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A SCAR SEISMIC DATA LIBRARY SYSTEM FOR COOPERATIVE RESEARCH: SUMMARY REPORT OF THE INTERNATIONAL WORKSHOP ON ANTARCTIC SEISMIC DATA

Oslo, Norway
11-15 April 1991

Conveners

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and the
ANTOSTRAT Steering Committee[1]

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SUMMARY

In April 1991, principal geoscientists from research groups in 11 countries that have collected nearly all offshore Antarctic multichannel seismic-reflection (MCS) data met at a workshop in Oslo, Norway to discuss issues and procedures regarding the release and dissemination of these data. MCS data are the principal tool for mapping and determining the detailed-structure and evolution of the Earth's crust. These data are costly to collect, process, and analyze. Because MCS data are greatly desired by earth scientists for research purposes, special procedures are needed for the equitable release and dissemination of MCS data under the requirements of Article III (1)(c) of the Antarctic Treaty.

Many long-standing and difficult geopolitical and scientific concerns regarding MCS data release were debated at the Oslo workshop, leading to a consensus decision (Appendix I) to recommend implementation of an Antarctic seismic data library system (SDLS) for cooperative research under the auspices of SCAR (ANTOSTRAT project). In June 1991, the SCAR Executive Committee formally accepted the SDLS as a SCAR initiative, as recommended.

In concept, the SDLS is an intermediate step between data collectors and World Data Centers. In practice, the SDLS will foster research objectives by having branch libraries located around the world at research institutions that have collected and contributed Antarctic MCS data. The SDLS will not alter existing national or World Data Center policies. Each library branch will have copies of all Antarctic digital MCS data that are in the SDLS. All MCS data, existing and future, will be sent to the SDLS within four years of collection. Eight years after collection, MCS data will go to World Data Centers or other archives for general dissemination. While in the SDLS, MCS data can be openly viewed by researchers, although some restrictions will apply to the use of the data (eg the collector's data can be copied only with their consent; data can only be used by researchers for cooperative studies with the data collector and data cannot be used for commerce) to protect the collector's intellectual property rights and to promote basic science.

Implementation of the library system will begin by late 1991. CD-ROM technology now used by the US Geological Survey will be used for dissemination of digital MCS data to SDLS branches. Costs for the SDLS will be paid by the data collectors and the library users. The SDLS will be overseen by the SCAR-ANTOSTRAT Steering Committee and an SDLS Coordinator. Management of individual library branches and adherence to SDLS guidelines will be the responsibility of a librarian and a senior Antarctic scientist at the host organization.

Antarctica is "a continent for science". The seismic data library system that was designed by consensus at the Oslo workshop is a new data-release concept that will take advantage of recent technological developments and should promote cooperative science in Antarctica. In the future, other geophysical data sets may be incorporated into the SDLS to enhance this cooperation.

INTRODUCTION

On April 11-15, 1991, a special workshop was convened by the Antarctic Offshore Acoustic Stratigraphy project (ANTOSTRAT)[1] in Oslo, Norway to design a viable system for open access to Antarctic offshore multichannel seismic-reflection data (MCS). Principal investigators from research organizations, in 11 countries, that have collected nearly all of the 136,000 km of offshore MCS data attended and participated actively (Table 1). Before the workshop, participants were asked to deliberate within their country and prepare responses to a list of topics and concerns that would be raised at the workshop. At the workshop, a consensus was reached and a statement was written (see Appendix I) to implement an Antarctic seismic data library system for cooperative research under the auspices of SCAR (ANTOSTRAT project).

This report provides a brief background for the workshop, summarizes some of the important workshop discussions, and outlines the structure of the seismic data library system (SDLS).

BACKGROUND

Since implementation of the Antarctic Treaty in 1961, Antarctica has been designated as "a continent for science". Earth scientists working there have made major contributions to our understanding of the processes that formed Antarctica and its massive ice sheets. These processes have global significance to studies of plate tectonics and global sea levels and climates. Much of our detailed understanding about the earth's crust under Antarctica comes from the analysis of seismic data, especially multichannel seismic-reflection data (MCS), which gives detailed information about the structure and evolution of rock strata beneath the earth's surface.

Since 1978 nearly 136,000 km of MCS data have been collected in offshore areas of the Antarctic continental margin by research groups in 11 countries (Table 2). These data have been used in past research projects to:

1. determine the geologic histories of Antarctica and adjacent ocean basins, and
2. understand possible hydrocarbon occurrences in Antarctica.

This dual usage of MCS data has led some observers to claim that MCS data are being withheld for use in mineral prospecting. To avoid this perception, earth-science data need to be made openly available, yet with appropriate restrictions that would protect the intellectual property rights of scientists to analyze and publish their data.

The need for MCS data release for research purposes has been clearly recognized from two other positions within the Antarctic scientific community. The SCAR Working Group on Solid Earth Geophysics has long dealt with the issue of MCS data release for scientific studies. Formal SCAR resolutions (e.g. SEG 1988-4, SEG 1990-4) have been approved, but have not been successful, mostly for technical reasons, in assuring open access to MCS data for cooperative research. Secondly, the two Groups of Specialists within the earth science community have established major cooperative international projects (e.g. ANTOSTRAT and ANTALITH) that require access to, and use of, existing MCS data for operational-planning and data-analysis purposes.

Within this framework, the principal scientists who have collected nearly all Antarctic MCS data were asked to consult with their national agencies and to assemble in Oslo to work as a

[1] ANTOSTRAT, an international project to study Antarctic glacial history and its effects on global climate and sea levels, was initiated in 1989 under the auspices of the Scientific Committee on Antarctic Research (SCAR) Group of Specialists on Evolution of Cenozoic Paleoenvironments of the Southern High Latitudes.

community in designing viable solutions to the long-standing concerns surrounding open access to MCS data for research purposes. The consensus decision to implement an Antarctic seismic data library system, which was reached after several days of intense discussions by all participants, was a major breakthrough for cooperative geoscience research within SCAR.

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Table 1. List of Workshop Participants

WORKSHOP DISCUSSIONS

Workshop presentations and discussions were structured to provide background information for all participants, to identify important concerns relating to MCS data release, to propose options for viable long-term solutions to the concerns, and to reach consensus on a specific solution for MCS data release.

In the following section, the principal concerns and options are briefly summarized. The order of presentation is arbitrary and does not indicate any priority.

General Concerns

Two general concerns were raised:

1. MCS data collectors have been criticized about access to their MCS data, yet they have acted in accord with Article III of the Antarctic Treaty.

Most data collectors felt that MCS data, and other geophysical data, had been made available as required by the Antarctic Treaty through publication in research papers and in data exchanges with other Antarctic research scientists. In fact, few requests have been made for copies of Antarctic data since they were first collected in 1978. All but two requests have been honored. In one of those two requests access to the data was encouraged but copies were not allowed. Joint research projects using MCS data have been encouraged and not denied. Open access to all Antarctic MCS data at one location(s) has never before been possible; all participants agreed that this would be beneficial for cooperative research and for the long term goal of advancing the scientific understanding of the Antarctic continent.

2. Many observers incorrectly perceive geoscience research as being done primarily for exploitation of Antarctica's mineral resources.

Because some active Antarctic geoscience research groups are affiliated with government-sponsored oil companies, many observers associate earth science research with mineral prospecting and exploitation. Such a perception can unjustly threaten the future of Antarctic seismic (and other geoscience) research. In some countries funding for MCS investigations is

Country	MCS data (km)	Principal Data Collector
Australia	4,800	Bureau of Mineral Resources
Brazil	5,600	Brazilian Antarctic Program (PETROBRAS)
France	5,000	Institut Francais du Petrol
Germany	22,400	Bundesanstalt fur Geowissenschaften und Rohstoffe (BGR)
Germany	7,000	Alfred-Wegener-Institut
Italy	15,000	Osservatorio Geofisico Sperimentale
Japan	27,000	Japan National Oil Corporation
Norway	4,500	University of Bergen
People's Republic of China	3,000 [1]	Ministry of Geology and Mineral Resources
Poland	1,100	Instytut Geofizki Pan
Soviet Union	23,500	Ministry of Geology
United Kingdom	6,000	British Antarctic Survey
United States	4,000	US Geological Survey
United States	7,000	US National Science Foundation (University of Texas at Austin and Lamont Doherty Geological Observatory)
TOTAL	135,900 km	

High-fold data (24 channels or more)	69,000
Medium-fold data (about 12 channels)	29,500
Low-fold data (6 channels or less)	37,400
TOTAL	135,900 km

[1] These data were collected during the 1990-91 austral season. The ANTOSTRAT Steering Committee was unaware of their existence until July 1991 when information was provided by Dr Yao Bochu of the Ministry of Geology and Mineral Resources.

Table 2. Approximate quantities of existing MCS data

handled either directly through, or cooperatively with, corporations that have the necessary facilities to conduct the research. Access to, and use of, MCS data should determine the true intent of the MCS investigations rather than the perceived corporate affiliation of the data collector. Generally, data that are proprietary and are used only for internal reports are characteristic of commercial activities, whereas data that are openly accessible to researchers and are used for scientific publications are typical of research studies.

Concerns About Seismic Data Release

Several specific concerns were raised about Antarctic seismic research studies and the release and dissemination of seismic data, especially MCS data:

1. It should not be expected that MCS data would be openly distributed for unrestricted use, as envisaged in the Antarctic Treaty, until data collectors and other Antarctic scientists have had adequate time to complete and publish individual and cooperative research projects.

Open distribution and unrestricted use of MCS data implies that these data may be used for any purpose, including commerce. As Antarctica is "a continent for science" and is regulated by the Antarctic Treaty, special preference should be given to promoting research. Participants suggested that during the first 8 years from the time of data collection, some restrictions should be placed on the use of seismic data, especially MCS, to promote cooperative research and to avoid commercial use. Such restrictions would further help change the incorrect perception that Antarctic data are being used for prospecting aimed at future exploitation of Antarctic minerals.

2. Seismic data collection groups should be given priority in conducting research using their data, especially when many scientists wish to do the same research.

In view of the great expense and effort involved in MCS studies and the great usefulness of MCS data in understanding the structure of the earth, some research priority, for a limited period, should be allowed those who have funded the MCS studies. Such priority would encourage faster data release to the scientific community and would promote greater cooperative seismic research studies. During an initial period, the data collector would have priority use of the data for an established and active research project, especially if another scientist(s) wished to do the same project with the same data. Such a priority period would extend from 4 to 8 years from the time of data collection.

3. For future seismic studies, adequate time should be allowed for the data collection group to process, analyze, and interpret the group's own MCS data, especially in view of the immense costs involved with such studies.

Usually, several years are required to complete the final processing of all seismic data from a single MCS cruise. Even so, some lines are never processed due to a lack of money or work-priority. Interpretation and publication of the data can take one to two years following processing. The minimum time for the entire process of data collection, processing, analysis, and publication is 2 to 3 years if a dedicated staff works on the data. The process can take several more years if many projects are being done simultaneously. Four years, a reasonable average, was accepted as the period of time after data collection during which data collectors should have exclusive intellectual property rights to their Antarctic data.

4. For past seismic studies, adequate time should be allowed to complete ongoing studies and to prepare (edit and reformat) the processed data for use in the seismic data library system, World Data Centers, or other data-access system.

Seismic data sets that are currently being processed or have finished being processed and analyzed will all require additional time before they are ready for release from the data collector's archives. Generally, data sets that are older than 8 years from the time of data

collection (i.e. data collected in 1982/83) have been processed and analyzed, and first results using them have been published. These data require editing and clean-up but could be generally distributed. Data sets that are between 4 and 8 years old (i.e. data collected between 1982/83 and 1986/87) have mostly been processed, but not all have been completely analyzed and published. These data sets could be available for limited cooperative research. Data sets that are less than 4 years old (i.e. data collected since 1986/87) are generally still in data processing and analysis stages. These data should be proprietary to the data collector.

5. Although a new system for access to and dissemination of Antarctic seismic data is needed and would promote cooperative seismic research, the system should not have excessive operational costs and management requirements.

From workshop discussions, the present system for release and dissemination of Antarctic seismic data is considered inadequate for (a) efficiently and cost-effectively helping investigators, located worldwide, to participate in major cooperative projects, and (b) dispelling geopolitical perceptions that Antarctic data are being kept secret and being used for mineral exploitation. Major cooperative projects (e.g. ANTOSTRAT and ANTALITH under the auspices of SCAR) require access to all MCS and other seismic data in many regions around Antarctica to coordinate and facilitate the research. A new data system must have low operational costs and managment requirements, and must compliment existing local, regional, and world-wide data management systems.

Also, a new system must

(a) be implemented quickly,
(b) be based on modern technology available to all countries,
(c) be easily accessible to all Antarctic researchers,
(d) be operated and overseen by those within the geoscience community (i.e. SCAR),
(e) be paid for by all seismic-data contributors and users of the system (not by SCAR), and
(f) be coordinated with the World Data Centers.

ANTARCTIC SEISMIC DATA LIBRARY SYSTEM

After several days of intense discussions at the Oslo workshop, the data collectors present, representing 11 countries, reached consensus that a seismic data library system (SDLS) for Antarctic data should be implemented under the auspices of SCAR (ANTOSTRAT project). The discussions focused on identifying all possible options that would satisfy the concerns of the individual scientists and of national programs. These options were considered and the most viable ones were used in designing the SDLS. All principal concerns were addressed, but some less important details could not be resolved fully due to time constraints. The unresolved details will be handled by the SCAR-ANTOSTRAT Steering Committee in consultation with the data collectors.

The SDLS described below was recommended to the SCAR Executive Committee, and was formally endorsed by them as a SCAR iniative in early June 1991.

As structured, the SDLS will be a new and separate entity that will not alter or supercede

(a) existing national data policies,
(b) data ownership (i.e. by data collectors) and its implied rights, or
(c) World Data Center policies and procedures.

The SDLS will take advantage of new CD-ROM technology to disseminate data and make such a world-wide system feasible and practicable. The SDLS will be reviewed thoroughly in October 1993, approximately two years after initial implementation, to re-evaluate the usefulness and effectiveness of the new system.

General Structure

The seismic data library system (SDLS) is a new concept for the release and dissemination of Antarctic seismic data in support of cooperative research. The concept, which is illustrated in Table 3, emphasizes open access to data by researchers but with some restrictions to ensure that data be used only for research during a specific period. The SDLS will be an intermediate step between the data collector's archives (where data are proprietary) and the World Data Centers (where data have unrestricted distribution).

Once fully implemented, the SDLS will have library branches located worldwide at research institutions that have collected Antarctic MCS data, that have given these data to the SDLS, and that wish to host a library branch. Every library branch will have copies of all MCS data that have been given to the SDLS based on the time-guidelines outlined below. Seismic data will be available in digital format on CD-ROMs (Compact Disc - Read Only Memory) at all branches and on paper rolls at branches with adequate facilities. Library branches will be open to all researchers who wished to view or study the seismic data, but restrictions will apply for a specific period regarding the use and copying of the data as outlined below. In the future, other types of geophysical data may be added to the SDLS.

Time Guidelines

The following will apply to newly collected and existing data:

1. For a period of up to 4 years after data collection, the data will remain in the data collector's archives. This period will allow time for processing, interpretation, and first publication by the data collectors and their chosen colleagues, if any.

2. To the greatest extent feasible and practicable, data will go into the SDLS 4 years after data collection (or earlier, if possible). Data will remain in the SDLS for 4 years, or until 8 years from the time of data collection, before being sent to the World Data Centers or other data bank for general release. While in the SDLS, data will be subject to the data-use guidelines listed below.

3. Existing data will be subject to the same time-guidelines as future data sets. In practice, some time will be needed to edit and format data for the CD-ROMs, which will be used to send data to the SDLS branch libraries and World Data Center (or alternative).

Data-use Guidelines

The following guidelines will apply to the use of MCS data. These guidelines are recommended to protect the intellectual property rights of Antarctic data collectors and to promote cooperative research projects.

1. Data collectors will have exclusive rights to the use of their data until the data are sent to the SDLS within 4 years from the time of data collection.

2. Data that are in the SDLS (i.e. during the period of up to 8 years following data collection) will be subject to the following restrictions:
   a. The data can only be used for research, and not for commerce.
   b. Copies of the collector's data can only be made and removed from the SDLS branches with the consent of the data collector. Branches will not generally be equipped to make large volumes of data copies or large-size copies on-site. Large requests for data copies must be directed to the data collector.

c. Data can be used only in cooperative research studies with the data collector, and the data collector must be offered authorship on research papers based on his or her data.
d. The data collector must be given a copy of all research products based on his or her data, including copies of reprocessed data.
e. The source of data must be properly cited in all reports.
f. Data at each SDLS branch will be overseen by a librarian and a senior Antarctic research scientist residing at that branch.

PRIOR CONCEPT

DATA OWNER — *WORLD DATA CENTER*

Data collected, processed interpreted and published —?? years→ Data copied and given to anyone at the cost of reproduction

⇕

COOPERATIVE PROJECTS

Data exchanged and published

NEW CONCEPT (SDLS)

DATA OWNER — *SCAR-ANTOSTRAT SDLS* — *WORLD DATA CENTER (or equivalent)*

Owner collects processes, analyzes and publishes data —A*→ Researchers have open access to data[1], but data are used only for cooperative research projects[2] —B*→ Data copies given to anyone at cost of reproduction

⇕ ⇕

COOPERATIVE PROJECTS

Data exchanged and jointly published

A* Data go to the Seismic Data Library System (SDLS) within 4 years of collection.
B* Data go to the World Data Center or equivalent 8 years after collection.
1 The new CD-ROM technology makes physical access to digital MCS data feasible and practicable on a world-wide library-branch basis.
2 Copies of a collector's data can only be made at, and removed from, SDLS branches with the consent of the data collector, until data are sent to the World Data Center (or equivalent).

Table 3: Prior and New Concepts for Data Dissemination

The above guidelines give the data collectors some "rights" to control the use of their data. These "rights" come with the implicit understanding that access to MCS data for cooperative research projects proposed by other scientists will only be denied when the proposed research directly conflicts with active research projects currently being conducted by the data collector. Such "rights" and restrictions on use of data in the SDLS will encourage timely contributions of data to the SDLS and will promote greater involvement in cooperative Antarctic seismic studies.

Facilities and Costs

The SDLS will initially have limited facilities and relatively low costs. The costs for the SDLS will be shared between the data collectors and the SDLS users, and will not be paid for by SCAR.

Facilities

Library branches will be located at MCS data collectors' research facilities worldwide, at the prerogative of the data collector. The minimum facilities and personnel for a library branch consist of a secure space overseen by a librarian (and a senior Antarctic scientist), a computer system, and a set of CD-ROMs (about 50) containing all digital Antarctic MCS data in the SDLS. At present, the required computer system is an IBM "386" personal computer or equivalent with a CD-ROM reader, a VGA color graphics monitor, and a compatible graphics printer/plotter. An intermediate-sized library branch may have paper navigation plots and some regional MCS seismic profiles. A large library branch will also have paper rolls for all Antarctic MCS seismic profiles in the SDLS.

Other facilities may exist at library branches to enhance the research capabilities. These include different storage media for the MCS data (e.g. tapes, film, etc.) and additional computer facilities for data processing and analysis. The size and complexity of the library branch is optional and depends upon the interests and resources of the host organization. Library branches are not intended to be distribution points for off-site data-copy requests or for large, onsite data-copy requests. Such requests must be directed to the data collector or to a World Data Center, as appropriate according to the above time guidelines.

Costs

Costs for the SDLS fall into two general categories, system costs and branch costs, and will vary depending upon the size and complexity of the library branches. System costs are needed to operate the entire SDLS system and include those for (a) production of CD-ROMs and their distribution to library branches, (b) upgrades to CD-ROM software, as needed and (c) SDLS management (oversight, newsletter, communications, etc.). Branch costs are needed to operate the individual branches and include costs for (a) on-site facilities, (b) reproduction costs to obtain any desired paper records for the branch, and (c) other (e.g. hosting research meetings at the branch, reproduction costs for user-requested data copies, travel to branch libraries, etc.)

Costs will be shared by the data collectors and the SDLS users as outlined in Table 4. In general, most system costs will be paid by data collectors, as these services are also likely to be of direct benefit to the data collectors for internal archiving of their data. Library users will share in the system management costs. Branch costs will be paid by the host organization and the library users, with the largest share to the host organization, which is likely to be the largest user.

Item	Data Collector	Host Organization for SDLS branch	SDLS user
I. System Costs:			
Data editing and shipping, CD-ROM production and distribution[1]	O		
CD-ROM software upgrades[2]	O		
SDLS management[3]	O		O
II. Branch Costs:			
Set-up and maintenance of on-site branch facilities		O	
Reproduction costs for paper records used by:			
Branch library		O	
Library user			O
Travel to branch libraries			O

[1] For the first two years (until October 1993), the USGS will pay costs for production of CD-ROMS (i.e. file-formatting, pre-mastering, printing, and distribution). Costs for editing, transcribing, and shipping data to/from the USGS (or for travel expenses for a USGS scientist to visit the collector's archives and transcribe the data with a portable USGS computer system) will be paid by the data collector. After October 1993, the USGS will assist as needed, in the CD-ROM production, but printing and distribution costs will be paid by the data collector. Printing and distribution costs are likely to be about US $1700 for a CD-ROM master and 250 copies. Each CD-ROM currently will hold 2,000 to 4,000 km of digital MCS data.

[2] Software upgrades will hopefully be done through cooperative projects involving all SDLS data collectors.

[3] The mechanism(s) by which SDLS system management costs (e.g. oversight, communications, newsletter, etc.) and library-user costs (e.g. copies of data, materials, etc.) will be funded has not yet been established, and is under consideration. It is anticipated that proposals may be submitted to national programs of countries that utilize the SDLS to provide ongoing grants to cover these expenses.

Table 4: Distribution of costs for the Antarctic Seismic Data Library System (SDLS)

Management

The SDLS will have two levels of management:

1. The entire system will be managed and overseen by the SCAR-ANTOSTRAT Steering Committee and an SDLS Coordinator.

2. The branch libraries will be managed locally by the host organization and will be overseen by a senior Antarctic research scientist (and SDLS librarian) at that organization.

System-wide and local policies will be determined by the respective management groups. Major changes in system-wide policies and procedures will require consultation with data collectors. Major disputes, if they occur, will be handled by an international review panel, appointed by the SCAR-ANTOSTRAT Steering Committee and composed largely of MCS data collectors.

Implementation

Immediately following formal endorsement by SCAR in early June 1991, steps were taken to begin implementing the SDLS. These steps included publication of the workshop summary report, acquisition of USGS computer equipment for transcribing and file-formatting MCS data, and distribution of an ANTOSTRAT newsletter. The goal of the SDLS is to have all existing MCS data (about 136,000 km, Table 2) on CD-ROMs and into the system within 5 years.

For now, data and text files will be entered into the SDLS in either of two ways:

1. Data collectors can send their digital MCS stacked data (SEG-Y format), navigation data, and text files (describing how the data were collected and processed) to the USGS on magnetic tapes or other USGS-compatible high-density media, or
2. A USGS scientist can be invited to bring a portable USGS computer system to the data collector's archives (travel costs paid by the data collector) to transcribe the digital MCS stacked data and navigation data onto magnetic tapes.

The following outlines the general procedures for making and distributing the CD-ROMs for the SDLS:

a. the data collector will edit the data (i.e. MCS, navigation and text) and will transcribe the MCS data into SEG-Y format;
b. at present, the USGS will file-format all data to insure that the data files are in the correct format required for the CD-ROM pre-mastering process; in the future, the data collectors may do these processes;
c. the formatted data will be further processed by a special computer system at USGS facilities to make a pre-master magnetic tape;
d. the pre-master tape will be sent to a contractor to "print" the CD-ROM master and 250 copies of the CD-ROM;
e. the master and copies of the CD-ROM will be sent to the SDLS Coordinator who will inventory, serialize, and distribute a copy of the CD-ROM to each SDLS branch library; and
f. the SDLS Coordinator will store the master CD-ROM and a few copies for later distribution to new library branches and to the World Data Center (or alternative data center, at the choice of the data collector); the remaining copies of the CD-ROM will be sent to the data collector for their use.

The total time required to produce a CD-ROM, once the data are received by the USGS will be a minimum of five to eight weeks, but may be longer if additional data editing are required. Two CD-ROMS can be in production at the same time, thereby yielding ideally about 12 CD-ROMs per year. As each CD-ROM currently holds 2000 to 4000 km of data, the entire 136,000 km of existing digital MCS data could be put on CD-ROMs within 5 years.

The implementation plan and schedule listed below requires efficient cooperation of data collectors in carefully editing their data and providing them for CD-ROM production. To encourage rapid entry of data into the SDLS, the USGS will pay for "printing" of CD-ROMs for data sets received by them before October 1993.

By October 1991:

a. USGS will complete CD-ROM software upgrades and will implement CD-ROM file-formatting, transcribing, and pre-mastering systems.
b. The initial sequence for input of MCS data sets onto CD-ROM will be established.
c. Data collectors will begin editing MCS data and preparing MCS tapes either for shipping to USGS or for on-site transcription to a portable USGS computer system.

By May 1992:

a. The first 5 CD-ROMS (5 cruises) with MCS Antarctic data will be completed.
b. The locations of likely SDLS branches will be established and approved, and CD-ROMS would be sent to those branches whose data collectors have contributed data to the SDLS.

By October 1992:

a. At least 12 CD-ROMS will have been completed (24,000 to 48,000 km of MCS data), and sent to branches that have contributed data.

By October 1993:

a. At least 24 CD-ROMS will have been completed (48,000 to 96,000 km of MCS data.
b. The SDLS system will be reviewed in October 1993.

After October 1993:

a. USGS will assist with file-formatting and pre-mastering, but costs for CD-ROM printing will be paid by the data collectors.
b. CD-ROMs will be produced at the rate of about 12 per year until all remaining MCS data are on CD-ROMs (about 1995 or 1996).

Benefits

The SDLS will have direct benefits to the general Antarctic scientific community as well as to the data collectors. The system will:

1. provide numerous locations world-wide for access to all MCS data, in accord with Article III (1)(c) of the Antarctic Treaty;
2. promote greater coordination of future seismic field studies to maximize scientific data collection and avoid duplication;
3. aid in making proposals for major international and national projects such as multi-ship surveys and scientific drilling;
4. provide a standardized, compact, durable, convenient, and relatively inexpensive way to archive and access digital MCS data;
5. promote greater interchange of scientific ideas at workshops and site visits at library branches; and
6. facilitate more-widespread cooperative seismic research at shipboard and land-based facilities using easily accessible digital MCS data on CD-ROMS and using micro-processor computers.

SUMMARY

The Oslo workshop provided the opportunity for research groups in the eleven countries that have acquired Antarctic offshore multichannel seismic reflection data to address and resolve many long-standing issues and concerns regarding the dissemination and use of these data. The workshop consensus on implementing a seismic data library system and the acceptance of this system as a formal SCAR science initiative are significant steps toward promoting greater cooperation in Antarctic seismic research. New technologies for high-density data storage on CD-ROMs, for data display, and for data analysis on small personal computers have made

such a library system feasible and practicable. The success of the seismic data library system and its new concept in data management will depend upon a basic trust that the system will be implemented quickly and that the scientific community will faithfully comply with the guidelines of the library system. Such trust can lead to stronger international cooperation and more-rapid advances in Antarctic earth science.

ACKNOWLEDGMENTS

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APPENDIX I

Consensus Statement Written at the April 1991 Workshop on Antarctic Seismic Data in Oslo, Norway

SCAR Group of Specialists

on

Evolution of Cenozoic Palaeoenvironments

of the High Southern Latitudes (GOSC)

A seismic data library system for cooperative Antarctic research: a new concept for Antarctic data release

Solid-earth science disciplines have made major contributions to the under-standing of our planet. Such work in Antarctica has long been recognized as having global significance as applied, *inter alia*, to studies of plate tectonics and Antarctic glacial history, including its effects on world climate. It is therefore very important that freedom of scientific research in the earth sciences in Antarctica be maintained. Now, certain essential aspects of earth science research are being construed by some as hidden mineral prospecting. To avoid this perception it is essential that scientific data collected in earth science research using the same methods as are employed in prospecting - for example digital data from multichannel seismic reflection surveys and data from solid-earth drilling - be exchanged and made openly available at the cost of copying, in full compliance with Article III (1) (c) of the Antarctic Treaty. The scientific community has taken steps to accomplish this.

In April 1991, an international workshop with 21 representatives of 11 countries that have acquired nearly all digital multichannel seismic refection data in the Antarctic Treaty area was convened to discuss scientific cooperation and data release. Consensus was reached at the workshop regarding the implementation of a new seismic data library system for cooperative research in Antarctica, under the auspices of SCAR. Library branches, located worldwide, containing multichannel seismic reflection data would be open to researchers for studies in Antarctic geoscience. It is expected that all such data, including those that have been previously released in other forms under Article III, will be incorporated in this library within 4 years. To the greatest extent feasible and practicable, new seismic data would go to the library branches no later that 4 years after data collection, and would be held in the branches for 4 years. These periods reflect the time needed for seismic data processing, and provide some limited initial protection of the collector's intellectual property rights. While data are in the seismic library branches they shall be used for cooperative research projects with the data collectors. Thereafter, the seismic data would be sent to the World Data Centers of other archives for general release.

Implementation of the library system would start within six months, with the costs of the system being shared between the data collectors and the library users.

The SCAR seismic data library system was designed by the *consensus* of the entire Antarctic multichannel seismic research community to promote and help coordinate cooperative Antarctic seismic research. In the future, the library system may be expanded to include other types of geophysical data that would further enhance Antarctic geoscience research. Such a library system will be a major contribution to international research in earth science by the Antarctic community.

APPENDIX II

List of Workshop Participants Oslo, Norway, 11-15 April 1991; addresses as at 27 May 1991

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SCAR Report

SCAR Report is an irregular series of publications, started in 1986 to complement *SCAR Bulletin*. Its purpose is to provide SCAR National Committees and others directly involved in the work of SCAR with the full texts of reports of SCAR Working Group and Group of Specialists meetings, which had become too extensive to be published in the *Bulletin*, and with more comprehensive material from Antarctic Treaty meetings.

SCAR Bulletin

SCAR Bulletin, a quarterly publication of the Scientific Committee on Antarctic Research, is published on behalf of SCAR by Polar Publications, at the Scott Polar Research Institute, Cambridge. It carries reports of SCAR meetings, short summaries of SCAR Working Group and Group of Specialists meetings, notes, reviews, and articles and material from Antarctic Treaty Consultative meetings, considered to be of interest to a wide readership. Selections are printed as part of *Polar Record*, the journal of SPRI, and a Spanish translation is published by Instituto Antártico Argentino, Buenos Aires, Argentina.

Polar Record

Polar record appears in January, April, July and October each year. The Editor welcomes articles, notes and reviews of contemporary or historic interest covering the sciences and humanities in polar and subpolar regions. Recent topics have included polar aspects of agriculture, archaeology, biogeography, botany, ecology, geography, geology, glaciology, international law, medicine, politics, human physiology, psychology, pollution chemistry and zoology.

Articles usually appear within a year of receipt, short notes within six months. For details contact the Editor of *Polar Record*, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, UK: Tel (0223) 336567, Fax (0223) 334748.

The journal may also be used to advertise new books, forthcoming events of polar interest, etc.

Polar Record is obtainable through the publishers, Cambridge University Press, Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, or from booksellers. Subscription rates are: for individuals £25.00, for institutions £35.00; single copies cost £10.00

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