JOIDES Science Committee

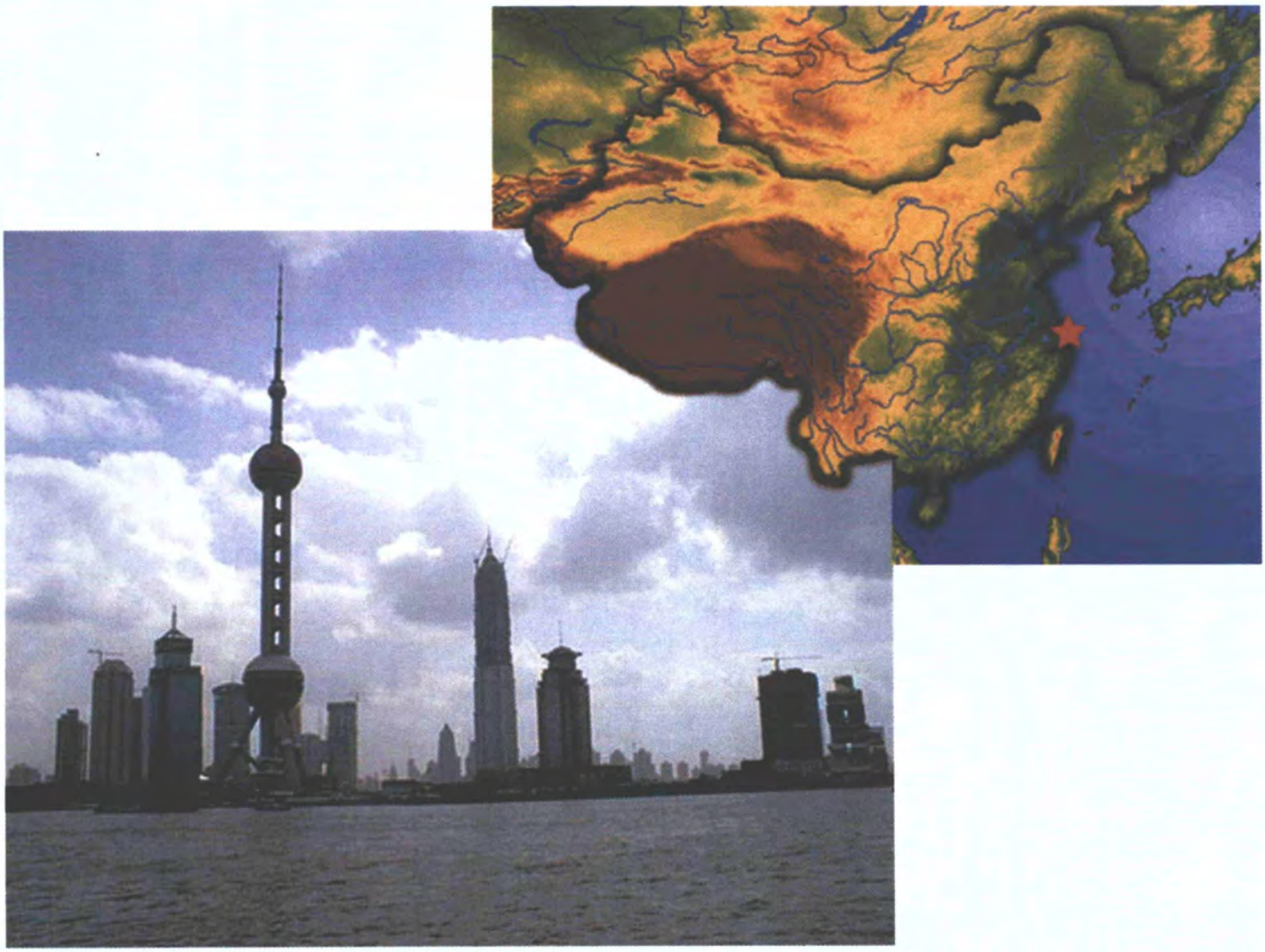
21-23 March 2001

JOIDES Operations Committee

20 March 2001

Shanghai, People's Republic of China

Agenda Book



Prepared by:

JOIDES Office, RSMAS, 4600 Rickenbacker Cswy., Miami, FL 33149, U.S.A.

OCEAN DRILLING PROGRAM
JOIDES OFFICE

28 February, 2001

TO: March, 2001, SCICOM and OPCOM Attendees

FROM: Keir Becker

RE: Chair's Perspective on OPCOM AND SCICOM Meetings

As regular OPCOM and SCICOM attendees probably realize, the March meeting is hopefully less pressured than the annual scheduling meetings in August, unless there are severe budget issues to be faced. As we will hear in presentations from NSF, JOI, and the ODP Operators (TABS 4 and 5), various budgeting adjustments have been made to mitigate the impact of rising fuel prices, such that FY01 and projected FY02 budgets should accommodate the scheduled science. As a result, we can devote more time at this March meetings to careful consideration of reports relating to ODP science planning – leg science reports, PPG/DPG reports, reports on progress toward IODP, reports from other international geoscience initiatives. Our agenda includes these reports, and at first glance might not seem to include many issues requiring action. Nevertheless, embedded within the agenda are indeed several items that will require some thoughtful action, described below. Please note that I have not programmed a rigid time schedule for the agenda; I prefer to be flexible enough to allow full discussion of these issues. Although I am hopeful SCICOM can adjourn mid-afternoon of 23 March, we will run the full day if needed.

Responses to EXCOM requests

At its January meeting, EXCOM was relatively benign and did not make any significant new requests of SCICOM (TAB 6). EXCOM approved the FY02 Program Plan, were satisfied with the budget projections, endorsed the August SCICOM motion to maintain JOIDES panels through the end of ODP drilling, and commended the SCICOM plan for *Achievements and Opportunities of Scientific Ocean Drilling* (although they also requested a different "Greatest Hits" kind of document). Stemming from motions at the June, 2000, EXCOM meeting, at its next meeting EXCOM is going to expect formal SCICOM reports on two subjects that have already been approached in motions from the August, 2000 SCICOM: a draft phase-out plan for JOIDES panels and an overall ODP legacy that includes technical developments and publication database in addition to the *Achievements and Opportunities...* document. Under agenda items N and O, we will probably need to flesh out the former in light of the plans to phase in an IODP Interim Science Advisory Structure in 2001. Also under item N, we should review progress toward the overall ODP legacy and ensure that there is an acceptable action plan to meet the EXCOM request for a June draft report.

Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Cswy., Miami, FL 33149, USA
Phone: (305) 361-4668, Fax: (305) 361-4632, Web site: http://joides.rsmas.miami.edu

Responses to Service Panel Recommendations
The service panel minutes (TAB 3) contain several specific recommendations, including one from TEDCOM relating to the technical ODP legacy. These will first be considered by OPCOM, which will formulate recommended responses for SCICOM review under agenda item K.

PPG and DPG Reports
The two most recently formed PPG's – Arctic and Hydrogeology – each conducted their third and presumably final meetings in early 2001. In addition, the Arctic DPG conducted its first meeting in early 2001. The timing was such that neither of the PPG final reports nor the initial Arctic DPG report were available before this agenda book was distributed, but reports are expected to be available at the meeting for insertion in TAB 8.

Preparation for Final ODP Scheduling at August SCICOM/OPCOM

The SSEP's chairs will report on the disposition at their November, 2000 meetings (TAB 7) of the final round of ODP proposals that will be eligible for consideration for scheduling in FY03 at the August, 2001 SCICOM/OPCOM meetings. The prospectus for FY03 will include the proposals sent out for external review after the November SSEP's as well as those proposals carried over from past years. There will be many strong proposals addressing high-priority Long-Range Plan objectives for the few final scheduling slots, and we must be sure we will be prepared to make the best possible decisions in August.

Among the proposals to be carried over from last year into the FY03 Prospectus are two highly rated programs that would require use of "alternative" or "mission-specific" platforms. In fact, one of these programs was so highly rated that SCICOM formed the Arctic DPG to consider various cost, logistical, and operational issues. At its initial meeting, the Arctic DPG made big initial strides toward achieving their mandate, and they are well on track for a strong final report for our summer meeting. Dave Rea will present a report on the initial DPG findings, which include logistical and cost options which are worth serious thought even at our March meeting. Likewise, at a special OPCOM meeting in December (TAB 2), we were presented with logistical and cost considerations for the New Jersey program which are also worth serious thought.

From my perspective, any discussions at our March meeting should not attempt to anticipate or prejudge the August scheduling decisions; instead, we should be prepared to map out a generic parliamentary strategy that will support any possible scientifically-based scheduling decision at the August, 2001 SCICOM/OPCOM. If this strategy will require unusual EXCOM-level approval, we should probably

aim for a motion for review at the June 2001 EXCOM, setting the stage for acceptance of any scheduling decision at the August SCICOM/OPCOM. From a parliamentary perspective, we should cast our discussions in the light of relevant prior SCICOM and EXCOM actions. These include the 1998 SCICOM Prioritization Document (TAB 9), which was endorsed by EXCOM (motion in first page of TAB 9) as the framework for decision-making in the light of budgetary constraints through the end of ODP. The relevant documents also include the Long-Range Plan, which has several passages concerning Arctic drilling and use of alternative platforms (excerpted in the second section of TAB 9). Please read these documents carefully!

IODP Planning (TAB 10)

The IWG and IPSC have made great strides since the August, 2000 SCICOM/OPCOM meeting, including: agreement on a set of IODP principles, very positive review of the near-final draft of the Initial Science Plan which is on track for publication May 1, and agreement on formation of an Interim Science Advisory Structure (ISAS) for IODP and ISAS Support Office in 2001. On 22 March, we will review these exciting developments in some detail.

Social Agenda

Finally – please be prepared to enjoy and acknowledge the gracious hospitality of our hosts in Shanghai – one of the most exotic locations yet for a PCOM or SCICOM meeting. This hospitality includes an invitation to those not on the March 20 OPCOM attendee list, to attend that day's session (to be conducted in English) of a three-day Chinese ODP Symposium. This Symposium, and the banquet on March 21, will present a wonderful opportunity to become acquainted with the community of ODP scientists from the People's Republic of China. If you intend to participate in any of the other social activities, please be sure you have RSVP'd to our hosts if necessary, as summarized in email messages from Bridget Chisholm at JOI.

AGENDA BOOK

JOIDES OPERATIONS COMMITTEE
(20 March, 2001)

JOINT JOIDES SCIENCE AND OPERATIONS COMMITTEES
(21 March, 2001)

JOIDES SCIENCE COMMITTEE
(22-23 March, 2001)

TONGJI UNIVERSITY
SHANGHAI, PEOPLE'S REPUBLIC OF CHINA

SOCIAL AGENDA

Chinese ODP Symposium - 19-21 March, Report Hall, 2nd floor, Graduate School Building
Note: 19 and 21 March programs to be conducted in Chinese.
20 March program to be conducted in English, SCICOM attendees welcome.

19 March – Research achievements of ODP Leg 184 (South China Sea) – in Chinese
20 March, AM – Invited lectures by Ted Moore, Bill Hay, JAMSTEC representatives – in English
20 March, PM – Sight-seeing in downtown Shanghai
21 March – IODP lectures and discussion – in Chinese

Dinner Banquet – 21 March, 1800, 14th floor, Magnolia Hotel

Acrobatics Show – 22 March, 1830, depart Magnolia Hotel for Shanghai Center

Field Trip to Suzhou – 24 March, 0730, depart Magnolia Hotel

OPCOM – 20 March 20, 0830-1700, "Small Conference Hall," 1st floor, Magnolia Hotel

Attendees:

Members:

Keir Becker (Chair)	University of Miami – RSMAS, USA
Kevin Brown	Scripps Institution of Oceanography, University of California at San Diego, USA
W.W. Hay	GEOMAR Research Center, University of Kiel, Germany
Nick Pisias	College of Oceanic & Atmospheric Sciences, Oregon State University, USA
Alastair Robertson	Department of Geology and geophysics, University of Edinburgh, United Kingdom
Thomas Shipley	Institute for Geophysics, University of Texas at Austin, USA

Liaisons:

Jack Baldauf	Science Operator (ODP-TAMU)
John Diebold	Lamont-Doherty Earth Observatory , Columbia University, USA (SSP Chair)
John Farrell	Joint Oceanographic Institutions, Inc.
Dave Goldberg	Wireline Logging Services (ODP-LDEO)
Thomas Janacek	Florida State University, USA (SCIMP Chair)
Bruce Malfait	National Science Foundation
Alister Skinner	British Geological Survey, Edinburgh, United Kingdom (TEDCOM Chair)

Guests and Observers:

Steve Bohlen	Joint Oceanographic Institutions, Inc.
J. Paul Dauphin	National Science Foundation
P. Jeff Fox	Science Operator (ODP-TAMU)
Aleksandra Janik	JOIDES Office, Science Coordinator
Elspeth Urquhart	JOIDES Office, International Liaison

Apologies:

Mahlon Ball	U.S. Geological Survey, Denver (PPSP Chair)

A. Welcome and introductions
B. Approval of agenda
C. Approval of minutes from Dec 16 meeting — TAB 2
D. Report on FY01 budget (Farrell)
E. Service Panel Reports — TAB 3
    1. PPSP - review minutes
    2. SSP (Diebold)
    3. SCIMP (Janacek)
    4. TEDCOM (Skinner)
    5. Discussion of panel issues
1215 Lunch at second floor, Magnolia Hotel
F. Operator Reports — TAB 4
    1. ODP/TAMU
    2. LDEO
    3. Discussion of issues
G. Special issues/new items?
H. Review of action items to be brought to SCICOM

SCICOM, March 21-23, Conference Hall, 3rd floor, Graduate School Building

Attendees, Joint SCICOM/OPCOM, 21 March, 2001 and SCICOM, 22-23 March, 2001

SCICOM Members:

Keir Becker (Chair)	University of Miami – RSMAS, University of Miami, USA
Kevin Brown*	Scripps Institution of Oceanography, University of California at San Diego, USA
Millard Coffin	Institute for Geophysics, University of Texas, Austin at Texas, USA
Steven D'Hondt	Graduate School of Oceanography, University of Rhode Island, USA
Andrew Fisher	Department of Earth Sciences, University of California at Santa Cruz, USA
William Hay	GEOMAR Research Center, University of Kiel, Germany
Nils Holm	Dept. of Geology & Geochemistry, Stockholm University, Sweden (ECOD)
Jock Keene	School of Geosciences, University of Sydney, Australia (PacRim)
Larry Mayer	Center for Coastal and Ocean Mapping, University of New Hampshire, USA
Nick Pisias*	College of Oceanic & Atmospheric Sciences, Oregon State University, USA
David Rea	Department of Geological Sciences, University of Michigan, USA
Alastair Robertson	Dept. of Geology and Geophysics, University of Edinburgh, United Kingdom
Hidekazu Tokuyama	Ocean Research Institute, University of Tokyo, Japan
Douglas Wiens	Department of Earth and Planetary Science, Washington University, USA

Apologies: (*K. Brown and N. Pisias appointed USA alternates)

Sherm Bloomer*	Department of Geosciences, Oregon State University, USA
Patty Fryer*	School of Ocean and Earth Science and Technology, University of Hawaii, USA
Frederick Sarg*	ExxonMobil Exploration, Houston, USA

Associate Member Observers:

Bernard Celerier	Universite de Montpellier II-CNRS, France
Zuyi Zhou	Department of Marine Geology & Geophysics, Tongji University, P.R. of China

OPCOM Member:

Thomas Shipley Institute for Geophysics, University of Texas at Austin, USA

Liaisons:

Jack Baldauf	Science Operator (ODP-TAMU)
John Diebold	Lamont-Doherty Earth Observatory , Columbia University (SSP Chair)
John Farrell	Joint Oceanographic Institutions, Inc.
Dave Goldberg	Wireline Logging Services (ODP-LDEO)
Thomas Janacek	Florida State University (SCIMP Chair)
Neil Lundberg	Department of Geology, Florida State University (ESSEP Chair)
Bruce Malfait	National Science Foundation
Julie Morris	Dept. of Earth and Planetary Science, Washington University (ISSEP Chair)
Alister Skinner	British Geological Survey, Edinburgh (TEDCOM Chair)

Attendees, Joint SCICOM/OPCOM, 21 March, 2001 and SCICOM, 22-23 March, 2001 (cont.)

Guests and Observers:

Hans Amann	Technischen Universitat Berlin (HYACE)
Ray Binns	CSIRO, Division of Exploration and Mining, Australia (Leg 193)
Steve Bohlen	Joint Oceanographic Institutions, Inc.
Warner Brueckmann	GEOMAR Research Center, University of Kiel (InterMargins)
David Christie	College of Oceanic & Atmospheric Sciences, Oregon State University (Leg 187)
Dennis Darby	Old Dominion University (Arctic PPG)
J. Paul Dauphin	National Science Foundation
P. Jeff Fox	Science Operator (ODP-TAMU)
Shermin Ge	University of Colorado at Boulder (Hydrogeology PPG)
Toshihiko Kanazawa	Earthquake Research Institute, University of Tokyo (Leg 191)
Yoshiro Miki	JAMSTEC, International Liaison
Ted Moore	Department of Geological Sciences, University of Michigan (IPSC)
JoAnne Reuss	Department of Geological Sciences, University of Michigan (IPSC)
Izumi Sakamoto	JAMSTEC, OD21 Program Office
Lei Shao	Department of Marine Geology, Tongji University
Kensaku Tamaki	Ocean Research Institute, University of Tokyo (InterRidge)
Pinxian Wang	Department of Marine Geology, Tongji University
Minoru Yamakawa	JAMSTEC, ISAS Support Office
Wencai Yang	Continental Drilling Research Centre, Institute of Geology, Beijing (CCSDP)

JOIDES Office:

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

SCICOM, 21-23 March, Conference Hall, 3rd floor, Graduate School Building

Morning Coffee Break, 1000-1030, Coffee Room, 2nd floor
Lunch, 1215-1300, Coffee Room, 2nd floor
Afternoon Break, 1530-1600, Coffee Room, 2nd floor

Joint SCICOM/OPCOM – March 21, 0830-1700

A. Welcome and introductions (Becker)

B. Meeting logistics (Wang, Shao)

C. Approval of agenda

D. August 2000 minutes – previously approved by email — TABS 1/2

E. Agency and Prime Contractor Reports — TAB 5
1. NSF (Malfait/Dauphin)
2. JOI (Bohlen)

F. Operator Reports — TAB 4
1. Science Operations (Fox/Baldauf)
2. Logging Operations (Goldberg)

G. FY01 Budget (Farrell) — TAB 5

H. FY02 Planning and Budget (Farrell)

I. EXCOM Report (Becker) — TAB 6

Lunch

J. Leg Science Reports (20-30 minutes each)
1. Leg 187 (Christie)
2. Leg 191 (Kanazawa)
3. Leg 192 (Coffin for Mahoney/Fitton)
4. Leg 193 (Binns)
5. HYACE Leg 194 Report (Amann)

K. Items forwarded from OPCOM

Dinner Banquet – 1800, 14th floor, Magnolia Hotel

SCICOM – 22 March - Forward Planning

L. SSEP's Reports TAB 7
1. ISSEP (Morris)
2. ESSEP (Lundberg)

M. PPG/DPG Reports (20-30 minutes each) TAB 8
1. Hydrogeology PPG (Ge)
2. Arctic PPG (Darby)
3. Arctic DPG (Rea)
4. Discussion of PPG and DPG issues and status

Lunch

N. Phase III Planning (Becker) TAB 9
1. Revisit 1998 SCICOM Prioritization Document
2. ODP Legacy Document
3. Evolution of JOIDES panels
4. JOIDES Journal

O. IODP Planning TAB 10
1. IWG Report (Malfait)
2. IPSC Report (Moore)
3. Phase-in of iSAS (Moore)
4. OD21 Report (Miki/Sakamoto)
5. ISAS Support Office (Yamakawa)

Acrobatics Show – 22 March, 1830, leave hotel for Shanghai Center

SCICOM – 23 March (adjourn mid-afternoon?)

P. Reports from international geoscience initiatives and SCICOM liaisons (20-30 minutes each)
1. ICDP/CCSDP (Wang)
2. InterRidge (Tamaki)
3. RIDGE 2000 (Christie)
4. InterMargins (Brueckmann)
5. ICDP (Rea)
6. IMAGES (Mayer)
7. PAGES (Hay)

Q. Finish issues from Planning Session (as much time as is required)

R. Future Meetings, Liaisons etc. TAB 11

Aug/Sept 2001 tentatively in Portland, with IPC observers and first IPC meeting
Options: week of August 27 or week of September 3

March 2002 – SCICOM/IPC to be hosted by Japan?

MEETING OF THE
JOIDES SCIENCE AND OPERATIONS COMMITTEES

DALHOUSIE UNIVERSITY
HALIFAX, NOVA SCOTIA, CANADA

1-4 AUGUST 2000

SUMMARY OF MOTIONS

SCICOM Consensus 00-2-1: SCICOM approves the minutes of its February 2000 joint meeting with EXCOM.

SCICOM Motion 00-2-2: SCICOM approves the minutes of its February 2000 meeting.

Miller moved, Coffin seconded; 12 in favor, 1 abstained (Shipley), 2 absent (Robertson, Wiens,).

SCICOM Consensus 00-2-3: SCICOM decides to forward the top twelve ranked drilling proposals plus APL-10 and APL-14 to OPCOM for possible scheduling.

SCICOM Motion 00-2-4: SCICOM notes the current imbalance between U.S. and non-U.S. panel chairs and recommends establishing a balanced representation as soon as possible.

Holm moved, Miller seconded, 11 in favor, 1 opposed (Rea), 1 abstained (Pearson), 2 absent (Hay, Pisias).

SCICOM Motion 00-2-5: SCICOM establishes a detailed planning group (DPG) to investigate the logistical, technological, and budgetary requirements for Arctic drilling related to Proposal 533-Full2. The DPG will prepare a report on these issues for SCICOM to review in August 2001.

Rea moved, Moore seconded, 12 in favor, 3 absent (Hay, Hodell, Pisias).

SCICOM Motion 00-2-6: SCICOM requests the JOIDES Office to revise the ODP guidelines for submitting Ancillary Program Letters as follows, with new text shown as underlined:

<u>Ancillary programs are generally limited to the general geographic area of leg operations and to no more than 2-3 days of dedicated ship time.</u> Requests for accommodation of ancillary programs in the Ocean Drilling Program should be submitted in the form of an Ancillary Program Letter to the JOIDES Office <u>in accordance with normal proposal deadlines</u>.

Rea moved, Pisias seconded, 15 in favor.

SCICOM Consensus 00-2-7: SCICOM approves OPCOM Consensus 00-2-1 and 00-2-2.

SCICOM Consensus 00-2-8: SCICOM approves TEDCOM Recommendations 00-1-1 through 00-1-4.

SCICOM Consensus 00-2-9: SCICOM approves SciMP Recommendations 00-2-1 through 00-2-5.

SCICOM Motion 00-2-10: SCICOM prioritizes leg operational expenses for FY2001 over additional expenditures such as the purchase of a digital camera and measurements-while-drilling (MWD) work on Leg 196.

Moore moved, Holm seconded; 14 in favor, 1 absent (Pisias).

SCICOM Motion 00-2-11: SCICOM approves the following operations schedule for 2001 and 2002, contingent upon the proponents of Proposal 499-Rev informing us of the expected timeline for installing the ION observatory.

Leg	Proposal	
195	431-Rev	Western Pacific ION
"	505-Full3	Mariana Convergent Margin (South Chamorro Seamount mini-leg)
196	517-Full	Nankai II
197	523-Full	Hawaiian Hotspot-Emperor Seamounts
198	534-Full	Shatsky Rise
199	486-Rev2	Paleogene Equatorial Pacific Transect
200	500-Full2	H2O Observatory
201	571-Full	Peru Margin Deep Biosphere
202	465----	Southeast Pacific Paleoceanography
203	544-Full2	Costa Rica Subduction Zone
204	546-Full	Hydrate Ridge
205	499-Rev	Equatorial Pacific ION

Rea moved, Moore seconded; 14 in favor, 1 absent (Pisias).

SCICOM Motion 00-2-12: SCICOM strongly endorses the activities of TAMU and JOI in assembling a database of publications related to ODP. We further encourage them to make this database searchable (e.g., by index terms, geological age, and geographic region). We recognize the current lack of allocated resources for these activities, and we encourage their financial support.

Miller moved, D Hondt seconded; 15 in favor.

SCICOM Motion 00-2-13: SCICOM recommends that TEDCOM and SciMP, together with TAMU and LDEO/BRG, prepare a one-page summary for each tool (including drilling, coring, logging, and other measurement tools) developed by or for the ODP community, emphasizing how the tool contributed to the scientific results of the program. These summaries could serve as appendices to operational manuals and as a basis for compiling a technical reference document for the ODP legacy.

Miller moved, Coffin seconded; 15 in favor.

SCICOM Motion 00-2-14: SCICOM endorses the following plan for preparing an ODP legacy document entitled *Achievements and Opportunities of Scientific Ocean Drilling*.

Outline

I. Dynamics of Earth s Environment

A. Earth s Changing Environment

1. Rapid climate change
2. Extreme climates
3. Climate response to orbital forcing
4. Causes and effects of sea-level change
5. 180 million years of ocean history

B. Sediments, Fluids, and Bacteria as Agents of Change

1. Sediment processes and budgets
2. Fluids in sediments and rocks
3. Formation of gas hydrates
4. Deep biosphere

II. Dynamics of Earth s Interior

A. Transfer of Heat and Material from Earth s Interior

1. Mantle and core dynamics
2. Ocean crust and mid-ocean ridge processes
3. Hydrothermal and sulfide mineral processes
4. Subduction factory

B. Lithosphere Deformation and Earthquake Processes

1. Passive continental margins and rift environments
2. Convergent margins and collisional settings
3. Earthquake mechanisms

Contents

Executive summary	5 pages
Short summaries of achievements for sixteen sub-themes	4-5 pages each
Introduction or statement of scientific issues and challenges	1 page
Bullets summarizing achievements and opportunities	1-2 pages
Summary of goals met	1 paragraph
Summary of future opportunities	1 paragraph
List of greatest hits (from bullets)	

Timeline

SCICOM Chair invites Editorial Review Board (ERB)	1 September 2000
ERB and SCICOM Chair invite authors	1 October 2000
Authors and ERB compile bullets and circulate among community	Fall 2000
Authors and ERB compile final bullet list	1 February 2001
ERB provides final bullet list to SCICOM	1 March 2001
Completion of short summaries	1 May 2001
Executive summary and excerpt of greatest hits	1 June 2001

C. Moore moved, Rea seconded; 14 in favor, 1 abstained (Shipley).

SCICOM Motion 00-2-15: SCICOM proposes to EXCOM that all committees and panels of the JOIDES Science Advisory Structure remain extant through September 2003. Although the duties of these committees and panels may diminish greatly after September 2001, and some of them may not need to meet in person, the program will continue to require their advice on scientific prioritization (SCICOM, SSEPs), shipboard operations (OPCOM, PPSP, SSP), shipboard measurements (SciMP), and technical developments (TEDCOM). The maintenance of the JOIDES Science Advisory Structure through September 2003 will allow the greatest flexibility in the transition to the interim IODP science advisory structure (iSAS). We foresee that some or all of the JOIDES committees and panels may meet in tandem with their iSAS counterparts.

Miller moved, D Hondt seconded; 15 in favor.

SCICOM Motion 00-2-16: SCICOM directs SciMP to continue advising JOI, TAMU, and LDEO/BRG in developing options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies.

Miller moved, Pisias seconded; 15 in favor.

SCICOM Motion 00-2-17: SCICOM endorses the membership of the Industrial Liaison Working Group, as proposed by IPSC.

Bloomer moved, Shipley seconded; 14 in favor, 1 abstained (Hay).

SCICOM Consensus 00-2-18: SCICOM bids fond farewell to Kensaku Tamaki. Ken helped SCICOM make the transition to the new advisory structure, provided advice on drilling ocean crust, and kept us informed on Japanese plans for the new program. We wish him well in his new role as chair of the InterRidge Office.

Presented by Miller

SCICOM Consensus 00-2-19: SCICOM sincerely thanks Ken Miller for his untiring efforts on behalf of ODP. Ken has outspokenly supported scientific ocean drilling, his advice and counsel have forwarded the goals of the project, and he has served this committee well, faithfully, and with his own special brand of enthusiasm. We wish him well in all future endeavors.

Presented by Rea

SCICOM Consensus 00-2-20: SCICOM notes with regret the last meeting of J. Casey Moore as a member of this committee. Casey has served ODP and its predecessor DSDP as a panel member, proponent, co-chief scientist, and willing source of advice and counsel. His thoughtful comments, thorough understanding of technical and scientific issues, and commitment toward crafting the best science for ocean drilling have proved invaluable to the program. He has helped SCICOM and all of ODP through hydrates, hiatuses, and wholehearted hurrahs for holes in the ocean floor. We thank Casey and have no doubt that we will see him again soon as IODP takes wing.

J. Casey Moore s not quite a druid;
He s simply enamored with fluids.
Alas he is done,
Heading back to the sun,
When we let him go we sure blew it.

Presented by Bloomer

SCICOM Consensus 00-2-21: SCICOM extends its heartfelt thanks to Gerard Bond for his keen insight, reviews, and discussions (IRD) during his tenure on this committee. We will miss the unique perspective that comes from a petrologist turned paleoclimatologist whose broad geological expertise spans hard rocks to Heinrich events. We wish Gerard continued success in his efforts to understand climate change in the North Atlantic and its societal implications, and we look forward to the day when Bond cycles become part of the public lexicon.

Presented by Hodell

SCICOM Consensus 00-2-22: SCICOM thanks John Ludden for his dedicated service to the Ocean Drilling Program. Despite some flexibility in nationality (having represented variously the United Kingdom, Canada, and France), he has always proved himself as a valued citizen of the international scientific community. We know that John thrives on having simultaneous membership in at least a half dozen international committees, and we suspect that his contributions to planning scientific ocean drilling have not ended.

John Ludden has donned many hats,
But we have no problem with that.
He s ne er made a fuss,
Though working with us
Is really like herding large cats.

Presented by Bloomer

SCICOM Consensus 00-2-23: SCICOM thanks Emily Klein for her service on the committee. Her extensive knowledge of mid-ocean ridge petrology and geochemistry proved invaluable. We will miss her boundless enthusiasm, unmistakable voice, and constant support of ODP.

Presented by Wiens

SCICOM Consensus 00-2-24: SCICOM thanks Kate Moran for her contributions to ocean drilling over the past two decades: She has always brought energy and focus to the tasks at hand. We appreciate her continuing efforts to promote IODP in the Canadian academic, governmental and industrial communities, and we wish her well in her new position.

Presented by Moore

SCICOM Consensus 00-2-25: We thank Bill Hay for his sage chairmanship of SCICOM and OPCOM. His current stewardship builds on a remarkable four-decade history of contributing to scientific ocean drilling, including his pivotal leadership during the transition from DSDP to ODP. SCICOM has especially appreciated Bill s emphasis on essential scientific issues and his desire to keep the program focused on the most exciting problems. We wish him well in the post-SCICOM world as he explores and models the balmy Cretaceous climes.

Presented by Moore

SCICOM Consensus 00-2-26: SCICOM expresses its profound appreciation and thanks to the JOIDES Office staff, Warner Br ckmann, Jeff Schuffert, Emanuel S ding, and Bettina Rohr, for their untiring energy, enthusiasm, and efficiency. Their combined efforts played an essential role in the smooth running of the program. We wish each of them all the best in the future.

Presented by Robertson

MEETING OF THE
JOIDES SCIENCE AND OPERATIONS COMMITTEES

DALHOUSIE UNIVERSITY
HALIFAX, NOVA SCOTIA, CANADA

1-4 AUGUST 2000

MINUTES

Tuesday, 1 August 2000.....8:30 AM

SCICOM Meeting

A. Welcome and introduction

A.1 Introduction of participants

Bill Hay called the meeting to order at 8:40 AM, and the participants introduced themselves. Note that the SCICOM membership at this meeting includes three extra participants who stepped in as alternates during the discussion, ranking, and scheduling of drilling proposals because three of the attending regular SCICOM members had a conflict of interest as proponents of specific proposals.

A.2 Meeting logistics

Sam Scully, Academic Vice-President and Provost of Dalhousie University welcomed everyone to the university and to Halifax. Shiri Srivastava explained the meeting logistics and the schedule of social events.

A.3 Approval of agenda

Hay announced that OPCOM would meet in an unscheduled session Tuesday evening. He also noted that Yoshiro Miki would give the OD21 report instead of Nakanishi. Pisias requested to move the IPSC report, scheduled for Friday afternoon, forward on the agenda because several committee members would have to leave the meeting early. Hay said that he would consider the request and decide later. Otherwise, the committee approved the agenda by consensus.

A.4 Approval of minutes from February 2000 EXCOM and SCICOM joint meeting

Hay called for approval of the minutes from the one-day joint meeting of EXCOM and SCICOM in February 2000. No one requested any further corrections, and the committee approved the minutes by consensus.

SCICOM Consensus 00-2-1: SCICOM approves the minutes of its February 2000 joint meeting with EXCOM.

A.5 Approval of minutes from February 2000 SCICOM meeting

Hay called for approval of the minutes from the separate SCICOM meeting in February 2000. No one requested any further corrections, and the committee voted to approve the minutes.

SCICOM Motion 00-2-2: SCICOM approves the minutes of its February 2000 meeting.

Miller moved, Coffin seconded; 12 in favor, 1 abstained (Shipley), 2 absent (Robertson, Wiens,).

A.6 Update on motions from February 2000 SCICOM and EXCOM meetings

Hay noted that EXCOM endorsed SCICOM Motion 00-1-5 regarding the forwarding of ODP proposals to IODP.

B. Discussion of how to document scientific achievements of ODP

Hay summarized the history of drilling legs within the context of the various themes and initiatives of the ODP Long-range Plan.

Climate change

Hay showed the geographic distribution of legs related to climate change among equatorial, temperate, subpolar, and polar environments. Pisias suggested also placing the achievements for climate change in a geological time perspective because geographic maps alone can give a misleading appearance. Miller noted for example that we have only scratched the surface of Paleogene and Cretaceous climate records.

Sea-level change

O Brien emphasized the importance of the Antarctic margin for sea-level studies. Miller said that the amplitudes of past sea-level change remain very poorly defined, but further drilling on atolls and guyots could yield valuable results despite the difficulty of poor recovery. He also noted that the depth limitations of the *JOIDES Resolution* have precluded drilling in very shallow water.

Carbon cycle, gas hydrates, and fluids.

D Hondt thought that the list of achievements on the carbon cycle should include studies devoted to the late-Paleocene thermal maximum (LPTM). Miller said that the carbon cycle lies behind almost everything we do. Pisias viewed Arctic drilling as the best chance for gaining new insight on these topics. C. Moore suggested that gas hydrate studies must advance from an exploratory stage to a process-oriented approach. Morris expected to see increasingly important contributions from hydrogeology.

Microbiology

C. Moore mentioned that Leg 146 contributed to early achievements in microbiology. D Hondt believed that microbiology still represents only a minor component of most studies. Morris suggested that perhaps microbiology should also move toward a process-oriented approach.

Hydrothermal processes

Ludden and Morris referred to several existing proposals concerning hydrothermal processes in various settings. Coffin noted that we have not yet studied hydrothermal processes on a large igneous province (LIP). D Hondt added that we also have not looked at cool hydrothermal systems such as mud volcanoes.

Subduction zones

Bloomer stated that an opportunity now exists to quantify subduction zone processes. Morris noted that most proposals related to subduction zones refer to present-day systems.

Mantle dynamics and ocean crust studies.

Morris mentioned an upcoming Caribbean LIP proposal, but noted the failure of ODP to drill a deep hole and sample a complete, intact section of oceanic crust. Bloomer also lamented the lack of a plan for drilling a deep hole, especially after the request for proposals (RFP) to do so. He described Hole 735B as one of the greatest successes for the hard-rock community and for enhancing knowledge about ophiolites. Ludden cited the failure to drill on a ridge axis.

Lithosphere deformation and earthquake processes.

Coffin thought that the program could make major progress on these topics if the ship returns to the western Pacific. He would also include the ION legs as achievements under mantle dynamics. C. Moore advocated the benefits of focusing on a few carefully selected sites, rather than spreading

C. Leg reports

C.1 Leg 187 — Australia-Antarctic Discordance

The committee did not hear a report on Leg 187 because neither of the co-chiefs could attend the meeting as scheduled.

C.2 Leg 188 — Prydz Bay

Phil O Brien reported on Leg 188 to Prydz Bay, Antarctica. In brief summary, the alternate shelf site yielded good logs and sufficient core recovery to determine the local stratigraphy. Palynological studies should provide a good estimate of the regional temperature range during the early Eocene. A change in sedimentation rate at the drift sites marks the onset of ice on the shelf, and debris flows in the prograding clinoforms on the rise indicate that the East Antarctic ice sheet reached the shelf edge only five times in the last 3 million years.

Coffin asked whether O Brien saw a need for further drilling in Prydz Bay or elsewhere around Antarctica, given the need to modify the original seismic interpretations. O Brien said that he would not drill again in Prydz Bay because sediment had accumulated more rapidly than expected during the early Miocene. They wanted to reach the bottom of the fan but ran out of time at the last site. Miller asked if Leg 188 recovered a section equivalent to that drilled at Site 739. O Brien said that the results from Prydz Bay can better constrain the ages; they still found pollen in Oligocene deposits, though from an impoverished tundra flora. Pearson asked about the age of the sequence boundary. O Brien identified the boundary as Eocene in age. Hay asked if the results could provide an estimate of sea-level change during the initial glaciation. O Brien replied that the working models focus more on identifying the major driver of climate change.

C.3 Leg 189 — Southern Gateways

Jim Kennett reported that Leg 189 experienced very good weather and met all of its major scientific objectives and more. They recovered continuous sections across several major stratigraphic boundaries, with the Oligocene interval proving most difficult to recover. The initial results support the hypothesis that the South Tasmanian gateway opened at the Eocene-Oligocene boundary. This event isolated the Antarctic continent, increased the ventilation of the surrounding oceanic system, and thus led to glaciation. Kennett showed a series of diagrams modeling the opening of the gateway and consequent changes in ocean circulation. They found no evidence of Antarctic glaciation during the Oligocene. The circumantarctic current and its unifying influence had not yet developed at that time, allowing regional variability in circumantarctic climate regimes.

Jansa asked about the rate of opening for the gateway. Kennett estimated a deepening of 1000-2000 m in a few million years. Keene asked about silica productivity. Kennett replied that the Eocene-Oligocene boundary coincides with a change in the diatom assemblage, with some indication for a slight change in siliceous productivity. Miller asked about the lack of core recovery in Oligocene intervals. Kennett suggested that regional patchiness of preservation and erosion might have played a role.

C.4 Leg 190 — Nankai Trough

Greg Moore reported on Leg 190 to the Nankai Trough. He cited the objectives to document the structural and hydrologic evolution of the d collement, constrain the fluid flow and geochemical gradients through the deformation zone, and characterize the pre-deformation geology and geochemistry of the accreting sediment. Chloride profiles provide evidence of fluid flow along the d collement. Physical properties show a large decrease in porosity in the hemipelagic sediments under the weight of the trench sediments. The sediment cores contain no apparent evidence of the

d collement and episodic deformation at out-of-sequence thrusts. The entire frontal 40 km of the sedimentary prism has accreted and deformed in the last two million years. Operationally, the Kuroshio Current varied from 0-4 knots on a daily basis, but this caused no problems thanks to the upgraded station-keeping system. For the return to Nankai on Leg 196, Moore emphasized the importance of logging the reference sites in the east, but characterized the upper-slope sites as expendable.

C. Moore asked what produced the difference in taper. G. Moore supposed that a cut off of sands or the collision of seamounts could explain the taper. Robertson wondered about the mechanism for such rapid accretion and whether it has affected the de-watering history. G. Moore said that it would take more time to evaluate that question. Robertson also asked how the microbiology worked out. G. Moore replied that microbiology played only an ancillary role in the leg objectives, but the microbiologists seemed pleased with their results. Shipley asked about the sampling of oceanic crust. G. Moore said that they recovered 1 m of basalt at the western site. The CORK scientists asked not to penetrate basement at the eastern sites, but he anticipates more recovery of basement rocks in that area on Leg 196.

Tuesday, 1 August 2000.....1:30 PM

SCICOM and OPCOM Joint Meeting

D. Management and operations reports

D.1 NSF

Paul Dauphin reported on the ODP budget for FY 2000, targeted at $46.1M plus a carryover of nearly $500K in uncommitted funds from FY 1999. He noted that EXCOM approved the program plan for FY 2001. On the membership front, Dauphin announced that Ireland has joined ECOD, NSF and China have begun crafting an MOU for the continued participation of China to the end of ODP, and JOI and PacRim have approached India about joining the program, but India has not responded. Dauphin reported on proposed NSF funding for ODP-related field programs. NSF has asked for a large increase in its overall budget for FY 2001 but does not expect further changes in national or international contributions to ODP.

Hay asked about funding for EarthScope. Dauphin said that the NSF budget no longer provides for EarthScope, but that could change in the next congressional session.

D.2 JOI

John Farrell reported on activities at JOI, including recent changes in personnel, planned changes in the management structure, and the formation of a management oversight committee among the JOI Board of Governors. Farrell described the selection of, and transition to, the new JOIDES Office at the Rosenstiel School of Marine & Atmospheric Science in Miami, noting the ongoing staff search for an international liaison from the U.K. Farrell reported on the FY 2001 Program Plan and showed the breakdown of the budget among the various program components and among individual drilling legs. He emphasized the risks of budget assumptions about fuel costs and the canceling of plans for refurbishing spare drill pipe. ODP received external funding from DOE, LExEn, and JAMSTEC in FY 2000 and expects additional funding from JAMSTEC and perhaps Schlumberger in FY 2001.

Farrell briefly mentioned some of the important issues identified in the PEC-V report and the overall response from JOI. He also reported on recent JOI efforts and strategy in public affairs. Farrell noted that JOI has started working on the ODP legacy, thus far primarily through the efforts of an intern who has begun compiling a citation database. He described a limited search for ODP

using GeoRef. The two methods yielded complementary results, with the manual search seen as more inclusive and the GeoRef search as more efficient. Farrell also announced the availability of a new educational and promotional CD-ROM entitled From Gateways to Glaciation.

Hay asked about the status of the COMPLEX report. Pisias said that the organizers of COMPLEX had submitted the final draft report to JOI. Farrell expected to receive the final edited version from the external contractor in August and distribute it in September or October.

D.3 TAMU

Jack Baldauf reported on ODP activities at TAMU. He presented data showing the greatly reduced motion of the drill string using the new system for active heave compensation (AHC). He also described the limitations of the AHC and identified several remaining issues for achieving a fully tested and satisfactory operation. Baldauf mentioned a potential deep-biosphere policy issue regarding proprietary rights to biological materials sampled by ODP, and he gave a brief update on the Distance Learning Initiative. In reviewing the leg schedule, Baldauf noted a rescheduling of the HYACE test from Leg 191 to 194, with ship time shifted accordingly. Leg 192 to the Ontong Java Plateau and Leg 193 in the Manus Basin face potential clearance issues with the Solomon Islands and Papua New Guinea, respectively. The proponents and co-chiefs of Leg 199 to Hydrate Ridge have requested to postpone the leg until 2002 and reschedule it into a better weather window. Leg 200 may require an additional casing string to stabilize the hole for installing the ION observatory.

D Hondt asked whether the AHC would eventually work with APC. Baldauf identified that as the next step. Shipley asked about the possibility of obtaining direct measurements of weight on bit rather than at top of the drilling rig. Baldauf hoped to get the necessary tools for such measurements on an upcoming leg. Coffin asked whether the new shipboard email system works or not. Baldauf explained that TAMU had revamped the entire email system and it now works after some initial bugs. Farrell asked about the possibility of operating in shallower water with the new beacon system. Fox placed the shallow depth limit now at around 50 m rather than 30 m as originally mentioned. He noted that industry does not use dynamic positioning in such shallow water, and ODP thus has to push the limits with the vendor. Skinner added that improved access to the newly declassified GPS data might eliminate the need for beacons altogether. Robertson asked about shipboard staffing and the low number of applicants for several upcoming legs. Baldauf replied that the size of the applicant pool could merely reflect the nature of those particular legs, but it never hurts to broaden the publicity of the leg schedule.

D.4 LDEO

Dave Goldberg reported on past logging operations during Legs 188-191 and previewed those on Leg 193. Leg 188 tested the tools for logging-while-drilling (LWD) and measurement-while-drilling (MWD). Leg 189 tested the core-log integration software and provided a real-time display of LWD data in the sedimentology lab. Leg 190 successfully logged a reference site for correlation with the LWD data expected on Leg 196. Leg 191 deployed a high-resolution GR tool to improve the integration of multi-sensor-track (MST) and logging data. Leg 193 could employ a modified high-temperature core-barrel tool. Goldberg also noted other activities involving seismic-log integration and the log database.

Shipley wondered if the shear-log data mentioned in the Leg 190 report represent something new. Goldberg confirmed that these data reflect a new logging capability.

E. Committee, panel, and PPG reports

E.1 EXCOM

Hay reported on news from the two previous EXCOM meetings, including the charge to SCICOM for developing an ODP legacy document and a phase-out plan for the JOIDES science advisory structure. Hay also mentioned that EXCOM approved the general ship track for the remainder of the program and endorsed the intent of SCICOM to forward ODP proposals to IODP.

Pisias asked about the contractual obligation of ending ship operations in a U.S. port. Fox explained the contract and confirmed that it does contain such an obligation.

E.2 TEDCOM

Alister Skinner reported briefly on the TEDCOM recommendations that OPCOM would review, emphasizing the need to measure the effects of the new system for active heave compensation (AHC). He also stressed the importance of documenting the currently used ODP tools as a legacy for the future program.

E.3 ESSEP

Neil Lundberg reported on the previous SSEPs meeting, noting that only two proposals went for external review. The SSEPs evaluated previous reviews for nineteen other proposals and received nine new pre-proposals, five new addenda, and six new APLs. Lundberg explained the meaning of the proposal grouping numerals assigned by the SSEPs. He then summarized the groupings assigned to the current set of proposals and advised about relevant proposals not yet forwarded to SCICOM.

E.4 ISSEP

Julie Morris reported on the proposal groupings assigned by ISSEP and identified the proposals deemed most worthy of drilling before the end of the program.

Pisias asked whether the SSEPs discussed the Antarctic proposals in the context of devising the best overall strategy for a combined program. Lundberg replied that the SSEPs discussed priorities in that sense because of the overwhelming number of proposals they had to consider. They also discussed the rotation of watchdogs for those particular proposals.

E.5 SciMP

Tom Janecek deferred the SciMP report until the OPCOM meeting.

E.6 SSP

John Diebold reported on the recent SSP meeting, noting that panel had received an APL for the first time, concerning sites not directly related to another proposal. He stated that SSP favors the SciMP recommendation on submitting digital data to the site-survey data bank. Diebold also noted that SSP discussed membership issues and the upcoming phase-out period.

E.7 PPSP

Mahlon Ball did not attend the meeting but submitted a written report from PPSP.

E.8 Extreme Climates PPG

Jim Zachos delivered the final report of the Extreme Climates PPG. He explained that the group decided to focus on transient climates or abrupt climate change events that offer a large signal to noise ratio and good global correlation. They also elected to focus more on warming rather than cooling events, and consequently on the potential effect of rising greenhouse gas levels on climate. Zachos described several drilling proposals and legs designed by the PPG and identified the late-Paleocene thermal maximum (LPTM) and similar methane-related events as a particularly interesting

Coffin asked if the recommendation that ODP had not drilled properly in the Pacific Ocean for studying climate properties also implies a similar lack of proper drilling for such studies in the Atlantic and Indian Oceans. Zachos characterized the Pacific Ocean as critical for constraining global carbon models. D Hondt noted the importance of the Pacific for also investigating the global nature of oceanic anoxic events. Miller commended the Extreme Climates PPG for a job well done.

E.9 Arctic s Role in Global Change PPG

Martin Hovland reported on the interim progress of the Arctic PPG. The group recommends forming a detailed planning group for project management of Arctic drilling at least two years before the anticipated start of drilling. Preliminary estimates indicate that an Arctic drilling leg will cost up to twice as much as a standard leg. Hovland spoke of the need for contingency plans for ice management and site abandonment. He also outlined the content of the final report that the PPG will complete in 2001.

Hay asked if a suitable barge exists for drilling in the Arctic, and Hovland answered yes. D Hondt asked if the estimated cost of an Arctic leg includes icebreakers. Hovland said yes and noted that an Arctic leg would require at least two icebreakers. Sweden has already committed the *Oden* for possible use by ODP, and such a project would ideally use a Russian nuclear-powered icebreaker as well. D Hondt asked about dating of the available sediment cores from the Arctic. Miller noted that Arctic stratigraphy relies mostly on silicoflagellates for dating.

F. International Continental Scientific Drilling Program (ICDP) activities

Ulrich Harms provided background information on ICDP. He described past drilling projects in Lake Baikal, Owens Valley, and on Hawaii. Harms also described various pieces of drilling equipment acquired for future ICDP projects in Mexico, China, Japan, and elsewhere.

D Hondt asked whether the ICDP drilling equipment could really withstand temperatures of 300-500ßC. Harms confirmed that a cooling mechanism enables the drilling tools to withstand such temperatures. Ludden asked if the ICDP drilling barge could operate in a lagoonal, reef environment. Harms imagined that it could. Miller described the GLAD800 system as designed for water depths of less than 200 m and seas less than 1 m. Harms added that the rig could probably operate in deeper water if placed on a barge with dynamic positioning.

Wednesday, 2 August 2000.....8:30 AM

PARALLEL SESSIONS

****

SCICOM Meeting (chaired by Hay)

Bill Hay reconvened the committee meeting at 8:30 AM in a closed session for presenting and discussing drilling proposals. Participants included only the non-conflicted SCICOM members and alternate members, plus the chairs of SSEP and SSP. All other attendees with either a conflict of interest on a drilling proposal or else no direct role in reviewing the drilling proposals participated in the separate subcommittee meeting concerning the ODP legacy and JOIDES phase-out plan.

G. Presentation and discussion of drilling proposals

SCICOM began reviewing the scientific merits of thirty-three drilling proposals (see listing below under Item J) and five ancillary program letters (APL-10, 11, 12, 14, and 16). Each proposal and APL received approximately twenty minutes for presentation and summary of its objectives by the watchdogs, followed by comments from the other participants.

****

SCICOM Subcommittee I Meeting (chaired by Miller)

Ken Miller called the subcommittee meeting to order at 8:45 AM. Participants included the two other conflicted SCICOM members, D Hondt and Robertson, the chairs of TEDCOM and SciMP, and all other liaisons and guests with no direct role in presenting and discussing the drilling proposals.

H. ODP Legacy

Miller introduced the topic of documenting the ODP legacy and referred to the following charge from EXCOM.

EXCOM Motion 00-2-5: EXCOM requests SCICOM to develop an ODP legacy that includes, among other things, the following:

- 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 developments, from TEDCOM with help from LDEO and TAMU,
- a reply to the question How well did ODP do in answering the questions originally asked? This study should consider all phases of ODP (*i.e.*, it should extend back to COSOD 1).

EXCOM would like to receive a draft report on the ODP legacy at its June 2001 meeting.

Miller suggested using the ODP Long-range Plan (LRP) as a basic outline for the legacy document. He thought the document should include a one-page executive summary of accomplishments, a few pages of text per theme of the LRP, and a list of things that ODP did not accomplish. Miller said that if the group agreed with this general idea, they must identify the specific topics and authors as well as the audience of the legacy document.

T. Moore advised to minimize the length of the document. Dauphin suggested including good figures. Robertson said that it would simplify the editorial job to stipulate the length and format and to supply a template for use by multiple authors. He also wanted to identify the intended audience and exactly how the legacy document would benefit the new program. T. Moore noted that IPSC targeted the IODP Science Plan at informed scientists. Salisbury believed that the legacy document should also serve the purpose of convincing the funding agencies about the need for a new program, and the group agreed. Dauphin mentioned that USSAC intends to write a companion document for the IODP Science Plan, and they could certainly make use of an ODP legacy document. Robertson confirmed that the U.K. and other European countries also intend to prepare a companion document for the IODP Science Plan.

D Hondt asked if the legacy document should consider only ODP. Miller said yes, according to the charge from EXCOM. Salisbury questioned the idea of making such a distinction because ODP has built upon the legacy of DSDP. Skinner suggested describing the things done by ODP that DSDP failed to do. Miller agreed that the legacy document should include a section showing how ODP built on the foundation of DSDP. Pezard preferred focusing on the achievements and ignoring the failures because the funding agencies might take an unfavorable view. Zachos suggested that some of the failures stem from a lack of time and the limit of having only one ship. He added that the mission of ODP expanded on the run as we answered old problems and encountered new ones.

Miller commended Salisbury for the list of achievements published in the recent Canadian ODP newsletter, and he asked whether JOI intends to produce another greatest-hits volume. Farrell said that USSAC and others have expressed interest in doing so, but JOI has only committed to compiling a database of publications. Robertson expected diminishing returns from a second greatest-hits volume but suggested extracting a list of them from the legacy document at a later stage. Pezard asked whether the greatest-hits list would have a different audience than the legacy document. Farrell noted that JOI and USSAC designed the previous greatest-hits volume primarily for educational and publicity purposes and not to sell the program for funding. Miller suggested that SCICOM could revisit the issue of producing a greatest-hits list after completing a draft of the legacy document.

The group assigned a working title of *Achievements and Opportunities of Scientific Ocean Drilling* to the legacy document. Miller discussed how to define the outline of the document based on the themes and initiatives of the LRP. Others suggested beginning with the reports of COSOD and COSOD II. The group subsequently identified nine sub-themes under the heading Dynamics of Earth s Environment and seven sub-themes under Dynamics of Earth s Interior. They also identified a list of candidates for writing each section and noted that those responsible for individual chapters should highlight any particularly exciting or unexpected results. The group agreed that the legacy document should include a bibliography, dispersed section by section. The discussion then turned toward identifying a potential editorial review board. Further discussion ensued about the possibility of publishing a multi-volume report that would synthesize the results of the entire program.

Farrell reported on efforts at JOI to compile a database of publications on ODP results and noted an ongoing debate over whether to include abstracts and publications derived from DSDP. He mentioned the possibility of increasing the value of the database through various means, but with added cost and time, and he cited the problem of excluding papers because of the limits of keyword searches.

Pezard asked about the timeline of the JOI effort and whether this project represented strictly a U.S. effort. Farrell described the project as international in scope with no fixed timeline yet. JOI has an intern working on it and should complete it some time next year. Robertson asked if the search included only publications in English. Farrell saw that as the easiest way to start but not a necessary limit. D Hondt asked about the difficulty of tracking the national origin of all authors on the papers. Others stressed the value of creating a usable database, searchable by scientific fields or for keywords. Farrell acknowledged the added value of categorizing each paper by fields or keywords, or the authors by nationality, but emphasized the cost and labor of doing so. Dauphin raised the issue of accountability for participating scientists, and Miller suggested trying to tie in the database with the publication requirements of ODP. The subcommittee concluded that SCICOM should strongly encourage JOI and TAMU to continue their efforts in creating a publications database.

The group then discussed the EXCOM request for a description of technical developments from TEDCOM, LDEO, and TAMU and wondered if it would suffice merely to endorse TEDCOM Recommendation 00-1-4. D Hondt interpreted the EXCOM motion as intended more for identifying and publicizing the major technical developments rather than producing a user s manual. Miller concluded that SCICOM should instead recommend producing a one-page summary of technical developments emphasizing how they contributed to the science program. D Hondt and Pezard suggested that this effort should apply to all coring, logging, and laboratory tools and thus

I. Phase-out plan for JOIDES Science Advisory Structure

Miller referred to EXCOM Motion 00-2-3 that requests SCICOM to develop a draft phase-out plan for the JOIDES Science Advisory Structure, for review by EXCOM in June 2001. He then asked Ted Moore to give a brief progress report on the establishment of the interim IODP science advisory structure (iSAS). Moore reported that iSAS probably would resemble JOIDES closely in size and shape, though with an increase in Japanese membership and a decrease in U.S. membership. He expected that iSAS and JOIDES panels would meet in parallel until the end of ODP. For example, iSSEP should begin working as soon as possible, preferably by 2001. Moore noted that IPSC has not yet developed the mandates of the iSAS panels and committees or answered the question regarding to whom those committees would report, and he cited the difficulty of proceeding before establishing the necessary international agreements and funding arrangements.

Robertson said that other countries want to see what they will get for their money before deciding whether to join IODP. He recalled that ODP had developed the LRP under pressure from Council to move away from a proposal driven system, and he expressed concern that existing proposals designed for the current LRP might not fit the science plan of the new program. Farrell believed that ODP had not turned down any proposals because they did not fit into the LRP. Miller doubted whether even the top-ranked ODP proposals could sustain the momentum to last for six to eight years before drilling in IODP. Moore stressed the importance of informing proponents whether they need to revamp their proposals, and he wants to establish the iSAS panels with the power to answer those types of questions. Srivastava questioned the need for iOPCOM. Moore replied that IODP would need advice from iOPCOM before 2003.

Farrell asked if any JOIDES committees would need to exist beyond 2003. Moore thought that ODP might still need some of the higher level committees for oversight. Dauphin stated that the U.S. would assume all obligations for ODP after the end of September 2003, when the current MOUs expire. Robertson suggested that some committees or panels might not need to hold formal meetings but instead could handle problems by email as they arise. Janecek suggested that panel meetings should occur only if the chair submits an agenda showing the need for a meeting. Dauphin noted that iSAS holds no legitimacy among the current ODP partners. Furthermore, the JOIDES advisory structure must execute all tasks required by the existing MOUs. He therefore advised against the idea of dismantling the JOIDES advisory structure or abandoning its meeting schedule before the end of ODP.

Miller supposed that SCICOM, for example, could meet again in 2002, perhaps only briefly, but in succession with iSCICOM, and he asked for input on the tasks envisioned for SCICOM until ODP ends. Robertson thought that the program would need continuing input from SCICOM for prioritizing drilling sites and approving the recommendations of TEDCOM and SciMP. Miller suggested that OPCOM should continue serving as a subcommittee of SCICOM and meet as needed until 2003. The subcommittee also believed that SSP and PPSP should remain active until the end of ODP drilling, and they viewed it as appropriate for PPGs to work on future planning.

Miller raised the question of whether the SSEPs need to continue beyond 2001 and whether they should contribute toward documenting the ODP legacy as mandated and requested by EXCOM. Robertson worried about giving the impression of more of the same if the SSEPs continue, but he recognized the importance of having an overlap between the old and new panels. Moore expected that many current SSEP members would also serve on iSSEP and thus might not have time for working on the ODP legacy. Dauphin noted that SCICOM has the right to seek help on the legacy document and should logically turn to the SSEPs. D Hondt added that the SSEPs would also still

shepherding until the end of the program. He noted that IWG presently has nearly the same membership as ODP, except the U.S. and Japan will have equal representation on the new panels.

D Hondt questioned whether the current panel chairs should continue serving or rotate as scheduled. Moore suggested having different chairs for JOIDES and iSAS panels. Robertson favored the idea of parallel advisory structures because that would allow the greatest flexibility. Farrell said that the U.S. has no funds available to support the phase-in of the new program before October 2003. Pezard agreed that JOIDES and iSAS committees should have overlapping memberships but not overlapping duties. Dauphin noted that JOIDES has already participated in planning for IODP, and he imagined that the national program committees would eventually say how they want to staff the IODP panels. Dauphin hoped that NSF and STA could reach an agreement soon on the IODP management structure and thus lay the foundation for defining the IODP advisory structure.

Miller noted that EXCOM Motion 00-2-3 also requests JOI and the JOIDES Science Advisory Structure to develop options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies, for review by EXCOM in January 2001. After a brief discussion, the subcommittee decided that SCICOM should direct SciMP to continue its activities in this regard. Miller felt satisfied with the accomplishments of the subcommittee regarding the phase-out plan and suggested forwarding the recommendations to EXCOM in January 2000, pending approval from the rest of SCICOM (see SCICOM Motions 00-2-15 and 00-2-16 below).

Thursday, 3 August 2000.....8:30 AM

PARALLEL SESSIONS

****

SCICOM Meeting

SCICOM reconvened at 8:30 AM in a closed session with only the non-conflicted members and alternate members, plus the chairs of SSEP and SSP. Once again all other attendees with either a conflict of interest on a drilling proposal or else no direct role in reviewing the drilling proposals participated in the separate subcommittee meeting.

G. Presentation and discussion of drilling proposals (continued)

SCICOM finished reviewing the scientific merits of thirty-three drilling proposals and four ancillary program letters (APL), as begun the previous day.

J. Vote on scientific ranking

SCICOM excluded Proposal 499-Rev (Equatorial Pacific ION) from ranking and forwarded it directly to OPCOM for possible scheduling, as stipulated in SCICOM Motion 99-2-22.

SCICOM Motion 99-2-22: SCICOM recognizes the importance of completing the high-priority ION sites and thus intends to schedule Proposal 499-Rev before the end of the current program. SCICOM will forward this proposal to OPCOM for possible scheduling at the August 2000 meeting.

SCICOM decided not to rank Proposal 478-Full4 (Eastern Nankai Subduction Processes) and Proposal 520-Full3 (Kyushu-Palau Ridge) because the proponents of these two proposals had not responded to previous comments and requests of SCICOM and the SSEPs.

SCICOM then voted by closed ballot to establish a global scientific ranking for the thirty remaining drilling proposals, as summarized below.

Rank	Proposal		Mean score	Std. dev.
1	533-Full2	Arctic Ocean	5.20	5.31
2	534-Full	Shatsky Rise	5.80	5.75
3	525-Full	MAR Peridotite	7.93	6.05
4	571-Full	Peru Biosphere	8.13	4.69
5	505-Full3	Marianas Conv. Margin	8.93	8.30
6	455-Rev3	Laurentide Ice Sheet	9.27	6.65
7	482-Full3	Wilkes Land	10.40	5.93
8	544-Full2	Costa Rica	10.87	7.76
9	559-Full	Walvis Ridge	11.73	6.06
10	564-Full	New Jersey Shelf	12.40	6.13
11	539-Full2	Blake Hydrates	12.80	6.13
12	512-Full2	Core Complex	13.27	6.09
13	522-Full2	Fast Spreading	14.93	6.40
14	577-Full	Demerara Rise	14.93	9.01
15	549-Full2	Arabian Sea OMZ	15.20	6.57
16	560-Full	Woodlark Basin	15.33	9.27
17	514-Full4	Maldives	15.53	8.14
18	537-Full3	Protoseismogenic Zone	17.47	9.79
19	551-Full	Hess Deep	17.93	8.09
20	489-Full2	Ross Sea	18.47	6.59
21	545-Full2	Juan de Fuca Fluid Flow	18.80	5.70
22	519-Full2	Sea-Level Rise S Pac.	19.07	7.89
23	553-Full	Cascadia Margin	19.27	3.95
24	570-Full	East Pacific Rise	20.47	5.37
25	555-Full2	Crete	21.07	6.77
26	566-Full3	Nankai Hydrates	22.00	6.37
27	477-Full2	Okhotsk and Bering Seas	22.27	8.88
28	535-Full2	735-Deep, Slow Spreading	24.67	5.26
29	521-Full5	Indus Fan	24.87	5.80
30	503-Full2	Weddell Basin	25.27	4.70

In addition to Proposal 499-Rev, SCICOM agreed by consensus to forward the top twelve ranked drilling proposals as well as APL-10 and APL-14 to OPCOM for possible scheduling.

SCICOM Consensus 00-2-3: SCICOM decides to forward the top twelve ranked drilling proposals plus APL-10 and APL-14 to OPCOM for possible scheduling.

****

SCICOM Subcommittee I Meeting (chaired by Miller)

H. ODP Legacy (continued)

The subcommittee reviewed the plan drafted yesterday concerning how to document the ODP legacy. Miller explained that the subcommittee had thus far: developed an outline of themes using the LRP, COSOD, and COSOD II reports; proposed a series of potential authors, indicating the

legacy document. The subcommittee had also concluded that the target audience should include EXCOM, national science boards, and the general scientific community. The group then discussed the idea of holding general science meetings or workshops related to the four major themes of the legacy document. These meetings would serve to determine and evaluate its final content.

I. Phase-out plan for JOIDES Science Advisory Structure (continued)
The subcommittee completed its work on the phase-out plan the previous day and thus did not discuss it further here (see Item Q for the related motions approved by the full committee).

Thursday, 3 August 2000.....1:00 PM

PARALLEL SESSIONS
****

SCICOM Subcommittee II Meeting (chaired by Coffin)

The majority of SCICOM, excluding those members serving on OPCOM at this meeting (Hay, Moore, Pisias, Robertson, and Shipley), met in a separate session parallel with OPCOM. With Pearson alternating for Robertson as the U.K. representative, the committee determined that it held the requisite membership quorum to act with full authority.

K. Status of PPGs

K.1 Deep Biosphere PPG and microbiology recommendations
Steve D Hondt reported on recent progress in establishing and using the microbiology lab aboard the *JOIDES Resolution*. He noted the scientific achievements thus far, through Leg 190, but suggested that microbiology has not yet fully integrated itself into the routine shipboard activities.

Keene asked about the availability of documents describing the shipboard microbiology facilities. Coffin asked whether a position description existed yet for shipboard microbiology. D Hondt characterized both as works in progress.

Nils Holm presented a mandate drafted by John Parkes for a proposed microbiology oversight group. He also presented a detailed review of the proposed mandate regarding development and assessment of standard protocols, quality control and data interpretation, and promotion of deep biosphere opportunities in ODP. Holm concluded that SCICOM should refrain from establishing a microbiology oversight group at least until the PPG submits a final report and the SSEPs have evaluated it.

Morris thought that the Deep Biosphere PPG had communicated poorly with the SSEPs from the beginning, partly because of a lack of prior ODP involvement and an uncertainty of how to fit in. Lundberg suggested asking the entire group for a final report.

K.2 Other PPGs
The committee discussed the status of the other PPGs. Morris stated that in March 2000, the SSEPs Chairs requested final reports from the chairs of the Deep Biosphere, Shallow-water Systems, and Extreme Climates PPGs. Only the latter group responded. Lundberg noted that the Shallow-water Systems PPG informally requested SCICOM to extend their term. The SSEPs chairs asked this group to justify their request in writing, but again have not received a response. Lundberg rated the Extreme Climates PPG report as excellent and said that the Gas Hydrates PPG submitted a good report that needs only minor revisions. He described the Climate and Tectonics Links PPG report as brief and lacking specific recommendations for a drilling program.

Morris characterized the draft Architecture of Oceanic Lithosphere PPG report as strong on scientific issues but weak on the technical aspects of drilling. It also lacks an executive summary. The AOL PPG apparently discussed drilling strategies and techniques in their meeting, however, and perhaps could add this to their final report. Phillipe Pezard, a member of the AOL PPG, said they spent their whole first meeting trying to decide what their mandate meant and how they should proceed. Miller wondered how to get a final report from all of the groups and recommended trying to repair any damaged communication lines. Coffin thought it looked like the SSEPs chairs had succeeded in establishing good communication with the newest PPGs. Lundberg said it would help to have more than one liaison between the SSEPs and each PPG.

L. Discussion of panel chairs, memberships, and liaisons

Coffin informed the committee about upcoming membership rotations on various JOIDES panels. He noted that SCICOM must name a successor to the current SciMP Chair, who would finish his term after the next meeting. Coffin expected that Janecek would present a recommendation from SciMP tomorrow.

The committee decided to retain the current SCICOM watchdogs for the Arctic, Deep Biosphere, and Hydrogeology PPGs (D'Hondt, Holm, and Fisher, respectively) and the liaison for ICDP (Rea). They also nominated new liaisons for InterMargins (Wiens), InterRidge (Holm), IMAGES (Mayer), and PAGES (Hay).

Ludden expressed dismay about the lack of international panel chairs, noting that JOIDES would not have any non-U.S. panel chairs as of January 2001, except for the Arctic PPG. Coffin noted the opening for a new SciMP Chair. Rea thought that an ability and willingness to do the job ought to count more than nationality in appointing panel chairs.

SCICOM Motion 00-2-4: SCICOM notes the current imbalance between U.S. and non-U.S. panel chairs and recommends establishing a balanced representation as soon as possible.

Holm moved, Miller seconded, 11 in favor, 1 opposed (Rea), 1 abstained (Pearson), 2 absent (Hay, Pisias).

M. Other matters

M.1 Guidelines for approving second post-cruise meetings

The subcommittee considered a draft motion to establish formal guidelines for approving second post-cruise meetings, as put forth by the ODP managers.

SCICOM Draft Motion: SCICOM requests that all second post-cruise meetings of the shipboard scientific party occur in ODP member countries, with approximately 50% in the U.S. Whenever possible these meetings should occur in conjunction with other international science meetings. The choice of a meeting location should not depend on the desire to hold an affiliated geological field trip.

Schuffert explained the history behind the proposed motion and noted that the JOIDES Office, TAMU, and JOI all agreed upon the usefulness of these guidelines. Pearson questioned the relevance of this matter to SCICOM. Although the committee recognized the value of such guidelines, they concluded that this matter did not involve any scientific issues that justified input from SCICOM and therefore declined to vote on the proposed motion.

M.2 Establishment of a detailed planning group (DPG) for Arctic drilling

Given the high ranking of Proposal 533-Full2, the subcommittee discussed the idea of establishing a detailed planning group (DPG) for Arctic drilling. One SCICOM member suggested that the DPG

aspects of Arctic operations. The committee voted to establish the DPG but did not decide upon its mandate or membership.

SCICOM Motion 00-2-5: SCICOM establishes a detailed planning group (DPG) to investigate the logistical, technological, and budgetary requirements for Arctic drilling related to Proposal 533-Full2. The DPG will prepare a report on these issues for SCICOM to review in August 2001.

Rea moved, Moore seconded, 12 in favor, 3 absent (Hay, Hodell, Pisias).

M.3 Request for proposals for drilling deep holes

The subcommittee also debated what to do about the past request for proposals (RFP) for drilling a deep hole. Bloomer suggested forming a DPG to address this issue. D Hondt did not want to devote one of the remaining ODP legs to drill a deep hole just for the sake of doing it. Morris regarded the idea as having scientific as well as technical value and worried about losing those proponents from the program. Pezard agreed about the need to encourage that side of the scientific community, and he cited the mere existence of the Architecture of Oceanic Lithosphere PPG as an acknowledgement of the importance of drilling a deep hole. He noted that drilling through an intact section of ocean crust represents one of the main objectives of the LRP and a pervasive theme of the AOL PPG final report. Ludden did not see any need for a DPG and suggested that the watchdog letters to the proponents could stress the importance of deep drilling. Rea noted that the IODP science plan should guide the science of the new program.

M.4 Ancillary Program Letters

The subcommittee debated whether to establish a more limited definition for Ancillary Program Letters (APL). Morris explained that several of the recently submitted APLs seem more like proposals for separate mini-legs rather than strictly ancillary programs. Lundberg recognized the possible advantages of drilling a few mini-legs, but only after appropriate panel and peer review. T. Moore noted that the program had previously accommodated APLs successfully with Palmer Deep and Saanich Inlet, but those projects took only one or two days of drilling time. The subcommittee agreed that APLs should not take significant time away from a scheduled drilling leg. They suggested limiting APLs to the general vicinity of the ship track and to no more than a few days of ship time, though with some room for flexibility.

SCICOM Motion 00-2-6: SCICOM requests the JOIDES Office to revise the ODP guidelines for submitting Ancillary Program Letters as follows, with new text shown as underlined:

<u>Ancillary programs are generally limited to the general geographic area of leg operations and to no more than 2-3 days of dedicated ship time.</u> Requests for accommodation of ancillary programs in the Ocean Drilling Program should be submitted in the form of an Ancillary Program Letter to the JOIDES Office <u>in accordance with normal proposal deadlines</u>.

Rea moved, Pisias seconded, 15 in favor.

N. SCICOM Subcommittee I report

Miller explained the rationale behind the development of four draft motions during the separate subcommittee session concerning the ODP legacy and JOIDES phase-out plan (see Items H and I above). He presented an outline for a legacy document based on the initiatives of the LRP, COSOD, and COSOD II. The subcommittee submitted a list of suggested writers for each sub-theme of the legacy document and nominated potential members for an editorial review board with expertise in each of the four proposed main themes.

Pearson asked where the evolution of marine biota fit within the proposed outline. Miller suggested

theme from ocean history to earth history. Moore could not recall any proposals that addressed the evolution of the biosphere. Pearson stressed that ODP had produced the best examples available for evolution of species. Morris suggested that the SSEPs could serve as an editorial review board for the legacy document. The committee deferred voting on the draft motions until the next day (see Item Q below).

****

OPCOM Meeting

OPCOM met in parallel with the SCICOM Subcommittee II. The OPCOM minutes appear separately.

Friday, 4 August 2000 ..... 8:30 AM

SCICOM and OPCOM Joint Meeting

O. Items forwarded from OPCOM

O.1 OPCOM consensus items

OPCOM Consensus 00-2-1: If and when funds become available, OPCOM recommends that JOI allocate funds for the following two projects, in priority order:

1. Purchase of an off-the-shelf shipboard digital core scanner by ODP-TAMU, as per SciMP Recommendations 99-2-12, 00-1-4, and 00-2-2.
2. LDEO-BRG and ODP-TAMU deployment of measurements-while-drilling technology on Leg 196 (originally scheduled for Leg 193) to evaluate the performance of the newly installed system for active heave compensation (AHC), as per TEDCOM Recommendation 00-1-2.

OPCOM Consensus 00-2-2: OPCOM recommends that LDEO-BRG reprogram the cost savings from the engineering of a fluid sampling tool (large-diameter tool) into modifying the high-temperature core-barrel sensor for Leg 193, as endorsed by SciMP in June 2000.

SCICOM Consensus 00-2-7: SCICOM approves OPCOM Consensus 00-2-1 and 00-2-2.

O.2 TEDCOM recommendations

Alister Skinner briefly explained the TEDCOM recommendations forwarded from OPCOM.

TEDCOM Recommendation 00-1-1: Following the excellent progress on the AHC installation and monitoring of its effectiveness, TEDCOM requests that SCICOM ensure that ODP-TAMU proceed quickly with the simulation studies which can now use real data. This is required in order to build a model, analyze existing observations, predict what may happen in different geological and geographical areas, and allow unexplained or aberrant behavior when using the AHC to be analyzed.

TEDCOM Recommendation 00-1-2: TEDCOM requests that SCICOM take steps to ensure immediate collaboration between ODP-TAMU and LDEO-BRG in order that their combined expertise be pooled to provide a comprehensive package of down hole and rig floor instrumentation for upcoming Leg 193 and any future sensor developments. If necessary both should prioritize their objectives and should be supported with funding if necessary in order that the studies shown by both parties at the current meeting be properly harnessed for effective use by the program.

TEDCOM Recommendation 00-1-3: TEDCOM requests that SCICOM ask ODP-TAMU to review their approach to poor core recovery in unconsolidated, non-cohesive sediments and when doing so bear in mind existing tools available in the geotechnical industry together with ones currently under development.

TEDCOM Recommendation 00-1-4: TEDCOM requests SCICOM to ensure that, before the end of the current program, ODP-TAMU have an up-to-date inventory of all their existing operational tools, and that each has a folio of up-to-date drawings and an operational manual, together with a digital copy of the information in a commonly available format. This is probably the best legacy that engineering can give to IODP, and it should therefore be a requirement that the Borehole Research Group at LDEO also comply with regard to all down-hole logging tools and associated software.

Hay noted that OPCOM had already endorsed all of the TEDCOM recommendations and asked SCICOM to approve them by consensus. No one objected or offered any further comments.

SCICOM Consensus 00-2-8: SCICOM approves TEDCOM Recommendations 00-1-1 through 00-1-4.

O.3 SciMP recommendations

Tom Janecek briefly explained the SciMP recommendations forwarded from OPCOM.

SciMP Recommendation 00-2-1: SciMP recommends that a temporary working group be established to advise SciMP on the minimum capabilities needed for a routine core-log-seismic data integration program aboard the *JOIDES Resolution*.

Mandate:

1) Evaluate required shipboard facilities for acquiring and processing seismic data (U/G and VSP).
2) Evaluate required shipboard facilities for integrating and interpreting core-log-seismic data.
3) Evaluate the need for shipboard scientific and technical staff support.
4) Evaluate how to obtain, store, and distribute digital seismic data.
5) Evaluate the requirements for shore-based facilities and personnel.
6) Estimate the cost of different aspects of the seismic laboratory.

Timeline:

The evaluation of required seismic acquisition and processing facilities on *the JOIDES Resolution* (U/G and VSP) should be completed by December 2000 and a report and recommendations presented at the December 2000 SciMP meeting. The final report and recommendations should be presented at the June 2001 SciMP meeting.

Members:

Members should include (but not necessarily be limited to) one person from SciMP, SSP, TAMU, LDEO, a shipboard scientist participating in the ODP-LDEO FY2001 pilot study, and an industry representative.

Meetings:

One to two meetings held at the LDEO Borehole Research Group facilities.

Hay saw a clear need for this working group. The Terms of Reference allow SciMP to form *ad hoc* advisory committees for such purposes. Coffin suggested that the mandate should include

Resolution has the capability now to do such interpretations. Reagan explained that the Borehole Research Group at LDEO has already installed IESX software onboard the ship to provide interpretation capabilities.

SCIMP Recommendation 00-2-2: SciMP recommends that JOI direct ODP-TAMU to reallocate current fiscal year funds to move forward immediately with the purchase of a single-track, moving-sensor, line-scan digital imaging system.

Janecek stated that SciMP regards this piece of equipment as the highest priority scientific instrument intended for shipboard use. Rea asked how much the system would cost. Janecek estimated the cost at $100K. Miller noted that ICDP has used such a system routinely for five years already, and ODP still does not have one. Hay suggested regarding this as a top priority, pending availability of the necessary funds.

SCIMP Recommendation 00-2-3: SciMP recommends that all investigators who produce data using leg-specific, non-ODP scientific analytical equipment and instrumentation on board the *JOIDES Resolution* follow all standard ODP data policies and data moratoriums. In all cases, these data should be made freely available in the same way that other shipboard data are distributed.

Coffin noted that this item represented only a recommendation and not a mandate.

SCIMP Recommendation 00-2-4: SciMP recommends that the ODP-IODP transition plan address the issue of long-term use of ODP boreholes, with particular emphasis on the distribution and archiving of data collected from these legacy holes.

Hay noted that this recommendation should go forward to IPSC for consideration.

SCIMP Recommendation 00-2-5: To establish a protocol for the consistent linking of metadata with digital single-frame images (*e.g.*, thin-sections, scanned core photographs), SciMP recommends that ODP-TAMU purchase and implement the use of an asset-management software/database (*e.g.*, Extensis Porfolio or Cumulus Canto). The database generated should interface with JANUS, have SQL compatibility, and be able to export data in a long-term archive format.

Pisias expressed concern about purchasing off-the-shelf software that might lack support in the future. He suggested instead that ODP should adapt the JANUS database for this purpose. Janecek worried that waiting another year or more for JANUS compatibility might preclude the project from happening at all. He noted that ODP could always export the data into JANUS later.

Hay noted that OPCOM had endorsed all of the SciMP recommendations, though without knowing the specific membership of the working group in the first recommendation. SCICOM fully approved the SciMP recommendations by consensus.

SCICOM Consensus 00-2-9: SCICOM approves SciMP Recommendations 00-2-1 through 00-2-5.

O.4 Presentation of drilling schedules

Baldauf presented a single draft operations schedule through Leg 205. The proposed plan involved a rescheduling of several programs in late 2001 and early 2002, including Paleogene Equatorial Pacific (from Leg 198 to 199), Hydrate Ridge (from Leg 199 to Leg 204), and Southeast Pacific Paleogene (from Leg 201 to 202). Newly scheduled programs for 2001 and 2002 included the

Margin Deep Biosphere (Leg 201), Costa Rica Subduction Zone (Leg 203), and Equatorial Pacific ION (Leg 205). Baldauf noted that the proposed schedule places Leg 198 in a typhoon window.

Keene asked about the two APL considered by OPCOM. Baldauf replied that neither APL made it onto the schedule. C. Moore added that OPCOM viewed the highly ranked leg science as a priority and saw no compelling proposals among the APL. Ludden asked if OPCOM had devised an alternate scenario that involved sending the ship into the Atlantic Ocean. Baldauf answered no. Wiens thought that SCICOM had discussed scheduling the Mariana proposal as a full leg. He expressed concern that as a mini-leg it might subsequently drop off the schedule entirely. C. Moore explained that OPCOM interpreted the rankings fluidly to schedule as many high-priority proposals as possible. Morris noted that the SSEPs had grouped Mariana as a mini-leg. She also mentioned that the Leg 190 report by G. Moore implied that the operational plan for Leg 196 might change. Baldauf said that TAMU would examine that issue later this year.

Hay commended Baldauf and Fox for their hard work in preparing the draft operations schedule. He also noted that this schedule would require approval from EXCOM because it changes the FY2001 program plan.

P. Vote on schedule (non-conflicted SCICOM members only)
SCICOM recognized that although the full Mariana proposal lacked sufficient site-survey data, the mini-leg version did not. Several committee members wanted to devise a strategy for ensuring that the highly ranked Mariana proposal stays on the schedule regardless of budget constraints. Fox explained that Mariana would not fit elsewhere on the schedule, and in case of a budget shortfall TAMU would present a list of possible cuts in the overall FY2001 program at the managers meeting in September. Farrell estimated that $100-200K of uncommitted funds might carry over from FY2000 to FY2001. He also characterized the issue as a matter of timing concerning the availability and expenditure of funds and not just a matter of priorities. Hay suggested prioritizing Mariana above the other equipment expenses already identified as high priorities (see OPCOM Consensus 00-2-1 above). Other committee members agreed. Harms noted that ODP could perhaps use the digital core scanner of ICDP for one leg. With Hodell alternating for Miller, SCICOM passed the following motion.

SCICOM Motion 00-2-10: SCICOM prioritizes leg operational expenses for FY2001 over additional expenditures such as the purchase of a digital camera and measurements-while-drilling (MWD) work on Leg 196.

Moore moved, Holm seconded; 14 in favor, 1 absent (Pisias).

One SCICOM member questioned the overall time devoted by ODP for drilling three ION sites and suggested deferring the Equatorial Pacific ION leg until IODP, thus adding one month of scheduling flexibility to the remainder of ODP. A second member saw merit in reconsidering the necessity of committing now to drilling the final ION site, whereas another member argued in favor of honoring the previous commitment to this proposal. Baldauf stated that TAMU would prefer to schedule some proposal as Leg 205 now because that particular leg straddles the fiscal year boundary. Hay suggested leaving the Equatorial Pacific ION leg in the schedule but writing a letter to the proponents asking when they expect to install the instruments. Other members agreed, noting that SCICOM had scheduled legs in the past on a contingency basis. Bloomer wondered if SCICOM should devise an alternate plan now, in case the ION proponents respond that they cannot install their instruments until sometime after IODP begins drilling. Rea thought that SCICOM could wait until its next meeting to decide that if necessary. With Hodell alternating for Miller, SCICOM voted

SCICOM Motion 00-2-11: SCICOM approves the following operations schedule for 2001 and 2002, contingent upon the proponents of Proposal 499-Rev informing us of the expected timeline for installing the ION observatory.

Leg	Proposal	
195	431-Rev	Western Pacific ION
"	505-Full3	Mariana Convergent Margin (South Chamorro Seamount mini-leg)
196	517-Full	Nankai II
197	523-Full	Hawaiian Hotspot-Emperor Seamounts
198	534-Full	Shatsky Rise
199	486-Rev2	Paleogene Equatorial Pacific Transect
200	500-Full2	H2O Observatory
201	571-Full	Peru Margin Deep Biosphere
202	465----	Southeast Pacific Paleoceanography
203	544-Full2	Costa Rica Subduction Zone
204	546-Full	Hydrate Ridge
205	499-Rev	Equatorial Pacific ION

Rea moved, Moore seconded; 14 in favor, 1 absent (Pisias).

Q. Report and vote on motions drafted by SCICOM Subcommittees

Miller presented two motions drafted by the SCICOM Subcommittee I in response to the request from EXCOM concerning the ODP legacy (see Item H above). The committee voted to approve the draft motions without further substantive discussion.

SCICOM Motion 00-2-12: SCICOM strongly endorses the activities of TAMU and JOI in assembling a database of publications related to ODP. We further encourage them to make this database searchable (e.g., by index terms, geological age, and geographic region). We recognize the current lack of allocated resources for these activities, and we encourage their financial support.

Miller moved, D Hondt seconded; 15 in favor.

SCICOM Motion 00-2-13: SCICOM recommends that TEDCOM and SciMP, together with TAMU and LDEO/BRG, prepare a one-page summary for each tool (including drilling, coring, logging, and other measurement tools) developed by or for the ODP community, emphasizing how the tool contributed to the scientific results of the program. These summaries could serve as appendices to operational manuals and as a basis for compiling a technical reference document for the ODP legacy.

Miller moved, Coffin seconded; 15 in favor.

Miller then presented a plan for an ODP legacy document, also in response to the request by EXCOM (see Item H above). He explained that the legacy document should prove useful for international planning of IODP, for planning a series of meetings in 2002 to produce synthesis volumes of ODP results by theme, written in 2003 and published in 2004, and for producing a glossy greatest-hits volume.

SCICOM Motion 00-2-14: SCICOM endorses the following plan for preparing an ODP legacy document entitled *Achievements and Opportunities of Scientific Ocean Drilling*.

Outline

I. Dynamics of Earth s Environment

A. Earth s Changing Environment

1. Rapid climate change
2. Extreme climates
3. Climate response to orbital forcing
4. Causes and effects of sea-level change
5. 180 million years of ocean history

B. Sediments, Fluids, and Bacteria as Agents of Change

1. Sediment processes and budgets
2. Fluids in sediments and rocks
3. Formation of gas hydrates
4. Deep biosphere

II. Dynamics of Earth s Interior

A. Transfer of Heat and Material from Earth s Interior

1. Mantle and core dynamics
2. Ocean crust and mid-ocean ridge processes
3. Hydrothermal and sulfide mineral processes
4. Subduction factory

B. Lithosphere Deformation and Earthquake Processes

1. Passive continental margins and rift environments
2. Convergent margins and collisional settings
3. Earthquake mechanisms

Contents

Executive summary	5 pages
Short summaries of achievements for sixteen sub-themes	4-5 pages each
Introduction or statement of scientific issues and challenges	1 page
Bullets summarizing achievements and opportunities	1-2 pages
Summary of goals met	1 paragraph
Summary of future opportunities	1 paragraph
List of greatest hits (from bullets)	

Timeline

SCICOM Chair invites Editorial Review Board (ERB)	1 September 2000
ERB and SCICOM Chair invite authors	1 October 2000
Authors and ERB compile bullets and circulate among community	Fall 2000
Authors and ERB compile final bullet list	1 February 2001
ERB provides final bullet list to SCICOM	1 March 2001
Completion of short summaries	1 May 2001
Executive summary and excerpt of greatest hits	1 June 2001

C. Moore moved, Rea seconded; 14 in favor, 1 abstained (Shipley).

Miller summarized the views of the subcommittee concerning the anticipated duties of each JOIDES committee and panel until the end of ODP. SCICOM must remain available to provide scientific advice on operational issues that may arise during ODP drilling. Most important, SCICOM must

SCICOM may also have a role in cooperating with the nascent iSCICOM. OPCOM must remain available to evaluate operational issues during ODP drilling and should continue to exist as a subcommittee of SCICOM, meeting in person or by e-mail as needed in 2002-2003. Although PPSP and SSP will have completed much of their work upon the scheduling of the last leg, they must remain available to advise on possible operational changes until ODP spuds its last hole in 2003. TEDCOM and SciMP should continue until at least 2003, advising not only ODP, but also IODP. The subcommittee viewed such planning activities as not only appropriate, but also as necessary to meet the objectives of the LRP and the mandates of the JOIDES Terms of Reference. The SSEPs will presumably turn over all active proposals to the new iSSEPs after the August 2001 scheduling meeting. Although most scheduling-related activities of the SSEPs will end in 2001, they must remain available through September 2003 to evaluate ancillary program letters (APL) and participate in documenting the ODP legacy, as requested by EXCOM and mandated by the JOIDES Terms of Reference.

SCICOM Motion 00-2-15: SCICOM proposes to EXCOM that all committees and panels of the JOIDES Science Advisory Structure remain extant through September 2003. Although the duties of these committees and panels may diminish greatly after September 2001, and some of them may not need to meet in person, the program will continue to require their advice on scientific prioritization (SCICOM, SSEPs), shipboard operations (OPCOM, PPSP, SSP), shipboard measurements (SciMP), and technical developments (TEDCOM). The maintenance of the JOIDES Science Advisory Structure through September 2003 will allow the greatest flexibility in the transition to the interim IODP science advisory structure (iSAS). We foresee that some or all of the JOIDES committees and panels may meet in tandem with their iSAS counterparts.

Miller moved, D Hondt seconded; 15 in favor.

Coffin asked what had happened with the DSDP databases. Fox replied that the digital remnants went to NGDC while the analog data went to TAMU. D Hondt suggested mentioning the DSDP database in the motion, but Reagan objected over practical difficulties. Coffin assumed that such additional measures would have significant budgetary implications.

SCICOM Motion 00-2-16: SCICOM directs SciMP to continue advising JOI, TAMU, and LDEO/BRG in developing options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies.

Miller moved, Pisias seconded; 15 in favor.

R. Review of watchdog letters

SCICOM discussed the general content and format of the watchdog letters that the JOIDES Office would send to the lead proponents of the proposals considered at this meeting. Lundberg suggested that the letters should specify the submission deadline of 1 October 2000 for those proposals that may require another external review and the final deadline of 15 March 2001 for the last chance of scheduling in ODP. C. Moore noted that many recently updated proposals remain active but unlikely candidates for scheduling in ODP, and he suggested that SCICOM should try to avoid reconsidering those proposals next year. Sarg opposed the idea of deactivating a proposal and not forwarding it to IODP. Wiens noted that some proposals could only improve through a fresh start. Lundberg requested that proponents not receive any statement stronger than that SCICOM would most likely not schedule their proposal next year. Hay preferred indicating that SCICOM would definitely not schedule certain proposals and thus not reconsider them again next year.

SCICOM then reviewed the specific comments for each proposal, with assistance from the SSEPs chairs. Proposals that lie outside the expected area of operations for 2003 include 477-Full2, 482-Full3, 489-Full2, 503-Full2, 514-Full4, 521-Full5, 535-Full2, 537-Full3, 545-Full2, 549-Full2, 551-Full, 553-Full, 555-Full2, 560-Full, 566-Full3, and 570-Full. SCICOM agreed not to reconsider these proposals next year and instead forward them to IODP. Coffin suggested advising the proponents exactly when they could start submitting proposals to IODP. Malfait noted that IPSC suggested that iSSEP should begin reviewing proposals for IODP in 2001. Keene asked what would happen to the APLs. Lundberg recommended encouraging the proponents of the APLs to submit full proposals.

S. IODP planning

S.1 IWG Support Office

Jennifer Peterson reported on administrative activities of the IWG Support Office. She outlined plans for publicizing IODP at various professional meetings in 2000 and 2001. Peterson also described a new IODP brochure, available soon in English, French, German, and Japanese.

S.2 NSF/IWG

Malfait reported on NSF activities for IODP planning. He noted that the IODP website includes the minutes from all IODP planning meetings. Malfait presented a draft model of international arrangements for IODP. He anticipates two types of formal agreement, one for science and technical operations and another between NSF, STA, and other national funding agencies, similar to the current MOUs. NSF and STA hope to reach an agreement by mid 2001, with other agreements in place by early 2002 for the start up in October 2003. No intent exists to extend the present international agreements for ODP beyond September 2003. Malfait noted a formal joint statement by the Japanese science minister and NSF director that recognizes the ongoing collaborative effort for planning and implementing IODP. IWG has asked for help from JOIDES up to now, but sees a need over the next few years for a more independent group to begin planning IODP science activities. IWG will establish an international review committee for the IODP science plan, and Malfait outlined the schedule for the review process.

S.3 STA/OD21

Yoshiro Miki reported on STA activities and the status of OD21. He said that actual construction of the riser drilling ship would begin in early 2001. Miki noted that many students and several members of the Japanese Diet visited the *JOIDES Resolution* during the recent port call in Yokohama. He also mentioned the ongoing preparations for the next IWG meeting in Tokyo. Miki stated that the Japanese government plans to reorganize next year. The number of ministries and agencies will decrease from 23 to 11, and STA and Monbusho will merge. Universities and research institutes will collaborate more closely, and JAMSTEC will take a larger role in oceanography and geosciences. JAMSTEC will also open an office in Washington, D.C. in October 2000. Miki expects severe competition among various science and technology items in the FY 2001 budget request, due by the end of August, with many ambitious projects proposed. He mentioned the possibility of establishing a new Japanese research institute for marine sciences that would involve participation of international scientists. Meanwhile, Miki encouraged all present to visit JAMSTEC if in the area.

Hay asked for details on the new research institute. Miki envisioned fifteen research positions at the start, increasing later to perhaps thirty. Miller suggested that perhaps speakers from the USSAC distinguished lecturer series could visit Japan.

S.4 European initiative

John Ludden described the mandate of ESCOD related to IODP planning and said that a big science program such as IODP will most likely require coordinated European involvement. ESF, France, Germany, and the U.K. have committed funding for a technical coordinator, Alister Skinner, who will consider alternate platform possibilities. One of the next steps involves submitting a bid to the European Community to obtain extended funding for IODP planning efforts. The EC has agreed to hold a workshop in Brussels in November to define industry needs and interests in ocean drilling. Skinner added that he also hopes to explore options for industry involvement. The EC has funded the Fifth Framework Program for pan-European scientific cooperation. In addition, the European Union has shown great interest in ocean drilling and wishes to move toward a more integrated European involvement.

C. Moore asked if PacRim expects to participate in IODP. Keene said that Australia plans to send Trevor Powell as a representative to IWG. He noted a strong level of interest among scientists, with a workshop planned to write a companion document to the IODP Science Plan for applying for funding, but final plans remain uncertain.

S.5 IODP Planning Subcommittee (IPSC)

Hay explained the role of SCICOM in commenting on the IPSC report for forwarding to EXCOM. Ted Moore then began his IPSC report by encouraging SCICOM members to comment on the Conceptual Design Committee (CDC) report using the questionnaire available on the IODP website.

Moore outlined the IPSC proposal to establish an IODP interim Science Advisory Structure (iSAS) similar to the JOIDES Science Advisory Structure. He noted that JAMSTEC has volunteered to establish an iSAS support office similar to the JOIDES Office. IPSC recommends that JOIDES and iSAS panels should hold overlapping meetings during the transition phase beginning in 2001, with as little difference as possible in panel membership. The simplest scenario for iSAS involves an increase in the number of Japanese panel members and a decrease in U.S. numbers, but this depends upon the final agreement of IWG on representative membership and voting rights in the new program. Moore also outlined a schedule for when iSAS members should start attending JOIDES panel meetings as observers. For example, iSSEP should begin ranking proposals with regard to the IODP Initial Science Plan as soon as possible.

Farrell asked Moore to clarify the reporting structure of iSAS and whether the iSAS office would include an iSCICOM chair. Moore said that the iSAS panels must report to an oversight committee similar to EXCOM, but much else still depends on further negotiations. C. Moore asked how planning for riser drilling fits in the new advisory structure. Hay noted that PPSP considered at its last meeting how to do safety reviews for riser drilling and concluded that the process would require a long lead time of perhaps as much as five years. T. Moore said that IPSC expects to have a Detailed Planning Group (DPG) for each riser project and to have iPPSP begin working early. He invited PPSP to send a liaison to the next IPSC meeting.

Moore reported on the status of the IODP Initial Science Plan (ISP). Version 3.0 of the ISP has already gone to an outside editor and should appear on the IODP web site by the end of August. IPSC expects to deliver the ISP to IWG by 1 October 2000 and receive a response from them by early February 2001. Moore thanked Mike Coffin and the others involved in writing the ISP. Coffin thanked Nick Pisias and the organizers of CONCORD and COMPLEX for producing the documents vital to preparing the ISP.

Moore mentioned the need to obtain better cost estimates for all operational components of IODP.

database management, engineering development, logging, education and public relations. Moore highlighted the possibility of a new panel in IODP for industrial liaisons and stated that this panel might make TEDCOM unnecessary in iSAS. He noted that ODP has had success with placing individual industry scientists on JOIDES advisory panels, but not in developing contacts with individual companies, particularly in the U.S. IPSC intends to seek advice from professional societies and hopes to develop better contacts with upper-level management, grass-roots industry researchers, and government lease oversight boards.

Coffin wondered about the percentage of sites that ODP has drilled with industry versus academic data. Diebold doubted that ODP has used much industry data, but he predicted a growing trend with riser drilling. Sarg agreed that ODP could not have used much industry data because industry did not work in deep water until recently. He also predicted an increasing opportunity to obtain data as industry continues moving into deeper water.

Moore presented a mandate for the industrial-liaison working group (ILWG), noting its approval by SCICOM in August 1999, and he identified the members whom IPSC had already appointed to the ILWG, including the co-chairs, plus other candidates under consideration. Moore stated that one of the co-chairs might play only a limited role because of other commitments. He then asked for comments and suggestions for additional candidates. Bloomer moved that SCICOM endorse the IPSC proposal on membership of the ILWG. Other SCICOM members offered additional names and initiated further discussion.

Malfait asked about the transition of duties from the ILWG to the proposed new committee in iSAS. Moore explained that the ILWG would pass recommendations on to IWG. Malfait stated concern about the potential for confusion with two groups involved in technical planning. He asked whether the ILWG would establish a model itself for industry involvement or if it would establish a process for the iSAS committee to follow. Moore answered that the ILWG would not establish a process per se but only develop models for iSAS to use in establishing the new committee. Malfait viewed the problem as a matter of defining the spectrum of interaction with industry rather than accomplishing a specific job. He advised taking a careful approach in developing cooperative deals with industry and emphasized the risk of creating an unfair competitive advantage or conflict of interest without knowing the identity of the operators in the new program.

Sarg suggested that the ILWG should include some actual working scientists with technical expertise from the major industry research labs and technical centers. He also recommended that IPSC should visit those places and explain what the IODP science plan could offer to industry. Moore doubted the value of focusing on involving the industry research labs. Sarg replied that many industry labs have adopted a new attitude because they realize that they cannot do everything in house. He advised that IODP identify where its research goals overlap with those of industry. Skinner added that TEDCOM had received considerable help from an industry laboratory. He disagreed with IPSC about how to interact with industry and about the entire proposed membership of the ILWG, citing their lack of expertise for advising on riser drilling and other technical aspects. Moore explained that the ILWG would only make recommendations to IPSC and IWG. Ludden questioned the need for a formal, structured group such as the ILWG. He noted the possibility that their efforts would overlap with those of the European initiative and suggested that individual program members should at least have a chance to nominate representatives. Pisias said that how the ILWG develops recommendations would depend on relations in individual countries.

Hay noted that the proposed group would have two co-chairs from the U.S. Miller suggested having one U.S. and one non-U.S. co-chair. Coffin also expressed concerns about having two U.S.

co-chairs, especially considering the motion that SCICOM passed yesterday regarding the current imbalance of panel chairs among the program members (see SCICOM Motion 00-2-4). He regarded Europe and the U.S. as centers of the petroleum industry and thought that Europe should have a strong presence in the group. Coffin recalled the previously stated concerns about the commitment of one of the co-chairs and suggested appointing a third co-chair, preferably from Europe. He also suggested that the ILWG membership should include a representative from a seismic contractor. Salisbury suggested also contacting mining companies and not just the petroleum industry. Pisias emphasized the need for people who would get the job done and voiced support for the proposed group. Moore said that he wanted to move forward fast on this and not worry about having representative membership.

SCICOM Motion 00-2-17: SCICOM endorses the membership of the Industrial Liaison Working Group, as proposed by IPSC.

Bloomer moved, Shipley seconded; 14 in favor, 1 abstained (Hay).

T. Other business

SCICOM Consensus 00-2-18: SCICOM bids fond farewell to Kensaku Tamaki. Ken helped SCICOM make the transition to the new advisory structure, provided advice on drilling ocean crust, and kept us informed on Japanese plans for the new program. We wish him well in his new role as chair of the InterRidge Office.

Presented by Miller

SCICOM Consensus 00-2-19: SCICOM sincerely thanks Ken Miller for his untiring efforts on behalf of ODP. Ken has outspokenly supported scientific ocean drilling, his advice and counsel have forwarded the goals of the project, and he has served this committee well, faithfully, and with his own special brand of enthusiasm. We wish him well in all future endeavors.

Presented by Rea

SCICOM Consensus 00-2-20: SCICOM notes with regret the last meeting of J. Casey Moore as a member of this committee. Casey has served ODP and its predecessor DSDP as a panel member, proponent, co-chief scientist, and willing source of advice and counsel. His thoughtful comments, thorough understanding of technical and scientific issues, and commitment toward crafting the best science for ocean drilling have proved invaluable to the program. He has helped SCICOM and all of ODP through hydrates, hiatuses, and wholehearted hurrahs for holes in the ocean floor. We thank Casey and have no doubt that we will see him again soon as IODP takes wing.

J. Casey Moore s not quite a druid;
He s simply enamored with fluids.
Alas he is done,
Heading back to the sun,
When we let him go we sure blew it.

Presented by Bloomer

SCICOM Consensus 00-2-21: SCICOM extends its heartfelt thanks to Gerard Bond for his keen insight, reviews, and discussions (IRD) during his tenure on this committee. We will miss the unique perspective that comes from a petrologist turned paleoclimatologist whose broad geological expertise spans hard rocks to Heinrich events. We wish Gerard continued success in his efforts to understand climate change in the North Atlantic and its societal implications, and we look forward to the day when Bond cycles become part of the public lexicon.

Presented by Hodell

SCICOM Consensus 00-2-22: SCICOM thanks John Ludden for his dedicated service to the Ocean Drilling Program. Despite some flexibility in nationality (having represented variously the United Kingdom, Canada, and France), he has always proved himself as a valued citizen of the international scientific community. We know that John thrives on having simultaneous membership in at least a half dozen international committees, and we suspect that his contributions to planning scientific ocean drilling have not ended.

John Ludden has donned many hats,
But we have no problem with that.
He s ne er made a fuss,
Though working with us
Is really like herding large cats.

Presented by Bloomer

SCICOM Consensus 00-2-23: SCICOM thanks Emily Klein for her service on the committee. Her extensive knowledge of mid-ocean ridge petrology and geochemistry proved invaluable. We will miss her boundless enthusiasm, unmistakable voice, and constant support of ODP.

Presented by Wiens

SCICOM Consensus 00-2-24: SCICOM thanks Kate Moran for her contributions to ocean drilling over the past two decades. She has always brought energy and focus to the tasks at hand. We appreciate her continuing efforts to promote IODP in the Canadian academic, governmental and industrial communities, and we wish her well in her new position.

Presented by Moore

SCICOM Consensus 00-2-25: We thank Bill Hay for his sage chairmanship of SCICOM and OPCOM. His current stewardship builds on a remarkable four-decade history of contributing to scientific ocean drilling, including his pivotal leadership during the transition from DSDP to ODP. SCICOM has especially appreciated Bill s emphasis on essential scientific issues and his desire to keep the program focused on the most exciting problems. We wish him well in the post-SCICOM world as he explores and models the balmy Cretaceous climes.

Presented by Moore

SCICOM Consensus 00-2-26: SCICOM expresses its profound appreciation and thanks to the JOIDES Office staff, Warner Br ckmann, Jeff Schuffert, Emanuel S ding, and Bettina Rohr, for their untiring energy, enthusiasm, and efficiency. Their combined efforts played an essential role in the smooth running of the program. We wish each of them all the best in the future.

Presented by Robertson

U. Future Meetings
Shanghai, China, 21-23 March 2001
Newport, Oregon, Summer 2001

Meeting adjourned..... *5:00 PM*

MEETING OF THE
JOIDES SCIENCE AND OPERATIONS COMMITTEES

DALHOUSIE UNIVERSITY
HALIFAX, NOVA SCOTIA, CANADA

1-4 AUGUST 2000

Science Committee - SCICOM

Sherman Bloomer	Department of Geosciences, Oregon State University, USA
Millard Coffin	Institute for Geophysics, University of Texas at Austin, USA
Steven D'Hondt	Graduate School of Oceanography, University of Rhode Island, USA
William Hay (Chair)	GEOMAR Research Center, University of Kiel, Germany
David Hodell[a]	Department of Geological Sciences, University of Florida, USA
Nils Holm	Department of Geology and Geochemistry, Stockholm University, Sweden (ECOD)
Jock Keene	School of Geosciences, University of Sydney, Australia (PacRim)
Kenneth Miller	Department of Geological Sciences, Rutgers University, USA
J. Casey Moore	Department of Earth Sciences, University of California, Santa Cruz, USA
Masao Nakanishi[b]	Ocean Research Institute, University of Tokyo, Japan
Paul Pearson[c]	Department of Earth Sciences, University of Bristol, United Kingdom
Larry Peterson[d]	Rosenstiel School of Marine & Atmospheric Science, University of Miami, USA
Nicklas Pisias[e]	College of Oceanic & Atmospheric Sciences, Oregon State University, USA
David Rea	Department of Geological Sciences, University of Michigan, USA
Alastair Robertson	Department of Geology and Geophysics, University of Edinburgh, United Kingdom
Frederick Sarg	ExxonMobil Exploration, Houston, USA
Thomas Shipley[f]	Institute for Geophysics, University of Texas, USA
Douglas Wiens	Department of Earth and Planetary Science, Washington University, USA

Associate Member Observers

John Ludden	Centre de Recherches P trographiques et G ochimiques, CNRS-Nancy, France
Xin Su[g]	Center of Marine Geology, China University of Geosciences, P.R. China

Operations Committee - OPCOM

William Hay (Chair)	GEOMAR Research Center, University of Kiel, Germany
David Hodell[h]	Department of Geological Sciences, University of Florida, USA
J. Casey Moore	Department of Earth Sciences, University of California, Santa Cruz, USA
Nicholas Pisias	College of Oceanic & Atmospheric Sciences, Oregon State University, USA
Alastair Robertson	Department of Geology and Geophysics, University of Edinburgh, United Kingdom
Thomas Shipley	Institute for Geophysics, University of Texas, USA

Liaisons

Jack Baldauf	Ocean Drilling Program, Texas A&M University, USA
J. Paul Dauphin	National Science Foundation (NSF), USA
John Diebold	Lamont-Doherty Earth Observatory, Columbia University, USA
John Farrell	Joint Oceanographic Institutions, Inc. (JOI), USA
David Goldberg	Lamont-Doherty Earth Observatory, Columbia University, USA
Tom Janecek	Antarctic Research Facility, Florida State University, USA
Neil Lundberg	Department of Geology, Florida State University, USA
Julie Morris	Department of Earth and Planetary Science, Washington University, USA
Mary Reagan	Lamont-Doherty Earth Observatory, Columbia University, USA
Alister Skinner	British Geological Survey, Edinburgh, United Kingdom

[a] Alternate for Kenneth Miller
[b] Alternate for Hidekazu Tokuyama
[c] Alternate for Alastair Robertson
[d] Alternate for Steven D'Hondt
[e] Alternate for Larry Mayer
[f] Alternate for Patricia Fryer
[g] Alternate for Zhou Zuyi
[h] Alternate for Keir Becker

Guests

Jeff Fox	Ocean Drilling Program, Texas A&M University, USA
Ulrich Harms	GeoForschungsZentrum, Germany
Martin Hovland	STATOIL, Norway
Luba Jansa	Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Canada
Kate Jarrett	Department of Earth Sciences, Dalhousie University, Canada
Jim Kennett	Department of Geological Sciences, University of California, Santa Barbara, USA
Bruce Malfait	National Science Foundation (NSF), USA
Yoshiro Miki	Japan Marine Science and Technology Center (JAMSTEC), Japan
Greg Moore	Department of Geology and Geophysics, University of Hawaii, USA
Ted Moore	Department of Geological Sciences, University of Michigan, USA
Kathryn Moran	SeaMap Office, Canada
Phil O Brien	Australian Geological Survey Organization, Canberra, Australia
Jennifer Peterson	International Working Group (IWG) Support Office, USA
Philippe Pezard	CEREGE, France
Frank Rack	Joint Oceanographic Institutions, Inc. (JOI), USA
Joanne Reuss	Department of Geological Sciences, University of Michigan, USA
Matt Salisbury	Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Canada
Sam Scully	Vice-President, Academic and Provost, Dalhousie University, Canada
Masanori Shinano	International Working Group (IWG) Support Office, USA
Shiri Srivastava	Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Canada
James Zachos	Department of Earth Sciences, University of California, Santa Cruz, USA

JOIDES Office

Warner Br ckmann	GEOMAR Research Center, University of Kiel, Germany
Bettina Rohr	GEOMAR Research Center, University of Kiel, Germany
Jeffrey Schuffert	GEOMAR Research Center, University of Kiel, Germany

JOIDES OPERATIONS COMMITTEE MEETING

Marriott Hotel

San Francisco, California

16 December 2000

Members

Bill Hay (Chair)	GEOMAR Research Center, Kiel, Germany
Casey Moore	University of California, Santa Cruz, USA
Alastair Robertson	Department of Geology and Geophysics, University of Edinburgh, UK
Thomas Shipley	Institute for Geophysics, University of Texas, USA
Nick Pisias	College of Oceanic & Atmospheric Sciences, Oregon State Univ., USA
Keir Becker	University of Miami - RSMAS, Miami, USA
Kevin Brown	Scripps Institution of Oceanography, UCSD, San Diego, USA

Liaisons

Jack Baldauf	Ocean Drilling Program, Texas A&M University, USA
John Diebold	Lamont-Doherty Earth Observatory, Columbia Univ., USA (SSP Chair)
Jeff Fox	Ocean Drilling Program, Texas A&M University, USA
John Farrell	Joint Oceanographic Institutions, Inc., USA
Paul Dauphin	National Science Foundation, USA
Mary Reagan	Lamont-Doherty Earth Observatory, Columbia University, USA

Invited Guests

Bruce Malfait	National Science Foundation, USA
Frank Rack	Joint Oceanographic Institutions, Inc., USA
Chris Harrison	University of Miami - RSMAS, Miami, USA
Tom Davies	Ocean Drilling Program, Texas A&M University, USA
David Goldberg	Lamont-Doherty Earth Observatory, Columbia University, USA
Jan Backman	Department of Geology and Geochemistry, Stockholm University, Sweden
Greg Mountain	Lamont-Doherty Earth Observatory, Palisades, NY, USA

Other Guests

Gary Brass	Arctic Research Commission, Arlington, USA
Kathryn Moran	592 Three Fathom Harbour Road, B0J 1N0 Nova Scotia,Canada

JOIDES Office

Warner Br ckmann	GEOMAR Research Center, University of Kiel, Germany
Jeff Schuffert	GEOMAR Research Center, University of Kiel, Germany

A. Welcome and Introductions

Bill Hay welcomed members, liaisons, and guests of the JOIDES Operations Committee meeting and explained the rationale for holding the meeting at this time. The following agenda was proposed and accepted:

- ¥ Report from ODP-TAMU on status of operations and plans (Baldauf)
- ¥ Discussion of funding of alternate platform drilling
- ¥ Potential impact of fuel costs (Baldauf)
- ¥ Liaisons (Becker)

B. Status Report (Jack Baldauf reporting)

Leg 193-Manus Basin is currently ongoing. The focus of the Leg is on microbiology and on hydrothermal alteration issues. Operations on Leg 193 have been challenging due to problems with stuck pipe, severed pipe, etc. LWD was used down to 72 mbsf.

Planning for Leg 194-Marion Plateau now has the HYACE test firmly on the schedule; there are no other new items related to this cruise.

Leg 195-WP-ION/Mariana: Hole KS1 has been added as a contingency. Time permitting, it will be drilled and double or triple APC cored.

Port calls:
Guam port call: ODL is negotiating with its contractors to re-evaluate performance of the ASK. Two days are needed for testing - the program will be charged at the standby rate.
Hawaii port call: Now scheduled for 17 December, but it can not get much closer to the Christmas holidays.

Leg 203-Costa Rica is currently in the budget as using standard CORKs. These may need to be upgraded to A-CORKs.

Coastal state approvals are available for Leg 194. Leg 195 is pending. KS (Taiwan) and Leg 196-Nankai are pending. The paperwork for Leg 197-Hotspots is in.

C. Funding for alternate platform operations

Greg Mountain presented an overview of the proposed alternate platform drilling at the New Jersey marginand explained his interests in shallow water drilling. The New Jersey Transect Group (involved in bridging the gap between land and the deep drilling offshore on Leg 150) has utilized engineering firms (FUGRO & Warren George) to drill in 100 foot water depths. They have already drilled three sites, targeted at addressing the most interesting scientific issues (understanding clinoforms, sea level change, and several other processes).
The project has many contributors; there has been some funding from JOI. The Transect Group went to PPSP for an informal safety review.
The proposed continuation of the project would need 35 days of drilling to recover 750m core with a jack-up rig. Costs would include $70K premobilization, $420K transit r/t Atlantic City; total without drilling - 623K$, drilling - $1.4M; LWD support: $212K. The strategy is to use a

jack-up to drill a pilot test hole and set casing. The project would also need a mud-sniffer program to be safe in terms of hydrocarbons. Total cost of drilling operations: $2232K

Cores will be removed from the drilling vessel with a supply vessel that would comes visit the drill site regularly. Cores will then go to Rutgers for storage and laboratory work. It is planned to collect a standard data suite. Funding for the laboratory set up are covered by various organizations. NSF funding has been requested with Ken Miller, Greg Mountain and others as co-PI«s. A $384K logging subcontract would be awarded to the BRG, other contracts to Rutgers ($320K) and LDEO ($290K), the overall total is $3.21M.

ICDP, State and Federal Geol Survey have also been contacted. A grant of 500K$ from ICDP is available as long as there is international participation in the project.

Nick Pisias asked if ODP could support this effort through the supply of BRG services, maybe in a year where there is light logging. This is not feasible in the framework of the current contract. Equipment or personal can not be transferred from the JOIDES Resolution, there has to be additional money to be paying for this.

Alistair Robertson inquired about potential support from industry support? There has been very little interest from industry up until now.

Bill Hay asked about costs related to the recent rise in oil prices.

Nick Pisias asked if operations could be supported with ODP special operation expenses funds. In response Jeff Fox pointed out that the amount in question is in excess of all SOE currently available per year. He asked about potential ONR sponsorship. Greg Mountain replied that ONR has been helpful with site surveys etc. It has been a quiet supporter so far.

Tom Shipley suggested that industry interest would be more likely if ODP and other organizations would be willing to support part of the total costs of the drilling operation. Nick Pisias posed the question whether ODP is taking a proactive approach in encouraging alternate platforms at this point in time.

In partial response Bill Hay brought attention to SCICOM motion 98-2-8:

> SCICOM Motion 98-2-8
> ==========
>
> SCICOM supports, encourages, and recognizes the scientific importance of innovative programs which incur more than typical leg-related costs (<$300,000). Such expenses could include ice boats, alternate platforms, LWD, and CORKs. However, given the financial constraints under which the ODP operates, proponents or partner programs of such legs are strongly encouraged to seek additional resources to help cover costs in excess of a typical leg.
> We hope that the opportunity to leverage against ODP«s financial and technological resources will provide the international scientific community with exciting new opportunities.

Jan Backman reviewed Proposal 533 (Lomonosov Ridge), including ist submission date, data collection, and related studies. Existing seismic data coverage (Jokat & Kristofferson) will be supplemented next year with the ODEN.

Development of proposal 533
¥ 1991 — Site survey and coring cruise
¥ 1996 — Drilling/coring & seismic cruise
¥ 1998 — Preproposal submittedBackman, Mayer, Moran, Jakobsson, Kristofferson
¥ 1998 — Full proposal submitted. Enlarged proponent group: Coakley, EdwardsForsberg, Jackson, Jokat & Musatov
¥ 1999 — SCICEX cruise
¥ 1999 — SCICOM formed Arctic PPG
¥ 2000 — SCICOM ranked 533 #1 and formed Arctic DPG
¥ 2001 — Site survey cruise planned (x-lines)

He explained the development of the Arctic DPG, goals, mandate and timeline. The essential issues for the Arctic DPG are: (1) ice managment and platforms, (2) drill rig and drilling systems, (3) cost estimates and identification of external financial sources.

Backman reported that he had attended a meeting of ice managers in Helsinki on 14 November. The purpose of this meeting was to seek advice from experienced Arctic Ice managers regarding:
- ice management during transit and drilling
- icebreaker configuration
- feasibility of project

Highlights of the meeting included the following:
¥ The plan to drill on the Lomonosov Ridge crest at 87¡-88¡N is realistic and can be achieved with existing ships/barges.
¥ Accurate sea-ice monitoring is needed, including use of satellite imagery, helicopters, weather forecasts, etc.
¥ *Sea Sorceress* is one suitable drilling platform for this operation, in combination with icebreakers, e.g., *ODEN* NIB hunter ice breaker.
¥ Prediction of sea-ice conditions for key target areas (87¡-88¡N / 140¡-150¡E) probably can be done using long time-series of statistics kept in Russia.

In essence one nuclear ice breaker is needed, in addition to the ODEN icebreaker, which the Swedish Arctic Secretariat has proposed to provide as a support vessel for 3 weeks of drilling and transit. Additionally "hunter icebreakers" will be needed to take manage the smaller ice. Total time for the project will be on the order of 35 days with 5 days each for transit in and out of the area and 25 days of drilling.
The day rates for a nuclear icebreaker is $50K, for 2 hunter icebreakers $25K. The total icebreaker support for the whole operation will be no less than for 3M$. This question will be addressed by the DPG. To carry out this plan however will take political will and courage.

Casey Moore asked about the day rate for the drilling barge.

Jan Backman replied that the day rate had recently increased from $10K to $30K. The barge can be used for all kinds of drilling operations. It was originally built for the Beaufort Sea.

Bill Hay remarked that the Sea Sorceress is now being outfitted for wireline operations in Houston.

Kate Moran remarked that 4 different drill rigs have been on the Sea Sorceress before. The last time it was used to drill very large diameter holes on the Grand Banks offshore Canada.

Alastair Robertson asked about the timing of the operation. Is 2003 the best time because of the availability of Swedish icebreaker ODEN? How firm is the commitment?

Bill Hay informed the committee about the Laptev Sea drilling campaign in the Russian Arctic last summer, conducted by Heidi Kassens of GEOMAR. That project had problems achieving their drilling objectives even using 4 ice breakers, two of them nuclear powered.

There was a general agreement that the Russian icebreaker fleet management is the most professional available. Jan Backman remarked that the Russian icebreaker fleet would be preferred over the Canadian fleet. The icebreaker Healy would probably not ^be suitable.

Bill Hay inquired about the total cost of the whole operation. Jan Backman replied that $6-8M would be sufficient.

Turning to the issue of financing the operation Casey Moore asked about the financial and contractual conditions of the transition from ODP to IODP.

Jeff Fox clarified that the contract with ODL can be cancelled with 90 days lead-in time, in a mutually agreed-upon US port.

Alistair Robertson suggested that the interim phase should be the right time for this activity when additional money from the European contribution which could be used to support this operation.

John Farrell stated that some support, like logistics, could be provided by ODP.

Greg Mountain reminded that 1968 was a pivotal time when DSDP was beginning to be formulated. This is also true for today where we are in a similar transition situation. We need to go to alternate platforms, high-latitude drilling, deep-biosphere studies. All this requires some sort of transition planning.

D. Potential impact of fuel costs

Fuel costs issues & budget impact etc (Farrell & Baldauf)

John Farrell recalled that in the budget it was assumed that the cost for oil over the next year was expected to relax, and was budgeted for $200/metric ton. The question is what has been done to address the potential shortfall.

Jack Baldauf reviewed the long term history of oil prices. The forecast costs of $2.7M vs budgeted $1.6M produces a shortfall of $1.1 M. He showed the long-range total budget of TAMU/ODP.

John Farrell reported a total projected shortfall of 1.4 M$ for FY 2001. He identified savings in subcontractor budgets (plus 200K carry-forward money) that will bring down the budget shortfall to $700K, but this is only mid-FY 2001. He also noted that it is important to provide support for the Arctic DPG.

Kate Moran inquired how 3rd level subcontractors would be supported.

Jack Baldauf remarked that the only cost saving option for FY 2002 is Leg 203-Costa Rica.

Jeff Fox made clear that ODP TAMU is not operating with a margin any more; there is no more cost cutting without serious impacts (e.g. the PR position at TAMU will not be filled), further cuts in personnel are difficult and have to be considered very carefully.

Keir Becker suggested that there may be a need for an extra meeting of OPCOM before the March meeting.

John Farrell suggested to wait for the new JOI President to settle in and define priorities.

Alastair Robertson asked if there is a possibility to conclude the program a little earlier. Chris Harrison replied that we can t borrow from the future budget. Jeff Fox stated that ODP-TAMU will need to know what to do in terms of staffing by end of January 2001. Kevin Brown suggested that the Costa Rica Leg might be moved into FY03, to save money in FY02. In addition to this you could also end the program early by a few months.

John Farrell again stated that we should wait until end of January, when the new president has talked to NSF...Potentially we are looking at a total shortfall of $1.5M.

E. Liaisons

Keir Becker quickly reviewed the status of OPCOM liaisons with other panels. The following members will act as liaisons from 2001:

- Keir Becker (future OPCOM chair): PPSP
- Nick Pisias: SciMP
- Kevin Brown: SSP

E. Next OPCOM Meeting

Keir Becker proposed a special OPCOM meeting (if necessary) in association with the next ODP Managers Meeting to be held on 13 February.

The next meeting of OPCOM is scheduled for 14/15 February in Washington DC in case the need arises.

JOIDES OPERATIONS COMMITTEE MEETING

Dalhousie University

Halifax, Nova Scotia

3 August 2000

Members	
Bill Hay (Chair)	GEOMAR Research Center, Kiel, Germany
Casey Moore	Earth Sciences Department, University of California at Santa Cruz, USA
Alastair Robertson	Department of Geology and Geophysics, University of Edinburgh, United Kingdom
Thomas Shipley	Institute for Geophysics, University of Texas, USA
Nick Pisias	College of Oceanic & Atmospheric Sciences, Oregon State Univ., Corvallis, USA

Members	
Jack Baldauf	Ocean Drilling Program, Texas A&M University, USA
John Diebold	Lamont-Doherty Earth Observatory, Columbia Univ., USA (SSP Chair)
Jeff Fox	Ocean Drilling Program, Texas A&M University, USA
Thomas Janecek	Antarctic Research Facility, Florida State University, USA,
John Farrell	Joint Oceanographic Institutions, Inc., USA
Paul Dauphin	National Science Foundation, USA
Mary Reagan	Lamont-Doherty Earth Observatory, Columbia University, USA
Alister Skinner	British Geological Survey, Edinburgh, United Kingdom (TEDCOM Chair)

Guests	
Frank Rack	Joint Oceanographic Institutions, Inc., USA
Tom Davies	Ocean Drilling Program, Texas A&M University, USA
David Goldberg	Lamont-Doherty Earth Observatory, Columbia University, USA

JOIDES Office	
Warner Br ckmann	GEOMAR Research Center, University of Kiel, Germany

A. Welcome and Introductions

Bill Hay welcomed members, liaisons, and guests of the JOIDES Operations Committee meeting.

B. Approval of minutes

Consensus 00-2-1
OPCOM approves the minutes from the February 2000 meeting.
Proposed by Tom Shipley, seconded by Alastair Robertson, 5 in favor, 1 absent (Moore)

C. Approval of agenda

Approved by consensus (00-2-2)

D. TEDCOM Report (Skinner)

The recommendations from the most recent TEDCOM meeting were presented and discussed.

TEDCOM RECOMMENDATION # 001-1
Following the excellent progress on the AHC installation and monitoring of its effectiveness TEDCOM request that SCICOM ensure that ODP-TAMU proceed quickly with the simulation studies which can now use real data. This is required in order to build a model, analyze existing observations, predict what may happen in different geological and geographical areas and allow unexplained or aberrant behaviour when using the AHC to be analyzed.

Jeff Fox repiled that this is being pursued at this point in time. Results will be presented at the next TEDCOM meeting in November.

Endorsed by consensus (00-2-3)

TEDCOM RECOMMENDATION # 001-2
TEDCOM request that SCICOM take steps to ensure immediate collaboration between ODP-TAMU and the BRG of LDEO in order that their combined expertise be pooled to provide a comprehensive package of down hole and rig floor instrumentation for upcoming Leg 193 and any future sensor developments. If necessary both should prioritize their objectives and should be supported with funding if necessary in order that the studies shown by both parties at the current meeting be properly harnessed for effective use by the programme.

Mary Reagan and Jeff Fox assured that LDEO and ODP-TAMU are cooperating in this effort.

Endorsed by consensus(00-2-4)

TEDCOM RECOMMENDATION # 001-3
TEDCOM request that SCICOM ask ODP-TAMU to review their approach to poor core recovery in unconsolidated, non-cohesive sediments and when doing so bear in mind existing tools available in the geotechnical industry together with ones currently under development.

Alister Skinner presents the TEDCOM recommendation to purchase and use standard geotechnical tools for the solution of recovery problems, operational difficulties, based on an observations by Brian Taylor during a recent cruise.

Endorsed by consensus(00-2-5)

TEDCOM RECOMMENDATION # 001-4
TEDCOM request SCICOM to ensure that, before the end of the current programme, ODP-TAMU have an up-to-date inventory of all of their existing operational tools, that each has a folio of up-to-date drawings and an operational manual together with a digital copy of the information in a commonly available format. This is probably the best legacy that engineering can give to the IODP and it should therefore be a requirement that the Borehole Research Group at LDEO also comply with regard to all downhole logging tools and associated software.

John Farrell remarked that this task is already part of the subcontractors contract.

Endorsed by consensus (00-2-6)

E. SCIMP Report

Before presenting recommendations from the last SciMP meeting in May Tom Janecek reviewed the success rate of SciMP recommendations, which indicates a compliance or action rate of about 80%. In terms of the overall number the SciMP recommendations forms a bell shaped curve.
SciMP had discussed the handling of digital photomicrographs and other images and reviewed information on two asset management applications (Extensis Portfolio and Cumulus Canto) that could be utilized by ODP for organizing, viewing, sharing, and previewing digital files across networks and platforms.

SCIMP Recommendation 00-2-5: To establish a protocol for the consistent linking of metadata with digital single frame images (e.g., thin sections, scanned core photographs) SCIMP recommends that ODP-TAMU purchase and implement the use of an asset management software/database (e.g., Extensis Porfolio or Cumulus Canto). The database generated should interface with JANUS, have SQL compatibility and be able to export data in a long-term archive format.

Endorsed by consensus

SCIMP Recommendation 00-2-4: SCIMP recommends that the ODP-IODP transition plan address the issue of long-term use of ODP drilled boreholes, with particular emphasis on the distribution and archiving of data collected from these legacy holes.

OPCOM briefly discussed the question who this recommendation is addressed to. There was agreement that the JOIDES Office should send this forward to IPSC;

Endorsed by consensus

SCIMP Recommendation 00-2-3: SCIMP recommends that all investigators who produce data using leg-specific, non-ODP scientific analytical equipment and instrumentation on board *the JOIDES Resolution* follow all standard ODP data policies and data moratoriums. In all cases these data should be made freely available in the same way that other shipboard data are distributed.

There was concern about limited coverage of this question in the ODP data and sample policy. ODP TAMU needs to stress this when external instrument providers get in on the leg, should be part of the invitation letter, needs to be included in the policy!

SCIMP Recommendation 00-2-2: SCIMP recommends that JOI direct ODP-TAMU to reallocate current fiscal year funds to move forward immediately with the purchase of a single-track, moving sensor ~~GEOTEK~~ line-scan digital imaging system.

John Farrell posed the question if producer brand names should be spelled out in motions like this one, because it could be a problem in procurement. Better communication between SciMP and TAMU was needed to avoid this.

Endorsed by consensus (with GEOTEK removed)

SCIMP RECOMMENDATION 00-2-1: SCIMP recommends that a temporary Working Group be established to advise SCIMP on the minimum capabilities needed for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution*.

The **mandate** of the Working Group is as follows:

1) Evaluate required seismic acquisition and processing facilities on the *JOIDES Resolution* (U/G and VSP).
2) Evaluate facilities required for core-log-seismic integration and interpretation on the *JOIDES Resolution.*
3) Evaluate the need for scientific and technical staff support on the *JOIDES Resolution.*
4) Evaluate how to obtain, store, and distribute digital seismic data.
5) Evaluate what shore-based facilities and personnel are required.
6) Estimate cost of different aspects of the seismic laboratory.

Timeline:

The evaluation of required seismic acquisition and processing facilities on *the JOIDES Resolution* (U/W and VSP) should be completed by December, 2000 and a report and recommendations presented at the December, 2000 SCIMP meeting.

The final report and recommendations to be presented at the June, 2001 SCIMP meeting.

Members:

Members should include (but not necessarily be limited to) one person from SCIMP, SSP, ODP-TAMU, and ODP-LDEO, a Shipboard Scientist participating in the ODP-LDEO FY 01 pilot study, and an Industry representative).

Meetings:

One to two meetings held at the Borehole Research Group facilities at LDEO.

There was some discussion about the question where this group would be located in the advisory structure.

Endorsed by consensus (add PPSP member)

E. Update on currently scheduled legs

Jack Baldauf provided OPCOM with an update on logistical issues with currently scheduled legs.

ONTONG-JAVA (Leg 192)
The Co-chiefs will ask for permission to drill an additional site if they don t get permission from the Solomon Islands, originally 807, Basement reach at this site is in question, but the co-chiefs are working on an answer.

MANUS BASIN (Leg 193)
There is an ongoing discussion with Papua-New Guinea concerning the microbiology program, ODP currently plans on participation of two microbiologists on board without industry ties.

GAS HYDRATES (Leg 199)
Because of the weather problem, the drilling on Hydrate Ridge needs to be moved to summer 2002. The move into 2002 should be considered together with the development of a new schedule.

H20 (Leg 200)
It has been suggested that chert may be present at the proposed site. Time needs to be added in case chert is encoutered and additional dasing is required. If no chert is found the time gained might be used to core for the following cruise (SE Pal.).

SE Paleo. (201)
Mix has asked for extra time, since they are now down to 51 days (30 on site).

F. Scheduling of highly ranked proposals

The following list of 12 highly ranked proposals was forwarded by SCICOM to OPCOM for consideration in FY 2002:

Rank	Proposal #	Proposal Name	mean ranking	stdd dev.
1	533-Full2	Arctic Ocean	5.20	5.31
2	534-Full	Shatsky Rise	5.80	5.75
3	525-Full	MAR Peridotite	7.93	6.05
4	571-Full	Peru biosphere	8.13	4.69
5	505-Full3	Mariana Conv. Margin	8.93	8.30
6	455-Rev3	Laurentide Ice Sheet	9.27	6.65
7	482-Full3	Wilkes Land	10.40	5.93
8	544-Full2	Costa Rica	10.87	7.76
9	559-Full	Walvis Ridge Transect	11.73	6.06
10	564-Full	New Jersey Shelf	12.40	6.13
11	539-Full2	Blake hydrates	12.80	6.13
12	512-Full2	Core Complex	13.27	6.09

SCICOM also forwarded two Ancillary Program Letters to OPCOM for consideration: APL-10 (Conical Seamount) and APL-14 (Pleistocene Kuroshio Paleoceanography).

Jack Baldauf explained to the panel that ODP-TAMU had prepared a set of operational options focussing on the perceived top ranking proposals (Project A). In the preparation of possible scheduling options the following operational issues must be considered:

- Environment (weather windows, sea state)
- Special Operating items and related expenses
- Minimization of the transit times
- goals of the LRP

Before evaluating possible scheduling options OPCOM discussed highly ranked proposals 533-Full2 (Arctic Ocean) and 564-Full (New Jersey Shelf). Regarding the Arctic Ocean proposal it was noted that during the SCICOM meeting Martin Hovland, Chair of the Arctic Program Planning Group, had informed the committee that the drilling on Lomonosov Ridge would involve at least three ships - a drilling vessel of some sort and at least two icebreakers, one of which should be a Russian nuclear powered ship. Hovland also stated that the estimated cost of this operation would be between one and two ODP Legs. OPCOM also considered the fact that the budget for FY 2001 was being balanced based on the assumption that oil prices will fall back to the levels of last year and will not remain at the current high cost. Regarding the New Jersey Shelf OPCOM considered the fact that $2.2 million were requested for the operation of an alternate drilling platform.
After a perfunctory discussion there was a general agreement that the funds necessary to implement 533-Full2 and 564-Full would not be available without drastic cutbacks in JOIDES Resolution operations in FY 2002. Hence OPCOM decided not to pursue these two proposals any further. It was doubted that the funding situation in FY 2003 would improve to the extent that funds of this magnitude would become available. OPCOM briefly discussed the negative impact of the steadily increasing operations costs against the fixed budget.

Baldauf then provided OPCOM members and liaisons with documents outlining the key operational parameters and constraints for the proposals selected for FY 2002. An overview of parameters is included below (table 1).

Proposal #	**Weather window**	**Site time**	**Est. total Cost**
534-Full	Apr - Sept	51.0	$199.411
525-Full	Nov-Dec / Mar-May	64.9	$465.214
571-Full	any	56.6	$302.304
505-Full3	Jan-Jul	14.1	$332.415
455-Rev3	Jul-Nov	52.4	$325.021
482-Full3	Jan-Mar / Febr (best)	26.8	$370.120
544-Full2	any	61.6	$922.636
559-Full	any	49.1	$313.935
539-Full2	Oct-Dec / Mar-May	46.8	$365.124
512-Full2	Nov-Jul	42.7	$527.888

Baldauf explained that for logistical and operational reasons there was some flexibility in the current schedule beginning after Leg 197 (Hotspots), ending August 2001. The approach should be to define cornerstones in the new schedule first, then tie in the connections.

After considerable discussion the following draft schedule was developed for presentation to SCICOM:

Proposed schedule

Leg **198**(Aug - Oct)	Shatsky (or Mariana) **new**
Leg 199(early Oct - Nov)	H2O
Leg 200(Nov - end Jan)	Paleogene
Leg **201**(Febr & March)	Peru **new**
Leg 202(end March - May)	SE Pacific
Leg **203** (June — July)	Costa Rica **new**
Leg 204(late July - late Sept)	Hydrate Ridge
Leg **205**	Eq. Pac, ION **new**

Since OPCOM considered the scheduling of highly ranked proposals as their first priority, APL-10 and APL-14 were not included in the proposed schedule.

USGS
science for a changing world

DATE: January 23, 2001

TO: Keir Becker, Chair, JOI-SCICOM

FROM: Mahlon M. Ball, Former Chair, JOI-PPSP

SUBJECT: PPSP meeting November 30 - December 1, 2000

This meeting was held in a conference room of the Sea Lodge Hotel, La Jolla, CA

Chief Scientists and Proponents

Attendance

JOI-PPSP
K. Andreassen
M. Ball
G. Claypool, Chair
N. DeSilva
P. Flemings
T. Francis
H. Juvkam-Wold
B. Katz
J. Lowell
D. Mackenzie
D. Strack
P. Verdier
J. Watkins

ODP-TAMU-SP
K. Burke
M. Hovland

SCICOM
K. Burke
W. Hay

ODP-TAMU
J. Baldauf

JOI-ODP-Data Bank
D. Quoidbach

NSF
B.Malfait

TAWG-IPSC
T. Bourgoyne

JAMSTEC
K. Kuroki
S. Takagawa

JDC (JAPAN DRILL. CO.)
Y. Ichikawa

Review
Leg 198, Shatsky, T. Bralower
Leg 201, Peru, S. D'hondt
Leg 202, S.E. Pacific, A. Mix

Preview
Lomonosov Ridge, K. Moran

Mahlon Ball opened the meeting requesting self introductions and circulating a signature list.

Minutes of the last meeting were approved.

Jack Baldauf discussed drilling results for legs 190, Nankai; 191, W. Pac ION; 192, Ontong Java. No difficulties with hydrocarbons were encountered. Drilling on leg 193, Manus Basin is in progress.

Bill Hay described the new drilling schedule for legs 194-205 resulting from SCICOM-OPCOM transition deliberations at their August meeting.

Kier Becker described the structure of interim science advisory panels designed to smooth to OD 21.

Baldauf and Dan Quoidbach led description and discussion of additional sites for legs 194 (Marion Plateau), 195 (Mariana/W. Pacific ION); and 196 (Nankai II). The following sites were approved.

LEG 194 Marion Plateau

Site	Latitude	Longitude	Depth(m)	Penetration (m)
CS-11A	20°03.4045'	151°45.7735'	360	650
CS-12A	20°04.4480'	151°47.0760'	360	650
CS-13A	20°34.5317'	152°24.5509'	369	650
CS-14A	**tbd**	**tbd**	**tbd**	650
CS-15A	20°45.1387'	152°49.1927'	365	650
CS-16A	20°58.8973'	152°55.2067'	312	670
CS-17A	21°05.0935'	153°03.04836'	336	650

Notes:

AA: Proposed site CS-14A was relocated from CDP of 4980 to CDP 5300 on same line to avoid an amplitude anomaly. New lats and longs need to be calculated

BB: Sites CS-16A and –17A should be drilled last to ensure that an understanding of the sediments and the environment is achieved prior to drilling CS-16A and CS-17A.

LEG 195 Mariana/West Pac. 10N.

Site	Latitude	Longitude	Depth(m)	Penetration (m)
MAF-4B	13°46.99'	146°0.17'	2930	400
KS-1	24°48.24'	122°30'	1270	410

LEG 196 Namkai II

Site	Latitude	Longitude	Depth(m)	Penetration (m)
808	32°21.12'	134°56.67'	4676	1450
Site 1173	32°14.66'	135°1.51'	4790	900
Site 1174	32°20.54'	134°57.39'	4751	1300
ENT-02A	32°19.26'	134°58.06'	4790	1200
ENT-10A	32°22.2775'	134°55.1938'	4554	1400
WNT-01A	31°43.87'	134°56.85'	4850	1300
Site 1177	32°39.15'	134°0.71'	4844	1000
WNT-03B	32°47.99'	134°53.59'	4850	1650

Notes:
AA: ENT-10A is approved for LWD operations without coring of the sediment

Tim Bralower led the description and discussion of Leg 198 (Shatsky Rise). The following sites were approved.

LEG 198 Shatsky

Site	Latitude	Longitude	Depth (m)	Penetration (m)
Shat-1	32°39.099'N	158°30.357'E	2400	1347
Shat-2B	32°6.865'N	158°3.030'E	2764	1083
Shat-3	31°34.641'N	158°17.862'E	3863	800
Shat-4	36°7.629'N	158°12.094'E	3300	985
Shat-5B	tbd	tbd	tbd	1198
Shat-6	37°15.763'	158°41.126'	4361	510
Shat-7	37°9.900'	158°40.529'	4125	685
Shat-8	32°44.065'	158°39.924'	3668	887
Shat-9	tbd	tbd	tbd	1003

Shat-10	34°33.318'	159°22.831'	3799	328
Shat-11	36°27.601'	160°16.955'	4800	1246
Shat-12	39°14.959'	163°10.955'	4673	768
Shat-13	37°39.911'	162°51.630'	3750	343
Shat-14	31°25.51'	157°15.43'	4322	250

Notes:

AA: Site 5B relocated to SP 27.25 on same line

BB: Site 9 relocated to SP 1003 on same line

CC: No crossing lines are required

LEG 201 **Peru**

Site	Latitude	Longitude	Depth(m)	Penetration (m)	
PRB-1A	9°0.6'S	83°31.8'W	4487	155	Previously DSDP 320
PRB-2A	12°1.2'S	81°34.8'W	4827	124	Previously DSDP 321
PRU-1A	10°59'S	77°59'W	150	200	Previously ODP 681
PRU-2A	11°3.9'S	76°16.3'W	252	300	Previously ODP 680
PRU-3A	8°59'S	79°54.6'W	426	160	Previously ODP 684
PRU-4A	9°6.6'S	80°34.8'W	5070	200	Previously ODP 680
EQP-1A	3°5.7'S	90°49.2'W	3314	400	Previously ODP 846
EQP-2A	2°46.2'N	110°34.2'W	3780	318	Previously ODP 851

Notes:

AA: Site PRU-1A is targeting base of brine zone. Potential Shallow gas. Drill last in sequence of shallow water sites.

BB: Site PRU-4A may contain gas hydrates

LEG 202 **S.E. Pacific**

Site	Latitude	Long.	Depth(m)	Penetration (m)
CAR-1C	0°40.319'S	82°04.853	1423	550
CAR-2C	1°53.406'S	82°46.914'W	2223	500
COC-4	7°51.352'N	83°36.402'W	1370	250
COC-2	5°50.566'N	86°26.667'W	2042	450
COC-3	4°37.089'N	86°42.334	919	150

Nazca 17A	16°00.42'S	76°22.68'W	3228	300
Nazca 16A	16°8.04'S	76°58.623'W	2244	350
Nazca 14A	17°02.10'S	76°06.54'W	2930	350
Nazca 10A	21°21.54'S	81°26.16'W	1323	250
Pan-2	0°1.312'N	86°42.334	2941	300
SEPAC-13A	tbd	tbd	tbd	200
SEPAC-14A	36°10.32'S	73°34.32'W	509	200
SEPAC-9A	39°53.28'S	75°53.28'W	4087	500
SEPAC-10A	40°28.98'S	75°54.96'W	3858	350
SEPAC-14A	41°0'S	74°27.0'W	851	80
SEPAC-14A	46°19.02'S	76°32.28'W	2825	350

Note:

AA: Need completed site form for Site SEPAC-13A, Site 13A was relocated to SP-585 on Line 4. Requires new latitude and longitude.

BB: SEPAC-14A should contain gassy sediments, possible H_2S

CC: SEPAC-19A requested deeper penetration, but will only be permitted following review of additional crossing lines.

Kate Moras led a description and discussion of the Lomonosov Ridge (Arctic Ocean). This presentation was a preview of a potential drilling leg and no specific sites were approved. The concensus of the safety panels was that reasonably safe sites could be selected in this region and that Moran should continue planning a drilling leg in this area.

Ball led a preliminary discussion of safety strategy for OD 21. PPSP members repeated the necessity for increased petrolelum engineering expertise on safety panels of the OD 21 operator and JOI. Barry Katz reiterated lead time requirements for holes in thick sedimentary sections where 3-D seismic measurements may be needed prior to drilling. Industry drilling on oil and gas prospects can involve as much as 5 years work between identifying a prospect and drilling its test. Neil DeSilva and Tim Francis re-emphasized permitting problems. It is very important that OD 21 operations be identified as scientific drilling in order for the operator (Jamstec) to obtain a blanket permit rather than being required to obtain permits for each hole. PPSP advises that Jamstec create its operator's safety panel as soon as possible and that JOI expedites requests for proposals for 2003 and beyond as quickly as it can. PPSP also recommends use of small diameter, pilot holes to be drilled to the projected depth of the base of surface casing in areas where sediments or sedimentary rocks are thick and potential for oil and gas shows are deemed more likely. Small diameter holes are more easily plugged, if oil and gas are encountered.

Jamstec team representatives and JOI's Technical Advisory Working Group (TAWG) Chair participated in these discussions. Ted Burgoyne (TAWG chair) and former dean of Petroleum Engineering at LSU represents exactly the form of additional expertise JOI needs for proper

conduct of risored drilling. The Jamstec team, with participants from Japan Drilling Co. and Japex, are clearly able to meet the operator's manpower requirements. The attached "Site Survey for OD 21 Riser Drilling" outline shows that Jamstec is well on its way to identifying site survey and safety needs for the OD 21 program.

Site Survey for OD21 Riser Drilling

JAMSTEC
Operation Team
Nov., 2000. IPSC, Copenhagen

Site Survey for OD21 Riser Drilling

JAMSTEC
Operation Team
Nov. 2000. IPSC, Copenhagen

JAMSTEC OD21

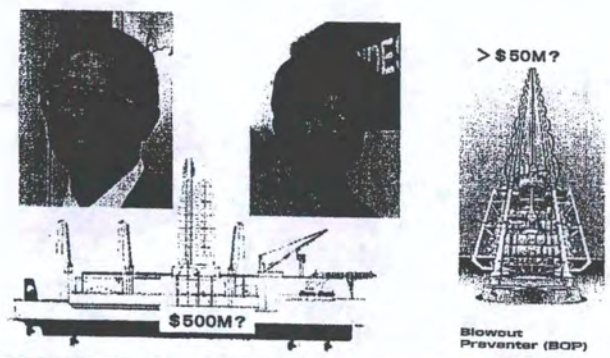
JAMSTEC Study on Site Survey for Riser Drilling(Sep. 1998–Apr.2000)

Purpose of Study

To establish a draft of site survey standard for the OD21 riser operation

- Safeguard Personnel & Facility
- Pollution Prevention
- Good Operation Planning
- Safety Precaution
- Economical & Effective Operation
- Touch down to Scientific Target

JAMSTEC OD21



JAMSTEC OD21

Approach to Hazard Investigation (+Industry+World Leading Survey Companies)

Study on Deep Water Drilling Hazards

- Definition
- Mechanism & Magnitude
- Occurrence
- Potential Damage

Study on Site Survey Methods to Detect Drilling Hazards

- Industry's Practice
- Regulations and guidelines -MMS, NPD and UKOOA etc.
- Survey methods for ultra-deep submarine cable and pipeline.

JAMSTEC OD21

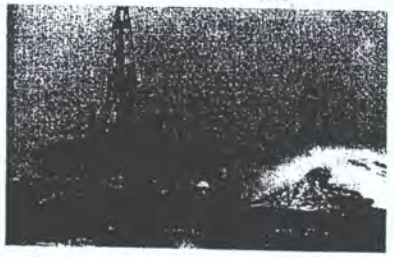
Potential Operation Hazards in Deep Water Riser Drilling

Hazard 1: Metocean
Hazard 2: Shallow gas/ Hydrate
Hazard 3: Geo pressure
Hazard 4: Geological
Hazard 5: Man-made structure

JAMSTEC OD21

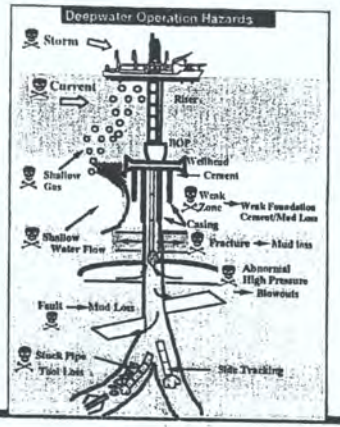
Hazard 1: Metocean(1)

Storm



Potential risk
- Damage to Riser
- Drift off
- Evacuation

JAMSTEC OD21



JAMSTEC OD21

Hazard 1: Metocean(2)

Sea Current

Potential risk
- Damage to Riser
- Drift off
- Operation Shutdown

JAMSTEC OD21

Hazard 1 : Metocean(3)

Extreme Cold Climate

Potential risk

- Limitation of Survey by Pack ice
- Iceberg
- Titanic Event
- Equipment Mullfunction

JAMSTEC OD21

Shallow Gas

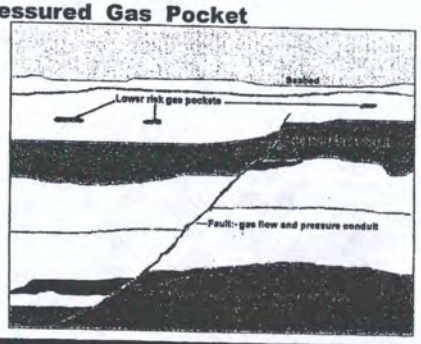
Potential risk

- Blowout
- Hole Collapse
- Lost Buoyancy

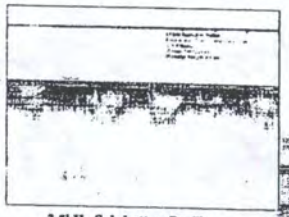
JAMSTEC OD21

Hazard 2 : Shallow Gas

Pressured Gas Pocket

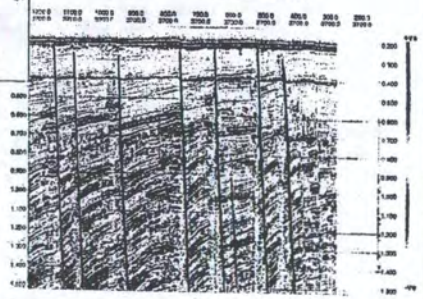


JAMSTEC OD21



3.5kHz Sub-bottom Profiler

High-Resolution Seismic Survey



JAMSTEC OD21

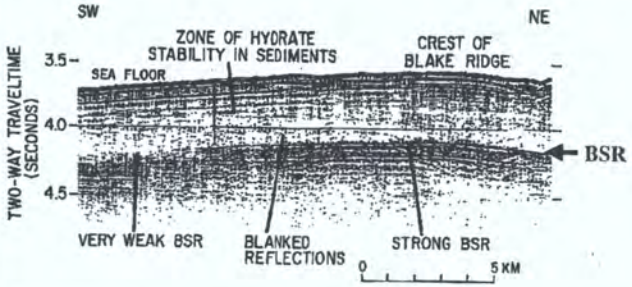
Hazard 2: Hydrate

Gas Hydrate

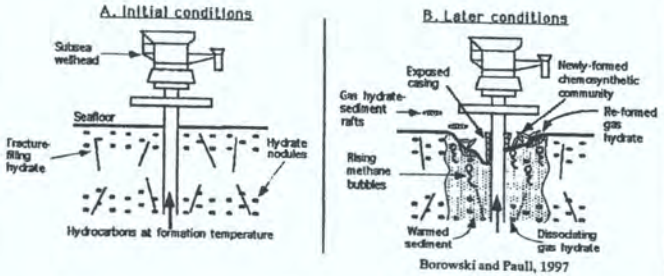
Potential risk

- Sediment Instability
- Lost Circulation
- Stuck Pipe
- Blowout
- Seabed Erosion

Hydrate



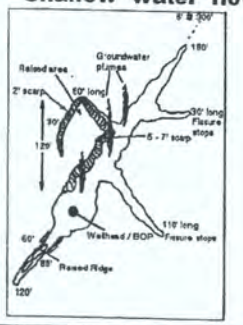
Hydrate



Borowski and Paull, 1997

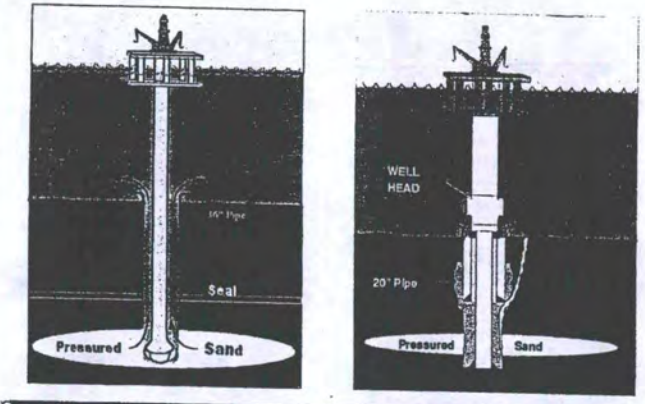
Hazard 3: Geo Pressure(1)

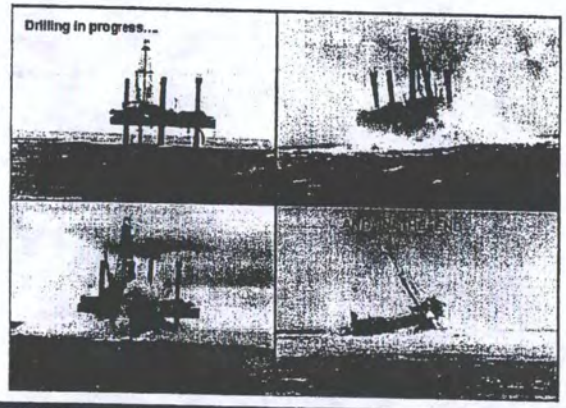
Shallow water flow



Potential risk

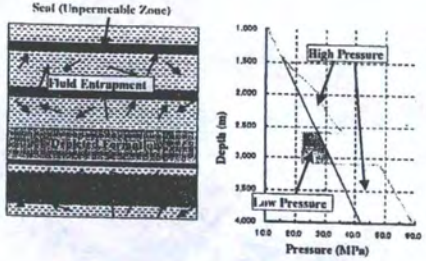
- Hole Collapse
- Seabed Collapse
- Damage to Wellhead/BOP/Riser





Hazard 3: Geo Pressure(2)

Abnormal Pressure



Potential risk

- Blowout
- Stuck Pipe
- Lost Circulation
- Underground Blowout

Hazard 4: Geological(1)

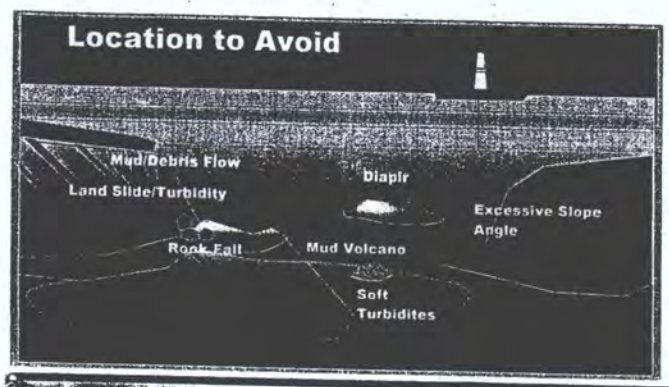
Unconsolidated Sediment

- Turbidite
- Slumping zone
- Landslide

Potential risk

- Hole Collapse
- Stuck Pipe

Location to Avoid



JAMSTEC OD21

Hazard 4: Geological(2)

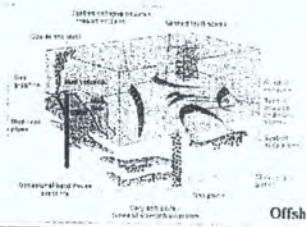
Complicated seabed topography
- Steep slope
- Fault scarps
- Rocky seabed

Potential risk
- Difficulty in ;
  - Wellhead/BOP set
  - Spud in
- Excessive Riser Angle

JAMSTEC OD21

Hazard 4: Geological(3)

Diapir
- Mud Volcano
- Salt Dome



Offshore, 1998

Potential risk
- Heaving Shale
- Stuck Pipe
- Lost Circulation

JAMSTEC OD21

Hazard 4: Geological(4)

Volcanic Activity
- Hydrothermal
- Hydrogen Sulfide

Potential risk
- Damage to;
  - Bottom Hole Assembly
  - Logging Tools
- Drilling Mud Deterioration
- Threat against the life

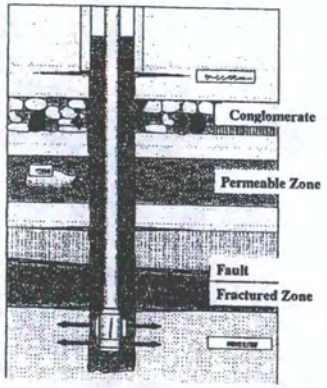
JAMSTEC OD21

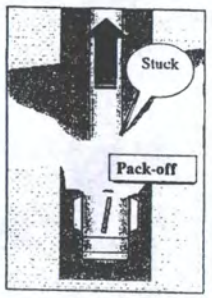
Hazard 4: Geological(5)

Structural
- Faults
- Buried channels
- Fracture Zones
- Dipped Bed

Potential risk
- Lost Circulation
- Blowout
- Stuck Pipe
- Low Rate of Penetration

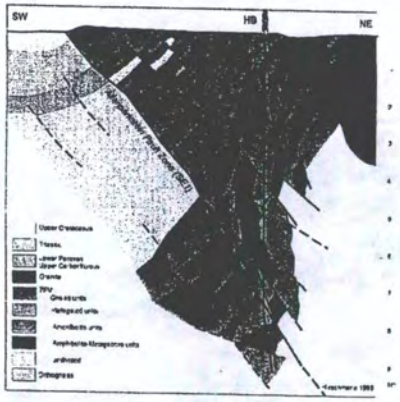
JAMSTEC OD21





JAMSTEC OD21

Dipped Bed (KTB)



JAMSTEC OD21

Man-made Objectives

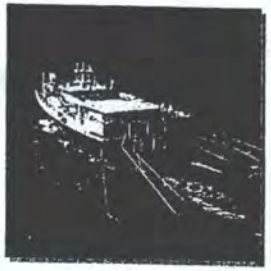
Submarine Pipeline
Submarine Cable
Fishing Gear & Net
Mine
Ship Wreck

JAMSTEC OD21

Consideration on Site Survey in Ultra-Deep Water

- Deep Penetration Seismic Survey
- Shallow Hazard Survey
  - Bathymetric Survey
  - Seabed Condition Survey
  - High Resolution Seismic Survey
  - Geotechnical Survey
- Geophysical Survey
  - Gravimetric Survey
  - Magnetometer Survey
  - Heat Flow Measurement
- Current Measurement

JAMSTEC OD21



JAMSTEC OD21

Deep Penetration Seismic Survey

Seismic survey with high resolution is required to detect and locate drilling hazards in the deeper position.

→ **3D Seismic Survey is recommendable**

JAMSTEC OD21

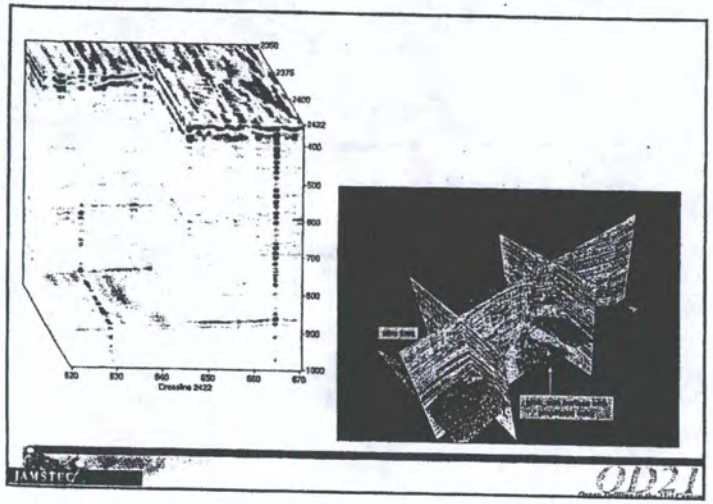
Survey Plan for 3D Seismic Survey

The 3D design with enough information will lead to successful survey results.

Those information are;

- Structural Contour Map
- Geological Cross Sections
- Lithology of Target Horizons
- Interval Velocity of Layers
- Stratigraphy of the Regions
- Seabed Topography
- Parameters for Existing Seismic Data Acquisition and Processing
- Various Well Data in the Area
- Etc.

JAMSTEC OD21



Shallow Hazard Survey

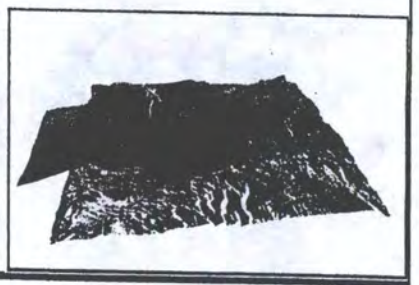
- **Sea Bottom Topography and Condition Survey**
  - Multi-Beam Echo Sounder
  - Side Scan Sonar
  - Side-Scan Swath Bathymetric Sonar
- **High Resolution Seismic Survey**
  - Sub-bottom Profiler
  - (3D) High Resolution Seismic Survey
- **Geotechnical Survey**
  - Corer, Sampler
  - Cone Penetration Test

Shallow Hazard Survey

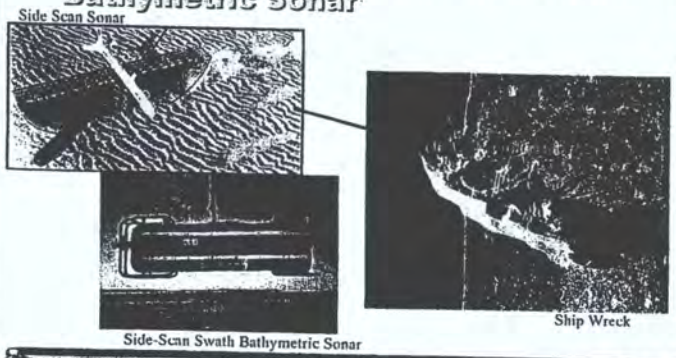
Almost serious drilling hazards exist in the interval from mudline to 1,000m

- Damage caused by shallow hazards is serious.
- High resolution seismic survey is recommended to detect and predict drilling hazards.
- The importance of shallow hazard survey is re-recognized and emphasized for these years with acceleration of hydrocarbon exploration in ultra-deep water region.

Multi-Beam Echo Sounder



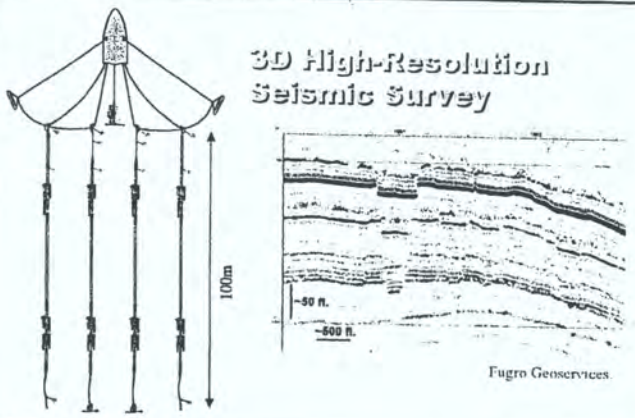
Side Scan Sonar & Side-Scan Swath Bathymetric Sonar



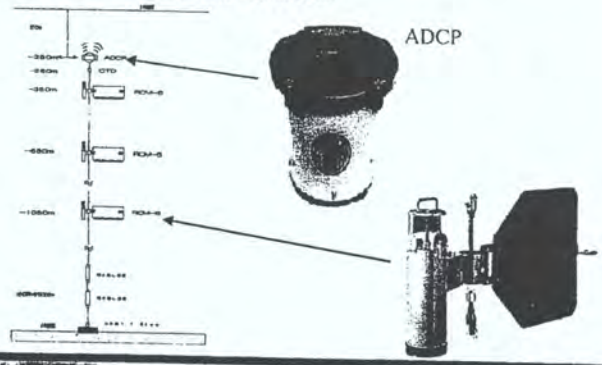
Current Measurement

- Sea Current is a critical issue to Riser, Re-entry, Running Casing, etc.
- Current Measurement should be conducted for;
  - Casing Running Analysis
  - BOP/Riser Running Analysis
  - In-Place Riser Analysis-Static & Dynamic
  - Assessment of Vortex Induced Vibrations in Casing and Riser Strings
  - Operability Analysis

3D High-Resolution Seismic Survey



Current Measurement



A Draft of Site Survey Standard for the OD21 Riser Operation

- Three tables shown below have been completed.
  - Drilling Hazards vs Target Types
  - Survey Equipments vs Drilling Hazards
  - Survey Equipments vs Target Types

JAMSTEC OD21

Survey Equipments vs Drilling Hazards (Draft)

	Shallow Gas	Hydrocarbon Bearing Formation (Deep Formation)	Shallow Water Flow	Abnormal Pressure	Soft Seabed	Complicated Seabed Topography and Geology	Hazardous Geological Structures	Hydrothermal Activity	Landslide and Turbidity Current	Methane Hydrate	Diapir and Mud Volcano	Man-made Objects	Current
2D Deep Penetration Seismic Reflection	X	X	X	X	Y		X			X	X		
(3D) High Resolution Seismic Reflection	X		X	Y*	Y		X*		Y	X	X*		
3D Deep Penetration Seismic Reflection	X*	X*	X*	X*			X*			X*	X*		
Seismic Velocity Determination				X						X			
Refraction													
Swath Bathymetry (Hull-Mounted)						X			X*		Y		
Side Scan Sonar (Deep Tow)	Y		Y		Y	X	X*	X	Y	Y	X*	X	
Side-Scan Swath Bathymetic Sonar (Deep Tow)	Y		Y		Y	X	X*	X	Y	Y	X*	X*	
SBP (Hull-Mounted)	X		X		X	X	X		X		X		
SBP (Deep Tow)	X		X		X*	X*	X*	Y	X*		X*	Y	
Photography or Video					X*			X				X*	
Heat Flow								X		Y*			
Magnetics												Y	
Gravity	Y	Y					Y			Y			
Sampling					X	X	Y	Y	X*	Y	Y		
Current													X

X = Required X* = May be required for specific sites Y = Recommended
Y* = May be recommended for specific sites

JAMSTEC OD21

Drilling Hazards vs Target Types (Draft)

	New Ocean Crust	Old Ocean Crust	Large Igneous Provinces	Convergent Margins	Passive/Rifted Margins	Deep Ocean Basin Sediments	Back Arc Basins	Continental Slope	Continental Rise
Shallow Gas	Mn	L - Mn	M - L	H - M	H - M	H - M	H - M	H - L	H - L
Hydrocarbon Bearing Formation (Deep Formation)	Mn	Mn	L	H - M	H - M	H - M	H - M	H - L	H - L
Shallow Water Flow	Mn	Mn	L - Mn	H - M	H - M	H - M	H - L	H - M	H - M
Abnormal Pressure	L	M - L	Mn	H - M	H - M	H - M	H - M	M - L	M - L
Soft Seabed	Mn	L - Mn	Mn	H - M	H - M	H - M	H - M	M - L	M - L
Complicated Seabed Topography and Geology	M	Mn	Mn	H - M	H - L	L - Mn	M - L	H	H - L
Hazardous Geological Structures	M - L	M - L	M - L	H	H - M	M - L	M - L	H	M - L
Hydrothermal Activity	H	M - Mn	L - Mn	M - L	H - M	L	H - L	L - Mn	L
Landslide and Turbidity Current	Mn	Mn	M - L	H - M	H - M	H - M	H - M	H	M - L
Methane Hydrate	Mn	Mn	L- Mn	M	H - M	H - M	H-M	H - M	H - L
Diapir and Mud Volcano	Mn	Mn	L - Mn	H - M	H - M	M - L	L - Mn	H - L	H - L
Man-made Objects	NOT APPLICABLE - NON GEOLOGY DEPENDANT								
Current	NOT APPLICABLE - NON GEOLOGY DEPENDANT								

Existence Possibility: High (H), Moderate (M), Low (L), Minor(Mn) * May be on specific sites

JAMSTEC OD21

Survey Equipments vs Target Types (Draft)

	New Ocean Crust	Old Ocean Crust	Large Igneous Provinces	Convergent Margins	Passive/ Rifted Margins	Deep Ocean Basin Sediments	Back Arc Basins	Continental Slope	Continental Rise
2D Deep Penetration Seismic Reflection	X	X	X	X	X	X	X	X	X
(3D) High Resolution Seismic Reflection			X*	X	X	X*	X	X*	X*
3D Deep Penetration Seismic Reflection	X*	X*	X*	X*	X*	X*	X*	X*	X*
Seismic Velocity Determination				X	X	X	X		
Refraction	Y	Y							
Swath Bathymetry (Hull-Mounted)	X	X	X	X	X	X	X	X	X
Side-Scan Swath Bathymetic Sonar (Deep Tow)	X	X	X	X	X	X	X	X	X
SBP (Hull-Mounted)	X	X	X	X	X	X	X	X	X
SBP (Deep Tow)	Y			X	X	X	X	X	X
Photography or Video	X								
Heat Flow	X	X*		Y*	Y*	Y*	Y*	Y*	Y*
Magnetics	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gravity	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sampling	X	X	X	X	X	X	X	X	X
Current	X	X	X	X	X	X	X	X	X

X = Required X* = May be required for specific sites Y = Recommended Y* = May be recommended for specific sites

JAMSTEC OD21

Survey Equipments vs Target Types (Draft)

	New Ocean Crust	Old Ocean Crust	Large Igneous Provinces	Convergent Margins	Passive/ Rifted Margins	Deep Ocean Basin Sediments	Back Arc Basins	Continental Slope	Continental Rise
2D Deep Penetration Seismic Reflection	X	X	X	X	X	X	X	X	X
(3D) High Resolution Seismic Reflection			X*	X	X	X*	X	X*	X*
3D Deep Penetration Seismic Reflection	X*	X*	X*	X*	X*	X*	X*	X*	X*
Seismic Velocity Determination				X	X	X	X		
Refraction	Y	Y							
Swath Bathymetry (Hull-Mounted)	X	X	X	X	X	X	X	X	X
Side-Scan Swath Bathymetic Sonar (Deep Tow)	X	X	X	X	X	X	X	X	X
SBP (Hull-Mounted)	X	X	X	X	X	X	X	X	X
SBP (Deep Tow)	Y			X	X	X	X	X	X
Photography or Video	X								
Heat Flow	X	X*		Y*	Y*	Y*	Y*	Y*	Y*
Magnetics	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gravity	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sampling	X	X	X	X	X	X	X	X	X
Current	X	X	X	X	X	X	X	X	X

X = Required X* = May be required for specific sites Y = Recommended Y* = May be recommended for specific sites

What shall we settle before "Call for Proposal" ?

C.Year	2000	2001	2002	2003
Action Item/Month	Mar.	Apr. Mar.	Apr.	Mar. Oct

IODP Science Adv.Panels & Groups

Site Selection

Call for Proposals

Proposal Evaluation

IPC Recommend

Setup Pannels

What shall we settle ?

Oct

Call for Proposal

iSAS

iSSEP

evaluation

IPC

Recommend

Setup iSSP

Input to Prop. Evaluation

Setup iPPSP

Input to Prop. Evaluation

JAMSTEC to Propose;
1. Preliminary Safety Operation Limit of OD21 Riser Ship to the science community
(Feb,2001, IPSC, Kyoto?)

To establish a mechanism to discuss and address ;
1. the Site Survey Standard for IODP (esp. for riser hole)
2. Required data set to be provided by ;
   (a) Proponent
   (b) Science Operators
   (c) Quarity
3. Poduce Proposal Format (by Aug, 2001?)

JOIDES SITE SURVEY PANEL MEETING

Feb 25 - 27 2001
Banff, Canada

Members: Diebold, John (*LDEO, NY, USA*) -- Chair

Caress, David (MBARI, USA)
Droxler, Andre (*Rice U., USA*)
Enachescu, Michael (*Husky, Canada*)
Kleinrock, Martin *(VU., USA)*
Kuramoto, Shin'Ichi *(GSJ, Japan)*
Holbrook, Steve *(UWYOM, USA)*
Lee, Chao-Shing *(PACRIM)*
Lizarralde, Daniel (GA Tech, USA)
Lyle, Mitchell *(BSU., USA)*
Mallinson, David (*USF, USA)*
Meyer, Heinrich *(BGR, Germany)*
Lewis, Stephen *(CSU, USA)*
Scrutton, Roger (*UK*)
Yao, Bochu (GMGS, China)

Liaison: Malfait, Bruce *(NSF, USA)*
Janik, Aleksandra (JOIDES Office)
Klaus, Adam (*ODP/TAMU*)
Shipley, Tom (*SCICOM/OPCOM*)
Quoidbach, Daniel (*ODP Data Bank*)
Claypool, George (*PPSP*)

Apologies:
Anselmetti, Flavio (*ESF*)
Leroy, Sylvie(*France*)

1 **Preliminary Matters** (Enachescu, Diebold, Quoidbach)
- **1.1** Introduction of members, liaison, guests and meeting logistics.
- **1.2** Charge and procedures for the meeting
- **1.3** Greet new members - Droxler, Lewis, Mallinson, Scrutton
- 1.4 Watchdog assignments and feedback to proponents

2. Reports

- 2.1 JOIDES (Janik)
- 2.2 PPSP (Ball)
- 2.3 ODPDB (Quoidbach)
- 2.4 TAMU (Klaus)

2.5 NSF (Malfait)
2.6 SCICOM/OPCOM (Shipley)
2.7 SCIMP ad Hoc Committee (Diebold/Quoidbach)

3. Site Survey Status Of Upcoming Scheduled Legs For 01, 02

3.1 Leg 194: Marion Plateau 510 (Mallinson)
3.2 Leg 195: West Pacific Ion 431 + 505 – Full3: Mariana Convergent Margin Subduction Factory (Holbrook)
3.3 Leg 196: Nankai II 517 (Diebold, for Leroy)
3.4 Leg 197: Hawaiian/Emperor Hotspot 523 (Diebold)
3.5 Leg 198: 534 - Full: Extreme Warmth/Shatsky Rise (Lyle)
3.6 Leg 199: Paleogene Equatorial Pacific APC Transect 486 (Yao)
3.7 Leg 200 H2O 500 (Caress)
3.8 Leg 201 571-Full Peru Margin deep biosphere (Meyer)
3.9 Leg 202 465 SE Pacific Paleoceanography 465 (Lyle)
3.10 Leg 203 544-Full2 Costa Rica Subduction Zone (Holbrook)
3.11 Leg 204 Gas Hydrates on Hydrate Ridge 546 (Diebold)
3.12 Leg 205 499 – Rev: Equatorial Pacific ION (Caress)

4. Highly Ranked by SCICOM, AUGUST 2000

4.1 533-Full2 Arctic Ocean (Lyle)
4.2 525 - Full: MAR Mantle Peridotites (Kleinrock)
4.3 455 – Rev3 Laurentide Ice Sheet Outlets (Lee)
4.4 482 – Full2: Wilkes land Margin (Meyer)
4.5 559-Full Walvis Extreme Climates (Yao)
4.6 564-Full New Jersey Shelf (Enachescu)
4.7 539-Full2 Blake Ridge (Kuramoto)
4.8 512-Full2 Core Complex (Kleinrock)

5. Forwarded To SCICOM For Consideration

5.1 519-Full2 Tahiti Sea Level (Scrutton)
5.2 522-Full2 Fast Spreading (Caress)
5.3 544-Full2 Costa Rica Subduction Zone (Holbrook)
5.4 561 – Full3 Caribbean LIP (Scrutton)
5.5 577-Full/Add2 Demerara Rise (Lee)
5.6 584 – Full TAG II (Lizarralde)
5.7 APL-14 Okinawa (Kuramoto)

6. SSEPs Sent For External Review

6.1 543-full2 CORK Hole 642.E (Kleinrock)
6.2 547-Full3 Oceanic Subsurface Biosphere (Lewis)
6.3 548-Full2 Chcxulub K/T Impact (Lewis)

6.4 554-Full4 Gas Hydrates in a Petroleum Basin (Enachescu)
6.5 557-Full2 Storegga Slide gas Hydrate (Lizarralde)
6.6 572-Full2 Late Neogene Climate, N. Atl: Distal LISO (Droxler)
6.7 573-Full2 Modern Carbonate Mounds, Porcupine Basin (Droxler)
6.8 575-Full3 African Climate, Gulf of Aden (Mallinson)
6.9 581-Add L. Pleistocene drowned reefs (Mallinson)
6.10 589-Full2 Gulf of Mexico Overpressures (Diebold, for Leroy)
6.11 594-Full Newfoundland margin (Enachescu)

7. Other Business

7.1 SSP Recommendations re SCIMP/SSP/etc. ad-hoc Core-log Integration, U/W Geophysics working group report.
7.2 Thanks and applause for departing members: Anselmetti, Kleinrock, Kuramoto, Lyle, Meyer.
7.3 Schedule Feb.,2002 meeting – Taiwan?
7.4

Report of the

JOIDES Scientific Measurements Panel

Casa Munras Garden Hotel

Monterey, California

December 12th-14th, 2000

Summary of SCIMP Recommendations to OPCOM/SCICOM

The following eight recommendations resulting from the December, 2000 SCIMP meeting in Monterey, California are forwarded to OPCOM/SCICOM for comment and approval.

SCIMP RECOMMENDATION 00-3-1:	Hand-Held Digital Camera purchase
SCIMP RECOMMENDATION 00-3-2:	Hard Rock Core Description Protocols
SCIMP RECOMMENDATION 00-3-3:	Automated Titration System
SCIMP RECOMMENDATION 00-3-4:	Personal Computer Policy
SCIMP RECOMMENDATION 00-3-5:	Computer Hardware upgrades
SCIMP RECOMMENDATION 00-3-6:	Email Charges
SCIMP RECOMMENDATION 00-3-7:	Ephemeral Property measurement Protocols
SCIMP RECOMMENDATION 00-3-8:	MRC maintenance in IODP

SCIMP RECOMMENDATION 00-3-1

SCIMP recommends the immediate purchase of a medium resolution (e.g., 3-megapixel), unmounted, camera for quick and easy recording of interesting sedimentological features in cores by the shipboard scientists.

See page 12 in Report for more details

SCIMP RECOMMENDATION 00-3-2

SCIMP recommends that the Excel worksheet-format Hard Rock Core Description data files that are now being converted to PDF files for inclusion into the Initial Report CD-ROM should be preserved (in Excel format) for eventual migration into the ODP data archive at the end of the program. In addition, these Hard Rock Core Description files should be included on the Initial Report CD ROM in their original format (Excel). Any Excel formatted Hard Rock Core Description Data files from previous legs that have been converted to PDF files and that have not been destroyed should be preserved and published as an appendix on the ODP website (in the event the Leg CD ROM has already been produced)

See page 14 in Report for more details

SCIMP RECOMMENDATION 00-3-3

To provide more efficient, accurate, and precise measurements of chlorinity, Ca, and Mg concentrations, SCIMP recommends that an automated titration system be purchased for the chemistry laboratory on the JOIDES Resolution

See page 15 in Report for more details

SCIMP RECOMMENATION 00-3-4:
ODP-TAMU should provide a concise manual/letter for shipboard scientists that outlines responsibilities of both shipboard scientists and the ODP-TAMU Marine Computer specialists with respect to setting up and maintaining personal laptop computers on the JOIDES Resolution. This manual/letter should be sent out to shipboard scientists upon their acceptance to a leg.

See page 19 in Report for more details

SCIMP RECOMMENDATION 00-3-5:
SCIMP registers concern regarding the decision by ODP-TAMU to stop routine upgrades of computer hardware onboard the JOIDES Resolution for the remainder of ODP. We acknowledge that uncertainties regarding operating systems and program budgets may cause temporary interruptions in computer hardware upgrades, but nevertheless caution the science operator that it would be unwise to allow significant differences to develop between shipboard computer capabilities and those used by shorebased researchers.

See page 20 in text for more details

SCIMP RECOMMENDATION 00-3-6: SCIMP recommends that at least the first 500,000 bytes of sent and received email be free-of-charge to Shipboard Scientists and ODP technical staff.

See page 20 in Report for more details

SCIMP RECOMMENDATION 00-3-7: SCIMP recommends that ODP-TAMU develop protocols to ensure that timely measurements are made of ephemeral properties on all cores that are not fully processed aboard the ship.

See page 23 in Report for more details

SCIMP RECOMMENDATION 00-3-8: SCIMP recognizes the Micropaleontological Research Center collections as a valuable legacy of ODP. To provide for maintenance and growth of the MRC collections in IODP, SCIMP endorses the continued support of the MRC effort by national ODP offices and recommends that IODP continue to both recognize the MRCs as component of the new drilling program and provide a mechanism for oversight of the MRCs within the new advisory structure.

See page 24 in Report for more details

Scientific Measurements Panel Participant List

SCIMP Members

Jamie Allan	(US, Appalachian State University)
Christian Buecker	(Germany, GGA)
Bernard Celerier	(France, Universite de Montpellier II-CNRS)
Mike Fuller	(US, University of Hawaii)
Thomas Janecek	(US, Florida State University
Dae Choul Kim	(PACRIM, Pukyong National University)
Masataka Kinoshita (alt)	(Japan, Tokai University)
Mike Lovell	(UK, Leicester University)
Ken MacLeod	(US, University of Missouri)
Philip Meyers	(US, University of Michigan)
Peter Michael	(US, University of Tulsa)
Sverre Planke	(ESF, University of Oslo)
Carlos Pirmez	(US, ExxonMobil Upstream Research Co)
David Smith	(US, University of Rhode Island)
Geoff Wheat	(US, W.Coast &Polar Reg Undersea Res Ctr)

Liaisons

Keir Becker	(JOIDES)
Paul Dauphin	(NSF)
Dave Goldberg (alt)	(ODP-LDEO)
Frank Rack	(JOI)
Carl Richter	(ODP-TAMU)

Guests

David Divins	(NGDC)
Brad Julson	(ODP-TAMU)
Bill Mills	(ODP-TAMU
Charlie Paull	(Monterey Bay Aquarium Research Institute)
Bill Ussler	(Monterey Bay Aquarium Research Institute)
Roy Wilkens	(Office of Naval Research)

Regrets

Gerry Iturino	(ODP-LDEO)
Eiichi Kikawa	(Japan, JAMSTEC)
Joe Ortiz	(US, Lamont-Doherty Earth Observatory)
Jeff Schuffert	(JOIDES)

NOTE: This report of the meeting is grouped primarily by agenda items and is not always in chronological order of discussion.

A) Introduction

The meeting started on Tuesday, December 12, 2000 at 8:30 am and ended on Thursday, December 14th, 2000 at 12:00 p.m.

The Chairman welcomed the panel to the meeting and expressed a special welcome to new members Jamie Allan, Phil Meyers and Carlos Pirmez. Masataka Kinoshita attended as the Japanese alternate for Eiichi Kikawa. Dave Goldberg attended as the alternate for Gerry Iturrino.

Regrets received from Gerry Iturrino, Eiichi Kikawa, Joe Ortiz, and Jeff Schuffert.

Geoff Wheat, the meeting host, explained some of the logistical arrangements for the meeting.

The Chair presented a brief overview of the Agenda and asked if there were any other items that panel members wanted to add to the agenda. None were suggested. The Chair continued with the Agenda.

B) Liaison Reports

1) NSF

Paul Dauphin reported to the panel that the NSF FY01 budget increased by 13%. The FY01 budget for ODP was $48.1M (Legs 192-198) with $22,845 added for data legacy issues. Dauphin noted that the US now supports 64% of the Program.

Dauphin also reported on the meeting of the ODP Council in June 2003 (including the PEC V review), the reorganization of the NSF Ocean Sciences Division, and new personnel at NSF. One note of concern was the PEC V review of the Scientific Measurements Panel. See Appendix 00-3-1 for this review and SCIMP's rebuttal comments *(Note: the comments were actually written for the SCIMP 00-1 report but the JOIDES office requested that they be deleted because the PEC V review was not officially distributed when the SCIMP 00-1 report was finalized)*

Finally, Dauphin discussed aspects of the new Program Plan. The reader is directed to the website - *www.iodp.org* - for details on the IODP, IPSC and IWG meeting minutes, and the program timeline.

2) JOI
Frank Rack reported on the changes in the JOI office since the last meeting, the Program budgets, the Program Development Plan, Long Range Plan initiatives and future planning in the Program (see Appendix 00-3-2 for complete details). Of immediate concern to SCIMP is the potential shortfall in the budget of up to $1.2M because of higher than expected fuel prices. Any budget shortfall could pose delays in purchasing equipment SCIMP has deemed essential for the program (e.g. a digital imaging system).

3) JOIDES
Keir Becker reported on the move of the JOIDES office from GEOMAR to RSMAS (Miami). Personnel at the new office include Keir Becker (Director), Aleksandra Janik (Science Coordinator) and Elspeth Urquhart (International Liaison). See http://joides.rsmas.miami.edu for more details about the office.

Becker further reported on the aspects of the current advisory structure and that for IODP. He noted that SCIMP will need to meet regularly until the end of the current program as the panel's mandate includes shipboard instrumentation, publications, and downhole measurements. These are all issues that will require oversight throughout the length of the Program. At the next SCIMP meeting, iSAS (interim Science Advisory Structure) observers may be present. It is not clear at this point, however, the manner in which the current JOIDES advisory structure and the ISAS structure will meld.

4) ODP-TAMU
Carl Richter reported that the ODP-TAMU operator's update (Appendix 00-3-3) stands as read. Richter fielded several questions regarding the Davis-Villinger tool, which the Chair deferred to the "Laboratory/Services" update and review section later in the day.

5) ODP-LDEO
Dave Goldberg presented highlights from the Borehole Research Group's SCIMP report (Appendix 00-3-4), in particular the results of the deployment of the Multisensor Gamma Ray tool on Leg 191 and Logging While Drilling (LWD) operations on Leg 193. Goldberg then reported on the status of the IESX project, including tasks completed to date and future activities. The IESX project plays an integral role in the establishment of a seismic-log-core integration capability aboard the JOIDES *Resolution.* Details of this project and how it ties in with SCIMP's ad hoc Working Group on seismic-log-core integration are found in Section G "Update on Workshops" of this report.

C) Update of Previous Meeting Recommendations

The five recommendations resulting from the June, 2000, SCIMP meeting are summarized below. A short background/summary section is presented for each

recommendation. Detailed discussion of these recommendations can found in the June, 2000 SCIMP report and associated appendices (posted on the JOIDES website).

SCIMP REC 00-2-1: Data Integration Working Group
SCIMP REC 00-2-2: Digital Imaging of Split Cores
SCIMP REC 00-2-3: Data Protocols for Non-ODP equipment
SCIMP REC 00-2-4: Data Protocols for Legacy Holes
SCIMP REC 00-2-5: Software for Discrete Digital Images

1) SEISMIC/DOWNHOLE/CORE DATA INTEGRATION

Background

The lack of routine exchange, use, and integration of seismic/downhole/core data by scientists aboard the JOIDES Resolution has been a problem throughout the history of the program. The software and hardware necessary for the establishment of a Seismic/downhole/core data integration capability aboard the JOIDES Resolution now exist. Seismic/downhole/core data integration, however, encompasses a wide variety of issues and thus, input from SCIMP members, SSP members, ODP-TAMU, and ODP-LDEO is needed before expenditures are made. For example, The minimum capabilities required for routine seismic/downhole/core data integration aboard the *JOIDES Resolution* are not well defined. What are the minimum capabilities needed with respect to underway geophysical operations, downhole tools, core analytical equipment, computational instrumentation, and technical support staff to make this data integration facility a reality? In order to keep moving forward with this issue, SCIMP recommended that a temporary Working Group be established to define the minimum capabilities for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution.* The following recommendation defined the mandate, reporting timeline, members and meetings for this Working Group.

SCIMP RECOMMENDATION 00-2-1: SCIMP recommends that a temporary Working Group be established to advise SCIMP on the minimum capabilities needed for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution.*

The mandate of the Working Group is as follows:

1) Evaluate required seismic acquisition and processing facilities on the *JOIDES Resolution* (U/G and VSP).
2) Evaluate facilities required for core-log-seismic integration and interpretation on the *JOIDES Resolution.*
3) Evaluate the need for scientific and technical staff support on the *JOIDES Resolution.*
4) Evaluate how to obtain, store, and distribute digital seismic data.
5) Evaluate what shore-based facilities and personnel are required.
6) Estimate cost of different aspects of the seismic laboratory.

Timeline:

The evaluation of required seismic acquisition and processing facilities on *the JOIDES Resolution* (U/W and VSP) should be completed by December, 2000 and a report and recommendations presented at the December, 2000 SCIMP meeting.

The final report and recommendations to be presented at the June, 2001 SCIMP meeting.

Members:

Members should include (but not necessarily be limited to) one person from SCIMP, SSP, ODP-TAMU, and ODP-LDEO, a Shipboard Scientist participating in the ODP-LDEO FY 01 pilot study, and an Industry representative).

Meetings:

One to two meetings held at the Borehole Research Group facilities at LDEO.

Update:

The ad-hoc working group was formed during Fall, 2000 and a meeting, chaired by Sverre Planke (SCIMP member) was held at Lamont-Doherty Earth Observatory on October 30, 2000. A Draft Report of that Working Group is presented in Appendix 00-3-5. See Section G "Workshop Reports" for the details of SCIMP's discussion of the report and recommendations to be forwarded to SCICOM.

2) DIGITAL IMAGING OF SPLIT CORES

Easy acquisition, processing, and distribution of digital core images while at sea is central to developing more objective core description procedures and analyses. In June 1999, SCIMP made a recommendation (SCIMP Recommendation 99-2-12) that ODP-TAMU purchase a commercially-available RGB line-scan digital imaging system and that this system be fully functional and replace the existing core photography system on board the *JOIDES Resolution* by July 2000. SCICOM approved this recommendation and forwarded it to JOI. Although SCIMP did not specifically name a vendor, panel members did inform ODP-TAMU personnel of the system of choice (GEOTEK).

Seven months later at the January, 2000 SCIMP meeting, panel members were informed by ODP-TAMU personnel (perhaps incorrectly or inadvertently) that ODP-TAMU was moving forward with the purchase of the GEOTEK system. SCIMP recommendation 00-1-4 specifically applauded ODP's decision to purchase this system and reiterated the request that the system be fully operational as specified in SCIMP recommendation 99-2-

12. SCICOM approved this recommendation and forwarded it to JOI. At this point, SCIMP members believed the purchase and deployment of the system was "on schedule" per SCIMP recommendation 99-1-12.

Unbeknownst to SCIMP members, ODP-TAMU had been seriously investigating other systems that required additional development (i.e., not off-the-shelf, commercially-available systems as specified in two SCIMP recommendations). An RFQ finally was finally submitted in early March, 2000 to vendors of digital core-imaging systems. This RFQ was developed by the ODP-TAMU digital imaging project team without SCIMP or JOI input. ODP-TAMU received responses from three vendors as of the closing date for the RFQ. Review of the responses to the RFQ was ongoing as of early May, 2000 when the ODP-TAMU project team was informed by ODP-TAMU management that because of budgetary constraints related to the high cost of fuel the digital imaging project would be shelved and the RFQ closed.

Fully one year after the first SCIMP recommendation, the *JOIDES Resolution* is still without digital imaging capabilities for split cores and a vendor has not been selected.

The off-the-shelf GEOTEK line-scan system suggested by SCIMP is the system of choice. The basic GEOTEK core logging system is used by over 50 institutions around the world (including many JOIDES institutions and institutions in most member countries). The digital camera system developed by GEOTEK exceeds the specifications offered by any other comparable system in the world. This system, when put on the ship, would (1) have known capabilities; (2) work the first day it was set up; and (3) address known, high priority issues with respect to core description, photographic distribution, and publications. SCIMP makes the following recommendation with respect to digital imaging:

SCIMP Recommendation 00-2-2: SCIMP recommends that JOI direct ODP-TAMU to reallocate current fiscal year funds to move forward immediately with the purchase of a single-track, moving sensor GEOTEK line-scan digital imaging system.

UPDATE: (From ODP-TAMU Report)
The digital imaging system issue is currently being re-examined. The digital imaging working group has had several conversations with three potential vendors regarding the need for a less expensive system. This can probably be achieved by purchasing an off-the-shelf system that will not be custom modified to suit ODP's needs. During the week of 27 November, a review meeting attended by SCIMP chair Tom Janecek and Frank Rack (JOI) was held at ODP-TAMU, and a request went out to vendors for bids on such digital imaging systems December 5. The bids were due January 5 so that a selection of an imaging system will have taken place before the next SCICOM/OPCOM meeting at which time funds may be reprioritized. Since there will be no funds available before the SCICOM meeting, the bidding and selection procedure will not delay the purchase of a digital imaging system.

3) LEG-SPECIFIC (NON-ODP) DATA ACQUISITION AND DISTRIBUTION

SCIMP discussed how data from non-standard, leg-specific equipment and instrumentation (brought on board by shipboard scientists) was distributed and archived. The panel discovered that data distribution protocols for this type of equipment are not discussed by either the ODP Data Policy or the Third Party Tool Policy. The panel felt that data from all leg-specific tools should be distributed to the entire shipboard party, archived in ASCII format on the Initial Reports CD-ROM, and be subject to the same one-year data moratorium as are all other standard ODP data types. The following recommendation resulted:

SCIMP Recommendation 00-2-3: SCIMP recommends that all investigators who produce data using leg-specific, non-ODP scientific analytical equipment and instrumentation on board *the JOIDES Resolution* follow all standard ODP data policies and data moratoriums. In all cases these data should be made freely available in the same way that other shipboard data are distributed.

UPDATE: (From ODP-TAMU Report)
This recommendation is in accordance with the spirit of data acquisition on the JOIDES Resolution and will be supported and enforced by ODP-TAMU personnel.

4) DATA DISTRIBUTION FROM LEGACY HOLES

SCIMP discussed the acquisition, distribution, and archiving of long-term data from ODP boreholes (e.g., strain-meter measurements). The use of ODP boreholes after a cruise has been discussed previously by the panel (e.g., see Recommendation 99-1-15) and by the Long-Term Observatory PPG. The Long-Term Observatory PPG recommended the establishment of an oversight group for legacy holes (possibly a subset of SCIMP and/or OPCOM members). This group would deal inter alia with guidelines for use of holes, duration of experiments, check on ability to remove or add equipment, and resolve multi-user conflicts. The use of legacy holes will continue after the end of the current program and most definitely into the successor program, IODP. The issues regarding legacy hole use and data distribution are broad and often political in nature and many are well beyond the scope of an advisory panel such as SCIMP (e.g., territorial issues). Because of these broad issues and the use of these holes both in the current program and in IODP, SCIMP believes the issue of legacy holes (particularly data distribution) should be addressed by the ODP-IODP transition plan.

SCIMP Recommendation 00-2-4: SCIMP recommends that the ODP-IODP transition plan address the issue of long-term use of ODP drilled boreholes, with particular emphasis on the distribution and archiving of data collected from these legacy holes.

UPDATE:
SCICOM approved Recommendation. Forwarded to IPSC for consideration.

5) PROTOCOLS FOR HANDLING DISCRETE DIGITAL IMAGES

SCIMP discussed the handling of digital photomicrographs (and other single-frame digital images). Current single-frame digital image archiving protocols aboard the *JOIDES Resolution* are ad hoc in nature. The panel discussed the use of commercial asset management applications (e.g., Extensis Portfolio and Cumulus Canto) that could be utilized by ODP for organizing, viewing, sharing, and previewing digital files across networks and platforms. This type of off-the-shelf asset management software appears to be a viable solution for the consistent linking of metadata with digital single-frame images. The purchase and routine use of this commercial software would relieve ODP-TAMU of the burden of developing such an asset management package. SCIMP makes the following recommendation regarding the handling of single-frame digital images:

SCIMP Recommendation 00-2-5: To establish a protocol for the consistent linking of metadata with digital single frame images (e.g., thin sections, scanned core photographs) SCIMP recommends that ODP-TAMU purchase and implement the use of an asset management software/database (e.g., Extensis Portfolio or Cumulus Canto). The database generated should interface with JANUS, have SQL compatibility and be able to export data in a long-term archive format.

UPDATE: (From ODP-TAMU Report)
Jay Miller has tested the digital image handling software that SCIMP recommended to investigate in terms of handling digital images. Jay's detailed report is provided in the Science Services update section of the ODP-TAMU Report (See Appendix 00-3-3).

Summary

Pros

* *Great for shipboard scientist use (provided it is archived properly)*
* *Relatively inexpensive ($200 for each single user-$2500 for server version which allows easier administration and $200 for each additional client over 5)*

Cons

* *Does not guarantee proper archiving*
* *Does not provide required original file security*
* *Does not guarantee proper storage of metadata*
* *Does not provide for ease of transport off the ship*
* *Requires heavy administration to even potentially overcome the above cons*

This type of software provides some of the user friendly (shipboard only) features ODP needs, but is not transportable, does not ease the administration tasks (in fact they will probably increase), and does not provide the security ODP requires.

NOTE: See panel discussion and associated action items in Section D (Core Description) of this meeting report for SCIMP response.

D) Laboratory / Services Review

1) Core Description:

Digital Imaging system

Carl Richter updated the panel about the status of the acquisition of a digital imaging system (See ODP-TAMU operator report --Appendix 00-3-3 for full details). Richter reported that a request for bids went out on December 5th, 2000. The bids were due on January 5 so that a selection of an imaging system could take place before the SCICOM/OPCOM meeting, at which time funds may be reprioritized. SCIMP emphasized that it is ***imperative*** that ODP-TAMU pick a vendor after this bidding process so, that should funds become available, the operator can move quickly to acquire the system. SCIMP also emphasized that ODP-TAMU should involve SCIMP members (in particular, Joe Ortiz) in discussions surrounding the selection of the appropriate vendor.

Hand-Held Digital Camera

Panel members discussed the need not only for the acquisition of standardized digital images (via a track system) but also for a hand-held, medium-resolution digital camera for easy and quick acquisition of interesting sedimentological and petrological features in the core. This capability would allow shipboard scientists more freedom to select close-up photographs for inclusion in the Initial Reports than is afforded with the current (analog) format. Panel members also heard about a more dedicated, copy-stand-mounted system being considered by ODP-TAMU personnel. This request for a hand-held digital camera should be considered a separate issue.

SCIMP RECOMMENDATION 00-3-1

SCIMP recommends the immediate purchase of a medium resolution (e.g., 3-megapixel), unmounted, camera for quick and easy recording of interesting sedimentological features in cores by the shipboard scientists.

Archiving of Digital Photographs

The acquisition of discrete digital images is rapidly increasing aboard the JOIDES Resolution (e.g., paleontology, core description). Proper management and archival of these images is a concern to the panel. Indeed, a recommendation was made at the

previous meeting (Recommendation 00-2-5) regarding the establishment of protocols for handling these images. SCIMP recommended that ODP-TAMU investigate the use of commercially-available, off-the-shelf, software for management of these images (e.g., Extensis Portfolio). By utilizing an off-the-shelf product, ODP-TAMU would not need to invest time and effort into developing an application. ODP-TAMU evaluated these commercially available packages and came to the conclusion that: "*This type of software provides some of the user friendly (shipboard only) features ODP needs, but is not transportable, does not ease the administration tasks (in fact they will probably increase), and does not provide the security ODP require (from ODP Operator's Report - -Appendix 00-3-3).*

Although these commercial applications may not be ideal, SCIMP members still believe that the Program needs a consistent protocol for handling discrete digital images. Several ideas were suggested by panel members for methodologies that would preserve the required metadata associated with the digital images and not be an undue burden on the scientists or ODP-TAMU personnel. SCIMP members will work with ODP-TAMU personnel to develop the necessary protocols for discrete digital image archival.

***Action Item**: Core description SCIMP LWG members (Peter Michael and Jamie Allan) will confer with Jay Miller (ODP-TAMU) and other LWG members (e.g., Paleo) to forge a plan and protocol for acquiring, recording, and labeling all types of digital images.*

Hard-Rock Core Description.

ODP-TAMU staff scientists and publications personnel requested input from SCIMP on an issue concerning Hard Rock Core Description data. According to ODP-TAMU personnel, the protocols for archiving and publishing data such as alteration, vein logs, and structural geology description scans is inconsistent from leg to leg. On some legs the staff scientists seem to consider this material, which is generated on Excel spreadsheets, as "prime data" and on other legs they consider it as supplemental data.

SCIMP members feel that these Excel worksheet-format Hard Rock Core Description data files are generally the best core description record generated from the leg and should be considered "prime data. In addition, the Excel files should be kept (and published on the Initial Report CD-ROM) in Excel format. Changing the Excel file to an ASCII or pdf file can (and often does) result in the deletion of key information. Although the Excel format is not an "archive-quality" format (i.e., ASCII), panel members felt that, for now, it was more important to retain and publish this Excel-based information in its original format (as most everyone currently has access to Excel). The conversion of these files to an "archive-quality" format that retains all the original information will have to be addressed towards the end of the program.

SCIMP members made the following recommendation concerning Hard Rock Core Description data:

SCIMP RECOMMENDATION 00-3-2

SCIMP recommends that the Excel worksheet-format Hard Rock Core Description data files that are now being converted to PDF files for inclusion into the Initial Report CD-ROM should be preserved (in Excel format) for eventual migration into the ODP data archive at the end of the program. In addition, these Hard Rock Core Description files should be included on the Initial Report CD ROM in their original format (Excel). Any Excel formatted Hard Rock Core Description Data files from previous legs that have been converted to PDF files and that have not been destroyed should be preserved and published as an appendix on the ODP website (in the event the Leg CD ROM has already been produced)

The question of the development of a more useful (perhaps GIS-based) Hard-Rock core description application was again brought before the panel. The current JANUS application is considered useless by most petrologists (hence, the use of Excel-based spreadsheets). Any new Hard-Rock Core Description Program should be based on the presentation and annotation of rapidly-acquired digital images. As the Program currently does not have the capability, the panel decided to defer pursuing the development of such an application until this image-capture capability is available.

SCIMP member heard about an easy-to-use (Microsoft Access-based) core description program developed for the Hawaii Drilling Project. The application looked promising as an interim-application for certain hard-rock legs. SCIMP members will investigate the application in more detail and report back on its utility at the next meeting.

Action Item: *Core description LWG members (both SCIMP and ODP) acquire a copy of the core description program utilized by the Hawaii Drilling Project and evaluate its utility for potential modification and use onboard the JOIDES Resolution.*

2) Chemistry

Automated Titration equipment

At its previous meeting (June, 2000) SCIMP heard about requests from scientists for purchase of an automated titration system. SCIMP felt it needed more information about the nature of the request and the benefits to the program before it could make a specific recommendation. Geoff Wheat prepared a report that outlined the current (manual) methodology (and associated problems) and the benefits of an automated titration system.

Titration techniques are the most accurate and precise means for determining concentrations of chlorinity, calcium, and magnesium, three important (essential) measurements for understanding the oceanic geochemical environment. Given the small changes in chlorinity (typically <2%) that are meaningful to a variety of researchers, chlorinity must be measured at sea to avoid problems associated with evaporation. Several automated titration systems are available on the market. These systems provide many benefits, including decreased sample processing time and the elimination of the use

and disposal of butanol. An added benefit would be the removal of the present old spectrophotometer and hence, reclamation of needed lab counter space.

Expected costs for the upgrade of the current system are approximately $13,000. Considering that the current schedule is full of legs that would benefit from such a capital expenditure late in the Program (including gas hydrate legs, continental margin legs, and several paleoceanographic legs), this request is modest and should be implemented.

SCIMP RECOMMENDATION 00-3-3
To provide more efficient, accurate, and precise measurements of chlorinity, Ca, and Mg concentrations, SCIMP recommends that an automated titration system be purchased for the chemistry laboratory on the JOIDES Resolution.

Organic Extraction Upgrades
The panel was informed of requests by shipboard scientists for new organic analysis extraction equipment. The panel, however, did not have much information on the types of equipment and availability of funds. The chemistry LWT members felt the need to more fully investigate the nature of the issues associated with this request for new equipment before approaching SCIMP with specific recommendations.

Action Item: *Phil Meyers to investigate the issues associated with the request for new extraction equipment of organic analyses and report back to the panel at the June 2001 meeting.*

Miscellaneous
Panel members noted that over $21,000 for supplies and $10,000 for maintenance were allocated in the Fiscal Year 01 budget for X-ray diffraction. At the risk of micro-management, some panel members wanted to know why these numbers are so high.

Action Item: *Brad Julson to report back to panel about x-ray expenditures.*

At some point, the old XRD may cease to operate and have to be replaced. In order to avoid some of the problems associated with the purchase of the digital image system (e.g., not having a vendor selected when funds are available), SCIMP asks that ODP-TAMU continue to update its vendor information (and bids) and keep SCIMP apprised of potential vendors and expected costs. In this way, SCIMP and ODP-TAMU can move quickly in the event a replacement system is needed (and warranted).

3) Physical Properties:

Resistivity Measurements

Several requests have come before the panel for acquisition or development of as systematic means to collect resistivity measurements (Formation Factor) on board the JOIDES *Resolution* (See Appendix 00-3-6). The panel heard about a four-point resistivity meter and several other instruments in current use by researchers. Panel members noted that this type of measurement can be difficult to make and is very operator and machine dependent. Standardized data collection protocols are essential. A consensus developed that it would be best for Physical Property and Chemistry LWG members to identify a methodology (both hardware and protocols) for the next meeting. The technique will be reviewed by panel members at the next meeting and a formal recommendation made to SCICOM.

***Action Item**: Physical Property and Chemistry LWG members to identify a systematic means to collect resistivity measurements (Formation Factor) on board the JR (including equipment and data collection protocols).*

Pycnnometer

The Qauntachrome pycnometer, while not ideal, remains the instrument of choice for moisture and density measurements made onboard the JOIDES Resolution. Sufficient spares and replacement parts have been purchased by ODP-TAMU to keep at least one system running. The major problem with the pycnometer stems from the large number of samples analyzed each leg. The equipment is not designed for such a large throughput. In addition, the pycnometer is used in an environment (at sea) where it was not designed to operate. Panel members suggested that ODP-TAMU work with Physical Property scientists to minimize the number of samples run. ODP-TAMU Physical Property technical staff and staff scientists should stress, that in most situations, the pycnometer is best used as a calibration tool for the high-resolution bulk density data gathered on the multi-sensor track. This application of the pycnometer would help to reduce the overall number of moisture and density samples collected and analyzed on the ship and relieve stress on the pycnometer (and the physical property scientists, too!).

Natural Gamma improvements

SCIMP members briefly discussed what progress has been made toward upgrading the natural gamma detectors on the multi-sensor track. At the June 2000 SCIMP meeting, Prof. Rob de Meijer from the Kernfysisch Versneller Institut reported on a new generation of natural gamma detectors and analytical techniques. The bismuth germanate (BGO) crystals, although more expensive than NaI crystals, are much more sensitive. This BGO/full spectrum analytical system can offer a five-fold increase in sensitivity over a NaI/windows system. Total gamma counts could be a factor of 50 greater than produced with the current ODP system. Such an increase in sensitivity would reduce analytical time and make the acquisition of high-resolution gamma data more feasible for core-log integration. Unfortunately, with the increased sensitivity comes a high financial

cost. Given the current equipment priorities and a budget severely affected by high fuel prices, it is not feasible to develop this new detection system within the current Program. The BGO-based natural gamma system, however, should be utilized on the next generation Multi-sensor track built for IODP.

4) Paleomagnetics:
SCIMP and ODP-TAMU Paleomagnetics Lab Working Team members reported that the Paleomagnetics laboratory is functioning well. Most items brought to the LWT's attention are being addressed. The manual, modeled after the Physical Properties "cookbook", is being developed.

5) Underway Geophysics:
Most discussion concerning Underway Geophysics issues was deferred until the panel heard the report from the Seismic-Core-Log Working Group (See Section G "Seismic-Core-Log" Working Group discussion and Appendix 00-3-5 for more details of the draft report).

Scientist cruise evaluations report that several U/G items could (or should) be surplussed as they are no longer used or functioning. These items include the old Magnavox GPS, the Galatee speed log, and the Hamco 200 gun. ODP-TAMU personnel said the first two items were scheduled for surplus but the Hamco 200 gun is still needed and thus remains on the ship.

SCIMP members noted what appears to be a deficiency in trained U/G technicians. ODP-TAMU personnel responded that a technician is currently being trained and several other technicians (although not assigned to the lab) are well-versed in U/G operations.

6) Downhole Tools:
An overview of current tool usage and development was provided to the panel (See Drilling Services Update in Appendix 00-3-3 and Specialty Tool and Engineering Developments in Appendix 00-3-4). Specific downhole tools/issues requiring SCIMP input are discussed below.

<u>Davis-Villinger Temperature Tool</u>
The Davis-Villinger Temperature Tool (DVTP) is being adopted as an ODP operational tool. Appendix 00-3-3 (Drilling Services Section) outlines the steps taken by TAMU toward this implementation. Several prototype upgrades to the tool, including the integration of a pore pressure measurement and a LabView based communication and

data reduction program have been tested recently. The next major deployment of the DVTP is Leg 195.

Action Item: *SCIMP and ODP-TAMU Downhole Laboratory Working Teams to monitor DVTP tool status to ensure the tool is ready for deployment on Leg 195.*

Maintenance of CLIP software

Maintenance and upgrades to the Core-Log Integration Platform (CLIP) software have been inconsistent since its implementation on the JOIDES Resolution. The Chair of SCIMP and the Borehole Research Group (BRG) worked on a maintenance/upgrade protocol to ensure the CLIP software is properly maintained and available for use (Appendix 00-3-7). First, BRG will continue to maintain software and support shipboard users through such mechanisms as daily user support (e.g., training, email/ phone queries), updating user manuals, maintaining current versions of the software on the workstation, and ensuring compatibility with operating system upgrades. New software modules and/or enhancements to the CLIP software may be proposed by community users (e.g., through JOI, USSSP, or NSF proposals) with a pre-review by BRG. This maintenance and upgrade program will ensure the CLIP application is always usable and allow scientists to propose enhancements as the need arise.

Natural Gamma Tool Status

The third party Multisensor High-Resolution Gamma tool (MGT) was successfully deployed on Leg 191. An initial analysis shows the data are of excellent quality. The tool is scheduled for deployment on Legs 194, 199 and 201. SCIMP needs to determine whether the MGT should move toward certified tool status by evaluating the need for this tool throughout the remainder of the program.

Action Item*: SCIMP and ODP-TAMU Lab Working Team members to evaluate need for the MGT throughout remainder of program and determine if recommendations should be made to move the tool toward certified status.*

High-Resolution Magnetic Susceptibility Tool

The development of a Seismic-Log-Core integration capability is dependent on the ability to measure parameters on cores and in the borehole at the same spatial resolution. Magnetic susceptibility and natural gamma are two of the best (and easier) measurements to make both downhole and on the cores at the same resolution. BRG reported to the panel that it is possible to develop a high-resolution magnetic susceptibility tool that can be run downhole independently or with the MGT tool (see above). Development time for telemetry, electronics, and software design and testing is about 3 months with another 1.5 months for the pressure casing. Costs are expected to about $60,000 for tool development. SCIMP Downhole Lab Working Team members need to evaluate the potential for the tool throughout the remainder of the program. If such a tool is deemed essential upon evaluation, SCIMP can put forth a recommendation that Program costs be

allocated toward development and deployment and rank this development and deployment with other requests.

***Action Item**: SCIMP Downhole Lab Working Team members to evaluate need for a high-resolution magnetic susceptibility tool throughout remainder of program and provide the panel with enough information to put forth a recommendation, if necessary, at its next meeting.*

7) Shipboard Computers/Networks

Laptop usage

Laptop PC usage aboard the JOIDES Resolution is becoming more common. The cruise evaluations from recent legs all have complaints about limited power plugs and network connections for laptops. These complaints speak to a larger issue of what are the responsibilities of ODP-TAMU technical staff with respect to the support of personal laptop computers. Issues such as software availability, virus protection, network connections and cabling, and equipment repair need to be addressed by ODP-TAMU. SCIMP has seen a draft document (Appendix 00-3-8) that outlines these responsibilities and would like to see this document finalized and implemented by the next leg.

SCIMP RECOMMENATION 00-3-4: ODP-TAMU should provide a concise manual/letter for shipboard scientists that outlines responsibilities of both shipboard scientists and the ODP-TAMU Marine Computer specialists with respect to setting up and maintaining personal laptop computers on the JOIDES Resolution. This manual/letter should be sent out to shipboard scientists upon their acceptance to a leg.

Equipment and software upgrades

ODP-TAMU has been upgrading/replacing about 30% of the computers on the JOIDES Resolution each year. This upgrade plan has kept the computer environment on the ship relatively state-of-the-art. SCIMP learned that ODP-TAMU does not plan any routine upgrades of computer equipment over the remainder of the program. The result would be that by the end of the program in 2003 most computer equipment in the labstack would be over 3 years old. With current advances in hardware, application software, and operating systems, the Program risks establishing a big gap between what scientists use on shore and what is found on the ship. For example, increasing shipboard acquisition and manipulation of digital images will require continuous improvements in computer speed, memory and operating systems to take advantage of improved software tools.

SCIMP acknowledges growing budget concerns within the Program and understands a fixed hardware and software replacement upgrade scheme of 30% may be unworkable in the current climate. ODP-TAMU, however, must be prepared to make selective upgrades

when needed and develop a plan, with SCIMP input, that keeps the Program's computational capability similar to that used by the community.

SCIMP RECOMMENDATION 00-3-5: SCIMP registers concern regarding the decision by ODP-TAMU to stop routine upgrades of computer hardware onboard the JOIDES Resolution for the remainder of ODP. We acknowledge that uncertainties regarding operating systems and program budgets may cause temporary interruptions in computer hardware upgrades, but nevertheless caution the science operator that it would be unwise to allow significant differences to develop between shipboard computer capabilities and those used by shorebased researchers.

Email

The Groupwise Email system and proposed billing schemes have generated quite a bit of discussion (See Appendix 00-3-9). Two email-related issues have developed. First of all, is Groupwise the best option we (ODP) have at this time for an email platform? The second issue is a more philosophical argument as to whether the scientific and ODP staff should be charged for personal incoming email, outgoing email, or both and how much?

Email is an accepted fact of life and if the Program is to continue to get top quality people on the ship (who by their nature have many pokers in the fire and need daily contact with shore), should we burden them with email costs? In addition, in a critical period where we are trying to maintain some esprit de corps in a technical staff that spends six months on the ship and has a very uncertain future ahead, is it wise to charge the staff for personal email?

In these days of flat-funding, however, any money saved (or recovered) is important. To help us get a handle on the magnitude of costs and put these monetary issues in perspective Carl Richter supplied the panel with costs associated with ODP email (Appendix 00-3-10). With the old CC mail system (Leg 165-Leg 186), the average scientist was charged about $45/Leg (with the first 100 Kbytes free). With the advent of the Groupwise software and more importantly, renegotiated COMSAT rates, the average scientist is now charged about $11 (with the first 200,000 Kbytes). This charge amounts to ODP-TAMU recovering about $250/leg from scientists. SCIMP contends that it is not worth the time and effort of ODP to establish a billing system for such a trivial return. With reasonable filters in place to prevent transmission of large documents or an excessive number of documents SCIMP recommends that ODP mail should be free-of charge to scientific and technical staff. The goodwill generated from such a gesture would be invaluable.

SCIMP RECOMMENDATION 00-3-6: SCIMP recommends that at least the first 500,000 bytes of sent and received email be free-of-charge to Shipboard Scientists and ODP technical staff.

The other email issue, the use of Groupwise software, is a bit more problematic. Clearly, some of the problems with the Groupwise are simply those that result from the use of a new software application on the ship. ODP-TAMU has solved many of the initial problems. Other problems with Groupwise are the result of inadequate or over-complicated manuals. SCIMP suggests that ODP-TAMU review recent complaints about GroupWise software and tailor a short document (revised after each cruise evaluation) that provides concise solutions for common problems.

***Action Item**: ODP-TAMU to provide short manual for common email problems.*

Miscellaneous

The computational needs of the microbiology lab need to be addressed (see Microbiology Section below for more details).

Integration of the Unix environment with the shipboard network is poor at best. ODP-TAMU plans to review NetWare 5.1, in terms of its ability to integrate with the UNIX environment (before Leg 196). SCIMP will expect an update as soon as possible.

***Action Item**: ODP-TAMU Information Services to supply SCIMP with a review of NetWare 5.1 as soon as possible.*

8) JANUS/Data Migration

Some of the discussion concerning JANUS and data migration was deferred until the panel heard a presentation by Frank Rack (JOI) on archival strategies for the JANUS database at the end of the program (see Section G: JANUS-NGDC Transfer Meetings).

Establishment of Mirror Sites

ODP-TAMU has asked for guidance regarding the distribution of the JANUS database to mirror sites not under the direct control of TAMU. A request for a mirror site had come from an individual scientist. This request raised a number of issues:

(1) Was this a formal request from an ODP member country or from an individual scientist or group of scientists?

2) If this was not a formal request from an ODP member country, then how should ODP/TAMU respond? One of the primary concerns was how the IS department at ODP/TAMU should prioritize their time with respect to this request?

If the request comes from the ODP national office, then there is mechanism to arrange for the transfer of data within the framework of the memoranda of understanding (MOU's) between the U.S. NSF and internationalODP members, with the appropriate checks and balances about appropriate use and security.

In this case, the request came from an individual at an institution. Frank Rack informed the panel that he had spoken to the person who made the request to ODP/TAMU (in December) advised him on the proper course of action regarding his request, which was to go through the national office first, and then proceed through official channels. The individual is now

The immediate concern that the IS department at ODP/TAMU have, is the following:

Creating a mirror site for JANUS is fairly straightforward (the issues of cost for the computer, software, and staffing notwithstanding), and in this case the capability to limit access to the proprietary data associated with the 1-year moratorium would be preserved. However, if only the non-proprietary data within the JANUS database are to be mirrored, then this would require significant additional programming and staffing resources, which could significantly impact their prioritized work plan.

SCIMP members feel that JANUS data migration efforts and establishing improved data uploading and reporting capabilities are paramount over programming efforts to remove proprietary data from mirror sites. Panel members believe there has to be some level of trust established between ODP-TAMU and the administrators of a qualifed mirror sites in member countries.

Data loss

Jamie Allan reported that there may be significant data losses occurring between the time the data is "finalized" aboard the ship and when it is published on the CD-ROM. Discrepancies may arise during the editorial post-cruise meeting and also during Initial Report manuscript review that many not be reflected elsewhere (i.e., JANUS Database). The extent of the problem is not known and SCIMP will investigate this issue in more detail.

Action Item: *Jamie Allan to begin investigation of the extent of changes that occur in data sets from the ship to the initial post-cruise meeting to the final publication of data on the CD ROMs.*

9) Curation

Curatorial Advisory Board

The Curation LWT reported there has been very little Curatorial Advisory Board activity since the last meeting. This inactivity may mean the new Data Policy and Sample

Advisory Committees are working well. Alternatively, it could mean that shipboard scientists are not fully aware of possible recourses if sample requests are denied or altered. ODP-TAMU personnel were reminded to advise shipboard scientists during the initial port-call group meetings that the new Data Policy provides a mechanism to ensure that scientists are fairly treated with respect to sample requests.

Ephemeral Properties and Sampling

A letter sent by Ellen Thomas (Wesleyan College) to the SCIMP Chair concerning ephemeral property sampling was distributed to the panel (See Appendix 00-3-11). Apparently, cores collected on Leg 178 in the Palmer deep were not fully sampled or analyzed by the micropaleontology lab. Full sampling and analysis did not occur until nearly six months later. At that time, researchers found that almost all calcareous forms had disappeared (presumably dissolved). As a result, the possibility of precisely dating the high-resolution Quaternary cores has been compromised.

Two issues come forth with respect to this letter. First, a mechanism needs to be emplaced by ODP-TAMU to ensure that all cores are properly sampled on the ship. If shipboard sampling is difficult due to time constraints or personnel shortages (as may happen with Ancillary Sites), then researchers (either leg participants or shore-based researchers) need to be identified (preferably at the pre-cruise meeting) to sample the cores immediately upon their arrival at the repository. SCIMP, as an advisory board, can assist ODP-TAMU with this task by identifying legs/sites where routine sampling for ephemeral properties may be a problem.

SCIMP RECOMMENDATION 00-3-7: SCIMP recommends that ODP-TAMU develop protocols to ensure that timely measurements are made of ephemeral properties on all cores that are not fully processed aboard the ship.

The second issue regarding this letter is that it appears there is a problem with core degradation over time. SCIMP members recalled that a geriatric study had once been attempted by TAMU but they did not know what parameters were studied nor the results of the study. Presumably, geriatric studies have been conducted at non-ODP facilities, too. Further action on this second issue was deferred until more information could be gathered

***Action Item**: SCIMP curatorial, micropaleontological, and chemistry LWT members to poll the community and determine extent of geriatric studies on core degradation.*

10) Paleontology/MRCs/Thin sections

PAL application

Cruise evaluations from the paleontology scientists register common complaints about The PAL application. Problems persist with application crashes and making/loading non-

standard dictionaries. Several options/fixes have been implemented for 194 and will be evaluated.

Micropaleontological Reference Centers

The most recent report of the Micropaleontological Reference Centers is found in Appendix 00-3-12. Several long-term issues are of concern to the MRC curators including formal recognition in IODP and the accession / transfer / ownership of collections. SCIMP recognizes the value of the MRC collections to the scientific community and sees the need for such a program to continue, in some form, in the next drilling program. SCIMP is not aware of any formal support or designation in the current plans for IODP and makes the following recommendation:

SCIMP RECOMMENDATION 00-3-8: SCIMP recognizes the Micropaleontological Research Center collections as a valuable legacy of ODP. To provide for maintenance and growth of the MRC collections in IODP, SCIMP endorses the continued support of the MRC effort by national ODP offices and recommends that IODP continue to both recognize the MRCs as component of the new drilling program and provide a mechanism for oversight of the MRCs within the new advisory structure.

In concert with this recommendation, MRC curators must propose and justify a plan to carry the MRC program forward into the next Program.

Action Item: *SCIMP and MRC curators will investigate alternatives that maximize support and use of MRC collections on a day-to-day basis, through the end of the program, and into IODP. Issues to be considered include particulars of the status of the center, and support of the Facility by host institutions and national ODP/IODP offices.*

11) Publications

Funding acknowledgements

The lack of acknowledgement of funding sources in ODP manuscripts (IR, SR, and outside) is a concern to the Program. To rectify the situation, JOI, TAMU and NSF developed a standard acknowledgement statement for researchers to use in manuscripts. The statement will be included ODP Data Policy.

It reads:

"This research used samples and/or data provided by the Ocean Drilling Program (ODP). The ODP is sponsored by the U.S. National Science Foundation (NSF) and participating countries under management of Joint Oceanographic Institutions (JOI), Inc. Funding for this research was provided by _____."

Authors would fill in the name of their respective funding agencies as appropriate. In the U.S., for example, the funding for ODP post-cruise research is typically provided by the U.S. Science Support Program (USSSP).

Scientist Cruise Evaluations

The panel was pleased that ODP-TAMU is now supplying SCIMP members with current post-cruise evaluations by the shipboard scientists. Additional format changes are needed, however, to make the reviews easier to use.

***Action Item**: The Chair will work with the ODP-TAMU SCIMP liaison to establish a better reporting format for the cruise evaluation*

Equipment Manuals

SCIMP is pleased with the progress being made toward finalizing many of the laboratory "Cookbooks".

***Action Item**: In order to keep the development of these valuable resources on track, SCIMP asks that ODP-TAMU supply the panel with "cookbook" status at each meeting (See Appendix 00-3-13 for status of "cookbooks" as of December, 2000).*

12) Microbiology

Dave Smith reported on the establishment of the Microbiology Laboratory on the JOIDES *Resolution* beginning with the temporary lab on Leg 185 to the final relocation of the lab to level 5 (F deck). In addition to establishment of the laboratory, a Technical Note (No. 28) is being prepared and Microbiology now has representation in the JOIDES advisory system (SCIMP).

Several issues still need attention, however, with respect to establishment of routine microbiological capabilities on the ship. Technical support from ODP-TAMU is paramount. ODP-TAMU has informed SCIMP that hiring of the microbiology technician is on hold for financial reasons.

The microbiology program will soon need access to a radioisotope facility. SCIMP, however, cannot comment further on implementation of this program until the logistics and costs for such a facility have been more fully explored.

***Action Item:** Dave Smith and ODP-TAMU microbiology LWG members to investigate issues regarding implementation of Radioisotope van, including costs, insurance, location, swab team, etc. Report/update due at next meeting.*

Additional issues regarding nitrogen gas requirements, establishing shipping and handling protocols, obtaining clean subsamples, determining basic supply inventories, and collecting clean water samples need to be addressed by SCIMP and ODP-TAMU Microbiology LWT members.

E) Pressing Issues -- Recent developments:

Tools/needs identified by the Gas Hydrate PPG (Charlie Paull -MBARI)
Charlie Paull reported on (1) what the community has learned about Gas Hydrate drilling and analysis from previous legs, (2) needs and tools identified by the Gas Hydrate PPG for future legs, and (3) HYACE tool developments

Based upon Leg 164 results Paull told the panel that the most productive measurement for Gas Hydrates is still Chloride. Although some of the baseline Chloride assumptions may be faulty, the measurement is consistent and reliable. Paull stressed, though, that in-situ measurements are a must and hence, a pressure core system (i.e., the PCS). In addition, distinct variations in temperature are commonly observed in freshly recovered core samples from gas-rich sediments. These variations are believed to be due to both the endothermic gas hydrate decomposition and gas expansion, and thus represent fundamental information about the presence and distribution of gas and gas hydrate within cores

Paull then discussed the results of the Gas Hydrate PPG (Appendix 00-3-14) and identified several needs/tools for a successful Gas Hydrate program. First, because even simple degassing experiments take a few hours to perform, and because it takes trained tool specialists ~2-6 hours to prepare the current PCS tool for the next deployment, hardware limitations severely restrict deployment. Thus, at least 2 to 3 PCS tools with 5 chambers are needed, along with two dedicated engineers. Currently, a functional manifold to degas the PCS does not exist. The core material within the PCS sample chamber cannot be directly accessed or transferred without depressurizing the PCS sample chamber.

Finally, Paull discussed HYACE tool development. He noted that the HYACE tool should be considered a complementary tool to the PCS, not a competitive one. In the long run, once proven, it should be a better tool as it (1) has push-in, hammer-coring and drill-in capabilities, (2) obtains larger samples, (3) can be run on the MST, (4) can obtain subsamples through ports and (5) can easily transfer material to a laboratory pressure container.

Based upon Paull's presentation, SCIMP identified several areas to help the Gas Hydrate program move forward. First, a functional manifold is needed. The approximate cost for a manifold is about $5000. ODP-TAMU personnel, however, believe that much of the necessary equipment for construction of a manifold may be available on the ship.

Action Item: *Bill Mills to work with Charlie Paul/Bill Ussler to determine if ODP-TAMU has current parts in stock to assemble a manifold for the PCS.*

A reliable device for measuring core temperatures on the catwalk is a high priority. At a previous meeting, Frank Rack identified several options (See SCIMP 00-1 report and

appendices therein) and compiled a comprehensive list of techniques and vendors. Based upon this information SCIMP Recommendation 00-1-13 asked that ODP-TAMU investigate the capability to measure spatial variations in core temperature on the catwalk. Without a proponent from the Gas Hydrate community identifying a specific catwalk temperature technique and pursuing funding avenues, it will be difficult to move forward on this issue.

Temperature/Pressure/Conductivity tool development efforts (Bill Ussler-MBARI)

Bill Ussler gave the panel an update on the design and development of the Temperature-Pressure-Conductivity tool, a joint project between MBARI and ODP (Appendix 00-3-15). The tool will provide a means of measuring temperature changes and gas evolution from the core every two meters from core acquisition to the sea surface. These changes can then be linked to gas hydrate concentrations through modeling of ascent profiles. Ussler briefly explained the modeling efforts behind the design and then explained the operation of the tool in detail to the panel. Test operations of the tool are proposed for Leg 195.

F) IODP planning

The Chair of IPSC, Ted Moore, requested assistance from SCIMP in devising a conceptual plan for laboratories in an alternate platform environment in IODP. To assist SCIMP in this endeavor, Roy Wilkens was invited to give a presentation on the Hawaii Drilling Project. This well-run project provides a good model as to what can be accomplished in terms of core processing. Dr Wilkens outlined the drilling operation, on-site core analysis, database needs, and data publication methodology for the program. The panel was most impressed with the database and core description programs (e.g., See Section D: Core Description, this report).

Panel discussion following the presentation centered on how to develop this conceptual model requested by IODP. The panel outlined a spectrum of laboratory/core processing ideas. On one end of the spectrum, all cores are processed at a shore-based laboratory(s). On the other end, all cores are fully processed on the platform. Further options include some processing of cores on the platform to measure ephemeral properties with the remainder of the processing done at a shore-based laboratory(s). In many cases, safety considerations, drilling decisions, in-situ testing and monitoring will require additional core processing on the platform. Inherent in many of these options is the need for compact, transportable, mission-specific equipment that can be housed in standard 20ft shipping vans. The specific equipment needs and logistics required for these options, along with some measure of the advantages and disadvantages of the options (both scientifically and financially) will be generated post-meeting.

Action Item: *SCIMP will develop a document for IPSC describing a conceptual plan for alternate platforms in the new IODP. To begin the process, the SCIMP chair will distribute a "strawman" conceptual plan for alternate laboratory environments to SCIMP members. SCIMP members will assist the Chair in "fleshing" out the document.*

G) Workshop updates

1) Seismic-Core-Log Data Integration Meeting

Sverre Planke presented the draft report of the Seismic-Core-Log integration Workshop (Appendix 00-3-5). The report stems from a previous recommendation by SCIMP (Recommendation 00-2-1) to develop a capability to enhance the vastly underutilized seismic, downhole, and high-resolution data collected for each leg. Very little data integration between these three areas occurs because the tools and software have been lacking onboard the ship and protocols for staffing and data acquisition have not been developed.

The Working Group proposes the permanent establishment of an ODP core-log-seismic integration capability by June 2001. The capability will be formed in a collaboration between TAMU, BRG and the Site Survey Data Bank (SSDB). The core-log-seismic integration facility will mainly build on existing facilities and staff, but will require both new and reallocated resources.

The plan involves shore-based, shipboard, and archival aspects (see report for full details). Resources that will be needed to establish this facility include:

- A facility leader based at the BRG.
- A seismic data loader position at SSDB.
- New air guns on JR (GI and GIG gun).
- Development of a hydrophone receiver.
- 2-3 new seismic workstations (hardware, software, plotting).
- Software development (JANUS, SAGAN).
- Training programs for scientists, seismic crew and SSDB/BRG staff.
- Facilities for archiving and distribution of digital seismic reflection data.

Some of these items are in place (e.g., seismic workstations, SAGAN, training programs at BRG). Some will require new expenditures (e.g., GI Guns), and others will require increased funding levels (e.g., Facility leader at BRG, seismic data loader position at SSDB).

The plan is very ambitious and would provide a new and very much needed routine capability to the program. SCIMP members discussed the report and determined that a phase-in plan must be developed before a final recommendation can be made to SCICOM. This phase-in plan would need to detail when certain aspects of the resources

are needed (i.e., a particular leg) and what purchases/positions could be implemented over time or utilize some current resources to minimize budgetary impact.

NOTE: The final version of the report will be distributed at the OPCOM/SCICOM meeting in Shanghai, and SCIMP's recommendations will be presented at that time.

2) JANUS-NGDC Transfer Meetings

Frank Rack reported on the outcome of two meetings held during Fall, 2000 that explored the resources needed for transfer of the JANUS data base and other ODP data sets to NGDC at the end of the program (See Appendix 00-3-16 for meeting minutes). The objective of these two data transfer/archive meetings was to discover the present status of data holdings throughout ODP and to begin to develop and evaluate options for the long-term maintenance of these resources. The impetus for these meetings stemmed from EXCOM motion 00-2-3 (See Appendix 00-3-17) which speaks to the need of addressing, in a timely manner, many unresolved issues related to ODP-IODP transition. In particular, they have requested that "JOI and the JOIDES Science Advisory Structure will develop options for the long-term maintenance of the ODP data base, JANUS database, core repositories, and other ODP legacies". Understanding the scope of this problem and moving toward a solution will involve three steps. The first is a discovery phase. For example, we need to find the answers to what types data are out there (photos, paper, digital data, etc), where is it stored, how much is there? The second phase will involve some risk/benefit analyses to determine what data should be kept. Finally, a plan of action (with costs and identified resources) will be developed.

Over the next few years, SCIMP increasingly will become involved in many issues identified in this EXCOM motion. In particular, the long-term maintenance of the ODP data base, JANUS database, core repositories, MRC status, and equipment cataloguing are just some of the issues that SCIMP will need to address and provide oversight to ODP-TAMU and the Program.

ODP-TAMU has asked for SCIMP assistance with one the issues outlined above, the JANUS database. In particular, ODP-TAMU is trying to assess what it will take to develop the necessary ASCII files that will be generated from JANUS and sent to NGDC for archival at the end of the program. They need to know which data fields in each data set are important for the archive.

To assist ODP-TAMU in this endeavor, SCIMP will develop a short document that lists the required data fields for each shipboard measurement. SCIMP and ODP-TAMU LWT members will develop this list for their particular labs over the next few months and review it at the next meeting.

***Action Item**: SCIMP Chair to distribute to SCIMP members several examples of ASCII data outputs for the development of the ODP data archive at end of the program. SCIMP*

members will then compile a complete list for each shipboard laboratory/service for next meeting.

Documentation of Laboratory equipment/software
Another legacy/data transfer issue that SCIMP and ODP-TAMU can begin to address is the status of equipment and facilities within the program. ODP-TAMU, working with SCIMP, should begin to compile a document that lists: (1) current lab equipment aboard the JOIDES *Resolution* (and on shore), (2) associated technical manuals (both in-house and vendor manuals), (3) repair and maintenance histories, and (4) other such information that would allow the program to assess what it currently operates, as well as the utility of that equipment for potential use in a new program.

Action Item: *ODP-TAMU will compile a document of current lab equipment which will include a listing of equipment by lab, schematics and vendor manuals, ODP operator manuals, potential use for new program, service contracts, and tech reports. The SCIMP Chair will work with ODP-TAMU on a format for the document.*

3) Geochemistry -Post 2003 Workshop
Geoff Wheat provided a brief update on the recently held JOI/USSSP-sponsored Workshop on Opportunities in Geochemistry in Post-2003 drilling. The workshop, attended by 54 geochemists concentrated on four areas of research including (1) Sediments/Porewater, (2) Chemical Paleoceanography, (3) Deep Igneous Basement/Alteration/Hydrothermal and (4) Biogeochemistry/Microbiology/Hydrates. Although there are no immediate issues for panel to keep an eye on, SCIMP (and its iSAS-equivalent) will have to monitor progress in instrumented CORKs, borehole samples, in-situ anaerobic samplers and advances in organic, biomarker and isotopic analytical equipment.

H) All Other Business

1) New SCIMP Chair
The current Chair, Tom Janecek, rotates off the panel after the SCICOM meeting in March, 2001. The panel discussed potential candidates for Chair. After considerable discussion of the duties required of a chair, the panel decided that a Chair/Vice Chair selection would be preferable to reduce the workload for any one person. Eiichi Kikawa was suggested as Chair and Jamie Allan as Vice Chair. The actual duties of each position are under discussion between the candidates and the current Chair. Once this job description effort is complete, the current Chair, Tom Janecek, will forward the names (and breakdown of duties) to the SCICOM chair for approval.

2) New Member selection

Sverre Planke and Tom Janecek rotate off the panel after this meeting. The major experience gaps on the panel are now the areas of Information Services/data archiving and seismic acquisition and interpretation (Appendix 00-3-18).

With legacy issues taking on an increasing priority over the next few years, it would be most beneficial to the panel to have at least one member with Information Services/data archiving experience. A top candidate for the position is David Divins (NGDC). Dr. Divins is a quite familiar with ODP operations and the data legacy/archive issues facing the program.

3) ODP-TAMU Representation

Panel members have always been impressed with the preparation and input by ODP-TAMU liaisons attending the SCIMP meetings. As the panel deals with both science and technical issues it is important the members are able to interact with both staff scientists and technical staff. While the panel understands the budget ramifications of sending two ODP-TAMU representatives to SCIMP meetings, it stresses that TAMU needs to make every effort to send science and technical representatives to future meetings when the Chair feels the agenda discussion would benefit.

Action Item: *SCIMP Chair to work with ODP-TAMU Science operator to insure presence of both science (Carl Richter) and technical (Bill Mills/Brad Julson) liaisons at future SCIMP meetings.*

I) Next Meeting Date and Venue

Several venues were discussed for the next meeting. The first choice is to hold the meeting at Montpelier, France (Bernard Celerier -host) during the week of June 18-22, 2001.

Action Item: *The Chair will petition the JOIDES office for permission to hold the next meeting in Montpelier.*

J) Acknowledgements

The panel thanks Geoff Wheat for hosting the meeting and Bridget Chisholm (JOI) for help in making the arrangements.

Sverre Planke rotates off the panel after this meeting. The panel will greatly miss his input and assistance. We wish him all the best of luck in his future endeavors and hope to see him on the ship in working on seismic-log-core integration!

Finally, this is the last SCIMP meeting for this Chair. I would like to take this opportunity to thank all of those who have participated as panel members on SCIMP. The selflessness, enthusiasm, and expertise of these people have made the panel a vibrant and pro-active voice in overseeing the myriad of issues that the panel has under its mandate. In addition, I would like to thank the liaisons to SCIMP for their efforts. The working relationship that has developed between SCIMP members and Frank Rack, Gerry Iturrino, Jay Miller, and Carl Richter has ensured that the Program responds in a timely manner to community input and needs.

Simply put, it has been a pleasure to work with all you.

To: OPCOM/SCICOM members
From: Thomas Janecek, SCIMP CHAIR

Attached is a copy of the final report by the SCIMP Advisory Group on Core-Log-Seismic Integration (herein referred to as the C-L-S report). This Advisory Group and the Report are an outgrowth of the SCICOM-approved SCIMP Recommendation 00-2-1:

SCIMP RECOMMENDATION 00-2-1: SCIMP recommends that a temporary Working Group be established to advise SCIMP on the minimum capabilities needed for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution*.

(See full recommendation in APPENDIX 4 of attached Advisory Group report)

Over the past three years SCIMP has worked towards establishing the capability for routine Core-Log-Seismic Integration on board the *JOIDES Resolution*. Throughout most of ODP very little data integration has occurred between these three areas, mainly because the tools and software have been lacking onboard the ship and protocols for staffing and data acquisition have not been developed.

The C-L-S report presents an ambitious, but much needed, capability for ODP (and IODP) and SCIMP endorses the approach outlined in the report. Implementing this capability will require collaboration between ODP-TAMU, the Borehole Research Group (BRG) and the Site Survey Data Bank (SSDB). Routine core-log-seismic integration on board the *JOIDES Resolution* will mainly build upon existing facilities and staff, but will require both new and reallocated resources. Page three of the report outlines six resources necessary to maintain this routine capability aboard the *JOIDES Resolution* and presents a plan for implementation of routine C-L-S integration.

The new resources required for routine C-L-S integration include:
a. A facility leader based at the BRG.
b. Continuation of the seismic data loader position at the SSDB
c. New air guns on JOIDES Resolution (GI and GIG gun)
d. 2-3 new seismic workstations (hardware, software, plotting)
e. Software development (JANUS Database)
f. Training programs and manuals

Some of these items are minimally in place (e.g., seismic workstations, plotting software, training programs at BRG). Some will require new expenditures or protocols (e.g., GI Guns, Seismic Integrator scientific position on the ship). Others will require increased funding levels (e.g., facility leader at BRG, seismic data loader position at SSDB).

SCIMP is cognizant of the current budgetary constraint within the ODP and to some extent, we are still in the "learning phase" as to what the full costs of routine Core-Log-Seismic integration will be to the program. In particular, the completion of the two IESX pilot studies on Legs 194 and 196 will go a long way toward fully defining the cost of these resources (in particular, the personnel requirements).

To keep moving forward with this C-L-S capability, however, certain resources will need to be allocated during the next fiscal year. Of immediate need is the allocation of personnel resources in FY02 for management oversight (based at BRG) and for a data loader position at the SSDB. Discussions between SCIMP, BRG and SSDB suggest that increased allocations of 2-3 additional FTE months for BRG would allow sufficient management oversight for the currently planned C-L-S operations in FY02. Similarly, an extension of the 0.5 FTE data loader position currently at the SSDB should provide enough support for the FY02 C-L-S projects (Legs 199-204). New positions do not need to be created in FY02.

As C-L-S integration becomes more routine, additional resources will need to be allocated towards the purchase of capital equipment. For example, two seismic workstations (hardware, software, plotting capabilities) are currently available in the Downhole Measurements laboratory on the *JOIDES Resolution* (and should suffice for FY02), but some resources will be needed in FY02 for new equipment at the SSDB. Similarly, even though new GI and GIG guns would streamline the acquisition of checkshot and VSP data, the program currently has the capability for gathering this well-seismic data (though cumbersome and time consuming). Increased demands for the acquisition of well-seismic data (as C-L-S integration becomes routine in the next two years) most certainly will require a more streamlined data acquisition capability involving GI and GIG guns (post FY02).

With these short- and long-term issues in mind, SCIMP makes the following recommendation toward establishing routine core-log-seismic capabilities aboard the *JOIDES Resolution*.

SCIMP Recommendation 00-3-9:

SCIMP endorses the findings of the SCIMP Data Integration Advisory Group towards the establishment of seismic-log-core integration capabilities aboard the *JOIDES Resolution*. SCIMP recommends implementation of the following specific Data Integration Advisory Group recommendations for FY02.

1) Borehole Research Group support for C-L-S integration, including personnel, *JOIDES Resolution* systems support, travel, and training costs

2) Continued funding to the Site Survey Data Bank for support of the data loader position

3) Funding for a Seismic Workstation at the Site Survey Data Bank

4) Establishment of a Seismic Integrator position onboard the JR

Plan for Establishing a Core-Log-Seismic Integration Facility in ODP/IODP

SCIMP advisory group on core-log-seismic integration

Sverre Planke (SCIMP), Christian Bücker (SCIMP), Joe Ortiz (SCIMP), John Diebold (SSP), Peter Flemings (PPSP), Adam Klaus (ODP-TAMU), Dave Goldberg (ODP-BRG), Dan Quoidbach (ODP-SSDB), Garry Karner (LDEO) and Jan Erik Lie (RWE-DEA)

February 15, 2001

TABLE OF CONTENTS

EXECUTIVE SUMMARY

We propose the permanent establishment of a ODP core-log-seismic integration facility by FY02. The facility will be formed in collaboration between TAMU, BRG and SSDB. A staff member at BRG should head the facility.

The core-log-seismic integration facility will mainly build on existing capabilities and staff. However, it will require both new and reallocated resources. The facility must be established by FY02 to have an impact on the ODP program and to ensure that it is a well-operating facility by the start of IODP.

The resource requirements will be more accurately determined after the evaluation of the ongoing IESX pilot study headed by the BRG. IESX is currently used at sea (Leg 194), and the co-chief F. Anselmetti reports that "*Overall, I am very satisfied having these seismic capabilities here on board. We couldn't progress without it.*" IESX is currently likely of interest for eight scheduled legs (Legs 196 to 204).

Key aspects of the proposed core-log-seismic integration facility are:

Shore-based

1) Proponents and co-chiefs will be urged to have a plan for core-log-seismic integration and to submit digital seismic data when possible.
2) A digital seismic workstation project should be established for each leg using the GeoQuest IESX software.
3) SSDB will be responsible for pre-cruise seismic data loading and security, project maintenance and training of scientific staff and post-cruise archival of digital data.
4) The shore-based core-log-seismic integration research facility currently established by BRG and SSDB should be continued. Visitors will be responsible for providing their own funding.
5) A procedure for depth calibration of image log and core data should be established if a core imaging system is purchased.

Shipboard

1) We propose the establishment of a **Seismic Integrator** scientific position. The Seismic Integrator will be responsible for on-board core-log-seismic integration, establishing a depth-time model for each logged hole, incorporating the depth-time model in the JANUS database and creating a backup tape of the workstation project at the end of the cruise. The Seismic Integrator will receive pre-cruise training at BRG/SSDB and shipboard support by the BRG logger. It should be staffed on an "as-needed" basis.
2) Each leg needs a seismic crew with experience in acquisition and processing of seismic reflection and borehole data.
3) Check-shot data should be routinely collected at all logged sites. A plan for more efficient acquisition of check-should data should be developed by BRG.
4) A core-log-seismic integration laboratory should be established in a central location in the lab stack (e.g., 8th floor) and the underway laboratory should be remodeled.

Archival

1) The Initial Report CD-ROM should normally contain pre-stacked and stacked seismic reflection data within 5 km of each site.

Implementation plan

1) Core-log-seismic integration sea trials ("IESX trial").
    a. Pilot study during Leg 194 (Marion Plateau; 6/1 to 4/3 2001). Preliminary evaluation report by 1. April, final evaluation report presented at June 2001 SCIMP meeting.
    b. Pilot study II during Leg 196 (Nankai II; 2/5 to 1/7 2001). Evaluation report presented during December 2001 SCIMP meeting.
2) Organization
    a. The core-log-seismic integration facility should be continued at LDEO during FY02 in collaboration between BRG, SSDB and ODP-TAMU. Legs 196 to 204 are all likely to use IESX.
    b. A person based at the BRG should head the facility. This person should be appointed by July 2001, and start by the beginning of FY02.
    c. The seismic data loader position at the SSDB should be continued in FY02.
    d. Training of the current seismic crew at JR should be completed by December 2001.
    e. All remaining ODP legs should all have a plan for core-log-seismic integration.
    f. A **Seismic Integrator** scientific position should be established by Leg 196 and should be filled on an "as-needed" basis.
    g. Training programs for scientists, seismic crew and staff, including cookbooks on IESX, seismic acquisition and core-log and log-seismic integration, should be completed by December 2001.
    h. Seismic data should be included on the Initial Reports CD-ROM starting with Leg 194.
3) Equipment
    a. New shipboard facilities should be available by Leg 196. This includes purchase and testing of new air guns, remodeling of the underway laboratory and establishing a core-log-seismic integration laboratory with computers, plotters and software. ODP-TAMU will organize the changes in collaboration with BRG and SSDB.
    b. A time-depth conversion model should be included in JANUS by December 2001 by ODP-TAMU.
    c. A draft plan for purchasing or developing a more efficient check-shot receiver should be presented to SCIMP in June 2001 by BRG.
4) Evaluation
    a. The newly formed SCIMP core-log-seismic laboratory work group will review the usefulness and progress of the facility at the two yearly SCIMP meetings.
5) Costs
    a. A facility leader based at the BRG.
    b. Continuation of the seismic data loader position at SSDB.
    c. New air guns on JR (GI and GIG gun) (35-65 000$).
    d. 2-3 new seismic workstations (hardware, software, plotting) (<30 000 $).
    e. Software development (JANUS).
    f. Training programs and cookbooks.

Note that this implementation plan should be evaluated after the completion of the IESX trials at the June and December 2001 SCIMP meetings.

1. INTRODUCTION

Seismic data are essential for both the scientific and operational success of ocean drilling. All Ocean Drilling Program (ODP; See Appendix 1 for other acronyms) sites are located on seismic reflection profiles. However, it has been a concern that seismic data are not fully utilized by ODP, and that the scientific outcome of drilling legs can be significantly enhanced by more dedicated shipboard core-log-seismic integration.

The current use of the seismic data in ODP can be summarized as:

1) Seismic data are submitted by the proposal proponents as paper copies to the SSDB at Lamont. The site survey data are reviewed by the SSP and PPSP. The site survey data are of variable quality, from old single-channel data to modern three-dimensional data cubes.
2) Single-channel seismic reflection data are occasionally acquired by the JR if required for navigation accuracy or safety considerations.
3) Downhole VSP or check-shot surveys are sometimes conducted at the JR. However, seismic surveys are currently done in a limited number of holes.
4) ODP has no facilities for digital seismic interpretation. However, the GeoQuest IESX software is currently being tested.

SCIMP has recommended several changes in the acquisition and use of seismic data in ODP and IODP (Appendix 4). The suggested changes are based on a concern that seismic data are commonly not fully utilized in the program and that industry-quality seismic data and interpretational tools are commonly not available for ODP research.

The implementation of the recommended changes has been fairly slow. This is partly due to organizational problems as the responsibilities for seismic data are divided between several different contractors and committees (ODP-TAMU, BRG, SSDB, SSP, PPSP, SCICOM, SCIMP) and that limited resources have been dedicated to core-log-seismic integration.

SCIMP proposed to form an ad-hoc advisory group on seismic-core-log integration at the July 2000 meeting in Amsterdam (Recommendation 00-2-1; Appendix 4). The Mandate (see next chapter) of the group was to make a plan to establish a core-log-seismic integration facility to enhance the scientific outcome of the ODP and IODP programs.

The core-log-seismic integration advisory group met at Lamont-Doherty Geological Observatory from 30-31 October 2000. All members were present during the meeting. This plan is the result of the meeting, and all members of the advisory group have reviewed it.

The recommended plan and cost for establishing a core-log-seismic integration facility is found in Chapter 6. The preceding chapters contain a background and discussion of what the facility should contained.

Mandate and scope

The Mandate and the participants of the core-log-seismic integration advisory group are included in the next chapter. The group consisted of member from the ODP advisory panels (SCIMP, SSP, PPSP), the ODP contractors (TAMU, BRG, SSDB) and the petroleum industry.

We have focused on developing a plan for establishment of a core-log-seismic integration facility within the current organizational structure of ODP. Another organizational structure should be

considered for the IODP depending on the experiences obtained from the proposed core-log-seismic integration facility.

Long-term issues that we have not considered as a part of our Mandate are:

- Establishment a seismic sub-contractor. The responsibilities of this sub-contractor could be:
    - Acquisition and processing of site-survey data.
    - Acquisition and processing of VSP data.
    - Integrated seismic interpretation and processing.
    - Long-term archival and distribution of seismic data.
- Core-log-seismic integration of image data.
    - Implementation and development of software for accessing core and borehole image data from seismic interpretation software. However, this capability will likely be included within GeoFrame standard software package on the JR and at BRG in the next release (target - Fall 2001).

These additional capabilities may preferably be organized in conjunction with other scientific programs or the petroleum industry (e.g., PetroBank for archival or seismic research programs – see for instance NSF workshop report "*US marine seismic reflection acquisition needs for he next decade*" by Schipley and Moore, 2000). The long-term issues are relevant for IODP, but are unlikely to be completed within current funding levels in ODP.

2. MANDATE

The Mandate is based on SCIMP Recommendation 00-2-1, and has been approved by SCICOM.

The Mandate of the advisory group is to plan a efficient, high-quality, cost effective, research laboratory on seismic-log-core data integration onboard the JOIDES Resolution. The major objective of this data integration laboratory is to provide shipboard scientists with the equipment, software, and technical support that will allow them to seamlessly move, manipulate, and interpret digital seismic, log and core data to obtain the research goals of the leg.

The data integration laboratory requires the input of digital data from pre-leg site surveys, shipboard site surveys, downhole logging and high-resolution core scanning equipment. The primary task of the advisory group members will be to evaluate the space, equipment, software, and personnel support required to insure the necessary digital data is acquired and accessible by shipboard scientists. Further, complimentary shorebased facilities and continuation of the laboratory in the IODP should be evaluated.

The advisory group will need to address (at a minimum) the following:

1) *The required seismic acquisition and processing facilities on the JOIDES Resolution (Underway Geophysics and Vertical Seismic Profiling).*
2) *Protocols for obtaining, storing, and distributing proprietary digital site-survey seismic data.*
3) *The space, equipment, and software required for core-log-seismic integration and interpretation on the JOIDES Resolution.*
4) *The level of scientific and technical staff support on the JOIDES Resolution.*
5) *The shore-based facilities and personnel required for support of the shipboard data integration facility, pre-cruise planning, and post-cruise research.*
6) *The costs of equipment and software (both start-up and maintenance costs) and the cost for technical and scientific staffing levels associated with this data integration facility.*
7) *A time schedule and logistic plan for how to establish the facilities.*
8) *How the establishment of a core-log-seismic integration laboratory will be beneficial for IODP.*

Timeline

A draft report and recommendations presented at the December 12-14, 2000 SCIMP meeting. This report will address, at a minimum, items 1-8 above.

A final report and recommendations to be presented to SCICOM at the March, 2001 meeting.

Members

The advisory group will be staffed by:

1) SCIMP panel members with expertise in seismic and logging data acquisition and interpretation, and with expertise in acquisition and interpretation of high-resolution core analytical data sets (e.g., multi-sensor tracks, core imaging etc),
2) one member each from Site Survey Panel and the Pollution Prevention Safety Panel,
3) one member from each of the main ODP contractors including ODP-TAMU, the Borehole Research Group, and the Site Survey Data Bank,
4) one participant in the ODP-LDEO FY01 IESX pilot study, and
5) at least one industry representative with expertise in data integration.

Table 2. Core-log-seismic integration advisory group member list.

Name	Representing	Email
Sverre Planke (chair)	SCIMP	planke@vbpr.no
Christian Buecker	SCIMP	buecker@gga-hannover.de
Joe Ortiz	SCIMP	jortiz@ldeo.columbia.edu
John Diebold	SSP	johnd@ldeo.columbia.edu
Peter Flemings	PPSP	flemings@austin.emsadm.psu.edu
Adam Klaus	ODP-TAMU	aklaus@odpemail.tamu.edu
Dave Goldberg	ODP-BRG	goldberg@ldeo.columbia.edu
Dan Quoidbach	ODP-SSDB	daniel@ldeo.columbia.edu
Garry Karner	LDEO	garry@ldeo.columbia.edu
Jan Erik Lie	RWE-DEA	Jan-Erik.Lie@rwedea.telemax.no

Other issues

Frank R. Rack, Assistant Director or the Ocean Drilling Programs, further request if the advisory group could evaluate the issues involved in the following hypothetical scenario:

A proponent of a scheduled JOIDES drilling proposal sees the possibilities of IESX and thinks that it will be important to the upcoming ODP leg to get a package of relevant site survey data into IESX and onto the ship prior to the cruise.

The proponents suggests that having this data available for quick comparisons among (core-based) composite sections, (downhole) logging data, and the seismic data already collected by the proponents would be extremely valuable to the scientific objectives of the cruise. For the purpose of this scenario, take this to be a high-recovery paleoceanography-focused leg.

The proponents have previously collected both digital 3.5 kHz data, and digital 4-channel seismic data (80 cubic inch airgun), which require processing and assembly. Getting this database together will allow the shipboard science party to compare their drilling results directly to the seismic survey and understand the regional sediment patterns much better. The proponents want to be able to tie at least some of the high-resolution digital subbottom profiling to the drilling results while still at sea.

The potential costs of preparing this data package would include technical assistance (i.e., personnel with salary costs) to extract the appropriate data from the tapes and CD's from the relevant cruise, to reprocess the data, to pick important seismic horizons, and to put the data into the appropriate format for IESX (additional costs might be for media, network fees, software upgrades, etc.). When this task is completed, the resulting database would be archived with the ODP Site Survey Data Bank.

The cost for this data assembly project would be on the order of $15-20K USD. (NOTE: these costs are hypothetical - I don't know what the actual costs would be for this activity, but this range may be in the ballpark).

The questions I would ask you to discuss include the following:

1) *How should the costs associated with these activities be provided, and by whom? Should it be left to the individual proponents to find the funds? Should this activity be funded by national funding agencies through external grants? Using ODP (international, co-mingled) program funds? Or, by some other means?*
2) *If the IESX software is platform dependent, and the appropriate platform (and/or software) is unavailable to the proponents, then how should this situation be handled?*

Should the proponents spend weeks at LDEO getting the data package ready? Where should the funding for the travel costs related to this activity come from? Should this be a program cost?

Please feel free to expand on this scenario to explore other potential issues and questions that may arise during your discussions. Please provide recommendation related to this possible scenario.

3. CORE-LOG-SEISMIC INTEGRATION

Chapters 3 to 5 provide background information of the scientific rational, current status and new facilities required to establish a basic core-log-seismic integration facility in ODP.

Core, log and seismic data are complimentary data sets providing information on different scales and in different domains.

- **Core data** give very detailed information about the sub-bottom geology in one dimension. However, ODP coring is incomplete, and recovery is commonly biased to certain lithologies and massive intervals.
- **Wireline data** provide continuous records of *in situ* measured physical parameters in one dimension. The vertical resolution is from cm (FMS logs) to 10's of meters (VSP data).
- **Seismic reflection data** provide two or three-dimensional structural control of the subsurface. However, depths are measured in time and the vertical and horizontal resolutions are 10's to 100's of meters.

Core-log-seismic integration is important to obtain geological control on identified seismic sequences. However, core-log-seismic integration is just as important for geoscientific interpretation of the borehole data. This is because the seismic reflection data give constraints on the regional structure penetrated by the borehole, and thus ensures that the sampled rocks are representative for local or regional features of scientific importance.

Core-log-seismic integration is normally done as a two-step procedure; core-log integration and log-seismic integration. It is also possible to do simple core-log-seismic integration.

Core-log integration

High-resolution core measurements, for example natural gamma ray and magnetic susceptibility measurements, are routinely done using the multi-sensor track (MST) on JR. These measurements are very useful for core-log integration. The track might be upgraded with new tools in the future, e.g., a full-spectrum BGO source gamma ray tools.

Core-log depth merging and integration is currently done using the ODP SPLICER and SAGAN applications.

- SPLICER gives a continuous section of multi-hole sedimentary strata for building composite sections and developing age models.
- SAGAN defines a set of precise depth correlations between core and log datasets at any given site by establishing a unique mapping function linking two independent depth scales.

Both SPLICER and SAGAN are used for high-recovery sedimentary sections. There is currently no standard application for linking logging and coring depth scales in low-recovery hard rock holes. Core-log integration can in these cases be obtained by comparing structures defined on high-resolution image logs (e.g., FMS) with structures identified in the cores. This time-consuming procedure can locally give relative depth uncertainties of 1-2 cm which is significantly less than the vertical resolution of standard wireline logs (15-50 cm).

ODP is planning to purchase a core imaging system. It will be important to implement new software applications for depth merging of image logs (e.g., FMS) and core image data. Such

applications will be likely with the next release of GeoFrame (target - Fall 2001), and will subsequent be available on JR and at BRG.

Conclusion: We find that the current ODP core-log integration procedure works well for high-recovery sites. However, we suggest that a plan for core-log integration of low-recovery holes and new software applications for image log – image core correlation should implemented by BRG.

Log-seismic integration

Log-seismic correlation is a standard utility in seismic interpretation software. Log-seismic integration is very important for tying borehole data to seismic reflection data to obtain geological information about seismic sequences and uniformities. However, log-seismic integration is not straight forward as borehole data are measured in depth whereas seismic data are measured in time. Our experience is that log-seismic integration is commonly not done properly for ODP Sites.

Depth-time conversion of borehole data requires information about seismic interval velocities. It is also important to know the well deviation for non-vertical holes. Reliable depth-time conversion and tie of reflections requires sonic logs, VSP or check-shot data and calculation of synthetic seismograms. It further requires appropriate software and trained scientists and staff.

We suggest the following standard procedure should be adapted for log-seismic integration in ODP holes:

- Import velocity and density logs in the seismic interpretation station providing high-frequency acoustic impedance information.
- Import check-shot information providing low-frequency velocity information.
- Calculate synthetic seismograms based on appropriate source wavelet function.
- Compare synthetic seismograms and real seismic data. Accept the model or modify log, check-shot or source wavelet data within uncertainty bounds until an acceptable model is obtained.
- Export depth-time function and incorporate the model as the official depth-time model in JANUS.

The implementation of this procedure will require:

- Seismic interpretation software and digital seismic data.
- Acquisition of sonic and density logs and check-shot/VSP data.
- Modifications of the JANUS database to allow entry of a depth-time model.
- Trained scientists and staff.

ODP is currently evaluating the GeoQuest IESX software package for log-seismic integration. This is an industry-standard software package for seismic interpretation. Our experience with IESX is that the software is clearly capable of performing the tasks of the proposed log-seismic integration procedure. A full report of the results of the IESX evaluation will be completed after the Leg 194 sea trial.

Sonic and density logs are routinely collected by ODP. Check-shot and VSP data are no so frequently collected (acquired on 6 legs and in 13 holes since Leg 171B; scheduled for Legs 194, 200 and 204). Reliable log-seismic integration is very difficult without check-shot data. This is mainly due to two reasons:

1) Sonic log data are not collected in the top part of the boreholes due to presence of casing. The velocity of this interval is thus undetermined.
2) The dominant wavelength and the wave paths of seismic waves in check-shot/VSP surveys and reflection surveys are similar. In contrast, sonic data relies on much higher frequency waves (2000 Hz versus 30 Hz) and shorter wave paths (0.5 m versus km's). Velocity models derived from sonic logs often require a low-frequency correction to enable generation of reliable synthetic seismograms.

Note that IESX requires check-shot data for depth-time conversion.

Conclusions: We suggest that a new procedure for log-seismic integration is implemented on the JR. This will require allocation of new resources, in particular routinely acquisition of check-shot data. The IESX trial is an important step towards implementing these changes.

Core-log-seismic integration

Core-log-seismic integration should ideally be accomplished on a seismic workstation where all downhole core and log data are accessible from a seismic display. It is currently possible to import unevenly depth-sampled parameters (e.g., minicore velocity measurements or multi-sensor track data) in IESX. However, we are not aware of any standard application where it is possible to access image data (e.g., core pictures/scans, FMS data) by seismic workstation software. It is a fast development of geodatabases and visualization software in the petroleum industry, and relevant software is scheduled to be available in the next release of GeoFrame (Fall 2001).

A simple, but practical way of doing core-log-seismic integration is to import different graphics (e.g., core images, logs, seismic data) in conventional drawing programs. The different data sets can then be displayed on large-scale plotters currently available on JR. Example plots and simple cookbooks may be very useful for shipboard scientists.

Seismic interpretation

Pre- and post-cruise seismic interpretation is mainly a task of the leg proponents and shipboard scientists. It is not regarded as an important shipboard task. The proposed log-seismic integration procedure will facilitate better shore-based seismic interpretation and may lead to more studies on seismic wave propagation and imaging based on ODP data.

Table 3. Summary of core-log-seismic activities.

	Core-log	
Depth model	Develop consistent depth model for a site using SAGAN and SPLICER.	*Seismic Integrator* in cooperation with BRG logger and Stratigraphic Correlator.
Image data	Integration of core pictures, scanned data, image logs and other core and log data.	Evaluate new functions in IESX (Fall 2001)
Training	Pre-cruise training program.	BRG
Archive	JANUS.	TAMU
	Log-seismic	
Depth-time model	Generate a depth-time model from log, check-shot and seismic reflection data combined with synthetic seismogram modeling using GeoFrame (IESX).	*Seismic Integrator* in cooperation with BRG logger.
Training	Shore based training program currently developed by IESX trial group.	BRG/SSDB
Archive	Modify JANUS to include depth-time conversion function.	TAMU

4. SEISMIC ACQUISITION

Seismic acquisition onboard JR is focused on adding scientific value to the borehole data and on safety. Borehole check-shot or VSP data are important for the scientific results of the leg, in particular for core-log-seismic integration. The drilling vessel should only be used to acquire seismic reflection data in rare occasions. Acquisition of seismic reflection data might be required to relocate a site for safety reasons. It might also be required to accurately locate a drilling target when the proposed site is located on old seismic data with poor navigation.

We propose that check-shot data should be acquired routinely in logged holes for core-log-seismic integration purposes. This capability currently exists on the JR. However, the air guns are old and need replacement. We propose that two new guns are bought, a GI and a GIG gun. The guns can be used separately or in a cluster, are easy to maintain and store, and can be used for check-shot, VSP and seismic reflection work.

The cost of a GI gun (210 cu in; G105/I105) with various size chamber and a full set of spare parts is currently $35,000. It can be purchased now and allow upgrade to GI-G gun linear "cluster". Upgrade would cost $30,000 (see SCIMP Recommendations 99-2-11 and 00-1-7).

Check-shot surveys currently require a separate logging run using the WST. We see the need to obtain a new receiver that can be connected to one of the standard logging strings. Check-shot data can then be collected when the tool is on its way down, saving logging time associated with an extra run. We propose that BRG investigate other borehole check shot tools (hydrophones or others) that could be used to record check shots, but require less rig time.

VSP data are fairly time-consuming to collect and requires special processing and trained people. We propose that ODP maintains the expertise to acquire VSP data, but that it is a specialty tool.

JR currently has a single-channel system for acquisition and processing of seismic reflection data. We regard this system to be sufficient when the new GI/GIG guns have been installed. However, a 2 or 3-channel streamer should be considered if the current streamer needs to be replaced.

All seismic data collected during ODP cruises should be made available in SEGY format on the CD-ROM in the initial report. Navigation data and explanatory notes should be stored in ASCII format. ODP-TAMU shall insure long-term archival and availability of the data on the Internet after the memorandum period.

Adequate space needs to be allocated on the JR for storage and easy deployment of the seismic equipment. The GI/GIG guns will require less space and maintenance than the current guns. They should be stored in the Underway lab when they are not used or in a place where they are easy to deploy when they are actively used (e.g., on a part of the helicopter deck).

The responsibility of seismic acquisition is currently divided between several ODP contractors. We propose that ODP ensures that each cruise has a seismic crew consisting of technicians from TAMU and BRG. The seismic crew needs to have proper training in seismic data acquisition and processing, and needs to know how to maintain and repair the equipment. Updated manuals and/or cookbooks are further required.

Table 4. Proposed seismic acquisition and seismic facilities onboard JR.

Activity	Comment	Requirements
Check-shot	Should be collected in all holes with logs. Important for IESX. Try to get new receiver that can be connected with other tool strings.	Source: GI or GI+GIG Receiver: WST/hydrophone Recording: Schumberger/BRG Seismic crew
VSP	Specialty tool.	Source: GI or GI+GIG Receiver: WST3 Recording: Schumberger/BRG Seismic crew
Reflection	Safety requirement.	Source: GI or GI+GIG Receiver: 1-3 channel streamer Acquisition: SIOSEIS Processing: SIOSEIS/SU
Laboratory	Space for acquisition, processing and interpretation.	Underway laboratory. Part of helideck (guns). Seismic integration laboratory.
Archive	Distribution and long-term archive.	IR CD-ROM: SEGY and ASCII format. Long-term archive (TAMU).

5. SEISMIC REFLECTION DATA

Seismic reflection data are essential for pre-cruise planning and post-cruise research. Limited resources have been allocated for integration of seismic reflection data in the ODP system. We believe that ODP needs to allocate more resources to enhance the use of seismic reflection data in the future and that the program needs to make digital seismic data near drilling sites available to the scientific community. A potential problem is that seismic reflection data are commonly proprietary, and rules thus have to be flexible.

Modern seismic interpretation requires access to digital seismic reflection data. ODP has until recently lacked facilities for digital core-log-seismic integration and interpretation. The on-going IESX trial is an important step in the right direction. The results from the trial will be important for determining how seismic data will be dealt with in the ODP/IODP system in the future. However, several important conclusions based on experience from other organizations can be made before the trial has been completed.

A summary of the proposed handling of seismic reflection data in ODP is shown in Table 5. We do not suggest major organizational changes in the current program, as this will not be possible to implement with the current resources and duration of the ODP. However, we believe that seismic reflection data need to be more integrated in the IODP and the responsibilities of handling the seismic data and facilities need to be more precisely defined.

Pre-cruise

We propose several changes in the application procedure to ensure that the proponents

1) clearly state their plan for usage of drilling results to improve the seismic interpretation,
2) have a plan for core-log-seismic integration and
3) have access to digital seismic data.

Seismic data and digital navigation data should be submitted to SSDB when the proposal has passed through external review. The data will be used for the site survey reviews by SSP and PPGP.

A seismic workstation project should be created by the SSDB when a proposal has been scheduled based on the submitted navigation data. The proponents then have to submit digital seismic data that will be loaded by SSDB. SSDB are responsible for data security by applying the password protection mechanism in IESX. The seismic data can be used for site survey and safety review. In addition, SSDB should provide facilities, but not funding, for pre-cruise interpretation by project proponents scientists.

Shipboard

We propose to generate a new shipboard scientific position, *the Seismic Integrator* (Appendix 2) This person will have the responsibility to do core-log-seismic integration. The seismic integrator will receive training at SSDB/BRG before the cruise. The person will be responsible for installing, maintaining and backing up the workstation project at JR. BRG staff will provide shipboard assistance.

Post-cruise

The shipboard scientists have the complete responsibility of post-cruise seismic analysis. SSDB should provide facilities, but not funding, for post-cruise seismic interpretation. TAMU will ensure that digital seismic data in the vicinity of the drill sites are stored on the IR CD, whereas

SSDB will do the quality control on the backup tape before the workstation project is deleted on the JR (SCIMP Recommendations 99-1-13 and 00-1-12).

Table 5. Proposed handling of seismic reflection data in ODP.

Area	Description	Resources
	A) Proposed Leg	
Application	Update proposal guidelines to require plan for seismic imaging and interpretation:	NA
	Revise site description form to include information about core-log-seismic integration and availability of digital seismic data (Appendix 3).	NA
SSDB	Revise data submission guidelines to require submission of paper seismic data and digital navigation data. Submission of digital seismic data should be optional, but recommended.	Data loader. Seismic workstation.
	B) Scheduled Leg	
SSDB	Require submission of digital seismic data. Data bank responsible of creating seismic workstation project. SSP and PPG members can use the workstation project.	Data loader. Seismic workstation.
Training	BRG/SSDB provide one-week pre-cruise training for scientists on interactive seismic interpretation and core-log-seismic integration. Scientist responsible of quality control and to create seismic workstation project tape to be loaded on the shipboard computer.	Seismic integrator. Data loader/borehole and training program. Seismic workstation.
Interpretation	BRG/SSDP provide facilities, but not funding, for scientists to do pre-cruise seismic interpretation.	Seismic workstation.
	C) Cruise	
Data loading	Shipboard loading of workstation project. Loading of wireline data when required. Create workstation backup tape.	Seismic integrator. Support staff.
Interpretation	Core-log-seismic integration and initial revision of the seismic interpretation based on drilling results.	Seismic integrator. Co-chiefs.
	D) Post-Cruise	
Interpretation	Optional final seismic interpretation based on cruise results. Problem-oriented re-processing. Update and maintain workstation project. BRG/SSDB can provide facilities but not funding.	Seismic integrator. Co-chiefs.
	E) Archive	
SSDB	Quality control and tape archive of backup tape from shipboard workstation project.	Data loader.
IR-volume	Provide navigation (ASCII) and digital seismic data (SEGY) on the IR CD-ROM. Normal minimum requirement: Stacked seismic data within 5 km of drill site. Pre-stack data should normally be included for logged holes at least within 5 km of the drill site.	Data loader. IR production staff.

Notes:
Data loader: One or more persons with responsibilities to maintain the seismic interpretation workstation.
Seismic integrator: Scientific position on JR.
Seismic workstation: Need at least 2 two screen solutions; one for SSDB and one for training/visitors.

6. RECOMMENDED CORE-LOG-SEISMIC FACILITY

We see a strong need to build a core-log-seismic integration facility in the ODP. The industry has developed procedures and applications for core-log-seismic integration during the past three decades. ODP has only partly incorporated these technological changes into the program. However, the establishment of an ODP core-log-seismic integration facility has started with the IESX pilot study. We strongly endorse the continuation of the pilot study in FY2002.

Short-term implementation
The short-term goal is to complete the establishment of a core-log-seismic integration facility by the end of December 2001. See "*Implementation plan*" (pg. 3) for further details.

The proposed facility needs a leader. This person should have a strong background in seismic interpretation and imaging and experience in core-log-seismic integration. The leader should be based at BRG, and coordinate core-log-seismic integration activities between TAMU, BRG and SSDB.

Human resources (Table 6). The establishment of a core-log-seismic integration facility can to a large extent be completed using the current ODP and JR staff. However, new resources are also likely needed. The facility needs a full-time leader based at BRG. We further propose the continuation of a full-time Data Loader position at the SSDB. In addition, we propose the establishment of a new scientific position, the Seismic Integrator. Additional resources are finally required for training the seismic crew on JR and core-log-seismic integrators at BRG.

The required staffing levels are not yet known. This should be deferred until after the IESX pilot project has been evaluated. However, it is required that sufficient resources are allocated for FY02 to ensure that the IESX pilot project is continued.

Shipboard (Tables 7 & 8). A core-log-seismic integration facility requires establishment of new shipboard laboratories. A seismic integration laboratory should be located in a central part of the lab stack on JR. A central location is required to facilitate interaction between scientists working on seismic, wireline and core data.

We propose to use the spare laboratory on the 8th floor on the lab stack. The laboratory should be equipped with a seismic workstation and peripheral equipment. The room should be large enough to allow at least 3-4 people to have work meetings in the laboratory.

The Underway laboratory should be remodeled. The laboratory should have equipment to acquire and process navigation, bathymetry and seismic reflection data. It can further be used for storage and maintenance of the new GI guns. Plotting and general computer facilities can be moved to the seismic integration laboratory.

Equipment (Table 9). The core-log-seismic integration facility requires purchase of new air guns. We recommend that one GI and one GIG gun is ordered immediately.

Check-shot surveys currently require a separate logging run. We propose the purchase or development of a borehole hydrophone, which can be deployed with other tools. BRG will research this issue and propose a solution.

Shore based (Tables 7 & 8). The shore based core-log-seismic facility should be continued in cooperation between BRG and SSDB. The main tasks of the SSDB will be to generate and

maintain IESX seismic workstation projects for each leg, provide training and guest interpretation facilities and to make a digital archive of leg-dependent data. SSDB should be responsible of data security (e.g., password protection of proprietary data), but shall not distribute data. BRG will be responsible for facilitating incorporation of core-log integration and to facilitate loading of borehole data in the IESX workstation project. They will also be responsible for training and providing guest facilities in cooperation with SSDB.

Training (Table 10). The core-log-seismic integration facility needs three cookbooks. One cookbook is in progress and will be completed by December 2001; the other two requires revision of older booklets.

Software development (Table 11). We propose that two software development projects are undertaken. Incorporation of a depth-time model in JANUS is very important to be able to move seamless between depth and time domains. It will further be important to establish a common depth axis for image logs and scanned core images if a Geotek system becomes available.

Archival. All digital data should be archived digitally. Distribution of public data should take place as SEGY and ASCII data on the Initial Report CD-ROM by SSDB. The data should further be placed on the ODP long-term archive. The seismic workstation project should be stored on tape by the Seismic Integrator. Quality control and storage of the tape is the responsibility of SSDB.

Core-log-seismic integration work group. We propose that SCIMP establishes a core-log-seismic integration work group that will oversee the development and evolution of the core-log-seismic facility. The work group should last for the remaining part of the ODP program. An important task of this group will be to ensure improved implementation of the core-log-seismic facility in the IODP.

Long-term issues

Several long-term issues need to be addressed after the establishment of the core-log-seismic integration facility and the completion of the IESX trial.

1) Are the established facilities sufficient?
2) Are further resources needed to operate the facility?
3) Is the organization with joint responsibility between TAMU, BRG and SSDB appropriate?
4) Will a future program benefit from establishing a seismic sub-contractor with facilities for core-log-seismic integration, seismic processing and interpretation and site survey data?
5) Should digital seismic data be distributed or archived differently? Should ODP establish links with commercial seismic archive companies such as PetroBank?

Table 6. Suggested personnel required for core-log-seismic integration facilities.

Position	Location	Cost	Comment
C-l-s head	BRG	1 FTE	Possibly new position. Person with a strong background in seismic interpretation and imaging and knowledge of core-log-seismic integration.
Seismic data loader	SSDB	1 FTE	Possibly new position. Person will be responsible for generating and maintaining seismic workstation projects and training of scientists.
Seismic integrator	Scientist	Training	New shipboard position. The scientist will be responsible for shipboard core-log-seismic integration (Appendix 2).
Seismic crew	JR	Training	Each Leg should have a seismic crew. The crew responsibilities are to collect check-shot/VSP data and seismic reflection data. It should consist of technicians from TAMU and BRG, which are trained for using and maintaining the seismic equipment and facilities. Current technicians will be able to do the job with some additional training.
Core-log-seismic integrator	BRG	Training	One current staff member with special responsibility for core-log-seismic integration facilities and training. Training of BRG loggers in core-log-seismic integration.

Table 7. Suggested ship and shore based core-log-seismic integration laboratories.

Laboratory	Location	Comment
Seismic integration	JR	Central location in the JR lab stack (8th floor).
Underway	JR	Needs remodeling. Use for seismic reflection acquisition and gun storage.
Core-log-seismic integration	BRG/ SSDB	Shore based facilities for seismic interpretation and core-log-seismic integration used for science, training, planning and safety.

Table 8. Suggested computer resources required for the core-log-seismic integration facility.

Equipment	Location	Price (k$)	Comment
Two double screen Unix workstation with IESX	SSDB	20	Project loading and maintenance facility. Guest and training seismic interpretation facility
Large-scale plotter	SSDB	8	Plotting of maps and seismic data.
CGM plotting software	SSDB	5	
Double screen Unix workstation with IESX and core-log integration software.	BRG	Available	Core-log-seismic integration facility. Guest and training core-log-seismic integration facility.
Large-scale plotter	BRG	Available	
CGM plotting software	BRG	Available	
Double screen Unix workstation with IESX	JR	Available	Shipboard core-log-seismic integration laboratory.
Large-scale plotter	JR	Available	
CGM plotting software	JR	Available	

Table 9. Suggested new seismic acquisition and processing equipment.

Application	Responsible	Cost	Comment
Air guns	TAMU/ BRG	35-65,000	Purchase new GI and GIG guns. Abandoned old guns. Training of seismic crew. Make storage and maintain ace facilities in modified U/W lab. Make temporary storage space on helicopter deck for easy deployment.
Borehole hydrophone	BRG		Purchase or develop borehole hydrophone that can be deployed in combination with other logging tools. Training of seismic crew. A development project will be proposed by BRG.

Table 10. Core-log-seismic integration cookbooks.

Cookbook	Responsible	Cost	Comment
Core-log-seismic integration	BRG/ SSDB		IESX data loading and interpretation. Procedure for making and documenting depth-time model and how to load model in JANUS. Written as a part of IESX trial.
Core-log integration	BRG		SPLICER and SAGAN integration. Need update on core-log image integration and on core-log integration in low-recovery holes.
Seismic acquisition on JR	TAMU		Cookbook needs update when new guns have been acquired. Also include procedure for check-shot/VSP acquisition and processing.

Table 11. Suggested software development for core-log-seismic facilities.

Application	Responsible	Cost	Comment
JANUS	TAMU	0.25 FTE	Modify JANUS to incorporate depth-time conversion model. Allow listing of all data in depth or two-way travel-time.
SAGAN	BRG		Modify SAGAN/SPLICER to enable plotting of image logs and core data with same scale and depth axis. A development project will be proposed by BRG.

APPENDIX 1

ODP Structure and Acronyms

The Ocean Drilling Program (ODP) is an international partnership of scientists and research institutions exploring Earth processes by deep sea drilling. It is a complex organization with numerous partners, committees and contractors. Acronyms commonly used by the ODP are shown in Table 1.

The scientific objectives and organization of ODP/IODP are explained in the following publications:

- A guide to the Ocean Drilling Program, *JOIDES Journal,* 1999 (www.joides.geomar.de/journal/).
- Ocean Drilling Program Long Range Plan, *JOIDES,* 1996 (www.joi-odp.org).
- IODP Initial Science Plan (www.iodp.org/ipsc/isp_v2.2/).

Table 1. Acronyms used in this report.

Acronym	Explanation
FMS	Formation MicroScanner; an electrical image log.
IESX	Seismic interpretation software. Part of GeoFrame (www.geoquest.com).
JANUS	ODP borehole database.
VSP	Vertical seismic profile.
WST	Well seismic tool.
	Ocean Drilling Program
ODP	Ocean Drilling Program (www.oceandrilling.org).
IODP	Integrated Ocean Drilling Program (www.iodp.org).
JR	JOIDES Resolution, the drilling vessel.
JOI	Joint Oceanographic Institutions, Inc. (www.joi-odp.org).
JOIDES	Joint Oceanographic Institutions for Deep Earth Sampling (www.joides.geomar.de).
	ODP Contractors
BRG	Borehole Research Group (www.ldeo.columbia.edu/BRG/ODP).
LDEO	Lamont-Doherty Earth Observatory
SSDB	Site Survey Data Bank (www.ldeo.columbia.edu/databank).
TAMU	Texas A&M University (www-odp.tamu.edu).
	ODP Panels (www.joides.geomar.de/panels)
PPSP	Pollution Prevention and Safety Panel.
SCICOM	Science Committee.
SCIMP	Scientific Measurement Panel.
SSP	Site Survey Panel.

APPENDIX 2

Job Description: Seismic Integrator

We propose the establishment of a **Seismic Integrator** scientific position. The position should be filled by a person with scientific background in seismic interpretation and core-log-seismic integration. The person should facilitate integrated interpretations.

The responsibilities of the Seismic Integrator are to:

- receive pre-cruise training at BRG/SSDB,
- create an IESX backup tape at Lamont,
- load the IESX project at JR,
- do on-board core-log-seismic integration and prepare results for the Initial Report,
- establish a depth-time model for each logged hole,
- incorporate the depth-time model in the JANUS database and
- create a backup tape of the workstation project at the end of the cruise.

The Seismic Integrator will get shipboard support by the BRG logger.

APPENDIX 3

Revised ODP Site Description and Data Submission Forms

The Site Description and Data Submission forms need to be updated to ensure that proponents have considered core-log-seismic integration as a part of the drilling proposal. Furthermore, the proponents have to provide information about availability of digital seismic reflection data, and if the seismic data are available to the public.

We propose the following modifications to the forms:

ODP Site Description form
Page 1: Needs check boxes for VSP and check-shot surveys.
Page 2: Needs an additional box for description of digital seismic data.
Page 3: Need a box where the plan for core-log-seismic integration can be written.

Data Submission form
Proponents are strongly encouraged to supply digital seismic data and to generate an IESX project. Digital navigation data should be submitted together with paper plots of seismic data when the proposal has been reviewed. Digital seismic data, if available, should be submitted to the SSDB when a proposal is scheduled. The Data Submission form needs to be modified to reflect these changes in data submission procedure at the SSDB.

APPENDIX 4

SCIMP Recommendations on Core-Log-Seismic Integration

SCIMP Recommendation 98-2-13

Background: SCIMP members discussed the utility of the Well Seismic Tool (WST) for correlation of logging, core, and seismic data. The panel felt that the ability to correlate these data would be greatly improved by the standard use of the WST on each leg.

Recommendation 98-2-13: SCIMP recommends that the WST be a part of standard logging operations.

Update: *OPCOM Action Item 98-2-8A: BRG-LDEO will investigate the cost of making the WST part of the standard logging operations. Gerry Iturrino reported the tool is available for standard use as of Leg 182. There is, however, some concern from ODP/TAMU of resource allocation if this is to become a standard measurement. Operation of the tool requires manned underway watch, as well as over -the-side watch in even moderate seas. Seventy-two man-hours were required for maintenance on the guns during Leg 179 and they were never fired. This extra resource allocations is not seen as a stringent limitation, but all should be aware that making this a standard measurement (i.e., no additional cost from BRG-LDEO perspective) does have a significant hidden cost. See Section H (core/log/seismic integration) and Section N (Technical Support) of this report for further discussion of technical resource allocation.*

SCIMP Recommendations 99-1-11 through -13

Background: The seismic data sets currently used in ODP include physical property data on cores, wireline logging, downhole seismic experiments, and seismic reflection data. SCIMP discussed a plan (See SCIMP Report Appendix 99-1-14) that would focus, strengthen, and coordinate activities related to seismic data acquisition, processing, and interpretation and assure industry-standard data quality. Discussion among the panel members suggested that many aspects of this plan are in place but not tied together formally. This lack of formal integration often results in a "hit or miss" seismic integration during and after legs and, most-assuredly, an overall lack of quality control from leg to leg. In light of potential post-2003 activities, especially on a riser ship that could sit on site for months, such an integration of core/log/seismic facilities is essential.

The panel further discussed ways (in light of current fiscal and physical constraints) of making core/log/seismic integration a more routine action on the ship before 2003. To initiate this effort SCIMP made the following recommendations:

SCIMP Recommendation 99-1-11: SCIMP recognizes the importance of maximizing the integration between core, log, and seismic data both on the JOIDES Resolution and in post-cruise research. Presently, there are limited formal resources available on the JOIDES Resolution to integrate these datasets. To this end, SCIMP recommends that the Borehole Research Group enable the seismic and sonic analysis software presently installed as part of the GeoFrame system both on the JOIDES Resolution and at the Borehole Research Group at Lamont-Doherty Earth Observatory.

SCIMP Recommendation 99-1-12: SCIMP recommends that BRG-LDEO should have as their baseline expertise the ability to do time-depth calibration (i.e., to tie depth data [core/log] to time data [seismic]). This capability should include the ability to integrate checkshot data with wireline sonic data and the ability to generate synthetic seismograms at sea.

Update: *ODP-LDEO has software on the ship to make synthetic seismograms and time-depth conversions. They have been available for quite a long time but they are mostly ad-hoc programs located in the DHML on the JOIDES Resolution*

Current shipboard capabilities for depth-time calibration and synthetic seismograms include:

Depth-time calibration:

a) *Calibrating depths to travel time by interpolating between known travel times (e.g. WST check-shot). (Unix shell script, Analyseries).*
b) *Adding up interval travel times of the Sonic logs and/or travel times measured on core (short Igor-Pro script, short Fortran program), to get a depth vs. travel-time relation, then (a).*
c) *Various editing to remove anomalous data spikes and fill in intervals of missing data prior to (a) and (b) (Excel, Kaleidograph, Igor Pro).*

Synthetic seismograms:

a) *Get a source wavelet by calculation (Igor Pro, Khoros, short Fortran code (e.g. Yue Feng Sun's code) or by extracting from the seismic section (Sioseis).*
b) *Make an impedance log and reflection coefficient series (Excel, Kaleidograph, Awk, Igor pro).*
c) *Convolve the source wavelet with the reflection coefficient series to get the synthetic seismogram (Fortran code, Igor Pro, GMT utility).*
d) *Plot synthetic within seismic section (Khoros/Cantata).*

Thus the capabilities to integrate checkshot data with wireline sonic data and the ability to generate synthetic seismograms are currently available on the ship (albeit a somewhat cumbersome process).

To improve these capabilities ODP-LDEO has initiated reviews and evaluation of more comprehensive commercial processing packages for ODP use. In particular, ODP-LDEO is looking at Geoframe/IESX modules that can accomplish the required tasks in a more efficient manner. This review should not take too long, but, in the mean time, LDEO still has the capabilities on board the JOIDES Resolution to integrate checkshot data with wireline sonic data and the ability to generate synthetic seismograms (per the SciMP recommendation). The new modules should better facilitate the entire process.

The evaluation of a larger seismic/log/core package (IESX in conjunction with Geoframe) is also in progress. ODP-LDEO wants to have a package that can display, process, and enable interpretation of seismic sections, synthetic seismograms, checkshots, offset VSP's, sonic data (DSI and SDT tools), and core data. This integrated package should also facilitate training, expand user options, and more importantly, increase compatibility between the different kinds of ODP data. This evaluation should be completed prior to the next SciMP meeting. Barring any unforeseen circumstances or problems, the ODP-LDEO plan is to test the at-sea use of this package during Leg 188. ODP-LDEO will also provide the panel members with a written report

at the next SciMP meeting and hopefully post a notice on the message board if they make a decision significantly sooner than the January 2000 meeting

SCIMP Recommendation 99-1-13: SCIMP recommends site seismic surveys in the vicinity of ODP sites (w/in 2 miles) be released in digital form to the general scientific community via a long-term data archive, within 3 years of drilling. "Digital Form" is considered at this point to be both the raw and the final stacked seismic data in SEGY format.

Update: *SciCom removed the "raw" data from this recommendation. Discussion beginning with Site Survey Data Bank on how to proceed.*

SCIMP Recommendation 99-2-10

Background: ODP-TAMU has been unable to dependably obtain data from their two ITI 6-channel streamers. When the streamers have worked, the data are not appreciably better than that collected from the single-channel Teledyne streamers. Each of the ITI streamers has been returned to the vendor for repair several times and yet problems still remain. The TAMU U/G Lab Working Group feels that sorting out remaining problems will take more ship time than warranted (especially considering the good quality and dependability of the single channel data) and would like to abandon the efforts to implement the ITI 6-channel streamers and remove them from the ship. SciMP concurs with this recommendation. The *JOIDES Resolution* is not a survey ship and the Teledyne single-channel streamers provide adequate data for site characterization when needed.

SCIMP RECOMMENDATION 99-2-10: SciMP recommends that efforts to implement the ITI six-channel streamer be abandoned and that the three currently available Teledyne single-channel streamers be kept operational and properly maintained.

Update: *This has been done. The six-channel streamers are no longer on the ship, and ODP is using only the Teledyne single channel streamers.*

SCIMP Recommendation 99-2-11

Background: Currently, ODP-TAMU has three SSI S-80 and two HAMCO 200 cu.in. water guns for seismic surveys. One of the S-80 guns is worn out and the replacement cost will be over $15,000. The TAMU U/G lab working group would like to immediately purchase one new GI-gun (replacement cost about ~$30,000) and ultimately replace all the S-80 guns with GI guns.

SciMP feels that ODP-TAMU and ODP-LDEO should investigate the cost of a using a tuned-gun array for well bore and seismic survey use in lieu of purchasing new GI guns. The tuned array would consist of a three-gun array in a frame that is standard issue from Schlumberger. The cost of leasing a tuned-gun array from Schlumberger may not be significantly different than the cost of purchasing GI-guns. In the long term, obtaining a tuned-gun array could simplify logistics (and ODP technical support) since the contractor would provide the equipment and maintain it for ODP. Such a change in underway operations would allow the ODP technical staff the flexibility to expand responsibilities in other domains.

SCIMP RECOMMENDATION 99-2-11:SciMP recommends that ODP-LDEO and ODP-TAMU investigate the financial and operational aspects of a tuned-gun array for well bore and seismic survey use and report the findings of this investigation to SciMP before purchasing GI guns for seismic use.

Update: *See ODP-LDEO Operator Update in SCIMP Appendix 00-1-3 for action by ODP LDEO and ODP-TAMU on this issue. Also see Underway Geophysics discussion and recommendations in Section E.5 for further SCIMP action on this issue.*

SCIMP Recommendation 99-2-13

Background: SciMP was asked by the IPSC (IODP Planning Sub-Committee) to assist in planning the laboratory design on the OD21 riser vessel (see SciMP Report and SciMP Appendix 99-2-7 for more details and drawings). IPSC's viewpoint is that the essential laboratory capabilities of the *JOIDES Resolution* should be preserved and enhanced on the OD21ship. Planning and designing the OD21 ship for a very minimal scientific party may prevent expansion of shipboard capabilities in a cost-effective way, if it is discovered later that a larger shipboard party is desirable. Intellectual ownership of the cores and the holes themselves may also diminish if the scientific team is not intimately involved in the drilling and coring operations. Planning for the maximum shipboard activity is a safer and more flexible strategy.

SciMP recommends the following changes to the OD21 Laboratory Working Group Laboratory Design.

SCIMP RECOMMENDATION 99-2-13
...
Lab Management Deck:
A Data Integration Center for Core/Log/Seismic data integration and display should be added to the Lab Management Deck. This area is in addition to a Computer User room.
...

Update: *The OD21 design group incorporated these design suggestions into their second draft. See SCIMP Appendix 00-1-4 revised design drawings*

SCIMP Recommendation 00-1-7 and -8

Background: Underway Geophysics currently involves three data collection processes, including: (1) Precision Depth Records, (2) single channel seismic imaging, (3) magnetometry. The most frequent data type collected are PDR. Seismic lines are being acquired only rarely on a as needed basis. The equipment being used is adequate to the task but is clearly antiquated and of declining serviceability. The technical staff has no experience or expertise in data processing so that the data tend to remain in a crude state unless scientific expertise on a given leg is available to process the data further.

The panel was in unanimous agreement that the JOIDES Resolution's forte is not as a survey ship. The panel, though, did recognize that on some legs a limited survey capability is required. In an effort to define the capability required and whether it would be most efficient and cost effective to have this capability reside in the program or be out-sourced, the following two recommendations were made:

SCIMP Recommendation 00-1-7: SCIMP recommends that the pending purchase or lease of the new seismic gun arrays for the JOIDES Resolution be deferred pending full evaluation of the JOIDES Resolution underway geophysical operations by the SCIMP U/G sub-panel. The evaluation will be completed and presented at the next SCIMP meeting and a full recommendation on U/G operations will follow.

SCIMP Recommendation 00-1-8: SCIMP recommends that ODP-TAMU determine the cost to repair both magnetometers and properly maintain and service them for the remainder of ODP. These data will be incorporated into the SCIMP's evaluation of U/G operations. Any repairs or other expenses should be deferred pending the U/G report.

SCIMP Recommendation 00-1-9 through 11

Background: A SCIMP sub-committee was tasked with developing a vision for the integration of seismic, wireline, and core measurements onboard the JOIDES Resolution and for post-2003 drilling (The report is presented in its entirety in SCIMP Appendix 00-1-7).

The report stemmed from the concern of the panel and scientists who have sailed on the JOIDES Resolution over the current capabilities to integrate logging, core measurements, and seismic measurements on the JOIDES Resolution.

We acquire seismics before we drill, we core and make measurements on core, we run wireline logs, and we perform checkshots to determine a time-depth calibration. From these operations there are two levels at which to integrate data. In a Level One capability, core sonic and density measurements, log sonic velocity measurements and Vertical Seismic Profile data, and seismic data are displayed side by side and a synthetic seismogram is constructed from the log data. To achieve this a time-depth tie ('welltie') must be made that typically involves the combination of low frequency check-shot (VSP) data and wireline sonic data to generate a time-depth table. Once this is established, it is possible to post log, core, and synthetic seismic data on a single figure. This image provides an important connection between logging and seismic that has not been utilized consistently on the JOIDES Resolution.

Once wireline and borehole information are time-depth calibrated it is possible to directly post this information on seismic data. This is a second level of complexity because one now must have the seismic data loaded onto a workstation. This information would allow scientists to truly integrate drilling with seismic data on the workstation. Level 2 capability would allow the shipboard party to visualize drilling results and integrate drilling results with previously shot seismic data. This has the potential to increase the interdisciplinary research on the ship.

Efforts to integrate seismic, log, and core data have taken two approaches on the JOIDES Resolution: 1) there are services provided through the Borehole Research Group (BRG); and 2) individual scientists have brought their own hardware and software on board to achieve this integration.

We applaud ODP-LDEO efforts to work on testing and obtaining seismic software (e.g., IESX) and further encourage cooperation with the Site Survey Panel/Data Bank for resolving the issues regarding making digital seismic data available for all ODP cruises. This is an appropriate long-term vision.

In order to continue toward meeting the Level 1 and Level 2 core/log/seismic integration needs, several hardware/equipment, training, and data issues need to be addressed:

SCIMP Recommendation 00-1-9: SCIMP recommends:

1) **That shipboard facilities for Wireline/Seismic/core integration include a separate workstation dedicated to this effort.**
2) **That the IESX software be able to plot directly to large-scale (36") plotters and printers and that this capability be implemented by June 2000 SciMP meeting.**
3) **That ODP-LDEO and ODP-TAMU provide a plan for integrating the Unix network on the ship.**

SCIMP Recommendation 00-1-10: SCIMP recommends that LDEO develop a procedure for creating IESX project files for each ODP drill site that will include the digital seismic profiles so that these data can be visualized interactively with the log and core data during and after the drilling of each site. The project file should be the basis for the seismic/log/core integration and time-depth conversion capabilities defined in (SCICOM-approved) SCIMP recommendations 99-1-11 and 99-1-12.

SCIMP Recommendation 00-1-11: SCIMP recommends that LDEO also create a tutorial and training project file with seismic /log/core integration for the shipboard "cookbooks" so that technicians and scientists can improve their skills with IESX , GEOFRAME, and the integration process while at sea. This training project and documentation should be available for SCIMP review by June 2000.

SCIMP Recommendation 00-1-12

SCIMP recognizes the need to have digital seismic data available on each ODP Leg and also recognizes the challenges faced by ODP-TAMU and ODP-LDEO in getting such data from scientists. Therefore, SCIMP makes the following recommendation regarding site survey data and wireline/seismic/core integration.

SCIMP Recommendation 00-1-12: SCIMP recommends that JOI modify the site-survey data requirements for seismic profiles in the Data Submission Guidelines (DSG). The modification will include the following.

(a) For each final processed seismic profile submitted with a proposal, digital seismic data with navigation supplied and with supporting documentation of the processing stream used, must be provided to the data bank manager in industry standard SEG-Y format on 8-mm tape. The data bank manager will advise the appropriate SSEP when these data are received. This data submission requirement should be rigorously enforced and proposals should not be considered for scheduling by OPCOM until this requirement is met.

(b) the data bank manager will maintain the digital seismic data and support documentation and these data will be treated as ODP proprietary information as specified in the current DSG.

Update: *SCIMP discussed its previous recommendation (00-1-12) that all site survey data be submitted to the Site Survey Data Bank (SSDB) in digital form (SEGY format). The Site Survey*

Panel (SSP) raised concerns that this recommendation may be too restrictive as sites are often picked on analog data. In addition, SSP was concerned about the volume of data, how data could be handled effectively by the limited staff at the SSDB, and costs associated with this data collection. SCIMP reiterated that it was only concerned with data from within a couple miles around the borehole and that analog data within and around the borehole could be easily converted to a digital format by commercial firms specializing in analog to digital conversion. In addition, survey data would need to be supplied in digital from the SSDB in order to make a Data Integration Facility aboard the JOIDES Resolution (and its successors) a reality. The Leg 194 IESX project pilot study scheduled for Leg 194 should go a long way towards addressing the data handling issues and support issues.

SCIMP Recommendation 00-2-1

Background: At its previous meeting in Fremantle, SCIMP decided to undertake an evaluation of Underway Geophysical operations to determine if the current operation is the most efficient means of acquiring, processing, using, and distributing seismic data collected on the ship (SCIMP Recommendation 00-1-7). This evaluation was to be part of a larger effort to develop an integrated seismic/downhole/core analysis program aboard the *JOIDES Resolution* and successor IODP platforms. Indeed, several previous SCICOM-approved SCIMP recommendations have spoken to this data integration issue and progress is being made toward certain aspects of this goal (e.g., the FY 01 seismic-log-core integration pilot study being undertaken by the LDEO Borehole Research Group). Establishing this capability as a standard facility aboard the *JOIDES Resolution* would be one of the most beneficial legacies that SCIMP could leave to this program and its successor, IODP.

Recent changes in the SCIMP membership, however, delayed the specific U/G evaluation proposed at the January, 2000 SCIMP meeting in Fremantle. In addition, SCICOM and SSP members expressed concern that SCIMP was trying to eliminate U/G operations from the *JOIDES Resolution*. This is not the case. SCIMP is merely attempting to find the most efficient means of acquiring seismic data and subsequently distributing and integrating this data with downhole and core geophysical data aboard the *JOIDES Resolution*.

The minimum capabilities required for routine seismic/downhole/core data integration aboard the *JOIDES Resolution* are not well defined. For example, what are the minimum capabilities needed with respect to underway geophysical operations, downhole tools, core analytical equipment, computational instrumentation, and technical support staff to make this data integration facility a reality? Clearly, this seismic/downhole/core data integration program encompasses a wide variety of issues and input is needed from SCIMP members, SSPmembers, ODP-TAMU, and ODP-LDEO. In order to keep moving forward with this issue, SCIMP recommends that a temporary Working Group be established to define the minimum capabilities for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution.* The following recommendation defines the mandate, reporting timeline, members and meetings for this Working Group.

SCIMP Recommendation 00-2-1: SCIMP recommends that a temporary Working Group be established to advise SCIMP on the minimum capabilities needed for a routine seismic/downhole/core data integration program aboard the *JOIDES Resolution*.

The mandate of the Working Group is as follows:

1) **Evaluate required seismic acquisition and processing facilities on the *JOIDES Resolution* (U/G and VSP).**
2) **Evaluate facilities required for core-log-seismic integration and interpretation on the *JOIDES Resolution.***
3) **Evaluate the need for scientific and technical staff support on the *JOIDES Resolution.***
4) **Evaluate how to obtain, store, and distribute digital seismic data.**
5) **Evaluate what shore-based facilities and personnel are required.**
6) **Estimate cost of different aspects of the seismic laboratory.**

Timeline:
The evaluation of required seismic acquisition and processing facilities on *the JOIDES Resolution* (U/W and VSP) should be completed by December, 2000 and a report and recommendations presented at the December, 2000 SCIMP meeting. The final report and recommendations to be presented at the June, 2001 SCIMP meeting.

Members:
Members should include (but not necessarily be limited to) one person from SCIMP, SSP, ODP-TAMU, and ODP-LDEO, a Shipboard Scientist participating in the ODP-LDEO FY 01 pilot study, and an Industry representative).

Meetings:
One to two meetings held at the Borehole Research Group facilities at LDEO.

Final Draft of Minutes of the 27th TEDCOM Meeting held at College Station, Texas on 28th and 29th November 2000

Summary of TEDCOM Recommendations to SCICOM

TEDCOM RECOMMENDATION # 002-1
TEDCOM recommend to SCICOM that they maintain a closer than usual dialogue with the ship operation and the essential baseline costs for same due to the adverse effect which rising fuel costs and hardware replacement costs may have on the planned science programme.
In this current year fuel costs have risen form $200 to $336/MT and are still rising. Replacement hardware and consumables are being minimised and/or purchased only when absolutely necessary to run down stocks and conserve funding. Flexibility in programme planning and prompt action will be required to meet unexpected expenditure for immediate replacements when the need arises.

TEDCOM RECOMMENDATION # 002-2
TEDCOM recommend to SCICOM that they clearly and formally request from ODP-TAMU and LDEO the information required for Legacy documentation together with the timescale for same.
The topic has been discussed at this meeting and pathways outlined following direction given to TEDCOM after the OPCOM meeting at Halifax. This should have been an opportunity to finalise the documentation strategy but ODP-TAMU said that they had been given no direction in this matter. It is up to SCICOM to ensure that this does not happen in future by using formal channels to ensure that requests are made and direction is given.

TEDCOM RECOMMENDATION # 002-3
TEDCOM recommend to SCICOM that ODL and ODP-TAMU work together with immediate effect towards minimising or removing the Vibrations experienced on Leg 192 so as to reduce their effect on drilling equipment and rig structure.
The committee heard about vibration on Leg 192 caused when drilling Basalt (Basalt Rumble). Since the meeting TEDCOM Chair has been informed that ODP drilling operations have recommended deploying shock subs to try to counteract this on leg 197 and in the meantime will try to document the nature (frequency and intensity) of such vibrations.
TEDCOM Chair was conscious of the contractual and legal problems this item generated and the recommendation above has been modified from the initial draft following information supplied by ODP-TAMU not available at the meeting. However the chair still stresses that monitoring may not be enough until action is taken in leg 197. SCICOM must insist that every effort is made to resolve the vibration issue forthwith should it continue to be a problem when using the AHC.

TEDCOM RECOMMENDATION # 002-4
TEDCOM recommend to SCICOM that they explore with EXCOM and IPSC a means whereby promising technical developments, which will not be brought to completion within the current Ocean Drilling Programme, are nurtured for the future IODP.

Annex 4 of this report shows the development schedule of equipment projecting well beyond 2003. Clearly this can not be accommodated within the present programme and may be further curtailed if budgetary constraints increase. The committee are aware that IODP have high expectation of hitting the ground running and thus need to explore ways of conserving the developments from this programme for tools in the next.

Those present:
Members:

Joe Castleberry (USA)
Frank Schuh (USA)
Alister Skinner (UK, Chair)
Marvin Gearhart (USA)
Earl Shanks (USA)
Walter Svendsen (USA)
Hugh Elkins (USA)
Howard Shatto (USA)
Shinichi Takagawa (Japan)
Brian Taylor (Aus/Can/Pacrim)

Apologies from:
Sergio Persoglia (ESF)
Keith Morton (USA)

Guests/Liaisons:

Jeff Fox (USA, Director, ODP-TAMU
David Goldberg (USA, LDEO)
Mike Friedrichs(USA, ODP-TAMU)
William Hay (Germany, SCICOM Chair)

Yuichiro Ichikawa (Japan, JDC)
Tom Janecek (USA, SCIMP)

Doug Kennedy (USA, ODL)
Kazushi Kuroki (Japan, JAMSTEC)

Greg Myers (USA, LDEO)
Gene Pollard (USA, ODP-TAMU)
Brent Shoemaker (USA, ODL)
Tom Pettigrew (USA, ODP-TAMU)
Frank Rack (USA, JOI)
Eddie L. Wright (USA, ODP-TAMU)

Opening Remarks:

Alister Skinner opened the meeting by thanking Jeff Fox for hosting the meeting and everyone present for coming. He advised the committee that two new members have been appointed to TEDCOM since the last meeting and welcomed Joe Castleberry of Fugro as one of them. Keith Morton of Chevron, the other new member was unable to attend. A self introduction of all present followed and e-mail details of those attending are contained in **Annex 1**.

Jeff Fox detailed the housekeeping arrangements for the meeting and then highlighted some of the issues facing the programme at the present time. The biggest constraint on the programme is effectively a reducing budget from the flat funding as cost cutting efforts do not match inflation and oil price increases (Fuel average has increased from $200 to $336/MT and is still rising). He stressed that it was not only ODP-TAMU who were having those problems it

was also true of other contractors/subcontractors. However he was pleased that, despite the squeeze, ODP-TAMU had not reduced their service and have even expanded I some areas. In response to a question by Gearhart, Fox stated that these circumstances related to ODP only. IODP is a separate programme under active discussion but it is not yet implemented.

In discussion it was felt that TEDCOM needs to ensure that the implications of flat funding and increasing costs for basic services needs are emphasised to OPCOM and SCICOM. In general terms they are certainly aware but some further leg decisions may have to be made if, for example, fuel costs continue to escalate.

Frank Rack updated the committee on the new structure at JOI, pertinent to ODP. Dr Steve Bohlen took over as the new president/executive director of JOI on the opening day of this meeting. Some internal changes within the management structure of JOI will also take place and also, in January, the JOIDES office will rotate from Geomar in Germany to the University of Miami in Florida.
Frank also outlined the activities underway to document the legacy of ODP and the preparations which are in hand for IODP. A town meeting is to be held during AGU in December to update people on this and IPSC and IODP also have web sites which can be accessed. **Annex 2** has further details.

Agenda Items
A prepared draft agenda was accepted for the meeting format and is attached in **Annex 1**. The numbering which follows ties in with the agenda topics.

1. Welcome to New Members
Already done under the opening remarks.

2. Apologies for Absence
Apologies were received from Members as shown above. The ESF alternate, Sverrier Thorallson was also unable to attend.

3. Approval of 26th TEDCOM Final Draft Minutes
The Final Draft Minutes plus Annexes mailed after the 26th TEDCOM meeting at GFZ Potsdam included changes tabled after the first issue and were approved. Skinner said that he would mail a complete set of annexes with the finally agreed draft minutes of this meeting as for the previous two meetings.

4. Report of SCICOM/OPCOM Meeting in Halifax, Canada
Bill Hay opened the topic. The main impact on ODP-TAMU from the above meeting was the re-scheduling of legs to cut down long traverses and allow better operational windows in some geographical areas.
Bill then summarised the science being undertaken on legs 194-205 with the proviso that 200-205 are tentative at this stage. **Annex 3** has details of these legs and the associated technology required.

Leg 195 will have a site on which a seismometer will be emplaced and linked to a deepsea communications cable which is being prepared for this by JAMSTEC. Leg 197 is investigating hotspots and there are still negotiations with Russia over the location of one of the sites. Leg 198 is in an area where chert layers have stopped drilling in the past. It is important to try again as the area has the potential to have answers to the climate record. Leg 200 will have another seismometer emplacement linked to an abandoned (but still useable) telephone cable. Leg 201 explores the deep biosphere of Peru in an area where there is a high organic supply. It was also mentioned that the deep biosphere research is coming under increasing scrutiny from National Governments unwilling to allow cart blanche activities in territorial waters. Leg 204 will be a Gas Hydrate leg at Hydrate Ridge and Leg 205 will emplace another seismic recorder but this time as it is not near any communications cable a buoy and satellite combination will be used for data transmission.
A Detailed Planning Group (DPG) has also been formed to investigate drilling in the central Arctic Ocean at Lomonosov Ridge. This is discussed later under AOB.

Alister Skinner said that all of the previous meeting TEDCOM recommendations had been taken on board by both OPCOM and SCICOM and that further requests had been made by both committees regarding legacy documentation for the technology of ODP. These are agenda items for later in the meeting and will be discussed there.

Marvin Gearhart also informed the committee that Brian Jonasson of ODP-TAMU had given an excellent presentation on the work of ODP at TAMU to their local chapter of the Drilling Association in Fort Worth.

5. Report on ODP Activities at TAMU and Shipboard

Annex 4 contains staffing and administrative data pertinent to this section and **Annex 5** has technical detail.
Brian Jonasson commenced this section with details of budget control management . Reductions in staffing by not filling vacant positions allowed some cash flow and recuiting graduate researchers to specific tasks allowed continuation of some important activities where there were insufficient internal staff resources. Two areas highlighted where this was relevant were in the MATLAB Simulation and PCS development. Upcoming legs were as ambitious as ever and in addition there have been a number of costly hardware losses on recent legs which will require hardware replacement purchases. Minimum stocks of equipment and consumable will be maintained from now until the programme end to assist with meeting scientific programme requirements under a flat-funded regime. The FY 02 will focus on ION, Biosphere and Hydrate orientated legs.
Various graphs and project plans contained in **Annex 4** show how the distribution of staffing and costs has been made to accommodate flat funding and operational requirements. This annex also has more specific detail on each project and will be referred to again under a separate topic later in the minutes.
The Short Range Project Plan contains project plans up to the end of the present programme in 2003 and links them in to the scientific requirements. The Long Range Plan items are presently beyond this ODP programme.

There was some discussion on the legacy targets but this is pulled together under a separate agenda item later. Discussion also indicated that ODP-TAMU need to make more efforts to be aware of information available from other bodies pertinent to their research and development. In particular Gearhart felt that the drilling sensor sub being developed by TAMU may have many similarities to that in one already being worked on at Sandia. Passive Heave Compensator issues on wear and siting of service loops to the Active Heave were also discussed and are under examination or have been modified. There is further discussion on this later. Similarly WOB and string weight clean signals which allow coring with reliable bit weight indication are under development and discussed later.

Gene Pollard summarised the leg 190-193 achievements to date and provided information on the planning and equipment required on the legs up to 205. **Annex 3** has more Leg details. Legs 190-193 provided good results but leg 193 was experiencing difficult hole conditions resulting in hardware losses. However this may offer an opportunity for further tests of the HRRS and ADCB systems.
Leg 191 hammer tests were time curtailed by a typhoon, a medivac and drillfloor equipment problems but good results on the operation of the hammer and the various types of bit were achieved. There is a report of the HRRS activities and the ADCB in Annex 5.
Leg 193 is experiencing borehole stability an spudding-in problems including caving and non-cleaning of heavily mineralised cuttings. Two stuck pipes have had to be blown off. There may be opportunity to try the hammer system to achieve a stable entry into the formation and if the hole can be cleaned up an opportunity to try the Advanced Diaimond Core Barrel (ADCB).
The HYACE tool system will be field tested on Leg 194 along with further tests of the ACDB.

Tom Pettigrew introduced the scenario for Leg 196 (Nankai) where Advanced CORKS (ACORKS) will be emplaced together with a seismometer. This programme of work is extremely ambitious and will contain a number of firsts for the ODP programme. A huge number of technical requirements have to be brought together in timely fashion to allow the spacing and assembly in the moonpool of a multi-string gravel screen and packer system which will then be guided into a drilled and LWD assessed open (i.e. non-cased) borehole. Having completed this, which in itself contains a number of technological achievments, the leg will continue with the drilling deeper (into basement) in the same borehole and through the ACORK string, with the aim of emplacement and cementing of a seismometer at the base of the borehole.
The geology of the area suggests that the borehole will be in unstable formation and the environmental regime indicates that there will be ocean currents at the site. Given this and the added complications of assembling of third party components on site the committee wish Tom good luck and appreciate the huge preparatory effort which has gone into the planning of the tools and the logistics of the operation. Annex 5 has more details and diagrams pertaining to the operation.

Derryl Schroeder introduced the DMT Service Centre and its aims and priorities. Main development projects are the completion of a Data Acquisition System (DAS) for the APC —

T as the Adara equipment and electronic spares are no longer available. The APC is a good tool to start with as it is the most widely used. All results can then be transferred to the DAS systems required by other tools in incremental fashion.
Developments with the DVTP tool with added Pore Pressure component DVTP-P (in conjunction with the Canadian Pacific Geosciences Centre) is progressing as is the APC methane tool with MBARI and the in-house downhole sensor sub which will be linked to LDEO technology in its second phase.

The DVTP-P and APC methane will be required for upcoming gas hydrate legs as will the PCS which is being re-investigated by a graduate researcher. It is hoped that the APC methane tool will be able to be used routinely in the future to accumulate data on the methane mass budget.

There was then a lot of discussion on the Passive and Active Heave Compensators, the practicalities and data being recorded while using it and further issues to be addressed. Rates and frequencies of sampling were discussed, was too much being monitored?, were the right parameters being monitored?.
Basically the AHC system is working well but appears to be causing wear in the passive compensator and unstable Martin Decker gauge readings due to the 20msec response time of the AHC. There is also derrick vibration issues when drilling in some formations. Some issues may relate to the age of the passive compensator, others relate to tuning and understanding of the system now employed. Discussion on the subject was curtailed as it was hoped to have Mike Friedrichs join us for the following day and we would revert to the subject then.

Buddy Bolfrass and Gene Pollard addressed issues relating to legacy documentation. The EXCOM/SCICOM requirements and preparations for this issue to be addressed at this meeting had obviously not been clearly stated to ODP-TAMU and much discussion ensued on what was required and what was within the art of the possible given staffing and other issues. Skinner brought discussion to a close and said that he would open it again tomorrow under the appropriate agenda item. This gave members and guests time to reflect on what was required and have informal discussion before then. It was clear however, from this discussion, that the re-drafting and re-dimensioning of engineering drawings was not an option which should be considered as it was not relevant to the requirement and could introduce errors.

6. Report on Activities at BRG (LDEO)

Dave Goldberg mentioned the experiments reported on at the previous TEDCOM and distributed a published article highlighting the results of the leg 188 experiment where the MWD tools were configured to allow downhole drillstring monitoring under Passive Heave Compensation conditions. **Annex 6** contains this and other details of items summarised by Greg Myers (below). He stated that the next possible opportunity for a repeat of the experiment, but this time using Active Heave parameters, would be on leg 196 when the LWD/MWD tools would be mobilised for the work associated with the emplacement of the ACORK tools.

Greg Myers highlighted some of the achievements the logging group had made and opened by showing the comparisons which they were able to make between uphole and downhole measurement parameters when trying to achieve bit weight indication. Some of this is contained in the paper mentioned above. There could be a correlation which is useable and thus it is important to make more measurements when opportunity allows. It is now possible to make accurate measurements on deck and thus, if a correlation exists between the deck and downhole indicators, at least an interim, real-time set of downhole drilling parameters may be achievable. The prime requirement for use with the AHC is a reliable weight on bit indicator however it is achieved.
There was much discussion on this topic and a general feeling that all parameters are not yet known, far less fully understood. A model which will allow desktop input of variable data will certainly help when it is developed. The topic will be discussed again tomorrow.
Greg then informed the committee of the developments with the Multisensor Gamma ray Tool (MGT) which worked well on leg 191. The drillstring acceleration tool (DSA Tool) was also used on the same leg while using the APC and RCB systems. On the current leg 193 measurements are being made of Resistivity At Bit (RAB), (imaging while drilling), and temperature measurements while drilling with the Core Barrel Temperature Tool (CBTT). The DSA tool will be run with HYACE on leg 194 and the CBTT will also be used when coring the carbonates. Leg 196 will have LWD and use the RAB tool. It will also be an opportunity carry out active heave downhole data recording. Leg 197 will use the CBTT once more.

With regard to the previous TEDCOM recommendations it was pleasing to see a summary of the actions taken and implementations being made, including a record of the ongoing collaboration with ODP-TAMU.

7. Report on OD21 Activities

Shinichi Takagawa provided an update on the construction schedule for OD21 and presented a paper addressing the noise and vibration in the new vessel. The issue had been brought up by IPSC. Clearly a great deal of thought and care has gone into making the vessel, and particularly its accommodation and laboratory areas as quiet as possible. **Annex 7** contains all of the information. A short video presentation was made of the test tank trials of the dynamic positioning for the OD21 together with a riser sensor system (MRDPS) for Dynamic Positioning control when a deepwater riser is deployed.

8. IPSC — an Update

As IPSC were holding a meeting in Copenhagen, Denmark at the same time it was not possible to have a presentation from them. However Skinner will obtain any information and add this in to the final minutes of this meeting.

No further information was provided by the time of the issue of this final draft.

A short video presentation of the HYACE tests overseen by TEDCOM at Clausthal in Germany was presented and closed the meeting for the day.

****

The meeting was called to order the following morning and Mike Friedrichs of ODP-TAMU was able to join us for this session.

9. ODP-TAMU Development Scheduling to meet requirements of remaining Legs

Gene Pollard opened the morning session by addressing the request from TEDCOM (Recommendation 001-3) regarding investigation into geotechnical tools suitable for use in ODP. **Annex 8** is attached. He also mentioned that some non-coring tools could be adapted for use with the XCB (piezo-cone) with little cost and that some investigation of this had been carried out with Fugro. (see also Annex 5).

With regard to sampling in non-cohesive materials he suggested that the most likely tools to have any degree of success would be the percussion type tools but that they would be likely to obtain only disturbed core. Alister Skinner suggested that the presentation dwelt on many of the negative points of those types of corers and completely missed the point that no core at all is being collected in some important formations, at present. He also suggested that measures can be taken to mitigate core disturbance. Brian Taylor highlighted the onboard problems for scientists when no core is being obtained and how a simple percussion sampler could assist. Joe Castleberry stated that there are even more tool variations than those outlined and some could be relevant. It was his feeling that the percussive or hydraulic action tools were probably the most promising for obtaining core during deepwater operations.

Gene finished his presentation with a short video and explanation of the successful trials of the DOSECC GLAD 800 rig and container barge explained to TEDCOM at Potsdam. It had undertaken Lake Trials on Great Salt Lake and Bear Lake and would probably be shipped for work in Lake Titicaca in Bolivia during the coming year.

Mike Friedrichs carried on the discussions of yesterday regarding the Passive and Active Heave Compensators and the requirement for a Weight on Bit filter. All detail of this and yesterday s discussion is included in **Annex 9**. There is increased wear on the Passive Heave Cylinder rods and a severe bounce on the driller s weight indicator. This bounce is due to the inertia of the travelling block and the top drive, and to the 20msec response time of the AHC as it responds to the ship s heave and holds the drillpipe motion, relative to the seafloor, to less than 100mm. Basically the system is now so rigid under active heave conditions that every small fluctuation and correction is seen on the analogue dial of the Martin Decker rendering it unstable. It should be possible to filter this out by separately recording acceleration motion and transmitting the information via telemetry to a filter module which then displays Weight on Bit (WOB) and String Weight as two separate digital readouts independent of the Martin Decker.

As yesterday there was much discussion on the wear on the PHC rods and its possible cause. The wear is restricted to approximately 12 inches at the mid-stroke of the rod, with both rods having the chrome coating deterioration in the port-aft quadrant. The chrome failure has also contaminated the PHC hydraulic oil. Due to the 15 years of service of the PHC, the primary cause of the PHC problems may be normal wear and tear as the expected life of chrome-coated rods is 10-15 years.

At present the drillers are able to use the system and keep a relatively constant weight on bit by entering a pre-set bias and operating to that - effectively giving a bit weight when the bias

reverts to zero. Permanent corrections or filters/gains and adjustments are difficult to implement as ODP-TAMU do not presently have access to the software codes of the AHC and are trying to negotiate a non-disclosure act with maritime Hydraulics to be allowed this access. TEDCOM felt that access points or gain controls could be made available to ODP-TAMU without compromising software agreements but it would cost money to implement this. Mike Friedrichs was not too happy about allowing this degree of operator intervention but was able to confirm, in answer to a question by Wally Svendsen, that the AHC continues to perform in the range of 92-98% efficiency of compensation. The requirement to have drillers alert to coring rather than drilling parameters is now very obvious and all efforts must be made to enhance their displays and to reduce operator fatigue. This will be ongoing, with the primary focus on training, and ultimately may involve automatic drilling assistance.

Various comments were made about rig vibration which occurred on leg 192 and will probably continue while coring harder formations. Although this could not be quantified at the meeting with some engineers saying it was trivial and others potentially serious it must be considered as a problem which is potentially serious.
ODP stated after the meeting that it will be investigated during Leg 197 but this may not be soon enough. Jeff Fox stressed that there were contractual problems within this area relating to ownership and maintenance of the AHC and its relationship with the PHC and that they were not going to be discussed at this meeting.
The chairman accepted this and upon discussion with ODP TAMU after the meeting has revised the recommendation #002-3 and modified the section below from what appeared in the draft minutes. The chairman still wishes to re-iterate, so that there can be no doubt that TEDCOM have highlighted the issue the following comments.
The ODP programme needs to be aware that induced drilling vibration, if not addressed and properly dealt with immediately, could seriously impinge on the science by the vessel incurring downtime and possibly also cost penalties while repairs are undertaken. Currently the Joides Resolution is undertaking challenging coring operations in remote locations and Leg 197 is a long way forward.

Howard Shatto asked when the simulation studies now about to be started with a research graduate would be completed. The response was that TEDCOM would be unlikely to see anything constructive until one year from now.

Jeff Fox said that it was quite difficult to have substantive communication with Maritime Hydraulics which could allow things to be brought to a successful conclusion. Earl Shanks thought that Transocean may be able to use some leverage with Maritime Hydraulics regarding software access or expediting some of the requirements which ODP-TAMU have. Brent Shoemaker said that one of his engineers does have a dialogue ongoing with Maritime Hydraulics and that they were helpful.

Brian Jonasson then returned to the short range plan in response to Skinner s request that TEDCOM be informed on the prioritizations made by ODP-TAMU under their development schedule to meet the commitments for science from now until the end of the field programme in 2003. The Short Term Plan is effectively the workscope of the

development engineering team up to end operations in 2003 — given all the caveats on budgets and other conditions which prevail within the active ODP programme. There is also a Long Range Plan scheduled through 2005 but items beyond 2003 do not form a part of the current ODP Drilling Programme.

Alister Skinner asked whether the high priority given to the drilling sensor sub **(see Annex 4)** was to forestall use of MWD techniques to try to ascertain what was happening to the drilling string dynamics downhole. He was concerned that an item giving a quick return to the benefit of the AHC (the add-on to LWD on leg 196) may be dropped for something which could not be on stream before end 2001 at the earliest. This provoked a lot of discussion in justification of the scheduling. The engineers from ODP-TAMU and LDEO explained that there is no conflict because the Drilling sensor sub is a tool for the future and its development can run in parallel with data acquisition for active heave refinements or understanding without conflict of budget or manpower.
It was important to clarify this. If a simple, even empirical, relationship can be found between string reactions downhole and what can be measured on board ship then this will allow fast progress in coming to terms with the new dynamics of the AHC controlled drilling. In view of the TEDCOM recommendation 001-3 Skinner also enquired why there was no development time allocated for an investigation of geotechnical tools for ODP use within the projected programme. He was informed that the projects listed were not exclusive and others were ongoing also.

10. Preparing the Technology Legacy of ODP

Following yesterday s presentations Alister Skinner revisited the EXCOM and Scicom Recommendations under their original agenda scheduling. He re-stated the EXCOM and SCICOM recommendations and what TEDCOM, ODP-TAMU and LDEO were charged to do to meet those. He submitted a one page overview of a possible solution for discussion on the two objectives required — a one page summary of current tools for EXCOM and a Technical Documentation Plan to meet the legacy requirements of the ODP phase-out plan. All information including the proposals and outlines made yesterday by Buddy Bolfrass and Gene Pollard are attached as **Annex 10**.
During the discussion on the one-page EXCOM requirement Eddie Wright produced ODP-TAMU equipment flyers which will meet the Excom requirements with little revision or staff effort. These will be used as a basis of meeting their request and ODP-TAMU will organise this directly for the forthcoming EXCOM meeting. Bill Hay outlined the timescale and said that EXCOM would be looking at getting their final document out by the Fall of 2001. Thus they would need the material for consideration at their Spring meeting in 2001. If we extend the one-page document to mean two sides of the same page then scientific highlights of the use of each tool over the full span of the ODP years can easily be incorporated into the existing format without undertaking any but obvious update requirements to existing content. An example of the PCS flyer is included in Annex 10 by way of illustration of what exists but which was not generally known.

Gene Pollard s outline covers the main technical document envisaged as a legacy document. Tools not in use or never fully developed should not be ignored but need not be documented

to the same level. Salient points as to why they were not developed need to be stated because the technology available now could perhaps allow a revisit in the future. Also it could have simply been budget restrictions which curtailed development. Tools which have an earlier incarnation (e.g. the motor driven core barrel) could have an annex in the current tool manual relating to that earlier prototype(s).

Wally Svendsen reminded us to document tools under development and which would not be completed under this programme. It was also felt that some indication of the lack of foresight relating to this and the expectation of a new programme to outperform the old one from day one be passed on to SCICOM by TEDCOM.

11. A.O.B.

Alister Skinner stated that he had a request from the PACRIM Consortium for information on the Australian Protable Remotely Operated Drill (PROD) and the Hammer Drill system (HRRS) under development with ODP. The HRRS information is included in Annex 5. No information is available on the PROD and a request has been relayed back to PACRIM to see if their Australian Colleagues can give the information directly and subsequently inform TEDCOM.

Bill Hay reported on the setting up of an Arctic Detailed Planning Group which has to look into all aspects of conducting scientific drilling at the Lomonosov Ridge area of the Central Arctic. The area is permanently covered with drifting ice and will require extensive and well organised logistics in addition to the drilling requirements. It will be a multi-ship operation involving icebreakers and an icebreaker or ice-strengthened drilling vessel. Bill requested any possible TEDCOM assistance which could be given to help this group. The chairman of the group can be contacted at (BILL PLEASE GIVE ME SOME DETAILS HERE). Alister Skinner will also pass on any relevant information from TEDCOM members if they wish to use this route.

When Bill had completed this item Alister Skinner took the opportunity of thanking him, on behalf of TEDCOM, for all of his efforts on our behalf whilst Chair of SCICOM and OPCOM and for his most agreeable merging of science presentation and technological requirements for our deliberations.

Wally Svendsen asked about the RPM parameters available on the Joides Resolution for diamond coring and it was ascertained that they were within suitable range for operation of the ADCB. He further undertook to contact the Diamond Drilling Association to investigate the range of sampling tools for non-cohesive and poorly consolidated formations which they had researched.

12. Date and venue for next meeting

Alister Skinner returned to the question of utilisation of geotechnical tools within ODP and wondered if a visit to a contractor developing and using those routinely would be profitable. Consequently a meeting has been proposed in Houston in late May or early June 2001, at Fugro. Joe Castleberry will investigate if this is possible and offer suitable dates for

consideration. Alister Skinner will advise with the final draft minutes. Holding a meeting there will allow first hand dialogue with geotechnical enginers well versed in the techniques of coring and collecting high quality cores in non-cohesive and difficult to collect materials.

Subsequently a meeting date of 29-30th May 2001 has been agreed with Fugro Houston. Please make a note of this and more details will follow closer to the time.

There being no other business the 27th TEDCOM was then concluded.

Annex 1 - Contact List, Agenda for Meeting

Annex 2 - Changes at JOI, ODP information, IODP Planning

Annex 3 - ODP Leg Information
- Science Requirements
- Tool performance and planned operations

Annex 4 - ODP-TAMU Project Schedule Information
- Drilling Service Department Tool Development Schedules

Annex 5 - ODP-TAMU Technical Information
- Hard Rock Re-entry System
- Advanced Diamond Core barrel
- Advanced Cork Installation Leg 196
- Downhole Measurements — Service Centre & Tools

Annex 6 - ODP-LDEO Information
Recent Results on ODP Heave Evaluation

Publication	Title	Author(s), year
SPINLA	3-axis drillstring acceleration (measured below top drive)	Myers et al, 1999
Sci. Results, 179	SWD experiment results	Myers et al, 2000
Joides Journal	MWD experiment with PHC (Leg 188) & corebarrel acceleration tool (Leg 185)	Goldberg et al, 2000/1
Offshore Journal	Summary of above	Goldberg et al, 2000
AGU Poster	Core barrel acceleration experiment (legs 185 & 191 data)	Guerin et al, 2000
Sci. Results, 191	Detail of above	Guerin et al, 2001

It is hoped to conduct a further experiment with AHC and Downhole Measurements on Leg 196 and TEDCOM strongly supports this.

Annex 7 - OD21 Information

Annex 8 - Geotechnical Tools for ODP

Annex 9 - AHC & PHC Information

Annex 10 - Legacy Documentation
- OPCOM & SCICOM Motions
- Bolfrass suggested System Modernisation
- Pollard Suggested Technical Scheme
- Skinner discussion page
- Wright suggestion to meet EXCOM requirement (use existing data leaflets e.g. PCS)

SCIENCE OPERATOR'S SCICOM REPORT

Review of Activities
June 2000 through January 2001

Executive Overview

In FY00 the Program experienced rising fuel costs, as well as associated accelerated increases in day rates for ship operations, that cumulatively resulted in a deficit in excess of 600 thousand dollars relative to our FY00 PP. We successfully offset this deficit by postponing the replacement of vacant positions, by delaying certain maintenance activities (i.e. the refurbishment of one of our drill strings) and postponing laboratory enhancements (i.e. the purchase of a digital camera for core photography). As of this writing we are four months into FY01 and we are already experiencing the deleterious consequences of marine fuel costs that have reached record levels and are $100/metric ton higher than what the Program budgeted for FY01. If fuel costs remain at high levels (i.e. in excess of $280/metric ton), and if day rates continue to increase at an escalated rate, we anticipate a budget deficit in the range of 1 million to 1.3 million dollars. Over the next several weeks ODP Management will investigate a variety of cost saving strategies to offset the fuel-induced deficit in FY01. Strategies presently being implemented are: vacant positions are being closed (i.e. the Public Information FTE at TAMU, two engineering positions) or being left unfilled at this time (i.e. the Assistant Laboratory Officer position); new equipment is not being purchased (i.e. digital camera), and embellishments to scientific operations are not likely to be scheduled (i.e. a measurement while drilling experiment to ascertain weight on bit on Leg196). Additional options are under review by ODP management so that the budgetary erosion caused by escalating fuel can be offset by reduction in programmatic activities. Options being considered will be outlined at EXCOM.

The ODP/TAMU base budget in FY01 (core services, leg related costs and special operations but excluding our subcontract for ship operations) is equal to what we spent for these services in FY91. It is clear that the budget is indeed lean, but our staff remain dedicated to making every attempt to maintain our core service deliverables in the face of these challenging financial circumstances.

Introduction

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

Schedule of Science Operations for the *JOIDES Resolution*: January, 2001 – November, 2002

	Leg	Port (Origin)†	Dates €	Total Days (port/sea)	Days at Sea (transit/on site)	Co-Chief Scientists	TAMU Contact	LDEO Contact
194	Marion Plateau	Townsville	6 January - 5 March	58 (5/53)	13/40	F. Anselmetti, A. Isern	P. Blum	H. Delius
195	Mariana/W. Pacific Ion	Guam	5 March - 3 May	59 (5/54)	8/46	M. Salisbury, M. Shinohara	C. Richter	S. Barr
196	Nankai II *	Keelung	3 May - 2 July	60 (5/55)	9/46	K. Becker, H. Mikada, & C. Moore	A. Klaus	S. Saito
197	Hotspots	Yokohama	2 July - 28 August	57 (5/52)	17/35	R. Duncan, J. Tarduno	G. Acton	F. Einaudi
198	Shatsky Rise	Yokohama	28 August - 24 October	57 (5/52)	17/35	T. Bralower, I. Premoli Silva	M. Malone	T. Williams
199	Paleogene Pacific	Honolulu	24 October - 17 December	54 (5/49)	13/36	M. Lyle, P. Wilson	C. Escutia	P. Gaillot
200	H_2O Observatory	Honolulu	17 December - 31 January '02	45 (5/40)	12/28	R. Stephen, J. Kasahara	P. Wallace	Y. Sun
201	Peru Biosphere	Mazatlan	31 January - 2 April	61 (5/56)	21/35	S. D'Hondt, TBD	J. Miller	G. Guerin
202	SE Paleoceanography	Valparaiso	2 April - 1 June	60 (5/55)	20/35	A. Mix, R. Tiedemann	P. Blum	U. Ninnemann
203	Costa Rica	Panama City	1 June - 31 July	60 (5/55)	12/43	J. Morris, TBD	A. Klaus	S. Saito
204	Gas Hydrates *	San Francisco	31 July - 28 September	59 (5/54)	6/48	G. Bohrmann, A. Trehu	C. Richter	D. Goldberg
205	Eq. Pac. Ion ‡	San Francisco	28 September - 3 November	36 (5/31)	15/16	J. Orcutt, TBD	G. Acton	TBN

€ Port call dates have been included in the dates which are listed. For example, Leg 205 begins on 28 September with 5 days of scheduled port call. The scheduled sailing date is 3 October.
† Although 5 day port calls are generally scheduled, the ship sails when ready.
* A mid-leg port call will occur for Leg 196 and may occur for Leg 204.
‡ Leg 205 is tentatively scheduled to end in Panama City.

13 February 2001

Co-Chief Scientists and Cruise Staffing for Science Operations

Co-Chief Scientists for Legs 188-205:

	Leg	Co-Chief Scientists
194	Marion Plateau	F. Anselmetti A. Isern
195	Mariana/W. Pacific Ion	M. Shinohara M. Salisbury
196	Nankai II	K. Becker (CORK) H. Mikada (both) J.C. Moore (LWD)
197	Hotspots	J. Tarduno R. Duncan
198	Shatsky	T. Bralower I. Premoli Silva
199	Paleogene	M. Lyle P. Wilson
200	H_2O	R. Stephen J. Kasahara
201	Peru	S. D'Hondt TBN BO JORGENSEN
202	SE Paleoceanography	A. Mix R. Tiedemann
203	Costa Rica	J. Morris TBN
204	Gas Hydrates	A. Trehu G. Bohrmann
205	Eq. Pac. ION	J. Orcutt TBN ADAM SCHULTZ

Scientific Party Staffing:

Staffing for Legs 195 and 196 is complete. Staffing of Legs 197 and 199 is in progress.

Tabulated below are the numbers of applications on file as of January 2001.

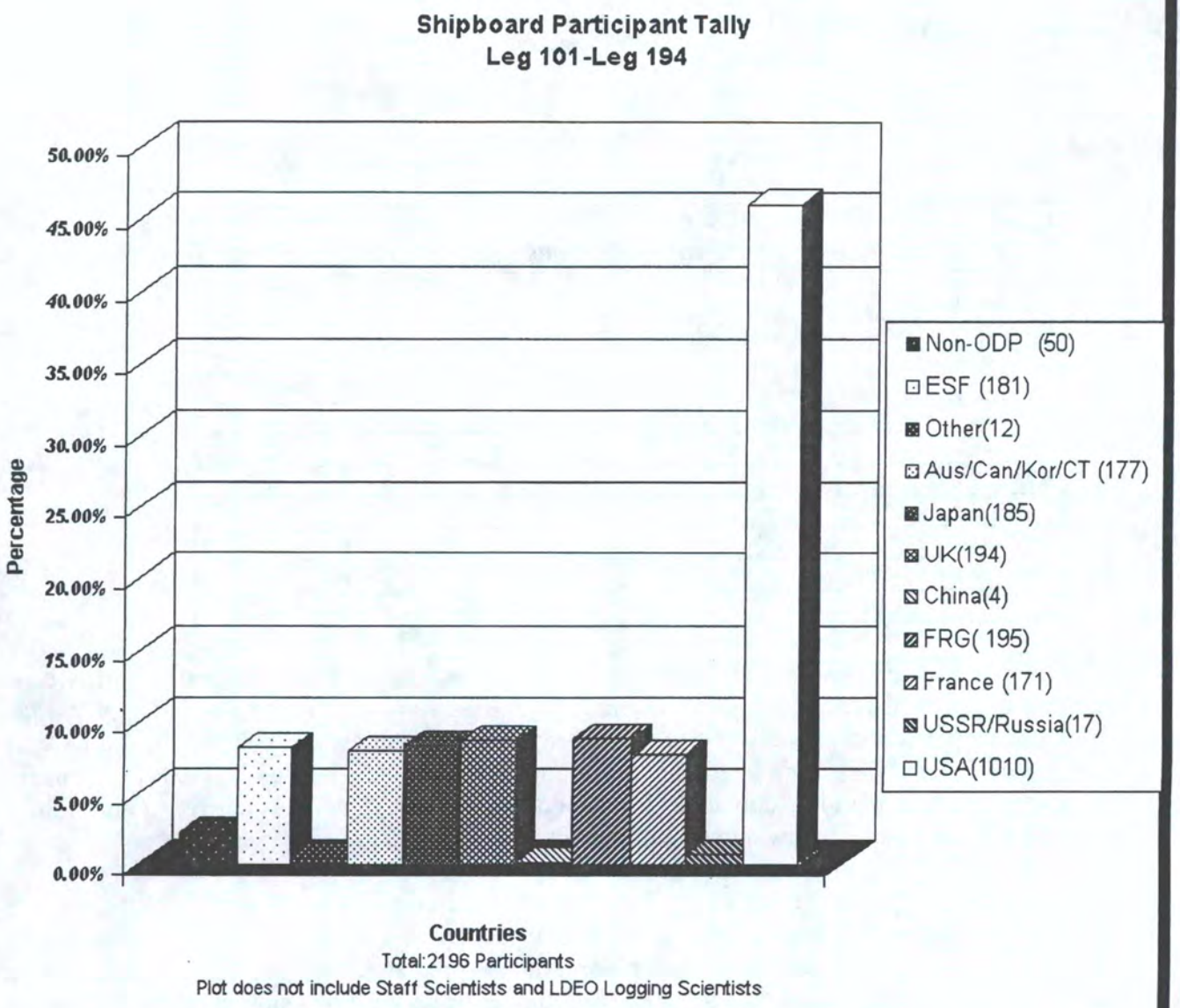
Legs	Total Applicants	U.S. Applicants	U.S. Students	Non-U.S. Applicants	Non-U.S. Students
195	33	10	4	14	5
196	29	7	3	11	8
197	39	14	7	13	5
198	18	3	2	9	4
199	35	10	3	15	7
200	0	0	0	0	0
201	3	2	0	1	0
202	16	4	0	8	4
203	4	1	1	1	1
204	17	1	1	9	6
205	1	1	0	0	0

The numbers of applications for berths on future legs seems to have rebounded and is now moving closer to historic levels of 45-75 per leg. The previously noted drop-off in applications seems to have been largely a consequence of earlier uncertainties in the schedule and lack of information readily accessible to the community. Legs 195, 196 and 200 are primarily concerned with implanting downhole instrument packages, rather than coring, which likely accounts for the relatively low numbers of applicants for those legs.

When our old e-mail addresses were discontinued at the end of August 2000, all of the links embedded in the ODP/TAMU web page had to be updated. In November 2000, it was discovered that the link related to the online Cruise Application had not been updated. The problem has now been fixed, but an unknown number of applications submitted in October or November may have failed to reach us. Notices regarding the problem were immediately distributed via e-mail lists and on the web in order to alert as many potential applicants as possible. The ODP member offices were also advised, and notices placed in upcoming issues of both the USSAC Newsletter and JOIDES Journal. In response to the notices we were advised of several applications which had failed to reach us, and we were able to make the necessary corrections. We are confident that all missing applications have now been recovered.

Shipboard Participant Tally:

Please reference the table below for a compilation of all sailing participants since Leg 101 through Leg 194.



Status of the Labstack

Recent modifications:

In addition to relocating the microbiology lab (see below), other changes made in the lab stack during Leg 191 included set up of a new sampling table and drawers, and renovations to counter and desk space in the core lab. These changes will improve the efficiency of core lab operations.

In anticipation of future encounters with H2S, and to enhance the safety of scientists and ODP staff in such situations, we have now improved the exhaust system in the core lab, especially the core splitting room. In collaboration with ODL we have also completed installation of a new breathing air system on the core receiving platform which will permit essential staff to work there in the presence of H2S-laden cores more easily and safely. (When H2S was encountered

on Leg 182, we had to resort to emergency breathing packs which are designed for only brief periods of use and are heavy and cumbersome.)

Microbiology:

At the Yokohama port call (beginning of Leg 191) the XRF was removed from *JOIDES Resolution*. Following this, during Leg 191, the thin section making facilities were moved to space on the new 7th level of the lab stack. The space on the F-deck level vacated by these changes was then converted to a permanent microbiology lab, and the equipment moved down from the temporary quarters on the new 7th level, as recommended by SCIMP. These changes, which were completed before the end of Leg 191, put microbiology, geochemistry and micropaleontology labs in proximity, thus fostering synergy between the different groups of scientists, and from a practical point of view allow for more efficient arrangement of utilities such as gas distribution and exhaust lines.

Since dry dock (late 1999) microbiology has been an important component of Legs 187, 190, 191, and 193 and each case has been very different. Some microbiologists simply want to collect clean samples for future study on shore; others have visions of extensive laboratory research conducted on board ship. We are also seeing an increase in sample requests from microbiologists not sailing on the leg who are potential shore-based leg participants. Now that the basic laboratory is in place and we have some experience behind us, we are working with SCIMP to address these issues and establish more standardized procedures and the base level of support and routine laboratory equipment and supplies which microbiologists can reasonably expect when they sail. This will be the next step towards integrating microbiology into ODP seagoing operations.

Status of Projects

Digital Imaging:

An RFQ was submitted in early March, 2000, to vendors of digital core imaging systems so that ODP-TAMU could identify which commercially available RGB line scan digital imaging system should be purchased for use on the *JOIDES Resolution*. In spring 2000 ODP-TAMU received responses from three vendors, however review of these was stopped when it became clear that due to the high price of fuel for the ship funds to purchase a digital imaging system would not be available in FY00.

Since that time, informal discussions have been held with each of the vendors who responded to the original RFQ to see if there are less expensive options which would achieve the SCIMP objectives. Encouraged by the results of these discussions, a revised RFQ has been issued. Review of the responses to the revised RFQ is in progress. The intent is that ODP/TAMU will be in a position to move expeditiously as soon as funds to acquire and install a digital core imaging system become available.

ICP Analyzer:

We continue to gain experience and confidence with the inductively coupled plasma analyzer (ICP) purchased by the U.S. Department of Energy and installed in the chemistry lab at the beginning of Leg 187. With the removal of the XRF, the ICP is now the principal instrument used to obtain major and trace element data from bulk rock analysis. It is also used for interstitial water analysis. A new technical note for ICP analysis on board the *JOIDES Resolution* has been written and is now posted on the world wide web.7

Drilling Services

Summary of Leg Operation: Legs 191, 192, 193

	Leg 191 **W. Pacific ION** **16 July - 8 Sept '00** **Yokohoma – Guam**	**Leg 192** **Ontong Java** **8 Sept – 9 Nov '00** **Guam – Guam**	**Leg 193** **Manus Basin** **9 Nov – 8 Jan '01** **Guam – Townsville**
Transit/Onsite (day)	17.6 / 30.7	13.2 / 41.8	8.9 / 41.6
Sites	4	5	4
Holes	18	6	13
Water Depth (m)	970 - 5577	1673 - 3910	1652 – 1714
Deepest Penetr. (m)	475	1211	218
Cored Interval (m)	509	1764	736
Tot. Recov. (m, %)	363 (71.3%)	898 (50.9%)	79 (10.75%)
APC Recov. (m, %)	296 (102.5%)	0	0
XCB Recov. (m, %)	17 (63.1%)	0	0
RCB Recov. (m, %)	50 (26.0%)	898 (50.9%)	48 (8.5%)
ADCB Recov. (m, %)	-	-	31 (18.3%)

Review of Operations

Leg 191 (W. Pacific Ion):

- Cored 509 m (71.3% recovery) at one site in 5566 m water depth.
- Hole 1179E: Set Reentry Cone with 64 m 16 in. and 393 m 10-3/4 in. Drilled to 475 m and installed broadband seismometers (3rd long-term borehole geophysical observatory for the International Ocean Network (ION)).
- In the Fall of 2000, the Jamstec ROV "Kaiko" will connect the observatory to an undersea cable.
- Lost 4.3 days of operating time in a typhoon and medivac.
- A drawworks brake band cracked late in the leg, however, a new brake band was expedited to the ship to allow time for limited hammer drill tests.

- Conducted limited spud tests of the SDS 260 mm downhole fluid hammer and 4 bit designs for Hard Rock Reentry System (HRRS). Washed and hammer drilled to 8 m on volcanic seamounts near Guam with no equipment problems.
- Minimized surface pressure pulsations from the hammer drill using downhole pulsation-dampener sub and improved standpipe support in the derrick.

Leg 192 (Ontong Java):

- Set 2 free fall funnels and 1 reentry cone.
- Cored 5 sites in 1673 – 3910 m water depths.
- Drilled 2383 m sediment.
- RCB cored 907 m sediment (41.5% recovery) and 856 m basement (60.8% recovery). Total recovery 50.9%.
- One BHA was lost when the drilling jars failed.

Leg 193 (Manus Basin):

- A total of 2 free fall funnels, 2 HRRS cones, and 1 full size reentry cone were deployed.
  1. First operational use of HRRS – Hole 1189B.
  2. First operational use of ADCB – Hole 1188F.
  3. First free fall deployment of a standard sized reentry cone.
- Longest ever 8 _" BHA – 204.1 meters to top of the tapered drill collar with most 8 _" drill collars (21) ever used in a BHA.
- Longest ever 6 _" BHA – 343.5 meters to top of crossover sub with most 6 _" drill collars (29 @ 30', 8 @ 20', and 8 @10') ever used in a BHA.
- Fluid Hammer used to assist in 13 3/8" csg installation in Hole 1188F.
- Nineteen reentries (14 in small 8' cones) made in average time of 19 minutes each.
- Three helicopter rendezvous on-site and 1 boat rendezvous in port were made.
- All coring was conducted using the Rotary Core Barrel (RCB) or the ADCB. Coring and HRRS statistics for Leg 193 are shown in the table below.
- Lost 2 BHAs. Three severing charges were deployed to severe the drill string 2 times during the leg. Two charges were used in Hole 1188A and one in Hole 1189A.

Review of Engineering Development Projects

The developmental engineering projects that ODP/TAMU is working on can be divided into three categories. The first category includes Actives Heave Compensation (AHC) and the Rig Instrumentation System, two pieces of equipment that were installed in dry dock in the Fall of 1999. These systems are functioning and are now undergoing refinement as they are incorporated into the daily drilling operations of the JR. The second category includes two new drilling technologies that have been under development at ODP/TAMU for a few years. These systems are now operational and have undergone initial field tests with a goal to enhance scientific returns in geologic environments that have been historically hard to drill. The Hard Rock Re-entry System (HRRS or Hammer Drill) and Advanced Diamond Core Barrell (ADCB) were tested on Leg 193 (Manus Basin) and the ADCB will also be deployed on Leg 194 (Marion Plateau). The third category are downhole tool development projects that are currently underway

and include: Advanced Piston Core Temperature tool and WSTP, Davis/Villinger Temperature Probe (DVTP), APC Methane Tool and the Memory Drilling Sensor Sub.

Active Heave Compensator (AHC) Operational Review

AHC vs. Passive Heave Compensation (PHC) Performance:

Heave compensation is designed to reduce the effects of ship heave on the drill string, and thus the drill bit.

The PHC provides approximately an 80% reduction in ship heave on drill pipe motion over a 3-meter (10-ft) stroke of the PHC. This efficiency decreases to 50% reduction of heave with a 2-meter stroke and to virtually 0% reduction of heave with less than a 1-meter stroke. At low sea states the large frictional forces of the rod and piston seals limit the PHC effectiveness.

The AHC was designed and installed to minimize the absolute motion of the drillpipe relative to the seafloor over the full range of sea-states and compensator stroke. The AHC equipment has far exceeded the contract Statement of Work (SOW). The SOW required 90% average efficiency at 4-ft/sec vertical ship velocity. There has never been less than 92% efficiency reported and several occurrences of 96-98% efficiency with 4.3-ft/sec vertical ship velocity. The system is capable of 5-ft/sec vertical ship velocity. The AHC controls the absolute drill string motion to within 4-in. relative to the seabed. This has been demonstrated even with 4 m to 4.5 m of absolute ship motion (approximately 6 m seas). Keep in mind that the best efficiency documented for the Passive Heave Compensator (PHC) is 80%, which would correlate to .72 - .84 m of absolute drill string motion.

Drill String Stiffness

The AHC minimizes drill string motion, but does not change the effect of drill string stiffness on WOB variation.

The drill string stiffness is a function of:

- the bottom hole assembly selected;
- the drill string configuration (5-in. vs. 5 _-in.); and
- water depth

The drill string stiffness will vary from 20,000 lb./ft. up to 35,000 lb./ft. with decreasing water depth.

Example of Impact of Drill String Stiffness on WOB Variation

The drill string stiffness during hammer drill testing on Leg 191 was approximately 24,000 lb. / ft. This means that for each 1-foot change in drill string stretch, the hookload would change +/- 24,000 lbs. Given that the AHC controls the absolute drill string motion within 4-in., this equates to 8,000-lbs. weight on bit (WOB) variation (+/- 4000-lbs) during the hammer drill tests. This requires that there be more than 4000 lbs. of WOB, or there could be lift-off of the bit from the bottom of the hole. With an average of 2-ft of absolute drill string motion with the PHC, this

equates to 48,000-lbs. weight on bit (WOB) variation (+/- 24,000-lbs). This then requires that there be more than 24,000-lbs. WOB, or there could be lift-off of the bit from the bottom of the hole when using the PHC.

Weight Indicator Readings & AHC WOB Bias Force:

The inertial effects of the travelling block have historically imparted a dynamic force into the crown-mounted load cell, which is exhibited by needle bounce on the Martin Decker weight indicator. The inertial effects of the travelling block responding to the ship's motion has been measured as creating a 5,000-10,000 lb. variation in WOB on the Martin Decker gauge. With the addition of the AHC, the AHC dynamic forces required to maintain the 4-in. absolute drill string motion are superimposed at approximately 50 hertz on the Martin Decker (MD) Weight Indicator. As a result the MD needle bounces around, to the point of being unreadable by the Driller.

AHC WOB Bias Force

Because of the AHC dynamic forces, Maritime Hydraulics (MH) added an algorithm to the operational software to obtain a usable AHC WOB. The algorithm performs a simple average of the AHC hydraulic forces over a 30-second period. The output of this function is the so-called AHC WOB Bias Force, which is updated each second, but exhibits a lag since it is the average over the previous 30-seconds. This is the best approach until the filtered WOB circuit can be implemented.

The Driller creates a quasi-WOB with the AHC by stroking-out (bleeding-off) the PHC while the AHC is in the landing mode. The AHC is designed to minimize the absolute motion of the drill string with the PHC set at a mid-point. When the PHC stokes out the AHC applies a force to lift the drill string back to its set mid-point. This is seen on the AHC driller console as a minus force (bias) or AHC WOB Bias Force. When the Driller does set the drill string down on the seabed, he maintains the AHC WOB Bias Force at zero value with the brake, thereby establishing a WOB equal to the bias force.

If there are motions at the bit that are much slower than the 30-second period the real time conditions at the bit will be averaged and not considered in the calculation by the MH algorithm, which is displayed as the AHC WOB Bias Force.

Weight on Bit Filter

The Active Heave Compensator (AHC) has elevated the need for a reliable and stable hook load measurement. With the addition of AHC and its rapid (20millisec) response the hook load signal from the crown-mounted load cell has become unusable. The driller is unable to effectively control the weight on bit due to excessive gauge needle bounce. The AHC Project Manager sailed on Leg 191 to develop a WOB filter, which can electronically filter the dynamics of the ship and derrick travelling equipment. Sensors were installed on the top-drive and the derrick (travelling block equivalent accelerations) to measure the dynamic forces, and a computer program was written to record, analyze and model the dynamic forces. A beta version of the WOB filter software was developed during Leg 191.

The WOB filter will be implemented during Leg 195 port call. The installation includes permanently mounting a sensor module on the top drive and a sensor module on the drill floor. Both modules consist of acceleration sensors and a controller. A radio transmitter in the top drive module will send acceleration data to the drill floor module, which will process the data and send the filtered data to the two new digital gauges in the console and to Rig Instrumentation System for recording.

Driller's Console

The implementation of the WOB filter is being carried out in conjunction with the installation of instrumented load pins on the hook and reconfiguration of the Driller's console for improved visibility by the Driller of the AHC driller console. The load pins were installed for Leg 192 to provide a more stable WOB measurement. Because the load pins are mounted at the hook the dynamic effects of the travelling block are reduced compared to the reading from the hydraulic load gauge in the crown (water table). The WOB filter can be applied to either the instrumented load pin signal or the hydraulic load cell signal.

The new Driller console will feature the AHC display in front of the driller for easier viewing and operation. Space has been provided for installing two digitally driven gauges to display filtered hook load and filtered WOB. The console panel was installed during the Leg 194 port call.

AHC Hydraulic Umbilical:

Dynamic interference between the new AHC service loops and the existing PHC and top drive service loops caused significant wear within the AHC bundles at several places during Legs 188 through 190, to the extent that the AHC service loop was replaced at the Leg 191 port call. The spare service loops were reconfigured by the ODP Project Engineer to reduce the causes for wear. The worn bundle was considered to be unsalvageable and discarded at the Leg 191 port call.

The hydraulic umbilical was inspected during Leg 193 and found to be without any similar wear problems.

Rig Instrumentation System

The purpose of the Rig Instrumentation System (RIS) is to improve the quality and quantity of core recovery by virtue of improved decision making with the aid of RIS data. The system was installed during dry dock and displays and records data from the various rig sensors, measurement while drilling (MWD) transmissions, ODP/TAMU measurement systems, and third-party systems. RIS is operating to specification, and its documentation is complete. Hardware is being acquired to allow the driller's RIS screen to be broadcast over the ship's TV network.

The instrumented load pins were installed and functioning properly. The installation was completed during the Leg 192 port call, and RIS was set up to calculate weight on bit (WOB) from the load pin measurement. A meeting was held with M/D Totco to discuss the instrumented load pin reliability problem. A newly installed load pin failed within hours of installation during Leg 190. M/D Totco agreed to supply ODP with the diagnostic procedures to trouble shoot and repair the load pins onboard the ship and to sell spare electronic modules to support the repair effort.

The addition of an Active Heave Compensator (AHC) has increased the need for a stable hook load measurement. The dynamic effect of AHC operation renders the hook load signal from the crown-mounted load cell unreliable. A WOB filter is being developed that can electronically filter the dynamics of the top-drive and AHC. A beta version of the WOB filter software was developed during Leg 191. Implementation of the filter and the addition of a WOB digital meter output will occur during the Leg 195 port call.

The driller's instrumentation panel is being reconfigured to improve the driller's view of the data. The primary change consists of moving the AHC display to the front. The new panels have been installed. The WOB meter will be added to the console when the digital filtering scheme is implemented during the Leg 195 port call.

RIS received and recorded real-time transmissions from an MWD tool during Leg 188. An RS422 cable was run between the RIS master computer in the server room to the Schlumberger Anadrill unit in the LDEO Downhole lab. Two-way communication was established using Well Site Information Transfer Standard (WITS) protocol. The WITS link between the RIS and Anadrill data acquisition systems was used while drilling two MWD/logging while drilling (LWD) holes. RIS received the Anadrill rig sensor data (time stamp, hook load, bit position, standpipe pressure, rate of penetration) as well as the sensor data from MWD transmissions (WOB, torque on bit) at a 2-second data rate. RIS sent Anadrill the ship's motion data (heave, roll, and pitch) at a 2-second data rate. This was the first time that MWD was used in an ODP borehole, and the first time real-time downhole data was displayed alongside real-time surface data in the driller's cabin.

Advanced Diamond Core Barrel (ADCB) Project

The scientific goal of the ADCB was to improve core recovery in fractured hard rock.

The ADCB Project goal was to adapt existing mining technology s thin kerf concept and to utilize off the shelf hardware where possible. The resulting thinner kerf bits would cut less rock and in turn reduce the amount of potential disturbance that the formation sees while coring. The ADCB Project will provide ODP with a "PQ" mining style, thin-kerf diamond coring system.

A second land test of the ADCB in early June 2000 allowed all the new components to be tested as a system. The new hardware included the positive indicator latch, shock sub, circulation sub, and split steel liners with the PQ-3 style bits. Forty core runs were made over a 3.5-day test period with an overall core recovery of 86%. All of the hardware operated successfully.

Information obtained from this second field test will be incorporated into the Draft ADCB Operations Manual.

The new positive indicator latch worked perfectly every time it was deployed. The compression spring in the latch was operated over the full range of settings to ensure that there were no downside effects from higher-pressure settings. Two miss latches were observed. These were caused by core left in the bottom of the hole and had nothing to do with the performance of the latch.

The Shock sub was operated behind the core barrel during more than half the core runs. We realize that land drilling probably would not demonstrate any significant difference in core recovery whether the sub was in the string or not. Operating with the sub was done to ensure that it could withstand the rigors of actual drilling without any detrimental effect to the coring operations.

Poor hole conditions caused the circulation sub to be tested near the surface only. The circulation sub ports opened as designed when the drill string pressure reached the cracking pressure on both tests. The cracking pressure of the circulation sub was set at the lowest pressure of 850-900 psi. The circulation sub was removed from the drill string after initial tests confirmed it worked as tested in the laboratory.

The split steel liners were run with the PQ-3 bits during the last eight runs and showed improved recovery over runs without the liners with the same PQ-3 bits. Based on the observations, it was recommended that the ADCB be operated in the PQ version with the split steel liners unless friable or granular material was being cored.

The mid-body inner barrel stabilizer could not be used during the land tests. We learned that a retainer ring was needed behind the inner barrel stabilizer to prevent the stabilizer from pulling out of its cavity during inner barrel retrieval. On two occasions, the stabilizer was lifted out of its cavity and rotated inside the outer core. This prevented the inner barrel from landing correctly. For the remainder of the test program, the inner barrel stabilizer was not used and no detrimental effects were noticed.

The new float valve design was not evaluated during this test. The float valve interfered with the initial make-up of the core barrel when the lower stabilizer did not screw onto the core bit. The ADCB Project Manger learned that the float valve was designed by the vendor for a standard 5-1/2 F.H. connection and not the modified 5-1/2 F.H. connection which is 1 inch longer. A new float valve design will be made and tested on the next deployment of the ADCB.

The ADCB Project Manager assisted the Japan Drilling Company (JDC)/JAMSTEC in a controlled laboratory testing program of the Japanese Small Diameter Rotary Core Barrel (SD-RCB) which is very similar to the ADCB system. This testing program occurred in late September at Terratek's facility in Salt Lake City, Utah. ODP provided the majority of the ADCB hardware to the JDC for this test program. Several tests were performed both under atmospheric and pressure conditions. JDC was very encouraged by the results of the ADCB (SD-RCB) over several of the other coring systems being evaluated. The ODP provided ADCB

equipment was shipped directly from Salt Lake City to Guam for the Leg 193. Results from Leg 193 and 194 are forthcoming.

Draft copies of the Phase II Field Report and the ADCB Operations Manual were circulated for comments and review within the department. The Phase II Field Report should be completed in October 2000. The ADCB Operations Manual will be updated during Legs 193/194 and be ready for final review by March of 2001.

As a part of the development vision in the ODP Long Range Plan, the next phase of the ADCB is the development of a retractable bit. This ADCB retractable bit (Retractabit) development phase is dependent upon future funding for this technology. This project has been described as innovative work that could rewrite the chapter on offshore coring tools. However, because of constraints on funding there are no plans to pursue this project.

The ADCB Retractabit will allow:

- Bits to be changed via wireline so that the drill string would not have to be round tripped. This will result in reduced trip time with significant savings as water depths increase.
- Diamond bit selection can be optimized to the lithology (change bit type if different material is encountered throughout the course of a hole)
- Fresh bits may be introduced allowing high ROP to be maintained
- Bits can be checked for wear/damage and prevent running an under-performing bit to total destruction
- Reduced number of pipe trips results in better hole conditions and less time required for re-entries
- Logging may be performed without a round trip of the drill string and the elimination of the costly practice of using mechanical bit releases
- Higher quality logs due to less formation disturbance
- May allow other coring tools to be operated in the same BHA such as the MDCB, APC, and XCB by applying the Retractabit technology to these tools in the future.

The Retractabit program is a natural continuation of the ADCB development program. Successful development and demonstration of the retractable bit will open new doors for science coring for year to come.

Hard Rock Reentry System (HRRS) Project

The scientific goal of the HRRS has been the development of a cased reentry system for unstable surface formations of fractured hard rock and pillow basalt. The objective has been to develop a system that would allow the emplacement of a reentry funnel and surface casing on the seafloor where conventional casing, hard rock guide bases and standard re-entry cones can not be used. The HRRS project goal has been the development of downhole fluid hammer drilling technology with a nested drill-in-casing system.

Land testing of the HRRS prototype bit designs was completed in February 2000. A report was completed in May 2000 that discusses the three land tests on the bits and hardware. The report has been classified as confidential due to confidentiality agreements with the vendors.

To support the sea trails on Leg 191, ODP purchased eight bits based on four different bit types. These bits are a combination of new and refurbished prototype bits. These bits have been developed and improved over the last two years to be more robust than the bits tested on Leg 179. The bits have been redesigned for an improved bare rock spud.

ODP purchased additional support equipment for the Leg 191 sea trials, including bit breakers, stabilizers, hammer components, and various subs. SDS completed machining, inspection and bench testing of the bits and support equipment in June 2000. The HRRS Project Manager witnessed the final assembly of the bits in Australia. The hammer bits, fluid hammers, and ancillary equipment were shipped to Yokohama for Leg 191.

ODP purchased a pulsation sub from Houston Engineers in Houston, Texas. The pulsation sub was completed in June 2000. The ODP Project Manager witnessed the final assembly and testing of the pulsation sub at the Houston Engineers facility.

The HRRS equipment and hardware were ready for Leg 191 sea trials during the last 12.5 days. Unfortunately, the HRRS testing was postponed to the last seven days due to severe weather delays to avoid approaching typhoons, one emergency medical evacuation, and downtime/transit for drawworks repair parts. With limited time, both the original and alternate HRRS sites at Shatsky Rise were canceled. Two new sites (ROTA-1 and Mariana Back Arc) were selected that were closer to Guam.

Three potential drill sites were identified from a 3.5 kHz seismic survey at ROTA-1. These sites were abandoned after 20 hours because the seismic reflection of a hard bottom turned out to be a soft ash-covered seamount and not hard rock. The soft materials allowed the hammer to penetrate up to nine meters under its own weight without rotation and with a pump jet force of only 100-200 gallons per minute. The soft material would close around the HRRS tools and cause a loss of circulation. The fluid hammer never encountered sufficient hard rock to operate properly in any of the six test holes at ROTA-1.

A second site, Marina Back Arc, was hastily selected with limited information. The 3.5kHz seismic survey data indicated that volcanic lava flows were present at the seafloor. The vibration-isolation television camera confirmed the seafloor hardness during two jet-in tests (without rotation) to a maximum penetration of two meters. After removing the VIT camera, two holes were spud with the dual cam underreamer bit to 5 meters and 3.5 meters with penetration rates of 3.2 and 4.7 meters per hour. The drill string was round tripped to change from the dual cam underreamer bit to the flat-faced underreamer bit. Three holes were spud with the flat-faced underreamer bit to 4.5 meters, 7 meters, and 5 meters with penetration rates varying from 2.7 to 9 meters per hour.

Both sites used less than five days to test the HRRS bit designs. There was insufficient time remaining in the last two days to complete the next step in the HRRS testing program. This step required deploying an umderreamer type bit with the 13-3/8 drill-in casing. The remaining time was insufficient to make up and test the HRRS running tool hardware, space out the casing, perform the drill-in operational test, and retrieve the HRRS tools back on board the drillship. Despite the reduced testing time, the HRRS testing program accomplished the following:

1. The fluid hammer operated and tested successfully in 2880 meters water depth at the Mariana Back Arc site.
2. The fluid hammer operated in conjunction with the Active Heave Compensator.
3. The fluid hammer operated flawlessly and without damaging or breaking any hardware.
4. No new operational problems were noted during the Hammer tests while operating at full flow rates of 400-450 gallons per minute (80-90 pump strokes per minute).
5. The dual-cam and the flat-faced underreamer bits were tested and confirmed to be acceptable for future ODP deep-water operations. Both bits survived without any damage to the bit body, bit arms, and without loosing any tungsten carbide compacts.
6. Bare rock spuds were successfully performed in sea states of 2.5 to 4 meters and penetration rates of 2.7 to 9.0 meters per hour in volcanic lava flows.
7. Supplemental bracing of the standpipe that was installed during dry-dock reduced the harmonic vibrations to an acceptable level.
8. Pulsation Sub was deployed in the BHA to help reduce vibration in the standpipe.
9. The drill crew was trained and was comfortable with the fluid hammer operation.

At the conclusion of Leg 191, many of the test objectives for the HRRS project were not completed. The HRRS remained on the vessel for use during Leg 193 for bare rock spuds in hard volcanic rocks to drill in a short string of casing. Report from Leg 193 is forthcoming.

The future of the HRRS Project is dependent upon the level of funding that is available through the end of the program. Future use of the HRRS technology, casing equipment, bits, and hammer rental could be included in the DSD operating expenses under specific leg costs. At this time, no funding is planned for the HRRS project for the remainder of the ODP Program.

As a part of the vision of the ODP Short Range Plan, the HRRS Project could deploy of a smaller fluid hammer that could offers several new opportunities to increase operational efficiency. The smaller fluid hammer could be used for hole opening operations, drilling instrumented sections such as for ION holes, and assisting in setting conventional casing through deep unstable formations which are susceptible to bridging.

It is also envisioned in the ODP Long Range Plan that a nested casing system would be developed upon the successful demonstration of this technology through Legs 191 and 193. The nested system would allow a smaller second casing to be run independently or nested inside the first casing string.

APC Temperature Tool and WSTP

The purpose of this project is to find alternative support for the APC Temperature tool and WSTP electronics since the original supplier, Adara Systems, discontinued support.

Blue Mountain Instruments (BMI) was selected to provide repair and calibrations services for the APC temperature tool and WSTP data logger. BMI is also compiling all software source code and drawing files (i.e., compiling a technology transfer package) held by Adara Systems, which they will deliver to ODP. A portion of these files has been received.

Six thermistors for the WSTP were purchased and sent to the ship. Instead of purchasing a low temperature and a high temperature thermistor, a single thermistor was bought, which can operate over the full WSTP temperature range by using two calibration coefficients.

Davis/Villinger Temperature Probe (DVTP)

The purpose of this project is to adopt the Davis/Villinger Temperature Probe (DVTP) as an operational ODP tool.

All of the existing DVTP documentation is collected and centralized in DSD's library. Ninety percent of the mechanical and electrical drawings are integrated into ODP's drawing system. The overall assembly and the electrical assembly drawings are 75% complete.

ODP is working with Earl Davis of Pacific Geosciences Center, Canada to help integrate the pore pressure measurement into the DVTP tool. The prototype tool was deployed on Leg 190 and run 12 times. The pressure data response curve appeared to be credible on all but the last two runs, which was attributed to bottom-water infiltration. The final report is pending. The tool was shipped back to College Station at the end of Leg 190 for inspection and refurbishment. It experienced significant corrosion in the pressure transducer region. Modifications will be made to alleviate this problem as well as address some assembly difficulties. The next leg deployment of the DVTP-P will be determined by science requirements.

A beta version of DVTP Comm, which is a LabView based communication and data reduction program, is on the ship and operational. This program takes the user through all steps of setup, run, and data recovery for the DVTP. A final version of DVTP Comm will be installed at the Leg 194 port call. APC Temperature and WSTP will be included in an expanded, comprehensive version of this software.

Two new DVTP's are being procured. The data loggers for the new tools allow for upgrading so that they can handle the addition of the pore pressure measurement. This will provide for the DVTP stock to have two standard DVTP's and two DVTP's with pore pressure.

APC Methane Tool

The purpose of the project is to monitor the effects of gas loss in cores from the time the core is cut until it reaches the deck. This is done by recording temperature, pressure, and conductivity in the headspace at the top of the core with sensors mounted in the APC piston head. In situ concentrations of methane can then be calculated from the data.

The APC Methane tool is being developed in concert with Charlie Paull and Bill Ussler of Monterey Bay Aquarium Research Institute (MBARI). The sensor development is being done at MBARI, whereas the electronics and packaging is being done at ODP/TAMU.

The ODP/TAMU APC Methane tool development schedule was delayed due to Derryl Schroeder and Mike Friedrich's involvement with commissioning the Rig Instrumentation System and Active Heave Compensator. Because of this delay, the ODP/TAMU engineering group is

repackaging the MBARI acquisition electronics, instead of using the ODP DAS (in development) into the APC piston. Prototype testing is targeted for Leg 195 and operational deployment is targeted for Leg 199.

A design review meeting with MBARI was conducted on 29 August, where the mechanical packaging concept for the MBARI acquisition electronics and the sensors was approved. Six modified MBARI acquisition electronics were ordered by ODP. Another design review meeting with MBARI was held on 25 October, where the sensors for the APC piston were selected. MBARI placed orders for six of each thermistor probe, pressure transducer, and conductivity sensor.

Memory Drilling Sensor Sub

The purpose of this project is to operate a Memory Drilling Sensor Sub (DSS) near the bit. The DSS will provide data to improve the understanding of the dynamic forces at work downhole and to quantify the impact of heave and surface inputs (torque, weight, rpm, and flow rate) on coring performance. The DSS will be a short 8-1/4 in OD collar 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 demonstration test of a commercial sensor sub was run using an Anadrill measurement while drilling (MWD) system on Leg 188. The Anadrill MWD tool had weight-on-bit and torque-on-bit sensors. The test successfully demonstrated the practical application of the DSS, especially when data is transmitted in real time.

The procurement of DSS is divided into two parts, (1) downhole electronics and (2) sensor/sensor body. The downhole electronics have been sourced. The sensor/sensor body will be sourced after competitive bidding among engineering/sensor companies. The sensor/sensor body development will be in two phases. Phase I consists of the preliminary design where the fabrication methodology is determined and manufacturing specifications are produced. The deliverables of Phase I will be a detailed design layout, load and stress analysis, material specifications, expected sensor accuracy, testing and calibration requirements, and an estimate of time and cost to complete Phase II. The companies will bid on Phase I work and one will be selected. Phase II will build on the Phase I engineering work and produce the first article for testing. Phase II work will be competitively bid using the Phase I document as the starting point.

Scheduling of this tool was delayed because of the ODP/TAMU project manager's involvement with commissioning the rig instrumentation system.

Status of Janus Database

In December, 1999, a Janus review committee prioritized tasks for the programming effort at ODP/TAMU. The results of the committee's work was incorporated into the work schedule of the Programming Services Group of ISD. Considerable progress has been made in completing these prioritized tasks since the committee last met in 1999. Since then, a review process has been underway to revisit the prioritized task list and adjustments to that list will be forthcoming. Additionally, the responsibility for adjusting the task list, including adding new tasks, was delegated to the Lab Working Teams (LWT) at ODP/TAMU. In turn, these teams' requests are considered by management and adjustments to the task list are then made. These adjustments are passed on to the Programming Services Group of ISD for implementation.

The information in the tables below indicate the work currently underway and tasks which have already been completed. Note that tasks identified in the last report as "completed" have been removed from this period's report. Also, all items marked with an asterisk "*" are taken from the task list produced by the original Janus review committee. As each task in the "Tasks in Progress" table are completed, the next higher priority task(s) will be assigned, based on available resources.

Tasks Completed	Area
*Reformat Gas Element Table	Chemistry
*Reformat Gas Element Graphs	Chemistry
*Section Breaks in Net Query	Pmag
*IW Data Upload on PC	Chemistry
*Carbonate Data Upload on PC	Chemistry
*Fix/Create Splice Reports	Misc. Labs
*Implement Updated MAD Application	Phys. Props.
Generic Data Uploader	All
BOL/EOL Synchronizer	ISD
*Correct Gas Upload	Chemistry
*Create Net Query for Zplot	Pmag
*Fix Applecore Batch Export	Phys. Props.
Upgrade "PWS"	Phys. Props.
Automated Color Reflectance	Phys.Props.

Tasks in Progress	Area	Phase	Target Leg
*ICP Data Model; Upload; Data Retrieval	Chemistry	Development	194
*Scope of Work for Bar Code Implementation	All	Development	194
*AppleCore Sedimentary Data Uploader	Core Desc.	User Testing	194
*Age-Depth Control Points	Misc. Labs	Development	194
*Implement JRS (JAVA version) on Ship	Curation	User Testing	196
*Fix Slider Entry and Bugs	Core Desc.	Development	194
*MAD Control Measurements	Phys. Props.	User Testing	194
Generic Editor for all of Janus Data	All	Analysis	196
WCMST Control Data	Phys. Props.	Dev. Testing	TBD
NGR Data Transfer	Phys. Props.	Development	194
Deploy, Test PC Version of Coulometer	Chemistry	Development	194
WCMST Threshold Warnings	Phys. Props.	Analysis	TBD

Status of Migration of Historical ODP Data into the Janus Database

The data migration projects (migrating old ODP data: legs 101-170 to the Janus database) have been progressing very well. Two data migration projects are active at this time, (A) MST and Color Reflectance data migration, and (B) Physical Properties and Paleomag data migration.

(A) Ninety five percent of the MST and Color Reflectance data migration has been completed. The remaining five percent requires checking all the migrated data, consolidating the raw files, merging the data migration code, and completing the project report. The Database Services Group of ISD expects to complete this migration project by August 2001.

(B) The migration of physical properties data began in December 1999. The project includes migrating moisture and density (formerly known as "Index Properties"), thermal conductivity, PWS, shear strength, and paleomag. The group expects to complete this project by December 2001.

Please see the information in the graphs below for details of the status of these two data migration projects.

MST and Color Reflectance Data Migration:

Start Date: September 1998
Current: February 2001
Target Completion Date: August 2001

Leg / Data	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145
GRAPE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	x	x	x
P-Wave	x	x	x	x	x	x	x	o	x	x	x	x	x	x	x	x	x	o	x	x	x	x	o	x	x	x
MagSus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	x	x	x
NGR	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	x	x	x	1				
Color Reflectance	x	x	x	o	x	x	x	o	o	x	x	x	o	x	x	o	x	2								

Leg / Data	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119
GRAPE	x	x	o	x	o	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P-Wave	x	x	o	x	o	x	x	o	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
MagSus	x	x	o	x	o	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
NGR																										
Color Reflectance																										

Leg / Data	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
GRAPE	o	x	x	x	x	x	x	x	x	o	x	x	o	x	x	x	o	x
P-Wave	o	x	x	x	x	x	x	o	x	o	x	o	o	o	o	o	o	o
MagSus	x	x	x	x	x	o	o	x	x	o	o	x	x	x	x	o	o	o
NGR																		1
Color Reflectance																		2

Legend:

- x Migration to Janus database completed
- o Data not acquired by ODP
- 1 NGR acquisition started Leg 150
- 2 Reflectance acquisition started Leg 154
  Magsus Leg 104-130 in S1032

Completed = 210 = 100 %

Remaining = 0

Feb.5, 2001

Physical Properties Data Migration:

Start Date: December 1999
Current: February 2001
Target Completion Date: December 2001

Leg / Data	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145
Thermcon	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
MAD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PWS			x	x	x		x		x	x	x	x	x	x	x	x	x	x		x	x		o	x	x	x
Shear Strength		o	x	o	x		x	o	x	o	x	x	o		x	x		o			o		o	o		
Paleomag																										x

Leg / Data	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119
Thermcon	x	x	o	x	x	o	x	o	x	x	x	o	o	x	x	x	x	x	x	x	x	x	x	x	x	x
MAD	x		o	x	o	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PWS	x		o	x	o	x	x	x	x	x	x	x	x	x	o	x	x	x	x	x	x	x	x	x	x	x
Shear Strength	x	o	o	o	o	o	x		x	x	x	x	x		o	x		o	x	x	x	x	x		x	x
Paleomag			o			o										x										

Leg / Data	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
Thermcon	x	x	x	x	x	x	x	x	x	x	x	x	o	x	x	x	o	x
MAD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	x
PWS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	o	x
Shear Strength	o	x				x	x	x		o	x	x	o	x		x	o	x
Paleomag	x																o	

Legend:

x Migration to Janus database completed

o Data not acquired by ODP, or Bad files or no data found

Completed = 222 = 71 %

Remaining = 90

Feb.5, 2001

Mirror Sites

The Publication Services and Information Services Departments completed the work on establishing Web mirror sites that contain all the e-publication products of ODP in Australia, the Federal Republic of Germany, and the United Kingdom. None of these sites mirror the Janus database.

Australian mirror site: http://www.agso.gov.au/odp (Australian Geological Survey Organisation; site is functional and updated weekly).

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]; this site is functional and updated weekly).

United Kingdom mirror site: http://owen.nhm.ac.uk/odp/ (The Natural History Museum, London; this site is functional and updated weekly).

The mirror sites are updated at the end of each week from the main site located at ODP/TAMU and supported by the Information Services Department at: ODP Science Operator: http://www-odp.tamu.edu/isg (Texas A&M University).

Publication Services

Volume Production

From July through November 2000, the following ODP *Proceedings* volumes were produced and distributed:

Initial Reports

Booklet/CD-ROM: 185 (Sep 2000), 186 (Aug 2000)
Web (PDF and HTML): 185* (19 Sep 2000), 186* (28 Jul 2000)

* PDF and/or ASCII versions of all materials published on the volume CD-ROM become available initially on the Web; HTML versions of chapters become available as soon as the material is formatted.

Scientific Results

Booklet/CD-ROM: 167 (Jul 2000), 168/169S (Aug 2000), 169 (Oct 2000)
Web (PDF and HTML) : 167 (31 Jul 2000), 168 (4 Aug 2000), 169S (8 Aug 2000),169 (15 Apr 2000), 170 (30 Jun 2000), 171A (2 Aug 2000), 171B (4 Jul 2000), 172 (1 Sep 2000), 173 (3 Oct 2000), 174A (29 Sep 2000)

From December 2000 through June 2001, the following ODP *Proceedings* volumes are expected to be produced and distributed:

Initial Reports

Booklet/CD-ROM: 187 (Jan 2001), 188 (Mar 2001), 189 (Jun 2001)
Web (PDF and HTML): 187* (Mar 2000), 188* (May 2001)

Scientific Results

Booklet/CD-ROM: 170 (Feb 2001), 171A (Dec 2000), 171B (Feb 2001), 172 (Apr 2001), 173 (June 2001)
Web (PDF and HTML): 174B (first paper Dec 2000), 175 (first paper anticipated 2001), 176 and beyond: chapters will be published on Web after manuscripts have been accepted and processed for publication.

Update on the New-Format *Proceedings* Publications

It has been 18 months since the first new-format *Initial Reports* (IR) volume was published and eight months since the first *Scientific Results* (SR) paper was published on the Web for Leg 169. The overwhelming feedback we have received about the new publication formats has been positive, although it is clear that some authors will always prefer printed books to electronic publications, especially those who want to compare data from two or more volumes simultaneously.

The consensus among ODP community scientists is that given the constraints of the ODP Publications mandate and current technology, they are pleased with the cross-media publication formats we have produced. Authors are recognizing that electronic publication formats allow the utilization of publication features unavailable in printed books (e.g., unlimited color figures, video clips, high-resolution color plates, and large data sets). In addition, having the volumes available in cross-media electronic formats has given users much greater flexibility in how they can use the volume material (e.g., copying text, data or figures; searching text; linking to other resources) and transportation and storage of volumes is no longer a problem. The move to electronic publications has also enabled ODP to increase the distribution of the *Proceedings* throughout the world, as online volumes provide readers with 24-hour access to the materials from anywhere in the world where there are Internet services.

To date, three SR volumes are complete on the Web (169, 170, 171A), and the associated booklet/CD-ROM products are being produced or distributed. As of 20 November 2000, 41 papers have been published on the Web for SR volumes 169 through 174A. On average, papers

---

† Dates represent the date the first paper in the volume was published on the Web.

were published 44 months postcruise, or four months before the booklet/CD-ROM was distributed. For the last four volumes in production (171B through 174A), the first papers for each volume were published between 38 and 41 months postcruise, or 7 to 10 months before the distribution date for the booklet/CD-ROM.

ODP *Proceedings* Web Site User Statistics:

There are now 26 IR volumes and 28 SR volumes on the Web. Between November 1999 and October 2000, an average of 31 unique users have accessed each IR volume every month (see Table 1). The actual number of unique users per volume per month ranges between 8 (IR 174AXS, November1999) and 112 (IR 185, October 2000). Overall site access per volume has increased by 60% between November 1999 and October 2000. In November 1999, an average of 12 unique users accessed each IR volume; in October 2000 the average number of unique users increased to 41 per IR volume.

Table 1. *Initial Reports* Volumes Web Site User Statistics*

Volume	Nov 99	Dec 99	Jan 00	Feb 00	Mar 00	Apr 00	May 00	Jun 00	Jul 00	Aug 00	Sep 00	Oct 00	Web Publication Date
166†	32	41	34	27	44	44	57	44	34	36	44	52	1 Oct 1997
167†	27	20	37	37	36	29	52	38	25	41	45	41	13 Feb 1998
168†	23	19	33	22	26	19	23	32	20	32	35	29	23 Feb 1998
169†	39	33	37	41	39	29	33	27	21	24	35	35	17 Apr 1998
169S†	14	19	25	32	18	16	17	24	20	23	23	26	10 Apr 1998
170†	20	25	27	25	21	23	33	37	28	29	28	34	24 Apr 1998
171A†	22	18	23	23	20	16	20	29	25	26	31	32	26 June 1998
171B†	31	20	31	31	31	24	1	30	24	31	1	26	26 June 1998
172†	18	19	36	29	26	26	25	25	23	36	43	37	31 July 1998
173†	22	19	29	16	18	22	25	31	23	23	31	33	4 Sept 1998
174A†	36	14	21	22	17	25	24	28	28	27	36	31	31 Dec 1998
174B†	17	20	16	16	12	13	18	20	17	16	26	22	31 Dec 1998
174AX†	20	11	25	16	12	14	19	22	17	17	28	32	31 Dec 1998
174AXS**	8	21	32	27	18	17	18	17	121	3	22	27	28 Dec 1998
175†	22	27	29	28	35	25	21	27	26	42	40	50	9 Feb 1999
176**	25	20	18	13	19	25	18	27	26	26	30	33	30 June 1999
177**	50	26	33	40	30	24	49	57	52	31	39	46	28 May 1999
178**	29	31	37	39	37	26	38	39	53	52	39	51	31 Aug 1999
179**	36	44	37	36	18	30	27	25	30	19	29	34	23 July 1999
180**				38	63	44	46	30	31	29	43	39	4 Feb 2000
181**							42	33	39	36	28	33	12 May 2000
182**							42	38	28	20	32	57	26 May 2000
183**								45	40	23	61	44	9 June 2000
184**								42	63	40	60	46	12 June 2000
185**											50	112	19 September 2000
186**									34	57	86	73	28 July 2000

Notes: * = numbers indicate hits to the entry page of each volume. = volumes are only in PDF format. ** = volumes posted initially in PDF format and subsequently in HTML format.

Between November 1999 and October 2000, an average of 63 unique users have accessed each SR volume every month (see Table 2). The actual number of unique users per volume per month ranges between 15 (SR 159T, December 1999) and 160 (SR 160, October 2000). Total access to SR volumes increased by 54% between November 1999 and October 2000. However, the average number of unique users per volume decreased during this time because ODP began to publish papers individually beginning with SR 169, and as a result the newer volumes contained fewer chapters because they were not complete (in November 1999, an average of 93 unique users accessed each SR volume; in October 2000 the average number of unique users decreased

to 61 per SR volume). Also, some of the first volumes published in the new format contained relatively few chapters (see Table 3).

Table 2. *Scientific Results* Volumes Web Site User Statistics*

Volume	Nov 99	Dec 99	Jan 00	Feb 00	Mar 00	Apr 00	May 00	Jun 00	Jul 00	Aug 00	Sep 00	Oct 00	Web Publication Date
150X†	58	42	63	61	63	57	53	58	40	62	60	64	7 Aug 1998
152†	98	65	75	87	76	64	78	65	47	58	84	102	8 July 1998
154†	93	65	82	78	78	80	116	67	46	58	72	78	1 Oct 1997
155†	86	72	101	80	103	66	73	87	53	69	70	100	15 May 1998
156†	59	46	64	55	70	53	49	59	46	55	74	64	21 Aug 1998
157†	98	70	80	79	75	64	62	60	46	45	52	80	14 Aug 1998
158†	66	65	68	65	77	52	71	56	43	50	56	66	15 May 1998
159†	96	73	82	65	62	46	70	64	44	53	74	79	31 Dec 1998
159T†	30	15	26	19	22	20	33	35	21	25	36	38	31 Dec 1998
160†	144	124	118	131	145	97	122	113	94	99	133	163	9 Nov 1998
161†	86	88	88	98	80	68	79	79	65	58	81	89	19 Mar 1999
162**	50	44	47	46	58	37	45	37	25	36	49	34	20 Aug 1999
163**	62	38	68	63	60	51	50	40	29	21	34	36	19 Sept 1999
164							70	87	48	59	43	48	19 May 2000
165							34	57	55	34	45	50	26 May 2000
166							43	90	60	35	47	44	29 May 2000
167									31	55	68	54	31 July 2000
168										54	71	43	4 August 2000
169††						25	62	77	71	61	77	41	15 April 2000
169S††										50	46	34	8 August 2000
170††								30	41	52	75	64	20 June 2000
171A††										49	37	46	2 August 2000
171B††									53	72	55	39	4 July 2000
172††											84	40	1 September 2000
173††												34	2 October 2000
174A††											10	48	29 September 2000

Notes: * = numbers indicate hits to the entry page of each volume. = volumes are only in PDF format. ** = volumes posted initially in PDF format and subsequently in HTML format. = volume will be published chapter by chapter in the order of acceptance in both PDF and HTML formats; date indicates when first paper was published.

Leg-related Citations:

During Legs 160 through 175, authors were permitted to fulfill their ODP publication obligation by either *submitting* a manuscript to a peer-reviewed journal that is published in English, or a paper or data report to the *Scientific Results* (SR) volume. Beginning with Leg 176, authors are required to *publish* a paper in a journal or book, or a paper or data report in the SR volume. In addition, authors from Legs 160 and beyond are supposed 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 Publications Web site (<http://www-odp.tamu.edu/publications/, click on "Citation List").

The Publication Services Department began collecting leg-related citations in January 1999. The citation lists now include 326 citations, of which 233 are submitted, in review, in press, or published papers and 65 are conference abstracts. Of the 233 papers, 99 have abstracts reproduced on the ODP/TAMU web site. (ODP requests abstract reprint permission from all publishers.) 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 incomplete despite our efforts and those of the Staff Scientists to remind scientific party members of their obligation to submit citations to ODP after their papers have been published. Publication Services has cross-checked the citations they have received with the reprints received by Curation. It has also sent reminders to Co-chiefs and correspondence authors to remind them to submit this important information. The success of the leg-related citation lists is dependent upon authors remembering to fulfill their final obligation requirement and submit all published citations and a reprint of each publication to ODP. Though it does appear that our records are more incomplete for earlier legs than more recent legs, we believe this process does not work well and a comprehensive citations list will be very difficult to maintain for some legs.

Table 3 reflects the number of ODP-related papers that are projected, submitted, or published in the *Scientific Results* volume, and the number of papers that are projected, submitted, or published in books or journals. The data on books and journals are based on the information members of the scientific parties from each leg have submitted to ODP. (There is no guarantee the counts are complete.)

Figure 1 shows the total number of published or in press papers that ODP has been notified of per leg. For Legs 101 through 159, only *Scientific Results* papers were tracked. Beginning with Leg 160, papers published in journals and books were also tracked. All legs through 169 have passed the 4-years postcruise mark. Legs 170 through 179 have passed the 28-month postcruise mark when all SR and book or journal submissions are due (170 deadline = April 1999; 179 deadline = October 2000).

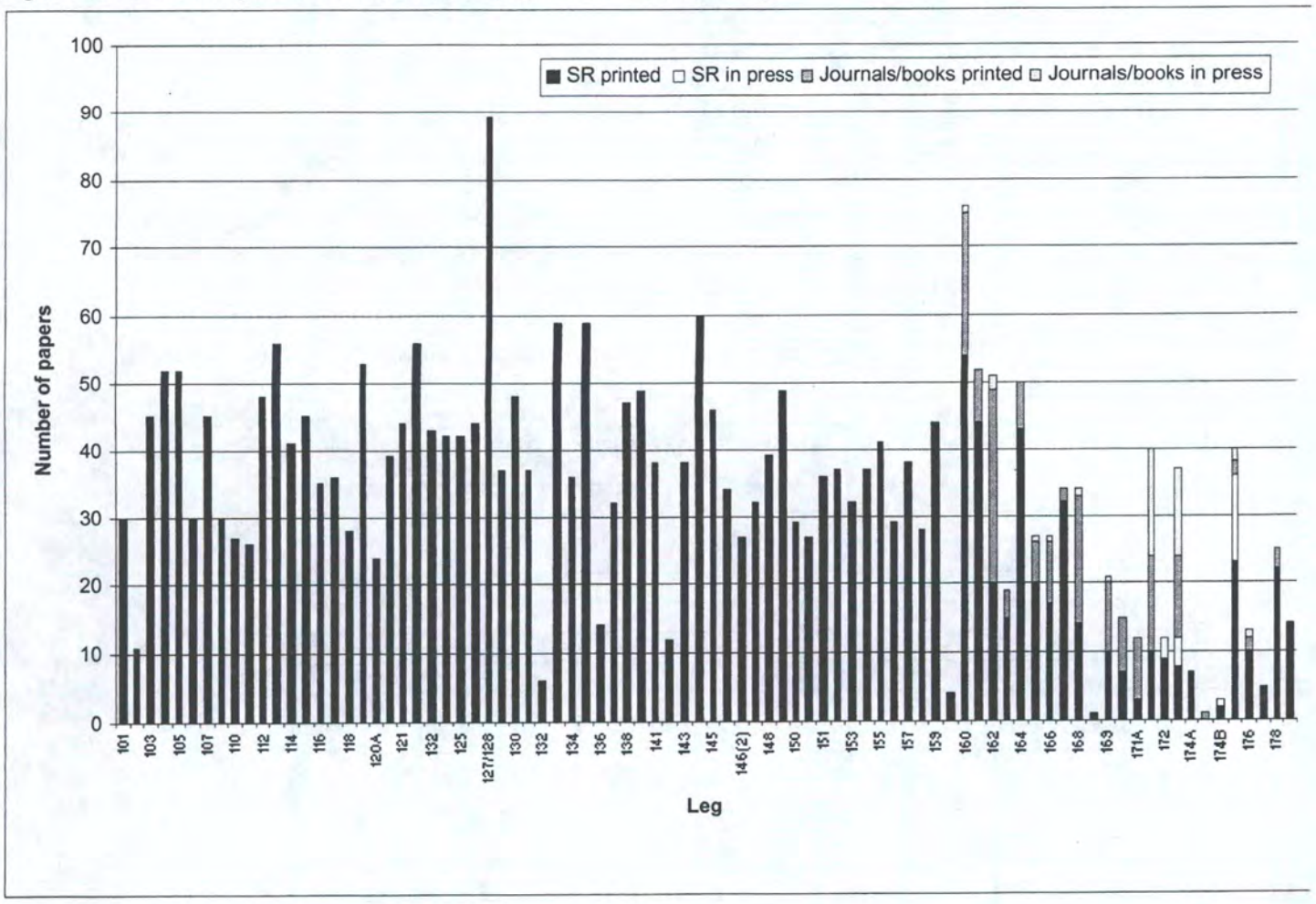
Table 3. Number of ODP-related papers projected, submitted, and published in SR volumes and in books or journals.

Leg	SR Volume			Journal or Book		
	Projected*	Submitted	Published	Projected*	Submitted	Published
160	62	54	54	0	2	21
161	47	46	44	6	6	8
162	24	23	20	32	10	29
163	22	16	15	4	5	4
164	35	41	43	18	5	7
165	26	24	20	2	11	6
166	28	18	17	7	9	9
167	40	33	32	11	8	8
168	17	13	14	47	9	19
169S	0	1	1	28	7	0
169	14	10	10	29	7	10
170	6	7	6	15	11	8
171A	1	3	3	16	10	9
171B	15	9	6	43	28	14
172	8	11	4	36	11	1
173	8	12	2	19	10	12
174A	8	6	2	17	13	8
174AX						1
174B	1	1	11 Dec 00	5	2	
175	14	24	12 Feb 01	24	11	2
176	17	11	9 Apr 01	20	7	2

177	7	4	11 June 01	34/10	26	
178	8	25	6 Aug 01	17/27	11	3
179	15	2	8 Oct 01	8	3	
180	15	11 Dec 00	10 Dec 01	23/2	11 Dec 00	2
181	21	12 Feb 01	11 Feb 02	23/2	12 Feb 01	
182	13	9 Apr 01	8 Apr 02	37	9 Apr 01	3
183	15	11 June 01	10 June 02	18/19	11 June 01	1

Notes: Data updated in November 2000. * = count from table of contents prepared at second postcruise meeting. † = "published" and "submitted" counts reflect the number of papers authors have notified the ODP Publications Coordinator about. ‡ = second number indicates papers proposed without a specific venue. — = no information. Dates reflect deadlines when submissions are due.

Figure 1. Number of published and in press papers on record per leg.



***ODP Proceedings* Distribution:**

The Department has sold DSDP and ODP volumes for a cumulative revenue of $11,825 between June 2000 and October 2000. This revenue supports a portion of the cost budgeted for the printing and distribution of new volumes.

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 June 2000 and November 2000, 3 institutions (Broward Community College, USA; University of Miami RSMAS, USA; Appalachian State University, USA) were sent 321 ODP and 165 DSDP volumes. Total value for the books in these shipments equals $13,455.50.

Panel-Related Issues and SCIMP Recommendations

Sample Distribution, Data Distribution, and Publications Policy Revision:

In February 2001, the Sample Distribution, Data Distribution, and Publications Policy will be revised with the following changes.

1) reference to policy guidelines for Legs 160 through 174 will be removed from Section 4.4.b. and Appendixes A and B.
2) specific wording for acknowledging the Ocean Drilling Program in all publications that result from the data collected from ODP samples will be added to Section 4.4.b.i.

AGI Database (Rec. 99-2-1):

On 20 December 1999, the American Geological Institute (AGI) delivered a CD-ROM to ODP/TAMU containing a compiled database of citations to papers published on DSDP/ODP-related research. The database (drawn from the full American Geological Institute GeoRef database) contains over16,000 citations related to research tied to the Ocean Drilling Program and the Deep Sea Drilling Project since 1969. The Publication Services Department has prepared the second portion of a review of the data, which primarily focuses on ODP *Proceedings* and DSDP *Initial Reports* citations (see Publications Appendix.)

In September 2000, staff from the JOI office and ODP Publication Services Department met with AGI staff to develop a plan for updating the DSDP/ODP citations database. In November, the following message was distributed to all leg participants and drilling community members.

> 10 November 2000
>
> Dear ODP Scientist:
> The Ocean Drilling Program (ODP) is creating a bibliographic database of citations related to the ODP and to the Deep Sea Drilling Project (DSDP). This electronic citations database will catalog more than thirty years of scientific ocean drilling and will be made available in 2001 for research, education, and other purposes.
>
> We have created a preliminary database based on a key-word search of GeoRef, the bibliographic database produced by the American Geological Institute (AGI). Although GeoRef is comprehensive, some DSDP- or ODP-related citations may have been missed, possibly because of key word associations. Consequently, we are asking you, the international community of scientists involved in scientific ocean drilling, for your help in making the database as complete as possible.
>
> Please review our preliminary database for any overlooked publications. We are keen to capture publications outside of the ODP *Proceedings* or the DSDP *Initial Reports* volumes, which are

already in the master database. Citations contributed by the scientific community will be reviewed by AGI. Citations that are not already in GeoRef will be added, and all submitted citations will be included in the revised DSDP/ODP database.

To participate, go to: http://janusaxp.tamu.edu/predef_queries/general/citation.shtml. Review the preliminary database and complete the online form for any DSDP- or ODP-related citation that has been overlooked. All submissions must be received by 31 December 2000.

Thank you for your assistance.

Ocean Drilling Program

Web Development

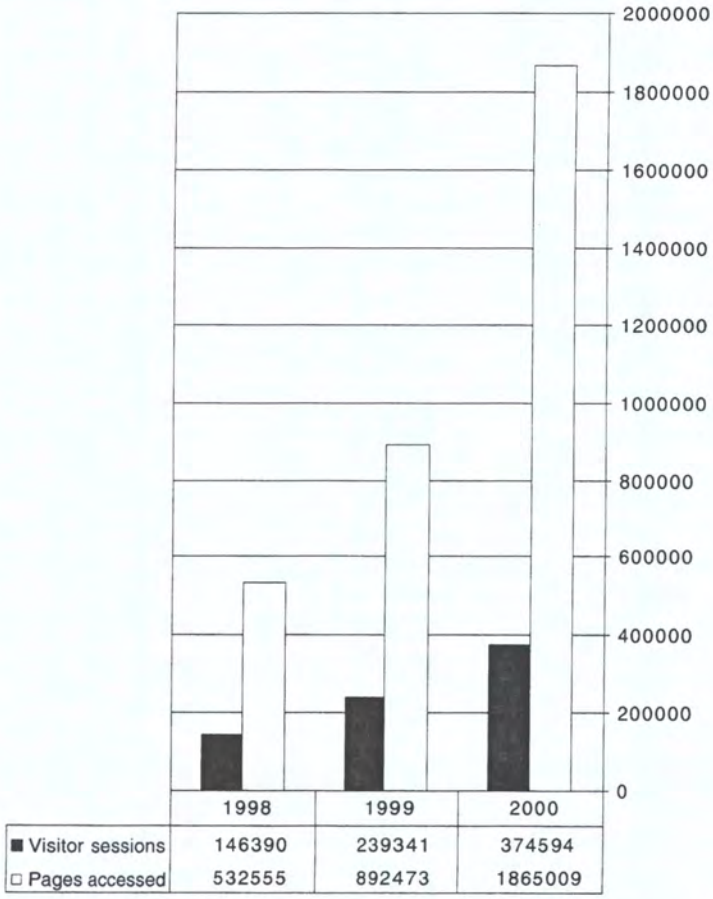
ODP/TAMU Web Site User Statistics:

The number of site visitors (defined as single computers accessing the site) to the ODP/TAMU Web site increased 157% from fiscal year 1998 to fiscal year 2000 (see Figure 2). The total number of pages, or files, accessed at the ODP/TAMU Web site during this three-year period has increased 250% (see Figure 2). Figure 3 shows the breakdown by month of total site visitors during this period.

Overall, the number of unique-computer sessions to the ODP/TAMU Web site pages that are listed below increased 74% between November 1999 and October 2000 (see Table 4). The largest increase was seen at the *JOIDES Resolution* page (170%), followed by increases of 41% and 37% at the Publication Services main page and ODP/TAMU main site page, respectively.

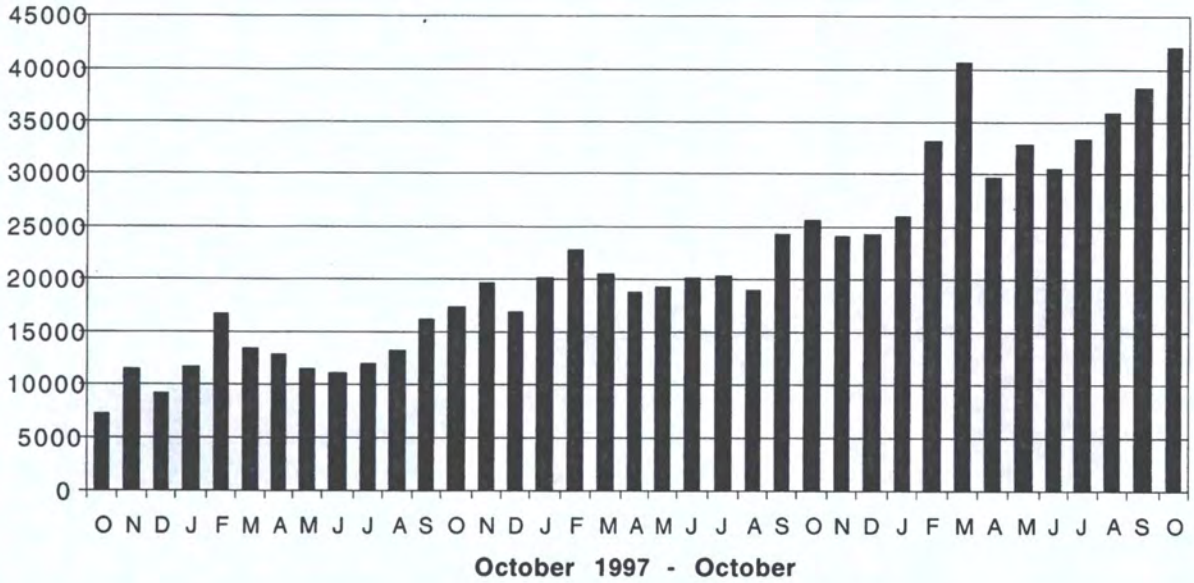
The German mirror site went online in June 2000. User site statistics are listed in Table 5. User statistics are not available yet for the mirror sites in Australia and the United Kingdom.

Figure 2. ODP/TAMU Web Statistics by Fiscal Year



Note: Visitor session = a single computer accessing the Web site; page = a single HTML file.

Figure 3. ODP/TAMU Web Site Visitors



Note: Visitor = a single computer accessing the Web site.

Table 4. ODP/TAMU Main Entry Points*

	Nov 99	Dec 99	Jan 00	Feb 00	Mar 00	Apr 00	May 00	Jun 00	Jul 00	Aug 00	Sep 00	Oct 00
ODP/TAMU site www-odp.tamu.edu	24,069	24,309	26,021	33,162	40,643	29,790	32,920	30,623	33,370	35,744	38,229	41,962
ODP/TAMU main page	5,622	4,651	5,900	6,492	6,649	5,271	5,749	4,656	4,782	5,016	5,860	7,713
Publication Services main page**	1,211	973	1,166	1,311	1,380	1,133	1,344	1,153	1,266	1,351	1,406	1,540
Cruise Information	908	749	1,146	1,476	1,380	976	1,148	967	1,005	986	1,370	1,279
Database main page	1,182	1,023	982	1,086	1,180	1,068	1,049	921	1,037	1,111	1,022	1,166
Operations Schedule	640	558	826	711	764	598	756	573	566	699	830	831
Drilling Services main page	755	591	727	825	896	701	832	552	562	604	801	830
JOIDES Resolution	297	282	NA	749	862	680	783	603	698	754	806	803
Search	763	625	791	862	932	738	823	668	644	597	731	902
Science & Curation main page	563	433	567	584	609	484	567	452	457	486	533	589
ODP & DSDP Site Maps	423	348	481	414	417	329	413	351	408	386	473	472
Cruise Participation	311	277	NA	314	388	296	362	305	328	349	339	360
Janus queries (janusaxp.tamu.edu)	948	866	982	1,186	1,180	891	746	804	925	1104	726	867

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. = Janus sessions are in addition to those given for the ODP/TAMU site. ** = see Update on the New-Format *Proceedings* Publications section for statistics on unique-computer sessions for each volume. NA = not available.

Table 5. Mirror Sites Web User Statistics

	Nov 99	Dec 99	Jan 00	Feb 00	Mar 00	Apr 00	May 00	Jun 00	Jul 00	Aug 00	Sep 00	Oct 00
German mirror site* (odp.pangaea.de)									178	350	1049	1656

Note: * = German mirror site went online in June 2000. No user statistic data available from mirror sites in Australia and United Kingdom.

Public Information

Aaron Woods, the individual who was responsible for Public Information at ODP/TAMU left the Program in May 2000. Because of budgetary constraints caused by escalating fuel costs in lat FY00, I decided not to fill this position until early FY01. Because the negative consequences of escalating operational costs continue, the decision has been taken that this position will not be filled and the important tasks and responsibilities associated with the position has been re-distributed . Mr. Phil Rumford, Superintendent of the Gulf Coast Repository, will handle port call activities associated with ship tours and public events. Mr. Rumford has already handled one port call activity this past summer in Yokohama and the next one is planned for Keelung, Taipai in May 2001. Ms. Agatha Moy,

Administrative Assistant in the Director s Office is coordinating all requests for ODP/TAMU public information.

Fall 2000 GSA Meeting

ODP/TAMU personnel assisted JOI personnel in the staffing of an ODP booth at the Fall GSA meeting.

Public Information Requests

During the last 7 months we have responded to 30 requests from scientists, news media and the general public regarding ODP promotional material.

Appendix 1

ODP and DSDP Citations Report: Citations from Deep Sea Drilling Project and Ocean Drilling Program Research, 1969–1999

In Part I of this report (issued in the June 2000 EXCOM report), the bulk of the summary focused on the nonproceedings citations in the database. Non-proceedings citations are defined as citations from all publications other than the publications produced and published directly by DSDP or ODP (*ODP Proceedings* and *DSDP Initial Reports* series publications, and ODP Scientific Prospectus, Preliminary Report, and Technical Note publications; but not the *JOIDES Journal*).

Most of the initial analysis reported in Part I was based on the citation records in the database that contained author affiliation data. Author affiliation data includes the institution and country of contributing authors. Approximately 1800 citations in the database, or ~11%, do not have author affiliation data; 97% of these records are nonproceedings citations. (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.)

Part II of the database analysis that is presented here is focused on all citations in the database, including those without author affiliation data. It also includes data on program proceedings citations (see definition of nonproceedings citations above).

FigureA1 shows the number of citations in serial publications vs. the number of program proceedings citations per year, from 1969 through 1999. (Note: Proceedings citations only include citations to the printed books, not the citations to CD-ROM materials from 1999.) Table A1 shows a complete listing of the nonproceedings serial publication sources listed in the DSDP/ODP database and the number of citations per year, per publication (this includes all database records with and without affiliations).

Figure A1. Nonproceedings serial citations vs. program proceedings citations, 1969—1999.

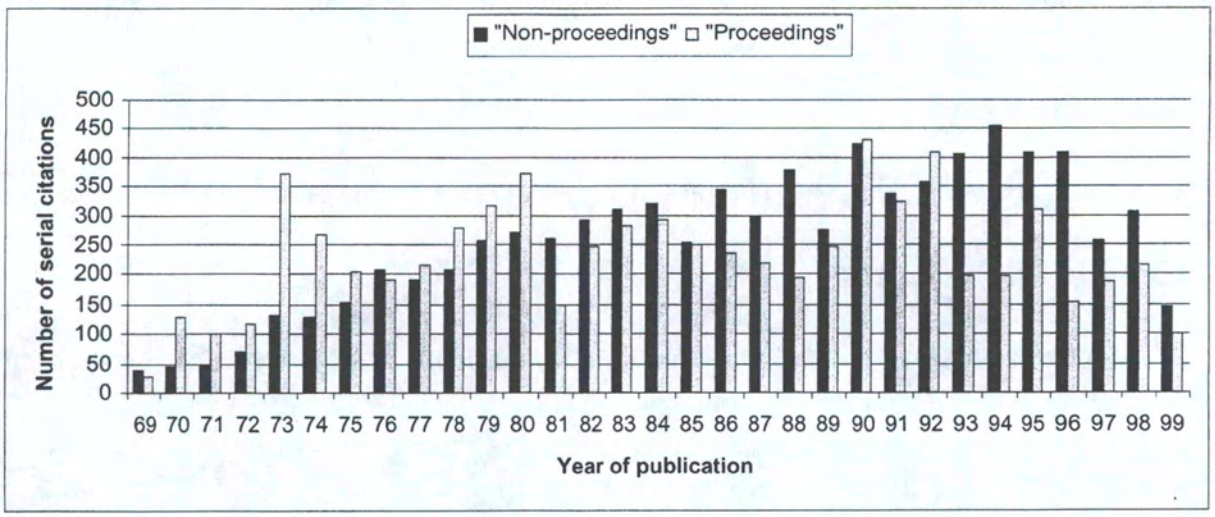


Table A1. All nonproceedings publication sources listed in the DSDP/ODP database and the number of citations per year for each publication.

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
AAAS Publ (Am Assoc Adv Sci)	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
AAPG Bulletin	1	3	2	2	8	2	2	5	2	7	26	10	14	11	10	7	14	14	15	17	2	56	18	8	2	3	1	2	4	10	3	281
AAPG Explorer	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	3
AAPG Memoir	•	•	•	•	•	•	•	•	•	•	1	•	•	6	•	1	•	•	•	•	1	•	39	2	•	•	•	•	•	•	•	50
AAPG Studies in Geology	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	4	•	•	•	4	2	3	•	•	1	•	1	•	•	•	•	17
Abhandlunger der Geologischen Bundesanstalt	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	3
Abs - Geol Soc Australia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	6	•	2	•	•	•	1	•	16	3	•	•	29
Abs - Intl Conf Geochron, Cosmochron, Isotope Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Abs - Intl Conf on Natural Glasses	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Abs - Intl Palynological Conf	•	•	•	•	•	•	•	•	•	•	•	4	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Abs - Intl Symp on Observation of the Cont Crust through Drilling	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Abs - Nordic Geol Winter Meeting	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	3
Abs - Palaeontological Assoc Aston, Ann Conf	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Abs - SEPM Midyear Meeting	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	19	9	1	•	•	•	•	•	•	•	•	•	•	•	33
Abs - Soc Exploration Geophysicists Intl Mtg	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Abs Gen Mtg Intl Mineral Assoc	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Abs papers - Pacific Sci Congr	•	•	•	•	•	•	•	•	•	•	6	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Abs papers Submitted to the Lunar and Planetary Science Conf	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	4	1	1	3	•	5	•	•	3	•	•	•	19
Abs paps - Am Chem Soc, Natl Mtg	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Abs paps - Regional Congr Geol, Mineral and Energy Resources of Southeast Asia (GEOSEA)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Abs/of Reports - Intl Cong Org Geochem	•	•	1	•	•	2	•	•	5	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	8
Abs/prog GSA	11	2	7	12	12	32	21	22	22	19	22	32	33	40	49	26	27	14	39	18	34	29	34	24	50	49	37	45	27	29	•	818
Abs/Prog/Excursion Guide - Intl Workshop on Agglut Foraminifera	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	2
ACS Symp Sers (Am Chem Soc)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	2
Acta Botanica Neerlandica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Acta Geol Acad Sci Hung Magyar Tudomanyos Akad Foeldtani Koezloenye	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Acta Micropalaeontologica Sinica Weiti Gushengwu Xuebao	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Acta Mineralogica-Petrographica (Szedge)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Acta Palaeontologica Polonica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Acta Universitatis Carolinae. Geologica	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Actas Cong Latinoamericano Geol	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Advs Underwater Tech, Ocean Sci & Offshore Engineering	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
AGI Reprint Series	•	•	•	•	•	•	1	1	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
AGSO J Austral Geol & Geophys	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
AGSO Research Newsletter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Ameghiniana	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
American Journal of Botany	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
American Journal of Science	•	•	•	•	•	•	•	•	•	•	1	•	1	1	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	1	6
American Mineralogist	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	2
American Scientist	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Anais da Academia Brasileira de Ciencias	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	4
Anais do Congresso Latino-Americano de Paleontologia	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ann Conv & Seminar Expl Geophys	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ann des Mines et de la Geologie	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ann Geologiques Pays Helleniques. Hors serie.	•	•	•	•	•	•	•	•	•	•	1	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Ann Mtg - Israel Geological Soc	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	2
Ann Mtg [Ext] Abs - AAPG/SEPM	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7	12	9	6	19	7	9	•	72
Ann Res Conf. Gulf Coast Sect. SEPM Prog & Abs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	11	•	•	8	1	•	•	•	•	•	•	•	•	•	•	•	20
Ann Rev Earth & Planetary Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ann Rpt Director, Geophys Lab, Carnegie Inst	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Ann Rpt Inst Geosi, Univ Tsukuba	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Annales - Soc Geologique du Nord	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	4
Annales de l'InstitutOceanographique (Monaco)	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Annales Geophysicae	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6	•	6
Annales Geophysicae, Ser B: Terrestrial & Planetary Physics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Annales Societatis Geologorum Poloniae	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Annales Societatis Scientiarum Faroensis, Suppl	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Annals of the S. African Museum	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Antarctic J of the United States	•	•	•	1	1	•	•	6	•	•	1	5	2	1	•	4	1	•	2	2	1	2	1	•	•	•	•	•	•	•	•	30
Antarctic Research Series	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	4	•	•	•	1	•	•	6
APEA J (Aus Petro Explor Assoc)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Applied Geochemistry	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Archiwum Mineralogiczne	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Arctic and Alpine Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
ASTM Spec Tech Pub (AM Soc Test & Materials Spec Tech Pub)	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ateneo Parmense. Sezione 2: Acta Naturalia	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Atlantic Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	1	•	•	•	3
Atti della Accademia Nazionale dei Lincei. Rendiconti Lincei. Scienze Fisiche e Naturali	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
AusIMM Bull & Procs (Aus Inst Mining & Metallurgy)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	2
Australian J Earth Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	2
Bacillaria	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Beitraege zur Meerestechnik	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Berichte - Rpts, Geol-Palaeon Inst und Museum, Christian-Albrechts-Universitaet Kiel	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Berichte der Deutschen Mineralogischen Gesellschaft	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Berichte des Inst fuer Geophysik der Ruhr-Univ, Bochum	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
Berichte Sonderforschungsbereich 313 "Veraenderungen der Umwelt: der Noerdliche Nordatlantik"	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	3
Berliner Geowissen. Abhandlungen, Reihe A: Geol & Palaeontol	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Bild der Wissenschaft	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2
BIO Review	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Biogeograph. & Palynol. Resumes Commun, Assoc des Palynols Langue Francaise, Symp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	2
Biosystems	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
BMR J Australian Geol & Geophys	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
BMR Research Newsletter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	.	.	.	.	.	.	.	3
BMR, Yrbook Bureau of Mineral Resources, Geology & Geophysics	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bochumer Geologischeund Geotechnicshe Arbeiten	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	4
Boletim de Minas	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Boletin de Geologia Publicacion Especial	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Boletin Geologico y Minero	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Boletin Informativo - Asociacion Venezolana de Geologia, Mineria y Petroleo	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Boletin Sociedad Geol Mexicana	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Boll Soc Geologica Italiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
Boll Soc Paleontologica Italiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	2	.	.	.	.	.	.	.	4
Buletin Persatuan Geologi Malaysia (Bull Geol Soc Malaysia)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
Bull - Australia, Bur Miner Resour, Geol & Geophys	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bull - Australian Soc Explor Geophysicists	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bull - Corpus Christi Geol Soc	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bull - Dry Valley Drill Proj (DVDP)	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull - Houston Geol Soc	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Bull - New Mex Bureau Mines & Mineral Resources	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	4
Bull Bur Recherches Geol & Mins	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull Canadian Petroleum Geology	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bull de l'Inst de Geologie du Bassin d'Aquitaine	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2
Bull de Mineralogie	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bull des Centres de Recherches Explor-Prod Elf-Aquit. Memoire.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull des Centres de Recherches Explor-Prod Elf-Aquitaine	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	3
Bull du Groupe Francais des Argiles	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull du Mus Natl d'Histoire Nat. Sect C: Sci de la Terre: Paleontol, Geol, Mineral.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull Earthquake Res Inst Tokyo (Daigaku Jishin Kenkyusho Iho)	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull Marine Geol Inst Indonesia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Bull Natl Sci Museum Ser. C: Geol and Paleontol	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
Bull Ocean Res Inst, Univ Tokyo	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Bull S. Carolina Acad of Sciences	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Bull Seismological Soc America	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	1	3
Bull Soc Geologique de France [Huitieme Ser.]	•	•	•	•	1	1	2	5	2	10	5	8	•	6	•	3	5	1	6	2	1	2	1	•	1	•	1	•	•	1	•	64
Bulls Am Paleontology	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Byulleten' Moskovskogo Obshchestva Ispytateley Prirody, Otdel Geologicheskiy	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	2	1	•	•	•	•	•	•	•	•	4
California Geology	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Campus Museum Contributions	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Canadian J Earth Sci - J Canadien des Sciences de la Terre	•	•	•	•	•	•	•	•	22	•	2	•	•	•	•	1	1	•	3	•	1	1	1	1	3	•	1	•	•	•	•	37
Carbonates and Evaporites	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	•	2
Chem Congr of N. Am. Abs paps	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	3
Chemical Geology	•	•	•	•	•	•	•	1	2	2	•	2	3	5	1	1	1	2	1	7	•	3	1	2	2	3	3	2	1	4	6	55
Chemical Geology; Isotope Geoscience Section	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	1	•	•	•	•	•	•	•	•	•	3
Chemie der Erde	•	•	•	•	•	•	•	•	•	•	•	•	•	1	2	1	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	6
Chigaku Zasshi (J of Geography)	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	1	1	2	1	•	1	•	3	•	•	1	2	•	3	•	•	17
Chikyu Kagaku (Earch Science)	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1	4
Chikyukagaku (Tokyo) (Geochem)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	2
Chishitsu Chosajo Geppo (Bull - Japan, Geological Survey)	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	1	•	•	•	•	•	•	2	•	5
Chishitsu News	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	2
Chishitsugaku Ronshu (Mems Geol Soc Japan)	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	3	•	•	•	1	•	•	•	•	•	•	•	•	•	•	6
Chishitsugaku Zasshi (J Geol Soc Japan)	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	2	•	1	•	•	•	•	•	•	•	1	1	4	•	•	11
Ciencias da Terra	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Circum-Pacific Council for Energy & Mineral Resources, Earth Sci Ser	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	6	•	•	1	•	•	•	•	•	•	•	•	•	8
Clay Minerals	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1	•	•	•	2
Clays and Clay Minerals	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	1	•	1	•	•	•	•	2	1	2	•	•	•	9
Climate Dynamics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	2
Climatic Change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Coll Colloques et Seminaires - Inst Francais du Petrole	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Coll Reprints - U S Natl Oceanic and Atmos Admin, Atlantic Oceanogr and Meteorolog Labs	•	•	•	•	2	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Coll Reprints - Woods Hole Oceanogr Inst	•	•	6	2	•	•	15	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	23
Colloque Intl sur l'Exploitation des Oceans	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Colloques Internationaux du Centre National de la Recherche Scientifique	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Comments on Earth Science; Geophysics	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Compt Rendus Hebd des Seances de l'Acad des Scis, Serie D: Sci Natur [C.R.'Acad Sci., Ser 3]	•	•	•	1	1	•	•	•	•	1	3	4	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	10
Compte Rendu - Congres Intl Stratig & Geologie du Carbonifere (Intl Congress on Carboniferous Stratigraphy and Geology)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Compte Rendu Sommaire des Seances de la Soc Geol de France	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3

Comptes-Rendus Seances de l'Acad Sci, Ser 2: Mecanique-Physique, Chimie, Sci de l'Univers, Sci de la Terre (several vol title changes)	•	•	•	•	•	•	•	•	•	•	•	•	2	3	3	5	3	8	2	2	11	6	4	1	2	•	5	3	1	2	2	65
Computers and Geosciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	2
Conf Clay Mineralogy & Petrology	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Congr of Intl Union for Quat Res	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	12	•	•	•	•	•	•	•	•	•	•	•	•	12
Continental Dynamics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Contrib - Hawaii Inst of Geophysics	•	•	•	•	1	5	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Contrib - U C, San Diego, Scripps Inst of Oceanog	•	1	•	•	3	12	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	16
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Contribs Mineralogy and Petrology	•	•	•	•	•	•	1	•	4	1	1	3	2	1	•	1	•	•	•	•	1	•	•	1	•	1	3	1	•	1	2	24
Contribs Ser - Am Assoc Strat Palynologists (AASP)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Contribs to Sedimentology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Cretaceous Research	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	1	•	•	1	•	•	1	•	1	•	•	•	•	2	1	9
Cruise Report - Geol Surv Japan	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Cruise Rpt - Inst Oceanograph Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	2
CSPG Reservoir (Canadian Soc Petroleum Geologists)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	2
Current Activities Forum Prog/ abs (Geol Surv Canada)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Daiyonki-Kenkyu (Quaternary Res)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	3	•	•	4
Deep-Sea Research	•	•	•	•	•	•	•	•	2	•	1	•	•	1	•	1	•	1	•	•	1	•	•	1	•	•	•	•	•	•	•	8
Deltio tes Ellenikes Geologikes Etaireias (Bull Geol Soc of Greece)	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	4
Der Aufschluss	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Developments in Geotectonics	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	2
Devs in Palaeontol & Stratigraphy	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	2
Dicengxue Zazhi (Journal of Stratigraphy)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Die Geowissenschaften (Weinheim, Zeitschrift)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	2	•	•	•	2	•	•	•	•	•	•	5
Diqiu Kezue Kihan TAO, Terrestrial, Atmospheric & Oceanic Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Dixue Qianyuan (Earth Science Frontiers)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	2
Dizhen Gongcheng yu Gongchen Zhendong (Earthquake Engineering & Engineering Vibration)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Dizhi Keji Qingbao (Geological Sci & Technology Info)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	•	2
Dizhi Kexue Scientia Geol Sinica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Documents - B.R.G.M.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	•	2
Documents des Laboratoires de Geologie, Lyon	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Documents des Laboratoires de Geologie, Lyon, Hors Serie	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Doklady Akademii Nauk SSSR	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	2
DSIR Bulletin	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Earth & Planetary Sci Letters	•	•	•	•	2	1	3	5	8	5	9	4	3	2	5	1	•	6	11	5	5	4	10	18	14	12	12	13	12	13	7	190
Earth Evolution Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Earth in Space	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Earth Surface Processes and Landforms	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Earth, Planets and Space	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	2

Earth-Science Reviews	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Eclogae Geolgicae Helvetiae	•	•	•	•	•	•	•	•	•	•	•	1	1	1	•	2	1	•	•	•	•	•	1	•	•	•	•	•	•	•	•	7
Economic Geology & the Bull of the Soc of Economic Geologists	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Economic Geology Res Unit News	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Endeavour, New Series	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
EOS	2	•	2	4	40	15	26	36	44	51	22	34	37	42	62	49	37	50	29	83	15	111	19	61	121	159	91	113	45	11	4	1415
Episodes	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	5
Estudios Geologicos (Madrid)	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	2
European Geophys Soc, mtg abs	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Evolutionary Monographs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Exploration Geophysics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Explorer (Clevelalnd)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Ext abs - Intl Symp Water-Rock Interaction	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Facies	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	•	•	•	2
Field Trip Guidebk - Pac Section SEPM	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Fisica de la Tierra	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Forschung (Boppard)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Fortschritte der Mineral, Beiheft	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Fossils	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	4
Fossils and Strata	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Frontiers in Sedimentary Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	•	•	•	•	•	•	•	4
Geobios	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	1	•	•	3
Geochemical Journal	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	1	1	•	1	1	•	•	•	6
Geochemistry International	•	•	•	•	•	•	•	•	•	•	1	1	•	1	•	2	2	2	•	•	•	•	•	•	•	•	•	•	•	•	•	9
Geochim et Cosmochim Acta	•	1	•	•	1	•	2	2	2	•	1	3	3	4	2	3	4	5	3	4	2	2	4	5	4	3	4	3	2	5	3	77
Geodynamics Series	•	•	•	•	•	•	•	•	•	•	•	•	•	1	4	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1	•	7
Geografia Fisica e Dinamica Quaternaria	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
GeoJournal	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geokhimiya	•	•	•	•	•	•	•	•	1	•	1	2	1	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	7
Geol Greenland Survey Bulletin	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Geol Jahrbuch. Reihe A: Allgem Regionale Geol BR Deutschland und Nachbargebiete, Tektonik, Stratigraphiek Palaeontologie	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	3
Geol Jahrbuch. Reihe B: Regionale Geologie Auslalnd	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geol Jahrbuch. Reihe D: Mineral, Petrogr, Geochem, Lagerstaettenkunde	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geol Soc New Zealand Misc Publ	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	1	•	•	2	•	•	1	•	•	1	•	•	•	•	•	8
Geol Soc Special Publ (London)	•	•	•	•	•	•	•	•	•	•	•	•	1	3	1	6	•	15	4	3	1	7	2	8	7	•	•	8	2	41	2	111
Geolog (Geol Assoc Canada)	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geologi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	2
Geologia Tecnica	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geologica Balcanica	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geologica Ultraiectina	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Geological Journal, Spec Issue	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geological Magazine	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1	•	•	•	•	1	•	•	1	•	•	•	1	•	5
Geologicky Pruzkum	•	1	•	•	•	•	•	•	1	2	1	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6

Geologie en Mijnbouw	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Geologie Mediterraneenne	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	2
Geologische Rundschau	•	•	•	•	•	•	•	•	•	2	•	•	2	•	1	•	•	4	•	•	17	•	1	•	1	1	1	•	•	1	•	31
Geology (Boulder)	•	•	•	•	2	6	3	•	1	1	2	1	1	2	3	4	5	3	1	8	5	4	8	11	9	11	9	20	15	8	13	156
Geology Today	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	2
Geo-Marine Letters	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5	1	1	•	1	5	1	1	1	1	•	1	2	•	•	•	20
GEOMAR-Report	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Geomorphology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	2
Geophys J Royal Astron Soc	•	•	•	•	•	•	•	1	2	2	•	2	1	2	4	1	3	2	•	•	•	•	•	•	•	•	•	•	•	•	•	20
Geophysical Journal International	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	1	•	3	3	2	3	15
Geophysical Monograph	•	•	•	•	•	•	•	4	•	•	•	1	•	•	•	•	3	•	1	•	1	•	•	•	6	•	17	2	2	•	•	37
Geophysical Research Letters	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	2	1	2	1	1	8	1	10	1	3	9	12	1	3	4	61
Geophysical Surveys	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Geophysical Transactions (Geofizikai Kozlemenyek Geofizicheskiy Byulletin')	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Geophysics	•	6	•	•	•	•	•	•	•	•	•	•	•	1	•	1	1	•	1	•	•	1	•	•	•	•	•	•	1	•	•	12
Geophytology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
GeoResearch Forum	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Geos (Ottawa)	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1	•	•	•	•	•	•	•	3
Geoscience and Man	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Geoscience Canada	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	1	1	•	•	•	•	•	•	3	•	•	7
Geoscience Journal	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
GeoTech	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Geotectonics	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geothermal Energy	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Geotimes	11	12	8	11	9	5	11	7	7	7	5	3	7	10	7	4	4	8	9	9	6	5	2	5	4	4	4	1	•	2	2	189
Giornale de Geologia	•	•	•	•	•	1	•	•	•	•	1	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	6
Global & Planetary Change	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	1	•	1	•	4
Global Giogeochemical Cycles	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Gondwana Geological Magazine	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Grondboor en Hamer	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Grzybowski Foundation Spec Publ	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	2	•	•	3
GSA Bull	•	•	•	•	5	1	3	5	3	3	3	4	2	6	5	•	3	2	1	2	1	2	•	3	•	3	3	•	2	2	3	67
GSA Today	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	2	•	2	•	•	•	•	7
Haeyang Yon'gu (Ocean Research)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Haiyand Dizhi yu Disiji Dizhi (Marine Geology & Quat Geology)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	2
Hanguk Kukchi Yongu (Korean J Polar Research)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Hauptversammlung der Deutschen Geologischen Gesellschaft	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	3
Heidelberger Geowissenschaftliche Abhandlungen	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	1	•	•	•	•	•	•	•	4
HIG (Hawaii Inst Geophysics)	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Historical Biology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	3
Hydrobiologia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	2
IAGA Bulletin (Intl Assoc Geomagnestim & Aeronomy)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	3

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
INA Newsletter	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	4	•	3	•	•	1	•	•	•	1	•	•	•	•	•	10
Indian Colloq Micropalaeo & Strat	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Indian J of Marine Sciences	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	2	•	•	4
Indian J of Petroleum Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Indian Journal of Earth Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Indian Journal of Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	1	•	1	•	•	•	•	•	•	•	4
Indian Minerals	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Inst Geol & Nuclear Scis Contrib	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Interagency Airborne Geosci Wkshp	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Intl Assoc Sedmintols Reg Mtg.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	•	3
Intl Congr Sedimentology (Congres Intl de Sedimentologie)	•	•	•	•	•	•	3	•	•	9	•	•	•	20	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	32
Intl Geological Congr, Abs (Congres Geolog Intl, Resumes)	•	•	•	•	•	•	•	10	•	•	•	27	•	•	•	•	•	•	•	•	18	•	•	54	•	•	•	•	•	•	•	109
Intl Geology Review	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	1	•	•	1	2	1	•	•	•	•	•	•	•	•	7
Intl J of Coal Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Intl J Radiation Apps & Instrumenta, Part E, Nclu Geophys	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Intl Sedimentological Congr (Proc)	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9	•	•	•	•	•	•	•	•	•	11
Intl Sedimentological Congr Abs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5	•	•	•	•	•	5
Intl Series of Monographs on Earth Sciences	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Intl Symp Antarctic Earth Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	1	•	•	4
Intl Symp Borehole Geophys Minls, Geotech, & Groundwater Apps	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Intl Symp on Ostracoda	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	3	•	•	•	•	•	•	6
Intl Union Geodesy and Geophys	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Intl Union Geodesy and Geophys, Gen Assemb	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	6	•	•	•	•	•	•	•	21	•	•	•	•	29
Intl Union Geological Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Inzhenemaya Geologiya	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
IPOD-Japan Basic Data Ser. Ocean Res Inst, Univ of Tokyo	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Isotope Geoscience	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Isreal J of Earth-Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	2
Izvestiya Adademii Nauk SSSR. Ser Geologicheskaya	•	•	•	•	•	•	•	•	•	•	4	•	•	•	•	•	•	2	•	•	•	1	•	•	•	•	•	•	•	•	•	7
Izvestiya Vysshikh Uchebnykh Zavedeniy. Geologiya i Razvedka	•	•	•	•	•	•	•	•	•	•	4	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
J Acoustical Society of America	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
J African Earth Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	3	•	•	1	•	•	•	1	•	•	4	1	12
J Colorado-Wyoming Acad Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
J Czech Geol Soc (Casopis Ceske Geolgicke Spolecnosti)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
J Faculty of Marine Sci & Tech, Tokai University	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	2	3
J Faculty of Sci, Univ Tokyo, Sec 2: Geol, Miner, Geogr, Geophys	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
J Foraminiferal Research	•	•	•	•	1	2	1	•	•	3	•	1	1	1	•	1	3	2	1	1	1	•	3	2	1	3	1	2	2	1	1	35
J Geodynamics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	1	3

J Geol Soc Australia	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
J Geol Soc India	•	•	•	•	•	•	•	1	•	•	•	•	•	1	1	1	•	1	•	•	•	•	1	3	1	•	2	•	1	2	•	15
J Geol Soc London	•	•	•	•	•	•	•	•	•	•	•	•	•	3	1	1	•	1	•	•	1	1	•	1	2	1	4	1	2	1	•	20
J Geol Soc Philippines	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
J Geological Education	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
J Geology	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	1	•	1	1	•	•	•	1	•	1	•	1	•	1	•	•	9
J Geomag & Geoelectricity	•	•	•	•	•	•	•	•	•	•	•	1	•	•	2	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	6
J Geophysical Research	•	•	•	•	1	1	3	19	4	1	3	4	11	4	6	1	4	5	5	3	4	24	5	5	10	12	9	10	5	14	10	183
J Geoscience Education	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
J Geotechnical Engineering	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	2
J Intl Assoc for Mathematic Geol	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
J Micropalaeontology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	3	•	1	•	4	•	•	•	•	2	•	•	2	•	13
J Mining College, Akita Univ, Ser A.: Mining Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1	•	2
J Mississippi Acad of Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	2
J Nannoplankton Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	13	•	4	4	1	24
J Nepal Geological Society	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
J Non-Crystalline Solids	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
J Palaeontological Soc of India	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	2	•	•	•	•	•	•	•	•	•	4
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
J Paleontology	•	•	•	•	1	•	1	2	3	1	2	1	1	4	1	2	1	•	•	2	1	•	1	•	2	1	1	3	•	•	•	31
J Petroleum Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
J Petroleum Technology	1	•	•	•	•	•	1	•	•	•	•	•	•	•	•	2	1	1	1	•	•	•	•	•	•	1	•	•	•	•	•	8
J Petrology	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	4
J Physics of the Earth	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
J Quaternary Science	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
J Royal Soc New Zealand	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	•	•	•	•	•	•	•	•	3
J Sci Hiroshima Univ, Ser C: Geology & Mineralogy	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
J Sedimentary Petrology	•	•	•	•	2	2	•	2	4	2	2	1	1	1	2	•	1	•	1	1	1	•	2	•	1	•	•	•	•	•	•	26
J Sedimentary Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	3	2	4	3	14
J Southeast Asian Earth Scis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
J Structural Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	2	1	•	•	2	•	7
J Tennessee Academay of Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
J Vertebrate Paleontology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	•	•	3
J Volcanology & Geothermal Res	•	•	•	•	•	•	•	•	•	2	•	1	1	•	•	•	•	•	1	•	1	•	•	•	•	2	•	1	•	•	1	10
Jahresbericht - Deutsche Forschungsgemeinscaft, Band 2, Programme un Projekte	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	2
Jahresbericht - Kemforschungsanlage Juelich GmbH	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Jahrestagung der Deutschen Geophysikalischen Gesellschaft e.V.	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
JOI/USSAC Newsletter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	2	•	•	•	5
JOIDES Journal	•	•	•	•	•	•	•	•	•	•	•	2	•	4	•	•	•	•	•	•	•	•	•	1	4	8	7	•	•	5	•	31
Journal of Geophysics Zeitschrift fuer Geophysik	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Kasan Bull Volcanolog Soc Japan	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	5	•	•	•	•	•	•	•	•	•	•	7
Kompleksnyy Issledovaniya Prirody Okeana	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
KTB Report	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
La Recherche	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	3

La Vie des Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	•	•	•	2
Le Courrier du C.N.R.S.	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Lethaia	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	2	•	•	5
Lithology & Mineral Resources	•	•	•	•	•	•	•	•	•	•	2	•	2	2	5	2	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	14
Lithos	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1	•	•	•	1	1	5
Litologiya i Poleznyye Iskopayemyye	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
LPI Contribution	•	•	•	•	•	•	•	•	•	•	1	•	3	•	•	•	•	2	•	3	1	•	1	•	•	9	•	•	•	•	•	20
Lund Publications in Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Magyar Allami Foldtani Intezet Evkonyve (Annals Hungarian Geol Inst)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Marine & Petroleum Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	2	2	•	•	1	•	1	•	2	•	•	2	•	1	•	13
Marine Chemistry	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	2	•	•	1	•	•	5
Marine Geology	•	•	2	•	3	•	1	2	4	9	5	18	3	5	1	6	1	7	4	3	6	1	13	7	6	6	7	8	6	9	20	163
Marine Geophysical Researches	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	1	4	1	1	•	•	2	•	•	1	•	•	12
Marine Georesources & Geotechn	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	2	•	1	1	•	•	5
Marine Geothechnology	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	3
Marine Micropaleontology	•	•	•	•	•	•	•	2	1	4	5	3	3	2	8	1	2	5	2	1	3	2	3	15	9	9	8	13	9	9	7	126
Marine Science (Plenum)	•	•	•	•	•	4	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Maritime Sediments	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Mathematical Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	2
Maurice Ewing Series	•	•	•	•	•	•	•	•	1	•	46	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	47
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Meddelanden fran Stockholms Univ Inst for Geologi och Geokemi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Mem - Canadian Soc Petroleum Geologists	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	2
Mem - Congreso Latinoamericano de Paleontologia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Mem - Geol Soc India	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	2
Mem - GSA	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	9	11	•	1	•	•	•	1	2	•	•	•	•	•	•	25
Mem - Miami Geological Society	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Mem della Soc Geol Italiana	•	•	•	•	•	1	•	1	•	•	•	•	•	1	•	•	•	1	•	•	•	•	7	•	•	•	•	•	•	•	•	11
Mem Geol de l'Univ de Dijon	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Mem Hors Serie - Soc Geol France	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Mem Natl Inst Polar Res. Spec Iss.	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Mem Soc Geol France [varies]	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	3	•	1	•	•	•	7
Memoires du B.R.G.M. (Bur. Recherches Geol et Minieres)	•	•	•	•	•	3	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Mems des Sciences de la Terre	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Messinian Seminar (Seminario sobre el Messinense)	•	•	•	•	•	•	•	•	3	4	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7
Meteor-Forschungsergebnisse. Reihe C: Geologie und Geophysik	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Meteoritics	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	3	•	•	•	•	1	•	•	•	•	•	6
Meteoritics & Planetary Science	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	2	4
Meteorologiya i Gidrologiya	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Micropaleontology	•	•	•	•	•	•	1	2	3	2	3	3	3	5	2	7	•	2	2	1	3	2	2	5	4	2	1	3	2	3	•	63
Micropaleontology Spec Publ	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Mineral Resources Bulletin	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Mineral Resources Devel Series	•	•	•	•	1	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	3

Mineralia Slovaca	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Mineralogical Magazine	•	•	•	•	•	•	•	•	•	•	•	•	2	1	1	•	•	•	•	•	•	•	•	•	•	7	•	1	•	•	•	12
Mitteil aus dem Geol Inst Eidgenoessischen Technischen Hochschule und der Univ Zuerich, Neue Folge	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Mitteil aus dem Geologisch-Palaeontologischen Inst der Univ Hamburg	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9	•	•	•	•	•	•	•	•	•	•	•	•	•	9
Mitteilungen - Deutsche Forschungn	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Modern Geology	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	3
Mosaic (Washington)	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Moscow Univ Geology Bulletin	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Mus Argentina Ciencias Natur "Bernardino Rivadavia" - Inst Nacional Investig Ciencias Natur, Rev, Geol	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Nachrichten - Deutsche Geologische Gesellschaft	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	13	•	•	•	•	•	•	•	•	•	13
Nanhai Dizhi Yanjiu (Geological Research of South China Sea)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
NASA Conference Publication	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
NATO ASI Series. Ser C: Math & Physical Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7	3	•	•	•	•	•	•	•	•	•	10
NATO Conf Ser. IV. Marine Sci	•	•	•	•	•	•	•	•	•	•	•	1	•	•	4	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5
Nature	•	1	•	•	3	1	10	5	4	8	6	9	8	15	16	5	14	9	11	5	11	6	2	2	9	6	4	7	8	9	2	196
Nature und Museum	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Nature; Physical Science (London)	•	•	•	1	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Naturen	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1
Naturwissenschaften	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Naturwissenschaftliche Rundschau	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	•	1	•	•	•	•	3
NERC News (Natural Environmental Res Council, UK)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	2
Neues Jahrbuch fuer Geologie und Palaeontologie. Abhandlungen	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Neues Jahrbuch fuer Geologie und Palaeontologie. Monatshefte	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Neues Jahrbuch fuer Mineralogie. Abhandlungen	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
New Zealand Geophysical Soc Symp, Abs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
New Zealand J of Geol & Geophys	•	•	•	•	•	•	1	•	1	1	•	•	1	1	•	•	1	•	•	1	•	1	1	1	•	•	•	2	•	•	•	12
New Zealand Soil Bur Sci Report	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Newslet - Geol Soc N. Zealand	•	1	•	2	1	1	1	•	•	•	•	1	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	1	•	1	•	11
Newslet - New Concepts in Global Tectonics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	2
Newslet Spec Grp Tectonics & Struct Geol, Geol Soc Australia Inc	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Newsletters on Stratigraphy	•	•	•	•	•	•	•	•	•	1	•	1	•	•	1	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	4
Nippon Kaiyo Gakkai-Shi (J of the Oceanographical Soc of Japan)	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Norelco Reporter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Nova Acta Leopoldina	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Nuclear Instruments & Methods in Phys Res, Sect B: Beam Interacts w/ Materials and Atoms	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	2
Nuclear Tracks & Radiation Measurements	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1

Occasional Rept - Univ Waikato, Dept Earth Sci (New Zealand)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Ocean Industry	2	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Ocean Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Ocean Science and Engineering	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Oceanologica Acta	•	•	•	•	•	•	•	•	•	1	3	2	13	1	2	1	•	•	•	•	1	1	2	•	1	•	•	•	•	•	•	28
Oceanology	•	•	•	•	1	•	•	2	3	1	1	2	•	1	•	•	•	•	•	1	3	•	1	1	•	•	1	•	2	3	2	25
Oceans	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	2
Oceans (New York)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9	•	1	•	•	•	•	•	•	•	•	•	•	•	•	10
Oceanus (Woods Hole)	•	•	•	•	•	•	•	•	•	1	1	•	•	1	3	•	•	1	1	•	•	•	•	•	1	•	•	•	•	•	•	9
Offshore (Conroe)	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	3
Ofioliti	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Ohio Journal of Science	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Oil and Gas (Sydney)	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Oil and Gas Journal	1	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	•	2	•	•	1	•	•	•	•	1	1	•	•	•	•	9
Open File Report - State of Oregon, Dept Geol Mineral Industries	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Open-File Rpt - Geol Surv Canada	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Organic Geochemistry	•	•	•	•	•	•	•	•	•	•	•	•	1	•	2	9	•	8	•	4	1	1	•	3	•	3	4	3	2	1	•	42
Origins of Life & Evol of Bioshpere	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Pacific Rim Congress	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Pacific Science	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Pacrofi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Palaeocology of Africa & of the Surrounding Islands [& Antarctica]	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	3	•	•	•	1	•	•	•	•	•	•	•	•	6
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Palaeogeogr, climatol, ecology	•	•	•	•	•	•	•	•	1	1	2	•	3	4	4	6	2	4	1	2	1	1	3	7	2	14	5	2	6	6	5	82
Palaeontologia Electronica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	2
Palaeontological Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Palaeontologische Zeitschrift	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Palaeontology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	2
Palaios	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	1	1	1	3	2	1	•	1	•	•	12
Paleobiology	•	•	•	•	•	•	•	•	•	•	•	•	1	•	2	1	•	•	•	•	•	•	1	•	•	1	1	4	•	1	•	12
PaleoBios	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	3	•	•	1	•	•	•	8
Paleoceanography	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6	2	3	6	12	6	6	8	6	8	•	6	7	7	83
Paleontological Journal	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Paleopelagos	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	2
Palynology	•	•	•	•	•	•	•	•	2	3	•	•	•	1	3	2	1	4	•	14	•	2	2	2	•	•	•	7	•	2	•	45
Paper - Geol Surv Canada	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	3	•	•	•	•	•	•	•	•	•	•	•	•	6
Peoc - SPE/IADC Drilling Conf (Soc Petroleum Engineers)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Petros	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Philos Trans Roy Soc London Ser. A: Math and Physical Sciences	•	•	•	•	•	•	•	•	•	•	•	15	•	2	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	19
Phys of the Earth & Planet Interiors	•	•	•	•	•	•	•	•	1	•	•	•	•	3	•	1	•	•	2	•	•	2	•	•	•	1	•	•	2	•	2	14
Physics & Chemistry of the Earth	•	•	•	•	•	•	•	•	•	•	1	6	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7
Physics of the Solid Earth [Izvestiya, Physics of Solid Earth]	•	•	•	•	•	•	•	•	•	•	1	•	2	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	6

Polar Geoscience	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
Polar Record	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	2
Polar Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Prelim Rpt - Ocean Res Inst, Univ Tokyo	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	52	•	•	•	•	•	•	•	•	•	•	52
Preprints - Offshore Tech Conf	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Principaux Resultats Scientifiques - Bur de Recherches Geol & Mins	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	3
Priroda	1	•	•	•	•	•	•	•	•	2	2	•	•	•	•	3	•	•	•	1	•	•	•	•	•	•	•	•	1	•	10
Proc - Geoscience Info Soc	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc - Intl Clay Conference	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc - Intl Conf on Port and Ocean Engineering under Arctic Conditions	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc - N. Am Paleontologic Conv	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	4
Proc - Offshore Technology Conf	•	•	•	•	•	•	•	•	•	1	2	•	•	1	2	1	1	1	1	1	1	2	1	1	•	•	1	•	2	1	•	20
Proc - Planktonic Confr	•	•	6	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Proc - Soc Potroleum Engineers of AIME. California Regional Mtg	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc - World Petroleum Congr (Actes et Documents - Congres Mondial du Petrole)	•	•	1	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Proc Seminar on Petroliferous Basins of India	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Proc Biological Soc Wash (DC)	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Conf Civil Engineering in the Oceans	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Congr - Reg Commit on Mediter Neogene Strat, Intl Union of Geol Sciences	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Indian Acad Sci: Earth & Planetary Sciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	1	•	•	•	3
Proc Intl CODATA Conf	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Proc Intl Conf Basement Tectonics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	2
Proc Intl Congr of Speleology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1
Proc Intl Diatom Symposium	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	2
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Proc Intl Mtg Organic Geochem	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9
Proc Intl Symp on Ostracods	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Intl Symp on Shallow Tethys	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Proc Intl Symp Water-Rock Interact	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	4
Proc Koninklijke Nederlandse Akademie van Wetenschap., Ser B: Palaeo, Geol, Phys, Chem, [Anthro]	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	3
Proc Lunar & Planetary Sci Conf	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	2
Proc Natil Sci Council, Rep China, Part A: Physical Sci & Engineering	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Nebraska Acad Sciences & Affiliated Societies	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	2
Proc NIPR Symp on Antarctic Geosci (Natl Inst Polar Res) Tokyo	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	2
Proc of the Ussher Society	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	2	•	•	•	•	•	•	•	•	•	•	4
Proc Pacific Science Congr	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Proc Royal Soc Edinburgh. Sect. B: Biological Sciences	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1

Proc Session of the Committee Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Symp on Geol of Bahamas	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Proc Intl Geological Congress [Rept Session]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	19	•	•	•	•	•	•	•	•	•	•	•	1	2	•	•	25
Proc N. Am Rock Mech Symp	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Proces-Verbaux - Intl Assoc Physical Sci of the Ocean	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	3
Procs Ann Res Conf, Gulf Coast Sect, SEPM Foundation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Prog Rpt - Natl Sci Foundation	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
Prog/Abs - Am Assoc Strat Palynologists (AASP)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	13	•	1	•	•	•	•	•	•	•	•	•	•	18
Prog/Abs - Am Quat Assoc Conf	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	3
Prog/Abs - Ann Clay Minerals Conf	•	•	•	•	•	•	•	2	•	•	•	1	•	•	•	1	•	•	•	2	1	•	2	•	•	•	•	•	•	•	•	9
Prog/Abs - Geol Assoc Canada; Mineral Assoc of Canada; Canadian Geophys Union, Joint Ann Mtg (GAC/MAC/CGU)	•	•	•	•	•	•	•	22	•	•	•	•	•	•	1	1	8	10	2	21	3	16	7	2	•	10	14	•	•	•	•	117
Prog/Abs; Biennial Pan-Am Conf on Res on Fluid Inclusions	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
Progress in Oceanography	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Przeglad Geologiczny	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	2
Pubblicazione - Milan, Universita, Instituto di Geologia e Paleontologia	•	•	•	9	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	11
Publ - Earth Sciences Centre	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	2
Publ - Soc Geologique du Nord	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Publ Occasionnelle - Centre Intl Pour la Formation et les Echanges Geologiques	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Pubs Centre Natl pour l'Exploit des Oceans. Ser. Rapports Scientifiques et Techniques	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Pubs Series - Australasian Inst Mining and Metallurgy	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	2
Quarterly of the Colorado School of Mines	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Quaternary International	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	2
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Quaternary Newsletter	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	1	•	•	•	•	•	•	•	•	4
Quaternary Research (New York)	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1	1	•	•	2	7
Quaternary Science Reviews	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	4	•	1	1	•	•	1	4	•	13
Radiocarbon	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	3
Rapport - Groenlands Geologiske Undersoengelse (Rpt - Geological Survey of Greenland)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	2
Rapports et Proc Verbaux des Reunions - Comm Intl pour l'Explor Scientif de la Mer Mediterranee	•	•	•	•	4	•	•	•	4	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	10
Rapports et Proc-Verbaux des Reunions - Counseil Intl pour l'Exploration de la Mer	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Recent Researches in Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	2
Record - New Zealand Geol Surv	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Records Geol Surv New S. Wales	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Report on the Conf on Scientific Ocean Drilling (COSOD)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1

Journal title	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	Total
Rept - Dept Mines & Energy (Halifax)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Rept NZGS (New Zealand Geol Surv)	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Rept: AGSO Bulletin	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Rept: Circum-Pacific Map Series	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Rept: Curr Res - Geol Surv Canada	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
Rept: SAND (Sandia Natl Lab, NM)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	3
Repts Faculty Sci, Shizuoka Univ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	2
Res Repts - Natl Geogr Society	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Reunion Ann des Sci de al Terre	.	.	.	.	1	4	.	3	.	.	.	.	.	.	.	.	.	2	.	.	.	2	.	3	.	.	.	3	.	.	.	18
Rev de Geologie Dynamique et de Geographie Physique	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Rev l'Inst Francais du Petrole [& Ann des Combustibles Liquides]	.	.	.	.	.	.	.	.	.	.	1	1	.	.	2	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	5
Rev Palaeobotany & Palynology	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	2	.	1	1	.	1	9
Reviews of Geophysics	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	1	1	.	4
Revista Brasileira de Geociencias	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
Revista Espanola de Micropaleo	.	.	.	1	.	1	.	1	1	1	.	2	.	.	.	1	1	1	2	.	2	1	.	1	1	1	2	1	.	.	.	21
Revista Espanola de Paleo	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	2
Revista Geologica de Chile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	4
Revista Soc Geologica de Espana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Revs Geophys and Space Physics	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Revue de Micropaleontologie	.	.	1	.	.	.	.	1	1	.	.	.	1	1	.	1	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	9
Revue de Paleobiologie	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Rivista Italiana di Paleontologia e Stratigrafia	.	.	.	2	2	3	2	.	1	.	2	1	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	16
Rock Magnetism & Paleogeophys	.	.	.	.	.	.	1	.	.	.	2	.	.	.	1	1	.	.	1	1	.	1	4	2	.	.	.	.	.	.	.	14
Rock Mechs & Rock Engineering	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
Russian Geology and Geophysics	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
S. African Journal of Science	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
S. Pacific Marine Geological Notes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Schriften Naturwissenschaftlichen Vereins fuer Schleswig-Holstein	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Schweizerische Mineral Petrograph Mitteil Bull Suisse de Mineral et Petrographie	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Sci of the Total Environment	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Sci Rpts Kanazawa University	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Sci Rpts Niigata Univ, Ser E, (Geol)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Sci Rpts Tohoku Univ. Ser 2: Geol Tohoku Daigaku Rika Hokoku. Dai 2: Shu Chishitsugaku	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	3
Science	1	4	1	1	3	1	3	2	1	3	3	2	4	3	2	4	2	2	2	.	.	2	2	1	3	1	4	7	.	5	3	72
Science J. (London)	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Science News (Washington)	.	.	.	.	.	.	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Science, Progres, Decouverte	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Sciences de la Terre	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Sciences Geologique (Bulletin)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Scientific Drilling	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	.	1	2	.	.	.	.	10
Scripps Inst of Oceanography	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Scripta Geologica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
Sea Frontiers/Sea Secrets	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Sea Technology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	2
Sedimentary Basins of the World	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	2
Sedimentary Geology	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	1	•	7	•	1	•	1	•	1	2	2	1	1	3	2	2	27
Sedimentology	•	•	•	1	•	•	1	1	1	•	2	•	1	•	3	•	•	1	•	•	•	•	1	•	1	•	2	•	•	1	•	16
SEG Abs (Soc Explor Geophys)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	2
Seismological Research Letters	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Sekiyu Gijutsu Kyokaishi (J Japanese Assoc Petroleum Tech)	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	2	1	•	2	•	1	•	•	1	•	•	•	•	8
SEPM Reprint Series	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
SEPM Short Course	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Shigen Chishitsu (J Soc Resource Geology)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	2
Shiyou Yu Tianranqi Dizhi (Oil & Gas Geology)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Short Course Notes - Geol Assoc Canada	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Show and Tell Messinian Seminar	•	•	•	•	•	•	•	8	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	8
Skrifter - Norsk Polarinstitutt	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Slovensky Kras	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Soil Mechs & Foundation Engineer.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1
Sonderforschungsbereich 313 "Sedimentation im Europaeischen Nordmeer"	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	•	•	•	2
Southeast Asia Pet. Explor. Soc.	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Sovetskaya Geologiya	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	2
Soviet Antarctic Expedition, Inf Bull	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Spec Paper - Geol Soc America	•	•	•	•	•	•	•	•	•	•	•	•	1	5	•	•	•	•	•	2	•	2	•	1	•	•	1	6	•	•	4	22
Spec Publ - Geochemical Society	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Spec Publ - Geol Soc Australia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Spec Publ - Soc Econ Paleon Mineralogists (SEPM) [Soc Sedimentary Geol] [3 titles]	•	•	•	•	•	1	•	•	•	•	•	•	26	•	•	•	1	•	•	•	•	•	2	•	•	•	6	•	1	2	•	39
Spec Publ - The Paleontologic Soc	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5	•	•	•	5
Spec Publ European Assoc Petroleum Geoscientists	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	2
Spec Publ of the Intl Assoc of Sedimentologists	•	•	•	•	•	6	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	•	•	•	2	2	•	•	•	•	•	12
Spec Publs - Cushman Foundation for Foraminiferal Research	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1	1	1	•	•	•	•	•	•	•	•	•	•	4
Spec Rpt - Geotherm Resources Council	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Stanford U. Publs. Geological Sci.	•	•	•	•	•	•	•	•	•	9	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	10
Stero-Atlas of Ostracod Shells	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	1	•	1	•	•	•	4
Stockholm Contribs in Geology	•	•	•	•	•	•	•	•	•	•	2	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	4
Strata. Actes du Lab de Geol Sed et Paleontol de l'Univ Paul-Savatier, Toulouse, Ser 1: Communications	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Stratigrafiya, Geologicheskaya Korrelyatsiya	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Studi Geologici Camerti. Vol Spec	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	2
Studia Geologica Salmanticensia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	•	•	•	2
Studies in Geology (Knoxville)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	1
Surveys in Geophysics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Syllogeus - Natl Mus Natural Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Systematic Zoology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Tech Bull - U.N., Econ & Social Commiss. Asia & Pacific (ESCAP), Committ. Co-ordination of Joint Prospecting for Mineral Resources in S. Pacific Offshore Areas.	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1

Tech Prog/Abs Papers - European Assoc Exploration Geophysicists	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	•	•	•	•	•	•	•	•	•	2
Tech Rpt - Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Tech Rpt - Marine Geosci Unit, Joint Geol Surv/Univ Cape Town	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Tech Rpt - Woods Hole Oceanographic Institution	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	1	•	•	•	•	•	•	•	•	•	•	2
Tech Rpt ISEI, Series A (Inst Study Earth's Interior, Okayama Univ)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	1	•	•	•	•	•	•	•	•	3
Tectonics	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	1	1	•	•	•	•	•	•	4
Tectonophysics	•	•	•	•	1	•	•	•	•	1	2	•	•	•	2	4	1	1	2	1	•	•	2	2	1	2	2	3	3	4	•	34
Terra Abstracts	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	29	•	18	•	3	•	•	•	•	50
Terra Antartica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	2	•	3
Terra Cognita	•	•	•	•	•	•	•	•	•	•	•	•	8	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9
Terra Nostra (Bonn)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	14	•	•	•	•	14
Terra Nova. The European J of Geosciences	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	1	2	1	•	•	•	1	•	6
Tertiary Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Thalassografika	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
The Canadian Mineralogist	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	3
The Edinburgh Geologist	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	•	•	•	•	•	2
The J Alabama Academy of Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	•	•	•	2	•	•	•	•	4
The J Geol Soc Jamaica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
The Log Analyst	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	6	•	•	•	•	•	•	•	•	7
The Palaeobotanist	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
The Paleontological Soc Papers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1
The Sciences (New York)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	1
Tikhookeanskaya Geologiya (Pacific Geology)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Trans - Gulf Coast Assoc Geological Societies	•	•	•	•	1	•	1	•	•	1	1	•	•	•	•	2	1	1	2	•	•	1	•	•	•	•	•	•	•	•	•	11
Trans (Doklady) USSR Acad Sciences: Earth Sci Sections	•	•	•	•	•	1	•	•	•	2	1	•	•	•	•	•	4	•	•	1	•	•	•	•	1	1	•	•	•	•	•	11
Trans Caribbean Geological Conf Memorias - Conf Geologica del Caribe	•	•	•	5	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	6
Trans CIBCASIO (mtg)	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Trans CWLS Formation Evaluation Symp (Canadian Well Log Soc)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Trans Latin Am Geologiacl Conf	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Trans R Soc Edinburgh: Earth Sci	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	2
Trans SPWLA Ann Logging Symp	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	2	1	•	•	•	1	•	•	•	•	1	•	•	1	•	7
Trans/Proc Palaeontol Soc of Japan; New Series	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	1	•	•	•	1	2	•	•	•	•	6
Travaux du CRM Jean Cuvillier	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Travaux et Docs de Geographie Tropicale	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Journal title	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**Total**
Travaux et Docs de l'ORSTOM	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Trudy - Geol Inst, Akad Nauk SSSR	•	•	•	•	•	•	•	•	•	•	•	•	•	1	16	8	9	1	•	•	•	•	•	•	•	•	•	•	•	•	•	35
Trudy - Naucno-Issledovatel'skij Inst Geologii Arktiki	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Trudy - Vsesoyuznyy Ordena Lenina Nauchno-Issledovatel'skiy Geologicheskiy Institut im A. P. Karpinskogo, Novaya Seriya	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Trudy Inst Geologii I Geofiziki (Novosibirsk)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1

Trudy Inst Okeanologiy im. P.P. Shirshova	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3
Tulane Studies Geology and Paleontology	2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2
Tulsa Geological Soc Digest	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Umschau in Wissenschaft und Technik	•	1	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
USGS Bulletin	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1	•	•	•	•	1	3
USGS Circular Report	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1	•	11	•	•	•	•	•	14
USGS Digital Data Series	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1
USGS Open File Report	•	•	•	•	•	•	•	•	•	4	1	•	•	•	•	•	•	•	•	1	•	2	3	8	2	11	1	2	•	•	1	36
USGS Prof Paper	3	•	•	•	•	•	•	•	•	•	•	•	•	1	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7
Utrecht Micropaleo Bulls	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Verhandlungen der Naturfor-schenden Gesellschaft in Basel	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Vestnik Akademii Nauk SSSR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Vestnik Moskovskogo Univ, Ser 5: Geografiya	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Voporsy Mikropaleontologii	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Warta Geologi (Newsl Geol Soc Malaysia)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	3	•	•	•	•	•	•	•	3
WAT on Earth (Univ Waterloo)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Water Resources Research	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1
Water Spectrum	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
World and Regional Geology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4	•	•	4
World Data Center A for Marine Geology & Geophysics, Rept MGG	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	15	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	16
World Oil	•	2	1	1	1	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
Xiandai Dizhi (Geoscience)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1	•	2
Yanjiu Baogao - Guoli Tawan Daxue Lixueyuan Haiyang Yanjiusuo Acta Oceanographica Taiwanica	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Yanshi Zuebao Acta Petrologica Sinica	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	1
Year Book - Carnegie Inst of Wash	•	•	•	•	1	•	1	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	4
Yearbook - Lamont-Doherty Geol Observatory Columbia Univ	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	2
Zeitschrift der Deutschen Geologischen Gesellschaft	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	1	•	•	•	•	•	•	•	•	•	•	•	2
Zeitschrift fuer Angewandte Geologie	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Zeitschrift fuer Geol Wissenschaft	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1
Zeitschrift fuer Gletscherkunde und Glazialgeologie	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Zentralblatt fuer Geol & Palaeo, Teil I: Allglemeine, Angewandte, Regionale und Historishe Geologie	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	1
Zhizn' Zemli	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	1
Zhongguo Diqiu Huaxue Xuebao (Chinese Journal of Geochemistry)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	1
Zitteliana	•	•	•	•	•	•	•	•	•	•	•	•	2	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	3
Totals	**37**	**44**	**49**	**71**	**133**	**127**	**153**	**208**	**191**	**210**	**258**	**272**	**260**	**293**	**308**	**318**	**254**	**343**	**297**	**377**	**275**	**422**	**338**	**356**	**406**	**456**	**410**	**410**	**256**	**305**	**146**	**7983**

Executive Summary

Leg 190 Nankai I

Leg 190 was the first of a two-leg program designed to sample a transect of sites across the Nankai Trough accretionary prism (SW Japan). The main logging effort of this program will take place on Leg 196 in 2001 using logging-while-drilling (LWD) technology; however, wireline logs were acquired at Site 1173 to tie the core and LWD to seismics

Leg 191 W. Pacific Ion

The main scientific goal of Leg 191 was to drill and case a borehole at a site in the northwest Pacific Ocean between Japan and Shatsky Rise and install a seismic observatory. In addition to the standard Triple Combo toolstring, the newly developed 3rd party Multisensor Gamma Ray (MGT) tool was successfully deployed for the first time. The high-resolution natural radioactivity data are well correlated to the HNGS downhole measurements and to the MST core measurements, particularly in shallow ash layers.

Leg 192 Ontong Java

The primary objectives of Leg 192 were to determine the age and emplacement of the Ontong Java plateau, the range and diversity of magmation, and the environment and study of eruption. High-quality logs were acquired in igneous basement and in parts of the cored sedimentary interval at 1186A, where core recovery was very low. The sharp boundary between sediments and basement is well defined, particularly on the FMS logs, which also enables pillows and massive flows within the igneous basement to be distinguished.

Leg 193 Manus Basin

The overall aim of Leg 193 was to determine the subsurface volcanic architecture, structural and hydrologic characteristics, and the deep-seated mineralization and alteration patterns of the Manus hydrothermal field. The Resistivity-at-Bit (RAB) tool was used for the first time in ODP in Hole 1188B to record total gamma-ray counts and electrical resistivity logs as well as resistivity images (like FMS images) in these difficult to recover rocks. Wireline logs provided the opportunity for direct correlation between LWD and conventional log data.

Leg 194 Marion Plateau

The objectives of Leg 194, Marion Plateau, were to study the causes, magnitudes, and effects of sea-level change on continental margin sediments. To date, logging operations were conducted in two holes and the Drill String Acceleration Tool (DSA) was deployed in conjunction with HYACE testing at the start of the leg. In addition, the shipboard scientists used IESX software for core-log-seismic integration.

Active Heave Compensation

The Drill String Acceleration (DSA) tool was deployed during Leg 191 on three APC cores using a new high-pressure transducer. Planning for measurement-while-drilling sub (MWD) operations on Leg 196 has begun. In addition to providing necessary operational information, these data will provide valuable insight into the drill string behavior as affected by heave, heave compensation and pipe length.

Large Diameter Tool Project
A conceptual design for a large diameter logging tool was developed for the Schlumberger MDT tool (a fluid sampling tool) using ODP style packers and a logging cable "wet-connect". Considering overall program priorities, OPCOM decided to place further developments of this project on hold, pending future funding.

Core Barrel Temperature Tool
The core barrel fluid temperature tool (CBTT) was modified from the DSA to measure borehole temperatures while coring. The tool was successfully deployed at Site PCM-2A in Hole 1188A, and although the measured fluid temperature was low, the CBTT will be capable of measuring in up to 250° C environments in the future.

Seismic Data Integration
The production of the IESX project for Leg 194 was completed and sent to the drillship. Use of IESX during the cruise has been very successful. Flavio Anselmetti, Leg 194 Co-Chief, reports "Overall, I am very satisfied having these seismic capabilities here onboard. We couldn't progress without it." IESX has proved particularly helpful for going back to the seismic lines and examining reflections in more detail to reassess the interpretation after drilling. Additionally, access to the seismic data has been very helpful for the correlation of drill sites by tracing significant horizons for lateral age control.

I. MANAGEMENT

The French subcontract for logging services moved to the Univ. of Montpellier from CEREGE in October. Dr. Philippe Pezard (Univ. of Montpelier) will fill the position of chief scientist of this group since Veronique Louvel will not be making the move. Contract activities will continue through the umbrella NEB organization. Joëlle Gastambide (Administrator), Patrick Pinettes (Computer Support) and Philippe Gaillot (Logging Scientist) joined the staff at LMF, replacing Caroline Philippot, Vincent Bayles, and Graeme Cairns.

Pat Fothergill left LUBR to take up a post with Schlumberger in Aberdeen. Advertisements have been placed for a Logging Scientist to replace him. Janette Thompson joined the staff at LUBR as Co-ordinator.

Alex Meltser resigned from his Research Engineer position at BRG. An advertisement for his replacement will be out shortly.

II. STANDARD LOGGING OPERATIONS

Leg 190 Nankai I

Leg 190 was the first of a two-leg program designed to sample a transect of sites across the Nankai Trough accretionary prism (SW Japan) within a three-dimensional (3-D) seismic survey. One additional site was drilled to the west of the main transect to compare along-strike variations in accretionary processes. The main logging effort of this program will take place on Leg 196 in 2001 using logging-while-drilling (LWD) technology to collect further in situ physical properties data at most of the same sites. Therefore, wireline logging on Leg 190 was only performed at Site 1173, the Eastern (Muroto) Transect reference site.

Even though LWD is planned for Site 1173 on Leg 196, wireline logging was considered important and in particular the velocity log is desirable because it is required to convert the 3-D seismic data to depth. As expected, logging Site 1173 was technically challenging. A highlight was the acquisition of a high-quality shear travel time sonic log with the new DSI-2 low-frequency source, despite the very low formation shear velocities (300-700 m/s). Having both shear and compressional velocity logs permits calculation of Vp/Vs or Poisson's ratio, useful for interpreting important petrophysical properties. Overall, the logging data expand upon core-based observations and provide in situ data at Site 1173.

Leg 191 W. Pacific Ion

The main scientific goal of Leg 191 was to drill and case a borehole at a site in the northwest Pacific Ocean between Japan and Shatsky Rise and install a seismic observatory. Logging operations at Hole 1179D consisted of the Triple Combo and the 3rd party Multisensor Gamma Ray (MGT) tools. Large hole size degraded data quality for some of the logs. Electrical and natural radioactivity provided the best results. Lithologic changes as describe in Holes 1179C and D are clearly recorded by these downhole measurements.

During the leg, the newly developed 3rd party Multisensor Gamma Ray (MGT) tool was successfully deployed for the first. The high-resolution MGT data are well correlated to the HNGS downhole measurements and to the MST core measurements. These correlations are well expressed in the upper logged interval with several ash layers detected from tools.

The Drill String Acceleration (DSA) tool was deployed during Leg 191 on three APC cores using a new high-pressure transducer. The data acquired are presently being processed at BRG.

Leg 192 Ontong Java

The primary objectives of Leg 192 were to determine the age and emplacement of the Ontong Java plateau, the range and diversity of magmation, and the environment and style of eruption. Site 1186, on the eastern slope of the main Ontong Java Plateau replaced the planned site on Stewart Arch that had to be cancelled for clearance reasons. The very different volcanic stratigraphy at Sites 1183 and 1185, particularly the discovery of high-MgO basalt of probable latest Cenomanian to Albian age at Site 1185, highlighted the importance of a site at a location intermediate between the crest and eastern edge of the main plateau.

Hole 1186A was logged with the Triple Combo and FMS/Sonic tool strings. High-quality logs were acquired in igneous basement and in parts of the cored sedimentary interval at 1186A. The logs are particularly useful in the sedimentary section where core recovery was very low. Interbedded cherts and limestone show up clearly on the FMS, density, and porosity logs. This thick chert layer, initially thought to be a volcanic sill, has a marked signature on the resistivity logs, the others probably being too thin to be well resolved by the medium and deep induction. The Aptian-Albian limestones appear to be thinly and regularly bedded on the FMS logs. The sharp boundary between sediments and basement is well-defined on conductivity, porosity, density, and particularly the FMS logs. Using these same logs, we can distinguish between pillows and massive flows within the igneous basement.

Leg 193 Manus Basin

The overall aim of Leg 193 was to determine the subsurface volcanic architecture, structural and hydrologic characteristics, and the deep-seated mineralization and alteration patterns of the Manus hydrothermal field. Wireline logging operations were carried out at three holes (Holes 1188A, 1188F, and 1189B). FMS images from these holes show a high degree of fracturing and brecciation over several large intervals. They also show significant changes with depth in styles of alteration and fracture density. Several temperature profiles were obtained during wireline operations, as well as 5 and 7 days later using the UHT-MSM temperature probe. The profiles show an average steady increase in temperature with time and a thermal rebound of approximately 204° C over a seven-day period to a maximum of 312° C, the highest in situ temperature ever measured in ODP or DSDP.

The Resistivity-at-Bit (RAB) tool was used for the first time in ODP in Hole 1188B to record total gamma-ray counts and electrical resistivity logs as well as resistivity images (like FMS images) in these difficult to recover rocks. RAB images show many distinctive resistive features that may represent silica replacement alteration or pervasive anhydrite precipitation.

Borehole images show that most of Hole 1189C is characterized by subhorizontal and subvertical fracturing as well as alternating numerous resistive and conductive features. Wireline logs provided the opportunity for direct correlation between LWD and conventional log data, and show the same range of low resistivity values. The UHT-MSM temperature probe was deployed prior to the wireline operations to determine the temperature conditions of Hole 1188C. The probe measured a maximum bottom-hole temperature of 46° C.

Leg 194 Marion Plateau

The objectives of Leg 194, Marion Plateau, were to study the causes, magnitudes, and effects of sea-level change on continental margin sediments. To date, logging operations were conducted in two holes. In addition, LDEO deployed the Drill String Acceleration Tool (DSA) in conjunction with HYACE testing at the start of the leg. The DSA, which measures 3-axis acceleration and pressure on the core-barrel, was used several times to monitor the downhole behavior of the HYACE Pressure Core Sampler (H-PCS). The acquired data will be used to examine the conditions surrounding the successes and failures of the HYACE testing.

In Hole 1194B high-quality log data was collected using the triple combo toolstring, the multi-spectral gamma tool (MGT), and the FMS/Sonic toolstring. The FMS log imaged the formation well, however the LSS was used for the sonic log due to the failure of the DSI. A check shot survey with the WST was limited the run to three stations above 158 mbsf due to hole conditions. The water gun was used instead of the air gun. Check shots using the water gun were compared with synthetic seismograms, and the basement and other reflectors were erroneously detected because the lower quality of the signals from the water gun made picking first arrivals difficult.

In Hole 1195B, one triple combo log and three WST check shots at shallow depths were recorded. The triple combo log, with the TAP tool, retrieved excellent data. Three check shots were completed using the air gun, which provided much improved results over the water gun used at Hole 1194B.

During this cruise, shipboard scientists used IESX software for core-log-seismic integration. Synthetic seismograms were successfully created using the IESX software package. Access to the seismic data using the IESX project turned out to be very helpful for horizon correlation between drill sites.

III. SPECIALTY TOOLS AND ENGINEERING DEVELOPMENTS

Active Heave Compensation

The Drill String Acceleration (DSA) tool was deployed during Leg 191 on three APC cores using a new high-pressure transducer. Planning for measurement-while-drilling sub (MWD) operations on Leg 196 has begun. The MWD sub will acquire downhole weight-on-bit and torque while instruments at the surface acquire ship heave and calculated weight-on-bit and measured torque. Both downhole and uphole data will be acquired in real-time. In addition to

providing necessary operational information, these data will provide valuable insight into the drill string behavior as affected by heave, heave compensation, and pipe length.

Large Diameter Tool Project
A conceptual design for a large diameter logging tool was developed for the Schlumberger MDT tool (a fluid sampling tool) using ODP style packers and a logging cable "wet-connect". Considering overall program priorities, OPCOM decided to place further developments of this project on hold, pending future funding.

Core Barrel Temperature Tool
The core barrel fluid temperature tool (CBTT) was modified from the DSA to measure borehole temperatures while coring. The tool was successfully deployed at Site PCM-2A in Hole 1188A, and although the measured fluid temperature was low, the CBTT is capable of measuring in up to 250° C environments. Further attempts to deploy the CBTT were not possible due to damage to the tool during operations. It has been returned to LDEO for repairs.

Drill String Acceleration Tool
The DSA housing, chassis and end caps were lost on Leg 193 when a mechanical bit release failed. Fortunately, the DSA electronics were not in use and thus were not lost with the rest of the tool. Replacement parts were quickly fabricated at the LDEO machine shop facility and the new DSA was shipped to Townsville for use on Leg 194. The DSA was used on four occasions with the HYACE deployments during Leg 194 and excellent data were acquired.

High-T Temperature Tool
The High-T Temperature Tool (HTT) was used once on Leg 193, however an electrical short in the cable head severely damaged the tool's onboard electronics. It was shipped back to LDEO and has since been repaired.

Legacy Project
Inventory and archiving of ODP Logging technical developments continued as per JOIDES recommendation. Digital and paper drawing files continue to be collected and archived.

Third Party Tool Support
The third party Multisensor High-Resolution Gamma tool (MGT) was successfully deployed on Leg 191. The acquired data are presently being processed. An initial analysis shows that the high-resolution data are of excellent quality.

IV. SHIPBOARD LOG ANALYSIS

Core/Log Integration Project (CLIP)
The development phase of CLIP has been completed. Work continues on the user guide. Copies of both the Splicer and Sagan modules are available for download from the ODP Logging Services website (http://www.ldeo.columiba.edu/BRG/ODP/). An article on CLIP was published in the current issue of the *JOIDES Journal.*

Seismic Data Integration
ODP Logging Personnel gave a demonstration of the IESX software capabilities to the Site Survey Panel (SSP) on July 24. A discussion of the software followed the presentation and reactions were generally quite positive.

The first meeting of the SciMP detailed planning group for Seismic Integration was hosted by LDEO-BRG in October and evaluation of the IESX pilot study results was discussed. The goal of the project is to determine the feasibility of using IESX by the Databank for digital data management, as well as its usefulness as a shipboard tool. Unix systems at BRG, the Data Bank, and in the DHML have been upgraded with the latest versions of operating system and software (GeoFrame 3.8). A second workstation equipped with two monitors will be added to the DHML during the Leg 194 port call. All seismic data for the Marion Plateau have been received and loaded into an IESX project on this workstation. The second phase of this pilot study involves a similar exercise using Leg 196 digital data. An article on the use of IESX in ODP will appear in the Spring 2001 issue of the *JOI/USSAC Newsletter*.

The production of the IESX project for Leg 194 was completed and sent to the drillship. Use of IESX during the cruise has been very successful. Flavio Anselmetti, Leg 194 Co-Chief, reports "Overall, I am very satisfied having these seismic capabilities here onboard. We couldn't progress without it." IESX has proved particularly helpful for going back to the seismic lines and examining reflections in more detail to reassess the interpretation after drilling. Additionally, access to the seismic data has been very helpful for the correlation of drill sites by tracing significant horizons for lateral age control.

Test Facility
Construction of the LDEO test facility continued. The hole was logged and work was completed on the geological and geophysical characterization of the site. The facility will be available for testing of ODP and 3rd party tools in late FY 01.

V. SHOREBASED LOG ANALYSIS

ODP Conventional Data Processing:
Leg 190 - Hole 1173A
Leg 191 - Hole 1179D
Leg 192 - Hole 1186A
Leg 193 - Hole 1188F

FMS Processing:
Leg 189 - Hole 1170D
Leg 190 - Hole 1173A (2 passes)
Leg 192 - Hole 1186A

GHMT Processing
Leg 189 - Holes 1168A, 1170D, 1172D

Training and Visitors
The following personnel visited the LDEO Log analysis Center for training or access to software:
Anne Bartetzko - training in preparation for her participation on Leg 193.
Rob Pockalny - GeoFrame software for Leg 185 FMS data analysis.
Mike Coffin - Leg 192 JOIDES Logger for IESX training.
Dave Feary - GeoFrame and IESX software use.
Alex Isern - GeoFrame and IESX software use.
Philippe Gaillot - training in preparation for his participation on Leg 195.

VI. DATABASE

The ODP Log Database has been updated through Leg 192 including Schlumberger original and processed data (conventional, geochemical and FMS), specialty tools (borehole televiewer, multi-channel sonic and temperature), borehole images and sonic waveforms.

A meeting was held at NGDC in November to discuss future archiving of the ODP databases. Representatives from JOI, JOIDES, ODP Logging Services, TAMU and NGDC were in attendance.

Historical Data Migration
The conversion of processed FMS data to Unix-compatible files is in progress. The following holes have been converted: Leg 148 (2 holes), 139 (3 holes), 138 (3 holes), 136 (1 hole), 135 (5 holes), 134 (4 holes). Also, GIF files were created for the following holes and included in the online database: Leg 134 (1 hole), 135 (3 holes). Hole 504B (Leg 140) and Hole 801C, Pass 2 were re-processed to provide Unix-compatible files.

Post Cruise Distribution of Log Data
All log data CDs up to and including Leg 186 have been made and sent to Sony. As no logging took place on Leg 187, there will be no data CD produced. The Leg 188 log data CD is scheduled for publication in March 2001.

VII. PUBLICATIONS AND REPORTS

AAPG/Datapages, "Borehole Image Atlas", CD-ROM, including 18 digital log examples from the ODP Logging Services scientists.

Barr, S.R., Revillon, S., Brewer, T.S., Harvey, P.K., and Tarney, J., Reconstruction of the Mariana Subduction Factory input: Results from integration of core and log data from ODP Site 801C, EOS, Trans. Am. Geophys. Union.

Bartetzko, A., Pechnig, R., and Wohlenberg, J., Interpretation of well-logging data by study lateral variations in young oceanic crust: DSDP/ODP Holes 504B and 896 A, Costa Rica Rift, in: Geological application of wireline logs, AAPG.

Burgdorff, K., and Goldberg, D., Feasibility study for CO_2 sequestration in a natural olivine-diabase aquifer: preliminary site characterization in the Palisades sill, NY, Trans. Am. Geophys. Union, EOS suppl., in press.

Buysch, A., Harms, U., and Pechnig, R., Geophysical Downhole Measurements in the Scientific Drillhole HSDP Hilo/Hawaii: Core-log Integration to Characterize Effects of Alteration and Structures. AGU Fall December 2000. San Francisco. EOS Trans. Am. Geophys. Union. Fall Meeting suppl., V21A-04.

Goldberg, D., Book review: "Well Logging for Physical Properties", EOS, Trans. Am. Geophys. Union, in press.

Goldberg, D., Lupo, T., Caputi, M., Barton, C., and Seeber, L., *In situ* stress and fracture evaluation from borehole televiewer and core data in the Newark Rift Basin, *In:* Advances in Triassic-Jurassic Rift Geoscience, Oslen, P.E., and LeTourneau, P.M., Eds., Columbia Univ. Press, Part I, Ch. 7.

Goldberg, D., Collett, T., and Hyndman, R., Ground truth: in situ properties of hydrate, In: Nat. Gas Hydrate in Oceanic and Permafrost environments, M. Max (Ed.), Klewer Publ, Amsterdam, ch. 23, 295-311.

Guerin, G., and Goldberg, D., Sonic waveform attenuation in gas hydrate-bearing sediments from the JAPEX/JNOC/GSC Mallik 2L-38 research well, Mackenzie Delta, Canada, Geochemistry, Geophysics, Geosystems (G^3), submitted.

Guerin, G., Goldberg, D., Meltser, A. and ODP Leg 191 Shipboard party, 2000, Initial evaluation of drilling dynamics on the *JOIDES Resolution*: measurements of downhole bit motion while coring, Trans. Am. Geophys. Union, EOS suppl., in press.

Haggas, S.L., Brewer, T.S., Harvey, P.K., and Iturrino, G.J., Relocating and orientating cores by the integration of electrical and optical images: a case study from Ocean Drilling Program Hole 735B. J. Geol. Soc., London, Vol. 158, in press.

Iturrino, G.J., Ildefonse, B., and Boitnott, G. Velocity structure of the lower oceanic crust: Results from ODP Hole 735B, Atlantis II Fracture Zone. Submitted to Natland, J., Dick, H.J.B., Miller, J., (Eds.), Proc. ODP Sci. Results, 176: College Station, Texas (Ocean Drilling Program).

Kroon, D., Williams, T., Pirmez, C., Spezzaferri, S., Sato, T., Wright, J.D., Coupled Early Pliocene – Middle Miocene bio-cyclostratigraphy of Site 1006 reveals orbitally induced cyclicity patterns of Great Bahama Bank production. In: Proc. ODP Sci. Res. Vol. 166, p155-166, 2000. eds. Swart, P.K., Eberli, G.P., Malone, M.J., Sarg, J.F.

Louvel, V. and Galbrun, B., Magnetic Polarity Sequences from Downhole Measurements in ODP Holes 998B and 1001A, Leg 165, Caribbean Sea, accepted in Marine Geophysical Research.

Louvel, V., Le Gall, Celerier, B., Gardien, Huchon, Structural analysis of the footwall fault block of the Moresby detachment (Woodlark rift basin) from borehole images, submitted to the ODP Leg 180 Scientific Results.

Major, C., and Goldberg, D., Lithologic control on decollement development and deformation within the northern Barbados Accretionary prism, Earth and Plan. Sci. Lett., submitted.

Miller, D.J., Iturrino, G.J., and McQuire, J., Core/log correlations in oceanic basement from Hole 1105A on the Southwest Indian Ridge. Submitted to Casey, J.F., and Miller, D.J. (Eds.). Proc. ODP Sci. Results, 179: College Station, TX (Ocean Drilling Program).

Pechnig, R., Kück, J., Harms, U., Buysch, A. & Wohlenberg, J., Geophysical Downhole Measurements in the Scientific Drillhole HSDP Hilo/Hawaii: Logging Program and Results of Interpretation. AGU Fall Meeting. December 2000. San Francisco. EOS Trans. Am. Geophys. Union. Fall Meeting suppl., V21A-12.

Pezard, P.A., Einaudi, F., Hermitte, D., Cochemé, J.J., Coulon, C., and Laverne C., MORB emplacement and structure : insights for the semail ophiolite, Oman. Geophys. Research Letters, 27, p 3933-3936.

Sun, Y. F., and. Goldberg, D., High-resolution wave modeling of seismic energy loss due to scattering in the upper oceanic crust, In, "Ophiolites and Oceanic Crust: New Insights from the Ocean Drilling Program", Dilek, Y., Ed., Geol. Soc. Am., Special Paper 349, ch. 17, 209-216.

Williams, T., Louvel, V., Lauer-Leredde, C., Magnetic Polarity Stratigraphy from Downhole Logs, West Antarctic Peninsula, ODP Leg 178, Trans. Am. Geophys. Union, EOS suppl.

ODP MANAGEMENT

The FY 2001 ODP Program Plan (1 October 2000 to 30 September 2001) was initially approved at a budget level of $46,122,845. At this level NSF would pay 64% of Program costs and the remaining 36 % would be provided by international contributions. Three members (U.K. , Germany and Japan) are participating in 2001 at full membership level ($2.95M), two members (PACRIM and ECOD) retain full JOIDES membership rights but are participating at less than full membership levels, and France and China continue at Associate membership levels. The original approved budget was expected to cover remaining support for leg 192, full support for legs 193 to 198, and initial support for leg 199 which spans the FY 2001 — FY 2002 transition. The budget had been increased slightly above the original $46.1M target level to provide initial support for planning long-term ODP data archiving and transitioning of the JANUS data base system to IODP. Although NSF approved the plan in late September, concerns were raised on the limited funds identified for items such as fuel, drilling supplies inventory, and maintenance of equipment. Fuel costs have remained at extremely high levels. To help offset costs of fueling, NSF has directly purchased fuel at three port calls in Guam (once in FY 2000 and twice in 2001) using funds that would normally flow directly to JOI and then Texas A&M under the prime contract. These direct purchases have saved the Program approximately $150,000 that would have been charged as tax by the government of Guam. Using residual FY 2000 funds and additional NSF funds, the Program plan budget has been increased to $46,521,644 to help offset the continuing high cost of fuel for the remainder of 2001. Any additional unexpected Program costs will have to be met by rebudgeting of funds. Funding of the Program Plan is complete through April, with timely funding of the remaining budget contingent on timely payment of international membership fees.

JOI has submitted data on program operations for FY 2000 that are required by NSF under the Government Performance Results Act. The data show only minimal down time for Program operations. The final report on dry-dock work and costs has been submitted by JOI, bringing this activity to a close. EXCOM discussion of the fifth performance evaluation committee report was concluded in Japan and the report and recommendations should be submitted to NSF prior to the SCICOM meeting. As of late February, JOI is continuing to prepare the next revision of the ODP Policy manual, which is required under the terms of the prime contract.

ODP COUNCIL

The ODP Council has not met since College Station in June of 2000. In College Station the Council heard a report from Barry Raleigh on JOI corporate management and changes and discussed events associated with the departure of Kate Moran as ODP Program Director at JOI, as well as the process (now completed successfully) to hire the new JOI President. Other issues discussed included: 1) the status of PACRIM and ESF Consortia; 2) concerns with available funds to meet requirements of the FY 2001

Program Plan; 3) general responses to initial presentation of Program phase-out plans and the PEC V Report; 4) and a presentation on the status of IPSC planning for IODP. In closed session the Council also reviewed financial audit data for the international contribution account at NSF. The next meeting of the Council will be held in conjunction with the June 2001 EXCOM meeting. Program phase-out (as identified in JOI and subcontractor planning) will be a primary topic of discussion.

NSF COUNTRY REPORT

Although the FY 2001 NSF budget for NSF has been reduced by 4% from the President s requested level, the overall increase finally approved by Congress (13%) represents the largest increase in the history of the agency. High priority NSF initiatives (Biocomplexity, Information Technology, etc) are likely to see significant growth at this funding level. The Geosciences Directorate and the Division of Ocean Sciences expect to see increases roughly comparable to the overall Foundation increase. Internal distribution of NSF Program funds has not been announced as this report is being written, but will hopefully be available prior to the SCICOM meeting. Primary ODP arguments during formulation of the 2001 budget were for increases in U.S. scientific research as part of the ODP, and incremental support for drilling related research under the MARGINS initiative.

There have been significant personnel and structural changes internally within the Division of Ocean Science. First, the Division has been re-organized into 3 sections. The first is the **Ocean Section** composed of Biological Oceanography, Physical Oceanography and Chemical Oceanography. The second (and new) section is the **Marine Geosciences Section** composed of the Marine Geology and Geophysics Program and the Ocean Drilling Program. The third section, the **Integrative Programs Section** includes support for cross-Division activities including ship operations, Instrumentation and technical services, Ocean Technology and Interdisciplinary Coordination Program, and education activities. Personnel changes have accompanied this reorganization. Larry Clark has been appointed the new head of the Ocean Section with Mike Reeve as the head of the Integrative Programs Section. Our Division Director, Mike Purdy left NSF on 30 November to become the director of the Lamont-Doherty Earth Observatory. Don Heinrichs has emerged from his retirement to assume the position of interim Division Director (and acting head of the Marine Geoscience Section). Formal recruitment actions are ongoing to fill the Division Director and Marine Geosciences Section head positions. Within the Ocean Drilling Program, Jamie Allan has departed to become the department chair at Appalachian State University. Brad Clement from Florida International University will be arriving in April to fill this position. A second visiting scientist/engineer position has been identified for the ODP Program. It is expected that this position will concentrate on IODP planning — specifically with respect to the acquisition of the non-riser drill ship. The position was announced in the November 16 issue of EOS.

Focused NSF funding in support of ODP science is divided between the U.S. Science Support Program (USSSP) administered by JOI ($6.4M in FY 2000) and a separate unsolicited proposal/grant activity administered by NSF ($9M in FY 2000). A separate discussion of USSSP activity can be found in a following report from JOI.

ODP supported field programs for calendar year 2001 include (1) An MCS and OBS study of rifting processes in the Gulf of Aden under the direction of Neil Driscoll (Woods Hole), John Diebold (Lamont) and Brian Taylor (Hawaii); (2) an MCS study of megamullions on the Mid Atlantic Ridge by Brian Tucholke (Woods Hole); (3) a heat flow study of the eastern Cocos plate under the direction of Andy Fisher (University of California at Santa Cruz); (4) an MCS study of the Gulf of Corinth led by Brian Taylor (Hawaii) (6) construction and installation of instrumentation in the corks to be deployed at Nankai under the direction of Keir Becker, University of Miami, and (7) installation of fly-in corks in eastern Pacific ODP holes. Additional proposals for field programs in 2002 (designed for planning IODP drilling) are under review, with others expected for panels in March and May of 2001.

JOI's SCICOM Report for 3/01 meeting

A review of activities since the last SCICOM meeting

Challenges in FY01

Based on the outcome of the August SCICOM meeting, changes were proposed for the draft FY01 Program Plan (e.g., expanding the scope of Leg 195 to include Mariana). After review and approval by SCICOM and EXCOM, the FY01 Program Plan was submitted and approved by NSF in September. The approved budget is $46,123K. This is $23K higher than in FY00.

Management is facing an interesting situation in that SCICOM, at their last meeting, ranked number one (out of over 30 proposals) a plan to drill in the high, ice-covered Arctic Ocean. This is the first time in the history of ODP that a proposal requiring alternate platforms has been selected as the top scientific priority, and the first time that a #1-ranked proposal remains unscheduled for drilling. When the proposal was considered in OPCOM last August, the outcome was, "After a brief discussion there was a consensus among panel members that budgetary constraints and the considerably technical difficulties of Arctic drilling would preclude OPCOM from scheduling proposal 533-Full2 (Arctic Ocean) in FY 2002." To further consider implementing this proposal, SCICOM, in August, called for the creation of an Arctic Detailed Planning Group (DPG). This group was established in December. The group has an extensive mandate and a specified membership including logistics and operations experts. The DPG is chaired by Jan Backman, the lead proponent, and the group held their first meeting in Stockholm, on Jan. 31 and February 1, 2001. On behalf of this group, Dave Rea will present a status report to SCICOM, in Shanghai. The DPG's final report is slated for the next SCICOM meeting in 2001.

A pressing concern to the ODP has been the increase of fuel prices for the *JOIDES Resolution* and the resulting budget impact. In light of a projected $1.34M deficit in the FY01 operating budget, induced by higher fuel prices and affiliated increases in the day rate, NSF has agreed to directly purchase fuel at three Guam port calls, effectively offsetting the projected deficit.

An update on SCICOM and OPCOM motions and consensuses (including those forwarded from TEDCOM, SCIMP, and others) resulting in recommendations to JOI and its subcontractors will be presented in Shanghai.

Fiscal Year 2002 Program Plan

JOIDES, JOI and its subcontractors are currently preparing the first draft of the FY02 Program Plan, which will be considered by EXCOM in June and is slated for final NSF approval in August, before the plan commences on October 1, 2001. The plan will include partial or full funding for ODP Legs 198 through 205. The target budget from

NSF is $46.1 million for all ODP activities. In consideration of fuel prices that have recently been higher than the long-term (10-year) historical mean, the plan will budget fuel at no less than $250/metric ton. If the average cost of fuel exceeds this level during FY02, NSF will be prepared to consider a request for additional resources.

Fiscal Year 2003 and beyond

In response to guidance from NSF, JOI and its subcontractors will prepare a multi-year program plan for the last year of science operations and for a phase-out period that is slated to end in FY07. The first draft of this plan is due to NSF in March 2002. At the January EXCOM meeting, JOI presented an initial phase-out plan for ODP based on preliminary reports from JOI and its subcontractor for Science Operations (TAMU), Wireline Logging Services (LDEO-BRG), and for Site Survey Data Bank services. JOI will continue to work with the subcontractors to refine the reports and to brief EXCOM regularly on this matter.

JOI Reorganization

Since the August SCICOM meeting, JOI Inc. has experienced several transitions and significant changes, but has continued to successfully manage ODP without interruption.

On October 1, the final corporate ties linking JOI and CORE (Consortium for Oceanographic Research and Education) were eliminated. The two companies no longer share presidents, administrative support staff, office space, and property, among other things. The split-out was initiated in June and resulted in only minor perturbations to each corporation. JOI now occupies the 7th floor (Suite 700) of the Brookings Institution annex building in Washington, and CORE occupies the 8th floor (Suite 800). JOI's phone numbers and email addresses remain unchanged.

The leadership of the JOI BoG also changed on October 1. Paul Stoffa and Neil Opdyke replaced Barry Raleigh and Arthur Nowell, respectively, as Chair and Vice Chair. James Watkins stepped down as JOI President on September 30, 2000. John Orcutt served as interim President from October 1 until November 26th. Steve Bohlen began his tenure as JOI President on November 27th. John Farrell continues as Acting Director of ODP at JOI. A search for a permanent JOI/ODP Director is currently being conducted. Announcements of this opportunity were published in February issues of *Nature* and *EOS*.

Several vacancies were filled at JOI over the past six months. Nine of the current 16 JOI employees have worked at JOI for less than one year, and seven have been employed for less than five months. A few positions remain unfilled.

Update on developing options for long-term maintenance of ODP database, JANUS database, core repositories, and other legacies

At the EXCOM meeting in January, a joint report was given by JOI and JOIDES that summarized the following steps taken to meet this goal:

1. Subcontractors have begun to review their data holdings, ranging from computer databases to blueprints.

2. JOI (Frank Rack) organized and ran a meeting at the US National Geophysical Data Center (NGDC) at NOAA, in Boulder on November 2nd, of ODP subcontractor computer database personnel and liaisons from NSF, JOIDES, JOI, and NGDC. The purpose of the meeting was to review the computer databases in the ODP, review requirements for archiving, needs to do so, etc. A smaller, follow-on meeting at TAMU was held on November 27th. Detailed minutes and action items from the first meeting were made available on November 21st. These minutes were reproduced in the January 2001 EXCOM agenda book. Follow-up continues. JOI awaits further advice and guidance from SCIMP regarding prioritization of data types and databases.

3. Agreements have been reached between JOI and JAMSTEC and between TAMRF and a JAMSTEC subcontractor to begin the process of creating a duplicate of the Janus relational database in Japan. Supplemental funding for this activity has been provided by NSF and JAMSTEC.

4. Options for the maintenance of the core repositories are presented in the TAMU phase-out plan.

5. Creation of the DSDP/ODP bibliographic database is well underway and a detailed report was presented in the Science Operator's report in the EXCOM agenda book and further details will be provided to SCICOM, in response to August SCICOM motion 00-2-12

ODP Co-Chief Review

The next co-chief review is scheduled for April 2 and 3, 2001, in Washington DC. This date approximately coincides with the 25th anniversary of JOI as a non-profit corporation. JOI will host the meeting, as it has for the last two reviews. Co-chiefs from Legs 181 through 192 have been invited, as have representatives from Science Operations (TAMU), Wireline Logging Services (LDEO-BRG), Site Survey Data Bank, JOIDES (SCICOM Chair), and NSF. An agenda is being prepared and a report on the outcome will be presented to SCICOM at their next meeting.

External Evaluation of JOIDES drilling proposals

JOI continues to conduct the twice-yearly external evaluation of JOIDES drilling proposals. Based on the last JOIDES SSEPs meeting in November, eleven proposals were selected for evaluation. JOI typically secures four evaluations per proposal.

JOIDES EXECUTIVE COMMITTEE MEETING
KAMAKURA PRINCE HOTEL
KAMAKURA JAPAN
29-30 JANUARY 2001

SUMMARY OF DRAFT MOTIONS

EXCOM Consensus 01-1-1: EXCOM approves the agenda of this meeting
Orcutt moved, Prior seconded; 14 in favor, 1 absent (Kent).

EXCOM Motion 01-1-2: EXCOM approves the minutes of its June 2000 meeting.
Hiscott moved, Beiersdorf seconded; 14 in favor, 1 absent (Kent).

EXCOM Motion 01-1-3: EXCOM acknowledges the initial planning done by JOI and its subcontractors to prepare for the winding down of ODP from FY03 through FY07. EXCOM recognizes that detailed project planning is now needed to ensure that no gaps or overlaps occur during the lead-up to and phase out. EXCOM requests JOI to continue to develop the phase-out project plan, including contingencies and options for most cost-effective implementation, and report again in June 2001.
Falvey moved, Mutter seconded; 14 in favor, 1 absent (Kent).

EXCOM Motion 01-1-4: EXCOM acknowledges preliminary plans made by JOI and its subcontractors for the maintenance of ODP and JANUS databases, core repositories and other ODP legacies after ODP ends. EXCOM recognizes that detailed planning will be a continuing activity as new types of observations and measurements are made, and encourages JOI to develop up-to-date plans for this activity and to make regular reports to EXCOM.
Beiersdorf moved, Detrick seconded; 14 in favor, 1 absent (Kent)

EXCOM Motion 01-1-5: In response to the request from IWG for nominations to iPC and iSAS panels, EXCOM proposes that the distribution of nominations to each panel be as follows:
(1) U.S.A. - 6 nominations, to be determined by USSAC
(2) Japan - 6 nominations, to be determined by OD21 Science Advisory Committee
(3) One nominee each from U.K., France, Germany, Canada, Australia and ECOD, to be determined by appropriate national committees or

organizations.
Where possible, EXCOM encourages that individuals be selected who are members of parallel JOIDES panels. Nominations should be provided to the EXCOM chair and the OD21 Science Advisory Committee Chair by March 1, 2001.

Hiscott moved, Falvey seconded; 15 in favor.

EXCOM Consensus 01-1-6: EXCOM recognizes the exciting science, technological achievements and important interactions with other earth science programs by Legs 190-192.

EXCOM Motion 01-1-7: EXCOM concurs with the SCICOM motion 00-2-15 concerning the terms of office of the current JOIDES advisory panels.

Larson moved, Stoffa seconded; 15 in favor.

EXCOM Motion 01-1-8: EXCOM: EXCOM requests that JOI provides necessary support to develop a "Greatest Hits" document during the current calendar year. The JOIDES Office will work with the ODP members in the selection of these topics and oversight will be provided by the JOIDES Public Affairs Committee. The SCICOM Achievements and Opportunities document will be a valuable resource for their effort. The target audience includes the public, Congressmen and Ministers.

Orcutt moved, Prior seconded; 15 in favor

EXCOM Motion 01-1-9: EXCOM approves the FY02 Science Plan.

Beiersdorf moved, Taira seconded, Orcutt and Silver were excused for conflict of interest; 12 in favor, one abstain (Larson)

EXCOM Consensus 01-1-10: EXCOM accepts Eli Silver's gracious invitation to meet in Santa Cruz in early 2001.

EXCOM Consensus 01-1-11: EXCOM thanks Asahiko Taira at his last meeting as EXCOM member for his diligent service. His input has always been very useful, and has been an important link to IODP. We wish him well in his future. We will miss him very much.

EXCOM Consensus 01-1-12: EXCOM thanks Asahiko Taira, Satsuko Tanaka, Naoko Shiba, Hiroko Imoto and Masanori Ienaga for helping to organize and run a very successful EXCOM meeting.

Fall 2000 Joint Meeting of the Scientific Steering and Evaluation Panels for the Dynamics of Earth's Interior and Earth's Environment

November 7-9, 2000, King Kamehameha Hotel, Kona, Hawaii

Tuesday Morning, November 7, 2000

I. Introductory Remarks.

ESSEP Chair Neil Lundberg and ISSEP Chair Julie Morris opened the Eighth Joint Meeting of the Scientific Steering and Evaluation Panel After introduction of panel members, liaisons, and guests, the meeting host, Mike Mottl of the University of Hawaii, offered some information on local logistics of the meeting. The panels thanked the meeting host for organizing an outstanding field trip focused on the volcanology of the Big Island. They also expressed their deep appreciation to Scott Rowland, also from the University of Hawaii, who led the trip, which included a hike into the caldera and to localities on the south coast where skylights in the lava tubes provided direct views of flowing lava. The panels are grateful to Mike Mottl and Bridget Chisholm, of the JOI office, for the outstanding arrangements for the meeting.

II. JOIDES Office report: Bill Hay

A. Bill reported on the August 2000 SCICOM/OPCOM meeting, where 30 proposals were evaluated and ranked. OPCOM reviewed and revised the existing schedule from Leg 200 on, and scheduled new legs as indicated in the schedule below, which is subject to EXCOM approval at their January 2001 meeting.

Schedule:

193: Manus Basin	9 November-6 January 2001
194: Marion Plateau	6 January- 4 March
195: Mariana/W. Pacific Ion	4 March- 2 May
196: Nankai II	2 May-1 July
197: N. Pacific Hotspots	1 July-27 August
198: Shatsky Rise	27 August-23 October
199: Pacific Paleogene	23 October- 16 December
200: H2O Site	16 December-6 February 2002
201: Peru Biosphere	6 February-7 April
202: SE Pacific Paleoceanography	7 April-6 June
203: Costa Rica Margin	6 June-5 August
204: Oregon Gas Hydrates	5 August-3 October
205: Eq. Pacific ION Site	3 October-8 November

Bill noted several main points in this changed schedule:

a. The Gas Hydrate weather window in the previous schedule was poor, so the Leg was rescheduled to 2002 to optimize weather window, transit time etc
b. Leg 199 (Paleogene Equatorial Paleoceanography) drilling may be extended if Leg 200 (H2O Site) drilling takes less time than expected

c. Legs 199 and 201 have some similar sites, and some combination of sites may be possible
d. The last currently scheduled leg (205) ends 9 November 2002.
e. The schedule was deliberately crafted to position the ship near the Panama Canal to minimize transit time and optimize fuel usage for transit to the Atlantic in 2002.
f. The highest ranked proposal (Arctic) is not drillable in the current program. The Arctic PPG expects to have a prelimary report end by the end of this month, with a final report in January. SCICOM is currently establishing a DPG for Lominosov Ridge drilling . Due to the difficult conditions, GEOMAR s estimate for costs per sample recovered lies somewhere between that of moon rocks and 504B. SCICOM is looking for nominations to the DPG, particularly people with expertise in polar expeditions and ice drilling. The Office of Polar Programs is also providing expertise.
g. Changes were made to the Nankai II Leg: First will be a LWD mini-leg, ca. 3 weeks. Then corking of near trench sites; upslope sites in out-of sequence thrusts are now not considered candidates for corking, so back to original plan.
h. Budget: fuel costs have not returned to expected, historically average, lower values, so some changes in schedule must be considered to offset increased fuel costs.

B. Bill showed an overhead with the complete list of proposals considered in August, with dispositions for each proposal. Proposals could be forwarded to OPCOM for scheduling, retained for consideration at SCICOM in August 2001, forwarded to IODP for consideration during the next phase of drilling, or deactivated.

C. Interim science committees: Bill led a discussion of the role of the science panels during the transition to IODP. Bill notes that they will be similar to the current panels, with their mandates now being written up at IPSC. The interim SSEPs (iSSEPs) panels will review and nurture proposals, but will not group them. The interim SCICOM will not rank or schedule legs. The expectation is that the fall iSSEP meeting will be back to back with OD21 meeting, with many of same people serving on both panels. The final IODP advisory structure may differ somewhat from the interim structure, and will depend on participation by member countries. IPSC will focus on specifics in their January, 2001 meeting.

D. There were several questions for Bill.

Julie Morris asked about the recent history of ODP s efforts to facilitate interaction with industry, as background to a preproposal for JOIDES/Industry drilling in the Gulf of Mexico. Bill noted that a JOI/USSAC sponsored workshop held in Houston in 1999 emphasized the importance of such cooperation and noted possible areas of interest. The specific preproposal resulted from a subsequent SEPM meeting. As currently written, the preproposal is based on the assumption that 2 riser ships would participate in the next phase of drilling, which is not the case. Bill emphasized the point that any cooperative venture must be on the basis of scientific interest to be of value to JOIDES.

Keir Becker asked how SCICOM decided which proposals were to be deactivated, and which forwarded to IODP. Bill answered that proposals were deactivated when there was no proponent response to prior SCICOM request for revisions.

The issue of the quality of figures in proposals sent for external review was raised, as some proposals seen by the panels had some illegible figures. The JOIDES office could burn CD-Roms for each reviewer, including figures, which would minimize degradation of figure quality due to multiple Xeroxing. It isn t possible to allow reviewers to access proposals on the JOIDES web site because reviewers are required to be anonymous to the JOIDES advisory structure; reviewer log on to the website would violate confidentiality. Warner noted that some proposals have poor quality figures in their original .pdf files. The panels will pay attention to the issue of figure quality during their deliberations and note which proposals need improved quality before external review, and request the JOIDES office to work with proponents to deliver improved figures where necessary.

III. Incoming SCICOM Chair, Keir Becker

A. Keir Becker of the Rosentiel School of Marine and Atmospheric Science, incoming head of the JOIDES office and chair of SICOM/OPCOM, reported on the new JOIDES office. Keir noted that the new office begins to operate as of Jan 1, 2001, with the transition effort started with his trip to GEOMAR in September, 2000. The JOIDES office personnel are Keir Becker, Chris Harrison (EXCOM), Elspeth Urquarht as international liaison, and a science coordinator to be named this month.
Keir noted that after the November SSEPs meeting, proposal files and database will be shipped from GEOMAR to RSMAS, and that the website will be copied to RSMAS for modification, with the website to commence 1/1/01.
Keir provided the attendees with contact information as of January 1, 2001:
Phone: 1 (305)361-4668
FAX: 1 (305)361-4632
E-Mail: joides@rsmas.miami.edu
Web Site: http://joides@rsmas.miami.edu

B. Keir also discussed the JOIDES transition to the interim structure. He noted that the final scheduling of ODP drilling legs will occur at SCICOM s Aug 2001 meeting. SCICOM recommended that the JOIDES panels continue through September 2003. As the time required by the advisory structure for tasks related to proposal scheduling decreases, SCICOM recommends that more time be invested in documenting and evaluating the ODP legacy, especially by SCICOM and the SSEPs. The SCICOM legacy document would further thematic evaluations of drilling related science. Keir finished by noting that the interim Science Advisory Structure (iSAS) would phase in during 2001, and requested nominations for iSSEPs staffing.

IV. SCICOM Liasions Report

Scicom liaisons Nils Holm (ESSEP) and Sherman Bloomer (ISSEP) discussed issues from the August 2000 SCICOM meeting that affect the SSEPs.

A.Sherm presented a complete list of proposals considered at SCICOM, showing the actions taken in the case of each proposal. He and Nils further discussed the criteria by which proposals were scheduled, selected for carryover to the August 2001 SCICOM meeting or referred to IODP. The proposal ranking guidelines emphasize the importance of ranking proposals on scientific criteria. In practice, rankings are primarily scientific, although proposal maturity, site survey completeness, proposed locations relative to the ships track and the extreme competition near the end of this phase of drilling all play into the way SCICOM members rank proposals. Twelve proposals were forwarded to OPCOM for possible scheduling, and the question was asked how these twelve were separated from the other proposals. There was a break in mean score that separated the top 12 from the rest; this combined with a need to be realistic in considering the few slots to schedule dictated the number forwarded to OPCOM. Ten proposals were carried over to the August 2001 SCICOM meeting, with the remainder forwarded to IODP. Most proposals forwarded to IODP were either outside the area of ships operation or needed additional information or site survey work to be considered for drilling. A general difficulty in adhering to strict scientific ranking at SCICOM is that some scientifically important proposals are clearly out of the area of operation or not ready to drill, and may therefore be ranked lower than their scientific merits dictate. This in turn may affect proponents ability to fund site survey cruises, etc. Bill Hay made the suggestion for SCICOM in the future that all proposals first be ranked strictly on scientific merit, then proposals that are in the area of ship s operation be re-ranked for scheduling purposes.

B. SCICOM Motions. Nils and Sherm discussed the following SCICOM motions and their impact on the SSEPs:

00-2-5: Established the Arctic DPG for Lominosov Ridge

00-2-6: Clarified guidelines for Ancillary Program Letters (APL) to be < 2-3 days dedicated ship time in the area of drilling of the scheduled Leg.

00-2-13: Approved plan for TEDCOM to work with SciMP and TAMU to provide 1 page tool summaries for each tool in use, as part of the ODP legacy activities.

00-2-14: Established plan and timeline for ODP Legacy document.

00-2-15: Recommended that the JOIDES SSEPs be extant through 9/03, with extensive overlap with iSSEPs.

There was discussion of the planned legacy document, and concern that it might repeat much of what is in the ODP Greatest Hits Volume, or is already discussed at some length in the Initial Science Plan for IODP. The planned legacy document would be intended for a general audience and for funding agencies, as well as members of the drilling community. The format will be invited contributions, ca. 2600 words and four figures each, thematically focused on important areas of ODP science. The deadline for article submittal will be June 2001, because funding agencies will need them by then. The articles will also be published in the JOIDES journal, which has a circulation of ca. 8000. Editors for the volume will be Larry Peterson, Catherine Mevel, John Tarduno, and Harry Elderfield.

There was also general discussion at SCICOM, but no motion, regarding deep drilling during IODP with the JR successor. It is regarded as an important capability for the non-riser ship, and one that is unlikely to be tested before 2003, despite the fact that several deep hole proposals were submitted in response to a request for proposals for deep drilling.

V. JOI Report: Neil Lundberg reporting for John Farrell and Frank Rack

Using materials provided by Frank and John, Neil provided a brief overview of the current ODP advisory structure, and the position of the SSEPs therein.

A. Neil then reported on recent personnel changes at JOI:

The JOI Board of Governors has appointed a Management Oversight Committee (MOC) to oversee the Ocean Drilling Program. The MOC is chaired by Robert Detrick (WHOI). The other members are Jim Gill (UC Santa Cruz), Dennis Kent (Rutger s University) and Neil Opdyke (U. of Florida).

Admiral Watkins, President of JOI/CORE retired effective October, 1, 2000. A corporate split between JOI and CORE was implemented and Dr.John Orcutt was designated as Interim President of JOI

Dr. Steve Bohlen, from the U.S. Geological Survey, has been named President/Executive Director of JOI, effective 11/27/00.

B. Neil then discussed Long Range Plan Initiatives that include:

Deep Biosphere Program Planning Group and lab upgrades; Gas Hydrates Program Planning Group and Tool Development and Alternate Platforms Program Planning Group, shallow water continental margin drilling, coral reef drilling and arctic drilling.

C. Neil announced an ODP Town meeting to be held during AGU in San Francisco, December 2000.

D. Neil closed by showing IPSC/IODP Web Site addresses. Input to the Initial Science Plan for IODP and the Conceptual Design Committee for a post-2003 non riser ship, was requested from attendees before mid November, 2000. This is helpful feedback to IPSC for their Nov. 20-29, 2000 meeting, which will in turn provide documents to the International Working Group (IWG) for their meeting in January, 2001.

VI. NSF Report, Julie Morris reporting for J. Paul Dauphin and Bruce Malfait.

A. NSF has been extremely busy in implementing changes and agreements necessary to bring about IODP. Julie reported the following, provided by Dauphin and Malfait, and excerpted from an article by Paul Dauphin in the fall USSAC newsletter:

* The director of NSF and the Japanese minister of STA issued a joint public statement indicating strong support for a next phase of scientific ocean drilling
* IODP will commence Oct 1, 2003 with non-riser ship operations scheduled to start in FY 2005 and for the riser-capable ship in FY 2006
* During the interval from 1 Oct 2003- 1 Oct. 2004, NSF will support conversion of a non-riser vessel to CDC specifications, site surveys, and program planning
*The riser vessel is under construction in Japan, and the final budget allocation from the Japanese government is expected in 2001
* NSF will present the U.S. plan for IODP to the National Science Board, Fall 2001

*USSAC (U.S. Science Advisory Committee) is currently preparing a U.S. companion to the Initial Science Plan for presentation to the NSB, and is also examining and recommending to NSF optimal models for support of US scientists in IODP
*NSF/Ocean Sciences (OCE) Personnel has undergone some changes with Mike Purdy, OCE Division Director, leaving NSF to become Director at Lamont Doherty Earth Observatory. A search for a permanent replacement is underway; D. Heinrichs is the Acting Division Director. The head of the Ocean Sciences Research Section, Mike Reeve, has moved to Centers & Facilities.

B. Paul Dauphin reported via Julie on the status of productive negotiations with the Japanese government leading to a formal understanding of some guiding principles for IODP:
*IODP will be a scientific research program based on international cooperation
* The core of the IODP program is a riser-capable and a non-riser ship with a single science advisory structure. Additional drilling capability may sometimes be required
*Legal & financial platform responsibilities (including mobilization & operation) will reside with Japan for the riser-capable ship and with the USA for the non-riser ship. For additional platforms, the sponsoring organization will assume legal and financial responsibilities.
*Financial contributions for international partners will be co-mingled to support science operations (including those resulting from alternative platforms).
* IODP membership is currently open, and will require a 10 yr Memorandum of Understanding. The specific financial contribution required for "a participation unit" in the program is not yet finalized. Contribution of an alternative platform will not be accepted in lieu of annual IODP membership contribution.
* STA & NSF will contribute equally to the total program costs & will acquire additional units if necessary to fully support the program
*An Interim Science Advisory Structure (iSAS) to operate from June 1, 2001 to Oct 1, 2003.

C. For 2001, NSF/ODP has tentatively committed to support of the following site survey and pre-cruise proposals:

1. An MCS and OBS study of rifting processes in the Gulf of Aden under the direction of Neil Driscoll (Woods Hole), John Diebold (Lamont) and Brian Taylor (Hawaii).
2. An MCS study of megamullions on the Mid Atlantic Ridge by Brian Tucholke (Woods Hole).
3. A heat flow study of the eastern Cocos plate under the direction of Andy Fisher of the University of California at Santa Cruz.
4. A study of the geochemistry and structure of serpentinite diapers in the Marianas forearc under the direction of Patty Fryer of the University of Hawaii.
5. A seismic study of gas hydrates on the Oregon margin by Ingo Pecher (University of Texas)
6. Construction and installation of instrumentation in the corks to be deployed at Nankai under the direction of Keir Becker, University of Miami.

Additional proposals are still being evaluated in light of budget constraints and review comments. Beyond 2001, NSF funding will begin to focus on research and data acquisition required for preparation of drilling proposals in IODP.

VII. Logging Report, Ulysses Ninneman, ESSEP Logging Liaison

Ulysses reported on two new tools that could provide much needed capacity for improved core-log integration.

The Multi-Sensor gamma-ray tool is particularly useful where depth correlation between core and log or between multiple adjacent cores is critical. A test of this tool in Houston in June 2000 shows that the new tool has much better resolution than currently possible (3-4x existing tool; ca 10 cm). Tests on Hole 1179D using both conventional and the multi-sensor tool showed that the amplitude and position of peaks are much better resolved with the multi-sensor. This resolution provides improved capability for core-log correlation, but noise in the multi-sensor track (MST) makes this difficult. SciMP is planning to upgrade the shipboard MST sensors to provide a record complementary to the new multi-sensor gamma-ray tool. The new tool fits on a standard Schlumberger wireline tool string and requires 1 extra pass, about one hour of additional time. Ulysses also discussed magnetic susceptibility measurements as another critical tool for core-log integration. There are many on-market tools that could reasonably be adapted for ODP, and the logging group is exploring these options.

VIII. PPG Reports

A. Hydrology PPG, Barbara Bekins, ESSEP liaison to the Hydrogeology PPG

Barbara reported on the 2nd meeting of the PPG, held Sept. 24-25, 2000 in Paris, France. Much of the focus of this meeting was on the technology available for measuring state of stress and determining fluid flow. Presentations were made by Warner Brueckmann on site survey techniques, by Dave Goldberg discussing logging approaches, and by Kevin Brown, liaison from the Seismogenic Zone DPG. Detailed minutes of this meeting may be found on the JOIDES web site.

The PPG members discussed a draft report covering: 1) the importance of fluid flow; 2) driving forces for flow and 3) tests and technology.

They also planned for a second draft that would:

1. Identify five settings where fluid flow is a key process, and prepare case studies outlining conceptual models, study approach, types of measurement possible for each of the following settings. Names indicate PPG members with primary responsibility for each section.

a) active margins including accretionary prisms and the seismogenic zone, Tokunaga & Henry
b) mid-ocean ridges , Davis
c) carbonate platforms, Whittaker & Swart
d) coastal zones, Kooi & Voss
e) subsurface biosphere and gas hydrates, Bekins and Brown.

And

2. Develop the following recommendations for the drilling program:
   a) undertake routine measurement of hydrogeologic parameters;
   b) staff hydrologists on relevant legs
   c) encourage legs dedicated to fluid flow

d) support fluid flow analyses and modeling with a special pool of funds, with awards to be recommended by a panel of hydrogeologists and the MG & G community
e) sponsor a workshop identifying key questions, to expand participation beyond current members of the PPG to a broader group of scientists and and expand funding for hydrogeology studies beyond the now typical industry sources and applied programs.

The third and final meeting of the PPG is proposed to be in Miami, Feb 25-26, 2001, with Peter Swart as host. The emphasis for this meeting will be on technical aspects of hydrogeologic studies using the riser and non-riser ship.
Barbara noted that the SSEPs are not likely to see a proposal emerging from the PPG as a group. There is now, however, the Dogger bank pre-proposal in the system and a carbonate banks proposal is likely to be forthcoming. Other communities, such as those involved in studies of the seismogenic zone and gas hydrates, are already active.
Keir Becker noted that the PPG s time line in its mandate from SCICOM required a final report by March 2001, which could be presented to SCICOM at its March 2001 meeting in Shanghai. Barbara noted that the PPG should have a draft report available by March, but probably not the final version. Barbara made the point that a better product would emerge from the PPG if the deadline for a final report were somewhat later, allowing PPG members to thoughtfully incorporate results from the third meeting. The SSEPS could look at an electronic draft version in March, 2001. SCICOM must approve an extension of the deadline for the PPG and a third meeting. At the end of this meeting, the SSEPs will discuss a resolution recommending extension of the Hydrogeology PPG.

B. Arctic Climate PPG. Hans Brumsack, ESSEP Liaison to the Arctic Climate PPG
The Arctic Climate PPG held its second meeting, June 26-27, 2000 at the Geological Survey of Canada in Calgary, Canada. Detailed minutes of the PPG meeting may be found on the JOIDES website. The PPG conducted a status review of the Lomonosov Ridge Drilling Proposal 533, which was very highly ranked by SCICOM. The review concluded that successful drilling in the high Arctic Ocean requires a drilling platform and two support icebreakers.
Future actions for year 2000 include:

- attempt to acquire funding for seismic cross lines at proposed drilling locations in response to request from the SSP.
- Establish a time frame for the remaining schedule if Proposal 533 were to be scheduled for drilling by SCICOM. The optimal window would be July-Sept. 2003.
- Schedule proponent group to meet at Lamont for an update of the site survey package.

Year 2001

- Lomonosov Ridge expedition planned by the Swedish Polar Research Secretariat 5 days for seismic reflection program provided that funds to cover shiprate are obtained

PPG Discussion of Lomonosov Ridge drilling include the following:

* The need for seismic cross lines, and how to fund them. Members noted that site survey data are very expensive in the Arctic.
* BSR & hydrocarbon consideration; there is no indications so far of serious safety issues.
* Core analyses recommended on the drilling barge: hydrocarbon monitoring, micropaleontology, and multisensor track (MST). Desirable are labs for ephemeral properties such as pore water chemistry and microbiology.
* Timing: up to 2yrs advance planning would be required for the drilling leg
* Contingency Planning: back-up sites are required for flexibility

Hans reported that PPG members also discussed a wide range of broader scientific objectives for Arctic drilling. These included the vital role of the Arctic in Cenozoic climate change; the record of Mesozoic global anoxic events in the Arctic; the tectonics of Arctic ridges and plateaux, and the tectonics of Arctic gateways; hydrates, fluids and microbiology of the Arctic and the prospect of generating a greatly needed new chart of the Arctic. Hans noted that there should be no difficulty in generating exciting new proposals for Arctic drilling, but the community is waiting to see the fate of Proposal 533 before undertaking major new efforts in proposal development.

The PPG also reviewed the technological demands of Arctic drilling systems
They note that successful drilling would require a vessel of Polar Class 4 (PC4) or better. The existing fleet that meets these standards includes: 25 Russian, 6 Swedish, 10 Candian, 2 US and 2 Finnish vessels. The most powerful vessel for these conditions is Polar Class 6, Russian nuclear-powered vessels are best for the distance ice management required. The PPG developed two possible drilling scenarios and their requirements for drilling 500 mbsf in 2000m water depth in the Arctic.

Scenario 1:

- Drilling rig aboard an Ice Class Barge (e.g. the Sea Sorceress, with dynamic positioning from azimuthal thrusting)
- 2 dedicated ice management vessels; one should be a Russian nuclear icebreaker.
- Tow the barge to site and keep in place by anchors or vessel
- Use continuous ice management and early warning systems for oncoming heavy ice conditions.

Scenario 2:

- Mount drilling rig on the after deck of an icebreaker
- 2 dedicated ice management vessels.

A problem might be fuel capacity a large Ice Class Barge may be needed to provide fuel.
The PPG made a series of conclusions and recommendations regarding the Lomonosov Ridge proposals:
Scenario 1 is the most suitable using the Sea Sorceress
A commerically available drill rig system appear to be viable

Detailed long term planning needs to begin ASAP, with representation from the proponent group
Total cost: estimates vary from 1-2x the cost of standard ODP legs.

With respect to the general requirements for Arctic Drilling, the PPG noted that jurisdiction is multinational as only a small central portion of the Arctic is International waters. Environmental aspects will require cooperation with international agencies, several national governments and various NGOs. The PPG advise that ODP strongly emphasize the minimal environmental impact of shallow penetration scientific drilling, in comparison to oil and gas drilling.
The next and final meeting is requested for Stockholm, Jan 20-30, 2001. Jan Backman will be the host. The PPG will be finalizing their report for the March 2001 SCICOM meeting.

Mitch Lyle, SSP liaison to ESSEP, commented that site survey work costing ca. $100,000 is small for $15M program and so funding should not be an issue. Seismic work can be an added on to the Swedish cruise scheduled in 18 months.
Mitch also noted that SSP has 3 seismic lines in the repository. Much other data is noted as available but is not in repository. Because SSP doesn t yet have a complete package, they cannot determine whether the Lomonosov Ridge Proposal is ready to drill from a SSP perspective.

Michael Enachescu, SSP liaison to ISSEP, noted that Husky Oil has been drilling in the Arctic for 30 years and that well costs are typically double the estimates. He notes that Arctic Drilling management will require accurate knowledge of financial and technological (e.g. barges, icebreakers, etc) commitment well ahead.

A general discussion followed regarding European plans for ice drilling. Bill Hay noted that a meeting will be held in January, 2001 in Belgium to discuss the possibility of Arctic drilling during the interval between ODP and IODP drilling. The critical need would be to convince funding agencies to support such drilling. NSF funding during the interval is committed to converting and outfitting a non-riser ship, while STA funds are committed to the riser ship. European funding is not committed to other activities, but much remains to be worked out.
Michael Enachescu commented that the program should negotiate turn-key operation with a fixed cost for the total program, rather than agreeing on a day rate. Jurgen Thurow commented that the costs will be critically dependent on fuel costs (half of total). Ice barge availability was previously relatively easy and inexpensive cheap, but they are now more in demand from the oil industry.

C. Arctic DPG .
At its August 2000 meeting, SCICOM approved an Arctic DPG for Lomonosov Ridge Scientific Drilling. Hans presented to the SSEPs the overall goals, mandate and timeline for the DPG, which is available on the JOIDES web site. The DPG is still being staffed and nominations from the SSEPs are welcome. Hans noted that many Arctic PPG members and guests represent a lot of capability that should be incorporated in the DPG.

IX. ODP-TAMU Report, Part I: Engineering and Operations, Carlota Escutia & Gary Acton.

Carlota reported that seismometer installation on Leg 191 (W. Pacific Ion/Hammer Drill Engineering) went very well. The seismometer was installed in basaltic basement beneath 570 m of sediment cover in water 5777 m deep. This site in not in the vicinity of a submarine cable, so ROV data retrieval will be required yearly. A Japanese cruise is already scheduled. Hammer Drill testing on Leg 191 was limited to 2 days because of weather problems. They performed a spud-in test in basalt in the Mariana back arc with OPS in volcanic lava flows ranging from 2.7-9 m/hr. Supplemental bracing of the JR standpipe during the dry-dock has apparently resolved the harmonic vibrations experience previously. They did not test drill-in casing due to time limitations, and may test it on Leg 193.

Carlota also discussed the status of microbiology studies in recent ODP legs. She noted that Legs 185, 187, 190, and 191 all have a significant microbiology component.

Carlota discussed the two tests used to quantify drilling induced contamination of ODP cores. Tracers used are perfluorocarbon chemical tracers and fluorescent microspheres as particulate tracers introducted when drilling soft sediment, sedimentary rock and basalt. Perfluorocarbon experiments show that drilling fluid intrusion is ca. nannoliters per gram of cored material, corresponding to 1-10 bacteria per gram. Microspheres were never detected in the interior of material cored by APC, XCB, or RCB. The tracer experiments indicated that cores recovered on the JR can be suited for deep biosphere research. Leg 185 personnel noted that post-recovery sample handling can be a source of contamination, and developed a sampling protocol. ODP Technical Note 28, "Methods for Quantifying Microbial Contamination during Deep Ocean Coring" is available on the ODP web site under Publications.

Carlota presented the present status of microbiology, with a series of recommendations for incorporating microbiology as a standard part of most drlling legs. She noted the needs to develop a basic program which can be routinely done as part of multidisciplinary ODP leg, develop a list of routine microbiological supplies to be stocked, hire two technicians with microbiology background (who will be cross-trained for the chemistry lab), develop sample protocol for sampling, define basic sampling tools now provided by participating scientists, develop a cookbook for contamination tests to be routinely conducted by the technical staff, and to continue two-way educational process between ODP and the microbiology community.

Carlota concluded by discussing the status of the Gas Hydrate Autoclave Sampling and Monitoring System (HYACE). A third-party tool, HYACE was originally scheduled to be tested on Leg 191 but was not ready. Its now scheduled to be tested during three days at the beginning of Leg 194. Six HYACE engineers are scheduled to sail on the JR during the tests. Tests will be conducted at Site CS-13 in a Miocene to recent sequence of carbonate reefal debris and peri-platform oozes with continental influx of fine-grained terrigenous material. The test program for deploying the HYACE tools is now being defined, along with details of how to handle the pressure samples recovered.

Gary Acton discussed recent developments for the Advanced Diamond Core Barrel (ADCB), which ODP expects to test on Leg 193 and 194. Two land tests recently completed provided 96 and 86% core recovery. The ADCB has a smaller outside

diameter than the RCB, with larger inner diameter, resulting in ca. 2.1 times more core than the RCB. It operates with smaller drill collars than standard (6 3/4 vs. 8 1/4) and so is limited to <200m penetration. The system requires good control of weight on bit, and the new AHC is likely to provide the control needed. The ADCB is not intended for bare rock spud in; rather, the hammer drill or RCB will be necessary to start holes. Gary also noted that A-CORKS are under fabrication for Leg 196. One CORK will include a seismometer, located in the middle. They have developed a new re-entry design, which saves money by removing some unused capability in the standard cone. Gary noted that its use requires a BHA change, so it may not be time effective for chert-chalk sequences for example.

Separate ISSEP and ESSEP Meetings to Review Proposals

The SSEP chairs reviewed the conflict of interest rules prior to the start of proposal reviews. Proponents are excluded, as are those having active projects closely related to the projects proposed. For Ancillary Program Letters (APL), nominated co-chiefs must recuse themselves. SSEP members at the same institutions as a proponent must identify themselves to the SSEP chairs prior to review discussions. At this fall meeting, the major job of the SSEPs is to decide which proposals are mature enough for external review before forwarding to SCICOM. We also considered a few externally reviewed proposals.

During the meetings (November 7-10), the SSEPs considered the following proposals:

Prop. No.	Title	Lead Prop.	SSEP
543-Full2	(was 580-Full) CORK Hole 642.E	Harris	E
547-Full3	Oceanic Subsurface Biosphere,	Fisk	Joint
548-Full2	Chicxulub: Drilling the K/T Impct	Morgan	E/I
554-Full4	Gas Hydrates in a Petroleum Basin	Kennicutt	E/I
557-Full2	Storegga Slide Gas Hydrate	Andreassen	E/I
572-Full2	Late Neogene climate, N Atl: distal LISO	Channell	E/I
573-Full2	Modern Carb. Mounds, Porcupine basin	Henriet	E
574-Full	Hydrotherm. proc. & metallogen. in mantle	Fouquet	I/E
575-Full3	African Climate, Gulf of Aden	deMenocal	E/I
581-Add	L Pleistocene Drowned Reefs	Droxler	E
585-Full	Murray Ridge Deep Drilling	Clift	Joint
586-Full	Hawaiian Reefs and Basalts	Rubenstone	Joint
588-Full	N. Atlantic Cretaceous Gateway	Gradstein	E/I
589-Full2	Gulf of Mexico Overpressures	Flemings	E/I
590-Pre	JOIDES-Industry Drilling in GoM	Fillon	E/I
591-Pre	Magmatic-Hydrothermal Systems	Herzig	I/E
592-Pre	Shallow Drilling in Dogger Bank	Andriessen	E/I
593-Pre	Terresterial/Ocean Interaction, GoM	Flower	E
594-Full	Newfoundland Margin	Tucholke	I/E
APL-13	Re-Drill Hess Rise	Erba	E
APL-16	Mertz Drift	Harris	E
APL-17	Scotian Margin Cenozoic	Piper	E/I
APL-18	Loc. of Grenville Front, N. Atlantic	Scanlon	I

EXTERNALLY Reviewed Proposals

561-Full2	Caribbean Large Igneous Province	Duncan	I
584-Full	TAG II: Volc.-hosted Hydrotherm	Rona	I\E

Addendum to Proposals at SCICOM

577-Add2	Paleog. & K Paleocean., W. Equat. Atl.	Erbacher	E

The panels ended the afternoon session at 1800.

Tuesday Evening, November 7.
Meetings of Joint SSEP Review Working Groups

Joint ISSEP-ESSEP Working Groups,
Meeting Tuesday, November 7, 2000, 20:00
King Kamehameha Hotel, meeting rooms

These joint working groups met Tuesday night, after the two panels have separately discussed the proposals of joint interest. The first job of the working group was to ensure that a single coordinated review, representing both panel perspectives, gets written. This means reconciling different viewpoints between the panels, and deciding individual responsibilities for writing and revising the panel comments. Both panels met together Wednesday afternoon to discuss proposals of joint interest.

Note that some working group members may have conflicts of interest with a proposal in their working group. Members discuss jointly all those proposals for which there are no conflicts. After that, they discuss those proposals where there is a conflict, with the conflicted person out of the room.

The themes of the working groups, and their numbers have been changed to reflect the changing nature of incoming proposals.

Joint Working Group on Deep Biosphere Zone and Gas Hydrates.
These two groups met jointly to discuss the microbial aspects of gas hydrate proposals, then separated to discuss proposals, or aspects thereof, that are strictly deep biosphere (DB) or gas hydrates (GH).

Members:
Dave Vanko
Ingo Pecher
Paul Baker
John Hayes, Working Group Leader
Hans Brumsack

New/revised proposals for consideration: 547-Full-3 (DB), 554-Full4 (GH/DB), 557-Full2 (GH/DB), 573-Full2 (DB), 574-Full (DB) and, time permitting, 584-Full (DB)

Joint Working Group on Fluids in the Near-surface
Members:
Mike Bickle (conflict with 584)
Mike Mottl
Harold Tobin
Barbara Bekins, Working Group Leader
Liz Screaton

New/Revised and Pre-proposals for consideration: 543-Full2, 554-Full4, 584-Full, 589-Full2, 591-Pre

Wednesday Morning, November 8, 2000.

Separate ESSEP and ISSEP meetings to discuss proposals.

Wednesday Afternoon, November 8, 2000.

Joint Meeting of ESSEP and ISSEP

I. Discussion of Joint Proposals: Review Working Group Leaders

After another review of the conflict of interest rules, the following Review Working Groups Leaders provided a brief summary of the groups discussions and final recommendations regarding the proposals considered:
Fluids in the Near-surface: Barbara Bekins
Gas Hydrates and Deep Biosphere: John Hayes
During this joint session, the panels also discussed other proposals considered by both panels: Proposals 548, 572, 575, 585, 586, 588, 590, and 594.
The panels wrote a single joint review for each of these proposals.

II. Transition Planning to IODP, Keir Becker

Keir led a discussion of the interim science advisory structure, based on IPSC planning, which will be presented to the IWG in January, 2001. The interim SAS will start meeting in mid-2001. The iSSEPs may begin meeting as early as May 2001, but will definitely be sitting by November, 2001. The respective jobs of the current SSEPs and the iSSEPs in handling incoming proposals during the interim were discussed briefly. Keir and Bill noted that a big job for the JOIDES SSEPs will be in working with SCICOM to help document and evaluate the ODP legacy. An issue still to be worked out is where proponents should send proposals during the interim. The JOIDES structure and office will continue until ODP ends, but will not be accepting new pre-proposals and new proposals. Neil distributed to the panel a copy of the iSAS mandates for the SSEPs, so that panel members may comment on the planned role and responsibilities of the iSSEPs.

III. Recommendations and New Business, Julie Morris and Neil Lundberg

The SSEPs offered several resolutions.

A. Hydrogeology PPG

Given the time required to staff the Hydrogeology PPG, and recognizing the importance of the PPG to IODP drilling, the SSEPs encourage SCICOM to extend the timeline for the PPG long enough to allow thoughtful completion of their final report.

B. Thanks to the GEOMAR JOIDES Office.

The SSEP s express their deep appreciation to the outgoing JOIDES Office. Bill Hay, Warner Brueckmann, Jeff Schuffert, Bettina Rohr, and Emmanual Soeding have kept the program afloat as we head to the end of ODP. Their emphasis on highest quality science, successful transition to largely electronic proposal submittal, and their ability to keep up with the heaviest proposal pressure in ODP is greatly appreciated. The SSEPs extend their thanks for all the JOIDES office members have done.

C. Outgoing ESSEP members

ESSEP deeply appreciates the conscientious and creative input of Barbara Bekins. Her unflagging championing of fluid flow issues has kept us on track, and her appreciation of the broader context has been a model for us all.

ESSEP greatly appreciates the imaginative input of Paul Baker. His expertise is sediment geochemistry has been very helpful, and his consistent offering of alternate opinions has served to broaden scientific discussion and provided fresh insight.

ISSEP agrees!

Other Business

Membership in the Arctic DPG.

SSEPs members were asked to provide SCICOM with names of possible candidates for the Arctic DPG. They noted that much of the current PPG staff is appropriate for the DPG.

IV. ODP-TAMU REPORT Part II: Leg Summaries, Gary Acton and Carlota Escutia

Gary Acton updated the panels on the status of cruise-related publications, noting that Initial Reports volumes up to Leg 186 on now available on the web, as are the Scientific Results Volumes, up to Leg 171. New data synthesis and technical notes are available on the web site, along with the ODP citation list. Authors should send citations to their published papers to ODP for inclusion in the citation list. Gary notes that the Web site has been having a major impact, with an 800% increase in hits on the site between October 1997 and projected hits in 2002. This totals over 1.8M pages accessed.

Gary summarized basic results from Leg 189, which are also available on the web site. The drilling recovered 4.5km of sediment core from around Tasmania, with a goal of understanding the rifting of Tasmania and Antarctica and its role in development of the Circum-Antarctic Current. A major finding of the Leg is the observation of visual changes in sediment from glauconitic sandstones to carbonates, marking a change in the current. A lot of post-cruise isotopic work is underway.

Gary also summarized results from Leg 190, Nankai I. The Leg drilled 6 sites along 2 transects across the trench. They cored through the decollement, which is 6-7 my old in both places. Physical properties are an important part of this leg; the preliminary report is

on the web site. Leg 196, Nankai II, will build on this leg, adding LWD and A-CORKing to better study the deformation and fluid flow.

Carlota Escutia summarized results from Leg 191, which included ION site seismometer installation at site 1179. The test of the hammer drill was discussed earlier. Shipboard scientists also characterized 377m of sediment and 98 m of basalt at Site 1179. These results add to the data base for sedimentology, petrology, and basement chemistry near the Mariana volcanic arc.

Carlota also discussed Leg 192, which focused on the Origin of the Ontong Java Plateau. ODP was unable to obtain clearance to drill at a high priority Solomon island site, did drill 1183-1187. With the leg just concluded, the shipboard party did report some surpising results. At Site 1184, they cored Eocene basaltic ash, not the expected basalt reflector; the party did not hit basalt at this site. They did recover high MgO basalts (9-10%MgO) in approx. 90 Ma pillow basalts overlying approx. 120 Ma basalts.

Leg 193 is just about to start. Clearance to drill was finally granted by Papua New Guinea. PNG government observers will sail to report to the PNG government on economic minerals and to participate in discussion on microbiological sample requests. The observers will have no ability to determine or modify sample requests. The daily report will go to the PNG Government and Nautillus company 6-12 hrs ahead of general distribution. The leg will involve both drilling and LWD at elevated temperatures. They will test ADCB and Hammer in casing during the leg.

Upcoming cruises:
Marion Plateau Leg 194. This leg will include a distance learning trial. ODP will sail 1 teacher to interact with middle school classes. The teaching component will include science modules on climate change, etc. available on web site.

Leg 195: This leg will combine installation of the Philippine Sea Ion Site with drilling and corking of a site in a serpentine mud volcano in the southern Mariana fore-arc. If time permits, drilling to support the goals of APL 14 to study the Kuroshio current, may be included.

IV. Next meeting:
The May 2001 meeting will be held at Airlie House, VA, near Dulles Airport and close to Washington DC. Bridget Chisholm of JOI will be organizing the meeting. Best dates for the panels are May 17-19, 2001, immediately before the Goldschmidt Conference in Roanoke, VA.

The joint session was adjourned, and the formal sessions ended Wednesday at about 4pm Panel members returned to their separate meeting rooms and continued working on proposal reviews. Review writing continued Wednesday evening until about 11pm

Thursday Morning, November 9, 2001

Panel members worked on reviews, and provided panel chairs with electronic copies of reviews and lists of possible external reviewers. The reviews will be forwarded to the JOIDES office for transmission to proponents, and the list of external reviewers will be supplied to the JOI office.

Meeting Attendees

ISSEP
Dick Arculus
Mike Bickle
Peter Clift
Colin Devey
Donald Fisher
Bernie Housen
Benoit Iledefonse
Teruaku Ishii
Julie Morris (Chair)
Mike Mottl
Ingo Pecher
Christopher Small
Piera Spadea
Harold Tobin
David Vanko

ESSEP
Paul Baker
Barbara Bekins
Svante Bj rck
Hans Brumsack
Gilbert Camoin
Chris Charles
Steven Clemens
Craig Fulthorpe
John Hayes
David Hodell
Neil Lundberg (Chair)
Hiroki Matsuda
Dick Norris
Liz Screaton
Juergen Thurow
Kuo-Yen Wei

Liaisons and Guests

William Hay, JOIDES chair
Warner Brueckmann, JOIDES

Jeffrey Schuffert, JOIDES
Nils Holm, SCICOM liaison to ESSEP
Sherman Bloomer, SCICOM liaison to ISSEP
Michael Enachescu, SSP liaison to ISSEP
Mitch Lyle, SSP liaison to ESSEP
Gary Acton, TAMU liaison to ISSEP
Carlota Escutia, TAMU liaison to ESSEP
Ulysses Ninneman, Logging liaison to ESSEP
Keir Becker, Incoming JOIDES chair
Elspeth Urquart, incoming international liaison to the new JOIDES office

Attachment:

A. SSEP Decisions on Proposals Reviewed

Disposition of Proposals, Addenda, Ancillary Program Letters and Externally Reviewed Proposal Nov 7-9, 2000 in Kona, HI

Proposals Deemed Ready for External Review

Prop. No.	Title	Lead Prop.	SSEP	Disposition
543-Full2	(was 580-Full) CORK Hole 642.E	Harris	E	External Review
547-Full3	Oceanic Subsurface Biosphere,	Fisk	Joint	External Review
548-Full2	Chicxulub: Drilling the K/T Impct	Morgan	E/I	External Review
554-Full4	Gas Hydrates in a Petroleum Basin	Kennicutt	E/I	Fast Track, Ext.Review
	Need to ensure that site description forms for all proposed sites are in reviewed copies			
557-Full2	Storegga Slide Gas Hydrate	Andreassen	E/I	External Review
572-Full2	Late Neogene climate, N Atl: distal LISO	Channell	E/I	External Review
573-Full2	Modern Carb. Mounds, Porcupine basin	Henriet	E	External Review
575-Full3	African Climate, Gulf of Aden	deMenocal	E/I	External Review
581-Add	L Pleistocene Drowned Reefs	Droxler	E	External Review
	Send Addendum with 581-Full for external review			
589-Full2	Gulf of Mexico Overpressures	Flemings	E/I	Fast Track,Ext. Rev
	Strongly urge proponents to include seismic line for Ursa site in reviewed copies			
594-Full	Newfoundland Margin	Tucholke	I/E	External Review

Proposals requiring further revision, and submission to IOPD

574-Full	Hydrotherm. proc. & metallogen. mantle	Fouquet	I/E	Revise
585-Full	Murray Ridge Deep Drilling	Clift	Joint	Revise w/add. data
586-Full	Hawaiian Reefs and Basalts	Rubenstone	Joint	Revise w/add. data
588-Full	N. Atlantic Cretaceous Gateway	Gradstein	E/I	Revise
590-Pre	JOIDES-Industry Drilling in GoM	Fillon	E/I	Revised Pre
591-Pre	Magmatic-Hydrothermal Systems	Herzig	I/E	Full w/add. data
592-Pre	Shallow Drilling in Dogger Bank	Andriessen	E/I	Revised Pre
593-Pre	Terresterial/Ocean Interaction, GoM	Flower	E	IODP (or APL w/major changes)

APLS

APL-13	Re-Drill Hess Rise	Erba	E	"Moot" Comments
APL-16	Mertz Drift	Harris	E	Positive Comments
APL-17	Scotian Margin Cenozoic	Piper	E/I	Negative Comments
APL-18	Loc. of Grenville Front, N. Atlantic	Scanlon	I	Negative Comments

EXTERNALLY Reviewed Proposals

561-Full2	Caribbean Large Igneous Province	Duncan	I	Group in May
584-Full	TAG II: Volc.-hosted Hydrotherm	Rona	I\E	Group in May

Addendum to Proposal at SCICOM

577-Add2	Paleog. & K Paleocean., W. Equat. Atl.	Erbacher	E	At SCICOM

Draft 2001 Time Table for iSAS implementation

Jan '01

- Approval of draft iSAS Panel Mandates by IWG

February '01 – March '01

- JOIDES and OD21 advisory structure nominate members for following committees and panels:
  iPC
  iESSEP
  iISSEP
  iSSP
- IWG sets up iSAS Support Office

April '01

- IWG approves iSAS nominees, iSSEPs, iSSP, and iPC membership established

May '01

- iSSEPs members attend JOIDES SSEPs meeting as observers

July '01

- iSSP members attend JOIDES SSP meeting as observers

August '01

- iPC members attend JOIDES SCICOM/OPCOM meeting as observers
- iPC/IPSC develop mandate for interim Pollution Prevention and Safety Panel and discuss needs and mandates for new Industry/Technology liaison panel
- Nominate iPPSP members

November '01

- Joint meeting of iSSEPs and SSEPs
- Establish iPPSP, members attend JOIDES PPSP meeting as observers.

December '01

- iPC establish first riser iDPG.

JOIDES Arctic Detailed Planning Group

Minutes from the 1st Meeting, January 31 - February 1, 2001
Stockholm, Sweden

Members present

Jan Backman	Stockholm University, Sweden (Chair)
Margo Edwards	University of Hawai i, USA
Tim Francis	Geotek Ltd, UK
Mikhail Gelfgat	Aquatic Company, Russia
Martin Hovland	Statoil, Norway
Thomas Janecek	Florida State University, USA
Wilfred Jokat	Alfred Wegener Institute, Germany
Heidi Kassens	Geomar, Germany
Anders Karlqvist	Swedish Polar Research Secretariat, Sweden
Kate Moran	University of Rhode Island, USA
Kozo Takahashi	Kyushu University, Japan

Member absent

Chris Wiley	Department of Fisheries and Oceans, Canada (sent regrets)

Liaisons present

Gene Pollard	ODP/TAMU
David Rea	SCICOM
Alister Skinner	TEDCOM
Trevor Williams	LDEO Borehole Group

Guests

Martin Bergmann	Department of Fisheries and Oceans, Canada
Dmitri Surkov	Aquatic Company, Russia

Arctic DPG Goal and Timeline

The overall goal and timeline of the DPG is to:
- develop a project management plan encompassing the logistical, technical, and budgetary requirements for scientific drilling on Lomonosov Ridge. The DPG will:
- devise operational strategies and identify technological options for achieving the scientific objectives of Proposal 533,
- identify the organizations that can deliver each of the required operational and technological components,
- produce accurate and reliable cost estimates and define any required partnership plans or agreements.

The DPG will submit a preliminary written report before the March 2001 SCICOM meeting and a final written report before the August 2001 SCICOM meeting.

Meeting Agenda

A. Welcome and meeting logistics
The meeting began at 0900 hours on 31 January at Stockholm University, Department of Geology and Geochemistry. Meeting logistics were presented. Financial support provided from the Swedish Natural Science Research Council to run the meeting was acknowledged. Martin Bergmann brought regards from Chris Wiley and explained the unfortunate circumstances why Chris could not participate (family illness).

B. Proposal 533-Full2 Status and Update
Proponents Backman, Edwards, and Jokat provided information about the history and development of the proposal, about its key scientific objectives, and about available site survey data, including newly processed SCICEX data.

The situation concerning acquisition of additional site survey data was explained. In a review by SSP, the lack of reflection seismic crossing-lines was pointed out. To obtain permission to penetrate beneath the regional unconformity, separating the overlying pelagic/hemipelagic sediments (target for Cenozoic paleoceanographic objectives) from the underlying Mesozoic (?) age bedrock (target for tectonic objectives), crossing-lines need to be acquired.

Results of the proponent site survey review meeting held in October 2000 were presented. This meeting resulted in revisions to sites, and, thus a revised site survey package was prepared. The revised package includes a request to drill within defined shotpoint ranges along key seismic profiles. A preferred site location was selected for each shotpoint interval. The purpose of this request is to provide flexibility for decisions about site locations in this unique environment where ice conditions can vary greatly over short distances. The revised site survey package also seeks permission for deeper penetration, to the regional unconformity at ca 500 mbsf, and for drilling beneath the unconformity wherever appropriate seismic coverage (crossing-lines) will exist.

A meeting of Arctic experienced ice breaker masters and a Beaufort Sea ice manager was held aboard Finnish icebreaker *Urho* in November 2000. They were presented with the proposed drilling program, reviewed the proponent s plan and agreed that the program could be achieved with existing technology. Icebreakers capable of breaking and supporting the drilling program include a *Yamal*-type nuclear icebreaker, *Oden*, *Terry Fox*, and the *Kigoriak*.

C. Arctic DPG work plan
The group agreed to discuss each mandate task separately, identify DPG members who could complete the task, and identify tasks that would require outside expertise not held among the DPG members/liasons. It was agreed that the DPG would need to contract individuals or companies to complete some of the tasks. In discussions with JOIDES and JOI, the Chair was informed that ODP co-mingled funds could be made available for this purpose and contracts could be set up through JOI.

The DPG s SCICOM liaison, David Rea, was asked to present the preliminary report to SCICOM at its March 2001 meeting in Shanghai, China. Dave graciously agreed.

D. Discussion of mandate tasks No. 1 - 13

SCICOM formulated 13 mandate tasks for the Arctic DPG, that focused on preparing an operational plan to achieve the science objectives of Proposal 533. These tasks are:

1. identify suitable drilling platforms and define the type and configuration of the drilling rig and drilling equipment,
2. determine the optimal weather window and precise length of time needed to meet the proposed science objectives,
3. determine the required number, type, and cruise configuration of support icebreakers,
4. prepare an ice management plan for all phases of the project, including drilling and transits,
5. prepare a communication plan, compatible with existing ODP operations,
6. prepare contingency plans,
7. investigate safety, liability, and insurance issues,
8. evaluate the need for environmental impact statements,
9. evaluate the advantages and disadvantages of conducting the program under the auspices of ODP,
10. recommend procedures for core handling and curation, shipboard data capture, and database systems,
11. estimate the detailed costs of full mobilization and any resources required from the ODP science operators,
12. identify potential external funding sources and develop a strategy to seek support,
13. identify all factors that could limit the ability to complete one or more of the proposed science objectives.

The DPG concluded that in order to better meet the overall goal of the DPG, two additional issues should be added to task list. These tasks are:

14. propose a project management structure for achieving Proposal 533,
15. propose a 2-year timeline, beginning in March 2001, needed to steer Proposal 533 into fruition.

Results of the DPG discussions are included in Appendix A, the Draft DPG Report to SCICOM. Some of the tasks were completed during this 1st DPG meeting. Information needed from outside consultants was also defined, where needed, for some tasks and, for these cases, recommended contractual workstatements were prepared. However, all of the information in this report should be considered preliminary because some of the details are being reviewed and checked by DPG members in preparation for the next meeting. The final report will be finalized at the next meeting and delivered to SCICOM at their August 2001 meeting.

E. Next meeting

The DPG agreed that June would be an appropriate time for the next meeting where the primary focus will be finalizing the DPG report to SCICOM. At this meeting, results from the external contractors will be presented, discussed and incorporated into the final report. The JOIDES SCICOM Chairperson has approved the next and final meeting to be held in Washington, DC on June 18-19, 2001. The meeting agenda and proposed invited guests are included in Appendix B.

Appendix B

Arctic Detailed Planning Group 2nd Meeting
June 18-19 2001
Washington DC

DPG Members

Jan Backman	Stockholm University, Sweden (Chair)
Margo Edwards	University of Hawai i, USA
Tim Francis	Geotek Ltd, UK
Mikhail Gelfgat	Aquatic Company, Russia
Martin Hovland	Statoil, Norway
Thomas Janecek	Florida State University, USA
Wilfred Jokat	Alfred Wegener Institute, Germany
Heidi Kassens	Geomar, Germany
Anders Karlqvist	Swedish Polar Research Secretariat, Sweden
Kate Moran	University of Rhode Island, USA
Kozo Takahashi	Kyushu University, Japan
Chris Wiley	Department of Fisheries and Oceans, Canada

Liaisons

Mitch Lyle	SSP
Gene Pollard	ODP/TAMU
David Rea	SCICOM
Alister Skinner	TEDCOM
Trevor Williams	LDEO Borehole Group

Guests

Garry Brass, US Arctic Research Commission
Steve Bohlen, JOI
Trond By, DSND
John Farrell; JOI (meeting host)
Ulf Hedman, Swedish Polar Secretariat
Harry Hoogeboom, Lloyds Registry
Marius Lengkeek, Lengkeek Vessel Engineering
Bruce Malfait, NSF
Marcus Rampley, Seacore Ltd.

Day 1

I. Introductions and meeting logistics [Backman, Farrell]
II. Review and approval of 1st meeting minutes [All]
III. Background Reports
    a. US Arctic interests [Brass]
    b. NSF [Malfait]
    c. ODP/JOI [Bohlen]
IV. DPG-specific Reports
    a. Arctic PPG report [Hovland]
    b. SCICOM report [Rea]
    c. SSP report [Lyle]
    d. Site survey cruise status [Backman]
    e. ODP/TAMU [Pollard]
    f. ODP/LDEO [Williams]
V. Contract reports & discussion
    a. Drilling systems [Rampley]
    b. Botnica review [Lengkeek]
    c. Ice monitoring plan [Hedman]

Day 2

VI. Review and discussion of platform options [Hoogeboom, All]
VII. Revise DPG report [All]
VIII. Review, revise timeline [All]
IX. AOB
X. Next meeting?

JOIDES Arctic Detailed Planning Group

Appendix A
Report from the 1st Meeting, January 31 - February 1, 2001
Stockholm, Sweden

Executive Summary

Over that past few years, there has been a growing and increasing awareness that the Arctic Ocean plays a fundamental role in the global ocean-climate system. Yet, there is a remarkable lack of even the most rudimentary information about this ocean s geologic history. Ocean Drilling Program (ODP) Proposal 533, Paleoceanographic and Tectonic Evolution of the Central Arctic Ocean, directly addresses this critical lack of information and its scientific importance was recently confirmed when it was ranked number 1 by SCICOM at their August, 2000 meeting. The Proposal is one of only a few within ODP that proposes the use of platforms other than the *JOIDES Resolution* (JR) because the JR is not capable of entering the central Arctic Ocean due to its lack of an ice-reinforced hull.

Since this proposal is highly ranked scientifically within ODP, but cannot be achieved with existing ODP technology, SCICOM instituted an Arctic Detailed Planning Group (DPG) in December 2000 to develop the implementation plan that would achieve the science of proposal 533. The mandate of the DPG includes specific tasks that should be addressed to successfully develop an implementation plan. The Arctic DPG met in Stockholm on January 31 — February 1, 2001, and focused their work on each of these tasks. The DPG also added two additional tasks. In this report, each task is listed with the results from the first DPG meeting. For some tasks, the DPG agreed that external information or evaluations were needed from service contractors. For these cases, recommended contractual workstatements were prepared and submitted to JOI so that this work can be completed prior to the next DPG meeting. The DPG will incorporate the results from these external contracts into their final report to SCICOM.

This draft report lists each of the mandated tasks and the results from the DPG.

Task 1. Suitable drilling platforms and define the type and configuration of the drilling rig and drilling equipment

NOTE: ***This task is not yet completed, and requires input from external experts***

Platforms

To function in the central Arctic Ocean, the drilling platform must meet three basic criteria:

1. It must be ice-class for operating in the central Arctic Ocean (which does not imply that the platform must be able to break ice; it can be towed by, or steam behind, icebreaker(s)).
2. The platform must be equipped with a dynamic positioning (DP) system.

3. The platform must be equipped with a moonpool.

The potential drilling platforms fulfilling, or which can be modified to fulfill, the above criteria were identified and include:

- Finnish icebreaker/drillship *Botnica* (96.7 m - www.fma.fi), built in 1998 and fulfilling the three basic criteria. *Botnica* is not built for breaking Arctic ice, but can operate in the Arctic Ocean if assisted by icebreaker(s).
- Canadian-built drilling barge *Sea Sorceress* (114 m - www.caldive.com), built in 1983. The DP system requires external evaluation to ensure that it could function in Arctic Ice. This platform was assessed by a marine architect (see JOI report, November 2000: "Alternate Platform Evaluation for ODP 533", Report 99019-01). A few other ice-classed Canadian barges exist: *Artic Immerik Kamotik* (sister to the *Sea Sorceress), Arctic Tarsuit, Arctic Breaker,* and *Arctic Tuk.* These platforms would require modifications, either installation of a moonpool or DP, in order to meet the basic criteria.
- Swedish icebreaker *Oden* (107.8 m - www.sjofartsverket.se), built in 1988. *Oden* was fitted in 1996 with a purpose-built moonpool for drilling operations. Since a drilling operation was attempted on this vessel in 1996, it was agreed that, with modifications, this ship has the potential to meet the criteria. *Oden* would require a refit to improve the moonpool configuration for efficient drilling. It also requires installation of a DP system to meet the basic criteria.

Because the *Botnica* meets all of the criteria without modification, the DPG ranked this platform highest. A workstatement for external evaluation was prepared and submitted to JOI to address the following:

- confirmation of ice class suitability of *Botnica* for work in the central Arctic Ocean
- assessment of the suitability of *Sea Sorceress* DP thrusters for use in the central Arctic Ocean
- feasibility study of modifying *Oden* for DP and moonpool modifications

Drilling Rig and Drilling Equipment

Several different drill rigs and equipment (drill string, bottom hole assemblies, and sampling /logging tools) are available for installation on the selected drilling platform. The primary requirements for drilling equipment are:

- the capability of recovering continuous core in mud, and mudstone lithologies;
- capable of being mobilized on the selected drilling platform;
- a total depth of 1800 m (combined water depth and depth below seafloor); and
- a sample diameter no smaller than the current ODP size (ca. 5.8 cm).

A drilling system capable of handling ODP drill string and thus, deployment of ODP tools, particularly the APC and XCB is not required, but would be a great benefit because the APC is the sampling tool of choice for paleoceanographic objectives like this proposal. Heave compensation may not be required.

The only drilling systems that fully meet these requirements are the Seacore C100 and C200 rigs that can hang enough API string and are compatible with the APC ODP tool. A purpose-built rig system could also be developed, if these existing systems are not available.

External evaluation of these systems and a recommended configuration for each of the proposed drilling platform options is needed and the DPG prepared a recommended contractual workstatement with the following tasks:

- prepare recommended drilling systems for each platform;
- describe the mobilization and demobilization times, shipping, and port requirements;
- if appropriate, identify and include the length of time and possible locations for shakedown of any or all drilling system equipment;
- determine the sampling times for achieving each of the sites in Proposal 533 for each drilling system option and determine the minimum time to trip out of each proposed hole at each of the deepest target penetrations below seafloor;
- identify any characteristics of the each of the three drilling platform options that would affect the performance of each of the drilling systems to recover high quality, continuous samples and logs.

Task 2. Optimal weather window and precise length of time needed to meet the proposed science objectives

A 35 day operation within the pack ice is envisaged, from the ice edge to the drill sites back. The 35 days includes 5 days transit from the ice edge at ca 80¡N to the key paleoceanographic sites located at about 88¡N, 25 days onsite, and 5 days transit back to open waters. Variations in regional ice conditions will determine the optimal location for entering the pack ice, which can be anywhere between Svalbard and the Kara Sea, perhaps even the Laptev Sea. Drilling operations of 25 days is considered sufficient to achieve the major scientific objectives of Proposal 533.

Optimal ice conditions for icebreaker operations occur during August and early September. Therefore, it is recommended that the program begin during the first week of August (2003). The plan would then include leaving the pack ice 35 days later, in early or mid-September. Transit times to the rendezvous point for starting the drilling leg at the ice edge will vary among platforms, depending on each of their respective mobilization ports.

Task 3. Required number, type, and cruise configuration of support icebreakers

Based on the expert advice from the icebreaker captain and ice management experts (November 2000 meeting), as well as the discussions at the DPG, three different platform configuration (Arctic Armada) options can meet the science objectives. These configurations are dependent, however, on the suitability of the

selected drilling platform, and, thus, the assessment of these platforms (see Task 1) may ultimately determine the optimal Arctic Armada configuration. Based on the DPG s current understanding of each of the platforms, the configurations are listed in priority order.

Arctic Armada Option 1

This is the highest ranked and most preferred option, comprised of three vessels: the *Botnica* as the drilling platform with two supporting icebreakers, a Russian nuclear icebreaker (NIB — there are several to select from) and the *Oden* (provided by Sweden). The cruise configuration would be different for transit and on site operations. The transit configuration would have the NIB leading the Armada, followed by the *Oden* with *Botnica* bringing up the rear in the most protected position. Onsite, the Armada would change slightly. The relative positions of the ships with respect to the ice floe direction would stay the same, but the NIB would be positioned 400-500 m ahead of the *Botnica,* breaking the largest floes (the technique for this will vary for floe types and will be decided onsite by the Master), the *Oden* would be positioned 100-300 m ahead of the *Botnica,* breaking any smaller floes and managing the ice around the Botnica.

Arctic Armada Option 2

This is the second ranked Armada option, comprised of four vessels: the *Sea Sorceress* as the drilling platform with three supporting icebreakers, a Russian NIB, the *Oden* (provided by Sweden), and the *Terry Fox*, a quick, highly maneuverable ship capable of breaking and moving smaller floes. As with option 1, this configuration would be different for transit and onsite operations. The transit configuration would have the NIB leading the Armada, followed by the *Terry Fox* with *Oden* towing the *Sea Sorceress* at the rear. The *Oden* and *Sea Sorceress* have already been evaluated and the towing configuration is suitable for both vessels. Onsite, the Armada would change slightly from option 1. The NIB would be positioned 400-500 m ahead of the *Sea Sorceress* breaking the largest floes, the *Oden* would be positioned 100-300 m ahead and the *Terry Fox* would remain close to the drilling platform to protect the vessel from any impact by bergy bits. This added support for this option is needed because the *Sea Sorceress* does not have a powerful propulsion system that can aid the DP when small ice (bergy bits) hit the barge. The *Terry Fox* is ideally suited for this work because it had done this type of work in the Beaufort Sea and inshore Newfoundland, protecting non-ice class ships from impacts by bergy bits.

Arctic Armada Option 3

This is the lowest ranked Armada option, comprised of three vessels: a Russian NIB, the *Oden* (provided by Sweden) as the drilling platform, and the *Terry Fox.* As with option 1, this configuration would be different for transit and onsite operations. The transit configuration would have the NIB leading the Armada, followed by *Oden* with the *Terry Fox* bringing up the rear. Onsite, the Armada is the same as option 1, except the Terry Fox would be replace the *Oden*, and the *Oden*, as the drilling platform would replace the Botnica. As described in Task 1, this option is likely only suitable if Oden is outfitted with dynamic positioning capabilities.

Task 4. Ice management plan for all phases of the project, including drilling and transits

NOTE: ***This task is not yet completed, and requires input from external experts***

Transiting through the pack ice is probably the least difficult part, in comparison to the drilling phase when DP mode must be maintained for continuous periods of time. During drilling, an ice forecast is essential for making decisions on the relative positions of the vessels ahead of the drilling platform, for deciding on optimal icebreaking modes, and for long-term forecasting of the predominant heading of ice movement.

During Beaufort Sea drilling operations, Canadian Marine Drilling (CANMAR), Gulf Canada Ltd. and Imperial Oil Ltd. developed techniques for "managing" ice for their summer and winter drilling operations. These techniques became known as "ice management systems" (Clark, K., et al., eds., 1997: *Breaking Ice with Finesse, Oil & Gas Exploration in the Canadian Arctic.* The Arctic Institute of North America, The University of Calgary.). These systems build on a combination of ice monitoring techniques and icebreaking methods (break or deflect). The systems include techniques for surveying both regional and local ice conditions. Air photos (satellites and airplane) and radar (SAR - developed by CANMAR in cooperation with the Canadian Centre for Remote Sensing) comprise the basis for regional ice reconnaissance.

The ice management plan requires precise and reliable ice monitoring systems that include access to satellite imagery (RADARSAT), airborne Synthetic Aperture Radar (SAR), helicopter reconnaissance visual observations (local ice conditions), and weather forecasting. This ice monitoring information is then used to develop the icebreaking and management operations on a daily basis (e.g. distances from the drill platform, headings for all vessels, whether to break ice or move it away).

To provide details of the ice management systems (equipment, personnel, external data requirements) needed to support ice management, the DPG prepared a recommended contractual workstatement with the following tasks:

1. Identify all data (both historical and real time) that are required for both sea ice condition predictions and weather predictions during the proposed time period of Proposal 533 (Aug-Sept).
2. Develop plans for predicting weather and sea ice conditions that includes regional conditions for all three of the proposed regions in proposal 533 in order to select the initial drilling location.
3. Develop plans for monitoring weather and sea ice conditions while drilling on site. Predictions must be made for making decisions to continue or stop drilling within a time window of 2 hours (the estimated time to trip 500 m of pipe out of a drillhole).

Task 5. Communication plan, compatible with existing ODP operations

The DPG recommends that a communication plan be established similar, if not identical to the ODP. This plan includes the following reports that are the responsibility of the co-chief scientists, the drilling superintendent and the staff scientist:

- ¥ preparation of a daily drilling summary by the operations manager onboard the drilling platform,
- ¥ preparation of a daily ice management summary and forecast,
- ¥ preparation of a weekly science summary by the co-chief scientists.

These reports should be sent to ODP/JOI, ODP/TAMU, ODP/LDEO, and the JOIDES Office daily or weekly (depending on the report) using Maritex transmission. All vessels are equipped for this transmission type.

Communication among the Armanda will be based on standard HF radio transmission.

NASA recently used their Tracking and Data Relay Satellite for data exchange with a team of government researchers using six satellites that flew over the North Pole as they worked on the ice in 1999. The DPG recommends that ODP investigate and, if appropriate, request this type of communication for the drilling period in 2003. This would provide full, continuous email and internet communication for the leg.

In addition to routine reports, this program s vessels would follow their respective emergency communication plans and strategies in the event of an accident. Each of the vessels recommended here already have plans in place that meet this requirement and have been approved by their national standard associations and external auditors (Lloyds).

Task 6. Contingency plans

There are two types of contingencies to consider: scientific and operational. The ability to achieve the science objectives will depend, to some extent, on the severity of the ice conditions. The proponents have developed an ideal plan to address this type of need for contingency, by including alternate regions for meeting the science objectives. The alternate sites are distributed over a 360 nm long and 40 nm wide stretch along the crest of the Lomonosov Ridge. In the event where the primary sites have conditions too severe for operations, it is highly likely that one of the other regions, being located up to 360 nm away, will have better ice conditions.

Operational contingency plans need to be prepared in order to minimize the impact which unforeseen events might have on the whole operation. One can envisage a number of scenarios, for example:

- ¥ Loss of drill string
- ¥ Engine breakdown to an icebreaker
- ¥ Serious fire onboard a vessel
- ¥ Serious injury illness to an individual, or loss of life

Protection against some of these scenarios can be achieved by ensuring that adequate quantities of spares and self-maintenance capabilities are available. For example, a drill string of up to 1800 m in length is needed for successful operations. At least two complete drill strings should be carried in case one is dropped or damaged.

The fact that drilling on the Lomonosov Ridge is a multi-vessel operation adds a significant degree of protection against the risks that a vessel may suffer (fire, flooding, etc.). For this program, there will always be vessels nearby to provide assistance. The breakdown of a single icebreaker could bring the operation to a halt by preventing ice management. To minimize this risk, the DPG has proposed only proven, well-maintained, reliable icebreakers for this program.

In terms of medical emergencies, all of the proposed icebreakers, except the *Sea Sorceress*, have medical personnel and hospital facilities on board (*Oden* carries a medical doctor for high Arctic expeditions).

Task 7. Safety, liability, and insurance issues

Each of the vessels proposed have well-developed safety procedures that follow national standards in the United States, Canada, Sweden or Finland. Also, because drilling on the Lomonosov Ridge is a multi-vessel operation, there are lower risks associated with health and safety than in the current ODP. In the event of an on-site need for vessel abandonment (fire, water-ingress, etc.), there will be a vessel nearby, which will be on-call within a maximum rendezvous period of less than one hour. Evacuation will therefore rely on one or two of the other participating vessels.

Liability and insurance for the supporting icebreaker platforms will be carried by each of the operators and their respective countries, as each vessel is owned or operated by a national federal government. If *Botnica* is selected as the drilling platform, then the Finnish Maritime Administration will carry insurance and liability.

Task 8. Environmental impact statements

The proposed program is in international waters, thus no national environmental regulations apply. However, the Arctic is recognized, as a sensitive region of the world and, thus, stringent pollution protection procedures must be followed

For the Swedish 1991 Expedition to the North Pole, the Swedish Polar Secretariat prepared an Environmental Impact Statement (EIS) for *Oden*. This document provided strict environmental procedures for ship waste, fuel burning, and fuel waste handling. These EIS procedures should be implemented on all vessels in the Arctic Armada. It is anticipated that the International Maritime Organization (IMO) will release the first environmental guidelines for operating ships in ice-covered waters in April 2001. The DPG recommends that all ships in this program follow these new IMO guidelines.

Task 9. Advantages and disadvantages of conducting the program under the auspices of ODP

The advantages of conducting proposal 533 within ODP far outweigh the disadvantages. The science of LORI is currently the highest ranked within ODP and the proposal was written within the ODP framework to optimize the scientific return.

Specifically, the advantages, in terms of science, include: the paleoceanographic methods developed within ODP are the best in the world for successfully recovering a complete sediment record, the science operations infrastructure within the ODP can efficiently deliver the science objectives as well as publish these results, and the experience of the ODP staff to plan and conduct paleoceanographic legs cannot be duplicated.

Conducting this program within ODP also has advantages for ODP itself. In ODP s Long Range Plan, both Arctic research and the use of other platforms are goals that are highlighted. By conducting LORI within the Program, ODP demonstrates that it can deliver the majority of its goals set out in the Long Range Plan. This demonstration is beneficial for all nations to justify new funding in the next program, IODP. At recent science planning for IODP (e.g., COMPLEX), the Arctic and alternate [sic] platforms were again highlighted as essential. The LORI program, if conducted within ODP, will provide the Program with knowledge and experience for conducting mission-specific research in the Arctic and elsewhere that will be essential to a successful IODP.

The DPG could find no real disadvantages for conducting this program under the auspices of ODP.

Task 10. Procedures for core handling and curation, shipboard data capture, and database systems, or:
Laboratories in an Alternate Platform Environment

Laboratory environments for Arctic drilling will be highly dependent on the platform chosen for drilling and coring operations. Laboratory needs could span the range from simply packaging the cores up for off-loading at the end of the cruise to a shipboard environment with analytical capabilities similar to those on the *JOIDES Resolution*. Three laboratory scenarios are outlined below. They range from an environment that considers only the most essential laboratory functions to one in which cores are split on the platform. All scenarios assume that no pre-built integral laboratory space is available on platform.

Essential Laboratory Functions:
At a minimum, basic core storage and safety (hydrocarbon) monitoring is essential. In this scenario, cores would be monitored for hydrocarbons and then properly marked/stabilized/packaged, stored in a climate-controlled container, and transported to a shore-based repository/laboratory at the end of the Leg. Three containers would be required on the drill platform, including a containerized laboratory with Gas Chromatographs (and, potentially, Rock Eval and CNS units), a

container for core marking/stabilization/packaging and one (at least) for core storage. All containers would require climate control, including the core-storage container(s).

Additional Laboratory Functions:
Given the efforts put toward the planning and implementation of this Leg and the high scientific interest of this first major drilling effort in the Arctic, a larger suite of laboratory facilities should be considered if space is available. In addition to basic (essential) safety and curation functions, additional facilities (containers) for whole-core physical property work (multi-sensor track), basic micropaleontological age dating, and deep-biosphere analyses could be added.

Split-core Laboratory Functions
The next incremental consideration is that of splitting the cores on the platform (or at least one hole from each site). This scenario incorporates the laboratory needs of the previous two scenarios (core curation/storage, hydrocarbon monitoring, whole-core multi-sensor analyses, micropaleontological age dating, and deep biosphere analyses) plus needs for core splitting and core description containers. Core description involves macroscopic and microscopic descriptions, digital line-scan photography, and split-core spectral imaging at a minimum. Some of the required equipment could be housed in the same container as the whole-core multi-sensor track. Additional chemical/biological and physical property analyses (containers) could be considered on a space available basis.

Other considerations
Considering the need for the modular nature of laboratories in an alternate platform environment, the technical laboratories will most likely be supplied (or leased) by interested investigators. ODP-TAMU simply does not have the duplicate whole-core and split-core equipment readily available for use on alternate platforms. Most, if not all, of the modular equipment/laboratories outlined above (including core splitters) exist at institutions around the world and have been used on research vessels for years. This equipment usually has its own (very capable) data-capture systems. A standard output format can be specified so the data can be uploaded into the JANUS database at the end of the leg. Commercial (off the shelf) or readily available applications (e.g., that used by the Hawaii Drilling Project) could be utilized for core descriptions. These packages have the basic information needed for graphical and text-based core descriptions and have a variety of output formats.

Flexibility is *the* key consideration in all scenarios. To the extent possible, all laboratory functions should be modular in nature, utilizing standard 20-ft shipping containers. This modular approach would minimize the laboratory preparations on the drill platform and as well as mobilization/demobilization time and costs.

Task 11. Detailed cost estimates of full mobilization and any resources required from the ODP science operators

The DPG received cost estimates from operators of all of the platforms. DPG members experienced in managing mission-specific programs prepared the other costs, based on recent experience in the Arctic and elsewhere. For cost estimates that had a range, based on this experience, the highest cost estimate was selected and used here.

These cost estimates do not subtract the contribution from the Swedish Polar Secretariat for 2003. This contribution is use of the *Oden* for 21 days in the ice and twenty days of transit. Currently this contribution is estimated at $902, 000. All costs are estimated in US dollars.

Platform-independent mobilization costs of $1,690,000

Item	Estimated Cost
Shakedown cruise, test of platform/drilling equipment	350,000
Laboratory containers	80,000
Helicopter x 2	200,000
Radar imagery & Northern Sea Route	170,000
Project manager	300,000
Project sub-management	240,000
Logging	350,000

Option A - total cost: $1,690,000 + $5,525,000 = $7,215,000

Composition	Mob & demob (transit)	35 days x dayrate
Botnica[i]	570,000 (North Sea)	35 x 57,000 = 1,995,000
Oden	440,000 (Stockholm)	35 x 22,000 = 770,000
NIB	—	35 x 50,000 = 1,750,000

Option B - total cost: $1,690,000 + $6,425,000 = $8,115,000

Composition	Mob & demob (transit)	Mob & demob (rig)	35 days x dayrate
Sea Sorceress	1,400,000 (Gulf of Mexico	50,000	35 x 34,000 = 1,190,000
Oden	440,000 (Stockholm)		35 x 22,000 = 770,000
NIB	—		35 x 50,000 = 1,750,000
Terry Fox	300,000 (St. John s)		35 x 15,000 = 525,000

[i] Botnica day rate cost includes an already mobilized drilling rig and system

Option C - total cost: 1 340 000 + 4 285 000 = $5 625 000

Composition	Mob & demob (transit)	Mob & demob (rig)	35 days x dayrate
Oden[ii]	440,000 (Stockholm)	500,000	35 x 22,000 = 770,000
NIB	---		35 x 50,000 = 1,750,000
Terry Fox	300,000 (St. John s)		35 x 15,000 = 525,000

Resources from the ODP science and drilling services operators include the services of staff, including an ODP Coretech, curator, staff scientist, marine technical specialists to support the selected laboratory program, and LDEO logging specialist, and a Schlumberger engineer. The hardware resources include: 4000 m of ODP API drillstring (this could be supplied by the drilling contractor), 3 ODP BHAs, and enough APCs, XCBs, and RCB tools to complete the work. It is expected that the lease of the logging tools will be included in the drilling contract. Finally, core curation and publication resources would be required.

Task 12. External funding sources and strategy to seek support

There are two types of external funding sources that would require different strategies to seek support. These are external funding within the framework of ODP and external funding completely separate from ODP.

Because of the clear advantage of completing this science within ODP, it is important to identify "external" funding that could be achieved within the ODP framework. There are four options for external funding within an ODP framework: (1) seek "in-kind" vessel support similar to the contribution from Sweden; (2) use innovative management, i.e. exchange the *JOIDES Resolution* with the *Botnica* because DSND, Ltd. operates *Botnica* and owns 50% of the *JOIDES Resolution*; (3) the third-tier subcontract within the ODP with Offshore Drilling Ltd. could be terminated early and another contact established with DSND Ltd. to supply the drilling platform for LORI; and (4) request more funding through the ODP Council at a cost of approximately $3M for the US and $750k for each of the full members (less if associate members contribute).

For truly external funding, the proposal would have to be submitted to the national science funding agencies of the proponents (Sweden, United States, Norway, Germany, Canada and Denmark). A "membership" fee from each of the nation agencies should be established and it is recommended that the proponents set up "rules" for scientific participation similar to the current ODP. A Memorandum of Understanding would be needed to cooperate and get access to ODP drilling tools and potentially other support services. The major issues that accompany this approach are (1) the funding agencies are the same as those that now fund ODP and some may have the view that "they already paid at the office"; and (2) the timing schedule is tight for getting funds in time to take advantage of the Swedish contribution in 2003.

[ii] Oden costs does not include the required upgrade for dynamic positioning

Task 13. Factors that could limit the ability to complete one or more of the proposed science objectives.

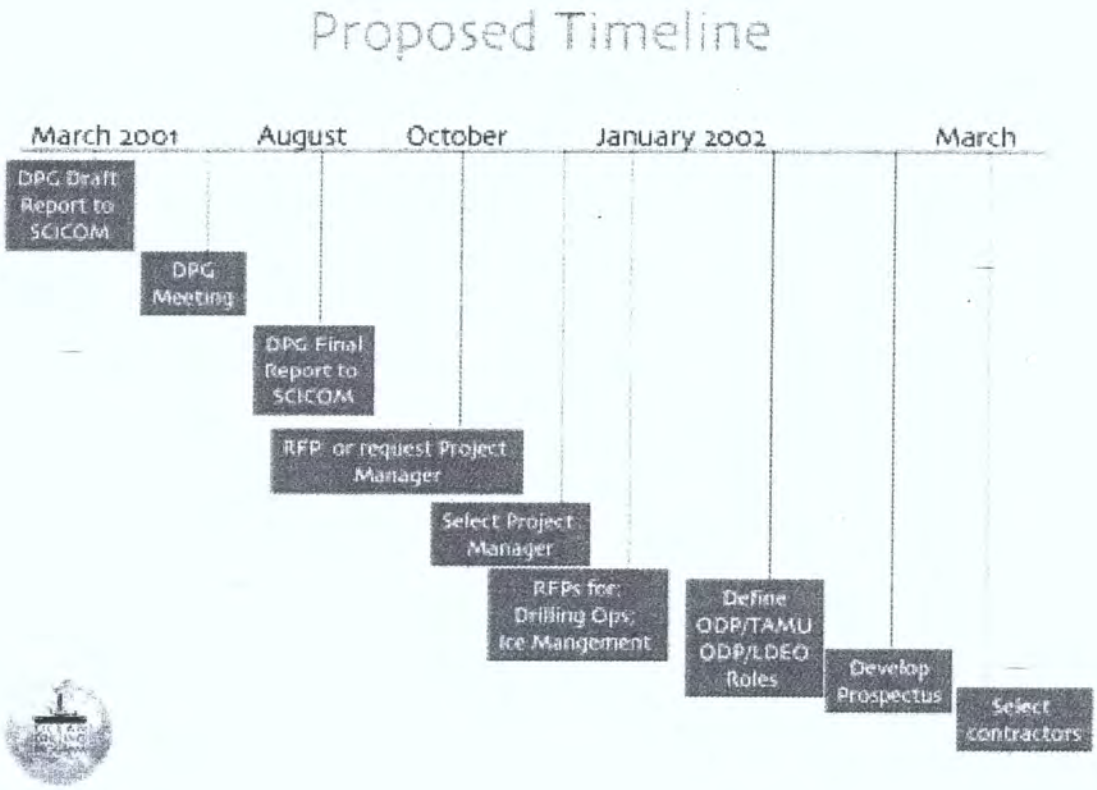
The two factors that control the program s ability to complete the science objectives are not different from any other ODP leg. These two factors are (1) limiting the funds that are made available for the equipment and facilities needed to complete the science, and (2) the weather conditions that can limit the drilling operations. For the special case of proposal 533, budgets are needed for a special platform. However, the DPG has provided recommendations that address this factor (see task 12). In terms of weather, the limiting factor in the central Arctic Ocean is the sea ice conditions. The proposed location is one of the most favourable in the Arctic Ocean in terms of ice thickness (typically first and second year ice). Also, the DPG has recommended vessel support and alternate sites to ensure that this factor is a very low risk.

Task 14. Propose a project management structure for achieving Proposal 533

The management requirements for proposal 533 are similar to those of any other ODP leg with additional expertise related to ice management. As in the ODP, there should be an overall project manager who begins 2 years prior to the scheduled leg on a full time basis. This manager should have Arctic experience, and a good knowledge of drilling management and multiple vessel management. In addition, this project should be supported, beginning 8 months prior to the beginning of the leg with three specialized managers: a drilling/coring operations manager (this position could be an existing ODP engineer), a science operations manager (this position could be an existing ODP staff scientist), and an ice and vessel manager to oversee subcontractors.

Task 15. Timeline needed to steer Proposal 533 into fruition.

The DPG recommended the following schedule over the next 13 months to implement proposal 533 within ODP.



The High-Arctic Drilling Challenge

Final report of the Arctic's Role in Global Change Program Planning Group (APPG)

March 2001

The High-Arctic Drilling Challenge

Final Report of the Arctic s Role in Global Change Program Planning Group (APPG)

Edited by Martin Hovland
Chairman APPG

March 2001

The High-Arctic Drilling Challenge

Final Report of the Arctic s Role in Global Change Program Planning Group (APPG)

Contents

1 Organization

Members of the APPG

The following members from the scientific community, industry, and governmental agencies were selected by the appointed Chairman and approved by JOIDES (SCICOM):

Jan Backman	(Stockholm U, Sweden)
Bernard Coakley	(Tulane U, New Orleans, USA)
Timothy Collett	(US Geol. Survey, Denver, USA)
Dennis Darby	(Old Dominion U, Virginia, USA)
Jean Paul Foucher	(IFREMER, Brest, France)
Tim Francis	(Geotek Ltd, UK)
Mikhail Gelfgat	(Aquatic Co, Russia)
Anatoly Gorshkovsky	(Murmansk, Russia)
Martin Hovland	(Statoil, Stavanger, Norway) (Chair)
Wilfred Jokat	(Alfred Wegener Inst., Germany)
Michael Kaminski	(U College, London, UK)
Yngve Kristoffersen	(U of Bergen, Norway)
Kozo Takahashi	(Kyushu U, Japan)
J rn Thiede	(Alfred Wegener Inst., Germany)
Chris Wiley	(Dept. of Fisheries & Oceans, Canada)
James Zachos	(U of California, Santa Cruz, USA)

Liasons

Ted Bourgoyne	(IPSC, Bourgoyne Enterprises Inc, USA)
Hans J. Brumsack	(ESSEP, Oldenburg U, Germany)
Alister Skinner	(Tedcom ECOD, British Geol. Surveys, UK)
Shiri Srivastava	(ODP, Canadian Geol. Surveys, Canada)
J rgen Thurow	(ESSEP, U College, London, UK)

Special Observers / Guests / Contributors

Martin Bergmann	(Dept. Fisheries & Oceans, Canada)
Robin Browne	(ACAN Inc., Canada)
Art Grantz	(Stanford U, USA)
Ove Tobias Gudmestad	(Statoil, Norway)
Dick Hedberg	(Polar Res. Com., Sweden)
Thomas Janecek	(Florida State U, USA)
Arno Keinonen	(ACAN Inc. Canada)
Naja Mikkelsen	(Danish Geol. Survey, Greenland, Denmark)
Eugene Pollard	(ODP, TAMU, USA)
Rudiger Stein	(Alfred Wegener Inst., Germany)
Dmitri Surkov	(Aquatic Co., Russia)
Trevor Williams	(Lamont-Doherty U, USA)

2 Excecutive Summary

Global climate models demonstrate the sensitivity of the polar areas to changes in forcing of the ocean/climate system. The presence or absence of snow and ice influences the global heat distribution through its effect on the albedo, and the polar oceans are the source of dense, cold bottom waters which influence the thermohaline circulation in the world oceans. In spite of the critical role of the Arctic Ocean in climate evolution, only very little material from the Cenozoic is represented in available core material, representing one of the largest current gaps in the Earth Sciences.

Key scientific questions to be addressed by dedicated Arctic scientific drilling include:

〈 The response of the Arctic during periods of extreme polar warmth

〈 Variations in the physical and chemical characteristics of the water mass in an evolving polar deep ocean basin, and the oceanographic response to opening of gateways

〈 The history of marine polar biota and fertility

〈 What is the history of Arctic sea ice?

〈 Ice rafting and the history of local vs. regional ice sheet developments

〈 Processes of methane release of destabilized permafrost associated gas hydrate accumulations

〈 The history of emplacement of Large Igneous Provinces (LIPS) in the Arctic Ocean and its environmental impact

The APPG concludes that:

〈 scientific drilling can be carried out in permanently ice-covered areas of the Arctic Ocean without harm to the environment. In the short-term (3-5 years), this can be achieved with present technology and the potential for scientific rewards are high.

〈 an Arctic scientific drilling campaign should start as soon as possible which would be the beginning of a long-term program in a climatically important, but largely unknown, ocean.
〈 in preparation for a long-term drilling program in the high Arctic, new geophysical data are urgently needed for drillsite definition. Site survey data exist from sections of the Yermak Plateau, Lomonosov Ridge and the Chukchi Plateau for the definition of targets for drilling in the near future (3-5 years) time frame (Fig. 1).

〈 stationary marine operations in drifting sea-ice require careful ice management, which combines modelling icebreaker performance, ice reconnaissance studies (weather forecasting, radar imaging, and ice floe tracking), and icebreaker operations.

〈 proven systems for drilling single-bit holes should be utilized in the short-term. As operational experience is gained, the system capability can be expanded to include re-entry and multi-cased boreholes with instrumentation.

〈 a long-term drilling commitment in the central deep Arctic, where drilling targets of high scientific priority are located, will ideally require a large icebreaker with deep-water drilling capability. It is recommended that a feasibility study for such a vessel be made.

3 Mandate

According to SCICOM Motion 99-1-6, the following mandate and overall goal was defined for the APPG:

Mandate

1. Design a scientific drilling strategy to investigate the role of the Arctic in influencing the global climate system. Besides climatic and paleoceanographic studies, this strategy may also address those aspects of the Arctic's tectonic development and magmatic history that may have significantly impacted global climate or that may otherwise relate to globally important problems.

2. Summarize the technical needs, opportunities, and limitations of drilling in the Arctic.

3. Encourage and nurture the development of drilling proposals.

Overall Goal
To develop a mature science plan concerning those aspects of Arctic drilling that bear on global problems, particularly with respect to the climate system on time scales from decades to millions of years. This PPG will build on the existing Implementation Plan of the Nansen Arctic Drilling (NAD) program and will consist partly of NAD scientists.

In order to meet this goal and fulfill its mandate, the APPG had three meetings: in Stavanger (Norway), March 2000; in Calgary (Canada), June 2000; and Stockholm (Sweden), Jan. 2001. This final report contains contributions by the APPG members and others, and was completed in March, 2001.

4 Scientific Objectives

Introduction
Earth's climate has undergone a significant and complex evolution, the finer details of which are just coming to light through investigations of deep-sea sediment cores (Fig. 2). This evolution includes gradual trends of warming and cooling driven by tectonic processes on time scales of 10^5-10^7 year, rhythmic or periodic cycles driven by orbital processes with 10^4-10^6 year cyclicity, and rare rapid aberrant shifts and extreme climate transients with durations of 10^3-10^5 years. This history has been determined largely through investigations of cores recovered from the worlds oceans by DSDP and ODP, particularly the high latitude southern oceans where signals of climatic change tend to be amplified.

Very little is known about signals of climatic change in the Arctic Ocean. This represents a major and unacceptable gap in the global paleoclimatic database. What little information is available on Arctic paleoclimates comes from a few piston cores, exploration wells, and land based marine outcrops. While these provide glimpses of climate signals for a few brief intervals, the lack of continuous sediment records, severely limits efforts to establish a chronologic sequence of climate and environmental change for this important region.

In essence, the history of Arctic climate and circulation is so poorly known that we can view the recovery of any material as a major advance and that will, by definition, increase our knowledge and understanding of this critical region.

Questions
There are a number of specific outstanding questions that are critical to answer in order to understand the influence of the Arctic on global climate change, on all time scales, from tectonic to millennial.

〈 What is the history of Arctic sea ice? When did perennial sea ice first appear in the Arctic? Has it appeared and then disappeared on more than one occasion? Under what circumstances did this pack-ice form or disappear?

〈 When did the first circum-Arctic ice-sheets appear? Once established, what was the history of growth and decay of these cyclic ice-sheets.

〈 How has the circulation and stratification of Arctic water masses evolved over the Cenozoic? How have the changes in Arctic water mass characteristics influenced global thermohaline circulation (intermediate or deep water)?

〈 What was the nature of the Arctic environment during periods of extreme global warmth.

〈 Have there been major changes in the biogeochemical cycles of the Arctic, particularly those affecting methane hydrates.

〈 What is the history of marine polar biota and fertility?

〈 How has the tectonic evolution of the basin influenced regional and global climate?

The Arctic and Global climate

The Arctic Ocean plays a fundamental role in the global ocean/climate system: it is the primary northern hemisphere heat sink. It is a source of cold, dense intermediate- and bottom waters to most of the world s oceans. The permanent sea-ice cover has a tremendous influence on the Earth s albedo, atmospheric circulation, and the distribution of fresh water. It s variation both seasonally and over longer time periods thus has a direct influence on global heat distribution, climate, nutrients, biota, and sediments. Whether the Arctic ocean influences changes in global climate or how it responds to these changes is unclear.

Perennial Sea-Ice History

The factors that control sea-ice thickness and extent are poorly understood. However, their influences are manifested through, a) changes in albedo, b) water-column stability, and bottom-water formation, c) ocean/atmosphere heat and evaporative exchange, and d) bio-productivity and carbon sinks. The distribution of perennial sea-ice is tied to several global boundary conditions including temperature, salinity, and atmospheric and oceanic circulation. We know that this pack-ice cover is sensitive to at least some of these conditions on decadal time scales (Cavaleri et al., 1997; Proshutinsky and Johnson, 1997). Establishing the initiation of Arctic perennial ice cover would permit correlation to global climate changes and thus a clearer understanding of the climate system. In this regard, when did perennial sea-ice cover develop? Under what boundary conditions did it develop, and disappear? Are fluctuations in sea-ice cover linked to the growth and decay of continental ice? What is the climatic feedback from an evolving ice pack in amplifying polar cooling by increasing albedo and restricting ocean-atmosphere heat transfer?

In order to accomplish this objective, the ridges in the central Arctic Ocean need to be cored, especially in areas where sedimentation rates might be high (>1 cm/kyr). While seasonal ice would occur in the periphery of the Arctic Ocean, only the central Arctic would record perennial pack-ice.

Circum-Arctic Ice-sheet Evolution

The evolution of Northern Hemisphere glaciation is complex. There is little doubt about the scale and timing of the major glacial cycles of the Pleistocene which are well constrained from both direct and indirect evidence (i.e., oxygen isotopes). In addition, the pre-Pleistocene evolution of the Greenland ice-sheets is known from the results of ODP exploration in the Nordic seas. What remains unclear is the pre-Pliocene evolution of small-scale ice-sheets. For example when did the first ice-sheets form, and what was their extent? Were they ephemeral?

Several major ice sheets calved icebergs into the Arctic Ocean as evidenced by the ice-rafted detritus (IRD) record (Polyak et al., 1995; Bischof and Darby, 1997; Phillips and Grantz, 1997). The timing, causes, and consequences of the repeated growth and decay of these ice sheets throughout their history must be closely linked to global climate. For example, are the growth and decay of the ice-sheets synchronous with sub-polar ice-sheets such as the Laurentide ice-sheet that collapsed periodically to produce Heinrich events in the North Atlantic?

In order to expand on the late Pleistocene record of the Arctic ice-sheet evolution we recommend drilling the continental slopes offshore of the known margins of these ice-sheets. For example, the slope off McClure Straights should contain a complete record of that portion of the Laurentide ice-sheet that calved into the Arctic Ocean. Similar areas offshore of the Innuitian and Barents Sea ice sheets also should be targeted. In addition, sections of the Lomonosov Ridge that would intersect drift tracks of icebergs from the Canadian ice-sheets should be a prime target for obtaining the history of these ice-sheets.

Circulation/Stratification of the Arctic Ocean

The series of interconnected basins comprising the Nordic Seas contain about 0.7% of the volume of the world ocean, excluding the Amerasian Basin of the Arctic Ocean. Despite the small volume of these areas, they act as a primary source of a large portion of deep, ventilated waters in the World Ocean. Also, the export of ventilated deep waters to the Atlantic via the Fram Strait is compensated by a corresponding import of relatively warm and saline surface waters of Atlantic origin (Aagaard et al., 1985). The Arctic Ocean is hence commonly described as one of the lungs of the deep global ocean (the other being the Weddell Sea). The tectonic development and opening of the Fram Strait has determined the history of water mass exchange between the Arctic Ocean and the World Ocean, as the strait represents the only deep connection between the Arctic and all other oceans. The initial opening of the Fram Strait may have occurred as early as late Eocene, some 35 million years ago.

An understanding of the exchange of water masses between the Arctic Ocean and the world ocean is an essential element in modelling the change in global oceanographic conditions over the past ~40 million years. Such models require knowledge about, for example, when bottom water formation began in the Arctic, how chemical and physical characteristics of this water mass varied through time, and which cause and effect relationships governed the development of the Arctic water masses.

Extreme Warmth and the Arctic

Another important challenge in paleoclimatology /paleoceanography is to develop a quantitative understanding of the underlying mechanisms responsible for maintaining the extreme polar warmth observed for the Eocene and other intervals, older and younger. In terms of intervals of extreme warmth, there are seven key time intervals to examine in the Arctic, the Aptian — Albian, early Eocene, middle Miocene, early Pliocene, MIS 11, Cenomanian, and late Paleocene. What was the climate of the Arctic during these periods? Studies of terrestrial floras suggest mean annual temperatures as high as 13¡C during the Cenomanian greenhouse conditions (Kelley et al., 1999). What was the circulation and fertility of this open basin? Was there sea-ice during the Neogene warm intervals? Perhaps the most extreme greenhouse interval is the late Paleocene Thermal Maximum (LPTM). This event, which could have been driven by the release and oxidation of methane from clathrates, is characterized by as much as 8¡C of warming in the high southern latitudes. What was the response of the Arctic to this warming?

At present, the existing climate proxy data for the Arctic are at odds with paleoclimate simulations (General circulation models) that produce polar regions characterized by sub-freezing temperatures and significant seasonality. And yet, the fossil record suggests mild climates characterized by winters that rarely see sub-freezing conditions. The reasons for the model/data discrepancies are not known. In terms of the dynamics of maintaining extreme polar warmth, climatologists have focused on heat transport processes as well as the effects of greenhouse gases (Lyle, 1997). Simulations have been run to test the effects of increased oceanic heat transport on high latitude climates, but have found this to be inadequate for sustaining polar warmth. Along these lines, the presence of a large body of water with its attendant heat capacity should have a major influence on high latitude temperature, daily and seasonal, although the impact of this quantitatively requires additional testing. One potential solution to the high-latitude warmth paradigm may involve methane in generating polar-stratospheric clouds which tend to insulate the poles.

Evolution of Polar Biota

What little we know about the composition of the Arctic floras and faunas is largely derived from isolated studies of the shallow-marine assemblages in the onshore sediments of Arctic Canada, Spitsbergen, the Pechora Basin, Western Siberia, and a few piston cores on the Alpha Ridge. Mesozoic microfossils (mostly foraminifera and palynomorphs) have been studied from Siberia (Azbel et al., 1991), Canada (Hedinger, 1993), and Spitsbergen. Cenozoic foraminifera and palynological assemblages have been studied in offshore exploration wells in the Beaufort-MacKenzie Basin (McNeil, 1989, 1997). These areas provide at least some insight into the nature of Arctic marine faunas.

A number of questions remain to be answered:

What is the taxonomic composition of the Polar marine faunas and floras? Is there any evidence for bipolarity of Polar Faunas? Can we establish a workable microfossil biochronology for the Arctic that can be used for correlation purposes? Given the endemic nature of floras and faunas reported from the Arctic, to what extent has the Arctic fauna and flora evolved in isolation from the world ocean? Has the Arctic served as a refugium for species that suffered extinction elsewhere?

Can we use the microfossil record of the Arctic as proxies of watermass properties and productivity, or do we need to develop new proxies? Can we use fauna and flora to interpret the circulation history of the Arctic basins? What role has the Arctic Ocean played in the origin of cosmopolitan oceanic faunas and floras, and terrestrial biota? To what extent is the evolution of polar marine faunas and floras influenced by the evolution of the cryosphere? To what extent can we use the siliceous faunas and floras to interpret the history of sea-ice formation in the Arctic?

Arctic gateways and basin evolution

The environment of the Arctic Ocean changed dramatically during the Mesozoic/Cenozoic tectonic evolution. The Cenozoic opening of the gateways, especially the Fram Strait, favoured the formation of continental ice sheets and the sea-ice cover in the Arctic, perhaps changing the mean average tempeature from 13 degrees Centigrade to the present day situation. Knowledge about this history can only be obtained by direct rock sampling.

The current models suggest that the oldest Arctic deep-sea basin (Canada Basin) opened in the Cretaceous (Vogt et al, 1979). For most of the Mesozoic, the Arctic Ocean consisted of an isolated deep-sea area with no major deep-water connection to the World Ocean. Although this model is widely accepted, details on the evolution of the Mesozoic Arctic are very limited. While the Cenozoic spreading at the Gakkel Ridge explains the opening of the Eurasian Basin and its relationship to the Lomonosov Ridge, the nature of the Alpha-Mendeleev Ridge in the Amerasian Basin as well as the age of the surrounding deep-sea basins is not known. For the Cenozoic history the most important question to be addressed is the timing of the opening of the Arctic gateways. For unravelling the geological history of the high-Arctic a number of key areas have to be investigated by drilling.

The Alpha-Mendeleev Ridge is the largest single submarine feature in the Arctic Ocean. Seismic investigations show that the Alpha Ridge is covered in the most part by a sedimentary sequence of up to 1 km thickness. Shallow cores indicate that Cretaceous sediments are present (Clark et al., 1986). The first multichannel seismic survey in 1998 along the central part of the Alpha Ridge shows completely undisturbed sediments up to 1200 m thick (Jokat et al., 1999). One model suggests the ridge complex may represent a Cretaceous LIP. Supporting evidence for the emplacement of a LIP can also be found in the terrestrial record of continental flood basalts of Cretaceous age. Recent geological and geophysical investigations support the oceanic origin of the structure. Sampling of the ridge provided a basalt with close affinity to MORB samples (Muehe et al., 1999). Furthermore, the seismic data indicate that the central part of the Alpha Ridge is covered by an undisturbed package of Cenozoic and Mesozoic sediments. This provides a unique opportunity to obtain a complete record of the Post-Paleozoic history of the high-Arctic.

It has been suggested that the Lomonosov Ridge is a continental fragment originally split from the Barents-Kara Sea margin. Seismic reflection data acquired across the ridge show a continuous cover of parallel-laminated pelagic sediments on the ridge top underlain by sediment-filled half grabens and diverging reflectors (Jokat et al., 1992). The sediments beneath the Cenozoic pelagic section, are the only preserved records from this Mesozoic margin, one edge of the Amerasian Basin. Drilling

through the unconformity will constrain the development of this passive margin, providing age constraints for the rifting of the Eurasian Basin.

The Gakkel Ridge is unique among ocean ridges for its very slow spreading rate. The properties of its eruptive rocks and their melting residuals, including the direct interaction of mantle rocks with seawater hold important information to our understanding of global mid-ocean ridge melting systems. The drilling objectives are to obtain relatively fresh basement samples from the sedimented central and eastern portions of the ridge and to establish the depth and extent of mantle-seawater chemical and thermal interaction on the ridge.

Geophysical data suggest that the Morris Jesup Rise and the northern section of the Yermak Plateau represents an oceanic LIP which once formed an Iceland-like massif at a triple-junction of the North American/Greenland and European plates and are presumably underlain by oceanic crust. The determination of the origin of these plateaux is essential for understanding the opening of the Fram Strait. However, the dating and origin of the plateaux are essential for the reconstruction of the opening history of the Eurasian Basin as well as the Fram Strait.

The Chukchi Borderland is considered to be of continental origin and the Amerasian Basin formed when Arctic Alaska rotated away from Arctic Canada during the Mesozoic (Grantz et al., 1999). However, there is little geological and geophysical data from either of the margins or the Canada Basin, which can be used to test this hypothesis. Furthermore, this simplistic model cannot explain either the Alpha Ridge or the Chukchi Cap region.

The two modern Arctic gateways, the Fram Strait and the Bering Strait, developed as a result of plate motions, and have later been influenced by vertical motion, volcanism and sea-level changes. During the Cretaceous, marine connections with the world ocean were maintained through the Western Interior Seaway, whereas during the early Paleogene intermittent connections with the Tethys occurred via the Turgai Strait in Western Siberia. These gateways have had a profound impact on global oceanic circulation, and their tectonic evolution therefore needs to be determined by drilling.

Potential for High Resolution Coring in the Arctic Ocean

The paleoclimate studies dealing with rapid climate change and short-lived climatic events require cores from areas with high sedimentation rates in the Arctic Ocean. In order to resolve changes such as Dansgaard-Oeschger events on the 1.5 kyr frequency, deposition rates of at least several cm/kyr are a must and >10 cm/kyr highly desirable. Besides paleoclimate, there are many processes that are unique to the Arctic such as sea ice-rafting from shelf to shelf across thousands of kilometers of ocean (Bischof and Darby, 1999). Such records could also be useful for investigations of biogenic and nutrient paleo-fluxes in the Arctic Ocean, especially those from the shelves to the basins. Other aspects to investigate with high-resolution records are the ventilation of the deep Arctic Ocean and the impact of fresh water fluxes and the effect of sea ice formation on the stability of the Arctic pack-ice.

Potential locations for high-resolution sediment records in the Arctic Ocean are reviewed below:

Continental Slopes

The most promising areas for both high sedimentation marine records and adequate amounts of biogenic proxies are the continental slopes in certain areas. The margins of the Arctic Ocean have the thinnest pack-ice and probably the shortest intervals of low productivity in the past. Aside from the problem of downslope transport from the shallow shelf or terrigenous sources swamping the marine signal, these locations offer the potential for a compromise between continuous deposition above 10 cm/kyr and adequate amounts of biogenic proxies. Most of these slopes have contour currents that could generate drift deposits with high sedimentation rates. Many canyons cut these slopes and high rates of downslope sediment transport and deposition should occur in fans or deltas associated with these canyons. While these may have a high proportion of terrigenous input, they do provide high resolution.

Not all continental slopes are equally promising. One example of a slope with good potential for high resolution cores with abundant proxies are the slopes off the Laptev, Chukchi, and Kara Seas (especially in and around the Santa Anna Trough). The Laptev Sea continental slope should contain a record of the western Russian Arctic Ocean as well as a signal from the Lena, Ob and Yenisey Rivers, and other important Russian rivers (Kassens et al., 1999; Stein, 2000; Stein and Fahl, 2000). The Kara and Barents Sea slopes leading into the depths of the eastern Arctic Ocean should contain an excellent detailed record of former ice sheets on these shelf areas (Stein et al., 1994). These fluvial signals are important to both paleoclimatology and paleoceanography. The Chukchi Sea continental slope should provide a marine record of the western Amerasian Arctic Ocean as well as the Bering Strait influx from the north Pacific. The Kara Sea continental slope should provide a marine record for the eastern Arctic Ocean and the influx of North Atlantic water that enters the Arctic Ocean via the Barents Sea. This later location could be critical for understanding the North Atlantic Oscillation and its potential relationship with Arctic paleoclimate changes.

Central Arctic Ocean Ridges

There are three sub-parallel ridge systems of quite different age, origin, and morphology in the central Arctic Ocean, the Alpha-Mendeleev, the Lomonosov, and the Gakkel Ridges. There are abundant graben features on each of these ridge systems that afford conditions for ponded sediment and higher sedimentation rates. In addition, there are locations where contour currents or geostrophic currents such as the North Atlantic Intermediate Water spill over these ridges in less than 1000 meters water depth. These afford the opportunity for drift deposits and thus high sedimentation rates. Seismic evidence on at least the Lomonosov Ridge for a two-fold thickening of the Tertiary sediment package in some areas (Jokat, 1999; Jokat et al., 1999). In addition, the Northwind Ridge/Chukchi Plateau area offers potential coring sites close to open water or favorable ice conditions in most summers.

Because of the generally thicker pack-ice conditions in the Amerasian half of the Arctic Ocean, the Alpha-Mendeleev Ridge and to a large extent, the Lomonosov Ridge have a lower potential for good biogenic proxy accumulations. Parts of the Gakkel Ridge should not be as severely affected and thus could have a much better proxy record than the other two ridges (Stein et al.. 1994).

Deep Arctic Basins

While normal pelagic deposition occurs in the deep Arctic basins (e.g., core 94BC20, Darby et al., 1997), these basins are dominated by turbidite sequences (Campbell and Clark, 1977; Darby et al. 1989). The deposition rates for the normal pelagic sediment in these basins is usually no higher than on adjacent ridges (Darby et al., 1997). There are some exceptions where sedimentation rates of normal pelagic sediments were found to be up to 3.2 cm/kyr in the Canada Basin (Grantz et al., 1999). Turbidite sequences have sedimentation rates of 145 cm/kyr; however, unless someone can discover a way to interpret turbidite sequences for paleoclimatic or paleoceanographic problems, these areas should have a low priority for high resolution coring. Turbidite sequences do preserve a good record of the sporadic flux of sediment off the shelves or from large rivers (e.g., the Mackenzie fan). The main problem is the sporadic nature of turbidites and establishing a good stratigraphy without having to date nearly every turbidite layer.

Gas Hydrates in the Arctic

The distribution of gas hydrate in marine arctic environments is poorly documented, although conditions exist for gas hydrate to occur associated with permafrost on the submerged continental shelves of the circum-arctic sedimentary basin, much like their terrestrial counterparts (Kvenvolden and Grantz, 1990; Max and Lowrie, 1992). Gas hydrate may also be present in deep marine arctic basins, as suggested by the recent observation of bottom-simulating reflectors (BSR) on seismic lines through the Lomonosov and Alpha Ridges (Jokat, 1999). The amount of methane that is trapped in gas hydrate is perhaps 3,000 times the amount contained in the atmosphere. A large portion of this methane reservoir is located on the Arctic continental shelf associated with permafrost.

Of particular relevance to global climatic change is the question: Could large quantities of methane be released to the water column and ultimately to the atmosphere as a consequence of destabilization of gas hydrate present in seafloor sediments? The exact link between global warming and gas hydrate dissociation is still debated. A unique site to document the on-going process of methane release from gas hydrate dissociation is the Arctic continental shelf. The process of methane release to the atmosphere may have been active on the extensive Arctic continental shelf since the end of the Pleistocene glaciations, when submergence of the shelf considerably increased the temperature at the sediment surface. This would have produced progressive warming of the shelf sediments with gas hydrate destabilization and methane release.

The processes leading to permafrost and gas hydrate destabilization on the Arctic continental shelf has received little attention. Scientific drilling of destabilized permafrost and gas hydrate accumulations on the Arctic shelf would be of great benefit in characterizing the distribution of gas hydrate in the Arctic shelf sediments and in unveiling thermal and hydrogeological processes that control methane release. Such boreholes would provide important clues as to the interplay between permafrost-associated gas hydrate in Arctic shelf sediments and global climatic change.

The APPG recommends drilling a destabilized permafrost-associated gas hydrate accumulation on the Arctic shelf in order to characterize active processes of methane release. This could be achieved through drilling a suite of 3-4 holes across the shelf, from an outer position at the former limit of permafrost, to an inner position where permafrost has been virtually preserved (reference site possibly on land). Drilling objectives should include determining the distribution of permafrost, solid gas hydrate and free gas, to establish the nature of the thermal regime, to investigate active gas transport processes and fluxes, and to develop models of methane release from destabilized permafrost-associated gas hydrate accumulations.

Other biogeochemical cycles, such as the silica cycle, should also be investigated in context of regional and global climate change. Very little is known about these elements and their record of nutrient flux in the Arctic Ocean (Aagaard et al., 1999).

5 The Arctic Environment

or monthly ice motion is explained by the local geostrophic wind (hypothetical wind above the friction layer where the pressure gradient balances the Coriolis force).

The ice moves at an angle to the right of the geostrophic wind, ranging from 5... in the winter to 18... in the summer (Thorndike and Colony, 1982). During periods of decelerating wind, ice motion can become current driven, manifested both as skin drag and form drag on the underside of the ice. The ratio of the ice sail height to keel depth may reach 1:5 for first year ice, making form drag in the oceanic boundary layer of equal or greater importance to that of skin drag (Smith and McLean, 1977). Excluding eddies and other transient phenomena, currents in the upper waters tend to be relatively slow (<10 cm/s) and similar to the ice motion both in speed and direction (SCOR WG 58, 1979). Because winds are highly variable variations in ice motion are approximately 50% wind driven and 50% current driven on annual and longer time scales (Thorndike and Colony, 1982).

Typically, 5-10 years are required for ice to make one curcuit around the Beaufort Gyre with mean drift speeds of 1-3 cm/s (Thorndike, 1986). Ice island T-3 made two rounds in the gyre and exited the Fram Strait about 30 years after its discovery north of Canada. Average ice velocities in the Transpolar Drift increase towards the Fram Strait, and are 2-3 cm/s over the Asian part of the Lomonosov Ridge and 5-10 cm/s in the Fram Strait (Fig. 3). Approximately 20% of the total ice area of the Arctic Basin exits annually through the Fram Strait (Thorndike, 1986). This ice consists of 80% multiyear floes of 2-3 m thickness (Gow and Tucker, 1987).

Sea ice thickness

The sea-ice thickness is determined by two main factors; a thermodynamic effect controlled by fluxes of radiative, sensible, and latent heat in the adjacent atmospheric and oceanic boundary layers, and by a dynamic effect from surface tractions at the ice-air and ice-water interfaces. Wind traction on the ice surface and current traction on the underside of the ice cause mechanical compression and conversion from thin ice to thicker ice, as well as divergence and opening of new leads and opportunities for the generation of new ice.

The annual cycle of freezing and melting begins with freezing of meltwater ponds on the ice and open-water leads as the air temperature starts to drop rapidly in early September (Figs. 4 and 5). About 80% of the annual snowfall (10-15 cm water equivalent) takes place by early November. From this time until May, the air is too cool to carry significant amounts of moisture (Untersteiner, 1990). The accretion of ice continues until May, slowly under thick ice and more rapidly under thin ice.

The onset of melting corresponds to a mean air temperature near —1.2... C (Doronin, 1974). Development of melt ponds at 85... N starts on average about July 1, and the melt season continues until late August. The extent of ponds increases to about 25% of the surface area (locally up to 45%) by mid-July. Through the annual cycle, ice is added at the bottom and melted away at the top. The seasonal variation in ice draft due to melting and freezing processes is approximately 0.3 m (Maykut and Untersteiner, 1971).

The most extensive data base for ice thickness distribution in the Arctic Ocean comes from

operational purposes. Data from 12 submarine cruises into the central Arctic Ocean during the period 1958-87 have been compiled (Bourke and McLaren, 1992). Mean ice draft and deep-draft keel statistics was calculated for 50 km segments along the track of the submarine (Fig. 6). The mean ice draft over the Siberian sector of the Artic Ocean is 3 m or less. The thickest ice occurs north of Canada and Greenland, and is a result of the general ice circulation pattern with convergence towards these landmasses (Fig. 3). Here, the mean ice thickness is determined by the mechanical strength of the ice, which sets a limit to the amount of deformation that can occur (Wadhams, 1994).

Visual observations of ice ridging taken during U.S. Navy Birdseye flights covering most of the Arctic Ocean, have been compiled and published (Weeks et al., 1971). In broad terms, 0.5-2 ridges per km characterize the ice surface (Fig. 7). Pressure ridges have keel draft to sail height ratios of 3-4:1, with larger ratios for first year ice (Tucker, 1989). Keels are usually wider than sails and cluster around 50-150 m with mean total widths around 70 m (Wadhams, 1994). The mean draft of pressure ridges exceeding a 9 m threshold is 10-12 m for most of the Arctic Ocean during summer. Their occurrence is 1-3/km (Fig. 8). The deepest ridge keel reported had a draft of 47 m (Lyon, 1961). The highest recorded free-floating sail was 13 m (Kovacs et al., 1973).

Thinning of the sea ice in the Arctic Ocean as well as a reduction of the areal extent of the ice cover has recently been reported (Rothrock et al., 1999) although other sources report on unchanged conditions. In the 1960s Russian scientists observed that drift of the pack ice was dependent on the air pressure distribution over the Arctic Ocean and that it alternated periodically between cyclonic and anticyclonic circulation (Proshutinsky and Johnson, 1997). The air pressure variations in the Arctic Ocean may be linked to the North Atlantic Oscillation (Kwok, 2000), and in this context it is interesting to note that the present warming coincides with a period of increasing amplitude of the North Atlantic Oscillation, two mechanisms that may reinforce each other.

Sea-ice variability

Using a comprehensive sea-ice model forced with daily varying winds and monthly mean air temperatures from 1951 to 1990, Flato (1995) examined spatial and temporal variability of monthly-average ice thickness fields over the Arctic Ocean. Regions exhibiting the largest inter-annual variability were the Beaufort Sea and the Siberian Shelf. The Laptev Sea and the central Arctic Ocean were much less variable. Some of the inter-annual variability may result from differences in wind-driven ridging, forming thick ice which survives several years.

Only in the vicinity of the North Pole are there sufficient submarine tracks to provide a temporal and consistent record of ice thickness (McLaren et al., 1994). Over a 34 year period, the overall draft was 3.6 m, but with large interannual variations ranging from 2.8 m in 1986 to 4.4 m in 1970. Figure 7 shows the variation of the mean draft and how the mean thickness varies in multiyear and deformed ice (>4 m). It also shows variations in young and first-year ice (<2 m) contribute to the total value. Ice with drafts less than 2 m generally comprise less than 20% of the surface area near the North Pole (Fig. 9a). Recent observations during the SHEBA project in the western Arctic Ocean, indicate about half a meter of pack-ice thinning between the early 1970's and 1999 (Rothrock and Maykut, 1999).

The peak strength of the Beaufort Gyre ice circulation during spring can be related to a seasonal shift toward increased anticyclonic activity over the Beaufort Sea with concurrent decrease in activity over Alaska/Yukon and Siberia (Serreze et al., 1993). During the summer, particularly August-September, temporary reversals of the mean clockwise ice motion in the Beaufort Gyre, lasting up to a month, are caused by a persistent low in the atmospheric sea-level pressure field of the central Arctic Ocean (Serreze et al., 1993). Anomalous halting of the Beaufort Gyre leads to convergence in some regions and divergence in other regions. During these periods, ice in the Transpolar Drift may move eastwards across the general drift direction (Serreze et al., 1989). Wadhams (1994) has related such events to as much as a 50% reduction of the regional mean ice draft north of Greenland in 1987.

Lower than normal sea-level pressure over the central Arctic Ocean is the characteristics of a high phase in the Arctic Oscillation (AO). The AO can be interpreted as the surface signature of modulations of the strength of the polar vortex aloft, and is manifested as a seesaw pattern in which the atmospheric pressure at polar and middle latitudes fluctuates between high and low phases (Thompson and Wallace, 1998). Seven out of the last ten years have seen a high AO state and the high frequency variability is much greater than its decadal variability. Ice drift velocities are generally slower during a high AO state, the center of the Beaufort Gyre is several hundred kilometers closer to the Alaskan coast and the Transpolar Current is shifted more towards Canada with concurrent increased advection of ice from the Laptev Sea into the Transpolar Current (Rigor pers. comm., 2001).

(See http://tao.atmos.washington.edu/wallace/ncar_notes/ and http://iabp.apl.washington.edu/Deploy2001.gif)

Arctic Ocean weather

Summer cyclones and anticyclones in the Arctic, north of 65… N are generrally more frequent, but weaker than their winter counterparts (Serreze et al., 1993). The increase in cyclonic activity occurs between April and June and is associated with an increase in the extent of low-level Arctic stratus clouds. The primary difference from winter is that cyclones are distributed more widely throughout the Arctic (Fig. 10). The average surface pressure over the Arctic Ocean is positive, but during the summer, low pressures frequently move into the central basin. The melting of the pack-ice in summer leads to the formation of persistent fog and low clouds. The cloud amount during July and August exceeds 90% and most of it is low-level stratiform clouds (70%) (Curry and Herman, 1985; Herman and Goody, 1976). Arctic stratus clouds tend to occur in well-defined layers of 300-500 m thickness.

Optimum Operation Time-Window

The optimum time-window for marine summer operations in the Arctic Ocean is the period between the peak of the melt season in early August and the rapidly falling temperatures in early September.

Ice Forecasting

Ice forecasting requires reliable synoptic information of the wind field. Presently, fourty automatic data buoys report surface pressure and temperature from the Amerasia Basin in the Arctic Ocean, but none from the Eurasia Basin. Plans for 2001 are to deploy

fourteen buoys distributed along the trend of the Lomonosov Ridge. Coverage of synthetic aperture radar (SAR) satellite imagery extends to 88... N and allows for identification of ice types and ice consentration. A viable strategy would be to explore the target region by SAR imagery early in the season, project the ice motion from analysis of the wind field and follow up with more frequent coverage to identify the movement of characteristic ice fields into the target area.

6 Strategies for successful scientific drilling in the Arctic

Context

In the context of the Integrated Ocean Drilling Program (IODP), scientific drilling in the Arctic can only be accomplished by an alternate (fit to mission) platform. Neither the present ODP drillship JOIDES Resolution nor the riser and the non-riser vessels proposed for the IODP will ever penetrate into the permanently ice-covered areas of the deep polar basin. Furthermore, because operations will be restricted to summer months and because of the wealth of scientific problems that need to be addressed in the Arctic Ocean, a dedicated effort over 10-20 years is required.

More extensive geophysical site surveys of potential drilling targets are urgently needed. Underway geophysical surveys in the Arctic Ocean carried out both from surface icebreakers and from submarines during the past decade, have considerably improved our knowledge of the principal features of the Arctic sea floor. This activity needs to continue in order to provide the detailed geophysical foundation from which the best scientific drilling targets can be selected. This site survey data needs to be shared throughout the scientific community. A successful scientific program is thus dependent on a flourishing program of marine geophysical surveys in the Arctic.

Jurisdiction

Five coastal states border the Arctic Ocean: Canada, Greenland (Denmark), Norway, the Russian Federation and the United States of America. A large proportion of the Arctic Ocean lies within the 200 nm jurisdiction of these states. However, no maritime boundaries have yet been agreed in the Arctic between adjacent states, and to date only two of the five Arctic coastal states (Norway [1996] and Russia [1997]) have ratified the United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS has been in force since 1994, one year after achieving ratification by 60 countries.

Article 76 of UNCLOS specifies ways in which national jurisdiction may be extended beyond the 200 nm limit. A coastal state has 10 years from ratification of the treaty to assemble data on which to make such claims. Considerable efforts are underway in the Arctic Ocean to acquire new bathymetric and geophysical data on which claims for extended jurisdiction may be made. The existence of extended shelf areas and of prominent ridges extending into the Arctic Basin from the adjacent continental margins (e.g. Alpha Ridge, Lomonosov Ridge) implies that claims of extended jurisdiction will be made and may extend 350 n.m. or more. If

all the Arctic coastal states extended their jurisdiction to 350 nm, the High Seas area of the Arctic Ocean would be much reduced.

The uncertainties about future jurisdiction in the Arctic Ocean, however, should not reduce the chances of getting clearance to conduct scientific drilling there, as all of the coastal states have an interest in increased scientific understanding of the region and in scientific ocean drilling. However, the decisions of some governments might be influenced by pressures from indigenous populations (e.g. Denmark by the indigenous population of Greenland and Canada by the indigenous population of Nunavut).

Environmental Issues

The sensitivity of low-temperature environments to oil pollution is recognized in Article 234 of UNCLOS (Taagholt, 1992):

Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation. Furthermore, pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence. This article could be used by Arctic coastal states in the future to restrict navigation within their area of jurisdiction.

The sensitive and pristine nature of the Antarctic environment has already been recognised by the Antarctic Treaty and by the MARPOL Convention (International Convention for the Prevention of Pollution from Ships). MARPOL has designated all sea areas south of 60..S as a Special Area. This came into force in the mid nineties, so that the capabilities of the ODP drillship *JOIDES Resolution* for handling solid waste and oily water run-off from the rig floor had to be substantially improved in order for the vessel to be in compliance for Leg 178 (Antarctic Peninsula) in 1998. The techniques which had been used on Leg 113 (Weddell Sea) and Leg 119 (Prydz Bay) in the late eighties no longer sufficed.

The Arctic Ocean is not designated as a Special Area under MARPOL (though it might be in the future, especially if the Northern Sea Route (Northeast Passage) from Europe to the Far East became economically viable). However, numerous international bodies have come into being over the last decade which have responsibilities or jurisdiction for the Arctic environment:

The *Arctic Environmental Protection Strategy* (AEPS) was adopted by the eight Arctic nations in 1991 at Rovaniemi, Finland.

The *Arctic Monitoring and Assessment Programme* (AMAP) was set up in 1991 with responsibilities to monitor the levels of, and to assess the effects of, anthropogenic pollutants in all compartments of the Arctic environment, including humans.

The Working Group on the *Protection of the Arctic Marine Environment* (PAME) was established in 1993. PAME addresses policy and non-emergency response measures related to the protection of the marine environment from land and sea-based activities.

The *Arctic Council,* established in 1996, is a high-level intergovernmental forum to address common concerns and challenges in the Arctic. Protection of the Arctic environment and sustainable development are its main concerns. AMAP and PAME are now two of the five Working Groups of the AEPS, functioning under the auspices of the Arctic Council.

The *OSPAR (Oslo Paris) Convention* for the Protection of the Marine Environment in the North-East Atlantic entered into force in 1998. The maritime area it covers extends from 51... E to 42..W (longitude of Kap Farvel), and from 36..N (latitude of the Strait of Gibraltar) to the North Pole. Thus this convention applies to a substantial sector of the Arctic Ocean.

The *United Nations Environmental Programme* (UNEP) also maintains an interest in the Arctic environment.

In addition to these governmental bodies, environmental non governmental organizations (NGOs) are also deeply concerned about the Arctic environment:

The *World Wildlife Fund* (WWF) created its Arctic Programme in 1992. In addition to implementing its own Arctic conservation strategy, it monitors the governmental steps that have been made in Arctic management. WWF has expressed concern at irresponsible oil and gas development.

The *Greenpeace Arctic Action* programme is hostile to oil developments and aims to stop any oil drilling projects in the Arctic.

It is clear from the above summary that any scientific drilling programme in the Arctic Ocean must make it absolutely clear that it has nothing to do with oil exploration and that the environmental impact of riserless scientific drilling is negligible.

Pollution Prevention

For over 30 years DSDP and ODP have maintained an unblemished record with respect to pollution. There have been no blowouts and no accidental releases of hydrocarbons into the sea from the wells drilled. The reasons for this are as follows:

Since the early days of DSDP all proposed drill sites have been carefully scrutinised by the JOIDES Pollution Prevention and Safety Panel (PPSP) before approval is given for drilling. Sites at which geophysical or other data suggest that hydrocarbons might be encountered are either moved to acceptable locations or are not approved.

All sites are continuously cored from the sea floor. Cores recovered are monitored in the drillships chemistry laboratory for hydrocarbons. If significant quantities of migrated thermogenic hydrocarbons are detected, deeper drilling at that site is abandoned. About ten

holes in DSDP and ODP have been terminated before reaching target depth due to rising levels of hydrocarbons in the cores.

Most holes in DSDP and ODP have been shallow by oil industry standards (penetrations typically in the range 300-1000 mbsf) and in much deeper water (generally 1,000-5,000 m). The diameter of the holes drilled in DSDP and ODP has been small (usually 25-30 cm). Because of the longevity and unblemished record of scientific ocean drilling, it is important that all drill sites proposed for the Arctic Ocean are reviewed in the same way as ODP holes are today by the JOIDES PPSP.

In order to emphasise the difference between riserless scientific drilling and exploration for oil and gas by riser drilling, the following points should be noted:

All drill cuttings in riserless scientific drilling operations are released at the sea floor. By contrast, in riser drilling operations the bottom hole cuttings (i.e. those produced once the marine riser is in place) are released near the sea surface. The volume of drill cuttings released from a scientific drill hole onto the sea floor is much less than from an industry well because the hole diameter and depth are generally much smaller. The drilling fluid used in scientific ocean drilling is seawater, with only occasional slugs of mud. The latter are simple muds of natural origin (e.g. bentonite, barite) and no complex chemical additives or oil-based muds are used.

Since the objectives for scientific drilling in the Arctic Ocean are primarily paleoceanographic and paleoclimatological, the proposed drill sites are likely to be of shallow penetration (< 500 mbsf). This in itself reduces the risk of hydrocarbon flows.

Management issues

Management tasks of high-Arctic drilling operations will include:

- Seek coastal state approvals, where necessary.
- Manage budgets and maintain auditable accounts.
- Select contractors for ice management, drilling operations, core handling and curation.
- Negotiate contracts.
- Monitor contracts and pay for work done.
- Invite scientific participants.
- Identify safety issues and develop contingency plans.
- Define operational plans and establish lines of responsibility.
- Organize logistics.
- Arrange insurance policies (Government backing may be needed, as with ODP).
- Submit appropriate reports to funding agencies and to the scientific community.
- Interact with international environmental organizations.

In order to carry out the above mentioned tasks, management will need to include experience from Arctic ice management, drilling operations, core handling, and project management / contracting. This is not something that can be relegated to a transitory committee of experts.

Health and Safety aspects
Because drilling in the high-Artic is, both within short and long-range time-frames, a multi-vessel operation, there are low risks associated with health and safety. In the event of an on-site need for vessel abandonment (fire, water-ingress, etc.), there will be a vessel nearby, which will be on-call within a maximum rendezvous period of less than one hour. Evacuation will therefore rely on one or two of the other participating vessels.

There is normally a hospital and health personnel available onboard the large participating icebreakers. However, in the event of a need for medical evacuation, transport will rely upon shore-based and/or ship-based helicopters.

Short-term strategy
A scientifically top rated proposal for drilling the Lomonosov Ridge (533) already exists. This will be dealt with further by the recently established Arctic Detailed Planning Group (DPG).

Drilling within the permanently ice-covered regions of the Arctic should continue with operations on the periphery of the Arctic ice pack where some site survey data already exists, but for which drilling proposals have yet to be submitted. The approach adopted for these early legs will be:

a) use existing technology and ice management techniques already developed for drilling in ice covered areas;
b) ensure that many sites are available, over a considerable geographical area. This will prevent the operation from failing because of difficult ice conditions at just a few sites;
c) adequate site surveys must be available for all sites, including back-up sites.

Long-term strategy
In order to achieve the scientific goals of an Arctic drilling program, at least a decade of drilling is required. This long-term strategy assumes that a committment to long-term funding of an Arctic drilling program exists.

The long-term strategy will build on the results of the first drilling legs in the Arctic ice pack. Indeed, learning from the experience gained on earlier legs will be essential to the success of the whole program.

7 Technology for Arctic Drilling

Drilling Platform criteria
The general requirements for a drilling platform capable of operating in Arctic sea-ice areas include:
1. Dynamic positioning (DP)
2. High-Arctic ice-class
3. An adequate moon pool with a reinforced deck capable of supporting a drill rig

4. Sufficient deck space for drilling, coring, logging equipment, and tools
5. Provision for modular laboratory containers, including provision of services (water, fuel, power etc.)
6. Sufficient accommodation for crew and scientists
7. Helideck and other appropriate navigation and safety features for Arctic work.

Potential platforms

Drilling Vessel or barge

Dynamically positioned ice-class vessel or barge with a moon-pool and equipped with at least a 100-ton capacity, heave-compensated drill rig. This vessel will require support by icebreaker(s).

Icebreaker-based platform

A portable heave-compensated drill rig installed on a dynamically positioned icebreaker with a moon pool.

Ice supported drill rig

A portable drill rig transported by an icebreaker or by air and installed on land-fast (non-moving) ice.

Coring systems

There are several existing technologies and systems available for scientific drilling worldwide. The system selection will depend on scientific objectives, water, and borehole depth and the type of drilling platform. The currently available systems are:

ODP system - a unique heavy-duty offshore scientific coring system with abilities to operate from oil field size DP drill vessel (e.g., JOIDES Resolution).

Geotechnical Marine coring systems, including the *Piggy-back* option - used on geotechnical DP drill vessels and other platforms (e.g., Bucentaur).

Complete Coring System (CCS) - designed for the Russian deep ocean scientific drilling. The CCS is able to operate from oil-field or geotechnical type DP vessels.

Baikal - Nedra Coring system - a development based on ODP and CCS techniques. This system has been used from a drilling barge in Lake Baikal.

DOSECC/Cape Roberts style systems - hybrid, specially-designed mining style, multi-string systems used in scientific coring.

Coring Strategy

In the short-term (3-5 years), the technology should allow high-performance and high-resolution coring using single-bit drilling technology. The proposed technology includes hydraulic piston sampling (in ooze, soft clays), percussion sampling (in formations, such as sand, silt clays), and rotary coring.

Additional coring technology, compatible with single-bit operations should be part of the system (e.g., Piggy-Back /nested coring system, down-hole motor coring, HYACE or PCS sampling).

Drill string selection

Primary drillstring

Candidates for the main drill string include:

1. Modified 5 (127-mm OD) steel drill pipe, as used by ODP and geotechnical drilling vessels.
2. CCS 164-mm OD aluminium drill pipe, used by geotechnical vessels for deep-water operations.
3. 131-mm OD aluminium drill pipe with similar internal dimensions to the ODP steel drillstring.
4. Large diameter mining rods with heavy-duty connections (e.g. GLAD-800 application).

The use of an aluminium drill string extends the operating depth of any drillrig. The large diameter aluminium drillpipe allows increased core diameter and more versatile coring techniques.

Secondary drillstring

Standard mining drill rods are normally used for secondary drill string assemblies. The length of the secondary drill string is limited by the rig capacity and drill rod strength. In order to extend the secondary string capacity within the rig limits and to reduce the risk of connection failure, the secondary drillstring could comprise a bottom section of standard mining rod and top section of purpose built durable aluminium rods. Drill string parameters are presented in the Appendix, Table 1.

Drill rig selection

A dedicated drilling vessel will have an integral derrick and heave-compensated drilling capability. Alternatively, suitable vessels of opportunity can be equipped with portable, heave-compensated marine drilling rigs on a project-by-project basis. Either facility then needs to be equipped with a suitable coring system. Appendix, Table 2 illustrates the technical characteristics of different drill rigs available.

Coring tools/technology selection

The modular coring system will include:

1. Core bits suitable for single-bit operations
2. Hydraulic piston sampler
3. Hydropercussion Sampler
4. Rotary Coring tools
5. Mining style coring system operated through the secondary drill string.

Different coring tool parameters are presented in the Appendix, Table 3. Appendix, Table 4 summarizes an example of the Arctic Drilling Program technology and equipment selection process.

Logging system and strategy

A portable wireline logging system compatible with coring system and anticipated borehole diameter is required. This system should include a winch, cable, and data acquisition unit. The basic logging requirements include:

1. Natural gamma-radiation
2. Electrical resistivity
3. Acoustic velocity
4. Density
5. Neutron porosity
6. High resolution magnetic susceptibility and magnetic field
7. Formation micro-imaging
8. Well seismic tool.

The logging-while-drilling (LWD) system needs to be considered on a project-by-project basis.

On-board laboratories

Modular laboratories for core curation and safety assessment are required, as a minimum.

Other modular (containerized) laboratories on a project-by-project basis could include:

1. Physical properties
2. Geochemistry
3. Micro-paleontology
4. Microbiology.

Technical Quality Assurance

Although it will not guarantee success, an important part of the technical quality assurance is to test all major systems in advance, before entering into the "hostile" ice-covered Arctic waters for operation.

Site Survey Needs

Despite substantial efforts to collect seismic reflection data over the past decade, including the SCICEX program of the US Navy, the geophysical data base for the entire Arctic Ocean is scarce. Exceptions are selected sections of the Yermak Plateau, Lomonosov Ridge, and the Chukchi Plateau. The use of multiple platforms (surface and submarine vessels) of complementary capabilities should be employed for site survey and exploratory purposes.

In preparation for a long-term drilling program in the high-Arctic, the APPG urgently recommends acquisition of new geophysical data of adequate extent and depth of penetration to support drillsite definition.

Ice management
Drilling in drifting ice demands careful planning. Several companies have extensive experience in "Stationary Marine Operations in Drifting Ice" (STAMARDI) particulary offshore Sakhalin (Okhotsk Sea) and in the Beaufort Sea. One main consideration is to determine the maximum allowable lateral vessel movement. This parameter determines how much time is available for decisions to be made (i.e., response time). Therefore, all STAMARDI requires work to be carried out according to an "Operational and Alert / Response Plan" which predicts when appropriate actions need to be taken. In order to manage ice during a STAMARDI, at least one primary and one secondary icebreaker are required. Refuelling and fuel capacity of these vessels has to be carefully evaluated before embarking on a prolonged STAMARDI.

The appropriate ice management system can be modelled by combining icebreaker performance models, ice regime modification models, and ice drift-force models.

The important essentials of STAMARDI include:
1. Weather and ice data from all available sources
2. An ice management team capable of interpreting all data
3. An officer responsible for directing the ice management vessels
4. Forecasting of weather, ice drift and hazardous ice
5. Definition of hazardous ice and/or weather conditions within the parameters of the project
6. Definition of a "T-time", the decision time remaining for different operations (i.e. how much time remains before a final decision to abandon site)
7. Abandoment plan.

Operational flexibility
In order to maximise the chances of success the following operational approach should be adopted:
1. A multi-vessel approach is required for operational flexibility and safety.
2. A larger than normal fuel capacity is required (perhaps double) due to the nature of Arctic operations.
3. Alternate drill sites should be approved because the primary drill site may not be accessible. It is likely that the sites drilled will be heavily influenced by ice conditions.
4. An appropriate ice management plan is required.

8 Future Technological Developments

Although there exists technology to perform deep-water drilling in ice-covered regions, there is a need for particular developments for a long-term drilling commitment in the central deep Arctic, where the drilling targets of the highest scientific priorities are located. These developments may comprise several different systems, including remotely operated vehicles and submarines, but APPG only focus on a new "conventional" system:

A New Surface Vessel

Because available barges and large icebreakers are either very cumbersome in operation (often lacking proper DP), or are too small for scientific work in difficult ice conditions, a new large research icebreaker with a deep-water drilling capability is needed. For the summer months, the vessel will provide an alternate platform for deep drilling in the Arctic, with a derrick and a lab-stack to be mobilized for each season. Such a vessel will guarantee a commitment to Arctic deep-drilling, as well as a continuous drilling program, and be a potential contribution to the IODP.

The APPG recommends the establishment of a technical feasibility study for such a vessel, which at present does not exist.

9 Cited References

Aagaard, K., Coachman, L.K., and Carmack, E.C., 1981. On the halocline of the Arctic Ocean, Deep Sea Research, 28, 529-545.

Aagaard, K. and Carmack, E.C., 1989. The role of sea ice and other fresh water in the Arctic circulation. Jour. Geophy. Res., 94, 14,485-14,498.

Aagard, K. and Carmack, E., 1994. The Arctic Ocean and Climate: A Perspective. In: O.M. Johannessen, R.D. Munch and J.E. Overland (eds), The Polar Oceans and Their Role in Shaping the Global Environment, Am. Geophys. U. Geophysical Monograph 85, 5-20.

Aagaard K., Darby D., Falkner, K., Flato, G., Grebmaier, J., Measures, C., and Walsh, J., 1999. Marine Science in the Arctic: A Strategy, Arctic Research Consortium of the United States (ARCUS). Fairbanks, AK, pp 84.

Aagard, K., Swift, J.H., and Carmack, E., 1985. Thermohaline circulation in the Arctic Mediterranean Seas. Journal of Geophys. Res., 90, 4833-4846.

Azbel, A.Y., Akimetz, V.S., et al., 1991. Mesozoic Foraminifera. In: Azbel, A.Y. and Grigalis, A.A. (eds), Practical Manual on microfauna of the USSR. Nedra Publishers, Leningrad Division , 375 pp. [in Russian].

Barry,R.G., Serreze, M.C., and J.A. Maslanik, 1993. The Arctic sea ice-climate system: Observations and modeling. Reviews of Geophysics, 31, 397-422.

Bischof, J. and Darby, D., 1999. Quaternary ice transport in the Canadian Arctic and extent of Late Wisconsinan glaciation in the Queen Elizabeth Islands. Canadian J. Earth Sciences, 36, 2007-2022.

Bourke, R.H. and A.S. McLaren, 1992. Contour mapping of Arctic Basin ice draft and roughness parameters. Jour. Geophys. Res., 97, 17,715-17,728.

Campbell, J.S. and Clark, D.L., 1977. Pleistocene turbidites of the Canada Abyssal Plain of the Arctic Ocean. Jour. Sed. Petrology, 47, 657-670.

Cavaleri, D.J., Gloersen, P., Parkinson, C.L., Comiso, J.C., and Zwally, H.J., 1997. Observed hemispheric asymmetry in global sea ice changes. Science, 278, 1104-1106.

Clark, D.L. 1988. Early history of the Arctic Ocean. Paleoceanography, 3, 539-550.

Clark, D.L., Byers, C.W., and Pratt, L.M., 1986. Cretaceous black mud from the central Arctic Ocean. Paleoceanography 1(3), 265-271.

Coachman, L.K. and Agaard, K., 1981. In: The Eastern Bering Sea Shelf: Oceanography and Resources, D. W. Hood and J. A. Calder (Eds.), Univ. Washington Press, 95-110.

Curry, J. and Herman, G., 1985. Relationships between large-scale heat and moisture budgets and the occurrence of Arctic stratus clouds. Mon. Weather Rev., 113, 1441-1457.

Darby. D.A., Bischof, J.F., and Jones, G.A., 1997. Radiocarbon chronology of depositional regimes in the western Arctic Ocean. Deep-Sea Research, 44, 1745-1757.

Darby, D.A., Naidu, A.S., Mowatt, T.C., and Jones, G.A., 1989. Sediment composition and sedimentary processes in the Arctic Ocean, In: Y. Herman (ed.), The Arctic Seas: Climatology, Oceanography, Geology, and Biology. Van Nostrand Reinhold, New York, 657-720.

Doronin, Yu. P., 1970. Thermal Interaction of the Atmosphere and the Hydrosphere in the Arctic. Israel Program for Sceintific Translations, Jerusalem, 244 pp.

Evans, J.R. and Kaminski, M.A., 1998. Pliocene and Pleistocene chronostratigraphy and paleoenvironment of the central Arctic Ocean, using deep-water agglutinated foraminifera. Micropaleontology, 44 (2), 109-130.

Evans, J.R., Kaminski, M.A., Cronin, T.M., and Futterer, D.K., 1995. Pleistocene agglutinated foraminifera from the Lomonosov Ridge and Amundsen Basin, Arctic Basin. Initial report on piston cores 2177-5 (KAL) and 2176-3 (KAL). Marine Micropaleontology, 26 (1-4), 245-253.

Flato, G.M., 1995. Spatial and temporal variability of Arctic ice thickness. Annals of Glaciology, 21, 323-329.

Gow, A.J. and W.B. Tucker III, 1987. Physical properties of sea ice discharge from Fram Strait. Science, 236, 436-239.

Grantz, A., Phillips, R.L., and Jones, G.A., 1999. Holocene pelagic and turbidite sedimentation rates in the Amerasian Basin, Arctic Ocean from radiocarbon age-depth profiles in cores. GeoResearch Forum, 5, 209-222.

Herman, G. and Goody, R., 1976. Formation and persistence of Summertime Arctic Stratus Clouds, J. Atmospheric Sci., 33, 1537-1553.

Hibler, W. III, 1986. Ice Dynamics. In: N. Untersteiner (ed), The Geophysics of Sea Ice, NATO ASI Ser., B Phys., Plenum, New York, 146, 577-640

Jacobsson et al., 2000. Shaded relief of the Arctic Ocean and adjacent continents. IBCAO.

Johannessen, O., Shalina, E.V., and M. Miles, 1999. Satellite Evidence for an Arctic Sea Ice Cover in Transformation. Science, 286, 1937-1939.

Jokat, W. (ed), 1999. Arctic 98: The Expedition ARK-XIV/1a of RV Polarstern in 1998, Berichte zur Polarforschung, 308, 159 pp.

Jokat, W., Stein, R., Rachor, E., Schewe, I., and the Shipboard Scientific Party, 1999. Expedition gives Fresh view of Central Arctic Geology, EOS Transactions, 80 (40), p. 465, 472-473.

Jokat, W., Uenzelmann-Neben,G., Kristoffersen, Y., Rasmussen, T., 1992. ARCTIC«91: Lomonosov Ridge - a double sided continental margin, Geology, 20, 887-890.

Kassens, H., Bauch, H., Dmitrenko, I., Eicken, H., Hubberten, H.-W., Melles, M., Thiede, J., and Timokhov, L. (Eds.), 1999. Land-Ocean Systems in the Siberian Arctic: Dynamics and History, Springer-Verlag, Berlin, 711 pp.

Kovacs, A., Weeks, W., Ackley, S., and Hibler, W., 1971, Structure of a multiyear pressure ridge. Arctic, 26, 22-32.

Kvenvolden, K.A. and Grantz, A., 1990. Gas hydrates of the Arctic Ocean region in The Arctic Ocean Region: Boulder, Colorado, Geological Society of America, The Geology of North America, 7, 539-550

Kwok, R. and Rothrock, D.A., 1999. Variability of Fram Strait ice flux and North Atlantic Oscillation. Jour. Geophysical Res., 104, 5177-5189.

Lyon, W., 1961. Ocean and sea-ice research in the Arctic Ocean via submarine. Trans. N.Y. Acad. Sci., srs. 2, (23), 662-674.

Maykut, G.A and Untersteiner, N, 1971. Some results form a time dependent, thermodynamic model of sea-ice. J. Geophys. Res., 76, 1550-1575.

Max, M.D. and Lowrie, A., 1992. Natural gas hydrates: Arctic and Nordic sea potential. In: Vorren et al. (eds.) Arctic Geology and Petroleum potential. Norwegian Petroleum Soc. (NPF) Spec. Publ. 2, Elsevier, Amsterdam, 27-53.

McLaren, A.S., Bourke, R.H., Warsh, J.E., and R.L. Weaver, 1994. Variability in Sea-Ice Thickness Over the North Pole From 1958 to 1992. In: O.M. Johannessen, R.D. Munch, and J.E. Overland (eds) The Polar Oceans and Their Role in Shaping the Global Environment. Am. Geophys. Union Geophys. Monograph 85, 363-373.

McNeil, D.H., 1989. Foraminiferal zonation and biofacies analysis of Cenozoic strata in the Beaufort-MacKenzie Basin of Arctic Canada. Geological Surveyof Canada Paper 89-1G, 203-233.

McNeil, D.H., 1997. New foraminifera from the Upper Cretaceous and Cenozoic of the Beaufort-MacKenzie Basin of Arctic Canada. Cushman Foundation for Foraminiferal Research, Special Publication, 35, 1-95.

Milnes, M.W. and Barry, R.G., 1989. Large scale characteristics of fractures in multi-year Arctic pack ice. In: K. Axelsson and L. Fransson (eds), Proceedings, 10the International Conference on Port and Ocean Engineering Under Arctic Conditions (POAC 89), 1, 103-112, Department of Engineering, Luleaa University of Technology, Luleaa, Sweden.

Nakamura, N. and Oort, A.H., 1988. Atmospheric heat budgets of the polar regions. J. Geophys.Res., 93 (D8), 9510-9524.

Nansen, F., 1902. The Norwegian Polar Expedition, 1893-1896, Scientific Results, 6 volumes, Jacob Dybwad, Oslo.

Parkinson, C.L. and Cavalieri, D.J., 1987. Arctic sea ice 1983-1987:Seasonal, regional, and interannual variability. J. Geopgys. Res., 94 (C10), 14.199-14.223.

Phillips, R.L. and Grantz, A., 1997. Quaternary history of sea ice and paleoclimate in the Amerasia basin, Arctic ocean, as recorded in the cyclical strata of Northwind Ridge: Geological Society of America Bulletin, 109 (9), 1101-1115.

Proshutinsky, A. and Johnson, M., 1997. Two circulation regimes of the wind driven Arctic Ocean. Jour. of Geophysical Research, 102, 12,493-12,514.

Polyak, L., Lehman, S., Gataullin, V., and Jull, A.J., 1995. Two-step deglaciation of the southeastern Barents Sea. Geology, 23, 567-571.

Rothrock, D.A. and G.A. Maykut, 1999. Thinning of the Arctic sea-ice cover. Geophy. Res. Lett., 25 (9), 1297-1300.

Rothrock, D.A. and Thomas, D.R., 1990. The Arctic Ocean multiyear ice balance. Ann. Glaciol., 14, 252-255.

Serreze, M., McLaren, A., and Barry, R., 1989. Seasonal variations of sea ice motion in the Transpolar Drift Stream. Geophys. Res. Lett., 16, 811-814.

Serreze, M., Box, J., Barry, R., and Walsh, J, 1993. Characteristics of Arctic Synoptic Activity. Meterol. Atmos. Phys., 51, 147-167.

Smith, J., and McLean, R., 1977. Spatially averaged flow over a wavy surface. J. Geophys. Res., 82, 1735-1746.

Stein, R. (Ed.), 2000. Circum Arctic Paleo-River Discharge and Its Geological Record, International Journal of Earth Sciences, 89/3, in press.

Stein, R., Nam, S.-I., Schubert, C., Vogt, C., F tterer, D., and Heinemeier, J., 1994. The last deglaciation event in the eastern central Arctic Ocean. Science, 264, 692-696.

Stein, R. and Fahl, K., 2000. Holocene Accumulation of Organic Carbon at the Laptev Sea Continental Margin (Arctic Ocean): Sources, pathways, and sinks. Geo-Marine Letters, 20/1, 27-36.

Thompson, D.W.J. and Wallace, J., 1998. The Arctic Oscillation signature in the wintertime geopotential height and temperature fields. Geophys. Res. Letters, 25, 1297-1300.

Thorndike, A.S.,1986. Kinematics of sea ice. In: N. Untersteiner (ed), The Geophysics of Sea Ice. NATO ASI Ser.., Ser. B Physics, vol. 146, 489-549.

Thorndike, A. and Colony, R., 1982. Sea ice motion in response to geostrophic winds. J. Geophys. Res., 87 (C8), 5845-5852.

Tucker III, W., 1989. An overview of the physical properties of sea ice. In: Proc. Of Workshop on Ice Properties, Associate Committee on Geotechnical Research, National Research Council Canada (June 21-22, 1988, St. Johns, Newfoundland). Technical Memorandum No. 144, NRCC 30358, 1989.

Untersteiner, N., 1990. Structure and dynamics of the Arctic ocean ice cover. In: A. Grantz, L. Johnson, and J.F. Sweeney (eds) The Arctic Ocean Region. The Geology of North America Volume L, Geol. Soc. of America, Boulder, Colorado, 37-53.

Wadhams, P., 1994. Sea Ice Thickness Changes and Their relation to Climate. In: O.M. Johannessen, R.D. Munch, and J.E. Overland (eds) The Polar Oceans and Their Role in Shaping the Global Environment. Am. Geophys. Union Geophys. Monograph 85, 337-363.

Walsh, J.E., and Johnson, C.M., 1979. Interannual atmospheric variability and associated fluctuations in Arctic sea ice extent. J. Geophys. Res., 84, 6915-6928.

Weeks, W.F., Kovacs, A., and Hibler III, W.D., 1971. Pressure ridge characteristics in the Arctic coastal environment. In: S. Wetteland and P. Bruun (eds), Proceedings From the First International Conference on Port and Ocean Engineering Under Arctic Conditions, 1, 152-183.

Zachos, J. C., Pagani, M., Sloan, L. C., Thomas, E., and Billups, K., submitted, Trends, rhythms, and aberrations in global climate: 65 Ma to present. Science.

Other available literature:

DOSECC GLAD-800 scientific coring rig, 1999

Gelfgat, M., Gamsakhurdia, G., Geise, J. and Spierings, H., Complete System for Continuous Coring with Retrievable Tools in Deep Water, IADC/SPE 27521.

Gelfgat, M.Ya., Podrazhansky, A.M., Geise, J.M. and Paff, G., Stratigraphy Drilling in Deep Water with Aluminium Drill Pipes Application, SPE 37597.

Gudmestad, O.T., A.B. Zolotukhim, A.I. Ermakov, R.A. Jakobsen, I.T. Michtchenko, V.A. Vovk, S. L¿set, and K.N. Shkhinek: Basis of offshore petroleum engineering and Development of Marine Facilities with emphasis on the Arctic Offshore, printed by Oil and Gas Printing House, Gubkin University, Moscow, ISBN 5-7246-0100-1, July 1999, 344 pp.

Holloway, G.L., 1999. Phase II Report on drilling systems for Antarctic Research Vessels. Cape Roberts project.

Melamed, Y., Kiselev, A., Gelfgat, M., Dreesen, D.S., and Blacic, J., 1997. Hydraulic Hammer Drilling Technology: Developments and Capabilities, 8th Annual Int. Energy Week Conference, Houston Tx, January 28-30.

Zolotukhin, A.B., O.T. Gudmestad, A.I. Ermakov, R.A. Jakobsen, I.T. Michtchenko, V.A. Vovk, S. L¿set and K.N. Shkhinek: Fundamentals of offshore petroleum engineering and development of Arctic marine facilities, printed by Oil and Gas Publishing House, Gubkin University, Moscow, ISBN 5-7246-0117-6, December 2000 (in Russian), 770 pp.

9 Appendices

Figures

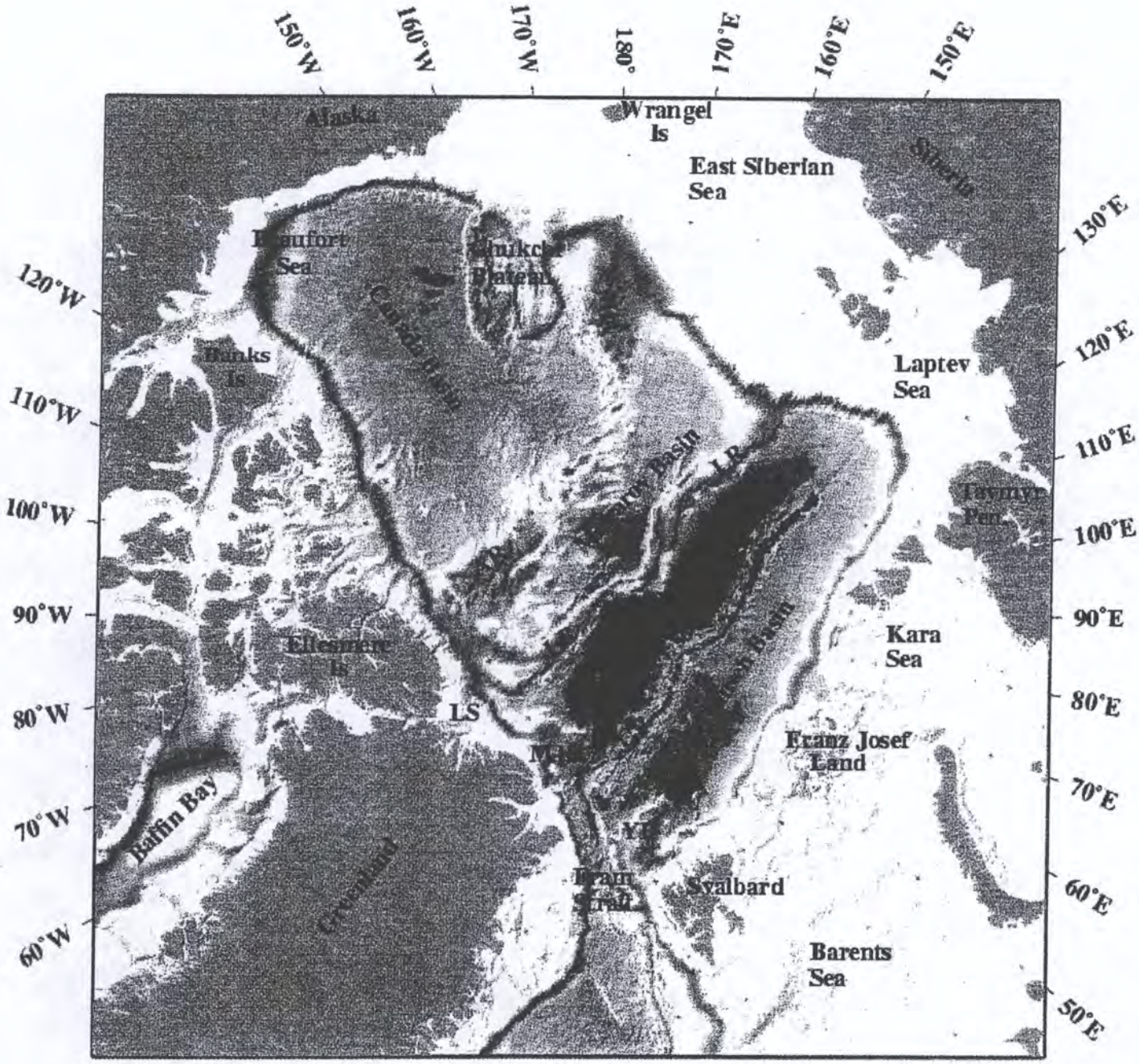
Fig. 1a Bathymetry and structure of the Arctic Ocean.

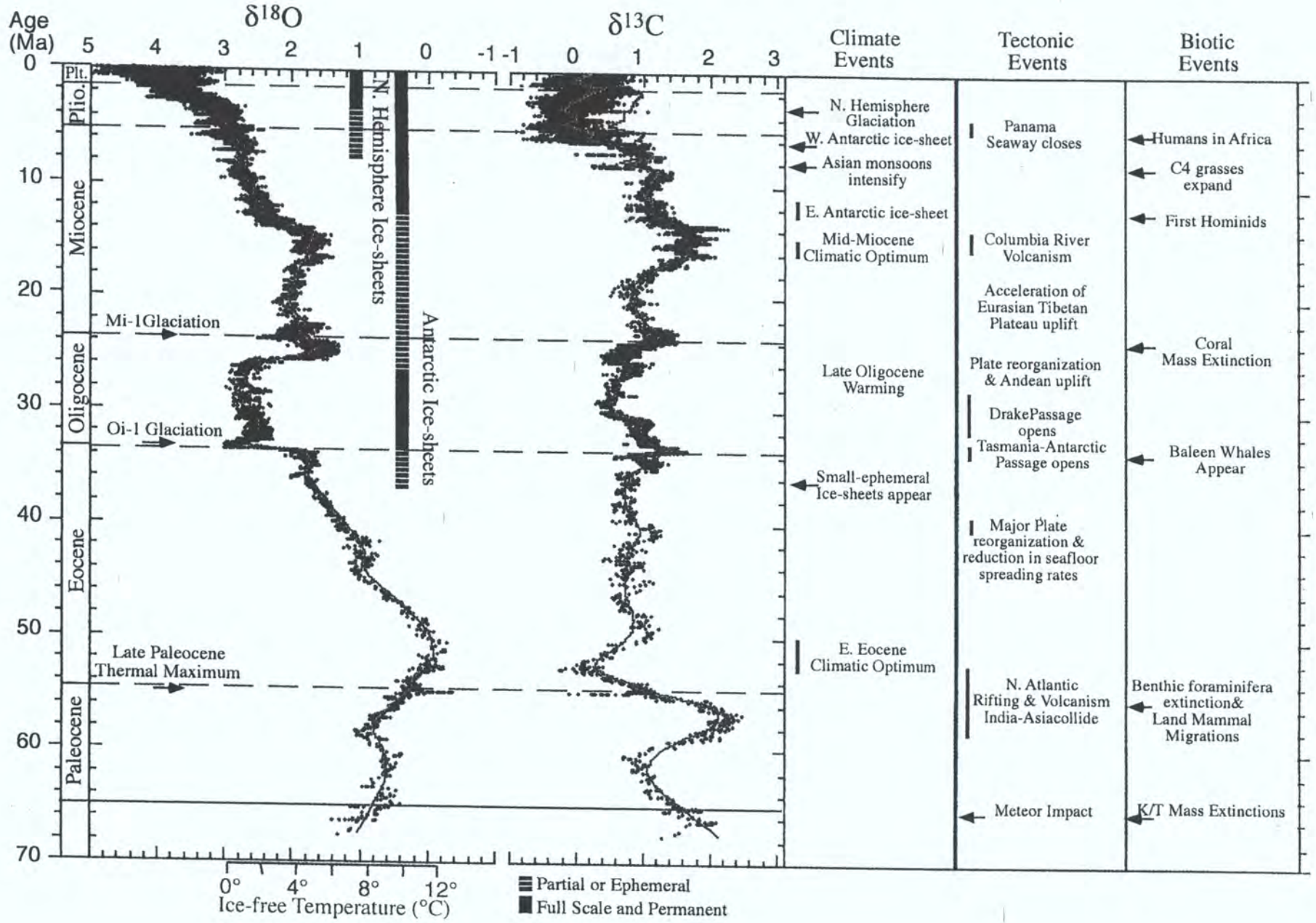
Abbreviations:AR-Alpha Ridge; MR-Mendeleev Ridge; LR-Lomonosov Ridge; GR-Gakkel Ridge; LS-Lincoln Sea; MJR- Morris Jessup Rise; YP-Yermak Plateau; NP-North Pole.

Fig. 1b The new IBCAO bathymetry map of the Arctic Ocean (Jacobsson et al., 2000).

Fig. 2 A global compilation of deep-sea isotope records based on isotope values of Cibicidoides and Nuttallides (Zachos et al., submitted). The records are based on benthic foraminifera isotope data from 50 DSDP and ODP sites. The raw data were smoothed using a 5 point running mean. The curve fits are locally weighted means. For the carbon isotope record, separate curve fits are shown for the Atlantic and Pacific to show the effects of basin to basin fractionation after 15 Ma. Also shown

Tables


150°W
160°W
170°W
180°
170°E
160°E
150°E
Alaska
Wrangel Is
East Siberian Sea
Siberia
Beaufort Sea
Canada Basin
Banks Is
Laptev Sea
Taymyr Pen
Kara Sea
Ellesmere Is
LS
Franz Josef Land
Baffin Bay
Greenland
Fram Strait
Svalbard
Barents Sea
120°W
110°W
100°W
90°W
80°W
70°W
60°W
130°E
120°E
110°E
100°E
90°E
80°E
70°E
60°E
50°E


Age (Ma)
δ18O
δ13C
Climate Events
Tectonic Events
Biotic Events
Plt.
Plio.
Miocene
Oligocene
Eocene
Paleocene
N. Hemisphere Ice-sheets
Antarctic Ice-sheets
Mi-1Glaciation
Oi-1 Glaciation
Late Paleocene Thermal Maximum
N. Hemisphere Glaciation
W. Antarctic ice-sheet
Asian monsoons intensify
E. Antarctic ice-sheet
Mid-Miocene Climatic Optimum
Late Oligocene Warming
Small-ephemeral Ice-sheets appear
E. Eocene Climatic Optimum
Panama Seaway closes
Columbia River Volcanism
Acceleration of Eurasian Tibetan Plateau uplift
Plate reorganization & Andean uplift
DrakePassage opens
Tasmania-Antarctic Passage opens
Major Plate reorganization & reduction in seafloor spreading rates
N. Atlantic Rifting & Volcanism India-Asiacollide
Meteor Impact
Humans in Africa
C4 grasses expand
First Hominids
Coral Mass Extinction
Baleen Whales Appear
Benthic foraminifera extinction& Land Mammal Migrations
K/T Mass Extinctions
Ice-free Temperature (°C)
Partial or Ephemeral
Full Scale and Permanent

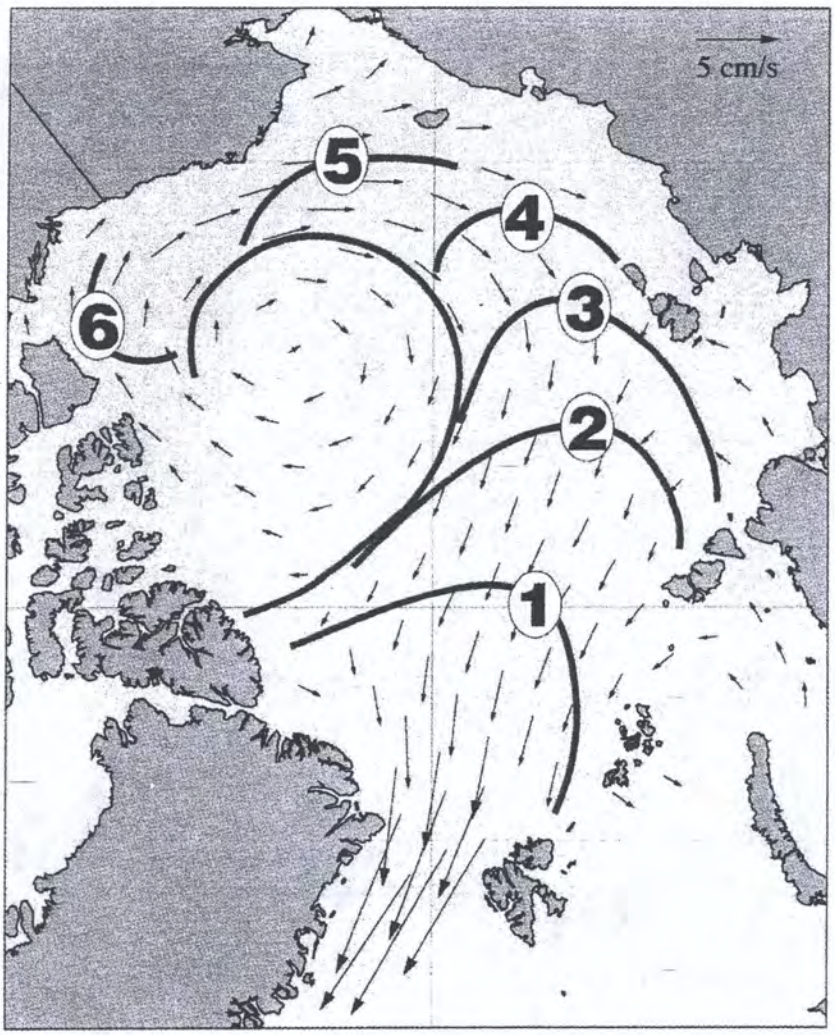


Figure 3.

Figure 4 .
24-month mean of the area covered by Arctic sea-ice.
(From Walsh and Johnson, 1979.)

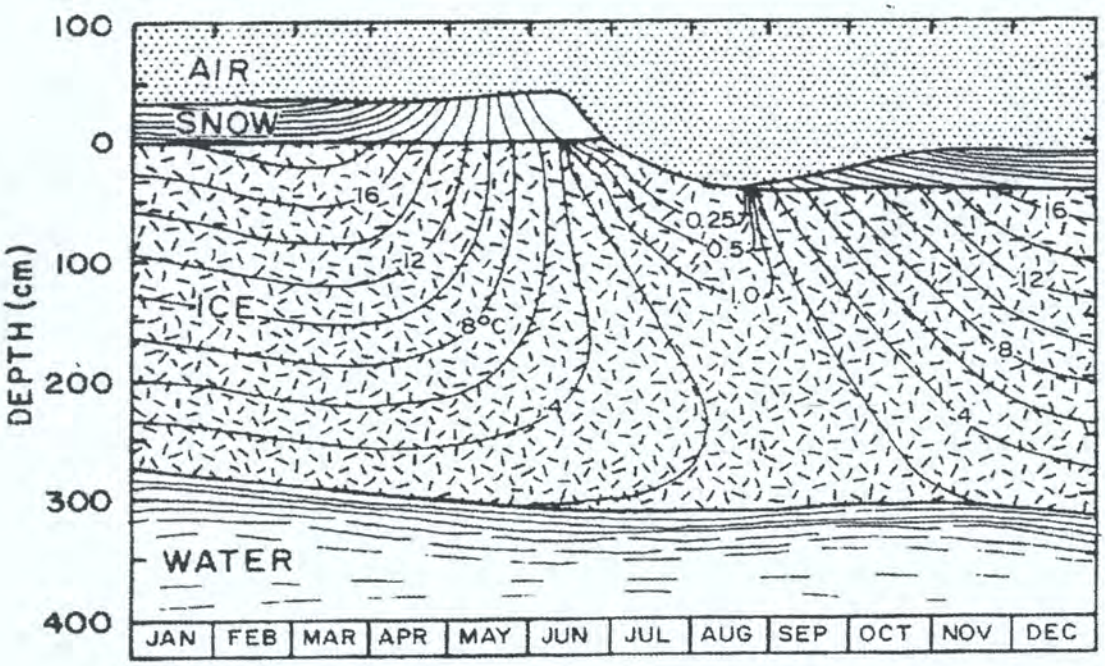
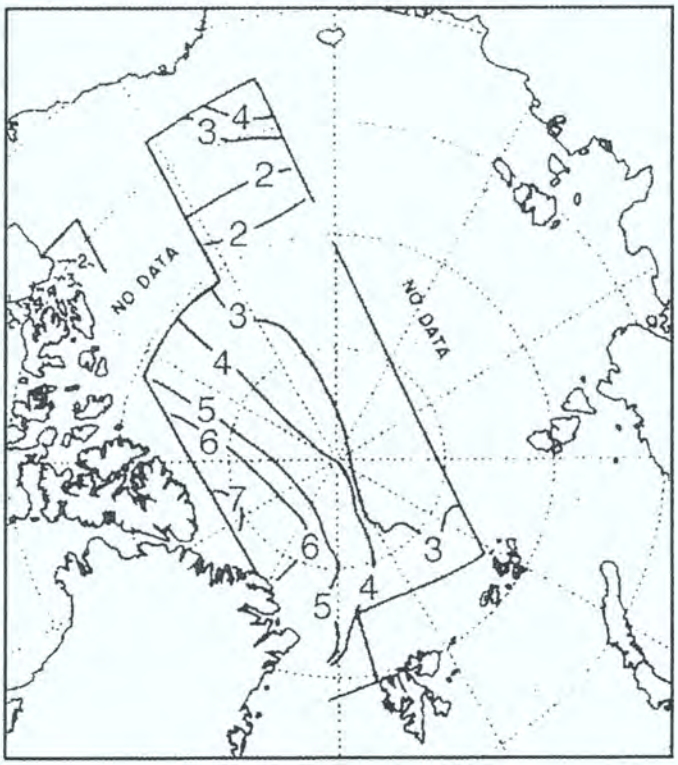


Figure 5. Predicted value of equilibrium temperatures and thickness of sea-ice from Maykut and Untersteiner (197). Temperatures are labelled in negative °C.

Figure 6. Contours of mean sea-ice draft (meters) for summer after Bourke and Mclaren (1972).



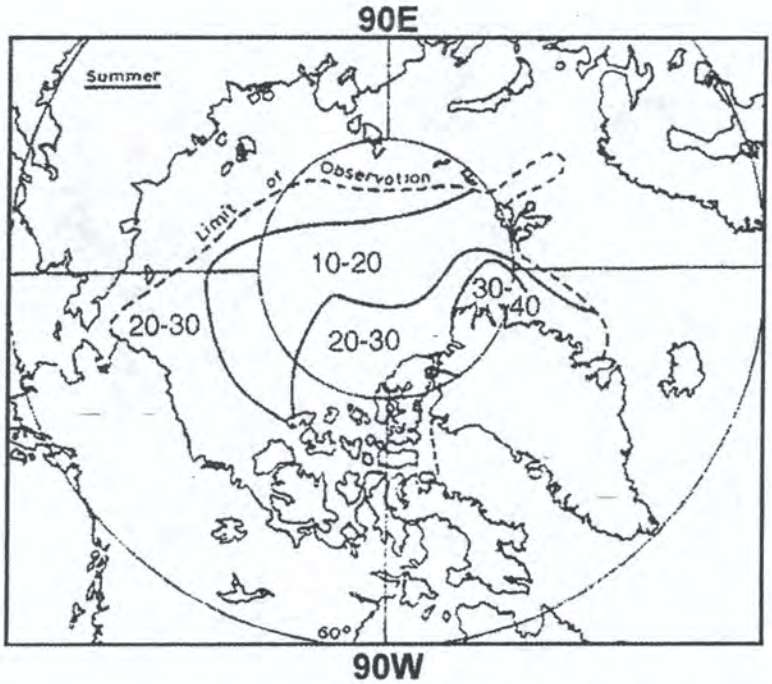
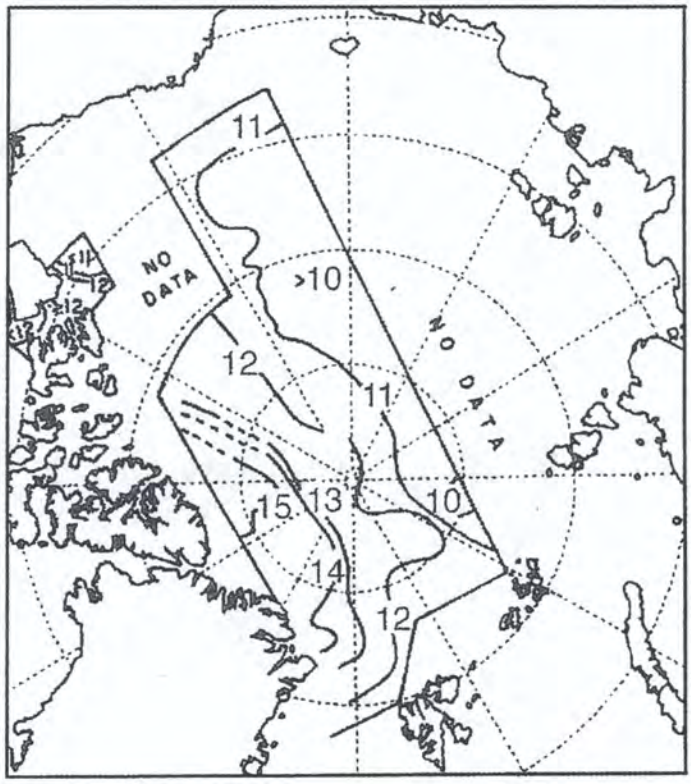


Figure 7. Number of ridges per nautical mile on the sea-ice during summer, from Weeks et al. (1971).

Figure 8. Contours of mean pressure ridge keel draft (meters) exceeding a 9-m thrshold for summer, after Bourke and McLaren (1992).



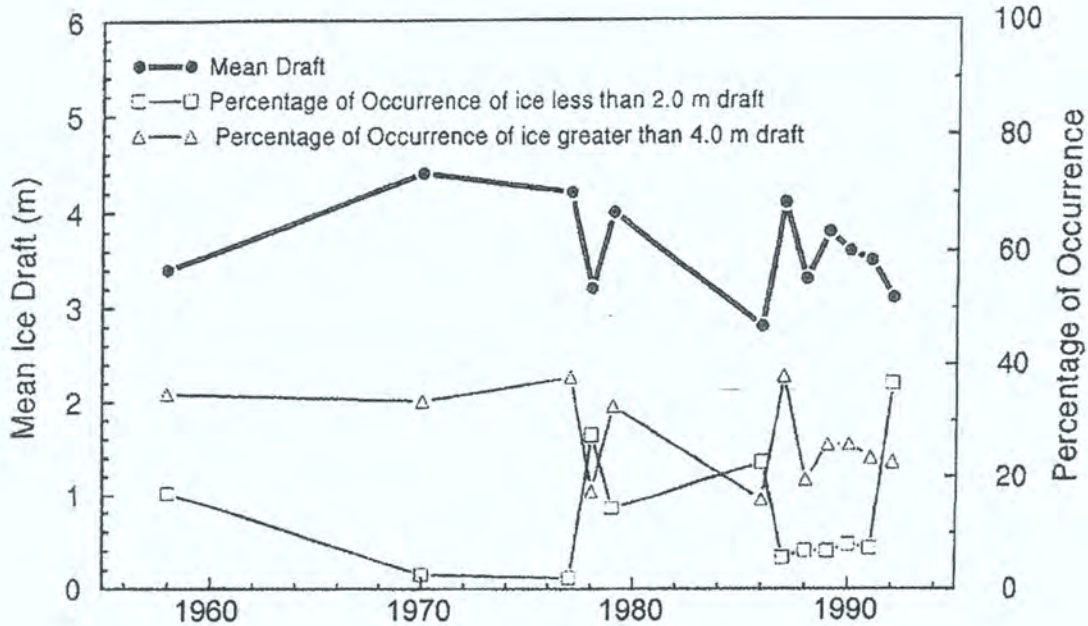
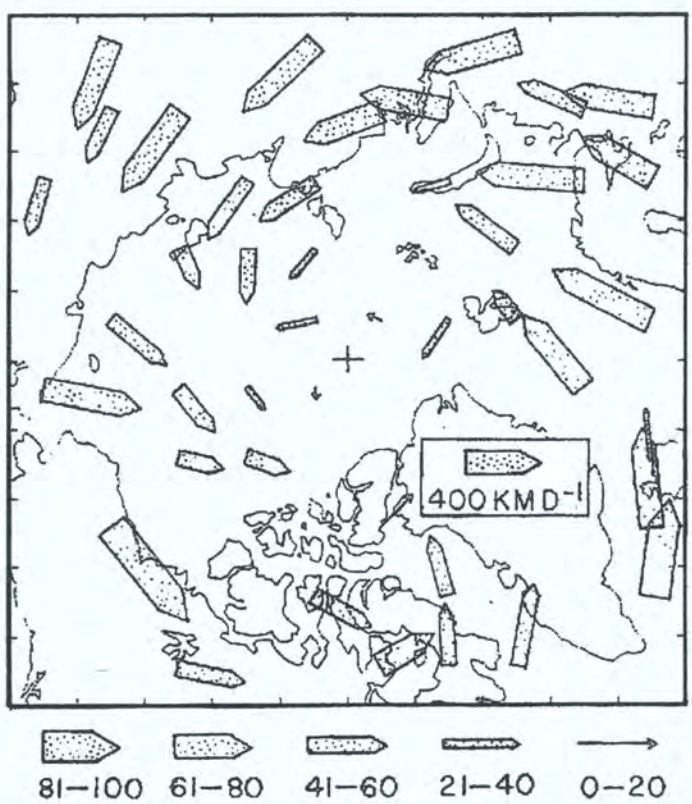


Figure 9. Mean sea-ice draft and occurrence for 50-km-long segments centered over the North Pole, after McLaren et al. (1994).

Figure 10. Mean cyclone motion vectors for summer 1975-1989, after Serreze et al. (1993.



Candidate drill pipes basic parameters

Table 1

Description	**5" API ODP**	**5" API Bucentaur**	**CCS (Aluminum)**	**AC 5 1/8" (Aluminum)**	**SHD SEACORE**	**Geobor S Craelius**	**Longyear PQ**	**Longyear HQ**	**H.DB.GR Diamond Boart**
Borehole diameter	250 mm	220 mm	220 mm	212 - 240 mm	220 mm	150 mm	122.6 mm	96.04 mm	96.3 mm
Pipe OD	127 mm	127 mm	164 mm	131 mm	177.8 mm	140 mm	117.7 mm	88.90 mm	88.9 mm
Tool joint OD	177.8 mm	161.9 mm	195 mm	178 mm	200 mm	n.a.	117.7 mm	88.90 mm	?
Pipe ID	104.8 mm	101.6 mm	146 mm	104.8 mm	157.8 mm	125 mm	106.33 mm	77.79 mm	70.0 mm
Tool joint ID	104.8 mm	101.6 mm	145 mm	104 mm	157.8 mm	n.a.	103.03 mm	77.79 mm	?
Weight per joint	318 kg	287 kg	197 kg	162 kg	266 kg	73 kg	48.15 kg	34.44 kg	11 kg/m
Joint length	9.66 m	9.2 m	11 m	9 m	6 m	3 m	3 m	3 m	?
String weight for 100m (under water)	2880 kg	2734 kg	1230 kg	1221 kg	3876 kg	2433 kg	1404 kg	1005 kg	960 kg

Candidate drill rigs basic parameters

Table 2

Model No.	SLIMDRILL HTA 3000	Fugro FODR III	Longyear HD-600	Seacore C-100	SHRAMM T685W
Dimensions of rig	5 x 6 m				
Height of derrick	17.7 m	18.0 m	17.8 m	20.0 m	10.7 m
Weight of rig/ (ex truck)	60,000 kg *3)	20,000 kg			17,917 kg
Structure	Tubular steel	Square tubing	Square tubing	Square tubing	Tubular steel
Wind rating	90 - 100 km/hr				
Guy wires required	Yes	Yes	Yes x 4	Yes x 4	Recommended
Containerized load	Yes	Yes		Yes	
Top drive	Yes	Yes	Optional	Yes	Yes
RPM (rotor)	0 - 700	0 - 150	15 - 950	0 - 200	0 - 160
Torque (rotor)	11650 Nm, 273rpm	2720 Nm	4880 Nm	25000 Nm (max)	5424Nm,0-160rpm 12316Nm,0-80rpm
Max pull up	68100 kg	30,000 kg	45,360 kg	100,000 kg	31978 kg
Max pull down	13620 kg	N.a.	3563 kg	N.a.	16000 kg
Pipe lengths, handled	9 - 10 m	4.5 m	12 m - 18 m	12 m	7.62 m (max)
Casing lengths, handled	12 m	4.5 m		12 m	9.14 m (max)
Max diameter through slipbox	340 mm	700 - 800 mm		450 mm	559 mm
High speed piggy-back top drive	No	No	No	Yes	No
R.P.M.	n.a.	n.a.	n.a.	5 - 900	n.a
Torque	n.a.	n.a.	n.a.	37 - 875 Nm	n.a
Max pull up	n.a.	n.a.	n.a.	150 kN	n.a
Max pull down	n.a.	n.a.	n.a.	150 kN	n.a
Type of power supply	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
General spec of system	6 pumps	1 pump	5 pump		6 pump open loop
Rod handling system	No	No	70 mm OD		114 mm OD, 8 pcs
Rooster box sampling	Yes	Yes	No	Yes	No
Heave compensation	No	Yes	No	Yes	No
Heave compensator stroke	No	3 m	n.a.	4.8 m	n.a.
Heave compensator capacity	No	20,000 kg	n.a.	60 ton	n.a.
Mud pump flow (3 pumps)	362 GPM	640 l /min			
Mud pump pressure	5000 PSI	20 bar			

Marine coring systems

Technical characteristics

Table 3

	SAMPLERS									
	Long Stroke Push Samplers					**Hydraulic Percussion Samplers**				
	ODP APC	**CCS Rapid Piston Sampler**	**Baikal-2 Rapid Piston Sampler**	**Baikal-3 Rapid Piston Sampler**	**Fugro Rapid Piston Sampler**	**Fugro Small Hydraulic Percussion Sampler**	**Fugro Large Hydraulic Percussion Sampler**	**CCS Large Hydraulic Percussion Sampler**	**Baikal-2 Hydraulic Percussion Sampler**	**Baikal-3 Hydraulic Percussion Sampler**
Sample diameter	66 mm	93 mm	56 mm	~ 75 mm	58.2 mm	57 mm	96.8 mm	93 mm	56 mm	~ 75 mm
Length	9.84 m	4.0 m	6.0 m	~ 3m	3.0 m	1.8 m	3.7 m *3)	3.0 m	6.0 m	~ 3.0 m
Liner?	clear plastic	PVC liner	Plastic	Yes	PVC liner	Yes	Yes	Yes	Plastic	Yes
Length Tool	12.8 - 22.3 m	6.3 - 10.3 m	~ 7.5 to 13.5 m	~ 4 to 7 m	4.5 - 7.5 m	5.0 m	8.6 m	7.16 m	~ 8 m	~ 7.5 m
Driving Mech.	mud pressure	mud Pressure	Mud Pressure	Mud Pressure	mud pressure	Mud pressure percussion	Mud pressure Percussion	Mud pressure Percussion	Mud pressure Percussion	Mud pressure percussion
Mud pressure (bar)	170	30/60/90/120	40/80/120	~40/80/120	43/85/126	45 bar	45 bar	40 - 60 bar	40 - 60 bar	40 - 60 bar
Max. Tool Diam.	95 mm	142 mm	101 mm	136 mm	92 mm	70 mm	129 mm	142 mm	95 mm	136 mm
BHA bit ID	96.5 mm	136 mm	79 mm	~ 95 mm	84 mm	> 78 mm	> 118 mm	136 mm	79 mm	~ 95 mm
BHA bit OD	257 - 290 mm	220 mm	213 mm	240 mm	244 mm	244 mm	244 mm	220 mm	213 mm	240 mm
J /Blow	n.a.	n.a.	n.a.	n.a.	n.a.	50	200	200	50	200
BHA	Comp. with XCB (ODP BHA)	CCS	Baikal-2	Baikal-3	Comp. with CCS (Fugro BHA)	Comp. With CCS, XP Fugro BHA	Comp. With CCS, XP Fugro BHA	CCS	Baikal-2	Baikal-3

Marine coring systems (continue)

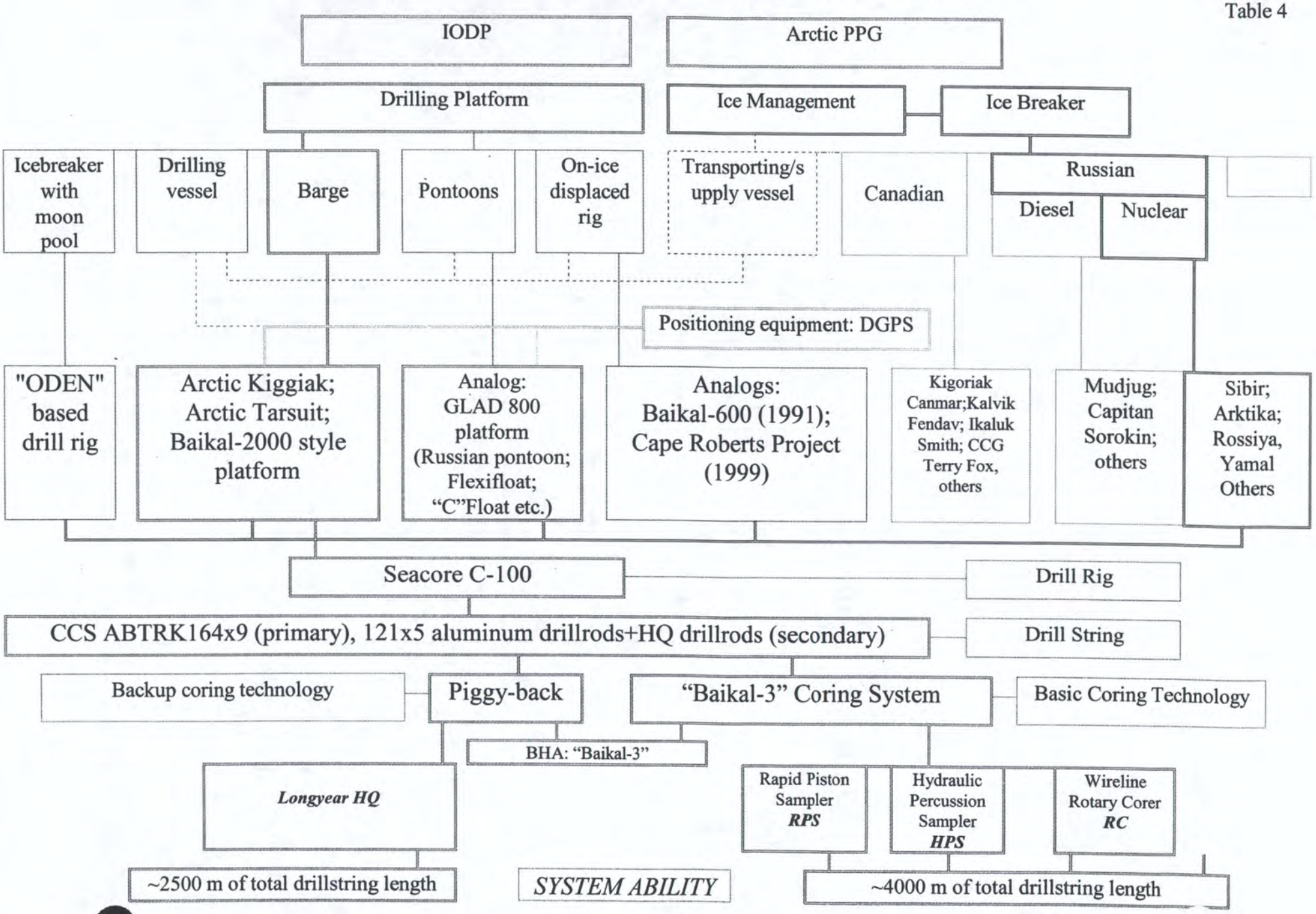
Technical characteristics

Table 3 (continue)

CORE BARRELS										
	Rotary Core Barrels				Extended Core Barrels					
	ODP Rotary Core Barrel	**Baikal-2 Rotary Corer**	**Christensen MWCB**	**Baikal-3 Rotary Corer**	**ODP XCB**	**Baikal-2 Pilot Rotary Corer**	**Baikal-2 Rotary-Percussion Corer**	**Baikal-3 Rotary Pilot Corer**	**CCS (SKV-127/67) Double Core Barrel**	**Christensen MWECB**
Core diam.	58.7 mm	79 mm	76.0 mm	~95 mm	60 mm	52 mm 65 mm	52 mm 65 mm	~73 mm	67 mm	66.7 mm
Length	9.5 m	~6.6 m	~4.0 m	~3.5 m	9.5 m	~6.6 m	>3.1 m	~3 m	4.5 m	~4.0 m
Liner?	Yes	No	No	Yes	Yes	plastic	Plastic	Yes	No	Steel liner
Length Tool	11.6 m	~8 m	~5.0 m	~5 m	12.8 m	~8.5 m	~8.5 m	~5 m	5.6	~5.0 m
Driving Mech.	drill string Rotary	drill string rotary	drill string Rotary	drill string Rotary	drill string rotary,	drill string rotary	Drill string Rotary	Drill string Rotary	Rotary, downhole motor (DM)	drill string rotary
Mud Pressure	n.a.	5 - 10 bar	n.a.	5 - 10 bar	n.a.	5 - 10 bar	40 - 60 bar	5 10 bar	5(rot.), 40-60(DM)	n.a.
Max. Tool Diam.	95 mm	101 mm	108 mm	136 mm	95.3 mm	101 mm	101 mm	136 mm	127 mm	108 mm
BHA Bit ID	62 mm	79 mm	76 mm	~95 mm	96.5 mm	79 mm	79 mm	~95 mm	136 mm	76 mm
BHA Bit OD	251 mm	240 mm	216 mm	240 mm	257 - 290 mm	213 mm	213 mm	240 mm	217-240 mm	216 mm
Coring bit OD	n.a.	n.a.	n.a.	n.a.	~93 mm	76 mm	76 mm	~93 mm	133.3 mm	~72 mm
WOB	1 - 7 ton	< 12 ton	1 - 5 ton	< 12 ton	1 - 7 ton	0.5 - 1.5 ton	< 1 ton	~< 1 ton	1-5 ton	1 - 5 ton
R.P.M.	50 — 70	< 120	70 - 90	< 90	30 - 70	< 90	< 90	< 90	<400	70 - 90
J/Blow	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	50	n.a.	n.a.	n.a.
BHA	ODP BHA	Baikal-2	Christensen	Baikal-3	Comp. with ODP APC	Comp. with RPS and HPS	Comp. with RPS and HPS	Baikal-3	CCS	Christensen

Example of the Equipment Selection Strategy for Arctic Drilling Program

Table 4



EXCOM Motion 98-1-8

Presently determined budgetary constraints through 2003 will negatively impact the delivery of the Long Range Plan. EXCOM asks SCICOM to prioritize future science objectives to maximize the objectives of the Long Range Plan, clearly indicating those which cannot be achieved under existing budget projections. SCICOM should also identify and prioritize changes in program activities, services, equipment needs and technological development. SCICOM is asked to forward its report to EXCOM by September 1998.

Proposed by Leinen, seconded by Prior.
Unanimous acceptance

EXCOM Motion 99-1-5

EXCOM enthusiastically welcomes the prioritization of scientific and programmatic activities within ODP that has been prepared by SCICOM in response to EXCOM Motion 98-1-8. EXCOM recommends that this prioritization provide a framework and reference for all future budgetary decisions. EXCOM recognizes that priorities may change as the program proceeds and that modifications may be necessary.

Proposed by Orcutt, seconded by Feary. 15 in favor.

PRIORITIZATION OF SCIENTIFIC AND PROGRAMMATIC ACTIVITIES WITHIN ODP:

A FRAMEWORK FOR BUDGETARY DECISION-MAKING

Prepared for:
JOIDES Executive Committee

Prepared by:
JOIDES Science Committee with Input from the JOIDES Advisory Structure

Distributed: 1 November 1998

TABLE OF CONTENTS

1. INTRODUCTION

The Ocean Drilling Program (ODP) Long Range Plan was published in 1996 and set forth a number of ambitious scientific objectives under two major themes: *Dynamics of Earth's Environment* and *Dynamics of Earth's Interior*. In order to better accomplish the goals outlined in the document, there was a profound reorganization of the JOIDES Advisory Structure to more closely reflect the themes and initiatives of the LRP.

Over the past two years, the Advisory Structure has worked to deliver the 1996 LRP through scheduling drilling legs that address high priority scientific objectives. However, most fiscal projections and ODP membership scenarios predict decreasing (in real terms) funding over the next five years. The impact of the financial constraints became particularly evident in planning for FY'99, when many of the "Special Operating Expenses" associated with the conduct of specialized drilling, coring and logging operations that would have been scientifically beneficial for some technically difficult legs had to be cut in order to meet the budget. In response to this, EXCOM recognized that there would be some difficult decisions that the Program would have to make over the next few years as to where the limited resources should be directed. The decision-making process should be guided by a framework that prioritizes the scientific and programmatic activities to be conducted within ODP over the next few years. This was expressed in an EXCOM Motion passed at the January 1998 meeting:

EXCOM Motion 98-1-8

Presently determined budgetary constraints through 2003 will negatively impact the delivery of the Long Range Plan. EXCOM asks SCICOM to prioritize future science objectives to maximize the objectives of the Long Range Plan, clearly indicating those which cannot be achieved under existing budget projections. SCICOM should also identify and prioritize changes in program activities, services, equipment needs and technological development. SCICOM is asked to forward its report to EXCOM by September 1998.

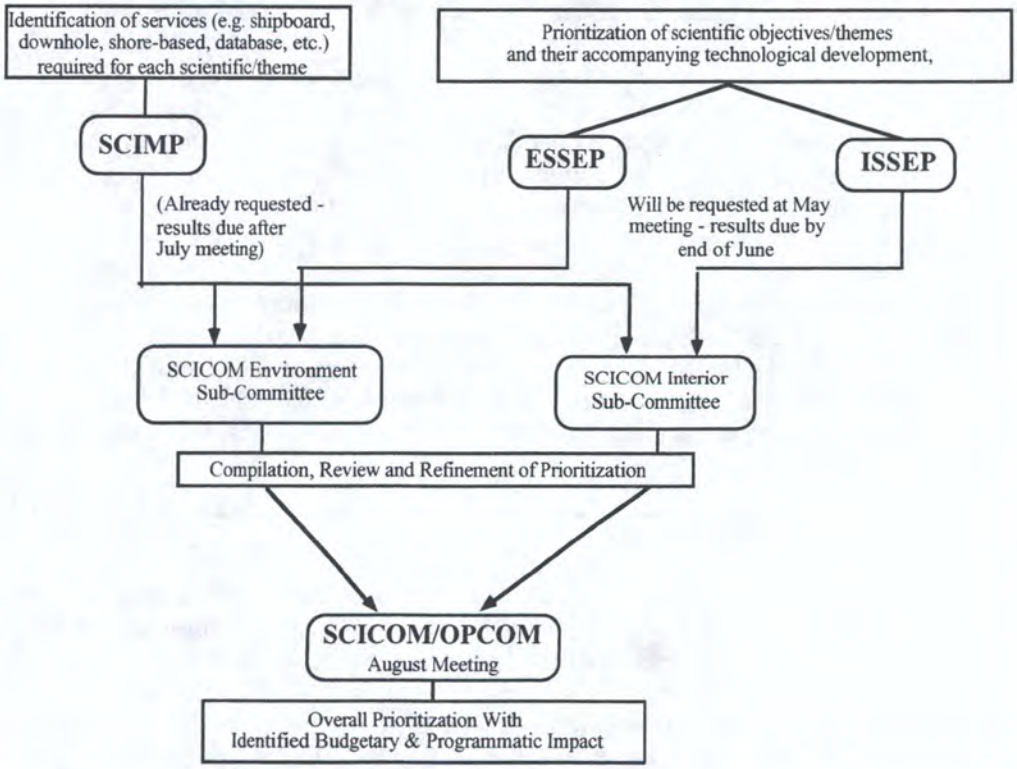
At their March meeting, SCICOM adopted a programmatic approach to addressing this issue that consisted of three activities:

- prioritization of scientific objectives/themes for Phase III by the Science Steering and Evaluation Panels (SSEPs), with input from the Program Planning Groups (PPGs).
- identification of services (i.e. shipboard, downhole, shore-based, database, etc.) required for the accomplishment of LRP scientific themes by the Scientific Measurements Panel (SCIMP).
- compilation of a prioritized list of scientific objectives/themes for Phase III, and their accompanying technological development, as well as recommendations related to shipboard, downhole and database services by Sub-Committees of SCICOM.

All of this information was presented to SCICOM at the August meeting, and a prioritization developed.

SCICOM Consensus 98-1-4
In response to EXCOM Motion 98-1-8, SCICOM adopts the following procedure to provide a framework based on a prioritization of themes of the Long Range Plan for future budgetary decisions:

Mechanism for Producing a Programmatic Framework for Budgetary Decisions



This document provides a summary of the overall programmatic prioritizations, together with the reports that were taken into consideration in making the decisions. It is important to note that this document is based on projections of scientific accomplishment and technological progress as seen in 1998. The prioritizaton will evolve over the next few years as proposal pressure (the major driving force for ODP science) changes and as scientific understanding advances. The priorities should be revisited using the expertise of the entire JOIDES review structure.

2. SCIENTIFIC PRIORITIZATION WITHIN THE MAJOR THEMES OF THE ODP LONG RANGE PLAN

Each of the Scientific Steering and Evaluation Panels produced documents that provided the foundation for prioritization and justification of scientific objectives within the ODP Long Range Plan by the SCICOM Sub-Committees. These documents are presented in Appendices I and II, and portions have been extracted to justify the overall scientific program prioritization in the next section. The two SCICOM Sub-Committees carried out the prioritization process differently. Individuals sub-themes within the *Dynamics of Earth's Environment* theme were ranked individually, with highest priority being placed on

themes of greatest societal relevance. Prioritization of scientific objectives within the *Dynamics of Earth's Interior* theme was accomplished by grouping sub-themes into priority levels, rather than rankings, taking into account what could be achieved by the end of ODP, as well as what preliminary drilling is required to prepare for the post-2003 drilling program. The SCICOM Sub-Committees produced the following prioritizations:

Dynamics of Earth's Environment: Prioritization of Scientific Themes by SCICOM Sub-Committee

Priority	Subtheme
Themes within Dynamics of Earth's Environment	
1.	Oceanographic and climatic variability on Milankovitch time scales, with special emphasis on Arctic drilling
2.	Decadal to millenial-scale climate variability
3.	Extreme warm climates
4.	Understanding history and effects of sea level
5.	Exploring the link between climate and tectonics
Themes Partly Overlapping with Dynamics of Earth's Interior	
1.	Deep biosphere
2.	Gas hydrates
NR	Long-term observatories
NR	Fluid flow
NR	Carbon cycling

NR = Not ranked either because they address goals more relevant to Earth's Interior themes (fluid flow and observatories) or because of insufficient information available to rank (carbon cycling)

Dynamics of Earth's Interior: Prioritization of Scientific Themes by SCICOM Sub-Committee

Top Priority	Subtheme
•	Understanding active deformation and fluid flow at convergent margins
•	Hydrothermal processes at convergent margins
•	An intact section of oceanic crust

High Priority	Subtheme
•	Seismological observatories at ION sites
•	Emplacement of oceanic Large Igneous Provinces (LIPs)
•	The plutonic foundations of the oceanic lithosphere

Moderate Priority	Subtheme
•	Mass balances at convergent margins
•	Rifting initiation and extensional margins

3. OVERALL PROGRAMMATIC PRIORITIZATION OF SCIENTIFIC OBJECTIVES

Integration of the priorities within major scientific themes into an overall Program prioritization was completed at the August SCICOM meeting with two goals in mind:

- By the end of ODP, the Program needs to be able to identify specific scientific objectives of the Long Range Plan that have been met.

- By the end of ODP, the Program needs be positioned both from a scientific and technological standpoint, to justify and move into a new scientific drilling program post-2003?

Clearly, different themes within the Long Range Plan are in varying stages of achievement. For example, by the end of the Program, ODP will have recovered a global array of records that will allow evaluation of climatic variability on Milankovitch time scales -- a major objective of the ODP Long Range Plan. Conversely, drilling an intact section with complete penetration of the oceanic crust is unlikely in the next five years. However, it is very important that preliminary drilling and technology development continue so that the Program is positioned to accomplish this goal in a new program that includes riser drilling capabilities.

SCICOM decided to divide all the themes into two groups, indicating their overall scientific priority. This resulted in a mix of projects in both groups, some of which will accomplish the scientific objectives before the end of ODP, and others for which progress may be made, but which will not be accomplished until the new drilling program

GROUP I (in no particular order):

- Oceanographic and Climatic Variability on Milankovitch Time Scales (with emphasis on Arctic drilling)
- Decadal to Millenial-Scale Climate Variability
- Gas Hydrates
- Hydrogeology -- Hydrothermal Systems
- Deep Biosphere
- Seismogenic Zone Preparatory Drilling and In Situ Monitoring
- Section of the Oceanic Crust
- Extreme Warm Climate
- ION Observatory Sites
- Large Igneous Provinces

GROUP II (in no particular order):

- Plutonic Sections of Oceanic Lithosphere
- Climate-Tectonic Links
- History and Effects of Sea Level
- Mass Balances at Subduction Zones
- Rifting Initiation & Extensional Margins

Each of these groups contains scientific projects which range in cost from that of a "standard" leg (as defined by ODP for budgeting purposes) to very expensive legs that involve high Special Operating Expenses (e.g. extensive casing, Logging-While-Drilling,

ice-support vessels, advanced CORKs). In defining a framework for budgetary decision-making, it is those projects that require resources considerably beyond those expected for a routine drilling, coring and logging leg that must be prioritized. Scheduling of legs with low SOEs can proceed through the current system of an annual ranking of scientific priority.

Approximate costs of legs associated with all of the LRP scientific objectives were estimated from consideration of the costs of (i) legs scheduled for the years FY'97-FY'99; (ii) proposals included in the FY'00 Prospectus; and (iii) examples of proposals that address important themes not covered in the previous two categories (Appendix III).

A complete listing of the final programmatic prioritization of scientific themes, together with the cost estimates and technological requirements is shown in Table 1. Those legs for which costs were "standard" or "moderate" (up to $250K above a standard leg) were not prioritized within each group, but maintain their prioritization within their scientific themes, as defined in the previous section.

GROUP I

Within Group I, five scientific themes were not prioritized as their costs fall in the "standard" to "moderate" category. The two paleoclimate themes -- **Oceanographic and Climatic Variability on Milankovitch Time Scales** and **Extreme Warm Climates** -- require standard coring and logging. The exception to this is the high priority placed on initiation of **Arctic drilling** during the next five years. At a time of budgetary shortfalls, it may seem inappropriate to argue for ODP to begin to explore the Arctic proper, particularly in Phase III. The cost of drilling in the Arctic is high, and ODP will be unable to embark on this project without the development of partnerships with other programs (e.g. NAD). ODP offers engineering, archiving, publication, and logging expertise that can be used to support ongoing efforts (e.g., NAD, others) to drill the Arctic at minimal costs to the program (for an example, see ODP Legs 150X and 174AX which offered significant enhancement to the program at minimal costs). The inclusion of Arctic drilling in Group I and as the highest priority for the *Dynamics of Earth's Environment* theme is an indication that, if such partnerships can be developed, and the costs to ODP reduced to those of a "standard to moderate" leg, then Arctic drilling would be a very high priority for ODP before the end of the program. ODP can and must continue to be a leader in ocean drilling, and this must include deep involvement with Arctic drilling.

The topic of the **Deep Biosphere** captures the imagination of all geoscientists, and widens the scientific communities that ODP serves to a broad spectrum of scientists (biologist, biochemists, etc.) outside of geosciences. Hence, it is one of the Program's top priorities, and requires that the immediate development of a microbiology facility is the first priority for SOE funding. Estimates for an equipped, containerized facility are ~$350K; thereafter, the inclusion of microbiological work on drilling legs should not provide a significant added expense.

Mantle Dynamics is the final Group I scientific theme that has not been prioritized. ODP is exploring this through two major strategies that have been itemized separately as they require different approaches. The sites drilled for the **International Ocean Network** often require reentry cones and specialty logging, and hence can be "moderate" in cost. However, they are critical to imaging the deep mantle and constraining mantle tomographic models which is fundamental to our understanding of how the Earth works. In addition, this is an area where ODP is successfully achieving its aim of fostering links with other communities. SCICOM puts a very high priority on drilling the six high priority oceanic sites identified by ION by the end of the Program.

The other approach is through exploration of **Large Igneous Provinces**, which are now recognized not only as prime targets for understanding mantle dynamics, but also for investigating the global response (environmental impact) of this huge outpouring of magma. Significant progress can be made with current drilling and logging technology in determining the formation and evolution of these large features and, before the end of ODP, two of the world's largest LIPs will have been drilled. Deep drilling on these structures will await a vessel with riser capabilities.

Five scientific themes that fall within the "high - expensive" category (that spans legs with costs >$250K above a standard leg) were prioritized:

Seismogenic Zone Preparatory Drilling and In Situ Monitoring

The highest priority in this category is seismogenic zone drilling. Substantial progress has to be made in understanding processes of active deformation and fluid flow while laying the foundations for future deep (riser-based) drilling. The Conference on Cooperative Ocean Riser Drilling (CONCORD) identified the study of a seismogenic zone in the Western Pacific as the first project for the riser drilling vessel. Hence, it is imperative that preparatory work be accomplished over the next five years. In order to understand the role of fluids in all aspects of deformation, studies in these environments are likely to require extensive casing, LWD, emplacement of advanced CORKs (which must have a high priority in terms of technological development within ODP), and *in situ* monitoring of seismic zones at active margins.

Decadal to Millenial-Scale Climate Variability

Drilling to address very high-resolution climate variability is the second highest priority within the "high - expensive" category. It is very relevant to society and is a topic in which ODP is already demonstrating a leadership role through drilling open ocean sediment drifts and marginal settings, such as the Cariaco and Santa Barbara Basin. Such studies range from standard to high in terms of cost, depending on the approach that is taken. In areas of rapid sedimentation in deep water, high-resolution records can be obtained on "standard" cost legs. However, very-high resolution (up to millenial scale) paleoceanographic and paleoclimatological studies require drilling on coral atolls and terraces in water depths shallower than possible with the *JOIDES Resolution*. The technological capabilities already exist; however, the costs of drilling in shallow water with supplementary platforms is high, and it is unlikely that funds will be available to support direct drilling costs in Phase III. However, as for Arctic drilling, costs to ODP may be kept to a minimum if it offers engineering, archiving, publication, and logging expertise to support ongoing efforts. By placing it has a high priority, SCICOM is indicating that if partnerships could be developed that would reduce the costs to ODP to those of a standard - moderate leg, then these studies would have a very high priority.

Gas Hydrates

ODP is already playing a leadership role in investigating the distribution, mechanism of formation, and migration paths of gas hydrates, and continuing to investigate this poorly understood global carbon reservoir is of great scientific importance, as well as being an area of potential interest to industry. The costs of legs are likely to be high due to the need for LWD. In addition, some technological innovations are required, including the development of pressure core samplers and systems for gas extraction. With the surge of interest in, and funding for, gas hydrate reservoirs, ODP must seize the opportunities that are opening up, and stand ready to place high priority on gas hydrate studies.

Intact Section of the Oceanic Crust

Recovery of a complete section of the oceanic crust has been a goal of scientific ocean drilling for over forty years, and it remains a very high priority. A major factor has been the

need to develop the technology to drill and then stabilize a hole through the highly fractured upper layers of the crust. The best opportunity for making a significant contribution toward the goal of a complete penetration of *in situ* oceanic crust may be in an ultra-fast spreading environment, where models predict that the gabbroic rocks are located at shallow depths. Although the goal of a complete penetration is unlikely to be achieved by the end of ODP, it is critical that technological developments (e.g. hammer drill-in casing, etc.) to overcome the formation problems continue in order that recovery of an intact oceanic crustal section is a realistic goal for the next drilling program.

Ocean Crust: Hydrothermal Processes

Drilling a hydrothermal system in an arc or back-arc setting will greatly enhance attempts to understand the nature and origin of world class ore deposits. Such drilling is considered a high priority to complement the already successful legs in a volcanic-hosted (TAG hydrothermal field) and a sediment-hosted (Middle Valley) massive sulfide deposit. Development of technology to drill in unstable formations, as well as construction of high-temperature logging tools is required for future drilling of these systems. In addition, this drilling will position the program to attempt a deep hole into a hydrothermal reaction zone once riser drilling becomes available.

GROUP II

Of the five scientific themes listed in Group II, two were not prioritized. The costs of drilling legs to study **Climate-Tectonic Links** are not likely to be considerably greater than a "standard" leg. **Sea Level** studies in water deep enough for the *JOIDES Resolution* to operate can be completed at "moderate" costs and require only some specialty logging. However, drilling on the continental shelf would require the use of a supplementary platform, which is likely to be prohibitively expensive without the development of partnerships with other programs. Antarctic drilling requires the use of ice support vessels, which places such legs in the "very expensive" category. In Phase III and previously, ODP has made a major commitment to explore the Antarctic. While SCICOM has endorsed efforts to support the scheduled Leg 188 with an ice boat (SCICOM Motion 98-2-6), it also has encouraged proponents or others to seek additional resources to support costs that exceed normal leg expenditures (SCICOM Motion 98-2-8 - this is discussed in the next section). This may affect our ability to drill Antarctic targets in Phase III other than those currently scheduled. and hence ODP's ability to drill in these environments may be severely impacted due to budgetary constraints.

Two scientific themes fall within the more expensive categories and have been prioritized:

Plutonic Sections of Oceanic Lithosphere

Within Group II, continuing to drill plutonic sections of the oceanic lithosphere that are exposed at shallow depths is the higher priority of the two high cost programs. This topic falls into Group II only relative to recovery of an intact section, which is higher priority. ODP has already demonstrated that the plutonic foundations of oceanic crust can be drilled with current technology where it is tectonically exposed at shallow depths. Studies of Hole 735B are revolutionizing the way in which we view oceanic crustal architecture, but additional sites are required to determine how representative the recovered section is of mid-ocean ridge lower crust. Although these studies can be conducted with current technology, scientific objectives of a deep hole would require multiple casing and possibly specialty logging, thereby increasing the cost. In addition, development of a core orientation method would greatly enhance the scientific value of the cores.

Mass Balances at Subduction Zones

Understanding the "Subduction Factory" and associated geochemical fluxes is key to investigations of recycling of material between the Earth's surface and interior. By 2003, ODP will have conducted studies at the Izu-Mariana convergent margin and will have sufficient information to conduct the first quantitative assessment of geochemical mass balances during the subduction process. However, it would be advantageous to complement the Izu-Mariana program with drilling at another subduction zone before 2003 in order to locate appropriate areas for more advanced mass balance studies in the post-2003 period.

Rifting and Extensional Margins

As with convergent boundaries, there is a need to prepare for post-2003 programs that address the processes of the initiation of rifting and continental breakup . However, these legs often require deep drilling and complicated casing operations, specialized logging, and installation of CORKs. A preliminary transect drilled with current technology would provide the opportunity to select a deep-penetration site for post-2003 drilling.

4. IMPACT OF BUDGETARY CONSTRAINTS ON ACCOMPLISHMENT OF SCIENTIFIC THEMES OF THE ODP LONG RANGE PLAN

The framework presented in Table 1 provides an overview of the sequence in which scientific themes of the Long Range Plan would be eliminated in an ever-tightening budget situation. SCICOM has recognized that accomplishments of high priority objectives that require very expensive legs could be ameliorated if resources could be leveraged from other international programs interested in participating in ocean drilling. Hence, in order to state the critical nature of the issue, as well as to encourage proponents, ODP member countries and consortia, and other international initiatives to seek other resources, SCICOM passed the following motion at its August meeting:

SCICOM Motion 98-2-8

SCICOM supports, encourages, and recognizes the scientific importance of innovative programs which incur more than typical leg-related costs (<$300,000). Such expenses could include ice boats, alternate platforms, LWD, and CORKs. However, given the financial constraints under which the ODP operates, proponents or partner programs of such legs are strongly encouraged to seek additional resources to help cover costs in excess of a typical leg.

We hope that the opportunity to leverage against ODP's financial and technological resources will provide the international scientific community with exciting new opportunities.

It is very difficult to devise a scenario of scientific themes that will be cut or seriously impacted as the budget decreases (in real terms) because so much of what can be done in a given year depends on what proposals are in the system, the combination of legs that are under consideration for scheduling and their relative costs, as well as the geographic location of the ship. In addition, it is impossible to free up any significant funds by not using the *JOIDES Resolution* for a leg, since ODP is required to pay for it year round. Hence, the following list provides an attempt to demonstrate how the framework would identify the sequence of themes that would be affected based on the assumptions that (i) the vessel maintains its standard schedule of six legs per year, and (ii) that no other resources are available to the Program. In addition, it is assumed that funds will be identified in FY'99 for some type of microbiological facility on the vessel.

Sequence of Scientific Themes Affected with Increasing Budgetary Constraints

(assuming no other resources)

1) **Elimination of the Possibility of Accomplishing Objectives that Require the Use of Supplementary Platforms:** this would mean that:
   - "Understanding the History and Effects of Sea Level Change" studies would be limited to legs with the *JOIDES Resolution* with no shallow water drilling
   - "Oceanographic and Climatic Variability on Milankovitch Time Scales" studies would complete global arrays, but there would be no Arctic drilling.

2) **Elimination of Programs that Require Ice Support Vessels:** the planned series of Antarctic legs as put forward by ANTOSTRAT and prioritized by the JOIDES Antarctic Detailed Planning Group would end with only two (out of a proposed five) legs having been completed.

3) **Rifting Initiation and Extensional Margins**: Leg 180 in the Woodlark Basin was the most recent leg addressing this issue, and there is currently a highly rated program to drill the North Atlantic Rifted Margin. This project had the added benefit of drilling a hole that would test the depth capabilities of the *JOIDES Resolution* as recommended in EXCOM Motion 97-1-17. Due to its location, the North Atlantic leg is not likely to occur until 2002-2003; however, its high cost might result in its elimination due to the lower priority of this scientific theme.

4) **Mass Balances at Subduction Zones:** Leg 185 would be the last leg to address this theme in the Program.

5) **Plutonic Sections of the Oceanic Lithosphere**: there is currently a highly rated proposal to drill a deep hole at Site 735 that has the potential to determine the nature of the crust-mantle boundary, as well as obtain sections of the oceanic lithosphere never before recovered. This is likely to be very expensive because of the multiple casing that is required. Budgetary constraints may dictate that further progress on obtaining plutonic sections concentrate on offset sections where the plutonic foundations are exposed and progress can be made with shallow "standard" drilling.

6) **Hydrothermal Systems**: Leg 192 is currently scheduled to drill Manus Basin, and the proponents have been informed of SCICOM Motion 98-2-8. If cuts have to be made, then it is likely that LWD will not be affordable. Previous experience has demonstrated that standard logging in a massive sulfide deposit with standard techniques is extremely difficult due to the unstable lithology. Given also the poor recovery in these formations, the absence of a logging program will severely impact the scientific objectives related to understanding the subsurface nature of the deposit.

None of these cuts impacts the level of technology development that must continue since it is the highest priority science (e.g. seismogenic zones, gas hydrates, and a section of the oceanic crust) to which much of the effort is directed. Should significant cuts in technological development become necessary to reduce the budget, then developments related to penetration of unstable formations would have to be suspended. This would mean the elimination of any plans to conduct preliminary holes related to an intact section of the oceanic crust, and would only serve to delay the development of this technology until the next Program. Advances in understanding crustal architecture would then be limited to collection of offset sections in areas where different crustal layers are exposed. In addition,

the planned hydrothermal drilling would be seriously impacted by the lack of hammer drill-in casing techniques.

5. PRIORITIZATION OF OTHER SERVICES WITHIN ODP

ODP has a responsibility to ensure that the services it provides are essential to accomplishment of the Long Range Plan, and that they are provided in the most cost effective manner. It is critical that the infrastructure of the Program is fully justified and is optimally configured before the scientific goals of the Program are compromised. Based on input from SCIMP, who evaluated the impact of eight services on the Long Range Plan, SCICOM recommended that there be a review of staffing and configuration in three areas.

SCICOM Consensus 98-2-12
Based on the recommendations from SCIMP and the need to ensure effective use of ODP's limited resources, SCICOM recommends the following program areas to be reviewed:
1) public affairs with respect to a consolidation of effort (SCIMP recommendation 98-2-9)
2) overall costs of the current wireline operations (SCIMP recommendation 98-2-10)
3) the staffing levels throughout the ODP organization (SCIMP recommendation 98-2-12).

SCICOM also requests that OPCOM and TEDCOM evaluate the cost benefit and feasibility of engineering projects to determine if they can be accomplished in a realistic time frame to benefit the goals of the LRP (SCIMP recommendation 98-2-11).

For other areas of ODP, SCIMP tabulated what *specific* shipboard and shore-based services are absolutely essential to accomplish each scientific objective in the Long Range Plan, and what services augment the science but are not absolutely necessary (see Appendix IV). They found that while all basic services were considered essential or useful, it may be possible to make savings in specific areas of the program.

1) Laboratories

Obtaining cores and providing the basic measurements necessary to characterize the cores is the most essential aspect of the Program. Each of the six shipboard laboratories (Chemistry/X-ray, Physical Properties, Core Description, Underway Geophysics, Paleomagnetics, and Paleontology) is essential for at least one of the themes of the Long Range Plan, and it is not cost effective to install or remove equipment depending on the nature of each Leg. Some savings can be made by deferral of capital upgrades, but this amount is not large as the need for equipment replacement in the near future is not significant. Furthermore, a reduction in shipboard laboratories or services is considered counterproductive because the savings are small considering the loss of primary data and its effect on the international scientific constituency.

2) Publications

Publication of the record of each cruise and description of the data collected are an essential product of the Program; hence, the Initial Results Volume should be retained. However, the Scientific Results volume, which is rapidly changing in nature, is considered useful, but not essential, to ODP. Its elimination would result in publications being widely scattered in the literature, and also possible loss of data generated during shore-based work that does not reach the open literature. However, in difficult financial times, elimination of this product could provide significant savings.

3) Information Services

Information Services includes data capture, database maintenance, data migration, computers and computer networks, and core photography. One of the most essential services is data capture since the cruise data represent the legacy of the Program. Maintenance of a relational database and data migration into the database are very useful, but not essential to the success of the Long Range Plan. However, these aspects of Information Services provides access to ODP data for the international community so are considered extremely important to the dissemination of the results of the Program.

4) Repositories

It is essential to provide a controlled environment for at least the short-term (~ 5 years) safe storage of ODP cores. ODP-TAMU studies have shown that the majority of sampling takes place within a few years of core collection, and that older cores are rarely sampled. Hence, the cost of retaining more than one or two active repositories needs to be carefully evaluated relative to the usage by the scientific community.

5) Public Affairs

A concerted public affairs effort is important to keep the scientific community and general public informed about the results and advances of ODP, and to keep a visible profile in all member countries. This is particularly true as momentum builds towards a new and more expensive program of ocean drilling post-2003. However, it is unclear that this function, which is conducted by offices both at ODP-TAMU and at JOI is optimally configured at the present time.

6) Wireline Services

Downhole logging is essential to the success of many objectives in the LRP, and is currently a great strength of ODP. However, better scrutinization and justification of the logging programs recommended for each drilling leg could result in some minor cost savings. For example, additional tools are often added to routine paleoceanographic legs which may offer an enhancement, but may not be essential.

7) Drilling Services

Engineering development represents a large portion of the ODP budget, and hence is an area where costs could be significantly reduced. However, as was pointed out in the previous section, the impact of doing so would be greatest on achieving the scientific themes under *Dynamics of Earth's Interior*. The loss of advancements in technology that would allow better drilling and recovery in hard rock would result in ODP losing a large part of its scientific constituency at a time when the community needs to rally in support for continuation of scientific ocean drilling. In addition, some level of innovation must be maintained to demonstrate its continued vitality at the Program nears its end. However, it is also important that engineering development proceed in the most cost- and time-efficient fashion. Hence, SCICOM has requested an evaluation of the cost benefit and feasibility of engineering projects to determine if they can be accomplished in a realistic time frame to benefit the goals of the LRP.

8) Personnel

ODP also has a responsibility to assess the level of personnel within the entire organization to ensure the most effective use of ODP's limited resources.

6. CONCLUSION

ODP is faced with a difficult period as it attempts to meet the goals of the LRP and plan for the future post-2003 within the framework of a decreasing (in real dollars) budget. However, SCICOM views the future as filled with opportunities to do innovative and top priority science. These opportunities will require us to be equally innovative in raising funds or developing partnerships outside the Program in order that we maintain ODP's scientific excellence and leadership role in scientific ocean drilling.

Appendix I

Progress and Priorities:
The Ocean Drilling Program Years 2000 - 2003

Themes addressing Dynamics of the Earth's Environment

Theme 1, "Understanding the Earth's Changing Climate"

This is the broadest of the themes considered by the ESSEP and includes several objectives, or sub-themes, that share the basic goal of gaining a better understanding of how the global climate system works. These objectives (oceanographic and climatic variability on the Milankovitch time scales; high resolution climate variability; extreme warm climates; and exploring the link between climate and tectonics) are grouped and discussed separately.

Oceanographic and climatic variability on the Milankovitch time scales. Of all the thematic interests of the ESSEP, perhaps the most progress has been made toward developing our understanding of "Milankovitch" scale (10^4 - 10^6 year) climate variations in the Pliocene - Pleistocene. This progress has been achieved by the well-planned development of a global array of sites that can monitor the longer term variability of the major surface and deep ocean currents in dynamic parts of the oceanic circulation system. These currents and associated water masses absorb and release gases, and distribute heat, nutrients, and other chemical species in the global ocean. They have a profound impact on both global climate and the large scale patterns of biological productivity.

The drilling legs that have helped establish this global array date back to the scientific drilling community's invention of the hydraulic piston coring device (first used extensively on DSDP Leg 85) and to the development of coring and logging strategies that insured complete recovery of the sedimentary record (first used on ODP Leg 138). This new coring tool has been used in the recovery of relatively undisturbed sedimentary sections that contain a pristine record of climatic and oceanographic variability. More than a decade of Ocean Drilling Program efforts have gone into building this array. Recent additions to the suite of sites needed to constrain global climate change on these time scales include: 1) Transects of the highly productive western boundary currents (Leg 167, The California margin and Leg 175, The Benguela Current); 2) A transect of the open ocean frontal region in the Southern Ocean (Leg 177, Southern Ocean transect), another region of very high biologic productivity; 3) Relatively high resolution records of deep, intermediate, and surface water variability contained in sediment drift deposits that have been constructed by the deep water part of the global "conveyor belt" (Legs 162, 172, North Atlantic sediment drifts and Leg 178, Antarctic Peninsula); and 4) Long-term development and timing of Northern Hemisphere glaciation (Legs 151, 162, 163, North Atlantic gateways).

As part of this overall strategy for developing a global array of sites and transects in climatically and oceanographically sensitive areas, there are several scheduled or highly ranked ODP legs that also fall into the categories listed above: 1) 465, SE Pacific Paleoceanography along the Peru-Chile western boundary current; 2) Leg 181, Southwest Pacific Gateway, and 3) Leg 188, Prydz Bay.

Recently drilled Leg 178 (Antarctic Peninsula) and scheduled Leg 188 (Prydz Bay) are part of a suite of full proposals (including 455, Laurentide Ice Sheet; 482, Wilkes Land; 489, Ross Sea; and 503, Weddell Sea) that seek to elucidate the development of the Cenozoic Ice Age and reveal the climatic variability associated with the development of the large Northern and Southern Hemisphere ice sheets. Proposal 455 has been reviewed and ranked highly; other Antarctic proposals (482, Wilkes Land, and 489, Ross Sea) have been

reviewed and passed on to SCICOM for ranking. Proposal 503 (Weddell Sea) is undergoing external review now. In addition there are several promising pre-proposals and active full proposals which target climatically sensitive areas - such as 477, Sea of Okhotsk and Bering Sea, and 513 Scott Plateau.

Considering the recently drilled sites and potential future drilling legs, by 2003 we will have accomplished one major goal of the LRP in obtaining this global array of moderately high resolution Pliocene - Pleistocene sites. A glaring gap in this array, addressed by a recent pre-proposal (533), is the Arctic Ocean.

In many cases, however, we have traded higher time resolution for total length of record. The result has been that most of the sites that we have drilled to date do not extend back into the Miocene or older periods. Thus we do not have a good global array of sites in sections as old as, or older than, the middle Miocene, the time of major growth in the Antarctic Ice sheets. We have obtained the first tantalizing glimpses of the real possibilities of developing a similar framework for these older intervals from data obtained by Leg 154 (Ceara Rise), Leg 165 (Caribbean), and 171 (Blake Nose).

We can evaluate the climatic impact, the variability, and the course of evolution of the Northern Hemisphere ice sheets; however, we cannot yet do the same for the global climate change associated with the development of the large continental ice sheets of East and West Antarctica. Scheduled legs and proposals now being considered for drilling in the higher southern latitudes will be a step in the direction of filling this gap. Given the successful completion of a substantial portion of these high southern latitude legs, we should be able to delineate the glaciation of Antarctica as it relates to the history of global cooling through the Cenozoic, and to describe the nature of climate variability that accompanies this long-term cooling trend.

High resolution climate variability. Extremely high resolution (10^0 - 10^2 year) records of climate change that extend back several thousand years are being derived from a few recently drilled sites: Leg 169S, Saanich Inlet; Leg 167, The California Margin; Leg 172, NW Atlantic sediment drifts; Leg 178; Antarctic Peninsula (Palmer Deep), and Leg 165; Caribbean Sea (Cariaco Basin). These records provide key ties to other high resolution records of climate variability (such as coral records in tropical oceans, cores from lakes and intertidal swamps, and tree ring and ice cores records on land), and they will expand the global network of such records. A few other such ultra-high resolution records are expected to be obtained if some currently ranked proposals can be scheduled for drilling (e.g., Saguenay Fjord site in Proposal 455); however, we are far from having the geographical coverage of the types of records that are needed to characterize the global nature of short-term climatic variability and the mechanisms of rapid climate change. These types of sites are widely scattered, but require only a short amount of drilling time; thus, we are open to their consideration as "targets of opportunity" as the drilling ship moves through the global ocean. We continue to consider the study of ultra-high resolution climate change to be a high priority.

If a handful of these sites are drilled by 2003, we will be in an excellent position to re-define our objectives for drilling beyond 2003 by identifying specific regions or environments to target. For the next 4 years, there is a great need to expand our knowledge of rapid climate change worldwide.

Extreme warm climates. Only one recent cruise, Leg 171C - Blake Plateau, has focused exclusively on extreme warm climates. While exciting data on Paleogene climates were also collected on Leg 165 (Caribbean paleoceanography), we are only beginning to meet our objective of understanding the climatic and oceanographic dynamics of a "hothouse" world - a world that approaches (and perhaps exceeds) the future greenhouse impact predicted by global climate modelers. Earlier ODP Legs (113, 114, 119) defined the "hot house" world by documenting the high temperatures in the Southern Oceans before the late Eocene

establishment of ice sheets. Results of ODP Legs 142 and 143 (atolls in the Pacific) have presented the enigmatic picture of a hothouse world in which coral reefs died as the Pacific plate on which they rode approached the equatorial region, a region where reefs thrive today! At present the data gleaned from DSDP and ODP sites have posed more questions than they have provided answers. These data have painted a startling picture of a very different ocean with warm polar regions, low pole to equator thermal gradients, periods having depth zones extremely low in oxygen, and periods of extremely high sea level and ice-free poles. We now have indications of short-term (10^3 years) climatic instability in an ice-free world during the Late Paleocene Thermal Maximum, and have started to look into evidence that gas hydrate instability may have been directly linked to climate instability.

The scant sedimentary records that we have also suggests that the hothouse world of the early Paleogene and Cretaceous may have been fundamentally different in terms of both deep and shallow circulation of the oceans, and deep ocean biota must have been profoundly different before the development of the cryosphere. The mathematical models of atmospheric circulation that are tuned to modern conditions have a difficult time emulating all aspects of these very warm climates.

There have been two JOI-USSAC funded workshops and one workshop of the Marine Earth Systems History Committee which have helped define the problems and the key sampling regions needed to establish an array of sites to constrain the global nature of these extremely warm periods of the Paleogene and Cretaceous. There are, as yet, only a few full proposals in the system that would help to address the problem of understanding extreme warm climates and be the first steps towards collecting such a global array of sites. Proposal 486, Paleogene Equatorial Pacific Transect (ranked and ready for scheduling) would provide the first cross section of a major ocean current system as it existed at the peak of the Paleogene warm interval. Full Proposals 534, Cretaceous and Paleogene Shatsky Rise depth transect and 503, Weddell Sea, would provide high and low latitude Cretaceous sections, with 534 providing a depth transect in sediments that have not been deeply buried. Both of these proposals are being sent out for external review. Full proposal 513, The Scott Plateau, could also provide Paleogene and Cretaceous sections that have not been deeply buried, and Proposal 524, The Oceanic Mesozoic Section targets one of oldest oceanic sections still lying on oceanic crust. The drilling of at least some of these legs is critical to addressing the LRP objective of gaining a better understanding the extreme warm climates. The Extreme Climate PPG will provide help in developing strategies, and more drilling proposals, that address the gaps in our understanding of the processes that create and control very warm climates. It is clear that we need to provide more constraints on the oceanic and climatic character of the hothouse world in order to set the stage for the next phase of drilling.

Exploring the link between climate and tectonics. Thus far, no legs in the past decade of the Program have been focused specifically on the link between climate and tectonics We have, however, learned something of the timing of enhanced river-borne and airborne sedimentation in the oceans that are likely to be related to the uplift of major orogens and the climatic changes that they may have induced. Compilations of drilling data from the Indian Ocean have given an approximate timing for the uplift of the Himalayas; however, both the recovery and the dating of many of these rather few sections are inadequate for gaining a detailed timing of this history. Drilling in the region of upwelling induced by Indian monsoonal circulation has given us a very reasonable picture of the changing impact of Himalayan and Tibetan uplift on local climate, whereas, eolian debris blown downstream from the Tibetan Plateau in the Westerlies offers clues to the drying of the Asian continent. Airborne dust delivery to the North Pacific (ODP Leg 145 and other sites) seems to indicate that the aridity of the Asian continent started to increase a million years before the onset of Northern Hemisphere glaciation and that there was an enigmatic pulse of aridity (high dust flux) some four to five million years before that. It has been proposed that the uplift of the

Tibetan Plateau has led directly to the global climatic deterioration of the late Neogene and much of the impetus for the development of this hypothesis has come from Sr-isotope data derived from DSDP and ODP sites. However, we have only this vague outline of the ties between tectonics and climate. The details of both links and timing need further exploration.

We must also consider the north-south spine of American mountains and the uplift of the Colorado Plateau and Alto Plano that affect zonal atmospheric circulation in both hemispheres . The timing of the orogenies on the western side of the Americas is known in general terms from studies on land and from earlier drilling legs. For example, sites on the Ceara Rise in the equatorial Atlantic (ODP Leg 154) have given an indication of the timing of the latest Andean orogeny on the far side of the South American continent. However, we have yet to tie the detailed timing of episodes of uplift to the changes in atmospheric and oceanic circulation.

There is another important aspect of the tectonic impact on climate and ocean circulation - one that has fascinated us since the beginnings of the new plate tectonics paradigm and the creation of paleoceanography as a science. That is the impact of the opening and closing of oceanic gateways on ocean circulation, climate, and the transport of heat, salt, and moisture. Through the continued detailed studies of plate tectonics we have gained a clearer understanding of the manner in which these gateways changed and of their approximate timing of change.

With our enhanced ability to recover complete sections and acquire detailed logs, we are now in a position to explore the precise links between the stages of change in these gateways and the impact that they have had on circulation. For example, comparisons of data from ODP Leg 138 with that of Leg 154 (Ceara Rise) and Leg 165 (Caribbean) is in progress, and is expected to throw additional light on whether the closing of the Panamanian Gateway led to, or delayed, the Northern Hemisphere glaciation. Similarly, scheduled Leg 182 (Great Australian Bight) may be expected to give new insight on he separation of Australia and Antarctica, and Proposal 485, The Southern Gateway between Australia and Antarctic (recently sent to SCICOM for ranking), proposes to establish the link between ocean circulation and tectonics as the Tasmin Rise cleared the coast of Antarctica. As a complement to this work, Full Proposal 513, The Scott Plateau: Evolution of Indonesian Throughflow (now in rewrite stage), would have the opportunity to document the oceanographic and climatic impact of the northward drift of the Australian Plate and its gradual restriction of the Indo-Pacific gateway. In a similar way Proposal 465 (see above) will explore the "upstream" impact of the opening of the Drake Passage on the Peru-Chile Current system.

The Climate and Tectonics PPG have yet to report from their first meeting; however, there is one program critical to this sub-theme that has already been scheduled as Leg 184, East Asian Monsoon History, and another full proposal that is in rewrite stage (521, Himalayan uplift and the history of the Indian monsoon recorded in the Indus Fan). Together these studies will help to resolve the tectonic influence on the monsoon development in Asia and India. In addition, ODP Leg 167 (California Margin) together with Proposal 465 (SE Pacific Paleoceanography, ranked and ready to be scheduled) will explore the links between climate changes as seen in the western boundary currents of the Pacific and the impact of American orogenies

From these studies and those carried out under the first sub-theme discussed in this section, we are developing a detailed knowledge of the character and timing of climate change in the late Neogene; and from our progress in establishing an orbitally tuned time scale, we are now capable of making measurements of fluxes and rates of change with a precision never before achieved. What remains is the development of a history of tectonic activity (collision, uplift, rifting, extrusions, and volcanism) of comparable precision that can be directly linked to our developing history of climate.

In summary, much progress has been made towards achieving our goals as laid out in the LRP, particularly with respect to Late Neogene climate variability. However, we have yet to extend this detailed record beyond the late Neogene in a global array of sites. We will continue to take advantage of targets of opportunity that will give us a record of annual to decadal resolution; however, we will not have a global array of such sites by 2003. There are several scheduled legs, and mature proposals, as well as promising new full and pre-proposals which focus on elements of our other top priorities. In order to both achieve some progress towards our goals and to position ourselves well for the next phase of drilling it is of great importance that we undertake some of the drilling programs that address the sub-themes of Extreme Warm Climates and Climate and Tectonics. Finally, there are other environments that are of critical importance, which cannot be easily accessed with our present drilling platform, such as the Arctic Ocean and shallow water systems. This limitation has impacted our ability to achieve our LRP goals in both the Understanding Climate and Sea Level themes of the LRP.

Theme 2, "Understanding History and Effects of Sea Level"

Documenting and understanding the timing, magnitudes, and impact of sea level changes on the architecture and facies of sediments that surround our shorelines is an important and challenging goal of the ODP Long Range Plan. The processes of sea level change are poorly understood, both in regards to controls and mechanisms; yet, the impact of fluctuating sea level on the largest centers of sediment deposition and on the reservoirs of much of the world's hydrocarbon resources is profound. Studying sea level pushes the limits of our ability to: drill and recover the appropriate sections, date and estimate the paleo-water depth of the sections that we do recover, and disentangle the interplay among sediment supply, sea level, and tectonics on preserved stratigraphic sections.

To date we have drilled two primary transects that address the sea level theme:

1) A series of sites across the Northern Hemisphere, siliciclastic passive margin (New Jersey: Legs 150/150X, and 174A/174AX) that have targeted the late Paleogene-Neogene. These sites have been drilled both with the *JOIDES Resolution* and with shore-based drilling rigs on the adjacent coastal plain. Recovered sections have been dated using biostratigraphy, magnetostratigraphy, and strontium-isotope stratigraphy. Follow-on studies have made approximations of the magnitude of sea level change associated with sequence and systems tract boundaries identified seismically and in the drilled sections. Downhole measurements have also played a critical role by serving as proxies for sedimentary cyclicity in unrecovered parts of the drilled sections.

2) A series of sites across a Northern Hemisphere shallow-water carbonate platform (Great Bahama Bank), targeting the late Paleogene-Neogene. These sites have also been drilled both with the *JOIDES Resolution* (Leg 166) and with a shallow-water jack-up rig on the platform top. Recovered sections have also been dated using biostratigraphy, magnetostratigraphy, and strontium-isotope stratigraphy. Logs have provided crucial information on sedimentary cyclicity.

The contrast of the clastic and carbonate settings has been important because the impact of sea level fluctuations on the two regimes is markedly different. Still, the dates associated with presumed sea level falls on and adjacent to the Bahama Banks are nearly all within the error of measurement of the falls detected on the New Jersey margin.

The efforts required to field these two programs have been massive. First, they have required the raising of funds independent of the Drilling Program to pay for shore-based drilling and offshore seismic surveys. Second, they have required the cooperation and participation of scientists not routinely associated with the Drilling Program. Third, additional grid-type seismic surveys have been necessary to satisfy site-specific safety concerns; and in some cases, drilling sites for which these concerns could not be met have had to be abandoned. Safety and drilling restrictions have become more stringent, and it has

only been through the dogged perseverance of the proponents and previous JOIDES thematic panels that these transects were ever drilled.

Although all the studies of these transects are not complete, we can say that the timing of sea level falls for the late Paleogene and Neogene appear to be similar in both clastic and carbonate settings of the western North Atlantic. Sea level fluctuations recorded in marginal settings can also be related to significant changes in the marine oxygen isotope record of ice volume change; however, the record at continental margins may be overprinted by successive sea level fluctuations closely spaced in time.

One leg has been scheduled (Great Australian Bight, Leg 182) that will target a temperate carbonate passive margin and sample both the Paleogene and the Neogene. While the number and location of sites scheduled for this leg will not permit a detailed reconstruction of sea level fluctuations through this entire time interval, it will provide a check (across a younger margin in an entirely different ocean) on the timing of some of the major presumed sea level changes seen in the North Atlantic. ODP Leg 182 will also provide insights into the sedimentary response to sea level change on a margin in a quite different depositional setting from the New Jersey and Bahamas Bank transects.

There are also a few active Full Proposals that offer transects crossing a Southern Hemisphere shallow-water carbonate-platform (Marion Plateau, Proposal 510, now in external review), a Southern Hemisphere siliciclastic passive margin (Canterbury Basin, Proposal 511, now being revised), and a mid-plate carbonate atoll chain in the Indian Ocean (Maldives Islands, Proposal 514, now being revised). In addition, there is a proposal for drilling in the Mediterranean Sea which focuses on the interplay between tectonics and sediment source during Pliocene - Pleistocene sea level fluctuations and their effects on the sedimentary architecture of deltaic and fan deposits. (Proposal 467, Rhone/Var Fans, now being revised). Included in this report as Appendix 1 is a "primer" for proponents wishing to submit a sea-level proposal (also available at www.whoi.edu/joides/)

If all of these scheduled and proposed legs were successfully completed, we would have a viable global array of transects that would address many of the goals of the LRP sea level theme. This is highly unlikely to happen prior to 2003; however, it is important that we make progress towards these goals. We should position ourselves to be ready to address some of the more difficult objectives embodied in this theme - such as: 1) what were the timing and magnitudes of global sea level changes in the Paleogene; 2) how does this history fit with the late Neogene model of ice-cap control on sea level changes; and 3) what are the rates, magnitudes, and regional distributions of tectonic changes that alter any eustatic signal preserved in the continental margin sedimentary successions?

We should also be ready to make the case for enhanced technical capabilities to address these questions in the next phase of drilling. Some parts of both the drilled and proposed transects (those sites in water depths <75 m) will never be drilled by the *JOIDES Resolution*.; yet, in many instances, drilling in shallow water will be required to reach crucial Paleogene sea-level targets. Therefore, alternate drilling platforms will be necessary. The Shallow Water PPG should provide advice on this issue. Additional community input should also be provided by the International Sea-Level Workshop, planning for which has been initiated by SCICOM.

Theme 3, Sediments, Fluids, & Bacteria as Agents of Change

This is another very broad theme within the ESSEP mandate with distinct overlaps with the interests of the ISSEP. However, under this flag we can integrate our shared interests in the Deep Biosphere, Gas Hydrates, and Long-term Observatories - all of which are represented by active PPGs. The Deep Biosphere PPG is making the prudent first steps in developing a microbiology program by participating in scheduled legs (*e.g.* Leg 180, Woodlark Basin) and evaluating contamination problems. The SSEPs support the early development of a ship-board microbiology laboratory in order to make progress in this area

of the theme prior to 2003. The Gas Hydrate PPG is similarly starting to develop drilling programs, with Pre-proposal 539 (Carolina Rise and the Blake Ridge Collapse Structure) aimed at determining the amount, distribution, source, and fate of oceanic gas hydrate. The Long-term Observatories PPG has made great strides in developing preliminary designs of advanced CORKs with multi-packer capabilities that will provide radically new information about the hydrogeology of the ocean crust. The SSEPs recommend that the Ocean Drilling Program support the design and deployment of these new CORKs immediately as an important start toward understanding flow in the ocean crust. Ultimately, the integration of deep biosphere, gas hydrate, and fluid flow objectives offer new intriguing scientific opportunities.

Investigations into fluid flow processes below the ocean floor figure prominently in the LRP. The plan mentions many aspects of fluid flow that need to be better constrained, including the driving forces, the rates of flow, and the effects of flow and chemical transport. There is almost certainly an interplay between fluid flow~~s~~ and the microbiologic ecosystem in the Earth's crust; however, this aspect of our investigations must await a more detailed program plan from the Deep Biosphere PPG. Some clearer insights into the nature of crustal fluid flow and the crustal biota are likely to be developed through the use of the new multi-packer CORKs, but interpretations of these new data will require advancements in numerical modeling and a refined understanding of natural chemical variation of pore waters. The SSEPs believe that the role of ocean drilling in these interpretations will be enhanced through development of a new PPG with a goal of introducing and linking the broad hydrogeologic scientific community to ocean drilling technologies and capabilities.

Fluid flow objectives have been accomplished in recent legs at mid-ocean ridges, active margins, passive margins, and carbonate platforms. Investigations of flow in and near mid-ocean ridges are more advanced than elsewhere in the oceans because of the dramatic discovery in the mid-1970's of hydrothermal systems. The Ocean Drilling Program has played a critical role in understanding flow at this tectonic settings through work on a number of drilling Legs, including Juan de Fuca Ridge (168), Sedimented Ridges II (169), and the Mid-Atlantic Ridge CORK and TAG legs (174B and 158). Results from the installation of 10 corks have illuminated the driving forces and scale of circulation in ridge flanks, and the nature of subsurface flow systems below young and old hydrothermal sulfide mounds. Pre-proposal 516 intends to look at the flow regime in an off-axis setting of the Costa Rica rift (Sites 504B/846A) and employ the advanced CORK (multi-packer) design to better constrain the nature of fluid flow in the crust. Future work will focus on identifying the three dimensional heterogeneity of the flow systems and understanding role of fluids in transporting heat and solutes in this environment.

Recent drilling legs at active margins include Cascadia (146), Costa Rica (170), and Barbados (171A). These legs have revealed that fluids are transported out of the margin from areas of deep-seated reactions. In addition, there are three CORK installations at active margins: two at Barbados and one at Cascadia. Attempts to understand the diagenetic and metamorphic controls on fluid chemistry, fluid pressures, permeabilities, and driving forces for the flow are making progress as the drilling and CORK data from several margins are compared. Proposed Legs that address these aspects of fluid flow include Proposal 445 (Nankai Trough, ranked and ready for scheduling) and the associated Pre-proposal 517 which proposes to install CORKs in the west Nankai study area. Full Proposals 478 (East Nankai) and 355 (Peru Margin) are strongly focused on fluid flow in ~~a~~ convergent margin settings where gas hydrates also play an important role. These proposals are now being revised. Finally, Pre-proposal 537 (Costa Rica Margin) intends to penetrate a section that encounters the seismogenic zone. If successful, the potential roles of fluids and dehydration reactions in such a setting would be of particular interest to ESSEP.

In the next few years, we will use the data from relatively shallow sites near the toes of active thrust complexes to help formulate testable conceptual and numerical models of the material properties and fluid pressures in the seismogenic zone. Meaningful progress toward the goal of understanding earthquake cycles will require iterative combinations of

modeling and empirical calibration of those models by drilling. Incremental progress in both concept and technology will leave the program poised to target riser-supported drilling into a seismogenic zone in the post-2003 program. Such a clearly identified problem is encouraging interdisciplinary collaborations between hydrologists, geochemists, seismologists, and marine geophysicists in order to formulate testable hypotheses.

Recently completed and scheduled drilling legs to passive margins and carbonate platforms include Blake Ridge (164), Bahamas (166), New Jersey Margin (Leg 174a) and Great Australian Bight (182). Leg 164 used the pressure core sampler to provide the first quantification of gas hydrate in continental margin sediment. Legs 166 and 174a have illustrated the potential significance of active fluid exchange between ocean water and sediments of carbonate banks and passive continental margins, but because few legs have focused on the hydrogeology of these margins, the magnitude and effects of the exchange is poorly quantified. In these legs, the fluid flow objectives were secondary and usually were added in response to panel feedback. This highlights a major problem with hydrology goals in the program. There are few trained hydrogeologists who work in the sub-seafloor environment. Frequently, proponents comment that they have difficulty identifying a hydrogeologist who can be added to the program. This occurs in spite of the agreement by all concerned that fluids clearly affect the sediments and many of the processes observed during the drilling. This problem is likely to continue because the panel commonly identifies possible fluid flow objectives as add-ons to existing proposals with other primary goals, rather than evaluating proposals that have a true focus on fluid flow objectives in bank and passive margin settings.

The panel believes a PPG emphasizing hydrogeology of the ocean crust is needed in order to foster hydrogeologic and related goals of the Ocean Drilling Program. This new PPG is particularly needed because a strong emphasis in the LRP is to integrate fluid flow with other processes. These processes include diagenesis, microbial growth, heat transport, seismogenic zone processes, and gas hydrate formation. Because these processes operate on different time scales, integration of different types of real-time measurements and geochemical proxies will be challenging. This integrative approach, moreover, requires formulation of conceptual and numerical models and drilling plans on a level that is difficult to obtain without greater involvement of hydrologists in the program. The newly-formed PPG would help plan the comprehensive study of physical and chemical hydrogeology of the ocean crust and integrate the study of fluid flow with other processes. It would identify methods of approach to hydrologic problems in various seafloor environments and recruit hydrologists to participate directly in the ODP. Another role of the PPG would be to identify specific hydrologic data to be collected during site surveys that could aid in the refinement and testing of models of fluid flow addressed in the drilling plan. As a part of this effort, the PPG might evaluate emerging technologies for seafloor piezometers, seepage meters, and fluid sampling and clarify their role in enhancing hydrologic site survey data. A third role for the PPG would be to identify methods for investigating flow systems with components in three dimensions. We feel that the formation of such a PPG is a critical element needed to derive the maximum benefit from proposed pre-2003 ODP Legs as well as to position ourselves well for post -2003 drilling with a strong and integrated approach to hydrogeologic studies.

Appendix II

ISSEP Priorities:

Themes addressing Dynamics of the Earth's Interior

July, 1998

Preface

The following is a summary of ISSEP priorities for programs needed to achieve goals of the ODP Long Range Plan (LRP). These priorities are based on panel discussions during the May 1998 ISSEP-ESSEP joint meeting. Comments from the PPGs were also considered. Additional panel comments will be included in the ISSEP report at the August 1998 SCICOM meeting.

As in most documents discussing priorities, the chances that the text below might be misinterpreted are reasonably high. Therefore, a few explanations and caveats should be considered. This effort was made by ISSEP in response to a request by SCICOM, which was in turn asked by EXCOM for scientific program priorities. As a guide, ISSEP started by considering the potential number of 2-month legs remaining through 2003. We were influenced most by the programs that we saw as having a high chance of reaching the mature-proposal stage in this time frame (i.e. projects for which we had already received pre-proposals or full proposals). Nevertheless, a few areas were identified where our panel will solicit the development of new or revised work to complement efforts in progress. The panel recognized that proposal pressure and competition, hallmarks of a healthy program, must be maintained. Therefore, the discussion below contains more programs than can be drilled-- ISSEP feels that the list is not excessively long and that competition between proposals (ultimately decided on by SCICOM), will will result in a final drilling program of highest quality.

ISSEP was convinced that even considering the constraints imposed by a now-limited number of legs, substantial progress can be made in the themes outlined in the long range plan. The panel, both alone and in our joint discussions with ESSEP, felt no need to exclude high priority programs to ensure overall progress.

I. LRP Theme: Exploring the transfer of heat and material to and from the Earth's interior

A. Mantle Dynamics

ISSEP recognizes the following priorities in this sub-theme: the start of an investigation of large igneous provinces by drilling surveys on the giant plateaus (Kerguelen and Ontong Java), the study of large scale mantle flow through drilling-based studies and by the establishment of borehole seismological observatories, and the study of mass balances (see below).

Rationale: ISSEP recognizes that in addition to scheduled work on Kerguelen plateau, drilling on the largest oceanic plateau, Ontong Java, is of highest priority to address

problems raised by the formation of these huge oceanic features. We have started an effort to study mantle flow in other ways, through the Australian-Antarctic Discordance leg, and other efforts may develop to address mantle flow through sample-based programs. Finally, the panel feels that priority should be given to the establishment of borehole seismological observatories that are needed to constrain mantle tomographic models. Many of these programs are new efforts for ocean drilling. The involvement of new scientific communities is viewed by ISSEP as important for the future of ocean drilling.

B. Ocean Crust

ISSEP recognizes the following priorities in this sub-theme: the preparation for complete penetration of in situ oceanic crust, drilling of the plutonic foundations of ocean crust exposed at shallow depths, an investigation of the importance of detachment faults in the formation of oceanic crust and the study of a hydrothermal system in a convergent setting. ISSEP also noted that efforts to study the hydrogeology of ocean crust (also of interest to ESSEP) should be given priority. With new CORK developments, some of these efforts may need reduced (or no) JR drilling time.

Rationale: ISSEP feels that it is important to start the process for the complete penetration of in situ oceanic crust, which is a long standing goal of ocean drilling. The best change of making a significant contribution toward this goal prior to 2003 may be in an ultra-high spreading environment where models predict a shallower depth to gabbroic rocks. Significant progress can also be made by drilling the plutonic foundations of ocean crust where tectonically exposed at shallow depths. Prior drilling (Hole 735B) has clearly demonstrated that progress can be made using existing technologies in some of these environments, while in others (for example, Hess Deep) continued developments will be needed. The panel felt that an initial investigation of the importance of detachment faulting in oceanic crust should be attempted prior to 2003. Such a study will be of great interest to scientific communities not associated previously with ocean drilling. Finally, ISSEP felt that the drilling of a hydrothermal system in a convergent (arc or backarc) setting should be completed prior to 2003. This effort is needed to complement prior legs devoted to the study of hydrothermal systems at divergent settings, and to understand the origin of world class sulfide mineral deposits. The panel noted that these studies may require continued developments in high-temperature down-hole tools.

C. Mass Balances

ISSEP recognizes the following priorities in this sub-theme: the need to complement work planned in the Izu-Marianas with additional efforts to study mass balances and the behavior of volatile elements at convergent margins.

Rationale: The priority of mass balances studies is established in the LRP, but ODP's entry into these studies is still relatively new. Therefore, ISSEP feels it would be advantageous to complement the planned drilling program in the Izu-Mariana area with drilling elsewhere (e.g. in a setting where sediments add a larger component to subducted materials) so we can proceed with more advanced studies after 2003. We note that many aspects of these studies are closely related other LRP themes and sub-themes. In particular, there are linkages with the sub-theme of mantle dynamics (including the role of volatiles during subduction) and LRP Theme II, Investigating deformation of the lithosphere and earthquakes processes (see below). The panel plans to solicit proposals in this area.

II. LRP Theme: Investigating deformation of the lithosphere and earthquake processes

As in theme I, the objectives of this the are best discussed in terms of the relevant sub-themes. Two of the ODP LRP initiatives (Initiative II, the in situ monitoring of geologic processes, and Initiative III, Exploring the deep structure of continental margins and oceanic crust), are also addressed by these sub-themes.

A. Convergent Boundaries

ISSEP recognizes the following priorities in this sub-theme: efforts to understand earthquake processes from core and fluid-base sampling programs and by the insitu monitoring of active seismic zones, and efforts to understand processes of active deformation.

Rationale: Substantial progress should be made in drilling convergent margins in preparation for post-2003 riser drilling. The CONCORD planning effort identified study of the seismogenic zone as highest priority, with the western Pacific identified as the first study area. ISSEP sees our goals and those of CONCORD as complementary. The JR can drill shallow faults and sample deeply sourced fluids from the seismogenic zone, and can constrain physical properties up dip from the seismogenic zone. Substantial progress can be made in both understanding processes of deformation and in laying the foundations for future deep (riser-based) drilling in the same JR drilling program. ISSEP recognizes that to understand the role of fluids in all aspects of deformation, priority should be given to CORK development. Finally, ISSEP recognizes the priority of insitu earthquake monitoring efforts, similar to those planned for the Japanese Trench, at convergent margins.

B. Extensional Boundaries

ISSEP recognizes the following priorities in this sub-theme: the need to address processes of continental breakup in an effort that builds on the results of recent drilling.

Rationale: Substantial efforts have been made to address these questions in previous drilling legs. ISSEP feels it is time to build on these results in a program that includes deeper objectives. An effort involving a transect suitable for choosing a deep penetration site would be desirable. The deep site should be within the limitations of the JR, allowing the community to evaluate and design future post-2003 projects. The panel has seen proposals that could fill part of such a program; we hope to solicit additional proposals in this area.

Notes on Technology Development

The following issues were noted by ISSEP and passed on to SCIMP for their consideration. These applications are grouped by LRP sub-theme:

IA. Mantle Dynamics
-Possible deep drilling on large igneous province.

IB. Ocean Crust

-Active heave compensation (Hess Deep-type environment)
-Hammer in drilling and casing (Hess Deep-type environment)

-Core orientation: important for many projects, but the highest priority sites for drilling ocean crust formed at ultrafast spreading centers have near equatorial paleolatitudes. Therefore to obtain magnetic information (needed to address question ranging from tectonics to the sources of marine magnetic anomalies), oriented hard rock cores would be highly desirable.
-High Temperature Tools (Hydrothermal system in convergent setting)

IC. Mass Balances
-Multi-packer CORK developments

IIA. Convergent boundaries
-Multi-packer CORK developments

IIB. Extensional Boundaries
-Possible deep margin drilling.

Appendix III

Appendix IV

PROGRAMMATIC PRIORITIZATION OF SERVICES

Scientific Measurements Panel

SciMP assessed the impact of eight services on the Long Range Plan and looked for potential economies within these services. SciMP prioritized these shipboard and shore-based services as either essential or useful to fulfilling the objectives of the Long Range Plan. SciMP found that while all basic services were considered essential or useful, it may be possible to make savings in specific areas of the program as summarized below:

1. Laboratories

First and foremost, SciMP believes that obtaining cores and providing the basic measurements necessary to characterize the cores is the most essential aspect of the program. Along these lines, SciMP looked at six laboratories on the ship (Chemistry/X-ray, Physical Properties, Core Description, Underway Geophysics, Paleomagnetics, and Paleontology). Equipment and services within the various laboratories were rated as essential or useful to the Long Range Plan. After detailed examination of the these laboratories SciMP came to the following consensus.

CONSENSUS 98-2-1
Having examined shipboard laboratory equipment and the importance of shipboard measurements to the LRP, SciMP considers most current equipment to be essential and sees few cost savings. Some savings can be made by deferral of capital upgrades, but this amount is not large as the need for equipment replacement in the near future is not significant. Furthermore, a reduction in shipboard laboratories or services is considered counterproductive because the savings are small considering the loss of primary data and its effect on the international scientific constituency.

A) Chemistry/X-Ray

Long Range Plan initiative or objective	Chemical / X-Ray Measurements Essential to Complete Objective (see key below)	Chemical / X-Ray Measurements Useful to Complete Objective (see key below)
Environment		
Climate Change	1 - 8, 10 -12	9, 13
Causes and effects of sea level change	1 - 8, 10 -12	9, 13
Sediments, fluids, bacteria, as agents of change (gas hydrates, carbon cycle, fluid flow)	1 - 8, 10 -12	9, 13
Earth's deep biosphere	1 - 8, 10 -12	9, 13
Interior		
Transfer of heat and material to and from the Earth's interior	1 - 8, 10 - 13	9
Investigating deformation of the lithosphere and earthquake processes	1 - 8, 12	9 - 11, 13
Safety	1	2 - 8, 10

Key to Chemical / X-Ray Measurements

#	Chemical / X-Ray Measurement
1	NGA and HP5890 (Gas Chromatography)
2	Carlo Erba C-H-N-S
3	Rock Eval
4	Carver Presses / Motors and IW Squeezer Apparatus
5	Dionex Analyses
6	Hamilton Microdiluter and Titrations
7	Spectrophotometer
8	Alkalinity - pH Titration
9	Atomic Absorption Spectrophotometer
10	Freeze - Dryer
11	Coulometer
12	X-Ray Diffraction
13	X-Ray Fluorescence

The following text is intended to justify the prioritization given in the included table, in which the instrumentation in the chemistry and X-ray laboratories is classified as either "essential" or "useful" to the Scientific Themes outlined in the Long Range Plan (LRP).

Specific Points to Consider

1. In addition to the "significance to the LRP" issue, the chemistry laboratory has the added and unique role of monitoring gas safety. This, of course, is an extremely significant role.

2. The prioritizations were identified keeping in mind the needs of shipboard scientists who are not at well-instrumented departments (either in the US or not), and how the LRP would be affected by certain parameters not being measured at all when such persons sail. Because the cost of many of the chemistry / X-ray apparatus precludes many shore-based facilities from having them, many of the measurements would not be made in a timely fashion (i.e., within the moratorium, and soon thereafter) OR at all, and thus the LRP would be strongly affected. This is most relevant when assessing the XRD and XRF devices.

3. While not intuitively obvious, the wet chemistry lab has proven "useful to the LRP" for safety on many occasions. Most recently, for example, Dr. M. Malone (ODP Staff Scientist) reported that on Leg 174A there was a situation of pressurized water shooting out the drill hole (to a maximum height of 1/2-way up the derrick) and maintaining such flow for about an hour or so. While the drillers were justifiably concerned that an over-pressurized formation had been breached, the chemistry lab was able to show that the fluid was drilling fluid (i.e., seawater) that had been vigorously pumped downhole to keep the drilling viable. Were the chemistry lab not able to prove this, drilling would have been halted, and much science would have not have been achieved, to the detriment of the LRP.

4. It is worth noting that the chemists through the years have been aggressive in voluntarily removing and updating instrumentation so that (a) essentially useless instruments have been removed already (e.g., the Geofina) and (b) those instruments that are on board are relatively state of the art (except of course for the XRD and XRF) and so are used heavily (e.g., the Dionex systems). Thus, with the exception of the AA spectrometer, each instrument is listed at least once in the "essential" category.

5. Financial savings of any realistic level can only be had in the general area of "capital replacement", and only for the AA spectrometer, XRD, and XRF. Every effort should be made to maintain these current instruments, however, because there is likely to be a

significant loss of morale and "constituency" were they merely turned off while in operating condition.

6. Capital replacement of the XRD is likely to be on the order of $50-60K, not the $150-$200K value that has entered the JOI panel discussions. This is a significant point to consider, and is due to the developments in the field of low-power XRD.

B) Physical Properties

Long Range Plan initiative or objective	Physical property measurements which are essential to complete the objective (see key below)	Physical property measurements which would be useful to complete the objective (see key below)
Environment		
Climate Change	1, 2, 4, 7, 11	3, 5
Causes and effects of sea level change	1, 2, 3, 4, 6, 7, 11	5, 8, 10, 12
Sediments, fluids, bacteria, as agents of change (gas hydrates, carbon cycle, fluid flow)	1, 2, 3, 4, 6, 7, 9, 11	5, 8, 10, 12
Earth's deep biosphere	1, 2, 4, 11	5, 7, 9
Interior		
Transfer of heat and material to and from the Earth's interior	2,5,6, 7, 9,11	8
Investigating deformation of the lithosphere and earthquake processes	2,5,6, 7, 9,11	8

Key to physical property measurements listed on the table above

#	Physical property measurement	% Impact on LRP*
1	Whole core MST-GRAPE (gamma-ray attenuation porosity evaluator)	80
2	Whole core MST-magnetic susceptibility	100
3	Whole core MST-compressional wave (P-wave logger)	50
4	Whole core MST-natural gamma radiation	80
5	Split core MST-magnetic susceptibility point counter	60
6	Split core MST-compressional wave (DSV1, DSV2, DSV3)	60
7	Split core color reflectance	90
8	Split core digital imaging	30
9	Thermal conductivity	50
10	Undrained shear strength (vane shear)	20
11	Index properties (bulk density, grain density, water content, porosity, dry density)	100
12	Resistivity (not commonly measured)	10

* Calculated assuming:
1. for every two Environment legs one Interior leg is drilled
2. Items which were considered essential were weighted 2 times more than those which were considered to be "useful".

The above assessment of the impact of physical property measurements on the implementation of the long range plan was calculated in the following manner:

- In general, the legs drilled in a given year are 2 to 1 in favour of legs whose mandate falls under the Environment SSEP as opposed to the Interior SSEP. As a result, physical property measurements commonly needed on "Environment-type legs" were weighted two times more than those for "Interior-type" legs. If the two divisions are

considered equally, the % impact values change to those seen in the third column on the second table.

- When calculating the impact on the Long Range Plan of each of the measurements, those which were considered "essential" were weighted two times more than those considered "useful".

The rationale used to determine whether a measurement was essential, useful, or not needed was whether the lack of this measurement would greatly impact the scientific outcome of an average leg falling under the main headings contained in the Long Range Plan (column 1 first table). For example, the inability to collect GRAPE data during a paleoceanography leg would hinder ability to correlate data within and between sites whereas the inability to measure thermal conductivity would be likely to have little effect on the scientific outcomes of the cruise.

C) Core Description

All the basic facets of core description on board ship are essential if ODP is to be successful in attaining of the goals of the LRP:

(1) Core description itself has to be done onboard ship, without question. This aspect overrides everything else (except collection of the core material itself. Not only does knowledge of cores lithology impact directly upon operational strategies during the cruise, but it is unlikely that the same level and expenditure undertaken by shipboard scientists could be duplicated by scientists onshore if they were to have to study them post-cruise. Some physico-chemical changes in the cores are inevitable in transport and storage, so for this reason, too, they need to be studied immediately.

(2) Dedicated data entry packages such as AppleCore and others created within the JANUS applications are extremely useful. Although individual software packages on their own are not essential to the goals of the LRP, some form of electronic data entry and management system is vital if full use of the shipboard data is to be made both during and after the cruise, and for efficient data archival and dissemination. (The merits of the JANUS program as a whole are dealt with elsewhere.)

(3) Film-based photography for core archival purposes onboard ship is essential, but only until the viability of digital imaging has been demonstrated and all storage/archival issues dealt with. After this time the ship-based and shore-based film photography will become non-essential. We suggest that line-scanning digital photography of the archive halves of the cores on the split-core multi-sensor track (probably at 300dpi) is the most appropriate method by which this should be carried out.

(4) The shipboard thin section laboratory is certainly useful, though only essential on a small number of legs. The micropaleontology laboratory is essential to all legs on which sediment is recovered. The microscope laboratory is essential to the vast majority of cruises.

D) Paleomagnetics

Long Rang Plan Objective	Essential Paleomagnetic Measurement	Useful Paleomagnetic Measurements
Environment		
Climate change	1	3,4,5,6,7
Causes and effects of sea level change	1	3,4,5,6,7
Sediments, fluids, bacteria as agents of change (gas hydrates, carbon cycle, fluid flow)		1,3,45,6,7
Earth's deep biosphere		1,3,4,5,6,7
Interior		
Transfer of heat and material to and from the Earth's interior	1	3,4,5,6,7
Investigating deformation of the lithosphere and earthquake processes		1,3,4,5,6,7

No.	Paleomagnetic Measurement	% Impact LRP
1	Whole core paleomagnetism (2G 750R cryogenic magnetometer)	65
2	Discrete sample paleomagnetism (Molspin spinner magnetometer)	0
3	Disc. sample magnetic cleaning (Schonstedt GSD-1 AF demag.)	50
4	Disc. sample magnetic cleaning (Schonstedt TSD-1 thermal demag.)	50
5	Disc. sample IRM acquisition (ASC IM-10 pulse magnetizer)	50
6	Disc. sample ARM acquisition (Dtech PARM)	50
7	Disc. sample mag. susceptibility & AMS (Kappabridge KLY-2)	50
8	Ambient magnetic field (Schonstedt 3-axis fluxgate)	0
9	Disc. sample mag. susceptibility (Bartington MS-2)	0

Explanatory Notes:
The 2G pass-through cryogenic magnetometer is used on nearly every leg to make measurements of core archive half sections as well as discrete samples taken from the working half. Using a conservative view of what "essential" means to the given themes, this instrument is shown as essential in only half of the theme areas. It is useful in all others. Most of the ancillary equipment are inexpensive to operate but are useful to paleomagnetists attempting to learn the nature of the magnetism they are studying; therefore removing these equipment will save no funds. Many of these ancillary measurements are for discrete samples and as such they are not absolutely necessary to derive a magnetic stratigraphy or susceptibility stratigraphy. Nevertheless, without such measurements, listed here as "useful," the primary measurements are of reduced value. Pieces of equipment numbers 2 and 9 are "backup" equipment. The Molspin is used for making discrete sample paleomagnetic measurements, but is almost entirely redundant with the cryogenic. It may be useful for some extremely magnetic rock samples that might cause trouble with the sensitive cryogenic. The Bartington susceptibility meter is the original "pass through" susceptibility meter used on the MST. Finally, the fluxgate magnetometer is used by paleomagnetists to examine ambient fields on the ship; such measurements are rarely published, but allow the scientist to look for magnetic fields that might be affecting samples.

E) Underway Geophysics

Long Rang Plan Objective	*Essential Underway	¶Useful Underway
Environment		
Climate change	1,2,3,4	
Causes and effects of sea level change	1,2,3,4	
Sediments, fluids, bacteria as agents of change (gas hydrates, carbon cycle, fluid flow)	1,2,3,4	
Earth's deep biosphere	2,3	1,4
Interior		
Transfer of heat and material to and from the Earth's interior	2,3	1,4
Investigating deformation of the lithosphere and earthquake processes	2,3	1,4

Meas

* "essential" is defined as "essential to locate site relative to site survey data"

¶ "useful" is defined as "necessary to provide geologic context for site"

No.	Underway Geophysics Measurement	% Impact
1	Seismic reflection profiles	80
2	Bathymetry echosounders	100
3	Navigation systems	100
4	Image production (plotters)	75
5	Magnetic anomaly profiles	0

Key to underway geophysics data equipment

No.	Underway Geophysics Equipment	Data Type
3	SSI 80-cu. in. water guns	1
2	Hamco 200-cu. in. water guns	1
1	SSI 400-cu. in. water gun	1
1	Bolt 120-1000-cu. in air gun	1
1	ITI 6-channel, 6 phone, solid streamer	1
1	ITI 6-channel, 30 phone, solid streamer	1
2	Teledyne single-channel, 60 phone, streamers	1
1	3.5 kHz EDO transciever w/10kW transducer	2
1	12 kHz PTR 105B transceiver w/EDO 323B transducer	2
2	CESP-III correlators (~20db S/N improvement)	1,2
1	Ashtech GC24 (GPS+Glonass)	3
2	Omistar dGPS capable receivers	3
1	Winfrog GPS navigation software	3
1	UNIX seismic data acquisition software	1
4	EPC Model 9802 thermal plotters	1,2
1	HP DesignJet 36" color plotter	1,3
1	Geometrics towed proton precession magnetometer	5

Explanatory Notes:

The underway geophysics (UWG) lab cannot be fairly compared to other shipboard laboratories that produce primary data. The purpose of the UWG lab is to locate sites relative to site survey data and to provide geologic context, especially for those sites not well documented by site survey data. In a perfect world, site survey data are dense, navigation accurate, and no problems are encountered so that all the ship need do is drive to a position and drill. In reality, it is often necessary to verify that the ship is at a particular site by comparison of underway data (seismic reflection, bathymetry, and echosounder records) with site survey data. In addition, it is often necessary to use the UWG to document alternate sites when problems are encountered at primary sites. For these reasons, the

ratings "essential" and "useful" here are relative to what is needed to verify a site (essential) and document it (useful).

Equipment Status:
Within most data type classes there is redundant equipment. This is normal for UWG data collection because of differing needs for different lithologies and the necessity of spares for towed equipment. Under seismic reflection equipment there are seismic guns and streamers. ODP has a total of 7 guns. Three are 80-cu. in. waterguns, which are the most used. The larger guns are useful if more energy is needed, for deep seismic penetration. The largest is energetic enough for VSP work. Probably not all of these guns are necessary. At a minimum, the 3 small water guns should be maintained so that two are working at a time and a third is available for a spare. The program also owns 4 streamers. This is also more than necessary. The program could get by with one good working streamer and a back up. The echosounding equipment is at a minimum (the two CESP correlators work with the two echosounders). It might be possible to operate with only one echosounder, but once again it is helpful to have two so that one is working. There are situations where one will not give as good or appropriate records as the other even though both are nominally working. The Ashtech GPS receiver is essential and as more site positioning accuracy is needed, and more data are positioned by dGPS, the two Omnistar receivers will also be essential (one for back up). Having 4 EPC recorders is also essential because two are needed for the echosounders and one is needed for the seismic reflection record. It is useful to have one as a back up or as a second seismic reflection recorder. The HP plotter is non-essential, but useful for making plots while at sea.

Cost Implications:
Most of the equipment in this list are low cost to operate once purchased. The most expensive items are the towed items, which often require significant maintenance costs. Air and water guns have moving parts and so they are usually the most expensive to maintain. Reducing the number of guns might save the costs of spares. Likewise, streamers can be expensive to repair, although their failures are often catastrophic (the whole thing or a significant piece are lost), so the costs come in replacement. The other towed instrument is the proton precession magnetometer. It is a robust piece of equipment and the operating cost is likely to be low unless the tow cable is lost.

F) Paleontology

Long Range Plan Objective	Essential	Useful
Environment		
Climate Change	1,2	
Causes and Effects of sea level change	1,2	
Sediments, fluids, bacteria	1,2	
Earth's deep biosphere	1,2	
Interior		
Transfer of heat and material		1,2
Investigating deformation of the lithosphere and earthquake processes		1,2

1. Prepare samples
2. Provide biostratigraphic ages and age models, enter data into Janus system

2. Publications

SciMP believes that publications are an essential product of the program and the ODP-TAMU Publications department has responded well to changing priorities. Of the publications produced within ODPTAMU, SciMP feels the Initial Reports volume is essential as a record of the cruise and a description of the data and came to the following consensus:

CONSENSUS 98-2-2:
It is the consensus of SciMP that the following ranking of ODP publications best serves the goals of the Long Range Plan.

Ranking:
1. IR - essential
2. WWW publications - very useful but not essential
3. SR - useful but not essential

3. Information Services

Under the heading of Information Services, SciMP evaluated the following services: data capture, database maintenance, data migration, computers and computer networks, and core photography. Appendix 98-2-6 contains detailed information on some of these services with respect to their utility for fulfilling the Long Range Plan.

CONSENSUS 98-2-3:
SciMP believes that data capture is one of the most essential services of the Ocean Drilling Program. Maintenance of a relational database and data migration in the database are very useful but not essential to the success of the LRP.

Current core photographic services are essential until digital imaging becomes a suitable replacement.

Computers and networks are essential in collecting the primary data. Continued network and storage upgrades are essential to the success of the LRP.

Long Range Plan Objective	Essential	Useful
Environment		
Climate Change	1,2	3,4,5
Causes and Effects of sea level change	1,2	3,4,5
Sediments, fluids, bacteria	1,2	3,4,5
Earth's deep biosphere	1,2	3,4,5
Interior		
Transfer of heat and material	1,2	3,4,5
Investigating deformation of the lithosphere and earthquake processes	1,2	3,4,5

1. Janus maintenance (data capture)
2. Complete Janus development (data capture)
3. Data migration (ingest old shipboard data into Janus)
4. Scientific results data (design relational database model and ingest old and new data)
5. Permanent archive of ODP data.

4 Repositories

SciMP believes it is essential to provide a controlled environment for at least the short-term (~ 5 years) safe storage of ODP cores. ODP-TAMU studies have shown that the majority of sampling takes place within a few years of core collection. With this fact in mind, SciMP has come to the following consensus about the ODP/DSDP repositories:

CONSENSUS 98-2-4
SciMP has determined that of the four repositories one is essential and the three remaining are useful but not essential to the goals of the LRP.

5 Public Affairs

SciMP believes that it is important to keep the scientific community and general public informed about the results and advances of Ocean Drilling. However, SciMP is concerned with apparent redundancies in public affair services between JOI and TAMU/ODP.

RECOMMENDATION 98-2-9:
The SciMP suggests a consolidation of resources relating to public affairs.

6 Wireline Services

SciMP recognizes that down-hole logging is essential to the success of the LRP and feels that wireline services are currently a great strength of the program. The present level of logging is the minimum that must be maintained (See Appendix 98-2-6). Moreover, we feel that it would be in the best interest of the program to include more specialty tools in logging operations. Of concern to SciMP is that the current types of logs being acquired are quite basic for the infrastructure that currently exists.

RECOMMENDATION 98-2-10:
SciMP feels that the overall cost of logging operations is high in relation to the basic types of logs being routinely collected. Therefore, SciMP recommends that OPCOM request JOI to evaluate the cost efficiency of current wireline operations.

Long Range Plan objective	Essential log	Useful log
Environment:		
Climate change	1, 2, 3, 4, 5, 7, 8, 15	8A, 10, 13, 14, 16
Causes and effects of sea level change	1, 2, 3, 4, 5, 7, 8, 15	8A 10, 13, 14, 16
Sediments, fluids, bacteria as agents of change (gas hydrates, carbon cycle, fluid flow, etc)	2, 3, 4, 5, 6, 7, 8, 15	1, 8A, 10, 13, 14, 16
Earth's deep biosphere	1, 2, 3, 4, 5, 6	10, 13, 15
Interior:		
Transfer of heat and material to and from the Earth's interior	1, 2, 3, 5, 6, 7, 8, 8A,12, 15	9, 10, 11, 13
Investigating deformation of the lithosphere and earthquake processes	2, 3, 5, 6, 7, 8, 8A, 11, 12, 15	1, 9, 10, 13

Log #	Standard Suite of Logging Tools	% Impact
1	Natural gamma	85
2	Density	100

3	Caliper	100
4	Induction resistivity	80
5	Porosity (APS)	100
6	Temperature	60
7	FMS (formation microscanner)	80
8	Sonic	90
8A	Sonic (Shear)	50
	Specialty Tools (require additional funds)	
9	ARI (azimuthal resistivity)	15
10	GLT (geochemical tool)	50
11	BHTV (acoustic televiewer)	15
12	DLL (dual lateral log)	20
13	VSP	50
14	GHMT (magnetic tool)	30
15	WST (well seismic tool)	90
16	LWD	30

7 Drilling Services

SciMP has prioritized several large FY99 engineering projects in terms of the Long Range Plan (see Appendix 98-2-6). Most of these projects were viewed to be useful but not essential to the success of the LRP. Considering that engineering development is a significant portion of the budget, SciMP recommends the following:

RECOMMENDATION 98-2-11:
SciMP recommends OPCOM and TEDCOM evaluate the cost-benefit and feasibility of engineering projects to determine if they can be accomplished in a realistic time frame in order to benefit the LRP.

Long Range Plan objectives	Drilling Services which are essential to complete the objective (see key below)	Drilling Services which would be useful to complete the objective (see key below)
Environment		
Climate Change	–	1,3,4
Causes and effects of sea level change	–	1,3,4
Sediments, fluids, bacteria, as agents of change (gas hydrates, carbon cycle, fluid flow)	–	3,4
Earth's deep biosphere	–	3,4
Interior		
Transfer of heat and material to and from the Earth's interior	2,3,4	1
Investigating deformation of the lithosphere and earthquake processes	1,3,4	–

1 - Diamond Coring; 2 - Auxiliary Hammer; 3 - Measurement While Coring;
4 - Active Heave Compensation

8 Personnel

It is the consensus of SciMP that the ratio of personnel to the scientific product produced by ODP is high.

RECOMMENDATION 98-2-12:
SciMP recommends that OPCOM advise JOI to initiate an evaluation of the present staffing throughout the ODP organization.

ALTERNATIVE PLATFORMS IN ODP LONG-RANGE PLAN

- INITIATIVE I, p. 48 re Arctic:
  "These other programs, providing their own specialized platforms and working in partnership with the ODP, will provide exciting new opportunities for climate studies in regions not readily accessible to the JOIDES Resolution. For example, the Nansen Arctic Drilling (NAD) program is targeting the Arctic regions presently covered by sea ice....As yet the Arctic is poorly explored. The NAD program will provide specialized platforms for studying this ice-covered region, operated on or accompanied by powerful icebreakers. NAD will interact closely with the ODP, seeking advice for proposal evaluation by the JOIDES advisory structure, storing cores in ODP repositories and data in ODP databases, and sharing information on drilling technology and data analysis. We anticipate cooperative NAD/ODP science programs, with ODP drilling platforms obtaining samples in open waters while NAD simultaneously works within ice-covered areas."

- TECHNOLOGY DEVELOPMENT, OTHER PLATFORMS, p. 60:
  "The scientific objectives outlined in this plan will require occasional access to drilling platforms other than ODP's "core" vessel, currently the JOIDES Resolution, and the proposed Japanese riser ship. Shallow-water rigs have recently been used by ODP researchers drilling on continental margins. These scientists have expanded their research programs by establishing separately funded projects in coastal regions (e.g., offshore New Jersey, the Bahamas Platform and Northeast Australia). Similar access to shallow water regions is required by some of the future science goals, in particular, those investigating the core theme "Causes and Effects of Sea-level Change". Similarly, objectives related to "Understanding Earth's Changing Climate" would clearly benefit from associated drilling in ice-prone polar regions, which will require extended work at high latitudes and the occasional use of specialized platforms. The ODP can accomplish these aims in collaboration with polar programs, such as the NAD and Antarctic Stratigraphy (ANTOSTRAT)."

- IMPLEMENTATION STRATEGY, first paragraph, p. 67:
  "This plan also calls for the use of alternative drilling platforms."

- IMPLEMENTATION, PHASE III, p. 70:
  "During Phase III, preliminary drilling to intermediate depths (2-4 km) will be carried out in a few locations to assess the technological feasibility of deep

drilling in the future….Phase III will also see the first use of additional platform capabilities, as required."

- DRILLING PLATFORM OPTIONS, ALTERNATE PLATFORMS, p. 76: "The ODP is also considering alternate platforms to supplement drilling, such as:

- Rental of a commercial jack-up or other style of conventional or exploration drilling platform to tackle Long Range Plan scientific objectives that require shallow water drilling that is beyond the current capabilities of the JOIDES Resolution….
- A recent Nansen Arctic Drilling Program (NAD) initiative identified at least one Russian ice-breaking drilling platform capable of operating in the Laptev Sea in water depths of less than 200 meters. Such a platform could service potential NAD/ODP cooperative program objectives around the Arctic continental margins as early as 1999.
- A similarly recent initiative by a group of European scientists, interested in relatively shallow penetration coring (up to about 300 meters) in intermediate water depths (up to about 2000 m) around the European continent, identified a number of commercial vessels that could be equipped for such operations using the ODP's Hydraulic Piston Corer (HPC). Subject to reasonable fitting-out costs, this would provide a platform that could service many site proposals aimed at objectives under the theme Dynamics of Earth's Environment."

- FUNDING, PROGRAM FUNDING REQUIREMENTS, p. 78:

"Funding for alternative drilling platforms has been allowed for, rising from $3M in FY99 to $6M after FY04." [In context of budget projection allowing for inflationary adjustment plus 2-3% growth rate of budget]

- EXECUTIVE SUMMARY (including STRATEGY) – NO MENTION
- IMPLEMENTATION, PHASE IV, p. 70 – NO MENTION

Achievements and Opportunities - SCICOM Motion, August 2000

SCICOM Motion 00-2-14: SCICOM endorses the following plan for preparing an ODP legacy document entitled *Achievements and Opportunities of Scientific Ocean Drilling*.

Outline

I. Dynamics of Earth s Environment

- A. Earth s Changing Environment
  1. Rapid climate change
  2. Extreme climates
  3. Climate response to orbital forcing
  4. Causes and effects of sea-level change
  5. 180 million years of ocean history
- B. Sediments, Fluids, and Bacteria as Agents of Change
  1. Sediment processes and budgets
  2. Fluids in sediments and rocks
  3. Formation of gas hydrates
  4. Deep biosphere

II. Dynamics of Earth s Interior

- A. Transfer of Heat and Material from Earth s Interior
  1. Mantle and core dynamics
  2. Ocean crust and mid-ocean ridge processes
  3. Hydrothermal and sulfide mineral processes
  4. Subduction factory
- B. Lithosphere Deformation and Earthquake Processes
  1. Passive continental margins and rift environments
  2. Convergent margins and collisional settings
  3. Earthquake mechanisms

Contents

Executive summary	5 pages
Short summaries of achievements for sixteen sub-themes	4-5 pages each
Introduction or statement of scientific issues and challenges	1 page
Bullets summarizing achievements and opportunities	1-2 pages
Summary of goals met	1 paragraph
Summary of future opportunities	1 paragraph
List of greatest hits (from bullets)	

Timeline

SCICOM Chair invites Editorial Review Board (ERB)	1 September 2000
ERB and SCICOM Chair invite authors	1 October 2000
Authors and ERB compile bullets and circulate among community	Fall 2000
Authors and ERB compile final bullet list	1 February 2001
ERB provides final bullet list to SCICOM	1 March 2001
Completion of short summaries	1 May 2001
Executive summary and excerpt of greatest hits	1 June 2001

Achievements and Opportunities - Status Report, March 2001 SCICOM

Editorial Review Board: W. Hay, K. Becker (overall editors)
L. Peterson, H. Elderfield, C. Mevel, J. Tarduno (section editors)

Authors:

I. Dynamics of Earth's Environment

A. Earth's Changing Environment (**L. Peterson**)
1. Rapid climate change (**J. Kennett/L. Peterson**)
2. Extreme climates (**D. Kroon**)
3. Climate response to orbital forcing (**R. Zahn**)
4. Causes and effects of sea-level change (**K. Miller**)
5. 180 million years of ocean history (**T. Bralower**)

B. Sediments, Fluids, and Bacteria as Agents of Change (**H. Elderfield**)
1. Sediment processes and budgets (**D. Piper**)
2. Fluids in sediments and rocks (**A. Fisher**)
3. Formation of gas hydrates (**E. Suess**)
4. Deep biosphere (**S. D'Hondt**)

II. Dynamics of Earth's Interior

A. Transfer of Heat and Material from Earth's Interior (**C. Mevel**)
1. Mantle and core dynamics (**K. Suyehiro**)
2. Ocean crust and mid-ocean ridge processes (**J. Pearce**)
3. Hydrothermal and sulfide mineral processes (**S. Humphris**)
4. Subduction factory (**T. Plank**)

B. Lithosphere Deformation and Earthquake Processes (**J. Tarduno**)
1. Passive continental margins and rift environments (**H.-C. Larsen**)
2. Convergent margins and collisional settings (**C. Moore/E.Silver**)
3. Earthquake mechanisms (?)

Production Timeline:

ERB finalized	October, 2000
Authors invited	9 November, 2000
Outline to JOIDES Office (13 of 15 submitted)	December, 2000
Draft article submission deadline	1 March, 2001
Final version	1 May, 2000
Volume to printer	June/July

IWG PLANNING

The most recent meeting of the IWG for IODP occurred in Southampton, United Kingdom, in January. Although Dr. Purdy co-chaired this meeting as his last official NSF responsibility, it was announced the Dr. Margaret Leinen (NSF s Assistant Director for Geosciences) will become the new NSF co-chair of the IWG. Dr. Yoichiro Otsuka (Director of Ocean and Earth Division) of the newly established Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) has replaced Dr. Satoshi Tanaka as the Japanese co-chair.

Primary activity at the meeting included:

- Discussion of review comments on the IPSC IODP science Plan. Following IPSC s submission of the draft initial science plan for the IODP in early October, the IWG commissioned an international panel to review and evaluate the proposed program. The committee met in New York on December 5-6 and was chaired by Seiya Uyeda (Univ. of Tokyo) and Frank Rhodes (Cornell University, and former chair of NSF s National Science Board). Results of the review were reported in Southampton. Overall, the Committee was highly supportive of the Initial Plan, noting that *the ISP is a bold interdisciplinary and international project of extraordinary importance, high promise and unique significance* . Primary concerns raised with the Initial Science Plan included: (1) the lack of detail on the integration of mission specific platforms into the plan, (2) need to clarify the strategies to encourage partnerships with other programs and industry, (3) need to clarify the status of required technologies, and (4) further clarification on the cost estimates for the IODP. The committee also identified organizational and implementation concerns which need to be clarified in IWG-IODP planning. Based on these concerns, the IWG has requested IPSC to modify its Plan prior to publication on 1 May.

- Discussion and acceptance of the basic principles (Platforms, Program, Membership, Implementation, and Management) for the IODP. The IODP Principles are designed to be the basic definition of the IODP and its groundrules for operation and will serve as the basis for the formal international agreements. The Principles — as agreed to in Southampton - are attached, with final consideration of the Management principle scheduled for the next IWG meeting in June.

- Further considered a key provision of the Implementation Principle which calls for establishing an interim Science Advisory Structure (iSAS) to carry-on the planning initiated by IPSC until the formal IODP Science Advisory Structure is established on 1 October 2003. The iSAS will be a joint working group representing JOIDES and OD-21 science advisory committees, with roughly 1/3 Japanese, 1/3 U.S., and 1/3 other membership. JOIDES and OD-21 will cooperate in identifying membership on the committees. The chairs of IPSC and OD-21 scientific advisory committees will co-chair iSAS and its governing interim Planning Committee (iPC) and report directly to the IWG. IPSC had submitted draft terms of reference and operational procedures for this new structure and IWG accepted them in Southampton. The IWG

co-chairs have formally requested OD-21 and JOIDES advisory structures to form this new advisory mechanism by June of this year. It is expected that there will be significant overlap in membership between corresponding JOIDES and iSAS committees and that the committees will meet in conjunction with each other.

- A final activity in Southampton was initial consideration of options for the IODP logo.

The next meeting of the IWG is scheduled for Ottawa, Canada, in June.

IODP MEMBERSHIP PRINCIPLES

1. Membership in the IODP is available to government and/or national agencies (or their representatives), which have an interest and capability in geoscience research.

2. Membership will be secured through signing of a memorandum of understanding between the government and/or national agency (or representative) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the National Science Foundation (NSF).

3. Lead Agencies of the IODP, (presently MEXT and NSF), will have equal membership rights and responsibilities. Lead agencies will contribute core capabilities to the Program. Lead agencies will contribute equally to total Program costs.

4. An IODP Council will provide governmental oversight for all IODP activity. All countries, as well as member organizations representing countries, participating in the IODP will be represented on the Council.

5. Members will have the right to: (1) participate in all drilling cruises, (2) be represented on all planning and advisory panels, (3) be represented on IWG or its successor, (4) have access to data, samples, scientific and technical results. (5) Submit proposals to the advisory structure for drilling or engineering developments in support of IODP science, (6) etc.

6. Members will have the responsibility to: (1) actively participate in all aspects of the IODP, (2) ensure publication and sharing of scientific results, (3) participate in providing data and proposals for planning of drilling programs, (4) etc.

7. Based on present projection of total annual Program costs ($130-140M) for a two drilling vessel program, the financial contribution for membership in the IODP will be $5 million/year. Financial contributions from international partners will be commingled to support science operations costs. This contribution will entitle a member to one participation unit, with one participation unit equivalent to one member per panel and two scientific participants per cruise leg, or equivalent. More than two participants on a cruise leg may be acceptable as offset by reduced participation in other legs. A member may acquire additional participation units through a corresponding increase in financial contribution, and/or long-term provision of mission specific platforms. It is understood that the Lead Agencies will contribute equally to total Program cost and acquire additional participation units necessary to fully support the program. When the Program is established, associate membership status will be considered.

8. Membership will be based on a 10-year commitment, in principle, to IODP participation.

Principle accepted 17 January 2001 by IWG in Southampton (Final version), except for Management Structure. Draft version (Management Structure) modified in Southampton (17 Jan. 2001). Comments from IWG members due by 1 March 2001

IODP PROGRAM PRINCIPLES

1. The IODP is a scientific research program with objectives identified in the IODP Science Plan. The results of the Program s scientific and engineering activities will be openly available.

2. The IODP is based on international cooperation and sharing of financial and intellectual resources.

3. Membership in the IODP is available to government and/or national agencies (or their representatives) which have an interest and capability in geoscience research.

4. The IODP will be guided by a science advisory structure, composed of scientists and engineers representing IODP members. The IODP science advisory structure will establish the appropriate panels to provide advice to IODP management on platforms and science operations.

5. The operation of two ocean drilling vessels (riser capable vessel and non-riser vessel) presently constitutes the core capability of the IODP.

6. The IODP will seek substantive cooperation with other earth and ocean sciences programs and initiatives.

7. Program costs will be determined by the IODP Lead Agencies (presently NSF and MEXT). The Lead Agencies will contribute equally to Program costs. Program costs are composed of platform operations costs and science operations costs[1]. Platform operations costs of the two primary vessels are to be the responsibility of MEXT and NSF. Mission specific platform operation costs will be the responsibility of the member(s) providing the platform. Members in the IODP (including MEXT and NSF) will contribute financially to support of the science operations costs.

8. Support of scientific research and development costs for shore-based analysis and research on IODP samples and data, and for non-routine downhole measurements, are the responsibility of member countries/agencies. Support of geophysical and geological research to prepare drilling proposals or identify drilling targets are also the responsibility of member countries/agencies.

---

[1] Platform Operations Costs will support the basic operation of the vessel as a drillship, and will include, for example: (1) costs of the drilling and ship s crew, (2) catering services, (3) fuel, vessel supplies and other related consumables, (4) berthage and port call costs, (5) disposal of wastes, (6) crew travel, (7) inspections and insurance, (8) drilling equipment, supplies, and related consumables, (9) administration and management costs of the platform operators.
Science Operation Costs will provide for those activities onboard program platforms necessary to the proper conduct of the scientific research program and those shore-based activities required to properly maintain and distribute samples and data, support seagoing activities, and administer and manage the program. These costs will include, for example: (1) technical services, (2) computer capability, (3) data storage and distribution, (4) description, archiving, and distribution of data and samples, (5) deployment of a standard suite of logging tools, (6) development of new drilling tools and techniques required by IODP research, (7) program publications, (8) costs of consumables (exclusive of those identified under platform operations costs), (9) costs required for administration and management, including the Central Management Office, (10) engineering or geophysical surveys required for hole design or evaluation of drilling safety during final site selection.

Principle accepted 17 January 2001 by IWG in Southampton (Final version), except for Management Structure. Draft version (Management Structure) modified in Southampton (17 Jan. 2001). Comments from IWG members due by 1 March 2001

IODP PRINCIPLES ON DRILLING PLATFORMS

1. The operation of two drilling vessels (riser capable vessel and non-riser vessel) presently constitutes the core capability of the IODP. The riser capable platform will be made available by MEXT and will be owned and operated by JAMSTEC, and the non-riser platform by the NSF.

2. Legal and financial responsibility including mobilization and platform operation costs for the riser capable vessel will reside with Japan and for the non-riser vessel with the United States.

3. Access to mission specific platforms (beyond the two primary vessels) will be required to meet specific objectives identified by the science advisory structure, but resources to support these activities have not been identified at this time.

4. Legal and financial responsibility, including mobilization and platform operation costs of mission specific platforms, is to reside with the organization(s) or country (ies) which make the decision to offer this additional capability to the Program. Provision of such a capability will not be considered a contribution in lieu of annual IODP membership contribution.

5. IODP commingled program funds will be used to support costs of science operations on IODP drilling platforms.

6. International participation in the science and operations of all IODP drilling platforms will be consistent with IODP program procedures.

Principle accepted 17 January 2001 by IWG in Southampton (Final version), except for Management Structure. Draft version (Management Structure) modified in Southampton (17 Jan. 2001). Comments from IWG members due by 1 March 2001

IODP IMPLEMENTATION PRINCIPLES

SCHEDULE

1. IODP will begin officially on 1 October 2003. Membership and Program implementation will be effective from this date.

2. The first year of the program will be spent in detailed planning activities and preparing for drilling operations (engineering development, detailed site surveys, etc.). 2005 will begin operation of the non-riser vessel. 2006 will begin operation of the riser vessel.

INTERIM SCIENCE ADVISORY STRUCTURE (ISAS)

1. An Interim Science Advisory Structure (ISAS) for IODP will be organized beginning in June 2001 and will exist until 1 October 2003. ISAS will be a joint working group representing JOIDES and the OD21 Science Advisory Committee. The purpose of ISAS is to continue scientific planning for IODP.

2. Membership on ISAS committees will be nominated by JOIDES and the OD21 Science Advisory Committee. Representation on the committees and panels of ISAS is expected to be proportional to the optimal international participation in IODP (1/3 Japan, 1/3 United States, 1/3 other IWG members). It is expected that JOIDES and the OD21 Science Advisory Committee will confer and consider appropriate disciplinary balance and expertise in making their nominations.

3. An Interim Planning Committee (IPC) will serve as the highest level committee and management authority for the ISAS and is expected to oversee and implement ISAS activity. Representation on IPC will be chosen from IWG members who are, in principle, seeking full IODP membership. The IPC will be responsible to the IWG for its guidance and direction and will report to the IWG. IPC will be co-chaired by the chairs of IPSC and the OD21 Science Advisory Committee.

4. IPC will encourage the international community to submit drilling proposals for IODP. The proposals will be examined and reviewed by ISAS, but final evaluation, ranking and scheduling will be conducted by the formal IODP Science Advisory Committee which will be established on 1 October 2003.

5. IWG will request IPSC to provide recommendations on the necessary committees and panels for ISAS, a schedule for their creation, and panel mandates by 1 January 2001.

6. ISAS committees are expected to meet in conjunction with their equivalent JOIDES committee.

Principle accepted 17 January 2001 by IWG in Southampton (Final version), except for Management Structure. Draft version (Management Structure) modified in Southampton (17 Jan. 2001). Comments from IWG members due by 1 March 2001

Draft

IODP PRINCIPLE ON MANAGEMENT STRUCTURE

1. A Central Management Office (CMO) will develop and manage the implementation plans for the IODP science program. The CMO will have a formal arrangement with IODP Lead Agencies for this activity and will operate in the best interest of the IODP and all member organizations, without preference.

2. The principal task of the CMO is to receive advice on priorities and plans from the IODP Science Advisory Structure, to receive plans, which are responsive to this advice from the IODP implementing organizations, and to submit an annual IODP plan to the Lead Agencies. The CMO will negotiate with the implementing organizations and the Science Advisory Structure to produce an annual IODP plan, which is consistent with budget guidance from the Lead Agencies.

3. Implementing organizations will have primary responsibility for the management of the Program s facilities and operational capabilities as identified in the annual plan. JAMSTEC will carryout the role of the implementing organization for operation of the riser platform. NSF will determine the implementing organization for the non-riser platform. Other implementing organizations may be established as appropriate and required, and those organizations supported by science operations costs will be selected by processes agreed to by the CMO and IWG or its successor.

4. The annual IODP plan will include presentation of science operations costs and platform operations costs.

5. The annual IODP Plan will be approved by the executive committee of the Science Advisory Structure (which represents all international members) prior to its consideration by the Lead Agencies.

6. Significant changes in the annual plan will be approved by the CMO and the Lead Agencies prior to implementation.

7. NSF will provide commingled funds to the CMO, which in turn will provide funds to implementing organizations for science operation costs through appropriate formal arrangements.

8. An IODP Council will provide governmental oversight for all IODP activity. All countries, as well as member organizations representing countries, participating in the IODP will be represented on the Council.

Principle accepted 17 January 2001 by IWG in Southampton (Final version), except for Management Structure. Draft version (Management Structure) modified in Southampton (17 Jan. 2001). Comments from IWG members due by 1 March 2001

This Report is a Review of

The Initial Science Plan (ISP) for The Integrated Ocean Drilling Program (IODP)

Earth, Oceans and Life--
Scientific Investigations of the Earth Systems
Using Multiple Drilling Platforms
and New Technologies
Version 5.0

Presented to the
International Working Group for IODP on

December 22, 2000

Prepared by:
The International Review Committee for
The Initial Science Plan

Dr. Frank Rhodes, United States, Co-Chairman
Dr. Seiya Uyeda, Japan, Co-Chairman
Dr. Gordon Greve, United States
Dr. Yoshihide Kozai, Japan
Dr. Alfred Kr ner, Germany
Dr. John Lowe, United Kingdom
Dr. Malcolm Walter, Australia

Preamble

The International Review Committee met on December 5-6, 2000 at Tarrytown, New York. Prior to the meeting, committee members had read the Initial Science Plan for the Integrated Ocean Drilling Program (IODP), shared preliminary reviews and reactions to it, and discussed some aspects by phone.

The meeting of the committee included presentations by both the former and the interim Directors of the United States National Science Foundation (NSF) Division of Ocean Sciences, Dr. G. Michael Purdy and Dr. Donald F. Heinrichs; the Director of the Japan Science and Technology Agency (STA) Ocean and Earth Division, Mr. Satoshi Tanaka; and the Chairman of the IODP Planning Sub-Committee (IPSC), Dr. Theodore Moore. There was a wide-ranging discussion by the committee of both the overall program and its various components, and this included the opportunity for consultation with the staff involved.

We structure our report using the major headings and questions addressed to us by the International Working Group (IWG) for IODP in the document *Terms of Reference for the Review Committee* circulated prior to the meeting (see Appendix I).

Introduction

The Integrated Ocean Drilling Program (2003-2013), as proposed in the Initial Science Plan (ISP), is a bold interdisciplinary and international project of extraordinary importance, high promise, and unique significance.

- The program is of great importance because of the breadth of its ambitious scientific goals, which collectively would generate fundamentally new levels of understanding and refinement in overall understanding of the ocean-earth systems and their various components. This is an intellectual quest equivalent to the exploration of the solar system.

- The program is of high promise because of the commitment by the United States and Japan to sponsor two ocean drilling vessels as the core capability of the program — a new riser ship to be provided by Japan and the modification of a non-riser ship by the United States. The existing non-riser ship has been used over the last 30 years and has provided much successful experience in deep ocean drilling. The United States and Japan have invited other nations to join them in applying both established technology and promising new technology in a multiple drilling platform program to probe the ocean crust and continental margins.

- The program is of unique significance because it promises to deliver new levels of understanding of:

  - solid earth and ocean systems;
  - the sub-sea microbiota;
  - major and short-lived climatic changes and related changes in sea level;
  - the nature, origin and effects of earthquakes, volcanoes and related hazards;
  - the formation and development of economic minerals and fuels; and
  - ocean biota as a foundation for responsible conservation and management practices.

In the pursuit of this knowledge, the program will rely on and promote the development of critically important new technology and instrumentation.

In our collective view, the present proposal is of such fundamental scientific importance and impact, technical timeliness and broad social benefit as to justify a major increase in funding support levels by Japan and the United States, as well as the increased participation of other nations.

ISP Statement of Scientific and Technological Objectives

1. REVIEW AND EVALUATE THE SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES OF THE IODP AS IDENTIFIED IN THE IPSC SCIENCE PLAN

The review should be carried out in the context of earth and ocean science research in general, and the potential contributions to economic and social development.

Specific issues:

- *Degree to which the IPSC Science Plan reflects the planning and high priority recommendations of national and international scientific communities for a future ocean drilling program.*
- *Degree to which the IPSC Science Plan builds on recent progress in earth and ocean sciences, including past scientific and technological accomplishments of research and commercial ocean drilling.*
- *Degree to which the IPSC Science Plan is complementary to, and enhances close cooperation with, other initiatives and programs in the earth, ocean and related life sciences.*

In response to the three questions addressed to us under the first item of the charge, we make the following comments:

The ISP is admirable, in terms of the scientific goals it so eloquently describes. The three general research themes and eight specific initiatives seem to us to capture the exciting discoveries that have emerged from recent ODP work and from the earth and biological sciences more generally. They raise fundamental questions that cannot be ignored if human societies are to be advanced, protected and fostered in the future. Not all of the eight initiatives are, perhaps, of equal urgency, but the process links between them (established and suggested) are such that a coordinated approach seems not only sensible, but essential.

The bold proposals made in the ISP promise to provide a unique level of insight into the nature of the oceanic crust, including its formation, composition, evolution, alteration, movement, fluid content, associated life forms and the interactions between these various processes and entities.

The review team finds the following:

1a) The program proposed is a comprehensive study of major Earth processes, based on the record preserved in the oceans. It is of unique importance and will yield results of major scientific significance. It is exciting, timely, important, and urgent.

1b) The extent of consultation has been remarkable. In our opinion, the requirements of consultation and international reviewer participation have been fully met. The process, rightly, has been one driven by a bottom-up rather than a top-down consultation. We believe an appendix to the ISP, describing the review process and participation, would strengthen the document (and counter the otherwise conspicuous apparent lack of participation by many nations). In our judgement, institutions, as well as individual scientists, have been adequately consulted and the plan builds on their collective interests, wisdom and experience.

1c) It is our view that the program reflects major scientific issues and priorities of national interests as well as the international community in marine geosciences. There is inevitably a high degree of overlap with national interests and international objectives in the ISP. This overlap leads to synergistic value to be gained from developing an international awareness of the ISP. The document might usefully include an additional appendix that identifies a representative series of national and international scientific programs together with what is known of future planning and funding of these and other programs.

1d) The overall scientific goals of the ISP are outstanding. It may well be that, as the Plan develops, new patterns of cooperation and new scientific and technological partnerships will be needed. We describe aspects of some potential partnerships in 1f-1h below. The committee was satisfied that the International Working Group (IWG) is fully alerted to this need.

The IODP is built on the robust cooperative practices that have endured through the DSDP and the ODP. The ISP also envisages new collaborations between scientific institutions and industry, which the committee encourages.

1e) We believe that the ISP would benefit by paying greater attention to the strategic development of mission-specific platforms. We understand the importance of describing in detail the science plan for the riser vessel and the non-riser vessel, but the plan will reflect the integrated areas of the program more fully by including more detail on the role of the work based on mission-specific platforms.

1f) The ISP should emphasize the links with land-based drilling initiatives and other major continental programs in order to ensure the various initiatives are complementary.

1g) The program would benefit from a stronger mandate to establish formal links with

other agencies and groups that have the capacity to work toward the ISP s objectives. Although some links have been specified, more links to such international programs as the Astrobiology Program and the International Lithosphere Program would be useful. The number of these international cooperative programs is growing and mutual awareness and liaison are important.

1h) The proposal to partner with industry is particularly laudable. The technological expertise and experience of major oil and other related companies will be of immense importance to the program. This represents an opportunity for industry and academic scientists and technologists to learn from each other and to develop not only new partnerships but also new models for partnerships. Although the goals of the ISP stand on their own merits, substantial value would be added by developing closer industry partnerships and support.

1i) The ISP would benefit from having a discussion of the strategy to encourage the development of these and other partnerships.

ISP Description of Facilities

2. REVIEW AND EVALUATE THE APPROPRIATENESS OF THE FACILITIES IN THE IPSC SCIENCE PLAN

This review should be carried out in the context of the identified scientific and technological objectives of the IPSC science plan.

Specific issues:

- *Capability of proposed facilities to address scientific and technological objectives identified in the IPSC science plan.*
- *Adequacy of proposed plans for integration of IODP facilities.*
- *Benefit and added value of international collaboration and implementation.*

In response to the three questions addressed to us under the second item of the charge, we make the following comments:

The ISP describes a highly significant and exciting research agenda which envisages, and which unquestionably will require, unprecedented levels of international scientific co-operation and forward planning -- unprecedented at least within the context of the Earth Sciences. The scientific questions to be addressed, the technical/technological developments anticipated, and the analytical and back-up facilities required to achieve the stated principal scientific objectives, are of a scale that exceeds anything developed to date. Given the importance of the ISP, there is an *onus* on the IODP, and on the relevant international and national committees, to ensure mechanisms are put in place for (a) clear-headed budgetary planning, (b) appropriate analytical facilities and networks for efficient data-streaming, and (c) maximization of the scientific dividend to be won from such an enormous investment.

2a) The ISP properly recognizes the importance of support facilities at every level and seems to have incorporated this need within its document. A brief description concerning the essential shore-based facilities that will be needed to support the enterprise would be useful. Although we are told that procedures are in place to address this issue, something more specific about the nature, adequacy, and state of readiness of these facilities is needed. We are encouraged by the earlier

success of both NSF and STA in establishing such facilities for precursor programs. We note, however, that the scale of provision will be greater, and that the present proposal will require at least a 10-year commitment for such facilities.

2b) We have questioned staff members about the adequacy of the time required to deliver two technologically innovative operational vessels. Assuming the availability of timely budget support, we are satisfied by their assurances that there is adequate time to complete the construction and sea trials of these vessels. We note, however, that it will be difficult or impossible to obtain access to mission-specific platforms by October 2003, unless funding becomes available within the very near future. We discuss this matter elsewhere.

The ISP contains almost no explanation concerning the program for the mission-specific platforms. The excellent description of the program for the two major drilling vessels should be supplemented by a discussion of opportunities available through the use of mission-specific platforms.

2c) A variety of technological capabilities, some established and some new, will be vital to the success of the Integrated Ocean Drilling Program described in the ISP. Some of these are listed on pages 78 and 79 of the ISP. The committee was satisfied that the technological innovations specified on these pages are achievable through a combination of tested technology and developments in progress; perhaps there should be a statement in this section of the plan which clarifies the present position. This mixture of new and existing technologies will require careful management in both its development and application.

2d) The drilling programs for investigation of both the upper mantle and the seismogenic zone, though technically difficult, represent extremely desirable scientific goals. Both of these investigations promise exciting, innovative advances in science, and the committee fully endorses the importance attached to these components, but suggests that some secondary targets be defined for investigation (in parallel with the primary objectives) of features at various depths within the drill holes. Even if the more demanding objectives prove difficult to achieve within the lifetime of this program, significant advances in understanding will nevertheless emerge.

2e) We believe that management of the IODP will be of critical importance to its success. We have discussed this in detail with representatives of NSF and STA. A draft model of the management organization of the program already exists but includes only these two agencies. It is important to determine in advance how additional members are to be accommodated in the management plan. The detailed management structure and support services for the program are of key importance, and these need to be carefully thought through. Special attention needs to be paid to the ultimate line of authority for major IODP decisions. An appropriate structure might be one with a single director advised by a broadly representative board.

2f) The ISP concentrates chiefly on the work of the riser and non-riser vessels. This work is of major scientific importance, but achieving the total goals of the ISP will require additional partners. Additional partners can enable funding for both the operations of the two primary vessels and for the employment of mission-specific platforms. We wish to stress the immense potential benefits of adding these mission-specific platforms in a timely fashion, so as to allow additional partners to share, not only in the strategic management of the program, but in its scientific work.

2g) We wish to stress not only the necessity, but also the urgency, of additional support to provide for the mission-specific platforms. The time lag involved in the design of scientific programs and in obtaining necessary access to mission-specific platforms means that we are already at a critical point if any are to become operational by October 2003, the anticipated date for the beginning of IODP.

ISP Proposed Organization and Implementation Options

3. REVIEW AND EVALUATE THE PROPOSED ORGANIZATIONAL AND IMPLEMENTATION OPTIONS FOR THE IODP AS IDENTIFIED BY IPSC

The review should be carried out in the context of potential international governmental arrangements, principles of international participation in scientific planning and operations, and overall efficiency and integration of the IODP activity.

Specific issues:

- *Proposed conceptual structures and organization in terms of IODP implementation.*
- *Capability of the program to ensure scientific excellence and educational opportunities by responding to new research initiatives, developments in technology and new scientific communities.*
- *Schedules and priorities for implementing IODP operations.*

The use of multiple drilling platforms to undertake major studies of the ocean crust is one of the most exciting and dramatic scientific developments of recent years. It also stretches existing technology to its limits and requires the development of new technological capabilities. The infrastructure support and the technical and scientific capabilities required to succeed pose unusual challenges for organization, funding, scheduling and implementation. We are generally satisfied that the staff members are aware of these challenges and have made appropriate arrangements to address them. With that in mind we offer the following comments:

3a) Provisions for detailed site surveys, site monitoring, and associated safety measures are of major importance and we are pleased to note that discussions on these issues are well-advanced and continuing. We are satisfied those existing procedures have been tested and have been found sound and work is in progress on enhanced procedures that will address the more complex issues.

3b) The successful completion of the proposed ISP and the responsible implementation of societal policies that reflect its findings, will require a high level of scientific expertise in all parts of the world. We are concerned that if, because of non-participation by other nations in the proposed program, activities are chiefly confined to Japan and the United States, other countries will be deprived of the opportunity to participate in the educational and scientific benefits of the proposed research.

3c) The period 2003-2005 will see a potential reduction in the level of operating funding for IODP, pending the completion of the two ocean drilling vessels. We believe it is important to guard against a loss of momentum in the science and training activities by taking the opportunity to schedule into this period the more urgent scientific projects and initiatives that employ mission-specific platforms.

3d) The successful scientific exploitation of drill holes described in the ISP will require the development of long-term down-hole monitoring and measurement. This will necessitate careful designation of responsibility for the management of these underwater observatories, together with networks for their maintenance and cooperative study. Thought should be given to the legal aspects of deep-ocean drilling in these new sensitive sites.

3e) We have already noted that the general concept, design and technological strategy of the program are well conceived and soundly based. The implementation proposed in the ISP is an appropriate and cost effective way to address complex problems of major scientific and social significance.

3f) We endorse the plans for creating a data management center with the capacity to provide web-based access to all data derived from the proposed study.

3g) There is a need to develop, before drilling begins, an international protocol and appropriate funding for core storage, ownership, curation, and access.

3h) The programs described in the ISP will inevitably present challenges and problems. The flexibility and the capacity to address these problems in a timely fashion and to take advantage of new and unanticipated scientific opportunities requires the assignment of appropriate responsibility for oversight of these issues.

3i) We urge that consideration be given to the development of real-time education and outreach to schools, colleges, and other institutions to promote public understanding. There is an educational opportunity to showcase science and huge potential to encourage public attention leading to better-informed public opinion.

ISP Resource Requirements

4. REVIEW AND EVALUATE RESOURCE REQUIREMENTS FOR THE IODP

Specific issues:

- *Adequacy of overall costs identified in the IPSC science plan to address program objectives.*

A scientific proposal of this magnitude can be assessed only in the most general terms as far as its description of resource requirements is concerned. We have been able to examine only an outline of the resource requirements and we are unable to provide specific opinions on anything but the broadest overall support levels. Recognizing this limited capacity, we make the following observations:

4a) The ISP contains no descriptions of cost estimates for the mission-specific platforms. While we recognize that this third element has not yet been defined, we nevertheless consider it important not only to describe its goals in rather more detail, but also to provide a more adequate estimate of its costs.

4b) In view of the extreme conditions under which drilling will sometimes take place, it is essential that platform operators should provide appropriate funding levels to cover unanticipated contingencies.

4c) Just as we have stressed above (in 2f) that the major benefits of the proposed plan will be far better achieved by the employment of mission-specific platforms, we also regard it as urgent to clarify the financial contributions -- if any -- of other nations in support of the activities of the two major vessels.

4d) We lack the experience to assess the adequacy of the costs of the proposed program activities identified in the ISP, but we are assured by the staff members that these costs are based on drill ship operating experience and have been reviewed by individual specialists in appropriate technical fields. We would find it helpful if the ISP contained some reference to this experience and consultation.

Conclusion

In conclusion, we reaffirm that the scientific significance, technical feasibility, and potential societal benefits of the ISP make it of exceptional importance and timeliness. Some of the most pressing societal issues we confront as a global population depend for their solution on knowledge that can be obtained only by a study of the kind described by the ISP. Gaining that knowledge will be challenging and costly. It will call for the highest level of scientific effort, wide-ranging technological expertise, and sustained government funding to ensure continuity of purpose over a period of a decade and longer. In our view, the benefits of the program described in the ISP far outweigh the costs and the technical uncertainties.

One of the great strengths of the proposed program is its remarkable breadth. Considered solely on the merits of its science, we judge it to be of vital importance; considered solely on the basis of the potential for development of enhanced technical expertise in matters of critical interest, we judge it to have great significance; considered on its potential societal benefits, we are of the view that it deserves the highest priority and urgency. In combination, these qualities reinforce the unique promise of the program, the urgency of obtaining sustained funding, and the necessity of developing the technological capacity to undertake it.

This review committee gives its unreserved support to the priorities of the program as described in the ISP.

Acknowledgements

We wish to acknowledge our gratitude to:

Dr. Theodore Moore and the other members of the IODP Planning Sub-Committee, Drs. Dieter Eickelberg, Hans Christian Larsen, James Austin, Hajimu Kinoshita, Asahiko Taira, and J rn Thiede, for the leadership they have given to this project.

Dr. G. Michael Purdy and Dr. Don Heinrichs of the United States National Science Foundation and Mr. Satoshi Tanaka of the Japan Science and Technology Agency for their interest and support.

Jennifer Peterson, Masanori Shinano, Bridget Chisholm and the other members of the IWG Support Office Staff for coordinating the meeting in Tarrytown, New York.

Appendix I

Terms of Reference
For
Review Committee for IODP Initial Science Plan

The terms of reference contain two primary and two secondary goals for the review process. The two primary issues (science and technological objectives, and required facilities) should be considered in detail. The two secondary issues (organization and implementation options, and required resources) should also be considered, but in general terms. Final resolution of these issues, including the specific funding levels available for the support of IODP, will be determined by the participating government agencies.

Primary issues to be considered in detail:

❑ 1. REVIEW AND EVALUATE THE SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES OF THE IODP AS IDENTIFIED IN THE IPSC SCIENCE PLAN

The review should be carried out in the context of earth and ocean science research in general, and the potential contributions to economic and social development.

Specific issues:

- Degree to which the IPSC Science Plan reflects the planning and high priority recommendations of national and international scientific communities for a future ocean drilling program.
- Degree to which the IPSC Science Plan builds on recent progress in earth and ocean sciences, including past scientific and technological accomplishments of research and commercial ocean drilling.
- Degree to which the IPSC Science Plan is complementary to, and enhances close cooperation with, other initiatives and programs in the earth, ocean and related life sciences.

❑ 2. REVIEW AND EVALUATE THE APPROPRIATENESS OF THE FACILITIES IN THE IPSC SCIENCE PLAN

This review should be carried out in the context of the identified scientific and technological objectives of the IPSC science plan.

Specific issues:

- Capability of proposed facilities to address scientific and technological objectives identified in the IPSC science plan.
- Adequacy of proposed plans for integration of IODP facilities.
- Benefit and added value of international collaboration and implementation.

Secondary issues to be considered in general terms:

❑ 3. REVIEW AND EVALUATE THE PROPOSED ORGANIZATIONAL AND IMPLEMENTATION OPTIONS FOR THE IODP AS IDENTIFIED BY IPSC

The review should be carried out in the context of potential international governmental arrangements, principles of international participation in scientific planning and operations, and overall efficiency and integration of the IODP activity.

Specific issues:

- Proposed conceptual structures and organization in terms of IODP implementation.
- Capability of the program to ensure scientific excellence and educational opportunities by responding to new research initiatives, developments in technology and new scientific communities.
- Schedules and priorities for implementing IODP operations.

❑ 4. REVIEW AND EVALUATE RESOURCE REQUIREMENTS FOR THE IODP

Specific issues:

- Adequacy of overall costs identified in the IPSC science plan to address program objectives.

Proposed Interim Science Advisory Structure (iSAS) for the Transition to IODP

The Interim Science Advisory Structure for the IODP

The interim Science Advisory Structure (iSAS) is a joint working group representing JOIDES and the OD21 Science Advisory Committee. The functions of iSAS are: 1) to plan for the Integrated Ocean Drilling Program (IODP); 2) to facilitate the transition from the Ocean Drilling Program (ODP) into the IODP; 3) to make recommendations on the science advisory structure for IODP; 4) to develop guidelines related to evaluations of science proposals, site surveys and form of drilling proposals submitted to IODP; and 5) to examine, review and nurture potential drilling proposals for IODP. Final recommendations for the scientific drilling program of IODP will be developed once IODP begins in 2003.

The iSAS committees, working groups, and panels will report and direct their advice through the interim Planning Committee (iPC) to the International Working Group (IWG) of IODP. Representation on most iSAS panels and committees will be proportional to the optimal international participation in IODP (1/3 Japan, 1/3 United States, 1/3 other IWG members. Members of iSAS committees and panels will be nominated by JOIDES and the OD21 Science Advisory Committee. For the iPC, it is expected that JOIDES will chose representatives from its full members. To the extent possible, it is expected that JOIDES nominations will be consistent with the membership on corresponding JOIDES panels and committees. JOIDES and the OD21 Advisory Committee will confer and consider appropriate disciplinary balance and expertise in making their nominations to IWG. The term of membership on iSAS panels and committees will be until 1 October 2003 (unless replaced before that time by the IWG member nations they represent). The iSAS is open to suggestions and proposals from the entire scientific community, and its plans will be open to continued review and discussion.

1. Interim Planning Committee

1.1 General Purpose. The Interim Planning Committee (iPC) will be responsible to the International Working Group (IWG) of IODP for its guidance and direction. The iPC reports to the IWG, provides advice to IWG, facilitates the establishment of the IODP Science Advisory Structure, develops guidelines for evaluations on science proposals for IODP, and continues scientific planning for IODP. More specifically, the iPC

is responsible for:

- ¥ custody and initial implementation of the IODP Initial Science Plan;
- ¥ categorizing of mature drilling proposals (*i.e.,* proposals having been grouped by the iSSEPs , undergone external review, and judged to be complete by iPC) that address the scientific themes and initiatives of the IODP Initial Science Plan
- ¥ advising how these proposals might be most effectively mapped into a drilling plan based on the IODP multiple platform concept;
- ¥ carrying out science planning, over the 2-year period of ODP to IODP transition;
- ¥ fostering communications among and between the international community, the JOIDES and OD21 Science advisory structures, and the IWG.

1.2 Mandate.

iPC will encourage the international community to submit drilling proposals for IODP, and will foster the further development of those proposals. Proposals submitted to JOIDES that remain unscheduled in ODP by September of 2001 will be forwarded to the iSAS Support Office. The Co-Chairs of iPC will contact proponents of these proposals requesting from them a statement of intent regarding submittal of their proposal to IODP, as well as any modifications or amendments they wish to make in their proposals that help focus the proposed drilling on important scientific objectives of the IODP Initial Science Plan.

In addition, iPC may assign special tasks to iSAS panels and planning groups. The iPC Co-Chairs convene the iSAS panel meetings and approve the meeting dates, locations, and agendas of all the iSAS science advisory committees, panels, and groups. iPC, through the iPC Support Office, assigns proposals for review to iSAS Science Steering and Evaluation Panels (iSSEPs) and, if relevant, to the three service panels - the interim Scientific Measurement Panel (iSciMP), Site Survey Panel (iSSP), and Pollution Prevention and Safety Panel (iPPSP). After proposals are reviewed by the panels and judged to be complete, with well-documented scientific objectives and drilling plans, they are considered to be mature and sent out for external (mail) review. After external reviews of these proposals are received, the iPC discusses the iSSEP comments and external reviews of each proposal and categorizes the scientific objectives of the proposals within the major thematic areas of the IODP Initial Science Plan. The iPC then categorizes all proposals based on their scientific merit and provides an assessment of their technical requirements and feasibility within the IODP multiple platform program. The final evaluation and ranking of these proposals will be carried out by the IODP Science Advisory Structure when it is established.

The iPC reviews the interim advisory structure in the light of developments in IODP planning, and recommends to IWG changes in the panel structure and mandates for IODP Science Advisory Structure. Much of the work of iPC is carried out by the commissioning of reports from other interim science advisory panels, including Detailed Planning Groups, *ad hoc* working groups, *ad hoc* subcommittees of its own membership, and its Co-Chairs.

1.3 Structure. iPC is empowered, with the approval of IWG, to modify the iSAS structure as appropriate to the definition and accomplishment of assigned tasks. Communication with the panels and active iPPGs and iDPGs is maintained by having their chairs meet with the iPC annually, and by assigning iPC members as liaison members to its panels and planning groups. Where counsel and communication are deemed important, other individuals may be asked *ad hoc* to meet with the iPC or its panels.

1.4 Meetings. iPC meets at least twice a year, normally right before or after the meeting of JOIDES SCICOM.

1.5 Membership. iPC will consist of approximately fifteen to eighteen members. All appointees to iPC shall satisfy the fundamental criteria of having the ability and commitment to provide mature and expert scientific direction to IODP planning. If members of the iPC miss two meetings in succession, the iPC Co-Chairs will discuss the problem of iSAS representation with the appropriate country representative on IWG.

1.6 Liaison. The Co-Chairs of IWG, or nominees thereof, are liaisons to the iPC. The iPC Co-Chairs are liaisons to IWG.

1.7 Procedure of Decision Making. Decisions concerning substantive issues (e.g. the categorization of mature proposals) are made through consensus among members present.

1.8 Co-Chairs . The iPC will be co-chaired by the chair of IPSC and the designated iPC representative from the OD21 Science Advisory Committee.

2. Interim Science Steering and Evaluation Panels

2.1 General Purpose: The Interim Science Steering and Evaluation Panels (iSSEPs) interact with proponents (and interim Program Planning Groups, as necessary) during the ODP-IODP transition (2001-

2003), in order to nurture submitted drilling proposals to maturity, make an initial assessment (in cooperation with the iPC) about the suitability of proposals for a particular drilling platform or technology, and recommend mature proposals for external comment.

¥ Environmental Change, Processes and Effects iSSEP: Areas of Interest

The interests of this iSSEP are explained in detail in the Initial Science Plan of IODP. Within the context of this plan, important thematic areas of investigation addressed by proposals that will be considered by this panel include:

- internal and external forcing of environmental change
- environmental change induced by internal and external processes
- extreme climates and rapid climate change initiatives
- the deep biosphere and the sub-seafloor ocean
- gas hydrates

¥ Solid Earth Cycles and Geodynamics iSSEP: Areas of Interest

The interests of this iSSEP are explained in detail in the Initial Science Plan of IODP. Within the context of this plan, important thematic areas of investigation addressed by proposals that will be considered by this panel include:

- formation of rifted continental margins, oceanic LIPs and oceanic lithosphere
- the dynamics, processes, and record of the solid Earth and fluid movement therein.
- recycling of oceanic lithosphere and formation of crust
- the seismogenic zone
- the deep biosphere and the sub-seafloor ocean

2.2 Mandate. Each iSSEP reports to the iPC and will respond directly to requests from the iPC. Each iSSEP will be responsible for:

¥ examining and reviewing drilling proposals and determining whether they address important scientific problems that are related to the scientific themes outlined in the Initial Science Plan of IODP.

¥ nurturing to maturity, and examining and reviewing the scientific merits of these drilling proposals, by interaction with proponents and Program Planning Groups (as necessary);

¥ providing proponents, and iPC with written reviews and comments on the proposals through the iSAS Support Office;

¥ selecting proposals for external comment, suggesting appropriate reviewers, and providing iPC with external comments and a written review and summary of those comments;

¥ advising iPC on initiatives and themes that need further development (through the formation of interim Program Planning

Groups, as necessary);

- ¥ facilitating communications among iPC, interim Program Planning Groups, and proponents.

2.3 Meetings. The iSSEPs will meet approximately twice per year, normally right before or after their counterparts in JOIDES. The iSSEPs will have overlapping sessions, as overlap in thematic coverage is expected to continue to evolve. The iPC Co-Chairs will approve iSSEPs agendas and meeting dates, and locations (normally in consultation with JOIDES).

2.4 Membership. The iSSEPs will consist of approximately fifteen to eighteen members each. The iPC, in consultation with JOIDES and OD21 Science Advisory Committee, will advise on membership replacement (if vacancies occur), based upon maintaining scientific balance and breadth of expertise. Members of the iSSEPs will not be members of any interim Program Planning Group. With the approval of the iPC Co-Chairs, guests may be invited to iSSEPs meetings on an *ad hoc* basis to help with examinations and reviews of proposals.

2.5 Liaisons. The Chairs of the iSSEPs are liaisons to the iPC and will meet with the iPC. The iSSEPs chairs will assign liaisons from their membership to the active iPPGs, as appropriate. The iPPG Chairs will normally meet with the iSSEPs at least once per year.

2.6 Chairs The iSSEP Chairs are appointed by iPC.

3. Interim Detailed Planning Groups

3.1 General Purpose. Interim Detailed Planning Groups (iDPGs) are usually short-lived planning groups that may be created by iPC for more intensive study of certain aspects of scientific or technical planning that may arise.

3.2 Mandate. iDPGs will be created by iPC with individual mandates that may be either scientifically or technologically based. iDPGs will provide written reports to iPC. Example tasks for iDPGs include: advising on specific technological issues; translating mature IODP science proposals into concrete drilling plans; advising on regional and site surveys needed for future drilling; preparing drilling prospectuses which synthesize all thematic and site survey input, and the detailed planning of all riser sites. The iDPGs associated with planning of riser sites will be longer lived and will maintain close communication with the

iPC, the iSSEPs, the iSSP, the iPPSP and the science operators throughout their multi-year planning process.

When their mandates involve scientific planning (such as for riser sites) or the integration of scientific proposals, the iDPG should establish liaisons and confer with the iSSEPs. The iDPGs reports to iPC should pass through the iSSEPs and other appropriate iSAS panels for comment.

3.3 Meetings. iDPGs meet at the request of iPC as required. Meeting dates, locations and agendas will be approved by the iPC Co-Chairs. iDPGs will be disbanded once their task is completed.

3.4 Membership. Members of iDPGs will be appointed by iPC for their expertise and experience with respect to the assigned iDPG mandate. Members may be recommended by the iSSEPs. Each member of IWG will have the right of representation. The size of the iDPG should be commensurate with the charge of the group; a maximum number of 16 members is suggested.

3.5 Liaison. The iPC appoints a liaison to each standing iDPG, and when appropriate, requests that liaisons from the science operators be assigned to the iDPGs.

3.6 Chair. The iDPG Chair will be appointed by iPC.

4. Interim Program Planning Groups

4.1 General Purpose. Interim Program Planning Groups (iPPGs) are small focused planning groups formed by iPC when there is a need to plan drilling programs to achieve the goals of the IODP Initial Science Plan. Calls for the establishment of an iPPG may arise from either the iSSEPs or from the iPC membership.

4.2 Mandate. The iPPGs will advise upon drilling strategies and proposals for major scientific objectives that are not adequately covered by existing drilling strategies or proposals. Drilling proposals arising from iPPG meetings must be submitted to the iSAS Support Office by individual proponents or groups of proponents. The iPPGs will report directly to the appropriate iSSEP in the interim Science Advisory Structure as directed by iPC.

4.3 Meetings. These will be on an as-required basis, determined by iPC and approved by the iPC Co-Chairs, who will also approve dates, locations, and agendas.

4.4 Membership. Members of iPPGs will be focused groups of specialists and proponents, chosen by iPC through consultation with the iSSEPs. Each member of IWG will have the right of representation. A maximum number of 16 members is suggested. The number of iPPGs will be determined by iPC's need to fulfill the IODP Initial Science Plan objectives, subject to budgetary constraints.

4.5 Liaison. The iPC establishes liaison with iPPGs by the appointment of liaisons. A liaison from the appropriate iSSEP will also be established. The iPC may ask that liaisons to iPPGs be established when appropriate to help foster communication between the IODP and other major geoscience initiatives.

4.6 Chair. The iPPG Chairs are appointed by iPC.

Service Panels

Service Panels provide advice and services to the iSAS. The Service Panels can respond to specific requests from the iPC, but in all cases, must report on these requests through the iPC. The Service Panels, beyond their help to the iSAS, are not directly involved with selection of drilling targets or definition of cruise objectives.

5. Interim Site Survey Panel

5.1 General Purpose. The general purpose of the interim Site Survey Panel (iSSP) is to provide information and advice to the iPC on the adequacy of, and need for, site surveys in relation to proposed drilling targets.

5.2 Mandate. The interim Site Survey Panel (iSSP) is mandated to:

- ¥ Review site survey data packages prepared by the IODP Site Survey Data Bank and to make recommendation as to their adequacy to the iPC in light of the needs defined in mature proposals of the interim Science Steering and Evaluation Panels, interim Program Planning Groups and interim Detailed Planning Groups;
- ¥ Identify data gaps in proposed future drilling areas and recommend appropriate action to ensure that either:
  - (1) sufficient site survey information is available to pinpoint

specific drilling targets and interpret drilling results; or

(2) sites will not be drilled until specific information has been reviewed.

¥ Provide guidelines for proponents and panels regarding required site survey data and examine the opportunities and requirements for the use of new technologies for surveying potential drill sites;

¥ Promote international cooperation and coordination of site surveys for the benefit of the IODP, particularly between participating IODP partners' survey activities;

¥ Promote the submission of all data used for planning drilling targets to the IODP Data Bank.

¥ Interface with the JOIDES Site Survey Panel to assure a smooth transfer of site survey data from ODP to IODP*.

5.3 Meetings. iSSP will normally meet right before or after the JOIDES SSP meeting or as requested by iPC. One meeting will usually be at the location of the JOIDES Site Survey Data Bank.

5.4 Membership. The iSSP is composed of 15 to 18 Members. It will be made up of experts who can provide advice on the site survey requirements of proposed drill sites. The membership will have an equal number of appointees from Japan, the US, and other IWG members. The iPC, in consultation with JOIDES and the OD21 Science Advisory Committee, will advise on membership replacement (if vacancies occur), based upon maintaining scientific balance and breadth of expertise.

5.5 Liaison. The Panel maintains liaison with the IODP Site Survey Data Bank Manager, and the iPC Support Office, each of which sends representatives to iSSP meetings. iSSP maintains liaisons to the iSSEPs.

5.6 Chair. The iSSP Chair is appointed by iPC.

**Note: IODP Site Survey Data Bank represents a function for IODP data repository to be defined by IWG.*

6. Interim Pollution Prevention and Safety Panel

6.1 General Purpose. The general purpose of the interim Pollution Prevention and Safety Panel (iPPSP) is to provide independent advice to the iPC with regard to safety and pollution hazards that may exist

because of general and specific geologic circumstances of proposed drill sites, and advice on what drilling technology should be applied in order to avoid drilling hazards.

6.2 Mandate. This panel will review all drilling proposed in IODP and advise on safety requirements and appropriate technology needed to meet these requirements. All drilling operations involve the chance of accident or pollution. The principal geologic safety and pollution hazard in ocean drilling is the possible release of substantial quantities of high-pressure fluids and volatiles including hydrocarbons from subsurface reservoir strata. However, the riser capability of the IODP will permit application of blow out prevention (BOP) technology to mitigate this hazard in a number of geological environments. In other environments, such as most of the deep-sea regions, the risk of hydrocarbon release can be reduced or eliminated by careful planning and proper site surveys.

Those who develop IODP drilling plans and select drilling sites are initially responsible to carefully assess sites in terms of safety and indicate the appropriate mode of drilling for each site. The iPPSP independently reviews each site to determine if and how drilling operations can be conducted safely.

The preliminary site survey information and the operational plan are examined for each site. Advice is communicated in the form of:

1. site approval, for riser/BOP or non-riser drilling,
2. lack of approval, or
3. technical advice for relocation or amendment

Approval is based on the judgment of the Panel that a proposed site can be safely drilled in light of the available technology, information, and planning.

6.3 Meetings. The panel will usually meet twice a year, and will normally meet right before or after of the JOIDES PPSP meeting, as approved by the iPC Co-Chairs.

6.4 Membership. Members of the iPPSP are specialists who can provide expert advice on the safe drilling of proposed drill sites, including sites in hydrocarbon prone areas. Members of the iPPSP are primarily selected on the basis of this specific expertise, with a view toward a fair representation of IWG members as a second priority. Membership is determined by iPC based on nominations from IWG countries. Panel membership, not to exceed 15, should be maintained

as small as is allowed by the range of expertise necessary to meet mandate requirements.

6.5 Liaison. The iPPSP maintains liaison with the interim Site Survey Panel, and a designated iSSP member attends its meetings. Representatives from the main drilling operators will also be invited to attend the meetings. The iPC Co-Chairs or a designate from iPC attends as a liaison.

6.6 Chair. The Chair is appointed by iPC.

7. Interim Scientific Measurements Panel

7.1 General Purpose. The interim Scientific Measurements Panel (iSciMP) will contribute information and advice to the IODP community through the iPC with regard to the handling of IODP data and information, on methods and techniques of IODP measurements, on laboratory design, portable laboratory needs and downhole measurements and experiments.

7.2 Mandate. iSciMP will provide advice on IODP information related to scientific measurements made onboard the riser and non-riser ships and on "as-needed" platforms, within and around boreholes, and on samples collected by IODP and associated programs. Its specific mandates are to develop guidelines concerning said measurements and to furnish advice about scientific measurements which will assist iPC in developing recommendations to IWG regarding equipment and measurement procedures in IODP.

Specific responsibilities for the panel are publications, databases, curation, computers, shipboard equipment usage and needs, measurement calibrations and standards, and borehole measurements, equipment, usage, and needs.

iSciMP recommendations will be sent to iPC.

7.3 Meetings. The panel will usually meet twice a year, and will normally meet right before or after the JOIDES SciMP meeting. Agendas are approved by the iPC Co-Chairs.

7.4 Membership. iSciMP will consist of fifteen to eighteen members. The iPC, in consultation with JOIDES and OD21, will advise on membership replacement (if vacancies occur), based upon maintaining breadth of expertise. Members should have expertise representing the

three core areas of the panel mandate covering information handling, downhole measurements, and shipboard measurements. With iPC approval, the panel may bring in additional information about its mandate issues by setting up *ad hoc* advisory committees whose lifetimes are mandated by iPC.

7.5 Liaison. The iSciMP will have liaisons from iPC. Liaisons to other iSAS advisory bodies may be sought with the approval of iPC. Representatives from the main drilling operators will also be invited to attend the meetings.

7.6 Chair. The Chair will be appointed by iPC.

Draft 2001 Time Table for iSAS implementation

Jan '01

- Approval of draft iSAS Panel Mandates by IWG

February '01 – March '01

- JOIDES and OD21 advisory structure nominate members for following committees and panels:
  iPC
  iESSEP
  iISSEP
  iSSP
- IWG sets up iSAS Support Office

April '01

- IWG approves iSAS nominees, iSSEPs, iSSP, and iPC membership established

May '01

- iSSEPs members attend JOIDES SSEPs meeting as observers

July '01

- iSSP members attend JOIDES SSP meeting as observers

August '01

- iPC members attend JOIDES SCICOM/OPCOM meeting as observers
- iPC/IPSC develop mandate for interim Pollution Prevention and Safety Panel and discuss needs and mandates for new Industry/Technology liaison panel
- Nominate iPPSP members

November '01

- Joint meeting of iSSEPs and SSEPs
- Establish iPPSP, members attend JOIDES PPSP meeting as observers.

December '01

- iPC establish first riser iDPG.

USSAC CONCEPTUAL DESIGN COMMITTEE (CDC) REPORT
Responses from Ocean Drilling Scientists

IPSC Report to the National Science Foundation

Overview of CDC

The U.S. National Science Foundation (NSF) has indicated that it would seek the necessary resources to bring a non-riser vessel of the *JOIDES Resolution* class but with significantly enhanced capabilities for the future ocean drilling program (IODP). In response to a charge from NSF, the United States Science Advisory Committee (USSAC) formed the Conceptual Design Committee (CDC) to formulate the conceptual design characteristics of a single, non-riser drilling vessel, optimally configured to address the widest possible range of non-riser scientific drilling objectives. In March 2000, the group submitted a final report to NSF outlining their definition of the performance specifications for the non-riser vessel. The CDC Report to NSF provides recommendations on the types and amount of on-board scientific measurement capabilities, the results of a survey of drilling vessels suitable for modification and conversion, basic screening criteria for narrowing the list of potential platforms, and initial guidance on how screening criteria might be applied in selecting a non-riser platform.

CDC Questionnaire

Once the CDC Report was submitted and approved, the National Science Foundation requested that IPSC coordinate efforts to obtain systematic input from the scientific community on the strategies used by CDC, and the recommendations of the CDC Report. CDC Chair Peggy Delaney and IPSC Chair Ted Moore together developed a survey-type questionnaire designed to elicit broad input on key design issues. It consisted of 35 check-off questions about target sections, vessel characteristics, drilling technology, hole characteristics, and coring/sampling/logging tools. Respondents were asked to indicate whether specific items were "Essential," "Important" "Nice, if possible," or "Not Important." Additionally, four open-ended questions requested comments and opinions on the completeness of target sections, IODP's biggest challenges, and recommendations for downhole logging. (see Appendix 1 for details of questions.)

The Questionnaire was designed to be completed and submitted in electronic form, either directly on the Web or via return e-mail. IPSC sent the Questionnaire to representatives from member ODP offices, requesting that ODP representatives discuss the CDC at scientific meetings in their countries, and urge their constituents to respond. IPSC also sent the Questionnaire via e-mail to over 800 ocean drilling scientists, from a list compiled from the JOIDES Directory, COMPLEX attendees, JAMSTEC scientists, and a variety of IPSC e-mail lists. As of November 30, 2000 IPSC has received responses from over 100 scientists from ten countries. (See Appendix 2 for overview of responses, Appendix 3 for written comments, and Appendix 4 for list of respondents.)

Summary of Responses to Specific Questions

Target Sections

An overwhelming majority (64 of 75) responded that the target sections were described completely or adequately. There were, however, quite a few comments about how target sections were specified. Some respondents felt that although the target sections were adequately described, the way they were

categorized was inadequate. For example, some felt that the target sections reflected particular physical environments, rather than processes. Others felt that gas hydrates and deep biosphere should not be separate targets.

Vessel Characteristics

Ship characteristics can generally be divided into operational capability, laboratory facilities, and living conditions. Generally, responses to living conditions, such as number of persons per cabin and number of persons per head/shower indicated that the desirability of generous facilities ranged from "Essential" to "Nice," with a modal response of "Important." Living conditions generally were viewed as being not as important as operating facilities.

There was a wider range in variety of responses to dimensions of operating capabilities, such as weather and sea conditions, water depth, and drill string length. This seems to reflect concern over what operating capability should be reserved for the riser vessel and alternate or "as-needed" drilling platforms, and what capability should be the province of the non-riser vessel. However, very few respondents indicated that these ranges of capability were "Not Important."

Laboratory facilities and core storage containers on deck also generated a range of responses between "Essential" and "Nice," with few indicating that these facilities were "Not Important." Respondents felt that the following were either "Essential" or "Important:"

- 1800 m2 of interior lab space
- mud storage
- geophysics doghouse

Well Control

There seemed to be some disagreement on the definition of "well control," and when it would be needed on the non-riser vessel. Although a majority responded that well control <500m and >500m of water was either "Essential," "Important," or "Nice," over twenty respondents felt that both were "Not Important." The number of locations for well control in <500m of water ranged from "all" to "less than 2/leg," while most respondents indicated less than ten locations. Respondents' time frame for number of locations is assumed to be 2003-2013, though this was not specified. For well control in water >500m, locations ranged from "several" to 50, with most suggesting around 10.

Hole Dimensions/Characteristics

These questions resulted in the smallest range of responses, with most respondents indicating that maximizing sample volume and hole stability, minimizing contamination and disturbance, use of downhole measurement tools, and compatibility of tools were all "Important." The questions that generated the most "Neutral" responses were sample volume and cross-platform compatibility of tools.

Coring/Sampling/Downhole Logging

Continuous coring/sampling and high recovery were overwhelmingly regarding as "Essential," while oriented cores and the ability to shift from APC/XCP to RCB without tripping the pipe was regarded as "Important" or "Nice to have." Very few felt that directional drilling was "Essential" or "Important."

Coring Systems

The vast majority indicated that APC, XCB, and RCB were "Essential." Pressure core sampling, diamond coring, and vibra/hammer coring elicited quite a range of responses between "Essential" and Nice," with few indicating these were "Not Important." Vibra/hammer coring generated the most "Not Important" and "Don't know" responses.

Summary of Questionnaire Comments

IPSC members were gratified to see that a large number of respondents took the time to include detailed comments attached to specific questions, as well as general comments regarding IODP challenges and downhole logging recommendations. Complete texts of comments by topic are included in Appendix 3.

IODP's Biggest Challenges

By far the most common concern expressed was maintaining high sample recovery and hole stability in all types of lithologies and physical environments. This was mentioned by a majority of those who commented at all. Almost as commonly expressed, as IODP's biggest challenge, was the need to minimize contamination of samples and disturbance of cores. The range of concern expressed about these two considerations was remarkably consistent.

As can be seen in Appendix 3, there were an additional 18 items listed as challenges for IODP. The capacity to drill deep holes was the most commonly cited concern. Other examples of comments on "biggest challenges" included drilling in hard/soft lithologies, increased core diameter, retrieval of cores under *in situ* conditions of pressure, temperature, etc., and drilling in sediments with a high likelihood of hydrocarbons.

Downhole Logging

Those that did express opinions in this area (of which there were many) were consistently in favor of downhole logging as standard practice in most drilling situations. Comments indicated the importance of maintaining state-of-the-art, accurate measurement tools, consistency in logging between platforms, and the need for tools that measure magnetic as well as physical properties and geochemistry.

Additional Comments

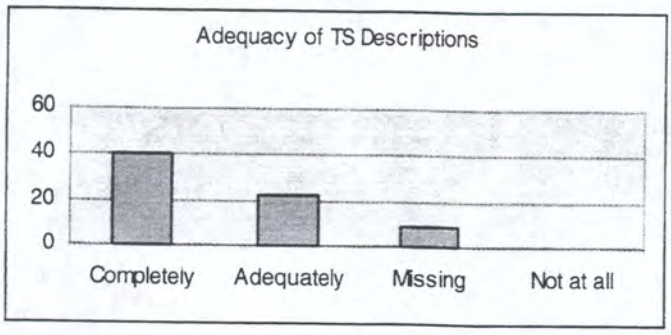
General comments about non-riser ship capability reiterated that operational capability should take precedence over "creature comforts," and that capacity generally around 50% greater than the current drillship would be adequate. Several mentioned the need for gym/recreational facilities. A fairly wide variety of specific observations regarding ship design and capability, such as handling larger cores, staff changeover, the desirability of partnering with the riser ship and alternate platforms on some projects, can be seen in the detailed comments included in Appendix 3.

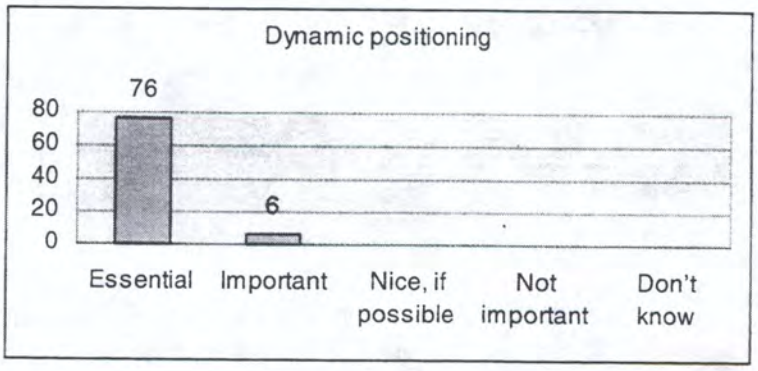
Appendix 1 – List of topics and blank questionnaire.
Appendix 2 – Overview of response data (table and bar graphs).
Appendix 3 – Summary of comments by topic.
Appendix 4 – List of questionnaire respondents.
Appendix 5 – Blank Questionnaire

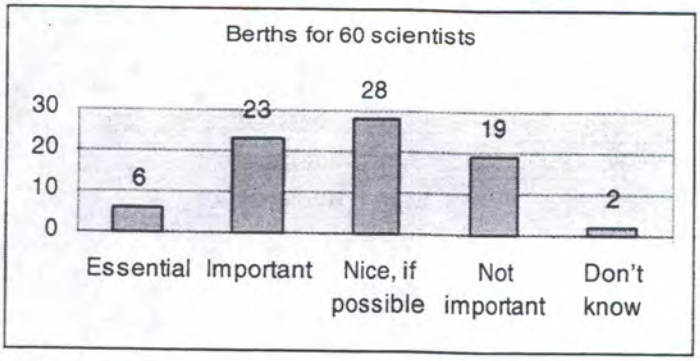
Appendix 2 - CDC Questionnaire Responses

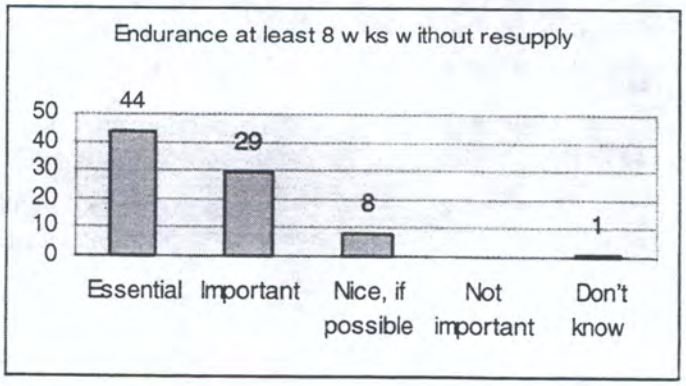
N=101 as of Jan. 2, 2001 (89 separate and 12 in summary narrative)

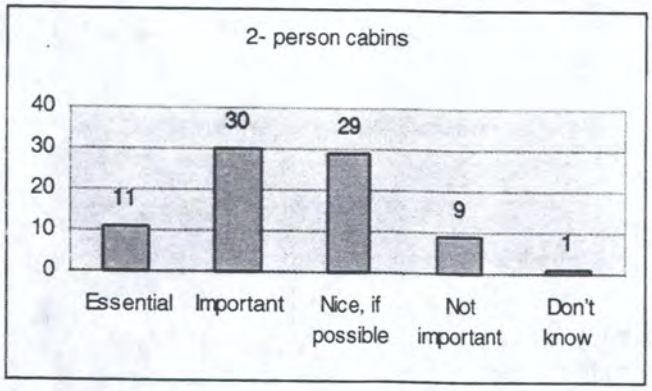
VESSEL CHARACTERISTICS

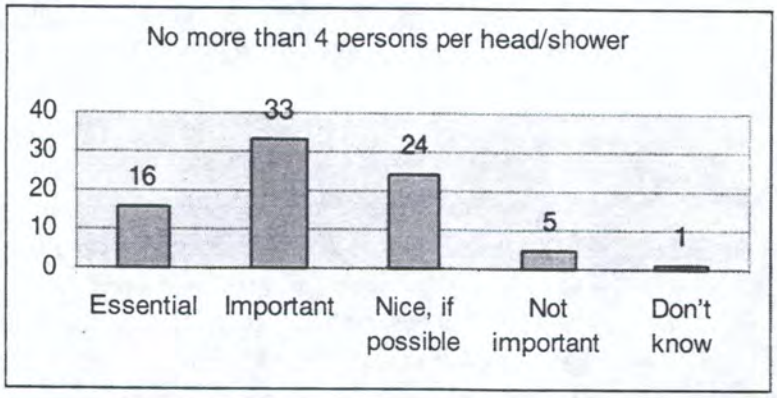


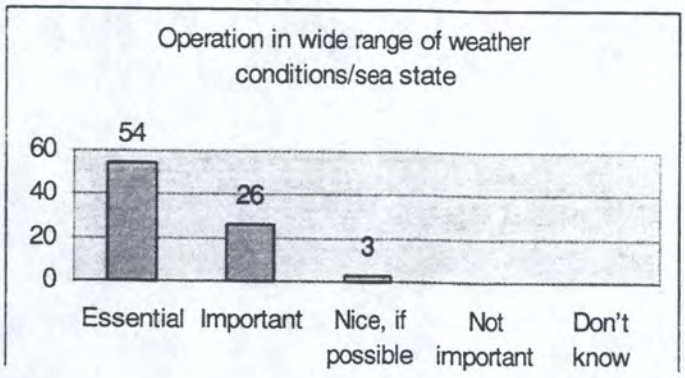


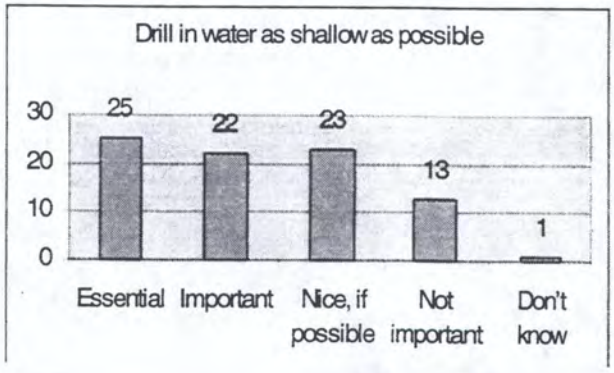


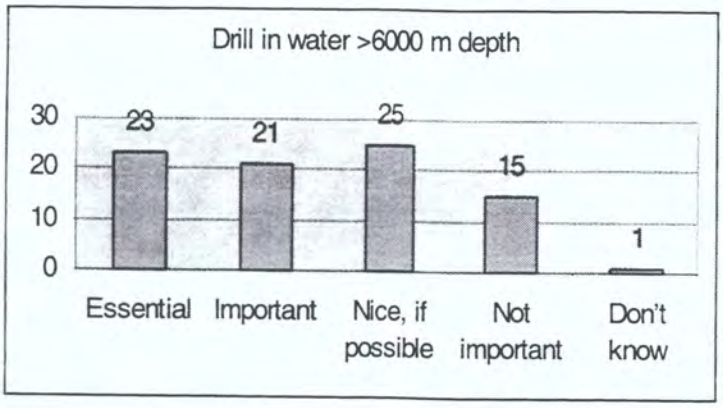


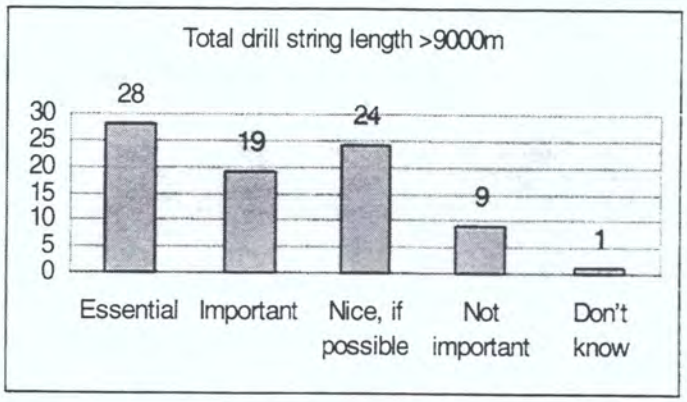


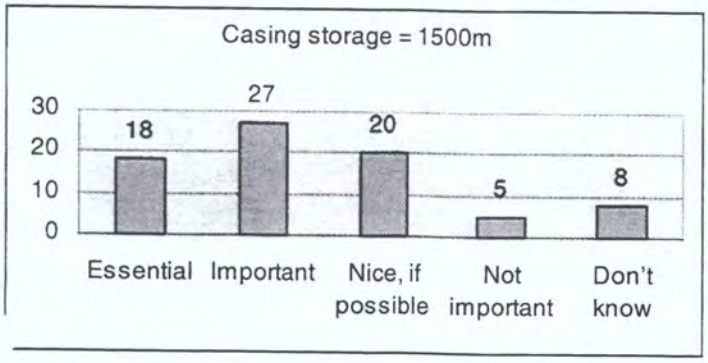


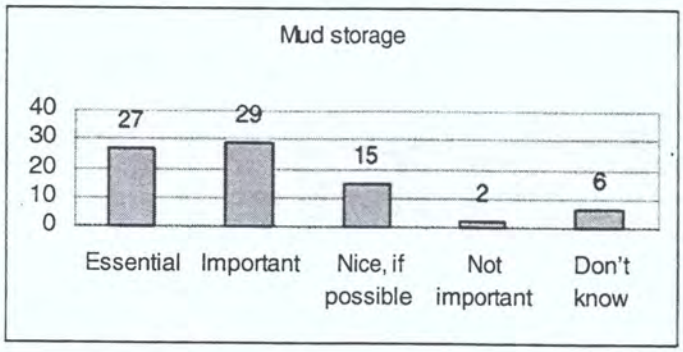


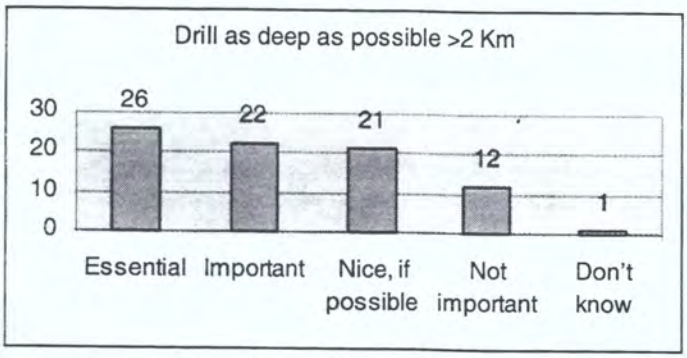


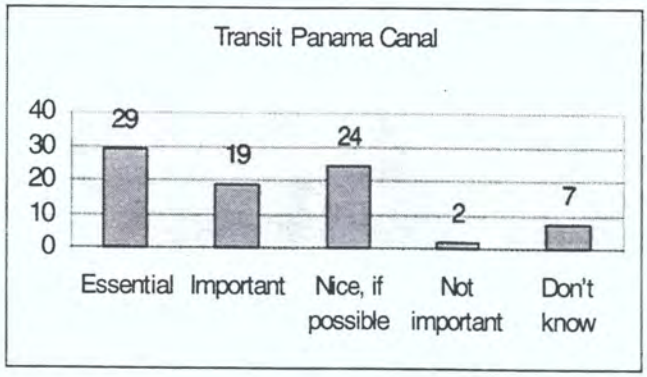

Drill in water >6000 m depth
30
20
10
0
23
21
25
15
1
Essential
Important
Nice, if possible
Not important
Don't know


Total drill string length >9000m
30
25
20
15
10
5
0
28
19
24
9
1
Essential
Important
Nice, if possible
Not important
Don't know

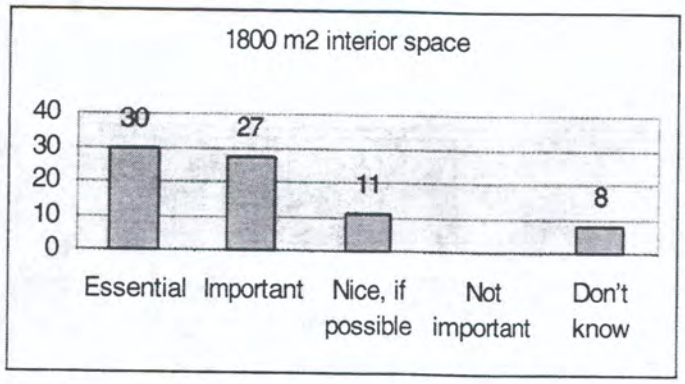

Casing storage = 1500m
30
20
10
0
18
27
20
5
8
Essential
Important
Nice, if possible
Not important
Don't know

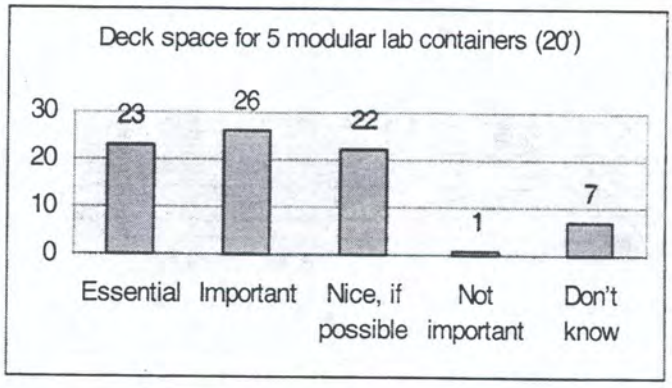

Mud storage
40
30
20
10
0
27
29
15
2
6
Essential
Important
Nice, if possible
Not important
Don't know

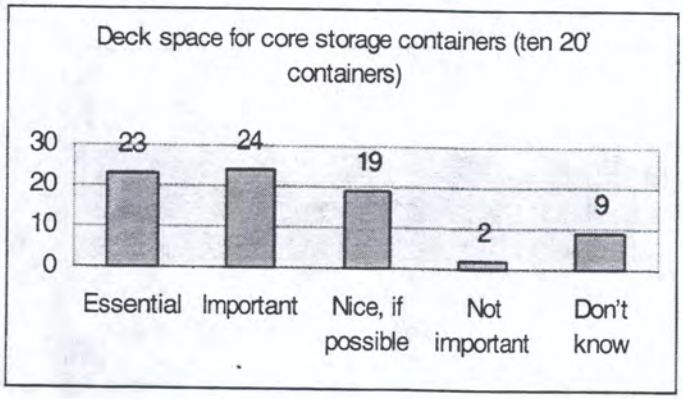

Drill as deep as possible >2 Km
30
20
10
0
26
22
21
12
1
Essential
Important
Nice, if possible
Not important
Don't know

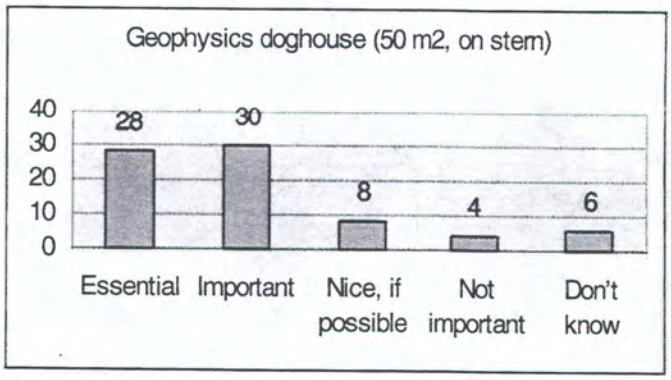

Transit Panama Canal
40
30
20
10
0
29
19
24
2
7
Essential
Important
Nice, if possible
Not important
Don't know

LAB SPACE

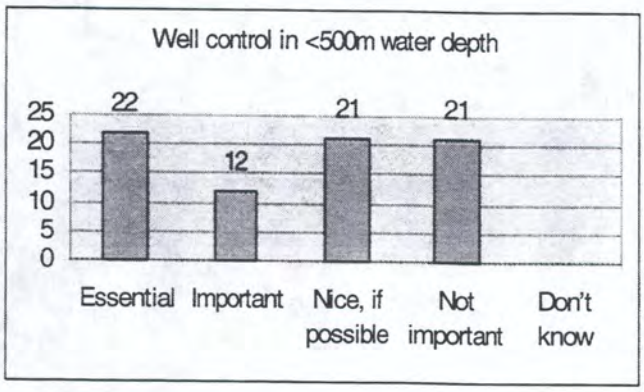


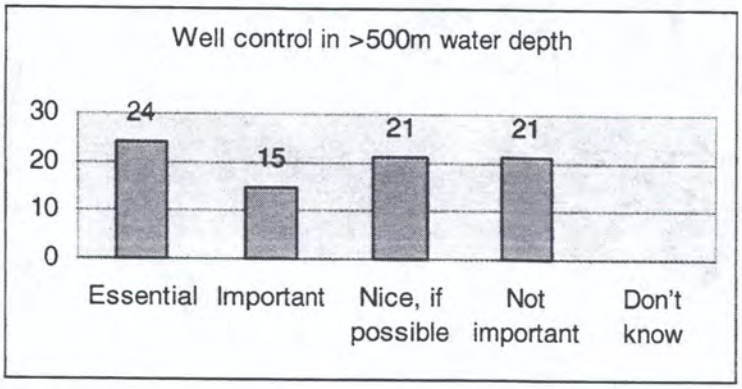




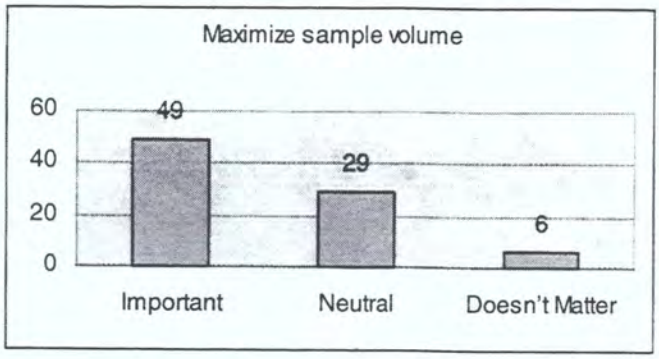


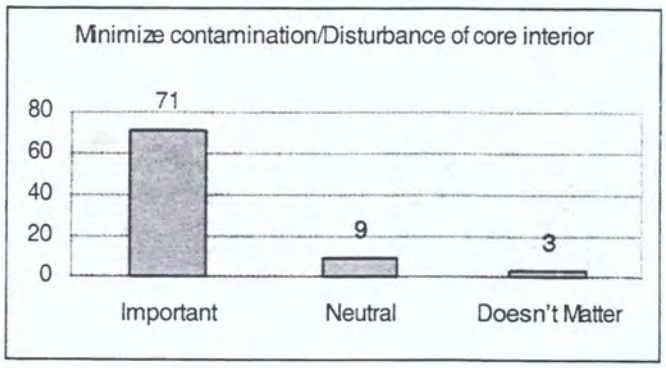
WELL CONTROL

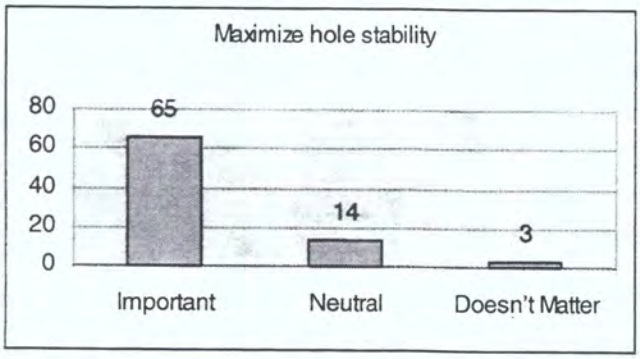


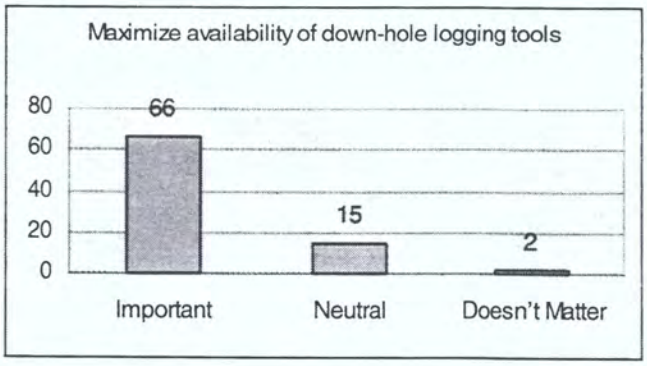


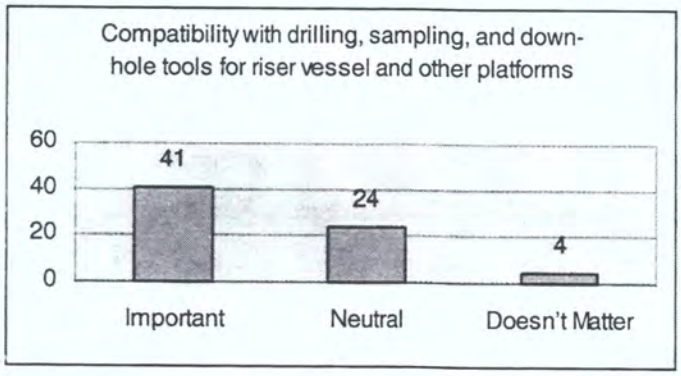
HOLE DIMENSIONS



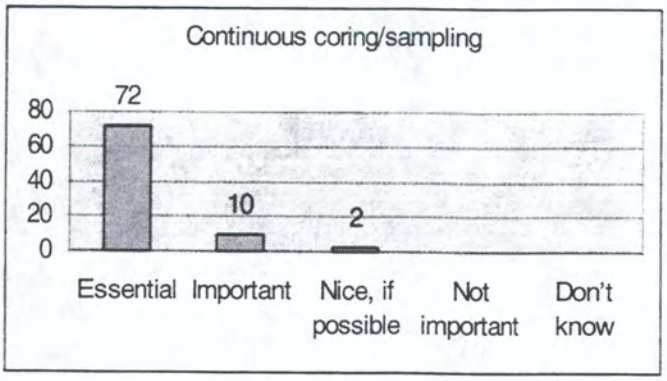


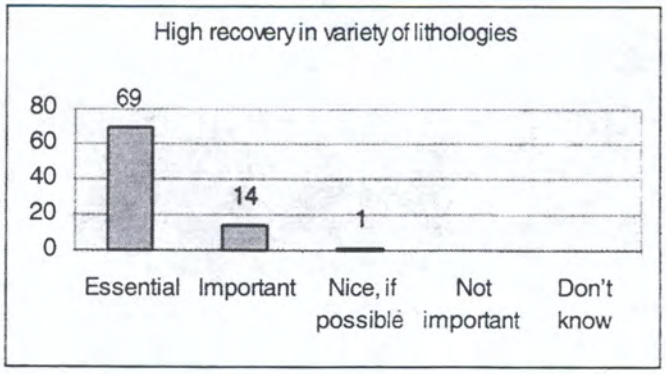


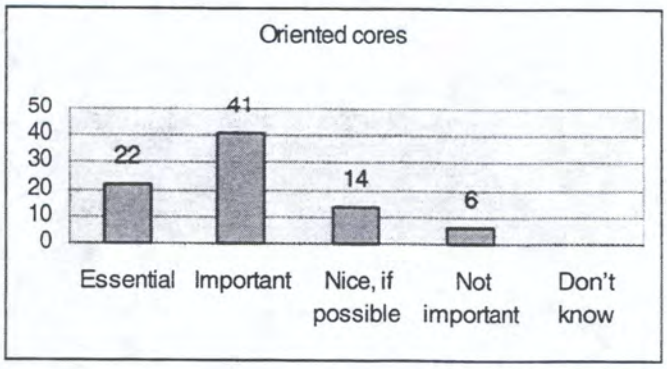


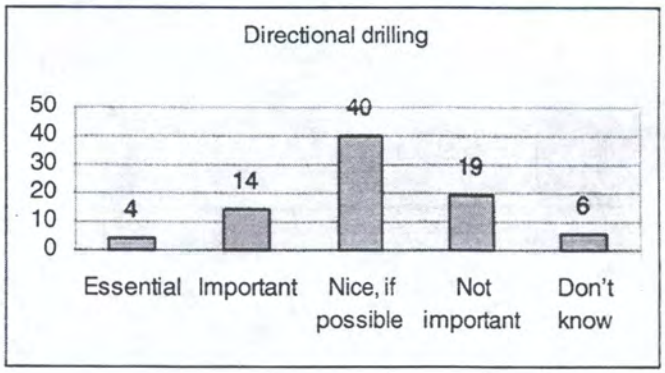


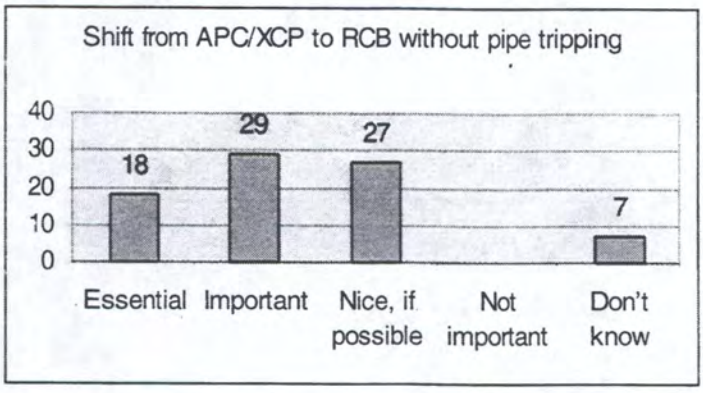
CORING/SAMPLING/DOWNHOLE LOGGING



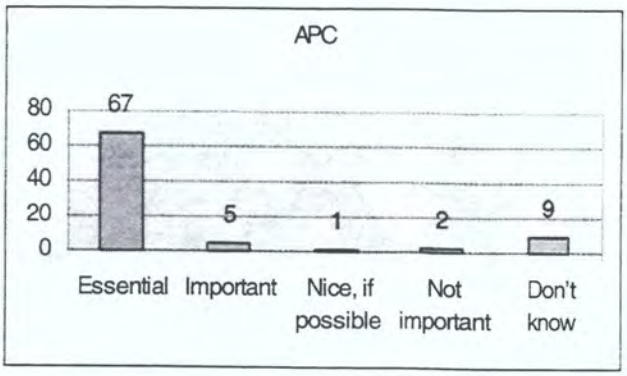


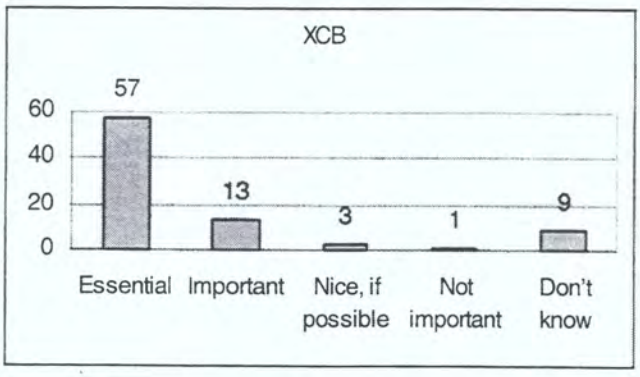


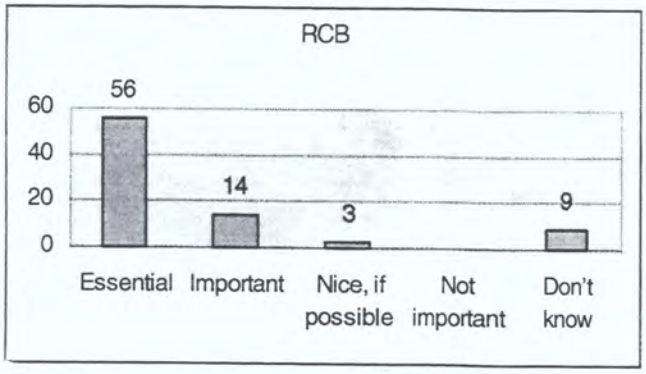


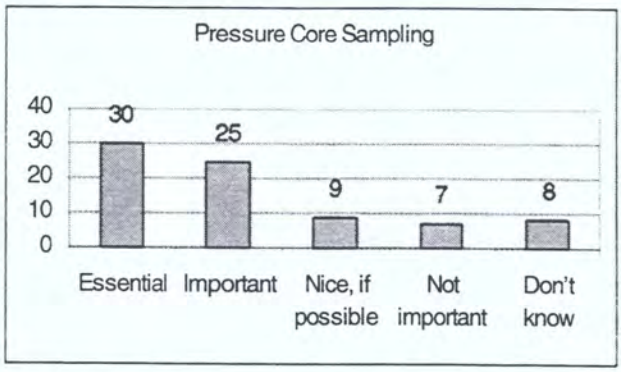


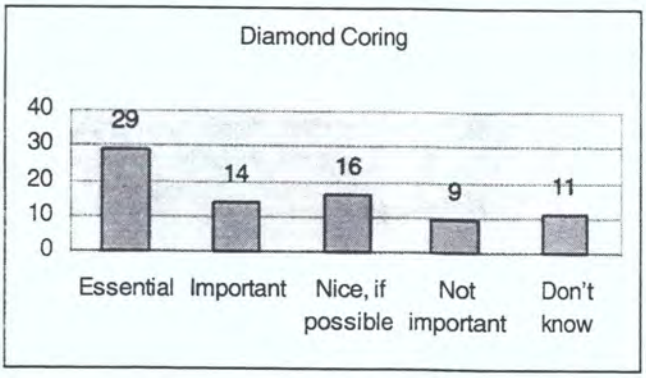
CORING SYSTEMS

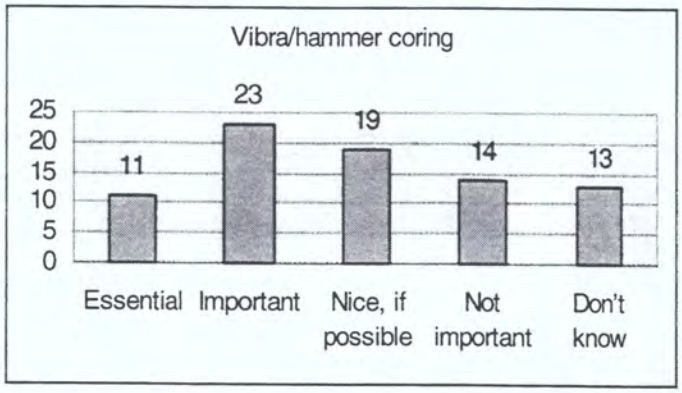












Appendix 2 - Summary Tally

TARGET SECTIONS--Adequacy of descriptions

	Completely	Adequately	Missing	Not at all		TOTALS
Adequacy of descriptions	41	23	11			75

VESSEL CHARACTERISTICS

	Essential	Important	Nice, if possible	Not important	Don't know	
Dynamic positioning	81	6				87
Berths for 60 scientists	6	25	31	19	2	83
Endurance at least 8 wks without resupply	45	32	9		1	87
2- person cabins	12	31	32	9	1	85
No more than 4 persons per head/shower	17	36	25	5	1	84
Operation in wide range of weather conditions/sea state	57	28	3			88
Drill in water as shallow as possible	26	24	24	14	1	89
Drill in water >6000 m depth	26	21	27	15	1	90
Total drill string length >9000m	31	20	24	10	1	86
Casing storage = 1500m	21	28	21	5	8	83
Mud storage	31	29	16	2	6	84
Drill as deep as possible >2 Km	29	23	21	13	1	87
Transit Panama Canal	30	21	25	3	7	86

LAB SPACE

1800 m2 interior space	31	31	11		8	81
Deck space for 5 modular lab containers (20')	24	28	24	1	7	84
Deck space for core storage containers (ten 20' containers)	23	26	22	2	9	82
Geophysics doghouse (50 m2, on stern)	30	30	10	5	6	81

WELL CONTROL

	Essential	Important	Nice	Not Imp.	Don't know	
Well control in <500m water depth	22	13	22	23		80
Well control in >500m water depth	25	16	21	21		83

HOLE DIMENSIONS

CHARACTERISTIC	Important	Neutral	Doesn't Matter			
Maximize sample volume	51	30	7			88
Minimize contamination/Disturbance of core interior	73	10	4			87
Maximize hole stability	68	15	3			86
Maximize availability of down-hole logging tools	68	16	2			86
Compatibility with drilling, sampling, and down-hole tools for riser vessel and other platforms	44	25	4			73

CORING/SAMPLING/DOWNHOLE LOGGING

Recommended Capability	Essential	Important	Nice, if possible	Not important	Don't know	
Continuous coring/sampling	75	11	2	1		89
High recovery in variety of lithologies	72	15	2			89
Oriented cores	22	42	16	7		87
Directional drilling	4	15	42	21	6	88
Shift from APC/XCP to RCB without pipe tripping	20	29	28	2	7	86
CORING SYSTEMS						
APC	70	6	2	2	9	89
XCB	60	14	4	1	9	88
RCB	59	14	4	1	9	87
Pressure Core Sampling	30	27	10	9	8	84
Diamond Coring	29	15	16	12	11	83
Vibra/hammer coring	11	25	20	16	13	85

SCICOM/PCOM MEETING LOCATIONS, 1990-2002

	ESF	Fr/Ass.	FRG	Japan	PacRim	UK	US
2002 (IPC): Japan + US ??				[√]			[√]
2001: Shanghai + Portland?		√					√
2000: DC + Halifax					√		√
1999: Freiburg + UCSC			√				√
1998: Boulder + Durham						√	√
1997: Kona + Davos	√						√
1996: Aix, Townsville, Arizona		√			√		√
1995: Tokyo, Portland, Scripps				√			√√
1994: Cardiff, Iceland, CS	√					√	√
1993: LDEO, Brisbane, Miami					√		√√
1992: OSU, Cornerbrook, [Bermuda]					√		√
1991: URI, Hannover, Austin			√				√√
1990: Paris, Scripps, Kona		√					√√

SSEP'S MEETING LOCATIONS, 1997-2002

	ESF	Assoc.	FRG	Japan	PacRim	UK	US
2002 (ISSEP'S): US + FRG or Japan ?			[√]	[√]			[√]
2001: DC + Japan or FRG?			[√]	[√]			√
2000: Cambridge + Kona						√	√
1999: Seattle + Udine	√						√
1998: Edinburgh + Gainesville						√	√
1997: DC + Hobart					√		√

Delivered-To: becker@mail.rsmas.miami.edu
Delivered-To: kbecker@rsmas.miami.edu
X-Sender: NEXUS\bin035@mail.riverside.csiro.au
Date: Thu, 15 Mar 2001 17:08:55 +1000
To: kbecker@rsmas.miami.edu
From: Ray Binns <r.binns@dem.csiro.au>
Subject: SCICOM meeting
Cc: BCHISHOLM@brook.edu, jock@lorica.ucc.usyd.edu.au, ausodp@es.su.oz.au,
Trevor.Powell@agso.gov.au, a.andrew@syd.dem.csiro.au,
lshaok@online.sh.cn, "Prof Fernando JAS Barriga":;,
miller@odpemail.tamu.edu, Baldauf@odpemail.tamu.edu

Dear Keir

Because of the rapidly declining exchange rate for $Aus, the Australian ODP Council has at this very late stage (my ticket and visa in hand!) withdrawn financial support for my travel to the SCICOM meeting in Shanghai next week, and I regret this means I must cancel my participation.

I was intending to report on the technical challenges faced during Leg 193, and the scientific outcomes, and then to make a few suggestions for the future. Brief notes follow, which perhaps could be printed and circulated at the meeting.

1. Technical challenges.

From the start we knew we faced many hurdles; siting holes on on bare rock with irregular topography, uncertain drilling behaviour of fresh and altered felsic rocks, high temperatures, borehole water sampling, safety issues (H2S, flashing). With great credit due to the initiative and persistence of ODP engineers and the drillers, these were successfully overcome except maybe for constraints on the borehole (hydrothermal) fluid sampling. Highlights included deployment of ADCB, use of hammer drill for hard rock entry and casing an existing hole (vital to achieving our deep penetrations), free-falling of the standard reentry cone (allowing deep hole to be commenced exactly at a small target under video observation), nesting of freefall funnel above the standard cone (allowing dual casing strings to enable deep drilling).

Except when diamond drilling with a new bit (which had separate problems - the core of fractured, altered rock tended to auto-fragment after removal from the barrel), core recovery was generally poor. Drilling was complicated by rapid variation from a surface cap of hard, fractured dacite to totally altered rock with the consistency of soap. We decided to surrender recovery in favour of penetration - wisely I think. Logging definitely helped overcome the poor recovery, both wireline and LWD. We performed the first direct comparison of LWD and FMS imagery and, of course, the first hardrock application by ODP of LWD.

2. Science outcomes.

Our strategy was to drill beneath a diffuse, low-T venting site (1188, maximum penetration achieved almost 400m), at a high-T chimney site (1189, maximum 206m; supplemented by shallow 1191 at a second chimney field drilled while waiting for engineering works prior to comencing deep hole 1188F), and at a "backgound" reference site (1190, not successful - a planned final attempt was prevented by early termination of the leg by uncooperative PNG officials). Thereby we aimed to document the vertical and lateral variations in alteration assemblages and subsurface mineralisation styles, for the first time in an active hydrothermal system in a felsic hosted, convergent margin environment (PACMANUS site in the Manus Basin PNG, basically a rifted arc in a backarc setting). Additionally we wanted to establish the volcanic architecture of the PACMANUS ridge, and to investigate the subsurface microbial biosphere in such a system. The need

to drill a fourth site at the base of the volcanic edifice where ingress of seawater to the hydrothermal system was expected) proved unecessary when early results (abundant anhydrite) indicated this was happening on a local scale at the crest.

These aims were achieved, and we collected the samples and data needed for subsequent laboratory research that will address major science issues such as the source of mineralising fluids (especially the role of magma-sourced fluids and metals), system structure and hydrology, subhalative mineralising processes, and fluid rock interction processes and their role in governing compositions of the surficial massive sulfides. As a major outcome, the predictions of the original proposal and Prospectus were borne out in that telescoped alteration patterns were found under the high-T site relative to the low-T one. However there were a number of surprises, which of course add to our holistic understanding of the system. Inability to penetrate hard lavas at the reference site has not prevented delineation of the volcanic architecture, for from within the altered holes we were able to conclude using preserved fabrics that we have a pile of dacite to rhyodacite lavas with several well-defined palaeoseafloor horizons.

The surprises included presence of a 10-40 m cap of largely unaltered dacite under both the low-T and high-T sites, and especially the intensity of alteration and rapid tranition to altered rocks below that. The predominance of clay minerals (especially illite, reflecting the relatively potassic nature of the parents, with clay-chlorite deeper down) in the alteration assemblages, and their similar vertical zoning (though telescoped) beneath low- and high-T sites, was also unexpected. The progression is marked especially by a transition from cristobalite to quartz and by increasing silicification at depth. The rapid way this is telescoped even from fringe to centre under the chimney site, implies extreme lateral changes in thermal gradient. Superimposed bleaching in which pyrophyllite appears a significant phase is widespread, particularly under the low-T site.

A second surprise was the abundance and widespread nature of anhydrite, implying an important role for recirculated seawater within the system. Much of this anhydrite appears related to the later bleaching, but detailed postcruise investigations will clarify whether seawater was also involved in the earlier stages of system development. The altered rocks are extremely porous (average 25%) and qualitative observations indicate they are also very permeable. Diffusive flow (early?) will clearly have an important role relative to fracture-controlled flow (late?) in hydrological models. Exceptional LWD and FMS imagery show that fracturing is very pronounced at both low- and high-T sites (at least partly explaining the low core recovery).

Although this is where poor recovery created the more worrisome gap in knowledge, yet another surprise was the scarcity of subsurface mineralisation, apart from ubiquitous pyrite as a minor component of alteration assemblages and in veinlets. In hole 1189B under the chimney site we intersected a subdued pyritic stockwork, possibly the fringe of the plumbing system responsible for surficial massive sulfides. In contrast to the latter, copper and zinc sulfides were nowhere common subsurface though trace contents were higher under the high-T relative to the low-T site. Nor is the alteration system auriferous like the chimneys (a shipboard conclusion enabled by sending out samples during a helicopter transfer). One interval of subsurface semi-massive sulfides (pyrite dominated) was cored above the stockwork in 1189B. While LWD and FMS in nearby hole 1189C suggest subhalative massive sulfides might be more common (the equivalent zone in 1189B was hammer-drilled and cased so could not be logged, although suggestive pyritic drill chips and sand were caught on the hammer drill). A thin interval of subhalative semi-massive sulfide controlled by pumiceous dacite hyaloclastite was encountered deep in 1188A under the low-T site, confirming on a small scale one subsidiary expectation of the Prospectus. Post-cruise research on these various phenomena will contribute better

understandings to a range of issues in Economic Geology.

A major success of Leg 193 was confirmation that microbes flourish in the subsurface portion of the PACMANUS hydrothermal system. Bacteria were confirmed in cores recovered up to 80 metres under the low-T diffuse site and up to 129 m under the chimney field. Cultivation experiments on board confirmed that they multiplied under anaerobic conditions at temperatures up to 90 degC, and higher temperature experiments will be conducted ashore.

Repeated temperature logging in hole 1188F gave a highest temperature of 314 degC at 360 mbsf (depest point accessible for logging) after 8 days of rebound. Early termination of the leg also prevented a comparable time series at 1189B where, however, temperature near the base of the stockwork zone increased (perhaps more rapidly) from that of the drilling fluid to 67 degC in 12 hours. Water samples were collected at both sites. Although temperature limitation of the WSTP tool (65 degC, not in fact achieved because of uncertainty regarding rebound rates) and dilution with drilling fluid and/or ambient seawater constrain the value of these, shipboard analyses of Mn and Fe contents promise that at least two samples will allow approximate estimation of subsurface hydrothermal component compositions.

3. Some suggestions for the future

The fine grained alteration assemblages encountered on this leg were not amenable to hand specimen or petrographic microscope characterisation. XRD analyses were invaluable, and it was fortunate we had a highly competent expert in clay mineral identification among the science party. Interpretations using an IR spectral analyser taken on the leg were initially affected by instrument malfunction - as experience was gained some interesting results were obtained, though rather too late to be useful in guiding interpretations. Analytical SEM capabilities aboard would have been a great advantage, allowing prompt acquisition of electron-beam petrographic and mineralogical data that would have resolved important questions raised during shipboard interpretations, here necessarily left to post-cruise research. If further legs devoted to hydrothermal systems are contemplated, possible acquisition beforehand of a medium-resolution SEM with an EDS analytical system is highly recommended.

Reliance on ICP-AES chemical analysis rather than XRF detracted from our ability to use rock compositions to help us understand the cores being recovered so as to develop optimal description procedures early in the piece. Difficulties were experienced analysing sulfide- and sulfate-bearing samples (the greater majority) and much time was spent initially on protocols and calibration. Early results were of questionable validity, and by the time this was overcome (for some rocks) the data were much to late to build effectively into shipboard reports, let alone guide core description and interpretation. I am not sure we reached a level of experience that would help future legs encountering similar materials to avoid the problems, but I strongly suspect we could have overcome them more rapidly had the XRF spectrometer remained aboard.

We ran out of time before Leg 193 trying to fund and manufacture a water sampler capable of handling expected maximum temperatures (~ 300 degC), preventing what would have been a breakthrough achievment. Nevertheless, as soon as possible after logging borehole temperature profiles we deployed the WSTP tool (modified at inlet and to take a larger sample) despite its relatively low temperature limitation (batteries 65 degC, electronics 70 degC). This actually worked quite well. For future hydrothermal legs, consideration should be given to building a similar tool in which the temperature-sensitive components are protected for a sufficiently long period (few hours), e.g. by enclosure within a Dewar.

As for future drilling options in hydrothermal legs, the SDS Digger Tools hammer-in casing system has clearly proved its value, as has ADCB. Several improvements to the diamond drilling technology deserve consideration. First, the core catcher system needs improvement (from rubble subsequently encountered in the hole, many of our zero recoveries were due to wash-out)

- perhaps a dual catcher system that will retain both whole and fragmented core. Secondly, a suitable core liner system must be developed. We operated ADCB without liners, and the tendency for core to expand along fractures meant it often became jammed in the barrel, requiring it to be hammered out generally leading to mangled samples. Polycarbonate liners like those used for RCB are easily opened but melt at high hydrothermal temperatures. Thin unsplit steel liners avoid this latter problem, but expanding core is still likely to jam and a different system for opening (angle grinder of tungsten carbide saw?) would be needed. Split steel liners as used on land will still jam if the core expands. Thirdly, despite their expense, systems under development for changing diamond bits without tripping would be a great time-saving advantage.

In regard to logging, LWD has also demonstrated its value for dealing with high temperature sites. As it happened, rebound conditions allowed us to use higher resolution wireline FMS except for the topmost 30m, but that would not necessarily apply in future hydrothermal legs.

Finally, returning to science, there would be two desirable further achievements at the PACMANUS site. One would be close-spaced shallow drilling to delineate more fully the lateral changes in alteration pattern and the hydrothermal conduits under chimney sites. Such a program using PROD was intended prior to Leg 193 but was abandoned for technical reasons. It is by no means unnecessary now. The other is for even deeper drilling. If the 314 degC temperature recorded at 360m in 1188F reflects thermal gradient (initial interpretation) rather than a localised hydrothermal conduit, then the magma or consolidated intrusive body forming either or both the heat engine and partial fluid source could lie at a depth of only 1.5 km below the crest of the dacite ridge at PACMANUS. Experience gained during Leg 193 shows the technology exists now for even deeper penetrations than the 400m we achieved. With this, or with riser drilling proposed for IODP, we could penetrate and investigate the very deepest levels of this already part-explored hydrothermal system and examine the so-far elusive high temperature reaction zone.

It is my great pleasure to report that I consider Leg 193 to have been outstandingly successful, and I repeat that the Staff Scientist, Operations Manager, ODP engineers and technicians deserve much credit for this success. Also I can say it was a very happy leg. The scientific party worked together particularly well, and relations betwen scientists, ODP and TFS staff were always excellent. Personally, participation in and leadership of Leg 193 was a great honour and the highlight of my career.

I extend my apologies to the SCICOM, and to the Chinese hosts. I was definitely looking forward to attending, and wish you a successful meeting.

Ray Binns
Co-Chief Scientist, Leg 193

Dr R A Binns
CSIRO Exploration and Mining
PO Box 136 North Ryde NSW 2113 Australia
Tel: +61-2-94908741 (H) +61-2-48836069
Fax: +61-2-94908921
e-mail: r.binns@syd.dem.csiro.au

DRAFT MINUTES

JOIDES SITE SURVEY PANEL MEETING

Feb 25 - 27 2001
Banff, Canada

Members*: Diebold, John (*LDEO, NY, USA*) -- Chair

Caress, David (MBARI, USA)
Droxler, Andre (*Rice U., USA*)
Enachescu, Michael (*Husky, Canada*)
Kleinrock, Martin *(VU., USA)*
Kuramoto, Shin'Ichi *(GSJ, Japan)*
Holbrook, Steve *(UWYOM, USA)*
Lee, Chao-Shing *(PACRIM)*
Lizarralde, Daniel (GA Tech, USA)
Lyle, Mitchell *(BSU., USA)*
Mallinson, David (*USF, USA)*
Meyer, Heinrich *(BGR, Germany)*
Lewis, Stephen *(CSU, USA)*
Scrutton, Roger (*UK*)
Yao, Bochu (GMGS, China)

Liaison: Janik, Aleksandra (JOIDES Office)
Klaus, Adam (*ODP/TAMU*)
Shipley, Tom (*SCICOM/OPCOM*)
Quoidbach, Daniel (*ODP Data Bank*)
Claypool, George (*PPSP*)

Apologies:
Anselmetti, Flavio (*ESF*)
Leroy, Sylvie(*France*)

*: Last meeting for this member

1 **Preliminary Matters** (Enachescu, Diebold, Quoidbach)
- **1.1** Introduction of members, liaison, guests and meeting logistics.
- **1.2** Charge and procedures for the meeting
- **1.3** Greet new members - Droxler, Lewis, Mallinson, Scrutton
- **1.4** Watchdog assignments and feedback to proponents

2. Reports

- 2.1 JOIDES (Janik)
- 2.2 PPSP (Claypool)
- 2.3 ODPDB (Quoidbach)
- 2.4 TAMU (Klaus)
- 2.5 SCICOM/OPCOM (Shipley, for Kevin Brown)

2.6 SCIMP ad Hoc Committee (Diebold/Quoidbach)
2.7 ISSEP/ESSEP Enachescu, Lyle

3. Site Survey Status Of Upcoming Scheduled Legs For 01, 02

3.1 Leg 195: West Pacific Ion 431 + 505 – Full3: Mariana Convergent Margin Subduction Factory (Holbrook) PPSP

3.2 **Leg 196:Nankai II**
Proposal #:572
Target Type: C(Active margin)
SSP Watchdog: Diebold
SSP Proponent(s): None
SSP Review: The cruise prospectus for this leg includes three sites, ENT–03, ENT-01,and hole 808. Migrated crossing lines from the Ewing Nankai 3D data set have been submitted to the data bank, and the data set is adequate for drilling. It is expected that more extensive amounts of further processed data will be available in IESX format by the time the cruise sails.
SSP Consensus: All sites in the cruise prospectus are backed by data in the Data Bank
Site Survey Readiness Classification: 1A.

3.3 **Leg 197: Hawaiian/Emperor Hotspot**
Proposal #: 524
Target Type: G (elevated feature)
SSP Watchdog: Diebold
SSP Proponent(s): None
SSP Review: Through the efforts of Data Bank personnel, all proposed sites had been previously brought to a status of 1A. Due to clearance problems, there is now a need to select an alternate to the northernmost site.
SSP Consensus: Proponents must work with the Data Bank to select an alternate site for which adequate data exist.
Site Survey Readiness Classification: 1A/1B

Leg 198: Extreme Warmth/Shatsky Rise
Proposal #: 534
SSP Watchdog: Lyle
SSP Proponents: None **Target type(s): all Sites D**
SSP Review: A bathymetric map was submitted as part of the PPSP report. This has resolved the one previously remaining issue about site SHAT-13.

SSP Consensus: Ready to drill
Site Survey Readiness Classification: 1A

3.4 **Leg 199: Paleogene Equatorial Pacific APC**
Proposal #: 486
Target Type: A
SSP Watchdog: Diebold
SSP Proponent(s): Lyle
SSP Review: The data package for this proposal has been classified as 1A for over a year now.
SSP Consensus: No new sites, no sites have been moved, Proposal is ready to drill.

Site Survey Readiness Classification: 1A

3.5 **Leg 200: H2O Observatory - Drilling fast spread Pacific crust at the H2O long term seafloor observatory**
Proposal #: 500 **Target Type: E**
SSP Watchdog: David Caress
SSP Proponent(s): NA

SSP Review:
This scheduled drilling leg 200 will drill a reentry hole at the Hawaii-2 Observatory (H2O) site in the eastern Pacific; a broadband seismometer will be installed within the hole as part of the worldwide ION program. As of the July, 2000 review, the proponents had designated drilling sites and provided a package of figures satisfying the site survey requirements, including site locations and annotated SCS and 3.5 kHz records.

SSP Consensus: All required data are in the Data Bank.
Site Survey Readiness Classification: 1A

3.6 Leg 201 Full Peru Margin deep biosphere
Proposal #: 571
SSP Watchdog: Meyer
SSP Proponent(s): None

SSP Review: Proponents, as well as DB personnel, have done a lot of work on the data package since the previous meeting.

SSP Concensus: The data package seems complete, and has been approved by PPSP>

Site Survey Readiness Classification: 1A

3.7 Leg 202 465 SE Pacific Paleoceanography 465 (Lyle) 1A but final sites not yet chosen

3.8 Leg 203 544-Full2 Costa Rica Subduction Zone (Holbrook) 1A
Costa Rica Subduction Zone (544) - Proposal Title: Fluid Flow, Seismic Cycling, and Pressure-Temperature Characteristics of the Costa Rica Subduction Zone

Proposal #:544-Full2 **Target Type: C, D**
SSP Watchdog: Dan Lizarralde (July 2000)
SSP Proponent(s): Eli Silver

SSP Review:
Sites 1039-S and 1039-T, previously not on a seismic line, have been moved eastward to lie on seismic line CR-30. Now all Sites lie along existing seismic lines. Although no cross lines exist through the 1039X Sites, Lines CR-20 and 30 are only ~1.5 km apart and exhibit very little lateral variability. All Sites are now considered 1A in site survey readiness.

SSP Consensus: Sites 1040R and 1043R lie close enough to previously drilled sites to be considered 1A. Sites 1039R,S and T lie along closely spaced seismic lines within a clear stratigraphic context of Leg 170 Sites 1039, 1040 and 1043. These Sites are now also considered 1A.

Site Survey Readiness Classification: 1A

3.9 **Leg 204: Gas Hydrates on Hydrate Ridge**
Proposal #: 546
Target Type:
SSP Watchdog: Diebold
SSP Proponent(s): None
SSP Review: We assume sites may be relocated on the basis of high resolution 3D MCS data acquired during June 2000. No new sites have been submitted, and we still await the processed 3D data set.
SSP Consensus: The classification of the data package for this leg remains 2A. Processed high resolution 3D data should be submitted to the Data Bank as soon as available.
Site Survey Readiness Classification: 2A

3.10 Leg 205 499 – Rev: Equatorial Pacific ION (Caress) 1A since '98

4. Highly Ranked by SCICOM, AUGUST 2000

4.1 **533-Full2: Paleoceanographic and tectonic evolution of the Central Arctic Ocean**
SSP Watchdog: Lyle
SSP Proponents: None
Target type(s): A/B/G [Alternate Platform Required]

This proposal was first examined at the February 2000 SSP meeting, and this is the third examination of the data package. New data has arrived—swath bathymetry from the SciCex cruise, a trackline map with shotpoint navigation, and data supporting 5 new drillsites.

The proponents have chosen to provide a series of alternate sites and alternate strategies to collect a Neogene-Paleogene section of sediments from the high Arctic and to sample the older continental margin sediments underneath a prominent unconformity. Site Survey Panel has encouraged similar strategies in other environments difficult for drilling, and we believe that this is also the proper approach here. The proponents also want to define drillsites as a length of seismic line between shotpoints. Again, this seems to be a proper strategy in a difficult environment. The proponents should be prepared to narrow the shotpoint range they propose since the proposed ranges now cover the entire top of the ridge.

There is a cruise on the Oden scheduled for August 2001 for crosslines on the sites nearest the pole (some combination of LORI-1,-3,-8, and –9) and we look forward to seeing this new data when it becomes available.

Comments about specific sites: For all sites with proposed 400-500 m penetration—a velocity in unconsolidated sediments of >2 km/sec is unrealistic and it is unclear how close the deep drilling will come to the unconformity. Better velocity information is needed, perhaps by sonobuoys on the summer surveys.

The SciCex chirp subbottom profile data is missing still. In the case of LORI-04 and –05, these data could provide crossline information that is currently missing.

All sites penetrating the unconformity need significant information about velocity and better control about the geometry of the sediments beneath the unconformity. Because these are margin sediments, there is a potential of hydrocarbon accumulation that must be avoided.

SSP Consensus: Significant data in support of this drilling proposal have been deposited in the data bank. A significant amount of important data are missing but should be collected for several of the sites in August 2001 for a subset of the sites. We thank the proponents for their efforts to complete this data package and look forward to reviewing it in the next year.

Site survey readiness status: Classification 2B-substantial items of data missing but should be collected on a scheduled cruise-Sites LORI-01,-03,-08,-09. Classification 2B or 5 (impossible for drilling in FY2003 because significant data are missing and no cruise scheduled to get data)—LORI-04, -05. Classification 5—LORI-06,-10,-11,-12

4.2 525-Full: Proposal for Drilling Mantle Peridotite along the Mid-Atlantic Ridge from 14° to 16° N

Target Type: F
SSP Watchdog: Kleinrock
SSP Review: This proposal is for drilling of mantle peridotites along the Mid-Atlantic Ridge from 14° to 16°N, where igneous crust is locally absent and the structure and composition of the mantle can be determined at sites over 100 km along strike. Focus of study is on 3D vs 2D upwelling below a slow spreading ridge. There are 7 primary and 4 alternate sites, all of which are classified as Target Type F: hard-rock drilling. This target type requires the following data types for drilling: swath bathymetry, photography or video over site, rock samples, and navigation. A substantial amount of data has been deposited into the data bank.

Regional swath bathymetry was submitted to the data bank, but it is insufficient for drilling. SSP requests enlarged swath bathymetry maps for each site with the site marked. Dive videos exist for all primary sites and 3 of the 4 alternate sites; however, only the Shinkai videos have been submitted to the data bank at this time and the SSP requests that the Nautile dive tapes be deposited in the data bank. Descriptions of rock samples for all sites are in the data bank. SSP requests that the bathymetric maps with compiled sample locations for all known dredging and submersible cruises be submitted to the data bank. Plots of all dives exist in the data bank; it is recommended that digital navigation of these dives also be supplied. The site survey readiness status of these sites is ranked 2A

Given the extremely high ranking of this proposal, the proponents <u>are very strongly advised</u> to get their site survey package completed prior to the 1 July 2001 data submission deadline. This is <u>the last chance</u> for submission for Site Survey Panel to designate the project as drillable prior to the final ODP scheduling meeting of SCICOM/OPCOM in August 2001.

As an aside, we note the recent success of new technology for bare-rock drilling; the proponents should consider its potential.

SSP Consensus: No new data have been submitted to the data base and thus the SSP consensus remains the same. The following data is believed to exist, and is requested for submission to the data bank: enlarged swath bathymetry maps for each site with the site marked, Nautile dive videos, bathymetric map with compiled sample locations, and digital navigation of Shinkai and Nautile dives. This proposal is extremely highly ranked, and it is essential that a final site survey package be provided to the ODP data bank prior to 1 July 2001.

Site Survey Readiness Classification: 2A

4.3 455-Rev3: High Resolution Transects of Laurentide Ice Sheet Outlets

Target Type: A/B
SSP Watchdog: CS Lee
SSP Proponent(s): None

SSP Review: The Data Bank have run an inventory before this panel meeting in Feb. 2001 and no new data was found. Since the proposal is highly ranked by the SCICOM, we would like to encourage the proponents to submit the missing data and a new drilling strategy as stated in the previous July 2000 SSP review. It is essential to submit the data before the July deadline (for July 2001 SSP meeting and subsequently for August 2001 SCICOM meeting).

SSP Consensus: Since no new data has been submitted, the site survey readiness remains unchanged. Proponents should make every effort to complete the data package.

Site Survey Readiness Classification: 1A/2A.
1A for sites HUD01A-HUD07A, and LAW02A-LAW05A;
2A for sites HUD08A, LAW01A, and LAW06A.

4.4 **559-Full: Early Cenozoic climate: The Walvis Ridge Transect.**
Target Type: A
SSP Watchdog: Yao Bochu

SSP Review: The proposal is a suggesting six ODP well sites which uses the high resolution seismic profiles on the Southern Atlantic margin and hope to recover fully intact sequences of sediments deposited at water depth between 2500m and 4500m. These data will be used to reconstruct in detail the paleoceanographic variations associated with several prominent episodes of early Cenozoic extreme climate change including the Latest Paleocene Thermal Maximum(LPTM),the Early Eocene Climate Optimum(EECO), and the Early Oligocene Glacial Maximum(EOGM).But the proposal well data were used in the DSDP Leg 74, the low resolution seismic data. The new site survey data didn't do, but they plan to collect the high resolution seismic data in this year, therefore, there haven't new site survey data in the Data Bank. So I believe that this proposal is not complete, and need to do additional site survey data.

SSP Consensus: A survey, aboard Meteor, is scheduled for Jan, 2002. We encourage proponents to submit data from that cruise by the July 1 deadline.

Site Survey Readiness classification : 3A

4.5 **564-Full New Jersey Shelf**
Target Type: A and secondary B
SSP Watchdog: Michael E. Enachescu
SSP Proponent(s): None

SSP Review: This proposal consists of three shallow water (33 to 36 m) holes located on the New Jersey/Mid-Atlantic Sea-Level Transect (MAT) and demanding each for 762m (1000ft) sediment penetration. All sites are located on the New Jersey inner shelf and are beyond Joides Resolution safe operation capabilities. Drill funds should be secured from different sources including ODP. The holes must be drilled using an oil industry jack up platform. Exept for a new ranking by SCICOM during

August 2000 (rank 10), nothing significant happened since July 2000 SSP meeting. We are aware that proponents are working on seismic stratigraphic interpretation and site survey report, however, no new data has been deposited with DB and therefore we are repeating here the observations that were made during July 2000 meeting.

Numerous multi-channel and high-resolution data sets related to MAT were inspected prior to leg 150 and 174. The various sets exist in the DB but must be repackaged to address the specifics of the new proposal. Swath bathymetry and sonar data is available, but not yet in the DB. We insist tat the proponents to complete and organize the data and re-write specifics site survey description forms after a final selection of the drillsites MAT-1 to MAT-3. It is understood that final drill sites will be selected after analysis and review of CH0698 hazard grid.

We expect that a detail seismic stratigraphic study and associated maps of the main interpreted sequences that were prepared for the SSEP review will be included with the proposal. They are absolute necessary to support the scientific objective of the MAT transect and allow for regional correlation of markers. All this remaining repackaging and documenting of the new selected sites should be received at the DB prior to the deadline of July 2001 SSP meeting.

SSP Consensus: The SSP acknowledges that most of the required data for this type of site is in DB, but must be properly organized. Final sites, once selected and displayed on data, should be analyzed and discussed by the panel. All required missing data, final site location and attached stratigraphic study should arrive at DB prior to July 2001 meeting. The authors should present all data and a detail site survey hazards report should be prepared on behalf of the marine drilling contractor. This site survey report should be tabled with the SSP.

Site Survey Readiness Classification: 2 A

4.6 **539-Full2: The Dynamics of Methane Cycling in a Large Gas Hydrate Deposit on the Blake Ridge**
Proposal #: 539-Full2 Target Type: B
SSP Watchdog: S. Kuramoto
SSP Proponent(s): S. Holbrook

SSP Review: This proposal was reviewed by SSP in February 26, 2001 at Banff, Canada. DB has been received several seismic data which were taken by the R/V Ewing cruise last year. SSP appreciates to the proponents that the data set looks very high quality and high resolution data. The data set is composed of 2-D and 3-D data. Current proposed sites are BRC-1, -4A, -4B, -4C, -4D, -4E, -5, -6, -10 and –11. The proposed sites are covered by the new seismic lines. Navigation data with bathymetry also stored in the DB. SSP requires 3.5 kHz sub-bottom profiles to store to the DB. The profiles are existing. Also SSP requests to send the description of seismic data acquisition (survey configuration) of the last cruise. Proponent will process the 3-D data, we recommend to do the mapping of gas hydrate BSR amplitude by the 3-D data. It will be quite useful to find the most significantly changing point of the BSR amplitude in the 3-D seismic survey box. It could be helpful.

SSP Consensus: We ask the proponents to send additional required data (3.5 kHz profiles) to the DB as soon as possible, no later than July 1st, 2001.

Site Survey Readiness Classification: 1B

4.7 **512-Full2: Quantifying the Processes of Oceanic Core Complex Formation**
Target Type: F plus

SSP Watchdog: Kleinrock
SSP Proponent(s): NA
SSP Review: In order to study the formation of oceanic core complex massifs, the proponents propose to drill a series of holes to bit destruction (expected to be ~100m deep, hole might be deepened) in the gabbroic and ultramafic rocks exposed in the foot wall of a detachment fault at the Western RTI of the MAR-Atlantis FZ. In addition, a single hole to bit destruction is proposed through a hanging wall block and the detachment below.

Given the extremely high ranking of this proposal, the proponents are very strongly advised to get their site survey package completed (as discussed below) prior to the 1 July 2001 data submission deadline. This is the last chance for submission for Site Survey Panel to classify the project as drillable prior to the final ODP scheduling meeting of SCICOM/OPCOM in August 2001.

Congratulations on an excellent site survey cruise--including the spectacular chimneys found! Thank you for submitting the Marvel Cruise Report, the multibeam and gravity grids and images, and the DSL-120 trackline info. The sample sidescan image provided in the cruise report looks very good indeed
In order for the data package to be completed, there are several items that need to be deposited in the ODP data bank:
1. From the Marvel cruise: navigation of all collected data (DSL-120, Argo-II, Alvin) the rest of the DSL-120 imagery, the processed DSL-120 bathymetry, the video and photography, and summaries of the bottom observations.
2. The final processed seismic data (all data, including reflection, refraction, and Nobel).
3. A description of the rock samples from the area. For the CD100 dredges, this can be satisfied by submitting reprint of Blackman et al. (1998). For Alvin and new dredge samples, new descriptions are needed.
5. Magnetics (both surface and near-bottom), and seafloor gravity.
6. Preliminary data to be collected during the upcoming MCS cruise on R/V Ewing should be forwarded to the Data Bank as soon as they become available, as the objective of drilling through the upper block to the fault will benefit greatly by getting knowledge of where the fault is.
7. Specification of proposed drill sites and complete Site Survey Detail forms for a modified Target-type F (bare rock drilling) for each proposed site (as described in the accompanying form). The ranking of 2A is tentative, depending on final specification of sites and objectives.

As an aside, we note the recent success of new technology for bare-rock drilling; the proponents should consider its potential.

SSP Consensus: The panel commends the proponents on their recent data collection and initial submissions to the data bank. Much remaining data are collected and need to be finally processed and submitted prior to the 1 July 2001 deadline.
Site Survey Readiness Classification: 2A (pending final siteselection)

5. Forwarded To SCICOM For Consideration

5.1 519 Full2: The Last Deglacial Sea-Level Rise in the South Pacific

Target Type:A [*Alternate Platform Required*]
SSP Watchdog: Scrutton
SSP Proponent(s):None
SSP Review: There has been a small but significant advance since the last SSP meeting in that a site survey cruise for the Tahiti transects has been secured on board l'Atalante in 2002 for dredging, high-

resolution seismic and bathymetric data. Unfortunately, apart from this nothing has progressed since July 2000 and there is still no data submitted for either the Tahiti or Great Barrier Reef transects. Moreover, there are outstanding comments from SCICOM to respond to and some doubt over the availability of the PROD alternative drilling platform. Also, the timing of the l'Atalante cruise may preclude the science being programmed as a component of the ODP bearing in mind the end date of the program of September 2003.
Thus, Tahiti will probably be in good shape to drill as target type A following the l'Atalante cruise. Site survey data are believed to exist for the Great Barrier Reef sites but are not yet at the Data Bank

SSP Consensus: The scientific reviews of this proposal are good and the SSP would like to see the proponents make every effort to continue to prepare it for drilling. They are urged to submit the necessary data for target type A to the Data Bank as soon as possible for the Great Barrier Reef and as soon as practicable after the site survey cruise for Tahiti.

Site Survey Readiness Classification: Overall, 3A

5.2 **522-Full2: An In Situ Section of oceanic crust spread at superfast rate**
Target Type: E
SSP Watchdog: Caress
SSP Proponent(s): NA
SSP Review: The proponents propose to drill a complete upper crustal section including volcanic rocks, sheeted dikes and into gabbros in 15 Ma crust generated at a superfast spreading ridge.

An addendum to the proposal and a data package was submitted prior to the July 2000 SSP meeting. Based on results from MCS and OBH tomography, the proponents changed the primary site, with a new designation of GUATB03B. The SSP requested some additional data items, and classified site GUATB03B as 2A. No new data have been submitted to the databank prior to the February 2001 SSP meeting, so the SSP ranking and requests for this proposal remain unchanged.

The proponents should be aware that the final opportunity for drilling legs to be scheduled in the ODP program will occur this August, 2001. Consequently, the July 2001 SSP meeting will be the last chance to achieve the 1A SSP ranking required for this proposal to be considered drillable in the current program. SSP strongly encourages the proponents to submit the required data to the databank by the July 1, 2001 deadline.

The previously submitted data package includes a location map, processed lines 21 and 22, and results from OBH 2D refraction tomography along lines 21 and 27. Site GUATB03B is located on MCS line 22, between crossing lines 26 and 27.

SSP requests additional justification for the placement of site GUATB03B between crossing lines. The tomography results for lines 22 and 26 should be submitted to the databank prior to the July 2001 SSP meeting. SSP also requests an MCS navigation plot annotated with CDP or shot number, new MCS with CDP/shot number and time annotation, and a location figure showing the location of the gravity core. SSP recommends that the proponents select alternate sites in the GUATB03 seismic grid, and that they indicate whether GUATB03A is considered an alternate site.

SSP Consensus: Substantial items of required data are not in the Data Bank but are believed to exist and are likely to be available in time for consideration for FY2002 drilling schedule.
Site Survey Readiness Classification: 2A

5.3 **561-Full3: The Caribbean Large Igneous Province (CLIP)**
Target Type:S & VB, D; BR, G
SSP Watchdog: Scrutton
SSP Proponent(s):J Diebold, S Leroy
SSP Review: The proposal has very good external reviews and the proponents have responded enthusiastically to review comments by SCICOM. The proponents model, based on a considerable amount of existing geological and geophysical data suggests that the CLIP offers the opportunity to study igneous emplacement processes and geochemistry both laterally and vertically through the province. The only negative aspect of an otherwise exciting proposal is that the drilling targets are ambitious.
Four sites are proposed. S6A in the Colombian Basin is a reentry of OD site 999 to deepen 300m through sediments and then 150m into basement. All the site survey data to satisfy type D target will be in the Data Bank. Sites BR3A and 4A are an offset drilling pair on the western, steep slope of the Beata Ridge. These are rentry sites planned to penetrate 500m into basement beneath 100m of sediments. Following a recent submission of seismic reflection data to the DB there is sufficient of this data for drilling. However, velocity data, 3.5kHz, multibeam bathymetry and seabed sampling data, although thought to exist, are not yet submitted, with the exception that the Nautile dive data are in the proposal. There are alternate sites BR1A and BR2A 50km to the south for which the same data situation pertains, but details of these sites are not in the proposal. These details are needed. Site VB3A is a reentry site planned to penetrate over 800m of sediments and then 800m into basement. For this, velocities and seabed sediment information are not yet in the DB though sufficient data is thought to exist. The situation is the same for the alternate site VB4A. Although these target type D sites are not on seismic profile crossing points it is felt that there is sufficient seismic data in their vicinity to be aware of any geological variability in the third dimension.

SSP Consensus: SSP believes that all necessary site survey data exist and would encourage the proponents to continue to assemble the database for this exciting proposal. Details of alternate sites BR1A and BR2A are needed.
Site Survey Readiness Classification: 2A overall

5.4 **577-FullAdd2: Demerara Rise: Equatorial Cretaceous and Paleogene Paleoceanographic Transect, Western Atlantic**
Target Type: B
SSP Watchdog: CS Lee
SSP Proponent(s): None

SSP Review: No additional data has been received by the Data Bank since July 2000. Therefore, the site survey readiness remains the same:

1A for sites DR-1, DR-6 and DR-7;
2B for sites DR-2, DR-3, DR-3alt, DR-4, DR-5, DR-6alt and DR-8.

The proponents have previously indicated that they have funds to collect the site survey data (high resolution single channel seismic data, sea beam, and core samples). Since this proposal is highly ranked and the SCICOM will decided on the legs for 2003, the last opportunity for the ODP phase, in August of this year, we would like to encourage the proponents to submit the required site survey data before the July deadline and this panel will review the data in next meeting.

The proponents have sent an addendum regarding the biochemistry objectives in Oct. 2000. It will be evaluated by the ESSEP panel.

Site Survey Readiness Classification: 1A for DR-1, DR-6 and DR-7; 2B for others (lack of crossing lines).

5.5 **584 – Full: TAG II: Evolution of a Volcanic-Hosted Hydrothermal System on a Slow Spreading Ocean Ridge**
Target Type: F
SSP Watchdog: Lizarralde
SSP Proponent(s): M. C. Kleinrock
SSP Review: This proposal seeks to drill at 5 of the identified mounds in the TAG hydrothermal region in order to extend the work of Leg 158 and continue investigations into the evolution of hydrothermal systems and the nature of the deep biosphere.

Site 1 is located in the Leg 158 active mound area, for which there is adequate site survey data, and its readiness was considered 1A at the July 2000 SSP panels.

The most recent data submission includes (among other items) bottom photography, video, and catalogues of existing data for each of the remaining sites that have been acquired through several submersible dives and deep-tow surveys. As for Site 1 (Active mound), it is clear that sufficient data now exist in the databank to site drill holes at the 4 other mound areas (Alvin, Mir, Shinkai, and Shimmering mounds). All 5 proposed sites are now considered 1A.

SSP Consensus: The proponents have submitted individual data packets for each of the five proposed sites. This submission was responsive to all of the site survey needs identified by the SSP. The data packets for each site contain bathymetric and bottom photography data required for hard-rock bottom site survey, and all sites are now considered 1A.

Site Survey Readiness Classification: 1A, Sites 1, 2, 3, 4, and 5

5.6 **APL-14: Pleistocene Kuroshio Paleoceanography: Transient On-Site Drilling in the Southern Okinawa Trough, Western Pacific**
Target Type: A
SSP Watchdog: Kuramoto
SSP Proponent(s): C.S. Lee

SSP Review: All required data were deposited in the DB in time for the last [July,2000] SSP meeting. We suggested that the proponents supply Kuroshio current information in the drilling area. The proponents kindly sent this data immediately, and there appears to be no problem for drilling.
SSP Consensus: Ready to drill.
Site Survey Readiness Classification: 1A

6. SSEPs Sent For External Review

6.1 **543-full2: Proposal for Installation of a CORK in Hole 642E to Document an Monitor Bottom Water Temperature Variations Through Time**
Target Type: B
SSP Watchdog: Kleinrock
SSP Proponent(s):
SSP Review: This proposal is to CORK ODP hole 642E (a legacy hole) to determine temperature as a function of depth and infer changes in temperature of bottom water as a function of time. There are no data presently in the data bank that are associated with this proposal, but Leg 104 drilled the hole originally, so there are presumably many data available. The proponent is encouraged work with the Dan Quoidbach of the ODP Data Bank to assure that all necessary data are placed in the appropriate .

SSP Consensus: The panel feels that all site survey data exist and are probably already are in the data bank under Leg 104. The data need to be reassigned to Proposal 543.

Site Survey Readiness Classification: 2A

Oceanic Subsurface Biosphere (Lewis) *New* sites, old data. Probably a 2A,but Hard to tell without serious work by proponents and DB.

6.2 **547-Full3: Oceanic Subsurface Biosphere (OSB): Exploring its Nature and Extent**
Target Type: E
SSP Watchdog: Lewis
SSP Proponent(s): None
SSP Review: The Ocean Subsurface Biosphere (OSB) proposal is a new and unique scientific theme for ocean drilling in a relatively mature and well-explored segment of the Juan de Fuca Ridge. Extensive data from previous geophysical, geochemical, and drilling programs are available in the region of this new proposed drilling. Thin sediment cover (<200 m), modest proposed basement penetration (100 m) and proximity to existing ODP drillsites makes leverage of existing site survey data feasible.

SSP Consensus: The proponents are urged to work closely with the ODP Data Bank to compile the relevant existing data from Middle Valley into a complete stand-alone data package in support of this drilling proposal. The proponents must make sure that the data required for this drilling environment are available for SSP review at its July 2001 meeting. The July 1, 2001 deadline for the receipt/compilation of data by the ODP Data Bank is an important deadline for this proposal to remain eligible for drilling by the current program.

Site Survey Readiness Classification: 2A

6.3 **548-Full2: Chicxulub: Drilling the K-T Impact Crater**

Target Type: B **[*Requires Alternate Platform*]**
SSP Watchdog: Lewis
SSP Proponent(s): None
SSP Review: This proposal defines drilling targets in the offshore Yucatan Peninsula on the Chicxulub inpct crater, hypothesized to be the impact resulting from the end Cretaceous event. This is a very timely and complex topic of scientific investigation that is amenable to scientific ocean drilling, given that a substantial portion of the Chicxulub structure is offshore. Land seismic reflection data from the northern Yucatan Peninsula are often of poor quality due to karst and cenote sturctures common tot he region.

This makes offshore investigations of the impact sturcture particularly attractive, where marine seismic techniques typically provide much higher data quality than onshore seismics.

The centerpiece of data reviewed by the SSP at this meeting was seismic Line Chicx-A, a BIRPS reflection profile acquired across the offshore northern flank of the impact structure. Crustal reflection events to Moho are imaged clearly in the data, including the shallow features directly related to the impact; 1) the central crater basin, 2) the annular trough, the peak ring structure, the crater rim, and the outer ring. However, the SSP was surprised to lean how little publically-available seismic and other geopysical data have been acquired over the Chicxulub structure in the 20 years that it has been hypothesized to be related to the end-Cretaceous impact event. We strongly support the proponents' efforts to acquire a 3-D seismic data set to augment the existing deep-penetration 2-D profiles.

The SSP recommends to the proponents that:
4 The upper 5 seconds or so of the deep-penetration BIRPS seismic data be reprocessed to optimize the stratigraphic and structural imaging of the Chicxulub structure at a resolution more compatible with drilling observations.
5 Special attention be paid to ODP guidelines for both shallow-water drilling and passive margin drilling during future site-survey data acquisition.
6 Special attention be paid to Pollution Prevention and Safety Panel guidelines for shallow-water drilling.

Please note that July 1, 2001 is an important deadline for receipt of data by the ODP Data Bank for review at its July 2001 meeting,

SSP Consensus: Drilling proposal addresses a new class of target for ODP, and represents exciting scientific opportunities. The proposed 3-D program is important to the requirements for site survey requirements.

Site Survey Readiness Classification 4

6.4 **554-Full4: Gas Hydrates in a Petroleum Basin**
Target Type: B and secondary A
SSP Watchdog: Enachescu
SSP Proponent(s): None

SSP Review: This recently received (Sept 2000) gas hydrate proposal consists of a series of drill holes at two slope sites in the north central Golf of Mexico. A total of 19 holes (GC-1 to 9, MC-1 to 5 and AT-1 to 5) are located, combining shallow (100-200m) and deep (200-500m) penetration at water depth between 500 and 1900m. The objective of the proposal include among others: the measurement of mass and phase distribution of gas hydrates and associated gases in shallow marine sediments in a high fluid flow regime and effect of gas hydrates on sediment physical properties, inferring potential for geohazards. Gas hydrates in the GOM is controlled by faulting and occurs as shallow vein-filling deposits, not as traditional BSR features. The proposal has received interest from oil companies active in the area. The proposal is scientifically well documented and after several re-writes the hypothesis to be tested and the measurement s program is clearly stated. The multiple-site drilling will provide a 3-D characterization of the biogenic and thermogenic gas hydrate distribution in the areas.

I find difficult to evaluate this proposal as in the log sheet 19 sites are listed and in the text the author proposed only two primary transects (named Garden Banks-425 and Atwater Valley- 425) with two alternative transects for backup. All sites are surveyed with industry 3-D MCS and closely-spaced 3.5 kHz echosounder profiles. Multibeam bathimetry exist in the area but only illustrative maps were provided in the text. An Appendix with site locations and associated geophysical survey is mentioned in the proposal but was not included (missing?) in the watchdog book. In the text is also mentioned that a site survey cruise was planed, proposal for this was submitted to NSF, but no results are yet communicated to the data bank and we need information as the status of this survey to accordingly classify the proposal.

As the date of this meeting, no support data was sent to the DB. However exempt for the site survey all other data is presumed to exist. The proposal needs cleaning with text and documentation to be referred mostly to the final selection of drillsites and site description should be provided for all of them. Geohazard report should be completed. Additional guidance for the main proponents is needed as to the Site Survey Panel requirement.

SSP Consensus: The SP believes that no required data for this type of site is in DB. A site survey cruise was proposed but I do not know if was funded. Data pertinent to the main site and alternates should be properly organized. Final sites, once selected and displayed on data, should be analyzed and discussed by the panel. The safety panel should carefully evaluate all possible drillsites. All required missing data, final site location and proper site description forms should arrive at DB prior to July 2001 meeting. ***We also note that the PPSP has never approved drilling in this type of environment.***

Site Survey Readiness Classification: 7= unclassifiable; no data in DB

6.5 **557-Full2: Storegga Slide Gas Hydrate Drilling**
Target Type: F
SSP Watchdog: Lizarralde
SSP Proponent(s): None
SSP Review: This proposal seeks to drill 7 sites in the region of the Storegga slide, offshore Norway. The goals of this work are to understand the relationship between continental gas hydrate deposits, slope stability, large mass-wasting events, and abrupt release of methane into the atmosphere. No data have been submitted to the databank, and so it is impossible to assess the site survey readiness of these sites. All seven site are thus assigned a readiness classification of 7, "No determination could be made because no data have been submitted to the Data Bank." Examples of data that are generally required for passive margin settings (and which would very likely be required for these sites) include crossing seismic lines through each of the sites and 3.5 kHz data at each site. The proponents indicate that a substantial body of industry and academic data exists for the region, and so many of these requirements could possibly be met with existing data.
SSP Consensus: No data have been submitted to the databank, and so it is not possible to determine the site survey readiness of the proposed sites. The data presented in the proposal are not sufficient in and of themselves for site survey of these sites. The proponents are urged to collect and submit relevant existing data by the July 1, 2001 data submission deadline.

Site Survey Readiness Classification: 7, Sites 1-7

Proposal Title: Ice Sheet-Ocean-Atmosphere Interactions on Millennial Time Scales during the Late Neogene-Quaternary Using a Paleo-intensity-Assisted Chronology (PAC) for the North Atlantic
Proposal #: 572-Full2 **Target Type: A: Paleo environment or Fan (APC/XCB)**

SSP Watchdog: André W. Droxler
SSP Proponent(s):NA

SSP Review:

SSP acknowledges receiving a series of data sets for the proposed leg (series of different and often relatively old vintage often single channel seismic lines, their track lines, the plotted location of the proposed site and known piston core locations).

According to SSP guidelines, there are a minimum of four types of required data sets that make a proposal viable for drilling:

(1) high resolution seismic reflection profile(s) passing through the proposed drill site
(2) 3.5 kHz record across the proposed drill site
(3) Existing sediment core(s) located in close proximity of the drill site
(4) Accurate navigation during the acquisition of these different data sets.

Moreover, the profiles need to be annoted by the proponents. The locations of the proposed sites and the existing piston cores have to be clearly shown on the seismic and 3.5 kHz profiles, as well as the line crossings if a seismic grid exists.

Overall the data set submitted to the Data Bank are still quite incomplete. The submitted seismic profiles and 3.5 kHz lines were often acquired by the R/V *Vema* and R/V *Conrad*. For several proposed sites, the proposed site location does not fall on top of existing seismic line(s).

According to the knowledge of one SSP member newer data sets than the one presented do exist for instance for the area of the Gardar Drift (WHOI cruise in early 1990). Based upon the proposal, we realized that high resolution MCS profiles from the Eirik and Gardar Drifts will be collected sometime but most likely not before 2002. Another set of data will be acquired on the Orphan Knoll in summer 2001.

SSP Consensus:

Based upon the Site Survey Readiness classification scheme, the panel members have classified 572-Full2 as a category "6" proposal: "Not considered because data in the Data Bank do not match present proposal: awaiting new data set and better prepared data set package".

Given the high level of interest for this proposal in the paleo community, the proponents are strongly advised to get their site survey package completed prior to the 1 July 2001 data submission deadline. This is the last chance for submission for Site Survey Panel to classify the project as drillable prior to the final ODP scheduling meeting of SCICOM/OPCOM in August 2001..

Site Survey Readiness Classification: 6

6.7 **573-Full2: Modern Carbonate Mounds: Porcupine Basin**
Target Type: B: Passive Margin
SSP Watchdog: André W. Droxler
SSP Proponent(s): NA
SSP Review: SSP acknowledges receiving a series of data sets for the proposed leg (bathymetric maps, seismic grids, high resolution single channel and multi channel seismic lines, and core descriptions). The panel members were impressed by the high quality of the submitted high resolution single channel seismic lines and the large and diverse data sets that have been and will be submitted in the near future to the Data Bank. Given the extremely high ranking of this proposal, the proponents are strongly advised to get their site survey package completed prior to the 1 July 2001 data submission deadline. This is the last chance for submission for Site Survey Panel to classify the project as drillable prior to the final ODP scheduling meeting of SCICOM/OPCOM in August 2001.

The sites (PORC-03A, 6A, 7A, and 12A) that are proposed to penetrate mud banks have crossing lines. Swath bathymetry is scheduled to be collected in 2001 for these sites and SSP feels that this type of data will be necessary to locate their final drilling latitude and longitude.

SSP Consensus: The panel was impressed by the overall quality of the submitted high resolution single seismic lines and the seismic images of the different carbonate mud banks proposed to be drilled. At their February 2001 meeting, SSP has classified ODP proposal 573-Full2 as 2A. Substantial items of required data are not yet in the Data Bank, but are believed to exist and are likely to be available in time for consideration for FY 2003 drilling schedule (see details in the attached sites description forms). As we mentioned above, this is the last chance for submission for Site Survey Panel to classify the project as drillable prior to the final ODP scheduling meeting of SCICOM/OPCOM in August 2001.
Site Survey Readiness Classification: 2A

6.6 **575-Full3: Gulf of Aden Drilling: Testing African Climate-Human Evolution Hypotheses**
Target Type: B, D, E
SSP Watchdog: Mallinson
SSP Proponent(s): N/A

SSP Review: The proponents propose to drill eight sites within the Gulf of Aden and on the Somalia Margin in order to link terrestrial records of climate and hominid evolution to the marine record of climate change in East Africa. The sites range from 650 to 2490 m water depth with penetrations ranging from 250 to 800 mbsf. The following objectives will be addressed by the proposed drilling:

7 Determine the late Neogene history of East African climate and vegetation changes;
8 Quantify late Neogene variations in atmospheric and oceanic signatures of variations in the Indian monoon;
4 Develop a comprehensive record of East African explosive volcanism and volcanic ash deposition;
5 Use the paleoclimatic, paleoceanographic, and tephra correlation data to place the fossil record of African hominin evolution within the context of regional and global paleoclimatic change.

Proponents indicate the existence of a substantial data base. Single channel seismic data are presented within the proposal and a follow-up site survey report. These seismic data were deemed sufficient for the purposes of this proposal at sites GOA-1, 2, 3, 4, 5, and 6. Seismic data at sites GOA-7 and 8 are insufficient as these sites will require crossing lines and greater penetration. Velocity requirements for sites can be met with LDEO sonobuoy data.

SSP Consensus: Seismic data have not yet been submitted to the Data Bank, but are known to exist. Please submit all required data to the data bank prior to the July 1, 2001 deadline.
Site Survey Readiness Classification: Sites GOA-1, 2, 3, 4, 5, 6 = 2A
Sites GOA-7, 8 = 5

6.9 **581-Add: Latest Pleistocene Drowned Coralgal Banks and Mounds along the Edge of the South Texas and Mississippi-Alabama Continental Shelves**
Target Type: B [*Requires Alternate Platform*]
SSP Watchdog: David Mallinson
SSP Proponent(s): Andre Droxler
SSP Review:
This is an alternate platform proposal. The proponents propose to use the drill-ship R/V Seaprobe 1 owned by Fugro-McClelland to drill a series of sites within late Pleistocene relict reefs along the Texas and Mississippi-Alabama continental shelf. The sites are at 60 to 98 meters water depth with penetrations ranging from 80 to 100 mbsf. The following objectives will be addressed by the proposed drilling:

9 To shed light on findings that coralgal banks flourished in the Gulf of Mexico during the first part of the last deglaciation;
10 To improve the resolution of the last deglacial sea-level and climate history from late Glacial to the Younger Dryas;
6 To better understand the processes involved with the origin, growth, and demise of carbonate reef tracts along siliciclastic shelves;
7 To use these banks as recent analogs for reefal reservoirs in siliciclastic shelves.

As an alternate platform, shallow-water, shallow-penetration site, many of the requirements for passive margin drilling were deemed unnecessary. Proponents have provided multichannel seismic data for the first five proposed sites on Southern Bank. Data have not been submitted for Baker Bank sites or Mississippi-Alabama sites.

SSP Consensus: The seismic data submitted to the data bank are sufficient for drilling on Southern Bank. Velocity measurements are unnecessary at these shallow penetration depths. Please submit all required data to the data bank prior to the July 1, 2001 deadline.
Site Survey Readiness Classification:

Sites SB-1, 2, 3, 4, 5	**2A**
Sites BB-1, 2	**5**
Sites MS-1, 2	**5**

6.10 **589-Full2:Overpressure and Fluid Flow processes in the Deepwater Gulf of Mexico**
Target Type: B
SSP Watchdog:Diebold
SSP Proponent(s):None
SSP Review: The sites have been chosen on the basis of industry data, which is presumably complete, but none of which has been either released or deposited in the DB. With the possible exception of 3.5 KHz data over the sites, the owners of the industry data are known, and have indicated some willingness to cooperate.

SSP Consensus: The proponents should make every effort to have the proprietary seismic data released to the data bank. Access limitations can be provided by data bank administration. *We also note that the PPSP has never approved drilling in this type of environment.*
Site Survey Readiness Classification: 7 [or 2A, if data are truly available]

6.11 **594-Full: Newfoundland margin**
Target Type: B
SSP Watchdog: Enachescu
SSP Proponent(s): S. Holbrook

SSP Review: This recently received (Sept 2000) proposal is a sound revision of the previously analyzed proposal 504, consists of a principal and series of alternate and follow-up drill holes at several deep water sites in the Newfoundland Basin. A total of 8 holes are located, illustrated with MCS seismic lines and fully documented in the site description forms. One site is in 3580 m water depth while all other sites are in water dept surpassing 4500 m.

The objective of the proposal include among others: drilling a non-volcanic rifted margin, correlation with Iberia margin, mechanisms of asymmetric rifts formation, composition and history of basement, dating and tectonic significance of major unconformities. The proposal is co-authored and has received interest from a large group of researchers from both sides of the Atlantic and also from the oil industry. The proposal is scientifically well documented and the various hypotheses to be tested and the measurements program are clearly stated. The authors suggest that one deep hole (2300 m) NNB01A in the central Newfoundland Basin will help test most of the objectives of the proposal and will take a full ODP leg time.

Various vintages of MCS migrated and unmigrated, single channel reflection and OBS data, magnetic and gravity, heat flow, bathimetry, side-sonar, water current, navigation exist in the area and was deposited with the data bank (Farnella, Conrad, Agnich, Huston, Euwing cruises). The multichannel and wide-angle data recently acquired by R/V Euwing during 2000 season and submitted to the DB is of excellent quality. A cruise report containing detailed description of data acquisition is annexed with the proposal.

The initial focus of the proposal is to drill the NNB01A hole 2200m through sediments and 100 m into the basement. The site is located slightly off the crest of a basement block, landward of the anomaly M3, in 4559 m water depth. Preliminary depth conversion for this and all other sites was obtained both from MCS reflection and OBS/H data (they differ by about 10%). Alternate sites with shallower depth to basement are fully documented and ready to drill, if the NNB01A is considered not feasible. After assimilating the scientific results, the initial central basin hole may be followed by several holes on the Newfoundland-Iberia transects that are all included and well documented in this proposal.

All the pertinent data was sent to the DB and site survey detail forms were properly filled in and attached to the proposal. However, some data is still labeled as preliminary or currently being analyzed. Also final velocity conversion and drilling depths should be corrected in the text. The proposal needs minimum editing work with both text and illustrations and some cleaning up of the seismic interpretation and geophysics maps. No geohazards are visible on the seismic lines.

SSP Consensus: The SP believes that most of the required data for this type of site is in DB. Intersecting MCS lines support all the proposed sites. Data pertinent to the main site and alternates is well organized. Minor fine-tuning of text and illustrations to include final maps and depth conversion is needed. All final modification of the site survey data set must arrive at DB prior to July 2001 meeting.

Site Survey Readiness Classification: 1B

7. Other Business

7.1 SSP Recommendations re SCIMP/SSP/etc. ad-hoc Core-log Integration, U/W Geophysics working group report. SSP supports the SCIMP adhoc Core-log Integration and Underway geophysics working group report in the matter of replacing all air guns currently aboard J/R with GI/G guns that can be used both for checkshots and, in case of need, for SCS acquisition. To facilitate the latter, the adhoc committee's recommendation for underway geophysics training and improved documentation are also supported. We acknowledge the importance of checkshots in correlating drilling results with reflection seismic survey data.

7.2 Thanks and applause for departing members: Anselmetti, Kleinrock, Kuramoto, Lyle, Meyer.

7.3 Schedule Feb.,2002 meeting – 25, 26,27,Feb.2002 Torogo Gorge, E.Taiwan? Peijing?.ChinaAcademy Geophysical andgeological institutes

7.4 May SSEP Liaisons Droxler ESSEP Alt Malinson Lewis ISSEPDiebold alt.