock core is split, so that more material is provided for scientific studies but a significant part remains preserved for archive. Allan suggested that a formal suggestion should be made for consideration at the next iSCIMP meeting.

SCICOM then accepted the six SCIMP recommendations by consensus.

SCICOM Consensus 02-02-03: SCICOM accepts the following SCIMP recommendations:

SCIMP recommendation 02-1-1 concerning the guidelines for digital seismic data submission
SCIMP recommendation 02-1-2 concerning the JANUS data model
SCIMP recommendation 02-1-3 concerning the petrologic results compiled by Kurnosov et al.
SCIMP recommendation 02-1-4 concerning metadata documentation in JANUS
SCIMP recommendation 02-1-5 concerning the FMS and digital line scan images
SCIMP recommendation 02-1-6 concerning conducting any future business only by email.

J. Leg Science Reports

Leg 197 - Motion of the Hawaiian Hotspot: A Paleomagnetic Test

John Tarduno presented the scientific results of the Leg 197, the objective of which was to test the hypothesis of southward motion of the Hawaiian hotspot. This was achieved by coring of flat lava flows on top of seamounts for shipboard and shore-based magnetization analyses. Three Emperor

Seamounts were cored for paleomagnetic comparison to data from Hawaii, and the shipboard results indicate significant southward motion of the Hawaiian hotspot in the late Cretaceous and early Tertiary. Shorebased studies are now being performed to verify the preliminary results but there is no scientific indication confirming the fixed hotspot theory, and the data verify the hot spot motion, possibly as a part of large moving mantle cell in Pacific.

MacLeod pointed out core-log integration techniques which, by matching core structures with their representations on borehole images, allow full restoration of paleomagnetic data to geographical coordinates. They can thus provide estimates of pole position independent of many of the assumptions made when using magnetic inclination data alone. Tarduno noted that precise age data for Leg 197 samples are now being collected at UC Berkeley and the results will be presented at the Fall AGU meeting. Allan commented that the Leg 197 results are amazing with exciting implications for interpretation of mantle movement.

Leg 198 - Extreme Warmth in the Cretaceous and Paleogene: a Depth Transect on Shatsky Rise, Central Pacific

Isabella Premoli-Silva presented the scientific results of Leg 198, which aimed at understanding the long-term climate transition in and out of warm climate greenhouse (Cretaceous and Paleogene global warmth) as well as transient but critical events that involved major changes in ocean environment, geochemical cycles and marine biota recorded in the marine sediments on the Shatsky Rise. Shatsky Rise is a medium-sized large igneous province (LIP) in the west-central Pacific and it contains sediments of Cretaceous and Paleogene age at relatively shallow depths on three prominent highs. Eight sites were drilled in 4 transects and the complete Cenozoic section was obtained except hiatus between 17-25 Ma. The recovered sediments were predominantly calcareous ooze, chalk and limestone with exception of clay- and silica-rich Neogene section.

Some of the scientific results include recovery of such critical intervals as the Cretaceous-early Aptian Anoxic Event (OAE 1a), Cretaceous/Tertiary boundary (K/T), Mid-Maastrichtian Event (MME), late Paleocene thermal maximum (LPTM). Premoli-Silva added that many chert horizons were also encountered and their frequency was utilized as indication of the chemical state of the water column — higher frequency of chert layers meaning reducing condition. The sediment provided the evidence for an abrupt rise in the level of the calcite compensation depth (CCD) during the LPTM, major deep-water cooling during Oligocene, deepening in the CCD at or during the Eocene—Oligocene transition and other important events.

Leg 199 - Paleogene Equatorial Transect

Paul Wilson reported on the scientific findings of the Leg 199, the objectives of which included defining the sedimentary record of paleoproductivity, paleocirculation and paleowind patterns in the Paloegene Equatorial Pacific and studying critical paleoclimatic intervals such as Paleocene/Eocene boundary, Eocene/Oligocene boundary in the Equatorial Pacific, where they have not been properly sampled before. A third objective was to obtain a complete Oligocene/Miocene record of ocean atmospheric circulation from Cenozoic warmth to initial Antarctic glaciation. The Paleogene was the focus interval because of the extreme perturbation in global climate at that time. Eight sites were drilled in total and Wilson briefly described five lithochronologic unit identified in the sediments: (1) surficial clay and radiolarian Ooze, (2) Oligocene—Lower Miocene nannofossil ooze and chalk, (3) Late—Middle Eocene radiolarian ooze, (4) Lower Middle—Lower Eocene cherts, clay and radiolarian Ooze, and (5) Lower Eocene—Upper Paleocene nannofossil ooze and chalk. Wilson said that there were two major peaks in sedimentation rates, one in lower Oligocene in the carbonate ooze sediments and the other in the upper middle Eocene in radiolarian ooze intervals, and then he briefly discussed the mass accumulation rates.

Wilson then highlighted the recovery of such important intervals like Oligocene/Miocene, Eocene/Oligocene and Pliocene/Eocene boundaries, and he emphasized a very good magnetostratigraphic record and excellent cyclostratigraphy in carbonate units. He added that, based on the degree to which the upper Eocene through Oligocene and Miocene sections at Sites 1218 and 1219 correlated, it can be concluded that central Pacific was behaving as one system in those times.

Wilson concluded his presentation with operational comment. He said that for such paleoceanographic studies it is very important to recover as much materials with APC coring system as possible allowing for crucial magnetostratigraphic measurements. He suggested that perhaps the APC core barrel length could be changed from 10 to 5 m near the APC-XCB transition to increase the depth at which we have to switch from APC to XCB.

D Hondt wondered if any impact debris was found in Eocene, but Wilson responded not.

Leg 200 - Drilling at the Hawaii-2 Observatory (H2O) and the Nuuanu Landslide

Ralph Stephen presented the scientific highlights of Leg 200. One of the objectives of that cruise was APL coring to investigate a landslide off Oahu from 2 Ma ago and study the distal units of the landslide debris. The coring demonstrated that the landslide was probably a complex pyroclastic event similar to Mount St. Helen eruption.

The primary objective of Leg 200 was establishing a cased reentry hole in fast-spread crust at H2O. The site is located in one of the high-priority regions for the Ocean Seismic Network, near the Hawaii-2 cable and the H2O junction box on the cable. The leg succeeded in establishing a cased reentry hole suitable for future installation of a seismometer. NSF has funded a program to instrument the hole with a broad-band borehole seismometer and link it to the H2O junction box. Stephen concluded by noting that both Leg 200 and 203 sites are high priority sites for Ocean Seismic Network.

K. Legacy Issues

Legacy Holes

Becker recalled the poster prepared by TAMU presenting the legacy hole documentation, and he suggested that this poster might be published in the next issue of the JOIDES Journal.

Greatest Hits

Urquhart updated the committee with the latest developments in planning for the publication of the Greatest Hits volume 2, prepared at the request of EXCOM and aiming at general audience. After very extensive call for articles 47 contributions were submitted. They were edited and returned for the authors approval. Urquhart said that the authors were very positive about these suggested modifications. She presented the breakdown of the contributions by countries: USA 20, UK 7, Japan 4, Germany 4, Australia 2, Switzerland 2, France 2, Russia 1, Norway 1, Canada 1, and Portugal 1. The SSEPs have reviewed the articles and have chosen 20 to be published as hardcopies, but all 47 articles will be available on the JOI website. Possibly a 3rd volume could be prepared to cover the remaining legs (198-210) but this will be a decision to be taken in the future by JOI.

Byrne described the SSEPs review process, noting that the SSEPs members were asked to pick 20 out of 47 hits, and 7 reviews were received (including the co-chairs). The next step now is to edit the top picks and have final versions available for potential hard copy publication. Some of the hits could be merged.

Brumsack suggested that the electronic files should be available in original format, for the ease of translation of the figure labels to the different language. Urquhart confirmed that all originals are available. D Hondt said that if this is prepared for popular readers then punchier titles could be better.

Austin wondered if the Greatest Hits address all the objectives of the Long Range Plan, but Mayer said that the hits are about the best accomplishments of the program and it is a separate issue from the Long Range Plan. SCICOM generally agreed but Allan and Rea noted that the hits generally do cover the Long Range Plan.

JOIDES History

Becker said that NSF had asked the JOIDES Office to compile a brief history of the JOIDES panels, and this will be presented at the March SCICOM meeting

L. APL 22 Review

Becker initiated a discussion regarding APL 22 (Installation of a Cabled-Observatory-Connected Test Hole in Monterey Bay), which was submitted to the JOIDES Office just before this SCICOM meeting. (Copies of the APL had been distributed earlier during the morning, so members and liaisons could read it for the afternoon discussion.) He presented a range of possible options for how SCICOM could respond to the APL, and he also recalled the discussions of APL 21 that had been submitted just prior to the previous SCICOM meeting. APL 21 had a few months of lead time that allowed a full review process by email, whereas APL 22 was submitted with only a few days lead time in that the drilling could only be conducted during the upcoming transit from Leg 204 to 205. In the light of such tight timing Becker requested that first SCICOM decide whether and by what process to review the APL, and only then turn to the scientific review. Some discussion followed with general consensus that APL 22 should indeed be reviewed, as each opportunity to do new and exciting science should be embraced by SCICOM.

Prior to SCICOM discussion of scientific merit of the APL, Becker asked Baldauf for a brief summary of any logistical issues. Baldauf summarized the following aspects:
- Drilling at the APL 22 site requires NOAA and MMS permitting; currently MBARI is in negotiation for the required permits.
- SSP and PPSP issues — there are cables in the area and site is not on crosslines of seismic profiles
- Lead times — Port call is on September 2 and drilling would have to be scheduled for September 9. Casing would need to be ordered immediately and a decision to proceed would have to be made by the day after the SCICOM meeting.
- 4.5 days added to already long Leg 205, which would complicate the TSF crew scheduling
- Cost about $163K (crew change not included)
- Would the proposed drilling maximize the potential science, i.e. what about logging?

SCICOM then engaged in a thorough discussion emphasizing a scientific review of APL 22. Austin was concerned that the proposed site was not located on a seismic crossline (which would almost certainly be a requirement from both SSP and PPSP). Pisias said that the financial aspects should not be considered a problem and that funds could be found should SCICOM decide to schedule APL 22. Baldauf said that the timing is very tight and the decision must be taken now, so there is enough time to be ready with casing for Victoria portcall. Bloomer commented that it is a good APL but put forward the proposition that it should go through the full JOIDES review system. Mayer responded that the program should be flexible when an opportunity to do interesting science arises. Sager seconded that opinion.

Pezard suggested that committee should focus on the scientific merit of the APL. D Hondt noted that there was potential that such a site could be interesting for a microbiological observatory. Bloomer said that APL 22 contains a very exciting idea but wondered if the technical aspects were appropriate. Sager noted that this APL is more exciting in terms of engineering than science. Mayer said that this APL could be yet another step toward defining future long-term observatory science, but he was unsure if in this particular case we would not be moving too fast without having enough time to think about the safety issues, optimal technology, etc. Austin replied that Mayer had in fact presented an elegant argument to emplace this test site in the beginning of IODP rather than at the end of ODP, so the planning could be done better and in order to gather more community input, with the desirable goal to ensure that the site would be useful to a broad scientific community.

Mayer asked Stephen to comment about the depth of such sites, and Stephen said that deep water might be better but in this case proximity to shore and thus fast access would be advantageous. He added it is always good to have convenient test sites.

Mayer wondered if ODP would have to depend on MBARI vessels for accessing the site. Dauphin said that there always must be an institutional commitment (MBARI in this case), but MARS is an NSF-funded project, so it would belong to the community.

Sager asked seismologists present as observers to comment on the suitability of the chosen site for the seismic research suggested in the proposal. Suyehiro said that the proximity to the plate boundary is advantageous and a seismometer is important for such location. He also noted that the broad seismological community is not aware yet of this project. Austin agreed that he would like to see a round of community discussion.

Goldberg said that the lack of logging should not stop SCICOM from scheduling the APL, but noted that rig time for logging of the formation should be added to provide useful in situ site characterization. Austin asked if logging can be done through casing and Goldberg confirmed for a few logs, provided that prior open-hole logging is done to calibrate them. Suyehiro noted that comparable Japanese test sites could also be considered in the future.

The discussion concluded with the following motion:

Preface to SCICOM Motion 02-2-4:

SCICOM applauds the proponents vision and is excited by the opportunities presented by a test hole connected to a high-bandwidth, high-power cable. This represents a tremendous opportunity.

However, SCICOM believes that there are scientific and technical issues that need review and discussion prior to a commitment to establishing such a test site. These issues include:

5) Is there a community consensus on the optimal technical requirements for such a site? Issues include hole diameter, seafloor landing structure, hole depths, and casing strategy.
6) How do the environmental and geological characteristics limit or enhance the prospects for instrument tests that might be done in the hole? Issues include porosity, formation pressures, lithologies, hydrocarbon potential, and so on.
7) How is community access to the site to be managed? Issues include interactions with MBARI and management of permitting issues within the sanctuary.
8) Should planning for the drilling operations include time for logging of the formation to establish adequate baseline characterization?

SCICOM Motion 02-02-04: SCICOM strongly encourages the proponents of APL-22 to submit a pre-proposal to the IODP interim Science Advisory Structure for a test hole in Monterey Bay as part of the MARS facility.

Bloomer moved, Austin seconded, all in favor.

M. Next meeting: the final SCICOM meeting?

Austin briefly but very enthusiastically introduced the committee to the location and amenities for the next meeting, which will take place in Austin, TX on Monday, March 17, 2003, followed by the iPC meeting. Becker noted this will be most probably be the final SCICOM meeting.

N. Before SCICOM adjourned, Becker proposed a consensus to thank the meeting hosts:

SCICOM Consensus 02-02-05: SCICOM thanks Jean-Pierre Henriet and Marc Faure of Ghent University for wonderful arrangements in hosting this meeting in such a quintessentially European location. SCICOM also sincerely thanks ECOD and ODP-France for financial co-support for the meeting arrangements.

E. ODP Agency and Prime Contractor Reports.

NSF Report - Allan

US ODP SCICOM Report

ODP Management

Based on approval of the ODP FY 03-07 Program Plans by the National Science Board, ODP phase out planning has begun in earnest. The JOIDES Resolution will move off contract Sept. 30, 2003; ship demobilization must have been finished by that time. JOI has reported the finishing of negotiations with TransOcean, Ltd. regarding what equipment is regarded as "permanently mounted" to the JOIDES Resolution, thereby allowing detailed demobilization planning to proceed. NSF has engaged in discussions with JOI concerning the possible use of shipboard scientific equipment in non-ODP drilling projects that would occur after demobilization.

NSF remains committed to ensuring access to ODP data and core during the transition to IODP. During FY 04 to 07, ODP publication, data, and knowledge archival activities will continue to take place.

Jamie Allan joined the NSF as Program Director, Ocean Drilling Program, on October 1, 2002. He replaces Bruce Malfait as the Contracting Officer's Technical Representative (COTR) on the ODP contract.

Membership Levels:

NSF is pleased to acknowledge that ESF has attained full membership status ($2.95M contribution) in the Ocean Drilling Program for U.S. Fiscal Year 2003.

NSF Country Report

The NSF continues to operate under a "continuing resolution," awaiting Presidential signing of the FY 2003 (October 1, 2002 - September 30, 2003) federal budget appropriation. This "continuing resolution" allows operations to continue at the FY 2002 levels, but prevents new "starts." It is unclear at this writing when FY2003 funds will be appropriated; hopefully appropriation will have occurred by the time of this meeting. The President's FY 2004 U.S. budget has been presented to the U.S. Congress, based upon the FY2002 budget. Funds for the non-riser drillship conversion, needed to meet IODP scientific needs as defined by the U.S. Science Advisory Committee's (USSAC) Conceptual Design Committee report, have been deferred to the NSF FY2005 budget.

Planning for the acquisition of a non-riser vessel and its implementing organization for IODP nonetheless continues. On November 15, 2002, NSF issued a Request for Information (RFI) seeking information to determine potential sources for a System Integration Contractor (SIC). This RFI details a two-step process for providing a non-riser drillship and its scientific support services for IODP. After initial identification of the SIC, the SIC will, together with the NSF, procure a non-riser drilling ship from bid. The RFI can be viewed at: http://www2.eps.gov/spg/NSF/DCPO/CPO/Reference-Number-RFI/SynopsisR.html. NSF is evaluating its acquisition strategy based on responses to the RFI and the recently released FY2004 budget, which does not include vessel conversion funds. Issuance of the Request for Proposal (RFP) for the U.S. SIC is on hold due to NSF operating under "continuing resolution."

The USSAC Conference of U.S. Participation in IODP (CUSP) report has been transmitted by the CUSP Steering Committee and USSAC to NSF in November 2002. It recommends the manner of U.S. participation, emphasizing the importance of pre- and post-drilling project science support, planning activities and production of comprehensive project data and knowledge sets, and facilitating education and outreach activities.

NSF and MEXT continue to work together in making IODP a reality, and have begun the process of establishing an IODP Central Management Office (CMO). Work on the IODP Memorandum, defining the participation and interaction of IODP Lead Agencies, continues, with signing of the Memorandum expected in Spring/Summer 2003.

New Field Programs

The NSF continues to actively support development of drilling science for IODP through its ODP unsolicited proposal program. Five unsolicited grants have recently been recommended for awards, three of them field programs in support of potential IODP drilling. NSF/ODP notes that the success rate for the unsolicited proposals considered at the Fall 2002 Panel was greater than 50%.

The three recently recommended field programs are:

1. South Pacific Eocene Paleoceanography (Lyle et al.), a transect across the Eocene sub Antarctic front in the south Central Pacific. This program will encompass seismic reflection surveys and piston coring. There is a significant exploration component to this program- there is very little data or cores from this part of the Pacific.

2. Alaskan Fjords/Continental Shelf (Mix et al.), acquiring high-resolution paleoceanography data from sediments deposited since the last Glacial Maximum. Again, there is a significant exploration component in this program. This research will include seismic reflection and piston coring.

3. Effects of Eustatic and Tectonic Forcing on Development of Forearc Basin Sequence Stratigraphy (Fulthorpe and McIntosh): This program, which will attempt to separate signals derived from sea level and tectonic activity in the sediments on the Nicaraguan and Costa Rican active margin, will entail multi-channel seismic surveys in a MARGINS focus area.

D R A F T
Feb 2003

OCEAN DRILLING PROGRAM LEGACY INFORMATION

The Ocean Drilling Program (ODP) has identified the following legacy documentation developed over the course of operations spanning Legs 101 through 210. The documents cover a wide spectrum of information, providing information on tools developed and used throughout the Program, improvements to tools, complete details on tool functions, laboratory manuals (i.e., cookbooks), technical notes, laboratory standard operating procedures, instrument manuals, sample records, curatorial notebooks, special core information (i.e., cores designated as permanent archives, on loan to museums, cores with educational purposes, etc.), business function standard operating procedures, Information Services policies and Janus database documentation.

The documentation is segregated into documentation involving operations, development, and miscellaneous. Legacy documentation is either completed or will be completed by the conclusion of FY04.

OPERATIONS

Staffing

Cruise staffing database (Crew & Cruise) (Note: While the database can be exported to ASCII files, the relationships between tables will be lost. The exported text files can be loaded into other database systems.)

Cruise

Scientific Proposal—Original Scientific Proposal, Addenda, updates and revisions.

Project A information—An operations-based evaluation of a scientific proposal for feasibility, operations and time estimates, a rough materials list, and a cost for budgeting purposes.

Leg Prospectus—Prepared by ODP Publication Services based on results of Precruise meeting.

Preliminary Report

Project B—An evaluation of the revised science plan based on the PPSP review, Precruise Meeting, and a prospectus-based operations plan.

Clearance Documentation—Details requirements for clearances and efforts to secure approval.

Time Estimator—Visual Fox Pro based coring/operations time estimator program used for Project A & B estimates

Participant Information Packages—Contains all information provided to participants (e.g., Science Services information, travel requirements, physical requirements, visa issues, port call locations, etc.).

Coring Data**—**Data summary prepared by Core Technicians for each hole, containing record of depths, core recovery, operating parameters, tool configuration, equipment used (core catchers, shear pins, etc.), failures/problems for each coring system (APC/XCB/RCB/PCS/MDCB/ADCB/etc.).

PDR/Final Position**—**Site location information, final statistical GPS site coordinates, etc.

Leg Operations Report**—**Prepared by ODP Operations Manager, step-by-step summary of leg activities from port call to port call, with detailed time breakdown, coring/recovery record, bit record, final position/water depth record, reentry/casing /instrument installations, etc.

Leg Engineering Report**—**Prepared by ODP Engineer (if one sailed), details equipment tests, modifications, failures, results, operating parameters, and suggestions**.**

Martin Decker Record**—**Automatic 8-pen recorder on the drill floor, records drilling operating parameters vs. time (i.e., depth, pump pressure and rate, hook weight, torque, etc.).

Curation

Curatorial Notebooks**—**Reports of all curatorial and sampling activities on the *JOIDES Resolution*.

Sample Records**—**Records of each sample request and its disposition, including lists of sample provided.

Special cores**—**Records of designated permanent archives (and samples from these), cores on loan to museums, cores used for educational purposes, etc.

Other

Laboratory Officer Notebooks**—**Reports of the status/problems/activities in each laboratory on the *JOIDES Resolution*.

Standard Operating Procedures (SOP's)**—**Brief, itemized list of tasks associated with each laboratory or group of related measurements, in order.

Laboratory Manuals ("Cookbooks")**—**Detailed step-by-step records of standard laboratory procedures for each measurement made on board the *JOIDES Resolution*.

Instrument Manuals**—**Manufacturer provided detailed operation and maintenance instructions for each instrument used on the *JOIDES Resolution.*

DEVELOPMENT

Engineering—Prepared by the ODP DSD staff, these manuals provide complete details on tool function, preparation, service, assembly/disassembly/testing, service specifications, maintenance and storage, parts, dimensions/specifications, deployment history, failure reports, abandoned concepts, proposed improvements, and references.

Tool Operations Manuals

- Advanced Piston Corer (APC)
- Extended Core Barrel (XCB)

- Rotary Core Barrel (RCB)
- Pressure Core Sampler (PCS) + Pressure Core Barrel (PCB)
- Motor Driven Core Barrel (MDCB) + Navidrill
- Advanced Diamond Core Barrel (ADCB), -Diamond Bits + Diamond Core Barrel
- Core Bits, APC/XCB/RCB roller cone & PDC bits.
- Armor, wear pads, ductile teeth, high temperature seals, close catch
- Underreamers, Bi-Center Reamers, Mud Motors (UR & MM)
- Mechanical Bit Release (MBR) + Hydraulic Bit Release (HBR)
- Free Fall Funnel (FFF)
- Reentry Cone Casing (RECC)
- Drill-In-Casing (DIC)
- Hard Rock Reentry System (HRRS) and Hammer Drill (HD)
- APC Sensor Tools, APC-T, APC-M, Orientation & Hole Angle
- TAM Straddle Packer, go-devils, press/temp, flow
- Davis-Villinger Temperature Probe with Pressure (DVTPP)
- Water Sampler with Temperature and Pressure (WSTP)
- Fissler Water Sampler (FWS)
- Downhole Sensor Sub (DSS)
- Circulation Obviation Retrofit Kit (CORK)
- Advanced CORK (A-CORK)
- Conical Side Entry Sub (CSS)
- Rig Instrumentation System (RIS)
- Passive Heave Compensator (PHC) & Active Heave Compensator (AHC), WOB

Technical Notes

Prepared by the ODP DSD staff, these Technical Notes (TN) will provide the history of a tool or systems technical development, discuss important technical innovations and scientific benefits, review tool operations and function (i.e., operational procedures, operating parameters, performance, and limitations), and cover drilling equipment problems. Technical Notes also will consolidate the design drawings and specifications and review deployment with other tool systems. Some TNs have been completed, and some items have partial or outdated technical notes, which will be updated.

- TN #10: A guide to ODP tools for Downhole Measurements
- TN #13: Stone Soup (acronyms used in the ODP)
- TN#14: A Guide to Formation Testing using ODP Drill string Packers
- TN#16: Hydrogen Sulfide High-Temperature Drilling Contingency Plan
- TN#17: The Design and Preparation of Wireline PCS

- TN#19: Revised Hydrogen Sulfide Drilling Contingency Plan
- TN#21: Design and Operation of a Drill-in-Casing System
- TN#22: Safety and Procedures aboard the Sedco/BP 471 (*JOIDES Resolution*)
- TN#23: Design and Operation of a Wireline Retrievable MDCB
- Advanced Piston Corer (APC)
- Extended Core Barrel (XCB)
- Rotary Core Barrel (RCB)
- Pressure Core Sampler (PCS) + Pressure Core Barrel (PCB)
- Motor Driven Core Barrel (MDCB) + Navidrill
- ADCB & Diamond Bits + DCB
- Core Bits, APC/XCB/RCB roller cone & PDC bits
- High temperature, close catch
- Lockable Flapper Valve (LFV)
- Bottom Hole Assembly (BHA)
- Drill String
- Mechanical Bit Release (MBR) + Hydraulic Bit Release (HBR)
- Free Fall Funnel (FFF)
- Reentry Cone Casing (RECC)
- Drill-In-Casing (DIC)
- Hard Rock Reentry System (HRRS) and Hammer Drill (HD)
- APC Sensor Tools, APC-T, APC-M, Orientation & Hole Angle
- TAM Straddle Packer, go-devils, press/temp, flow
- Davis-Villinger Temperature Probe with Pressure (DVTPP)
- Water Sampler with Temperature and Pressure (WSTP)
- Fissler Water Sampler (FWS)
- Downhole Sensor Sub (DSS)
- Circulation Obviation Retrofit Kit (CORK)
- Advanced CORK (A-CORK)
- Coring Wireline & Winch, wireline Jars & Overshot, Line Wiper, WL BOP, Kinley Line Crimper & Cutter
- TV & Sonar of VIT Frame, Coax Cable & Winch
- Conical Side Entry Sub (CSS)
- Rig Instrumentation System (RIS)
- Commandable Retrievable Beacons
- Passive Heave Compensator (PHC) & Active Heave Compensator (AHC), WOB

control

- Regulated power (Lab Stack) and power factor correction.
- Hard Rock Base (HRB)
- Hard Rock Orientation (HRO) & Sonic Core Monitor (SCM)
- Positive Displacement Coring Motor (PDCM)
- Vibratory Percussion Corer (VPC)
- XCB Flow Control
- Fishing Tools
- HYACE Rotary Corer (HRC) & Fugro Pressure Corer (FPC)
- Tri-Cone Retractable Bit

Material Services

Parts Database, "Base 471" in FoxPro database. Provides a list of all ODP tool parts, assembly drawings, and specifications by unique part number.

Inventory Control and Reorder System. ODP materials inventory control (updated by usage and physical counts) and parts reorder alert system.

Other

- WOB Filter firmware - Filters out high frequency noise and smoothes the weight-on-bit data from the TruVu rig instrumentation system.
- Legacy Holes & Equipment + Int'l Ocean Network (ION) + Map - List of all holes with reentry structures and casing, including details of the equipment and casing, any hole problems, legs, and a map.
- Historical Data - Operations Reports, coring records, and other information from sites cored previously by DSDP.
- Drill String Simulator Software - Program simulates loading under dynamic heave conditions for various drill string designs.

MISCELLANEOUS

Information Services

The Information Services Group will prepare the following legacy documents.

Department Level

- Supported software policy
- Communications policy
- Third-party software development policy

Database Group

- Version control and testing policy
- Sample data publication policy (JOI/ODP joint effort)
- Various computer programs, data, documentation

Janus database documentation

- Meta data files
- Flat (ASCII data) with table locations and attribute names
- Attribute tables
- Entity relationship diagrams (Janus data model)

Network/Systems Group

- Backup policy for the ship
- Backup policy for shore
- MCS duties document
- Procedures to send/receive e-mail between ship and shore
- Systems manuals and documentation

Publication Services

A list of legacy documents will be provided in future Program Plans as the final Initial Results and Scientific Results volumes near completion.

Administrative Services

Standard Operating Procedures (SOP)—Ten SOPs were developed to provide information and instructions on how to administer the business services associated with the Science Operator (Texas A&M University (TAMU)) and the business/compliance arm (Texas A&M Research Foundation (TAMRF)) of the Program. These SOPs involved Human Resources/Insurance Services, Travel/Conferences, Property, Procurement, Budgets, Accounts Payable, Accounts Receivable, Payroll, Administering USSSP Funding, and Writing, Revising & Archiving SOPs. These documents are not public documents; however, requests for copies can be made by contacting the President, TAMRF.

Crisis Management Plan (CMP)—An institutional specific, CMP is available on request from the Dean of Geosciences, TAMU.

ODP Logging Services
Legacy Activities
FY 04

Engineering Legacy Documentation

- Complete and finalize documentation related to downhole tools (including machine drawings, schematics, operations manuals, software, and performance reports).
- Document procedures for estimating logging times for both wireline and LWD operations.

Data Legacy Documentation

- Documentation of processing.
- Documentation of log database
- Addition of operations reports to log database.
- Transfer of database archive to NGDC

DSDP Processing/Archiving

- Reprocess and archive DSDP data.
- Addition of operations reports to log database.
- Transfer of database archive to NGDC

Legacy Activities

- Participate in legacy activities (e.g., ODP booth at AGU) as requested.
- Provide assistance to JOI on legacy matters related to logging as requested.

Arctic planning update for SCICOM meeting March 2003

To fulfill **SCICOM Motion 01-02-18: "**SCICOM endorses the joint JOI/European initiative to set up a Lomonosov Ridge Project Management team," from the Portland, Oregon meeting in August 2001, JOI initiated a two-year (and two-phase) planning contract with the Swedish Polar Research Secretariat (SPRS) in February 2002. This contract
(#JSC 2-02) is to provide JOI with a report that describes the "services to develop an implementation plan for an ocean drilling expedition to the Lomonosov Ridge, central Arctic Ocean." Contract activities have been reported to SCICOM at subsequent meetings in Tokyo (March 2002) and Ghent (August 2002)

The following progress was made since the last SCICOM meeting in Ghent:

- A major planning meeting was held onboard the Swedish icebreaker *Oden*, in the port of Lulea, Sweden, October 28 and 29. Participants included representatives from the SPRS, their subcontractors, and guests (Mr. Per Frejvall, Mr. Ulf Hedman, Mr. Harry Hogeboom, Dr. Anders Karlqvist, Mr. Arno Keinonen, Mr. Bertil Larsson, Mr. Marius Lengkeek, Dr. Kate Moran, and Dr. Dennis Nixon), from JEODI/British Geological Survey (Dr. Alistair Skinner and Mr. Colin Brett), from the University of Stockholm (Dr. Jan Backman), from the Swedish Research Council (Dr. Mary von Knorring), from JOI (Dr. John Farrell), and from the *Oden* crew (Captain Tomas Arnell and Captain Anders Backman). The purpose of this meeting was to discuss and integrate the individual reports developed for the final report from phase one of the planning contract. This report serves as the major contract deliverable. The meeting was also used to discuss various work tasks that would be undertaken in phase two of the contract, during 2003.

- In early December, JOI received the final report from phase one of the planning effort. This report was forwarded to JEODI representatives that have been designated by the interim ECORD council as the interim European Science Operator for Mission Specific Platforms. The report is available online at: http://www.joiscience.org/JOI/PPT/arctic/SPRS_Arctic_planning_phase1.doc

- JOI's and SPRS's powerpoint presentations on Arctic planning continue to be available from the JOI website (www.joiscience.org).

- The FY03 ODP Program Plan was approved by NSF in September, and went into effect October 1, 2003. Included in this plan is a description of work and identified funds to continue the Arctic planning effort. This effort would thus involve a continuation of the contract between JOI and the SPRS into a second phase, subject to NSF approval. Phase two was slated to begin in February 2003.

- After receiving NSF approval in early December 2002, JOI sent the statement of work to the SPRS for phase 2 of the Arctic drilling planning contract. This statement is reproduced below. In response, the SPRS developed a proposal and budget that accordingly addressed the work statement, deliverables and milestones. The response from the SPRS was received at JOI on January 9, 2003.

- JOI and the SPRS reached a negotiated agreement on the proposed work and forwarded the contract to NSF on January 16, 2003, as required by the ODP contract to JOI. Additional correspondence was exchanged on January 31. NSF approved the subcontract (JSC 2-02) on February 3. The phase 2 contract extends to February 2004.

SECTION C - STATEMENT OF WORK

C.1 - INTRODUCTION

The Ocean Drilling Program (ODP) is an international partnership of scientists and research institutions organized to explore the structure and history of the Earth beneath the ocean basins. The focus of the ODP is to provide core samples from the ocean basins, facilities for the study of these samples on board ship, down hole measurements (logging), and opportunities for special experiments to determine *in situ* conditions within the crust. These studies will lead to a better understanding of plate tectonic processes, the Earth's crustal structure and composition, conditions in ancient oceans, and changes in climate through time. This understanding will, in turn, lead to a fuller comprehension of the evolution of the Earth.

Funding for the Ocean Drilling Program is provided by the following agencies: Australia/Canada/Chinese Taipei/Korea Consortium for Ocean Drilling, Deutsche Forschungsgemeinschaft (Federal Republic of Germany), Institut National des Sciences de l’Univers-Centre National de la Recherche Scientifique (INSU CNRS; France), Ocean Research Institute of the University of Tokyo (Japan), National Science Foundation (United States), Natural Environment Research Council (United Kingdom), European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland), and the Marine High Technology Bureau of the State Science and Technology Commission of the People’s Republic of China.

Scientific planning for the ODP is provided by Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), an international organization of committees and panels. The reports of the Conference on Scientific Ocean Drilling (COSOD), Second Conference on Scientific Ocean Drilling (COSOD-II), the ODP Long Range Plan, and JOIDES panel White Papers provide the scientific basis for execution of the ODP.

C.2 SCOPE OF WORK

Completion of the operations, science support, logistics, and implementation plan for a scientific ocean drilling expedition to the Arctic s Lomonosov Ridge (IODP proposal 533)

Background

Despite the fact that the Arctic Ocean plays a fundamental role in the global ocean-climate system, there is a remarkable lack of even rudimentary geological information from this basin. In an attempt to redress this void, Prof. Jan Backman and colleagues submitted JOIDES proposal 533 "Paleoceanographic and Tectonic Evolution of the Central Arctic Ocean" to the international Ocean Drilling Program (ODP). The proposal was favorably reviewed and prioritized as evidenced by its number one ranking by the JOIDES Science Committee (SCICOM) in both 2000 and 2001.

For several reasons, including financial and programmatic limitations, and because implementation would require drilling platforms other than the ODP's *JOIDES Resolution*, this Arctic proposal was not scheduled as an operational leg of the ODP. Nevertheless, the JOIDES Executive Committee (EXCOM) and SCICOM endorsed the proposed science plan and the initial implementation plan and encouraged scheduling of a field program in 2004, under the auspices of the Integrated Ocean Drilling Program (IODP), which is slated to succeed ODP operations and to begin on October 1, 2003.

After the proposal was ranked #1 in 2000, SCICOM created an Arctic Detailed Planning Group (DPG) that was tasked with an extensive mandate to develop an initial implementation plan that would be capable of accomplishing the proposed science. The DPG was chaired by Prof. Backman, and consisted of 14 other volunteers with Arctic experience in logistics and operations from the international community. The DPG met twice in 2001 and produced a final report that was presented to SCICOM and accepted by them at their August 2001 meeting. This report fulfilled the assigned mandate, but the group clearly recognized the need for, and indeed recommended continued planning, in order to successfully implement a drilling expedition in 2004.

The DPG report recommended follow-on planning in four phases: (1) developing the detailed operational and logistical plans; (2) establishing the implementation teams and contractual agreements under which these teams would work; (3) conducting the expedition (aka field program); and (4) completing the post expedition analyses, studies and reports.

This contract will fund Phase (2) activities for the period of performance of award through February 1, 2004. This is the final phase of the contract. Plans developed under this contract have been, and will continue to be provided to the entity that we anticipate will ultimately implement this expedition. The entity will be European (i.e., European Science Operator, ESO) and it will provide Mission-Specific Platforms (MSP) to IODP. Joint European Ocean Drilling Initiative (JEODI) is currently providing advice and guidance to European funding agencies on the establishment of this new entity. Therefore, close interaction will continue to be necessary between JOI/ODP, the Swedish Polar Research Secretariat (SPRS) and JEODI.

Work statement

1. Based on information gained during phase one of the contract, update and refine the critical path of major timelines and milestones for planning and implementing the

expedition. Presume a field program of approximately 35 days within August-September 2004.

2. Further develop the operational plan in concert with developments in JEODI Work Package 2 and with the interim European Science Operator (British Geological Survey). Five specific tasks are defined:

    a. Based on the operational responsibilities assigned to each class of vessel in phase one, choreograph, during phase two, the fleet of icebreaker vessels to: (a) transit from ice edge to the initial drill sites; (b) defend the drilling vessel that is maintaining position (in DP mode) and drilling and coring in a variety of ice and weather conditions; (c) transit among drill sites; and (d) transit back from the high Arctic to the open ocean.

    b. Refine the position descriptions of the key personnel in the upper level of the management team defined in phase one, and develop descriptions for second, third, and lower tier scientific and technical positions necessary to successfully implement the field program. These positions will include operational groups responsible for, among other things, ice and weather monitoring, vessels, logistics and science.

    c. Re-examine the drilling, logging, safety monitoring, and sampling options in light of phase one findings.

    d. To minimize the eventual cost of mobilization and shakedown of drilling platform and tools, investigate options to coordinate and collaborate with other initiatives (e.g., Lake Malawi program funded by NSF, DOSECC, etc.).

    e. Flesh out the plans for ice monitoring, ice management, air operations, communications (ship-to-ship, ship-to-shore, coring platform dynamic positioning reference), environmental and weather database capture plans, and medical services.

3. The draft operational manual prepared by the SPRS during phase one should be updated and refined in phase two through the following five tasks:

    a. “scenario test” the manual’s procedures against emergency situations, and then modify the procedures as necessary;

    b. excerpt the appropriate sections of the manual to prepare vessel audit/inspection plans;

    c. as necessary, incorporate procedures that will address all guidelines of the International Maritime Organization and other organizations for ships operating in ice-covered Arctic waters;

   d. prepare training guidelines that are consistent with the procedures of the manual; and

   e. prepare the "Expedition Safety Case" to help define liabilities and project insurance requirements

4. The Arctic Detailed Planning Group and the SPRS recommended that ODP-type sampling and logging tools be used in this expedition. The two tasks required to meet this recommendation are:

   a. review potential contributions from the ODP in light of recent developments (e.g., schedule for demobilization and availability of BHAs, pipe, coring hardware, and other surplus equipment and supplies); and

   b. based on drilling and coring options for the expedition, identify the potential design modification needs for ODP tools (e.g., APC/XCB).

5. Successful operations will require an improved understanding of the performance of a dynamically positioned drilling platform supported by icebreakers in 8/10 to 9/10 ice (often typical conditions in the high Arctic). To gain such an understanding, three tasks must be completed:

   a. organize and analyze data from prior *Oden* Arctic expeditions as input to the design of the model tests (can also be used to prepare the ice management procedures);

   b. conduct model tests of the drill ship; and

   c. conduct an assessment of the below-hull ice protection needed for the coring platform.

6. This expedition will likely take on a high profile in public, scientific, and possibly political circles. As such, the SPRS will need to develop a preliminary public affairs plan, to be provided to the implementing organization, which is designed to provide information so as to minimize misunderstanding and to maximize scientific and educational return from the expedition. This work initially requires two tasks:

   a. Define the full range of activities (meetings, conferences, briefings) and the necessary knowledge base and experience required of individuals who would be most appropriate to represent the expedition; and

   b. prepare descriptions of tasks and specific projects that can be developed by the implementing organization.

7. Prepare a program-wide insurance plan that accommodates the various classes of anticipated expedition vessels. This work requires two tasks:

a. Defining liabilities based on the "Expedition Safety Case" and on program procedures; and

b. Establishing recommendations on insurance plans based on these liabilities and the roles and responsibilities of the indemnifying groups and companies.

Deliverables & Milestones

1. Prepare a report that describes the revised timeline and milestones (Workstatement Item #1).

2. Complete the operational plan and manual, and prepare the recommended insurance plans as described in Work statement Items #2, #3 and #7.

3. Prepare a summary report on potential ODP contributions and on options to modify the design of the drilling and coring tools as per Work statement Item #4.

4. Prepare a summary report on the results of the model tests (Work statement Item #5).

5. Prepare a timeline and public affairs plan as described in Work statement Item #6.

SCIENCE OPERATOR'S SCICOM REPORT

Review of Activities
August 2002 through January 2003

Executive Overview

As ODP approaches the final months of seagoing operations, a major emphasis for the Science Operator is on all those activities that support the scientific objectives of each leg. The last six months have been indicative of this commitment, both in terms of implementing legs, as well as planning for the future legs. It is exciting for the program that many of the legs that have recently concluded, or that are scheduled, represent new research initiatives that require enhanced drilling and sampling technologies.

Four cruises have been successfully implemented since the last SCICOM report. Leg 203 established a cased reentry hole to 212-m (91-m into basement). Leg 204 established a benchmark for the Program by completing 45 holes at nine sites through the gas hydrate stability zone on the southern part of Hydrate Ridge. Leg 204 highlights included the recovery of 50 m of hydrate core preserved in pressure vessels, recovery of 35 m of hydrate core preserved in liquid nitrogen and approximately 150 successful runs of specialty tools such as DVTP, PCS, Fugero PC, Furgo piezoprobe, and the RAB-C. In addition, a HazMat building was acquired and outfitted to provide safe storage for the Leg 204 gas hydrate samples at ODP/TAMU. Leg 205 completed three reentry cones to determine the character of fluid flow in the upper seismogenic zone. Osmoscreens and packers were installed in two holes. Leg 206 established a reentry hole to 752 mbsf (502 m into basement).

The remaining cruises (Legs 207-210) will utilize technology enhancements. For example, Memory Sensor subs allowing collection of weight on bit, torque, annulus pressure, pipe pressure and annulus temperature will be tested with data accessible after each pipe trip during Leg 208 and after each core during Leg 210. In addition, an improved water-sampling tool (Instrumented water Sampler) prototype will be tested during Leg 208. Leg 210 will be a technological challenge requiring installation of about 2000 m casing string. In addition to the tasks associated with successfully implementing the remaining cruises, other current activities include development of a demobilization strategy and identification of legacy documents.

Introduction

In an effort to codify relevant information and to streamline the summary of the Science Operator's activities, as much information as possible is presented in tabular form. These data are presented by functional department.

Science Services

Schedule of Science Operations for the *JOIDES Resolution*: January, 2002 – September, 2003

	Leg	Port (Origin)	Dates	Total Days (port[†]/sea)	Days at Sea (transit/on site)	TAMU Contact	LDEO Contact
204	Gas Hydrates	Victoria	8 July– 6 September '02	60 (5/55)	7/48	F. Rack	D. Goldberg, S. Barr
205	Costa Rica	Victoria	6 September – 6 November '02	61 (5/56)	11/45	A. Klaus	K.T. Moe
206	Fast Spreading Crust	Balboa	6 November – 5 January '03	60 (5/55)	6/49	G. Acton	F. Einaudi
	Transit	Balboa	5 January – 13 January '03	8 (2/6)	6/0	N/A	N/A
207	Demerara Rise	Barbados	13 January – 6 March '03	54 (3/51)	13/38	M. Malone	B. Rea
208	Walvis Ridge	Rio de Janeiro	6 March – 7 May '03	62 (5/57)	18/39	P. Blum	P. Gaillot
209	MAR Peridotite	Rio de Janeiro	7 May – 8 July '03	62 (5/57)	17/40	J. Miller	G. Iturrino
210	Newfoundland Margin	Bermuda	8 July – 7 September '03	61 (5/56)	6/50	A. Klaus	H. Delius
	Transit	St. John's	7 September – 21 September '03	14 (3/11)	11/0	N/A	N/A
	Demobilization[‡]	Galveston	21 September – 30 September '03	9 (9/0)	0/0	N/A	N/A

Notes:
Start date reflects the first full day in port. This is the date of the ODP and ODL crossover meetings. The JR is expected to arrive late the preceeding day. Port call dates have been included in the dates which are listed.
[†] Although 5 day port calls are generally scheduled, the ship sails when ready.
[‡] Demobilization assumes a seven day (+2 day port call) period tentatively scheduled for Galveston.

10 February 2003

Co-Chief Scientists and Cruise Staffing for Science Operations

Co-Chief Scientists for Legs 203-210:

	Leg	Co-Chief Scientists
203	Eq. Pac. Ion	J. Orcutt University of California, San Diego A. Schultz Cardiff University
204	Gas Hydrates	G. Bohrmann GEOMAR Forschungszentrum fur Marine Geowissenschften der Christian-Albrechts-Universitat zu A. Trehu Oregon State University

205	Costa Rica	J. Morris Washington University H. Villinger Universität Bremen
206	Fast Spreading Crust	D. Teagle University of Southampton D. Wilson University of California, Santa Barbara
207	Demerara Rise	J. Erbacher Bundesanstalt fur Geowissenschaften und Rohstoffe D.C. Mosher Geological Survey of Canada – Atlantic
208	Walvis Ridge	D. Kroon Vrije Universiteit J. Zachos University of California, Santa Cruz
209	MAR Peridotite	P. Kelemen Woods Hole Oceanographic Institution E. Kikawa Japan Marine Science & Technology Center (JAMSTEC)
210	Newfoundland Margin	J.-C. Sibuet IFREMER B. Tucholke Woods Hole Oceanographic Institution

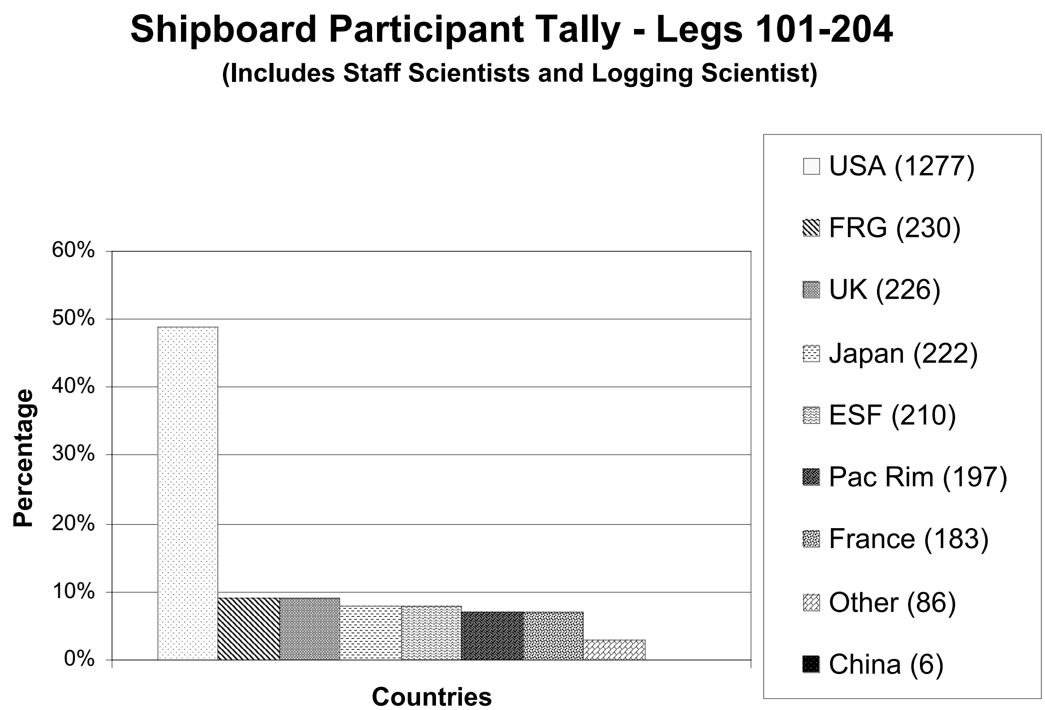
Scientific Party Staffing:
Staffing through Leg 209 is completed and staffing for Leg 210 is in progress.

Tabulated below are the numbers of applications on file as of January 31, 2003.

Legs	Total Applicants	U.S. Applicants	U.S. Students	Non-U.S. Applicants	Non-U.S. Students
203	21	8	3	8	2
204	69	19	12	26	12
205	43	10	10	15	8
206	22	4	4	8	6
207	64	15	10	24	15
208	58	15	11	22	10
209	55	12	6	24	13
210	63	17	8	29	9

Legs 206-210 are the last legs scheduled for ODP. This has stimulated community interest in sailing on *JOIDES Resolution* and resulted in a steady flow of applications for these legs even as the program nears the conclusion of the operational phase.

Shipboard Participant Tally:
Following is a compilation of sailing participants for Legs 101 through 204.



Status of Lab Stack

Analysis of Gas Hydrates:
There have been no substantial changes in the shipboard laboratories following the introduction of the digital imaging system (Leg 198) and the radio isotope van (Leg 201) since we are approaching the conclusion of the operational phase of ODP. The exception was Leg 204 (July-Sept., 2002), which focussed on gas hydrate studies on Hydrate Ridge (Oregon margin) and saw the one-time introduction of significant instruments in the shipboard labs. These included a track-mounted infrared thermal imager (camera) on the core receiving platform for the quick identification of core sections likely to contain hydrate, a vertical MST core scanner developed by Geotek, and an X-ray scanner from Lawrence Berkeley labs. Use of these instruments on Leg 204 was supported by funds from the US Department of Energy augmenting the basic ODP funding from the NSF.

We also borrowed a 20 ft refrigerated van from the Geological Survey of Canada. This was installed on top of the core tech. shop and used as a microbiology cold room, and later for sampling and storage of hydrate cores.

These additions, along with the pressure coring tools, the transfer, storage and logging chambers associated with the HYACINTH coring system, and the demand for large amounts of liquid nitrogen and ice, resulted in our using every possible space on the *JOIDES Resolution*. They also imposed a significant additional burden on the technical support staff.

Status of Projects

HazMat Building:
The objective of this project is to provide safe storage for gas hydrate samples recovered on ODP Leg 204 and kept in pressurized containers.

An appropriate temporary storage building has been installed near the loading dock at the back of the ODP Gulf Coast Repository for this purpose. Since gas hydrate dissociates at normal temperatures, the building is insulated and refrigerated to maintain an internal temperature of ~40 degrees F, at which temperature the samples remain stable. The building was purchased and installed during September and became operational on September 20.

The storage facility was completed with the installation of a second, back-up refrigeration unit and hook-up to the emergency power generator. We had significant problems with the reliability of the second unit - it failed over a weekend while being tested as the primary cooling system. All large pressure vessels had been removed previously to allow workers to install the second inside cooling fan, but the HYACE pressure vessel had been left inside and it experienced warming up to ~80 degrees F. The consequences of this were that we kept all vessels out of the building until both A/C units were tested at length, and until the Hawkeye surveillance system, which is monitored 24/7 by Campus Security, had been installed. In addition, a protocol was established for regular monitoring by staff and for improved communications to avoid another mishap. We now have two operational refrigeration units, either of which can serve as the primary or backup cooling system. We also have temperature and methane sensors connected to the Hawkeye surveillance system, which is monitored 24/7 by Campus Security, and the effectiveness of this system has been tested and proven. Should a temperature alarm go off, Campus Security has a contact list of repository staff to be called immediately.

A more sophisticated control system, which should smooth out the fluctuations in the internal temperature of the building has been ordered and will be installed in due course. In the interim we now have as reliable and fail-safe storage as can be achieved in the present circumstances.

Drilling Services

Summary of Leg Operations: Legs 203, 204, 205, 206

	Leg 203 Eq. Pac. ION 30 May — 6 July 02 Balboa - Victoria	Leg 204 Gas Hydrates 6 July – 2 September '02 Victoria - Victoria	Leg 205 Costa Rica 2 September – 6 November '02 Victoria - Balboa	Leg 206 Fast Spreading Crust 6 November '02 – 5 January '03 Balboa - Balboa
Transit/Onsite (day)	19.2/14.5	2.5/50.5	15.2/43.1	6/49
Sites	1	9	3	1

Holes	2	45	4	4
Water Depth (m)	3882 - 3868	1228 - 789	4387 - 4187	3645 -3645
Deepest Penetr. (m)	223	540	600	752
Cored Interval (m)	93	3675	405	850
Tot. Recov. (m,%)	28 (30%)	3068 (84%)	281 (69%)	515 (61%)
APC Recov. (m,%)	0	1861 (88%)	0	166 (102%)
XCB Recov. (m,%)	0	1125 (81%)	0	60 (66%)
RCB Recov. (m,%)	28 (30%)	18 (28%)	281 (69%)	289 (48%)
PCS Recov m,%)	0	38 (98%)	0	0
Hy.RC Recov (m,%)	3 (37%)	0	0	0
Fugro PC Rec (m,%)	8 (80%)	0	0	0

Review of Operations

Leg 203 (Eq. Pacific ION):

- The objective was to establish a cased reentry hole for a multidisciplinary observatory.
- A reentry cone was set at Hole 1243A (OSN-2) and 48 m of 20 in casing was jetted-in. The 10-3/4 in casing was set at 212 m (91 m into basement). The 16 in casing would not go to bottom; therefore, an 18-1/2 in hole was drilled to 224 m and 10-3/4 in casing was run to 212 m and cemented in place. The top of the cement is at 155 mbsf.
- Hole 1243B was cored and logged to 195 m (85 m into basement), and a free fall funnel was set for future reentry.
- RCB recovery was 26.8% in basement.

Leg 204 (Gas Hydrates Oregon):

- The primary objective: to drill a transect of sites through the gas hydrate stability zone on the southern part of Hydrate Ridge on the Cascadia accretionary margin offshore Oregon.
- The first hole was APC/XCB cored to 350 m for safety.
- 8 of 9 sites were logged with LWD tools to identify rapid changes in physical properties before coring (788-1228 m WD). The LWD tools were returned at a mid-leg port call.
- 45 holes at 9 sites were double APC/XCB cored through hydrate with 3068 m recovery (83.5%).
- During the leg, funds were obtained to purchase 40 core pressure vesels, six N2 dewars and a hydrate storage container. The pressure vessel and dewars were sent to the ship, and the container was sent to ODP/TAMU.
- 50 m of hydrate core were preserved in pressure vessels.
- 35 m of hydrate core were preserved in liquid nitrogen.
- 42 personnel were transferred by 7 choppers and 2 boats.
- 85 whirlpaks, infrared cameras, and a linear X-ray were used.
- Successful special tools runs included:

DVTP (8 of 8 runs - 100%)	DVTPP (16 of 16 runs - 100%)
APCT (61 of 61 runs - 100%)	APCM (107 of 110 runs — 97%)
PCS (30 of 39 runs — 77%)	HRC (4 of 8 runs — 50%)
Fugro PC (2 of 10 runs — 20%)	Fugro Piezoprobe (1 of 2 — 50%)
LDEO DSA (17 of 28 runs — 61%)	RAB-C (8 of 8 runs — 100%)

Leg 205 (Costa Rica):

- The objective was to install four reentry sites with osmosamplers to determine the character of fluid flow in the upper seismogenic zone in a plate subducting below a shallow forearc.
- Installed three reentry cones with 16-in casing, drilled and RCB cored, set and cemented 10-3/4 in casing, and cleaned out the holes to TD (600, 231, and 380 mbsf).
- Ran osmoscreen with packer on 4-1/2 in tubing and deployed osmosamplers by wireline in Holes 1253A and 1255A.
- Successful installation proved by Alvin dive after leg.

Leg 206 (Fast Spreading Crust):

- The objective was to recover an upper crustal section in gabbros on a 15-Ma superfast spreading ridge in the East Pacific.
- APC/XCB cored 254 m sediment (89% recovery) in two holes.
- Drilled and RCB cored two holes to 120 and 476 mbsf (22% recovery in sediment and 50% recovery in basement).
- Set reentry cone with 20-in casing, set 269 m 16-in casing (19 m into basement), RCB cored through basalt to 752 mbsf (502 m into basement), and logged and ran VSP survey.
- Two 18-1/4 in x 21-1/2 in bi-center hard rock reamers with 9-7/8 in pilot bits were used for the first time to open a 9-7/8 in RCB core hole 26 m into basement. The bi-center reamers have a fixed roller cone that wobbles eccentrically to enlarge a core hole in hard rock to run casing (as opposed to hydraulic arms used in conventional underreamers in sediments).

Review of Engineering Development Projects

The ODP/TAMU developmental engineering projects are divided into two categories: surface equipment and downhole instruments. The first category includes Active Heave Compensation (AHC) and the Rig Instrumentation System (RIS), two pieces of equipment that were installed in the fall of 1999. These systems are functioning and continue to undergo refinements as they are incorporated into the daily drilling operations of the *JOIDES Resolution*. The second category consists of downhole tool development projects that are currently underway and include: Davis-Villinger Temperature Pressure Probe (DVTPP), APC Methane (APCM), PCS Methane (PCSM), Pressure Core Sampler (PCS), the Memory Drilling Sensor Sub (DSS), Drilling Sensor Sub with wireless transmission to Retrieval Memory Module (RMM), and Instrumented Water Sampler (IWS).

Active Heave Compensator (AHC)

AHC Hydraulic Bundle:
Hose bundle covers were experiencing premature wear. Replacement of the old bundle covers with new covers was completed during Leg 204. A service call was performed at the Leg 207 port call. The system appeared to be functioning according to vendor specifications; however, investigations are continuing on the performance of the active heave. An electronics technician evaluated Rig Instrumentation data for the AHC over a three hour time period during Leg 207. He found that the cylinder position followed ship heave with WOB readings of up to 25 klb and not once did the drill pipe deviate more than 4 in absolute motion. A service call is scheduled for the Leg 208 port call.

Rig Instrumentation System (RIS)

Weight-on-Bit Filter (WOBF):
Because the AHC imparts significant dynamic forces to the derrick-mounted load cells, there are large variations in the weight-on-bit (WOB) indicator used by the driller. The large variations make it difficult for the driller to effectively control the WOB because of excessive needle bounce. A WOB filter was developed that electronically filters the dynamics of the top drive and AHC. The hardware was installed over the course of Legs 201 and 202. The WOB filter system, hardware, and software are operational, though fine-tuning of the filter will be made during Leg 208. A large dial WOB meter display was installed during the Leg 206 port call, which replaced a smaller hard-to-read meter.

Wireless Transmission of Load Pin Data:
The load pins, which are installed in the hook, currently receive power and transmit data through an umbilical cable suspended between the crossbeam dolly junction box and the top drive. The umbilical cable has a connector break ~2 m below the dolly junction box that must be connected and disconnected when the top drive is put into service and set back, respectively. The umbilical cable is prone to damage during operation (it has been replaced twice since 1999). To resolve this problem, wireless data transmission will be employed, and the umbilical will be eliminated. This will be done by relocating the WOBF radio transmitter box from the top drive to the lower crossbeam dolly (location of load pin junction box) and accessing power by dropping a cable from the AHC junction box located on the traveling frame. Moving the WOBF box to the lower cross beam allows the cables from the load pins to go directly into the WOBF box, eliminating a junction box and an umbilical from the system. A dedicated power supply for the WOBF box will be supplied by using spare conductors in the AHC junction box, which will have no impact on the AHC system. Wireless transmission for the load pins will be implemented during Leg 208.

Downhole Measurement Technology

Davis-Villinger Temperature and Pressure Probe (DVTPP):

The purpose of this project is to incorporate pore pressure measurements into the DVTP. The prototype DVTPP was developed by Pacific Geosciences Center in Canada and first deployed on Leg 190. Though the deployment confirmed the viability of the measurement, significant improvements were required to bring the tool up to operational status. The tool underwent a redesign prior to Leg 201 to address corrosion and assembly issues.

A redesigned DVTPP, using the prototype electronics, was deployed 12 times on Leg 201. The temperature measurement never functioned properly because of a corrupted setup file in the prototype data logger. Overall, the pressure measurement functioned as designed and recorded valid pressures on nine runs.

Another cycle of redesign followed Leg 201. A new, upgraded data logger was used and minor mechanical changes were made to improve reliability. Two DVTPPs were run on Leg 204. The tools were run 16 times with no failures. Valuable data was acquired on all runs except for those where the formation fractured during penetration. The new DVTPP had a slightly noisier temperature signal than the standard DVTP. However, the Conefit program was able to process the noisy data and resolve equilibrium temperatures.

The DVTPP and Fugro's Piezoprobe were run at the same site and depth on Leg 204 to evaluate both tools' pressure measurements. A cursory look indicated closely matched pressure results, though the DVTPP seemed to reach equilibrium at 3-5 psi higher than the Piezoprobe.

After Leg 204, one tool was returned to shore and the other was left on the ship for Leg 205. Deployments on Leg 205 had problems with respect to running in the rotary core barrel (RCB) bottom-hole assembly (BHA). Noisy temperature signals continued to be a problem on Leg 205. All DVTPs and the DVTPP were shipped back to shore to analyze the noise issue.

Post Leg 205 evaluation of the DVTPs and DVTPPs discovered that one of the DVTPP tools had faulty electronics. However, testing showed that the electronics in the other DVTPP data logger were more stable than the old DVTP electronics. Additional testing on the DVTPP also turned up intermittent problems caused by variations in the thermistor assembly construction. The DVTPP thermistor assembly will be redesigned to be more rugged.

APC Methane Tool (Temperature, Pressure, Conductivity):

The APC Methane (APCM) tool monitors the effects of gas exsolution in cores from the time the core is cut until it reaches the deck by recording temperature, pressure, and electrical conductivity in the core headspace. The sensors are mounted in the APC piston. The APCM tool is a joint development between ODP/TAMU and MBARI.

The tool was deployed eight times during Leg 201 to establish baseline data. The data degraded significantly on the fourth run when the tool experienced excessive shock and vibration. The data quality for the remaining runs was poor because of noisy signals.

Based on experience from Leg 201, the methane tool electronics were "hardened" by tightening clearances and adding additional cushioning. The methane tools successfully collected data on 107 of 110 cores during Leg 204.

The PCS Methane (PSCM) is a version of the APCM tool, which was integrated into the Pressure Core Sampler (PCS) tool for use during Leg 204. Three of the new PCSM assemblies were manufactured to provide temperature and pressure measurements of the PCS core headspace. Thirty-three runs recorded temperature and pressure data with the PCSM.

Pressure Core Sampler (PCS):
The PCS is a free-fall deployed, hydraulically actuated, wireline retrievable pressure coring tool for retrieving core samples maintained at bottom-hole pressures. Modifications of the tool for Leg 204 were made to improve reliability and to add continuous measurements of pressure and temperature of the core headspace.

The changes made to the PCS for Leg 204 were 1) larger link pins, 2) longer links to eliminate over-rotation, and 3) integration of the methane tool at the top of the inner core barrel. The addition of the methane tool was the most significant change. Three PCS core barrel assemblies, two actuation assemblies and three PCSM tools were deployed during Leg 204.

Leg 204 results:

Total Deployments:	39
Complete success (core under pressure):	30
100% Core recovery:	36
Full Tool Closure (recovered pressure):	32

Nine runs were unsuccessful. On seven of these runs, the ball valve did not actuate properly, either because the tool failed to actuate or the ball valve linkage jammed. The other two retrieved pressure but did not recover core because the core was washed out when the flow check valve failed. Methane gas was found in the 30 cores retrieved under pressure (Core1249F-4P contained over 94 liters of methane). The Methane tool was run on 36 PCS deployments and successfully recorded data on 33.

Two Gas Manifold Systems were set up in the Dry Lab (outboard of the Downhole Tools Lab) similar to Leg 201. Pressure monitoring and recording of bleed-off was added for Leg 204, using a laptop. The high number of PCS deployments and the long turn-around time (typically 8 to 24 hr) for gas sampling, frequently resulted in having to store the third PCS in an ice trough until a gas manifold station became vacant.

Conceptual designs for post Leg 204 PCS tool changes were generated to improve pressure retention and provide continuous temperature and pressure data during deployment and lab de-gassing. The proposed changes were: 1) a new ball valve pin with fixed stops to prevent over-rotation, 2) a temperature probe that penetrates the core material, 3) repackage Methane tool electronics and sensors to allow the data logger to remain on the tool during degassing, and 4) modify firmware/software to display pressure and temperature data directly from the tool while in the gas manifold station.

Memory Drilling Sensor Sub (DSS):
The purpose of this project is to create a Memory Drilling Sensor Sub (DSS) that would operate near the bit to: 1) provide data to better understand the dynamic forces at work downhole and 2) quantify the impact of heave and surface inputs (torque, weight, rpm, and flow rate) on bit performance. The DSS will provide data from sensors packaged in its collar wall. These sensors will measure weight on bit, torque on bit, annulus pressure, pipe pressure, and annulus temperature. The DSS will be an 8-1/4 in OD memory sub with a 4-1/8 in through bore to allow for core retrieval. It will be positioned in the BHA on top of the Outer Core Barrel.

A subcontract was issued to APS Technology for Phase II work on December 12, 2001. The first two stages (Mechanical Design and Electronics Design) were completed, reviewed by ODP, and accepted. The contract for the last two stages (Manufacturing of Test Article and Preliminary Testing and Sub Manufacture System Integration and Testing) was awarded on September 20, 2002. The delivery date for the DSS prototype is February 28, 2003 for sea trials during Leg 208.

An amendment to the contract was made in February 2003 for preliminary design work on the development of wireless transmission of DSS data to an instrumented core barrel. The data from the DSS deployment during Leg 208 will not be recovered until a pipe trip is made and the DSS retrieved. Wireless transmission to a retrievable memory module (RMM) will allow the five drilling parameter data sets to be recovered and analyzed in "near-time," after every core recovery rather than after a pipe trip. This design work is the first step in the development of transceiver electronics and antennae for the DSS and RMM. The RMM will be connected to the drill string acceleration tool (DSA), which will augment the DSS data with BHA acceleration data. The goal is to have an operational system for Leg 210. The DSS and RMM system is a precursor to transmitting data in "real-time" with a commercial, pulse telemetry measurement-while-drilling (MWD) system.

Instrumented Water Sampler (IWS):
The purpose of this project is to develop a tool with water sampling reliability superior to the Fisseler Water Sampler (FWS) and the Water Sampler Temperature Probe (WSTP). Joris Gieskes at Scripps implemented new concepts in the FWS as part of a collaborative effort to improve sampling.

The IWS tool will use a motor driven syringe to extract fluid from the formation. A feedback system based on the pressure drop across the probe tip sample port will provide for a smooth extraction rate and reduce the probability of filter pack off. The probe tip design is a derivative of the DVTPP probe tip. Along with the fluid sample port, a thermistor (based on the DVTPP design) is located in the tip, and a pressure port has been added to measure formation properties. ODP has completed the prototype design of the

IWS probe tip and the associated sampling hardware. The prototype electronics design is a derivation of the Methane tool electronics, using the same processor board and some of analog-to-digital circuitry. The tool software is also building off of the Methane tool software. The prototype IWS tool will be deployed during Leg 208.

Labview Software Interface for Downhole Tools:
The communication software for current ODP downhole tools was written for DOS operating systems. These programs are being converted to Labview for Windows to create a commonality in support software for all downhole measurement tools. The communication and analysis software for the DVTP tool has been rewritten in Labview and is operational on the ship. Work on the APCT tool has commenced. The communication software will be integrated into the base Labview program so that it will have the same software front-end as the DVTP. Project completion is expected at the end of the 2003 calendar year.

Information Services

Digital Imaging System (DIS)

An additional contract for programming services was negotiated with Geotek, Ltd. for ODP-required enhancements to their proprietary *ImageTools* software package. The contracted work included the addition of an automated method to produce color whole core images for use by scientists during a cruise. Geotek completed the contracted work before Leg 207. The software application was fully implemented by ISD during Leg 207. No additional work is proposed for the digital imaging system during the remainder of this program.

Status of Migration of Historical ODP Data into the Janus Database

To date, all ODP core, sample, MST, and physical properties data have been migrated to the Janus database. Of the chemistry data, only rock eval and XRD remain to be migrated. Migration efforts regarding paleomagnetic data, downhole temperature data, and paleontology data are 10%, 27%, and 15% completed, respectively. Planned completion dates for all data types may be found in the following table. The ODP web site, located at http://www-odp.tamu.edu/database/migration.htm, provides detailed and up-to-date information on the data migration projects.

Data Migration Progress Table

Data Type	Percent Completed	Begin/End Dates
1. Core, Sample	100%	Jan 97/Aug 98
2. MST: GRAPE, P-wave, Magnetic susceptibility, Natural gamma, and Color Reflectance	100%	Sep 98/Aug 01

3. Physical Properties: Thermal conductivity, Moisture and density, PWS, Shear strength	100%	Dec 99/Aug 02
4. Chemistry:		
Rock Eval	84%	Apr 01/Sep 03
Carbonates	100%	Apr 01/Sep 02
Interstitial water	100%	Apr 01/Sep 02
Gases	100%	Apr 01/Sep 02
XRF	100%	Apr 01/Sep 02
XRD	0%	Mar 03/Sep 03
5. Miscellaneous:		
Paleomagnetism	10%	Sep 02/Sep 04
Downhole temperature	27%	Mar 02/Sep 03
Splicer	100%	Mar 02/Sep 02
6. Paleontology: Paleo sample information, Range charts, Datum depths, Age models	15%	Dec 01/Sep 07

*Notes (1) No core description data will be migrated. (2) No DSDP data will be migrated. (3) No contributory (postcruise) data will be migrated.

ODP Data Archive at NGDC

The National Geophysical Data Center (NGDC) is the designated organization responsible for the archiving of the ODP digital data. After several meetings JOI, ODP/TAMU and NGDC have defined a model for how the ODP digital data will be archived. The model calls for extracting data from the Janus database using the pre-defined Janus web queries and saving the data as ASCII text files. Along with the ASCII text data files, ODP will produce a data flowchart for each data type, meta data files, and calibration files. A prototype of the model was created and tested by ODP during this reporting period. The results were presented to JOI for peer review and approval.

Mirror Sites

Web Mirror Sites. Web mirror sites that contain all the e-publication products of ODP continue to operate successfully in Australia, the Federal Republic of Germany, and the United Kingdom. A new disk drive was ordered for the facility in the United Kingdom. It will be configured and delivered in early 2003. None of these sites mirror the Janus database. The sites are updated at the end of each week and are listed below.

Australian mirror site: http://www.agso.gov.au/odp (Australian Geological Survey Organisation)

Federal Republic of Germany mirror site: http://odp.pangaea.de/ (Institute for Marine Environmental Sciences [MARUM] and Alfred Wegener Institute for Polar and Marine Research [AWI])

United Kingdom’s mirror site: http://owen.nhm.ac.uk/odp/ (The Natural History Museum, London)

Publication Services

ODP/TAMU Web Site

Overall Site User Statistics:
The number of site visitors (defined as single computers accessing the site that did not originate from ODP/TAMU) and the number of pages (or files) accessed at the ODP/TAMU Web site increased by 38% and 63%, respectively, between the 12-month periods ending in January 2002 and January 2003. In the 12-month period ending in January 2003, there were 873,719 visitor sessions, or 72,810 visitors per month. See Table 1 for 2002 detailed statistics and a list of the most active Web pages on the ODP/TAMU site. (All tables appear at the end of this section.)

New feature *JOIDES Resolution* Virtual Tour:
QuickTime panoramas of the *JOIDES Resolution* (various labs on levels 2—7, fantail, forward living quarters, and rig floor) were recently added to the Web site. This project was a collaborative effort between the Texas A&M University Digital Library (photographed the laboratories during the Leg 205 port call and produced panorama images) and the ODP Publication Services staff (assisted with photography and created the enhanced panorama images for the Web). The labs can be viewed at http: //www-odp.tamu.edu/drillship/index.html.

New feature Electronic Manuscript Submission:
Online electronic manuscript submission was initiated in August 2002. From August 2002 through January 2003 82% of *Scientific Results* initial manuscript submissions and 50% of *Scientific Results* revised manuscript submissions were submitted electronically. In addition, more than half of the *Scientific Results* reviewers requested to receive manuscripts and submitted reviews electronically and half of the journal/book manuscripts were sent to ODP electronically.

ODP *Proceedings* Online Publications:
As of the end of January 2003, 40 *Initial Reports* volumes and manuscripts from 40 *Scientific Results* volumes were published in HTML and PDF formats on the ODP/TAMU Web site. User statistics for the *Proceedings* volumes are counted from single unique computer user sessions to the entry page of a volume that did not originate from ODP/TAMU. (If users enter the web site directly to a chapter and do not pass through the volume entry page they are not counted in these statistics.)

The number of individual users of the *Proceedings* volumes continues to rise on the ODP/TAMU Web site. Figure 1 (all figures appear at the end of this section) shows the total number of user sessions for all online *Proceedings* volumes per month for the period of February 2000 through January 2003. The number of site visitors accessing the *Proceedings* volumes has increased by 49% and 22%, respectively, between the 12-month periods ending in January 2002 and January 2003. In the 12-month period ending in January 2003, there were 43,267 visitor sessions. An average of 57 unique users accessed each *Proceedings* volume per month for the period of the period of January 2000 through January 2003. *Initial Reports* volumes were accessed during 40% of these user sessions and *Scientific Results* volumes during 60% of these sessions. This ratio has remained stable for the past three years. Figures 2 and 3, respectively, show the number of user sessions per *Initial Reports* and *Scientific Results* volume for the same period of February 2000 through January 2003.

Users representing all member countries have accessed the online *Proceedings* volumes within the last six months. In addition, users from 91 other nations have used the online volumes during this period. On average, 41% of the users who access the *Proceedings* volumes from this site are from the United States. In January 2003, countries with higher than 1% of the total site visits included United States (41%), Germany (9%), Japan (7%), United Kingdom (7%), Canada (4%), Italy (4%), China 4%, France (3%), Spain (2%), Taiwan (2%), and Australia (2%). Note that these statistics do not include users who access the publications through the mirror sites in Australia, Germany, and the United Kingdom. Currently user statistics are not monitored from the mirror sites. Examination of the top 75 nations and the top 50 institutions accessing the online *Proceedings* volumes illustrates that the use of these publications is broader than the constituency of the ODP membership and extends worldwide.

Printed Volume and CD-ROM Production

The *Proceedings of the Ocean Drilling Program* volumes are produced electronically and distributed in three formats. A printed booklet (containing the table of contents to the entire volume and a summary chapter) is accompanied by a CD-ROM that contains all volume chapters and core description information (*Initial Reports* only) in PDF format and selected tabular material in ASCII format. The volumes are also published on the ODP/TAMU Web site. Chapter material is presented in both HTML and PDF formats, core description information (*Initial Reports* only) in PDF format, and selected tabular material in ASCII format. User statistics for online versions of the publications are discussed above.

The *Initial Reports* volume booklet/CD-ROM package and Web publication formats are distributed approximately one year postcruise. For the *Scientific Results* volumes, papers are published individually on the Web in order of acceptance. The booklet/CD-ROM package is produced and distributed after completion of the leg synthesis paper, which is produced by the Co-chiefs, and is scheduled to be distributed four-years postcruise.

Initial Reports:

From August 2002 through January 2003:

The following booklet/CD-ROM sets were distributed and the volumes were also made available online: 197 (August 2002); 198 (October 2002); 199 (November 2002); 200 (January 2003).

From February 2003 through July 2003:

The following booklet/CD-ROM sets are expected to be distributed: 174AXS (February 2003); 201 (May 2003); 203 (June 2003); 202 (July 2003).

These volumes are also expected to be available online in HTML and PDF format during the same time period.

Scientific Results:

From August 2002 through January 2003:

Publication of online volumes began for volumes: 183 (April 2002), 184 (October 2002), 185 (November 2002), 186 (November 2002), 187 (January 2003), 188 (January 2003).

The following booklet/CD-ROM sets were distributed: 180 (September 2002); 176 (December 2002); 178 (December 2002).

From February 2003 through July 2003:

Publication of chapters online is expected to begin for volumes: 187, 188, 189, 190/196, and 191. Chapters from other volumes will be published when manuscripts are accepted and processed for publication.

The following booklet/CD-ROM sets are expected to be distributed: 174A (February 2003); 177 (March 2003); 183 (May 2003); 181 (June 2003); 186 (July 2003).

Note: Publication of the following *Scientific Results* volume booklet/CD-ROM sets were, or will be, delayed by more than one month (and by as much as 17 months [Leg 179]) because the leg synthesis papers were not completed on schedule: 176, 179, 181, 182, 183, 184, and 185. It is hoped that these volumes will be distributed sometime in 2003.

Leg-Related Postcruise Publications

Since Leg 160, when the publication policy changed and scientific party members were allowed to publish their postcruise research results in either books and journals or the *Scientific Results* volumes, it has been important to track the number of papers projected and published in the different venues. Table 2 reflects the number of ODP-related papers that are projected for, submitted to, in press, or published in *Scientific Results* volumes and books/journals for Legs 160 through 198. Projected statistics are generated at the time of the second postcruise meeting. The other data on book/journal publications are based on the information ODP receives from the scientific participants from each leg. (There is no guarantee the counts are complete.) 525 papers (or 54% of all published papers tracked) have been published in the *Scientific Results* Volumes 160 through 190, and 448 papers (or 46% of all published papers tracked) have been published in books and journals.

The average number of papers published per leg has remained relatively constant over the history of ODP, even after the Policy changed with Leg 160 and papers could be published in books and journals. Figure 4 shows the total number of papers tracked for each leg. For Legs 101 through 159, only *Scientific Results* papers were tracked; beginning with Leg 160, papers published in books and journals and in-press and submitted manuscripts were also tracked. All legs through Leg 182 have passed the four-years postcruise mark. Legs through Leg 191 have passed the 28-months postcruise mark, which is the date when all *Scientific Results*, journal, and book submissions are due (Leg 192 deadline = 10 March 2003).

Although the average number of publications per leg has remained relatively constant since the beginning of ODP, the range of time over which postcruise research papers are published has expanded since the Publication Services Department began tracking the numbers and types of papers published per month beginning with Leg 169 (the first *Scientific Results* volume published in the electronic format). 483 papers have been published related to Legs 169 through 190. 8% (39 papers) were published by 28-months postcruise, 61% (294 papers) were published between 29-months and four-years postcruise, and 31% (150 papers) were published later than four-years postcruise. (See Table 3.) The Publication Services Appendix tracks the publication history relating to Legs 169 through 193. Each graph illustrates the breakdown of papers by *Scientific Results* and book/journal categories. All of the publications that were published by 28-months postcruise were in journals or books (this equates to an average of 1.6 papers per leg). Thus, while a few scientific participants have taken advantage of the policy revisions that allow authors to publish papers shortly after the moratorium has ended, a growing number of publications are now received past the four-year postcruise deadline.

Leg-related Citation Lists:
Authors from Leg 160 and beyond have been required to provide ODP/TAMU with copies of all citations from papers published in books or journals during the first 48 months postcruise. ODP/TAMU posts these citations on the ODP Publications Web site (http://www-odp.tamu.edu/publications/, click on Leg-Related Citations).

The Publication Services Department began collecting leg-related citations in January 1999. The citation lists now include 739 citations, of which 590 are submitted, in press, or published papers and 149 are conference abstracts. Of the 590 papers, 288 have abstracts reproduced on the ODP/TAMU web site. ODP requests abstract reprint permission from all publishers, but only receives it from some. Nature and the American Geophysical Union are two frequent publishers of ODP science who do not allows ODP to reproduce abstracts, whereas Science, the Geological Society of America, and Elsevier are some of the publishers who do. The numbers of citations listed per leg depend on whether authors notify ODP once their papers have been accepted for publication; whereas, the availability of abstracts depends on whether publishers permit their reproduction.

We know the leg citation lists are not complete despite efforts by the ODP staff to remind scientific party members of their publication obligations and review of geoscience journals looking for ODP-related publications. The success of the leg-related citation lists is dependent upon authors submitting all published citations and a reprint of each publication to ODP, as outlined in the ODP Policy.

ODP Proceedings Distribution

The Department has continued to distribute free sets of volumes to academic institutions that do not already have accessible sets of DSDP and ODP volumes (institutions pay shipping costs). Between August 2002 and January 2003, three institutions (University of Copenhagen, Demark; Hobart & William Smith College, USA; and University of Michigan, USA) were sent 511 ODP and 234 DSDP volumes. Total value for the books in these shipments equals $36,343.

The Department sold DSDP and ODP volumes for a cumulative revenue of $7,052.08 between August 2002 and January 2003. This revenue supports a portion of the cost budgeted for the printing and distribution of new volumes. Between FY00 and FY02 there was an average annual revenue decline of 34%. We expect this trend to continue because the cost of newer volumes is 60% less than older volumes and there will continue to be a decrease in volume orders as the Program phases out.

DSDP and ODP Citation Database

The Citation Database, which contains more than 19,000 ODP- and DSDP-related citations and produced by the American Geological Institute (AGI) has been online since August 2002 (http://odp.georef.org/dbtw-wpd/qbeodp.htm). Residing on the AGI server, the database is updated on a weekly basis from the GeoRef database. Users can access the database via the Internet and also download data into common bibliographic software.

ODP/TAMU also receives a copy of the database on CD-ROM annually that is used to generate citation reports and statistics for the program and provide statistics for member country offices and individual authors who request citation data.

Overview of the Database:
AGI indexes and records citations from approximately 3,500 foreign and domestic publications, as well as citations from books, other citation databases, and publications arising from meetings. To create the Citations from Deep Sea Drilling Project and Ocean Drilling Program Research database (or DSDP/ODP citation database), AGI used a series of key words to extract a subset of citations related to DSDP and ODP research from the AGI GeoRef database. Approximately 500 new records were added to the AGI database in 2001 after the ODP scientific community reviewed the database contents and provided ODP-related citations that were missing from GeoRef.

As of 5 February 2003, the database contained 19,085 records. These can be divided into program proceedings and nonproceedings citations (42% and 58%, respectively; See Figure 5). See Database Parameters for the definition of program proceedings. These percentages are consistent with the previous study s report.

Database Parameters:

- AGI indexes and records citations from approximately 3000 foreign and domestic publications, in addition to books and publications arising from meetings. AGI also obtains citation information from international data-exchange partners in Canada, China, the Czech Republic, Finland, France, Germany, Hungary, Italy, the Netherlands, New Zealand, Poland, Russia, and Spain. There is no guarantee that this covers all publication venues for ODP or DSDP research, but scientific publications throughout the world are represented.

- There is often a time lag between the date new papers are published and the date they are input into the GeoRef database. The length of the time lag varies depending on the source from which AGI gets its information. As a result, the DSDP/ODP citations database does not contain a complete listing of citations from 2002. It is possible that some citations are still pending from 2000 and 2001 as well.
- The program proceedings citations include publications produced and published directly by DSDP or ODP. This includes *ODP Proceedings* and *DSDP Initial Reports* series publications, as well as Scientific Prospectus, Preliminary Report, and Technical Note publications. It does not include other Program publications, such as the *JOIDES Journal.*
- Most of the information presented in this report is based on author affiliation (institution and country of contributing authors). AGI did not begin recording author affiliation information until 1975, so this information is absent from many records. Affiliation is also absent from some records simply because there are many publication venues that do not require an author to supply such information. In addition, some authorships, such as Shipboard Scientific Party, cannot be given author affiliations because the author is a group of individuals from a variety of countries. A small percentage of the citations in this database do not have author affiliation data. The majority of these records are nonproceedings citations. AGI has no plans to update these records in their master database except when ODP/TAMU supplies AGI with the information to complete those data fields. Although 1,933 records of the citations in the ODP/DSDP citation database do not contain country affiliation information, this database represents the best and most accurate record available of the science produced in the scientific literature.
- Since this database contains citations for meeting abstracts and proceedings, a single citation may indicate where a paper/abstract was presented as well as where it was published after the meeting. So, a single record may represent double dissemination into the scientific community.

Author Information:

Authors from 78 countries have contributed to DSDP and ODP nonproceedings publications (see Table 4).

Citation Distribution in Geoscience Publications:

Figure 5 displays the number of nonproceedings citations accounted for in the DSDP/ODP citations database vs. the total number of citations from ODP and DSDP publications. Proceedings citations include *DSDP Initial Reports* and *ODP Proceedings* volumes, as well as the ODP Technical Notes, Scientific Prospectus, and Preliminary Reports series.

Table 1. Web User Statistics for ODP/TAMU Main Entry Points*

	Jan 02	Feb 02	Mar 02	Apr 02	May 02	Jun 02	Jul 02	Aug 02	Sep 02	Oct 02	Nov 02	Dec 02	2002 total
ODP/TAMU web site	47,057	68,115	72,528	66,230	70,844	51,761	69,347	61,309	79,893	83,752	72,544	82,333	825,713
Indicative pages:													
ODP/TAMU homepage	7,393	8,820	8,660	9,087	8,559	7,019	7,870	8,610	10,045	9,641	8,739	7,374	101,817
Publication Services	1,624	1,963	2,086	2,209	2,132	1,726	1,917	1,862	2,123	2.374	2,409	1,954	24,379
Cruise Information	1,328	1,549	1,425	1,639	1,425	1,093	1,461	1,258	1,567	1,339	1,212	1,020	16,316
Janus Database	1,245	1,488	1,580	1,657	1,719	1,306	1,549	1,462	1,550	1,529	1,447	1,154	17,686
Operations Schedule	1,090	910	847	882	811	663	810	729	1,236	1,200	1,005	740	10,923
Search	810	952	962	993	943	652	845	762	880	945	792	615	10,151
Drilling Services	716	919	905	901	851	571	735	701	846	796	671	655	9,267
Site Maps	450	565	625	670	562	459	616	480	736	828	716	525	7,232
JOIDES Resolution	493	660	576	589	495	434	534	502	830	744	687	632	7,176
Science & Curation	539	616	643	665	583	466	577	509	638	598	503	400	6,737
ODP/TAMU jobs	312	518	745	1,138	963	789	408	309	408	394	322	287	6,593
Staff Directory	483	527	546	564	619	509	585	585	520	539	393	386	6,256
Cruise Participation	373	460	449	454	406	309	413	309	453	484	419	293	4,822
Sample request form	319	346	334	421	373	301	342	318	406	385	363	302	4,210
Meeting and travel info	352	332	313	367	342	258	335	315	421		289		3,324
Life on the ship	672	883	823	886	873	811	855	797	1,565	1,468	1,335	1,233	12,201
Leg 199 photos	237												237
Leg 200 photos	1,129	702	270			487							2,588
Leg 201 photos		929	1,364	775									3,068
Leg 202 photos				705	1,457	598							2,760
Leg 203 photos						673	977		315				1,965
Leg 204 photos								1,378	961	410			2,749
Leg 205 photos										1,257	607		1,864
Leg 206 photos											397	934	1,331

Notes: * = numbers represent unique-computer sessions that originate outside ODP/TAMU; each session may result in multiple page views and/or database requests; mirror sites are not included. † = see "Volume Production" section for statistics on unique-computer sessions for each volume. — = not in the top 50 pages accessed.

Table 2. ODP-related peer-reviewed papers projected, submitted, in press, and published in *Scientific Results* volumes vs. books or journals.

Leg	SR Volume				Journal or Book			
	Projected*	Submitted	In Press	Published	Projected*	Submitted†	In Press†	Published†
160	62			58	2		1	28
161	47			46	6	2		11
162	24			46	32	3	1	35
163	22			17	4			5
164	35			44	18			9
165	26			22	2		1	12
166	28			21	7	2		23
167	40			33	11			10
168	17			14	47			27
169S				1	28			25
169	14			10	29	1	1	13
170	6			7	15			15
171A	1			3	16			10
171B	15			11	43	2	2	47
172	8			12	36	3		16
173	8			12	19			26
174A	8			8	17	1	3	19
174B	1			2	5			1
175	14			24	24			20
176	17			14	20	1		9
177	7			15	44	3		25
178	8			37	44	1		13
179	15	4	2	1	8	1		1
180	15	26		26	25	1		6
181	21	10	1	9	25	7		6
182	13	15		15	37	3		7
183	15	16	4	12	25	6		13
184	23	25	23	1	34	20	12	4
185	9	12	7	4	29	3		4
186	19	19	18		11	7		
187	4	2	2		15	2		
188	16	13	13		19	6		1
189	14	9	9		50	8		3
190/196	21	13	13		50	7	1	4
191	13	6	6		16	0	0	0
192	5	10 Mar 03**			20	1	0	0
193	12	5 May 03**			27	2	0	0
194	13	7 Jul 03**			26			
195	Jun 03	1 Sep 03**						
197	Feb 03	5 Jan 04**				1	1	0
198	Sep 03	23 Feb 04**				0	0	1

Notes: * = estimated number of papers at second postcruise meeting. Submitted data = number of papers received (and in peer review) as of 31 January 2003.   = number of published papers ODP has received from authors or has identified in journals .   = date of second postcruise meeting. ** = deadline when initial submissions are due (28 months postcruise).

Table 3. Publication dates of *Scientific Results* and Journal/book papers.

Legs 169—190	†28-months postcruise	29 — †48-months postcruise	>48-months postcruise	Total
Scientific Results	0	172	40	212
Journals or books	39	122	110	271
Total	39 (8%)	294 (61%)	150 (31%)	483

Table 4. Number of "nonproceedings" publications contributed to by authors from each country.

Country	Number of publications	Country	Number of publications	Country	Number of publications
Argentina	28	Greece	9	Peru	2
Australia	280	Hungary	5	Philippines	5
Austria	22	Iceland	5	Poland	12
Barbados	2	India	96	Portugal	4
Belgium	54	Indonesia	2	Puerto Rico	7
Botswana	1	Ireland	3	Romania	1
Brazil	20	Israel	21	Saudi Arabia	1
Bulgaria	1	Italy	265	Senegal	1
Canada	691	Jamaica	6	Seychelles	1
Chile	7	Japan	603	Slovak Rep.	1
Chinese Taipei	14	Korea	14	Solomon Is.	2
Colombia	5	Lebanon	1	So. Africa	20
Costa Rica	3	Malaysia	1	Spain	76
Cuba	2	Malta	2	Sri Lanka	1
Cyprus	6	Mexico	45	Sweden	136
Czech Republic	3	Morocco	2	Switzerland	191
Denmark	79	Namibia	1	Tanzania	2
Dominican Rep.	1	Netherlands	189	Tonga	2
Ecuador	1	N. Caledonia	3	Trinidad/Tobago	2
Egypt	1	New Zealand	119	Tunisia	4
Estonia	1	Nigeria	4	Turkey	11
Fiji	1	Norway	192	Venezuela	2
Finland	9	Oman	3	UK	1,139
France	981	Pakistan	2	Un. Arab Em.	1
Fr. Polynesia	2	P. New Guinea	82	USA	5882
Germany	1,082	PR China	71	USSR*	241

Notes: These figures only account for citations with author affiliation data (see "Database Parameters"). Numbers include serial publications, meetings, and miscellaneous publications (see "Publication Categories"). * = USSR includes USSR, Russian Federation, and Ukraine totals.

Figure 1. Number of *Proceedings* volume user sessions per month (February 2000–January 2003).

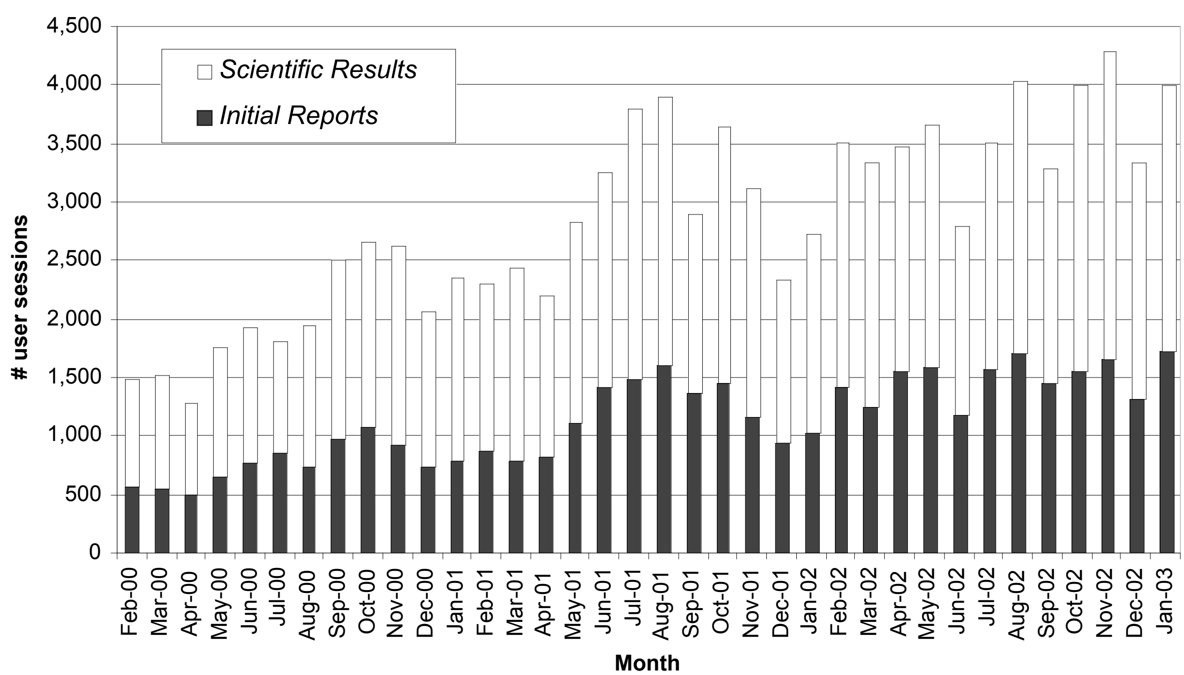


Figure 2. Number of user sessions per *Initial Reports* volume (February 2000–January 2003).

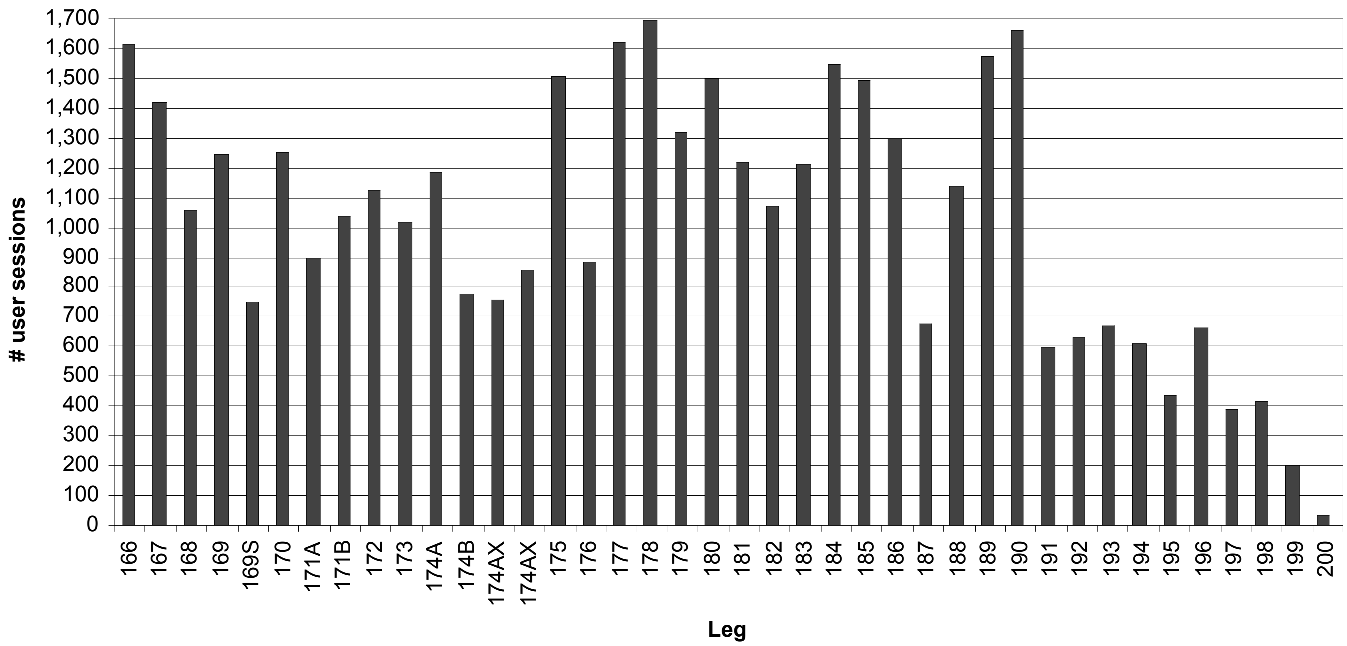


Figure 3. Number of user sessions per *Scientific Results* volume (February 2000–January 2003).

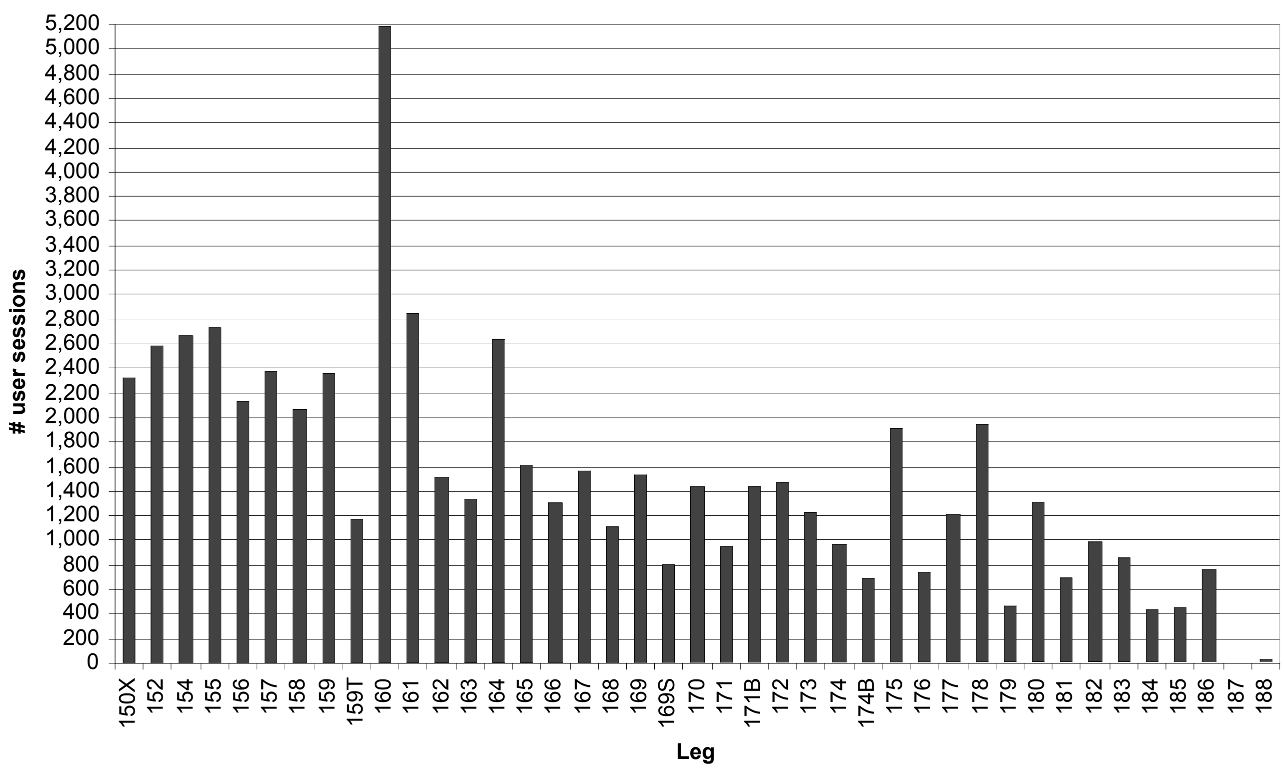
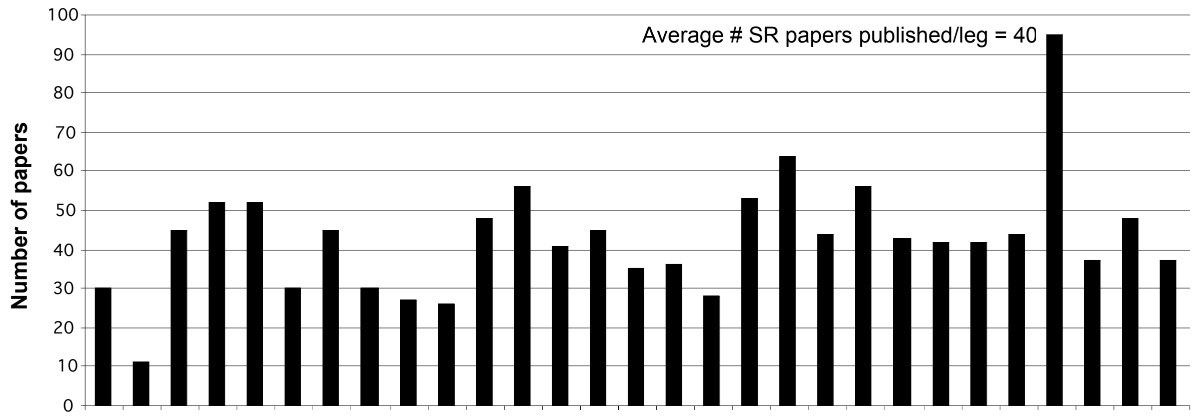
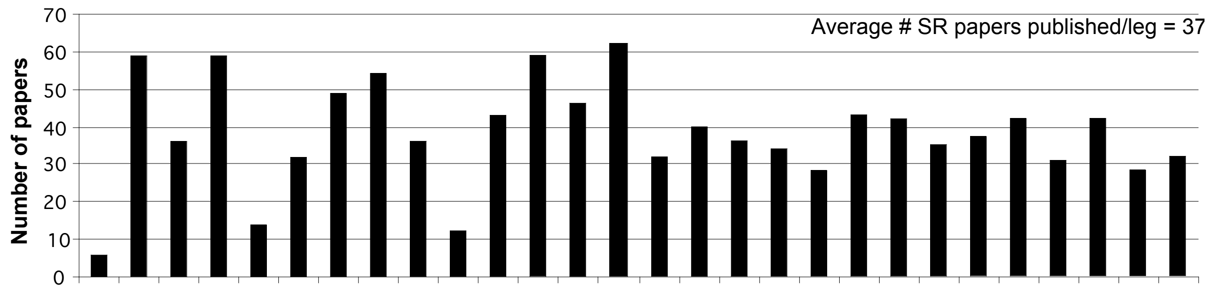
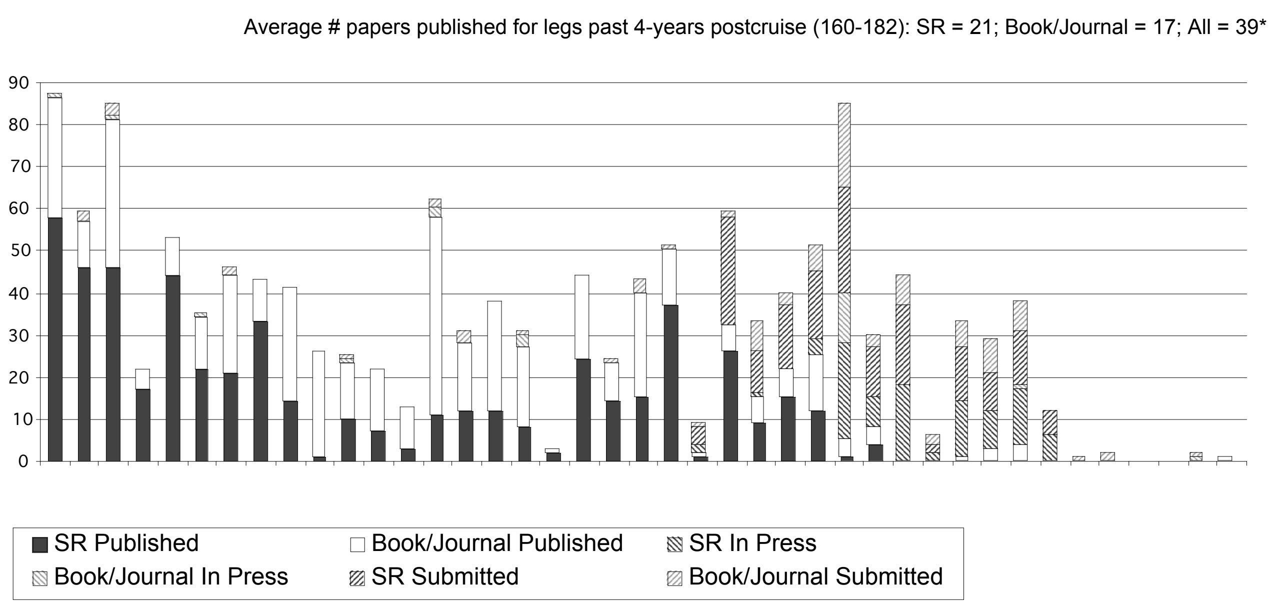


Figure 4. Number of *Scientific Results* papers for Legs 101–159 and number of papers published, in press, and submitted to the Scientific Results volume or journals/books for Legs 160–198.

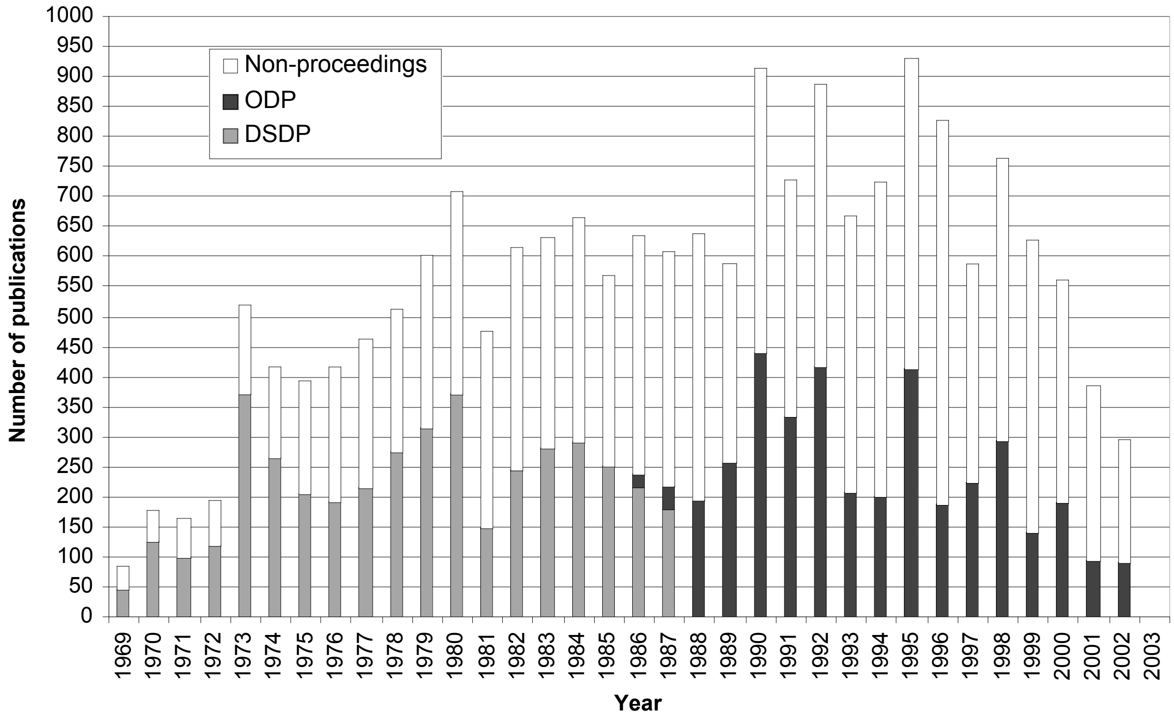






* = data on papers submitted, in press, or published in books/journals is provided by authors and may not be complete or up-to-date.

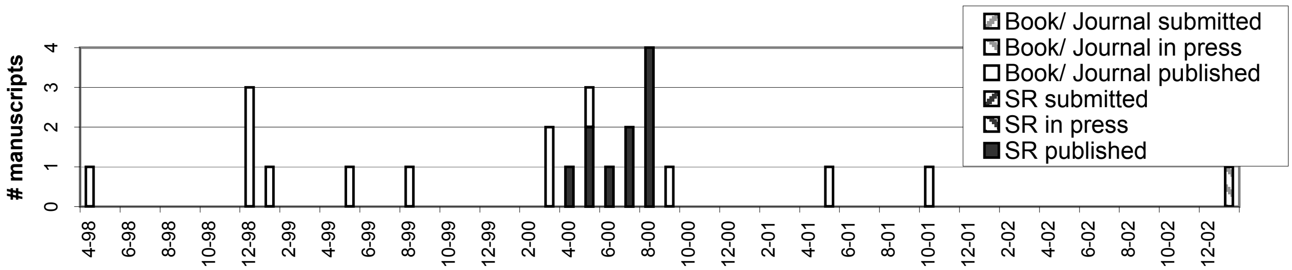
Figure 5. Number of "proceedings" and "nonproceedings" citations per year.



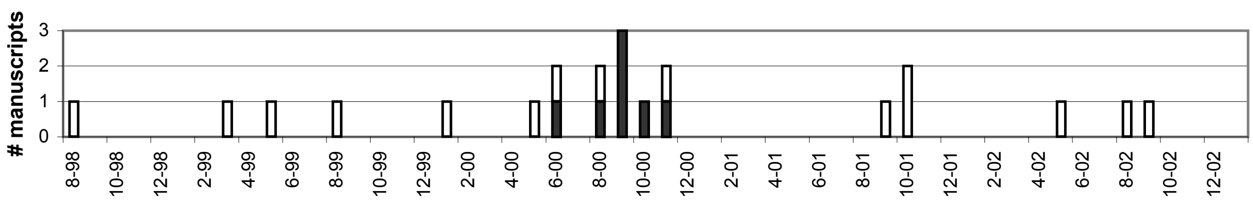
Public Information

Public Information Requests:
During the last six months, ODP/TAMU has responded to 18 requests for scientists, news media, television producers, universities, K-12 schools, government administrators and publishers. The material distributed includes: general PR packages, slide sets, B-roll footage, ODP video Planet in Motion, and the Cretaceous-Tertiary Impact Poster.

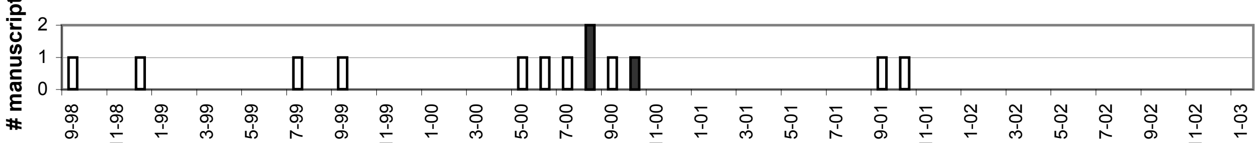
Leg 169 (23 published) 1-yr pc = Oct 97; 28-mo pc = Feb 99; 4-yr pc = Oct 00 (pc= postcruise)



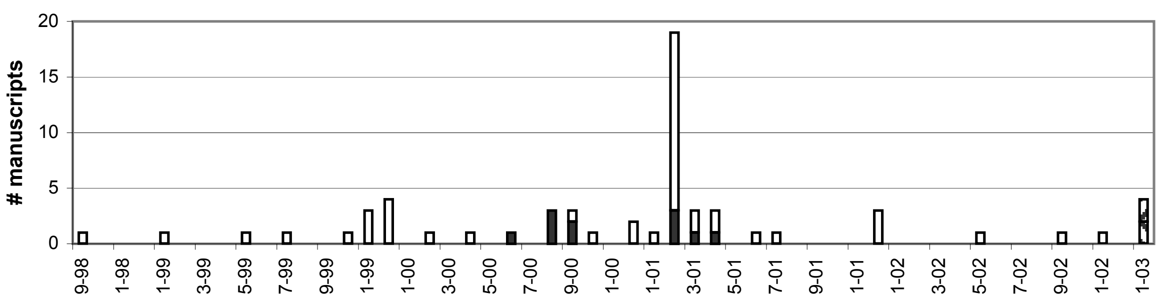
Leg 170 (22 published) 1-yr pc = Dec 97; 28-mo pc = Apr 99; 4-yr pc = Dec 00



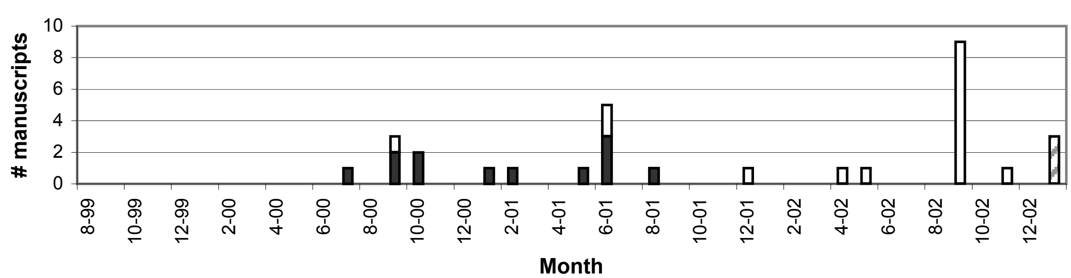
Leg 171A (23 published) 1-yr pc =Jan 98; 28-mo pc = May 99; 4-yr pc = Jan 01



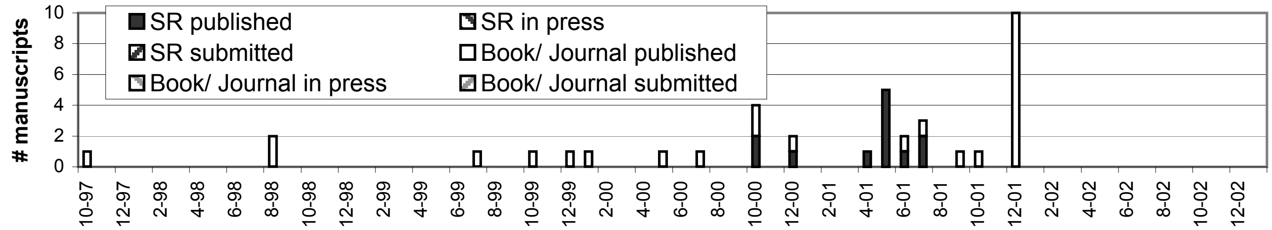
Leg 171B (58 published) 1-yr pc = Feb 98; 28-mo pc = Jun 99; 4-yr pc = Feb 01



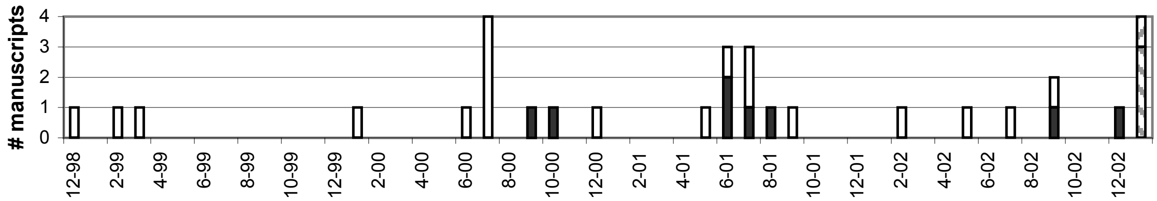
Leg 172 (28 published) 1-yr pc = Apr 98; 28-mo pc = Aug 99; 4-yr pc = Apr 01



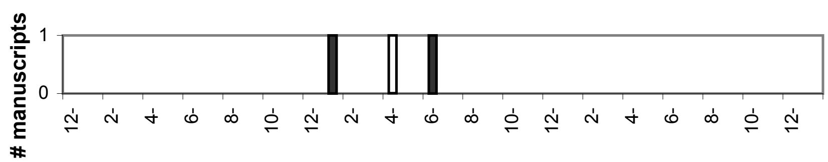
Leg 173 (38 published) 1-yr pc = Jun 98; 28-mo pc = Oct 99; 4-yr pc = Jun 01



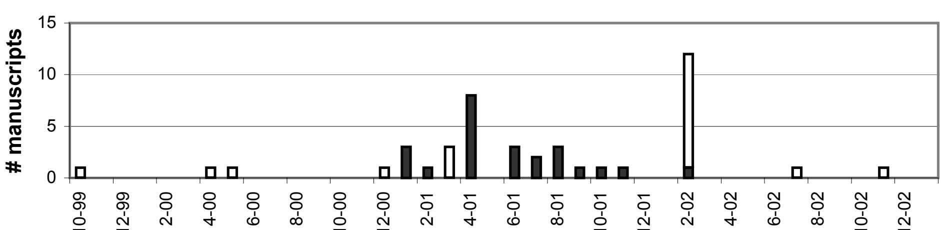
Leg 174A (27 published) 1-yr pc = Jul 98; 28-mo pc = Nov 99; 4-yr pc = Jul 01



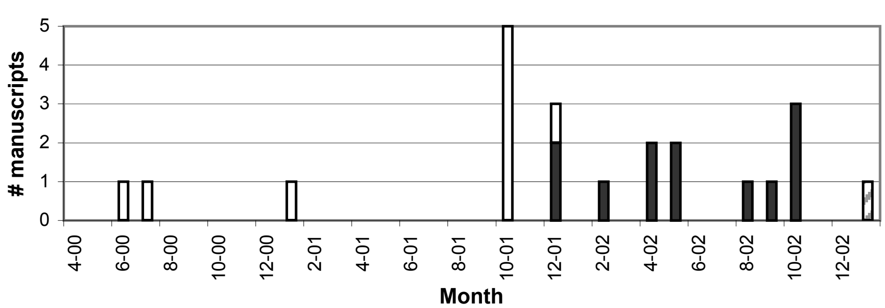
Leg 174B (3 published) 1-yr pc = Aug 98; 28-mo pc = Dec 99 ; 4-yr pc = Aug 01



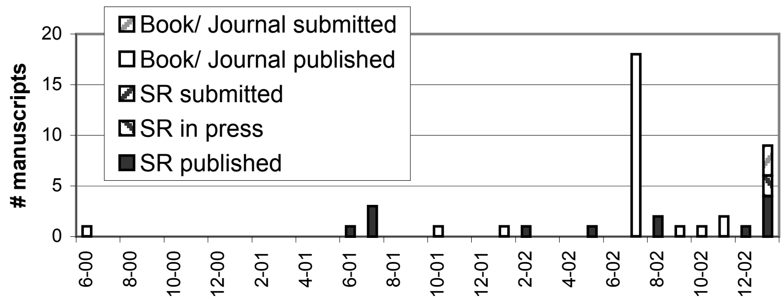
Leg 175 (44 published) 1-yr pc = Oct 98; 28-mo pc = Feb 00; 4-yr pc = Oct 01



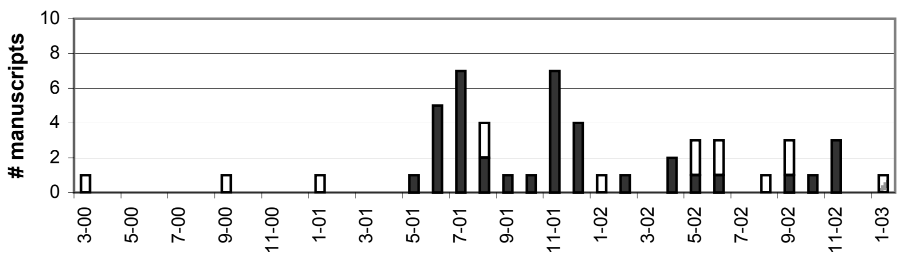
Leg 176 (28 published) 1-yr pc = Dec 98; 28-mo pc = Apr 00; 4-yr pc = Dec 01



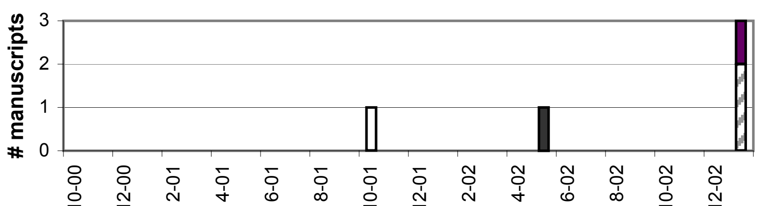
Leg 177 (38 published) 1-yr pc = Feb 99; 28-mo pc = Jun 00; 4-yr pc = Feb 02



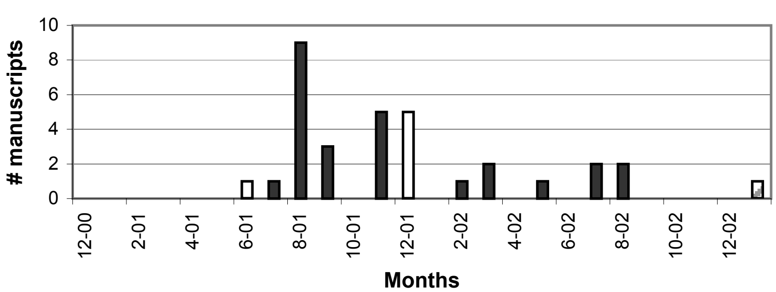
Leg 178 (51 published) 1-yr pc = Apr 99; 28-mo pc = Aug 00; 4-yr pc = Apr 02



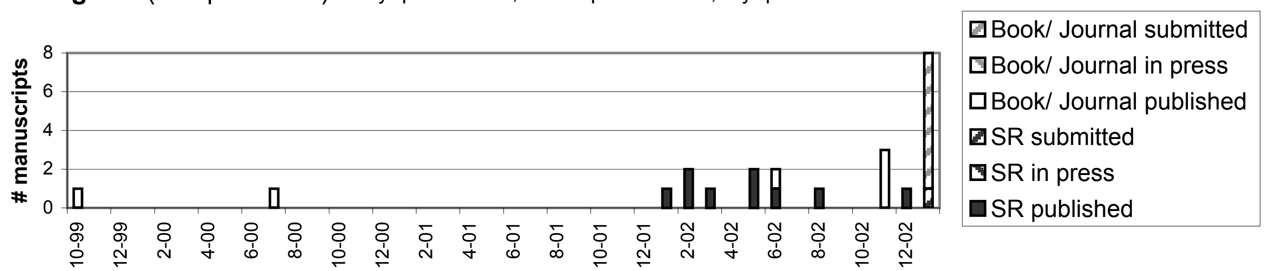
Leg 179 (2 published) 1-yr pc = Jun 99; 28-mo pc = Oct 00; 4-yr pc = Jun 02



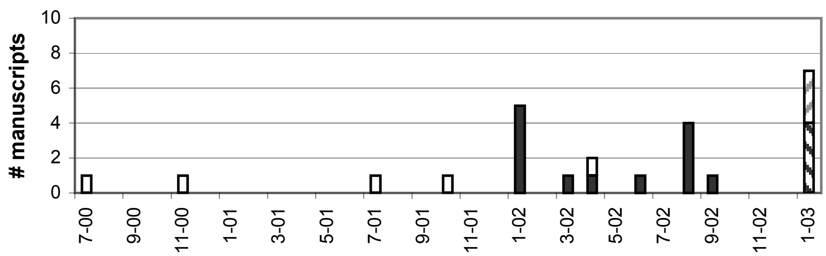
Leg 180 (32 published) 1-yr pc = Aug 99; 28-mo pc = Dec 00; 4-yr pc = Aug 02



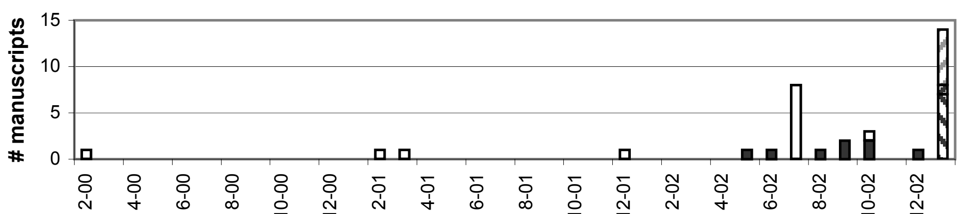
Leg 181 (156 published)   1-yr pc = Oct 99; 28-mo pc = Feb 01 ; 4-yr pc = Oct 02



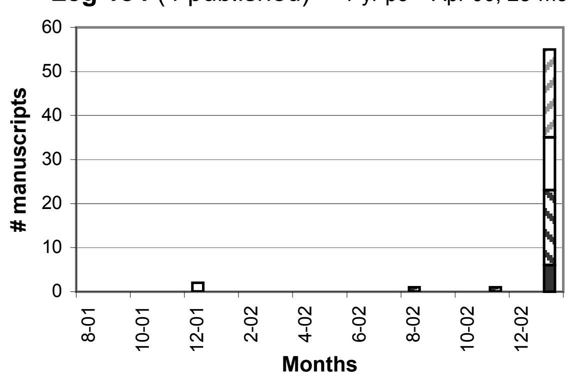
Leg 182 (16 published)   (1-yr pc = Dec 99; 28-mo pc = Apr 01; 4-yr pc = Dec 02)



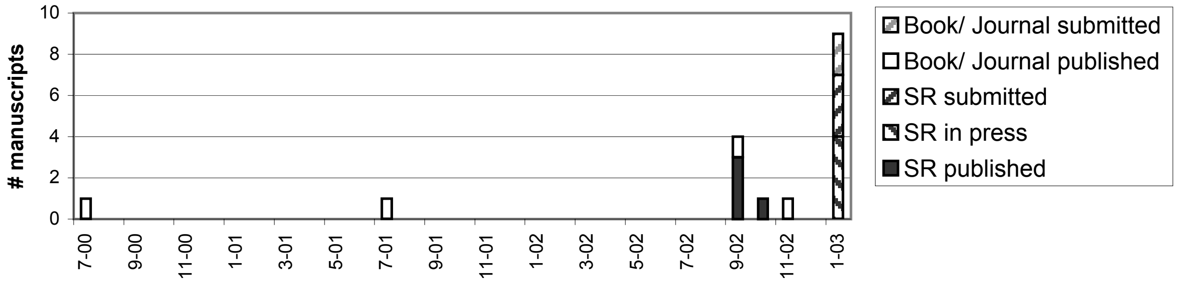
Leg 183 (21 published)   1-yr pc = Feb 00; 28-mo pc = Jun 01; 4-yr pc = Feb 03



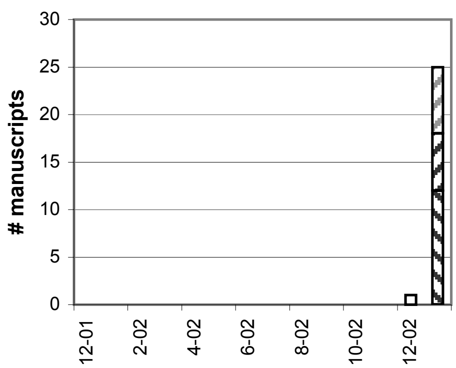
Leg 184 (4 published)   1-yr pc = Apr 00; 28-mo pc = Aug 01; 4-yr pc = Apr 03



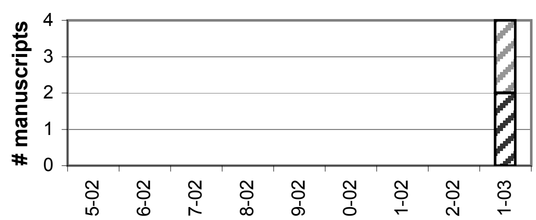
Leg 185 (8 published) 1-yr pc = Jun 00; 28-mo pc = Oct 01; 4-yr pc = Jun 03



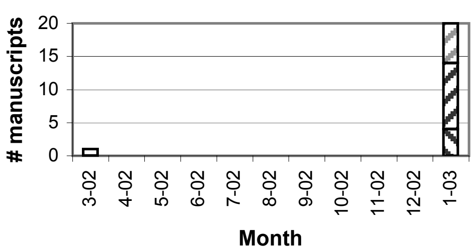
Leg 186 (1 published) (1-yr pc = Aug 00; 28-mo pc = Dec 01; 4-yr pc = Aug 03)



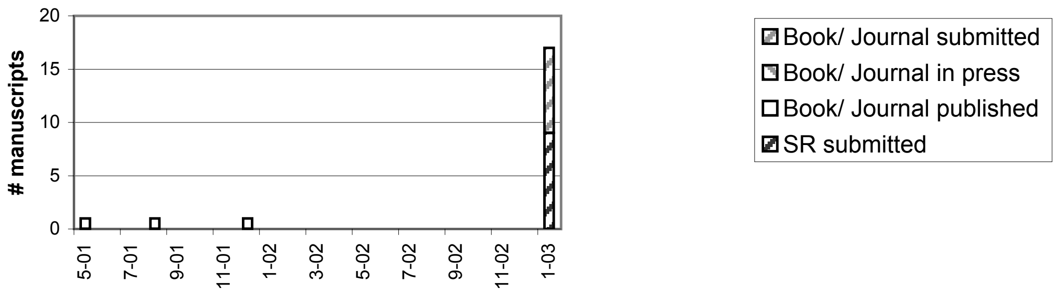
Leg 187 (0 published) (1-yr pc = Jan 01; 28-mo pc = May 02; 4-yr pc = Jan 04)



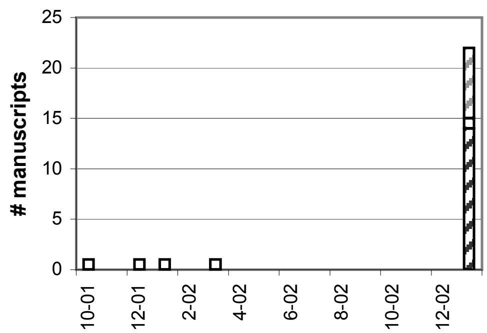
Leg 188 (1 published) (1-yr pc = Mar 01; 28-mo pc = Jul 02; 4-yr pc = Mar 03)



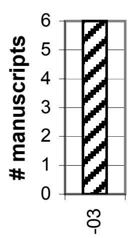
Leg 189 (3 published) (1-yr pc = May 01; 28-mo pc = Nov 02; 4-yr pc = May 05)



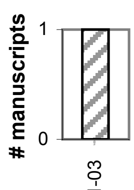
Leg 190 (4 published) (1-yr pc = Jul 01; 28-mo pc = Nov 02; 4-yr pc = Jul 04)



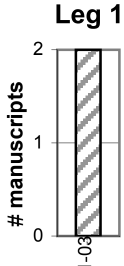
Leg 191 (0 published) (1-yr pc = Sep 01; 28-mo pc = Jan 03; 4-yr pc = Sep 04)



Leg 192 (0 published) (1-yr pc = Nov 01; 28-mo pc = Mar 03; 4-yr pc = Nov 04)



Leg 193 (0 published) (1-yr pc = Jan 01; 28-mo pc = May 03; 4-yr pc = Jan 05)



Executive Summary

Leg 204 Gas Hydrates

Logging-while-Drilling (LWD) and Measurement-while-Drilling (MWD) tools were deployed in ten holes and wireline logging tools were deployed in six holes, an ODP record total of sixteen logged holes during a single leg. Log images can be interpreted to reflect lithological features such as the turbidite sequences and several ash layers, the regional structure, and of particular interest for this leg, the presence and distribution of gas hydrates.

Leg 205 Costa Rica

Standard logging operations were conducted at the reference site on the incoming plate. Conductive features on the FMS images can be used to identify structurally important fractures, and to infer potential fractured intervals, which were important in determining the correct depth to deploy the osmotic samplers. The logs were also significant in identifying the exact depth of the igneous and sediment unit boundary where core recovery was poor.

Leg 206 Fast Spreading Center

In addition to the standard logging tools, the Ultrasonic Borehole Imager (UBI) was used in a hard rock environment for the first time in the history of the ODP. Despite the limitations of large boreholes drilled by ODP, the transit time and amplitude of the UBI signals provided good data and fractures identified in the UBI data can be correlated to the FMS images.

Leg 207 Demerara Rise

Operations are ongoing at the time of this report, with two holes having been logged to date. The continuous log data sets measured through the black shale interval have provided the basis for producing a full stratigraphy. A synthetic seismogram calculated from the density and velocity data was used as the basis for re-interpretation of the regional seismic data.

Drillstring Measurements System (DMS)

Drafting of the required retrievable memory module (RMM) components is underway and will be completed in the second quarter FY 03. Engineering teams from TAMU and LDEO visited the manufacturer of the downhole sensor sub in mid-January. Electronic design of the RMM will begin in the second quarter of FY 03.

Data Migration and Archiving Project

The current online database from Leg 101 through Leg 198 was thoroughly reviewed by the database group and a copy was transferred to NGDC for long-term archive. The next update will be sent to NGDC in June. Projects to archive seismic data, sonic waveforms, and multi-channel sonic data are underway.

RAB Coring Project

The RAB LWD coring tool was deployed successfully on Leg 204. Core recovery averaged 35% over a 45-m drilled interval during this test, and reached as high as 68%. The cores were processed and archived normally on board the *JOIDES Resolution.* Preparations are underway to deploy the RAB coring equipment on Leg 209. Some modifications to the coring apparatus including the manufacture of new shorter core tubes will be completed and deployed on Leg 209.

I. MANAGEMENT

The ODP Logging Services FY 03 Program Plan was submitted to JOI in August. The FY 04-07 Program Plan was submitted in October. A draft FY 04 Program Plan submitted to JOI in January.

ODP Logging Services assisted JOI personnel in the updating of the ODP Policy manual.

Dave Goldberg and Mary Reagan attended the ODP Manager s meeting in West Virginia in October.

Stuart Robinson (Oxford Univ.) joined BRG as a logging scientist in November.

Aleksandra Janik (RSMAS, U. Miami) was selected and accepted the open technical services position at BRG. She began work in January.

II. STANDARD LOGGING OPERATIONS

Leg 204 Gas Hydrates

During Leg 204, nine sites were drilled through the gas hydrate stability zone on the southern part of Hydrate Ridge on the Cascadia accretionary margin, offshore Oregon. The downhole logging program was specifically designed to obtain the data needed to assess the occurrence and concentration of gas hydrates on Hydrate Ridge. Logging-while-Drilling (LWD) and Measurement-while-Drilling (MWD) tools were deployed in ten holes and wireline logging tools were deployed in six holes, an ODP record total of sixteen logged holes during a single leg. The US Department of Energy provided additional funding support for an NMR-LWD tool, as well as a modified RAB imaging tool specially designed to be used in conjunction with an ODP core barrel. This allowed for coring and LWD data recording to be conducted simultaneously for the first time in the history of ODP. Vertical, offset, and walkaway VSP data were obtained using the WST-3 tool at Holes 1251H and 1244E and using the VSI (multi-level sensors) at Holes 1247B and 1250F, all in conjunction with the R/V *Maurice Ewing* as the seismic shooting ship.

The LWD and wireline data match relatively well, and were used conjointly in the interpretation of this particularly rich data set. The logged section was divided into four “Log Units” based on changes in gamma ray, density, electrical resistivity, and acoustic logs, as well as on the character of the FMS and RAB electrical images. The images can be interpreted to reflect lithological features such as the turbidite sequences and several ash layers, the regional structure, and of particular interest for this leg, the presence and distribution of gas hydrates. Intervals containing gas hydrate were identified primarily by the formation responses in the resistivity logs, the electrical images, and the acoustic logs. The resistivity logs were used to estimate the concentration of gas hydrate, which occupy as much as 90% of the pore space at the crest of the ridge. In several locations, RAB images clearly identify fault planes that have been filled by gas hydrate. Borehole breakouts, which result from horizontal stress differences, were also observed in the RAB images from several holes and appear to be consistent with an ENE-WSW regional horizontal stress orientation near the sites.

Leg 205 Costa Rica

Leg 205 had two primary objectives: determining the history of the uppermost part of the downgoing oceanic plate, and sampling subsurface fluid flow along faults by installing CORKs. Standard logging operations (triple combo and FMS-Sonic toolstrings) were conducted at Hole 1253A, the reference site on the incoming plate. The primary objectives at this site were to characterize the structure and petrology of the igneous basement, determine the alteration mineralogy and distribution and their implications for fluid flow, investigate microbial activity in altered basaltic crust, better constrain the temperature profile, and install the CORK for pressure and temperature monitoring with osmotic samplers for fluid and gas sampling. The logs indicated three lithospheric units on the basis of changes in hole diameter, velocity, resistivity, bulk density, and porosity. These units correspond to the upper igneous unit (18 m), sedimentary unit (30 m), and the lower igneous unit (103 m). The upper and lower igneous units are characterized by low porosity and high density, resistivity and velocity values. Unlike the igneous units, the sedimentary section is characterized by large caliper values, high porosity and low density, resistivity, and velocity. FMS images can be used to characterize the structure and fabric in the igneous units. Conductive features may be used to identify structurally important fractures, and to infer potential fractured intervals, which were important in determining the correct depth to deploy the osmotic samplers. The logs were also significant in identifying the exact depth of the igneous and sediment unit boundary where core recovery was poor.

Leg 206 Fast Spreading Center

Leg 206 was dedicated to coring the upper section of 15-Ma crust on the Cocos plate generated during superfast seafloor spreading in the eastern Pacific. Logging operations were conducted in Hole 1256D after it had been cored to a depth of 752 mbsf. Five tool strings were deployed in the hole: the triple combo toolstring including the Dual Laterolog (DLL), the Formation MicroScanner (FMS)-Sonic (Dipole Shear Imager, DSI) toolstring, the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) Magnetometer, the Ultrasonic Borehole Imager (UBI), and the Well Seismic Tool (WST).

The top of the igneous basement consists of a massive lava producing distinctive FMS images with numerous veins of variable dip. This massive unit is characterized by high resistivity, low porosity, and high density. Veins and fractures are observed in the UBI data, and correlate well with those recorded by the FMS. Pillow lobes are easily recognized on the FMS and UBI images at the uppermost part of this interval between 344 mbsf to 530 mbsf. Pillow basalts of varying sizes (10-80 cm diameter) and hyaloclastite zones also appear to be abundant in this interval. They consist of highly resistive material (basalt, basaltic glassy clasts) cemented in a conductive matrix (altered glass). Hyaloclastites do not exhibit any fractures in the FMS images, but show a heterogeneous distribution of generally lower and variable resistivity material. From 530 mbsf to the base of the hole (750 mbsf), some massive units can be recognized on the FMS and UBI images (resistive zones with abundant veins) but they are more altered and/or vein rich (lower resistivity) than those above.

The UBI was used in a hard rock environment for the first time in the history of the ODP. Despite the limitations of large boreholes drilled by ODP, the transit time and amplitude of the UBI signals provided good data. Fractures may be identified and correlated to the FMS images. In several intervals (460, 516, 612, 684 mbsf), breakouts may be suggested in the UBI images. Three attempts were made to deploy the BGR magnetometer. In all three attempts, the tool failed before it entered the open hole.

Leg 207 Demerara Rise

The main aims of the Leg 207 are the recovery of Paleogene and Cretaceous fossiliferous oozes and chalks and Cretaceous black shales. Operations are ongoing at the time of this report, with Holes 1257A and 1258C having been logged to date. In Hole 1257A the triple combo, MGT, FMS-Sonic and the WST were run. Core recovery in all three holes at this site was lower than had been anticipated and was particularly poor through the black shale interval. The log data has been useful for accurately locating the short sections of core that have been obtained. The continuous log data sets measured through the black shale interval have provided the basis for producing a full stratigraphy. Total organic carbon (TOC) levels have been calculated through the unit, providing a better opportunity to understand oceanic anoxic events (OAE). Temperature and resistivity data have also been useful in corroborating pore water chemistry data that indicated the presence of brine flowing through the black shale unit. A checkshot survey was used to calibrate the downhole sonic log. A synthetic seismogram calculated from the density and velocity data was used as the basis for re-interpretation of the regional seismic data. Contrary to previous interpretations a key reflector actually represents the base of the black shale unit, unconformably overlying the middle to late Albian syn-rift sediments. Other′ reflectors at the top of the black shale and in the middle Paleocene hiatus were reinterpreted.

In Hole 1258C the triple combo, MGT and FMS-Sonic tool strings were run. An excellent record of cyclic variation in sedimentation, back through the early Eocene and Paleocene, was recorded in the high-resolution gamma ray and porosity data. Core recovery was good through the black shale intervals and the log data again provided high quality geophysical property data with which to construct the full stratigraphy. A synthetic seismogram calculated from the density and velocity data was again used to locate and interpret the seismic stratigraphy.

III. SPECIALTY TOOLS AND ENGINEERING DEVELOPMENTS

Active Heave Compensation/MWD Project

Measurement while drilling equipment was successfully deployed on Leg 204. The downhole and uphole drilling dynamics data acquired on this leg will be synthesized with data from Legs 188 and 196 for a comprehensive analysis of the drill string heave compensation system in a wide variety of conditions.

Drillstring Measurements System (DMS)
This project is a joint TAMU/LDEO engineering development. The cooperative effort to design the downhole sensor sub (DSS) and the retrievable memory module (RMM) is expected to be completed by Leg 210. TAMU will be building the DSS and LDEO will build the RMM. Drafting of the required RMM components is underway and will be completed in the second quarter FY 03. Engineering teams from TAMU and LDEO visited the manufacturer of the downhole sensor sub in mid-January. Electronic design of the RMM will begin in the second quarter of FY 03.

Legacy Project
Tool summary sheets were uploaded to the ODP Logging Services web site (http://www.ldeo.columbia.edu/BRG/ODP/legacy.html). The most recent addition to the list was a technical summary for the RAB coring system.

RAB Coring Project
The RAB LWD coring tool was deployed successfully on Leg 204. Core recovery averaged 35% over a 45-m drilled interval during this test, and reached as high as 68%. The cores were processed and archived normally on board the *JOIDES Resolution.* The borehole images were processed post-cruise and correlated to recordings of standard RAB tool results in nearby Hole 1149A. The RAB underwent calibration checks, which verified the validity of the acquired data. Preparations are underway to deploy the RAB coring equipment on Leg 209. Some modifications to the coring apparatus including the manufacture of new shorter core tubes will be completed and deployed on Leg 209.

TAP Tool Replacement
The two new TAP tools delivered for use on Leg 204 were deployed successfully.

IV. SHIPBOARD LOG ANALYSIS

CLIP (Splicer/Sagan)
Stuart Robinson has been selected to succeed Ulysses Ninnemann as the project manager for CLIP support. He is currently undertaking the updating and expansion of the CLIP user guide.

V. SHOREBASED LOG ANALYSIS

The following holes were processed and prepared for inclusion in the database:

ODP Conventional Date
Leg 204 – Holes 1244E, 1245E, 1247B, 1250F, 1251H, and 1252A
Leg 205 - Hole 1253A
Leg 206 – Hole 1256C

FMS Processing
Leg 204 – Holes 1244E, 1245E, 1247B, 1250F, 1251H, and 1252A
Leg 205 – Hole 1253A

LWD Processing
Leg 204 – Holes 1244D, 1245A, 1246A, 1247A, 1248A, 1249A, 1250A/B, and 1251A

RAB Processing
Leg 204 – Holes 1244D, 1245A, 1246A, 1247A, 1248A, 1249A, 1250A/B, and 1251A

Temperature Processing
Leg 200 – Hole 1224F
Leg 201 – Holes 1225A, 1226A, 1229A, and 1230A
Leg 204 – Holes 1244E, 1245E, 1247B, 1250F, 1251H, and 1252A

VI. DATABASE

The ODP Log Database has been updated through Leg 206 including Schlumberger original and processed data (conventional, geochemical, and FMS), specialty tools (borehole televiewer, multi-channel sonic, and temperature), borehole images, and sonic waveforms.

Historical Data Migration
Online data. The current online database from Leg 101 through Leg 198 was thoroughly reviewed by the database group and a copy was transferred to NGDC for long-term archive. The next update will be sent to NGDC in June.

Seismic data. All ODP data recorded with seismic tools (WST, WST-3, BGKT, ASI) have been transferred to a Unix directory for future archiving onto a dedicated ODP Seismic CD-ROM. All data available in LIS or DLIS format (25 holes) have been translated into SEG-Y. The seismic archive now contains data from 39 holes.

Sonic waveforms. The sonic waveforms from Legs 143 thru 149 have been converted from DLIS into binary format and put online. The project is estimated to be completed at the end of the summer.

Multi-channel sonic (MCS) data. Data from eight holes have been downloaded into a Unix directory for future archival onto a dedicated ODP MCS CD. The data are currently being reviewed.

Proprietary data. The archiving of all ODP proprietary data has been completed.

Post Cruise Distribution of Log Data
The Leg 197-200 Data CD’s have been completed and duplicated. The Leg 201 Data CD is currently in production.

VII. PUBLICATIONS AND REPORTS

Bartetzko, A. and H. Delius, 2002, Application of downhole magnetic field measurements in the identification of petrological variations in basalts, gabbros and volcaniclastic sediments, *Eos, Transactions, American Geophysical Union, 83*(47), Abstract GP11A-1062, 2002.

Delius, H., T.S. Brewer, P.K. Harvey Petrology of Fe-Ti Oxides in Subaerial and Submarine Basalts and Their Effect on Magnetic Rock Properties Poster presented at the UK ODP Open Forum, London.

Einaudi, F., P. Gaillot, J. Stoll and M. Leven, General Purpose Inclinometry Tool in Hard-Rock Formations. Are Borehole Wall Micro-Resistivity Images Properly Oriented?, *Eos, Transactions, American Geophysical Union*, *83* (47), Fall AGU poster presentation.

Gaillot, P., ODP-PLOT and MAP-PLOT: Software for integration of geosciences data set. Trans. *Eos, Transactions, American Geophysical Union, 83* (47), Fall AGU poster presentation.

Guerin, G., and D. Goldberg, 2002, Sonic waveform attenuation in gas hydrate-bearing sediments from the JAPEX/JNOC/GSC Mallik 2L-38 research well, Mackenzie Delta, Canada *J. Geophys. Res.*, 107 (B5), DOI#10.1029/2001JB000556.

Guerin, G., and D. Goldberg, 2001, Initial evaluation of drilling dynamics on the JOIDES Resolution: measurements of downhole bit motion while coring, *Geo-Marine Lett.*, www.springer.de/link/service/journals.

Guerin, G., and D. Goldberg, 2002, Modeling of elastic wave attenuation in gas hydrate-bearing sediments, *Trans. 4th Intl. Conf. on Gas Hydrates*, Yokohama (expanded abstract).

Iturrino, G.J., and Bartetzko, A., 2002. Subsurface fracture patterns in the PACMANUS hydrothermal system identified from downhole measurements and their potential implications for fluid circulation. *Eos, Transactions, American Geophysical Union, 83* (47), Fall AGU poster presentation.

Ketcham, R.A. and Iturrino, G.J., 2002. Visualization and quantification of three-dimensional porosity variation and anisotropy in altered igneous rocks from deep-sea drilling. *Eos, Transactions, American Geophysical Union 83* (47), Fall AGU poster presentation.

Kock, I., Buysch, A. and R. Pechnig, 2002, In-situ petrophysical properties of volcanic rocks from Detroit Seamount (ODP-Leg 197, Site 1203A), *Eos, Transactions, American Geophysical Union, 83*(47), Abstract T62A-1287, 2002.

Matter, J. M., T. Takahashi, D. Goldberg, and Z. Alessi-Friedlander, 2002, Secure Long-Term Sequestration of CO_2 in Basaltic Rocks: Results from Preliminary Field and Laboratory Experiments, *Trans. Am. Geophys. Union, EOS suppl.*, 83 (LL).

Pechnig, R., Stoll, J. and A. Buysch, 2002, Borehole magnetometer data as information source for internal structure and stratigraphic evolution of Mauna Kea volcano, *Eos, Transactions, American Geophysical Union, 83* (47), Abstract GP11A-1061, 2002.

Rea, B.R. and Shipboard Scientific Party, Using Core (mcd) to log (mbsf) Depth Miss-Matches as a Basis for Interpreting Core Elastic Rebound and Re-calculating Core Physical Properties. Results From ODP Leg 199. Poster presented at the UK ODP Open Forum, London.

Rea, B.R., Gaillot, P. and Leg 199 Shipboard Scientific Party ODP Leg 199 - Paleogene Equatorial Transect: Preliminary Logging Results. Poster presented at the UK ODP Open Forum, London.

Rea, B.R. and Shipboard Scientific Party, Using Core (mcd) to log (mbsf) Depth Miss-Matches as a Basis for Interpreting Core Elastic Rebound and Re-calculating Core Physical Properties. Results From ODP Leg 199. *Eos, Transactions, American Geophysical Union, 83* (47).

Williams, Trevor, David Handwerger, Samantha Barr, A high resolution record of Early Miocene Antarctic glacial history from downhole logs, Site 1165, ODP Leg 188, *Eos, Transactions, American Geophysical Union, 83* (47).

Wood, J. L., Delius, H., Stewart, D., The Marion Plateau (Coral Sea): Integrating the history of Miocene carbonate platform set-up, subtropical lithofacies development and sea-level change from ODP Leg 194 drilling Poster were at the UK ODP Open Forum, London.

K. How well have we done? – input for EXCOM/PEC VI

Introduction

How Well Did ODP do?

Draft Contributions from SCICOM to EXCOM, for Possible Use by PEC-VI

Background

At its June, 2000 meeting, EXCOM Motion 00-2-5 was passed asking SCICOM to "develop an ODP legacy that includes…

- a list of ODP's greatest hits
- a database of publications related to ODP results, as already begun by JOI and TAMU,
- written documentation from SCICOM, the SSEPs, and other panels about major ODP-related results, by field, to accompany the list of greatest hits and the publications database,
- a description of major technical tool developments, from TEDCOM with help from LDEO and TAMU,
- a reply to the question "How well to ODP do in answering the questions originally asked?" This study should consider all phases of ODP (i.e., it should extend back to COSOD I)."

In reviewing progress at the June 2002 EXCOM meeting, the SCICOM chairman noted that the first four had essentially been accomplished with such activities as

- completion of the second volume of ODP "Greatest Hits" (printed January 2003)
- completion of the ODP publication database and on-line access
- publication of both the "Major Achievements of Scientific Ocean Drilling" (MASOD) section in the IODP Initial Science Plan and the special issue of JOIDES Journal entitled "Achievements and Opportunities of Scientific Ocean Drilling" (A&O)
- completion of the technical tool summary sheets by TAMU and LDEO with TEDCOM review.

However, he also noted that SCICOM hadn't fully addressed the last part of the EXCOM request yet, partly because so many important drilling legs remained to be drilled or their results fully assessed. He presented his own personal views on that aspect in two overheads, one on "How Well Have We Done?" and "For what goals might the program have done better and why?" and a second on how his own fields of expertise (submarine hydrogeology and subseafloor observatories) would be different if there had not been an Ocean Drilling Program. In discussion, he agreed to ask all SCICOM members to present their own versions of these two overheads, and compile them for review at the June 2003 EXCOM meeting, followed by forwarding to the sixth Performance Evaluation Committee (PEC VI) if deemed appropriate by EXCOM.

The main purpose of this document is to collate those contributions from SCICOM members, as brought to the August 2002 SCICOM meeting. Each SCICOM member took a slightly different slant on the request, but each response is useful and interesting, so they are presented here with very little editing. Three SCICOM members provided unexpected auxiliary material, two in terms of “grades” for ODP’s accomplishments against the themes and objectives outlined in COSOD, COSOD II, and the 1990 or 1996 Long-Range Plans (LRP), one in terms of spreadsheets tallying specific leg accomplishments against these objectives. These additional contributions are presented after the other SCICOM member contributions. A final contribution is a summary of goals of COSOD I, COSOD II, and the 1996 LRP prepared by the SCICOM chair.

In addition, in discussion at the June 2002 EXCOM and ODP Council meetings, it was noted that this approach of mapping accomplishments against goals doesn’t really assess the true scientific impact of ODP (even though it fits the format prescribed in the EXCOM 2000 motion above). Therefore, the SCICOM chair also asked SCICOM members to assess whether the scientific impact of ODP was well represented in the achievements documented in MASOD and A&O. For the most part, the answer to this question is in the affirmative, because of the comprehensive efforts made by (1) the Scientific Planning Working Group who assisted the IODP Planning SubCommittee (IPSC) in compiling the IODP ISP, and (2) (a) SCICOM in organizing A&O to span all the major themes of ODP and (b) the volunteer A&O authors who summarized accomplishments in those themes so well. Nevertheless, concentrated work in some initiatives is occurring near the end of ODP (e.g., 4 Extreme Climates legs in the last 3 years), and scientific impact of these initiatives remains to be fully assessed. Some SCICOM members contributed updated views of the most important scientific contributions of ODP, and those are summarized in this document as well. But for the most part, SCICOM stands by MASOD and A&O as the best current representation of the scientific impact of ODP. (MASOD is included as an appendix to this compilation.)

SCICOM Members represented in this compilation and the identifying codes listed on their contributions are as follows:

Jamie Austin (USA)	JA
Keir Becker (USA)	KB
Sherm Bloomer (USA)	SB
Steven D’Hondt (USA)	SD
Andy Fisher (USA)	AF
Teruaki Ishii (Japan)	TI
Patricia Fryer (USA)	PF
Chris Macleod (UK)	CM
Larry Mayer (USA)	LM
Delia Oppo (USA)	DO
Dave Rea (USA)	DR
Matt Salisbury (PacRim)	MS
Will Sager (USA)	WS

What important scientific objectives has ODP addressed well? How has scientific progress within ODP set the stage for IODP?

• COSOD-I: 8. Global mass balancing of sediments, 9. History of ocean circulation, 10. Response of atmosphere and oceans to variations of planetary orbits; COSOD-II: Global array of full Neogene sections/orbitally driven oscillations; 1996 LRP: Earth's changing climate – spatial and depth transects.

- **Paleoceanographic transects (latitudinal, water mass): e.g, 138 (Eastern Eq. Pacific Neogene), 145 (N. Pacific), 167 (CA Current), 175 (Benguela Current), 199 (Pacific Paleogene), 202 (SE Pacific)**
- **Gateways: e.g., 151/162 (N. Atlantic Arctic), 181 (SW Pacific), 189 (Tasmania)**
- **IODP: continue "continuous [non-riser] coring" globally.**

• COSOD-I: 4. Dynamics of forearc evolution; COSOD-II: Fluids in subduction settings (experiment: fluid flow and the cycle of deformation and seismicity in a subduction zone); 1996 LRP: Convergent margin fault processes; in situ monitoring of geological processes.

- **Barbados: e.g., 110, 156, 171A**
- **Costa Rica: e.g., 170, 205,…(IODP: Subduction Factory)**
- **Nankai Trough: e.g., 131, 190, 196, …(IODP: Seismogenic Zone).**

• COSOD-I: 11. Patterns of evolution of microorganisms; COSOD-II: Evolutionary processes in oceanic communities; 1996 LRP: Pilot project: Earth's deep biosphere.

- **Sampling the subsurface biosphere: e.g., 112/201 (Peru margin),…(IODP: Deep Biosphere).**

• COSOD-I: 2. Circulation, chemistry and dynamics of hydrothermal systems; COSOD-II: Hydrothermal circulation; 1996 LRP: Hydrothermal processes and sulfide mineralization.

- **Hydrothermal circulation at/near ridge crests: e.g., 139/169 (SRI and II), 158 (TAG), 193 (Pac-Manus)**
- **IODP: a prime example of observatory-based, process-oriented science, one possible IODP focus.**

• COSOD-I: 2. "natural laboratories"; COSOD-II: global seismic observatories; 1996 LRP: Mantle dynamics – LIPs, global seismic observatories.

- **ION activities: e.g., 136 (OSN-1), 179 (NERO), 186 (W. Pacific), 191 (NW Pacific), 195 (W. Pacific/Mariana), 200 (H2O), 203 (E Eq. Pacific)**
- **IODP: more of the same; increase integration with such liaison programs.**

In what areas of scientific endeavor could ODP have done a better job? How will IODP make our (drilling and coring) lives better?

• COSOD-I: 6. Reponse of marine sedimentation to fluctuations in sea level; COSOD-II: Changes in the global environment (experiment: Amplitude and Timing of Changes in Cenozoic Sea Level); 1996 LRP: Causes and effects of sea level change.

- **Atolls and guyots – the "dipstick" approach: e.g., 143/144. Science hampered by poor pre-drilling seismic imaging, poor core recovery, diagenetic overprinting of recovered samples.**
- **IODP needs: better geophysical surveys, tools to recover interbedded hard/soft lithologies, MSP's?**

• COSOD-I: 3. Early rifting history of passive continental margins; COSOD-II: Conjugate passive margin drilling; 1996 LRP: Extensional margin drilling.

- **Conjugate margin transects: Old N. Atlantic – 103/149/173 (Iberia) + 210 (Newfoundland); young W. Pacific – 180 (Woodlark Basin). Long-term community interest evident, but inability to drill deeply (and safely) and unwillingness to commit adequate drilling time has hurt the scientific goal of accessing early rift deposits and geologic history.**
- **IODP: riser capability, MSP's (?), community commitment! Also need to address other younger basins for processes – e.g., Gulf of CA, Red Sea, Adriatic.**

• COSOD-I: 1. Processes of magma generation and crustal construction at mid-ocean ridges. 2. "Natural laboratories" – arrays of holes, at least one deep; COSOD-II: Mantle-crust interactions (total crustal sections), stress and deformation of the lithosphere - world stress map (oceanic sites); 1996 LRP: Drilling in zero-age crust, complete crustal sections.

- **Zero-age ocean crust drilling: 106/109 (MAR), 118/176 (SW Indian Ridge), 142 (EPR), 153 (MARK) has been for the most part unsuccessful.**
- **Hole 504B deep penetration a serendipitous result, but a good example of community resolve.**
- **One example of designed full-penetration hole – 206 (E. Pacific)**
- **A combination of imperfect engineering (hard-rock spud-in, hard-rock guide base/reentry system, DCS system [!], hammer drill-in casing) and loss of community resolve over time has hurt this science.**
- **IODP: Will we do better?**

Selected ODP achievements that are near and dear to my heart, and how we can capitalize on ODP progress made within those themes in IODP:

• COSOD-I: 6. Reponse of marine sedimentation to fluctuations in sea level; COSOD-II: Changes in the global environment (experiment: Amplitude and Timing of Changes in Cenozoic Sea Level); 1996 LRP: Causes and effects of sea level change.
Continental margin transects/global coverage/variety of sediment types:

- **"Mid-Atlantic" U.S. (siliciclastic), e.g., 150 (slope), 174A (shelf), 174AX (coastal plain),…(IODP: NJ inner shelf MSP?)**
- **Bahamas/Australia (carbonates), e.g., 166 (tropical bank flank), 182 (cool-water temperate), 133/194 (tropical platform),…(IODP: Tahiti/Great Barrier Reef MSP?)**
- **We proved we could drill and core in these shelfal/platform environments safely. We showed that both local and eustatic base-level indicators exist and can be tracked. We learned how complicated the experimental plan must be.**
- **IODP: use MSP's when appropriate, develop coring tools that can recover sands better (VPC?), maintain the global focus.**

• COSOD-I: 3. Early rifting history of passive continental margins; COSOD-II: Conjugate passive margin drilling; 1996 LRP: Extensional margin drilling.

- **Volcanic passive margins – e.g., 104 (Voring Plateau), 152/163 (E. Greenland)**
- **We dated these volcanic accumulations (basalts and intercalated sediments) and assessed their paleoenvironments. In the process, we shifted the entire dialog about how continents rift and drift.**

How Well Have We Done?

For many goals of COSOD, COSOD II, and the Long-Range Plan, the program has done quite well, both in following the scientific plan and delivering results! A few good examples include:

- Paleoceanography and paleoclimate
  - High-resolution Neogene
  - Cretaceous/Paleogene "extreme climates"
- Subduction zone concerted drilling in 5 example settings
- Atlantic conjugate margin studies
- In situ monitoring of geological processes
  - ION global seismic observatories – 7 sites
  - CORK hydrogeological observatories – 18 sites

For what goals might the program have done better and why?

<u>Global stress mapping</u> – lack of proposals independent of ION sites

<u>Deep penetration</u> - lack of JOIDES (and community?) resolve for multi-leg commitment??

Full crustal penetration a high priority since COSOD I
Phase III drilling to 2-4 km at several sites promised in LRP
(504B was a DSDP/Phase I/II fortuitous accomplishment)
Special call for proposals issued, but first concerted steps being taken only during final year of Phase III

<u>Zero-age drilling</u> – realities of technological development

<u>Mission-specific platform drilling</u>, primarily for climate and sea-level studies – budgetary realities

While ODP has not fulfilled these expectations, the entire ODP community has made an important contribution – laying the groundwork for addressing most of them in IODP!

Subseafloor observatory science:
Where would it be without ODP?

- Almost nowhere, except for a few initial seismic efforts during DSDP or the potential of utilizing existing DSDP reentry holes for observatories
- Establishing borehole observatories is an important ODP contribution, both in hydrogeological studies and future global seismic studies
- ODP borehole observatory contribution has also been important factor within initiative for seafloor observatories

Submarine hydrogeology: Where would it be without ODP?

DSDP contributions include:

- Initial drilling in important crustal hydrogeological reference sites (504B, 395A, 417D/418A)
- Establishing basic crustal permeability/porosity model from 504B and 395A
- Important initial hydrogeological models on ridge flanks

ODP contributions include:

- Deep drilling in 504B, establishing other important sites for expanded global coverage in both ocean crust and subduction settings
- Significantly expanded global permeability dataset, indicating age variation and scale effects in highly permeable ocean crust
- Significantly expanded global dataset of alteration results, leading to better understanding of global fluxes
- Renewed modeling efforts based on realistic permeability structure
- Focus on subduction hydrogeology with indications of episodic fluid flow related to tectonics
- Important initial demonstrations of other fluid flow regimes: continental margins (NJ shelf), carbonate banks
- CORK observatories: time-series determinations of in-situ state and hydrogeological processes

Much work remains to be done, and ODP has set the stage for more sophisticated submarine hydrogeology studies in IODP.

How well do we do on fundamental scientific advances?
Area: Heat and Mass Transfer

Fundamental contributions:

- The program moved to provide **time** and **geologic** constraints on oceanic studies (FMS, magnetics, 3rd dimension)
- Provided the best constrained modern analogs for interpretation of the geologic record

Hits:

- Architecture of the ocean crust
- Chemical mass balance consequences of ocean crust formation and alteration
- Mantle dynamics – particularly the stability of the Hawaiian hotspot study (197)
- Dynamics and complexity of convergent margins – probably the most important contribution to land geology and geologic history interpretation
- The recognition of links…extinctions, volcanism, climate, circulation

Misses:

- Didn’t take enough advantage of the ability to orient core and do structural and paleomag – plate reconstruction constraints
- Never really figured out how the drill could be used in complex active tectonic areas – transforms, detachments
- Didn’t always attack the problems with the right tool
- The failure to do deep penetration and zero-age drilling was not, in my opinion, a major scientific failure in our studies of the oceanic crust

How well did we do in our operational goals in COSOD I and II and the LRP?
Area: Heat and Mass Transfer

With a couple exceptions, the goals of COSOD I and II can be mapped in the themes of the LRP.

Hits:

- § Ocean ridge construction, even without zero-age or deep penetration
- § Subduction system dynamics and evolution: arc, forearc, backarc
- § Mantle dynamics – LIPs (though we struggled), seismic observatories, Hawaiian hotspot drilling
- § Subduction zone fluid dynamics and balance: accretionary prisms and forearcs
- § Hydrothermal circulation: particularly sediment-buried, off-axis, and even bare-rock, given the tremendous technical difficulties

Misses:

- § Deep crustal penetration to total crustal penetration – 504B our best effort; also deep holes in hydrothermal areas and continental margins
- § Zero age drilling – though we may ask what the essential goals are now
- § World stress map
- § Magnetic field history (COSOD I) – incremental additions
- § Translational margin studies and active tectonic processes: simple not amenable to drilling strategies

1. ODP has delivered tremendous understanding of natural climate and ocean variability.

ODP has greatly advanced understanding of:

natural climate variability,
the interplay between ocean and climate,
the interplay between climate and planetary orbits,
high-resolution (Mikankovitch-based) geologic timescales,
and rapid climate change.

2. ODP has greatly helped to pave the way for a real understanding of subsurface life.

Without ODP, we would have little recognition of life beneath the seafloor.

What has the program done well? SD-2

It has greatly improved understanding of <u>Changes in the Global Environment</u>

<u>Categories of success:</u>

Response of atmosphere and oceans to variations of planetary orbits (COSOD / COSOD II)

Understanding natural climate variability and the causes of rapid climate change (1996 LRP Initiative)

Amplitude and Timing of Changes in Cenozoic Global Sealevel

passive margin stratigraphy (COSOD II "Illustrative" Experiment

isotopic global ice volume estimates (COSOD II "Illustrative" Experiment)

It has improved understanding of <u>Sediments, fluids, and bacteria as agents of change</u>

<u>An example of success:</u>

Pilot Project: Earth's deep biosphere (1996 LRP Initiative)

What goals might the program have met better?

ODP could have better improved our understanding of the biological history of the ocean, and its relationship to Earth's environmental history:

<u>Examples of success:</u>

Understanding of Paleocene/Eocene boundary event

Improved understanding of biological response to K/T impact

<u>Examples of under-achieved objectives:</u>

1. *Patterns of evolution of microorganisms* (COSOD)
2. *Long-term records in Jurassic/Cretaceous sections* (COSOD II)

Why? Lack of proposal pressure (1,2)? Lack of integration with related proposals (1)? Lack of commitment to deep penetration (2)?

What ODP has done well…

- documentation of variations in Earth's past climate, identification of possible "causes"
- evaluation of structures and links to hydrogeology, lithology, tectonics, magmatism at active margins
- elucidation of sediment, climate response to changes in sea level, occurrence of gas hydrates
- investigation of tectonics, composition, history of rifted margins (volcanic, nonvolcanic)
- quantification of <u>shallow</u> hydrogeologic crustal conditions, initial development of borehole laboratories

What could have been done better…

- focus more on *process* rather than *product*
- follow through *<u>after</u>* drilling to evaluate whether individual programs were successful, problem was solvable, etc.

Achievements in Marine Hydrogeology…

- Ridge crests: Middle Valley, TAG
- Ridge flanks: Costa Rica Rift, Mid-Atlantic Ridge, Juan de Fuca Ridge, EPR flank
- Passive margins: New Jersey, Bahamas, Australia
- Active margins: Barbados, Nankai, Peru, Mariana Forearc, Costa Rica
- Overall: direct testing of properties, installation of observatories to monitor related processes, documentation of scales (spatial, temporal) of fluid flow and related processes

But for the Ocean Drilling Program…

- we might still think that fluids circulate to depths of several kilometers throughout most of the crust,
- we would not know how transient many hydrogeologic processes are within the seafloor,
- we woul dhave much less understanding of development and evolution of ore deposits, and
- we would not know the magnitude of hydrogeologic driving forces, the enormous scales of flow, or relations between flow and tides or earthquakes.

What we have done well?

- Drilling variety of environments
- Deep Earth Biosphere –archea in serp mud volcanoes
- Exploring transfer of heat and materials from interior of earth in subduction zones to the sea
- Reference centers
- Innovations in seafloor observatories

What we could have done better?

- Riser drilling - never did it
- Legacy data still will need to be transitioned (esp. paleontology)
- JANUS database – costly cumbersome, might better have been kept in academia
- Could have drilled into active subduction zone of a nonaccretionary convergent margin for investigating earthquake processes and cycling of constituents during subduction (would have utilized the stated max capability of ODP drilling)
- Establishing more observatories (ALL “Futures” documents state that monitoring will be key)
- Reorganization of the program was a major hiccup (change is good in and of itself)
- Abolishing of publication was a bold step, but has led to a loss of continuity and readership.

Scientific Achievements

<u>Initiative II</u> In situ monitoring of geologic processes:
fluid flow in the lithosphere, geochemical fluxes:

- Recycling of slab constituents at convergent plate margins is accomplished in large part via fluid flux. Drilling on numerous accretionary convergent margins showed that both diffuse and channelized flow is a major factor in the recycling of Leg125 demonstrated active fluid egress at serpentine seamounts on the Mariana system.
- Drilling on Leg 195 placed a perforated casing in a hole in the conduit region of a serpentine mud volcano and instrumented (thermistor string, pressure sensor and osmo-sampler) and CORKed the hole recovery will take place in Spring 2003.

<u>Initiative III</u> Exploring the deep crustal structure of Continental margins and oceanic crust: to penetrate hitherto inaccessible regions beneath the seafloor - to explore the underlying processes that form continents, rifts, oceanic crust, and economic sources, and to test models of active processes occurring at convergent margins.

- 103, 147, 173 (Iberia) transition from continent to ocean lithosphere and the serpentinization and emplacement of serpentine serpentinization process and exposure by faulting.
- amagmatic ridge segments 37, 45, 82, 109, 153 mantle character and serpentinization process serpentinization process and exposure by faulting.
- Hess Deep: mantle near fast spreading ridges nature of diking serpentinization process and exposure by faulting.
- Non-accretionary convergent margins drilling.
- first evidence of blueschist in situ and first evidence of direct transport of slab-derived fluids to seafloor (cycling of constituents in subduction factory).

How the field would be different if there had been no drilling:

- No idea of magnitude of the serpentinization process (back to Hess hypothesis of serpentinized mantle throughout the oceans (not so)).
- No stratigraphic control over the relationships among peridotite bodies in the continent-ocean transition zone, along amagmatic sections of mid-ocean ridges, and at the crust mantlke boundary region of fast-spreading ridges.
- Would still be a controversy over diapiric vs fault emplacement of serpentinite at the edges of continents, in amagmatic spreading segments and fracture zones - the stratigraphy provides the answer.
- No way to prove the serpentine mud volcanoes of convergent margins are just that and that the associated pore fluids are slab-derived.
- No proof that blueschist does form in convergent margins.

Comparative studies on the geological cross-section of the oceanic crust down to mantle peridotite.
---ophiolite problem---

In-situ and semi-in-situ geological cross sections on the seafloor.
preserved clear exposure of outcrop
stratification
geological background

Petrogenesis of ophiolites (associated effusive rocks), mantle peridotites
Combination of:
dredge hauls, ODP cores, submersible observations

A. Serpentinite seamounts in the Izu-Ogasawara-Mariana forearc
(dismembered ophiolites)
(modern view of the Cyprus ophiolite

B. Tonga forearc, Yap Trench inner wall
(modern analogue of the Oman Semail ophiolite)

C. Southern Mariana Trench inner wall

D. Parece Vela Basin mega-mullion

E. Tectonic window

F. Mariana Trough cliff

How Well Have We Done? *CM-1*

What we have done well
(or what could not have been done without ODP)

- **palaeoclimate/palaeoceanography**
  primary tool in the field, directly responsible for progression in methodologies and hence stimulating massive progress in studying ocean history
- **deep biosphere**
  serendipitous discovery of deep biosphere one of major achievements of ODP;
  N.B. broad implications not only for science but also for biotechnology industry
- **gas hydrates**
  ODP has been a prime tool with which to investigate gas hydrates, not only for scientific aspects but also in the potential as a natural resource and societal relevance
- **convergent margin processes**
  insights into origin and dynamics of intra-oceanic forearcs and (early) arc volcanism
  subduction factory : consideration of fluxes and quantification of processes
- **mid-ocean ridge processes**
  providing the direct evidence that challenges the Penrose layer-cake paradigm
  starting to demonstrate the profound control spreading rate plays in processes of crustal generation
- **methodologies**
  training of young/non-U.S. scientists and exposure to the cutting edge
  establishment of consistent and methodical procedures for dealing with core etc.
  rigour of publication procedures and schedules to maximise scientific returns (N.B. high rate of output compared to publications arising from many conventional cruises)
- **keeping all sections of the community happy**
  one of the principal successes of ODP has been to maintain the adaptibility of a single platform so as to be able to do a huge range of scientific experiments, (for the most part) uniting a highly diverse marine geological community
  maintaining this breadth is key to the success of IODP and any other future programme

What we could have done better

- **mid-ocean ridge processes**
  not enough legs scheduled to address even basic first-order questions posed in the Long Range Plan etc.
  little attempt to start natural laboratory experiments
- **technology development**
  lots of money spent by ODP/TAMU on schemes that never delivered, or else were axed or capped, e.g. diamond coring, hard-rock core orientation etc
  insufficient notice taken by ODP engineers of developments outside Gulf of Mexico???

Achievements of ODP

Mid-Ocean Ridge Processes

- ***challenging the consensus paradigm for ocean crust formation of the 1970s—80s(—90s): the regular layer cake (Penrose) crustal structure independent of spreading rate***
- ***direct equation of seismic layering with (ophiolite-based) lithostratigraphy***
- ***fundamental differences in crustal construction between slow- and fast-spreading ridges***
- ***small-scale heterogeneity of magmatic processes in lower crust at slow-spreading ridge (Hole 735B) — completely unlike ophiolite layered plutonic sections***
- ***complexity of hydrogeology***
- ***critical inter-relationships between tectonic, magmatic & hydrothermal (& biological) processes at all stages***

HOW WELL HAVE THE DRILLING PROGRAMS DONE?

CRUSTAL OBJECTIVES: Magma Generation and Crustal Construction Total Crustal Sections (Deep Crustal Sections) Zero Age Crust	WE HAVE FAILED (technology and spirit)
Hydrated Mantle LIPs	SOME SUCCESS (blessing of soft rocks)
HYDROTHERMAL SYSTEMS	VERY SUCCESSFUL (technology-enabled: CORKs)
TECTONIC OBJECTIVES:	
World Stress Map	FAILED – lack of interest
Dynamics of Forearc Evolution Fluids and Deformation in Subduction Settings Circulation in Continental Margins Seismicity and Fault Processes	VERY SUCCESSFUL combination of technology (need more), strong community, and commitment
GAS HYDRATES	VERY SUCCESSFUL Convergence of technology, commitment, and willingness to take risks

Conjugate Margin Studies Early Rifting History	MODERATELY SUCCESSFUL Limited by need for deeper drilling and commitment to longer time at hole
PALEOCEANOGRAPHIC PROCESSES: History of Ocean Circulation Response to Orbital Forcing Patterns of Evolution Natural Climate Variability at a Range of Scales and Biogeochemical Cycles Linkages to Tectonic Events	VERY SUCCESSFUL Have established global stratigraphies and new tools for resolving very high-resolution variability… Have established global linkages, lead and lags that provide direct insight into working climate systems
OLDER SECTIONS and EVENTS (K/T, anoxic, impact, etc)	MODERATELY SUCCESSFUL – getting better as recovery improves…still lacking proper tools and commitment
GLOBAL SEALEVEL HISTORY	BARELY SUCCESSFUL – lack of appropriate tools (and perhaps testable models) – need for mission specific platforms
UNEXPECTED SURPRISES	VERY SUCCESSFUL – deep biosphere, global correlations, dessication of Med, etc.

A DAY-TO-DAY DEMONSTRATION THAT A WELL-RUN INTERNATIONAL COLLABORATIVE SCIENTIFIC PROGRAM CAN BE A REMARKABLE SUCCESS

SCIENTIFIC ACHIEVEMENTS IN MY FIELD

WHAT IS MY FIELD???

GEOPHYSICAL PALEOCEANOGRAPHY???

Paleoceanography would be a very different field without the drilling programs (if it would exist at all). Our view of Earth history would be constrained to small high-resolution snippets of very recent history or very low-resolution records of the long-term history of ocean and climate conditions. The drilling program has allowed us to obtain a global picture of oceanographic and climatic changes at scales ranging from decadal to 100's of thousands of years. The program has fostered the development of a number of new tools that allow for the global correlation of a range of paleoceanographic proxies and in doing so has established new approaches to refining very high-resolution stratigraphic control that has produced new, global time-scales that have revolutionized our ability to understand the spatial and temporal linkages between components of the earth/ocean system. The continuous recovery offered by the drilling programs has also revolutionized our ability to use seismic data to extrapolate beyond and interpolate between drill holes. Given that industry holes tend to sample only a small percentage of the drilled section, the ODP approach, in combination with detailed laboratory logging and sampling, has provided unprecedented insight into the relationship between the seismic and the geologic record – particularly with respect to paleoceanographic change.

How Well Have We Done?

High-resolution Neogene Paleoceanography and Paleoclimate:

Multiple offset holes and MST techniques have improved ability to acquire continuous sections. With 4 holes, continuous sections and sampling higher volume is possible (critical for high-resolution).

How could we have done better?

A minimum of 4 holes at each site should routine, allowing high-volume sampling of continuous sections.

More high-resolution (centennial-millenial) sites,
better spatial coverage, especially in tropics/subtropics.
Longer well-resolved, multiple proxy records (also requires better funding to work on existing material).

Technical needs:
- Improved MST/color scanner
- Improved/standardized digital camera
- Larger sed. lab, more lab facilities for shipboard analysis and sampling

Where would the science be without ODP?

No ODP ⇒ no long cores
Either poorly resolved (low sed rate) long records or well resolved short records

⇒ no high-resolution studies spanning several years glacial cycles;
aliasing

⇒ no knowledge of millennial-scale variability during previous interglacial,
last glacial in some locations

⇒ poor documentation of 40k-100k yr transition

⇒ poor documentation of ocean-cryosphere interactions

⇒ poor understanding of climate variability during altered boundary conditions
(e.g., tectonic and glacial)

Paleoceanographic Contributions that Required Scientific Drilling:

- Spatial and depth transects spanning continuously several Myr to address questions about evolution of Earth's climate with respect to changing boundary conditions. The roles of insolation, tectonics, deep ocean circulation, biogeochemical cycling. Evolution from 40kyr – 100 kyr cycles. High to low latitude linkages.

Legs 130 (OJP), 154 (Ceara Rise), 108 (E trop. Atl.), 114 (SubAA S. Atl.), 138 (ETP), 145 (N Pac.), 152/162* (N Atl.), 165* (Carib.), 167* (Calif. Margin), 172* (Bermuda Rise; BBOR), 175 (Benguela), 177* (S. Oc. Paleo.), 178 (AA), 181 (SW Pac.), 184* (SCS, 202* (SE Pac.)

*Has or will provide important insights on shorter time scales – characterize millennial variability during earlier time intervals.

- Mean ocean $\delta^{18}O$ change since the LGM was ~1‰ (Schrag et al., 1993, Leg 154, confirmed and refined on subsequent legs)
- Extending records from ultra-high-deposition-rate sites beyond that possible with piston cores, e.g., reaching the LGM, capturing a full glacial cycle (e.g., Leg 165 – 1002, Cariaco Basin, Leg 167 – 893, Santa Barbara Basin; Leg 178 – 1098, Palmer Deep)
- North Atlantic millennial scale climate variability during earlier peak interglacials (e.g., MIS 11), was persistently greater during glacial than interglacial times and occurred in the 40 kyr world (Leg 162)

For What Goals Might the Program Have Done Better and Why?

Understanding natural climate variability and the causes of rapid climate change (1996 ODP LRP Initiative):
Only a handful of ultra-high-resolution sites, records tend not to be very long (e.g., safety issues at SBB). Takes a long time to generate data at high resolution, funding is a problem. Few low latitude sites capture centennial-millennial resolution.

Achievements in the Field of Sediments and Ocean History

Essentially the entire pre-Quaternary aspect of paleoceanography, and much of the Quaternary science as well, would not be possible without DSDP, ODP, and the HPC-APC-XCB technology. This ranks with the strikingly clear demonstration of plate tectonics as the two greatest successes of the entire program.

It's hard to know where to start:

Orbital control of pelagic and hemipelagic sedimentation, thus paleoproductivity, oceanic and atmospheric circulation, climate, etc.

Millennial scale variability of ocean-wide, likely world-wide, climatic and oceanic processes

Tectonic control of longer term climate and oceanic changes
    Cenozoic climate, warm to cool – in steps

Oceanic record of continental variability, the land-sea links

Carbon cycles and paleo-CO_2
    Ocean anoxic events and broader implications thereof
    Sapropels
    Gas hydrates
    Estimates of past CO_2 concentrations

The nature and rate of evolution of the major microfossil groups

Geochronology in general

Sea level, passive margin architecture, ice volume

The reality of the deep biosphere

Understanding what really happened at the K/T and P/E boundaries and other boundary "events" – E/O, Cen/Tur, etc.

Resolving the atolls and guyots quandary

How Well Have We Done?

Success Stories

Ocean Crust

- Upper ocean crust revealed
- Porosity, fluid circulation in crust
- Massive sulphides (TAG, JdeF)

Paleoenvironment/Climate

- Orbital forcing
- Onset of glaciation
- Greenhouse / icehouse
- K/T

Margins

- Conjugate margins (eastern 1/2 N. Atl.)
- Convergent margin fluids
- Clathrate story

Special Bonus! - Connectivity

Technology

- Complete, undisturbed sediments
- Seismic observatories
- Packer technology
- Logging

Bummers

- Deep crustal penetration (technology)
- Zero-age crust (technology)

Jury's still out

- Seismic observatories (not much data yet)
- Conjugate margins (western 1/2 N. Atlantic undrilled)

Ocean Crust Achievements

- Upper 1/3 of ophiolite model confirmed
- Layer 2/3 ≠ petrologic boundary
- Porosity, permeability "gradient"
- Long-range hydraulic connectivity\
- Massive sulphides in situ

Without ODP:

- we would still be debating the validity of the ophiolite model,
- we would have no quantitative models of the hydrologic regime of oceanic crust,
- and we would have no way of sampling massive sulphides in-situ for comparison with on-land deposits.

How ODP Has Advanced Research in My Fields

Paleomagnetism: History of Earth s Magnetic Field Focus

- Largest number of paleomagnetists working on single program
- But paleomag was prime focus of only one leg
- Has had large impact, mainly by providing high-resolution records
- ODP has not revolutionized field, but without ODP progress would be slower, especially in high-resolution records
- Note: Magnetic susceptibility (environmental magnetism) has become paleoceanographic mainstay

Marine Geophysics

- ODP is the ground truth for many marine geophysics studies
- But very broad area, so impact diffuse
- Without ODP, we would know a lot less about marine geology

Gas Hydrate: LRP Theme

- ODP major impact on study of marine hydrate
- Without ODP, little progress on marine hydrates, BSR s
- Work mostly incomplete
  - Blake Ridge done and disseminated
  - Hydrate Ridge done summer 2002
  - Petroleum basin - problems interfacing with industry

Plate Tectonics / Geodynamics

- Not a focus area — many aspects of PT/G investigated as processes
- Like MGG, ODP collects critical data for many studies, diffuse impact
- ION observatories — huge ODP investment, but payoff still unclear
- Hotspot motions — Leg 197 and potential future legs
- Plate motions — ODP data play important role
- Without ODP, progress much slower in many areas

Shelf/Continental Margin Sedimentary Structure & Stability

- ODP provides data from deep margins
- But not many projects focusing on margins
- ODP has not been able to drill shelves effectively

Theme	Score	Comment
COSOD-I		
Environmental Changes — Tectonic Driver	2	Few attempts to address; tends to be local
Environmental Changes — Orbital Driver	8	One of best ODP efforts; many legs targeting Neogene wiggles
Solid Earth Geochemical Cycles	4	Few done in much detail; W. Pac. Subduction factory
Total Crustal Sections	1	None complete; Hole 504B best effort
Hydothermal Fluid Circulation	6	Sedimented ridges
Fluids in Subduction Settings	8	Costa Rica, Nankai, Peru, Barbados
Fluid Circulation in Continental Margins	5	Few attempts; New Jersey
World Stress Map — Ocean Sites	2	A few measurements here and there; little synthesis, no master plan
Neogene Evolutionary Processes	5	Follows Neogene paleoceanography, but impact not evident
Evolutionary Effects of Catastrophic Events	4	K/T only effort? Most of focus on K/T elsewhere
Evolutionary Records in Jurassic/Cretaceous	4	A few attempts; Atolls & Guyots
COSOD-II		
Amplitude & Timing of Eustatic Sea Level	7	A few notable studies: New Jersey, Atolls & Guyots; Bahamas; many lessor efforts; lacks systematic approach
Deep Crustal Penetration	5	Hole 504B; 735B, not much else
Fluid Flow & Deformation/Seismicity	1	Not well addressed; SEIZE (Nankai) will go there
K/T Boundary	3	Some successes: Legs 165; 198; no systematic approach
LRP-96		
High Resolution Climate Changes	6	Milankovitch cycles well studied; Piecemeal at shorter wavelength
Sediments, Fluids, Bacteria as Agents of Change	2	Only now beginning; Leg 201
Gas Hydrate	5	Getting there but approach still filling out; Blake Ridge (mature), other sites immature or not done
LIPs	5	Limited approach; OJP and Kerguelen only, one leg apiece (182,192)
Global Seismic Networks	8	Large investment in holes: Legs 136, 179, 186, 191, 195, 200, 203; not much data yet
Transect through Ocean Crust	1	Only a few attempts: Leg 147, 176, Hole 504B, 206, but no systematic approach
LRP-96 Big Themes		
Understanding Natural Climate Variability and Causes of Rapid Climate Change	7	Natural climate variability widely investigated, one of big contributions of ODP; Causes less well understood
In Situ Monitoring of Geological Processes	3	Many CORKS, ACORKS, but lack of systematic approach; many CORK installations piggy-back on other programs; problem with US infrastructure
Margins and Oceanic Crust	3	Some starts, but not much deep drilling; awaits riser ship

Objectives Outlined in 1990 Long Range Plan

Objective	Grade	MASOD#
• **Structure and composition of the crust and u per ntle**		
1. Exploring the structure and composition of the lower oceanic crust and upper mantle	C	22,26
2. Magmatic processes associated with crustal accretion	C+	22
3. Intraplate volcanism	A-	21,25
4. Magmatism and geochemical fluxes at convergent margins	B+	24
• **Dynamics, kinematics, and deformation of the hosphere**		18
1. Dynamics of the oceanic crust and upper mantle	C-	18
2. Plate kinematics	C	15.25
3. Deformation processes at divergent margins	A-	19,20
4. Deformation processes at convergent margins	A-	3,24
5. Intraplate deformation	C	
• **Fluid circulation in the lithosphere**		
1. Hydrothermal processes associated with crustal accretion	B	4,23
2. Fluid processes at plate margins	B	3,9
• **Cause and effect of oceanic and climatic variability**		5
1. Short period climate change	A	6,8
2. Longer period changes	B	12,15,16
3. History of sea level	B+	14
4. Carbon cycle and paleoproductivity	A/B	2,9,10
5. Evolutionary biology	A-	7,9,13

Other MASOD not parsed:

Deep biosphere - #1
Methane hydrates - #2
Deep sea sands - #11
Carbonate platforms - # 17

Major Achievements of Scientific Ocean Drilling

The Deep Biosphere & the Subseafloor Ocean

- **Extensive Microbial Populations Beneath the Deep Seafloor.** Sampling deep within the marine sedimentary section and in basaltic crust has revealed what appears to be a diverse and often very active microbial ecosystem. Recent sampling efforts have demonstrated that uncontaminated samples of these microbes can be recovered for laboratory study.

- **Frozen Methane Reservoir Beneath the Seafloor.** Extensive reservoirs of gas hydrates beneath the seafloor have been sampled by ocean drilling, providing valuable information regarding their possible impacts on the global carbon budget, submarine slope stability and their resource potential. Currently, only ODP technology is capable of retrieving and maintaining gas hydrates samples from the subseafloor marine environment at *in situ* pressures.

- **Fluid Pressure and Discharge along Main Thrust Fault Zones.** Drilling through the décollement and related thrust faults at convergent plate boundaries has confirmed three-dimensional seismic observations that fluids actively flow along the slip zone. These fluids have distinctive geochemical signatures and are likely involved in the mechanics of thrust faulting (Figure 3).

- **Hydrothermal Fluid Flux in the Upper Oceanic Crust.** Drilling of marine sedimentary and crustal sections is beginning to determine the sources, pathways, compositions and fluxes of fluids associated with mineralization within active submarine hydrothermal systems, and the influence of fluid circulation on ocean chemistry, crustal alteration and the crustal biosphere.

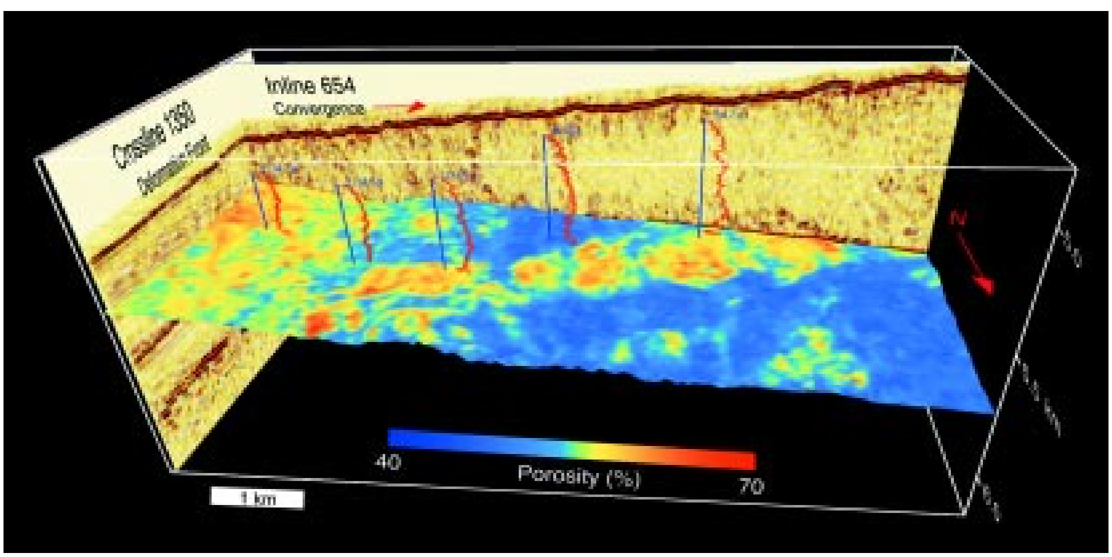


Figure 3. A perspective view of the Barbados Ridge three-dimensional seismic reflection data volume acquired in 1992. Crossline and inline profiles are shown on the east and south faces of the volume. The décollement surface at the base of the accretionary wedge is also shown, with colors representing porosity estimated from the seismic reflection data and calibrated with ODP Legs 156 and 171A logging-while-drilling logs. Vertical black lines are boreholes and red lines are corresponding density logs. High porosities, and presumably high fluid pressures, extend from the deformation front along a semi-continuous, NE trending zone interpreted to be a major fluid conduit. Figure reprinted from Bangs, N. L., T. H. Shipley, J. C. Moore, and G. F. Moore, *Jour. of Geophys. Res.*, 104, 20,399-20,414, 1999, Plate 4, p. 20,412.)

Figure 4. Beginning with the early days of DSDP, the recovery of core sample material has been a critical aspect of scientific ocean drilling. The recovery of a geologic section that is as complete as possible sets scientific ocean drilling apart from drilling conducted by the hydrocarbon exploration industry, and has resulted in the continued improvement of sampling and measurement technologies. In the early days of scientific ocean drilling, core assessment was almost exclusively based on visual inspection and discrete samples. As more advanced technologies have become available, we have progressed through hand-held devices for optical scanning and measurement of core sample properties (left) toward more sophisticated, continuous digital scans of the cores. In IODP this trend will continue, with more complete and detailed quantitative descriptions of the physical and chemical properties of cored materials. Photo courtesy of the Ocean Drilling Program.

Environmental Change, Processes and Effects

- **Development of the Field of Paleoceanography.** The near-global network of continuous stratigraphic sections obtained by ocean drilling is the foundation of the field of paleoceanography. Paleoceanographers study changes in the life, chemistry and surface, intermediate and deep circulation of the oceans through time. Paleoceanography provides the reference frame for nearly all other investigations of global environmental change (Figure 4).

- **Orbital Variability during the Cenozoic.** By linking the record of climatic variation preserved in deep-sea sediments to calculated variations in Earth's orbital parameters, scientists have demonstrated the role of orbital variability in driving climate change.

- **Development of High-Resolution Chronology.** Complete recovery of fossiliferous marine sedimentary sections has greatly facilitated linking Earth's geomagnetic polarity reversal history to evolutionary biotic changes and to the isotopic composition of the global ocean. Also of great significance is the orbitally tuned determination of time within marine sections, which has resulted in a greatly refined calibration of the Geomagnetic Polarity Time Scale back to 30 Ma. This newly calibrated, globally applicable time scale is crucial for determining rates of processes operating in every aspect of the terrestrial and marine geosciences.

- **Ocean Circulation Changes on Decadal to Millennial Time Scales.** The record preserved in marine sediments and recovered by ocean drilling has clearly demonstrated that deep- and surface-ocean circulation is variable on decadal to millennial time scales, confirming results from ice cores. This body of marine-based data has provided the evidence linking ocean-atmosphere-cryosphere interactions in and around the high-latitude North Atlantic to instabilities in thermohaline circulation, which propagates abrupt climate change to the farthest reaches of the globe.

- **Ocean Biogeochemical Cycles.** The concept of Earth System Science has evolved with detailed analyses of the relatively complete deep-sea sedimentary sections recovered by ocean drilling. These studies have revealed major changes in biogeochemical cycling through time, especially in the complex carbon cycle, resulting from evolutionary changes in the biota, tectonic changes, changes in climate, variations in seafloor hydrothermal activity and major alterations in ocean circulation.

- **Global Oceanic Anoxic Events.** Deep-sea sediments exhibit specific times when the surface water productivity of large areas of the ocean was unusually high. At these times, the global ocean developed zones of depleted oxygen content, and vast amounts of organic carbon were incorporated and preserved in marine sediments as black shales. Scientific ocean drilling has provided insights into oceanic anoxic events, which are a key to understanding short- and long-term perturbations in global climate and carbon cycling, as well as the timing of significant petroleum source-rock deposition (Figure 5).

- **Vast Sand Deposits in Deep Water.** Drilling has confirmed that the construction of deep-water fan systems, such as that off the Amazon River, are controlled largely by changes in sea level. The hydrocarbon industry is intensively exploring deep-water sand "plays" contained in the these fan systems for their proven economic potential.

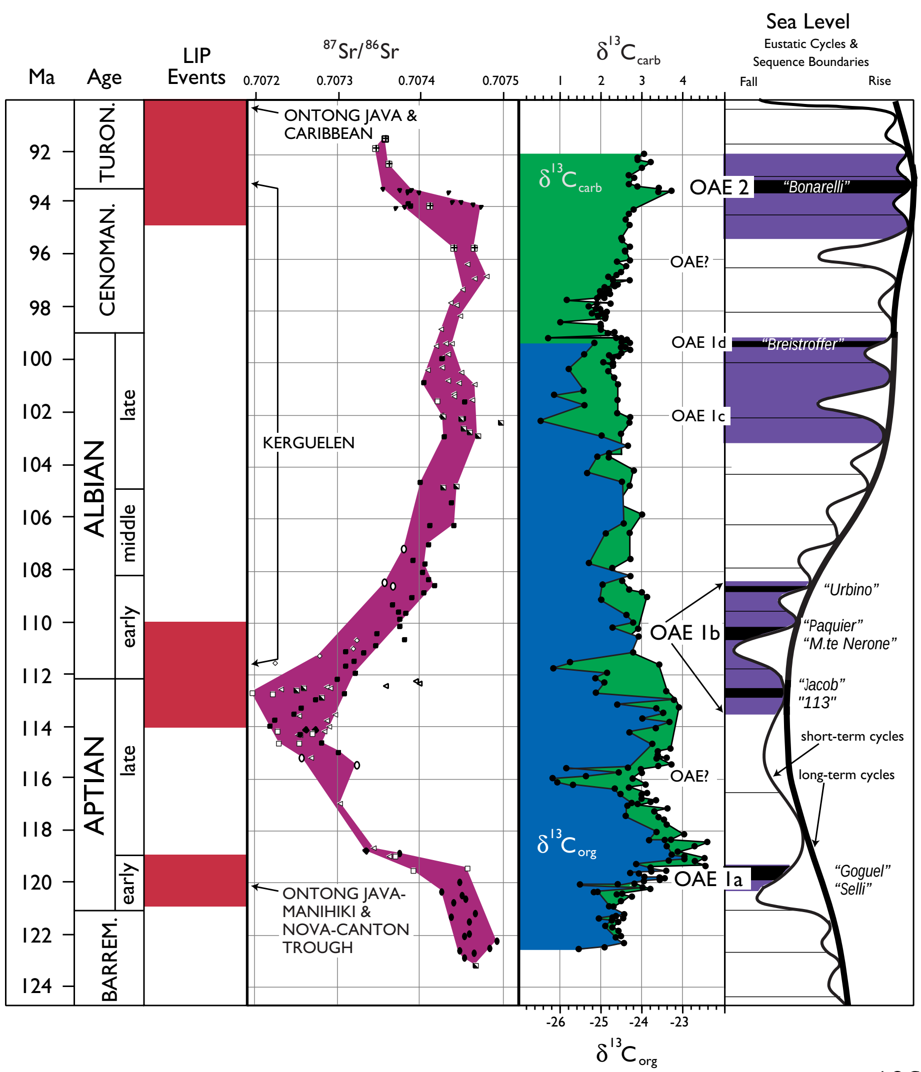


Figure 5. The mid-Cretaceous record of major black shales and Oceanic Anoxic Events (OAEs) in the context of the carbon isotopic record, changing global sea level and seawater chemistry, and emplacement history of Large Igneous Provinces (LIPs). Data are from both land-based sections and DSDP/ODP deep-sea cores. Organic matter production and preservation during the mid-Cretaceous appears to be closely related to submarine volcanism and hydrothermal activity, which may have stimulated productivity through the input of nutrients, particularly trace elements such as iron. Increased hydrothermal output during LIP emplacement may thus be linked to the three major OAEs. As a result of ocean drilling, the chrono-stratigraphic and biostratigraphic control on deep-sea sections has greatly improved, enabling better temporal resolution of geological processes. Figure compiled by Mark Leckie, University of Massachusetts, Amherst.

- **Timing of Ice-Sheet Development in Antarctica and the Arctic.** Drilling has revealed that Earth's entry into its current Ice Age extended over 50 m.y. and involved a complex history of uni-polar, then bi-polar, ice-sheet buildup. Ice streams reached the Antarctic seas as early as 40 Ma, but major ice-sheet formation on Antarctica apparently did not occur until some 25 m.y. later. Northern hemisphere ice sheets did not begin to develop until sometime after 15 Ma, and major northern hemisphere continental glaciations did not start until after 4 Ma. This extended period of climate change appears to have occurred in relatively rapid steps, each associated with major tectonic changes that affected both atmospheric and oceanic circulation.

- **Impact Events and Biological Evolution.** Drilling has established the global effects of a major bolide collision with Earth at approximately 65 Ma, including the extinction of as much as 90 percent of all planktonic organisms, and the subsequent repopulation of plankton in the global oceans from a few surviving species (Figure 6).

- **Sea-Level Change and Global Ice Volume.** Marine sediments recovered from shallow water areas have shown that important global sea-level change have occurred synchronously through at least the past 25 m.y., and that these changes can be matched to oxygen isotope records of climate produced from the deep sea. The new understanding of global eustacy has become a primary interpretative tool in unraveling the history of continental margin growth and in the search for hydrocarbons in margin settings.

- **Uplift of the Himalayas and the Tibetan Plateau.** Drilling in both the Indian and Pacific Oceans has helped to establish the timing of the Tibetan Plateau uplift, and to determine change in coastal upwelling, carbon sequestration, and regional and global climate associated with this tectonic event. Drilling results have shown that the onset and development of both the Indian and Asian monsoons are the result of climate change associated with this uplift.

- **Desiccation of the Mediterranean Ocean Basin.** Drilling demonstrated that the deep Mediterranean basins were sites of salt deposition as recently as ~5 Ma when flow into the basin was restricted and the level of the waters within the basin fell hundreds of meters through evaporation.

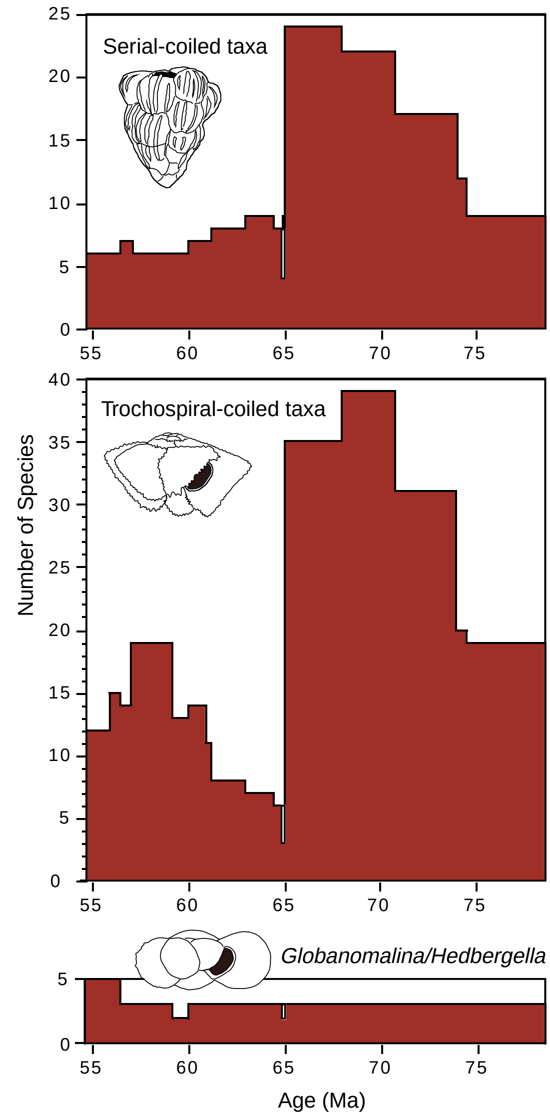


Figure 6. Species diversity across the Cretaceous-Tertiary boundary for three large groups of planktic foraminifera. Diversity increases rapidly during the ~5-10 m.y. before the boundary then plummets at the extinction. There is a modest rebound of diversity in the first 5 m.y. of the Paleocene. Species diversity reaches late Cretaceous values about 10-15 m.y. after the impact and mass extinction. Figure courtesy of Richard Norris, Woods Hole Oceanographic Institution.

- **Environmental Controls on Growth and Demise of Carbonate Platforms.** Drilling has illuminated the development and abrupt demise of large carbonate platforms along with their response to changing climate, sea level, oceanic circulation and gradual movement of the lithospheric plates.

Solid Earth Cycles & Geodynamics

- **Validation of Plate Tectonic Theory.** Dating of igneous basement rocks and overlying sediments recovered by scientific ocean drilling has demonstrated that the age of the oceanic crust increases systematically away from ridge crests, validating a fundamental prediction of plate tectonic theory.

- **Non-volcanic Passive Margin Evolution and Alpine Geology.** Drilling results and seismic data from the Iberian passive rifted margin have facilitated the development of new rifting and extensional deformation models of the continental crust where there is little attendant volcanism. These models imply nearly amagmatic thinning of the crust, with attendant widespread exposure of mantle rocks, a very different process than occurs on magma-rich margins. Rifted margin structure and stratigraphy strikingly similar to those found on the western Iberian margin have been identified in the Alps.

- **Large Igneous Provinces Associated with Continental Breakup: Volcanic Margins.** Drilling has established that seaward-dipping reflections identified on multichannel seismic reflection data from many passive continental margins consist of vast subaerial outpourings of lavas rapidly emplaced during the time of final continental separation and the initial formation of ocean basins. In some instances, enhanced melt production can be related to mantle plume heads thousands of kilometers wide, but other instances appear unrelated to known plumes (Figure 7).

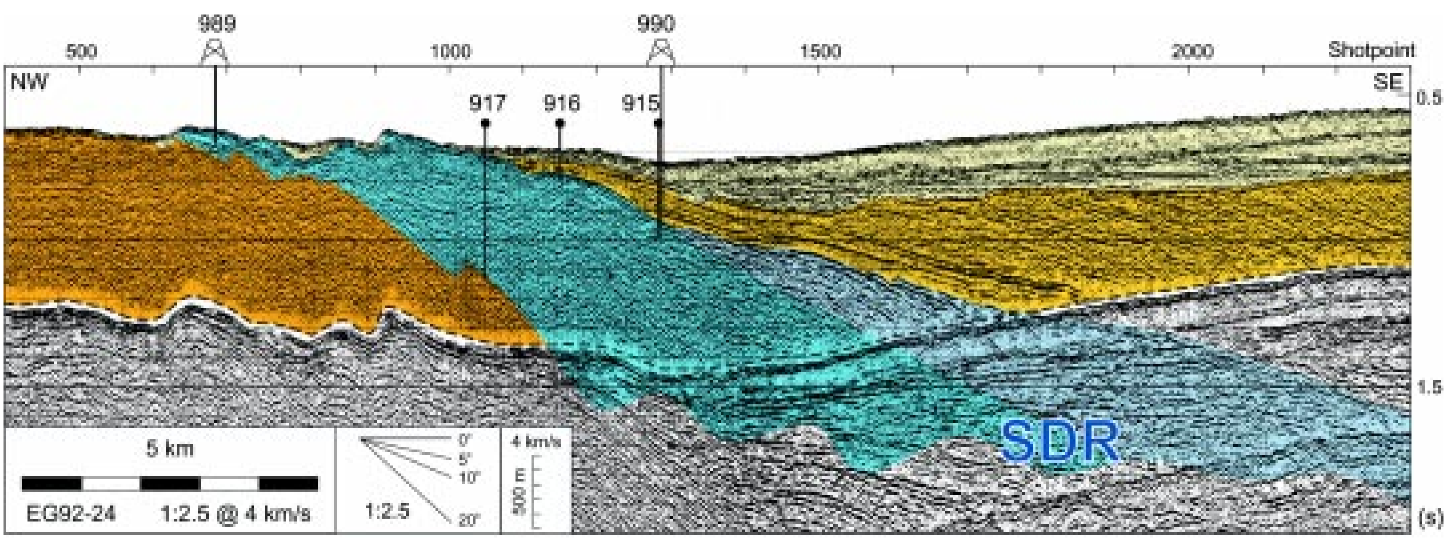


Figure 7. High-resolution seismic image of the inner part of the seaward-dipping reflections (blue) on the SE Greenland Margin. Subaerially emplaced basalts were recovered in five holes drilled during ODP Legs 152 and 163. The entire volcanic sequence was penetrated by Hole 917, bottoming in pre-breakup age sediments (orange). The average P-wave velocity of the basalt pile is 4 km/s, giving a 2.5 times vertical exaggeration of the profile. Figure courtesy of Sverre Planke, Volcanic Basin Petroleum Research, and is based on Planke, S., and E. Alvestad, 1999, Seismic volcanostratigraphy of the extrusive breakup complexes in the northeast Atlantic: Implications from ODP/DSDP drilling, *ODP Sci. Res.*, 163, 3-16.

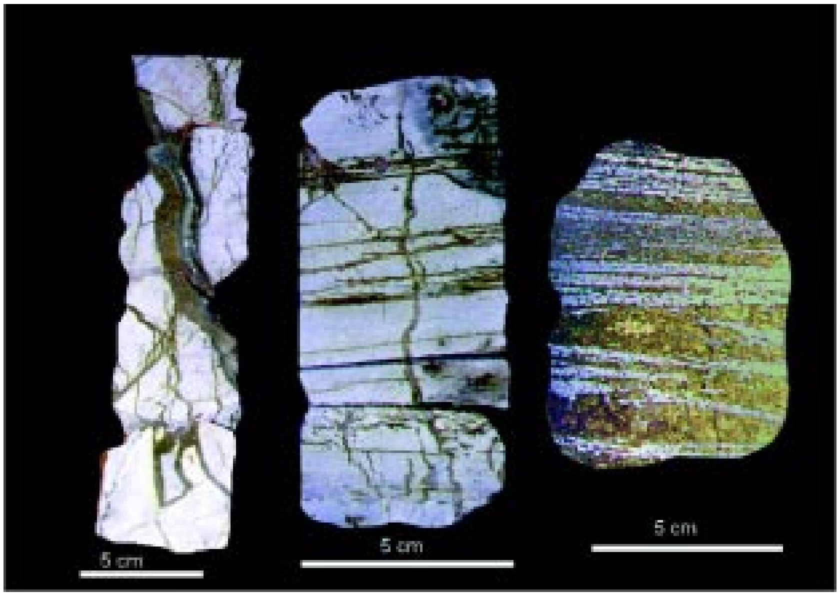


Figure 8. ODP cores recovered in a sedimented ridge crest in the Northeast Pacific Ocean are examples of feeder zone and deep copper zone mineralization below the Bent Hill massive sulfide deposit. Left: predominantly vertical crack-seal veins filled with pyrrhotite and Cu-Fe sulfide in altered turbiditic mudstone (856H 24R-1 50-70 cm, 134 mbsf). This style of mineralization is characteristic of the upper feeder zone underlying the center of the hydrothermal upflow zone. Center: less intense feeder zone mineralization underlying the south flank of the Bent Hill massive sulfide deposit. Mineralization consists of simple vertical and horizontal veins filled with pyrrhotite, sphalerite and Cu-Fe sulfide in graded fine sand to silt turbidites. Mineralization also occurs as subhorizontal replacement and disseminations along bedding planes (1035F 12R-2 43-55 cm, 112 mbsf). Right: Deep copper zone mineralization in cross-laminated turbiditic sandstone. Replacement of rock by Cu-Fe sulfide mimics original cross lamination; the matrix is extensively recrystallized to silver-gray colored chlorite and quartz (856H 31R-1, 99-107 cm, 202 mbsf). (Photo courtesy of Robert Zierenberg, University of California, Davis.)

- **Large Igneous Provinces: Origin of Oceanic Plateaus.** Drilling of two oceanic plateaus, which reach diameters of 2000 km and crustal thicknesses of 35 km, has established that their uppermost crust consists of basaltic lava flows with individual thicknesses of up to a few tens of meters. Major portions of these two plateaus were emplaced in geologically short time spans of a few million years or less, and may be the product of rising mantle plume "heads." Accretion of such plateaus to continental margins constitutes a form of continental growth by a mechanism not predicted by standard plate tectonic theory.

- **The Oceanic Crust.** To date, knowledge of the oceanic crust and shallow mantle has been largely restricted to geophysical observations, seafloor dredge samples and ophiolite studies. Limited ODP drilling into the oceanic mantle and principal crustal layers partly confirms models derived from these earlier studies, but also reveals major discrepancies that will change the estimates of the flux of heat and mass between mantle, crust and oceans over the last 250 million years. ODP drilling results have also challenged the assumption, critical to estimating the composition and volume of the oceanic crust, that seismic structure and igneous stratigraphy can be directly correlated.

- **Massive Sulfide Deposits.** Drilling into two actively forming volcanic- and sediment-hosted metal sulfide deposits sites has established that seafloor sulfide deposits are direct analogs with on-land massive sulfide deposits, in terms of ore-forming process, and with respect to size and grade of mineralizations. New insights gained by ocean drilling may aid in land-based mineral exploration (Figure 8).

- **Convergent Margin Tectonics and Subduction Recycling.** Strikingly different styles of convergent margin tectonics have been imaged by seismic data and constrained by scientific drilling, ranging from dominantly accretion to the overriding plate, to subduction of most trench sediment, to erosion at the base of the overriding plate. Drilling of down-going slabs and comparison with arc magmatism have provided the beginning of a quantitative understanding of subduction recycling.

- **Hot Spot Tracks on the Oceanic Crust.** Dating of sediment and basaltic rock recovered by drilling has documented a systematic age progression along several seafloor volcanic chains or ridges, verifying the hypothesis that these features were formed by relatively stable hot spots beneath the moving lithosphere. These drilling samples also provide the main observational evidence that hot spots are generated by deep mantle plumes. In addition, this work has helped establish the absolute movement of lithospheric plates with respect to the lower mantle. Paleomagnetic data from drilled seamounts demonstrate the motion of Atlantic versus Pacific hot spots with respect to each other.

- **Hydrated Mantle in Many Tectonic Environments.** Unexpected mantle-derived serpentinites at shallow crustal levels have been documented by drilling in a variety of tectonic settings from rifted continental margins to fore-arcs to spreading ridges. These results indicate that upper mantle alteration is much more pervasive than previously believed (Figure 9).

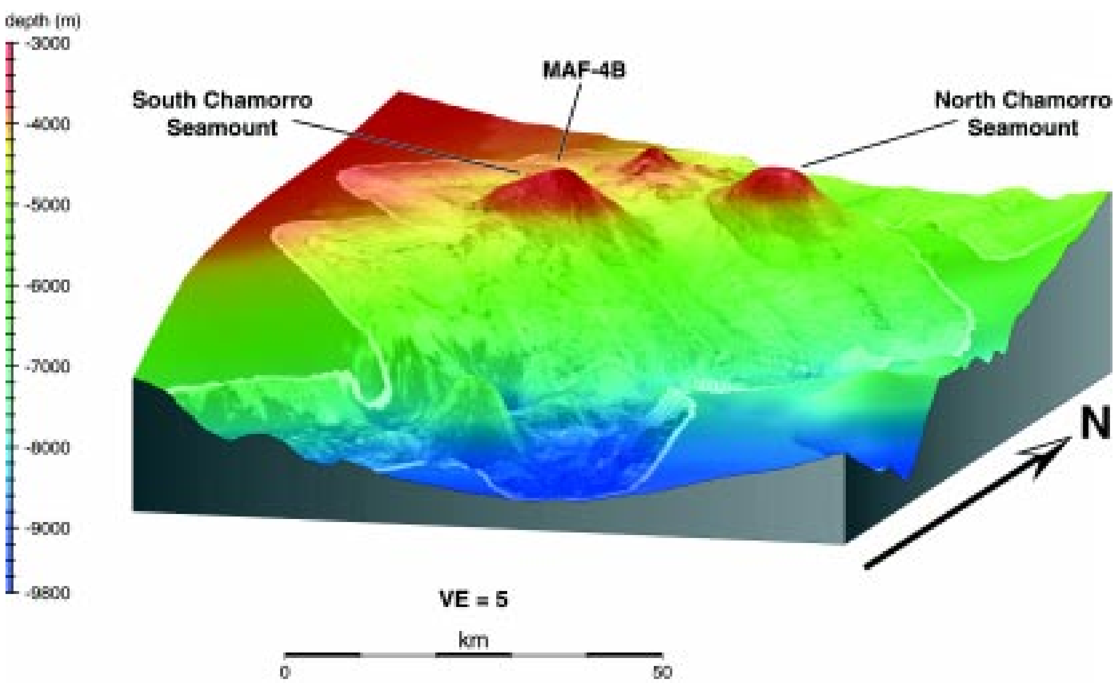
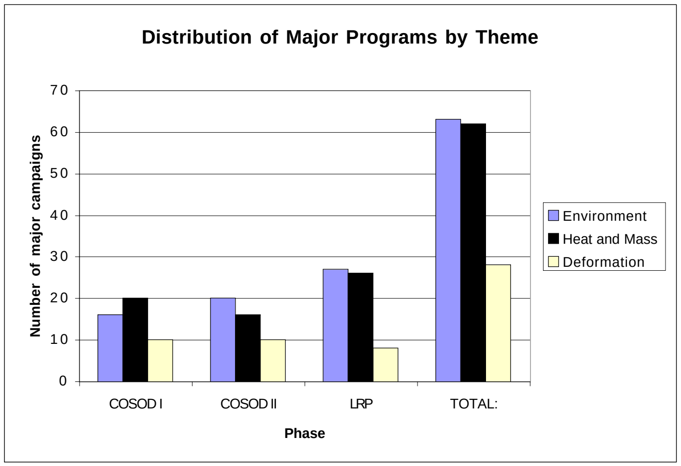


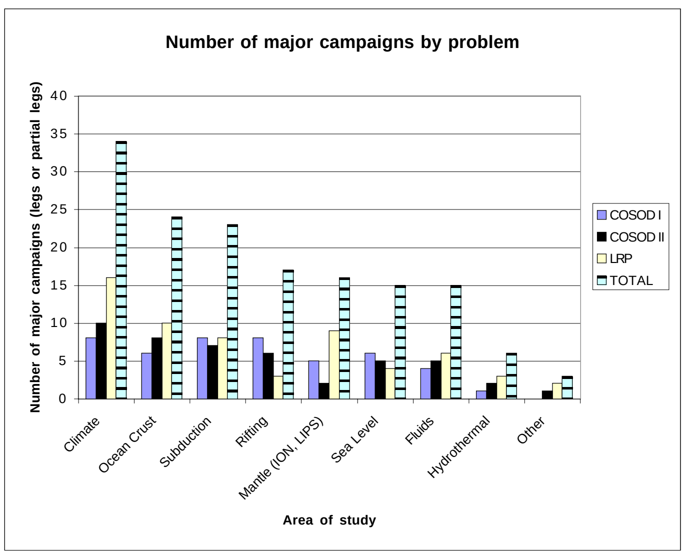
Figure 9. This side-scan sonar image, draped on bathymetry, shows several southern Mariana seamounts that are approximately 20 km in diameter and 2 km high. Most seamounts are basaltic volcanoes, however, ODP drilling along western Pacific forearcs has shown that edifices similar to ones shown in this image are mud volcanoes composed of fine-grained serpentine muds, fragments of serpentinized mantle derived from the overriding plate, and metamorphosed basalts from the subducted slab — materials derived from depths of up to 29 km. Pore fluids in cores from the active conduits have slab-derived geochemical signatures and support communities of organisms. The seamount in the foreground is currently active, and will be drilled by ODP in 2001; MAF-4B is one proposed drillsite. Figure courtesy of Patricia Fryer and Nathan Becker, University of Hawaii.

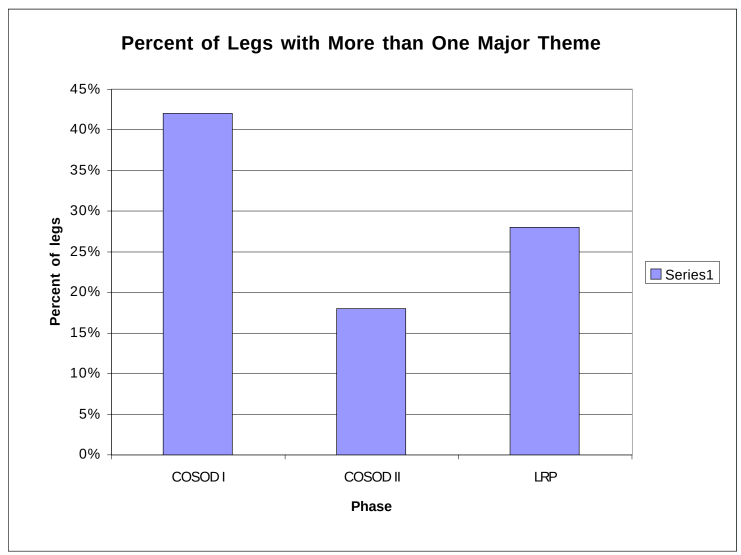
Some comparisons:
A "campaign" is a leg or a major theme of a leg; hence there are more "campaigns" counted per major phase of the program than there were legs
Legs or major parts of legs devoted to:

COSOD I	COSOD II	LRP
31 legs	38 legs	46 legs



	Environment	Heat and Mass	Deformation					
COSOD I	16	20	10					
COSOD II	20	16	10					
LRP	27	26	8					
TOTAL:	63	62	28					
	Climate	Ocean Crust	Subduction	Rifting	Mantle (ION, LIPS)	Sea Level	Fluids	Hydrothermal
COSOD I	8	6	8	8	5	6	4	1
COSOD II	10	8	7	6	2	5	5	2
LRP	16	10	8	3	9	4	6	3
TOTAL	34	24	23	17	16	15	15	6
Percent of legs with more than one major theme								
COSOD I	42%							
COSOD II	18%							
LRP	28%							





Areas of focus for ODP Legs, using the ODP LRP themes and initiatives

	SCIENTIFIC THEMES													INITIATIVES			
	Earth's Environment				Heat and Mass Transfer				Deformation/Earthquakes								
	Changing Climate	Sea Level	Sediments and fluids (gas hydrates, C cycle)	Deep Biosphere	Mantle Dynamics	Oceanic Crust	Hydrothermal Processes	Subduction zone mass blaance	Extensional boundaries	Translational Boundaries	Convergent boundaries and fluids	Earthquake mechanisms	Number of major thems in leg	natural Climate Variability and Rapid Climate Change	In-situ monitoring	Deep sturcutre of continental margins and crust	
Leg 100, Site 625: Gulf of Mexico																	
Leg 101, Sites 626-636: Bahamas		1	1										2				
Leg 102, Site 418: Bermuda Rise						1							1				
Leg 103, Sites 637-641: Galicia Margin									1				1				
Leg 104, Sites 642-644: Norwegian Sea									1				1				
Leg 105, Sites 645-647: Baffin Bay and Labrador Sea	1								1				2	1			
Leg 106, Sites 648-649: Mid-Atlantic Ridge						1							1				
Leg 107, Sites 650-656: Tyrrhenian Sea			1					1	1				3				
Leg 108, Sites 657-668: Eastern Tropical Atlantic	1												1	1			
Leg 109, Sites 669-670,395,648: Mid-Atlantic Ridge						1							1				
Leg 110, Sites 671-676: Northern Barbados Ridge											1		1				
Leg 111, Sites 677-678,504: Costa Rica Rift						1							1			1	
Leg 112, Sites 679-688: Peru Continental Margin								1			1		2				
Leg 113, Sites 689-697: Weddell Sea, Antarctica	1												1	1			
Leg 114, Sites 698-704: Subantarctic South Atlantic	1												1	1			
Leg 115, Sites 705-716: Mascarene Plateau					1								1				
Leg 116, Sites 717-719: Distal Bengal Fan	1	1											2				
Leg 117, Sites 720-731: Oman Margin													0				
Leg 118, Sites 732-735: Southwest Indian Ridge						1							1			1	
Leg 119, Sites 736-746: Kerguelen Plateau and Prydz Bay	1				1				1				3				
Leg 120, Sites 747-751: Central Kerguelen Plateau	1				1				1				3				
Leg 121, Sites 752-758: Broken Ridge and Ninetyeast Ridge					1								1				
Leg 122, Sites 759-764: Exmouth Plateau		1							1				2				
Leg 123, Sites 765-766: Argo Abyssal Plain and Exmouth		1							1				2				
Leg 124, Sites 767-771: Celebes and Sulu Seas								1					1				
Leg 124E, Sites 772-777: Philippine Sea/Engineering Tests								1					1				
Leg 125, Sites 778-786: Bonin/Mariana Region								1					1				
Leg 126, Sites 787-793: Izu-Bonin Arc-Trench System								1					1				
Leg 127, Sites 794-797: Japan Sea		1						1					2				
Leg 128, Sites 798-799,794: Japan Sea		1						1					2				
Leg 129, Sites 800-802: Old Pacific Crust						1	1						2				
Leg 130, Sites 803-807: Ontong Java Plateau	1				1								2	1			
Total in Area:	8	6	2	0	5	6	1	8	8	0	2	0	31	5	0	2	
Total in Theme:	16				20				10				42%	7			

	SCIENTIFIC THEMES													INITIATIVES			
	Earth's Environment				Heat and Mass Transfer				Deformation/Earthquakes								
	Changing Climate	Sea Level	Sediments and fluids (gas hydrates, C cycle)	Deep Biosphere	Mantle Dynamics	Oceanic Crust	Hydrothermal Processes	Subduction zone mass blaance	Extensional boundaries	Translational Boundaries	Convergent boundaries and fluids	Earthquake mechanisms	Number of major thems in leg	natural Climate Variability and Rapid Climate Change	In-situ monitoring	Deep sturcutre of continental margins and crust	
Leg 131, Site 808: Nankai Trough											1		1				
Leg 132, Sites 809-810: Western and Central Pacific						1							1				
Leg 133, Sites 811-826: Northeast Australian Margin		1							1				2				
Leg 134, Sites 827-833: Vanuatu, New Hebrides								1					1				
Leg 135, Sites 834-841: Lau Basin								1					1				
Leg 136, Sites 842-843: Hawaiian Arch					1								1		1		
Leg 137, Site 504: Costa Rica Rift						1							1			1	
Leg 138, Sites 844-854: Eastern Equatorial Pacific	1												1	1			
Leg 139, Sites 855-858: Middle Valley, Juan de Fuca Ridge							1						1				
Leg 140, Site 504: Costa Rica Rift						1							1			1	
Leg 141, Sites 859-863: Chile Triple Junction								1					1				
Leg 142, Site 864: East Pacific Rise/Engineering Tests						1							1				
Leg 143, Sites 865-870: Northwest Pacific Atolls and Guyots		1											1				
Leg 144, Sites 871-880,801: Northwest Pacific Atolls and		1											1				
Leg 145, Sites 881-887: North Pacific Transect	1												1	1			
Leg 146, Sites 888-893,857: Cascadia Margin			1								1		2				
Leg 147, Sites 894-895: Hess Deep Rift Valley						1							1				
Leg 148, Sites 896,504: Costa Rica Rift						1							1			1	
Leg 149, Sites 897-901: Iberia Abyssal Plain									1				1				
Leg 150, Sites 902-906: New Jersey Sea-Level Transect		1											1				
Leg 150X: New Jersey Coastal Plain		1											1				
Leg 151, Sites 907-913: North Atlantic-Arctic Gateways I	1												1				
Leg 152, Sites 914-919: East Greenland Margin									1				1	1			
Leg 153, Sites 920-924: Mid-Atlantic Ridge/Kane Fracture						1							1				
Leg 154, Sites 925-929: Ceara Rise	1												1	1			
Leg 155, Sites 930-946: Amazon Deep-Sea Fan	1												1	1			
Leg 156, Sites 947-949: Barbados Ridge Accretionary Prism								1			1		2		1		
Leg 157, Sites 950-956: Gran Canaria and Madeira Abyssal					1	1							2				
Leg 158, Site 957: TAG Hydrothermal Mound							1						1				
Leg 159T, Site 958: Eastern Canary Basin													0				
Leg 159, Sites 959-962: Cote D'Ivoire-Ghana Transform										1			1				
>Leg 160, Sites 963-973: Mediterranean I	1		1						1				3				
>Leg 161, Sites 974-979: Mediterranean II	1		1						1				3				
Leg 162, Sites 980-987: North Atlantic-Arctic Gateways II	1												1	1			
Leg 163, Sites 988-990: Southeast Greenland Margin									1				1				
Leg 164, Sites 991-997: Blake Ridge and Carolina Rise			1										1				
Leg 165, Sites 998-1002: Caribbean Ocean History	1		1										2				

	SCIENTIFIC THEMES													INITIATIVES			
	Earth's Environment				Heat and Mass Transfer				Deformation/Earthquakes								
	Changing Climate	Sea Level	Sediments and fluids (gas hydrates, C cycle)	Deep Biosphere	Mantle Dynamics	Oceanic Crust	Hydrothermal Processes	Subduction zone mass blaance	Extensional boundaries	Translational Boundaries	Convergent boundaries and fluids	Earthquake mechanisms	Number of major thems in leg	natural Climate Variability and Rapid Climate Change	In-situ monitoring	Deep sturcutre of continental margins and crust	
Leg 166, Sites 1003-1009, Bahamas Transect	1												1				
Total in Area:	10	5	5	0	2	8	2	4	6	1	3	0	38	6	2	3	
Total in Theme:	20				16				10				18%				

167 Ca margin	1												1	1			
168 E. Juan de Fuca hydrothermal							1						1		1		
169 Sed. Ridges II			1			1	1						3		1		
170 Costa Rica			1								1		2				
171A Barbados LWD			1								1		2				
171B Blake Nose	1												1	1			
172 NW Atlantic Sed Drifts	1												1	1			
173 Return to Iberia									1				1				
174 NJ Margin		1											1				
174B CORK 395A						1							1		1		
175 Benguela Current	1												1	1			
176 Return to 735B						1							1			1	
177 S. Ocean Paeloeoceanography	1												1	1			
178 Ant. Glacial History and Sea Level Change	1	1											2				
179 Hammer Drilling and NERO					1	1							2		1		
180 Woodlark Basin									1				1				
181 SW Pacific Gateways	1												1	1			
182 Aus. Bight-Cool Water Carbonates	1	1											2				
183 Kerguelen Plateau					1	1							2				
184 South China Sea	1												1	1			
185 Izu-Mariana Mass Balance						1		1					2				
186 W. Pac. Observatory-Japn Trench												1	1		1		
187 AAD-Mantle Reservoirs					1	1							2				
188 Prydz Bay	1												1	1			
189 Southern Gateways	1												1	1			
190 Nankai I			1								1		2				
191 W. Pacific ION, Engineering					1								1		1		
192 Ontong Java Plateau					1	1							2				
193 Manus Basin							1						1				
194 Marion Plateau		1											1				

	SCIENTIFIC THEMES													INITIATIVES			
	Earth's Environment				Heat and Mass Transfer				Deformation/Earthquakes								
	Changing Climate	Sea Level	Sediments and fluids (gas hydrates, C cycle)	Deep Biosphere	Mantle Dynamics	Oceanic Crust	Hydrothermal Processes	Subduction zone mass blaance	Extensional boundaries	Translational Boundaries	Convergent boundaries and fluids	Earthquake mechanisms	Number of major thems in leg	natural Climate Variability and Rapid Climate Change	In-situ monitoring	Deep sturcutre of continental margins and crust	
195 W. Pacific ION and Serp. Smt.					1			1					2		1		
196 Nankai II LWD, CORK			1					1			1		3				
197 Hotspots motion					1								1				
198 K-Paleogene Shatsky Rise	1												1	1			
199 Paleogene Equatorial Transect	1												1				
200 H2O Observatory					1								1		1		
201 Peru Margin Microbial				1									1				
Leg 202 SE Pac. Paleooceanography	1												1				
Leg 203 ION Equatorial Site					1								1		1		
Leg 204 Cascadia Gas hydrates			1										1				
Leg 205 Costa Rica Mass Balance								1					1		1		
Leg 206 Fast spreading crust						1							1			1	
Leg 207 Demerara Rise	1												1				
Leg 208 Walvis Ridge	1												1				
Leg 209 MAR Peridotite						1							1				
Leg 210 Newfoundland Margin									1				1			1	
Total in Area:	16	4	6	1	9	10	3	4	3	0	4	1	46	10	10	3	0
Total in Theme:	27				26				8				28%	23			
45																	

Major themes and Directions of the Ocean Drilling Program
1981 to 2003

ODP Long Range Plan Themes	LRP Focus Areas	COSOD II	COSOD I
Earth's Environment	Changing Climate	Orbitally driven oscillations (*global ice volume estimate from isotopes experiment*)	Ocean-atmosphere links to planetary forcing
		Global array of full Neogene sections	Ocean circulation history
		Long term records in Jurassic/ Cretaceous sections	
	Sea Level	Tecontically driven global changes (sea level) *(atoll carbonate record, passive margin stratigraphy experiment*)	Sedimentation response to sea level
			Mass balancing of sediments
	Sediments and fluids (gas hydrates, C cycle)	Fluides in Subduction settings (*instrumentation at decollement; 3-4 km penetration*)	Sedimentation in oxygen deficient oceans
		Circulation in continental margins	
	Deep Biosphere		
Heat and Mass Transfer	Mantle Dynamics	Global seismic observatories	
	Oceanic Crust	Solid earth geochemical cycles	Mid-ocean ridge construction
		Total crustal sections (*3 km hole to layer 3; 3 km hole in lower crust exposure*)	
	Hydrothermal Processes	Hydrothermal circulations	Dynamics o fhydrothermal systems
	Subduction zone mass blaance	Solid earth geochemical cycles	Volcanic arc history and structure
		Fluides in Subduction settings (*instrumentation at decollement; 3-4 km penetration*)	Forearc eveoluiton
Deformation/Earthquakes	Extensional boundaries	Conjugate passive margin drilling	Passive margin rifting
		Circulation in continental margins	
	Translational Boundaries		
	Convergent boundaries and fluids	Fluides in Subduction settings (*instrumentation at decollement; 3-4 km penetration*)	
	Earthquake mechanisms		
Initiatives:	Natural Climate Variabiity and Rapid Climate Change	Effects of environmental "catastropes" (K/T extinctions) (K-T gradient studies)	Microorganism evolution (not sure where this should fit)
	In-situ monitoring	Global seismic observatories	
	Deep structure of continental margins and crust	Total crustal sections (*3 km hole to layer 3; 3 km hole in lower crust exposure*)	
		World stress map--oceanic sites (*few hole pattern in one plate*)	
		Process-driven studies (hard to classify these)	
			Earth's magentic field history

COSOD (1981) – 12 (equal) top priority scientific objectives

Origin and Evolution of Oceanic Crust

1. Processes of magma generation and crustal construction at mid-ocean ridges
2. Configuration, chemistry and dynamics of hydrothermal systems "Natural laboratories" – arrays of holes, at least one deep

Tectonic Evolution of Continental Margins and Oceanic Crust

3. Early rifting history of passive continental margins
4. Dynamics of forearc evolution
5. Structure and volcanic history of island arcs

Origin and Evolution of Marine Sedimentary Sequences

6. Response of marine sedimentation to fluctuations in sea level
7. Sedimentation in oxygen-deficient oceans
8. Global mass balancing of sediments

Causes of Long-Term Changes in the Atmosphere, Oceans, Cryosphere, Biosphere, and Magnetic Field

9. History of ocean circulation
10. Response of atmosphere and oceans to variations of planetary orbits
11. Patterns of evolution of microorganisms
12. History of the earth's magnetic field

COSOD II (1987) – Working Groups and Drilling Objectives

Changes in the Global Environment (includes sea level)

Tectonically driven changes
Orbitally driven oscillations

Mantle-Crust Interactions

Solid Earth geochemical cycles
Total crustal sections
Process-driven studies

Fluid Circulation in the Crust and the Global Geochemical Budget

Hydrothermal circulation
Fluids in subduction settings
Circulation in continental margins

Stress and Deformation of the Lithosphere

World stress map – oceanic sites
Global seismic observatories
Conjugate passive margin drilling

Evolutionary Processes in Oceanic Communities

Global array of full Neogene sections
Effects of environmental "catastrophes" (e.g., K/T extinctions)
Long-term records in Jurassic/Cretaceous sections

COSOD II – 5 "Illustrative" Drilling Experiments

Amplitude and Timing of Changes in Cenozoic Global Sealevel

- atoll carbonate record
- passive margin stratigraphy
- global ice volume estimated from isotopic

Deep Crustal Section

- 3 km hole through layer 2 to top of layer 3
- similar depth hole in tectonic exposure of lower crust/mantle

Fluid Flow and the Cycle of Deformation and Seismicity in a Subduction Zone

- natural laboratory at selected subduction margin with permanently instrumented holes through decollement
- later, add 3-4 km deep penetration

Stress Pattern within an Oceanic Plate

- a few holes to establish stress pattern in example plate

Cretaceous/Tertiary Boundary

- global high-resolution records "along environmental and biogeographic gradients"

1996 ODP Long-Range Plan – Themes

Dynamics of Earth's Environment

Earth's changing climate
- High-resolution sites
- Spatial and depth transects

Causes and effects of sea-level change
- Siliciclastic passive margin sections
- Carbonate reefs and platforms deposited at sea level
- Pelagic carbonate oozes

Sediments, fluids, and bacteria as agents of change
- Carbon cycle – sites of strong perturbations
- Gas hydrates
- Fluid fluxes in representative tectonic settings
- Pilot Project: Earth's deep biosphere

Dynamics of Earth's Interior

Transfer of heat and materials to/from Earth's interior
- Mantle dynamics – LIPS, Global seismic observatories
- Oceanic crust
  - Tectonic exposures of lower crust and mantle
  - [DCS] drilling in zero-age crust
  - Complete crustal sections
- Hydrothermal processes and sulfide mineralization
- Mass balance and temporal variability at subduction zones

Deformation of lithosphere and earthquake processes
- Extensional margin drilling
- Convergent margin fault processes
- Earthquake mechanisms at subduction settings

1996 ODP Long-Range Plan – 3 Initiatives

I. Understanding natural climate variability and the causes of rapid climate change

II. In situ monitoring of geological processes

III. Exploring deep structure of continental margins and oceanic crust