SCIMP APPENDIX
00-3-01

PEC V review

In the Performance Evaluation Committee (PEC) V report, the committee wrote, " The new SCIMP has a number of problems that need to be solved (page 22) ". In particular the report stated:

> "PEC-V observed that with the integration of three service panels (Downhole Measurements, Information Handling, and Shipboard Measurements Panel) into one, the Scientific Measurements Panel (SCIMP), much expertise and engagement cannot be accessed during panel meetings. PEC-V considered whether the possibility of bringing in additional information by setting up ad hoc advisory committees (Guide to ODP, Appendix III, 12.4) would be sufficient. Because of the importance of these issues and the continuous need, we recommend that two subgroups of SCIMP should be established for concerning downhole measurements and information handling. These subgroups should meet just before the SCIMP meets to prepare important relevant issues and foster necessary developments".

NOTE: SCIMP response originally written January, 2000

SCIMP discussed this concern by PEC-V and came to the conclusion, in no uncertain terms, that establishment of subgroups to assist SCIMP is unnecessary. One of the major strengths of SCIMP, perhaps its best feature, is that it deals with issues from a community-wide perspective. Because of the wide variety of expertise sitting on the panel, issues are addressed by looking not only at specific problems but how these problems affect the program as a whole. This type of "big picture" look is often lacking in more detailed committees or panels. In effect, panel members keep each other from becoming too near-sighted.

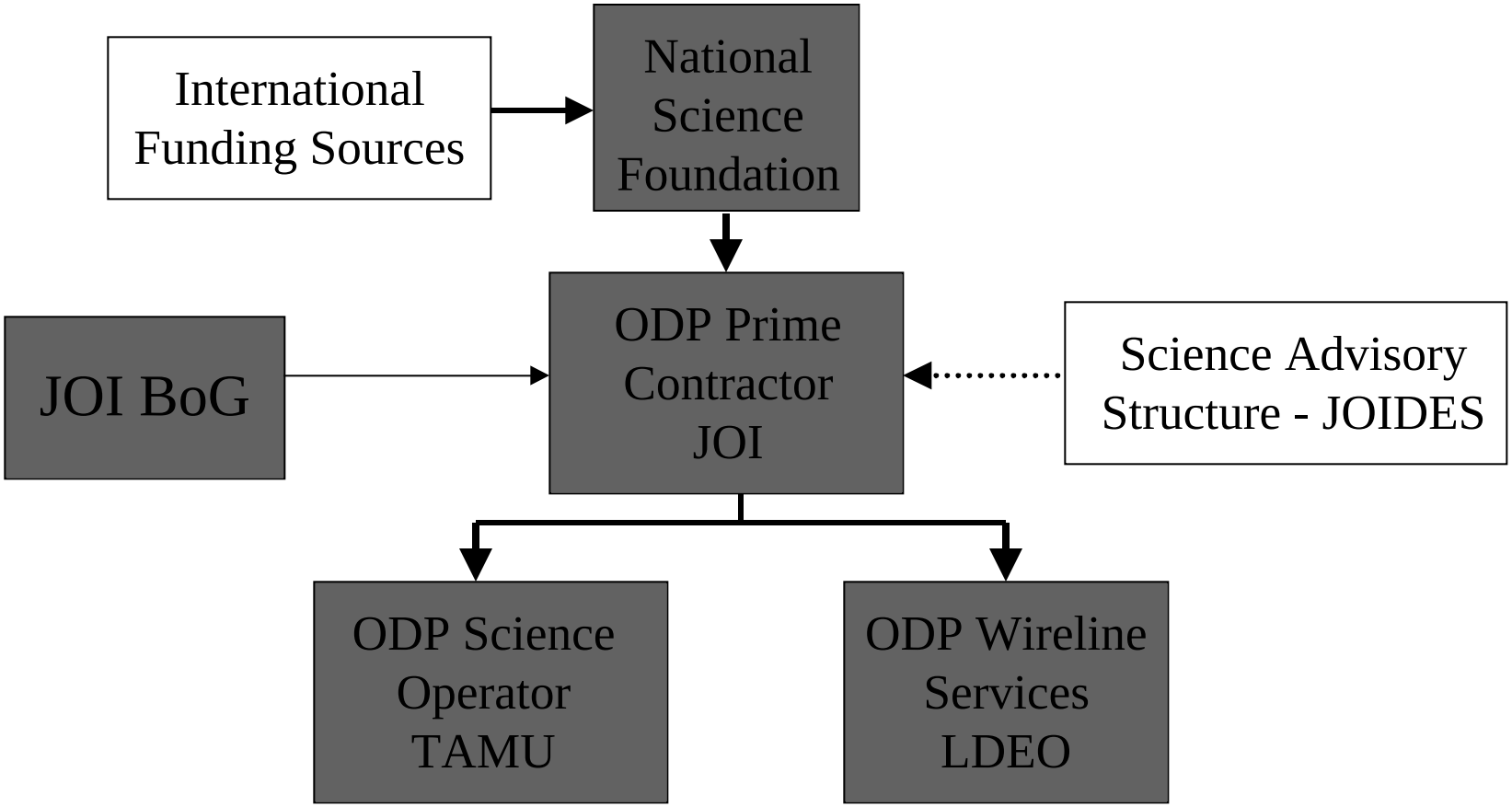
The concern that SCIMP cannot address specific issues on a timely basis is unfounded. SCIMP has several avenues to address specific issues and uses them quite often. First, SCIMP has the ability to invite experts as needed to its meetings in order to provide the panel with information they may find difficult to obtain by themselves. The recent attendance by David Smith (a microbiologist) to our last meeting is an excellent example. Numerous microbiology issues were effectively addressed during this meeting as a result.

A second avenue SCIMP utilizes to stay abreast of the issues under its mandate is through the use of eleven Laboratory Working Groups (LWGs). These LWGs consist of subsets of SCIMP members and ODP-TAMU staff. The LWGs regularly review labs and services and tap into expertise from the science community, industry, technical staff on the ship, and other JOIDES advisory groups to ensure that the needs of any discipline are well served. The recent review of the potential use of GI guns and the recommended review of current U/G operations is a direct result of these LWGs being proactive in their work.

It is the conclusion of SCIMP that the mandates currently addressed by SCIMP are best met by the *entire* SCIMP utilizing the avenues that are currently available to the panel to obtain expert input, when necessary.

SCIMP APPENDIX
00-3-02

ODP Management Structure



JOI Board of Governors (BoG)

Chair: Paul Stoffa; Vice Chair: Neil Opdyke

- **University of California, Santa Cruz - Department of Earth Sciences *new**
- **University of California, San Diego - Scripp's Institution of Oceanography**
- **University of Florida - College of Liberal Arts and Sciences *new**
- **University of Hawaii - School of Ocean and Earth Sciences and Technology**
- **Lamont Doherty Earth Observatory - Columbia University**
- **University of Miami - Rosenstiel School of Marine and Atmospheric Sciences**
- **University of Michigan - College of Literature, Science, and the Arts *new**
- **Oregon State University - College of Oceanic and Atmospheric Sciences**
- **University of Rhode Island - Graduate School of Oceanography**
- **Rutgers, The State University of New Jersey - Institute of Marine and Coastal Sciences *new**
- **Texas A& M University - College of Geosciences and Maritime Studies**
- **University of Texas at Austin - Institute of Geophysics**
- **University of Washington**
- **Woods Hole Oceanographic Institution**

Changes at JOI

2/21/00 Kate Moran resigns as ODP Director

3/2/00 John Farrell designated as Acting Director ODP/JOI

3/7/00 Director ODP/JOI position advertised in *Eos*, etc.

3/9/00 JOI Board of Governors (BoG) meets

1) Management Oversight Com. (MOC) formed

2) ODP/IODP Transition: Dr. John Orcutt

3) JOI President announces 10/1/00 retirement

4) JOI/CORE corporate split proposed

4/6/00 JOI proposal for reorganization submitted to NSF

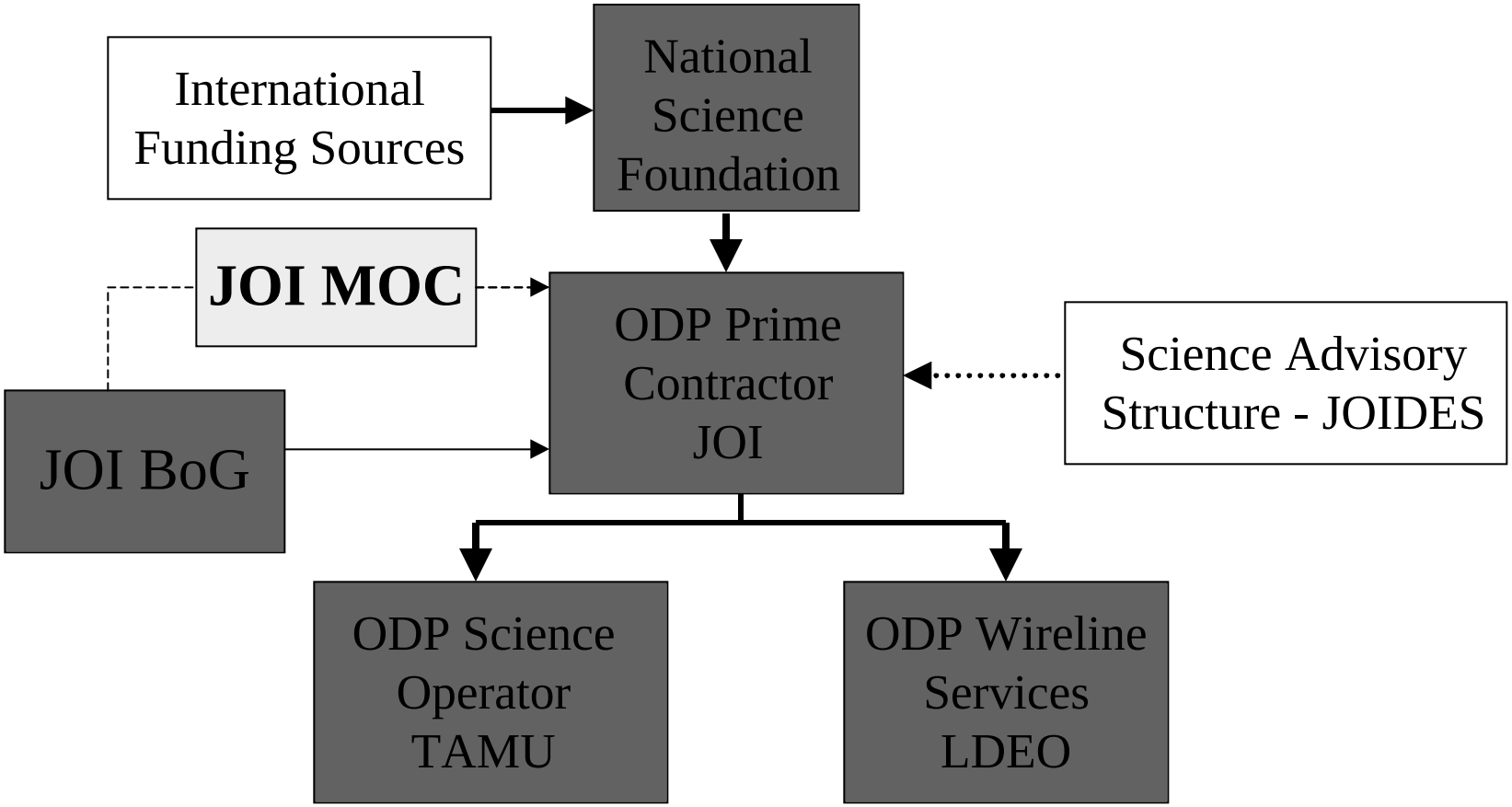
4/23/00 JOI President/ODP Executive Director position advertised in *Washington Post*, *Nature*, *Eos*, etc.

6/28/00 JOI BoG meets (New Chair/Vice Chair elected)

10/1/00 JOI President retires, JOI/CORE split implemented, Dr. John Orcutt designated Interim President of JOI

10/4/00 Dr. Steve Bohlen named President/Executive Director of JOI, start date is 11/27/00.

Modified ODP Management Structure

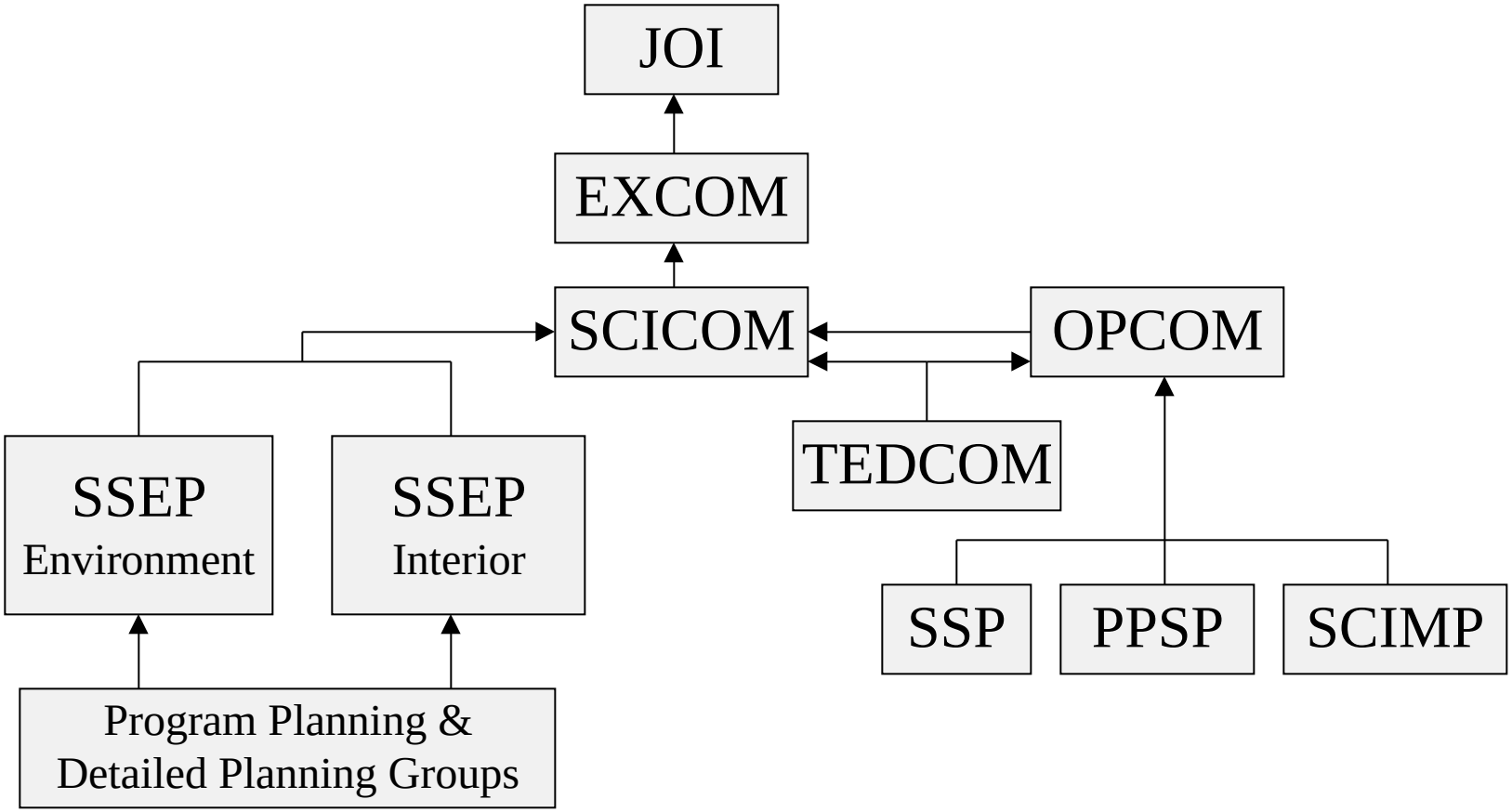


JOI Management Oversight Committee (MOC) Membership:

- **Robert Detrick (WHOI) - Chair**
- **James Gill (UC, Santa Cruz)**
- **Dennis Kent (Rutger's Univ.)**
- **Neil Opdyke (U of Florida)**

The future of the JOI Management Oversight Committee will be evaluated by the JOI BoG at their next meeting.

JOIDES Scientific Advisory Structure



International Membership in the Ocean Drilling Program

Full Members: $3M/year

12 scientists/year sail

Representation on all panels

All products

All technology developments

Associate Members: $0.5M to $2M/year

Scientists/year sail proportional to associate level

Representation on panels reduced proportional to level

Reduced products

International Membership

Full Members ($3M/year)

- **Australia/Canada/Chinese Taipei/ South Korea Consortium for Ocean Drilling**
- **European Science Foundation (ESF) Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Ireland, Italy, Norway, Portugal, Spain, Sweden, Switzerland, and the Netherlands)**
- **Germany**
- **Japan**
- **United Kingdom**
- **United States of America (funds >60% of the total ODP)**

Associate Members

- **France (Level 3 = $^2/_3$ of full membership)**
- **People's Republic of China (Level 1 = $^1/_6$ of full membership)**

FY01 ODP Program Plan Development

April 3 **Subcontractors submit draft plans to JOI**

May 1 **JOI sends composite draft Plan to subcontractors for review**

May 15 **Subcontractors' comments due at JOI**

May 25 **Draft Plan submitted to NSF and to JOIDES Office**

June 9 **NSF returns comments to JOI**

June 27-28 **EXCOM reviews and approves the Program Plan**

August 15 **JOI submits final Plan to NSF for approval***

*** Due to scheduling changes introduced at the SCICOM/OPCOM meeting, the FY01 program plan was revised at the end of August.**

October 1 **FY01 begins**

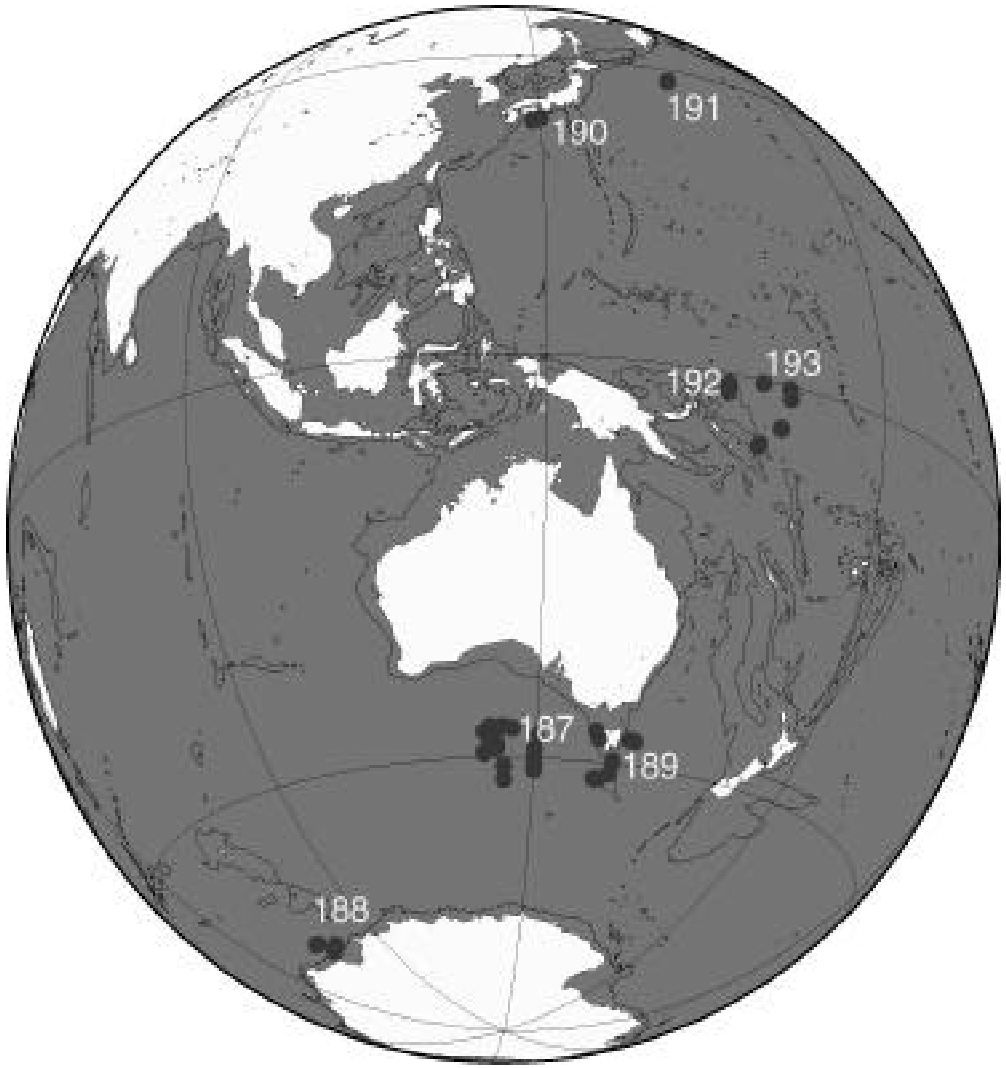
Note: This schedule reflects the development of the FY01 Program Plan. The exact sequence of events may be slightly different for other fiscal years cue to external factors and requirements.

Ship Schedule (FY00 - FY02)

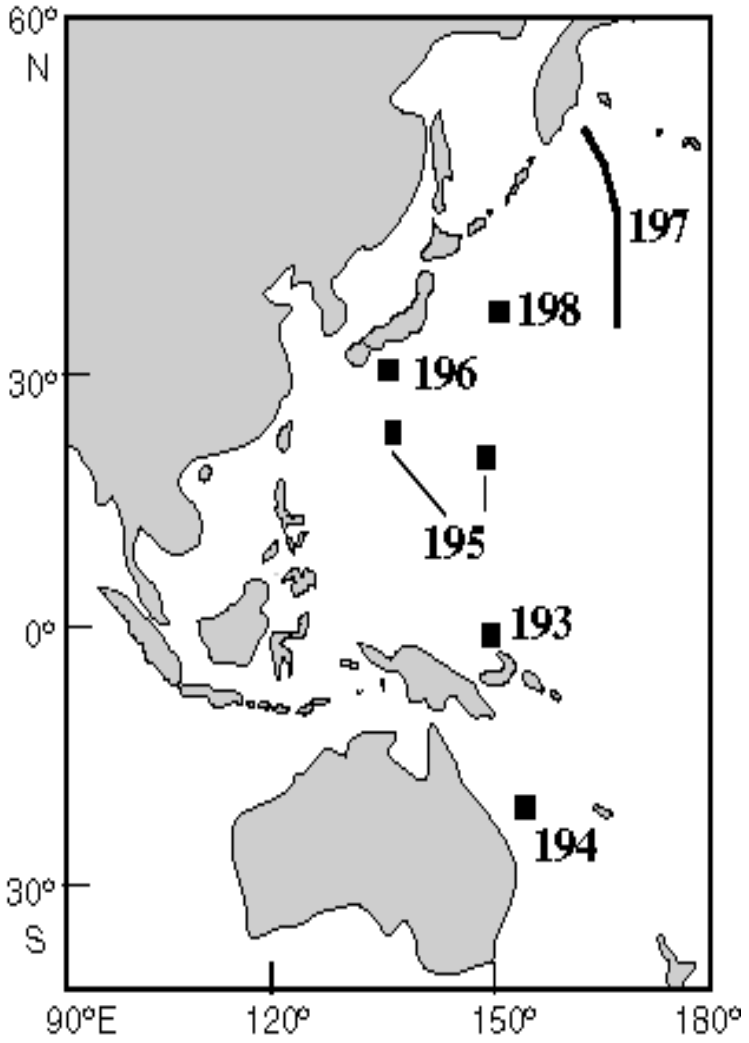
	Leg	Port (Origin)†	Dates –
187	Australia-Antarctic	Fremantle	15 November - 12 January, '00
188	Prydz Bay	Fremantle	12 January - 12 March
189	Southern Gateways	Hobart	12 March - 13 May
	Transit (Townsville-Guam)	Townsville	13-24 May
190	Nankai I	Guam	24 May - 17 July
191	W. Pacific ION/HD Engr.	Yokohama	17 July - 10 September
192	Ontong Java	Guam	10 September - 9 November
193	Manus Basin	Guam	9 November - 6 January, '01
194	Marion Plateau	Townsville	6 January - 5 March
195	Mariana/West Pacific ION	Guam	5 March - 3 May
196	Nankai II *	Keelung	3 May - 2 July
197	Hotspots	Yokohama	2 July - 28 August
198	Shatsky	Yokohama	28 August - 24 October
199	Paleogene	Honolulu	24 October - 17 December
200	H2O	Honolulu	17 December - 7 February, '02
201	Peru	Panama City	7 February - 8 April‡
202	S.E. Paleoceanography	Valparaiso	8 April - 7 June
203	Costa Rica	Panama City	7 June - 6 August
204	Gas Hydrates	San Francisco	6 August - 4 October
205	Eq. Pacific ION	San Francisco	4 October - 9 November

Notes: Port call dates have been included in the dates which are listed. For example, Leg 193 begins on 9 November. The scheduled sailing date is 14 November. 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 will end in Panama City.

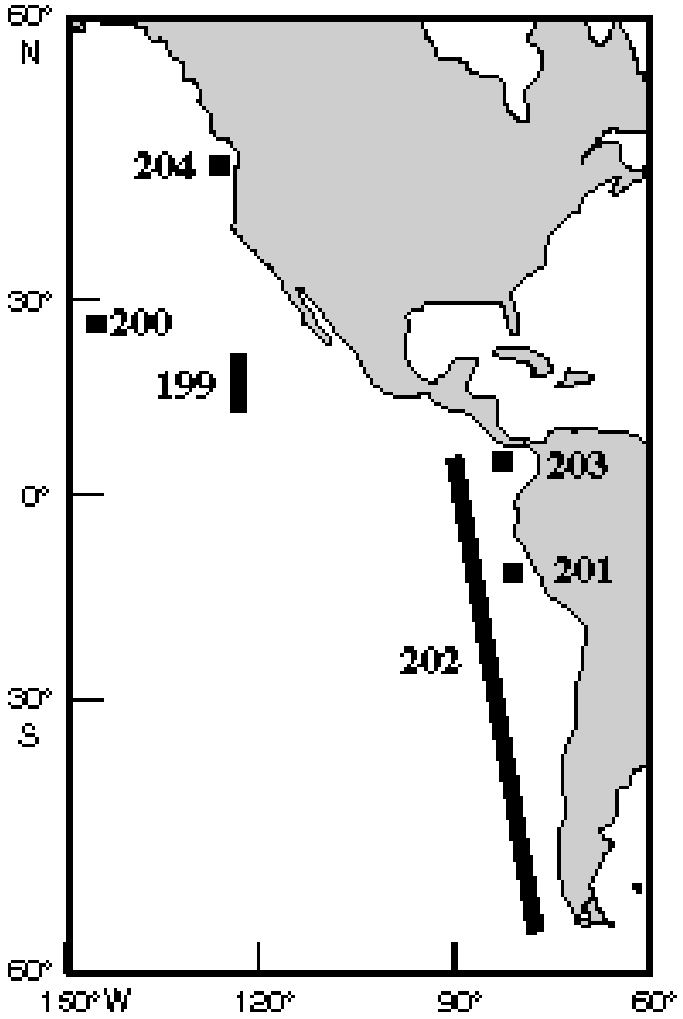
ODP Fiscal Year 2000 Schedule



ODP Fiscal Year 2001 Schedule



ODP Fiscal Year 2002 Schedule



ODP Long Range Plan Initiatives - Status

• Deep Biosphere

- **Microbiology Lab upgrades and downhole contamination studies for QA/QC.**
- **Dedicated leg scheduled for microbiological studies - Peru (Leg 201).**

• Gas Hydrates

- **Development of APC Methane Tool w/ MBARI (ongoing).**
- **Test of HYACE tool on Leg 194; upgrades to Pressure Core Sampler are planned.**
- **Reschedule Oregon Margin/Hydrate Ridge cruise for better weather window (Leg 204 August 6 to October 4, 2002).**

• Alternate Platforms

- **Arctic Detailed Planning Group (DPG) formed.**
- **Shallow water continental margin drilling (NSF and JOI/USSSP-sponsored workshop "MARGINS: Source to Sink", held in Lake Tahoe, CA on Sept. 11-15, 2000).**
- **Coral reef drilling (NSF and JOI/USSSP-sponsored workshop on "Submerged Coral Drilling", held in St. Petersburg, FL on Sept. 23-25, 2000).**

ODP FY00 - FY02 Schedule

Routine Legs

- 194 Marion Plateau
- 195 Mariana/W.P. ION
- 197 Hotspots
- 198 Shatsky Rise
- 199 Paleogene
- 200 Hawaii-2 Observatory (H2O)

Microbiology-focus

- 193 Manus Basin
- 196 Nankai II
- 201 Peru Microbiology
- 202 SE Paleoceanography
- 203 Costa Rica
- 204 Gas Hydrates

History of DSDP/ODP Gas Hydrate Research

- 1970 First BSR Drilled, DSDP Leg 11 Blake Ridge
- 1979 First Hydrate Recovered, DSDP Leg 67 Guatemala
- 1980 First Use PCS, DSDP Leg 76 Blake Ridge
- 1982 1.5 m Massive Hydrate, DSDP Leg 84 Guatemala
- 1983 Microbes & Hydrates, DSDP Leg 96 Gulf of Mexico
- 1986 Hydrates in Lower Slope Seds, ODP Leg 112 Peru
- 1989 Hydrates in Sea of Japan, ODP Leg 127
- 1990 Hydrates in Nankai Trough, ODP Leg 131
- 1992 Drilled through BSR, ODP Leg 146 Cascadia
- 1995 Dedicated Hydrate Cruise, ODP Leg 164 Blake Ridge

ODP Gas Hydrate Technology

- **Advanced Piston Corer**
- **Shipboard Laboratory Facilities**
- **In Situ Temperature Probes**
- **Pressure Core Sampler**
- **HYACE Tool (cooperative development with European researchers - field testing on Leg 194)**
- **Methane-APC Tool (cooperative development with MBARI - piston instrumented with pressure, temperature, and conductivity sensors)**

Post-2003
Scientific Ocean Drilling
Town Meeting
Fall AGU Meeting
San Francisco, CA
Marriott Hotel, Golden Gate A
Saturday, December 16, 2000 @5:30-7:30

The Ocean Drilling Program ends in 2003. Planning is well underway for a new, post-2003 program and your input is essential. This meeting is an open forum to learn the latest news about current planning efforts and to share your views on the future. All are welcome. Refreshments will be served.

IPSC/IODP Web Sites

URL: **http://www.iodp.org/** (IODP general web address)
URL: **http://www.iodp.org/ipsc** (IPSC general web address)
URL: **http://www.iodp.org/ipsc/default.html** (general information)

IODP Science Plan (V. 5): **http://www.iodp.org/pdf/IODP_ISP.pdf**
Text only: **http://www.iodp.org/ipsc/isp_v2.2/ISP_V2_2_text.pdf**
Figures (lr): **http://www.iodp.org/ipsc/isp_v2.2/ISP_V2_2_figs.pdf**
Figures (hr): **http://www.iodp.org/ipsc/isp_v2.2/ISP_V2_2_figs_hr.pdf**
HTML format: **http://www.iodp.org/ipsc/isp_v2.2/default.htm**

Please send comments to: **ipsc@umich.edu (Best if sent by Jan. 4, 2001)**

Conceptual Design Committee (CDC) Report:
PDF format: **http://www.joi-odp.org/USSSP/cdc/cdcreportfinal.pdf**
HTML format: **http://www.joi-odp.org/USSSP/cdc.default.html**

Please send comments to: **ipsc@umich.edu (Best if sent by Jan. 4, 2001)**

SCIMP APPENDIX
00-3-03

Science Operator's Report to the JOIDES Scientific Measurements Panel

Casa Munras

Monterey, California

December 12 - 14, 2000

Science Operator's report to SCIMP, December 2000

EXECUTIVE SUMMARY

Action on recommendations from January 2000 SCIMP meeting

Many recommendations and action items from the June 2000 SCIMP meeting have resulted in action by ODP/TAMU. This includes support of the SCIMP recommended seismic/downhole/core data integration working group, investigation of an asset management software/database, and a breakdown of email costs to and from the JOIDES Resolution. In addition the previously proposed policy change to compensate sea-going only employees during shore-based training came into effect in July 2000. Unfortunately, some other recommendations and action items, although desirable, could not be targeted because of budget problems created by the high price of fuel for the ship. Especially funds to purchase a digital imaging system, which has been a high priority for several years, are currently not available.

Operations Schedule

A revised operations schedule was released on 24 August, 2000 and updated on 10 October, 2000. The major changes to the previous schedule are the addition of Legs 202 through 205 and the addition of a CORK site to Leg 195. In addition two legs, Shatsky Rise (Leg 198), and Peru Biosphere (Leg 301) were inserted into the existing schedule.

Leg Reports

Leg 190 (Nankai 1)

Six sites along two transects across the Nankai Trough accretionary prism were successfully drilled during Leg 190, satisfying all leg objectives. Two reference sites at the seaward ends of the Muroto Transect (Site 1173) and the Ashizuri Transect (Site 1177) delineate the stratigraphic framework of the accreting subducting Shikoku Basin sedimentary section. A thick section of Miocene turbidites and smectite-rich mudstones is present within the subducting section at the Ashizuri site. The turbidites and mudstones are absent in the correlative section at the Muroto site, probably contributing to the difference in prism wedge taper between the two transects, while possibly controlling the seismic character of this active plate boundary.

Leg 191 (West Pacific ION Project/Hammer Drill Engineering)

The seismic observatory was successfully installed at Site 1179 and left ready for activation by a future remotely operated vehicle cruise. The hammer drill tests were less successful owing to a streak of bad luck. The hammer drill was tested on a seamount near Guam (Sites 1180 and 1181), but the lithology was unsuitable (soft volcanic ash) and a typhoon forced evacuation of the area. Finally, an abbreviated HRRS test was accomplished at a site atop a basaltic volcano in the Mariana Trough (Site 1182).

Leg 192 (Ontong Java Plateau)

ODP Leg 192 recovered igneous basement and sediment cores in five widely separated sites in previously unsampled areas across the Ontong Java plateau. Primary objectives of the leg were to determine (1) the age and duration of emplacement of the plateau, (2) the compositional range of magmatism, and (3) the environment and style of eruption. Acoustic basement at the four sites on the main or high plateau consists of pillow and/or massive basalt flows with rare, thin sedimentary interbeds. Biostratigraphic evidence indicates that basement ages at Sites 1183, 1186, and 1187 are Aptian. At Site 1185, two groups of basalt are present; the lower group is Aptian, whereas the age of the upper group is estimated only loosely as latest Cenomanian to Albian. Together with data for DSDP Site 289 and ODP Site 807, it now appears that the great bulk of the high plateau formed in a single episode in the early Aptian. Later volcanic events, including the ~90 Ma event recorded at Leg 130 Site 803 and in the eastern Solomon Islands, appear to have been volumetrically minor on the high plateau and largely confined to its margins. One of these late-stage events is recorded in our fifth site, Site 1184, on the plateau's eastern lobe or salient, where we cored 338 m of a middle Eocene basaltic volcaniclastic sequence.

Science Services Update

- Microbiology Lab has been moved to the F-Deck on Leg 191.
- Status of Microbiology Lab issues.
- In the light of the current financial situation an RFQs for a less expensive digital imaging system was issued early December and responses expected early January before the SCICOM/OPCOM meeting.
- New Tech Note for ICP analysis on the web.
- Investigation of asset management software/database
- Curational statistics and activities summarized

Information Services Update

- JANUS application projects status summarized.
- Data migration status summarized.
- JANUS database mirror site request by the University Bremen discussed

Drilling Services Update

- **Rig Instrumentation System (RIS):** Instrumented load pins completed during Leg 192 portcall, RIS set up to calculate weight on bit (WOB) from the load pin measurement. A WOB filter is being developed and scheduled for Leg 195.
- **APC Temperature Tool and WSTP**: Blue Mountain Instruments (BMI) was selected to provide repair and calibrations services for the APC temperature tool and WSTP data logger, because.Adara Systems discontinued support of these instruments.
- **APC Methane Tool**: Two design review meetings with MBARI conducted, where the mechanical packaging concept for the MBARI acquisition electronics and the sensors was approved and the sensors for the APC piston selected. MBARI placed orders for six of each thermistor probe, pressure transducer, and conductivity sensor.
- **Downhole Measurement Technology:** Fugro's Piezoprobe pore pressure tool and Hydraulic Fracture Tool (HFT) were evaluated for deployment in ODP bottom hole assemblies (BHA). Fugro and ODP engineers concluded that both tools could be adapted to APC/XCB BHA without compromising the coring operation.
- **Davis/Villinger Temperature Probe (DVTP):** Adoption of the Davis/Villinger Temperature Probe (DVTP) as an operational ODP tool. Two new DVTP's are being procured.
- **Memory Drilling Sensor Sub:** 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. Demonstration test run on Leg 188. Scheduling of this tool delayed.
- **Active Heave Compensator (AHC) operational review:** New load pins installed for Leg 192. Beta version of Weight on Bit filter developed during Leg 191, scheduled to be implemented during the Leg 195 portcall. AHC hydraulic umbilical replaced during the Leg 191 portcall.
- **Advanced Diamond Core Barrel (ADCB)** successful in land tests during June and October, 2000. Ready to be deployed on Leg 193.
- **Hard Rock Re-entry System (HRRS) Project**: Limited testing conducted on Leg 191. Many of the objectives could not be completed.

Publication Services Update

- Review of acceptance of new-format *Proceedings* publications
- IR through v. 186 and SR through v. 174A published
- Leg related citations lists compiled since January 1999, contains 317 citations (appended)
- ODP *Proceedings* distribution
- Sample distribution, data distribution and publications policy revision planned for February 2001.
- Web page development and web site statistics

ACTION ON RECOMMENDATIONS AND ACTION ITEMS FROM JUNE 2000 SCIMP MEETING

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*.

Adam Klaus attended the workshop at LDEO on 30-31 Oct, 2000, to provide input to the temporary working group.

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.

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 atttended by SCIMP chair Tom Janecek and Frank Rack was held at ODP-TAMU and a request will go out to vendors for bids on such digital imaging systems December 5. The bids are due on Januar 5 so that a selection of an imaging system will have taken place before the SCICOM/OPCOM meeting at the end of January at which 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.

A digital camera for color close-up photography will be considered as long as a core digital imaging system is not installed on the JR. The digital close-up pictures would not substitute for regular shipboard photography, but they should be extremely useful for preparing figures for the scientific reports and for scientists' post-cruise research.

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.

This recommendation is in accordance with the sprit of data acquisition on the JOIDES Resolution and will be supported and enforced by ODP-TAMU personnel.

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.

Requires no ODP-TAMU response.

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.

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.

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.

Update on action items

ACTION ITEM: ODP-TAMU personnel to keep SCIMP Chemistry LWG members updated on ICP-ES operations.

DONE: Rick Murray has been kept informed about the ICP operations. After Rick rotates off SciMP, his successor will receive this information.

ACTION ITEM: Determine if JANUS uploader programs for the Magnetic Susceptibility data from the Archive MST and the Discrete Bartington loop are on JANUS modifications task list.

The uploader program for the magnetic susceptibility data from the Archive MST is on the JANUS task list, however, with relatively low priority. Datamodel and uploader are very similar to the existing MST susceptibility measurements. Currently the susceptibility data occasionally generated with the Archive MST are stored and archived in separate files outside of JANUS.

The archiving of discrete susceptibility data generated on the Bartington loop is considered very low priority and is not on the JANUS modification task list. Discrete susceptibility data are rarely produced. If they are generated they are usually collected to monitor magnetic mineralogy changes during thermal demagnetizations or other rockmagnetic experiments.

ACTION ITEM: SCIMP and ODP-TAMU computer lab working teams develop a plan to upgrade Macintosh operating systems.

The Mac OS X has not been released other than in beta form. It will probably not come out before next summer. The ODP-TAMU computer specialists have done testing on the beta version recently and discovered some incompatibilities with the current configuration. There are no plans to upgrade to OS X any time soon, especially since there is no firm release date for it.

ACTION ITEM: Query shipboard microbiologists to determine computational needs in Microbiology Lab.

The following four stations essential for the microbiology lab require a dedicated computer:
1) Digital Imaging System for the Microscope
2) Total Organic Carbon (TOC)
3) GC/ECD HP Chemstation
4) Hydrogen GC

ACTION ITEM: SCIMP Physical Property LWG members to pursue the steps (and costs) required for development of a BGO/full spectrum natural gamma system for IODP.

Requires no ODP-TAMU response.

***ACTION ITEM**: ODP-TAMU to supply SCIMP with breakdown of email costs to and from the JOIDES Resolution.*

Ship/Shore communication costs are tracked by the ODP-TAMU administration. The COMSAT bills are charged to six accounts of which four accounts were combined for the purposes of this report into one ODP phone/fax account. It is not possible to track or distinguish sent versus received messages with this accounting system. The breakdown of the ship/shore communication accounts for FY'00 is:

ODP phone/fax accounts:	$12,221.27
ODP email accounts*:	$36,633.55
TSF/LDEO/Schlumberger:	$30,422.72
Total communication:	$79,277.54

*contains ODP business (estimated at about 5%) and personal email

The Transocean/Sedco/Forex (TSF)/LDEO/Schlumberger account is a rebilling account which includes business and personal email accounts (their policy regarding subsidized email is identical to ODP-TAMU's), phone, and fax charges. The ODP email account charges ($36,633.55) is the amount of money spend by ODP on business-related email and on free email for scientists and technicians. ODP-TAMU collected in other FY's about $1,000 to $2,000 per leg for personal email from scientists and technicians.

The requested breakdown of received versus sent messages and ODP business versus personal accounts is not easy to obtain. The cc:mail system in use before Leg 187 could only track sent email bytes, and any incoming mail was not accounted for. Not even the amount of the total received bytes can be easily generated today because ODP-TAMU was billed by Sedco and not directly by COMSAT. Although spreadsheets with the shipboard email charges were not routinely kept and archived after a leg, we were able to find three email bills from Legs 181, 184, and 185. Email charges for these legs broken down into different user groups are shown in Table 1 below. User groups are ODP business accounts (operations, curation, lab officer, staff scientist, and computer support), ODP staff accounts, Transocean-Sedco-Forex (TSF), LDEO, and Schlumberger accounts (fully billed to TSF, LDEO, and Schlumberger at no cost to ODP-TAMU), and scientist accounts.

After the installation of a new email system (Groupwise) during Leg 187, no system for email charges was in place through Leg 191. Leg 192 which ended November 9, 2000, was the first leg with the new billing policy in place (200 kb free, then charges for sent and received messages at $0.000033/byte), which limits the detailed email statistics requested by SCIMP at the moment to Leg 192. A breakdown of the Leg 192 email charges is shown below in Table 2**. Email traffic between ODP-shore and ODP-ship accounts is not included in these numbers**, because there are no charges for ODP internal emails. The system only tracks email sent over the internet. Once the November COMSAT bill comes in, we will be able to calculate that number for Leg 192. Estimates from Leg 193 show that less than 5% of the total email bytes account for ODP intern traffic. New high speed transmissions and better COMSAT rates have dropped the rates from $0.004/byte before July 2000 to currently $0.000033/byte.

The email expenses for the ODP personal accounts for four months from June through November, 1999 (excluding September and October because of drydock) totals $16,065 with the old email policy in place (100 Kb free, then charges for sent messages). During the following four months (December 1999 through March 2000), without an accounting system in place, the total personal email cost was $21,846, an increase of 36% over the previous period.

Table 1. Email usage during Legs 181, 184, and 185 (cc:mail, one-way billing)

	bytes sent	% sent	Paid	% paid
Leg 181				
Total bytes	13181588	100.00	$2,489.72	100.00
Average per account	148108		$27.97	
ODP business	2495237	18.93	$689.30	27.69
Avg ODP business	311905		$86.16	
ODP staff	2080729	15.79	$192.04	7.71
Avg ODP staff	86697		$8.00	
TSF, LDEO, Schlum	2833861	21.50	$346.80	13.93
Avg TSF, LDEO, Schlum	94462		$11.56	
Scientists	5771761	43.79	$1,261.58	50.67
Avg Scientists	213769		$46.73	
Leg 184				
Total bytes 184	14975052	100.00	$2,862.00	100.00
Average per account	161022		$30.77	
ODP business	2562060	17.11	$747.00	26.10
Avg ODP business	366009		$106.71	
ODP staff	2481468	16.57	$299.00	10.45
Avg ODP staff	118165		$14.24	
TSF, LDEO, Schlum	4502532	30.07	$654.00	22.85
Avg TSF, LDEO, Schlum	125070		$18.17	
Scientists	5428992	36.25	$1,162.00	40.60
Avg Scientists	187207		$40.07	
Leg 185				
Total bytes 185	15320985	100.00	$2,973.00	100.00
Average per account	156337		$30.00	
ODP business	2777595	18.13	$798.00	26.84
Avg ODP business	308622		$89.00	
ODP staff	3418800	22.31	$534.35	17.97
Avg ODP staff	122100		$19.00	
TSF, LDEO, Schlum	3650035	23.82	$466.00	15.67
Avg TSF, LDEO, Schlum	104287		$13.00	
Scientists	5474555	35.73	$1,175.00	39.52
Avg Scientists	210560		$45.00	

Table 2. Email usage during Leg 192 (Groupwise, two-way billing)

	Bytes received	% received	bytes sent	% sent	total bytes	% total	paid	% paid
Total bytes 192	24755964	100.00	20151228	100.00	44907192	100.00	$908	100.00
Average per account	193590		203492		325414		$6.58	
ODP business	170080	0.69	1429920	7.10	1600000	3.56	$52.80	5.82
Avg ODP business	24297		204274		200000		$6.60	
ODP staff	5939456	23.99	4279588	21.24	10219044	22.76	$193.45	21.31
Avg ODP staff	148486.4		213979.4		255476.1		$4.61	
TSF, LDEO, Schlumberger	10326916	41.71	8136776	40.38	18463692	41.12	$336.29	37.04
Avg TSF, LDEO, Schlumberger	178050		173123		302683		$5.51	
Scientists	8319512	33.61	6304944	31.29	14624456	32.57	$325.27	35.83
Avg Scientists	286880		252198		504292		$11.22	

ACTION ITEM: ODP-TAMU to supply estimated completion date for laboratory "cookbooks".

Physical Properties: Spring 2001
Paleomagnetism: Spring 2001
Organic Chemistry: Spring 2001
IW Chemistry: Will require update as a result of change from AA to ICP analysis
ICP Chemistry: Published and on the web (September 15, 2000)
UW Geophysics: No action, guide available, protocol changes quickly
Paleontology: No action, user manual for the PAL application and the microscopes exist; inventory is available on the web; processing methods and preferences depend on the scientist.
Shipboard Scientists Handbook: Summer 2001
Core Description: No action, core description manual still up-to-date, AppleCore manuals exist.
Downhole Tools: No action
Microbiology: No action, wait to hire technicians and establish procedures

Update on previous recommendation

SCIMP Recommendation 00-1-2: SCIMP recommends that ODP-TAMU provide the necessary shore-based training for all ASPP employees in a manner that appropriately compensates them for their time.

A proposed policy change to compensate ASPP employees for shore-based training or special projects at the same rate as sea pay, i.e., 80% above the base salary for the additional time came into effect July 18, 2000. Details about the policy can be found on the ODP website at

http://www-odp.tamu.edu/admin/humres.html

OPERATIONS SCHEDULE

LEG	PORT OF ORIGIN†	DATES*	TOTAL DAYS (port/sea)	DAYS AT SEA (transit/on site)	TAMU CONTACT	LDEO CONTACT
FY01						
193 Manus Basin	Guam	9 November 2000- 6 January 2001	58 (5/53)	9/44	J. Miller	G. Iturrino
194 Marion Plateau	**Townsville**	**6 January - 5 March 2001**	**58 (5/53)**	**13/40**	**P. Blum**	**H. Delius**
195 West Pacific Ion	Guam	5 March -3 May 2001	59 (5/54)	8/46	C. Richter	S. Barr
196 Nankai II*	**Keelung**	**3 May - 2 July 2001**	**60 (5/55)**	**9/46**	**A. Klaus**	**S. Saito**
197 Hotspots	Yokohama	2 July - 28 August 2001	57 (5/52)	17/35	G. Acton	F. Einaudi
198 Shatsky	**Yokohama**	**28 August - 24 October 2001**	**57 (5/52)**	**17/35**	**M. Malone**	**TBN**
**********						
FY02						
199 Paleogene	**Honolulu**	**24 October - 17 December 2001**	**54 (5/49)**	**13/36**	**C. Escutia**	**P. Fothergill**
200 H2O	San Francisco	17 December - 7 February 2002	38 (5/53)	18/15	P. Wallace	Y. Sun
201 Peru	**Panama City**	**7 February - 8 April 2002**	**60 (5/55)**	**20/35**	**J. Miller**	**TBN**
202 SE Paleocean	Valparaiso	8 April - 7 June 2002	60 (5/55)	20/35	P. Blum	U. Ninnemann
203 Costa Rica	**Panama City**	**7 June - 6 August 2002**	**60 (5/55)**	**12/43**	**A. Klaus**	**TBN**
204 Gas Hydrates*	San Francisco	6 August - 4 October 2002	59 (5/54)	6/48	C. Richter	D. Goldberg
**********						
FY03						
205 Eq. Pac. ION	**San Francisco**	**4 October - 9 November**	**36 (5/31)**	**15/16**	**G. Acton**	**TBN**

† Although 5 day port calls are generally scheduled, the ship sails when ready. Port call dates are included in total days, e.g., Leg 197 begins on 2 July with 5 port call days, so the ship will sail on 7 July. *Mid-leg port call will occur for Leg 196 and may occur for Leg 204.

Co-Chief Status

Leg	Co-chiefs
193	R. Binns, F. Barriga
194	F. Anselmetti, A. Isern
195	M. Shinohara, M. Salisbury
196	K. Becker (CORK), H. Mikada (both), J.C. Moore (LWD)
197	J. Tarduno, R. Duncan
198	T. Bralower, TBN
199	M. Lyle, P. Wilson
200	R. Stephen, J. Kasahara
201	S. D'Hondt, TBN
202	A. Mix, R. Tiedemann
203	TBN
204	A. Trehu, G. Bohrmann
205	TBN

Leg Reports

Summary of Leg Operations: Legs 190, 191, 192

	Leg 190 Nankai 23 May - 16 Jul '00 Guam – Yokohoma	**Leg 191** W. Pac. ION 16 Jul - 8 Sep '00 Yokohoma – Guam	**Leg 192** Ontong Java 8 Sep – 9 Nov '00 Guam – Guam
Transit/Onsite (day)	6.8 / 44.7	17.6 / 30.7	13.2 / 41.8
Sites	6	4	5
Holes	8	18	6
Water Depth (m)	1754 – 4856	970 - 5577	1673 - 3910
Deepest Penetr. (m)	1120	475	1211
Cored Interval (m)	3896	509	1764
Tot. Recov. (m,%)	2625 (67.4%)	363 (71.3%)	898 (50.9%)
APC Recov. (m,%)	685 (95.2%)	296 (102.5%)	0
XCB Recov. (m,%)	913 (85.1%)	17 (63.1%)	0
RCB Recov. (m,%)	1026 (57.2%)	50 (26.0%)	898 (50.9%)

Leg 190 (Nankai 1)

- 13-24 May 2000: Portcall in Townsville for crew change & to load consumables. Transit to Guam & board Leg 190 science party.
- 6 Sites (8 holes) in 1754 -- 4856 m WD
- APC 685 m (67%), XCB 913 m (85%), RCB 1026 m (57%)
- Cored 3896 m / Recovered 2625 m
- Deepest penetration: 1120 m through decollement
- Drill-In-Casing: 11-3/4 in. casing to 142.2 m

Six sites along two transects across the Nankai Trough accretionary prism were successfully drilled during Leg 190, satisfying all leg objectives. Two reference sites at the seaward ends of the Muroto Transect (Site 1173) and the Ashizuri Transect (Site 1177) delineate the stratigraphic framework of the accreting subducting Shikoku Basin sedimentary section. A thick section of Miocene turbidites and smectite-rich mudstones is present within the subducting section at the Ashizuri site. The turbidites and mudstones are absent in the correlative section at the Muroto site, probably contributing to the difference in prism wedge taper between the two transects, while possibly controlling the seismic character of this active plate boundary.

The décollement in both transects is localized along a stratigraphic unit (~5.9—7 Ma) within the lower Shikoku Basin. This horizon is correlative across both transects through its magnetic susceptibility.

The broad low-chloride zone in the lower Shikoku Basin unit, first identified at Site 808, progressively decreases across the Muroto Transect. This landward-freshening trend is due to both enhanced diagenetic reaction and fluid flow.

Our ideas of the tectonic evolution of the Muroto Transect have been dramatically changed. Accretion of a Miocene and Pliocene turbidite package forms the large thrust slice zone (LTSZ). This event is associated with a shift from a transverse sediment transport system that delivered coarse material from the arc to the trench to an axial transport system that delivers sediment down the trench axis from the east. Growth of the prism from the LTSZ to the toe of the slope (40 km) took place rapidly within the past 2 m.y.

Leg 191 (West Pacific ION Project/Hammer Drill Engineering)

- ION Site 1179 in 5566 m WD
- Cored 4 holes: APC 296 m (71%), XCB 17 m (63%), RCB 50 m (26%)
- Reentry Cone with 64 m 16 in., 393 m 10-3/4 in., drilled to 475 m
- Installed broadband seismometer in 3rd Int'l Ocean Network long-term borehole geophysical observatory
- Jamstec ROV "Kaiko" scheduled to connect to undersea cable in Fall 2000
- Deepest penetration 475 m
- Lost 4 days in a typhoon & medivac. Drawworks brake band cracked late in leg–new band expedited to ship for HD tests.

Engineering Test:

- Limited 4 day test of Hard Rock Reentry System (HRRS)
- Hammer operated flawlessly without damage or equipment failure
- Successfully tested Hammer Drill w/ 2 underreamer bits
- Minimized surface vibrations w/ downhole pulsation-dampner sub & improved standpipe support in the derrick.
- Bare rock spud in lava flows w/ rop 2.7 to 9 m/hr in sea states of 2.5 to 4-m with AHC.

Results

Leg 191 had two main goals: (1) to drill and case a borehole at a site in the northwest Pacific Ocean between Japan and Shatsky Rise and install therein a seismic observatory and (2) to test the drilling and casing emplacement capabilities of the hard rock reentry system (HRRS or "hammer drill") on a basaltic outcrop atop Shatsky Rise. There were also numerous ancillary scientific goals to be addressed using cores and logs obtained from Leg 191 sites. The seismic observatory was successfully installed at Site 1179 and left ready for activation by a future remotely operated vehicle cruise. The hammer drill tests were less successful owing to a streak of bad luck. Early in the leg, 4 days were lost when the JOIDES Resolution had to leave Site 1179 because of a typhoon. A medical emergency cost another 3 days and forced the ship to leave the Shatsky Rise area and return to Japan. In addition, a broken part on the drawworks made it impossible to return to Shatsky Rise for the HRRS test. In an effort to salvage the HRRS program, the hammer drill was tested on a seamount near Guam (Sites 1180 and 1181), but the lithology was unsuitable (soft volcanic ash) and another typhoon forced evacuation of the area. Finally, an abbreviated HRRS test was accomplished at a site atop a basaltic volcano in the Mariana Trough (Site 1182).

Despite the operational difficulties, an excellent set of cores was obtained from Site 1179,which is located on lithosphere of Anomaly M8 age (129 Ma). A 377-m-thick sedimentary column was cored in addition to 98 m of basaltic basement (total depth = 475 meters belowseafloor). The sedimentary column can be divided into four lithologic units. Unit I consists of223.5 m of clay- and radiolarian-bearing diatom ooze of late Miocene to late Pleistocene age. Ashbeds are common in this unit, recording volcanic activity from the western Pacific island arcs. UnitII is a clay-rich, diatom-bearing radiolarian ooze of late Miocene age with a thickness of 22.5 m.Unit III contains barren, brown pelagic clay in a 37.5-m-thick layer. Unit IV yielded poor recoverywith only chert and porcellanite fragments from an unknown sedimentary matrix within 93.7 mabove basement. The upper sedimentary section produced a well-defined magnetic reversalpattern, which shows that sedimentation was low (1.5 m/m.y.) during the mid-Miocene andincreased 300-fold (to 40-43 m/m.y.) in the Pliocene and Pleistocene. Biostratigraphy in Units Iand II was based mainly on siliceous microfossils and palynomorphs because calcareousmicrofossils were rare to absent. Sedimentation rates derived from biostratigraphy are in goodagreement with those calculated from magnetostratigraphy. The brown pelagic clay of Unit III isbarren, and few fossils were recovered from Unit IV; however, radiolarians observed in porcellanite samples indicate an Early Cretaceous age. The physical properties of the uppersedimentary section are unusual because porosities are extremely high (often >80%) and bulkdensities actually decrease downhole for the first 150 m. These characteristics probably result froman increasing downward abundance of diatom tests, which have low grain densities and containlarge amounts of pore space. The 98-m igneous section consists of aphyric ocean ridge basaltsdivided into 48 units based on lithologic differences and cooling boundaries. The section consistsof massive flows and pillows with small amounts of interunit sediments and volcanic breccia. Thebasalts are unusually fresh for Early Cretaceous igneous rock, and alteration is restricted to low-grade zeolite facies at temperatures less than ~10°-30°C.

Leg 192 (Ontong Java Plateau)

- Set 2 Free Fall Funnels & 1 Reentry Cone.
- Cored 5 sites in 1673 - 3910 m WD
- 1 of 4 primary sites was not drilled because ODP could not get permission from Solomon Islands.
- Drilled 2383 m sediment
- RCB cored 907 m sediment (41.5% recovery) & 856 m basement (60.8% recovery). Total Recovery 50.9%. penetration of 65 to 338 m.
- One BHA was lost when the drilling jars failed.
- Very calm seas throughout leg; returned to Guam 1.4 days early to begin repairs on heave compensator cylin

Results

With a surface area of 1.6×10^6 km^2 and a volume of 4-5×10^7 km^3, the Ontong Java Plateau is the world's largest volcanic oceanic plateau, and may represent the largest magmatic event on Earth in the last 200 m.y. ODP Leg 192 recovered igneous basement and sediment cores in five widely separated sites in previously unsampled areas across the plateau. Primary objectives of the leg were to determine (1) the age and duration of emplacement of the plateau, (2) the compositional range of magmatism, and (3) the environment and style of eruption.

Acoustic basement at the four sites on the main or high plateau consists of pillow and/or massive basalt flows with rare, thin sedimentary interbeds. Biostratigraphic evidence indicates that basement ages at Sites 1183, 1186, and 1187 are Aptian. At Site 1185, two groups of basalt are present; the lower group is Aptian, whereas the age of the upper group is estimated only loosely as latest Cenomanian to Albian. Together with data for DSDP Site 289 and ODP Site 807, it now appears that the great bulk of the high plateau formed in a single episode in the early Aptian. Later volcanic events, including the ~90 Ma event recorded at Leg 130 Site 803 and in the eastern Solomon Islands, appear to have been volumetrically minor on the high plateau and largely confined to its margins. One of these late-stage events is recorded in our fifth site, Site 1184, on the plateau's eastern lobe or salient, where we cored 338 m of a middle Eocene basaltic volcaniclastic sequence.

The basalt at Sites 1183 and 1186, and that making up the lower group of lava flows at Site 1185, are closely similar in composition, and belong to the remarkably homogeneous Kwaimbaita magma type found at Leg 130 Site 807 and in the eastern Solomons. Thus, much of the high plateau's upper crust appears to consist of Kwaimbaita-type basalt. The Eocene volcaniclastic rocks of Site 1184 also have a Kwaimbaita-like bulk composition. No flows of Singgalo-type basalt, which overlies Kwaimbaita-type lavas at Site 807 and on the island of Malaita, were encountered. An exciting discovery of Leg 192 was that basement at Site 1187 and the upper group of flows at Site 1185 are composed of a high-MgO (8-10 wt%), incompatible-element-poor (e.g., TiO_2 = 0.72-0.77 wt%; Zr = 36-43 ppm) type of basalt not found previously on the plateau. These rocks appear to represent very high total fractions of partial melting of their mantle source, and their presence in >100-m-thick lava piles at two sites 146 km apart suggests that such basalt is voluminous on the eastern edge of the high plateau.

Emplacement of lavas at all four high-plateau sites was entirely submarine. The shallowest estimated Aptian water depth for basement is several hundred meters, at Site 1183 on the broad dome of the plateau. Together with previous evidence, our results indicate that most of the Ontong Java Plateau formed well below sea level. The only evidence that a portion of the high plateau was ever at shallow depth is in two thin intervals of Aptian vitric tuff above basement at Site 1183, and possibly a vitric tuff just above basement at DSDP Site 289. The largely submarine emplacement of the plateau probably accounts for its apparently limited paleoenvironmental effects. Evidence for at least local Aptian "dead zones", however, is provided by ferruginous claystone layers above basement at Sites 1183 and 1187.

SCIENCE SERVICES UPDATE

Microbiology: the next step

After several legs with a substantial microbiology component (Legs 185, 187, 190, 191) we are now ready to take the next step in integrating deep biosphere studies into ODP. Following is a list if issues (not necessarily in priority order) which need to be addressed. Some of these can be dealt with in-house, some will require guidance from SciMP.

Reality check - 1: There is clearly a wide range of understanding and expectations in the microbiology community regarding what can be accomplished on an ODP leg. Some individuals are satisfied to collect and preserve clean samples for future study; some require immediate shipboard analysis for ephemeral properties, and some have visions of complex lab projects conducted while still at sea. A "basic" program, which defines what can reasonably be done while at sea within the context of the multidisciplinary activities of ODP, needs to be established and communicated to potential seagoing participants.

Basic supplies: During the past fiscal year we spent significantly more than budgeted on supplies for microbiology. Hopefully, this was a "start-up" problem resulting from lack of experience both at ODP/TAMU and among participating microbiologists. Following from the establishment of a basic observation/sampling program, we need to establish a basic "shopping list" of supplies which participants can reasonably expect to be available on board JR. This needs to be closely coordinated with the needs of chemistry so that where ever possible common supplies can be used. This simplifies inventory and is more cost-effective. Once the basic supply list is established, we need to make it clear to participants that if they require anything different, or beyond what we usually supply, then special arrangements must be made well ahead of the leg and they may have to provide their own supplies/equipment. Any special arrangements need to be coordinated with ODP/TAMU so that shipping, and safe storage and handling can be properly accommodated.

Technical support: Clearly microbiology, like every other discipline represented on board JR, needs technical support. We are presently planning to add to our technical support team an MLS whose duties will include microbiology support. In addition, we plan to cross train the chemistry and X-ray technicians in microbiology-related tasks so that we will have a team of 3 or 4 people with appropriate skills whose duties can be adjusted according to the needs of the specific leg. This may not be ideal, but it is the best that can be done with the present budgetary and berthing constraints.

Space: The location of microbiology adjacent to chemistry seems to be sufficient and functional, however we still have significant "fine-tuning " to do. Also, the microbiologists need to understand that space is not an infinitely flexible commodity. The more instruments are installed on the ship, the more crowded the labs will be. We cannot continue to squeeze other disciplines to make more space available for microbiology. Also, we should be alert for apparent duplication of instruments/measurements between microbiology and, say, chemistry.

Reality check - 2: the flip side of getting the microbiology community on board with regard to what is reasonable and feasible is getting the earth science community to appreciate what microbiology has to offer the non-biologists. This is a two-way educational process which will take time.

Sampling issues: On relatively high recovery legs the sampling needs of microbiology can be easily accommodated. However, on low recovery legs, or at sites which sample critical geologic intervals, or where the microbiologists need to do shipboard incubation studies or lipid analyses, which require large samples, sampling needs can be problematic. We need to establish protocols for handling these situations.

Sampling tools: On Leg 190 John Parkes' lab provided an elaborate sampling instrument. This worked well but required large amounts of nitrogen gas. On Leg 191, the need for uncontaminated samples was met in a much simpler, though possibly less rigorous, manner. We need to establish standard sampling

procedures which assure the microbiologists of clean samples, and at the same time are routine and easily supported by our core lab technicians.

Contamination testing: This will likely become a routine process. The procedure is now established and validated, but is short of routine. We need to make some improvements in the hardware to streamline the process, and develop "cookbooks" and procedures so that it becomes "transparent" to the shipboard scientists, i.e. it becomes a technician responsibility.

Radio isotope studies: Microbiologists have advocated eventually conducting radio isotope studies aboard JR. It is important to recognize that engaging in such studies has implications beyond satisfying the concerns of colleagues, finding a suitable location on the ship and using proper procedures, e.g. there are insurance issues ($12-18,000 per leg), port call issues, responsibility issues (if a visiting scientist does not follow procedure and contaminates the ship, who is pays for clean up and how do we enforce payment?), etc.

Digital imaging archiving software test

Jay Miller has tested the digital image handling software that SCIMP recommended to investigate in terms of handling digital images.

Jay read the webpages associated with one product (Cumulus) and purchased a single license copy of Portfolio by Extensis (they are both virtually the same, but you can import Cumulus catalogs into Extensis, Jay could not tell from the Cumulus webpages if it worked the other way). This is digital image cataloging software and offers some great utility for viewing and searching digital image catalogs, provided the proper metadata is associated with each file. This type of software provides part of the system we need for a digital image database, but there are critical shortfalls that make it problematic for the shipboard environment.

Here is the process as it works at this time and might work using this software:

1) User captures an image.
This is pretty straightforward with our current system. The data capture tools we use provide this function.

2) User saves image.
Here is where we run into challenges. File must be saved with a unique filename, with a minimal but critical amount of metadata (sample #, thin section #, illumination, filters, magnification, and description are the absolute minimum), and to a safe location where the original cannot be compromised. The way we are overcoming this right now is asking scientists to fill out an excel spreadsheet each time they save an image and they save the image to a temporary location. At least daily someone has to check to make sure that this has been done, that all metadata is present, transfer the files to a secure location, and create working file duplicates for shipboard use and easy transport at the end of the cruise. It is easy to make error(s) in this process. Typographic errors are common, copy and paste induced errors are common for metadata, and simply forgetting to fill in the spreadsheet happens regularly.

Because of the 8.3 naming convention that most systems still require to guarantee cross platform compatibility we cannot use sample IDs for filenames. Even if we could, it is common to have multiple images from the same thin section, and we would need some way to distinguish these. In practice, the only thing that has worked thus far has been a naming convention like XXXPMYYY.tif (where XXX is leg number, PM indicates photomicrograph, and YYY is a cumulative number starting with 001). This means there is no direct, easy to recognize link between the datafile and what it contains. We could use Extensis type software, and ask everyone to enter sample #, thin section #, illumination, filters, and magnification into the keyword file, and the description into the description file. For each file, however, this requires opening three windows and typing in these by hand. In the "Administrator" mode, it is possible to create a set of demand fields to queue users as to required information, and even create easy to chose from lists of

metadata (which still require double-click & drag & select for each datatype), but it is not possible to force users to fill in these fields (or even select the proper windows) before the file is saved.

This has a high potential for errors and omissions. Even the spreadsheet is somewhat preferable to this. You can see all the cells on a single data entry screen, you can copy and paste between cells, and it is easier to pick out errors or missing metadata. Although checking the spreadsheet daily is a real chore, Jay's experience working with this software indicates that administering a database using only this software without error proof data entry protocols these packages offer little if any improvement over what we do now for data archiving, and in fact make it more challenging and time consuming.

If we try to use this software, then we will need to have a posted protocol that goes like this (assuming we have both MAC and PC versions of the software).

1) Open the existing catalog as View-List.
2) Save the digital image file from the PCs attached the cameras to the digital image server with a filename of the next consecutive number based on the list.
3) Add item to catalogue
4) Open Item properties/fields window and add metadata
5) Open Item properties/general window and add description
6) Save additions to database

So far, even with the relatively simple spreadsheet we have used, Jay has not been able to get shipboard personnel to use it consistently. They save one image file after another, lose track, and then any number of problems crop up. This will not change under the above scenario. At least under our current system these files are only saved to a temporary location. The biggest problem is security and the integrity of the original files. Ultimately what we need is some type of system where a file cannot be saved unless the associated metadata is entered and is correct to the best of our ability to keep it so. We can predefine lists of metadata for illumination, filters, magnification and this helps a bit, but frankly of these only magnification is critical. We need some way to link and verify sample numbers to thin section number (via Janus output?) which is a common area of errors. We also need to have the control that the file cannot be saved without the description completed. While there are several categories of participation with this software from read only to full administration, in order for a user to be able to perform the tasks listed above, they also have the ability to accidentally delete or rename the originals from the catalog. Since this catalog is the only link between the image number and its metadata, the potential for lost data is huge. It is also problematic with everyone having access to the original files which is required if all users have the ability to save originals to the server.

3) Using the files.
Either of these software packages would potentially make part of this step easier if we were licensed shipwide, had a dedicated server for digital image files, and had strict control over how files got into the database (naming and metadata convention). The catalogs do not access all the files directly, but work with thumbnails created when the database is saved. The software maintains a hard link to the original files, but keeps the thumbnails and metadata separate for rapid searching. To view, copy, or edit the original, the link to the storage facility must be maintained. We could potentially use this software to create a second catalog of enhanced images, if we could convince folks to enter the additional metadata on how the image was processed to reach the end result. What this does not provide for, however, is carry off access at the end of the cruise. Under our current system, the working files are .jpg files that can easily be copied and burned to a CD. While the thumbnail files are great, if our scientists do not have the proper software at home, these files are useless.

Bottom line is, for a single user with a consistent naming and filing convention this is pretty decent software. For a multiuser environment with constantly changing and unfamiliar users who do not have access to the software postcruise, it is no better (actually worse) for the administrator and users than our existing system, and probably much more difficult to enforce. For shipboard users, the thumbnail catalogs are a real plus, but metadata entry is more of a task than entering into a spreadsheet, and we all know how

well that goes over (see AppleCORE). Free access to the original files also puts us in jeopardy, but there is no way around this if we use this type of software.

Finally, just sending this software out to the ship only addresses part of the problem. The only way to utilize all the benefits of this software would be to have someone responsible as digital image database administrator. The files could all be saved to a temporary location, then the administrator would have to check all the files for consistency and accuracy, correct any errors, migrate the images and the catalog file to a secure location, copy the corrected catalog back to the user volume, and reestablish the links from the catalog software to the secure originals. These tasks could potentially take a few hours per day on a heavy use leg. These tasks cannot be assigned to the Staff Scientist. Jay has been spending at least a couple of hours per day (that takes away from other duties or more often just increases the workload) with the current administration method. This is a new task with the advent of digital photomicroscopy and requires allocation of new resources to make it work.

Curation

Curatorial Statistics

See attached figures/tables for FY00 activity.

The GCR received 9468 m of core from Legs 187-192, and had post cruise sampling activity for Leg 189, plus additional post cruise sampling from Leg 184. The BCR has maintained a relatively high level of activity because of interest in recent legs such as 175, 177 and 178, and 188. The ECR decreased in sampling activity in FY00, although part of its sampling total includes hundreds of large u-channel samples, which are becoming more commonplace. The WCR maintained a similar amount of activity as the previous year, although the overall number (1927) still remains low. Requests for non-destructive scanning of cores (e.g., MST, scanning XRF) are becoming more common for the BCR, ECR, and GCR.

The number of visitors at each repository reflects the large amount of sampling activity at the BCR. The ECR had a moderate number of visitors, and the GCR's number of sampling visitors reflects the fact that the GCR staff took a considerable number of samples for Legs 184 and 189 without scientists from those legs coming to visit. The WCR had only a few sampling visitors. However, the WCR has had more time to arrange and accommodate visits of educational groups. The GCR's high number of educational visitors is a result of two initiatives: one was a group of Texas middle school science teachers who came for a week-long science/technology intensive related to the Ocean Drilling Distance Learning Project, and the second was TAMU Dept. Geology & Geophysics Historical Geology students who are now regularly doing a lab exercise each semester which involves describing and interpreting ODP sediment cores.

The number of days to complete post moratorium requests shows that 50% of requests were filled within 2 weeks of the date of request, and 75% are filled within one month. The long tail on the curve is the result of several situations: (a) requests for large amounts of samples which the investigators took themselves, sometimes over several widely spaced visits to the repositories, (b) a museum request where the cores were requested more than a year before the museum’s exhibit hall was ready to receive the cores, (c) requests that were dependant upon an investigator scheduling a visit to sample themselves, (d) requests for several thousand samples, where the repository staff took and shipped subsets of the samples over a long period, because of short staffing.

Permanent Archive Sampling

Nine permanent archive sampling requests were received during FY00, of which 7 were approved. The 9 requests were from 11 investigators. Total number of samples taken for these in FY00 was 141, of which 99 were <2cc.

Museum Displays/Conference Displays

One new Museum loan was filled in Spring, 2000, when two cores were sent to the North Carolina State Museum of Natural Sciences. The cores represent basaltic basement and early post rifting sediment from the North Atlantic. Another Museum Loan is pending with the Indiana State Museum.

Two core replicas (of K/T Boundary and Cariaco Basin cores) were on display at the Dec. 1999 AGU meeting (FY00). Two boxes of sulfide core sections from Legs 139 and 169 were sent to Toronto for display during the annual Prospectors and Developers Association Convention.

Reprint Collection/Bibliography DB

The Curatorial Bibliographic Database is now current with all published ODP SR volume publications and with all received journal reprints entered into it. We are currently still re-establishing links (>50 % have been done) between publications and sample requests that were entered into the old S1032 database. When the old records were migrated into Oracle, these links were not transferred.

ODP Requests: 8860
ODP Requests/parts: 11080
Publications: 5262
Publications linked to one or more sample requests/parts: 2753
Requests linked to one or more publications: 2798
ODP SR volume publications: 2530

FY00 Curatorial Activity

BCR	Oct./Nov	Dec./Jan.	Feb/Mar	Apr/May	June/July	Aug./Sept.	Total FY00
Archives viewed/scanned	321	6	2	14	312	224	879
Samples Issued	3905	1866	3405	4978	6675	3371	24200
Number of Requests	22	17	21	17	38	15	130
Visitors							
Sampling Visit	25	12	4	5	20	6	72
Tour/PR Visit	6	11	5	1	52	3	78
Education Visit	0	0	0	0	0	0	0
Personnel							

ECR	Oct./Nov	Dec./Jan.	Feb/Mar	Apr/May	June/July	Aug./Sept.	Total FY00
Archives viewed/scanned	1	23	160	150	20	509	863
Samples Issued	1582	1717	1186	469	1988	177	7119
Number of Requests	22	14	13	9	22	6	86
Visitors							
Sampling Visit	6	2	6	4	12	2	32
Tour/PR Visit	0	9	5	0	19	0	33
Education Visit	0	0	10	1	0	50	61
Personnel			Gar Esmay sailed on Leg 189			Gar Esmay sailed on Leg 192	

GCR	Oct./Nov	Dec./Jan.	Feb./Mar.	Apr./May.	June/July	Aug./Sept.	Total FY00
Archives viewed/scanned	0	0	0	127	19	0	146
Samples Issued	6672	16320	4999	5137	3421	1177	37726
Number of Requests	27	51	33	25	24	22	182
Visitors							
Sampling Visit	11	12	2	6	3	5	39
Tour/PR Visit	0	0	45	8	11	8	72
Education Visit	0	0	22	241	21	0	284
Personnel		Bruce Horan sailed on Leg 187					

WCR	Oct./Nov	Dec./Jan.	Feb/Mar	Apr/May	June/July	Aug./Sept.	Total FY00
Archives viewed/scanned	0	0	0	0	0	0	0
Samples Issued	458	209	254	463	304	239	1927
Number of Requests	11	5	13	10	5	9	53
Visitors							
Sampling Visit	7	0	3	0	1	3	14
Tour/PR Visit	0	5	1	0	0	0	6
Education Visit	46	0	75	8	0	21	150
Personnel							

Total Repositories	Oct./Nov	Dec./Jan.	Feb/Mar	Apr/May	June/July	Aug./Sept.	Total FY00
Archives viewed/scanned	322	29	162	291	351	733	1888
Samples Issued	12617	20112	9844	11047	12388	4964	70972

Number of Requests	82	87	80	61	89	52	451
Visitors							
Sampling Visit	49	26	15	15	36	16	157
Tour/PR Visit	6	25	56	9	82	11	189
Education Visit	46	0	107	250	21	71	495
Personnel							

Ship Sampling	Leg 187	Leg 188	Leg 189	Leg 190	Leg 191	Leg 192	Total
Number of Requests	18	31	33	28	19	29	158
Samples Issued	1276	11021	29647	18410	2511	3246	66111

Total FY00	BCR	ECR	GCR	WCR	Ship	Grand Total
Number of Requests*	130	86	182	53	158	609
Samples Issued	24200	7119	37726	1927	66111	137083
Sampling Visitors	72	32	39	14		157
PR Visitors	78	33	72	6		189
Education Visitors	0	61	284	150		495

*some requests were sampled, and thus reported on, over more than one bimonthly reporting period. Also some requests were filled by more than one repository, and were reported in the activity of each repository. Actual total # of requests for FY00 is 585.

INFORMATION SERVICES UPDATE

Personnel

Ken Emery retired. His position was filled by Phil Gates. The new Information Services contact to SCIMP is the manager of Information Services, David Becker.

JANUS Applications Status

The bulk content of these tables may be found on the Web at:
http://janusaxp.tamu.edu/predef_queries/general/whiteboard_janus.shtml

Work in Progress

ID	Task Name	Phase	Area	Target Leg
12	Fix AppleCORE uploader	DevTest	Core Desc.	194
20	Fix Slider entry and bugs	Development	Core Desc.	194
1	Integrate hard-rock ICP data	Development	Chemistry	TBD
40	Deploy, test PC version of Coulometer	Development	Chemistry	194
16	Implement JRS (Java) on ship	DevTest	Curation	196
21	WCMST control data	DevTest	Phys. Props.	TBD
34	NGR data transfer	Development	Phys. Props.	194
35	WCMST threshold warnings	Assigned	Phys. Props.	TBD
38	MAD control measurements	UserTest	Phys. Props.	192
10	Implement bar codes	Development	All	TBD
14	Age-depth control points	UserTest	All	194
	Generic Editor	Analysis	All	196

Tasks Completed

ID	Task Name	Phase	Area	Target Leg
13	Fix Applecore batch export of core id's	Closed	Core Desc.	190
30	Applecore software bugs/upgrades	Closed	Core Desc.	On-going
26	Reformat gas element table	Closed	Chemistry	189
27	Reformat gas element graphs	Closed	Chemistry	189
31	Ensure IW upload on PC	Closed	Chemistry	190
32	Ensure CARB upload on PC	Closed	Chemistry	190
48	Correct GAS upload	Closed	Chemistry	190
28	Section breaks in Net query	Closed	Pmag	190
29	Create Net query for Zplot	Closed	Pmag	190
11	Upgrade "PWS"	Closed	Phys. Props.	191
19	Automated CR	Closed	Phys. Props.	
41	Implement updated MAD	Closed	Phys. Props.	192
33	Fix/create splice reports	Closed	All	188
	Generic Uploader	Closed	All	188
	BOL/EOL Synchronizer	Closed	All	188

Tasks Pending

ID	Task Name	Phase	Area
9	Downhole temperature collection	Open	Downhole
17	Downhole temperature in database	Open	Downhole
36	Implement alternate demag. Measurement types	Open	Pmag
15	TC user interface	Open	Phys. Props.
22	Implement PWS4	Open	Phys. Props.
37	TC data model	Open	Phys. Props.
18	Splice as query parameters	Open	All
39	Better integrate Splicer	Open	All

About these Task Lists

These tables show tasks assigned to the ODP applications development team of the Information Services Group. ODP staff members may acquire more task detail by clicking on a 'Task Name' link.
Progress on these development efforts is reflected in one of two ways-- via milestones or via a percentage completion flag. The 'Phase' column reflects the last milestone achieved. For tasks where work completed may readily be expressed quantitatively, a status is still assigned, but the percent complete is used to show progress.
The accepted milestones in ODP applications development efforts are:

- **Assignment**. A responsible person has been assigned to complete a task.
- **Analysis**. The problem is being studied. A written analysis and set of specifications is being generated.
- **Development**. A solution system is being prototyped. Initial system and process implementation happens during this phase.
- **Development Testing** (DevTest). An initial prototype system is available for demonstration purposes. Alpha testing.
- **User Testing** (UserTest). The system is sufficiently stable to deploy on end-user's stations. Beta testing. System scrutinized for completeness, correctness, and usability from an end-user perspective.
- **Deployment**. Initial deployment of product into production environment with the approval of the end-users affected and associated Lab Working Team.
- **Documentation**. User and technical documentation is being finalized for the deployed product.
- **Production**. The system is in continued production use. Applicable staff are being trained on the usage of the system.
- **Acceptance**. Verify with the applicable staff and lab working teams that the system is performing acceptably.
- **Closed**. The current development effort is complete. Additional issues and requests will be logged and handled as a new task.

History

The original task list came out of extensive discussions and review internal to ODP. To better advise internal and external personnel of continuing changes, the task list has been moved to a database accessible via the Internet. At present only this task list overview is publicly provided. Detailed sub-task and action items recorded are available only for in-house reference.

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Lab Working Teams Legend

Abbreviation	Descriptions
ADMIN	Administrative ODP Functions
BIO	Microbiology
Core Desc.	Core Description
Chemistry	Chemistry Fluids & Solids (AllRF/ICP/AllRD)
COMP	Computers/Communications
Curation	Curation and Sampling
DA	Depth and Age
Downhole	Downhole Measurements
DOPS	Drilling Operations
PAL	Micropaleontology
Pmag	Paleomagnetics
Phys. Props.	Physical Properties
UND	Underway Geophysics
All	Cross-Lab Miscellaneous Issues

Data Migration

The projects to migrate 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) 95% of the MST and Color Reflectance data migration has been completed. We are currently working to migrate the remaining 5% MST data, checking all the migrated data, consolidating the raw files, merging the data migration code, and completing the project report. We expect to complete this migration project by August 2001.

(B) The migration of physical properties data started in December 1999. It includes Moisture & Density (formerly known as Index Properties), Thermal conductivity, PWS, Shear Strength and Paleomag. We expect to complete this project by December 2001.

Please see the attached Excel file for details of the status of these two data migration projects.

Status of data migration

Start Date: September 1998 Current: **October 2000** 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				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
P-Wave	x	x	o	x	o	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	o	x	O	x	o	o	o	o	o	o	o
MagSus	x	x	x	x	x	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 101-132 in S1032

Completed = 197 = 93 %

Remaining = 14

Oct.2, 2000

Janus database Mirror Sites

In May 2000 Martin Cepek of the University of Bremen requested help in establishing a Janus database Mirror site at the University of Bremen. Setting up a Janus database mirror site will require a significant amout of work both for us and for the host institution. We have sent him some start up information, but have not sent any data as yet. We need advice from SCIMP at 2 levels:

(A) Is this an official request approved by the JOIDES panel structure? Should we move forward in fulfilling this request or not?

(B) The proprietary and sensitive nature of some data stored in the JANUS database require that those data are not transferred to mirror sites. In order for the relational character of the database to be viable and allow web queries to work at the remote locations, additional time and effort will be necessary to prepare the database export files that will be used to build mirror site databases.

There are three types of data that comprise the proprietary and sensitive data.

Scientist name, and contact information. Scientist name and contact information will not be released, as it is published ODP policy that personal information will not be distributed to any outside parties.

Sample Request - scientist's proposed research. The sensitive nature of the proposed research is time dependent and should become part of the public database after the publication goal date has been reached.

Leg-specific scientific data within the one year moratorium period. These leg data are released to the public at one year after the end of the cruise.

These considerations will impose a penalty in terms of personnel time and effort. Instead of just dumping the whole Janus database to an export file, each table must be culled for data that should not be made public. Some scripts that have already been written can be modified to accomplish this task, and a few more scripts will need to be written. To finish these scripts and create a mirror site database will take approximately two dedicated months of an FTE. Doing this work will negatively affect our on-going efforts towards data migration.

We need SCIMP advice on which of the above proprietary and/or sensitive data must be protected, and at what priority should we do this additional work to set up a JANUS database mirror site?

DRILLING SERVICES UPDATE

Rig Instrumentation System (RIS)

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 are 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 and additional hardware were shipped to the Leg 193 port call for installation during the transit to Townsville at the end of the leg. 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 [ROP]) as well as the sensor data from MWD transmissions (WOB, torque on bit [TOB]) 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.

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.

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.

Downhole Measurement Technology

The purpose of this project is to provide centralized support for ODP/TAMU downhole measurement tools, as well as develop and acquire new measurement tools for improved science. A major part of this effort is to create a commonality in data acquisition and support software for all downhole measurement tools. This will be applied to current operational tools, third party tools and future tools. A service center has been set up to provide centralized documentation control, inventory control, technical support, and orderly implementation of upgrades and changes. Initially, the five tools being included in this project are the APC Temperature tool, the WSTP, the DVTP, the APC Methane tool and the Memory Drilling Sensor Sub.

Fugro's Piezoprobe pore pressure tool and Hydraulic Fracture Tool (HFT) were evaluated for deployment in ODP bottom hole assemblies (BHA). Fugro and ODP engineers concluded that both tools could be adapted to APC/XCB BHA without compromising the coring operation.

An adjunct to the downhole measurement tools is the Rig Instrumentation System. Rig Instrumentation deals primarily with data acquisition from surface measurements that provide information about downhole conditions. This system will become more coupled to downhole measurements with the deployment of the Drilling Sensor Sub.

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.

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.

Active Heave Compensator (AHC) operational review

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 12-ft to 14-ft of absolute ship motion (approximately 20-ft seas). The best efficiency documented for the Passive Heave Compensator (PHC) is 80%, which would correlate to 2.4-2.8 ft of absolute drill string motion.

Weight Indicator Readings & AHC Weight on bit 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 (20 msec) 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 will be installed during 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.

Advanced Diamond Core Barrel (ADCB)

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 in 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.

Based on the testing results, the ADCB Project Manager purchased seven PQ size impregnated bits for testing on Leg 193. These impregnated bits are designed to cut soft, medium and hard formations. The ADCB will be used extensively on Leg 193, if the rate of penetration, core recovery, and bit life meet or exceed the existing RCB system. Other parameters that will effect the ADCB success are the sea states, the operation of the Active Heave Compensator and the ability to maintain a constant Weight-on-Bit.

The ADCB will also be tested on Leg 194 with the PQ-3 style bit. This new bit is a Polycrystalline Diamond Compact (PDC) design that is similar to a JDC bit tested in Salt Lake City. This bit is expected to have higher penetration rates and be more suitable to the formations on Leg 194.

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 February 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.

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 Re-entry 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.

At the conclusion of Leg 191, many of the test objectives for the HRRS project were not completed. The HRRS is currently available for use on Leg 193 for bare rock spuds in hard volcanic rocks to drill in a short string of casing. The HRRS equipment was stored in Guam and will be loaded on the drillship for Leg 193.

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.

PUBLICATION SERVICES UPDATE

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)

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

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* 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

† Dates represent the date the first paper in the volume was published on the Web.

published on the Web for SR volumes 169 through 174A. On average, papers 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

* = 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 317 citations, of which 224 are submitted, in review, in press, or published papers and 65 are conference abstracts. Of the 224 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.)

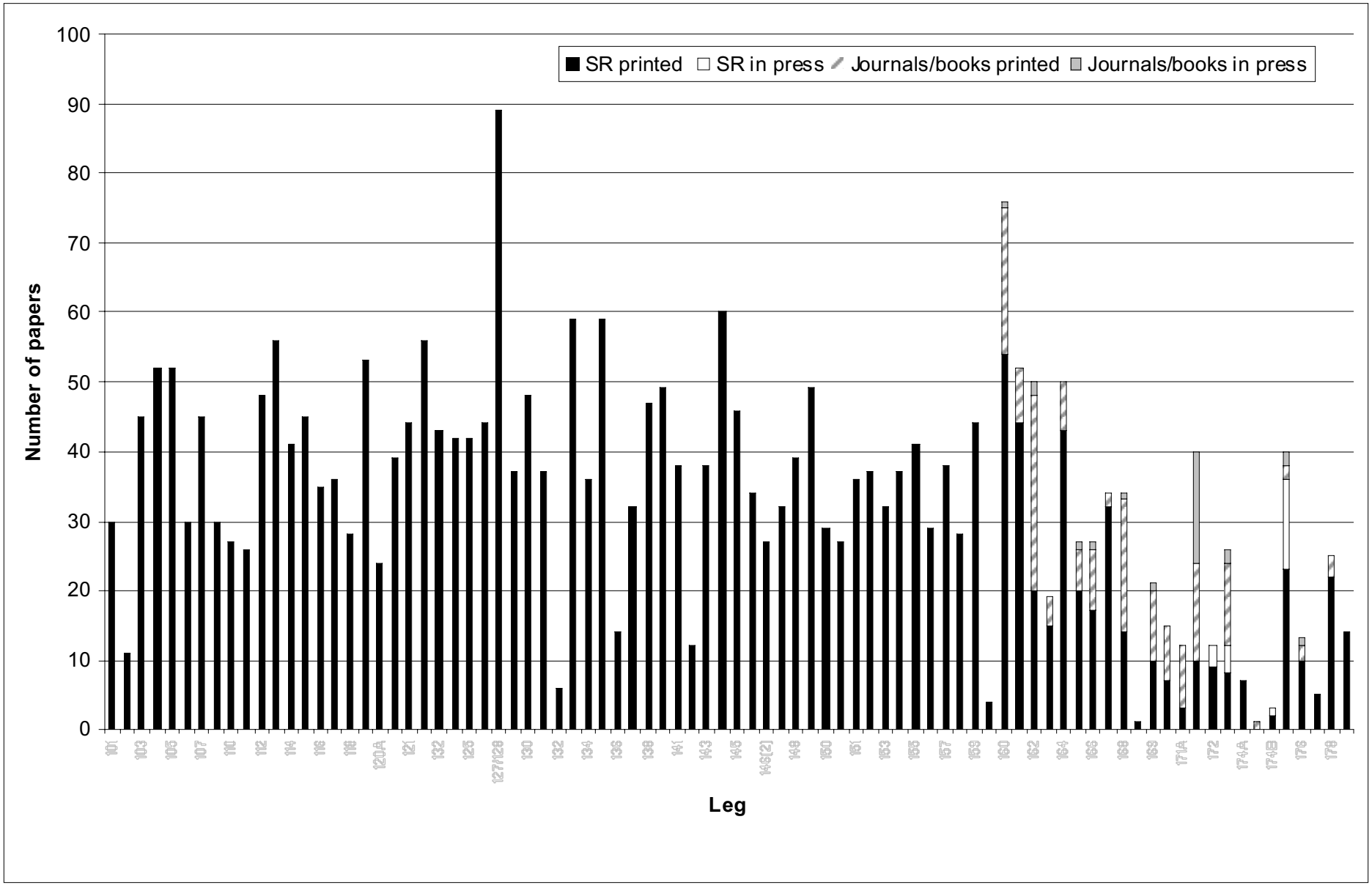
Figure 1 shows the total number of published or in press papers that ODP has been notified of per leg. For Legs 101 through 159, only *Scientific Results* papers were tracked. Beginning with Leg 160, papers published in journals and books were also tracked. All legs through 169 have passed the 4-years 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.

	SR Volume			Journal or Book		
Leg	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	28
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 upcoming 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

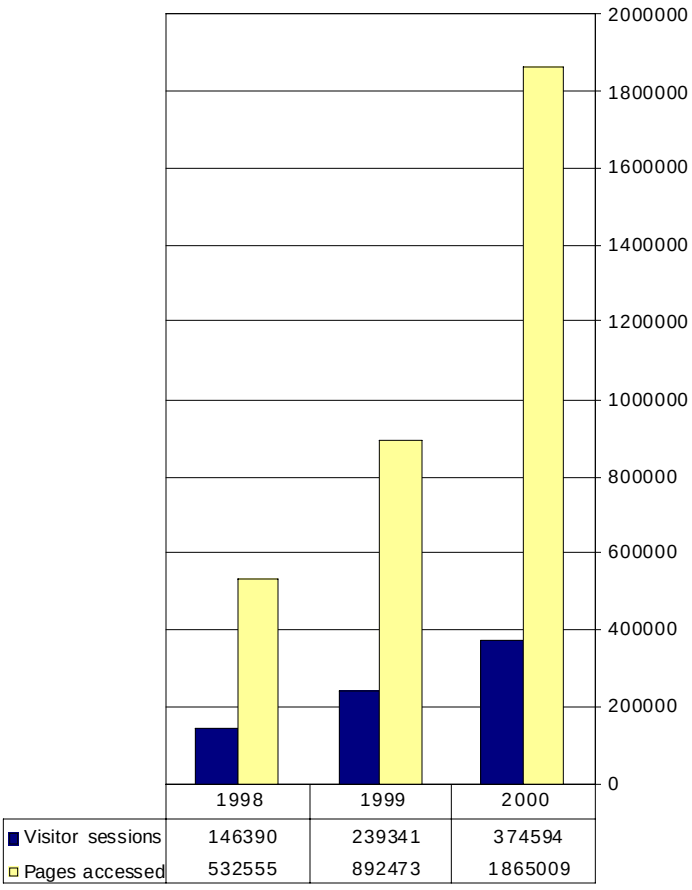
ODP/TAMU Web Site User Statistics

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.

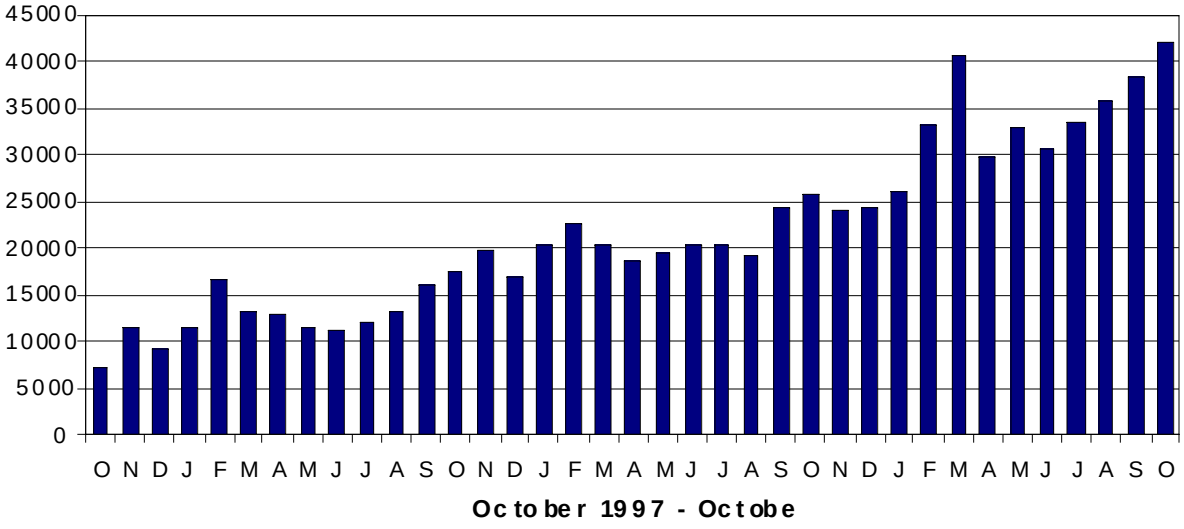
The German mirror site went online in June 2000. User site statistics are listed in Table 5. User statistics are not available yet for the mirror sites in Australia and the United Kingdom.

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.

Appendix. Part II—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 Spring 2000 panel 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 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 [those with and without affiliations]).

Figure A1. "Nonproceedings" serial citations vs. "program proceedings" citations, 1969–1999.

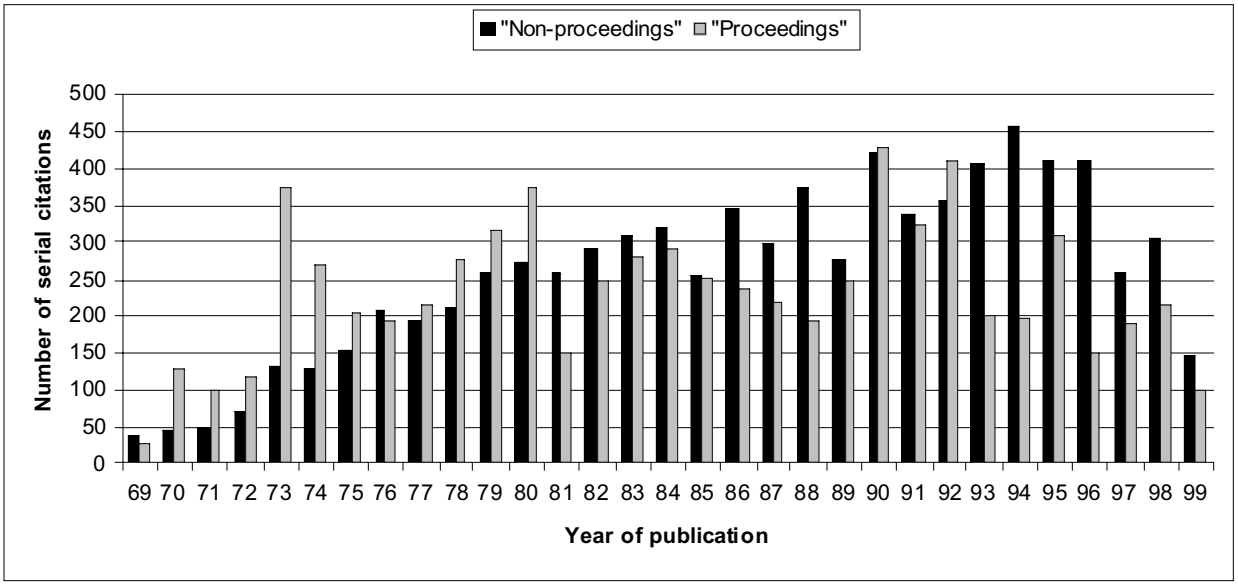


Table A1. All nonproceedings publication sources listed in the DSDP/ODP database and the number of citations per year for each publication.

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	Tota
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	Tota
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'Institut Oceanographique (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	Tota
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
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Biogeograph. & Palynol. Resumes Commun, Assoc des Palynols Langue Francaise, Symp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	2
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BMR J Australian Geol & Geophys	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
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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
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Boletin Informativo - Asociacion Venezolana de Geologia, Mineria y Petroleo	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Boletin Sociedad Geol Mexicana	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
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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
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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
Bull Ocean Res Inst, Univ Tokyo	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bull S. Carolina Acad of Sciences	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2

Bull Seismological Soc America	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	3
Bull Soc Geologique de France [Huitieme Ser.]	0	0	0	0	1	1	2	5	2	10	5	8	0	6	0	3	5	1	6	2	1	2	1	0	1	0	1	0	0	1	0	64
Bulls Am Paleontology	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
Byulleten' Moskovskogo Obshchestva Ispytateley Prirody, Otdel Geologicheskiy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	4
California Geology	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Campus Museum Contributions	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Canadian J Earth Sci - J Canadien des Sciences de la Terre	0	0	0	0	0	0	0	0	22	0	2	0	0	0	0	1	1	0	3	0	1	1	1	1	3	0	1	0	0	0	0	37
Carbonates and Evaporites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2
Chem Congr of N. Am. Abs paps	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
Chemical Geology	0	0	0	0	0	0	0	1	2	2	0	2	3	5	1	1	1	2	1	7	0	3	1	2	2	3	3	2	1	4	6	55
Chemical Geology; Isotope Geoscience Section	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	3
Chemie der Erde	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	6
Chigaku Zasshi (J of Geography)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	1	0	1	0	3	0	0	1	2	0	3	0	0	17
Chikyu Kagaku (Earch Science)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Chikyukagaku (Tokyo) (Geochem)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
Chishitsu Chosajo Geppo (Bull - Japan, Geological Survey)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	5
Chishitsu News	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Chishitsugaku Ronshu (Mems Geol Soc Japan)	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6
Chishitsugaku Zasshi (J Geol Soc Japan)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	1	1	4	0	0	11
Ciencias da Terra	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Circum-Pacific Council for Energy & Mineral Resources, Earth Sci Ser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0	1	0	0	0	0	0	0	0	0	0	8
Clay Minerals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Clays and Clay Minerals	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	2	1	2	0	0	0	9
Climate Dynamics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
Climatic Change	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Coll Colloques et Seminaires - Inst Francais du Petrole	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coll Reprints - U S Natl Oceanic and Atmos Admin, Atlantic Oceanogr and Meteorolog Labs	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Coll Reprints - Woods Hole Oceanogr Inst	0	0	6	2	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
Colloque Intl sur l'Exploitation des Oceans	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Colloques Internationaux du Centre National de la Recherche Scientifique	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Comments on Earth Science; Geophysics	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Compt Rendus Hebd des Seances de l'Acad des Scis, Serie D: Sci Natur [C.R.'Acad Sci., Ser 3]	0	0	0	1	1	0	0	0	0	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Compte Rendu - Congres Intl Stratig & Geologie du Carbonifere (Intl Congress on Carboniferous Stratigraphy and Geology)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Compte Rendu Sommaire des Seances de la Soc Geol de France	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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)	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	5	3	8	2	2	11	6	4	1	2	0	5	3	1	2	2	65
Computers and Geosciences	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Conf Clay Mineralogy & Petrology	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Congr of Intl Union for Quat Res	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
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	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	5
Estudios Geologicos (Madrid)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
European Geophys Soc, mtg abs	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Evolutionary Monographs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
Exploration Geophysics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Explorer (Clevelalnd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Ext abs - Intl Symp Water-Rock Interaction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Facies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Field Trip Guidebk - Pac Section SEPM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Fisica de la Tierra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Forschung (Boppard)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Fortschritte der Mineral, Beiheft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Fossils	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4
Fossils and Strata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Frontiers in Sedimentary Geology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
Geobios	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	3
Geochemical Journal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	1	1	0	0	0	6
Geochemistry International	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Geochim et Cosmochim Acta	0	1	0	0	1	0	2	2	2	0	1	3	3	4	2	3	4	5	3	4	2	2	4	5	4	3	4	3	2	5	3	77
Geodynamics Series	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	7
Geografia Fisica e Dinamica Quaternaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
GeoJournal	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geokhimiya	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	7
Geol Greenland Survey Bulletin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Geol Jahrbuch. Reihe A: Allgem Regionale Geol BR Deutschland und Nachbargebiete, Tektonik, Stratigraphiek Palaeontologie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3
Geol Jahrbuch. Reihe B: Regionale Geologie Auslalnd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geol Jahrbuch. Reihe D: Mineral, Petrogr, Geochem, Lagerstaettenkunde	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geol Soc New Zealand Misc Publ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	2	0	0	1	0	0	1	0	0	0	0	0	8
Geol Soc Special Publ (London)	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	6	0	15	4	3	1	7	2	8	7	0	0	8	2	41	2	111
Geolog (Geol Assoc Canada)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geologi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
Geologia Tecnica	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geologica Balcanica	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geologica Ultraiectina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Geological Journal, Spec Issue	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geological Magazine	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	5
Geologicky Pruzkum	0	1	0	0	0	0	0	0	1	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Geologie en Mijnbouw	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Geologie Mediterraneenne	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Geologische Rundschau	0	0	0	0	0	0	0	0	0	2	0	0	2	0	1	0	0	4	0	0	17	0	1	0	1	1	1	0	0	1	0	31
Geology (Boulder)	0	0	0	0	2	6	3	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Geo-Marine Letters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	0	1	5	1	1	1	1	0	1	2	0	0	0	20
GEOMAR-Report	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Geomorphology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
Geophys J Royal Astron Soc	0	0	0	0	0	0	0	1	2	2	0	2	1	2	4	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
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
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
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**	**Tota**
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

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	Tota
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
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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	4	1	1	0	0	2	0	0	1	0	0	12
Marine Georesources & Geotechn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1	0	0	5
Marine Geothechnology	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Marine Micropaleontology	0	0	0	0	0	0	0	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)	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Maritime Sediments	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Mathematical Geology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Maurice Ewing Series	0	0	0	0	0	0	0	0	1	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
Meddelanden fran Stockholms Univ Inst for Geologi och Geokemi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Mem - Canadian Soc Petroleum Geologists	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Mem - Congreso Latinoamericano de Paleontologia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mem - Geol Soc India	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Mem - GSA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9	11	0	1	0	0	0	1	2	0	0	0	0	0	0	25
Mem - Miami Geological Society	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Mem della Soc Geol Italiana	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	7	0	0	0	0	0	0	0	0	11
Mem Geol de l'Univ de Dijon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Mem Hors Serie - Soc Geol France	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Mem Natl Inst Polar Res. Spec Iss.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Mem Soc Geol France [varies]	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	1	0	0	0	7
Memoires du B.R.G.M. (Bur. Recherches Geol et Minieres)	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Mems des Sciences de la Terre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Messinian Seminar (Seminario sobre el Messinense)	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Meteor-Forschungsergebnisse. Reihe C: Geologie und Geophysik	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Meteoritics	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	3	0	0	0	0	1	0	0	0	0	0	6
Meteoritics & Planetary Science	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	4
Meteorologiya i Gidrologiya	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Micropaleontology	0	0	0	0	0	0	1	2	3	2	3	3	3	5	2	7	0	2	2	1	3	2	2	5	4	2	1	3	2	3	0	63
Micropaleontology Spec Publ	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mineral Resources Bulletin	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Mineral Resources Devel Series	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3
Mineralia Slovaca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Mineralogical Magazine	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	7	0	1	0	0	0	12
Mitteil aus dem Geol Inst Eidgenoessischen Technischen Hochschule und der Univ Zuerich, Neue Folge	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mitteil aus dem Geologisch-Palaeontologischen Inst der Univ Hamburg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Mitteilungen - Deutsche Forschungn	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Modern Geology	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Mosaic (Washington)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Moscow Univ Geology Bulletin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mus Argentina Ciencias Natur "Bernardino Rivadavia" - Inst Nacional Investig Ciencias Natur, Rev, Geol	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nachrichten - Deutsche Geologische Gesellschaft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	13

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	Tota
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
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

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	Tota
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
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

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	Tota
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
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	Tota
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
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
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**	**Tota**
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**	**Tota**
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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	7
The Palaeobotanist	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
The Paleontological Soc Papers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
The Sciences (New York)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Tikhookeanskaya Geologiya (Pacific Geology)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Trans - Gulf Coast Assoc Geological Societies	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	2	1	1	2	0	0	1	0	0	0	0	0	0	0	0	11
Trans (Doklady) USSR Acad Sciences: Earth Sci Sections	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	4	0	0	1	0	0	0	0	1	1	0	0	0	0	11
Trans Caribbean Geological Conf Memorias - Conf Geologica del Caribe	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6
Trans CIBCASIO (mtg)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trans CWLS Formation Evaluation Symp (Canadian Well Log Soc)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trans Latin Am Geologiacl Conf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Trans R Soc Edinburgh: Earth Sci	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Trans SPWLA Ann Logging Symp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	7
Trans/Proc Palaeontol Soc of Japan; New Series	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	0	6
Travaux du CRM Jean Cuvillier	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Travaux et Docs de Geographie Tropicale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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**	**Tota**
Travaux et Docs de l'ORSTOM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trudy - Geol Inst, Akad Nauk SSSR	0	0	0	0	0	0	0	0	0	0	0	0	0	1	16	8	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	35
Trudy - Naucno-Issledovatel'skij Inst Geologii Arktiki	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trudy - Vsesoyuznyy Ordena Lenina Nauchno-Issledovatel'skiy Geologicheskiy Institut im A. P. Karpinskogo, Novaya Seriya	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trudy Inst Geologii I Geofiziki (Novosibirsk)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Trudy Inst Okeanologiy im. P.P. Shirshova	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Tulane Studies Geology and Paleontology	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Tulsa Geological Soc Digest	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Umschau in Wissenschaft und Technik	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
USGS Bulletin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	3
USGS Circular Report	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	11	0	0	0	0	0	14
USGS Digital Data Series	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
USGS Open File Report	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	1	0	2	3	8	2	11	1	2	0	0	1	36
USGS Prof Paper	3	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Utrecht Micropaleo Bulls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Verhandlungen der Naturfor-schenden Gesellschaft in Basel	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Vestnik Akademii Nauk SSSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Vestnik Moskovskogo Univ, Ser 5: Geografiya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Voporsy Mikropaleontologii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Warta Geologi (Newsl Geol Soc Malaysia)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
WAT on Earth (Univ Waterloo)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Water Resources Research	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Water Spectrum	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
World and Regional Geology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
World Data Center A for Marine Geology & Geophysics, Rept MGG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	16
World Oil	0	2	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Xiandai Dizhi (Geoscience)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2

Yanjiu Baogao - Guoli Tawan Daxue Lixueyuan Haiyang Yanjiusuo Acta Oceanographica Taiwanica	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Yanshi Zuebao Acta Petrologica Sinica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Year Book - Carnegie Inst of Wash	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4
Yearbook - Lamont-Doherty Geol Observatory Columbia Univ	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Zeitschrift der Deutschen Geologischen Gesellschaft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Zeitschrift fuer Angewandte Geologie	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zeitschrift fuer Geol Wissenschaft	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zeitschrift fuer Gletscherkunde und Glazialgeologie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Zentralblatt fuer Geol & Palaeo, Teil I: Allglemeine, Angewandte, Regionale und Historishe Geologie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Zhizn' Zemli	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Zhongguo Diqiu Huaxue Xuebao (Chinese Journal of Geochemistry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Zitteliana	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	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**	

SCIMP APPENDIX
00-3-04

Executive Summary

Cruise Highlights:

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 is 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.

Active Heave Compensation

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.

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

Phase 1 of the IESX pilot study will deploy new hardware and software during Leg 194; Phase 2 will augment these exercises during Leg 196. The first meeting of the SciMP subcommittee on seismic integration was hosted at LDEO in October and evaluation of the IESX pilot study results was discussed. Future plans concern the feasibility of IESX for seismic data management by the Site Survey Databank.

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 are in progress and will continue through the umbrella NEB organization.

ODP Logging Services sent the FY 00 Close-Out Report to JOI.

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 study 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 our 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 a single pass of the Triple Combo tool string and two passes of the FMS/Sonic tool string. 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 is 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.

The ship proceeded to Hole 1191A (Satanic Mills area). Unfortunately while drilling this hole, the mechanized bit release failed the bit, core barrel, and DSA pressure case were lost. The loss of the pressure case precludes any further use of the core barrel temperature tool (CBTT). Operations on Leg 193 are ongoing.

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. The data acquired are presently being processed at BRG.

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.

MWD Project

Greg Myers and Dave Goldberg completed analysis of MWD data from Leg 188 to evaluate drill string motion at two sites. The preliminary results will be published, in collaboration with TAMU drilling services, in the *JOIDES Journal*. The repetition of the Leg 188 MWD experiment to evaluate the new AHC has been recommended by JOIDES, if resources are available.

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^{o} C environments in the future.

A total of 2.8 hours of fluid temperature data were acquired with approximately 2 hours acquired while drilling at Site 1188. Further attempts to deploy the CBTT were not possible due to the core barrel in Hole 1191A.

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 will appear in the next issue of the *JOIDES Journal*. A text-only copy appears in Appendix 1.

Maintenance, user support, and user training will be coordinated by Ulysses Ninnemann (LDEO). Maintenance efforts will focus on keeping Splicer and Sagan current with the Solaris operating system. A mailing list has been established to assist with the general dissemination of CLIP-related information to the community. Users can sign up for this mailing list on the CLIP page of the ODP Logging Services website.

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 IESX pilot study is nearing the end of its first phase. 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). As recommended by SciMP, 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 next issue of the *JOI/USSAC Newsletter*. A text-only copy appears in Appendix 2.

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 FY 01.

V. SHOREBASED LOG ANALYSIS

ODP Conventional Date
The following holes were processed and prepared for inclusion in the database at LDEO-BRG:
Leg 190 - Hole 1173A
Leg 191 - Hole 1179D
Leg 192 - Hole 1186A

FMS Processing
The following holes were processed at the LMF processing center:
Leg 189 - Hole 1170D
Leg 190 - Hole 1173A (2 passes)
Leg 192 - Hole 1186A

GHMT Processing
The following holes were processed at the LMF processing center:
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 as a logging scientist 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.

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. A list of action items was drawn up and the results of the meeting will be presented to EXCOM by JOI.

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.

Burgdorff, K., and D. Goldberg, 2000, 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.

Guerin, G., D. Goldberg, A. Meltser, 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.

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.

Appendix 1

Core-Log Integration Platform Update (CLIP)

The recovery of complete stratigraphic sequences has become an essential element of most paleoceanographic drilling legs. Obtaining a continuous paleo-environmental record is a prerequisite for fully understanding the frequency and evolution of climatic variability. Despite its importance, the continuity of the recovered sequence was commonly assessed only well after drilling had been completed. Leg 138 marked the first systematic effort to establish stratigraphic continuity between multiple holes at a given drill site [Hagelberg, et. al., 1992]. The continuous composite sequences generated from Leg 138 eventually led to significant improvements in the late Neogene geological time scale [Shackleton et. al., 1995]. Following these initial successes, the software program Splicer[1] was developed to provide a standard, integrated platform for rapidly generating composite depth scales and spliced sections.

Splicer is a graphical and interactive program for depth-integrating (depth-shifting) multiple-hole lithologic data for building composite sections and developing age models. Up to ten different physical property measurements (e.g. magnetic susceptibility, GRAPE density, P-wave velocity, natural gamma activity, color reflectance) can be used to simultaneously establish interhole correlations. The program uses an optimized cross-correlation routine for determining the best interhole depth correlation and depth offset. Once the correct depth offset is determined it is applied to the entire core and the user proceeds iteratively core-by-core until all cores of all holes at a given site are optimally depth-correlated. Metadata files generated by this program are now formally included in the JANUS database and with the recent upgrade to version 2.2, Splicer can directly open JANUS output files. Since it's introduction on Leg 151 (1993) Splicer has been used routinely on the *JOIDES Resolution* to provide a real-time assessment of the continuity of the recovered sediment sections and provide feedback to guide further drilling.

In addition to guiding drilling efforts and providing a continuous section for paleoceanographic studies, the process of compositing and splicing recovered sediment sequences also has highlighted some of the effects drilling and coring operations have on the recovered sediments. As shared stratigraphic features between holes are tied together and cores are shifted from their standard meters below sea floor depth (mbsf) so that the features are aligned, a new composite depth scale (mcd, meters composite depth) is created. The composite depths are commonly 10% greater than mbsf depths due to a variety of factors

not accounted for in original mbsf depths, including coring gaps [Hagelberg, et al., 1992], and elastic rebound [Moran, 1997]. Although compositing allows the complete section to be reconstructed, the final sequence is no longer representative of the original drilled depth, thus making estimates of sedimentation rates and mass fluxes problematic. In addition, because the same offset is applied to a given core when transforming to mcd, differential amounts of within core distortion are not accounted for, often resulting in identical events having slightly different mcd's in different holes. The expanded mcd depth scale also makes direct core-log data comparisons difficult since the reconstructed composite depth scale is no longer simply related to drilling or logging depths.

Fortunately, a number of borehole measurements routinely conducted during downhole logging are directly comparable to the shipboard core physical property measurements (e.g. natural gamma, bulk density, porosity, magnetic susceptibility, sonic velocity). These continuously measured, in situ logs provide a reference for mapping the composited sediment sequences back to their original stratigraphic positions. Sagan[1], a companion program to Splicer, was created in order to standardize and expedite this mapping process. Using the same graphical interface as Splicer, Sagan is designed to work seamlessly with Splicer output files to generate a single metafile that defines a set of precise depth correlations between core and log datasets at any given site. This metafile provides the foundation for core-log data integration as it establishes the unique mapping function linking the two independent depth scales. The program merges the core-log depths using physical parameters measured both on cores and downhole. The core-log depth correlations are conducted either manually (e.g., core-by-core from single or multiple holes, Figure 1) or automatically (e.g., an entire composite record from a given hole is correlated). Sagan can also perform smoothing, decimation, and culling procedures to modify the data. The program can manage up to 10 holes of core data, 5 data types per hole, nearly an infinite number of cores (limited only by computer memory) and data points and up to 3 reference log curves. Data management and computation is very efficient in Sagan (and Splicer) due to the use of dynamic memory allocation. The resulting core-log tielines can be applied across equivalent mcd depths in different holes or just for individual cores. Because multiple ties can be applied to a single core, the downhole logs can be used as a reference to compensate for differential inter-core distortion to improve inter-hole correlations. Finally, in environments where the resolution of the downhole logs captures the dominant lithologic variability, the completeness of the original splice can be assessed.

In intervals where core recovery is low or multiple holes are not drilled, core-log integration still has significant benefits. For instance, detailed core-log integration allows a

much more accurate estimate of the size and position of coring gaps. One example from ODP Leg 189 where the most recent version of Sagan (version 2.2) was first deployed is shown in Figure 2. The data plotted versus mbsf (top) illustrates the original inter-hole offsets and estimated core gaps versus those after core-log integration using Sagan (bottom). Despite the lower resolution of the downhole logs, the adjustments in the size of core gaps suggested by the correlation can exceed the length of a typical lithologic event. Thus, at sites where sediment cyclicity or cyclostratigraphy are of interest, core-log integration is a valuable step in both verifying the original splice and extending the stratigraphy beyond the splice.

[1] Splicer and Sagan were developed by Peter deMenocal and Ann Esmay. ODP Logging Services provides support for both programs and download files are available at http://www.ldeo.columbia.edu/BRG/ODP/ODP/CLIP.

Acknowledgements
We thank the Leg 189 shipboard scientific party for providing the data used for Figure 2.

Authors
U. Ninnemann, T. Janecek, P. deMenocal

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Hagelberg, T.K., Shackleton, N.J., Pisias, N. and party., s.s., 1992. Development of composite depth sections for Site 844 through 854. In: L. Mayer, Pisias, N., Janecek, T., Palmer-Julson, A. and van Andel, T.H. (Editor), Proc. ODP Init. Reports. Ocean Drilling Program, College Station, TX, pp. 79-85.

Moran, K., 1997. Elastic property corrections applied to Leg 154 sediment, Ceara Rise. In: N. Shackleton, W.B. Curry, C. Richter and T.J. Bralower (Editors), Proc. ODP, Init. Repts. Ocean Drilling Program, College Station, TX, pp. 151-155.

Shackleton, N.J., Crowhurst, S., Hagelberg, T., Pisias, N.G. and Schneider, D.A., 1995. A new Late Neogene time scale: Application to ODP Leg 138 sites. In: N.G. Pisias, L.A. Mayer, T.R. Janecek, A. Palmer-Julson and T.H. Van andel (Editors), Proceedings of the Ocean Drilling Program, Scientific Results. Ocean Drilling Program, College Station (TX).

Note: Figures are not included in this preview copy. Please refer to the *JOIDES Journal* article for them.

Appendix 2

"Seismic Data Integration: IESX Joint Pilot Study"
by Dan Quoidbach and Gilles Guerin

A shining achievement of ODP has been to bring an unprecedented amount of data only a few clicks away from our desktops. Readily available core and log data on the *JOIDES Resolution* and post-cruise allow scientists to combine data and results with ease. Integrating data is a natural way to analyze all shipboard measurements. For example, the juxtaposition of sample and log measurements with a core photo or an electrical FMS image may provide simple feature explanations. However, among scads of digital leg data, one major data type has often been omitted—seismic. Also, comprehensive data integration in a well's vicinity is usually deferred to post-cruise research. Individual scientists have produced synthetic seismograms and time/depth conversions, but these studies are rarely performed during a leg. Fortunately, the ever-increasing power of workstations and the availability of commercial software have made the shipboard integration of these data types possible: the GeoQuest IESX seismic interpretation package—part of the GeoFrame software used to process log data—is now available for routine use on the drillship.

IESX use was successfully initiated during Legs 180, 182, and 188, which highlighted some of the software's features that are most useful to ODP scientists: 1) basemap display of seismic lines and wells to monitor the distribution of data; 2) interactive 2-D visualization/interpretation of individual seismic lines; 3) 2-D visualization of intersecting seismic lines; 4) generation of synthetic seismograms from log data and their superposition on seismic lines; and 5) 3-D interactive visualization of seismic lines and wells. Figure 1 highlights some of these tools and illustrates how they are dynamically linked. IESX is also available for post-cruise work at the five shorebased facilities affiliated with ODP logging services: Columbia Univ. (USA), Univ. of Leicester (UK), Univ. of Aachen (Germany), Univ. of Montpellier (France), and Univ. of Tokyo (Japan), as well as at several other university-based locations.

Under recommendation from the Scientific Measurement Panel (SciMP), a joint LDEO-BRG and LDEO-SSDB pilot study is underway to determine procedures and tools to enhance routine seismic data integration in ODP with IESX. The study will determine guidelines for digital data submission to the Site Survey Databank so that they can be readily converted into IESX 'projects'. It will also address ways to insure data integration early in the cruise planning and the nature of the output for post-cruise archiving. The level of effort required to

prepare the projects and ways to secure their integrity onboard and post-cruise also need to be determined. SciMP has appointed an ad hoc working group to follow the progress of issues related to the IESX pilot study.

The pilot study focuses on two upcoming legs (Legs 194 and 196). Leg 194, in January 2001, will investigate the development of the carbonate platforms of northeast Australia. IESX has already been used to evaluate the available seismic data at all the proposed drilling sites. Pre-cruise efforts will define a 'project' containing all seismic data and site locations and will provide the basic framework for shipboard data integration. Core and log data collected during the leg will be progressively added into the project. Leg 196 will drill on the Nankai accretionary prism using Logging-While-Drilling (LWD) tools prior to the deployment of two advanced CORKS for long-term monitoring of fluid processes. During the leg, LWD data will be tied to the seismic surveys in the area by their progressive addition into the Leg 196 IESX project. The confidentiality of some of these data will be maintained by password-restricted access to each project. We are confident that this study will generate a significant improvement in the shipboard use of seismic data and well-to-seismic integration, leading to them becoming an essential and routine ingredient in most ODP legs.

Note: Figures are not included in this preview copy. Please refer to the *JOI/USSAC Newsletter* article for them.

SCIMP APPENDIX

00-3-05

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

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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., 8^{th} 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
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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 8^{th} 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 (8^{th} 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 Resolutio*n. 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 Resolutio*n.

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 Resolutio*n.

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.

SCIMP APPENDIX

00-3-06

Date: Wed, 07 Jun 2000 20:51:09 -0500
From: "JRS Miriam Kastner" <jrs_kastner@resolution.tamu.edu>
To: <Rickm@bu.edu>
Cc: <janecek@quartz.gly.fsu.edu>
Subject: SciMP meeting
Mime-Version: 1.0
X-MIME-Autoconverted: from quoted-printable to 8bit by quartz.gly.fsu.edu id JAA67698

Dear Rick and Tom,

In response to your email, rick, yes Art and I were planning to contact the panel's chair, Tom, before the meeting but were very busy and did not get to do i yet.

There are two important points we would like you to act upon at your meeting:

1. The squeezers;

2. Resistivity measurements.

1. Since at least Leg 131 (may be already 112) some of us geochemists have requested from TAMU to get two more automated squeezers plus the Ti containers essential for some topical cruises, but as yet it has not happened. For example, after Leg 131 Joris and I separately urged TAMU about it, and here we are back and are facing the same squeezing problems with no change and loosing again fluid samples from crucial intervals!!!!!!!!!!!!! . We are talking about a few thousand dollars over the past >10 years for better science that costs millions of dollars. We have faced this situation on every subduction zone leg and the same problem must apply to shallow water coring at any place, especially when diagenesis is intense.

The issue is that when we drill deeper in these difficult, or shallow water, environments it is difficult to squeeze pore fluid from low permeability sample in the short time available between cores, and therefore we either do not recover fluids from the most interesting and crucial intervals, like the decollement, or at best get 1-2 cm3, thus compromise both the shore-based and shipboard science. The squeezing time is especially short between cores at such intervals because the whole rounds require much pre-squeezing cleaning to avoid drill fluid (surface seawater) contamination. We have shown time and again when we had extra squeezing time because of drilling problems that we then recover 2 to 3 times the amount of pore fluid from such samples. For example, on the present cruise, we are trying to expand the geochemical program, trying to introduce new measurenments such as hydrogen and DOC concentrations, we are working closely with the microbiologists, providing them with samples when possible, but unfortunately because of a few thousand dollars, beyond certain depths we cannot share the fluids when almost nothing to nothing is available.

The solution to this important problem is simple: On such cruises, two additional automated squeezers should be installed on one of the lab counters in the nearby paleo-lab, which is not heavily used on such cruises, at most have two micro-paleontlogists, and then remove them and store them either downstairs or at TAMU. This is simple and cheap for cruicial biogeochemical science objectives of ODP and for the future program.

2. When I came aboard and asked about resistivity measurements on the two shifts Art Spivack and Pierre Henry told me that resistivity measurements are not being measured anymore. At first I thought it is a bad joke, but then realized that the physical properties tech indeed did not undertand what I am talking about. After Leg 185 when Art told Joris that resistivity measurements were not done because he was told that the electrodes for this measurement are not on board, Joris was shocked, but assumed it was anomalous; unfortunately he was wrong. Someone has decided to romove this important measurement from the routine protocol without consulting with some of the physical properties and geochemistry scientists. This is most unfortunate and Art and I, and definitely Joris and all other geochemists who wish to use pore fluid geochemistry for correct interpretations and modeling urge your panel to immediately re-introduce this measurement into the routine protocol and data base. For this leg we have solved the problem and are getting great data, including of resistivity anisotropy, by having one of the techs (Eric Meissner) built electrodes for the softer sediments (they are working great), and Pierre Henry brought with him a simple great system for the harder sediments, and I spent some time with the physical properties tech, explained to her what is being measured and why, and

wrote out for her the basic equations and definitions. The dollar investment for this measurement is minimal.

Art and I urge your panel (a) to decide that resistivity measurements be added to the required present list of protocol of physical properties measurements, and (2) to have on board at least two sets of working electrodes for resistivity measurements in softer sediments, plus a system for measuring resistivity of harder sediments and rocks.

If something else will come up in the next day or two we will let you know. Otherwise things are going well.

Best wishes,
Miriam and Art

SCIMP APPENDIX

00-3-07

SPLICER/SAGAN Software Status and Maintenance Program

• Development efforts on SPLICER/SAGAN software packages are complete.

•BRG will continue to maintain software and support shipboard and shorebased users of SPLICER/SAGAN, as noted below:

• CLIP Software Support:

Supported	Personnel
Daily user support (training, email/phone queries etc.)	U. Ninnemann
Develop user cookbook, and leg-to-leg user support	U. Ninnemann & Shipboard Loggers
Maintain current versions on DHML Unix workstation	Ted Baker & Shipboard Loggers
Ensure compatibility with operating system upgrades.	Ann Esmay

•New software modules and/or enhancements using the CLIP platform may be proposed by individual PI's with review by BRG.

SCIMP APPENDIX

00-3-08

Policy towards the use of personally owned computers aboard the JOIDES Resolution.

Definition:
Personally owned computers (POCs) is a term used in reference to desktop or laptop PCs, Macs or UNIX workstations that are not owned by ODP. These are computers brought to the ship by scientists or staff for personal use during a cruise and that return with their owner following the end of the cruise.

Use without access to the shipboard network or shipboard software or hardware. Many users wish to bring POCs for personal use and do not require access to the shipboard network, hardware or software. In these cases, the only restriction is that the POCs not interfere with standard shipboard operations. For example, a POC will not utilize space that is needed by others for standard laboratory measurements/analysis or ODP computers.

Use with access to the shipboard network or shipboard software or hardware: Similar to above, the POCs should not interfere with normal shipboard operations. In addition, users with the intent of bringing a POC aboard the JR for their cruise must inform the leg's Staff Scientist and pertinent ISD personnel (sailing MCSs) of this fact, at least three weeks before the start of their cruise. They will be informed of this, in the letter of direction and instructed to bring all necessary equipment for their POC (i.e., network hardware, backup devices/media)- Equipment specifics will be dealt with on an individual basis. Aboard the JR, the MCSs will not provide any hardware for their personal backups or connectivity to our network.

The MCSs first priority is to ODP shipboard *computers and* network, Thus, OOP cannot guarantee that an MCS will be available to assist with the installation of shipboard software or connection to the shipboard network or **hardware.** In such instances, the user MUST NOT connect to the network or other hardware nor install software unless approved by an MCS or by the Lab Officer or Staff Scientist in consultation with an MCS.

Software use:
Users must sign a software user agreement, which states that any software loaded on their POC that is licensed for use on the ship will be deleted before the end of the Cruise

Signed liability/insurance contract.,
This will be discussed with Admin but will run along the lines of stating that OIDP IS personnel will not be liable for accidental damage done to POC hardware or software while in their care.

SCIMP APPENDIX

00-3-09

Date: Wed, 01 Nov 2000 17:41:36 -0600
From: "JRS Mike Coffin" <jrs_coffin@odpemail.tamu.edu>
To: "Tom Davies" <davies@odpemail.tamu.edu>
Cc: <srivastava@agc.bio.ns.ca>, <macleod@cardiff.ac.uk>,
<ludden@crpg.cnrs-nancy.fr>, <a.robertson@ed.ac.uk>,
<rick_sarg@email.mobil.com>, <casey@emerald.ucsc.edu>,
<bloomers@geo.orst.edu>, <nils.holm@geo.su.se>, <kenj@geo.vu.nl>,
<joides@geomar.de>, <whay@geomar.de>, <dhondt@gso.uri.edu>,
<doug@kermadec.wustl.edu>, <jock@mail.usyd.edu.au>,
"Jack Baldauf" <Baldauf@odpemail.tamu.edu>,
"Jeff Fox" <fox@odpemail.tamu.edu>, <zhouzy@online.sh.cn>,
<tokuyama@ori.u-tokyo.ac.jp>, <janecek@quartz.gly.fsu.edu>,
<kgm@rci.rutgers.edu>, <kbecker@rsmas.miami.edu>, <pfryer@soest.hawaii.edu>,
<davidrea@umich.edu>, <larry.mayer@unh.edu>
Subject: Non-ODP-related communications at sea
Mime-Version: 1.0
X-MIME-Autoconverted: from quoted-printable to 8bit by quartz.gly.fsu.edu id eA26YR722914

Dr. Thomas A. Davies
Manager of Science Services
Ocean Drilling Program
Texas A&M University
1000 Discovery Drive
College Station, Texas 77845

2 November 2000

Subject: Non-ODP-related communications at sea

Dear Tom,

Greetings from the last days of Leg 192 on the Ontong Java Plateau. This letter outlines problems and concerns with the current email situation aboard the JOIDES Resolution, and our suggestions for improving it. Your memo of August 2000 to the Leg 192 Shipboard Scientists on the subject of "Non-ODP-related communications at sea," and a subsequent question-and-answer between one of us (Coffin) and Jack Baldauf at the August 2000 SCICOM meeting in Halifax (Appendix 1) provide some background to the issues.

Everyone using Novell GroupWise has experienced significant problems with the software and its implementation during Leg 192. One, we were assigned email addresses in your August 2000 memo. After a week at sea, we received a message from the shipboard MCSs (Appendix 2) stating that these addresses were not valid, and that there was no simple solution other than emailing all of our shore-based contacts with different, valid addresses. Two, after two weeks at sea, we discovered a significant glitch in Novell GroupWise, namely that the software or its implementation was altering firstname.lastname@xyz addresses to lastname.firstname@xyz addresses, causing all email to such addresses to bounce (e.g., Appendix 3). One of us (Coffin) reported this glitch to the MCSs, and, after copious bounced messages, the glitch was resolved. Three, Novell GroupWise creates multiple files of the same message on incoming email, which is a waste of costly satellite transmission time, not to mention a waste of scientists' personal funds. Four, Novell GroupWise software apparently does not allow effective archival of shipboard email and transferal to any of the much more popular email software packages commonly used by the ODP community around the world. In addition to the above difficulties, a regular email transmission/reception schedule has been impossible to maintain during Leg 192.

Thus, despite 10+ months of use aboard JOIDES Resolution, Novell GroupWise has proven far less than satisfactory for the Leg 192 shipboard scientific party; the software appears to be in perpetual beta development. In the short term, we believe that the Leg 192 scientists, technicians, and ship's crew should not be charged for acting as guinea pigs for a trouble-prone email system; it does not reflect well upon either the ODP or TAMU to require people to pay for something that doesn't work satisfactorily. In the longer term, given the significant problems associated with Novell GroupWise and the ongoing resources that must be devoted to addressing those problems, we recommend that ODP/TAMU evaluate and choose a more robust and popular email software that would serve the ODP community better, and implement the new software at your earliest convenience.

Please contact us with any questions or comments; we look forward to hearing from you soon.

Sincerely,

Mike Coffin, Leg 192 Geophysicist/JOIDES Logger & JOIDES SCICOM member
Godfrey Fitton, Leg 192 Co-Chief Scientist
John Mahoney, Leg 192 Co-Chief Scientist

cc: Jeff Fox, Director, ODP/TAMU
Jack Baldauf, Deputy Director, ODP/TAMU
SCICOM

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Appendix 1.

>From the August 2000 SCICOM minutes: "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."

****

Appendix 2.

>From David Morley on 20 September 2000:

From: JR Marine Computer Specialists

To: JRS Maria Antretter , JRS Neil Banerjee, JRS James Bergen, JRS Graeme Cairns, JRS Paterno Castillo, JRS Lynne Chambers, JRS Bill Chazey, JRS Mike Coffin, shipmail.ODPJR.jrs_fang, JRS Godfrey Fitton, JRS Stuart Hall, JRS Jose Honnorez

Subject: Email account problems

Message: A glitch (i.e. a goof on my part) occurred as I created your email account when you came onboard, and therefore your email address is not propagating to our shore post office. Thus, when mail from your friends and family get to ODP, our shore post office doesn't recognize you and the email is bounced back to the sender. I think most of you are getting mail now because your friends and family are replying to your messages, which circumvents the address book problem. But this only works for people that you have written to first so that they could reply to your message. Anyone trying to write to you that you haven't written to first won't get through unless they attach our post office name to your email address.

We can fix the problem by archiving your mail, deleting your account and recreating it, then unarchiving your mail into the new account. Due to security issues with GroupWise

that prevents anyone else from reading your archived mail (including your newly created account), this will take a few tricks to correct. Please stop by the computer office so that I can fix your account. I apologize for this inconvenience and will correct the problem as quickly as I can.

- David

****

Appendix 3

Novell Groupwise message on 27 September 2000, bouncing from olav.eldholm@geologi.uio.no

From: eldholm.olav@geologi.uio.no

To: JRS Mike Coffin

Subject: "eldholm.olav@geologi.uio.no" is undeliverable for Leg 192, Japan, Australia, France, etc.

Attachments: Envelope

Message: RCPT TO:<eldholm.olav@geologi.uio.no>
550 Unknown local part eldholm.olav in <eldholm.olav@geologi.uio.no>

****

Date: Thu, 30 Nov 2000 16:09:10 -0600
From: "David Becker" <becker@odpemail.tamu.edu>
To: <mikec@utig.ig.utexas.edu>
Cc: <ludden@crpg.cnrs-nancy.fr>, <gfitton@glg.ed.ac.uk>,
<janecek@quartz.gly.fsu.edu>, <a.robertson@odpemail.tamu.edu>,
"Jack Baldauf" <Baldauf@odpemail.tamu.edu>,
<bloomers@odpemail.tamu.edu>,
<davidrea@odpemail.tamu.edu>, "Tom Davies"
<davies@odpemail.tamu.edu>,
<dhondt@odpemail.tamu.edu>, <doug@odpemail.tamu.edu>,
"Jeff Fox" <fox@odpemail.tamu.edu>, <jock@odpemail.tamu.edu>,
<joides@odpemail.tamu.edu>, <kenj@odpemail.tamu.edu>,
<kgm@odpemail.tamu.edu>, <larry.mayer@odpemail.tamu.edu>,
<nils.holm@odpemail.tamu.edu>, <pfryer@odpemail.tamu.edu>,
<rick_sarg@odpemail.tamu.edu>, <srivastava@odpemail.tamu.edu>,
<tokuyama@odpemail.tamu.edu>, <whay@odpemail.tamu.edu>,
<zhouzy@odpemail.tamu.edu>, <kbecker@rsmas.miami.edu>,
<geosckm@showme.missouri.edu>, <j.mahoney@soest.hawaii.edu>,
<jfcasey@uh.edu>
Subject: Response to Mike Coffin's E-mail Dated November 2, 2000
Mime-Version: 1.0

DATE: November 30, 2000

TO: Dr. Mike Coffin

FROM: Dr. David Becker

SUBJECT: E-mail Service on the JOIDES Resolution

Note: Please use the full screen browser to read this message.

As manager of the Information Services Department at ODP, I welcome your comments regarding the level of service my department provided on the JR during Leg 192. You identify six separate issues in your letter to Tom Davies as follows:

1. At the beginning of the leg, e-mail addresses were incorrectly set up for scientists.
2. After two weeks at sea, first and last names were being reversed on outgoing e-mail messages.
3. GroupWise creates multiple files of the same message on incoming e-mail.
4. GroupWise software does not allow effective archival of e-mail.
5. "Regular" e-mail transmission/reception schedule has been impossible to maintain during the leg.
6. A new e-mail software package should be selected.

1. At the beginning of the leg, e-mail addresses were incorrectly set up for scientists.

>From the first day that e-mail services began on Leg 192 ISD knew we had a problem. New addresses for sailing scientists were incorrectly entered into the "corporate" address book in GroupWise by an MCS. The

individual acknowledged the error-- he made a mistake, admitted to it, and made the corrections as quickly as he could. Everyone should be reminded that the correct e-mail address for visiting scientists on the JR is: JRS_<lastname>@odpemail.tamu.edu, as indicated in the letter sent to each sailing scientist. Since the mistake had to do with the prefix (JRS), anyone on shore who used that prefix would find their e-mail returned to them. Once the correct address was entered into the database on the ship and, then, synchronized with the shore based address book, e-mail from shore and ship could reach its destination. Unfortunately, the process of correcting these addresses took longer than expected. This event and associated circumstances have been reviewed by management and discussed with the MCS's. To avoid such errors, the MCS staff will receive additional training in administering the e-mail system.

2. After two weeks at sea, first and last names were being reversed on outgoing e-mail messages.

Your second issue is related to three address books which exist in the GroupWise e-mail system: the "corporate" address book (which contains all the ODP addresses found on shore; it is actually synchronized with the shore address book and shared with all e-mail users, both on the JR and on shore), the "frequent contacts" list, and a personal address book. With these books, there are rules regarding the order in which the books are parsed for the address that one types into the system. The default sequence is: frequent contacts, personal address book, and "corporate" address book, in that order. The only way that this can be altered is when a user changes the order or adds address books and changes the order. In any case, the "corporate" address book is always checked last. For the record, the frequent contact list can be "turned off" by the user, which is a good move, in my opinion, since it is a known source of some addressing errors. To my knowledge, this was mentioned by the MCS's in the training they provided to the science party. To ensure that this is covered in future training sessions, the MCS's have been made aware of the problem associated with the frequent contact list and they will pay closer attention to it on future legs.

Since we have no information regarding the books you were using, it is impossible to reconstruct the problem you were experiencing. According to your letter, the "glitch" you experienced was actually resolved by the MCS. I trust that the problem did not reappear during the remainder of the leg. I did notice in Appendix 3 that e-mail was correctly delivered to a number of other recipients whose addresses were similarly formatted as: <name.name@organization.edu>.

3. GroupWise creates multiple files of the same message on incoming e-mail.

Regarding issue number three, I am not quite sure about your meaning of "...creates multiple files of the same message on incoming" e-mail? If you are referring to the "mime.822" reference in the attachments window, I can only reply to say that the mime is created before it goes over the internet. It is the common exchange format for internet e-mail which allows access to features such as interpreting hypertext mark up language (html) and hot links (e.g., becker@odpemail.tamu.edu). We cannot delete these files. As an alternative, we are investigating its size relative to the message and message header. This will give us an

overhead rate which can be factored into the number of free bytes allocated to the ODP user. The ODP policy provides for such flexibility.

4. GroupWise software does not allow effective archival of e-mail.

Archiving through GroupWise for use on other e-mail systems is a challenge, and we know it. However, we have asked the MCS's to ensure that users on board the JR know that they need to save their important e-mail to a text file as they read them during the leg. The text file can be loaded into other readers and text processing systems at a later date, back on shore. If the user is vigilant in saving the messages instead of waiting until the end of the leg, it will be a simple matter to transfer those messages/files to floppy disk or CD-ROM at the end of the leg. Until the vendor provides other archive options, this is the recommended procedure. If you did not receive such information during leg 192, I apologize since I realize that such information is difficult to ferret out of manuals and the online help facility. On future legs, MCS's will emphasize this procedure in their e-mail training sessions onboard the JR.

I assume that your reference to "...more popular email software packages commonly used by the ODP community..." in issue four refers to the use of Eudora, Pegasus, Outlook, etc. which are client software packages that reside on one's personal computer. These clients must communicate with a server such as GroupWise, Sendmail, Exchange, Domino, etc. in order to receive and send mail. All of these e-mail server systems were commercially developed for use on the world wide internet. Thus, they are most robust when used in that environment and much less robust when used to connect to remote facilities, such as a drill ship.

Also, I interpret your reference to "ODP community" that you intended to include both shore-based and ship- based e-mail systems. However, please be aware that these two environments (shore and ship) are, in fact, radically different. To address your concern, I refer to a survey, conducted by ISD staff last spring, of research vessels that provide e-mail services. A chart summarizing our survey is included with this message (see attachment: email survey.xls).

In comparison, the ODP e-mail system on the JOIDES Resolution compares very favorably with the other ship systems. Unless specifically funded to provide free e-mail services, the majority of all ships bill customers for e-mail traffic, and in both directions. When compared to ODP's research vessel, all ships that charge use rates that are higher than the ODP rate. ODP uses one of the highest connection speeds available to transmit e-mail. ODP provides a full function e-mail system with shared address books and shared folders. These are features not equally found in the other systems used on the other vessels. And, while a permanent web connection is available to the maritime community, the costs to ODP would be prohibitive and users would not stand for the per minute cost of that access (e.g., some cruise ships have web access and charge $9.00 per minute for that service.)

5. "Regular" e-mail transmission/reception schedule has been impossible to maintain during the leg.

Your last point, while not identified as issue five, is difficult to understand since during leg 192 there were on average 4.3 e-mail transmissions per day between the JR and shore (see attachment: logsum...). In our e-mail communications policy, we have indicated that we will support 3 e-mail transmissions per day. There are times when e-mail blasts are not made precisely at the "scheduled" hour. This is due to the ship being in an orientation which obstructs the connection to the satellite and the ship must be moved around the drill string until it no longer obstructs the connection. As you are aware, this may not be possible and the decision to move the ship does not rest with ISD or the onboard MCS's. Also, our MCS's are instructed to place the e-mail blasts on a lower task priority than requests which support science objectives and core flow. Therefore, if the MCS is on call in the lab stack, for example, the e-mail may not be sent on "schedule".

6. A new e-mail software package should be selected.

This section discusses the history of the current e-mail system used at ODP

3/29/99 - Communications Committee meeting.

The following selection objectives were stated for the replacement e-mail system.

1. Maintain all positive capabilities of CC:mail.
2. New system should support IMAP and POP (Currently supported on shore).
3. WWW access should be taken into consideration.
4. System should address transport to the ship. If possible, it should also improve the accounting of mail to the ship so that accurate billing can occur in both directions.
5. New system should address migration from old system to new.
6. It should not be necessary to ever shut down the mail system for maintenance.
7. New system should have a mechanism to take advantage of high speed link to ship.

(Since the old e-mail system was not Y2K compliant, that became another objective.)

At the meeting, the list of e-mail systems was reduced to four contenders which met the above criteria, to varying degrees: Netscape, GroupWise, Exchange, and IBM/CC:mail (which became Lotus Notes in fall 2000).

6/7/99-Communications Committee Meeting. At this meeting, the four e-mail packages were evaluated. Since all packages met the minimum requirements of the Communications Committee, other features of each package were discussed and included in the selection process. During the ensuing discussion, GroupWise appeared to be the system of choice since it had these distinct advantages over the others: 1. Maintenance time would be greatly reduced and management more efficient. (While this has been the case, it and other benefits of GroupWise have been overshadowed by the problems associated with implementing the software subsystem that allows us to transfer e-mail via satellite to shore.) 2. Since ODP already had licenses for Novell, there would be no licensing cost to implement GroupWise. 3. Added features such as calendar, scheduling, and document libraries are available in GroupWise. 4. Maintenance charges would be less for GroupWise. 5. Security is much

better in GroupWise. 6. Multiple clients as well as web interface available. 7. GroupWise server runs on many platforms which would allow migration from Novell to other operating systems.

6/99- ODP Manager Meeting. Approval given to implement the GroupWise e-mail system on shore and on the ship. Implementation began in earnest in August, 1999. Full implementation occurred before January 1, 2000 to avoid potential problems with Y2K. Since then, numerous problems arose with providing stable service to the ship. The primary problem was that an asynchronous gateway module in GroupWise failed to stand up to the requirements placed on it. The product had software bugs that prevented its full implementation on the ship. After several months of applying fixes and building a "work around", Novell agreed with ISD staff that the product would not meet our requirements. Working with GroupWise consultants, ISD was able to put together a ship to shore e-mail system that worked and one that cut the cost of e-mail by more than fifty percent. The primary criticism with the system onboard the JR is that it does not support IMAP or POP clients. This is true. Until ISD can find a work around for this, the lack of access to a simple e-mail client will continue. Currently, GroupWise clients (PC and mac) and GroupWise web access are provided on the JR. It must be pointed out that the use of a simple mail client will bring additional problems to the users of those clients. Two main problems come to mind: these clients provide little security to personal e-mail and they do not allow sharing of address books (each user would have to maintain their own) or mail folders. Options to providing access to these clients should be available before the new year. ISD will implement any viable options pending a directive from management.

I trust that this brief historical sketch puts your current e-mail concerns and issues in perspective. Based on our analysis, experience and requirements, the GroupWise e-mail system is a state of the art electronic mail system and remains the preferred system at ODP.

Lastly, neither ISD nor the Science Services Department sets the policy regarding charge back for e-mail services. ISD/ODP provides the e-mail service as well as the billing service (non ODP clients must be billed for their e-mail services) in response to management directives. It is my understanding that management is currently reviewing the e-mail policy with regards to overall costs to the program.

ISD tries to satisfy the wishes and expectations of the 75 plus e-mail users on the JR during each leg. As manager, I am sorry to hear that your expectations were not met on leg 192. We will keep trying harder in the future.

Dr. David G. Becker, Manager
Information Services Department
Ocean Drilling Program
Texas A & M University
1000 Discovery Drive
College Station, Texas 77845
979-845-9324
becker@odpemail.tamu.edu

Attachment converted: Curator5:email survey.xls (XLS4/XCEL) (000C1934)
Attachment converted: Curator5:logsummary.xls (XLS4/XCEL) (000C1935)

SCIMP APPENDIX

00-3-10

Email charges on the JR

FY	System	Total Charges	ODP charges	Personal Charges	%Personal Charges
FY'94	VAX	$32,403	$32,403	0	
FY'95	CC:Mail	$68,230	$68,230	0	
FY'96	CC:Mail	$72,511	$60,974	$11,537	16%
FY'97	CC:Mail	$69,088	$58,230	$10,858	16%
FY'00	Groupwise	$36,633	$36,633	0	

FY'00 ODP phone/fax accounts:	$12,221.27
FY'00 ODP email accounts:	$36,633.55
FY'00 TSF/LDEO/Schlumberger:	$30,422.72
FY'00 Total communication:	$79,277.54

Prior to Leg 165

* Vax mail
* no billing

Legs 165 (December 23, 1995) through 186 (August 15, 1999):

* cc:mail software
* billing of sent messages, first 100,000 bytes free, additional 25,000 byte increments purchased for $10 ($0.0004/byte)
* scientists account for about 40% of outgoing email traffic, ODP business 18%, ODP staff 18%, TSF for 24%
* average expense for scientists about $45 and for ODP staff $14 per cruise for email

Legs 187 (November 15, 1999) through 191 (September 10, 2000):

* Groupwise software
* No billing
* Increase of email expenses by 36% over previous period
* **Reduction of email cost by high-speed transmissions and renegotiated COMSAT rates in June 2000**

Starting with Leg 192 (September 10, 2000)

* Groupwise software
* Billing of sent and received messages, first 200,000 bytes free, additional byte increments purchased for $0.000033/byte
* Scientists accounted for 33%, ODP staff for 23% and TSF for 41% of all internet email, internal ODP traffic cannot be determined without the November COMSAT bill which has not arrived yet
* average expense for scientists about $11 and for ODP staff $4.50 for email
* No billing of ODP-internal email

SCIMP APPENDIX

00-3-11

X-Sender: ethomas@mail.wesleyan.edu
Mime-Version: 1.0
Date: Fri, 30 Jun 2000 17:02:17 -0400
To: janecek@quartz.gly.fsu.edu
From: Ellen Thomas <ethomas@mail.wesleyan.edu>
Subject: SCIMP

Hi Tom;

I'd like to bring a recently surfaced problem to the attention of SCIMP (and thus decided to bother you first). If any remedies are possible they will fall only partially under your mandate, but let me just start here, maybe you cna suggest where to go from here.

On Leg 178 (Antarctic Peninsula) cores were taken at Palmer Deep which were not sampled onboard ship; I understand from Lisa Ostermann (foram person on the leg) that they micropaleo lab did also not receive core catchers. Cores were sampled about 6 months later in Bremen. Yet another half year or so later some levels were re-sampled in order to obtain additonal material for 14C dating. It turned out that during this half year in the core repository almost all calcareous forams had disppeared (dissolved, presumably), because samples at the same level as earlier sampled material had order-of-magnitude fewer calcareous forms. The lack of shipboard sampling makes it impossible to ascertain whether carbonate dissolution also occurred during the time between taking the core and the first sampling in the repository. It worries me to think that cores deteriorate so badly in the core repository, and it also worries me that it might very well be that in this case samples taken for geochemical analyses may vary with time-after-cruise, or time-after-arrival-in-core repository.

I would like to suggest that the SCIMP lools into this matter, considers the possibility to treat carbonate microfossil material at least in cores from some regions as ephemeral properties, and requires at least some shipboard sampling in order to assess original sample composition (clearly not necessary for carbonate ooze cores). In the case of the Palmer Deep cores, the possibility of precisely dating the high-resolution Quaternary cores (rather obviously of prime importance) has been compromised by core deterioration, and the extent of the problem can not be easily assessed as a result of a lack of ship based sampling. Since there is no information handling panel anymore, I'm not sure where to go to address the core repository part of this problem; maybe you can make a suggestion.

Cheers, and good luck with the panel
Ellen

Dr. Ellen Thomas
Research Professor
Department of Earth and Environmental Sciences
Wesleyan University
265 Church Street
Middletown CT 06459-0139
USA

tel.: 1-860-685-2238
fax: 1-860-685-3651

web: http://www.wesleyan.edu/ees/ellen.html

SCIMP APPENDIX

00-3-12

Annual MRC Reports for the year 2000

MRC Basel, Switzerland

(Curator: Michael Knappertsbusch)

(1) the number of MRC visitors you have had;
(2) the types of research projects visitors have worked on;
(3) curation activities involving the MRC collection;
(4) any work that has been done on MRC sample databases,
(5) any work that has been done with sample preparation;
(6) any concerns you would like to express or suggestions you have for improving the operation of the MRCs.

General:
- visitation/usage of the MRCs was not bad this year: a total of 40+ specialists from all over the world visited/used the MRC collections. Interest in the collections is rising with the availability of the collections for micropaleo classes, teaching and training.
- From January 2000 on Michael Knappertsbusch has taken over as the lead MRC curator, coordinates MRC related tasks, and communicates between the various MRCs and SciMP liaison.

- The MRC homepage was updated several times.

- Guidelines for the loan of MRC samples were elaborated and published under http://www-odp.tamu.edu/mrc/loan_rules.html.
Now, that loan of MRC samples is less restricted than it was before (no loan possible) we feel that visitors become more interested in MRCs and exploit the collections for university level micropal teaching and training.

- The Utsunomiya radiolarian satellite MRC has formally been set up (date: 25 July 2000. Curator in charge: Dr. Yoshiaki Aita, Dr. Toyosaburo Sakai).

- A MRC sampling meeting was organized (7.-9. Juni, at the ODP core repository of the University of Bremen). Eight MRC curators (Walter Hale, Barbara Donner, University of Bremen; Annika Sanfilippo, Scripps Institution of Oceanography; Dave Lazarus, Naturkundemuseum Berlin; Jeremy Young, Natural History Museum London; Yoshiaki Aita, Utsunomiya University; Giuliana Villa, University of Padua; and Michael Knappertsbusch, Naturhistorisches Museum Basel) attended. Collaboration between the different MRCs was organized. In this way the backlog in nannofossil and radiolarian sample preparations could efficiently be reduced by splitting the work up among different MRCs and satellite MRCs. In addition we selected a total of 794 MRC samples from the most recent legs and so completed the coverage of MRC collections from paleoceanographically important sites and levels (ODP Request #'s 15,925B and 15,925C).A detailed report of the meeting is available from M. Knappertsbusch upon request.

- The MRCs were advertized in Seabed News (October, Issue 2), under http://www.eu-seased.net/seabed/latest.htm.

(1) the number of MRC visitors: 5 Visits for MRC collections.

(2) the types of research projects visitors have worked on: Babette Böckel, PhD student University of Bremen (April 3.-7. April 2000) studied nannofossil samples from various ODP holes.

- Jane Retter, Masters student University of Bristol, UK, April 7, 2000. studied planktic foraminifers, especially T. possagnoensis and from aus Type collection Toumarkine + Bolli, 1970 und 1975.

- Daniela Schmidt, PhD student ETH Zürich. Several visits. Used sample splits of Leg 40 und 122 for morphometric measurements and training of a neuronal network on microfossils.

- Keith A. Knabe, ExxonMobil Exploration, Houston, Texas, 26.5.-31.5.2000. Studied Plio-Pleistocene DSDP and ODP samples from various Legs (Angola Basin, NW Africa).

- We use MRC foraminiferal samples from DSDP Legs 502A and 503A for our morphometric analyses on Globorotalia menardii (as a part of research project of MK "Establishemnt of a microfossil database at the Basel MRC as a tool for evolutionary research"

- MRC samples (Rads, diatoms, foraminifera, nannos, Bolboforma) were used during introductory courses in micropaleontology given by me at the University of Basel.

(3) curation activities involving the MRC collection:
Selection of new MRC samples during MRC Meeting in Bremen (see above).
In addition, the Basel MRC received 200 Radiolarian slides from Leg 112 (prepared by the Utsunomiya MRC)
100 Radiolarien Slides from Leg 114 (prepared by the Berlin satellite MRC)
712 Nannofossil-Smearslides (DSDP Legs 40-56 und 74-75, prepared by the Bremen MRC)
244 bulk sediment samples for MRC foraminiferal preparations (Legs 165,171B,177,178,181; and samples representing levels illustrated in Kennett and Srinivasan (1983) foraminiferal Atlas, currently being processed by the Basel MRC)
A collection of washed foraminiferal residues from 5 Eureka Wells drilled by Shell Oil Company, received from Prof. H.M.Bolli, in Zürich.

(4) any work that has been done on MRC sample databases:
In the framework of the current research project of Michael Knappertsbusch (Establishemnt of a microfossil database at the Basel MRC as a tool for evolutionary research", funded by Swiss National Science Foundation, duration 1999-2002) a stratigraphic and micropaleontological information service called "Neptune-online" was made available on the web. This server includes the relational micropaleontological database Neptune, and a large collection of DSDP and ODP age models, together with interactive age modelling software, that can be downloaded from this server. "Neptune" is a 4D relational micropaleontological database, that has now made online; routines for online

queries are currently being developed and tested. The age model collection, originally initiated at ETH Zurich, was extended by new age models made in Basel, and the age modelling software was translated, so that there exist versions for Macintosh and PC. The age models will help to numerically date MRC samples in an efficient way. The server is currently being tested and is not yet public. Contacts at Michael.Knappertsbusch@unibas.ch.

(5) any work that has been done with sample preparation:
See MRC foraminiferal sample preparation under point (3).

(6) any concerns you would like to express or suggestions you have for improving the operation of the MRCs.

MRCs are one of the various shorebased labs and faclities of ODP financed by different nations and hopefully will continue to do so during the coming phase of IODP. I encourage scientists to use the collections and to use and extend age models from the Neptune server, and so help stabilize DSDP/ODP age models and taxonomy. In this way MRCs may develop towards a scientific network with biostratigraphers, taxonomists, paleoceanographers, and paleobiologists and so contribute to an improved integrated and standardized global biogeochronology. This may also help MRCs to be more recognized by the general paleoceanographic community.
****

MRC Parma, Italy
(Curator: Giuliana Villa)

Dear Michael, attached is my report,. As you 'll see this year we had some problems, the technician was off work for pregnacy most of the year, I had a contest for a promotion here and had few time to dedicate to the the collection. The situation is improving, I can pay a student now and the technician will be back in a month, so next year we will prepare all our committed 1200 + 800 slides.
The same is for the database that goes on slowly. I'm optimistic for the time coming.
Best wishes, Giuliana

The Nannofossil MRC Collection located at the University of Parma has been settled last year.

the number of visitors : 4;
the types of research projects visitors have worked on: Biostratigraphy, taxonomy
curation activities involving the MRC collection: slides are stored in a lab dedicated to nannofossil studies. ODP volumes are easily accesible from the

Department library. A Zeiss Axioscope 2 with camera and digital image capture system is available.
I'm trying to include the MRC collection in the Museum system of the University, this should provide a small funding to improve the organization of the collection
To arise the number of total number of processed samples (which is still very low), we are getting in contact with other Universities.
any work that has been done on MRC sample databases: a database of the all the processed samples was compiled and alleged to the distributed samples. The next task is to complete the database with ages for the samples derived from ODP volumes.
any work that has been done with sample preparation: during 1999 we processed 2000 smear slides, and distributed to the other 8 nanno collections.

****

Gulf coast MRC, Texas
Date: Tue, 05 Dec 2000 10:23:07 -0600
From: John Firth <firth@odpemail.tamu.edu>

Received all new slides from centers which are making them.

Had one user of the MRC this year:

Dr. Charlotte Brunner, Univ. of Southern Mississippi, requested the loan of 7 samples from Leg 154 material to study forams with a visiting European colleague. Material was loaned to her for a period of a month and returned. Dr. Brunner followed all the guidelines which you suggested concerning the loan of MRC material. She was very happy that MRC's now loan material - otherwise she wouldnt have bothered to come visit here.

Thats all.

John

****

MRC New Zealand:
REPORT FOR YEAR 2000

Lower Hutt, New Zealand

(1) the number of MRC visitors you have had:
Visitors have included Drs B.W. Hayward, H. Grenfell and Rowen Cowan, University of Auckland and (briefly) Dr Yoshiaki Aita, Utsunomiya University. Considerable use by local GNS staff, including Martin Crundwell, Chris Hollis, George Scott and Percy Strong.

(2) the types of research projects visitors have worked on:
Miocene bolboformid biostratigraphy, Paleocene foraminifers and radiolarians, many aspects of Leg 181 biostratigraphy. There is also much consulting of the ODP/DSDP volumes.

(3) curation activities involving the MRC collection;
Curation of volumes up-to-date; there is a small backlog of foraminiferal and diatom samples await a "hit" when the Curator has time available.

(4) any work that has been done on MRC sample databases:
None

(5) any work that has been done with sample preparation:
Large number of Leg 181 samples prepared for various studies; no strictly M RC sample prep.

(6) any concerns you would like to express or suggestions you have for improving the operation of the MRCs:
Will just note that several 100s of Leg 181 samples, mainly foram and radiolarian residues and mounted slides will be housed in Center when research on them is completed.

Visitors' binocular stereomicroscope has been upgraded.

A new slide storage cabinet, with a capacity of c. 2500 micropaleontological slides, has been acquired for the Center.

Submitted:

Percy Strong
5/12/00

****

U.S. West Coast: Scripps Institution of Oceanography Radiolaria MRC

Collection (Curator Annika Sanfilippo)

Dear Michael, Seems that the "Spring" meeting for the Scientific Measurements Panel is earlier and earlier each year. Here is my contribution for the MRC yearly report. I have had a fair number of very interested users this year and they have all expressed their gratitude for the existence of the MRC's. There is no other collection with such a geographic coverage available for paleoceanograhic overview investigations. Students are particularly interested in using the collections to explore the availability of DSDP/ODP material for future research projects, and post docs continue to be interested in using the collections to illustrate various depositional regimes.

VISITATION

CARINA LANGE, Scripps Institution of Oceanography, examined MRC radiolarian sequences from Neogene Atlantic and Pacific cores to illustrate examples of biogeographic diversity and environmental preferences of radiolarians and diatoms for a class she was giving in Paleoceanography.

JANE TERANES, Scripps Institution of Oceanography, examined MRC lithological smear slides from DSDP Leg 11 for comparison with siderite bearing sediments from Lake Michigan in preparation for a post doc investigation.

VALESCA EILERT, Laboratorio de Micropaleontologia, Departemento de Geologia, Universidade Federal de Rio De Janeiro, Brazil, visited the SIO MRC for one week, September 24-30, 2000, to examine Mesozoic radiolarians from the Atlantic in preparation for a new project focusing on assemblages from the Albian to Maastrichtian wells drilled in the South Basin, Southeast Brazilian Continental Margin.

AMY WEINHEIMER, Scripps Institution of Oceanography, used MRC radiolarian slides for a class given in Oceanography and Micropaleontology to illustrate distributional patterns of Recent radiolarians.

SIO CURATORIAL STAFF (Paula Worstell and Warren Smith) consults the MRC lithological smear slide collection periodically throughout the year to compare DSDP/ODP sediments with those collected on Scripps' cruises, to develop reference materials, and in conjunction with educational presentations. Together with visiting radiolarian specialists I often consult the MRC radiolarian collection to investigate biogeographic distribution and dissolution problems as they pertain to radiolarian taxa in different geographic settings.

RESEARCH ACTIVITY - As a result of my own research on deep-sea sediments, including radiolarian preparations from the MRC collection, new stratigraphic information has been added and included in the MRC radiolarian database.

DATABASE WORK Only minor additions of stratigraphic information to the radiolarian database.

CURATION ACTIVITIES The SIO West Coast MRC acquired Lillian Musich' (deceased DSDP scientist) pollen and spore collection from DSDP Leg 18. Paula Worstell, SIO Curatorial Assistant, inventoried and catalogued the collection that has now been added to the SIO MRC collection. 200 MRC radiolarian slides prepared under the supervision of Y. Aita, Utsunomiya University, Japan, have been added to the collection.

A. Sanfilippo participated in the DSDP/ODP MRC Sample Selection and Future s of MRCs planning discussions held June 7-9, 2000, at the Bremen Core Repository, Bremen, Germany.

- -

Annika SANFILIPPO (annika@ucsd.edu)
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-0244 USA
(858) 534-2049 (phone)
(858) 822-3310 (FAX)

****

MRC Berlin, Germany

(Curator: Dave Lazarus)

1. Annika, Yoshi Aita and Walter Hale have all visited me this year but only indirectly in relation to the MRC. Doubt if it really counts.

2. Currently only my student Marcus Apel and myself are using the MRC in research.

Comment on 1 and 2 (roughly the same comment I made last year) - there are probably only about a dozen or so active Cenozoic rad workers left in the world (i.e. pre-Quaternary but not Cretaceous or older). You can't expect very many external MRC visits, particularly when several of them are managing one of the rad MRCs themselves. In Europe I think we have just 4 people - counting myself.

I had hoped to get some visits from Russia etc, but until things improve there financially I do not see them having the travel money. And funding them myself with western money would be very difficult.

Best prospects for improving use of our MRC come from new research projects I start myself. I have a new proposal in which explicitly plans to use the MRC.

3. None needed

4. I hope to send you all a CD with the rad database and the freeware

version of 4D this year still as a Christmas present. I've been a bit stuck trying to find a way to create the PC version of the CD on my Mac - I'll get it figured out somehow tho.

5. As you know we shipped the first batch of 100 new rad slides from our lab a few weeks ago. (They are taking ages to arrive - DHL is doing a lousy job!). We hope to make regular shipments indefinitely into the future.

6. None that we did not discuss in our MRC meeting document.

cheers, dave

David Lazarus
Inst. f. Palaeontologie
Museum fuer Naturkunde
Invalidenstrasse 43
D-10115 Berlin, Germany

ph: (49) 30-2093-8579
fx: (49) 30-2093-8868
h0662bmt@rz.hu-berlin.de
http://www.museum.hu-berlin.de/pal/microp/lazmp.html

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Nebraska MRC:
(Curator: Dave Watkins)
Date: Wed, 29 Nov 2000 13:37:13 -0600
From: "David K. Watkins" <dwatkins1@unl.edu>
Subject: annual MRC reports

Dear Michael,
1&2. During the last year we have had six visitors to the department that have used the facilities of the MRC. Four of these include colleagues from Bochum University: Jorg Mutterlose and his three students Andre, Silke, and Natascha. This work is part of a cooperative grant between Mutterlose and I on the paleoecoogical control of the evolution of nannoplankton during the mid-Cretaceous Greenhouse Earth. MRC material used includes slides from the Cretaceous legs. In addition, Silke used some of the Cenozoic materials to brush up on Tertiary biostratigraphy in preparation for participation on a future ODP leg. Jean Self-Trail (USGS Reston) also used the MRC as part of

our joint project on Maastrictian. Finally, James Bergen UNC CHapel Hill) used some materials for comparison of Albian-Cenomanian sections from France.
3. Curation activities on MRC materials have been restricted to logging in slides and other materials that arrive. Much of the curation in the lab this year centered on getting the newly acquired literature collections of the late Ralph Salomon and H.V. Andersen incorporated with existing material.
4. no real work was done on MRC databases this year.
5. no work was done with sample preparation this year (no money available this annum).

Cheers,
David

****

Smithsonian MRC, Washington D.C.
(Curator: Brian Huber)
Date: Wed, 29 Nov 2000 08:41:45 -0500
From: Brian Huber <Huber.Brian@NMNH.SI.EDU>
Subject: Re: Need your annual MRC reports by 7 December
To: Michael.Knappertsbusch@unibas.ch

Hi Michael,
Here's the SI report. It's frustrating that despite all our efforts there's been no interest in visitation. I'm out of ideas how to improve the situation. Hope things are going well with you.

Cheers,
Brian

SMITHSONIAN MICROPALEONTOLOGICAL REFERENCE CENTER REPORT
Brian Huber
November 29, 2000

(1) the number of MRC visitors you have had:

ONE UNDERGRADUATE STUDENT (KARINE REITER) FROM GEORGE WASHINGTON UNIVERSITY

(2) the types of research projects visitors have worked on:

I'VE USED THE FORAMINIFER COLLECTION FOR CHECKING PRESENCE/ABSENCE OF CERTAIN SPECIES IN VARIOUS CRETACEOUS AND PALEOGENE STRATIGRAPHIC INTERVALS; KARINE REITER HAS USED THE FORAMINIFER

COLLECTION TO COMPARE PLANKTIC FORAMINIFER ASSEMBLAGES FROM THE HEDBERGELLA PLANISPIRA ZONE AT DIFFERENT SITES.

(3) curation activities involving the MRC collection:

RECEIVED, CHECKED AND ACCESSIONED RADIOLARIAN SLIDE COLLECTIONS FROM DRS. LAZARUS AND TANIMURA

(4) any work that has been done on MRC sample databases:

NONE

(5) any work that has been done with sample preparation:

NONE

(6) any concerns you would like to express or suggestions you have for improving the operation of the MRCs

NONE

Brian T. Huber
Curator of Foraminifera
Department of Paleobiology, MRC NHB-121
Smithsonian National Museum of Natural History
10th and Constitution Ave., NW
Washington, DC 20560

ph.: 202-786-2658
fax: 202-786-2832
****

MRC Bremen, Germany:
(Curators: Walter Hale and Barbara Donner)

Here is a list of the participants of micropaleo course who used the MRC foram samples. One major purpose of the exercises is to study the gradational nature of evolution as demonstrated by the Middle Miocene G. fohsi group of planktonic foraminifera.

The status of slide preparation is also included.
MRC Report 2000:

(1) the number of MRC visitors you have had;
(2) the types of research projects visitors have worked on;

Micropalentological exercises, participants:

Dreyzehner, Anke
Jaschke, Andrea
K^ster, Jana
L¸er, Vanessa
Meisen, Christoph
Ott, Carola
Perkuhn, Anja
Rohde, Meike
Schlemm, Volker
Schmidt, Elke
Schmitt, Rainer
(5) any work that has been done with sample preparation;

Preparation of nannofossil slides:
DSDP :
Legs 40, 41, 42, 43, 44, 45, 47, 48, 54, 55, 56 completed and sent to other MRCs
ODP:
Legs 115, 154, 171B in preparation

Date: Thu, 07 Dec 2000 08:34:34 +0100
From: Walter Hale <whale@zfn.uni-bremen.de>
****

MRC Brasil
((Curator: Aristoteles Rios-Netto)

ODP SATELLITE MICROPALEONTOLOGICAL REFERENCE CENTER ON FORAMINIFERA AT FEDERAL U
NIVERSITY OF RIO DE JANEIRO (UFRJ)

2000 ANNUAL REPORT

Rio de Janeiro
December 2000

1. VISITATION
Three researchers have visited and/or used the UFRJ Sat MRC facilities in 2,000:

a)Dr. Kjell Rasmus Bjorklund, biostratigrapher specialized in radiolarian, from the Paleontological Museum of the University of Oslo, Norway. The purpose of Dr. Kjell was to work with Dr. Valesca Eilert (LabMicro/UFRJ) on the radiolarian fauna from the Meteor Rise/Agulhas Basin (Leg 114, Site 704).
b) Dr. Carlos Augusto GonÁalves, Geophisist and Professor at the Universidade Estadual do Norte Fluminense/UENF, MacaÈ, Rio de Janeiro State, visited the ODP MRC/UFRJ to consult the ODP Scientific Reports, specially the vol. 155, concerning to a Ph.D. project on the Amazon Fan he is advising.

c) Dr. RogÈrio Loureiro Antunes, biostratigrapher specialized in calcareous nannofossils, from the Research Center of PETROBRAS (the Brazilian Oil Co.), Rio de Janeiro City, Rio de Janeiro State, Brazil. The purpose Dr. Antunes was to know the facilities of the ODP MRC/UFRJ, to evaluate the possibilities of future cooperative works.
d) Dr. Eduardo Hajdu, paleontologist specialized in siliceous sponges, from the Brazilian National Museum, Rio de Janeiro City, Rio de Janeiro State, Brazil, visited the ODP MRC/UFRJ to consult the ODP Scientific Reports (studies in siliceous sponge spicules), and to evaluate the possibilities of future cooperative works.
e) Fatima Sarkis, Professor at the Federal University of EspÌrito Santo, VitÛria , EspÌrito Santo State, Brazil. She is developing a Ph.D. thesis on dinoflagella tes from Pernambuco-ParaÌba Basin (Northeastern Brazilian Continental Margin) at the K/T boundary and visit the ODP MRC/UFRJ trying to get comparative data from ODP South Atlantic sites.
f) Dr. Robert Hulsbol, biostratigrapher, from the Core Laboratories Inc. Indonesia. The purpose Dr. Hulsbol was to know the facilities of the ODP MRC/UFRJ, to evaluate the possibilities of future cooperative works.
g) Leonardo Balbi, undergraduate student of Biology, from the EspÌrito Santo Federal University, VitÛria, EspÌrito Santo State, Brazil. Leonardo participates of Summer Training on calcareous nannofossils and radiolarians, being introduced to the ODP MRC/UFRJ facilities as well as what are its purposes and how the ODP operates.

2. CURATION ACTIVITIES
We acquired a new cabinet to store the foraminiferal samples, that are been transferred to special plastic boxes in that cabinet. Two hundred samples were transferred till this moment. Before labeling the new plastic boxes, the original list of samples is compared to the list of samples available in the ODP MRC homepage at TAMU. Some differences between the two lists have been found and will be checked later with the ODP staff.
Routine tasks necessary to maintain the sample collection clean, preserved and ordered, have been done during the whole year.

3. WORK ON SAMPLE DATABASE
No work was done on samples database.

4. SAMPLE PREPARATION
No sample was received to be prepared at the ODP MRC/UFRJ. After finishing the sample transference to the plastic boxes, the hired technician could work on sample preparation, if it is necessary. She will be with us at least until September 2001.

5. BIBLIOGRAPHY IMPROVEMENT
Bibliographic References Database
We have continued the work with the specialized bibliography pertaining to the Laboratory of Micropaleontology. This work began in 1997, but in the beginning of the present year we developed a classifying system and the whole old database was modified, besides new data have been entered. Till this moment were registered: 43 books (each chapter was also registered 212 chapters in total), 577 off-prints, 31 thesis/dissertations/monographs, 113 papers within diverse serials,4 private reports.

6. LABORATORY OF MICROPALEONTOLOGY/UFRJ STAFF
AristÛteles de Moraes Rios-Netto, UFRJ Researcher (Tertiary foraminifera); Claudia Gutterres Vilela, UFRJ Researcher, (Quaternary foraminifera); Maria Dolores Wanderley, UFRJ Researcher (Cenozoic and Mesozoic calcareous nannofossils); Valesca Maria Portilla Eilert, Associate Researcher (Cenozoic and Mesozoic radiolarian); Ortrud Monika Barth, Associate Researcher (Quaternary pollen and spores); M·rcia Aguiar de Barros, Associate Researcher (Quaternary pollen and spores); Wolfram Walter Brenner, Visiting Professor (Cenozoic and Mesozoic dinoflagellates).

7. STUDENT HELP
Currently we have one student that help us in the ODP MRC/UFRJ sample transference activities .

AristÛteles de Moraes Rios-Netto
ODP SatMRC / UFRJ Curator
****

MRC Tokyo
(Curator: Yoshihiro Tanimura)
PRESENT STATUS OF JAPAN MRC: DEC. 7, 2000

1. GENERAL

As one of the MRCs, we have been preparing diatom slides, distributing them to the other seven MRCs, curating the collection of four microfossil groups, building a database for the collection and assisting visitors in their research work at the center.

2. VISITATION

In 2000, 10 researchers visited the center (three visitors used radiolarian specimens, two micropaleontologists used foraminifera specimens, and five researchers used diatom specimens).

They mostly used the collection for comparison between their fossil specimens and MRC microfossil specimens of new taxa established from DSDP-ODP material.

3. CURATION OF THE COLLECTION AND DATABASE MANAGEMENT

The washed foraminiferal residues received from Basel NM are each divided in glass topped faunal slides and plastic storage vials. All the slides making up the collection (foraminifera, radiolaria, calcareous

nannoplankton and diatoms) have been stored in wooden cabinets in a humidity controlled room (60 %).
Information on the MRC samples has been entered into a Macintosh-based program "File Maker Pro" for database management. We are doing assignment each of the about 3,000 MRC diatom samples to a zone of newly proposed diatom zonations.

4. PREPARATION OF DIATOM SLIDES AND THEIR DISTRIBUTION

Preparation of diatom slides and their distribution to the other seven MRCs has been carried out since 1985. Two part-time people are assisting preparation and curation works. Sixteen diatom slides (eight sets of two slides) are prepared from each raw sediment material. Fourteen of those (seven sets) are distributed to the following centers:

B!& ODP at TAMU (Dr. John Firth)
B!& SIO (Dr. Annika Sanfilippo)
B!& USNM (Dr. Brian T. Huber)
B!& Basel NM (Dr. Michael Knappertsbusch)
B!& Inst. Geol. & Nucl. Sci., New Zealand (Dr. Percy Strong)
B!& University of Nebraska (Dr. David Watkins)
B!& Russia (Dr. Ivan Basov, sent tentatively to USNM)

About 5010 raw materials have been sent to the center for processing, of which 3445 have been prepared. Seven batches of diatom slides, representing 3223 core levels, have been shipped to the other seven centers.

The following table shows the history of distribution of diatom slides.

Distribution of Diatom Slides

August 1987, 680 slides (340 core levels)
December 1989, 638 slides (319 core levels)
November 1992, 1402 slides (701 core levels)
January 1995, 700 slides (350 core levels)
October 1995, 704 slides (352 core levels)
September 1997, 1400 slides (700 core levels)
December 2000, 922 slides (461 core levels)

5524 slides (3223 core levels) in total

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5. A FUND FOR THE CENTER

Since 1995, a necessary fund to run the center is provided by Japanese Ministry of Education, Science, Sports and Culture.

****

Nannofossil satellite MRC collection at the Natural History Museum, London
Curator: Jeremy R. Young

Types of research project - taxonomic verification
Curation/collection development activities - at the Bremen MRC meeting in June a major effort was made to rationalise the situation with the nannofossil collec tion by prioritisation of sample sets ana llocatin of these to diffenrent institutions. Following this:

1. Additional prepared sample sets have been receieved from both Bremen and FSU

- from sites 40-56, 132, 135, 138, 143, 144. These have been incorporated in the MRC collection here. As resut the total number of slides available has increased by about 505 and the number of useful slides by a much higher margin.

2. Samples for preparation, have been recieved from the sampling round - sites 122, 149 and 165. Work on these is in hand.

3. The nannofossil MRCs were publicised at the Bremen International Nannoplankton Association conference in Sept 2000 (INA8). In addition it was agreed to hold the next INA conference in Parma i 2002, with use of the nannofossil MRC collection as a focus for workshop activities. Further work is still needed on the nanno collections to make them a genuinely useful resource for the research community in particular (a) the prioritised sample sets need to be prepared (b) a basic database of the samples is needed. We believe these activities can be largely completed during 2001 and that major publicisation of the collections should then follow.
****

Satellite MRC San Francisco:
(Curator: P. Kociolek)

Return-path: <jdemouthe@CalAcademy.org>
Date: Wed, 13 Dec 2000 10:49:05 -0800
From: Jean DeMouthe <jdemouthe@CalAcademy.org>
Subject: MRC reports
To: Michael.Knappertsbusch@unibas.ch, pkociolek@calacademy.org

Dear Dr. Knappertsbusch:

In response to your request of 12/12, I attach the following information regarding the use and care of the Academy's MRC loan collection:

>

> (1) the number of MRC visitors you have had: 1 staff member used collection, 2 visitors were shown it but did not use it

> (2) the types of research projects visitors have worked on: staff member:
> Eocene & Oligocene diatoms

> (3) curation activities involving the MRC collection: none; collection remains in same place & condition

> (4) any work that has been done on MRC sample databases: we do not have an MRC: sample database

> (5) any work that has been done with sample preparation: we do not have any MRC samples (just slides)

> and (6) any concerns you would like to express or suggestions you have for
> improving the operation of the MRCs: if there is MRC data available in database or spreadsheet form, we would appreciate receiving a copy on disc or via e-mai
l.
>

Please direct any questions regarding the Academy's diatom collection and/or our MRC holdings to Dr. Pat Kociolek, Diatom Curator & Executive Director, and/or myself (address below).

Jean DeMouthe
****
Senior Collections Manager for Geology
California Academy of Sciences
golden Gate Park
San Francisco, California 94118
415-750-7094
fax: 415-750-7090
****

No reports were received up to this moment (19.12.2000) from the MRC in Moscow (Ivan Basov), Utsunomiya MRC (Yoshiaki Aita), MRC Talahassee (W. Wise+Tom Janacek).

SCIMP APPENDIX

00-3-13

Estimated completion date for laboratory "cookbooks".

Physical Properties: Spring 2001

Paleomagnetism: Spring 2001

Organic Chemistry: Spring 2001

IW Chemistry: Will require update as a result of change from AA to ICP analysis

ICP Chemistry: Published and on the web (September 15, 2000)

UW Geophysics: No action, guide available, protocol changes quickly

Paleontology: No action, user manual for the PAL application and the microscopes exist; inventory is available on the web; processing methods and preferences depend on the scientist.

Shipboard Scientists Handbook: Summer 2001

Core Description: No action, core description manual still up-to-date, AppleCore manuals exist.

Downhole Tools: No action

Microbiology: No action, wait to hire technicians and establish procedures

SCIMP APPENDIX

00-3-14

Report of JOIDES Gas Hydrate Program Planning Group

Contents

Executive Summary

Understanding the nature and significance of marine gas hydrates is a major objective of the Ocean Drilling Program's (ODP) current Long-Range Plan. The Science Committee (SciCom) of ODP has recognized that because this objective has never previously been identified in the planning documents associated with the ODP or the Deep-Sea Drilling Project, new approaches and emphases will be required. To assist in developing a strategy to achieve this objective, SciCom established a Program Planning Group (PPG) for Gas Hydrate research and gave it the mandate to stimulate a strong, long-range plan for drilling and sampling naturally occurring gas hydrates using existing and proposed facilities.

Three meetings of the Gas Hydrate PPG were held (June 23-24, 1998 in College Station, Texas; December 11-13, 1998 in Monterey, California; and September 27-29,

1999 in Berlin, Germany). Discussions focused on the relevance of gas hydrate research, the geologic environment of gas hydrate deposits, the tools needed for gas hydrate evaluation, and the approach necessary to meld a series of legs to form a unified program. The panel recommends that the JOIDES advisory structure concentrate resources on the following:

• At least three more interrelated ODP legs devoted to gas hydrate research that fit together into a sensible unified program.

• Greater efforts to develop new downhole tools that detect and retrieve gas hydrate and to optimize the use of existing tool. Current capabilities to detect the presence of gas hydrate in boreholes are extremely limited. We specifically recommend that both the existing ODP Pressure Core Sampler (PCS) and the Hydrate Autoclave Coring Equipment (HYACE) tool that is under development be supported strongly. Attempts to develop other new tools and techniques to detect gas and gas hydrate also need to be encouraged and supported.

Fundamental Objectives of a Gas Hydrate Research Program

The fundamental objectives are to establish the mass and distribution of naturally occurring gas and gas hydrate at all relevant spatial and temporal scales and to delineate the dynamics of gas hydrate deposits. Individual proposals and ultimately a collection of legs that are selected as a program should emphasize this theme.

Program Relevance and Focus

Answering the question of the mass and distribution of gas hydrate has many impacts and consequences that are of both practical and of scientific interest. These include the following:

(1) Gas hydrates represent a very large and dynamic reservoir of natural gas. Understanding the amounts and associated reservoir characteristics are required to evaluate the potential that parts of this reservoir may be a future energy resource.
(2) Because methane is a greenhouse gas, atmospheric release of large quantities of methane from gas hydrates could seriously affect climate. Knowledge of the amount of methane in hydrate is important in understanding how the planet sequesters carbon.
(3) Changes in bottom water temperature or changes in pressure (sea level) can destabilize hydrate layers, and potentially can result in large landslides and massive methane release. Any human activity on the seafloor (drilling, laying pipelines) can also change hydrate stability leading to significant environmental hazards.

(4) Because gas hydrate acts as a pore-filling material and its dissociation can increase fluid pressure, gas hydrates can influence sediment physical properties, diagenetic pathways, and even sedimentary tectonics.

A successful research program on gas hydrates will require investigation of the interrelated processes that affect the formation and dissociation of hydrate within its sedimentary host rock. Thus, proposals should focus on several of the following general themes:

• Determining the partitioning of the sedimentary gas into the dissolved, gas hydrate, and free gas phases.
• Identifying and quantifying the diffusive and advective processes that move gas into and out of the pressure and temperature conditions of the gas hydrate stability field.
• Defining where gas hydrate develops within the host sediment and its habit.
• Documenting the effect that the presence of hydrate has upon the diagenesis of the host sediment.
• Understanding how gas hydrate changes the physical properties of the sediment.
• Refining and calibrating our use of remote detection techniques to quantify gas hydrate amounts.
• Establishing whether significant transfers of methane from the geologic reservoirs to the ocean and atmosphere system are possible.
• Determining whether gas hydrate plays a role in slope failure on continental margins.
• Learning how bodies of gas hydrate evolve with time (grow or diminish).
• Documenting the geomicrobiological and biogeochemical activity that produces gas (especially methane) in marine sediments. (See Deep Biosphere section below.)

Finally, it is critical to understand how the importance of these processes varies among different geological settings.

Characteristics of a Generic Gas Hydrate Program

The panel is keenly aware that addressing many of these research questions will be difficult using only the existing techniques. To assure a maximally successful program, careful application of existing techniques, clever drilling strategies, development of new techniques, and innovative technology to document the in-situ nature of gas and gas hydrates will be required.

The proponents of any individual leg are encouraged to specifically identify how the available techniques will be applied and integrated into a unified research program. The basic components of any dedicated gas hydrate leg should include: 1) remote geophysical data for site characterization (e.g., 2D and/or 3D seismic data, OBS, side-scan sonar, etc.); 2) core recovery and analysis (including the use of pressure core samplers, porewater geochemistry, gas analyses, physical properties, and advanced core

analysis procedures); 3) downhole measurements (porewater samples, temperature measurements, conventional wireline logging, logging while drilling, VSP, tomography, etc.); and in some cases 4) long-term monitoring (e.g., CORKS).

An end-member strategy was endorsed by the panel as an approach for selecting geographic regions for individual drilling legs. For example, during the course of the multiple legs that collectively comprise a gas hydrate program, it will be desirable to drill sites with contrasting characteristics such as: high versus low fluid flow; porous versus conduit flow; locally produced versus thermogenic gas; failed versus intact sediment slopes; and distinct sediment facies. It will also be important to ground truth the effects of gas hydrates within typical environments rather than only studying areas where gas hydrates are heavily concentrated. Thus, proponents of individual drilling legs are encouraged to identify how their proposed sites fit within this end-member concept.

Within individual leg proposals, proponents are encouraged to select sites very carefully and provide clear justification for their selection. For example, one strategy is to select sites where similar formations can be drilled that have distinct remote sensing properties over short lateral distances. At least one hole should be drilled where there is a well-developed bottom simulating reflector. However, it is important to drill reference sites. At each site the entire section should be examined in detail from the surface to at least 200 m below the theoretical base of gas hydrate occurrence.

The development of new tools and techniques may be vital to the success of gas hydrate research. Thus, proponents are encouraged to advance existing techniques by trying new approaches, deploying experimental tools, and developing new technologies.

Targets for Future Legs

To accomplish these objectives we recommend at least a three-leg program. A minimum of three legs is required because of the nature of the geologic settings in which gas hydrates are known to occur. Examining the gas hydrate occurrence in diverse settings is the only way to provide a basis for more robust global extrapolations and to provide meaningful insight toward the diverse problems that need to be addressed. Thus, a range of geologic settings should be considered which include: accretionary margin complexes where there is evidence for high fluid flux and significant methane generation; passive margin sites with definable fluid fluxes and indication of high methane levels; a region where thermogenic hydrocarbons are actively seeping from greater depths; and areas where slope instabilities may have occurred because of gas hydrate dynamics. Specific features within these areas should also be targeted which include: near seafloor occurrence of gas hydrate, slump structures, chemosynthetic communities, mud-volcanoes, pockmarks, and faults which are active fluid conduits.

We note that a leg to drill gas hydrate-bearing sediments on Hydrate Ridge off Oregon has been selected for drilling in 2001. The selection of Hydrate Ridge was made

on the basis of the proposal's excellence. This leg will form the corner stone for future efforts. Thus, we encourage proponents to be sensitive to the changes in the program needs that are reflected by the scheduling of this leg.

Hydrate Ridge drilling will specifically address mechanisms of hydrate formation from methane carried by fluids that are escaping from compacting sediments and where some of the gas may be derived from the decomposition of gas hydrates within tectonically uplifting sea floor. Thus, the Hydrate Ridge leg will address some of the difficult problems associated with the internal dynamics of gas hydrate formation and will provide information of the physical properties of gas and gas-hydrate bearing sediments in an accretionary environment in which methane is abundant. Although it touches on many of the general themes listed above, it samples a limited range of sediment types and tectonic settings. Additional observations in contrasting settings will be needed in order to obtain a generalized understanding of distribution and dynamics of global gas hydrate deposits.

The panel also spent considerable effort discussing the major themes that will not have been addressed by the Hydrate Ridge Leg or by previous ODP drilling. The following major questions will remain largely unaddressed.

Unaddressed Questions - Post Hydrate Ridge Drilling

The most significant gas hydrate research issues that will remain unaddressed after the Hydrate Ridge leg concern the potential connections between the gas hydrate reservoir and the Earth's climate. Several possible scenarios have been proposed in the literature, leading to both positive and negative feedback between hydrate destabilization and climate. Common among these scenarios are mechanisms to transfer huge volumes of methane between the geologic reservoirs and either ocean or atmosphere. Thus, it is critical that the various mechanisms to release volumes of methane carbon from gas hydrate (and potentially free methane gas) bearing sediment sections are accessed. These include the potential for gas release through slope instabilities and through global scale perturbations associated with sealevel and ocean temperature changes (A and B below). In addition, significant progress on understanding geohazards is unlike until and active hydrocarbon provenance is targeted (C below). Moreover our understanding of the effects of gas hydrate on typically sediments will remain poor until appropriate data are also collected away from obviously gas hydrate dominated areas (D below).

Hydrate Ridge leg will be only the second leg dedicated to hydrates, and will be a testing place for many new drilling tools and techniques (see next section). There will invariably be both successes and disappointments among these efforts. The history of DSDP and ODP has been characterized by a continuing synergy between science objectives and tool development. The only way to continue the tool development required

to fully understand the dynamic effects of in-situ hydrates is through additional cruises to sample gas hydrates in different environments.

a). Slope stability and climate connections.

The potential for large-scale catastrophic release of methane is most likely associated with large-scale slope failure because Gigatons of methane are available to escape from the sediments during a large slide event in gas hydrate bearing sediment regions. During massive slope failures, the transported sediments disaggregate into turbidity flows. As this happens pieces of gas hydrate in the suspension are freed from adhering sediments and float upward because of their inherent buoyancy. Free gas will also be released from the transported material and from fractures that are generated in the sole of the slide. Estimates of the loss of methane that occurs during the process of major slope failure events from gas and gas hydrate bearing sediments can be made by comparing the volumes of gas and gas hydrate in recent slide deposits and under the slide's sole with adjacent intact sediments of similar age and lithology. In the process, valuable information will be gathered about the causes of the failure; another fundamental, but unanswered question that has important ramifications for evaluating and predicting natural hazards related to gas hydrates (e.g., tsunamis generated by slumping and destruction of offshore structures).

b). Natural perturbations.

The largest non-catastrophic releases of methane are inferred to be associated with thermal or pressure perturbations. For example, a significant warming trend that may be affecting the gas hydrate system is presently occurring in the Arctic. The warming is associated with the flooding of the arctic shelves after the last glaciation. Thus, a relatively huge thermal wave is propagating downward from the relatively warm ocean waters into the gas hydrate bearing submarine permafrost below. The temperature changes are forcing reductions in the size of the hydrate stability zone and presumably decrease in the gas hydrate reservoir. The dynamics of this ongoing change provide the opportunity to investigate the potential transferring methane carbon from a progressively decomposing gas hydrate reservoir to the seafloor. While a *JOIDES Resolution*-like vessel may not be able to operate in the shallow ice bound environments, alternative drill platforms can.

c). Drilling in an active hydrocarbon provenance.

The dynamics of gas hydrate bearing systems may be different in a thermogenic hydrocarbon provenance for several reasons: (a) Geohazard issues are most relevant in this environment and thus, represent the meeting point for industrial and scientific interests outside the hydrocarbon pipeline. (b) The presence of hydrocarbon gases (in

addition to methane) allows gas hydrate of multiple crystal structures to occur. Because both DSDP and ODP have consciously avoided drilling where other gases will be present, all our insight into the behavior of natural gas hydrates is based solely on Structure I methane gas hydrate. However, other gas hydrate structures (e.g., II, H) are nearly as common where thermogenic gases occur.

c). Gas Hydrate distribution away from BSR's.

Our knowledge of the quantity of hydrates in nature has been driven very strongly by the correlation with seismic detection of BSR's. However, it is likely that large portions of continental margins contain methane hydrates although their presence is not indicated by a BSR. We know almost nothing about the frequency of such occurrences. It would be hard to make a case that a hydrate leg be scheduled where there is no a priori evidence from seismic data. Instead we recommend the development of a set of basic procedures to test for the presence of gas hydrates on legs that do not have gas hydrate research as an objective. The simplest suite of measurements would consist of basic logs (e.g., Dipole Shear Sonic, Density, and Resistivity), routine porewater chloride measurements, and periodic inspection of cores using an infrared scanner.

Status of Critical Tools

The research drilling needs for gas hydrate research are unlike those for many of the more traditional ODP objectives because of the ephemeral nature of gas hydrate. Gas hydrate research requires a series of specialized tools that measure in situ properties because gas hydrate decomposition and gas escape occur during core recovery. Many of these tools are either not available or are in critical need of improvement. However, since ODP leg 164 (the only leg to date dedicated to gas hydrate drilling) there has been considerable progress on a number of instrument development issues. At the end of this section we summarize recent progress and future tool development needs.

Pressure core sampling systems

Continued development of tools that retrieve samples that remain under in situ temperature and pressure conditions are critical for the progress in gas hydrate research. Currently there are two systems, the PCS and the HYACE tool. These are viewed as complementary rather than competitive systems.

The existing ODP PCS is capable of taking small core samples (42 mm diameter, up to 0.86 m long) from the bottom of a bore hole and sealing the core into a pressure housing so that recovery occurs at near in-situ pressures. The PCS was used with great success on ODP Leg 164 as a tool to sample the total amount of gas that is contained within the original sediment volume. Repetitive use of the PCS tool is a fundamental aspect of ODP's gas hydrate research.

Currently, only one complete PCS system exists, (plus parts of a second tool). Because even simple degassing experiments take a few hours to perform, and because it takes trained tool specialists ~2-6 hours to prepare the PCS for the next deployment, hardware limits severely restrict deployment. In addition, 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.

HYACE is another tool to retrieve samples under in situ pressures. HYACE incorporates three different wireline coring concepts for sampling gas hydrate in various lithologies: a push corer for soft sediments; a rotary corer for hard sediment; and a percussion core for sandy sediments. The pressure conservation autoclave function will include specially designed and operated valves which will also permit the largest possible core diameter of at least 50 mm. Temperature conservation will be achieved by an acrylic core liner with three built-in temperature probes for measurement while coring from an electronic chamber where monitoring of pressure and acceleration for tool control is performed. The core of 1 m length will be pulled mechanically into the autoclave downhole core barrel. Onboard evaluation of the sample within the autoclave by core logging with gamma ray and other through-the-casing sensors will be possible. HYACE is being designed for easy transfer of the sample from the downhole autoclave to a laboratory pressure container. Sub-sampling of sediments and or pore waters through ports in the laboratory chamber is possible. Ultimate gas venting, sediment and water analyses under ambient conditions may follow using traditional methods.

With the advances in PCS obtained on ODP Leg 164, it is evident that the PCS is the instrument of choice for the immediate future in sampling gas-rich and gas-hydrate containing sediments. However, the HYACE tool has features that make it the system of the future.

In situ pore water sampling

Measurement of interstitial pore water concentration has become a standard and basic measurement to assess the original pre-coring gas hydrate content of sediment samples. However, the calculation requires an understanding of the in situ pore water composition. Unfortunately, tools that confidently and reliably retrieve uncontaminated samples from the formation have not been developed. The lack of pristine samples has complicated our interpretations. Thus, we desperately need to make progress on this front. While efforts to refine existing tools should be supported, a fundamentally new tool may have to be designed to provide these samples. Some progress may also come from developing better tracers to improve our understanding of the extent of contamination. Rigorous procedural and multiple tracer regimes will enable the quantification of sample contamination from drilling fluids and side-wall caving, and even core processing activities that may compromise sample integrity.

Core temperatures

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. Equipment to collect these data (such as an infrared thermoscanner) needs to be available on the drill ship for both fortuitous encounters with gas hydrates and to use in a routine way on gas hydrate-dedicated legs.

Tools that continuously measure temperature, pressure, and conductivity (TPC) inside the core barrel during routine coring operations are needed. Existing ODP technology does not provide any routine data that is readily interpretable concerning the *in situ* volumes of gas and gas hydrate in marine sediments. Unfortunately, because large pressure decreases occur during core recovery, most of the original gas is lost before the core barrel reaches the deck of the JOIDES Resolution. However, TPC sensors in the coring assembly could provide a simple and robust way to monitor the effects of gas loss in cores. Again, significant thermal variations will occur due to both endothermic gas hydrate decomposition and gas expansion. Conductivity measurements will detect whether and when gas bubbles develop in the core barrel headspace (i.e., gas saturation is achieved) during ascent. These data will allow estimates of in situ concentrations of methane to be calculated. Variations in these records with successive APC cores will indicate changes in the volume of gas, its vertical distribution in the sediments, and how it is stored in the sediments. This information is needed from many sites to assess the size of the global interstitial gas inventory.

Well logging

The ODP borehole logging program continues to make significant changes. The neutron-density porosity tools have been updated with devices that yield higher quality downhole log derived sediment porosity data in poor borehole conditions. The downhole acoustic tool has been replaced with the Schlumberger Dipole Shear Sonic Imager, which yields both compression- and shear-wave acoustic velocity data. Logging while drilling technology has also become a critical component of specialized ODP drilling legs when downhole stability problems are expected. Within the near future, pending ODP drilling configuration modifications will allow the deployment of new wireline conveyed downhole tools including the Modular Formation Dynamics Tester and Nuclear Magnetic Resonance log. Both of these relatively new tools have the potential of yielding important gas hydrate data. The panel recognizes the important contribution of the downhole-logging program to characterizing the in-situ nature of gas hydrate occurrences and the

panel supports the continued development and modernization of the ODP downhole-logging program.

Borehole geophysical experiments

Geophysical experiments are critical for linking the borehole observations to the results of regional surveys (Appendix 3). For example, offset VSP experiments, using P-waves and S-waves, define the distribution of hydrate in a cone around the borehole. Borehole-to-surface and cross-hole measurements have the advantage of sensing a larger volume of sediment than can be obtained using traditional borehole logging tools. Additional ways to use the boreholes for geophysical experiments need to be encouraged.

Tool Development Status Summary:

• Additional components for the existing PCS tool are being made which will make it possible conduct multiple closely spaced deployments.

• **HYACE** is being built and tested by a group of eight European research institutions and industrial companies. The project is being sponsored by the European Commission's MAST III program and coordinated by the Marine Technology Group at the Technical University of Berlin. HYACE should be available for field testing on *the JOIDES Resolution* in 2000 and operation in 2001.

• Improvements to the Fissler porewater sampling tool are underway through USSAC funding.

• Development of infrared thermal measurement systems to scan cores and record catwalk core data are strongly recommended.

• Development of a tool to measure Temperature, Pressure, and electrical Conductivity (TPC) during core recovery (joint project between MBARI and ODP) with funds from both MBARI and NSF.

• Downhole logging improvements continue to be made that allow better data to be collected under poor bore hole conditions.

• Innovative approaches to using the borehole for high-resolution geophysical imaging of a volume around the borehole are encouraged.

Maintaining Technology Development Efforts

The nature of tool development in ODP has always been an iterative process, closely linked to the opportunities to test prototype tools on a drilling leg. Hydraulic piston core development, for example, began in DSDP in the mid-seventies and took nearly ten years and several major design changes before APC coring became the routine operation that sustains paleoceanography today. We stress that the development of gas hydrate tools may be an iterative process too. Regular opportunities to test and refine new downhole tools are essential to maintain the momentum of tool development efforts.

Shipboard Manning for Complex Technical Legs

Because ODP is a multi-national program and there is widespread interest in gas hydrate science, the pressures for scientific berths on future gas hydrate legs will be very high. It is important that these pressures do not prevent a proper balance between scientific and technical personnel being achieved. The advent of complex downhole tools changes the balance between scientific and technical personnel on the *JOIDES Resolution*. On routine legs the operation of the basic tools (APC, XCB, & RCB) depends on the two coring technicians who each work on alternate 12 hour shifts. These technicians can accommodate only one or two additional runs of the ODP supported tools without additional help. However, gas hydrate drilling legs require repetitive operations of multiple complex tools. Many of the tools that are being developed are not supported by the existing staff and will require support of the personnel that are developing them. Thus, some of the normal scientific berth will have to be sacrificed to accommodate the increased technical manning requirements.

Long Term Observations

Long-term observations are needed to study changes in the hydrate system over periods of weeks to years, and are vitally important to measure aspects of the hydrate system when it has recovered from the disturbance caused by drilling. These observations include measurements within the borehole, such as those made with CORK's, and on the seafloor. Logging of the data from these measurements can be in self-contained packages that are retrieved during repeat cruises to the site. Alternatively, the data can be conveyed to shore either via fiber-optic cables or through satellite telemetry of data relayed through a surface mooring. These latter approaches provide real-time measurements and provide a link between ODP and other emerging oceanographic initiatives.

(1) CORK's - We encourage further development of CORK technology, as outlined in the report of the "Workshop on Advanced CORK's for the 21st Century", K. Becker and E.E. Davies, 1998. A CORK enables recording instrumentation to be left in boreholes after the hole has been hydraulically sealed and the drill ship has left. By using borehole seals, pressure recording and pump testing, it is possible to establish and monitor

downhole pore pressure and to estimate permeability, and thus fluid flow, at multiple depth intervals. Accurate measurement of formation temperatures can be obtained after the initial drilling disturbance has decayed away. Mechanical and hydrogeological properties of the hydrate bearing sediment matrix and the gas-bearing interstitial fluid below the phase boundary can be determined.

(2) Fluid Flow/Discharge - Long-term monitoring of fluid and gas escape around the site is desirable, to be correlated with other measures of flow through the system and the mechanisms driving the flow.

(3) Geophysical Monitoring - Seafloor geodetic measurements may be appropriate in tectonically active environments, where vertical movements are influencing the gas hydrate system. Microseismic activity should also be monitored in such environments, to detect linkages between deformation associated with faulting and fluid flow through the system.

(4) Slope Stability - Monitoring of pore pressures in situations where slope stability is an issue would be of particular value.

(5) Video Monitoring - Continuous camera monitoring of downhole conditions and of the seabed in the immediate vicinity of the hole could record any formation of gas hydrate, biological colonization, and other time varying changes following the drilling of the hole and emplacement of monitoring instrumentation.

(6) Repeat seismic experiments - Carefully calibrated repeated high-resolution seismic surveys provided a potential means of quantifying long-term regional subsurface changes associated with fluid flow and gas-hydrate formation and dissociation.

Perturbation Experiments

The panel discussed the possibility of conducting a set of perturbation experiments for innovation studies of the response of the hydrate bearing sediments to external forcing. These perturbations can include chemical, thermal, and mechanical stimuli to force a response that can be measured. The concept can be extended over a range of time and space scales. These studies would extend knowledge of the dynamics response of hydrate systems in ways that are not achievable by other means. Such experiments could be conducted as an add-on to legs that are located for independent reasons.

Deep-Biosphere Associations

Interactions between gas hydrate and deep-biosphere research objectives are strongly encouraged. Needs for collecting and subsampling representative materials with multiple degrees of sample validation in short time-spans while protecting redox chemistry ties gas hydrate and deep-biosphere research together. Many of the procedures, tools, techniques, and issues facing gas hydrate research are inseparable from the needs for deep-biosphere research. Both require extensive solid, liquid, and gas phase geochemical measurements to characterize the basic environment. Both require extensive use of PCS- or HYACE-type coring tools. Both require rigorous sample validation procedures insuring that sub-samples are representative and not compromised chemically or microbiologically by drilling fluids. Ultimately, both research themes also require our understanding the natural redox coupling and dynamics of both the mass and energy balances within the shallow subsurface. While considerable improvements in our understanding of gas hydrates could occur without including a biological perspective, the inclusion of biology greatly expands our comprehension of biogeochemical processes at little additional cost, as well as increasing the relevancy of ODP research to 21st century issues.

Preservation of Gas Hydrate-Bearing Core Samples

When hydrates are cored it is imperative that the samples are preserved as close to the *in situ* conditions as possible. In the past many cores have been pressurized with gases in ways that encourage gas hydrate dissociation. Studies of gas hydrate sample preservation show that the most effective method is to store gas hydrate samples in a dry Dewar container at liquid nitrogen temperatures. Thus arrangements need to be made to have liquid nitrogen and appropriate storage facilities available on the JOIDES Resolution for gas hydrate legs.

Industrial and Interagency Interactions

The hydrocarbon industry has long-standing research efforts into flow assurance problems related to artificially created hydrates. Outside the pipeline, gas hydrates are important to industry and governmental agencies as a current safety issue and as a potential resource in the long term. As such there is a natural infrastructure available for interaction with ODP on naturally occurring hydrates. ODP should encourage industrial and governmental partnerships to enhancement proposals. In many cases industry and government have data and technical expertise that may be valuable in ODP efforts. By combining efforts both groups may accomplish more.

Carbon Dioxide Sequestering

While natural gas hydrates are the focus of this PPG's mandate, we need to point out the ODP will be facing another gas hydrate issue associated with CO_2 sequestering. The

Kyoto Protocols have focused international efforts on ways of reducing emissions of CO_2 to atmosphere. Various concepts that involve pumping CO_2 into ocean are being widely discussed. The idea is that the CO_2 could be pumped to an adequate depth to be converted into CO_2-hydrate and that the CO_2-hydrate thus will stay sequestered on the seafloor. While there are some conceptual models to do this, very little empirical data exist. Fundamental and engineering research in CO_2 sequestration could realize a widespread application of great service to society. ODP may play an important role in developing strategies to assess various potential approaches to disposing of CO_2 as CO_2-hydrate.

Appendix 1

GAS HYDRATE PROGRAM PLANNING GROUP

G. Bohrmann (GEOMAR, Germany)
P. Brewer (MBARI, U.S.A.)
P. Cochonat (IFREMER, France)
T. Collett (USGS, U.S.A.)
N. Edwards (U. of Toronto, Canada)
M. Hovland (Statoil, Norway)
A. Johnson (Chevron, U.S.A.)
K. Kvenvolden (USGS, U.S.A.)
R. Matsumoto (U. of Tokyo, Japan)
C. Paull (MBARI, U.S.A.) (Chair)
D. Sloan (Colorado School of Mines, U.S.A.)
A. Trehu (Oregon State U., U.S.A.)
G. Westbrook (U. of Birmingham, U.K.)

Appendix 2

Mandate

Gas Hydrate Program Planning Group

Overall Goal

To develop a plan of drilling and sampling to:

* study the formation of natural gas hydrates in marine sediments;

* determine the mechanism of development, nature, magnitude, and global distribution of gas hydrate reservoirs;

* evaluate the source of the gas locked up in hydrates;

* investigate the gas transport mechanism and migration pathways through sedimentary structures from site of origin to reservoir;

* examine the effect of gas hydrates on the physical properties of the enclosing sediments, particularly as it relates to the potential relationship between gas hydrates and slope instability.

Mandate

To work with other appropriate international geoscience initiatives to:

1. Develop the drilling strategy to complete the defined goals.
2. Identify geographic areas appropriate to meet the scientific objectives.
3. Advocate new and/or better technologies to achieve the objectives.
4. Organize and nurture the development of specific drilling proposals.

Timeline

* The PPG will exist for a maximum of three years, during which time it will report to the SSEPs on a regular basis.
* SCICOM will conduct an annual evaluation of the necessity for its continuation, with advice from the SSEP's.
* The PPG will produce a final written report of the overall plan and its recommendations for implementation.

Appendix 3
Survey Needs for Both Pre-Drilling and Post-Drilling Experiments

Pre-Drilling (Site Survey)

The following are generally required:

- Systematic seismic reflection surveys to identify the presence of gas hydrate through the detection of BSR's and velocity anomalies. Preferably, seismic reflection data should be digital and cover a wide range of frequencies to assess the heterogeneity of gas hydrate distribution and to show structural and stratigraphic features associated with the escape of fluids and gas, such as wipeouts and other amplitude anomalies. Ideally data would be 3-D. Crossing lines at the proposed sites are essential in most cases.

- Multi-beam bathymetry and/or sidescan sonar data to show the shape and nature of the seafloor and to identify carbonates and gas hydrate at the seafloor and of features associated with gas and fluid escape.

- Navigation should be at least as accurate as normal GPS data. Surveys related to previously drill holes should be of higher precision if possible, preferably using DGPS or ranging to fixed markers.

The following are desirable, and may be of particular importance for some objectives:

- Heat-flow data to identify spatial anomalies that may reflect the pattern of fluid outflow. Careful selection of sites, guided by high-resolution surveys of the seafloor, may be required to ensure successful measurements.

- Information on the rates of fluid outflow (and inflow) at the seabed to constrain the relationship between flow and gas hydrate development.

- Pore fluid chemical data from the near surface sediments.

- Evidence of plumes of methane-enriched water in the water column that could indicate the proximity of active vents or seeps.

- Measurements of electrical resistivity of the sediments to a depth greater than the base of the hydrate stability field using seafloor or near-seafloor EM systems.

Resistivity is sensitive to the replacement of conductive pore water by more resistive hydrate.

- Seismic experiments to study the distribution of hydrate within the stability zone as well as the nature of the BSR. This would be most effective if the experiments are configured to also record S-waves using seafloor recording instruments, as S-waves are more sensitive to changes in the rigidity of the sediments caused by the presence of hydrate. S-waves can be generated by mode conversion at the BSR with sufficiently large angles of incidence from either surface towed sources such as air guns or bottom sources such as explosives or imploding spheres.

- Seafloor compliance is another method that detects changes in the elastic moduli, especially the shear modulus, produced by hydrate cementation. Ocean surface gravity waves and longer period infra-gravity waves induce time-varying pressure fields on the seafloor that deform the sediment and cause vertical accelerations which can be recorded by a precision pressure gauge and gravimeter on the seafloor. Compliance is obtained from the transfer function between these measures as a function of frequency. The depth of penetration depends on the wavelength and corresponds to the frequency of the gravity waves. At 0.01 to 0.5 Hz the stiffness of the sediment can be sensed to a depth of 200 mbsf.

A series of post-drilling surveys would be beneficial for setting the results from the borehole in the context of the spatial distribution of physical properties in the surrounding sediments.

- Offset VSP experiments, using P-waves and S-waves, to define the distribution of hydrate in a cone around the borehole. The variation frequency response of the BSR can be used to map and characterize its lateral variation.

- Borehole to surface measurements of electrical resistivity. This will provide a measure of the distribution of resistivity in a larger volume of sediment than can be obtained from just borehole resistivity logs. These measurements are not affected by signal degradation associated with the borehole irregularities.

- Cross-hole seismic and resistivity measurements to provide a more accurately defined distribution of properties than can be obtained from a single borehole. The boreholes should be no more than 100 m apart and preferably closer than 50 m, if the boreholes can be positioned and directed with sufficient accuracy. The combination of seismic

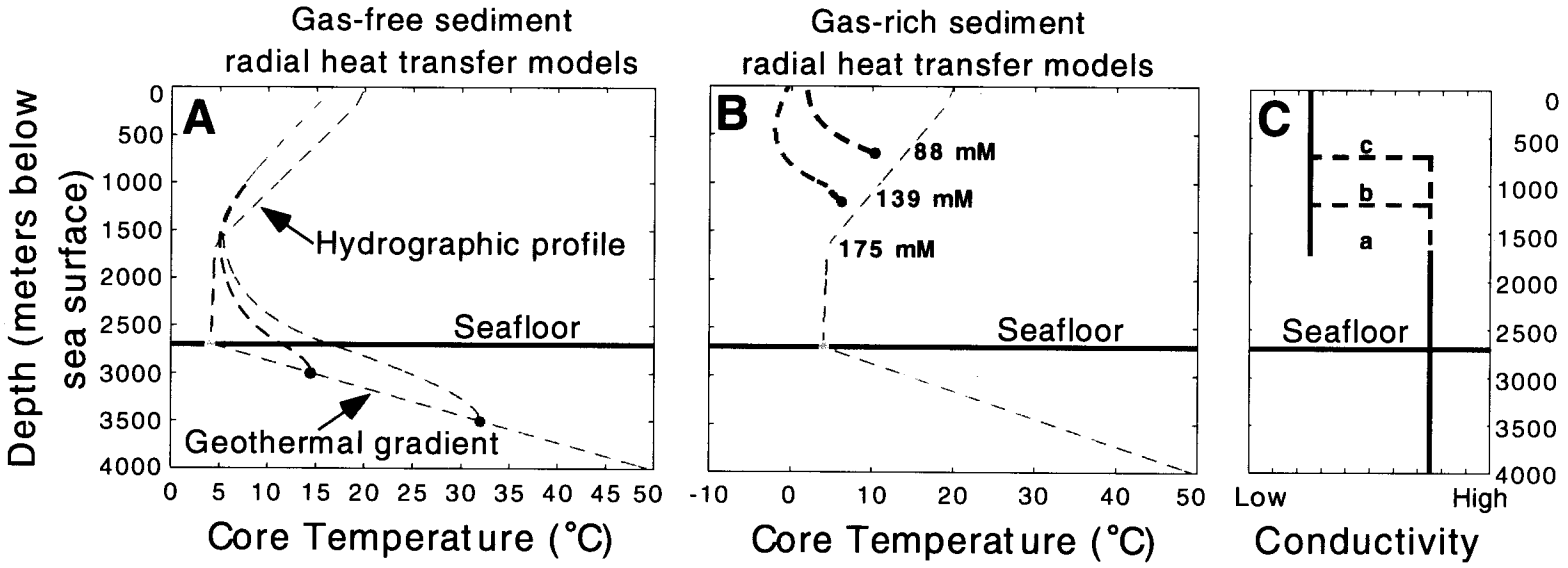
and electrical methods is a powerful technique, because these measurements respond differently to gas hydrate or gas replacing water.

To achieve their full value, all these techniques must be integrated with downhole geophysical logs, lithologic information, and chemical data and be calibrated against laboratory measurements of the physical properties of any recovered gas hydrate and their host sediment.

SCIMP APPENDIX

00-3-15

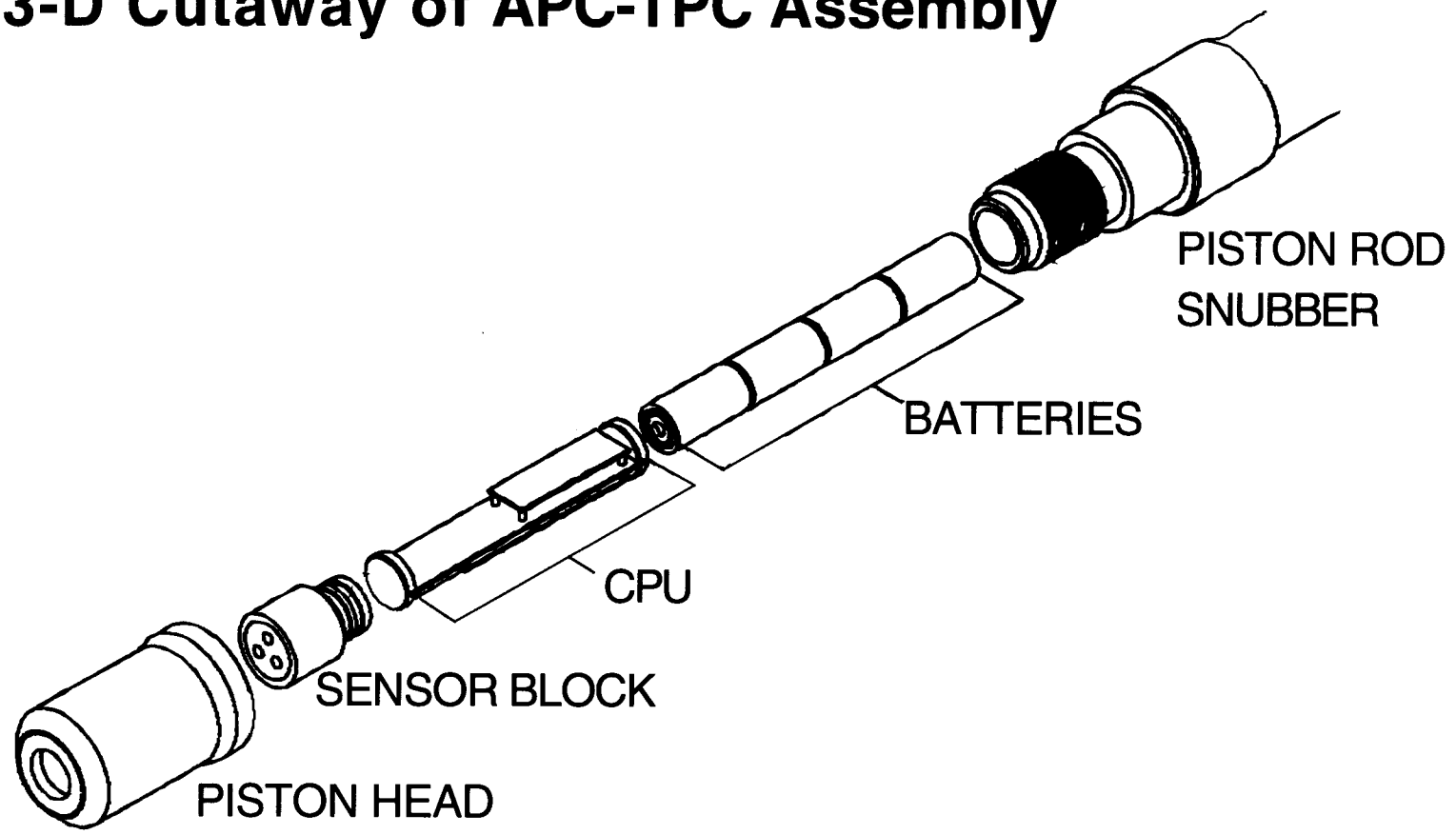
Model Ascent Profiles for Gas-rich Sediments



National Science Foundation

MBARI

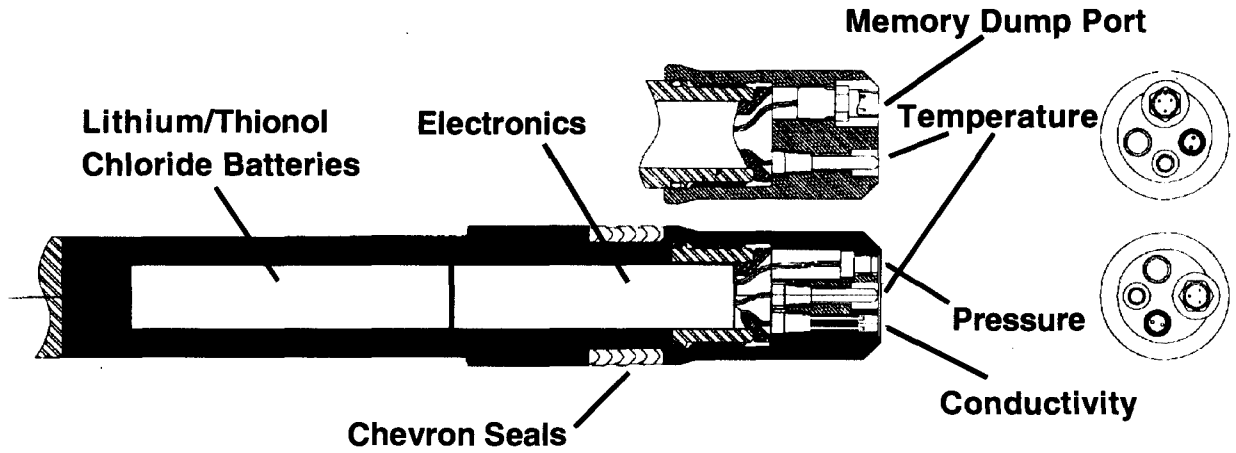
3-D Cutaway of APC-TPC Assembly

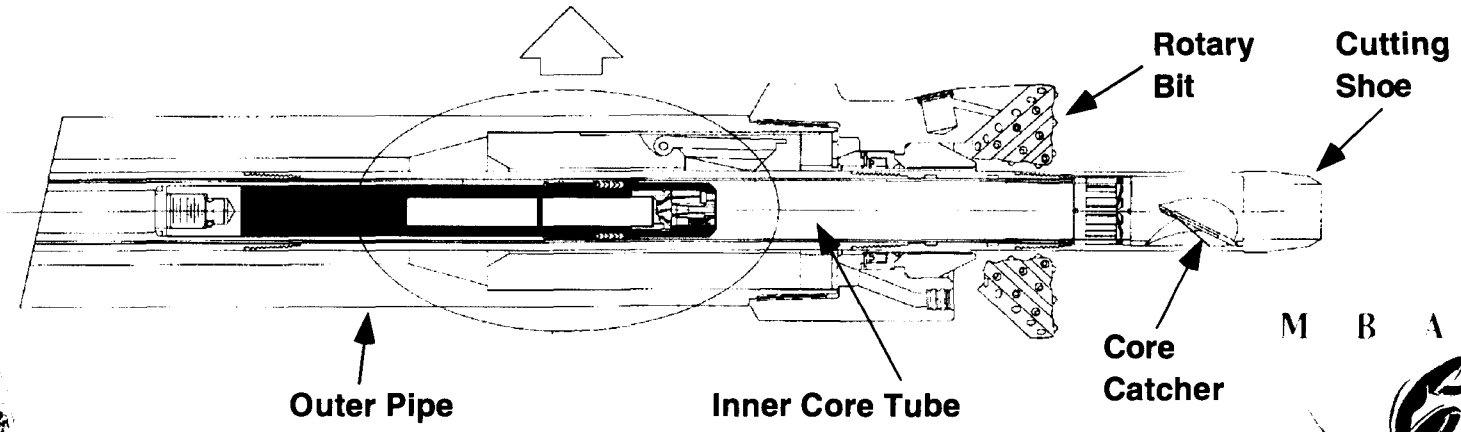


National Science Foundation

M B A R I

Schematic Diagram of the Modified APC-TPC-MPU Assembly

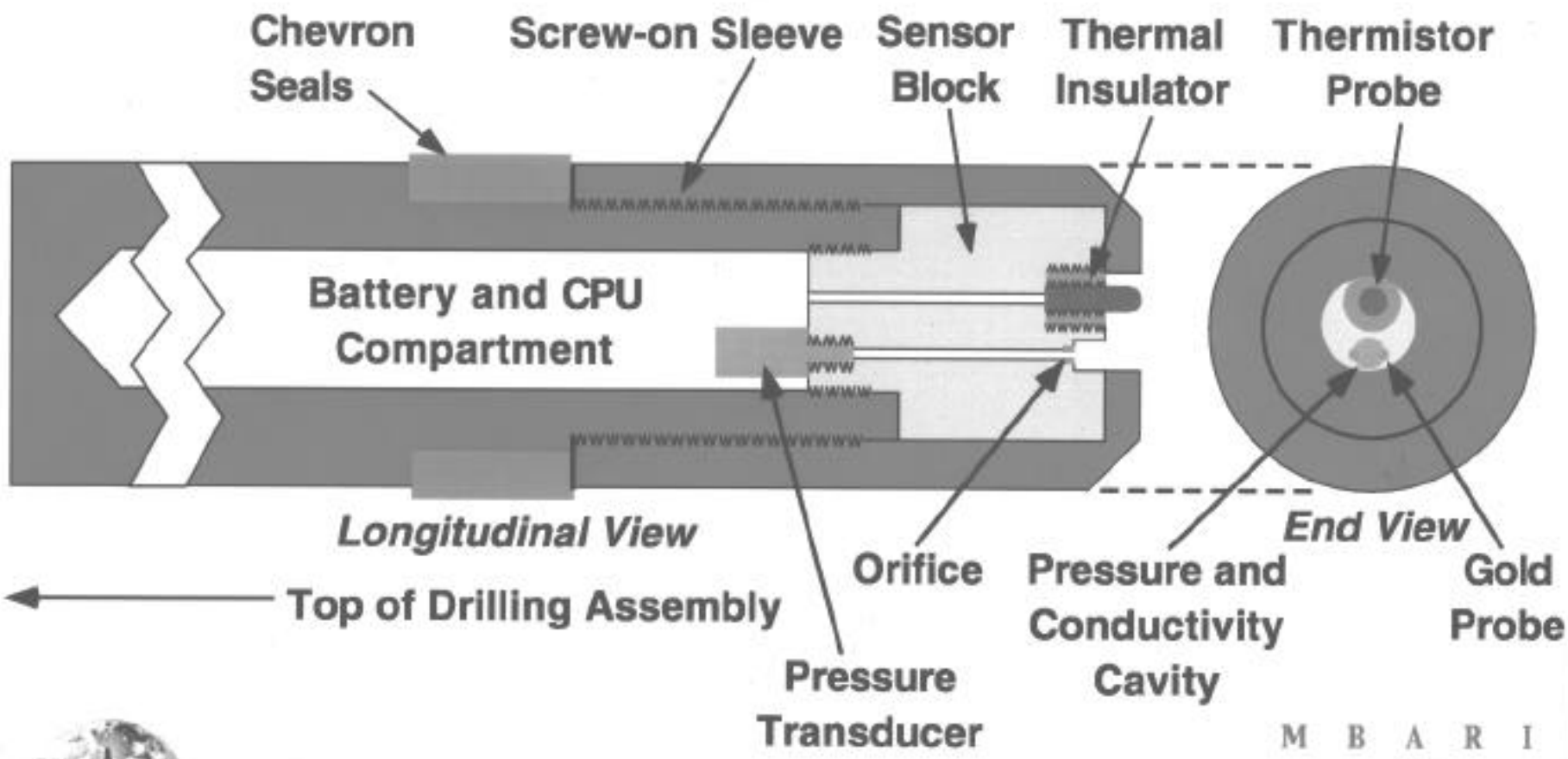




National Science Foundation

M B A R I

Modified APC Piston Assembly



National Science Foundation

M B A R I

SCIMP APPENDIX

00-3-16

ODP DATA
TRANSFER/ARCHIVE PROJECT

MEETING AGENDA
November 2, 2000

I. Opening Remarks - Frank

II. Describe TAMU, LDEO Borehole, and Site Survey data
(brief overview by each facility)

A. Current volume, condition, and format of data
B. Processing underway & anticipated status by end 2003
   1. Data migration in JANUS
   2. Log processing/format issues?
   3. Site Survey proprietary issues?

III. Build a definition of a data archive for each category in II.
(roundtable discussion)

A. Storage and distribution/access requirements
   1. NSF
   2. JOI

B. NGDC archive
   1. RDBMS
   2. Flat Files
   3. Analog Data

C. Any data not to be archived at NGDC?

IV. Possible digital data solutions
(roundtable discussion)

A. RDBMS approach (database technology transfer)
   1. Janus mirror site at NGDC?
   2. Create primary Janus database site at NGDC?

B. Flat file approach
    1. Extract data from Janus Database?
    2. Create special use files/DVD's?

C. Borehole data?

D. Site Survey data?

V. Possible analog solutions

VI. Action items and options

Meeting Attendees:

Bruce Malfait (NSF)
Frank R. Rack (JOI)
David Becker (ODP/TAMU)
Layne Westover (ODP/TAMU)
Mary Reagan (LDEO-BRG)
Cristina Broglia (LDEO-BRG)
George Sharman (NOAA/NGDC)
Carla Moore (NOAA/NGDC)
David Divins (NOAA/NGDC)
William Hay (present JOIDES SCICOM Chair, GEOMAR)
Keir Becker (future JOIDES SCICOM Chair, UMiami/RSMAS)

ACTION ITEMS (Summary):

ACTION ITEM 00-data-1: SCIMP and the ODP/TAMU JANUS database group should define the tables, scripts, and applications that need to be developed to meet the needs of the microbiological data acquisition within ODP. Recommendations should describe how to proceed and how these developments should be prioritized within the entire JANUS effort.

ACTION ITEM 00-data-2: The ODP/TAMU Data Librarian should (a) provide an accounting of the present data holdings and (b) provide an estimate of the overall status of data submissions from past ODP participants.

ACTION ITEM 00-data-3: ODP/TAMU should provide information about the status of the core photographs from ODP legs prior to Leg 161 and estimate the scope of the remaining task to scan, quality assure, digitize and store these assets in digital format (e.g., as high-resolution TIFF and low-resolution PDF files).

ACTION ITEM 00-data-4: ODP/TAMU and LDEO should generate inventories of the appropriate ODP and DSDP paper data products that should be scanned and digitized for long-term archive storage under this NOAA program. The appropriate specifications for this scanning process and the prioritization of this activity should be evaluated and prioritized by JOIDES (e.g, SCIMP). These inventories should be provided to NGDC to include in a digitization project proposal, as is determined to be appropriate.

ACTION ITEM 00-data-5: An assessment should be made (by ODP/TAMU and LDEO, with assistance from SSP) of the site survey data that may be duplicated in other databases and/or data centers, and therefore may not need to be archived. In addition, the extent of the JOIDES Resolution site survey and geophysical data not being archived at NGDC should be determined and a process should be set up to remedy this situation, as appropriate.

ACTION ITEM 00-data-6: LDEO should determine the required effort necessary to capture and preserve the complete metadata of the log processing and operations, and to preserve this ("corporate memory") as metadata linked to specific logging runs. This history of data processing is vital to maximizing the value of these data.

ACTION ITEM 00-data-7: ODP/TAMU requests advice from JOIDES (e.g., SCIMP) to define the appropriate archive data formats for JANUS transfer to NGDC.

Response from David Becker (ODP/TAMU): I asked staff about the detailed information regarding ODP data types. The response was clear that an effort is underway and will continue to end of program to add detailed information where needed in the form of additions to the existing user manuals and the Janus data models. Staff noted that as a general rule, the further data are from the "who, what, why, where, and how" of it's collection, the less reliable the data are likely to be. Therefore, one of our priorities is to try to capture as much information about how the data were collected, processed, etc., and to make that metadata readily available as we migrate data into the database. Essentially, the data formats currently used in the JANUS user manuals will be followed as data is migrated.

ACTION ITEM 00-data-8: JOI will arrange a meeting with ODP/TAMU, NGDC, and SCIMP representatives to discuss data format and data type definition issues.

Note: This meeting will be held in College Station, TX on November 27, 2000. In addition to the ODP/TAMU representatives, Frank Rack (JOI), Tom Janecek (SCIMP) and David Divins (NGDC) will attend this meeting. The outcome of this meeting will be transmitted to SCIMP at their December meeting for further discussion.

ACTION ITEM 00-data-9: All subcontractors (ODP/TAMU, LDEO-BRG, JOIDES SSDB) will develop more complete inventories of data holdings. These inventories will allow the identification of duplicate data assets (e.g., analog vs. digital formats) and will allow the evaluation of potential digital scanning (data rescue) projects.

Response from Dan Quoidbach (SSDB): We will finish the transfer of the old card catalog into the FileMaker database next year. We will then be able to produce inventory reports summarized by data type and by Leg/Proposal Number. However, it will be necessary to check these inventory lists against the actual records to obtain information regarding size of the document and the number of copies and current data quality.

With the end of Leg scheduling after the August 2001 SCICOM meeting, we will begin the transfer of effort from proposal review to close-out tasks.

ACTION ITEM 00-data-10: LDEO-BRG and JOIDES SSDB, with the help of the appropriate JOIDES panels (e.g., SCIMP, and SSP) should determine which data holdings are important, unique, and/or irreplaceable. Which data should be archived and/or improved through reprocessing activities? What are the potential costs of these activities? What is the level of effort that will be required? These activities should include an evaluation of the existing DSDP data holdings and a judgement of whether further

data rescue efforts are warranted (if yes, then by whom, and when?). How should this be prioritized?

Response from Dan Quoidbach (SSDB): I will discuss with John Diebold and Tom Janacek a procedure to determine what data are important to archive and what can be discarded. Hopefully SCIMP can discuss this issue at its next meeting. I think the first question that needs to be answered is whether we want to include data for non-drilled proposals. After that we should identify data that are already archived in other public databases and which would not need to be archived at NGDC.

We will also want to decide what the purpose of the archive will be. Will it be just the data needed to document the site locations, as in the shipboard data package, or do we want the full package of materials submitted which may contain reprints, cruise reports, correspondence and other metadata, as well as any miscellaneous data the Site Survey Panel required to pass their review? A subgroup of SSP might be charged with looking through the older data and determining if the materials are still scientifically useful. They could perform this at their July 2001 meeting which will be held here at LDEO.

ACTION ITEM 00-data-11: Throughout the Ocean Drilling Program, an effort should be made to inventory and evaluate paper record holdings that should be preserved (e.g., smear slide description forms, thin section description forms, VCDs, etc.). The overall inventory of paper record holdings should be communicated to NGDC to see if a proposal to scan and digitize these assets is possible using NOAA funding sources. The goal would be to make these resources more accessable in a digital archive.

ACTION ITEM 00-data-12: JOI will sent out a request to the ODP community to encourage researchers to submit digital copies of data obtained from ODP and DSDP samples (and the appropriate metadata) to the ODP Data Librarian. This is an existing obligation under the ODP sample, data, and publications policy, but this needs to be highlighted in an announcement to the community to preserve the data legacy of the ODP.

FINAL ODP/NGDC DATA TRANSFER/ARCHIVE MEETING MINUTES
(recorded and compiled by Frank Rack with contributions from ODP/TAMU, LDEO/BRG, and NGDC representatives - FINAL version, distributed on November 21, 2000):

George Sharman (NOAA/NGDC) welcomed the meeting participants to the National Geophysical Data Center (NGDC) in Boulder, Colorado and provided an overview of the meeting room facilities and logistics.

Frank Rack (JOI) presented an overview of the meeting objectives and described the rationale for convening a meeting between representatives of the Ocean Drilling Program (ODP), JOIDES, NSF, and the NGDC. The primary motivation for this meeting was to discuss and evaluate various options for the long-term maintenance of the ODP databases, JANUS database, and the contractually-mandated plans for data transfer activities leading up to the close-out of the ODP. A PowerPoint presentation that was prepared for this meeting is included with these minutes as **Appendix 1**.

From the JOIDES perspective, this meeting was called to partially address EXCOM Motion 00-2-3, which requests "JOI and the JOIDES Science Advisory Structure will develop options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies". This meeting also follows upon SCIMP Recommendation 98-2-8, which recommended "that NOAA/NGDC work with JOI to investigate the most efficient way to complete the DSDP/ODP data archiving". In January of 1999, NOAA/NGDC and ODP/TAMU established a preliminary agreement to test JANUS database transfers via 4-mm DAT tapes. By June of 1999, this collaboration had been successful in transferring a copy of the JANUS database tables to NGDC, with updates provided by ODP/TAMU to NGDC roughly twice per year.

One aspect of the ODP to NGDC Data Transfer Project that remains to be addressed is the form and contents of an ODP data archive at NGDC/World Data Center for Marine Geology and Geophysics, Boulder. The NSF Policy for Oceanographic Data (NSF 94-126) provides guidelines to ensure the timely submission of "high quality oceanographic data to the national data centers for secondary use" (see Policy in **Appendix 2**). This NSF policy was established during the 1980's and revised in 1994. NSF may choose to re-examine their oceanographic data policies in the future.

Keir Becker (JOIDES) asked if there were any international requirements with regard to data archiving. Bruce Malfait (NSF) said that NSF is primarily concerned with its national agreement to archive ODP data at a national data center, however, due to the

collocated World Data Centers at NGDC, the transfer of these data should also satisfy any international data archive requirements.

The key component of the ODP to NGDC data transfer activity is to determine the definition of an “appropriate” archive, and to determine which data are considered “appropriate” for consideration under this policy.

ODP/TAMU Report

David Becker (ODP/TAMU) presented a overview of the ODP/DSDP data holdings presently identified by the Science Operator (**Appendix 3a**). The JANUS database consists of over 450 data tables inter-linked by the Oracle relational data model that defines the JANUS database. This database is estimated to be about 20 GB in size when the data migration process is completed before the end of ODP. One aspect of the data definition that has not been addressed to date are the needs of the microbiology community, which were not defined when the JANUS data model was constructed. The JANUS data are governed by restricted access during the one-year moratorium period. Can data transfer to NGDC during the moratorium? NGDC can develop policies to allow the transfer of these data to NGDC during the moratorium.

ACTION ITEM 00-data-1: SCIMP and the ODP/TAMU JANUS database group should define the tables, scripts, and applications that need to be developed to meet the needs of the microbiological data acquisition within ODP. Recommendations should describe how to proceed and how these developments should be prioritized within the entire JANUS effort.

An additional pool of primary data are the scientific data files that have been submitted to the ODP Data Librarian, primarily as flat ASCII files. These data holdings are estimated to reach 12 GB by the end of the program. It is suspected that many of the obligated data submissions under the ODP sample, data, and publications policy may still be outstanding.

ACTION ITEM 00-data-2: The ODP/TAMU Data Librarian should (a) provide an accounting of the present data holdings and (b) provide an estimate of the overall status of data submissions from past ODP participants.

There are a variety of additional data holdings (see **Appendix 3a**), many in analog format (e.g., paper, film, and video), which need to be evaluated by the appropriate parties (ODP/TAMU and JOIDES representatives). Some of the issues that need to be addressed

are determinations of what data to preserve, e.g., does the program retain all original copies of data, even when these paper copies may be preserved on microfiche, microfilm, or other media? Should paper copies of forms, reports, and assorted intermediate data products (e.g., VCD's, smear slides, thin section descriptions, drilling and operations reports) be digitized if appropriate resources can be identified?

An ODP/TAMU concern is that turnover in personnel is a significant factor in the JANUS data migration activity. At the present time, only one overall FTE is assigned to this task. There are questions about the term of the data processing phase-out activity and the scope of these efforts.

Core photographs at high-resolution formats (1200 dpi) are a significant potential source of digital data (e.g., 2500 GB) in TIFF format. These data are presently stored on a separate hard drive at TAMU. Core photographs from Legs 161 to 187 are available as 300 dpi PDF format documents, but archive core photographs from earlier legs still need to be scanned and saved in digital format.

ACTION ITEM 00-data-3: ODP/TAMU should provide information about the status of the core photographs from ODP legs prior to Leg 161 and estimate the scope of the remaining task to scan, quality assure, digitize and store these assets in digital format (e.g., as high-resolution TIFF and low-resolution PDF files).

Additional information was provided by ODP/TAMU in response to questions raised by the meeting attendees (**Appendix 3b**).

George Sharman (NOAA/NGDC) suggested that there may be available options through specific NOAA internal programs, which would accept proposals to accomplish the systematic scanning and digitization of paper records, if appropriate estimates of these data holdings could be quantified (e.g., DSDP drilling parameters, paper prime data, etc.).

This approach has been utilized in the past to rescue other analog data holdings, such at historic BT profiles, and weather observation sheets. The criteria for this program are that the task be simple, repetitive, and that the scope of the project can be quantified. This NOAA program is a potential source of earmarked funds for data rescue, assuming that the specifications for the data rescue process can be clearly defined. The proposed project could be accomplished by workers located in West Virginia and Kentucky, assuming appropriate levels of programmatic oversight.

ACTION ITEM 00-data-4: ODP/TAMU and LDEO should generate inventories of the appropriate ODP and DSDP paper data products that should be scanned and digitized for long-term archive storage under this NOAA program. The appropriate specifications for this scanning process and the prioritization of this activity should be evaluated and prioritized by JOIDES (e.g, SCIMP). These inventories should be provided to NGDC to include in a digitization project proposal, as is determined to be appropriate.

ACTION ITEM 00-data-5: An assessment should be made (by ODP/TAMU and LDEO, with assistance from SSP) of the site survey data that may be duplicated in other databases and/or data centers, and therefore may not need to be archived. In addition, the extent of the JOIDES Resolution site survey and geophysical data not being archived at NGDC should be determined and a process should be set up to remedy this situation, as appropriate.

The four points emphasized by ODP/TAMU with respect to the question of the condition of ODP-related data are:

(1) Transferability – i.e., all data can be transported to a defined repository.

(2) Readablibility – i.e., all data are in good condition.

(3) Accuracy – i.e., the data uploaded into the JANUS database are error-checked to the extent possible and quality assured to be in the "best" condition.

(4) Accessibility – i.e., all data are under the one year moratorium before transfer to JANUS; this will require the JANUS activity to be preserved through FY2004, at the least.

The important processes for ODP/TAMU data stewardship during the ODP phase-out are: (1) archiving, (2) indexing, and (3) access, i.e, data provided to the community through JANUS database SQL queries.

Meeting notes submitted by David Becker (ODP/TAMU) are included in **Appendix 3c**.

LDEO-BRG Report

Cristina Broglia (LDEO-BRG) presented the status of the ODP Well Log Database (see **Appendix 4**), which includes 313 holes logged, with existing data including field, customer, and processed tapes. The field data are archived in DLIS-LIS format. Digital

data are stored primarily on 4mm DAT tapes; a small amount of the processed data (see **Appendix 4**) is saved on TK50 cartridges, 9-track tapes, and Zip disks. In addition to digital data, there are also analog data (Log blueprints and microfiche) and video files.

The keys to understanding the definition of "**field**" data are (1) that the tapes are provided to a client of Schlumberger, and (2) that these tapes include all of the data recorded by the MAXIS system, including lots of engineering information on multiple channels (e.g., all of the data that was acquired during the logging runs).

"**Customer**" data refers to the "standard" user data files, which are a subset of the field dataset.

All field data tapes are in good condition and can be used to create customer tapes as required. There are a number of additional data files, which could be considered as primary data (e.g., preserved on tapes, VHS film, and paper records, including 9-track tapes from DSDP), which need to be evaluated for archive storage, as appropriate.

The archive of DSDP data is an open question. All of the data (92 holes) currently stored on the NGDC CD-ROM are unreadable on any computer platform due to a format problem. A subset of these data (33 holes) is stored in LIS format on 4mm DAT tapes: these data are readable on any computer equipped with the appropriate loading software. An additional investment of time and funds is required to download and convert the remaining data (49 holes) into a usable format and to process all of the DSDP data with the same technique used for ODP data.

Most of the ODP Well Log Database are currently available on-line in specific data formats; additional logs and formats are also available upon request and have been saved on 4mm DAT tapes. Although some metadata documentation is available in digital format, the majority is in analog format.

The LDEO-BRG has developed expertise in understanding the needs and data requirements of the JOIDES scientific community, and these needs have evolved over time. This process has resulted in data formats that best address the scientific needs of the community, and has established the importance of the corporate memory of the logging program. It is very important to keep in mind the value of understanding the processing that the data have undergone prior to storage and/or distribution.

NOAA/NGDC is capable of archiving back-up tapes from the LDEO-BRG, but are not capable of reading original data (DLIS or LIS format).

ACTION ITEM 00-data-6: LDEO should determine the required effort necessary to capture and preserve the complete metadata of the log processing and operations, and to preserve this ("corporate memory") as metadata linked to specific logging runs. This history of data processing is vital to maximizing the value of these data.

JOIDES/ODP Site Survey Data Bank (LDEO) Report

Frank Rack provided a general overview of the JOIDES/ODP Site Survey Data Bank, based primarily on on-line sources of information. Dan Quoidbach (through Mary Reagan) provided a written summary of the data bank holdings (see **Appendix 5**) and a summary of the pertinent issues that should be addressed in the close-out process.

What happens to data from legs that are not scheduled?

The JOIDES Site Survey Panel should be tasked with helping the program evaluate site survey data bank legacy and archive issues (see ACTION ITEM 00-data-10), including who owns the data, what data are proprietary, and what data are held in common with NGDC.

NOAA/NGDC and World Data Center-A for MGG, Boulder Report

George Sharman (NGDC) provided an overview of the National Geophysical Data Center structure and operations (see **Appendix 6**, only hard copy is available at present), including the relevant information technology (IT) infrastructure. George explained the World Data Center structure and their role in data distribution around the world.

NGDC has recently reissued (September, 2000) the DSDP CD-ROM (Legs 1-96) with an HTML interface and tab-delimited text files. This CD-ROM replaces the 1989 DSDP CD-ROM; all 750 copies of the earlier version were distributed.

The majority of the NGDC data holdings (by volume) are DSMP satellite data being archived at NGDC. The tape archive for these satellite data provide NOAA/NGDC with resources and advanced technological capabilities, which include: (1) a robotic tape handling system for the (NARA standard) tape archive, and (2) a fiber optic network backbone deployed by the Boulder Research Area Network (BRAN) between the NOAA/NGDC, UCAR/NCAR, and the Univ. of Colorado.

NGDC have concerns about archive data availability, including the following issues:

(1) Archiving:
    a) completeness
    b) preservation
    c) access
    d) distribution

(2) Metadata
    a) usefulness

(3) Avoiding Disruptive Discontinuities
    (e.g., the disruption of data availability during the transition between DSDP and ODP.

NSF Comments

Bruce Malfait explained the NSF perspective on the ODP to IODP transition. There is an ongoing activity to transition the JANUS database as a mirror to JAMSTEC (OD21) so that the appropriate data can be available to the next program (IODP) and the scientific community. It was agreed that "appropriate" data to be archived could be defined by their scientific usefulness.

The specific resources (funds) available for the data transfer activity, under the terms of the NSF data policy, are undefined. For example, individual NSF investigators accomplish this by requesting specific funds in their grants to comply with data requirements; major identified programs have additional responsibilities that are defined by a dialog among the appropriate program managers. The pertinent issues related to the enforcement of data policies are also unclear and will require additional evaluation.

General Discussion

The group moved to a general discussion of database (flat file) export questions and issues to establish a common framework for detailed discussions. Some of these issues relate to the establishment of specific data file definitions and metadata descriptions for JANUS data. Frank felt that the JANUS data file definitions should exist, based on the previous discussions and minutes of the JANUS sub-committee, and the on-line TAMU manuals that describe data fields in JANUS.

What is the definition of an “archive”, i.e., the “letter of the law”, and the requirements that must be met to comply with the NSF Policy? Is a mirror of the JANUS database at

NGDC considered adequate for an “archive”? The general concensus of the NGDC representatives is that a mirror of the JANUS relational database structure is not considered a “true” archive, but could be considered as a first step toward facilitating creation of an archive, as a means of long-term maintenance of access to the JANUS database, and as an off-site "back-up" of the database.

Are flat ASCII downloads of the various JANUS tables sufficient, given the existing definition of the JANUS data model? Are data file definitions required, independent of JANUS (oracle) relationships, to develop metadata descriptions for individual ASCII flat files? ODP/TAMU needs advice from the scientific community (e.g., JOIDES panels) in order to define the appropriate data formats for permanent, software-independent archive by NGDC.

ACTION ITEM 00-data-7: ODP/TAMU requests advice from JOIDES (e.g., SCIMP) to define the appropriate archive data formats for JANUS transfer to NGDC.

ODP/TAMU view the JANUS database as a "living document" with evolving access requirements as each new scientific party collects new data (e.g., moratorium access, post-moratorium access, access to relationships between data files according to the Oracle data model for JANUS). The exisiting JANUS Tables may seem somewhat static, but they are continually evolving as the data migration effort populates the fields defined by the data model.

NGDC cautions that the transfer of data between DSDP and ODP was not smoothly accomplished. When a new program starts up, the focus of the new program is on the new data, not preserving the data from the previous program; therefore, less effort is expended on dealing with legacy issues. The long-term data transfer effort may be resource limited (e.g., not enough personnel, not enough funding).

Documentation of data (i.e., metadata) and capture of "corporate memory", as related to data acquisition, processing, quality assurance, and other activities (i.e., the history of the data collected; database scripts) are vital for the success of data archiving. At some point, it may be necessary to restrict new developments and focus on data documentation projects. Nobody really wants to focus on data documentation because it is a hard and tedious job.

ODP/TAMU is presently moving to Java as the basic programming language and converting older scripts to this language. The generic JANUS data uploader is nearly completed. This script will be able to deal with changes in data acquisition methods and

data types (e.g., changes in Labview implementation for various data sources and instruments). The process of data migration into JANUS is ongoing at ODP/TAMU. The changes in data format from leg to leg require the modification of the original data files to conform with a generic data definition before being uploaded into JANUS using the upload scripts. At present, the equivalent of one (1) FTE is working on the data migration project.

NGDC noted that a relational database is **not** an "archive". NGDC's goals for the archive include (1) ease of transport of data, (2) ease of access to data, and (3) long-term preservation of information. There is a risk that if the Oracle standard goes away or if the software changes significantly at a later date and resources are not available to redesign the system, then the data will be lost unless representative, database-independent ASCII files exist to preserve the archive data. By definition, an official NARA archive can't be software dependent (NARA = National Archives and Records Administration; see: http://www.nara.gov). Relevant portion reproduced in Appendix 7.

A relational database incorporates: (1) a defined data model, (2) defined entity relationships, and (3) pointers to, and among, specific data files.

ODP/TAMU suggests that the export of data from JANUS as stand-alone flat ASCII data files may be difficult, and/or require significant resources. This will require the development of many specific SQL queries, a determination of which data are important to be archived, and a description of specific format for each data type. Redundancy would have to be built into each data table to allow them to stand on their own. Each table currently has a number of dimensions built into it (e.g., site, hole, core, section, interval). There would need to be repetition of data within stand-alone files based on these sample/data descriptions.

Do we need to break the relational database management system (RDBMS) down to it's smallest elements in order to archive them? Can we reduce this complexity by reducing the scope of the data holdings to be archived? We need definitions of archival data types. Therefore, we need a group of people to define these at a selected level (e.g., basic unit of data). Do we want a large number of small data tables, or a smaller number of larger tables? Can we agree that data should be archived by ODP or DSDP 'HOLE', thereby reducing the complexity of the data archiving process while preserving what the community generally needs? What are the risks in this approach?

Long-term maintenance of a mirror site for JANUS at NGDC may facilitate the creation of a true "archive". The group was able to agree that there are three basic options for moving toward a transfer of JANUS data from ODP/TAMU to NGDC:

(1) Transfer the JANUS RDBMS as a mirror to NGDC. The foundation for this process, duplication of the data tables at NGDC, is occurring now, with updates from ODP/TAMU sent to NGDC on a regular basis using 4 mm DAT tapes. To create a true mirror site, access software would also need to be installed at NGDC. This "mirror" approach is not seen as a "archive" by NGDC because there is software dependence to the Oracle data model of JANUS. It is seen as a very desirable step toward maintenance of long-term access to the JANUS database itself. Establishment of a true, functioning mirror at NGDC could be accomplished in parallel to other database mirrors being constructed in Germany and Japan.

(2) Output flat ASCII data files from JANUS using the RDBMS structure as a "blueprint". This is essentially equivalent to downloading the existing JANUS tables at text files, but the metadata will only exist in the context of the JANUS Oracle data model. It was noted at the meeting that this approach actually archives the database rather than the underlying scientific data. To actually recreate the database from the results of this output may be expensive, perhaps requiring resources equivalent to the original design and implementation of the JANUS database itself.

(3) Output flat ASCII data files from JANUS in a form that is independent of the JANUS Oracle data model. This approach will require extensive documentation of each data file to preserve the relevant metadata (e.g., data definition, data acquisition and processing history, describe relationships with other data files, etc.). This option is thought to be the only approach listed that will create a true long-term archive of the data; however, this approach may also be expensive. An estimate of the level of resources required will need to be determined through futher discussions among the parties involved.

SQL scripts will need to be developed or modified from existing scripts to accomplish the output of data from JANUS in the appropriate data formats prescribed by options 2 or 3. The verification of data and quality control/quality assurance (QA/QC) steps suggest that data should be migrated and/or uploaded into JANUS to standardize the data product(s) before creating the flat ASCII files for transfer to an archive (e.g., NGDC).

ACTION ITEM 00-data-8: JOI will arrange a meeting with ODP/TAMU, NGDC, and SCIMP representatives to discuss data format and data type definition issues. The

outcome of this meeting will be transmitted to SCIMP at their December meeting for discussion. This meeting will be held in College Station, TX on November 27, 2000.

ACTION ITEM 00-data-9: All subcontractors (ODP/TAMU, LDEO-BRG, JOIDES SSDB) will develop more complete inventories of data holdings. These inventories will allow the identification of duplicate data assets (e.g., analog vs. digital formats) and will allow the evaluation of potential digital scanning (data rescue) projects.

On-line LDEO-BRG logging data are (generally) already preserved as ASCII flat files and digital GIF format images (e.g., FMS), but the original raw data are not in archive format, but rather exist as DLIS/LIS format files (i.e., log analysis software dependent formats).

There are questions about where to stop and archive data along the processing pathway to make the data available to the community in the best way. What data product(s) should be archived? Where there may be multiple formats of log data there may need to be better inventory control. There are also issues about data visualization and the presentation of data products, since some log interpretation may be visualization-dependent. How does the program deal with specific user requests when, and if, the corporate memory is lost? How do we capture this information as a program? How does changing user demands influence data access issues?

NGDC is not really capable of dealing with log data in DLIS/LIS format. They can store data tapes in a vault as an "archive", but they can't read or reprocess these data. NGDC is willing to accept a wide range of data, as long as it is fully described. NGDC has not accepted much analog data lately, although they did recently accept the Bruce Heezen library holdings.

LDEO-BRG provides individual customer service(s) by offeringa variety of specialized outputs.. Changes in these specialized outputs are dictated by evolving user needs based on available interpretation software and techniques

Two copies of the log data from each leg are archived. During the six months following the cruise, the second copy is kept on the ship. After that it is stored at LDEO in a separate building.

Seismic log data are saved in DLIS/LIS format. A subset is also available in SEG-Y format. An important note to remember is that there is no one standard SEG-Y format.

The SEG-Y format that LDEO-BRG has used for their archive has proven to be widely readable.

It was agreed that LDEO should maintain the log data archive as is being done at present. NGDC is archiving log data through Leg 145 but they can't read these data tapes. Recent log data are also being archived by NGDC on CD-ROMs, but access is not provided, since the more recent LDEO/BRG logging data are available on-line.

Microfilm and/or microfiche copies of paper records exist (e.g., FMS logs).

ACTION ITEM 00-data-10: LDEO-BRG and JOIDES SSDB, with the help of the appropriate JOIDES panels (e.g., SCIMP, and SSP) should determine which data holdings are important, unique, and/or irreplaceable. Which data should be archived and/or improved through reprocessing activities? What are the potential costs of these activities? What is the level of effort that will be required? These activities should include an evaluation of the existing DSDP data holdings and a judgement of whether further data rescue efforts are warranted (if yes, then by whom, and when?). How should this be prioritized?

ACTION ITEM 00-data-11: Throughout the Ocean Drilling Program, an effort should be made to inventory and evaluate paper record holdings that should be preserved (e.g., smear slide description forms, thin section description forms, VCDs, etc.). The overall inventory of paper record holdings should be communicated to NGDC to see if a proposal to scan and digitize these assets is possible using NOAA funding sources. The goal would be to make these resources more accessable in a digital archive.

ACTION ITEM 00-data-12: JOI will sent out a request to the ODP community to encourage researchers to submit digital copies of data obtained from ODP and DSDP samples (and the appropriate metadata) to the ODP Data Librarian. This is an existing obligation under the ODP sample, data, and publications policy, but this needs to be highlighted in an announcement to the community to preserve the data legacy of the ODP.

APPENDIX 2:
Policy for Oceanographic Data, NSF 94-126

Purpose

1. This statement updates and revises guidelines to implement Federal data policy by assuring timely submission of high quality oceanographic data to the national data centers for secondary use. Guidelines for oceanographic data were first issued by the National Science Foundation's (NSF) Division of Ocean Sciences (OCE) in October 1988.

Policy

2. Ocean data collected under Federal sponsorship and identified as appropriate for submission to a national data center are to be made available within a reasonable time as described below.

Responsibilities of Principal Investigators

3. Principal investigators are required to submit all environmental data collected to the designated national data centers as soon as possible, but no later than two (2) years after the data are collected. Inventories of all marine environmental data collected should be submitted to the designated national data centers within sixty (60) days after the observational period/cruise. For continuing observations, data inventories should be submitted periodically if there is a significant change in location, type or frequency of such observations. Inventory forms (Report of Observations and Samples Collected on Oceanographic Programs, (ROSCOP) and instructions are supplied by the National Oceanic and Atmospheric Administration's (NOAA) National Environmental Satellite Data and Information Service (NESDIS), based on lists of investigators provided to NOAA/NESDIS by funding agencies.

4. Data sets identified for submission to the national data centers must be submitted to the designated center within two (2) years after the observational period. This period may be extended under exceptional circumstances by agreement between the principal investigator and NSF. Data produced by long-term (multi-year) projects are to be submitted annually. Principal investigators working in coordinated programs may (in consultation with their funding agencies) establish more stringent data submission procedures to meet the needs of such programs.

5. NOAA's National Environmental Satellite Data and Information Service staff and program representatives from funding agencies will identify the data sets that are likely to be of high utility and will require their principal investigators to submit these data and related information to the designated center.

6. Funding agencies will apply this policy to their internal ocean data collection and research programs and to their contractors and grantees and will establish procedures to enforce this policy.

7. A list of oceanographic data types and the centers designated to receive them are the following:

7.A. Ocean physical data -temperature, salinity, light transmission or attenuation, currents, waves, pressure, sea level, and sound speed.

Ocean chemistry data -nutrients such as phosphates, nitrates, nitrites and silicates; chemical tracers such as helium, tritium, freon and argon; pollutants such as petroleum hydrocarbons, organochloride and organophosphorus pesticides, polychlorinated biphenyls (PCBs) and heavy metals. Data may represent chemicals in water samples or biota.

Ocean biology data -primary productivity; concentrations of pigments in phytoplankton, such as chlorophyll-a; biomass of phytoplankton, zooplankton, benthos and nekton; and bioluminescence.

National Oceanographic Data Center (NODC)
Data Officer, E/OC
1315 East-West Highway
SSMC3, 4th floor
Silver Spring, Maryland 20910
Phone: (301) 713-3267 x151
Fax: (301) 713-3301

7.B. Surface meteorological data - meteorological data in appropriate World Meteorological Organization formats as part of the Voluntary Observing Ship (VOS) program: air temperature, sea-surface temperature, dew point temperature, pressure, wind speed and direction, wind and swell waves, weather, short- and long-term radiation, visibility, cloud cover and type, and ice accretion.

National Climatic Data Center (NCDC)
Federal Building
151 Patton Avenue
Asheville NC 28801-5001
Phone: (828) 271-4800
Fax: (828) 271-4876

7.C. Geophysical, geological and geochemical data -bathymetry, magnetics, gravity, seismic and other quantitative geophysical data; geological data including station locations, collection/storage locations, preliminary descriptions of seafloor samples recovered, and all descriptions and analytical data, including geochemistry, derived from sediment and rock samples, including data from the Ocean Drilling Program (ODP).

National Geophysical Data Center (NGDC)
NOAA, Code E/GC
325 Broadway
Boulder, CO 80303-3328
Phone: (303) 497-6338
Fax: (303) 497-6513

7.D. Sea ice and other glaciological data - sea ice, icebergs, ice shelves and associated physical oceanographic and meteorological data.

National Snow & Ice Data Center (NSIDC)
CIRES
Campus Box 449
University of Colorado
Boulder, Colorado 80309
Phone: (303) 492-6199
Fax: (303) 492-2468

7.E. Carbon dioxide data - archival data for the World Ocean Circulation Experiment (WOCE) and the Joint Global Ocean Flux Study (JGOFS) CO2 measurements.

Carbon Dioxide Information Analysis Center (CDIAC)
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, Tennessee 37831-6335
Phone: (423) 574-0390

Fax: (423) 574-2232

8. Data are to be submitted according to formats and via the media designated by the pertinent national data center.

9. Principal investigators and ship-operating institutions are also responsible for meeting all legal requirements for submission of data and research results, which are imposed by foreign governments as a condition of that government's granting research clearances. Each principal investigator and institution must determine their legal obligations in this respect, with the assistance of the Department of State and sponsoring Federal agencies, as necessary.

10. Data-submission policies for U.S. WOCE, U.S. Global Ocean Ecosystems Dynamics (GLOBEC), U.S. JGOFS, Tropical Ocean Global Atmosphere Coupled Ocean-Atmosphere Research Experiment (TOGA COARE) and ODP are the following:

NOTE: The addresses provided (as of September 1994) change frequently. Please check with relevant program managers of the Division of Ocean Sciences if necessary.

10.A. U.S. WOCE

All WOCE data shall be made available no later than two (2) years after collection, unless specifically waived by the international WOCE Scientific Steering Group (SSG). However, several WOCE programs require PIs to submit data collected to a Data Assembly Center (DAC) for the purposes of quality control and data synthesis within shorter time periods. Detailed program requirements for data submission may be found in WOCE Report No.104/93, WOCE Data Management, available from:

U.S. WOCE Office
Texas A&M University
Department of Oceanography
Mail Stop 3146
College Station, TX 77843-3146
Phone: 409-845-1443
Fax: 409-845-0888

10.B. U.S. GLOBEC

In addition to the data submission requirements mentioned in this document, the U.S. GLOBEC Scientific Steering Committee (SSC) requires all principal investigators to submit plans for the collection of data to the U.S. GLOBEC Data Management Office (DMO) at least three (3) months prior to execution of a sampling program. Specifics to be included in the data collection plan are detailed in U.S. GLOBEC Data Policy, Report Number 10, February 1994, available from:

U.S. GLOBEC Scientific Steering Committee Coordinating Office
UMCES/ Chesapeake Biological Laboratory
P.O. Box 38/ One Williams Street
Solomons, MD 20688
Phone: (410) 326-7370
Fax: (410) 326-7341

PIs are responsible for documenting measurement and analysis techniques used to produce data sets and estimating accuracy and precision of these measurements. Specific physical measurements must be acquired along with all biological measurements and must meet pre-defined standards (see Report No. 10). In addition, the report specifies requirements for preservation of biological samples, including for the purpose of subsequent genetic analysis.

Data from measurements which do not involve manual analysis and which would be useful to the scientific community must be submitted by the PI to the DMO within six (6) months after collection. All other measurements and any standard analyses of these measurements must be available to the community within one (1) year after collection. PIs will submit data either directly to the DMO or by placing it on-line as a U.S. GLOBEC distributed database. Format standards for submission of data and development of the database will be specified by the DMO. The DMO will serve as an intermediate archival location and data source and will transfer data to the NODC and prepare necessary documentation for data collected in foreign waters.

10.C. U.S. JGOFS

U.S. JGOFS chief scientists are required to submit all data to the Data-Management Office (DMO) within one (1) year after the sampling date. However, data derived from long analytical procedures (e.g. 228Ra) which prevent the researcher from being able to readily analyze/publish can be exempted from this one (1) year requirement. In addition, final versions of Basic Core Measurements (i.e. temperature, salinity, dissolved oxygen) must be received by the DMO within six (6) months after the sampling date. Again, some

exceptions can be made for data requiring extensive analyses. However, all PIs making core measurements are urged to make their data available as quickly as possible. All data that are submitted to the DMO must be accompanied by detailed documentation of analytical procedures, data format, variables and units. Data may be in ASCII, TEXT or LOTUS (WK1 or WKS) formats. CO2 measurements should be submitted to the WOCE World Hydrographic Programme (WHP). More detailed information on the U.S. JGOFS requirements for data submission are available from:

U.S. JGOFS Data Management Officer
GEOSECS Building
MS 43
Woods Hole Oceanographic Institution
Woods Hole, MA 02543-1535
Phone: (508) 289-2497
Fax: (508) 457-2161

10.D. OCEAN DRILLING PROGRAM

The Ocean Drilling Program supports regional geological and geophysical field studies which can be used to develop mature drilling proposals in the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) system. The geological and geophysical data from these projects are a primary source of information in planning drilling and should be available for review by the Site Survey and Pollution Prevention and Safety panels of JOIDES. Site survey data requirements for mature drilling proposals are identified in the JOIDES Journal issue titled, "Guide to the Ocean Drilling Program." Additionally, such data can be important in interpreting the results of a drilling leg and should be available to cruise participants.

Successful applicants are expected to deposit data from their cruises in the Ocean Drilling Program Site Survey Data Bank at Lamont-Doherty Earth Observatory, in addition to other data archiving requirements described in this document (7.C.). The address is the following:

ODP Site Survey Data Bank
Lamont-Doherty Earth Observatory
Palisades, New York 10964
Phone: (914) 365-8343
Fax: (914) 365-3182

At the earliest possible date, the chairperson of the JOIDES Site Survey Panel, the manager of the Data Bank, and the representative of the appropriate national data center should be notified of the data types and schedule for submission.

The Ocean Drilling Program also supports more limited data collection activities through the U.S. Science Support Program administered by the Joint Oceanographic Institutions (JOI). Data reporting requirements under this program are the same as those identified above.

11. Federal agencies which engage in and/or fund data collection will promote quality control of ocean data which they and their contractors and grantees collect. Each national data center will:

upon archival of a submitted data set, send to the principal investigator a copy of the data set as archived; monitor submitted data to assure that they are submitted in accordance with these guidelines and in appropriate formats: and report regularly to principal investigators and Federal agencies on the rates of data submission, archiving and usage.

APPENDIX 3a:

ODP TAMU Data Holdings Table

See File (Excel Table): Appendix.3a.TAMU.data.xls

APPENDIX 3b:

ODP/TAMU Response to Questions Raised:

Nov. 2, 2000
To: Dr. David Becker and Ms. Carla Moore
NGDC, Fax (303) 497-6513
From: Rakesh Mithral, ODP/TAMU

1. DSDP analog data, including navigation, bathymetry, magnetics, seismic reflection, core logs, smear slides, thin sections, physical properties, chemical properties and GRAPE are available on microfilms. DSDP core photographs and seismic data are available on paper.

2. High resolution (1200 dpi) scanning of core photographs from ODP legs 163 to 190 has been completed. The lower resolution (300 dpi) images are produced at the same time and are made available on the web in pdf format (http://www-odp.tamu.edu/database). The original high-resolution images are available from the ODP Data Librarian (database@odpemail.tamu.edu). We are working on scanning the core photographs from legs older than Leg 163.

3. All 3.5 kHz ODP underway data is available on paper AND on microfilms.

4. The survey and re-entry videos in VHS format are individually labeled. A partial index of all the video is available (Legs 101-153). These videos are rarely requested by the scientific community.

5. All paper prime data, including visual core description, paleontology, thin sections and smear slides is available on paper AND microfilms. An index of paper prime ODP data is available from ODP Legs 133-191.

6. The archiving of photo films and data microfilms need special environments. We keep them in an air-conditioned, Halon fire protected room.

7. The microbiology data requirements have not been defined as yet. Tom Davies of ODP/TAMU is planning a Microbiology user group meeting to discuss the lab and data issues. After the user requirements are defined we will incorporate those data in the ODP database.

APPENDIX 3c:

ODP/TAMU Issues Regarding the Archiving of ODP/DSDP Data at NGDC

For what purpose is the digital archive to be built? This requires a definition to steer the efforts of the project team. It was pointed out that the archive should contain only "appropriate" data. This also requires a tight definition. Is the archive to be defined narrowly as the feds (NGDC) want? Or, is the archive to meet some other purpose in the long run? A general goal was offered: prepare an archive that is user friendly, distributable, and useable.

Who will use the archived digital data? Is the archive to be "used" at all or is it to be stored and used only in the event the alternative RDBMS disappears?

What data format should the digital archive support? This depends on #1 & 2. It was voiced that the archived data need to be "standalone" and able to be stored in ASCII format on a CD. Comment from NGDC (George): The existence of a "software dependence" negates the concept of an archive.

What data needs to be stored in the digital archive? This must be determined by the science community.

What meta data requirements are there? We need to capture "corporate memory" meta data to be able to explain what the data really mean.

What non-digital/analog data needs to be kept? Again, the science community must decide this issue.

How do we deal with moratorium and sensitive or proprietary data? A real problem since NGDC has already stated that anything in its archives is public information.

Options regarding the ODP/DSDP archive include the following:

Build a Janus mirror site at NGDC. Then, build a Janus primary data site at NGDC and archive using existing procedures. Comment from NGDC (Carla): There is no reason why we shouldn't be able to have a "live" Oracle Janus database running at NGDC (as in something like a "mirror site") while we are determining what data to archive and how to archive it.

Create an archive of all Janus tables in ASCII format and document the “road map” to reconstruct the relationships between tables. This will allow the reconstruction of a Janus system within any RDBMS or other data system.

Build an ASCII data archive that uses existing Janus queries to create ASCII tables. Break these tables down into “basic” tables as defined by the science community.

Build an ASCII data archive using new Janus queries to build “basic” tables as defined by the science community.

APPENDIX 4:

ODP LOG DATA ARCHIVE
Total holes: 313 (Legs 101-191)

ODP DIGITAL DATA

1. Archive Medium: 4-mm DAT tapes
a. Resistivity-Density-Porosity-Acoustic-GR-Seismic-Magnetic Logs (Legs 101-188)
Total: 1189 tapes
Field data: 354 tapes (DLIS or LIS format)
Customer data: 445 tapes (DLIS or LIS (326), ASCII (85), SEG-Y (28), Binary (6))
Processed data: 390 tapes (LIS or DLIS)

b. FMS Logs (Legs 126-191)
Total: 618 tapes
Field data: 161 tapes (DLIS or LIS format)
Processed data: 457 tapes (BITMAP, GIF, VMS Backup, TAR, Geoframe Backup)

c. MCS (Legs 102,103, 109, 110, 111)
Total: 11 tapes. Original data, BRG format.

d. BHTV (Legs 118, 121, 136)
Total: 11 tapes. Original data, digitized.

2. Archive Medium: CD-ROM
a. Legs 189-191 (All logs). Field and customer data, DLIS and ASCII format.
Total: 4 CD-ROMS

b. Legs 143-186 (Most logs). Processed data. Also included in ODP IR volumes.
Total: 39 CD-ROMS

c. Core-scan data (Legs 173, 176)
Total: 26 CD-ROMS

3. Archive Medium: 9-track tapes

Data loaded**:** FMS (Leg 128). Processed data, VMS backup.
Total: 23 tapes

4. Archive medium: TK50 cartridges
FMS (Leg 134). Processed data, VMS backup.
Total: 22 cartridges

5. Archive Medium: VHS tapes
BHTV (Legs 102-104-11-118-121-124-125-127-135-136)
Total: 27 videotapes

6. Archive medium: Zip disks
Temperature (Legs 123-191). Original and processed data, ASCII format.
Total: 5 Zip disks

ODP ANALOG DATA

(1) Analog well logs (film + paper, Legs 101 to 149)
(2) Analog well logs (paper, Legs 149 to 191)
(3) Microfiche (FMS data: Legs 126-141). Also included in ODP IR volumes.
(4) Processing notes (complete inventory pending)

ODP ONLINE LOG DATABASE
Total holes: 313 (Legs 101-191)

Current size of online database: ~16 GB

Data format: mostly ASCII files

Data currently included:
Conventional (resistivity-GR-density-porosity-acoustic) + documentation
Geochemical data + documentation
GHMT (magnetometer) data + documentation
SWF (ASCII or binary format: selected holes only) + documentation

FMS images (GIF format) + documentation
Temperature data (ASCII format) + documentation

DSDP LOG DATA ARCHIVE
Total holes: 82 (Legs 1-96)

DIGITAL DATA

1. Archive Medium: 4-mm DAT tapes
Schlumberger Logs (Legs 48, 50, 51B, 57, 80-84, 87. 89, 95, 96). Customer data, LIS format.
Total: 41 tapes

NOTE: remaining data is on NGDC CD-ROM. Needs appropriate conversion.

2. Archive Medium: VHS tapes
BHTV (Legs 69, 92)
Total: 11 videotapes

ANALOG DATA

Analog well logs (paper, Legs 1 to 96)

APPENDIX 5:

JOIDES/ODP Site Survey Data Bank

The Data Bank currently tracks 13,000 individual items submitted in support of drilling proposals. The bulk of the data fall into the following categories:

Primary Data Type	Number of Items
MCS profiles	3542
SCS profiles	2520
Navigation maps	1917
Sub-bottom Profiles (mostly 3.5 kHz)	1206
Bathymetry (mostly maps)	563
Reprints	516
Geology maps and cross sections	439
Structural Geology maps	358
Bottom Samples (maps and sample descriptions)	313
Swath Bathymetry	256
Seafloor Imagery (video and stills)	244
Magnetic maps	126
Velocity (mostly tabular data)	106
Gravity maps	99
Refraction (sonobuoy and OBS records)	73
Heatflow (maps and tabular data)	65

Most data are analog records on paper or vellum, or are on rolls of microfilm. Seismic data from the late 70's and early 80's tend to be small format (rarely larger than 11" x 17"). Data from the mid-80's and later tend to be large-format seismic lines reproduced on an ozalid machine, engineering xerox, or large plotter. These lines may be few to dozens of feet in length. Sub-bottom profiles are on paper rolls or on microfilm. The quality of the records varies widely and generally lessens with increasing antiquity.

The Data Bank also has digital shotpoint/cdp (common depth point) navigation files, time navigation, and some amount of SEG-Y seismic data to archive. As we are just beginning to deal with digital seismic data in a systematic way, it is difficult to predict the amount of storage that will be needed by the end of the program. In addition, should the IESX pilot project be followed up by a general use of the IESX software for managing digital

seismic data by ODP, there will be the issue of storing the IESX project files as well as the original SEG-Y records.

Under current policy, the site survey data are considered to be proprietary to the Ocean Drilling Program. This policy would have to be altered if the archived data are to be considered a resource for the wider science community in the post-ODP period.

APPENDIX 6:

NGDC Notes on Data Archival

To create a permanent archive of scientific data from the Ocean Drilling Program we must work within the constraints of the NARA definition of a data archive (see Appendix 7). Why build a digital archive? To preserve the ability of researchers to access scientific data resulting from the program.

Historically, data have been contained within printed publications meeting the official requirements of an archive. This method of archival meets the need for long-term access to the data in the strictest sense, but does not facilitate scientific use of the data given today's digital technology.

It was in order to facilitate researchers' abilities to use new digital applications to analyze data that the first "digital" drilling databases were created during the Deep Sea Drilling Project. "Prime" data types were carefully defined and documented by the relevant JOIDES panels for conversion to and maintenance in digital form; so they were easily extracted at the end of the project for archival in an officially sanctioned form. During the Ocean Drilling Program, technology again took a leap forward and relational database management was applied to digital data produced by the program, greatly expanding the usefulness of the data, especially to shipboard scientists. The new, very functional JANUS database system cost several million dollars to design and populate.

How do researchers obtain data from the new JANUS database? Post-shipboard use of the JANUS database primarily consists of access through a popular web-based interface to the data. This interface has greatly reduced the number of requests received by the ODP data librarian for custom extractions.

What does the JANUS web interface offer? It offers a set of pre-defined scripts that allow users to subset the database by data type and produce data files for download with a choice of delimiters. Simply put, the web interface offers flat ASCII files for the users to upload into their favorite software applications for further analysis and use.

Why not just use the scripts offered by the current JANUS web interface to produce data files for archival? A data archive should stand on its own as a complete and well-documented set of files. What the current web interface lacks is 1) complete documentation (metadata) about the data files for standalone use, and 2) assurance that all relevant parameters are offered to constitute a full data set for each data type. Basically,

the scripts currently offer a best guess as to what a researcher needs for a given data type and assumes that the data librarian is available to answer any questions that may arise or provide custom extractions of necessary auxiliary data and information.

One way to construct a data archive for the ODP is:

1) Create exact definitions of parameters (including necessary documentation and calibration information) for each data type that is considered "prime." Prime meaning a data type that is necessary to constitute a long-term legacy and archive for ODP.
2) Design scripts necessary to enhance the current web-based subsetting and data file creation capabilities to produce standalone, documented data files for each prime data type.

In order to accomplish this, the prime data definitions need to be agreed upon by a scientific panel or body within the JOIDES structure, and the definitions need to be translated technically for application to the appropriate data tables as scripts.

Why should this be done at all?

1) The long-term availability of the JANUS database to create such output on-the-fly is not assured. Just as data from the Deep Sea Drilling Project were not deemed of high enough priority to be fully maintained in the ODP database, so ODP data are not likely to take top priority in the new IODP. Each program is primarily concerned with collecting new, scientifically relevant data and staying abreast of the latest technology in offering the new data to the scientific community.
2) The corporate knowledge necessary to fully document the data will likely be lost at the end of the ODP.
3) Recreation of the JANUS database structure would be prohibitively expensive.
4) Individual scientists using ODP data are not likely to be willing to use a complex data description including over 450 tables and inter-relationships to reconstruct useful data files.

NGDC also views the creation of a complete mirror of the JANUS database at NGDC including access software as a prudent step toward ensuring uninterrupted access to data within the database during the program transition.

Appendix 7: NARA definitions

National Archives and Records Administration
Center for Electronic Records

TRANSFER OF ELECTRONIC RECORDS
(from 36 CFR 1228.270 -- formerly 36 CFR 1228.188)

Transfer media

1. Magnetic tape

Agencies may transfer electronic records to the National Archives on magnetic tape using either open-reel magnetic tape or tape cartridges. Open-reel tape should be on one-half inch 9-track tape reels recorded at 1600 or 6250 bytes per inch and blocked no higher than 32,760 bytes per block. Tape cartridges should be 18-track 3480-class cartridges recorded at 37,871 bpi and blocked at no more than 32,760 bytes per block.

2. Compact-Disk, Read Only Memory (CD-ROM)

CD-ROMs may be used as transfer media for fielded data files or text files if they: conform to the International Standards Organization (ISO) 9660 standard and to the American Standard Code for Information Interchange (ASCII); are not compressed unless NARA has approved the transfer of the compressed form in advance; and are individually addressable. The CD-ROMs may contain software files and temporary records, but permanent records must be in files that contain only permanent records.

Formats

Records shall be in a format that is not dependent on specific hardware or software, written in ASCII or EBCDIC with all extraneous control characters removed (except record length indicators for variable length records, marks delimiting a data element, field, record or file, or Standard Generalized Markup Language tags). Records should not be compressed unless NARA has approved the transfer in the compressed form in advance.

Data files and databases shall be transferred as flat files or as rectangular tables, that is, as two-dimensional arrays, lists or tables. All records in a database or tuples in a relational database should have the same logical format. Each data element within a record should

contain only one data value. A record should not contain nested repeating groups of data items.

Documentation in electronic format shall be transferred as separate files, and the transfer format standards for electronic records apply also to files that contain documentation.

For a complete listing of regulations, See: http://www.nara.gov/nara/cfr/cfr.html
For 36 CFR 1228.270, See: http://www.nara.gov/nara/electronic/transfer.html

ODP Data Transfer / Archive Project

Meeting Agenda - November 2, 2000

I. Opening Remarks

II. Description of Data Holdings and Facility

(a) TAMU Data Overview

(b) LDEO Borehole Data Overview

(c) LDEO Site Survey Data Bank Overview

A. Current volume, condition, and format of data.

B. Data processing underway and anticipated status by end 2003.

1. Data migration into JANUS?

2. Log processing and/or format issues?

3. Site survey databank proprietary issues?

ODP Data Transfer / Archive Project

Meeting Agenda - November 2, 2000 (cont.)

III. Roundtable Discussion - Data Archive Definition

- **(a) TAMU Data**
- **(b) LDEO Borehole Data**
- **(c) LDEO Site Survey Data Bank**

A. Storage and distribution/access requirements.

1. **NSF**
2. **JOI**

B. NGDC archive.

1. **RDBMS**
2. **Flat Files**
3. **Analog Data**

C. Any data not to be archived at NGDC?

ODP Data Transfer / Archive Project

Meeting Agenda - November 2, 2000 (cont.)

IV. Roundtable Discussion - Digital Data Solutions?

A. RDBMS approach (database technology transfer).

1. JANUS mirror site at NGDC?

2. Create primary JANUS database site at NGDC?

B. Flat File approach.

1. Extract data from JANUS database?

2. Create special use files / DVD's?

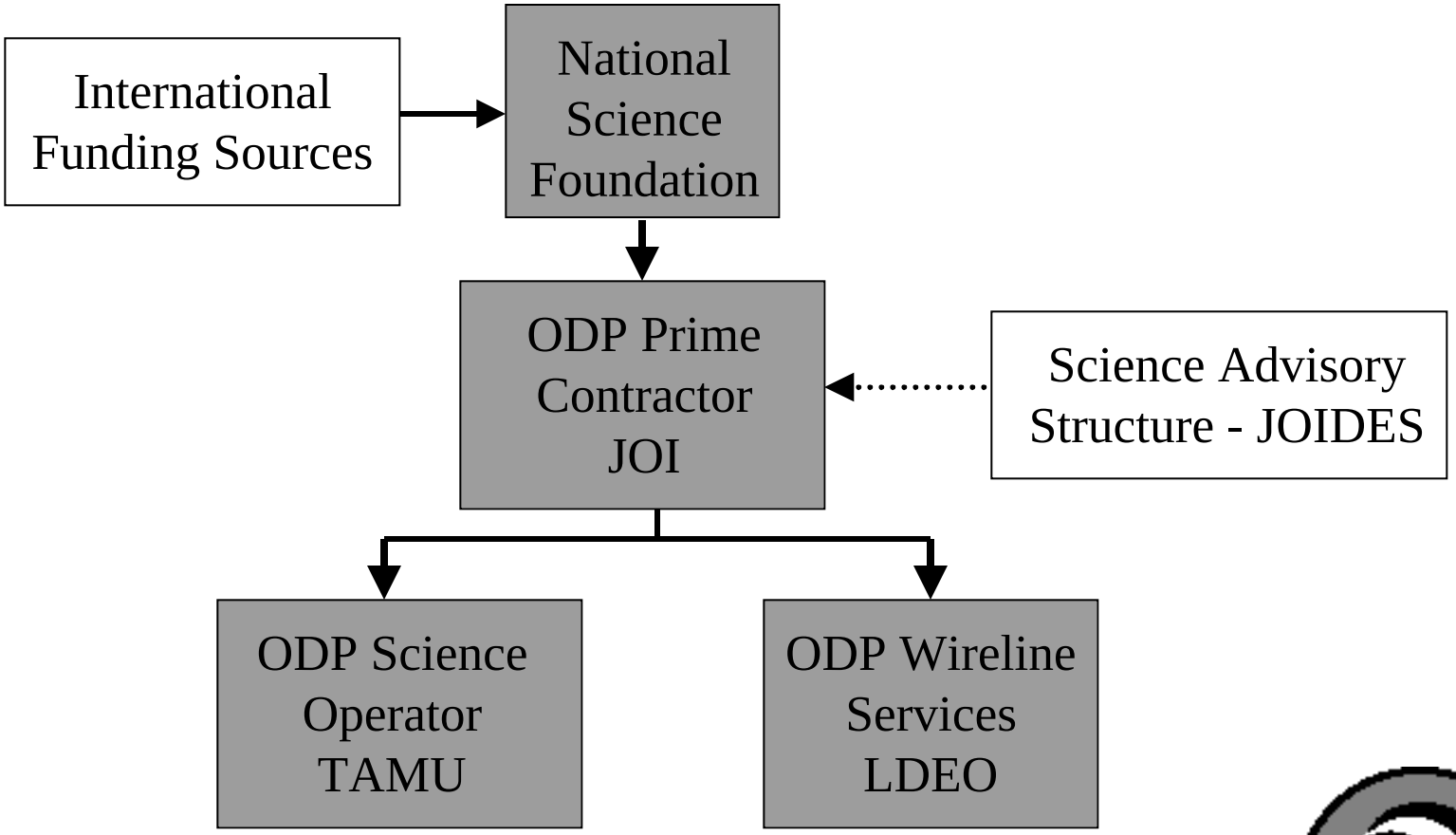
C. Borehole data?

D. Site Survey data?

V. Possible Analog Solutions?

VI. Action Items! Options!!

ODP Management Structure



ODP Data Transfer / Archive Project

JOIDES Executive Committee (EXCOM) Motion 00-2-3

EXCOM Motion 00-2-3: EXCOM accepts the Initial Report on ODP-IODP Transition Planning. This report raises a number of important issues and provides a very useful framework for planning the phase-out of ODP and the establishment of IODP. EXCOM thanks John Orcutt, JOI and its subcontractors, and other members of the JOIDES community who assisted in preparing this document. Given the importance of addressing in a timely manner the many unresolved issues related to the ODP-IODP transition, EXCOM requests the following actions.

For review at the January 2001 EXCOM meeting:

- **JOI will prepare a draft phase-out plan for ODP management and operations,**
- **JOI and the JOIDES Science Advisory Structure will develop options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies.**

For review at the June 2001 EXCOM meeting:

- **SCICOM will develop a draft phase-out plan for the JOIDES Science Advisory Structure,**
- **JOI will develop a plan for producing an ODP final report, including an outline of the contents of the report, defined writing responsibilities, and a timeline for completing it.**

Detrick moved, Orcutt seconded; 14 in favor, 1 absent (Raleigh).

ODP Data Transfer / Archive Project

SCIMP Recommendation 98-2-8:

"SCIMP recommends that NOAA/NGDC work with JOI to investigate the most efficient way to complete the DSDP/ODP data archiving."

January, 1999:

NOAA/NGDC reported that a preliminary agreement had been reached with ODP/TAMU to test JANUS database transfers to NGDC via 4-mm DAT.

ODP Data Transfer / Archive Project

ODP/NGDC Project status as of June 1999:

*** ODP/TAMU successfully exported the database to 4-mm DAT in a form readable by NGDC.**

*** The entire JANUS database is now loaded on an NGDC server.**

*** ODP/TAMU has agreed to send NGDC an update following each leg.**

*** NGDC has sent ODP a supply of 4-mm DAT media for data transfers.**

*** Work is underway at NGDC to design scripts to produce a comprehensive set of ASCII files from the JANUS database for permanent archival at NGDC/World Data Center-A for Marine Geology & Geophysics.**

ODP Data Transfer / Archive Project

Policy for Oceanographic Data, NSF 94-126

Purpose:
This statement updates and revises guidelines to implement Federal data policy by assuring timely submission of high quality oceanographic data to the national data centers for secondary use. Guidelines for oceanographic data were first issued by the National Science Foundation's (NSF) Division of Ocean Sciences (OCE) in October 1988.

Policy:
Ocean data collected under Federal sponsorship and identified as appropriate for submission to a national data center are to be made available within a reasonable time as described in this policy.

ODP Data Transfer / Archive Project

Policy for Oceanographic Data, NSF 94-126 (cont.)

*** The Ocean Drilling Program supports regional geological and geophysical field studies which can be used to develop mature drilling proposals in the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) system. The geological and geophysical data from these projects are a primary source of information in planning drilling and should be available for review by the Site Survey and Pollution Prevention and Safety panels of JOIDES. Site survey data requirements for mature drilling proposals are identified in the JOIDES Journal issue entitled, "Guide to the Ocean Drilling Program." Additionally, such data can be important in interpreting the results of a drilling leg and should be available to cruise participants.**

ODP Data Transfer / Archive Project

Policy for Oceanographic Data, NSF 94-126 (cont.)

*** Successful applicants are expected to deposit data from their cruises in the Ocean Drilling Program Site Survey Data Bank at Lamont-Doherty Earth Observatory, in addition to other data archiving requirements described in this document.**

*** At the earliest possible date, the chairperson of the JOIDES Site Survey Panel, the manager of the Data Bank, and the representative of the appropriate national data center should be notified of the data types and schedule for submission.**

ODP Data Transfer / Archive Project

Policy for Oceanographic Data, NSF 94-126 (cont.)

*** Federal agencies which engage in and/or fund data collection will promote quality control of ocean data which they and their contractors and grantees collect. Each national data center will:**

(a.) upon archival of a submitted data set, send to the principal investigator a copy of the data set as archived;

(b.) monitor submitted data to assure that they are submitted in accordance with these guidelines and in appropriate formats: and report regularly to principal investigators and Federal agencies on the rates of data submission, archiving and usage.

ODP Data Transfer / Archive Project

ODP Information Services Group (ISG)

The ODP Information Services Group (ISG) offers technical support for all developmental phases of computer usage on the ship (D/V JOIDES Resolution), at the Science Operator's headquarters in College Station, and the three other core repositories at Scripps Institution of Oceanography - University of California San Diego, Bremen University (Germany), and Lamont-Doherty Earth Observatory of Columbia University. Based upon input from, and the needs of, scientists and technicians, the Information Services Department specifies, acquires, and installs computer-related equipment and software at all ship and shore facilities.

The Ocean Drilling Program's data collection is archived, processed and edited by IS's Database group, which then distributes the information to the scientific community. The archived data from the Deep Sea Drilling Project and the computerized geological data collected onboard D/V JOIDES Resolution make up the ODP computerized database.

http://www-odp.tamu.edu/isg/

ODP Data Transfer / Archive Project

ODP JANUS Database

ODP has recently completed a major upgrade of the data management system that allows all interested users to conduct their own searches and extract data over the Internet (Janus Web).

The flow of information to the scientific community is maintained by the ODP/TAMU Operations/Network group who provide a major link between shipboard and shore-based computing on a daily basis. This group also plans for the future technology needs of the ODP.

The ODP/TAMU Application Development group designs, develops and maintains custom application programs to be used on ship and shore, when suitable commercial software is unavailable.

http://www-odp.tamu.edu/database/

ODP Data Transfer / Archive Project

ODP JANUS Database

JANUS Web:

Janus Web provides access to ODP's Oracle relational database Janus. The database contains over 300 tables of ODP's marine geoscience data that are collected onboard the drillship JOIDES Resolution. The database includes paleontological, lithostratigraphic, chemical, physical, sedimentological, and geophysical data for ocean sediments and hard rocks.

Janus has been used to collect data since Leg 171A (January 1997). During the first postcruise (moratorium) year, access to proprietary ODP data is only given to scientists who participated on the cruise. Proprietary data are released to the public one year after the end of each cruise. Non-proprietary data such as ODP & DSDP site information are available to everyone. Data collected prior to Leg 171A are being added to Janus as time permits.

For information: JanusWeb@odpemail.tamu.edu

ODP Data Transfer / Archive Project

ODP Database Services

The ODP Database Group archives, processes, and edits the program's data collection and distributes it to the scientific community. Included in the ODP data collection are the following:

All data collected onboard JOIDES Resolution (Legs 100 to present).
Archived data from the Deep Sea Drilling Project (DSDP) (Legs 1-96).
Any data generated from postcruise research.
All ODP and DSDP core photos.

ODP data from Leg 171A onward are available on-line through JANUS Web. The data remain proprietary for a period of one year after the end of a cruise and are available only to the participating scientists. After one year the data are released to the public. A Data Migration project is underway in which previous ODP and DSDP data are being migrated to the JANUS database. As older data get migrated they become available on the web. The data not available on the web can be obtained from the ODP Data Librarian in a variety of formats, including ftp, e-mail attachments, Mac/PC Floppies, CD-ROM disks, and paper printouts.

http://www-odp.tamu.edu/database/

ODP Data Transfer / Archive Project

JANUS Database Legal Disclaimer

This database and the data contained herein are provided to the public for informational purposes. The Texas A&M Research Foundation and the Texas A&M University System make no representation or warranties, express or implied as to the correctness, reliability, accuracy, completeness or usefulness of this database or the data contained herein, or any associated information or documentation, or that use of these data, associated information or documentation may not infringe third party rights. To the maximum extent permitted by applicable law, the parties stated above hereby disclaim, deny and negate any claim or cause of action whatsoever based on, any warranties and representation with respect to this database and the data contained herein, or any associated information, and documentation, including without limitation, any express or implied warranties of MERCHANTABILITY, ABSENCE OF DEFECTS, CONDITION, DURABILITY, DESIGN, CAPACITY, OPERABILITY, COMPLETENESS, TIMELINESS, SUITABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE.

ODP Data Transfer / Archive Project

LDEO-BRG ODP Log Database

The ODP Log Database contains the majority of the log data collected by ODP and in the future will provide access to all ODP log data. It can be accessed and searched through the ODP Logging Services web site. The web site provides convenient methods for downloading large amounts of data, as well as information about the applications of log data to scientific problems. In addition, log data is also distributed on a CD-ROM included in the ODP Initial Reports volume.

While the log database is an important asset to most ODP research, its value is greatly enhanced when the data can be integrated and compared with core data. For this reason, a link is provided from each listing of log data collected in a hole to the corresponding core data. A simple click on the link connects you the appropriate JANUS database page from which any of the core data files for that hole can be downloaded. Links are also provided to the Logging Summaries, Preliminary Reports, and Initial Reports volumes for legs where these items are available on-line.

ODP Data Transfer / Archive Project
LDEO-BRG ODP Log Database

Moratorium Data:

Access to ODP data is restricted to members of the shipboard scientific party for a period of one year following the cruise. Shortly after each cruise, the Data Services Supervisor will inform the scientific party that the data is available on-line and provide each person with a user name and password.

To access the data, simply follow the same instructions as for public data. However, when you click on an individual hole, a dialog box will appear requesting your user name and password. Access is denied to anyone without the proper authorization. Once you have successfully entered your user name and password, you can access data from any hole in that leg. You will not be asked to provide this information again during that session. However, if you return at another time, you will need to reenter the information. One year following the cruise, this restriction is lifted and the general public can access the data.

ODP Data Transfer / Archive Project
ODP Data CD-ROM

ODP Logging Services creates a CD-ROM for distribution with each ODP Initial Reports volume. The CD includes:

Processed conventional logs
Processed FMS images
Processed Dipmeter data
Processed GHMT data
Processed Temperature data
Sonic waveforms

All data are in ASCII format, except the FMS images which are GIF files. If additional specialty tools are run, the resulting data will be put on the CD in most cases. Please note that for many specialty tools (e.g., Borehole Televiewer, VSP) no routine processing is done.

In addition to the log data on the CD, a subset of the core data is also provided to allow users convenient access to complementary data. Upon the request of the Co-Chief Scientists, additional information can be added to the CD provided space is available.

ODP Data Transfer / Archive Project
LDEO-BRG ODP Log Database

All of the data that are not on-line are available free of charge to members of the scientific community. However, any request of data not currently on-line must be accompanied by an explanation of the use of logs in that particular research.

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

http://www.ldeo.columbia.edu/BRG/ODP/LOGGING/index.html
http://www.ldeo.columbia.edu/BRG/ODP/DATABASE/cd_rom.html
http://www.ldeo.columbia.edu/BRG/ODP/DATABASE/DATA/policy.html
http://www.ldeo.columbia.edu/BRG/ODP/DATABASE/DATA/manual.html
http://www.ldeo.columbia.edu/BRG/ODP/DATABASE/DATA/search.html

ODP Data Transfer / Archive Project

LDEO-BRG ODP Log Database

Searching the Database: A variety of search criteria are available to assist you with locating the data you desire. At present, searches can be based on Leg, Hole, Location, Ocean/Sea, and Specialty Tool. In the near future, a keyword search will also be available. Several criteria can be input during a single search and you have the option to use an "OR" search (to show all holes where any of the criteria are met) or an "AND" search (to show all holes where all of the criteria are met). The default is the "OR" search.

Data Catalog: The catalog entries contain a large amount of information. The description column provides the leg, hole, location, and ocean/sea. The data types collected are listed next. Standard tools are listed first, followed by specialty tools. Not all the data are currently available on-line. If the data type you desire is not available on-line, you can order it by contacting Cristina Broglia, the Data Services Supervisor.

When you have determined the holes you wish to download, simply click on the appropriate hole name. This will take you to the Data Files page for that hole.

ODP Data Transfer / Archive Project
LDEO-BRG ODP Log Database

Data Files:

As with the catalog, the Data Files page is organized by data type. At the top of each page is the list of documentation files. The first of these is labeled Standard Processing Notes. This file provides you with an overview of operations for that hole as well as information about the processing and quality control procedures that were carried out. Another file is called File Dictionary. This file provides you with a list of the file names for that hole and a corresponding explanation of the data type contained in each. While it is possible to decipher these files names, especially if you are familiar with the logging tool acronyms, it is much easier to simply download the file dictionary. The Acronym List provides not only a list of tool acronyms, but also a list of data channel acronyms and the corresponding measurement unit.

There are other documentation files that appear only when the FMS or certain specialty tools are run. These files outline the processing procedures used, the naming conventions for the files, or provide general information about the tools themselves.

ODP Data Transfer / Archive Project
LDEO-BRG ODP Log Database

Downloading Data:

There are two ways to download data files. If you only need a few files from a given hole, it is easiest to download each individually. Simply click on the file name. A data file will appear on the screen. Select "File" and "Save As" and the file will be downloaded to whatever folder you indicate. You will need to do this for each individual file.

If you would like all or most of the data from a hole, you should select the Zip method. Simply click on the box beside each data type you would like. The system collects all of the appropriate files, lists the data types and size of the files selected, and approximates the download time for various connection speeds. At this point, you have the option of modifying the selection or proceeding to download the selected files in compressed form. There are several programs that can be used to decompress the files. For a Macintosh, StuffIt is most common, for a PC it is WinZip, and Unix uses unzip (note: gunzip will not work in this case). Once uncompressed, the files can then be easily opened and manipulated in programs such as Excel, KaleidaGraph, or Canvas.

ODP Data Transfer / Archive Project

JOIDES / ODP Site Survey Data Bank

The JOIDES/ODP Site Survey Data Bank is located at Lamont-Doherty Earth Observatory, in Palisades, NY, USA. The Data Bank has served the JOIDES community since 1975 as the repository of site survey data for DSDP and ODP drilling Legs. The Data Bank distributes site survey data to the various JOIDES panels, planning groups, and to individuals involved in scientific ocean drilling.

The Data Bank archives site survey data used to support proposed, scheduled and completed drilling legs. Primarily these data are seismic lines and other geophysical records, as well as maps, charts and navigation color data.

ODP Data Transfer / Archive Project

JOIDES / ODP Site Survey Data Bank

Data Format:

The Data Bank usually receives cruise files in MGD77 format, but we can deal with most any format as long as we also get documentation on the structure of the data files. If the files don't have headers which clearly give the format of the data, please include a README file with these details.

The SSDB are no longer able to accept data on 9 track tapes, but we can read DAT and Exabyte tapes, CD-ROM, and can accept data via anonymous FTP. For information on their anonymous FTP site, please contact the Data Bank Manager, Dan Quoidbach (Email: daniel@ldeo.columbia.edu ; Tel: 845-365-8542).

Data Bank Overview:
http://www.ldeo.columbia.edu/databank/DataBank.html

Data Submission Guidelines:
http://www.ldeo.columbia.edu/databank/Submissions.html

ODP Data Transfer / Archive Project
JOIDES / ODP Site Survey Data Bank

In addition to maintaining the data collection, the Data Bank has the following functions:

1. Assembling data submitted for each drilling proposal into packages that are evaluated by the Site Survey Panel (SSP) and the Pollution Prevention and Safety Panel (PPSP). The Data Bank acts as the operational arm of these panels.

2. For each drilling leg, the SSDB provides Co-Chief Scientists and the Science Operator with identical packages of survey data to use when site selection and operational decisions need to be made during the cruise.

3. Provide data to various JOIDES panels and planning groups to assist them in critiquing proposed drilling programs.

4. Providing site survey data to investigators engaged in planning future drilling legs, or in post-mortem studies of completed legs. Investigators may request data be sent to them, or may schedule a visit to the Data Bank to work with the archive.

ODP Data Transfer / Archive Project

Site Survey Data Bank Proprietary Data Policy

All data submitted by proponents to the Site Survey Data Bank are considered proprietary to the Ocean Drilling Program, unless they are freely available from other data repositories (e.g., NGDC). Data are made available to panels and individuals in the JOIDES community on a need-to-know basis only. Members of the Site Survey Panel and the Pollution Prevention and Safety Panel are given access to any pertinent site survey data deemed necessary to carry out their mandated tasks. In addition, site survey data are provided to the Science Operator and to members of the shipboard scientific party. Requests for data in support of pre-cruise planning or post-cruise studies will be honored; all data requests not considered essential to ODP operations will be denied.

After the drilling leg, these restrictions remain in effect unless explicit permission is given by the proponent to relax them. All post-cruise data requests not originating from a shipboard scientific party member will be honored only after the original proponent has been consulted. These restrictions do not hold for the vast library of freely available "background" digital geophysical data held at the Site Survey Data Bank, and all JOIDES scientists seeking data for ODP purposes are encouraged to continue the practice of requesting data from the Data Bank in support of their drilling or site survey proposals.

ODP Data Transfer / Archive Project
JOIDES / ODP Site Survey Data Bank

Databases Available

Lamont's cleaned MGG database: This is a subset of data available through NGDC that has been screened and edited at LDEO to remove crossover and other errors. This is the primary data set used by the Data Bank to produce track charts, bathymetric maps, and plots of cruise geophysical data.

Lamont's analog geophysical records: Analog single channel records collected by Lamont's research vessels, Vema, Eltanin, Conrad and Maurice Ewing, give proponents a pool of data to use when preparing proposals or when seeking additional supporting data for certain proposed sites.

LDEO heatflow and sonobuoy records: Available at Lamont are more than 20,000 heat flow records which are being standardized and compiled, as well as 5,000 sonobuoy solutions from Lamont research cruises.

Survey data packages for previous DSDP and ODP Legs: The Data Bank archives site survey data submitted for drilling proposals from 1975 to the present. Data from previous proposals often overlap nearby, newly proposed sites and can be used to fulfill site survey requirements of these new sites. In addition, microfilm copies of underway data collected from DSDP and ODP Legs are available for use.

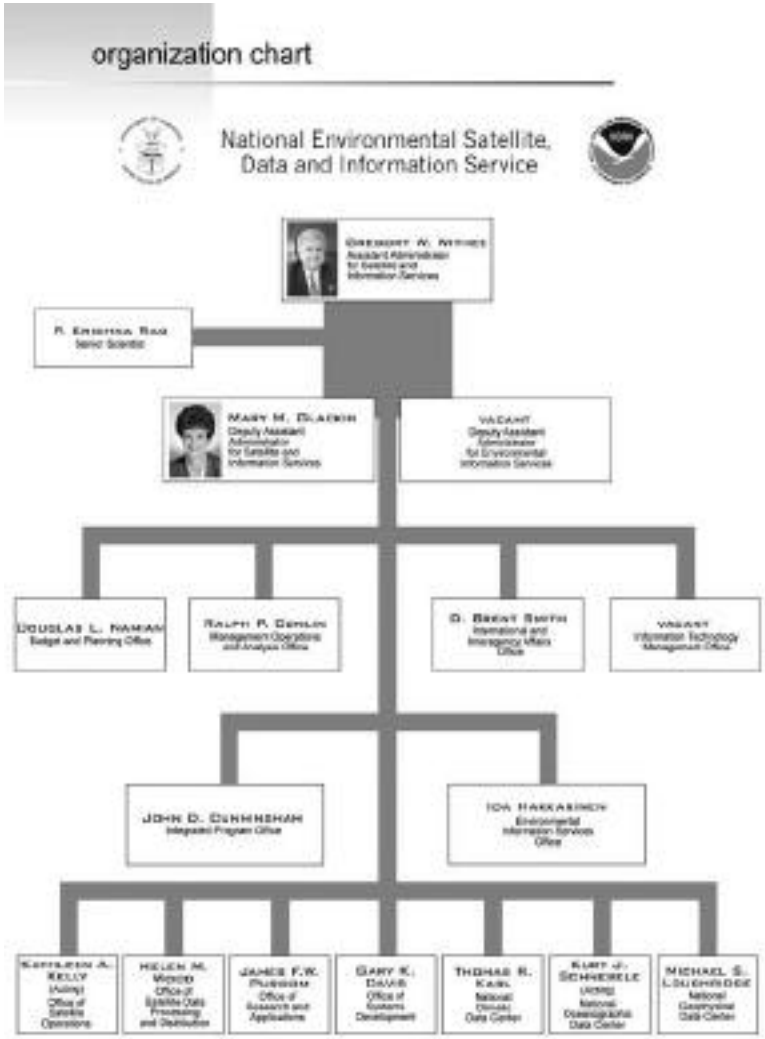
ODP Data Transfer / Archive Project

World Data Center (WDC) for Marine Geology & Geophysics

The World Data Center (WDC) for Marine Geology & Geophysics, Boulder promotes excellence in archiving, managing, and exchanging data obtained from measurements of the seafloor. WDC MGG, Boulder works with national and international groups to facilitate the collection and exchange of MGG data, including cooperation with the International Ocean Drilling Program (ODP), for which it operates a parallel data archive.

The World Data Center for Marine Geology & Geophysics, Boulder is collocated with the National Geophysical Data Center (NGDC) in Boulder, Colorado, USA. NGDC is part of the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). WDC MGG, Boulder exchanges data internationally and is active in many international projects.

NESDIS Organizational Chart
National Geophysical Data Center (NGDC)



NGDC

ODP Data Transfer / Archive Project

National Geophysical Data Center (NGDC), and the World Data Center (WDC) for Marine Geology & Geophysics

The National Geophysical Data Center (NGDC) and co-located World Data Center for Marine Geology & Geophysics, Boulder operates a parallel archive for ODP and DSDP data, offering the full suite of DSDP prime data (sediment and rock) on CD-ROM, and data from Legs 101-129 of the ODP on a separate two-disc CD-ROM set. Data from the DSDP CD-ROM and ODP CD-ROM set are offered on-line for searching, sub-setting, and free download.

The original DSDP version 1.0 CD-ROM set and the ODP CD-ROM data set were produced by NGDC in cooperation with, and with support from the JOI/US Science Support Program. In 2000, the supply of DSDP version 1.0 CD-ROM sets was exhausted; therefore, a new "Core Data from the DSDP" CD-ROM was released by NGDC to replace access to core data originally on the version 1.0 set.

ODP Data Transfer / Archive Project

National Geophysical Data Center (NGDC)

NGDC acts as an archive and distribution point for marine geological and geophysical data collected with NSF funds. This role is outlined in NSF document 94-126: Policy for Oceanographic Data.

NGDC is very flexible in accepting a wide variety of data types in marine geology and geophysics. NGDC is the official repository for MGG data collected with National Science Foundation funding.

NGDC accepts well documented data in almost any format, although they have preferred formats for some data types. They suggest that you contact them to work out the details before sending data.

ODP Data Transfer / Archive Project

National Geophysical Data Center (NGDC)

NGDC requires that all data contributions be well documented so that proper credit can be given to all authors, institutions, and funding sources associated with the research that generated the data.

NGDC asks that data be geographically located as accurately as possible, with latitude/longitude values for point/station data and begin/end latitude/longitudes for trackline data, dredges, etc.

Documentation should also include a description of the collecting instruments, any processing that the raw data has undergone, and analytical methods used in producing derived descriptions or measurements.

ODP Data Transfer / Archive Project

National Geophysical Data Center (NGDC)

Data sent to NGDC are in the public domain and will be distributed without restriction at basically the cost of reproduction, processing, and handling. Please do not send data that are still under proprietary hold.

By sending data to NGDC, you are giving your consent to public dissemination of these data.

Selected NGDC webpages:

http://www.ngdc.noaa.gov/ngdc.html
http://www.ngdc.noaa.gov/mgg/mggd.html
http://www.ngdc.noaa.gov/mgg/geology/drill.html
http://www.ngdc.noaa.gov/mgg/fliers/00mgg03.html
http://www.ngdc.noaa.gov/mgg/fliers/95mgg03.html

National Geophysical Data Center (NGDC)
WDC-A MGG: Contact Information

World Data Center for Marine Geology & Geophysics, Boulder
Division Chief: Dr. George Sharman
Phone: 303-497-extension

Marine Geology & Geophysics People

Name/more info	Email	Ext.	Specialty
Andersen, Gwen	Gwen.A.Andersen@noaa.gov	6586	Data services & requests
Divins, David	David.Divins@noaa.gov	6505	Sed thick/logs/Great Lakes
Moore, Carla	Carla.J.Moore@noaa.gov	6339	Geology systems, MGG Web
Sharman, George	George.F.Sharman@noaa.gov	6345	Chief, MGG Division
Warnken, Robin	Robin.R.Warnken@noaa.gov	6338	MGG Data Manager
Williams, Donna	Donna.L.Williams@noaa.gov	6144	Data services

Digital Data Types		Format	Description	Current / Projected Size
1	JANUS Database	Oracle tables	Oracle Database	10 gb / 20 gb
2	Scientific Data	Mostly ASCII	Raw scientific datafiles collected onboard the JOIDES Resolution (except # 3 and #4); contributed data from scientists' published papers	9 gb / 12 gb
3	Paleontology	Mostly ASCII	Paleontology data hand-entered from Scientific Reports	0.3 gb
4	Visual Core Description	ASCII, VCD, MacDraw, Applecore	Sedimentary and hard rock visual core descriptions, barrel sheets, Applecore, scanned VCDs	3 gb / 4 gb
5	Core Photographs	tiff format	Digitized photographs - 1200 dpi resolution (Legs 161-187 also available through the JANUS database in PDF format at 300 dpi resolution)	510 gb / 2500 gb
6	Seismic Reflection Profile	SEG-Y format	Seismic reflection survey data	150 / 200 4mm and 8mm tapes (9-tracks copied onto 4 or 8 mm)
7	Underway	mgd77 format	Navigation, bathymetry and magnetics	100 / 120 4mm and 8mm tapes
Analog Data Types		**Format**	**Description**	**Current/Projected Size**
8	Photographic Film	4"x5" film positives, 35mm slides, prints	1 B&W and 1 Color 4"x5" positives for each core (DSDP and ODP); 4"x5" closeups; PR and Historical Documentation 35mm slides	102,000 / 115,000 core photos; 60,000 / 70,000 closeups; 100 / 120 3" binders of slides
9	Microfilm	Microfilm rolls	Prime Data, Seismic profiles, Underway profiles	550 / 600 rolls
10	Underway Paper	Paper rolls	3.5kHz Profiler records	900 / 1100 rolls
11	Paper Prime Data	Paper (letter and legal sizes)	Handwritten barrel sheets, paleontology sheets, and logsheets	900 / 1000 reams
12	Video	VHS tapes	Mostly reentry videos	35 feet of shelf space

SCIMP APPENDIX

00-3-17

ODP Data Transfer / Archive Project

JOIDES Executive Committee (EXCOM) Motion 00-2-3

EXCOM Motion 00-2-3: EXCOM accepts the Initial Report on ODP-IODP Transition Planning. This report raises a number of important issues and provides a very useful framework for planning the phase-out of ODP and the establishment of IODP. EXCOM thanks John Orcutt, JOI and its subcontractors, and other members of the JOIDES community who assisted in preparing this document. Given the importance of addressing in a timely manner the many unresolved issues related to the ODP-IODP transition, EXCOM requests the following actions.

For review at the January 2001 EXCOM meeting:

- **JOI will prepare a draft phase-out plan for ODP management and operations,**
- **JOI and the JOIDES Science Advisory Structure will develop options for the long-term maintenance of the ODP database, JANUS database, core repositories, and other ODP legacies.**

For review at the June 2001 EXCOM meeting:

- **SCICOM will develop a draft phase-out plan for the JOIDES Science Advisory Structure,**
- **JOI will develop a plan for producing an ODP final report, including an outline of the contents of the report, defined writing responsibilities, and a timeline for completing it.**

Detrick moved, Orcutt seconded; 14 in favor, 1 absent (Raleigh).

SCIMP APPENDIX

00-3-18

SCIMP MEMBERS

Member	Affiliation	Lab Working Group	First Meeting	Last Meeting
Jamie Allan	USA	Core Description, Publications	Jan-01	Jun-03
Bücker, Christian	Germany	Physical Properties; Downhole Tools	Jan-00	Jan-02
Célérier, Bernard	France	Downhole Tools; Shipboard Computers	Jan-99	Jun-01
Mike Fuller	USA	Paleomagnetics	Jan-01	Jun-03
Janecek, Thomas R. (Ch)	**USA**	**Publications; Core Description**	**Jun-97**	**Jan-01**
Eiichi Kikawa	Japan	Paleomagnetics	Jun-00	Jan-03
Kim, Dae Choul	PacRim	Physical Properties	Jan-00	Jun-02
Lovell, Mike	UK	Downhole Tools; Physical Properties	Jan-00	Jun-02
MacLeod, Kenneth G.	USA	Micropaleontology/MRC, Curation	Jan-00	Jun-02
Phil Meyers	USA	Chemistry	Jan-01	Jun-03
Michael, Peter	USA	Core Description, Curation	Jan-00	Jun-02
Ortiz, Joe	USA	JANUS/Data Migration	Jan-99	Jun-01
Carlos Pirmez	USA	Seismic-Log-Core Integration	Jan-01	Jun-03
Planke, Sverre	**ECOD**	**Underway geophysics**	**Jun-98**	**Jan-01**
Smith, David C.	USA	Mircrobiology	Jun-00	Jan-03
Wheat, Geoff	USA	Chemistry	Jan-99	Jun-01

Liaisons
OPCOM - T. Janecek
TEDCOM - T. Janecek

BOLD indicates rotation off panel