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The papers in this volume of the Society's Proceedings were presented orally at the Eighth Annual Meeting in Dallas, Texas on November 13, 1973. An abstract or summary is included for three papers which were not received for publication. These are noted by an asterisk in the Table of Contents.

One half-day session was titled GIS Technical Session: Progress and Innovation, and a second half-day session (organized by Beverly Holmes) was titled GIS Symposium: New and Unusual Publications in Geoscience.

Papers are arranged in order of their presentation at the meeting. Some of the papers have been retyped, but each is reproduced in the style submitted by the author. Editorial prerogatives have been limited to correcting obvious typographical errors and occasional clarification.

Marjorie W. Wheeler

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*denotes abstract or summary

TECHNICAL SESSION

PROGRESS AND INNOVATION

UNISRCH

A Computerized Information Retrieval System

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ABSTRACT

For the past three years, Union Oil Company's librarians have been using computer searching of the technical literature. This computer system, called UNISRCH, is an on-line interactive system, currently using an IBM System 370/155 computer with an IBM 3270 CRT terminal located in the Union Research Center Library.

UNISRCH is designed to handle any keyworded data base. Union Oil currently is using the University of Tulsa's Petroleum Abstracts and American Petroleum Institute's Abstracts of Refining Literature as its search file for covering the petroleum literature. These information files occupy 60% of an IBM 3336 disc pack and contain over 300,000 citations. A search is made by the user keying on to the CRT screen keywords that pertain to his subject of interest. After each keyword search, the computer displays the number of documents that satisfy the search at that point. By connecting the keywords with the logical operators "and", or "or", or "not, the user can expand or narrow the search. If the user is having trouble with a keyword, the program will come to his assistance by displaying on the CRT screen all keywords starting with a specific prefix.

With UNISRCH, the computer has become an important library tool. Union Oil's scientists no longer hesitate requesting a literature search that used to take days to compile. A search can now be done in a matter of seconds while they wait, giving them immediate access to a number of references on a subject scattered throughout the literature.

For the past three years, Union Oil Company's librarians have been actively using the computer for searching the literature. The reason for our stepping into the computer age is a unique computer system, called UNISRCH, which was designed for us by a Union Oil Research engineer. UNISRCH is an on-line interactive system which enables us to do literature searches in seconds which used to take hours and sometimes days to complete. The library has acquired a new tool, the computer.

Our technical center serves the research department of Union Oil which employs about 525 employees, half of whom are scientists and engineers. This research center covers the entire field of petroleum technology, from exploration and production through refining and product development. However, with the computer now a library tool, we have extended our searching services to the entire company. We now do searches for the geologist in the field, the engineer in the refinery, and the planning engineer at the company headquarters, but more important we are helping the researcher in his development of new ideas.

UNISRCH was written in early 1970. Computer tapes from the indexing services of the American Petroleum Institute (API) and the University of Tulsa had been accumulating as a result of our subscription to their services. There were six years of tapes and while it was getting cumbersome to search the literature using the manual indexes, it was also too expensive for us to do tape searches as often as we would like. It just was not feasible for us with a small computer facility to run these lengthy sequential tapes. As a result, UNISRCH was created.

One of the objectives was to make the system as simple and convenient as possible for all users. Another objective was to design a system that would be as efficient and economical as possible for a small facility to operate on-line during working hours. Only then would we have a truly effective library tool.

UNISRCH is an on-line interactive system currently using an IBM System 370/155 computer with an IBM 3270 CRT terminal located in the library. It is designed to handle any keyworded data base. One of the unique features is its ability to store a large amount of material on a relatively small amount of disc space. Currently, our data base is made up of API's <u>Abstracts of Refining Literature</u> and the University of Tulsa's <u>Petroleum Abstracts</u> which combined contain over 300,000 citations. With UNISRCH, these two files together occupy only 60% of an IBM 3336 disc pack.

Doing literature searches with UNISRCH is really very simple. In fact, anyone could operate the system after a few minutes of instruction. The main reason it is operated by library personnel is because they are very familiar with the keywords and can phrase the search questions much faster and more skillfully.

The scientist either phones or, more frequently, comes in personally with a search request. One of the literature searchers on the library staff will select the appropriate keywords and the search is ready to begin. After signing on (the library assumes all charges for computer searching) the searcher requests the data file needed. For illustation, I have selected Petroleum Abstracts. We are going to search for references on Cretaceous carbonate oil reservoirs that exist in Texas or Louisiana. The first keyword, carbonate rock, is keyed in and the system advises that there are 5,061 documents indexed with that word. Using the system's logic, the search will be narrowed by using the logical operator "and" and the keyword, Cretaceous. If this word is mispelled or does not exist in the data set, the system will advise the user of this and he can request to see all keywords having a given prefix. The user can then select the proper keyword, and resume the search. With the addition of Cretaceous, there are now 1,076 documents. To narrow the search even more, the logical operator "not" is used along with the keyword diagenesis. There are now 980 documents. Adding the term, oil reservoir, narrows the search further to 47 documents, and the term, Texas, narrows it to 4 documents. The search can now be broadened slightly by using the logical operator "or" and the keyword, Louisiana. This gives us 6 references published in the literature since 1965.

Narrowing the search relieves the scientist of the problem of sorting through reams of irrelevant information to find precisely what he wants. Since this is a reasonable number to look at we can end the question and display the citations. If he wishes, he can receive a print-out of the bibliography. This search took a total of 9.1 cpu seconds within 2 minutes 31 seconds clock time, a far cry from the hours and sometimes days it used to take to do manually.

At the end of the search, the scientist can either jot down the reference he needs from the display on the screen or he can obtain a print-out of the bibliography. From the print-out, he selects the items he wants and either obtains them himself off the library shelf or the library staff will locate them for him. During the three years we have been doing computerized literature searching, we have performed nearly 2000 of these searches.

I want to briefly mention that the system also has the capability to use links in a search. These are used primarily when searching chemicals, so they are rarely found in geology files. API has them in their data file and our library uses them when indexing our internal research reports. We find them particularly useful when indexing catalysts.

One of the most beneficial uses of on-line searching is the capability to test the question and rephrase it until it is right. This could take days if run in batch mode. If the scientist requesting the search is present, he can watch the search progress and immediately determine if he is getting the type of references he needs. If not, the search will be rephrased until he finds the material he is seeking or it is obvious the information does not exist, at least not in that data set. All of this takes only a few minutes and rarely do we not find some information for him, which is a credit to the excellent coverage and indexing done by both University of Tulsa and API.

As mentioned earlier, UNISRCH can handle any keyworded data base. While we have not acquired these, we have run GEO-REF, Compendex, Chemical Condensates, and the Uniterm Index successfully on our system. UNISRCH has proved to be a truly effective computerized information retrieval system.

In Union Oil's technical library, the computer has become a library tool, used in the library, by librarians. No longer does a researcher have to hesitate about doing a search which could take days of his valuable time. We feel that because of the speed and immediate availability of a computer search, as soon as a man has an idea and wonders what has been written on the subject, we can hand him a bibliography. It takes only a few good ideas nurtured by the immediate access to information to make the development and operation of UNISRCH worthwhile.

SAMPLE SEARCH

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6 DOCUMENTS SATISY THIS REQUEST
  CARBONATE ROCK
& CRETACEOUS
¬ DIAGENESIS
& OIL RESERVOIR
& TEXAS
| LOUISIANA
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1 DOC NO      164937
  TITLE       SLIGO REEF. PT. 1. MORE RESERVES DUE IN SLIGO REEF
  REF         OIL GAS J V 70, NO 36, PP 130, 135, 139, 9/4/72
  AUTHORS     HERRMAN L A

2 DOC NO      163727
  TITLE       BLACK LAKE FIELD, NATCHITOCHES PARISH, LOUISIANA
  REF         AMER ASS PETROL GEOL MEM NO 16, PP 481-488, 1972
  AUTHORS     WHITE B R

3 DOC NO      154287
  TITLE       HYDROCARBON POTENTIAL OF GULF SERIES OF WESTERN GULF
              BASIN
  REF         AMER ASS PETROL GEOL MEM NO 15, PP 887-900, 1971
              (V 2)
  AUTHORS     HOLCOMB C W

4 DOC NO      152388
  TITLE       LOWER CRETACEOUS SLIGO REEF TRENDS IN CENTRAL
              LOUISIANA
  REF         21ST ANNU GCAGS + SEPM GULF COAST SECT MTG PAP
  AUTHORS     HERRMANN L A

5 DOC NO      103459
  TITLE       FACTORS CONTROLLING CARBONATE SAND DISTRIBUTION IN
              SHALLOW SHELF ENVIRONMENT ILLUSTRATED BY TEXAS
              CRETACEOUS
  REF         18TH ANN AAPG + SEPM GULF COAST SECTIONS MTG
              10/23-25/68 PAP
  AUTHORS     MOORE C H JR

6 DOC NO       60700
  TITLE       WOODLEY (1200 FT) ANACACHO FIELD, UVALDE COUNTY,
              TEXAS
  REF         CORPUS CHRISTI GEOL SOC ANN FIELD TRIP GUIDEBOOK
              PP 31-32, 1965
  AUTHORS     HIS G
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THE SEA GRANT PROGRAM AND INFORMATION SOURCES

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ABSTRACT

Enactment of the Sea Grant College and Program Act in 1966 was a significant step in the nation's increasing use, management, and conservation of coastal and ocean resources. In 1968, Texas A&M University was one of the first six institutions to receive broad support under the program, and in 1971 TAMU became one of the first four to be designated a Sea Grant College. The program has three primary elements - research, education, and advisory services. Written into the Sea Grant Act is a mandate for information dissemination - to the scientist, to the user of marine resources, and to the general public. A major problem in carrying out this mandate is the interdisciplinary nature of marine fields; marine sciences are applications of other disciplines to a specialized environment. The search for information, therefore, becomes complicated because it is often scattered.

Among the tools being developed for creation of a real-time transfer system for marine information are bibliographic listings and abstract services. A prime thrust of all efforts is the identification of audiences - "user groups" - and tailoring of publications, films, exhibits, etc. to those groups.

A national Sea Grant depository housed at the University of Rhode Island makes available all Sea Grant-supported publications for interlibrary loan. Texas A&M produces a monthly review of national Sea Grant activities (Sea Grant 70's), which includes abstracts of new publications. Other sources of marine information and their strengths and shortcomings are discussed. A comparison is made of information programs developed under Sea Grant with those of the land grant program. Several important differences are noted.

Recently, the public has become more aware of many facets of the earth's character: explosive population growth, pollution, and dwindling resources have become daily news. Growing knowledge and technology stress the importance of man's relationship with the oceans. The studies of marine resources and oceanography have become important tools for the analysis, prediction, management, and conservation of our ocean resources. Oceanographers have become aware of the prime importance of the land-sea interface - that apron of land and shallow water draped around the world's coastlines.

During this stage of transition concerning the role of the oceans, our nation has seen much debate and discussion concerning national goals and priorities. In 1966, the Congress took what seemed to be a relatively small step toward greater utilization of our ocean resources by enacting the Sea Grant College and Program Act. But, it turned out to be the most important legislative act ever passed with respect to marine resources development.

By name, the Sea Grant Program is analogous to the Land Grant Program, established under the Morrill Land Grant Act of 1862. The general reasoning behind Sea Grant, as envisioned by Dr. Athelstan Spilhaus as early as 1963, is that if an educational program of research, extension and training stimulated us to become the most advanced agricultural nation in the world, a similar program can stimulate economic advances in marine fields.

The general goal of Sea Grant is to apply the capabilities of the nation's universities to the advancement of national marine resources utilization. The specific language of the act reads - "to provide for the establishment of a program of Sea Grant colleges and education, training and research in the fields of marine science, engineering and related disciplines." To make certain that the act was comprehensive, its enactors defined the scope of subject matter such that virtually all academic subjects or fields of knowledge are included. Further, the term "marine" was defined in a manner to include the sea bed and the shore environment as well as the water and its contents. Even the Great Lakes were made "salty" by this act of Congress.

Some Differences. In spite of our obvious ties to Land Grant, there are important differences between the Land Grant and Sea Grant concepts. Agricultural information has developed steadily and slowly over almost a century. It serves a prime target audience that has been steadily decreasing in size. In the U.S. today, agriculture employs less than 5% of the population and this percentage is still shrinking.

Marine resources information systems, like Sea Grant, cannot identify their target audience as readily. Sea Grant's broad, interdisciplinary program is not solely concerned with an easily defined field like food production.

Another difference between the two programs is that of a rapidly developing technology. Whereas, before 1920, the average time span between the development and application of new technology was 34 years, now the lag is less than 8 years. Publications and other information mechanisms for dissemination of the results of the technological engine must be designed to effectively function within this compressed time cycle.

It is fairly evident also, that Sea Grant must deal with greater concentrations of people. Forty-five percent of the nation's population lives and works in the Sea Grant laboratory, the coastal zone. The thrust, then, must be urban rather than rural.

Educationally the audience of today is vastly different from the initial Land Grant audience. Americans have received more formal education in public schools and have been exposed to a dramatically increasing range of information "inputs." The ordinary citizen of the present industrial society is flooded with a maze of messages, carefully edited to achieve the greatest impact.

In 1968, Texas A&M University was one of the first six institutions in the country to receive broad-scale institutional funding under the Sea Grant Program. We became one of the first universities in the country to be named a Sea Grant college by the U.S. Department of Commerce in September, 1971. Along with University of Washington, Oregon State University, University of Rhode Island, University of Hawaii, University of Wisconsin, and University of California, Texas A&M University has been recognized for outstanding leadership in the development of marine programs oriented toward problem solving, educational excellence and information dissemination.

The Sea Grant activities of the university are partially supported by the National Oceanic and Atmospheric Administration with the Department of Commerce and partially by state funds, industrial contributions, and foundation funds. Since its beginning in 1968, the Texas A&M program has had a total funding of $8.1 million. Our current year's funding, which began September 1, 1973, amounts to $1.1 million from the federal government, matched by $550,000 in non-federal funds. Approximately 60 percent of these funds are directed toward research; 10 percent toward educational development; 20 percent for advisory services; and 10 percent for program management.

Our research efforts are currently concentrated in six program areas: fisheries and seafood technology, mariculture, environmental quality, resources management, shoreline processes and marine technology, and health-related activities. Educational activities are not as extensive as the research effort, yet we have support for technician training, course and curricula development at the college level, and support for some course development at other schools. The advisory service element is the most exciting aspect of Sea Grant.

Here, advisory services specialists, patterned after the agricultural extension agents, work directly with marine resource users to improve their knowledge and subsequent use of marine resources. This service constitutes a kind of "people-to-people" information transfer mechanism - the so-called "grass roots" approach to marine science education.

Information: A Major Mission. One of the major missions of the Sea Grant Program, nationally as well as locally, is the transfer of information. At Texas A&M the Department of Marine Resources Information performs this function. The department is a part of the Center for Marine Resouces which administers the Sea Grant College Grant. We have a staff of writer/editors, including the head of the department. The department is concerned with the preparation and dissemination of all types of information generated through our Sea Grant work. Publications, workshops, meetings, media contacts, films, pictures, exhibits and any other informational devices are incorporated into the program. We are striving to put the right kinds of information into the hands of those who can make the best use of them.

Currently our information/publications program is manageable. But, if the Land Grant analogy is any index, the future is likely to be a bit sticky. Some statistics from the agricultural extension publications effort point out some frightening facts. In 1968, Pennsylvania State University put out a pamphlet on "publications work" for extension services and agricultural experiment stations in 33 Land Grant universities. The schools accounted for 7,222 publications at that time. Add to these the 2,900 publications of the U.S. Department of Agriculture's Office of Information plus the Forest Service efforts and you get some idea of the magnitude of agricultural publications. Between 40 and 50% of these publications go into county agent offices.

Even though Sea Grant is young, we seem to have scored well since the first awards were made. The Texas A&M Sea Grant Program alone has produced more than 300 publications since 1970. Knowing that we are only one of 20 large grantees and almost 50 smaller ones will give some idea of the magnitude of the Sea Grant publications effort.

Evaluation. Sea Grant is attempting to build in some evaluation technique so that we do not become a "paper mill." However, when we begin to think in terms of publications evaluation, there are no easy answers. As a scientific discipline, the study of information needs and uses is largely a semi-enlightened trial and error procedure with little predictive value. The understanding of information uses involves a mixed clustering of several areas of behavioral science. Information needs vary with time, user, purpose, location and alternatives.

<u>In Search Of A System</u>. As the Sea Grant Program has grown nationally, the influx of new technical reports, publications, and other printed materials for marine science has sharply increased. The impact is being felt in information handling systems. The major problem, of course, is the interdisciplinary nature of the marine field. Marine science and oceanography are applications of other disciplines to a specialized field. The search for information in clearinghouses, bibliographies, and libraries then is one of persistence and dedication.

The problem is further complicated by the fact that more and more marine-related literature is becoming available - most of which deals with applied techniques and is scattered throughout a variety of fields.

Another acute problem, which is probably the most critical to researchers anddecision-makers, deals with the timely availability of project results and findings. The engineer dealing with a problem today may find its solution only after he has "re-invented" the wheel.

Also, work performed may not even have been in the "wet" environment, because the problems being addressed by marine science today are often those of the coastal zone. The definition of marine science as it is currently used is sort of a mixing pot into which a variety of ingredients are tossed.

Libraries are caught in this indefinable marine maze. Traditional cataloging imposes an artificial system which results in fragmentation of materials and confusion.

<u>Bibliographies and Abstracts</u>. At this stage in our search for a system, the chief tools are bibliographies and abstracting services. Both of these techniques are expensive and we have reached the point where we must compile bibliographies of our bibliographies. The bibliographic listing is the most common tool. Most of these are prepared as one-shot projects and are not kept up as time and the printing press go on. Academic institutions, such as Woods Hole Oceanographic Institution and Scripps Institute of Oceanography, are major producers of marine bibliographies along with commercial houses and the federal government.

Abstract listings seem to be the quickest way to let people know of the availability of information resulting from our Sea Grant findings. Therefore, the Texas A&M Sea Grant Program has undertaken a modest abstracting service for technical reports and other selected publications. Currently we distribute over 700 abstracts and our list is growing daily. The use of abstracts is also a form of evaluation for us.

When we get no buyers for the technical report we have a pretty good idea that the results are not needed or wanted.

The National Sea Grant Program has been wise enough to recognize the importance of centrally documenting all Sea Grant publications. Currently two different types of approaches are being used.

The Sea Grant Depository. Through a contract with the University of Rhode Island, a national Sea Grant depository has been formed. Over the past three years, the Library on the Narragansett Bay campus of the University of Rhode Island has been collecting three copies of every technical report, journal article, newsletter, general report and technical speech. One of these reports is set aside for interlibrary loan. A bibliography of this Sea Grant collection is available and periodically updated. Publications are listed by types (technical report, newsletter, etc.), author, key word in context or description, university and grant number.

Sea Grant 70's. The second type of information service provided is a monthly review of Sea Grant activities from across the nation. Under contract with Texas A&M University, the Office of Sea Grants has arranged this publication, called Sea Grant 70's as a fast method of letting others know of results of Sea Grant sponsored work and of new available publications. Sea Grant 70's is distributed free to about 6,000 persons.

Conclusion. Because "information" in many forms is a major Sea Grant mission, the problem of developing a real-time information system for marine information is critical to us. If marine programs in general, and Sea Grant specifically, are to serve their rightful place in national goals and priorities, the question of rapid and efficient information transfer must be solved.

THE UTILIZATION OF A GENERALIZED DATA MANAGEMENT SYSTEM FOR STORAGE AND RETRIEVAL OF GEOLOGICAL SAMPLE INFORMATION

by

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ABSTRACT

Sediment samples are routinely collected and analyzed as a part of the mission of the U.S. Army Coastal Engineering Research Center (CERC). In order to support this activity, the CERC Automatic Data Processing Office has developed a system for processing, storing, and retrieving the collected data which utilizes in-house facilities in conjunction with computer systems and software maintained by other agencies.

Whenever a sample is brought in for analysis, the principal investigator fills out a form which uniquely identifies the sample and describes its texture and mineralogy. The sediment size analysis is performed on a rapid sediment analyzer which digitizes the raw data directly onto punched cards. A data reduction program reads the data cards, and computes the statistical moments and the cumulative distribution at one-half Phi intervals. This output, along with the identification and descriptive information is used to update a magnetic tape file under the control of the QUICK QUERY file management system.

CERC uses the QUICK QUERY system by means of a remote batch terminal which is connected to the UNIVAC 1108 computer at the National Bureau of Standards. The use of a generalized data management system was necessitated by the large number of samples and the rate at which they are being collected. Some initial difficulties in both the design and implementation phases had to be overcome in co-operation with the end users. However, the implementation is now considered successful. In the future CERC expects to implement further files of scientific and engineering data using QUICK QUERY or a similar system.

INTRODUCTION

The U.S. Army Coastal Engineering Research Center (CERC) is an agency of the Corps of Engineers which has a mandate from Congress to perform pure and applied research leading to the solution of coastal engineering problems. This agency, formed as the Beach

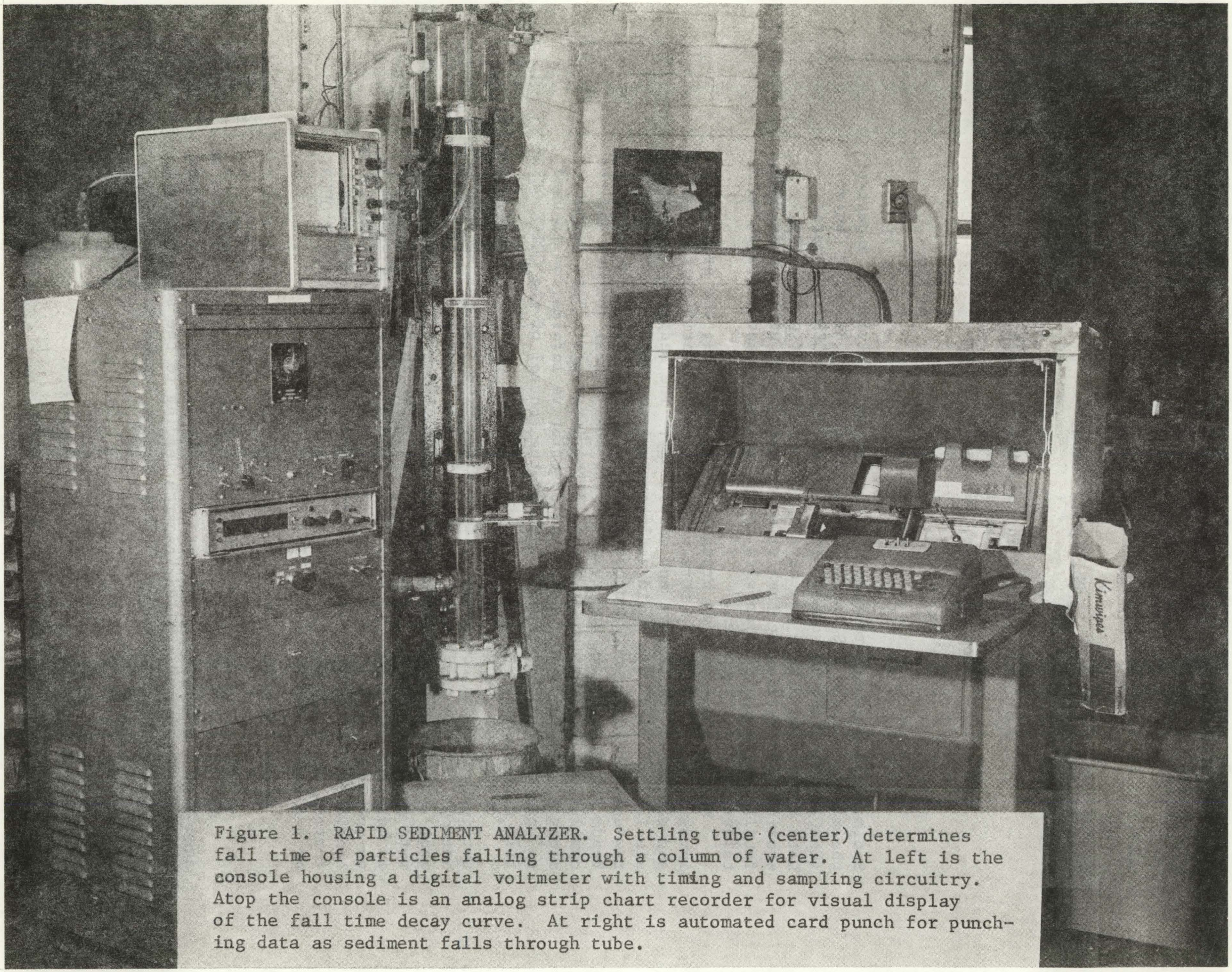


Figure 1. RAPID SEDIMENT ANALYZER. Settling tube (center) determines fall time of particles falling through a column of water. At left is the console housing a digital voltmeter with timing and sampling circuitry. Atop the console is an analog strip chart recorder for visual display of the fall time decay curve. At right is automated card punch for punching data as sediment falls through tube.

Erosion Board (BEB) in 1930, was reorganized under its present name in 1963. It has the additional mission of performing consulting services to the Corps of Engineers and to other government agencies. CERC has also provided these same services to state and local governments, and to private individuals who are concerned with coastal zone management. The systematic use of computers in coastal engineering is only about 10 years old. However, its influence has been profound. The two principal computer applications have been the processing of environmental data, and the modeling of natural phenomena. This paper describes the utilization of computers to process environmental data.

DESIGN CONSIDERATIONS

The U.S. Army Coastal Engineering Research Center has several ongoing environmental data collection programs which collect large numbers of sediment samples. Mostly these samples are from the beach or nearshore zone, although some come from on land, or from deep water. The principal projects which collect large groups of samples are the Inner Continental Shelf Study, the Radioisotopic Sand Tracer Study and the Littoral Environment Observation Study. These samples are an important source of information about beaches and nearshore areas. One project in particular, the Inner Continental Shelf Study, has been collecting marine sediment cores along the east coast of the United States since 1964. During a typical month, the CERC Sedimentological Laboratory may analyze over 400 samples.

The following is a description of the Geological Sample Information data base in its original, or ad hoc, configuration. When a scientist brought a sediment sample in from the field, it first received a reference number and a consecutive number to identify it uniquely within the data base. Next, the sample went to the Sedimentological Laboratory for size analysis on the rapid sediment analyzer. This device, shown in Figure 1, is a sedimentation tube that measures the time it takes a sample to fall through a 1-meter column of water. A differential pressure transducer continuously measures the weight of the sample in water and transmits the signal to an analog to digital converter which then transmits the signal to a specially modified keypunch. The raw data is punched on to cards automatically. Next, the cards went to the ADP Office for processing through the Sediment Data Reduction and Analysis (SEDANL) program. This program produces a printed report of the sample's cummulative size distribution and statistical moments. In addition, the program punches the same data onto cards. The data on cards then went into the Sediment Statistics data file through the QUICK QUERY data management system. Figure 2 is a flow chart of the sediment statistics data.

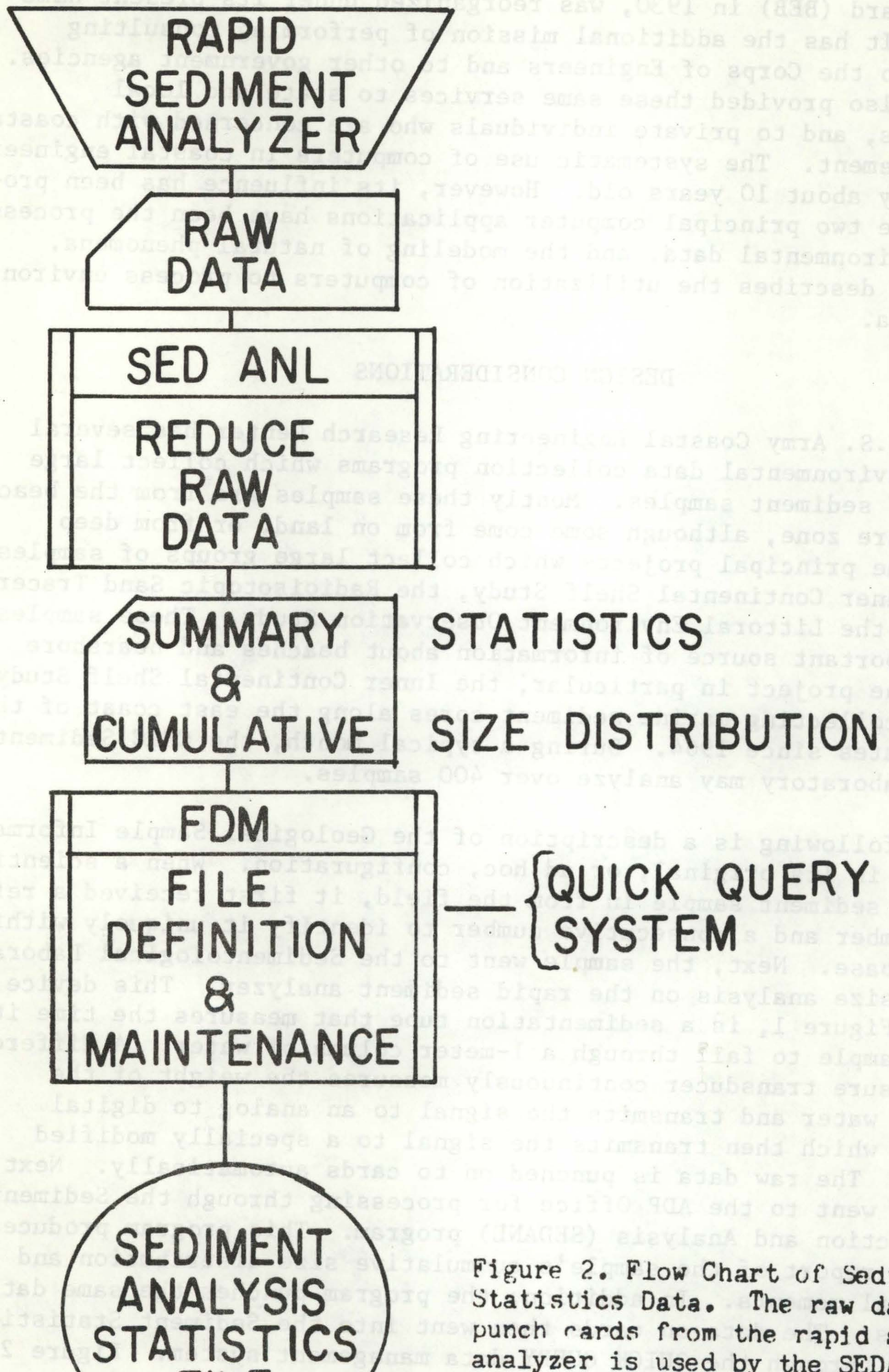


Figure 2. Flow Chart of Sediment Statistics Data. The raw data on punch cards from the rapid sediment analyzer is used by the SEDANL program to generate the summary statistics file on punch cards. The FDM program, which is part of the QUICK QUERY system, uses these cards to update the Sediment Statistics file.

The scientist, or whoever collected the sediment sample, also filled out a form which identified the time and place the sample was collected as well as any other identification that he wanted to give it. The required identification included the date and time in local standard time, the latitude and longitude, and the elevation of the sampling site with respect to a datum, usually mean low water. The scientist could also include information on the method of sampling or any miscellaneous remarks. In addition, the sample was also described in mineralogical terms. These are color, texture, and mineralogy, as determined by a megascopic examination. Figure 3 is a flow chart of the identification and descriptive information. Two forms were formerly used to code the data. The first was a hand coded form, from which the data was then keypunched and verified. The second form was an optical mark page reader (OMPR) form. These forms went through a scanner which punched the data onto cards. The cards generated by the OMPR then went through an edit and transformation program which produced the Geological Sample Information cards which, in turn, were used to update the Geological Sample Information data file.

DATA BASE ORGANIZATION

The organization of these files is diagrammed in Figure 4. As you can see the organization is quite parallel. The basic entity, from which each file is constructed, is the sample. It may be a solitary sample in the case of grab or dredge samples or it may be part of a core made up of a dozen or more samples. Each sample and core has its own identification. Also, each data collection project has its own identification which is based on the functional area of the project and the state or locality in which the project is operating. This structure had the basic advantage of being easy to implement, particularly on the QUICK QUERY data management system. The drawback, however, was that it was difficult to coordinate the retrieval of information from the different files. For example, Figure 5 shows the way in which these two files were implemented in the data management system. If someone wanted to query the files for summary statistics of sediments with a particular latitude and longitude he would first have to go to the Geological Sample file to get the reference number and consecutive numbers of the samples and then query the sediment statistics files in order to get the statistical data back out.

In order to improve the organization of the data in the system we made the following changes to our procedures for processing and analyzing the data. The first step was to get rid of the optical mark page reader forms. Although the volume of data being processed is rather large, cost analysis studies showed that optical mark page reader forms were not cost effective because the errors that they

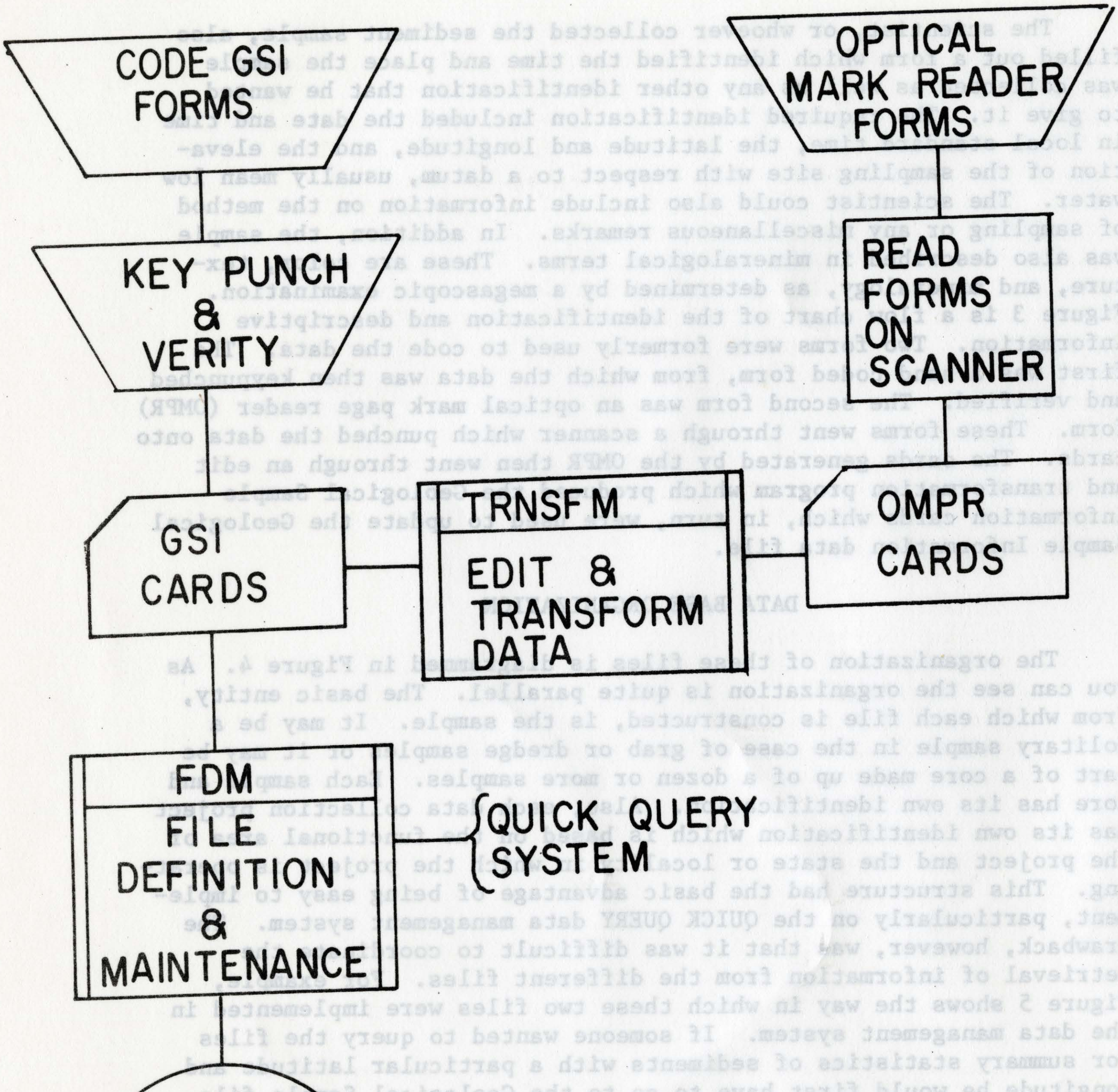
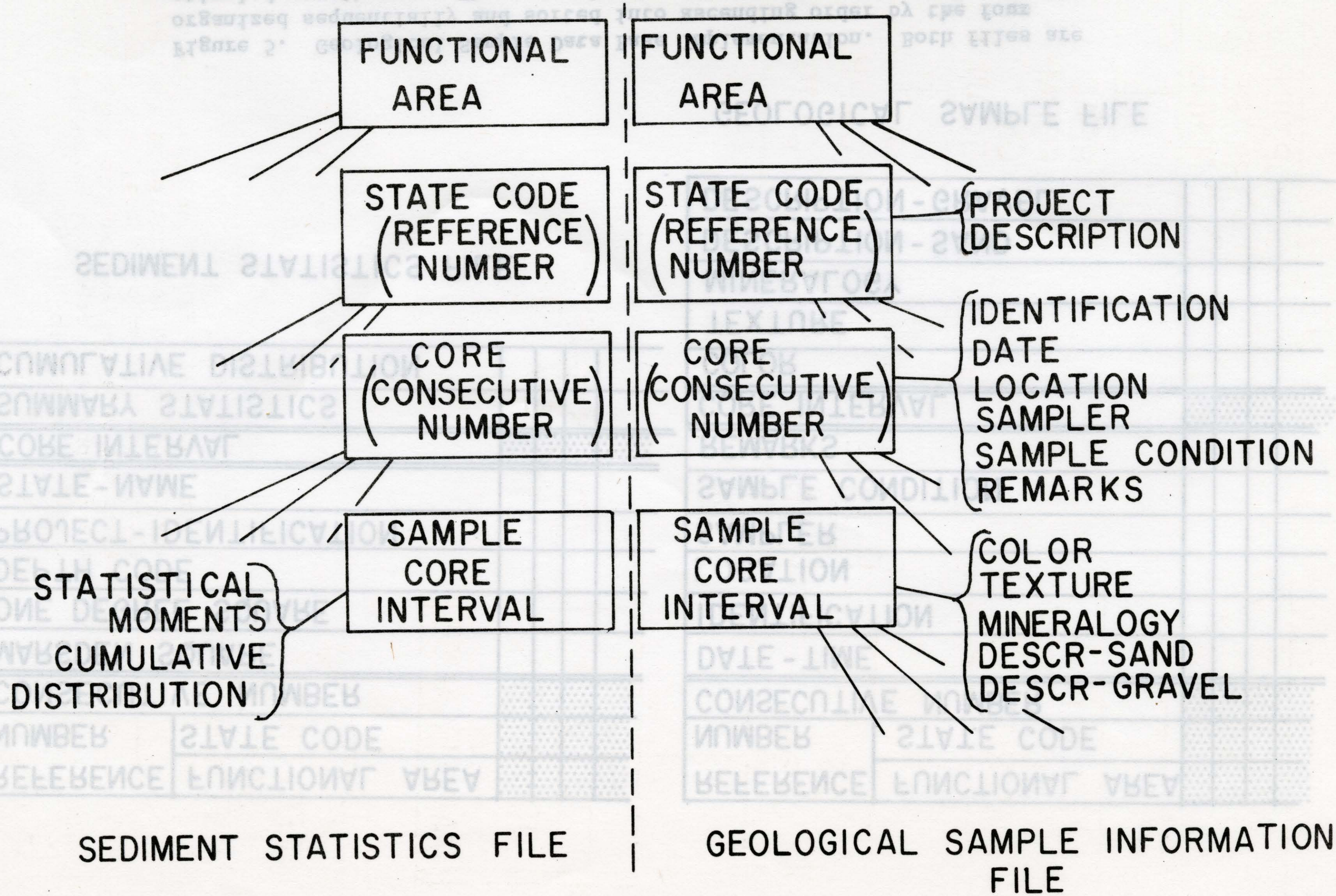


Figure 3. Flow Chart of Geological Sample Information. Identification and descriptive data are written on either coding forms or optical mark page reader forms. After the data has been punched and verified or edited, the FDM program updates the Geological Sample Information file with them

Figure 4. Organization and Structure of the Geological Sample Data Base. The basic entity in each file is the sample. Cores, projects and functional areas are the hierachies under which the samples are grouped. These hierarchies reflect not only the way in which the samples were collected but also the organization of the agency that did the collecting.



REFERENCE NUMBER	FUNCTIONAL AREA
	STATE CODE
CONSECUTIVE NUMBER	
MARSDEN SQUARE	
ONE DEGREE SQUARE	
DEPTH CODE	
PROJECT-IDENTIFICATION	
STATE-NAME	
CORE INTERVAL	
SUMMARY STATISTICS	
CUMULATIVE DISTRIBUTION	

SEDIMENT STATISTICS FILE

REFERENCE NUMBER	FUNCTIONAL AREA
	STATE CODE
CONSECUTIVE NUMBER	
DATE-TIME	
IDENTIFICATION	
LOCATION	
SAMPLER	
SAMPLE CONDITION	
REMARKS	
CORE INTERVAL	
COLOR	
TEXTURE	
MINERALOGY	
DESCRIPTION-SAND	
DESCRIPTION-GRAVEL	

GEOLOGICAL SAMPLE FILE

Figure 5. Geological Sample Data Base Implementation. Both files are organized sequentially and sorted into ascending order by the four stippled attributes. The major sequencing attribute is FUNCTIONAL-AREA; the least significant one is CORE-INTERVAL.

introduced more than off-set the cost savings due to automated processing. These forms tended to introduce errors in two ways. First of all, mistakes in coding the forms were easier to make and more difficult to recognize. They tended to escape detection even after extensive editing by the edit program. Secondly, if the optical mark page reader forms were roughly handled they tended to introduce errors or mispunches on the punch cards. These errors were also difficult to edit out, and once they went into the data base they were expensive to remove. We also changed the off-line processing of the data. These changes are shown in figure 6. We merged the identification and description information on the samples with the data from the rapid sediment analyser at the source of the latter data. Changes were made in the processing procedures of the samples in the sediment lab to the effect that no sample was processed without first having the identification and sample description data punched onto cards. When these cards became available, then the sample would be processed, but not before. The editing of the identification and descriptive information was combined with the sediment analysis program so that both processes occurred in the same computer step. The processed output from the sediment analysis program would then go directly into the QUICK QUERY system to update a Unified Geological Sample Information file. One over-riding reason for this latter step was a wish to eliminate the human factor from the system. The problem was simply that investigators were slow about filling out information which was essential to identify and describe the sample, but at the same time were insistent about having the analyses of these samples from the sand lab. Consequently, it was difficult to keep the descriptive and identification information current with the sediment statistics data. By changing the data analysis procedure, the overall integrity of the data base has been vastly improved. See Figures 7 and 8.

QUICK QUERY SYSTEM

The data management system used to process the Geological Sample Information data base is called QUICK QUERY. The Consolidated Analysis Center, Inc. designed and developed this system for the Economic Development Administration. Since the program is the property of a government agency, it is available to other government agencies as well. The National Bureau of Standards obtained the system from the Economic Development Administration and implemented it on their UNIVAC 1108 EXEC 8 computer system. The Coastal Engineering Research Center is a remote batch user of this system and the QUICK QUERY software. The QUICK QUERY system is made up of two programs. The first program is a file definition and maintenance (FDM) program. The second is a combined query and report writer program. These programs are written in UNIVAC FORTRAN V. Data files are kept on tapes or sequential disk files and the data which is used to create or update a QUICK QUERY file must be pre-sequenced before going into the FDM program. The principal

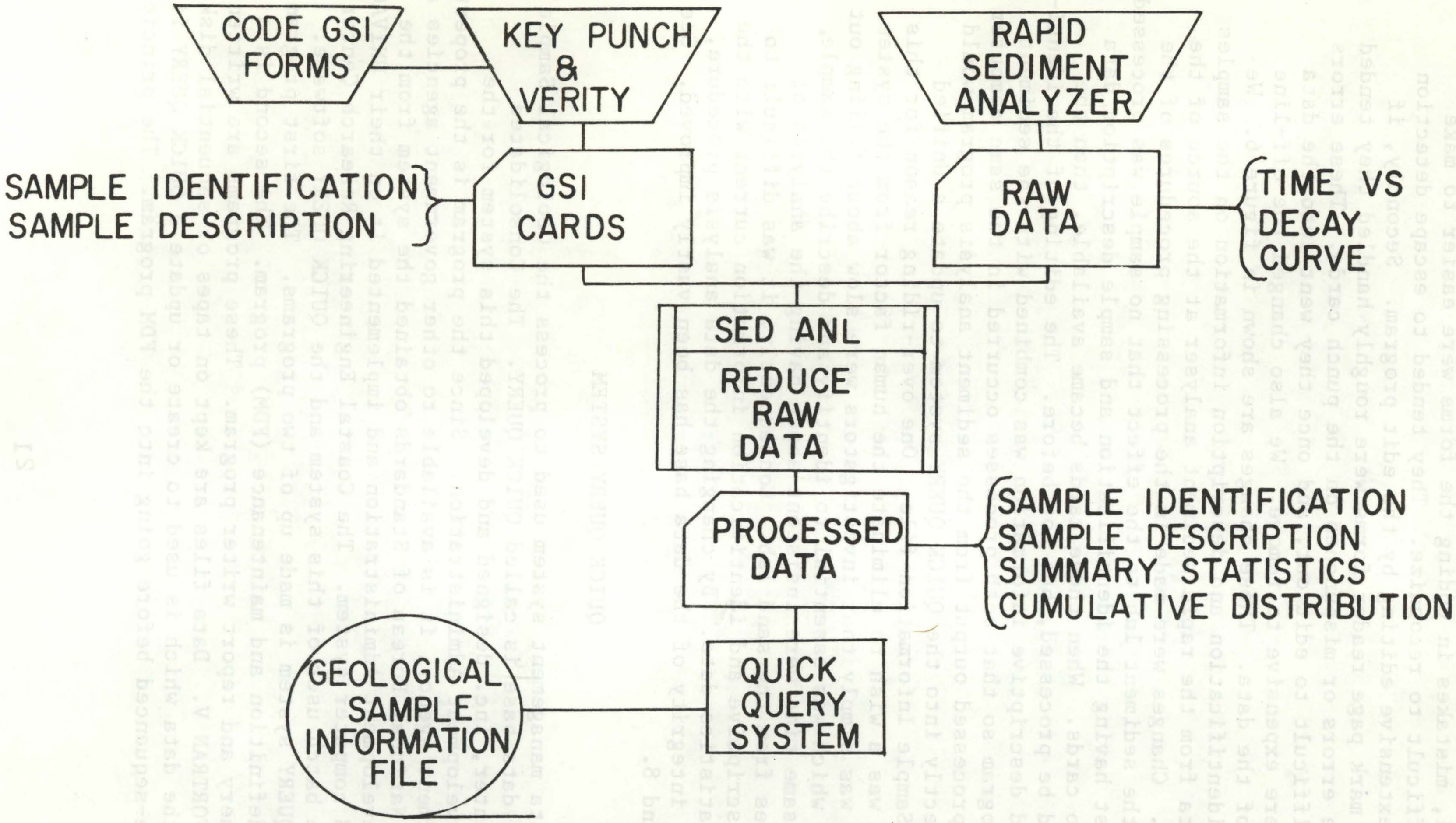


Figure 6. Flow Chart of Combined Geological Sample Information and Sediment Statistics Data Base. Note that the optical mark page reader forms are no longer in the system.

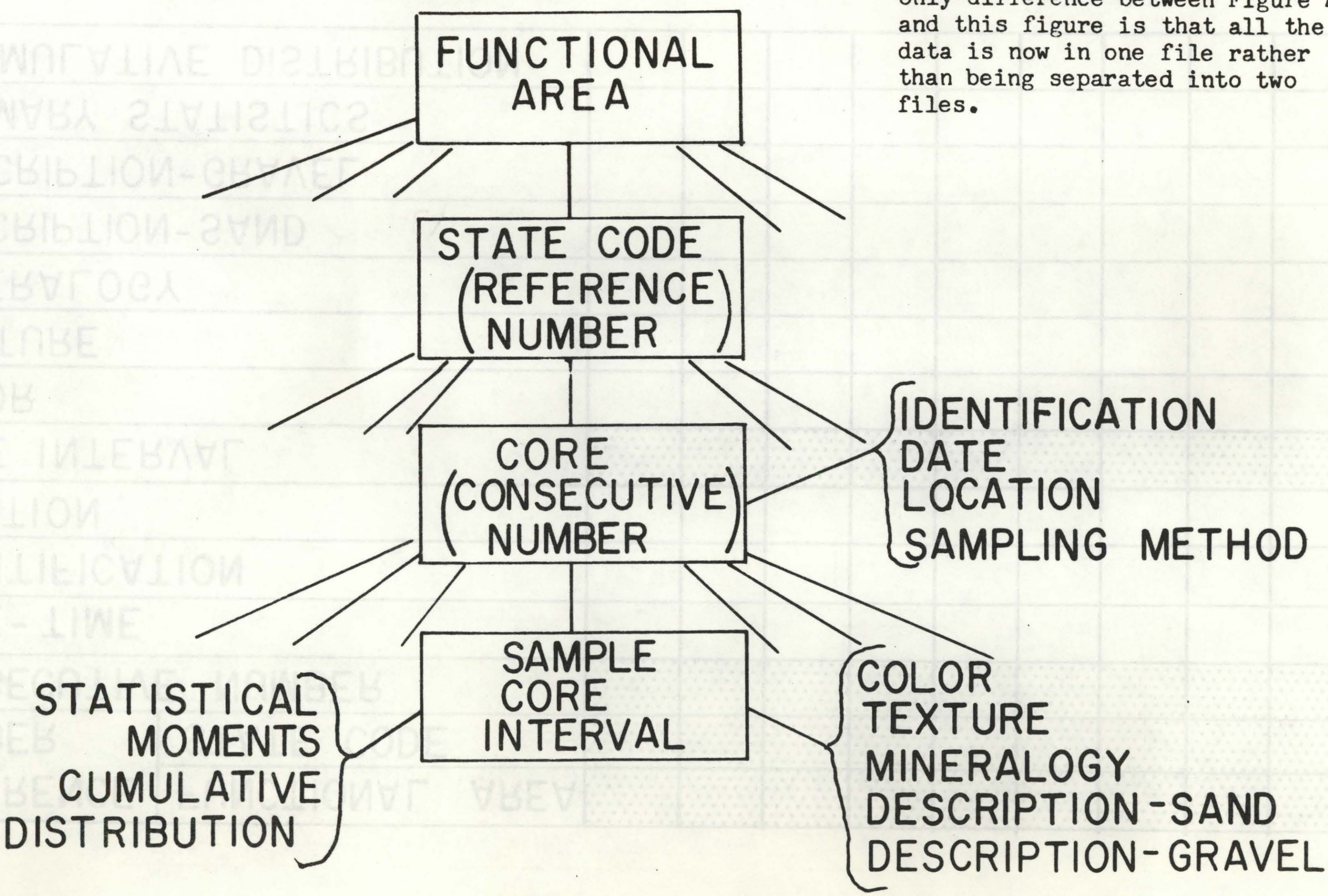


Figure 7. Organization and Structure of Combined Geological Sample Information File. The only difference between Figure 4 and this figure is that all the data is now in one file rather than being separated into two files.

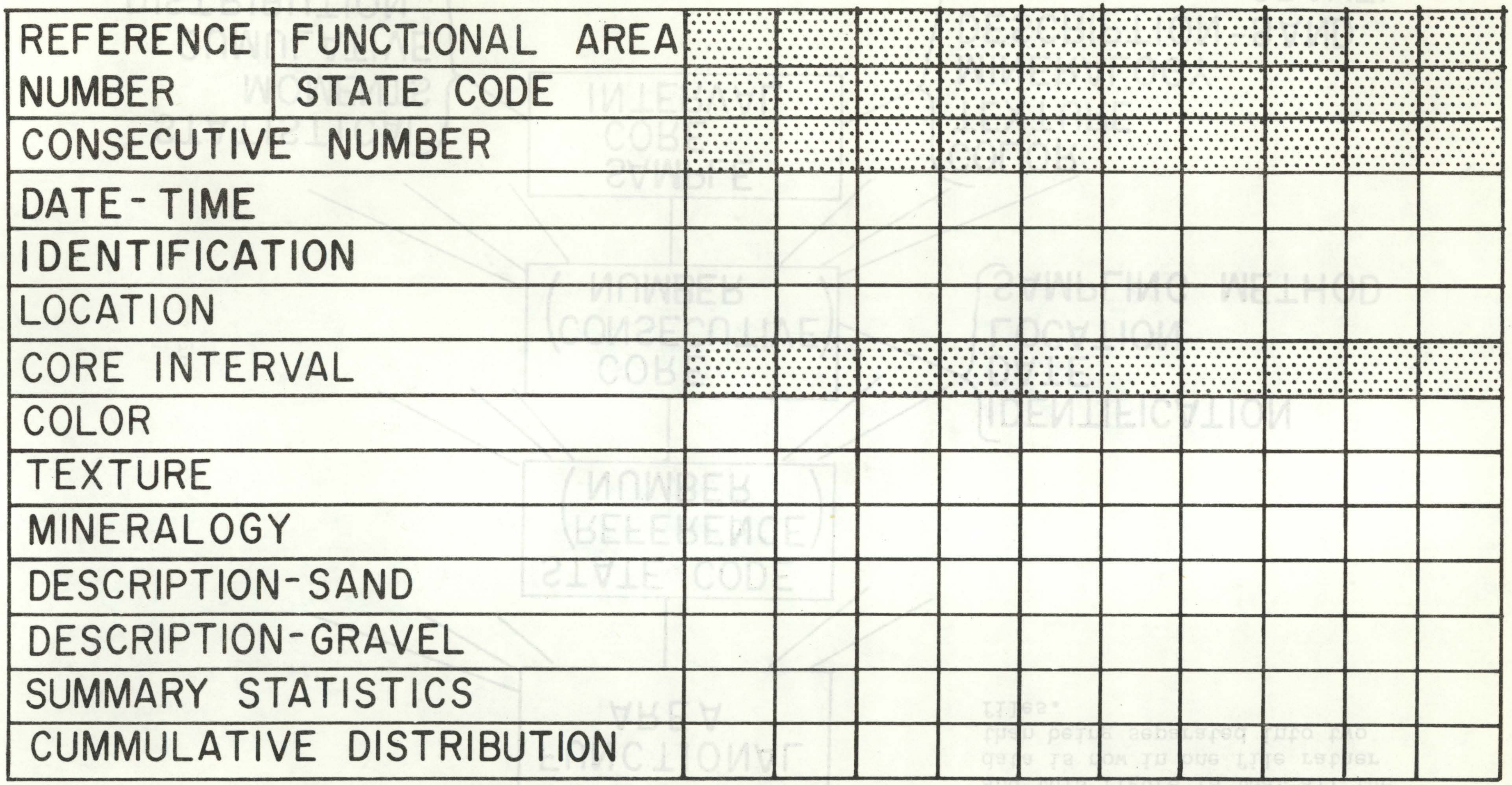


Figure 8. Implementation of the Combined Geological Sample Information Data Base. The file is organized sequentially on the stippled attributes.

advantages of this system are, first of all, that it is available on a generally available computer system, the UNIVAC 1108. Secondly, it is written in FORTRAN and therefore it is easily transferrable to another computer system if the need arises. Thirdly, the FDM program allows the user to update records in the file by specific record identification or by range of values. Also, the update function is self-contained within the FDM program and thus minimizes the amount of coding necessary to implement a data base. Lastly, the query program allows the user to make more than one report per each pass of the data base. This reduces the amount of computer time involved by batching queries into longer production runs.

Notwithstanding its excellent overall performance, QUICK QUERY does have certain disadvantages. First of all, it is a tape-oriented, batch processing file management system. All data records are stored sequentially. This is the reason that the input records to the FDM program must be pre-sequenced. Secondly, data fields must lie within computer word boundaries. This results in some waste of space both in main memory and on the tape files. However, it is unavoidable because of the programming language used to write the system. A third disadvantage is that some knowledge of FORTRAN is necessary for writing subroutines to read a transaction tape and to pass the update records to the FDM program. Lastly, the control cards for both the FDM program and the query program must conform to a strict format. Any errors will abort the execution of a run. These disadvantages did not hinder the implementation of the Geological Sample Information data base. In fact, they become insignificant when compared to the disadvantages of implementing and maintaining the same data base with a set of FORTRAN programs, as is often done with scientific data files. The person who has several different data files to maintain can save even more time and effort by using QUICK QUERY simply because he only needs one file management system for all of the files instead of one set of FORTRAN programs for each file.

SUMMARY

Based on our experience in using QUICK QUERY, the CERC ADP Office feels that data management systems are a cost effective way of storing and retrieving scientific and technical data. We have, however, discovered that the following steps are necessary in order to get a successful implementation. First of all, cooperation and communication with the users is extremely important. It is so important that CERC has set up a data base task group made up of representatives from the different user departments and from ADP Office. This is the sounding board through which users make their wishes known to the ADP Office and which sets the overall policy for data base implementation. Secondly, successful data base implementation requires data integrity. This means keeping erroneous data out of the data base. It is partly for this reason that we discontinued using optical mark page reader forms.

INDEXING FROM AN INDEXER'S POINT OF VIEW

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ABSTRACT

GEO•REF, the American Geological Institute's indexing system, is taken as an example of indexing since it is the oldest and most comprehensive, indexed referral system in the English language in North America. Indexers follow an open system, flexible enough to meet the growing needs of the earth science community. The methodology used is a keyword system consisting of a three-level term set in which the second- and third-order terms are either hierarchical or linked to a related or some entirely separate topic. Indexers are guided to formalize not only the terms used in the indices but also their hierarchy. Thus, indexers, with different backgrounds and interests, arrive at similar index entries for similar topics. Indexers, however, are faced daily with documents that cannot be adequately treated. They are faced with documents poorly written, uninformative, misleading, or containing highly specialized terminology. Indexers can only reflect the units of the document and not try to read in the mind of the author. Since indexing of geoscience literature is done by geoscientists, improvement must come not from the very few who index but through the constant cooperation between users, interested parties, and the indexing services.

Before indexers start their work they are usually given a briefing on the philosophy of the indexing service, its methods, its advantages and its pitfalls. I am sure this procedure is applied to all such services. Since GEO•REF, the American Geological Institute's Indexing system, is the oldest and most comprehensive indexed referral system in the geological sciences in the English language in North America, I will use it as the example of my discussion today.

The basic philosophy of GEO•REF, as I see it, is to acquire, annotate, index and provide a data base in the geosciences, and as such, to establish an information system in the earth sciences on a worldwide scale. Further, since the ultimate aim of GEO•REF is to serve the user thru scanning the Geological Society of American bibliography or other subject indices, or thru queries submitted for search and retrieval, a high degree of consistency and vocabulary control must be maintained. The terms used must be, to a great extent, those used by the geoscientists to aid both the indexer and user looking for the information. Thru the hierarchical system, the depth of indexing and the use of roles and links, the indexing philosophy serves a very useful purpose:

1. Hierarchical System: GEO·REF uses a three-level hierarchical system. The advantage of this is that it gives the user an excellent diversification of access or pathways. It also provides the indexer a simple and methodical manner in which to treat articles. The hierarchical and cross-indexing philosophy can be demonstrated with a paper on the "Cretaceous Ostracoda from Texas." It will be indexed under Texas, Cretaceous, and Ostracoda.

2. Depth of Indexing: Unlike other indexing services, GEO·REF serves the user by assigning to a document as many smaller sets of key words as possible which relate to the intellectual content of the original document. Therefore specificity is the goal. Indexing the term faults can be so specific as to give the type, orientation, style, structure, etc. (Fig.2).

3. Roles and Links: The use of roles or scope notes in the third-order levels as well as the function of links indicating relationships between terms, is one of the major features of GEO·REF's indexing system. Thus any term can be linked to any other in the index sets (Fig.1).

When the indexer has an understanding of the philosophy behind GEO·REF, he is given a manual for indexing. The manual represents a revised guide that has been compiled from U.S.Geological Survey guides prepared for the Bibliography of North America since 1892, and which has been used continuously until 1972 when the U.S. Geological Survey suspended its publications. The scheme is a key word system based on the assumption that subjects covered in most articles can be indicated or implied by a relatively small number of key words . Since the system is a three-level hierarchy, the vocabulary on the first and second levels, particularly on the first, has been kept as small and simple as possible (about 250) to minimize the number of pigeonholes in which a user must search and to make the indices more easily incorporated into an automatic data retrieval system.

Efficiency dictates some restrictions in the way in which certain broad terms may be used as first order headings. If all papers dealing with petrology or paleontology respectively were indexed under these two headings, the lists would take up pages of the index at only two levels of indexing, and there would be difficulty in discriminating between topics in articles of different content. Therefore, papers are not indexed on the first order under the names of the broad subdiscipline of earth sciences, but under more restrictive headings. First order headings that are of interest in connection with individual subdisciplines will be listed in an easily scanned form. (This will be appearing in the cumulative of the GSA Bibliography.) The more general terms, the disciplines, such as petrology and paleontology are used only as first order index terms for very general monographs, such as books and articles that apply to the field as a whole.

The main body of the guide gives a list of first-order terms regularly used in the index, together with an indication of the kinds of second- and third-order headings that normally follow (Fig.2). The main list also contains many cross-references not included as first-order headings.

The second- and third-order terms may either be hierarchical (i.e. logical subdivisions of the category in the next lower order of heading, i.e. igneous rocks; granite-granodiorite family; charnockite, geochemistry etc.) or cross-referenced to some entirely separate category of information (i.e. a geographic term following the name of commodity, or process).

Indexing of Geologic Documents

Indexing of geologic documents is done by geologists for geologists. Documents are distributed to GEO•REF indexers based on language experience, and field of knowledge. However, that is not always possible. For instance, an indexer who may have a strong background in petrology and happens to work on a GSA Bulletin, may be confronted with a micropaleontology paper. In that case he may either index the paper as best as he can, or refer it to another indexer.

The indexer tries to analyze the content of the article, organize the vocabulary, be as specific as possible, follow the rules, and bear the user in mind. Thus, the guide assists the indexers with different backgrounds and interests, in arriving at similar index entries for similar topics.

The terms and arrangements used are sufficiently simple and internally consistent to make the indices useful, even though users may, with good reason and logic, feel that other terms and arrangements would be preferable for some topics. The vocabulary used is somewhat controlled by the few indexers available at GEO•REF and the intellectual communication amongst themselves. The overall vocabulary and quality control are supervised to a great extent by a Chief Editor. Variations in indexing, however, do exist. No new first- or second-order terms can be introduced by any indexer within any one single year. Naturally, some indexers tend to use new terminology, and then it becomes too difficult to modify the index terms. New terms, mineral species etc., can always be inserted on the third-order level to provide specifity.

Further, the indexer must decide in what general category or subdiscipline a certain article is to be assigned, and there are twenty-one such subdisciplines presently accepted in GEO•REF. (i.e. areal geology, economic geology, extraterrestrial geology, stratigraphy, paleontology etc.)

Due to the expanded services of GEO•REF for providing special bibliographies and subject indices such as those for GSA Bibliography and Index of Geology, Tectonophysics, Geoderma, and Sedimentary Petrology, indexers have to pay special attention to these facts so that a high percentage of recall is achieved. It is a pleasure to report that the Elsevier Publishing Co., Journal of Sedimentary Petrology, The American Museum of Natural History and others are very pleased with the results.

Problems of Indexing and Indexers

We should be grateful that GEO•REF's system of indexing is flexible enough to meet the growing needs of the geologic community without affecting the data bank. However, indexing and indexers meet many problems, some of which have been resolved while others require further attention. We are faced with two main problems, indexing and indexers. I will try to deal with indexing from the indexer's point of view first.

1. Vocabulary Control and the Thesaurus

GEO•REF's vocabulary is not machine controlled. Naturally, indexers would prefer to have devices to control the vocabulary as well as a thesaurus. GEO•REF's indexers are very well aware of the existence of such devices. Joel Lloyd of AGI is involved with the International Union of Geological Sciences project for a multilingual thesaurus of geology. This International Union as well as GEO•REF realize that the introduction of new and sophisticated devices take more time, and more importantly, that such a project is costly and certainly beyond AGI's present financial means. Engineering Index spent aboat 1/2 million dollars to control their thesaurus. Experts in the field suggest an average cost of over $70,000 to design a code and thesaurus maintenance alone. Accordingly, indexers have no other alternative but work with the present methods.

2. Synonyms

Geologists being what they are, are to a great extent fixed with their own attitudes on certain terms. A glance through the AGI's new glossary will give you an idea of the tremendous number of synonyms available and the variations in interpreting certain terms. Accordingly, while indexers try desperately to accomodate the authors, or for that matter, the editors of journals, one has to bear in mind that consistency in the use of terms must prevail since it is a very important factor for the maintenance and efficient use of the data base. As a compromise, GEO•REF indexers will follow main entry of the glossary as a guide for avoiding synonyms.

3. <u>Criticism of Methods of Indexing</u>

Several people, particularly editors interested in obtaining subject indices for their journals, request a subject index either different from the present hierarchical system, or with first- and second-order terms, be in accordance with their needs. (Some are not interested in geographic terms, some are only interested in county names as first-orders, some want the mineral names as first-orders, some want county names or formation names as first-orders, and many such requests are received.) Through bilateral agreements some of these requests can be accomplished by the indexers, as long as any such request will not affect the data base and the index format of the GSA <u>Bibliography and Index of Geology</u>. Further, indexers are constantly faced with drastic changes of indexing methods agreed upon for the simple reason that a new editor has been appointed who wants changes. This puts the indexers and GEO•REF in a dilemma of either carrying out the changes and affecting the data base, or losing a potential client.

4. <u>Scope and Terminology</u>

The guide to indexing has been updated several times to meet the expanding needs in the fields of extraterrestrial geology, engineering geology, soils, geophysics, environmental geology etc. Indexers are constantly discussing the line to be drawn between engineering and engineering geology papers, between geophysics and physics, between environmental geology and environment etc. And since the amount of literature in the earth sciences is expanding daily, plus the fact that indexers have to input major earth science journals and articles in the system before marginal fields, and because of financial limitations and the availability of indexers, many articles and journals cannot be covered. Furthermore, highly technical terms occur in the literature which may be outside the indexer's area of knowledge. Consider, for example, the mass of papers that have been written on the soils, fines, glasses, and fragments from the moon - particularly when these terms are used intermittently or rarely. If an indexer assigns such papers to soils, many geochemists and petrologists would object, yet soil specialists have no other place to look except under the first-order soils.

5. <u>Quality</u>

The quality of indexing largely depends on the article, and naturally on the indexer. No matter what scheme of indexing is being used, if an article is uninformative, vague, misleading, poorly written or badly edited, there is not much that an indexer can do. Indexers cannot and should not read between the lines; they are not supposed to come to conclusions on what may have been in the mind of the author. There are many examples of the above. One particular paper was entitled something like "Precambrian rocks of a certain area." The article contained no abstract, no references, and so the indexer had to read the whole Russian article of 20 pages only to find out that the paper was on petroleum and gas potential and a short description of the Cambrian. In another example, the title mentions a fossil species with no indication whatsoever, even in the article itself, of what that species is or where it is from. Yet the same author fills two pages with paleogeographic conclusions. In all, the indexer spends much time on research and thus affects both the quality and rate of production.

Indexers

Now we come to the problem of indexers. Some contend that indexing be done by subject specialists with post-graduate work and experience. Others contend high school graduates could do the work. I say that geoscience indexing be done by geoscientists who know their subject well. Further, we can perhaps agree that however skilled and experienced an indexer, his final product depends on several factors.

1. Different Approaches

Specificity and depth of indexing amongst indexers vary. Experience has demonstrated that indexers with majors in geophysics tend to be more specific in indexing of geophysical papers than in paleontology. This depth of indexing is controlled to a great extent when checked by the Chief Editor. However, some of the indexing that arrives at GEO•REF is being done by either field indexers (free lance) and some come from overseas (France and Germany) with key words. (Great reliance is given to the indexed documents that come from overseas.)

2. Administrative

Like any other indexing service, GEO•REF is faced with usual problems such as personnel availability, training, monotony of the work (to some), advancement, and above all, security. This is particularly felt all the time at AGI, due to the regrettable fact that GEO•REF is not self-supporting and depends on financial support from the National Science Foundation. We hope this will soon be solved.

Solutions and Recommendations

Indexers at GEO•REF believe in the basic philosophy and methodology applied, but also that great improvements can still be made. This cannot be done by the very few who index but through the interest, encouragement and support shown by all concerned.

Though indexers welcome the introduction of devices in indexing and vocabulary control, they realize by the same token, that the costs to introduce such systems are at the moment inconceivable for GEO•REF unless the government and interested parties take a keen and decisive role in support of the project. Experts who employ these devices tell us that role and link devices, while they solve certain problems like syntactic ambiguities, lower recall and take more time from the indexers. In all, results are generally negative.

While indexers leave such matters to policy makers, they have to continue doing their work. Here are some of the ideas that indexers recommend to solve some of the indexer's and user's problems: (1) Editors and authors could list, under the abstracts in the primary journals, key words that will serve as an aid to the reader and a guide to the indexer. This is being practiced by some journals. (2) Journal editors should better examine author's abstracts and titles, and design them for the reader and the indexer. (3) Assessment of the performance of any indexing service from the community is badly needed. Many geologists and others involved in this matter may have thought of the problem but unfortunately have not expressed their opinion. Geologists should realize that their opinions are highly valued for the success of any information retrieval system. (4) Specialists in certain marginal fields of geoscience could help by giving the indexer some clue as to what the user wishes to recover at a later date. (5) There should be a move towards a more concerted effort to improve cooperation and coordination between editors, librarian, and indexers so as to evolve indexing terms or procedures that are acceptable to all.

Fig. 1

TITLE: Ground water resources; Mercer & Oliver counties, N.D.

CATEGORY: Hydrogeology

INDEX SETS:

1. North Dakota
2. Hydrogeology
3. Aquifers, Mercer County, Oliver County

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1. Ground water
2. Aquifers
3. United States, North Dakota, Sedimentary Rocks, Tertiary

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1. Tertiary
2. United States
3. North Dakota, Mercer County, Oliver County, Tongue River Fm.

---

1. Maps
2. United States
3. North Dakota ....Hydrogeologic

---

25. FORMATIONS

    i.e. Tongue River Formation

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26. COUNTY NAMES

    i.e. Oliver County

Fig. 2

1. **Faults**

    2. **Patterns**

        3. Parallel, en echelon, etc.

    2. **Orientation**

        3. Strike, dip, oblique, etc.

    2. **Mechanics**

        3. Shear, etc.

    2. **Displacements**

        3. Normal, wrench, etc.

    2. **Systems**

        3. Block, grabens, etc.

GEO·REF--THE USER'S VIEW

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ABSTRACT

GEO·REF is investigated from the point of view of the user, ranging from computer personnel to the geoscientist. Problems of implementation discussed include inconsistent mnemonics and repetition of index terms for a single document. Tape subscribers report that a major difficulty in search formulation is the lack of a controlled vocabulary or thesaurus. Retrospective searches were evaluated by users on a four-point scale; precision averaged 51 per cent.

INTRODUCTION

The history of the development of GEO·REF, the international data base of the geological sciences, is well-known to the geoscience community. In 1966 the American Geological Institute (AGI) agreed to produce monthly by computer the Bibliography and Index of Geology Exclusive of North America, published by the Geological Society of America (GSA). Its title was changed to the Bibliography and Index of Geology in 1969, with a concomitant increase in scope; in July of that year, the AGI Board of Directors accepted the request of the Committee on Geoscience Information to establish a "bibliographic reference center for the geosciences." (AGI, 1970) This reference center, to be known as GEO·REF, would use as its base the data on magnetic tape accumulated in producing the Bibliography.

In the early days apparently little, if any, thought had been given to the future use of the data base for retrospective and current literature searching. As Schneider (1971) has pointed out, the AGI is not unique in this lack of foresight:

> . . . many producers of indexed data originally focused the design of their systems on the production of a published product . . . Production of magnetic tapes as a by-product of the publication process, and their use for retrospective searching or for SDI services, was a much later development, almost an afterthought. Yet use of these tapes is growing so rapidly that it may be time to redesign the tape-producing systems, with ease of tape use for SDI services and retrospective searching as the primary consideration, and with publication of abstract and index bulletins or title listing relegated to secondary importance.

In 1971 AGI assumed responsibility for expanding GEO·REF to include information previously covered by various U.S. Geological Survey publications. Since that time GEO·REF has continued to serve as a multipurpose system and the "center for bibliographic control of the geologic literature." (Lloyd, 1973) By Fall, 1973, the data base contained approximately 195,000 references stored on magnetic tape with more than 3000 per month being added. These references include journal articles, symposium and conference proceedings, theses, monographs, and reports.

THE DATA BASE AND ITS IMPLEMENTATION

In order to obtain feedback on implementation and the use of GEO·REF tapes, three subscribers[1] were contacted and asked to respond to some open-ended questions. The experience of The University of Texas at Austin is also incorporated in the present discussion; UT is presently involved in establishing an SDI service using current GEO·REF tapes and creating a retrospective search facility beginning with January, 1973, data.

Mnemonics

The information, where applicable, supplied for each entry in the GEO·REF data base includes the accession number, category number, a complete bibliographic description (authors, original title and its English translation, notes, publication information), index sets, and, in some cases, additional annotative phrases to indicate subject matter. A list of current (post June, 1973) element mnemonics (tags) and descriptions is shown in Figure 1.

The meanings of some of these mnemonics as well as their presence and absence on the tapes have varied somewhat over the years. For example, PC once referred to "Primary Source Content Reference" (information on charts, graphs, maps, etc.), but was changed in 1970 to "Publication Date."[2] AGI's practice of adding and deleting fields from time to time is exemplified by the following:

Deleted from post 1971 tapes	IS	Tape issue number
	VO	Tape volume number
	YR	Year of tape issue
	ST	Subtitle
	UD	Universal Decimal Classification number
Added in June, 1973	CP	Primary journal Coden
	CS	Secondary journal Coden

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[1]Ms. Betty Miyahara, Marathon Oil Company, Littleton, Colorado
Ms. Mary Leham, Geological Survey of Canada, Ottawa, Ontario
Mr. John Edwards, University of Georgia, Athens, Georgia

[2]Letter from Phil M. Johnson to Ronald G. Parsons

AN Accession number (unique 5-digit number preceded by a letter prefix which indicates, for example, whether the item is a thesis, whether it is out of scope for the Bibliography and thus appears only in the data base, whether it was supplied by the American Museum of Natural History, etc.)

CN Category number (21 categories representing various fields of interest within geoscience such as areal geology, geochemistry, paleobotany, etc.)

PS Primary source imprint (type of publication, such as journal article or monograph, and language in which material is written)

SS Secondary source imprint (type of publication)

TI Title of article in original language

TT Translated title

SA Senior author

JA Junior author

CP Primary journal Coden

PJ Abbreviated journal name (unless item being described is a thesis, in which case PJ is type of degree)

PV Issue, volume, and page numbers plus content notes relating to illustrations, etc. (unless item being described is a thesis, in which case PV is the year thesis was granted)

PC Publication date (unless item being described is a thesis, in which case PC is the degree-granting institution)

SY Symposium information

CS Secondary journal Coden

SJ Abbreviated secondary journal name

SV Issue, volume, and page numbers for secondary journal

SC Publication date of secondary journal

NO Additional notes (material of interest not covered by other elements such as name of a special project of which the material being described is a part)

KW Keywords (phrases which supplement title information)

T1 First level index term

T2 Second level index term

T3 Third level index term (several third level terms may be present)

Fig. 1--Element Mnemonics

Thus, the programmer is forced to be "year conscious" when processing GEO·REF tapes--an annoying but manageable problem.

More serious is AGI's practice of letting the meaning of tags vary according to the type of publication, as shown in Figure 1 for PJ, PV, and PC. Thus, the attribute of one tag may depend on the value of another tag; the tape processing program can no longer be value independent if one wishes to be able to search on these particular fields. According to Mr. Chris Yurkanan, in charge of GEO·REF implementation at The University of Texas at Austin, UT's solution will be to use these fields only for printing purposes rather than for retrieval on specific values.

Indexing

Of particular interest to the user of any data base is the subject classification or indexing scheme employed. Let us examine more closely that of GEO·REF. Recall that in 1967 the sole aim of AGI was to produce the Bibliography and Index of Geology Exclusive of North America. Ochs[1] has pointed out that the problem was considered to be simply one of matching the content and format of the Bibliography.

Evidence of this correspondence of GEO·REF to the Bibliography is the rather unusual and complex approach taken for subject analysis--the three levels of index terms shown in Figure 1 as T1, T2, and T3, are familiar to all users of the printed Bibliography. A document may be indexed by several of the three-level "index sets" with increasing specificity in each set from first to second to third levels. A particular term may be used in more than one index set for a single document and may appear at different levels. The index sets for the reference shown in Figure 2 illustrate this repetition. Although standard lists of terms are used by AGI indexers, considerable latitude is allowed in adding terms on the third level; these new, uncontrolled terms do not appear in the GEO·REF Guide to Indexing (AGI, 1973), but may be discovered by a keyword listing by computer of all terms used.

Another implementation problem relates to the repetition among index terms. There is general agreement among GEO·REF tape users that, for computer implementation, no special designation or consideration of levels should be made. In other words, all terms at all levels are simply treated as keywords attached to the document. Care must be taken, therefore, to avoid loading duplicate keywords for a document. For example, one might use a stop list whereby each new term is compared to terms already posted for that document; if it already appears on the list it is not added.

One could also question the desirability of this indexing structure from the point of view of the printed Bibliography. GSA might well consider theoretical and practical aspects of their scheme and introduce some

[1]Gerald L. Ochs, Professional Staff Associate, GEO·REF; interviews with Mr. Ochs were held at AGI, Washington, D.C., September 19-20, 1973.

E73-15207 Seed, H. Bolton. "The Slide in the Lower San Fernando Dam" [abstr.] in Investigations of the San Fernando Earthquake; National Conference on Earthquake Engineering, Program and Abstracts of Papers, p. 24, Earthquake Eng. Res. Inst., Los Angeles, 1972.

T1 California
T2 Engineering geology
T3 Earthquakes, Los Angeles County, Lower San Fernando Dam

T1 Engineering geology
T2 Earthquakes
T3 Effects, dams, landslides, California

T1 Earthquakes
T2 United States
T3 California, San Fernando, 1971, effects

Fig. 2--Index Sets for a Typical Entry in GEO·REF

changes. Assuming, however, that the present system, including repetition of terms, is to be retained indefinitely, what are some alternatives for AGI? Ochs has suggested that an obvious first step would be to "clean up" inconsistent and extraneous terms which appear all too frequently in the 1967-1970 file. This file consists of approximately 80,000 references indexed by about the same number of keywords; it includes primarily material published from 1967 through 1970 with the addition of several thousand older references. Selections from the keyword listing of this file appear in Figure 3; some suggestions for its improvement are:

1) Use either singular or plural form but not both; for example, material is presently indexed under both CONGLOMERATE and CONGLOMERATES, SEDIMENT and SEDIMENTS, CYCLE and CYCLES.

2) Avoid use of very similar terms, for example, CASPIAN AREA, CASPIAN SEA AREA, CASPIAN REGION, CASPIAN SEA REGION.

3) Eliminate meaningless terms such as CURRENT WORK and OCCURRENCE.

4) Remove long phrases such as CALCULATION WITH INACCURATE DATA and CHANGE OF BIOTITE TO CHLORITE AND MUSCOVITE.

Fortunately, improvements in indexing have been made in files dating from 1971; the number of keywords used has been cut to approximately 65,000, for example. That much is left to be accomplished, however, is obvious when one examines a keyword listing from 1972 data and sees such terms as APPLICATION and APPLICATIONS, AUSTRALSIA[sic], and ALFRED.

A. G. WERNER
ABRAHAM GOTTLOB
ABRAHAM GOTTLOB WERNER
ABRAHAM GOTTLOB WERNER'S SYSTEM
ABRAHAM WERNER CONCEPTS
ABRAHAM WERNER CONTRIBUTIONS
ABRAHAM WERNER CONTRIBUTIONS IN USSR
ABRAHAM WERNER'S STUDENTS' CONTRIBUTIONS

BAIKAL
BAIKAL DEPRESSION
BAIKAL HIGHLANDS
BAIKAL MOUNTAIN REGION
BAIKAL MOUNTAINS
BAIKAL RANGE
BAIKAL REGION
BAIKAL REGION-ANGARA-LENA DEPRESSION
BAIKAL REGION-TRANSBAIKALIA
BAIKAL REGION-WESTERN TRANSBAIKALIA

BAR-BARRIER ISLAND SANDS
BAR-BARRIER ISLAND SANDS PROPERTIES

BASED ON POLLEN DIMENSIONS
BASED ON SKELETAL ELEMENTS

BEACH SAND
BEACH SANDS

BERING STRAIT
BERING STRAITS

BRITTLE FEATURES
BRITTLE FRACTURE
BRITTLE FRACTURE PROPAGATION
BRITTLE MATERIAL
BRITTLE MATERIALS
BRITTLE ROCK
BRITTLE ROCK FAILURE
BRITTLE ROCKS

BY NUCLEAR EXPLOSION

CHLORITE COMPOSITION
CHLORITE CONTENT
CHLORITE INCLUSIONS
CHLORITE MINERAL
CHLORITE SCHIST
CHLORITE SCHIST IN BAUXITE

Fig. 3--Selected Terms from AGI Keyword List, 1967-1970

Thus, GEO·REF tapes are more expensive and difficult to process than those of other data bases with standardized and unique tags and with non-repeating sets of keywords used to describe a document. The SPIN (Searchable Physics Information Notices) data base of the American Institute of Physics, for example, employs unique six-character hierarchical classification codes to characterize documents, with each code representing a class or term. For greatest specificity one searches on the complete code; if a broader area is desired, one may search on part of the code, the first two letters for example. The _Psychological Abstracts_ data base includes both codes and corresponding English text on tapes; thus one can search on the code and, when a "hit" occurs, print out the appropriate text for convenience of the user. All of these data bases employ a controlled thesaurus and provide a thesaurus tape to subscribers.

USER REACTIONS

In order to investigate the capability of GEO·REF for retrospective searching, queries were run on the complete data base as implemented by AGI on INQUIRE. Searchable fields on this data management system include date of publication, index terms, author, and accession number. In addition, any field may be scanned for specific combinations of words. Nine geoscientists at The University of Texas at Austin voluntarily participated in this project. Each was asked to state a research topic or topics of current interest, on which he would be willing to evaluate retrieved document surrogates. The topic could be as broad or as narrow as he wished.

These queries were translated into GEO·REF index terms by Mr. Gerald L. Ochs, who is an experienced indexer and user of the data base and a geologist by training. When setting up searches, he utilizes his very extensive knowledge of the indexing terminology, supplemented by: (1) keyword listings with number of occurrences for each term; and (2) standard printed texts, glossaries, and treatises, for example, _Dana's Manual of Mineralogy_, _Lexique Stratigraphique International_, _Treatise on Invertebrate Paleontology_, and _Webster's Third New International Dictionary_ (for family, genus, and species names). Recall that the third level of index terms is relatively uncontrolled. Thus it is helpful to try to "second guess" the indexer by using these printed tools to supplement the alphabetical keyword listings of 60,000-80,000 terms. All of the queries resulted in Boolean expressions. For example, a request for references on "Tertiary and Quaternary mammals of South America" (Query F) became:

> MAMMALIA and (TERTIARY or QUATERNARY or PLEISTOCENE or MIOCENE or PLIOCENE) and (SOUTH AMERICA or VENEZUELA or COLUMBIA or BRAZIL or PERU or CHILE or ANDES or ARGENTINA or BOLIVIA or ECUADOR or FRENCH GUIANA or GALAPAGOS ISLANDS or GUYANA or PARAGUAY or URUGUAY or SURINAM)

GEO·REF users agree that a major problem in search formulation is the lack of a thesaurus and controlled vocabulary. As pointed out by the Marathon Oil subscribers who offer both an SDI service and retrospective searching on post 1970 data:

> The main difficulty in formulating the search arises from the fact that there is no controlled vocabulary or thesaurus for GEO·REF. We partially solve this problem by generating - from the master record tapes themselves - a "term guide" or alphabetical listing of terms that have been used in indexing the records. This term guide must be consulted in order to know if a term can be used in a search strategy . . . even with the term guide the generating of useful descriptors depends primarily on the imagination of the searcher. This means that the immediate user of GEO·REF must either be very familiar with the nomenclature of the geosciences or have some other specialized thesaurus (with good "see also" references) available to him.

In addition to the keyword approach employed by all tape users, the University of Georgia has created a "concept listing" of broad concepts with associated relevant search terms, based on their experiences in query processing. This hierarchical treatment, which even includes scope notes, has proved useful in formulating searches.

After the searches were completed for the nine geoscientists at The University of Texas at Austin, each was asked to evaluate his output based on a document surrogate of: author(s), source, original and translated title, and keywords on which the item was retrieved. Results of this evaluation are shown in Table 1. Note that a four-point scale was used.

Eight of the eleven searches were successful from the point of view of the users, who felt that such a retrospective search capability would be a valuable aid to research efforts. The results of the three unsatisfactory ones were examined in order to ascertain the problems. Two of these queries were very narrow, and the requesters expected few relevant references:

> Query B--vertebrate paleontology of the Texas Permian, specifically the Wichita Group, Admiral Formation, Geraldine Bone Bed
>
> Query H--Amynodonts

Here the decision was arbitrarily made to run relatively broad searches, resulting in lowered precision. Recall, defined as (relevant items retrieved)/(total relevant items in the data base), was probably quite high, however. These two participants had the feeling that too much irrelevant material was retrieved and would have preferred higher precision, which would have been easy to accomplish in both cases.

The third of the three was a complete failure:

> Query E--replacement of evaporite minerals by silica

TABLE 1

RETRIEVAL STATISTICS FOR QUERIES

Query	Total Items Retrieved	Results of User Evaluations				Precision[a] %
		Relevant	Of Marginal Interest	Can't Be Evaluated	Irrelevant	
A	85	46	18	8	13	54
B	23	7	1	4	11	30
C	68	50	11	7	0	74
D	51	42	5	3	1	82
E	61	0	0	3	58	0
F	44	42	2	0	0	95
G	709	289	66	126	228	41
H	36	1	0	0	35	3
I	68	55	0	13	0	81
J	138	54	34	8	42	39
K	219	146	60	12	1	67

[a]Calculated on the basis of (relevant items retrieved)/(total items retrieved)

The geologist was able to suggest many relevant articles which should have been retrieved; these were located in the Bibliography and their index sets compared to the search strategy. It appeared that the only way to retrieve the relevant references for this query would have been to retrieve all items indexed by EVAPORITES or by CHEMICALLY PRECIPITATED ROCKS, since terms such as REPLACEMENT or ALTERATION were omitted from the sets, and the material replacing the evaporites (silica) was also not used as an index term.

184 items, or 12 per cent of the total of 1502 retrieved, could not be evaluated. This figure provides an interesting contrast to that of a similar experiment with the SPIN data base where less than one per cent of the retrieved surrogates could not be evaluated. (Bichteler, 1973) The reason for the difference, obviously, is that SPIN provides abstracts. GEO·REF users were unanimous in their desire to have abstracts or annotations included to aid in evaluation.

Other reactions from the users included strong appreciation of the translated titles and mild irritation over errors such as duplicate entries in the data base or incomplete information input for some references. Several were able to suggest references which they thought should have appeared in their output; upon examination of the Bibliography it was found that most of these, as in the case of Query E, had simply not been indexed in such a way as to be retrievable by the search strategy. A few, however, of appropriate type and date could not be located in the Bibliography. The question of completeness of coverage of the literature by AGI was thus raised.

Mr. Clarence Sturdivant has pointed out that GEO·REF users at Marathon Oil Company have also been concerned with this problem. Marathon produced a printout of all GEO·REF entries for 1972 by source. Several apparent gaps appeared in the list, particularly in publications from state geological surveys. Likewise, Ms. Mary Scott became aware of this situation when she examined the results of a GEO·REF search run for the North Dakota Geological Survey; many North Dakota publications which should have appeared were absent.[1] She investigated and discovered that AGI had inadvertently been removed from the Survey's mailing list and had not been receiving their publications! These examples illustrate that AGI's practice of simply relying on state surveys to forward their own publications may be inadequate.

CONCLUSION

Although this paper has presented some criticisms of the GEO·REF data base, it seems appropriate to conclude on a more encouraging note, given that the majority of geoscientists are pleased with the results of their SDI programs and retrospective searches. Assuming that adequate funding can be maintained, one can, in fact, predict an increasingly bright future for GEO·REF.

---

[1]Mary Scott, conversation held during meeting of the Geoscience Information Society, Dallas, Texas, November, 1973.

Some interesting innovations have been proposed, for example, the utilization of a grid system whereby a geographic name would be automatically translated into a grid reference for purposes of retrieval by a very specific locality. Mr. Joel Lloyd of AGI has suggested a system of worldwide indexing with the cooperation of many countries; AGI might become a training center for foreign indexers and serve as a coordinating agency.

Ochs has encouraged wider use of the data base for a variety of purposes, such as supplying listings of articles of interest to attendees at conferences. An example of this type of publication is GEO·REF's A Reference Listing to Stratigraphic Palynology, produced for the 1972 annual meeting of the American Association of Stratigraphic Palynologists. In addition to producing the Bibliography and Index of Geology, GEO·REF is, of course, already used for compiling special subject bibliographies such as Bibliography of Coal in Kentucky and Bibliography of Kansas Geology, as well as for providing indexes to several geological journals. The amazing increase in the number of searches conducted by AGI recently, shown in Figure 4, is evidence of the geoscience community's increasing reliance upon GEO·REF as a means of retrospective searching. Furthermore, the 1973 on-line implementation of GEO·REF by System Development Corporation may have implications for increased use of the data base, both for SDI and for retrospective searches.

Several recommendations for GEO·REF emerge from this study. For ease of data base implementation, standardized and unique mnemonics should be employed; the present variation of meaning by type of publication appears to have no reasonable basis. Hopefully, the current fields represent final decisions by AGI.

Specific suggestions have been outlined for improving the indexing used in GEO·REF. In addition, the development of a standardized thesaurus for controlled indexing terminology seems essential, particularly in light of the possibility of using cooperative foreign indexing. GEO·REF subscribers should, of course, be supplied a thesaurus tape. Further, basic questions concerning the indexing philosophy itself should be considered. Ochs has proposed one significant change--the use of longer annotations and less in depth indexing. For example, the term FRAMEWORK SILICATES might be eliminated as an index term, but appear in the annotation. Thus, the structure of the index evidently preferred by GSA for the Bibliography would be retained, with improvement of the data base for the GEO·REF user. Longer annotations or the eventual use of abstracts would serve a dual purpose: (1) user evaluation of retrieved surrogates would be easier and more accurate; and (2) the search capability would be enhanced, i.e., one could search on words or specific combinations of words appearing in the abstract.

Ensuring complete coverage of the geological literature should be a major concern of AGI. Perhaps a more active acquisitions program or, at least, a system of claiming missing publications should be instituted. Relying on many agencies to forward publications is risky at best.

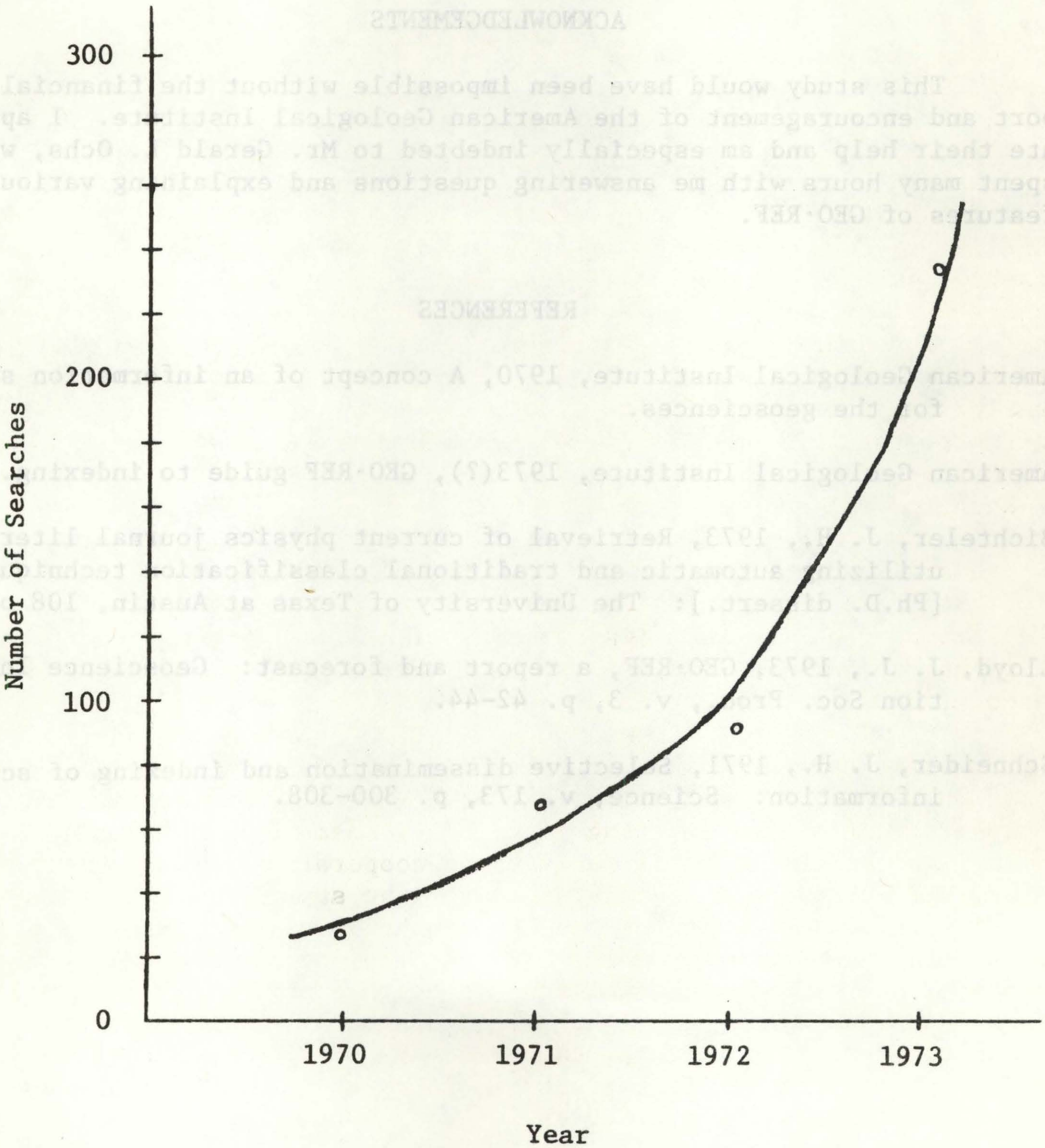

Fig. 4--GEO·REF Searches by AGI

Finally, when considering changes and improvements in GEO·REF, the geological community should keep in mind the significance and potential of the data base as a means of automatic retrieval. Requirements, real or imagined, necessary to produce various printed publications should not be allowed to dominate the system.

ACKNOWLEDGEMENTS

This study would have been impossible without the financial support and encouragement of the American Geological Institute. I appreciate their help and am especially indebted to Mr. Gerald L. Ochs, who spent many hours with me answering questions and explaining various features of GEO·REF.

REFERENCES

American Geological Institute, 1970, A concept of an information system for the geosciences.

American Geological Institute, 1973(?), GEO·REF guide to indexing.

Bichteler, J. H., 1973, Retrieval of current physics journal literature utilizing automatic and traditional classification techniques [Ph.D. dissert.]: The University of Texas at Austin, 108 p.

Lloyd, J. J., 1973, GEO·REF, a report and forecast: Geoscience Information Soc. Proc., v. 3, p. 42-44.

Schneider, J. H., 1971, Selective dissemination and indexing of scientific information: Science, v. 173, p. 300-308.

GEOWRITING

a guide to writing
editing, and printing
in earth science

edited by: Wendell Cochran
Peter Fenner
Mary Hill

ABSTRACT

With an eye toward better information transfer, we describe the process that begins with the germ of an idea and ends with formal publication.

Scientific research and data gathering are followed by literature searches, then by data synthesis. This should result in organization for paper writing. Many resources are available beyond the data-gathering stage. An abstract is written and then the title is selected.

Editorial chores are manifold, dealing with all four kinds of style (literary, editorial, usage, typographic), bibliographic citations, and culminating in a refereeing procedure to which editor, publisher, and author must react.

Publication details may be of importance to authors, and must be important to editors. Hot type, cold type, manual or automatic typesetting, letterpress, offset, or other production processes, as well as paper, inks, binding, and run size help determine production costs, hence, to set some style details. Format of publication can be an important determinant to information retrieval.

Standards for terminology are important, as are standards

for, and use of, understandable abstracts and titles. These should be generated with a clear understanding of user needs and the trend toward machine (computer) processing of data.

Just after World War I, according to Alvin M. Weinberg, the literary style of American scientists changed drastically -- and for the worse. Before the war, he said, 'the style was metamorphic and personal, with many I's and few passives. After the war, it became nonfigurative, passive, and impersonal -- and, to my mind, less intelligible.' [Quoted in *International science & technology*, March 1964, p. 13.]

Note that many geologists today seem to agree -- they argue that geologists won't read and can't write, and as 'good' examples they quote people like Davis, King, and Powell, all from the 19th century.

*Item: in 1970, of more than eleven hundred geologists who answered a survey, 95% said that technical writing is the single most important technical skill. Asked to judge their fellow geologists' professional skills, they invariably gave technical writing a low rank. [*Requirements in the field of geology*, edited by Robert G. Reeves & David M. Delo. CEGS Program Publication 5, American Geological Institute (1970). 38 p.]

*Item: last spring, answering another survey, employers generally agreed that their new employes share a glaring weakness: they can't write well.

During the last 2 years, Mary Hill, Peter Fenner, and I found the same thing while editing a little book called Geowriting [Geowriting: a guide to writing, editing, and printing in earth science, edited by Wendell Cochran, Peter Fenner, and Mary Hill. CEGS Program Publication 17, American Geological Institute (1973). 80 p.] We found that few professional geologists are professional writers. Worse, their inefficiency as writers detracts from their effectiveness as geologists.

None of that is new. What's more, our conclusions are mostly subjective -- we believe the picture would look worse if we had used the standard tests of professional journalists and linguists -- if we had calculated readability scores and fog indexes and shown, in numbers and not adjectives, how badly many geologists write.

The usual cure proposed for bad writing is a course in good writing. So far, so good. But we believe that writing cannot stand alone. We believe that geologists must go much further, that they must use the systems approach and treat writing, editing, and printing as a single interlocking entity.

Easy writing, it has been said, means damned hard reading. It also means hard editing, and hard printing. Neglect of any of these is likely to mean trouble for researcher, writer, editor, typesetter, printer, designer, artist, librarian, and reader.

Consider an author -- let's assume that he does his work well in gathering data, doing research, and synthesizing or analyzing his data (that is, that he is a competent geologist). Let's assume further that he organizes his material well, writes clearly, abstracts informatively, and chooses a title with keyword requirements in mind.

Still, how much trouble he can cause: if he writes too long for the journal he selects; if he calls, needlessly, for symbols not available in the type shop; if he does not illustrate his article properly (because he was told -- 20 years ago -- that zinc plates are expensive); if he unthinkingly plans for a multicolor map, does not know how to mark galley proofs, forgets to check spellings and arithmetic; and if he finally wants to make extensive changes in page proofs.

Editors commit sins as bad or worse. They may inadequately instruct the author, abuse the referee system, and fail to understand the intricacies of the 4 kinds of style (literary, editorial, usage, typographic) or bibliographic citations. Editors may not know how to help the printer (not to mention the author and reader) by choosing the 'best' production processes -- typesetting, letterpress or offset lithography, binding and so on, plus such matters as design, paper, inks, packaging, and mailing.

All these things interconnect. They work backward as well as forward; for example, the ultimate design may dictate use of a type font lacking certain symbols, and therefore determining the style for abbreviations.

Here let us pause and take stock. We are not urging every geologist to get a degree in journalism, or to try to become a professional writer, editor, and printer as well as a professional scientist.

We do urge every geologist to treat the entire range of information transfer -- from mind to mind -- as a single process.

SYMPOSIUM

NEW AND UNUSUAL PUBLICATIONS IN GEOSCIENCE

ENVIRONMENTAL GEOLOGY: A SELECTED BIBLIOGRAPHY

Vivian S. Hall
Geology Librarian, University of Kentucky

ABSTRACT

Much interest has been aroused in the area of ecology and the environmental disciplines in this decade. Due to widespread social and economic growth throughout the world, the deterioration of the environment and the exploitation of natural resources has become an international dilemma. If these problems are to be alleviated, steps must be taken to educate individuals on an international level in a way that will influence the habits, activities, and programs of this and future generations in the fields of research and treatment.

Currently a large amount of literature is being published in the environmental geology subject area. This paper is an effort to pull together this literature by listing 1973 and retrospective titles, primarily in the earth sciences. However the interaction between man and the environment is interdisciplinary, thus there are titles of interest in the subject areas of geography, urban-planning, chemistry and engineering. Included are publications from the professional societies, both domestic and international, primary journals, the United States governmental agencies and the state geological surveys.

The state geological surveys are attempting to cope with environmental problems in their particular state by working with planning groups, and state and federal agencies. Publication of the findings of this research and mapping is placed in new series within the state geological survey publication system.

Throughout all history the library has been seen as a vital part of civilization and its story has become interwoven with that of the peoples it has served. The nature of the services which the library and the librarian provides has always been determined by the needs of the people and these needs have been as diverse as the people served. It may seem that in the days of early civilization when only members of the priesthood were literate, that the task of the librarian was simple. Today in the developed countries essentially entire populations are literate and the spectrum of knowledge is broad. Technology as well as increasing awareness opens up new areas of interest and concern at a rapid rate. The librarian must keep searching for ways in which the flow of information and human knowledge can be brought to serve humanity.

Information is needed to guide or determine the relationship between past or former actions and their effects on the future. Information networks, and information resources must be sensitive to the needs of men, to the requirements of our cultures and to our common problems. The interest in this decade in the area of ecology and environmental quality is the rationale for this paper and for the publication on which I am working. It is one librarian's effort to make a contribution in the above frame of reference.

Widespread economic growth as well as population increase throughout the world has forced the recognition of the dangers of uncontrolled exploitation of natural resources and the deterioration of our total environment. If the problems are to be alleviated, there must be a worldwide education of individuals in a way that will influence the habits, activities and programs of this and future generations in their interactions with our environment. A "quality" evaluation of our lives must take place.

There is no doubt that the answers to the problems will come out of interdisciplinary efforts--and international interdisciplinary efforts at that. The question facing many libraries today is how best to make available information, old and new, from many traditionally separated fields of knowledge, so that it can be focused on environmental problems.

As a geology librarian I could not help but be aware of the large amount of information in "my" library that has a bearing upon the worldwide dilemma. The obvious answer seemed to be an interdisciplinary bibliography which would bring together titles relating to the environmental and management problems which plague the world today. The growing importance of geological factors that must be considered in this period of rapid metropolitan growth and expansion stresses the need for a one volume work specifically compiled to supply background data for research which may solve the problems.

For some time I have been working on such a bibliography, which is a subject oriented interdisciplinary work entitled "Environmental Geology, a Selected Bibliography." The titles listed in this international bibliography will range from introductory works to highly technical ones. Included are reference works, bibliographies, dictionaries, and handbooks as well as basic research reports and case studies.

Much of this literature in the area of environmental geology is current, but there are many earlier publications concerning the geological environment yet not labeled with the current terminology. This work is an effort to list 1973 and earlier titles in the discipline of the earth sciences including publications from the American Association of Petroleum Geologists, the Geographical Society of America, the Geological Society of America, the International Association of Scientific Hydrology, the International Society for Rock Mechanics, the United Nations Educational, Scientific, and Cultural Organization, Engineering Geologist and the American Geophysical Union.

The ten major subject categories with subheading under each are as follows:

1. Resources - raw materials-energy sources-water	6. Land use planning
2. Geologic hazards	7. Waste
3. Pollution	8. Legal aspects
4. Environmental impact	9. Water management
5. Urban geology	10. Weather modification

Naturally, some titles fit into two or more subject categories and these will be listed in each area. To date there are more than 2,200 titles with complete bibliographical data for each.

The purpose of this project is to publish a monograph citing publications in subject order to meet the needs of environmentalists, urban planners, geologists, federal and state agencies, and conservation groups who are doing research and working to solve environmental problems.

Major tools and sources used to compile this bibliography are:

1. U.S. Geological Survey. Publications of the Geological Survey 1879-1961. Washington, Government Printing Office, 1964. 457 pages. 1962-1970 publ'd 1972, 1971 annual publ'd 1972, 1972 annual publ'd 1973, 1973 monthly listings.

2. Bibliography of North American Geology, 1919-1928 cumulative with annuals: 1929-1970 and 10 year cumulative: 1929-1939, 1940-49, 1950-59. Washington, Gov't Printing Office. Ceased publication 1970.

3. Geological Society of America, Bibliography and Index of Geology Exclusive of North America. v.1-v.32; 1933-1968. New York, Geological Society of America. Annual cumulative index and cumulated bibliography issued with vols. for 1967-68. Continued by Bibliography and Index of Geology. Boulder, Colorado.

4. Geological Society of America in cooperation with the American Geological Institute. Bibliography and index of geology. v.33- Jan. 1969- Annual Cumulative index and cumulative bibliography. Monthly abstracts supplement v. 31, no 1, Jan.- 1967- (international coverage). Continues Bibliography and Index of Geology Exclusive of North American citations following the phasing out of USGS Bibliography of Geology of North America in 1970. Geological Society of America/American Geological Institute. Boulder, and AGI in Washingotn, D.C.

5. U.S. Geological Survey, Geophysical Abstracts, no. 1 -299; 1929-1971. Washington. Ceased Publication.

6. Bibliographie des sciences de la terre. Cahier F: Tectonique et geophysique. no. 1-, Feb. 1968- (France, Bureau de recherches geologiques el minieres). Monthly issues and an annual cumulative issue.

7. Ward, Dederick C. and Marjorie W. Wheeler, Geologic reference sources; a subject and regional bibliography to publications and maps in the geological sciences. With a section on geologic maps by Mark W. Pangborn, Jr. Metuchen, New Jersey, Scarecrow Press, 1972. 458 pages.

8. Books in Print. V.1 authors, V.2 titles, V.3 supplement, Cumulative author, title, and subject for 1972-73. New York, R.R. Bowker Company, 1972.

9. Faculty and knowledgable experts in the field.

10. Advertisements from reputable publishers, letters and acquisitions received in the Geology Library at the University of Kentucky during the last year as well as a search for the retrospective titles in the public catalog of the library which applied to the subject area.

11. State Geological Survey Publications and current correspondence from the geological surveys. The state geological surveys are attempting to cope with environmental problems in their particular state by working with planning groups, and state and federal agencies. Publications of this research and mapping is placed in new and old series within the state geological survey publication system.

Many state surveys have recently changed addresses and for this reason, a sheet with each state survey's name and mailing address and a listing of the environmental titles of each state have been copied for your use.*

Documentation for this bibliography is almost completed and it should be ready for the printer by March 1974.

[1] A young Navajo Indian speaking of the environmental crisis asks an important question, "When the last of the coal is gone, the plants will stop, the money will stop and then the land will be dead. The sun will be dim. The water will stink. Will the grass be gone? Will the people still know how to walk in beauty?"

[1]Energy, (Environmental Action Papers no. 1,) [1973] Denver, Colorado. Environmental Action Committee, University of Colorado. Unpaged.

* Addendum I and II

ADDENDUM I

STATE GEOLOGICAL SURVEY ADDRESS*

November 1973

Publication Sales Office
Geological Survey of Alabama
P.O. Drawer O
University, Alabama 35486

Department of Natural Resources
Division of Geological Survey and Geophysical Survey
Box 80007
College, Alaska 99701

Arizona Bureau of Mines
University of Arizona
Tucson, Arizona 85721

Arkansas Geological Commission
State Capitol
Little Rock, Arkansas 72201

California Division of Mines and Geology
1416 Ninth Street, Room 1341
Sacramento, Calif. 95814

Connecticut State Library
231 Capitol Avenue
Hartford, Conn. 06115

Colorado Geological Survey
Department of Natural Resources
1845 Sherman Street
Denver, Colo. 80203

State of Delaware
Delaware Geological Survey
University of Delaware
Newark, Delaware 19711

*Updated annually in Association of American State Geologists. State Geologists Journal. Place of publication varies with secretary and treasurer's address.

Florida Department of Natural Resources
Bureau of Geology
P.O. Drawer 631
Tallahassee, Florida 32302

Department of Natural Resources
Earth and Water Division
Agriculture Laboratory Building
19 Hunter Street, S.W.
Atlanta, Georgia 30334

State of Hawaii
Department of Land and Natural Resources
Division of Water and Land Development
Honolulu, Hawaii 96809

State of Idaho
Bureau of Mines and Geology
Moscow, Idaho 83843

Illinois State Geological Survey
Urbana, Illinois 61801

Publications Section
Geological Survey
Department of Natural Resources
Indiana University
611 North Walnut Grove
Bloomington, Ind. 47401

Iowa Geological Survey
16 W. Jefferson
Iowa City, Iowa 52240

State Geological Survey
1930 Avenue "A", Campus West
University of Kansas
Lawrence, Kansas 66044

Kentucky Geological Survey
University of Kentucky
307 Mineral Industries Building
Lexington, Kentucky 40506

Louisiana Geological Survey
Geology Building, Louisiana State University
P.O. Box G, University Station
Baton Rouge, Louisiana 70803

Maine Geological Survey
Forestry Department
Augusta, Maine 04330

Maryland Geological Survey
214 Latrobe Hall
The Johns Hopkins University
Baltimore, Md. 21218

New Massachusetts Geological Survey
Mr. Jose Sinotte, State Geologist
Department of Public Works
93 Worchester Street
Wellesley Hill, Mass. 02181

Department of Natural Resources
Stevens T. Mason Building
Lansing, Michigan 48926

Minnesota Geological Survey
1633 Eustis Street
St. Paul, Minnesota 55108

Mississippi Geological, Economic, and Topographical
Survey
2525 North West Street
P.O. Box 4915
Jackson, Mississippi 39216

Missouri Geological Survey and Water Resources
Box 250
Rolla, Missouri 65401

Montana Bureau of Mines and Geology
Room 203-B, Main Hall
Montana College of Mineral Science and Technology
Butte, Montana 59701

Nebraska Geological Survey
Conservation and Survey Division
113 Nebraska Hall
University of Nebraska
Lincoln, Nebraska 68508

Nevada Bureau of Mines
University of Nevada
Reno, Nevada 89507

New Hampshire Department of Resources & Economic Development
Division of Economic Development
State Office Building
Concord, New Hampshire 03301

Map & Publication Sales Office
Bureau of Geology
Trenton, New Jersey 08625

Publications Room 62
New Mexico State Bureau of Mines & Mineral Resources
Socorro, New Mexico 87801

The University of the State of New York
The State Education Department
New York State Museum & Science Service
Albany, New York 12224

Division of Natural and Mineral Resources
P.O. Box 27687
Raleigh, North Carolina 27611

North Dakota Geological Survey
University Station
Grand Forks, North Dakota 58201

Department of Natural Resources
Division of Geological Survey
Fountain Square
Columbus, Ohio 43224

Oklahoma Geological Survey
The University of Oklahoma
830 Van Vleet Oval, Room 163
Norman, Oklahoma 73069

Department of Geology & Mineral Industries
1069 State Office Building
Portland, Oregon 97201

Pennsylvania Geological Survey
Main Capitol Annex
Harrisburg, Pennsylvania 17120

Rhode Island Development Council
Roger Williams Building
Hayes Street
Providence, Rhode Island 02904

Division of Geology
State Development Board
P.O. Box 927
Columbia, South Carolina 29202

South Dakota Geological Survey
Science Center, University
Vermillion, South Dakota 57069

Tennessee Division of Geology
G-5 State Office Building
Nashville, Tennessee 37219

Bureau of Economic Geology
The University of Texas
University Station, Box X
Austin, Texas 78712

Utah Geological and Mineralogical Survey
W.P. Hewitt, Director
103 Utah Geological Survey Building
University of Utah
Salt Lake City, Utah 84112

Vermont State Library
Montpelier, Vermont 05602

Virginia Division of Mineral Resources
Box 3667
Charlottesville, Virginia 22903

Department of Natural Resources
Bert L. Cole, Commissioner of Public Lands
Division of Mines & Geology
Olympia, Washington 98504

West Virginia Geological Survey
P.O. Box 879
Morgantown, West Virginia 26505

University of Wisconsin-Extention
Geological and Natural History Survey
1815 University Avenue
Madison, Wisconsin 53706

Geological Survey of Wyoming
Box 3008, University Station
University of Wyoming
Laramie, Wyoming 82070

ADDENDUM II

GEOLOGY LIBRARY
Bowman Hall
University of Kentucky
LEXINGTON, KENTUCKY 40506

September 6, 1973

Selected Environmental Titles
Published or In Process by State Geologic Surveys

Alabama. Geological Survey.

Atlas Series

AS1. La Moreaux, P.E. and others, 1971, Environmental geology and hydrology, Madison County, Alabama, Meridianville quadrangle. 5.00.

Map Abstracts

MA1. Lineback, Neal G., C. Tim Taylor, and Neill E. Turnage, 1972, The map abstract of population and housing: Alabama, 1970. 148p. 3.00.

Alaska. Department of Natural Resources. Division of Geological and Geophysical Surveys.

Bulletins

No.8. Bureau of Mines' finds prevent pollution, August 1973. p.4.

Arizona. Bureau of Mines.

The state has no publications in print or in process on the subject.

Arkansas Geological Commission.

Water Resources Circular

No.10. Patterson, James L., 1967, Storage requirements for Arkansas streams. 35p. 65¢.

Water Resources Summary

No.5. Halberg, H.N. and J.W. Stephens, 1965. Use of water in Arkansas. 12p. 40¢.

California. Division of Mines and Geology.

Bulletins

No.198. Alfors, John T., and others, 1973, Urban geology: master plan for California. 112p.

California Geology
(formerly Mineral Information Service)
The monthly publication of the California Division of Mines and Geology contains articles on earthquake mechanics and accounts, floods, landslides, subsidence, urban geology, volcanics, and many miscellaneous environmental geology articles.

Colorado Geological Survey.

Environmental Geology Series

1. Hamilton, J.L. and W.G. Owens, 1972, Geologic aspects, soils, and related foundation problems, Denver metropolitan area, Colorado. 1.00.

Special Publication Series

1. Proceedings of the Governor's Conference on Environmental Geology, 1970. 1.00.
2. Pearl, R.H., 1972, Geothermal resources of Colorado. 1.00.
3. 1972 summary of coal resources in Colorado, 1973. 1.00.

Colorado School of Mines.

Quarterly

Vol.68, no.2. Future energy outlook: 1972 Proceedings of the Mineral Economics Symposium, and 1968 Proceedings of the Fuels Symposium (AAPG), 1973. 6.00.
Vol.68, no.3. Geology for planning: a review of environmental geology, 1973. 6.00.

Connecticut. Geological and Natural History Survey.

The state has no publications in print or in process on the subject.

Delaware Geological Survey.

Open File Reports

Miller, J.C., 1971, A preliminary report on nitrate contamination of shallow ground waters in Delaware.
Jordon, R.R., T.E. Pickett, and K.D. Woodruff, 1972, Preliminary report on seismic events in northern Delaware.

Florida Department of Natural Resources. Bureau of Geology.

Information Circulars

No.81. Public water supplies of selected municipalities in Florida, 1970, 1972. 213p. 1.00.

Georgia. Geological Survey.

Hydrologic Reports

1. Wait, Robert L. and D.O. Gregg, in press, Hydrology and chloride contamination of the principal artesian aquifer in Glynn County, Georgia.

Hawaii. Department of Land and Natural Resources.

Reports

R34. An inventory of basic water resources data, Island of Hawaii, 1970.

R35. Kokakohan Dam engineering feasibility, South Kohala Water Project, Hawaii, 1970.

R37. Flood Hazard Information, Island of Maui, 1970.

R39. Flood Hazard Information, Island of Maui, 1971.

Illinois State Geological Survey.

Environmental Geology Notes

EGN 51. Hughes, G.M., 1972, Hydrogeologic considerations in the siting and design of landfills. 22p.

EGN 59. Heigold, P.C., 1972, Notes on the earthquake of September 15, 1972, in Northern Illinois. 15p.

EGN 62. Risser, H.E., 1973, Energy problems for the 1970's and beyond. 12p.

EGN 63. Hester, N.C. and G.S. Fraser, 1973, Sedimentology of a Beach Ridge Complex and its significance in land-use planning. 24p.

Indiana. Department of Natural Resources. Geological Survey.

Bulletins

Wayne, William J., in process, Urban geology of Madison County, Indiana.

Miscellaneous Maps

Straw, W.T. and H.H. Gray, in process, Environmental geology of the Jeffersonville area.

Straw, W.T. and H.H. Gray, in process, Environmental geology in New Albany area, Indiana.

Powell, R.L., n.d., Environmental geology of the Evansville area.

Progress Reports

No.30. Gray, H.H., 1971, Glacial lake deposits in southern Indiana —engineering problems and land use. 15p. 75¢.

Special Reports

No.5. Bleuer, N.K., n.d., Geologic considerations in planning solid-waste disposal sites in Indiana. 7p.

Hartke, E.J., in process, Environmental geology of Lake and Porter Counties, Indiana—an aid to planning.

Gray, H.H., in process, Environmental geology of Monroe County.
Wiram, V.P., in process, Environmental geology of Vigo County.
Hartke, E.J., in process, Environmental geology of Marion County.

Iowa Geological Survey.

Miscellaneous Map Series

No.2. Dorheim, Fred H., Donald L. Koch, and Samuel J. Tuthill, n.d., Environmental geology and land-use planning in the Sioux City region, Iowa.

Public Information Circulars

No.4. Tuthill, Samuel J., Donivan L. Gordon, and Fred H. Dorheim, Hydrogeologic considerations in solid waste storage in Iowa.

Water Atlas

No.3. Cagle, J.W., 1969, Availability of ground water in Wayne County, Iowa.

No.4. Coble, R.W., 1971, Water resources of southeast Iowa.

Water-supply Bulletin

No.9. Hershey, H.G., K.D. Wahl, and W.L. Steinhilber, 1970, Geology and ground-water resources of Cerro Gordo County, Iowa. 75p.

Kansas (University). State Geological Survey.

Bulletins

No.205. Layton, D.W. and D.W. Berry, n.d., Geologic and ground water resources, Pratt County, south central Kansas.

No.206. McNillis, Jess M., n.d., Geology and ground water resouces of Rush County, central Kansas.

Kentucky Geological Survey.

County Reports

4. McGrain, Preston, Howard R. Schwalb, and Gilbert E. Smith, 1970, Economic geology of Hancock County. 24p.
5. McGrain, Preston, 1970, Economic geology of Marshall County, Kentucky. 33p.
6. McGrain, Preston and Donald G. Sutton, 1973, Economic geology of Warren County, Kentucky. 28p.
7. Noger, Martin, in process, Economic geology of Barren County.

Flood Prone Area Maps

The following maps consist of 7.5 minute quadrangle topographic base maps on which areas that may be subject to flooding have been outlined.

Miscellaneous Maps

A map of Fayette County showing relative favorability of areas for use as sanitary landfills for the city and county of Lexington and Fayette County, open file report.

Louisiana Geological Survey.

Control of Water Pollution

Hough, Leo W., 1963, Protection of underground fresh water sands in Louisiana. 6p.

Hough, Leo W., 1965, Progress in control of pollution of surface waters by oil field brine and waste oil. 13p.

Hough, Leo W., 1971, Underground industrial waste disposal in Louisiana; surface impoundment of petrochemical and other industrial wastes in Louisiana.

Maine Geological Survey.

Open File Report

Chaffee, M.A., J.M. Botbol, and J.C. Hamilton, n.d., The distribution of selected elements in stream sediments, central Maine.

Maryland Geological Survey.

Water Resources Basic Data Report

B.D.R. 4. Weigle, J.M. and W.E. W.E. Webb, 1970, Southern Maryland - records of selected wells, water levels, and chemical analyses of water. 48p.

Massachusetts. Cooperative Geologic Program.

The state has no publications in print or in process on the subject.

Michigan. Department of Natural Resources.

Environmental Geology Series Reports

No.1. Geology and hydrology for environmental planning in Washtenaw County, Michigan, in process.

Report of Investigations

No.3. Mozola, A.J., 1969, Geology for land and ground-water development in Wayne County. 25p.

No.13. Mozola, A.J., 1970, Geology for environmental planning in Monroe County. 40p.

No.14. Gravity and aeromagnetic anomaly maps of the southern peninsula of Michigan, in press.

Water Information Series

No.2. Flowing wells in Michigan.

No.4. Hydrology and recreation on the coldwater rivers of Michigan's upper peninsula.

Water Investigations

No.11. Ground water and geology of Barago country, Michigan.

Minnesota Geological Survey.

Educational Series

ES-5. Hogberg, R.K., 1971, Environmental geology of the Twin Cities metropolitan area.

Mississippi Geological, Economic, and Topographical Survey.

Environmental Geology Atlas

No.1. Green, John W. and Michael Bograd, 1973, Environmental geology of the Pocahontas, Clint, Raymond, and Brownsville Quadrangles, Hinds County, Mississippi. 10.00.

Missouri Geological Survey.

Engineerring Geology Series

1. Lutzen, Edwin E., 1968, Engineering geology of the Maxville Quadrangle, Jefferson and St. Louis Counties, Missouri. 75¢.
2. Rockaway, John D., Jr. and Edwin E. Lutzen, 1970, Engineering geology of the Creve Coeur Quadrangle, St. Louis County, Missouri. 75¢.
3. Whitfield, John W., and others, 1971, Engineering geology criteria applicable to sewage treatment locations in Missouri.
4. Lutzen, Edwin E. and John D. Rockaway, 1971, Engineering geology of St. Louis County, Missouri. 2.00.

Montana Bureau of Mines and Geology.

The state has no publications in print or in process on the subject.

Nebraska Conservation and Survey Division of the University of Nebraska.

Resources Atlas

1. Bentall, Ray, and others, 1971, Water supplies and the land - the Elkhorn River basin of Nebraska. 5.00.

Nebraska Geological Survey.

Water Supply Papers

31. Shaffer, R. Butler, 1972, Availability and use of water in Nebraska, 1970. 1.00.
32. Steele, Eugene K., 1972, Use of groundwater for irrigation in Clay County, Nebraska, 1970. 1.00.
33. Keech, C.F., 1972, Groundwater levels in Nebraska, 1971. 1.00.

Nevada Bureau of Mines and Geology.

Environmental Folios

1. Reno quadrangle folio, [1973?].
   a. Tinted relief map, by Susan L. Nichols. 2.00.
   b. Slope map, by U.S. Geological Survey. 2.00.
2. Mt. Rose N.E. quadrangle folio, [1973?].
   a. Tinted relief map, by Susan L. Nichols. 2.00.
   b. Slope map, by U.S. Geological Survey. 2.00.

New Mexico State Bureau of Mines and Mineral Resources.

Hydrologic Reports

1. King, W.E., and others, 1971, Geology and ground water resources of central and western Doña Ana County, New Mexico. 3.50.

New Hampshire. Department of Resources and Economic Development.

The state has no publications in print or in process on the subject.

New Jersey. Department of Environmental Protection.

Bulletins

71. Halasi-Kun, George J. and Kemble Widmer. eds., [1968], Proceedings of University Seminar on Pollution and Water Resources.

Pamphlets

A primer on waste water. 75¢.
Swenson, H.A. and H.L. Baldwin, 1965, A primer on water quality. 27p. 1.00.

Water Resources Circulars

19. Langmiur, Donald, 1969, Iron in ground waters of the Magothy and Raritan Formation in Camden and Burlington Counties. 1.50.
24. Anderson, Peter W., 1970, Occurrence and distribution of trace elements in New Jersey streams. 50¢.

New York State Museum and Science Service.

The state has no publications in print or in process on the subject.

North Carolina. Department of Natural and Economic Resources.

Educational Series

2. Broadhurst, Sam D., 1970, An introduction to the topography, geology, and mineral resources of North Carolina. Revised 1952 edition. 20p.

Maps

Nelson, Dennis O. and Jerry L. Bundy, 1972, Geologic map and mineral resources summary of the Oteen Quadrangle, North Carolina. 1:24,000.

Butler, James Robert, 1972, Geologic map and mineral resources summary of the Black Mountain Quadrangle, North Carolina. 1:24,000.

Miscellaneous Publications

The mining act of 1971 (G.S. 74-46 through 74-68), 1972. 15p.

Augster, Guy L., and others, 1970, Reclamation. 43p.

North Dakota Geological Survey.

Bulletins

B-63. Landis, E.R., 1973, Mineral and water resources. 50¢.

Miscellaneous Series

MS-48. Arndt, B. Michael, n.d., Environmental geology and North Dakota. 25¢.

Reports of Investigations

RI-50. Arndt, B. Michael, n.d., Geology for planning at Langdon, North Dakota. 25¢.

Ohio. Department of Natural Resources. Geological Survey.

Information Circulars

IC40. Stith, David A., 1973, Mercury concentrations in sediments of the Lake Erie basin, Ohio. 14p. 1.00.

Oklahoma Geological Survey.

Hydrologic Atlases

1. Marcher, Melvin V., 1969, Reconnaissance of the water resources of the Fort Smith quadrangle, east-central Oklahoma. 3.00.

Symposium Annals

No.2. Oklahoma Academy of Science, 1971, Environmental aspects of geology and engineering in Oklahoma. Proceedings of a symposium held December 4, 1970 at Oklahoma State University, Stillwater. 2.50.

Oregon. Department of Geology and Mineral Industries.

Bulletins

No.60. Schlicker, H.G. and R.J. Deacon, 1967, Engineering geology of the Tualatin Valley region, Oregon. 5.00.

No.74. Schlicker, H.G., and others, Environmental geology of the coastal region of Tillamook and Clatsop Counties, Oregon. 7.50.

No.79. Beaulieu, J.D., and others, 1973, Environmental geology of inland Tillamook and Clatsop Counties, Oregon.

Pennsylvania. Department of Environmental Resources. Topographic and Geologic Survey.

Environmental Geology Reports

EG1. McGlade, W.G., and others. n.d., Engineering characteristics of the rocks of Pennsylvania. 2.50.

EG2. Geyer, A.R. and W.G. McGlade, n.d., Environmental geology for land-use planning. 1.40.

EG3. Rudd, Neilson, n.d., Subsurface liquid waste disposal and its feasibility in Pennsylvania.

EG4. McGlade, W.G., n.d., Environmental geology of the Harrisburg area.

EG5. Horne, M.E., n.d., Environmental geology of the York area.

Rhode Island. Geological Survey.

The state has no publications in print or in process on the subject.

South Carolina. State Development Board. Division of Geology.

Environmental Geology Series

1. Beach erosion in the Charleston harbor area. 1.00.

South Dakota. Geological Survey.

Special Reports

54. Barari, Assad, 1972, Ground-water investigation for the city of Spencer. 19p.

55. Barari, Assad, 1972, Ground-water investigation for the city of Parkston. 26p.

56. Barari, Assad, 1972, Ground-water investigation for the city of Baltic. 19p.

Tennessee Division of Geology.

Environmental Geology Series

1. Miller, Robert A. and Stuart Maher, 1972, Geologic evaluation of sanitary landfill sites in Tennessee. 2.00.

Texas (University). Bureau of Economic Geology.

Environmental Geologic Atlases

[1]. Environmental geologic atlas of the Texas coastal zone. A folio of 63 multi-colored geologic and environmental maps.
— Galveston-Houston area, 1972, by L.F. Brown, Jr., J.H. McGowen, and C.G. Groat.

Utah. Geological and Mineralogical Survey.

Earth Science Series

2. Kaliser, B.N., n.d., Environmental geology and geologic hazards in Utah: a photographic series [including 100 slide transparencies]. 35.00.

Utah Geological Association.

Guidebooks

1. Environmental geology of the Wasatch front, 1971. 6.75.

Vermont Geological Survey.

Environmental Geology

No.1. Stewart, David P., 1971, Geology for environmental planning in the Barre-Montpelier Region, Vermont. 2.00.

No.2. Stewart, David P., 1972, Geology for environmental planning in the Rutland-Brandon Region, Vermont. 2.00.

Virginia. Department of Conservation and Economic Development. Division of Mineral Resources.

Maps

LeVan, D.C. and W.R. Harris, 1971, Mineral resources of Virginia. Color edition. 1:500,000. 2.75.

Washington. Department of Natural Resources.

Information Circulars

No.47. Artim, Ernest R., 1973, Geology in land use planning; some guidelines for the Puget Lowland. 18p. Free.

West Virginia Geological Survey.

Environmental Geology Bulletins

EGB 1. Lessing, P. and R.S. Reppert, 1972, Geological considerations of sanitary landfill site evaluations. 2nd ed. 1.50.

EGB 2. Reppert, R.S. and P. Lessing, 1971, Sanitary landfill sites in the eastern Panhandle. 1.25.

EGB 3. Lessing, P. and R.S. Reppert, 1971, Sanitary landfill sites in southeastern West Virginia. 1.25.

EGB 4. Reppert, R.S. and Paul Lessing, 1971, Sanitary landfill sites in southwestern West Virginia. 1.25.

EGB 5. Lessing, P. and R.S. Reppert, 1972, Sanitary landfill sites in central West Virginia. 1.25.

EGB 6. Reppert, R.S. and P. Lessing, 1972, Sanitary landfill sites in northwestern West Virginia. 1.25.

EGB 7. Lessing, P. and R.S. Reppert, 1972, Sanitary landfill sites in northern West Virginia. 1.25.

EGB 8. Landers, R. and P. Lessing, 1972, Bibliography of environmental geology in West Virginia.

EGB 9. White, I.C., 1972, The waste of our fuel resources. 1.25.

EGB 10. Erwin, R.B., n.d., Geology underlies it all.

Wisconsin (University). Geological and Natural History Survey.

The state has no publications in print or in process on the subject.

Wyoming. Geological Survey.

County Resource Series

CRS-1. Lane, Donald W., Gary B. Glass, and Forrest K. Root, 1972, Geologic map atlas and summary of economic mineral resources of Converse County, Wyoming. 1.50.

CRS-2. Root, Forrest K., 1973, Geologic map atlas and summary of economic mineral resources of Sweetwater County, Wyoming. 2.00.

Maps

Lane, Donald W., Forrest K. Root, and Gary B. Glass, 1972, Energy resources map of Wyoming. Colored edition. 1:500,000. 2.00.

Geoscience Document Distribution in Canada

by

Doreen M. Sutherland

Geological Survey of Canada

and

Mary T. LaHam

Geological Survey of Canada

ABSTRACT

Dissemination of geoscience information and data often bypasses traditional methods of publishing in order to reach the user, be he a research scientist or an exploration company interested in filing mineral claims. In Canada, several agencies are using the 'open file' system to release raw or unedited data and information. Computer tapes, black-line copies of maps or data and paper copy of descriptive text all form part of such files. To be successful, announcement of availability must reach the user public. Translations, theses and government publications are all being handled in new ways. Paper copies of geoscience translations prepared for the Geological Survey of Canada are available at reproduction cost from a commercial firm, through application to the Survey library. Canadian theses are available on microfilm through the National Library, and output of the provincial governments is being distributed on microfiche through a new service called 'ProFile'. Secondary publications such as bibliographies and indexes to information and data are also using modern technology for production. Three examples may be mentioned: the computer based indexes of the Canadian Centre for Geoscience Data; RESORS, the on-line retrieval system which provides references to remote sensing documentation, and CAN/SDI, a national system which disseminates current awareness of all types of literature, using data bases created externally. The recent advances in remote sensing, satellite imagery and specialized aerial photography in the study of the surface environment present both challenges and problems in disseminating the quantities of data being produced. Existing channels of release can be modified, others require newer techniques, such as these now established by the new Canada Centre for Remote Sensing.

> "Information is bought, sold, stored, traded, exchanged and consumed in economic terms. It is treated both as a product and a service ..."
>
> ASIS JR. v. 24, no. 4, p. 242

To do justice to this large and rather nebulous topic, it was decided to define the term 'document' for purposes of this paper, and then to list the particular types. Other papers presented at the Symposium on "New and Unusual Publications in Geoscience" concerned documentation in the United States; this paper is designed to show how Canada is handling the problem of dissemination of information on research in the geosciences.

Documents are defined as: publications or 'near' publications in any format, which are probably not handled by a commercial outlet; are not necessarily sold or advertised; or, by reason of the nature and format of the information, may not lend themselves to publication; the definition includes indexes to such documents. The types of documents selected include: Open File documents; translations; theses; provincial documents; aerial photographs; ERTS imagery; and document finding or indexing;RESORS; the Canadian Index to Geoscience Data; and CAN/SDI. Each of these types will be handled under the title of the program producing them, or under the name of the document series.

I The first program is concerned with Open File documents. This method of 'near' publication has been used by the United States Geological Survey for some time. It is comparatively new in Canada; the Geological Survey of Canada inaugurated its program in 1967, and the use of an Open File as an alternative to publication has grown gradually but steadily. The method is becoming increasingly popular, especially as conventional printing of information becomes more expensive and more time consuming. About 175 items were on Open File at the end of 1973. The document may be in the form of paper copy, computer program, map, magnetic tape, or a combination of these forms. The results of research released on Open File may include unfinished work containing valuable information; research results which industry urgently requires before the published work can be made available; items in formats for which preparation for full publication would be difficult and unduly time-consuming; and information not suitable for inclusion in any of the presently published series of publication of the Geological Survey.

Until 1973 announcement of the availability of an Open File document was accomplished by means of a postcard sent to the complete mailing list maintained by the Geological Survey,but increasing postal rates forced the Survey to find an alternative method of alerting people to new information. There is now a monthly information circular which covers all publications of the Geological Survey including the Open Files. Occasionally documents are so urgently needed by mining or oil companies that the announcement is made by a "timed release". Appointments at the Ottawa headquarters or at the Survey offices in Calgary, Alberta or Vancouver, British Columbia to see the item may then be scheduled. The importance of this information to industry can be vital, and the private sector has been pleased with this program. At least one other government department has announced research results through our Open Files, especially when a co-operative program is involved.

From its inception the Library has had the responsibility for looking after the files, and it handles all the housekeeping from gathering together the elements to indexing and answering queries, and making items available for viewing. If the material is suitable for reproduction, copies may be made using commercial firms. All billing and correspondence rests in the hands of these firms. Flexibility in handling is one of the most attractive aspects of this method.

Two of our provinces, Ontario and Quebec, also make use of the Open File method of releasing research information.

Ontario announces its documents by means of a circular, published irregularly. As in the federal system, commercial firms are responsible for making copies, with the Library of the Ontario Department of Mines, Geological Branch, holding reference sets. Their files presently contain mostly areal geology of Ontario.

The Quebec Department of Natural Resources (Departement de Richesses Naturelles) announces its documents by means of a post card and applies approximately the same conditions for obtaining copies as outlined above. Included in their program are various series of reports, each one numbered consecutively. They are available from the Quebec Technical Documentation Service (Service de Documentation Technique) which is part of the Quebec Mines Branch, either in microfiche or hard copy. The announcements are in English and French, but the reports generally in French only. The success of this service is reflected in the following figures - for the period April 1, 1972 to April 1973, 2167 requests were made in person and 1761 by mail.

II TRANSLATIONS of scientific articles from foreign languages are an important source of information. We are all aware of the ever growing need for these translations especially from the Russian language; furthermore, with the re-emergence of information on the geology of China, there will soon be a need for translations from the Chinese.

Canada is extremely fortunate to have the services of a Federal Government Department, that of the Secretary of State, which has a mandate to provide translations from foreign language material for Government employees. A large number of translators are employed and, in addition, a good deal of work is contracted out to free lance translators.

The translations themselves become the property of the Department requesting the work, and in most cases they are deposited in the Libraries of the originating Department. At the Geological Survey, the Library handles the entire transaction, including, of course, sending the record to our National Science Library for dissemination to the translation clearinghouse in the United States. They are catalogued in the Library's monthly accession list. Two Geological Survey papers containing lists of translations have been published and a third is in preparation. In the new series, begun in 1968, there is a record of 700 translations and many more older translations are in the Library awaiting recataloguing and listing.

This program is very popular, and the Survey's translations are much in demand by users. It is firmly held that the widest possible publicity should be given to the existence of the translations, though the problem has always been to ensure equitable distribution. After careful consideration it was decided to restrict lending and to make copies available only through reproduction by a commercial firm. When a request is made for a copy, it is forwarded with the original material to the firm for reproduction and billing. However, even this method of reproduction seems to require more time and effort than the small staff of the Library can cope with. Dr. Manheim of the Geochemical Society recently became concerned about the cost of this procedure to the individual user; largely as a result of his interest, we have decided to turn the entire task over to our National Science Library. This will reduce the cost by approximately one third, and it is possible that they may be available on microfiche in the future.

III THESES are now listed in the Bibliography and Index of Geology, and are stored on tape in GEO.REF, making awareness of their existence less of a problem than it has been in the past. Most of our Universities still have the titles of their theses published in Dissertation Abstracts International; however, in Canada we have a new outlet for obtaining copies. There has been, for the last two or three years, a national program for making them more accessible. Fifty-two per cent of Canadian Universities are now voluntarily subscribing to this program operated by our National Library called the "Canadian Theses on Microfilm Program".

The universities send their theses to the National Library where they are microfilmed and returned, a charge of five dollars being made for the service. The theses are then listed in Canadiana, our national bibliography, under a broad Dewey classification with author, title, and series indexes. A microfilm may be lent, or a copy purchased from the National Library for a nominal sum - about two or three dollars.

You will note that in Dissertation Abstracts, the user is referred to the National Library for copies of theses available there. Canadian libraries find this a much simpler way of obtaining theses, and hope that eventually all universities in Canada will subscribe so that coverage by this system will be complete.

Information about Geoscience theses may also be found in the Geological Survey's Annual Publication Current Research in Geological Sciences in Canada. This also includes a short statement about the subject of the investigation.

IV A recent and innovative system, PRO-FILE is a system which may assist in locating different types of information, hopefully including geoscientific material.

It is, quoting the promotional material, "a current subscription service to the publication of the Canadian Provinces, Territories, and selected municipalities on microfiche - delivered monthly, accompanied by a current index. PRO-FILE offers to Libraries and users of government information a current and readily accessible data bank of Canadian Provincial and Municipal information at a reasonable cost".

At present the problem is its limited scope; for example, the subject areas "Environments" and "Natural Resources", consist mainly of annual reports received during 1973, the year the service began.

Once it overcomes growing pains, this system has the potential for becoming a valuable tool for Geoscience document finding.

Further information may be obtained from "Micromedia Limited", Box 34, Station S, Toronto 20, Ontario, Canada.

V The field of AERIAL PHOTOGRAPHY for geoscientific information is an old one, to which some very new applications have been added. Canada's National Air Photo Library (NAPL) has a long and distinguished history. Tracing its origin back to 1921, the NAPL is the federal government agency responsible for the storage, indexing, documentation, ordering, and maintenance of reference copies of all aerial photography flown by or for, the Canadian Federal Government. The NAPL also provides this service for the provincial governments of Nova Scotia, Prince Edward Island, Alberta, Saskatchewan, and Newfoundland; in addition, it compiles information about the available aerial imagery held by the other provinces.

Since July, 1970, the NAPL has been active in the Airborne Remote Sensing (ARS) program, and the Earth Resources Technology Satellite (ERTS) program, providing the same services as outlined for mapping photography. In the ERTS program, the NAPL is the agency for the distribution of this material, and has coverage of any portion of Canada.

The Library has on file approximately four million black and white or color photographs, which are indexed on over 7,200 index maps.

Currently, a program of microfilming these photographs and index maps is underway, with the expected result that this information will be available to more people, at less than the present cost to NAPL, with faster "turnaround" imagery.

Acting as an order office, the NAPL receives requests for aerial coverage, makes the appropriate selection, forwards the information to its Reproduction Centre (NAPL/RC). They reproduce the imagery, and the user is billed.

Over 130 aerial photographic products are available through NAPL. The simplest method of ordering aerial imagery is to outline the exact area of interest on a suitably scaled topographic map, or to provide its exact longitudinal and latitudinal co-ordinates. The basic ten-by-ten-inch black and white contact print costs one dollar. There is also a search and handling fee of two dollars applied to each order.

ERTS imagery is reproduced by the NAPL/RC after initial processing by the Canadian Centre for Remote Sensing (CCRS).

Orders for the imagery are computer processed, and may be one of two types. With standing orders, the user may specify area, time, quality, and cloud cover limits. When images meet these criteria, they are reproduced and mailed to the user. The other type, data requests allow a user to order ERTS imagery when the frame identifier is known, and when other than contact prints are required.

VI The foregoing leads directly into a short description of the Canadian Centre for Remote Sensing. It is co-ordinated by the Department of Energy, Mines and Resources in co-operation with other agencies of the Government of Canada, Provincial Governments, Industry, and Canadian Universities and is the Federal agency for the co-ordination of remote sensing activity for all of Canada. One of the principal tasks of CCRS is to process the data gathered by ERTS satellite in its passage over Canada. The data are received by the Prince Albert station and sent to CCRS in Ottawa on digital tapes.

The total ERTS system and its mission will be well-known to most readers but the type of data available to the Canadian user, as well as the services available for obtaining output products may be of interest.

The Centre provides video-to-film conversion and correction, producing black and white images from individual spectral bands and colour composites from several spectral bands. Canadian imagery is collected in a browse file, and all other ERTS imagery, that is for the United States and the rest of the world, is available on 16 mm film. In response to specific requests the Centre provides information pertaining to the various spectral bands, their uses, and the suitability of composites for particular purposes. Interested users may also be put on mailing lists to receive various publications pertaining to the remote sensing programs. Of particular interest in this connection is the newsletter Remote Sensing in Canada which is sent all over the world.

The NAPL involvement in the Airborne Remote Sensing (ARS) program is the processing, annotation, indexing, documentation, and ordering of these data. During 1973, over 44,860 nautical miles were logged in this program. The potential benefits of this work in environmental studies, crop surveys, and so on, are enormous.

The remaining portion of this paper is concerned with Document Finding.

The Canadian Centre for Remote Sensing (CCRS) has established a Technical Information Service (TIS) whose function is to acquire, catalogue, and disseminate technical literature in the field of Remote Sensing. Because the field is interdisciplinary in the broadest sense, documentation tends to be scattered in a wide variety of journals and other information sources. This difficulty, together with the need to serve a large scientific community at various centres throughout Canada, led to the decision to develop a simple 'hands-on' document retrieval system. The result is RESORS: Remote Sensing On-line Retrieval System.

RESORS is an automated bibliography enabling the user to interactively search a computer stored data base of Remote Sensing references and obtain those documents which satisfy his information needs.

Potential sources of documentation are chosen by manual and computerized methods, read and indexed to extract bibliographic information, and a selection of controlled keywords are attached to them which define the conceptual content of each paper. This information is stored by the RESORS system and forms the computer 'data base'.

The two basic divisions of the keywords cover applications and techniques. Each is further subdivided to two or more levels of detail and each subcategory is designated by a five-figure code. The keywords are assigned weights according to their relevancy in the content of the document. There are presently about 2,600 documents on RESORS, forming a carefully selected and exhaustively indexed collection of documents mainly for the period 1971-73. Approximately two hundred documents per month are added to the file.

A simple but powerful conversational search program allows the user to interact with the data base from a remote computer terminal by submitting to the system a series of keywords which define an area of interest, allowing him to obtain an immediate printout of references to papers having the desired association of concepts.

The service being given to users by the CCRS system is extremely good, fast, and free. Requestors, particularly CCRS staff, may query the computer themselves. Users may request a search of the data bank by telephone or mail order if they do not have access to the computer directly. Information requests must be detailed and accurate in order that the CCRS staff may conduct a relevant search of the base. To this end the RESORS dictionary is available to the user, enabling him to compose his query with appropriate keywords.

The printout results of the search are mailed to the user; he may then order the articles from the printout which he considers of interest. These are reproduced by CCRS and forwarded to him free of charge.

Readers of this journal will be familiar with the work being done by Dr. C.F. Burk in the CANDAIAN CENTRE FOR GEOSCIENCE DATA (CCGD).

The Canadian Index to Geoscience Data is a computer-processable file to documents of all types, all of which contain observations and measurements, that is, data, on the geology of Canada. The project is the result of the co-ordinated efforts of seven Federal and Provincial agencies that either publish or hold the documents that have been indexed. The whole Index fills several volumes, and contains controlled keywords, title, source, mailing addresses, and NTS identifiers. NTS stands for National Topographic System, and is the method developed for dividing Canada into manageable map-areas. In addition the Canadian Centre for Geoscience Data has programs making the generation of custom indexes for special interest areas possible.

One instance of this possibility to further the ends of document finding is the indexing of the GSC Open File documents. No mention was made above of the cataloguing, indexing, or information retrieval methods used for these documents. As an agency of the CCGD, the Geological Survey provides indexing for its own publications and public documents.

During the summer of 1973 a student was employed in the Library to index all of the material not in the last update of the Index, including Open File documents. This work having been completed, a special index of the Open File will be produced from CCGD's tapes. This index will be made available to users as a finding tool much superior to the present, "homemade" manual methods.

The Ontario Department of Mines was one of the first agencies outside of the Geological Survey to enter its data into the Canadian Index, and it is using the indexing and computer programs in various ways.

One of these uses has been to publish a list of publications, using their contributions to the Canadian Index as a source. This list of publications is arranged according to type, supplemented by author and areal indexes.

Another example of their work is an Index To Assessment Work Reports, which represents a selective retrieval from the Canadian Index of the titles of the reports according to indexed concepts, NTS number, and alphabetical title. To date the 1972 reports are available, and later ones will be made available soon.

It is assumed that CAN/SDI, the Canadian Selective Dissemination of Information system, is known to readers of these pages, who may also be aware that the Geological Survey takes part in this system by making GEO/REF available to Canadian earth scientists. About 130 people use it for current awareness in their particular research.

Discussion of this topic will therefore be limited to the announcement of two interesting new events.

The first is that the National Science Library is planning a project called CAN/OLE (Canadian On-Line Enquiry), which is, as the acronym suggests, an on-line computer information retrieval system. During its initial period of operation it will use Chemical Abstracts Condensates, Inspec, Engineering Index, and Biological Abstracts Previews. Certain key organizations including the Geological Survey of Canada are participating in this exciting development, beginning in February 1974. We expect to have a report on its outcome by the Spring of that year.

The second event concerns the Geological Society of America's Ad hoc Committee on Bibliographical Information. As a result of its work, the G.S.A. is supporting a project to familiarize its members with the nature of Canadian services, in order to make better known the possibilities inherent in the GEO.REF data base.

Certain geologists across the United States have been chosen to participate by having a profile setup on GEO/REF using the CAN/SDI system.

This paper was designed to provide readers with new insight into the handling of geological information in Canada. Selection of topics for discussion was difficult because many new and promising systems are getting underway, in addition to those which have been mentioned here today. Nevertheless, the writer hopes that this short report will not only give some leads on how to obtain documents on geological research in Canada, but also illustrate the direction being taken in processing information about this research.

BIBLIOGRAPHY

CAN/SDI. A national system for the selective dissemination of information; National Science Library, National Library, Geological Survey of Canada. 1972.

Canada Centre for Remote Sensing. RESORS; computer based on-line document retrieval system, user's guide.

ERTS Imagery catalogue, Quarterly Publication, 1973.

Gaffney, Inez, 1973, CAN/SDI: Experiences with multiple-source computer based current awareness services in the National Science Library, Canada. Bulletin of the Medical Library Association, v. 61, no. 3, p. 309-313.

McGee, B.A., 1972. New key to mineral information - Canadian index to geoscience data Canadian Mining Journal, April, p. 43-44.

National Air Photo Library. How to order an air photograph. Folder.
Available from: N.A.P.L.
Surveys & Mapping Branch
Dept. of Energy, Mines & Resources
615 Booth St.
Ottawa

Remote sensing in Canada. Newsletter. Quarterly.
Available from
Canada Centre for Remote Sensing
Dept. of Energy, Mines & Resources
2464 Sheffield Road
Ottawa, K1A OE4

Strome, W.M. and Shaw, E., 1972
Canada centre for remote sensing ERTS program. Proceedings of the Eighth International Symposium of the Environment p. 1497-1508.

Personal interviews with Mr. Brian McGurrin (Canada Centre for Remote Sensing) and Mr. Peter Andrews (National Air Photo Library).

THE TECHNOLOGY APPLICATION CENTER AS AN INFORMATION SOURCE FOR THE GEOSCIENCE/NATURAL RESOURCE COMMUNITY.

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ABSTRACT

The Technology Application Center (TAC), a NASA-sponsored Regional Dissemination Center, has as its primary mission the transfer of NASA technology to secondary users, primarily business and industry in the Rocky Mountain Southwest. New and developing technologies and the application thereof are reported from thousands of diversified journals and proceedings which are scanned and categorized to meet the needs of technical users. The Center responds to individually defined technical problems, as well as developing generalized compendiums of technological areas which are of strong interest to a broad spectrum of people. TAC, in addition to being an information center in the overall sense, has specialized in providing Geoscience/Natural Resource information services nationally and, in some cases, internationally.

AERIAL PHOTOGRAPHY - USES, USERS, AND WHERE TO FIND IT

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ABSTRACT

Use of aerial photography as a unique information source has been increasing in a wide variety of disciplines. Photos taken for special use, such as topographic mapping or soil surveys, become a valuable source of information for other uses by the scientific community and the public. However, many potential users are unaware of the availability or the means of obtaining these photos. The principal holders of Federal photos are the Dept. of the Interior, Dept. of Agriculture, Dept. of Defense, National Aeronautics and Space Administration, Dept. of Commerce, Tennessee Valley Authority, and the National Archives. In addition, there are many sources of photos in State agencies and private firms.

Most Federal agencies maintain laboratories and will furnish copies at cost. Many private holders of photos also sell copies. The Map Information Office of the Geological Survey maintains a comprehensive record of existing photographs and addresses of the holders in the U.S. and can direct users to the proper source for obtaining the most suitable photo coverage.

That aerial photograph you have been looking for--the one of your favorite trout fishing stream or that excellent hiking trail, or the view of your cottage on the mountain lake or your home in suburbia, or the photo that will aid the urban planner, the land-use developer, the geologic or oil exploration engineer, the highway transportation expert, or the ecologist--chances are that that aerial photograph is available for purchase.

Various Federal agencies maintain aerial photographic coverage of the entire country, while State agencies, regional planning commissions, and commercial firms usually maintain coverage of select areas. In any case, reproductions may be ordered by the general public. These multiple coverages are primarily of the black-and-white film type, but also include color, black-and-white infrared, and color infrared. The photo scale varies widely as flight heights range from relatively low to very high. During fiscal year 1973, the Geological Survey (USGS) alone contracted for over 275,00C mi^2 (715,00 km^2) of aerial photography, and the Agricultural Stabilization and Conservation Service obtained a like amount.

The first place to inquire about aerial photographs should be the Survey's Map Information Office (MIO)[1], which will either have the photograph you are seeking or can direct you on how to obtain it. Within the first 9 months of the year, MIO replied to 1,900 letters either providing general information on aerial photography or informing customers that laboratory processing was scheduled on their prepaid orders. Before the year is out, MIO will have answered 3,000 or more inquiries about photography.

The Map Information Office has been operating since 1919, chartered as "a central information office in the Geological Survey for the purpose of collecting, classifying, and furnishing to the public information concerning all map and survey data available in the several Government departments and from other sources."

After World War II, the demand for surveying and mapping data increased to such proportions that the MIO staff and facilities were expanded to meet the many needs. The continual demand for greater information of all types has forced MIO to regroup into three specialized sections concerned with topographic maps, geodetic control, and aerial photography which is our special concern today.

The aerial photography section maintains up-to-date records of the photographs procured by Federal and State agencies, regional planning commissions, and commercial companies. The information is made available to the general public in graphical forms, such as three editions of 1:5,000,000-scale status maps showing available coverage, aerial mosaics for the 50 States and territorial possessions, and page-size State index maps showing the latest coverage. MIO keeps master-file index maps that show, by mapping project boundaries, all photographs acquired by the Survey since 1937 for its topographic mapping program.

Photographs for topographic and geologic mapping are generally taken in early spring and late fall. Reproductions of these photographs are usually quite satisfactory for many uses. Since reproductions are not stocked, all orders are custom processed from the original film negatives. There is no one central facility where this vast amount of film can be stored (though this is an eventual goal); therefore film is stored in various photographic laboratories throughout the country. Information requests and orders for reproduction should be directed to MIO although processing and shipment will probably come from another locality.

In addition to 45,000 photoindexes of Survey photography, MIO also provides information on the high-altitude photographs acquired by the former Army Map Service for producing the 1:250,000-scale topographic maps that completely cover the conterminous States. The AMS photographs were turned over to the Survey permanently for maintenance and public sale. Although of early 1950 vintage and of small scale (1:50,000 to 1:60,000), requests for information and orders for photoindexes and individual frames are still processed daily--20 years old and still a very popular item!

At present, MIO only maintains photoindexes showing Survey photographs and non-Survey photographs filed with the Survey for maintenance and public sale. The indexes are used for reference and research by the staff as well as walk-in customers. Although indexes and photographs from another agency may not be in hand, that does not necessarily mean we cannot aid the customer. References and other information, such as date, scale, and camera focal length, can be provided for other-agency or commercial photographs that are available. MIO also provides a browse center for the public to view microfilm copies of the imagery obtained with the Earth Resources Technology Satellite (ERTS-1). Additional microfilms will be available later for other NASA and U-2 aircraft photographs and imagery. Requests for all available imagery can be directed to MIO, where orders are transmitted by wire to the EROS Data Center in Sioux Falls, S. Dak.[2]

As I said earlier, the Agricultural Stabilization and Conservation Service (ASCS) procures extensive photo coverage; to a lesser extent, so do the Soil Conservation Service (SCS) and the Forest Service (FS). ASCS operates two photographic laboratories--one in Asheville, N.C., which handles coverage of areas east of the Mississippi[3], and one at their photography headquarters in Salt Lake City, Utah, which handles coverage of areas west of the Mississippi[4]. ASCS provides State and county officials with the photographs needed for efficient administration of farm programs, particularly in monitoring crop acreages. Most ASCS contracts are for 1:40,000-scale black-and-white photographs; until recently 1:20,000 was the standard scale. Photos are taken year-round and provide coverage by counties.

SCS uses photographs both to implement soil surveys and to provide bases for publishing soil survey data. In earlier years 1:20,000-scale photos were obtained, but now photo scales range from 1:38,000 to 1:75,000 with most at 1:48,000. Season is not a deciding factor unless the photos are to be used for survey work. SCS photo projects are obtained by counties though not in large blocks since an even distribution of projects among the States must be maintained. All SCS photographs are processed at their cartographic headquarters in Hyattsville, Md.[5]

The FS uses photographs to inventory, manage, and monitor our Nation's forests. The photo scale has been typically 1:15,840 for mapping, but recent changes in FS programs will mean less mapping and greater emphasis on orthophotographs derived from high-altitude (e.g., 1:70,000-scale) photos. In addition to black-and-white coverage, substantial color-infrared coverage is obtained. FS regional offices individually contract for and process photography. However, inquiries and orders may be directed to FS engineering headquarters in Washington, D.C.[6]

The Nation's coastal wetlands have come under the scrutiny of developers, legislators, planners, mappers, and environmentalists, all depending on aerial photographs at some point in their studies. The National Ocean Survey (NOS), formerly the Coast and Geodetic Survey, has obtained extensive coverage of shoreline areas. Taken at various flight heights, some of the photographs are in color and color infrared as well as in the conventional black-and-white. NOS also holds inland photographs centered over airports, which include the airport approach patterns. Inquiries and orders for NOS coverage should be directed to their headquarters in Rockville, Md.[7]

Another Federal agency procuring photographs is the Tennessee Valley Authority (TVA). Their area of interest is smaller--Tennessee and border States--and their purpose is mapping. Photo specifications are similar to those of the USGS. Inquiries and orders for TVA photographs should be directed to their headquarters in Chattanooga, Tenn.[8]

Although little advertised, the National Archives in Washington, D.C., provides the repository for Federally procured aerial photographs of pre-1942 years. The Archives laboratory processes photo requests.[9]

Prices for photo reproductions within the Federal complex are quite similar because they are set by an interagency committee. The basic criterion is to recover the cost of labor and materials. The Federal agencies work together to satisfy customer requests; should a request for photographic information be misdirected, you can be assured it will be referred to the appropriate agency.

Remember that MIO also compiles records on aerial photography obtained by State agencies, such as departments of highways, natural resources, conservation, forestry, and regional planning commissions. Photographs for State purposes that are retained by an agency able to make reproductions for general sale are advertised through MIO.

Through many years of collecting photographic data MIO has compiled a comprehensive listing of commercial firms that obtain and hold aerial photographs for private projects. Listing is, of course, voluntary and indicates that a firm is willing to process requests from customers referred to it. It is not uncommon for a customer to be referred to a firm that already has photos more suitable to the customer's needs than those in government files.

Questions often arise as to what the Government does with its photographs once they have served their initial purpose. Do the photos become available to others who might use them? Here I am not speaking of the original film negatives, of course, but contact prints such as are used in map compilation. Prints that become surplus after topographic mapping are offered to hydrologists, geologists, and other scientists in the Survey and the Department of the Interior. Generally the hydrologists take the surplus prints, but if there are no takers, the photographs are offered to State agencies, State universities, and scientific libraries. Please bear in mind that photographs available on surplus are fairly old and have already been replaced by new coverage. ASCS disposes of surplus prints in a similar manner. For information on available Geological Survey surplus photos, contact MIO; shipping costs are extra.

Since the Survey procures photo coverage generally for domestic uses, MIO does not provide information on aerial photographs of foreign countries. Requests for foreign coverage are referred to the Canadian and Mexican governments and to the Department of Defense for all other foreign areas.

Special sales items of interest to geologists, earth scientists, and educators are two catalogs of preselected photographs illustrating numerous types of geologic features inside and outside the U.S. These photographs were hand picked from many different sources by a group of geologists and a photographic specialist and assembled into sets of 1 to 6 contact prints. The sets available for 317 U.S. and 67 foreign features are listed in USGS Professional Papers 590 (U.S.) and 591 (foreign). Each catalog contains a subject index, detailed descriptions of the features illustrated, a map showing the geographic locations of features, and stereoscopic pairs of representative photos from each set. Laboratory processing of these sets is offered at reduced prices. The catalogs and photo sets have proved to be very popular sale items, particularly with university professors for classroom instruction and with libraries for permanent reference.

Occasionally MIO receives an out-of-the-ordinary request from an infrequent user of photographs. Contrary to what you might think, we are generally able to comply with these requests to the users satisfaction. Good examples are requests from law firms, particularly in land claim cases where a timely photograph may be used in litigation. For photographs that are to be used as evidence in court, the Survey offers a certification with the official seal for an additional 25 cents per photograph. Other special photo requests have come from the Secret Service, to select motorcade routes for the President and visiting foreign dignitaries, and from TV networks, to select camera sites for televising such events as the Presidential inaugural parade. More frequent requests of an unusual nature involve historical studies where the customer usually wants all known available photographs for the area of interest. The objectives can vary from the study of an ever-changing coastline in a California bay to the possibility of finding remnants of the old stone foundation of a New England historic home.

As you can see, the uses of aerial photography are quite varied and are representative of numerous disciplines. An aerial photo can be considered a unique information source in that it actually documents a portion of the Earth's surface at an instant of time. Aerial photographs are not really hard to find, now that you know where to look. With the extensive record of photographic holdings in the U.S. maintained by MIO, any potential user can find his way to the proper source.

At present, we realize there is no one contact a user can make to obtain complete service. However, we expect that within a year or so MIO will expand into the National Cartographic Information Center, which was conceived to provide one-stop service to the cartographic data user. Also in the near future, computer catalogs for topographic maps, geodetic control, and aerial photographs will enable more complete and rapid services to the public than were ever before possible.

REFERENCES

1. Write U.S. Geological Survey, Map Information Office, Aerial Photography Section, National Center (501), 12201 Sunrise Valley Drive, Reston, Va. 22092 or phone 703-860-6012.

2. Write EROS Data Center, Sioux Falls, S. Dak. 57198 or phone 605-594-6511.

3. Write Agricultural Stabilization and Conservation Service, Eastern Aerial Photography Laboratory, 45 South French Broad Ave., Asheville, N.C. 28801 or phone 704-254-0961, ext. 610.

4. Write Agricultural Stabilization and Conservation Service, Western Aerial Photography Laboratory, 2505 Parley's Way, Salt Lake City, Utah 84109 or phone 801-524-5856.

5. Write Cartographic Division, Soil Conservation Service, Federal Center Building, Hyattsville, Md. 20782 or phone 301-436-8186.

6. Write Division of Engineering, Forest Service, USDA, Washington, D.C. 20250 or phone 703-235-8638.

7. Write National Ocean Survey, Dept. of Commerce, NOAA, Washington Science Center, 6001 Executive Blvd., Rockville, Md. 20852 or phone 301-496-8601.

8. Write Tennessee Valley Authority, Maps and Surveys Branch, 200 Haney Bldg., Chattanooga, Tenn. 37401 or phone 615-755-2150.

9. Write National Archives and Records Service, Cartographic Branch, GSA, 8th and Pennsylvania Ave., NW, Washington, D.C. 20408 or phone 202-962-0173.

Presented at the joint meeting of the Geological Society of America and Geoscience Information Society, Dallas, Texas, November 12-14, 1973. Publication approved by the Director, U.S. Geological Survey.

EROS DATA CENTER: A NEW SOURCE OF EARTH SCIENCE INFORMATION

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SUMMARY

Substituting for Robert G. Reeves,* Mr. Fary described the Earth Resources Observation Systems (EROS) Data Center, a new source of earth science information. The Center is located 18 miles northeast of Sioux Falls, South Dakota, in a new building which will house all of the Center's function (except the photoreduction laboratory) by early 1974. Sources of data include ERTS imagery, high-altitude aerial photography and imagery, conventional aerial photography, and other remote sensing techniques. Coverage of the whole Earth is available, on various scales. Infrared, thermal infrared, Skylab, and radar mosaic information is also available. Turn-around time for requests is 3-4 weeks. Catalogs identifying various coverages can be purchased for $1.25.

*In a telephone conversation (April 5, 1974), Dr. Reeves advised that within a month there would be a publication on the EDC available at no charge from the EROS Data Center, Sioux Falls, S.D. 57198.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORTS

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Summary

Dr. Becraft described the open-file system as "the oldest system in the world: making a report available so that somebody can look at it and read it." The USGS commonly places a copy of a report in its various offices so that the information is available to the public prior to formal publication. Last year the Geologic Division released 270 reports in open-file, varying in length from a few pages to several hundred pages. About 180 contained maps. Maps if they need color for legibility are very difficult to reproduce. If they could be placed in open-file quickly, in color, then they could probably be published quickly--which is not the case. As it is, authors are requested to provide map copy reproducible in black and white which is quickly reviewed, even without checking geologic names. The USGS then determines which depository(ies) to send them to. One copy of the report is deposited in the Washington (soon to be Reston) library, and usually one in the Denver, Menlo Park and Flagstaff libraries, and commonly one in some of the seven Public Inquiries Offices of the USGS. Some state organizations are also depositories for open-file reports concerning that state. Periodically a list of current open-file reports and their respective depositories is distributed via a general mailing list. Annually a USGS Circular is published that lists all open-file reports for the previous year.

A user, if he knows the report exists, may go to the depository and read the report there. If he cannot go, he then writes the depository requesting a copy. This is where difficulties begin. At present, the USGS can not make copies of open-file reports. The user must be referred to nearby commercial firms to copy them for him, which commonly results in lengthy delays. Other difficulties pertain to the nature of each report, for example, a lengthy report, in typescript, with numerous photographs and folded maps is difficult to prepare for more than a few depositories.

The solution of these difficulties for the near future will be to have a central depository containing a reproducible copy of every open-file report, and a facility for reproducing the report for the user at cost. Each report will be announced in the Monthly List of New Publications, and each will have a unique number. This plan will be implemented within the next few months.

Looking ahead, the open-file system of the future will be computerized. The USGS already has a computerized data file of mineral resource information. Computer graphics will replace traditional maps and illustrations. Problems of cataloging and recording this type of data will have to be solved before the public can readily obtain it. "But... within a few years we will no longer be dealing with the open-file system as we know it now."

DISSIPATION OF BABEL - OBTAINING FEDERAL INFORMATION

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ABSTRACT

Librarians and information specialists have in recent years had problems with their use of the services of Federal and Quasi-Federal information-producing agencies. The vehicles for communicating or even solving these continuing problems have not always been satisfactory.

In June of 1970, the Los Angeles Regional Technical Information Users Council (LARTIUC) was established to act as an unofficial collective forum of communication with the Federal Government's technical information agencies. The Council is composed of librarians and information specialists of companies and other organizations in southern California who are vitally concerned with the problems of dissemination of scientific and technical information and its products.

This group has produced one formal report and is preparing to release a second, to all pertinent congressmen, committee chairmen, senators, and government agencies. It has been very effective.

If network cooperation and/or action is needed, the Federation of Information Users' organization can be utilized or the Special Libraries Association's Government Information Services Committee.

Perhaps a similar Council could be organized to handle the problems of the geological documentation.