GEOSCIENCE INFORMATION SOCIETY

Proceedings • Volume 9 • 1978

PROCEEDINGS OF THE THIRTEENTH MEETING
OF THE
GEOSCIENCE INFORMATION SOCIETY

October 22-26, 1978

GEOSCIENCE INFORMATION
PUBLICATION - PROCESSING - MANAGEMENT

Edited by

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PROCEEDINGS
Volume 9

Geoscience Information Society
1979

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PREFACE

The 1978 Geoscience Information Society symposium was jointly sponsored with the Association of Earth Science Editors (AESE). The idea for the symposium originated with Fred Spilhaus of the AESE, who proposed that it would be mutually beneficial for both societies to examine geoscience publishing from several points-of-view. Accordingly, we invited representatives from each of the phases of geoscience information production and use--an editor, book and journal publishers, a data base producer/operator, a librarian, and an end user--to present their particular views and conceptions of the publication process. Those in attendance felt that the symposium afforded new insight and a better feel for the publishing process as a whole. Audience participation was enthusiastic and added a great deal to the papers formally presented.

The second part of these proceedings consists of the Geoscience Information Society technical session of papers contributed by members and non-members. Topics reflect our concern with geoscience information retrieval and use, collection development, educating library users, and a proposed new international organization for the geosciences.

Julie Bichteler
Program Chairperson, 1978

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PART I

SYMPOSIUM ON GEOSCIENCE PUBLICATION:
PROBLEMS AND PROSPECTS

SELECTION OF MANUSCRIPTS IN THE GEOSCIENCES

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Abstract: Editors of geoscience journals should strive for excellence, within reason, by accepting only new, true, important, and intelligible material. The goal of the selection editing process must be the identification and rapid publication of new discoveries and their verification.

The quality of a journal eventually hinges on the review process, and this depends on the referees, not on masthead galaxies of superstars. Important cogs are the associate editors, active scientists who command the respect of their peers. They should help choose the referees. Referees must have the option of anonymity and should receive adequate explanations when their decisions are overruled. Most authors should have access to reappraisal to eliminate the possibility of bias. Associate editors should be involved with rejections, divergent reviews, duplication, and plagiarism but must not deal directly with authors. Scientific selection editors should serve as buffers, convey all unpleasant messages, and make the final, informed decisions.

Most editors of journals, including those of commercial publishing houses, have the freedom to establish their own selection systems. The main fault lies with them if these don't function well, and the quality of papers deteriorates. Government editors may have somewhat less freedom due chiefly to the tradition of internal reviews.

There are many obstacles confronting a good selection process. Most are caused by authors who are commonly egotistical and unreasonable (surprisingly the same people can be fair and objective referees!). Other obstacles are the pressure to publish symposia *in toto*, and the time demands on volunteer editors. A beneficial pressure, exerted only by professional societies, is a continuing performance check on the selection editor.

Whatever their motivations (deification, masochism?) selection editors are very powerful people in the geoscience community. Selection of these selectors must be made with great care and caution.

Introduction

Geoscientific manuscripts are generally accepted for publication because one or more seemingly qualified people have stated that they deserve to be published. We all know of some exceptions to this, cases where aggressive authors have bullied or cajoled editors into accepting shoddy manuscripts against their better judgement and cases where senior government officials or the executive members of learned societies have overruled their editors and the referees. But such exceptions are rare; a review process followed by an editor's decision is the usual case. If so, we might well wonder why the quality of published papers varies so much among different outlets.

That variation in quality must depend on the selection process and this is what I propose to examine here: the refereeing system, the people that an editor calls upon to help him[1] make decisions, the internal and external pressures upon the selection process, and, finally, the editor himself--the main cog in the process and a potentially very powerful person indeed.

Before delving very deeply into the selection process, I propose to explore why we publish geoscience papers and, in order to keep this paper to reasonable length, eliminate some forms of publication.

Why Publish?

The purpose in publishing scientific papers is to facilitate communication among scientists by broadcasting their discoveries and the verification of these discoveries. This leads to the simple rule that we should publish what is new, true, important and, with the help of the editorial process, what is also intelligible. DeBakey (1976) and her colleagues have very nicely explored the various possible emphases on these four elements of the ideal scientific paper in their virtually indispensable text on The Scientific Journal. For example, if an article contains material that is obviously new and important, even if the truth is not yet wholly assured by extensive documentation, it very probably deserves publication because it will lead to progress in scientific knowledge. Articles that are true but

[1]Him and her, he and she, and his and hers, are used alternatively throughout this paper; substitute one for the other whenever it makes for more comfortable reading.

neither new nor very important may even deserve publication because they might settle a scientific problem once and for all time.

Few published articles meet rigorous standards for all of novelty, proof, and significance--generally editors look for an acceptable blend or balance of all three. Primary research journals tend to give more weight to novelty. Secondary journals, e.g. those of many of our mining societies, are more interested in what is true and important. They emphasize case histories and pragmatic descriptions in terms of established concepts, and they are a most important link in the technology transfer cycle. However, as their goals and processes differ from those of primary research journals, I shall eliminate them from further consideration in this restricted treatment.

Geological surveys and related agencies also tend to emphasize what is true and important. Their mandates are to describe and interpret the rocks, soils, and resources of a country or state. This most useful work does not always lead to conceptual breakthroughs, but when it does the new idea more often than not will be communicated in a nongovernmental journal. Nevertheless, from their inception, some government agencies, particularly national surveys such as the U.S. Geological Survey (U.S.G.S.) and the Geological Survey of Canada (G.S.C.) have introduced revolutionary new ideas in their own publication series. For this reason, I shall take the opportunity to discuss and compare some government selection practices with those of primary research journals. Chiefly, though, my concern is with the selection processes of the journals.

The Selection Process

There are many ways to go about selecting scientific manuscripts. Possibly the simplest is for the editor to make a decision without consultation, just as would the editor of a small town newspaper. This can work well for a news magazine, a semipopular journal, or for a very specialized journal which receives only a small number of manuscripts. However, according to DeBakey (1976) the average journal editor sends each manuscript to two referees. This average editor is an unpaid volunteer and, quite apart from the need for good critical reviews, must share her load with others because of time constraints.

Most respected geoscience journals have evolved editorial policies and practices similar to those that have developed in biological and medical journals as summarized by DeBakey (1976). They are best illustrated by describing one example in detail and then mentioning other practices to show the latitude that prevails. The example chosen is the Canadian Journal of Earth Sciences (CJES) published by the National Research Council of Canada in cooperation with the Geological Association of Canada, all of whose members subscribe to it. I am the scientific editor, and I consider it a model of good selection practices, although at least some authors consider me as the Very Model of a Modern Manuscript Mangler.

The Very Model. . .

The CJES is a general journal that publishes a wide range of papers, from vertebrate paleontology to theoretical geodynamics. It is considered a fairly respectable national journal (Morrison et al., 1978) and has a tolerable international standing (Institute for Scientific Information, 1978).

Main Cogs in the Model. To aid me in the selection process, I have eighteen hand-picked associate editors, all fellows of the Geological Association of Canada, who together cover most of the major subdisciplines of the Journal. All are actively publishing, respected scientists; about half are among our best known national scientists, and the other half are pointed in that direction. Ages range from the early thirties to the early fifties. They are appointed for two or three year terms and, hence, rotated regularly so that eventually a significant number of leaders from the geoscience community are involved in the top level of our selection process. One copy of almost every manuscript is sent to an associate editor, who might review it himself but often sends it to a referee of his choice. Another copy is sent to a referee whom I choose, sometimes in consultation with Survey or University colleagues. Occasionally, an associate editor will advise me that I have picked the wrong type of referee in which case he sends the manuscript to a second person of his choice. The referee reports come back to me. If the reports are positive and the manuscript is considered publishable (almost always with revisions), my assistant and I carry on from there. If there are divergent reviews, I consult the associate editor in regard to a third referee. If both referees are negative and I feel this is the right decision, I advise the associate editor concerned, and, unless he objects, the manuscript is rejected.

Except under very special circumstances, the associate editors do not deal directly with authors, and I convey all the pleasant or unpleasant messages. Associate editors become very involved in decisions concerning suspected cases of plagiarism and duplicate publication. They also set the standards in their subdisciplines in regard to the balance between new, true, and important elements. We meet once a year to discuss these standards, to compare notes on progress in the various subdisciplines, and to discuss and revise our editorial policies and practices. From my own experience, I can't conceive of a journal, but especially a general journal, carrying on without such an active group of associate editors to share a very large responsibility.

The Workhorses. The referees whom we choose range from bright young Ph.D. students to seasoned old greybeards. Although associate editors' ages differ by as much as twenty years, I have noticed no tendency for any of them to restrict their choice of referees to any particular age group. Referees are offered the option of anonymity but, much to my surprise, less than half of them choose to hide their identity. This differs greatly from the experience of Canadian research journals in other sciences where most referees choose anonymity or have it thrust upon them by their editors. The referees' right to anonymity is essential. Honest appraisal and criticism of a manuscript is a difficult, time-consuming job, and some of these saintly creatures review as many as five or six per year for our Journal in addition to those they review for other journals. One of my colleagues has averaged over twenty reviews per year for the past several years! If people like this signed all reviews and subjected themselves to personal hassles with sensitive authors, their refereeing activity would soon consume much or all of their working lives!

One essential ingredient of a referee's happiness is an explanation if his decision is overruled or his major recommendations for revision are ignored. All editors tend to forget this occasionally, but if it happens too often, they find that their stable of willing workhorses diminishes rapidly.

The Troublemakers. The plagues of all journals, including the CJES, are the authors. Would that we could do without them. These are creative people who regard their works as parts of themselves. Any attempt to criticize their works is taken as an attack upon their persons. They want to see the ultimate product of their labours between covers, not just part of it but every carefully chosen word of their lengthy manuscripts. They are chiefly self-centered, unreasonable egotists, and I should have no time for them at all except that most of them also serve as referees when, by a remarkable transition, they become the most reasonable, self-sacrificing, objective people imaginable. For this reason I feel that authors should have the right of appeal, and where there are slight doubts about a rejection I commonly advise the author that his contrary arguments will be considered. Few take advantage of this which signifies that most accept the arguments of well-chosen referees. Once, in response to a second appeal, our Journal initiated a new round of reviewing that led to publication of a very good interdisciplinary paper which had been beyond the scope of the first four referees. It pays to keep the door open a little if you can spare the time and patience.

This system may seem involved and unwieldy--however, it need not be lengthy. The CJES averages about eight months from first receipt of a manuscript until publication.

Practices and Policies of Other Journals

Most well-regarded journals, whether operated commercially or by societies, follow a somewhat similar system of selection to that described above. There may be minor variations, for example, several editors consulted through a questionnaire stated that they did not ever give authors the slightest encouragement to appeal a negative decision. In the case of a very specialized journal, the editor is probably sufficiently on top of her field to maintain such an attitude with confidence. However, editors of more general journals who have such inflexible attitudes may lose papers with innovative material that didn't register on the first round of referees. Also, the editors of several specialist journals seldom consult their editorial boards in the case of divergent reviews, but make solitary decisions to reject, accept, or seek third opinions based on their own knowledge of the subjects. The citation and impact ratings of some such journals (Institute for Scientific Information, 1978) suggest that this shortcut can be successfully implemented.

However, the journals that depart farthest from the selection processes described briefly in this article and in more detail by DeBakey (1976) are generally those with dubious reputations. One serious departure is that which involves an editor who does not consult her associate editors in choice of referees or any other matters. I know of a couple of distinguished scientists who have been on the masthead of a society-sponsored journal for about five years who claim never to have been asked for an opinion on a manuscript or any other matter.

Another mistake which some journals make is to stack their mastheads with galaxies of former superstars who have burned out light-years ago. All of us who have scanned inner covers of geoscience journals have recognized the names of old friends and former classmates who switched to administration years ago or who retired to well-earned rests near California golf courses when their pensions came due. One geoscience journal masthead which was analyzed a few years ago consisted of over 50 percent retired practitioners. Admittedly, the wisdom of a few senior scientists could add balance to judgments and policy decisions, but this still seemed a little much! Commercially published journals appear most guilty of featuring masthead names that have only historical significance, but I have no hard, quantitative data on this. Attempts to find out who had responsibility for appointing masthead names almost always led to the same answer--the editors. True, some of them may have inherited an imposing list of headstones instead of active spirits, but they are the ones who maintained these graveyards instead of replacing them with active playing fields.

Another problem of ailing journals is the alienation of referees by continually disregarding their advice and recommendations. In many cases this is due to lack of consultation with editorial associates or to the ineptness of such associates. Authors, in their determination to publish the unsullied truth, sometimes pretend to have complied with the referees' demands in the hopes of sliding a barely altered manuscript past a trusting editor. They might succeed when the editor is not conversant with their specialties, but they are unlikely to get very far when their revised products are scrutinized by informed peers.

And, Finally, the Bureaucrats. . .

Government policies on scientific selection processes vary significantly from one agency to another, but most have a common thread that distinguishes them from those of nongovernmental journals--namely the fact that most or all of the reviewing procedures are internal. Several reasons are given for this: 1) Security until general public release; 2) Sufficient in-house competence; 3) External reviewers will require compensation; and 4) Special competence may be required which is not available externally. The first two of these do not wash at all well; the last two have some foundation in fact but are hardly insurmountable objections.

Most journal editors agree that there are very few examples of breach of confidence in the editorial system; ideas and concepts are seldom purloined although opportunities are plentiful and temptation must sometimes be great. It is difficult to understand why most government maps and reports would be any more subject to larceny than other forms of scientific literature--with the exception of a very few politically controversial documents that could be easily identified.

The argument of sufficient competence within the organization undoubtedly applies to the U.S.G.S., less to smaller national surveys, and not at all to many state and provincial surveys who usually have several one-of-a-kind specialists on staff. Some of the smaller surveys make a practice of sending their more highly specialized reports for external reviews but, commonly, to people chosen by authors themselves--which rather diminshes confidence in such reviews.

My own experience, augmented by discussions with other editors, suggests that external reviewers will cheerfully donate their leisure time to appraising short, sharp governmental reports which appear to be breaking new ground. They hedge over taking on reviews of long, dull (but important!) descriptive works, but a modest honorarium will usually induce them to do this just as it will get them to agree to assess a lengthy M.Sc. thesis--the small bribe acting as a catalyst to a latent sense of duty and curiosity.

Some forms of government publications are so specialized that external assessors are hard to find. Strangely enough, geological maps and sections qualify in this regard. Employees of geological surveys are practically the only people who now interpret the rocks in this most basic but most sophisticated format, and increasingly, they must rely on their close colleagues to comprehend and criticize their products. Except for interchanges of map-editing chores between government agencies, I see no possibility of obtaining good external reviews of complex maps and sections--they require gifted and very specialized assessors.

R. Davis of the U.S.G.S. pointed out to me at the Association of Earth Science Editors (A.E.S.E.) annual meeting at Butte (Neale et al., 1979) that there are hidden strengths in government review systems. Manuscripts are scanned and evaluated all along the chain of command before they can even reach formal editorial assessment. Even after passing refereeing procedures, they must receive approval by informed senior scientists. This undoubtedly explains why the final products of large national agencies are generally of superior quality, but, again, this argument is not applicable to the dozens of small surveys and research councils across the continent which lack the breadth to criticize capably the work of all their authors.

Apart from the lack of sufficient in-house experts, the other major weakness of internal reviews is the fear of offending a colleague (especially a senior colleague) in the next office--knowing that you may have to work beside her for the rest of your career. It could be particularly terrifying in small agencies where the potential for moving offices is rather restricted! This, of course, is the very reason why journal editors do not send manuscripts to referees in the authors' own institutions. My own impression is that internal reviewers will conscientiously and constructively point out flaws in a colleague's work but will stop short of recommending outright rejection.

An external check on in-house government review systems is provided through the manuscripts which government scientists submit to journals. Most editors of journals agree that these are the best-prepared, best-organized, best-illustrated manuscripts they receive. However, although the acceptance rate of manuscripts from government scientists is higher than that from academic and industrial scientists, it is only slightly higher. Many of these neat, well-prepared manuscripts are rejected or returned for major revisions. This suggests that the in-house referees either were reluctant to criticize their colleagues' work or lacked the special competence to do it.

Governmental geoscience publications would benefit from external reviews. It could be done at little cost, and strong editors are slowly bringing it about in several agencies. It is bound to lead to two very desirable ends: a decrease in quantity and an increase in quality.

Pressures on the Selection Process

There are many pressures on the ideal selection process, and not all of them are bad. I have already mentioned authors, those very unreasonable people who are convinced that their work deserves publication. In addition, there are journal sponsors and readers who also have an interest in and may attempt to influence what is published. Other pressures come from symposia, comparisons between subdisciplines, and limits to an editor's time.

A Beneficial Pressure

Societies that produce journals naturally are concerned about their quality, as individual members are usually locked into subscriptions and demand value for money. Most have editorial committees that have some influence in the selection of editors and mandates to monitor performance. Complaints of the readers filter up to the committee, and the executive of the society can exert pressure on the editor or relieve him of his duties. This check upon an editor's performance is very healthy--unfortunately, it is unique to society-sponsored journals.

Government agencies are also interested in quality of publications. However, complaints would probably have to be loud and long before an editor was shifted laterally to another position. Also, they would probably have to come from within, i.e. from the authors, rather than from the readers. Authors are not apt to complain too loudly as long as their work is being accepted.

Journals of commercial publishing houses have no spokesmen for the consumers. Through fortunate choices of editors some of them perform magnificently. Others have doleful scientific records but, if the ultimate aim of the publisher is profit and if libraries feel compelled to buy the product regardless of quality and continually increasing price, then why not leave the skipper in command of his leaky boat?

Society-sponsored journals are blessed to have quality control imposed upon them.

Some Unpleasant Squeezes

All pressures from sponsoring societies are not blessings. Members, through their executives or otherwise, may attempt to lower standards or unwisely change emphases. A common complaint is that one phase or subdiscipline is being ignored. This is often made without realizing that ultimately an editor has to select from what is submitted. Papers in fields that normally bypass his journal can be weaned only slowly from their normal resting places. This is particularly true of first-rate scholarly papers in pragmatic subjects such as mineral deposits--there are relatively few of these and competition is keen. Consequently, the pressure to publish more such papers is usually also a pressure to lower standards. The editor must resist, knowing that falling standards in one domain eventually lead to an overall drop in quality. We all know of some editors who have resigned rather than yield to such pressures.

Symposia are often published as special volumes of societies or as special issues of commercial or society-sponsored journals. Commonly, the enthusiastic organizer of a symposium volunteers or is nominated as editor of a special volume or issue--regardless of whether or not he has had any previous interest in editing or even if he is literate. It is not unusual for him to lose interest halfway through the ordeal and to take any shortcut possible to hasten his return to his research. There is a tendency to include abominable papers for the sake of "completeness" and a reluctance to reject papers, no matter how bad, when the authors were personally invited to submit them by the organizers. My own feeling is that we could do without most symposium volumes; the papers in them are generally not very closely related; the good ones would be read and cited just as much if they were published individually; and the poor ones don't belong between the same covers. If an editor is pressured into publishing a symposium, he should insist on maintaining the usual journal selection process so that the deadwood can be pruned. Often there isn't much left!

There may be a wide range of standards among the subdisciplines included in a general journal. If the associate editors have been chosen well, this will reflect only the stage of development of the subdiscipline. Thus, many papers rated as valuable contributions to paleontology and Pleistocene geology are mainly descriptive and still probably belong in a primany research journal. In contrast, papers in sedimentology, petrology, and most fields of geophysics must usually make a conceptual contribution before meeting the approval of peers. Authors don't always appreciate this, and one will find petrologists citing paleontological publications and saying "why hers and not mine?" Editors don't always appreciate the reason, either, and unfortunately yield the point to irate authors.

Volunteer selection editors are usually publishing authors in their own rights. This leaves them vulnerable to criticisms of selective bias in their own specialities, and authors are not loath to level such criticisms. There is no cure for this; the disease can be slightly alleviated by the editor's being seen to bend over backwards--but he must be careful not to topple when doing so.

Finally, there is the pressure of time. Volunteer selection editors are usually very busy people. They have full-time jobs as teachers or scientists or both, and they are commonly the types that take on many extramural chores. The fortunate ones have full- or part-time assistants who keep manuscripts moving back and forth and strive to avoid backlogs accumulating. Still the editors have to make the final decisions, and hurried acceptances or rejections are not always the right ones. Some editors are always pressed for time!

I've touched on just a few of the detrimental pressures. A strong editor can overcome most of these except the time factor--a wise one can cope with even this by sharing his load, by giving up less important extracurricular activities, or by a combination of both.

Post Selection Processes

Selection editors of the journals of small societies and editors of special volumes are commonly responsible for copy editing, layout, and even dealings with the printer. I am sorry for them. Selection editors for the larger society journals, all commercial journals, and most government publications are usually able to turn these tough chores over to others.

However, there are some aspects of the post selection process that deserve the attention of the selection editor. One is layout. Journals are usually hard pressed financially and will tend to reduce an illustration by as much as the lettering and line work will bear but, by doing so, will compress an author's message to an insignificant postage stamp size. The selection editor should advise on maximum reduction advisable. Conversely, governments are rich in paper, and it is not uncommon for some agencies to devote a full page to an index map that might be used to show a single fossil locality. If a government scientist sends such an illustration to a journal, the nongeologist copy and layout person might decide that lettering and line work cannot stand reduction and hence devote a full page to it--an aesthetic crime in a conserver society. The selection editor must nip such offences in the bud and return them to the author for redrafting to suit the reduction they deserve.

Proofs are commonly read by the author and the publishers' copy editor. Some authors have been known to insert material at this late stage which had previously been deleted at the referees' and editor's insistence. Any attempts to make major changes in proofs should be brought to the selection editor's attention.

One job that copy editors cannot do and that volunteer selection editors do not have time for is the real job of editing. That means tearing a paper apart: reorganizing, deleting repetitions, removing ambiguities, and tightening flaccid styles. Manuscripts from academics and industrial geoscientists are most in need of this attention, for many of these people do not have the sense or courtesy to circulate their papers to colleagues and co-workers before sending them to an editor for review. The only people in the journal circuit left to do this are the referees. Praise be Allah that some are capable of doing it and will actually devote time to it (often without any thanks). I disagree strongly with John Dewey's contention in this symposium that referees should concentrate only on the scientific worth of a paper and leave the editing to the editors.

Editors usually have too much on their plates to worry about editing!

The Selection Editor--A Powerful Person

Selection editors of journals are powerful people. They are generally free to design or redesign the processes responsible for the communication of most of the discoveries in our science. Their freedom and power seem to be the same whether their journals are published by professional societies or commercial publishing houses.

This leads us to wonder what manner of person aspires to so high a post, what qualities are desirable, and how is the favoured person chosen?

Duties, Requirements, Motivations, and Rewards

A science selection editor's goal should be to make her journal better than it was before she took it over. Essentially this means elimination of more of the chaff and recognition and publication of the bold new ideas on which our science grows.

It takes one to catch one, so the editor must be an established geoscientist with some good work to her credit and preferably still active in science. Just how active depends on the journal's demands. The editor of a specialized quarterly could and should remain a leader in research. The editor of a large, general geoscience monthly would probably find that competent operation of the journal would cut deeply into personal research time. The editor has to be a good organizer and manager in order to handle a large volume of correspondence, scan vast amounts of manuscript material, and to make firm, sometimes unpopular decisions. She should also be monitoring her journal's progress by following citation reports and periodically devising tests to gauge reader reaction and impact of papers on the scientific community. The editor should also have a wide range of acquaintances throughout the geosciences, not only to select the best people as associates and referees, but also to circumvent scientific feuds and war zones. Above all, the selection editor must be a buoyant character with no history of suicidal tendencies.

If referees remain anonymous, authors have only the editors to flail for insensitive treatment of their master works. And flail they do--by mail, by 'phone, and in person when opportunity offers. Masochism has to be a prime motivation of scientific selection editors, and the job offers many satisfactions of this kind.

There are also other rewards. The good selection editor knows that she is a powerful person with a very significant influence on the health of her science. Also, she has the genuine respect of the community--not because of this power (for only she knows she has it) but because she has taken on a job that most geoscientists know is demanding and which is one they personally would prefer to avoid. Finally, the name and address at the top of the masthead draw the geoscience community's attention not only to the editor but to her institution--who would have ever heard of Oxford, Calgary, Yale, or Toronto if it were not for the prestigious publications which are edited at these places?

Selection of the Selector

How do we discover and appoint these paragons of all geoscience virtues? As Arthur Meyerhoff pointed out to those attending the 1979 A.E.S.E. meeting at Butte (Neale et al., 1979), too often there is either an attempt to seduce a leading scientist into accepting the role or to accept the services of an eager volunteer who desperately wants his name inside the front cover. In neither case is a serious attempt made to determine if the person has the time and talents for the job. Commercial publishing houses, in particular, seem to seek big names of the past or present. Sometimes they are fortunate and secure a first-rate selection editor in the process, but more often than not they end up with only an impressive name plate. Government agencies sometimes use the post as a terminal lateral move for a senior scientist near the end of his career--without very close scrutiny of his abilities. Again, they are sometimes lucky, e.g. most of our authoritative guidelines to editing have emanated from government editors.

Surely the job of selection editor is important enough to warrant the executive of a society drawing up a list of desirable requirements, guidelines, and challenges and initiating a search for the right person instead of cheerfully electing the first name proposed. Some of the larger organizations produce editorial and policy guidelines that are used extensively when searching for a new editor. This has been done for the eleven research journals published by the National Research Council of Canada (Bishop and Williamson, 1978), and parts of it could serve as a guide to smaller societies. A society executive body, armed with a list of scientific and personal requirements, could then consult an appropriate segment of the community for nominations. Candidates who responded to the challenge would be aware from the start of the freedoms available to realize their goals and of the approximate time required to perform the functions of the office.

Enough is Enough

Many smaller societies elect their editors for a term of one or two years and then turn them out before they've had a chance to come to grips with the job, let alone accomplish anything worthwhile. Commercial publishing houses and government agencies seem to allow their selection editors to continue forever and ever, regardless of whether or not they are doing a good job, until profits fall off or retirement intervenes. The better-organized societies with the most successful journals seem to have policies that lead to dismissals of weak editors and retention of successful editors as long as they are successful--and this could seemingly be forever and ever.

A good selection editor needs time to create stability and to achieve his goals of excellence within reason. Most present and former editors whom I have talked with suggest that five to seven years is ample. If the editor hasn't done his thing by then, it's unlikely that he ever will. If he has, then he should step aside at the pinnacle of his success, before boredom sets in, and turn his talents to another challenge. No matter how successful an editor has been, when he retires, the journal usually takes a whole new lease on life: authors who have boycotted it will give it another try; suggestions for new tacks that have been turned down will now be reconsidered; and so on.

My advice to successful volunteer selection editors is to quit while you are winning--but do it gracefully and with ample notice so that you do not destroy the thing you have grown to love.

And Now to Tell You What I've Said

The publication of scientific papers is the important, culminating step that follows from discovery and verification of scientific knowledge. The selection process must separate out the chaff from the new, true, and important material which is the lifeblood of geoscience. There are proven ways to do this: the use of active, respected scientists as associate editors; the choosing of capable referees; setting up an appeal process to eliminate the possibility of bias, leading to wise and just final decisions. Some of the ways of effecting this are discussed in the present article, and there are several other more detailed accounts of the selection process (e.g. DeBakey, 1976).

Editors of most or all geoscience journals, whether commercially or society sponsored, are free to implement most of the time-proven methods of selecting scientific papers. Government editors have less freedom, partly because tradition binds many of them to internal review systems, but strong editors can probably do much to change the system and improve standards. This all adds up to the fact that selection editors are very important and powerful people in the community of geoscience. For this reason they should be chosen with extreme care, and there should be mechanisms to relieve them of their duties if they are not performing adequately. Even if they are doing well, selection editors should not continue in their post once their main goals are attained. That is the time to stand aside and allow another to impart a new thrust to the journal.

Acknowledgements

I am very grateful to the following who completed questionnaires concerning the journals which they edit and also added many interesting comments and insights: Louis Cabri, Eion Cameron, Bill Fyfe, Don Glass, Len Hills, Tony Naldrett, and Denis Shaw. My views on the selection of scientific papers have been expanded by discussions with many participants in the last two annual meetings of the Association of Earth Science Editors, particularly Art Meyerhoff, Alex McBirney, Bob Davis, and Fred Spilhaus, Jr. I am glad that Fred Spilhaus and Julie Bichteler coerced me into taking part in this joint G.I.S./A.E.S.E. symposium because the vigorous discussion following the panel presentations was highly informative. Finally, my thanks to Marion Benson and Jamie Gaetz, two admirable assistants to a selection editor, who typed and proofed this manuscript in the absence of the author and in the white heat that prevails when another final deadline has slipped past. Authors are criminals.

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BOOK PUBLISHING IN THE GEOSCIENCES: PROBLEMS AND PROSPECTS

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Abstract: Book publishing in the geosciences has enjoyed a long period of steady growth with the future continuing to look promising for quality and useful publications. Geoscience book publishing is largely a commercial operation, dominated by five or six American and European publishers, but in recent years university presses and the professional societies have increased their book publishing activity. All publishers have a common goal--successfully fulfilling worldwide educational and professional information needs.

With the assistance of consulting editorial experts, publishers are better able to anticipate book needs of the geoscience marketplace. Consulting editors are leaders in their subject area specialties and are invaluable in helping the publisher maintain quality and creativity.

Except for textbooks and general interest publications, publishers place most reference works in specific publishing programs to maintain identity and continuity. This is especially helpful to librarians but does have drawbacks; some books of quality and usefulness may be overlooked.

Today's major problem for all publishers is rising costs. This is due to inflation but also to increasing specialization. Publishers' counter measures include more market-oriented publishing decisions and institution of cost-saving production techniques. The presentation will expand on these and other publishing problems and possible solutions.

This year's program is a marked contrast to the Geoscience Information Society symposia of recent years. It is almost mundane by comparison--our old friend the book in the same company with such sophisticated papers as "RASP, a

System for Interactive Manipulation of Geologic Data," or "Status of REAP, R3S Bibliography File" or "JAWDEX, the National Water Data Exchange."

Now we have come full circle and, as book publishers, we are pleased and feel that we are getting back to basics. Although the information explosion of the past thirty years has stimulated a revolution and produced radical new information systems, we have not yet seen, as some have predicted, the demise of the book. In fact, in spite of serious problems in the industry and some of its markets, book publishing is booming. At present, more books are being published everywhere in the world than ever before. Recently, the Knowledge Industry Publications, Inc. (1978) estimated the worldwide English language book market place at close to $5.3 billion dollars. The U.S. market accounts for 75% of this total! Great Britain is in second place with about $1 billion, followed by Canada, South Africa, Australia, and India. Figures released by the Association of American Publishers show that book sales by U.S. publishers in 1977 totaled $4,605,500,000, which was an increase of 10% over 1976. Mass market paperback sales enjoyed the greatest increase, 24% or $516,000,000, followed by professional books with 12.2% or $600,000,000.

Our topic is "Book Publishing in the Geosciences: Problems and Prospects." Before commenting on some of the industry's problems, we think it would be interesting and helpful to take an overall look at current geoscience book publishing. How large is this business? Who are the major publishers?

By contrast with other segments of the scientific and technical book publishing industry, particularly the physical and life sciences, the total output of the geoscience book publishers is small but is expanding rapidly. Although there are no industry or association figures for geology, we can, by extrapolation, come up with a ballpark fix on the yearly magnitude of geoscience book production.

Looking first of all at geoscience literature, Graham Lea of Geosystems of Great Britain estimates the back files at 2¼ to 2½ million items with approximately 100,000 additions yearly. Estimates from various sources would indicate that books comprise 10% of this total or 10,000 titles.

In terms of language distribution, the percentages are as follows: English 55%, Russian 23%, French 8%, German 5%, Japanese 1%, and all others 8%. Note that this breakdown does not reflect the total geoscience output of these individual language areas since, except for Russia and France, most geoscience publishing is in English.

Today there are four general types of geoscience publishers: commercial houses, university presses, societies, and government agencies. These four groups produce three basic types of books: texts, professional reference, and general interest.

Generally speaking, in an average year at current levels of output, the list of commercial houses is led by Elsevier Scientific with 24 or 25 professional and reference titles. Springer-Verlag follows with 12 to 14 professional and reference titles, John Wiley (New York and London) does about the same with a dozen or so textbooks and professional and reference titles. We are pleased to note that the coauthor's former affiliation, Dowden, Hutchinson & Ross with their Benchmark books, ranks about fourth or fifth with 8 to 10 geology titles a year. McGraw-Hill, W. H. Freeman, Freeman-Cooper, and Prentice-Hall each publish 2 or 3 titles a year, mostly texts and general interest books. Several British firms, namely Allen & Unwin, Edward Arnold, and Longmans, each produce 3 or 4 books annually.

A number of university presses publish some geology titles, particularly trade or general interest type books. The majors in this group include Oxford, Cambridge, Harvard, Princeton, Chicago, Texas, and Oklahoma.

The society publishers are led by the Geological Society of America and the Geological Association of Canada with 4 or 5 titles annually closely followed by the American Association of Petroleum Geologists (AAPG) and the American Geophysical Union averaging 1 or 2 books a year. Most of the international or foreign societies such as the Geological Society of London, the International Union of Geological Sciences, and the national societies of Germany, France, and Australia follow similar patterns.

Last but not least are the various governmental agencies such as the U.S. Geological Survey and the individual state surveys. In Canada, both the federal government and the nine provincial agencies publish special books, primarily on resource management. While no one of the societies or government agencies makes a major input individually, in toto, they represent a significant contribution indeed.

In the United States, the most competitive but lucrative market for earth science book publishing is the college textbook field. There are approximately 400,000 students in the U.S. and Canada taking introductory geology courses every year. A successful new text or a new edition designed for this market can easily sell 50,000 copies in its first year. Since the average list price for such texts is about $15.00 the result is a net income of $600,000 (allowing for the usual discount of 20%) for the U.S. and Canadian markets alone. It is no wonder that, in any given year, there are 20 or more active texts competing for adoptions in the three or four types of introductory courses. The investment, however, required to produce a competitive basic textbook is considerable. The publisher's outlay per title can be fifteen to twenty times that required to publish a typical professional-reference book.

The risks and competition are tremendous; the author and publisher may take years to develop a fine book that, because of poor timing, may never realize its potential. It is very hard to displace one of the well-established texts. For instance, the various editions and versions of the Yale book by Flint et al., published by John Wiley, has been a best seller, year after year, since it first appeared about 1913.

Then, of course, there is additional competition from the used book market. Good for jobbers, students, and bookstores but bad for publishers and their authors. A book that sells 50,000 copies in its first year can maintain or even improve its relative position in the market the second year, but sell only 10,000 to 15,000 new copies and drop to the 3,000 to 4,000 copy sales level in immediately succeeding years--this seeming lack of consistency due largely to the competition from used books. Publishers try, of course, to counter this competition by various means, including new editions, soft covers, even unbound books. None of these practices, however, has proven to be very successful. Contrary to general belief, the used book marketing business is very well organized, a major industry in itself. As the price of undergraduate science and geology textbooks continues to increase, now approaching an average of $20.00 per copy, the market for used books will expand and prosper.

With the increased interest and concern of the general public in energy and environmental problems, general interest or trade books in the earth sciences have, we believe, an underdeveloped market. Recognizing this trend, three California publishers, W. H. Freeman, Freeman-Cooper, and William Kaufmann, are doing some interesting things. The National Geographic Society and the Smithsonian Institution are also becoming more active as publishers of general interest geoscience books.

Between 80% and 90% of all geoscience titles published can be classified as professional-reference books. Usually, they are multiauthored, headed by a volume editor or editors with contributions from a number of experts. State-of-the-art books are often triggered by or originate from a society-sponsored symposium. The commercial publisher places most of his professional-reference titles in a series or in a specific publishing program. This gives the individual volume identity and sales momentum from the series and continuing orders.

The most successful books are those concerned with timely topics, for example, fossil fuels, petroleum and mineral exploration, and that great favorite, plate tectonics. Markets tend to be somewhat inelastic, mostly institutional (libraries and industry) where price resistance is not a major factor. As we shall see, however, this situation may be changing.

Let's take a comparative look at the two major producers of professional-reference books: the commercial house and the society publisher. Traditionally, the commercial publisher published those books that were financially viable, providing a royalty for the author and a profit for the publisher. The society publisher, along with most university presses, published all of those good books that deserved publication but were too specialized for commercial houses. Scientific merit was the only consideration.

The subsidizing or underwriting of these high quality but commercially marginal projects traditionally has come from a number of sources. These have included society membership dues, journal subscriptions, research grants to authors (who receive no royalties and may also prepare camera ready copy), and indirectly from federal and state governments in the form of tax exemptions. This situation, however, is changing. This somewhat favored status may soon be a thing of the past for most society and university publishers with the result that they are now guided by many of the same decision-making factors employed by the commercial publisher. Publishing projects, to a great extent, must be able to stand on their own, financially. At AAPG, for instance, for a project to be viable it must have a fairly broad appeal with sales potential of at least 2,000 copies. This is a higher figure than some professional-reference commercial houses require as a minimum.

Does this mean that societies are or will be in direct competition with commercial publishers? The answer is yes, they are, they have been, and they will probably be even more so in the future. Is this unfair competition?

Perhaps it is. Let's take a look at how these two types of publishers carry on their book publishing operations. Both use "outside" subject experts to solicit and evaluate manuscripts. Both have ongoing series and programs to attract authors.

In the business of manuscript acquisition, the society has several techniques that are not generally available to the commercial publisher. The society-sponsored symposium is one of these unique situations. Obviously, the sponsoring organization has the inside track on any manuscripts that emerge from its own meetings. Sometimes authors will elect to go the commercial route because of marketing and royalty considerations. The commercial publisher may also have a better fix on the market, a worldwide distribution system that societies seldom have, and a willingness to gamble more than the bureaucracy of a society publishing program will permit. Another situation favorable to the society is the publishing of reprint books from their own journal publications.

Still another advantage over the commercial sector is the availability of mailing lists from their membership and journal subscriptions, normally the hard core market for this kind of book. Some societies even gain an edge on production costs as they can obtain "special prices" from their journal manufacturers for that "occasional book."

Other privileges usually enjoyed by the society are free advisory and referee services and last but not least, the tax free status of a C-3 or C-6 chartered organization. As some societies move into a more competitive posture with the commercial sector, they may put their tax free status in jeopardy. Periodically, their policies and practices are reviewed by the Internal Revenue Service. In 1978, the American Chemical Society, the American Institute of Physics, the American Physical Society (APS), and several engineering societies had their C-3 and C-6 status questioned by the IRS. At this time most of the decisions are still pending, but the APS won their appeal. The final decision on these cases is awaited with keen interest by all societies and, of course, the commercial sector as well. Regardless of the final IRS decision on this present review, I believe it is safe to assume that we can look for increased book publishing activity from many geoscience society publishers.

The major problem today for all publishers, commercial and noncommercial, is rising costs. More books at higher prices are competing for fewer dollars.

Inflation is affecting every phase of the book publishing process, but it is particularly severe in manufacturing (paper, printing, binding). Paper costs have been rising at an average of 10% to 12% per year and printing and binding 6% to 8% annually. Most other related costs, warehousing, distribution, promotion have increased similarly and this year are expected to go over the 8% level.

Geology books are expensive. In a survey of U.S. publishers from 1977 data compiled for the Association of American Publishers by John P. Dessauer, Inc. (1978), we see that earth science books are the highest priced of any in the technical and scientific category. The study showed that the average price for all scientific and technical books was $17.48, and for geology books the average price was $25.98. The life science books were close behind at $24.66 and the physical sciences were at $19.51. Medical books, surprisingly, were an average of only $16.28.

Perhaps even more interesting and even alarming were the rates of price increases this past year. Earth science books jumped up 37%, topped only by the life science books which increased 60%! Earth science books are expensive to produce for fairly obvious reasons: maps, half-tones, and small, specialized markets. This last in contrast to life science, physical science, and medical science market potential. These high prices tend to limit sales to the institutional buyer, libraries, and industry. Fortunately, the geoscience industry is enjoying great prosperity and overall sales throughout the world have been increasing steadily. Professor Gerald Friedman (1978), former President of the Association of Earth Science Editors and currently Chairman of the Geology Section of the American Association for the Advancement of Science, writes in an editorial that "Geoscientists will be in demand for the foreseeable future as the world seeks to meet its needs for energy and minerals. But, the lessons of the past should not be forgotten. The feast of today may once again be followed by famine." (Dr. Friedman had referred earlier to the famine in geology in the late 1950's and early 1960's.)

Professor Friedman may have also been thinking of the possible upcoming tax revolt. In addition to double digit inflation, we are facing a national tax revolt that could seriously jeopardize the tax base from which most academic and public libraries receive their funding. As we all know, libraries have been under severe budget pressures, even suffering actual cuts, for at least five years. The national adoption of Proposition 13 type tax programs must give all of us in this industry cause for alarm or at least great concern.

What can geoscience publishers do to slow down the rate of cost and price increases? For the short-run professional-reference book, the principal area of cost sensitivity and flexibility is that of plant costs, primarily composition or typesetting. It is here that dynamic new technology has and will continue to make a major impact on the total cost structure of most technical and scientific books.

Let's take a look at a model book where the composition is handled by four different methods, all other aspects of production remaining the same. The model will be a 6 x 9, 320-page book with a minimum of illustrations and fairly straight-forward, uncomplicated material for typesetting. The print run will be 1500 copies. The four choices are as follows:

1) Camera ready, author prepared copy (CRC)
2) IBM unjustified
3) IBM justified
4) VIP photo composition

From Table 1, we note that the unit cost for camera ready copy is $3.09, IBM unjustified is $3.90, IBM justified is $4.65, and VIP is $5.18. Assuming the commercial publisher's typical markup of five to six times, the selling price would range from $16.00 for the CRC book to about $27.00 for the book composed by VIP.

Camera ready copy prepared by the author has the added advantage of being faster. Most books can be off the press six weeks to two months after CRC is received by the publisher. It also can be more error free and involve fewer steps and fewer people.

More sophisticated variations of CRC combining CRC with computer typesetting are now coming into use. These include the use of an optical character recognition typing ball and MRM's (machine readable manuscripts). All three methods require very knowledgeable and experienced professionals on the publisher end of the process as the author must be provided with very carefully tested and detailed instructions.

Many authors are not aware of the typesetting facilities available at or near their institutions. Lauren Garson of the American Chemical Society is currently making a survey and study of computer and word processing facilities available on campuses and in research centers throughout the U.S.

TABLE 1

SAMPLE COSTS OF A MODEL BOOK[a]

Elements of Production	Methods of Composition			
	Camera-Ready	IBM Unjustified	IBM Justified	VIP (Photo)
Design/editorial	$ 500	$ 500	$ 500	$ 500
Composition	700[b]	1920	3040	3840
Plates	610	610	610	610
Dies	150	150	150	150
Paper	752	752	752	752
Press	453	453	453	453
Binding	1270	1270	1270	1270
Freight	200	200	200	200
Total	$4635	$5855	$6975	$7775
Unit Cost	$3.09	$3.90	$4.65	$5.18
Composition per page	$1.50	$6.00	$9.50	$12.00

SOURCE: Shirley End, Dowden, Hutchinson & Ross, Inc.

[a]Costs are based on assumptions of 1500 copies of a 320-page book, 6 x 9 trim size.

[b]Includes setting front matter, index, and running heads and folios.

This entire technology is in such a dynamic state of development and growth that it would not be productive to go into greater detail here, but it is enough to say that we, authors and publishers alike, must maintain an awareness and adopt an attitude of receptivity toward this vital aspect of our industry.

Another related move that can save time and money is author editing, or at least author manuscript preparation that can skip this time- and cost-consuming step traditionally performed by the publisher's copy editor. Some believe the time is approaching when professional copy editing for most professional-reference books will be a luxury of the past. Perhaps the use of computer editing will establish itself as an acceptable compromise.

One more area ripe for greater innovation and change is marketing and distribution. Small publishers and many societies would do well to combine these functions and benefit from the very direct and sizeable savings that can be realized from this volume-sensitive, noncompetitive but necessary step in the publishing process.

To conclude, in spite of these and other less dramatic problems, we believe that we can look for continued prosperity and considerable growth in geoscience book publishing. We can expect greater input from all sectors of the industry including the emergence of new commercial and society publishers offering exciting, innovative, and efficient publishing programs.

Acknowledgements

We wish to express our appreciation to the following individuals and organizations for their cooperation and assistance in the preparation of this paper.

Brahms, G. R. (Burgess Corp.)
End, Shirley (Dowden, Hutchinson & Ross, Inc.)
Freeman, W. H. (Freeman-Cooper Co.)
Holoviak, Judy (American Geophysical Union)
Licker, Mark (Springer-Verlag New York Inc.)
McGraw-Hill Book Co.
Odell, Glen (Princeton University)
Polhemus, R. B. (John Wiley & Sons, Inc.)
Prentice Hall, Inc.
Spilhaus, Fred (American Geophysical Union)

Stanley, D. J. (Smithsonian Institution)

Walker, Richard (University of Wisconsin)

Zeiders, Barbara (Service to Publishers)

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JOURNALS: A PUBLISHER'S VIEW

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Abstract: Critics say the journal as we know it today is dead and simply has not had the grace to allow itself to be buried. Proponents argue that the ink-on-paper journal will continue indefinitely. Obviously, the truth lies somewhere between these extremes. The great challenge for the journal publisher is to find this middle ground while coping with the problems that could possibly lead to the death of the journal. In addition to the standard inflationary factors, journal publishers must contend with paper prices that may increase between 30% and 50% in the next year and postage rates that threaten to increase at 15%-30% per year. New technologies and formats that promise to be the answer to these problems actually add to the pressure and uncertainty as well as to the cost. In the United States, government regulations, those directly affecting the publisher and those having a strong impact on the suppliers and services the journal publisher depends on, are also increasing costs. Sources of income are limited for the journal publisher, thus the reduction in the number of subscribers is increasing the rate the remainder must pay. If journals are to remain a key part of the information system, users must recognize the value of information and find quantitative means of evaluating the journal, so that the resources of science can be allocated effectively.

The birth of the journal has traditionally been attributed to the French Academy. The circulation of letters between scientists, first informally and then under the guidance of the academy, evolved into the first true scientific journals in about 1665. From a need to distribute and retrieve the works of individuals more efficiently, the journal was created. Today there are over 2000 scholarly journals published in the United States alone.

Despite its illustrious birth and its long and steady growth, cynics are predicting the demise of the journal. However, its supporters claim that although the journal may change, it is here to stay.

I believe that the journal will continue, but its form will inevitably change. Technology will no doubt have a significant impact on the direction the journal takes. Man's stubbornness will somehow make the change be on his terms.

When I speak of journals, I do not mean just collections of scientific articles printed on paper, bound between covers, and delivered by the postal services. I mean all of the various formats and media used for regular distribution. Although many of my remarks will be directed toward the problems of paper publishing, the objectives of the journal publisher relate to the dissemination of information and not to the format in which that information is delivered.

The primary objective of the journal publisher is to facilitate the rapid dissemination of high-quality scientific articles and at the same time to provide for the archiving of this information for future needs. These two equal roles frequently create conflicts, for methods and techniques that best serve one objective actually work to the detriment of the other. For instance, low-grade wood pulp papers definitely reduce production costs, and the resulting savings may be used to offset the expenses of more frequent distribution. But these papers soon become brittle and may self-destruct on the library shelf. Therefore, the problems of the journal publisher start with the objective itself.

My own background in journal publishing comes from a scientific society, and most of what I say will no doubt reflect this bias. Journal publishing is a traditional function of a scientific society. The two usually grow together, and the objectives of the society determine the directions that will be taken in meeting the goals set for its journals. The scientific society is committed to the continuation of the exchange of information. The scientific society thus has a major concern in the stability of the system designed to foster this exchange. The scientific society also has a commitment to serve the needs of the individual researcher. Please note that I said individual researcher not member. To meet this commitment, the society strives to maximize the dissemination of the journal through personal subscriptions and wide availability in libraries. But the dedication to this goal leads to what may be one of the more sensitive problems being brought before this audience, that is, the misunderstanding created by the differences between the individual and the institutional subscription rates of society-owned journals. Even with a dual rate structure, society journals are finding it difficult to maintain the broad dissemination they seek. The subscription rates, both individual and institutional, have increased significantly in the last ten years. The funds available in the scientific community are limited, and budgets are being squeezed. More titles are competing for the subscription dollars. As a result, there is a drop in the number of subscribers. This means the remaining subscribers must each cover a higher share of the total costs of publication and distribution. Thus subscription rates have and will continue to increase more rapidly than inflation.

Methods publishers have used to combat this problem have created frustrations and expenses for the library community that they want to serve. The need to reduce costs has caused many journal publishers to change trim size to take full advantage of the economics of newer printing technologies. Standard trim sizes on the almost extinct letter presses are not the standard sizes on the newer web offset presses. The extra paper spoilage that is created by printing on the newer equipment and trimming to the traditional sizes is expensive and wasteful of one of our natural resources.

Title changes are also costly for the publisher and the librarian, but publishers may change a journal title to attract more high-quality papers; this in turn should attract and retain more subscribers. More usually, the journal publisher finds that the direction of research has shifted to the point that the title is no longer an accurate description of the contents. The scientific society is keenly aware of its responsibility to the continuation of the journals it produces and would find a title change a more satisfactory solution than the creation of an entirely new journal.

It can be argued that the coverage of a journal by abstracting and indexing services enhances the dissemination of information. But a problem for the journal publisher is deciding which of the numerous requests for free subscriptions should be honored. With increasing specialized data bases come an increase in such requests. It is difficult to evaluate the benefit of being covered by a particular service. Each gratis subscription adds to the costs of the publisher. These costs must be passed on to the paying subscribers. Additionally, the publisher who responds positively to each request may be increasing the pressure on libraries to subscribe to more overlapping services.

Government regulations in the United States are increasing the costs and the headaches for the journal publisher. One of the more interesting bureaucratic wrinkles relates to the Postal Service. In the United States it appears that the Postal Service has the authority to define what a journal is, independent of any intellectual factors. A year ago they declared that the

85-year old Journal of Geophysical Research was in fact three journals. No amount of argument could dissuade them, and so we have complicated our issue numbering scheme, confused our masthead, and spent several hundred hours in an attempt to satisfy the Postal Service. However, we still retain the single continuing title that the coverage of the journal demands. The postal regulations are so cumbersome and frequently so confusing that some publishers are forced to seek legal help and thus to increase costs.

Dealing with the regulations stemming from the new copyright law has also added time and expense for the users of the journal system. Much of this is a result of our being left to cope with a new law and its attendant forms and will decrease as more authors become familiar with their rights and with the policies and practices of the publishers they deal with.

The postal and copyright regulations affect the journal publisher directly. Government regulations that affect the suppliers serving the publishers also increase costs. The impact of environmental protection regulations on the paper industry is the most clear-cut example. Older paper mills that are unable to meet the stringent requirements are closing and thus the supply of paper is decreasing. The cleanup expenses of those remaining are further escalating paper prices.

Even less easy to measure than the effects of government regulations on cost is the problem of dealing with subscription agents. Society publishers frequently find them difficult to deal with. Their wholesale orientation to ordering does not mesh easily with the individualized service we are accustomed to providing. At AGU we find their orders time consuming to handle, and frequently they arrive so close to the end of the year that continuous service is difficult if not impossible to provide. But of more serious consequence is the fact that subscription agents remove the direct contact between the publisher and the librarian and thereby weaken and distort, if not totally destroy, the feedback mechanism that should be operating to improve the system. Middlemen are often a necessary part of business, but they add costs and, more importantly, they represent a filter in the communication between the producer and the purchaser.

Creative journal publishers are experimenting with various ways to reduce costs through alternative formats, production methods, and delivery systems. Microform has been around for a long time as a storage medium, but lately it has been receiving a great deal of attention as an alternative publishing format. Summaries of articles are printed in hard copy and the full text is made available in microform. AGU's experiment with this method has been less than conclusive. In seven years we have had fewer than two dozen authors to choose the option. Many more have placed supplemental material on microform. Buyer acceptance of this format is also far from overwhelming. Only between 1% and 2% of the subscribers to the paper edition subscribe to the microform edition.

A more positive result has come from our experiments with author-prepared copy. A page produced in this way is about one-third less expensive than a typeset page. The author-prepared paper receives the same refereeing as any other paper submitted and the same copy editing for style and consistency. In the journal where the author is given this option about 20% select it. No complaints have been received from subscribers, even though typeset and author-prepared papers are interspersed in the same issue.

Two and three years ago there was a great deal of discussion about authors supplying machine-readable manuscripts to journals. The National Science Foundation spent millions of dollars studying its feasibility. AGU's two attempts at setting type from author supplied magnetic tape were disastrous. The experience of others has been more promising.

The collection of article copying fees through various licensing arrangements is introducing users and publishers to the concept of per use charges. As subscription rates continue to rise and force more library cancellations, it seems likely that fewer researchers will have immediate access to the journals they require. Their information will be obtained on a selective basis through interlibrary loan or long-range facsimile transmission and will be paid for as needed. I envision the time when the per use charge, whether for pages of photocopying or for the number of images called up on the local CRT, will form the major revenue base for many journal publishers.

Experiments with satellite transmission of page facsimiles are underway and discussions of full articles on magnetic tape are in the wind. Computer-assisted typesetting has not brought the savings that were expected but may provide the means for full-article retrieval from magnetic tape storage.

The various experiments, even if successful, are not solving the problems of the journal publisher. Instead, they are adding pressures and increasing the uncertainties of tomorrow. The journal publisher can be sure of increasing costs. In addition to standard inflationary trends, he must face the prospect of paper prices increasing between 30% and 50% next year and the threat of postage increases of 15% to 30% per year. Many competing technologies from laser plate making to video discs are promising to be the salvation of the journal. But which method will be sought and accepted by the scientist who creates and uses the information the journal delivers?

Being a pioneer can be dangerous. The publisher who chooses the wrong alternative today may be locked into an unacceptable position tomorrow. The journal publisher must have quantitative ways of weighing the options, including the cost of keeping their options open.

At the same time the users must recognize the value of information and must develop their own quantitative means of evaluating the journal. These evaluations will have to be made on similar bases. For instance, the subscription price per title is meaningless, since the amount of information delivered varies considerably. A better measure is probably words per subscription dollar. It has been suggested that quality can be measured by citation indexes. Thus another measure of a journal might be the citations per subscription dollar.

Journals are not just pages of print; they are a part of the mechanism for transferring information. The pool of money available to support this transfer is limited. It must support all aspects of publishing from manuscript preparation through the selection process, that is, the production and distribution in whatever format, the storage, and the retrieval. Journal publishers should also be concerned with the value of the end user's time. Unwise investments of time, unsound purchases of suppliers' wares, and unnecessary duplications take an unfair share of the funds.

Until all involved in the journal process are willing to ask the hard questions of their own operations we cannot be sure that scientific resources are being allocated effectively.

NETWORKED DATA BASES--A VIEW FROM THE MIDDLE

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Abstract: We live in an age of "more." There are more data bases offered by more vendors via more information search systems accessible by more networks than in any other period of history. Yet, this age of "more" certainly does not mean "better." For the end user, the needs are the same as twenty years ago. Information should be obtainable with as little effort as possible in the briefest form and be screened to eliminate as much noise as possible.

In the field of systems analysis there is a concept of suboptimization which indicates that optimizing the operation of individual components of a system does not optimize the operation of the overall system. That concept certainly holds true for technical information dissemination systems. New information technologies need to be viewed from a total systems perspective to understand why things are not getting much better in the knowledge dissemination area. Even more important, the total systems approach can help all of the participants (be they editors, publishers, data base producers/operators, information specialists, or end users) improve their understanding of and contributions to their information activities.

Evaluation of the current and projected role of the data base producer/operator within this broader systems perspective will help to clarify the real contribution of changes in indexing techniques, reduced time lags in data input, and other technological enhancements.

As the title of this paper implies, someone is viewing networked data bases from the "middle." Many would argue that the data base producer/operator is in the middle; I would argue that the user is caught in the middle--between burgeoning data bases that overlap in some areas and neglect other areas altogether, and a multiplicity of search systems that require specialists to conduct even relatively simple searches. Unfortunately, the user has little input to the design or operation of most data base systems, even though the user's information requirements should be the very keystone of these systems. Since user information needs really haven't changed in the past twenty years, Goodwin's (1959) list of what the user wants is still valid:

- To get information desired
- At time it is desired (not before/after)
- In briefest form
- In order of importance
- With auxiliary information
- And indications of reliability
- And authority of information/source
- To exert minimum effort
- And be screened from undesired information
- To know negative results are reliable

How are these users' needs being met today? Technology has changed a great deal since the list first appeared. Networking in a variety of forms now can provide system designers with new tools that, on the surface, are quite exciting. The three general classes of networks, shown in Figure 1, can be combined to provide new information and communication tools for the users. Communication networks such as TELENET and TYMNET provide relatively low-cost, error-correcting, multi-terminal compatible linkages to host computers. This form of value-added network currently offers distance-independent charges for digital communication in low- and middle-range transmission speeds. Computer networks such as ARPANET (involving a variety of machines located throughout the United States with some overseas ties) and ILLIAC-IV (involving similar computers physically located in the same facility that function as a single computing unit) provide resource sharing to form extremely powerful and flexible computing units. Information networks have been in existence long before the development of computer or communication networks of the type just discussed. Early information networks, such as the interlibrary loan arrangements, provide for exchange of information and material between cooperating libraries. More recently, networks such as OCLC have provided a mechanism for intellectual resource sharing between staffs at over 1500 libraries. Another concept of intellectual resource sharing is used by the New Jersey Institute of Technology. The Institute has developed an electronic information exchange system that provides a link between research scientists throughout the United States by means of a computerized conferencing network.

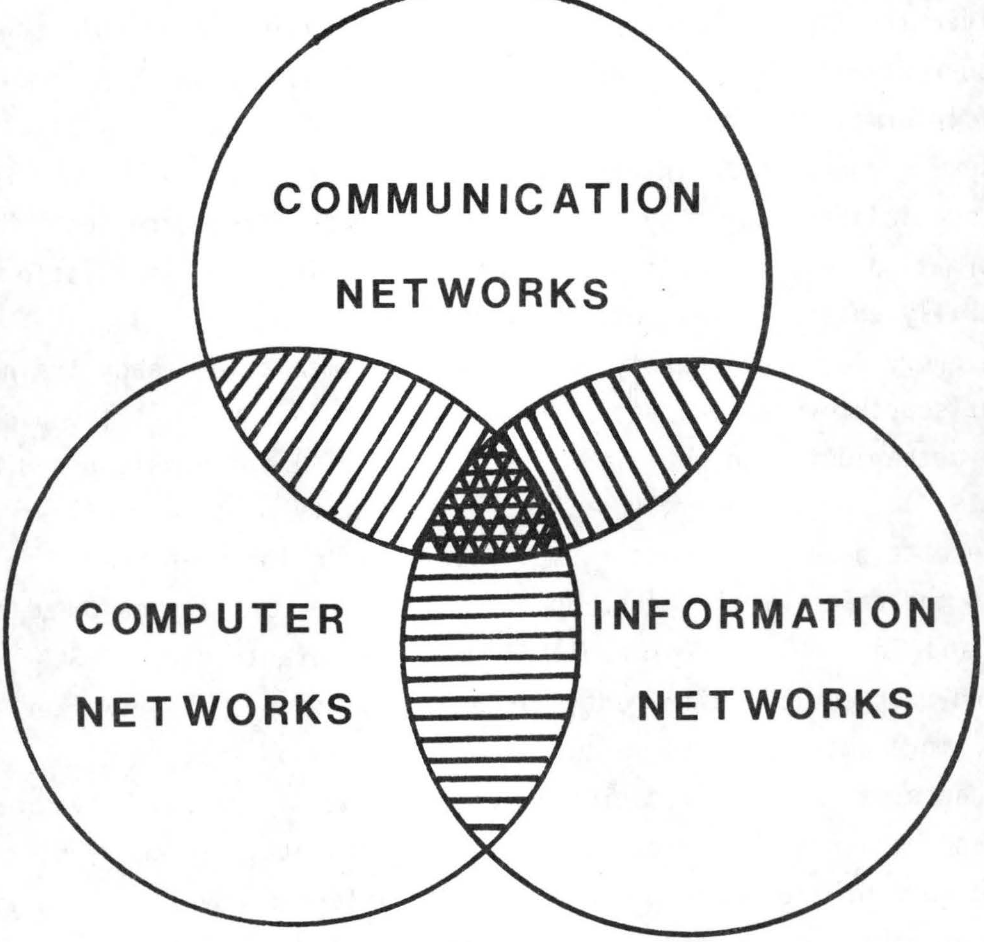


Fig. 1. What technology can offer

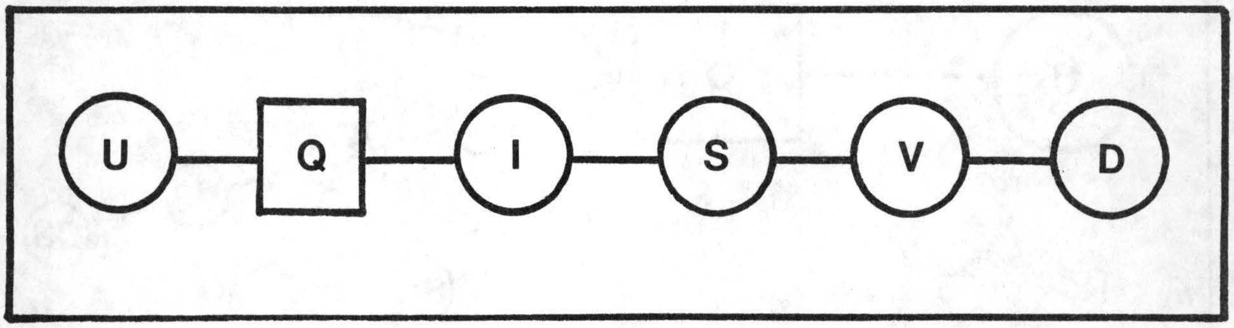
The most interesting networking applications combine use of more than one of the network types shown in Figure 1. For example: ARPANET uses a communication subnet that was the precursor to commercial value-added networks of the packet switched type; OCLC provides an information network with a specialized communication network to tie over 2000 terminals to its host computers. In time, the terminals located at each OCLC member library may be provided with local processing capability (as might be used for circulation control systems). Then, OCLC will incorporate computer networking as well as communications and information networking to accomplish its goals. (See Penniman et al. [1974] and Penniman [1977] for more details on various network combinations and their impact on information systems.)

Given the types of technologies and applications available today, the user's current situation is far from ideal. Figure 2 shows a simplistic model of information search systems as they currently exist. Typically, the user poses a query to an intermediary (e.g., a reference librarian) who, using a specialized search system and search vocabulary, accesses a data base for information related to the user's query. This is a simplistic model; what actually exists is reflected more accurately in Figure 3. The user with a single query may have to rely on several intermediaries--each trained in a different search system and set of data bases. This view of the user interface is further detailed in Niehoff et al. (1974) and Penniman and Kovacs et al. (1977). At the very least, the intermediary must be familiar with the available data bases and the ones most appropriate for each query. This is certainly the case in the geosciences field where the two major data bases (GeoRef and GeoArchive) are available from different vendors (SDC and Lockheed), and each employs different search vocabularies. (See Walker [1977; 1978] for more details on these two information resources.)

Because of the complications introduced by a multiplicity of search systems and data bases, a variety of research projects has been undertaken to alleviate some of the burden on the user, or intermediary. Table 1 lists the general categories of research in this area, noting some of the organizations/individuals involved in specific projects. Much of the work summarized in this table has been supported in the past by the National Science Foundation's Division of Information Science and Technology and Division of Mathematical and Computer Sciences.

The research under way seeks to optimize or at least improve selected components of the search system. But, such research often results in suboptimization. Suboptimization involves improving those parts of the system that can be recognized and understood best, in the hope that subcomponent improvements will result in overall system improvement. In complex systems, e.g., the current science information system, subcomponent improvements don't necessarily lead to overall system improvement for the user. The system designer--not the user--selects the improvements to be made. As an example, increased data base access and search capability may provide lengthier and/or more comprehensive bibliographies but do little in helping the user actually locate the documents cited.

"SYSTEM" BOUNDARY

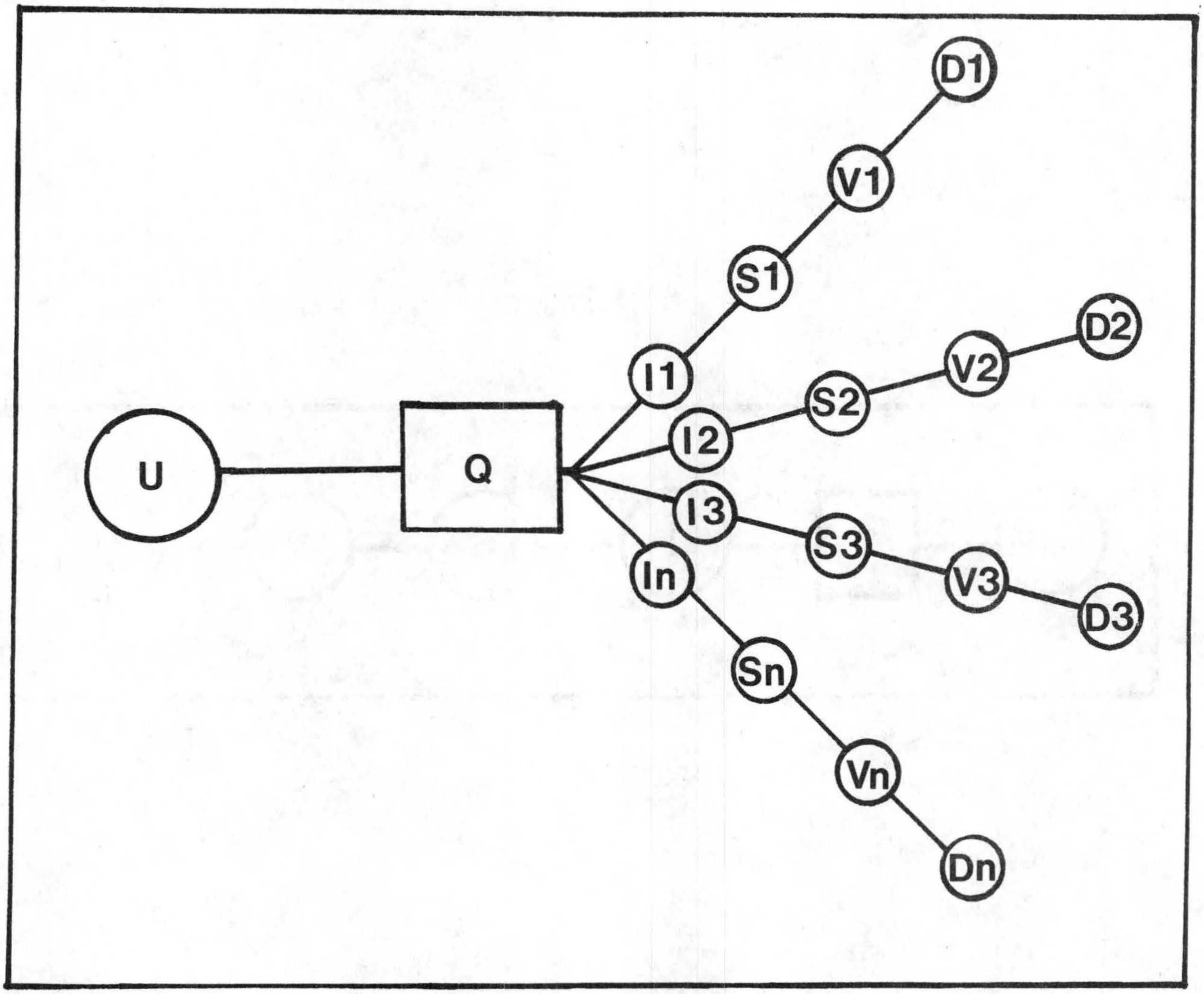


SIMPLISTIC MODEL

U = User
Q = Query
I = Intermediary
S = Search System
V = Vocabulary
D = Data Base

Fig. 2. What the user gets

"SYSTEM" BOUNDARY



COMPETITIVE MODEL

Fig. 3. What the user gets

TABLE 1

OVERVIEW OF SELECTED DATA BASE SYSTEM RESEARCH

System Component Addressed	Type of Research	Location	Principal Investigator	Brief Description
User	Naive User Interface	University of Southern California	William Mann	Human-computer interaction evaluated from a communication perspective to improve dialogue (Mann, 1975)
	Adaptive Prompting	OCLC, Inc.	David Penniman	Human-computer interaction model based upon communication theory and pattern analysis to aid in development of context-sensitive prompting messages (Penniman and Perry, 1976). See also Intermediary (Meadow et al., 1977)
Query	Query Analysis	Case-Western Reserve University	Tefko Saracevic	Analyzing questions in retrieval systems (Saracevic, 1978)
	Formalizing Queries	Rand Corp.	Fred Tonge	Old, but still relevant. Involved rules for automatically analyzing queries (Tonge, 1967)
Intermediary	Training Enhancement	University of Pittsburgh	Elaine Caruso	Development of an online training package providing programmed instruction and practice (Caruso and Griffiths, 1977)
	Diagnostics Enhancement	Drexel University	Charles Meadow	Development of error detection and diagnosis techniques (Meadow et al., 1977)

TABLE 1--Continued

System Component Addressed	Type of Research	Location	Principal Investigator	Brief Description
Search System	Coupling	MIT	Richard Marcus	Universal interface allowing interaction with variety of search systems (Reintjes and Marcus, 1974)
	Standards	Syracuse University	Pauline Atherton	Suggests standards for conversational language used in data base searching (Atherton, 1978)
Vocabulary	Subject Switching	Battelle Columbus Laboratories	Robert Niehoff	Automatic switching between search vocabularies based upon stem analysis and other linking algorithms (Niehoff, 1976)
Data Base	Selection	University of Illinois	Martha Williams	Automatic selection of best data base(s) for a particular query based upon content of data base and query analysis (Williams, 1975)

Figure 4 presents a brief indication of the larger system in which data base search systems reside. Note that interactions between some of the components are not understood well enough at this stage to be shown. What is clear, at least, is that document storage systems such as those in libraries must be introduced into the loop in order to provide the user not only with citations, but also with actual source documents. OCLC, for example, provides document location (holdings) codes for each of the items in its 4,000,000+ record data base. When the location of an item is determined from the bibliographic record of the item displayed during an on-line search, the item can be requested via interlibrary loan arrangements.

Since I've mentioned the OCLC data base, I will describe briefly its contents in terms of subject areas covered. Figure 5 shows a distribution of records (primarily citations to monographs) by general subject area, based on Library of Congress classification codes. Table 2 provides a detailed view of the science and technology subset (about 13% of the total data base). Note that geology represents 7% of the subset or about 1% of the total data base. Therefore, there are about 40,000 records related to areas of interest of your constituency.

Thus far, this presentation has described user needs, available technologies, existing systems, and research to enhance the user's situation. Within the presentation I've called for a broader view of the information system to include document delivery as well as document identification. Now I'd like to take one final look at networking as it is evolving today--with a particular emphasis on the benefits and drawbacks that system designers need to consider. Table 3 summarizes the results of an NSF study on information networks (Penniman et al., 1976) and indicates both potential benefits and disadvantages of networking. Impacts are classified in five general areas: functional, organizational, technological, financial, and social/psychological. Consider some of the negative impacts of networking including:

- the increasing demand for intermediaries, analogous to the demand for telephone operators in the U.S. prior to automatic switching equipment;
- the influence of competition (or lack thereof) on pricing policies for various networks. See Page and Sichra (1978) for details on current pricing policies.

"SYSTEM" BOUNDARY

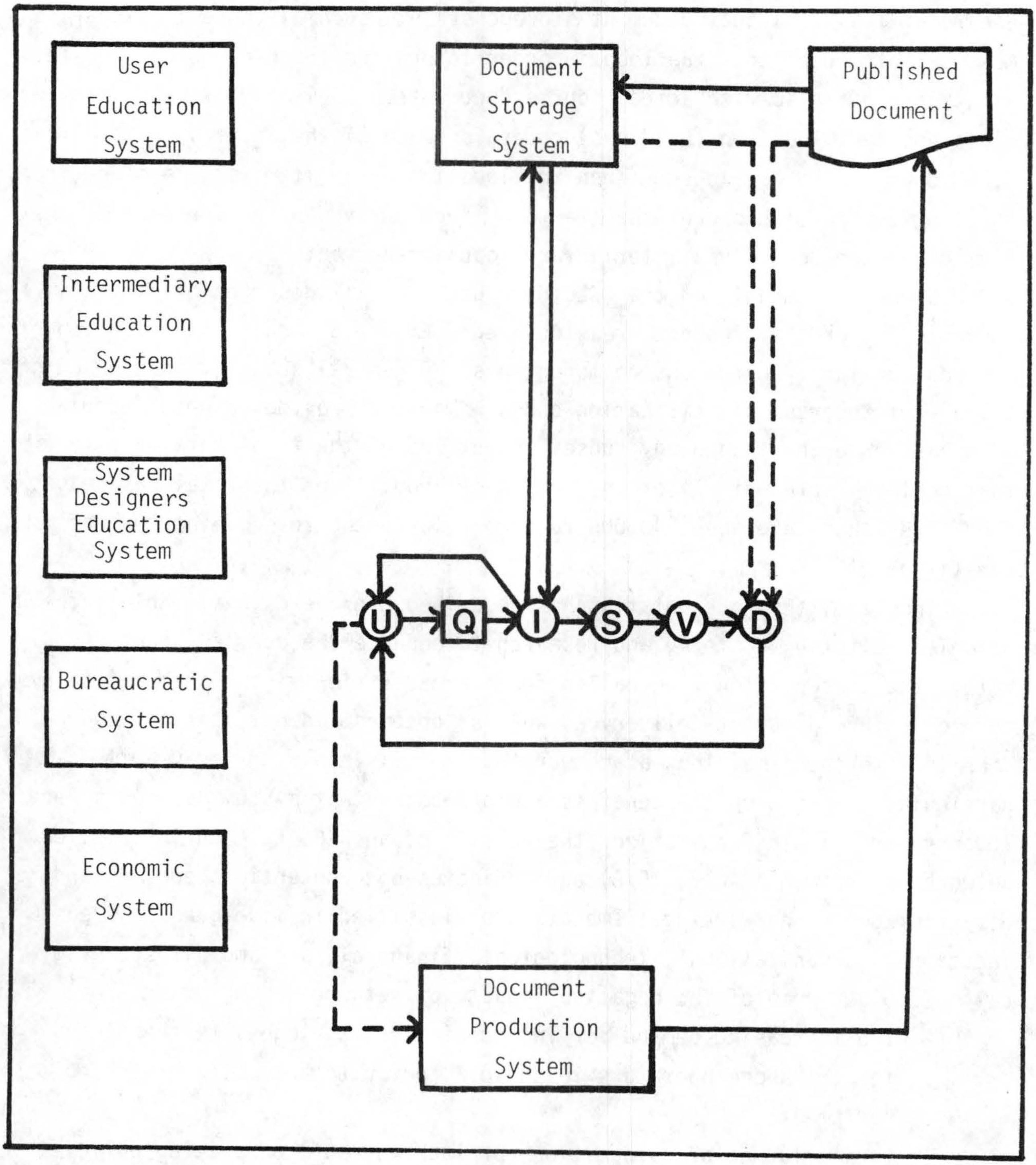


Fig. 4. A broader view

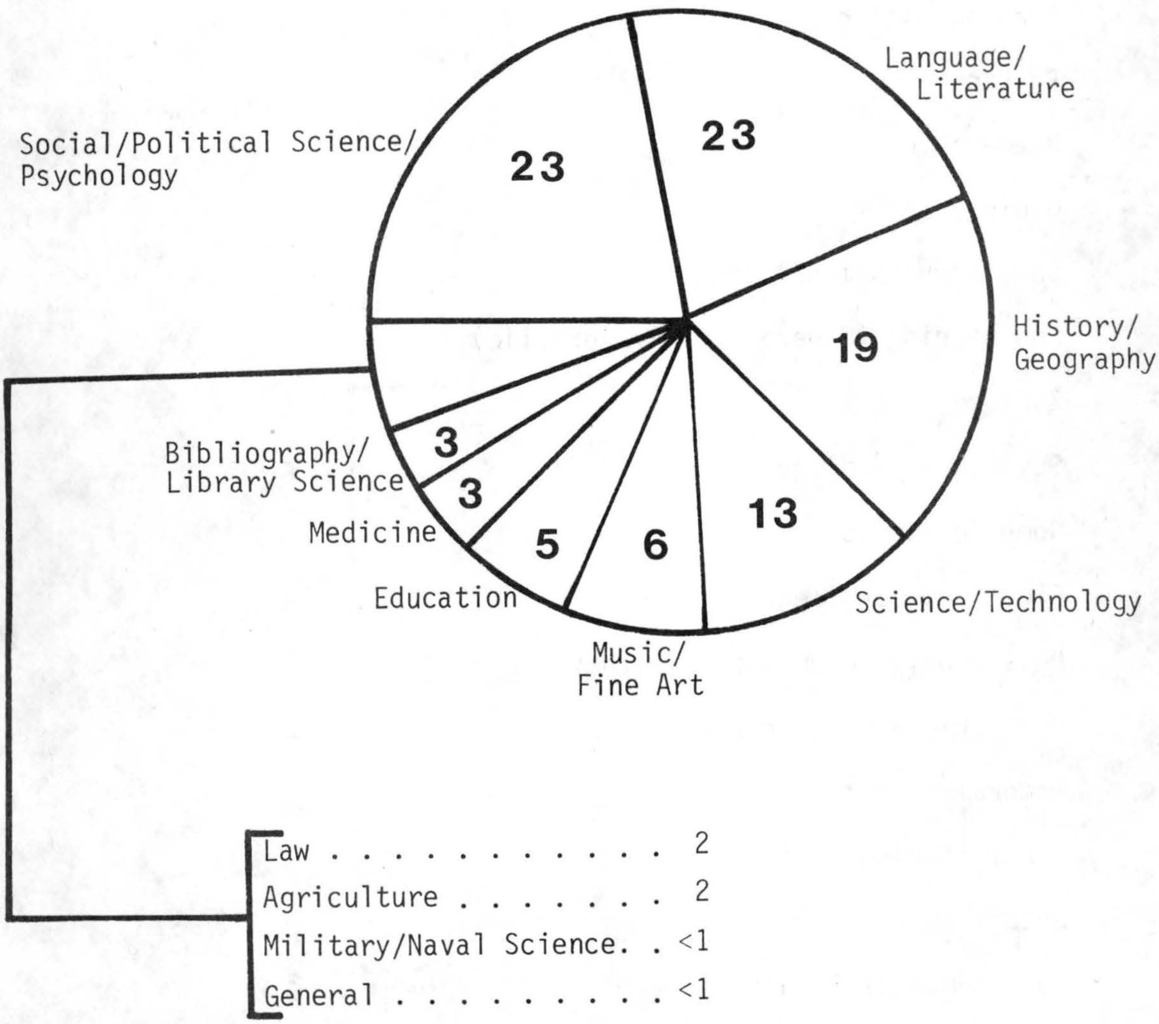


Fig. 5. OCLC data base distribution by subject percentage

TABLE 2

OCLC DATA BASE: SCIENCE/TECHNOLOGY SUBSET (13%)

Area	% of Subset
Transportation	9
Physics	8
Mathematics	8
Geology	7
Chemistry/Chemical Technology	7
Engineering (General/Civil/Hydraulic)	7
Zoology	6
Science/Technology (General)	6
Home Economics	5
Electrical Engineering	5
Physiology/Microbiology/Anatomy	4
Photography/Handicrafts	4
Natural History	4
Manufacturing	3
Botany	3
Environmental Technology	<3
Mining Engineering	<3
Mechanical Engineering	<3
Astronomy	2
Building Construction	1

TABLE 3

NETWORKING

Benefits	Disadvantages
• Functional	
Reduce search time	Reduce competition of ideas
Expedite SOTA reports	Overt/covert screening
Decrease lag time	Demand for intermediaries
Standardize form of presentation	
• Organizational	
Information as national resource	Monopolies
	Bureaucracies
• Technological	
Accelerated hardware development	Obsolescence of hardware
	Technological mandate
• Financial	
Increased productivity	Loss of revenue (competition)
Increased employment	Waste (immaturity)
	Inflated costs (inefficiency)
• Social/Psychological	
Increased communication	Over-reliance on network
Information as resource	Lack of browsing
Increased educational alternatives	Loss of privacy
	"Have/have not" gap

- the use of advanced technology because it is there, not because the technology solves the problem;
- the future of competing information products/services (such as the role of abstracting/indexing journals) in the light of up-to-date, on-line data bases;
- the further separation of the "haves" from the "have nots" in terms of available information resources as well as available financial resources.

The purpose of this discussion is not to demean the role of information networks and access to large data bases of technical information. There is no doubt that these are powerful resources. It is for this very reason that network designers/operators must pay more attention to the overall system in which they operate. These systems have as their major component the user, and the user's needs have been described well. Now it is time to use descriptions of user needs, such as the list presented previously, as a guide for further system development.

At the very least, system providers must:

- understand the total system;
- respond to fundamental user requirements;
- use appropriate technology (not necessarily the most advanced--particularly when dealing with naive users);
- establish links with other system components (such as document production systems and document storage systems).

Acknowledgments

Portions of the material presented in this talk are based on research conducted under the sponsorship of the National Science Foundation Division of Information Science and Technology.

Dr. Thom Hickey of the OCLC Research Department sampled and analyzed the data on the subject classifications for the OCLC data base.

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THE GEOSCIENCE LIBRARIAN'S VIEW OF THE PUBLISHING PROCESS

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Abstract: The objectives of a geoscience librarian are to select and acquire a collection of geoscience publications to support the needs of a particular organization, and to provide the user with easy access to this collection. In achieving these objectives the librarian interacts closely with geoscience editors, publishers, data base operators and the information user. Selection of material depends on clear articulation of needs by the user and detailed information from the publisher on forthcoming publications. There are three main methods used for selection of material: direct request from the users, requests by the subject specialist for the user, and automatic receipt of material under approval plans or standing orders. Poor choices by either the user or the subject specialist are often caused by insufficient knowledge of the material at the time of publication. To ensure continuing quality of acquisitions, standing orders and the profile of an approval plan must be constantly reviewed. Major problems are the time lags between order and receipt of material, and between receipt of material and access to the material through some form of indexing. The quality of material received is often not as high as expected, either in content or physical format. Changes in journal formats or titles are frustrating to the librarian. The escalating costs of both materials and services necessitate that the librarian use restraint in a time of tighter budgets.

It is very easy to state the objectives of a geoscience librarian or information specialist. The objectives are to select and acquire a collection of geoscience publications to fit the needs of a particular organization, and to provide the user with efficient access to this collection. If it were as easy to achieve these objectives as it is to state them, then there would be no need for this symposium. Problems occur with all three processes--selection, acquisition, and provision of access to the collection. At the root of most of these problems is faulty communication between the librarian and publishers, data base operators and users, not to mention the added complications of the various agents who act as go-betweens for the different groups.

Selection of library material is one of those mysterious processes that is very difficult to explain, probably because it involves no one single procedure, but a variety of activities that add up to selection of a collection. Good selection entails first and foremost a detailed knowledge of the clientele you serve. It is useless to build a fine collection in a specialty that does not fit in with the needs of your organization. A geolibrarian listens very intently to any discussion of the research activities and interests of the clientele he or she serves and tries to fill needs in those areas of interest. There are three main methods used for the selection of material for a library. These are direct requests from the user, requests from the subject specialist for the user, and automatic receipt of materials under approval plans or standing orders.

Direct request from the user is probably the simplest of all to deal with, and in my experience the least common. Some geoscientists are very active library users and are full of suggestions for acquisitions, often too many for that particular specialty, but most are of the "silent majority" type who just register shock and dismay when the material they need is not in the library. For these people the geolibrarian must select the relevant material, often checking with the user before finally sending the order out. A geolibrarian reads publishers' fliers, advertisements, and reviews in the various geoscience and science periodicals, and scans subject bibliographies to choose relevant material. In my library probably 60% of material received is ordered in this way.

The time sequence of these various activities is troublesome. Geolibrarians, in fact all science librarians, need relevant material in the library almost as soon as it is published. Timeliness is so important that often careful consideration of reviews etc. is not possible. Most reviews of new publications are published too late to be of much use in selection. Then there is the opposite problem with some publishers' fliers. They appear so far in advance of the actual publication date of the material that I find that my bookseller has written me three quarterly reports of "not yet published" on my order before I ever receive the book. This is a waste of his time and mine. For reviewing to be of use in selection, advance copies of new books or journals should be sent to reviewers and the reviews published at or before the time of publication. Failing that, publishers' fliers should at least be circulated at a realistic time before the publication date and should quote from the preface the stated objective of the work and/or list the contents. This practice gives a better idea of the subject matter and the approach taken than is given by sometimes rather cryptic titles. Publishers' fliers should be as complete and truthful as possible. In addition to quotations from the preface, contents listing, reviewer's comments if available, title, authors and their affiliations, ordering information, projected date of publication, number of pages, illustrations, series if any, should be included. A new edition of a work should really be a new edition. If it is just a reprinting of a work with a new preface then this should be stated. If an older work is being reprinted with an updated title then this should be clearly noted on the flier. If a work has already been published as a special issue of a journal then this should be stated prominently on the flier. Anything less than this is false advertising, and also a waste of time and money for librarians and users. Many publishers already do all of the above. For example, the Royal Society of London fliers state very clearly when a work is part of one of their series and constitute good practice in this area. "Cataloging-in-publication" (CIP) information, often used by booksellers for informing librarians about new books in stock, does not include information such as "already published as a special issue of journal A" and can be a source of duplication.

If librarians are sure that a particular series is useful to their clientele, then they may wish to place a standing order for the series. This is particularly useful to a geoscience librarian if the series is voluminous. It means (theoretically) that the series is received quickly and continuously with no gaps in the collection and with minimum time lags. Acquisitions librarians with whom I have talked have indicated that standing orders can be difficult for them to manage as they do not have a handle on a particular title. Also, in the case where volumes are published out of numerical sequence, claiming issues on a standing order can become confusing. However, standing orders are of great value to the subject specialist. Approximately 50% of all material received in my library is from some type of standing order. I cannot understand why publishers would not be overjoyed at an institution placing a standing order for their material. A standing order means that the publisher has an assured audience for his product, and cuts down considerably on individual handling of orders. However, some publishers still do not accept standing orders, especially the smaller society publishers whose material is so important and is sometimes the most difficult to acquire. I wish that publishers would explain this reluctance to accept standing orders to me. I have also heard that standing order customers tend to be taken for granted by publishers, and that individual orders get filled first. This is unacceptable practice if it indeed does occur, as standing order customers should receive priority service.

Approval plans are another method of receiving a great deal of material quickly without individual ordering. Approval plans seem to work well if the profile for receipt of material is finely tuned to the needs of the clientele, and if this profile is constantly updated. There is a tendency to treat the profile as a fixed entity after a few months instead of subjecting it to constant scrutiny. Librarians must be assiduous in reviewing all material received and sending back material of doubtful value to their collection. Our experience at Stony Brook was that although material was received quickly, our approval plan proved too expensive for our dwindling budget. We did not send back anywhere near the 10% that we were allowed under our contract with the bookseller. Most approval plans are also oriented towards domestic trade publications, and very often governmental, foreign, and society publications are more important to geoscientists.

A perennial problem for the librarian and the user is the delay between selection and ordering of material and receipt of this material. Some of this frustration definitely is caused by the problem that I mentioned earlier--that of premature advertising. Users read of a particular book or receive a publisher's flier and they immediately want to know whether the library has the book. Usually we have the book on order, but we do not know whether the book is actually published or not, so we cannot estimate when we will receive it. This is frustrating for the user and the librarian. I reiterate, please do not advertise unless you are sure of a publication date, then advertise this date on the flier. Some publishers already do this, and it is of great benefit to the librarian and the user.

Publishers' public relations often leave much to be desired. Either false, misleading, or no information is given by phone to librarians calling to find out the publication date of a particular book, or why, when we paid for a journal last year we have not yet received it. Once you can break through the outer layer of ineptitude then you are usually well-satisfied with the information received and the manner in which it is given, but some publishers would do well to revamp their first line of call in these matters.

Assuming that we have now received the material, I would like to make a few comments on physical format. Firstly, with regard to monographic material, there seem to be two types of books: those that fall apart after the first use and are reasonably priced, and those that are reasonably well put together and are exorbitantly priced. This situation is undoubtedly due to the steeply rising costs of producing a well-bound, well-printed book. It is puzzling to me, however, that when we buy the paperback version of a book and bind it ourselves to protect it for library use, we often end up with the better bargain. Our difference in cost is about $5, with the consequent delay for binding, but the list price difference between a paperback and hard cover version is often closer to $15. Often we have to rebind the hard cover version of a book after heavy library use, and this is a case of being charged twice for the same operation. Perfect binding is not suitable for libraries, neither are large paperbacks, or under- or over-sized or odd-shaped volumes. When a publisher chooses a nonstandard format he should be very aware of what he is doing to his product vis-a-vis library use. If a publisher does not expect a particular product to be sold to libraries then the format decision is a matter of free choice. If he wishes to sell his product to libraries, then "library-binding" type quality is needed for maximum circulation of his product.

The uneven quality of symposium volumes is a difficult and common problem. Surely a symposium volume should be able to serve as an accurate record of the symposium, as well as being a publishable volume. However, these two considerations often seem to be at cross-purposes. If the published volume is to be a record of the proceedings, then the refereeing process cannot work after the fact. After a contributor to a symposium has worked hard to present a paper, he has the right to expect that his contribution will appear in the published proceedings of the symposium. For some large international conferences the full texts of the papers are required before the conference, and strict refereeing practised at this time. This method is unrealistically time-consuming in most cases, and it also means that new developments from interactions at the conference are not incorporated into the published volume. Time lags in publication of symposium volumes are often unacceptable. It can be several years after the conference is held before the work is published, and this usually means that any benefit to the scientific community is lost. Symposium volumes are ideal subjects for the use of author-produced, camera-ready copy which speeds up the publishing process considerably. The finished volume is not as handsome, but rapid publication makes it much more useful.

Reprint volumes represent another difficult category for librarians. If the library is new or under-developed, well-edited reprint volumes can represent a quick method of acquiring classical papers in a particular field without having to buy long backfile runs. But, reprint volumes can easily become a waste of money if not carefully monitored. Some reprint volumes are worth buying because they genuinely serve as a good introduction to a field. Others are not useful because they duplicate material already owned, chosen and arranged in an uninspiring manner.

Journals eat up large portions of a geoscience librarian's budget, and take considerable time to acquire and bind. We know that libraries form a large part of the journal publisher's market, so we feel that our needs should have some impact in this area. There are some practices in journal publication that make the librarian's life far more difficult than it needs to be. Firstly, one of the chief banes of my existence, is the seemingly unnecessary changes in title and format of journals. I recognize the need to update the look of a journal to ensure its attractiveness, but why is it necessary to change its name or change the size of the volume? For example, American Association of Petroleum Geologists, Bulletin recently changed its appearance, but not its size or title. This does not cause any problems for the librarian. However, a host of journals seem to have recently changed size, no doubt due to economic pressures. Some journals have changed from a small size that could very nicely be bound once a year into a reasonably sized volume, to a large size issue that can only be bound once every two years into an emaciated version of its former self. Do journal publishers fully realize what they are doing when they format journals in such a way that they can only be bound every two years? In libraries this is an open invitation to lost and damaged issues. The more often, within limits, that a journal can be bound into a reasonably sized volume, the better are its chances of being retained and read. Publishers should not change the title of their journal unless absolutely necessary, and not even then. For every change of title all cards must be withdrawn from all library catalogs, cross references made, and new cards filed. It is not only librarians that hate these types of changes; users hate them too. There is no group more conservative in their habits than scientists. Any change in library operations is an anathema to them--even if they agree with the need for the change, they still do not like it. It is confusing for everyone if a journal changes its name. The worse example that I have noticed is GeoAbstracts D, which began its life as Geographical Abstracts, Part D, Social Geography and Cartography, which is in itself too long and unwieldy, then compounded the sin by changing to GeoAbstracts Part D, Social Geography and Cartography and is now GeoAbstracts, Part D, Social and Historical Geography all in the space of a couple of years. Journals do change in content and emphasis all the time, but I think that users recognize and follow these changes just by reading the journal. I feel that constancy of title is important. For example, American Journal of Science began as a general science journal, became a general geology journal, and has now evolved into a more specialised geology journal, but a librarian or user can still go to an old citation and know which journal is meant.

Some journals still have inadequate margins for binding. It becomes impossible to use plates and diagrams properly after the journal is bound if the margins are inadequate. Some journals still do not put the citation at the beginning of each article to ensure correct citation from a copied article, although as Garfield (1978) has noted, rather cynically, this is rapidly changing since the existence of the possibility of royalties from a copied article. The price, frequency, and ordering information for a journal should be displayed prominently on the verso of the cover, not hidden somewhere at the back of the journal. If there is an institutional price and an individual price, then this should be also clearly stated. Journals published in North America usually do this well, but some journals originating in Europe have a "hunt-and-find-it" attitude. Journals should be labelled clearly on the outside of every issue for volume number, part number, month, and year. If a librarian has 400 journals to check in, then he or she does not want to search through an issue looking for a part number. Volumes of journals should be numbered conservatively. As Eugene Garfield (1978) has pointed out, there is good reason why most journals have calendar year and volume number coinciding. The good reason is redundancy; it serves as a check on a citation to have two numbers to look up, and it also has the virtue of being familiar practice for users. A journal published in Fall-Winter, Spring-Summer with the volume number beginning in June is nothing but a headache to a librarian. It may be dull, but volume 6, parts 1 and 2, are so much more easily claimed and checked in. Extra parts to a volume are very difficult to manage. Combination of issues can be easily handled if this is stated clearly on the cover, but it is that 13th issue of a 12 part journal, or even worse an unnumbered supplement that comes in after the journal has been sent to the bindery, that makes librarians grey before their time. Subject and author indexes should be bound into the last issue of a journal volume and their cost included in the cost of a library subscription. Indexes are so important for finding material, and often they are lost or damaged or arrive six months after the journal is bound.

Now for the most common complaint of all concerning journal publishers: why cannot they publish on time? Our efficiency rating as librarians depends on our getting material into the library as quickly as possible. When the April issue, dated April on the cover, arrives in September, it is usually the library that is blamed. As Garfield (1978) has pointed out, false publication dates would not be tolerated in a popular magazine, so why should it be almost standard procedure for some academic journals? If Time came out with the April news in September, no one would buy it. Journal publishers should put realistic dates on the covers of their journals. I realize that it is very easy for me to say "publish on time" when I do not have to deal with printing deadlines and recalcitrant reviewers, but it is important to the reputation of a journal to publish it on time. Maybe the answer is to be less ambitious and publish less often if this is economically feasible. A quality, on-time quarterly is better than a chronically late monthly.

Journal publishers should be warned to take careful note of the process used to mail their journal issues to subscribers. For example, Journal of Geophysical Research used to arrive in our library torn so badly as to be useless because of inadequate protection in the mailing process. Details such as these may seem to be unimportant, but they all act as barriers between the author and the reader.

The third part of the librarian's job is to provide access to the collection. The major breakdown here appears to me to be between the user and the librarian. The user does not explain his or her needs clearly, and the librarian does not listen but goes rushing off to answer some preconceived notion of the question. Both librarians and users must realize that they are operating from different points of view. Unless librarians are very familiar with the research of a particular user, they will not understand a mumbled reference to a specialised tool.

The other problem is the familiar one of delay between receipt of material and access to that material through either printed indexes and bibliographies or through data bases. In an ideal world the indexers would receive a journal before the publication date and would publish the index to the journal at the same time as the journal itself was published. Speaking more realistically, I think that librarians would be well-satisfied if the delay was in the one to three month category, although this means that data bases and indexes are still not useful for current awareness and for selected dissemination of information (SDI) uses. Part of the problem of delays in indexing is illusory and is caused by the other problem that I mentioned earlier, that of late publication of journal issues. If the journal issue itself is late, then it is difficult to publish the index to it on time. The other problem with indexing is of course the quality and type of indexing used. As we all appreciate, especially those of us who have tried to do it ourselves, indexing is a very difficult and time-consuming process. The selection of the correct index terms, sufficient index terms, and the hierarchical arrangement of these chosen index terms is a highly skilled operation. Every individual has a slightly different concept of what a particular term implies, and this causes many of the difficulties encountered in retrieval. The added flexibility given by data bases allows more individualized combinations of terms for particular searches, and this aids retrieval. But in the geosciences we are still left with the problem of the lack of abstracts when the article citations are recovered. The demise of the geoscience abstracting tool has been mourned many times before, and I will say no more than to point out that the geosciences are the <u>only</u> major science division without a general abstracting journal and/or data base. <u>Engineering Index</u>, <u>Chemical Abstracts</u>, <u>Biological Abstracts</u>, <u>Mathematical Reviews</u>, <u>Oceanic Abstracts</u>, <u>Astronomy and Astrophysics Abstracts</u>, <u>Physics Abstracts</u>, etc., are the mainstays of their respective sciences. We do have several specialised services, for example, <u>Mineralogical Abstracts</u>, but our lack of a comprehensive abstracting and indexing service is a real detriment to the efficient retrieval of geoscience information.

I have not confronted, up to now, the problem which overshadows all others in the geoscience publishing field, and that is cost. Escalating costs force the librarian to make hard decisions. A certain tightness in the budget can often result in good choices and careful selection, but after the break-even point is reached real cuts must be made. Usually, balanced collection development is the first casualty. The librarian tends to buy only that material which serves the specific needs of the present clientele. This type of collecting results in scrappy, uneven collections. Often gaps appear which cannot be filled later as material goes out of print so rapidly. When we were faced with severe budget cuts two years ago at Stony Brook, the science librarians made the decision to drop our approval plan for monographic material, to buy only urgently needed books, and to try to maintain the necessary journal and series subscriptions. Some pruning of the serial subscription list was done, and we eliminated most duplicate subscriptions, but we felt that these journals and series formed the core of our collection and should be retained. However, this same strategy cannot be used in the future. Our collection development coordinator Gerhard Vasco (1978) recently calculated a five-year projection of our acquisitions budget, taking into account inflation, budgetary increases, etc. If we retain our present serials subscriptions list with its projected price increase, our net budget after paying for our serials would be -$46,000. This calculation speaks for the seriousness of the problem.

Looking to the future we have a rather murky prospect. It seems that the journal as we now know it will be too expensive to produce. A series of alternatives has been suggested and some are already being tested: paper summaries with microfilm backup, publishing on demand, author-produced copy, journals publishing major papers only, where a major paper is defined as one with five or more years of work behind it. Even with our existing systems, publishing on demand is already with us. In one academic department I know, the library is almost completely by-passed by faculty. A departmental copy of <u>Current Contents</u> is circulated and faculty members initial those articles that they are interested in receiving. The departmental secretary then sends off for reprints of these articles. This type of on demand publishing has already been formalized by some journals, for example, <u>Geological Society of America, Bulletin</u>.

Book publishing falls into a different category from journal publishing, with different aims. Books are now used mainly for reference or for basic learning. They offer an introduction to a new subject or give a survey of a broad field. For book publishing, timeliness will still be important as fields are changing so rapidly that information is soon out of date; but clear, concise, accurate, thorough, well-edited writing is even more important. Because of the tendency to use books as basic reference material, well chosen bibliographies and comprehensive indexes are becoming more important.

In fact, for all types of publishing, rapidity of publishing is ever more essential in these days of almost instantaneous scientific communication. As Thomas (1978) noted recently, science is being advanced by a worldwide buzz of scientific gossip. A laboratory on the west coast of the United States is in almost daily contact with a similar laboratory in the south of England. Corridor and teatime gossip is transferred, very accurately, within a week's time by a constant interchange of personnel and peripatetic researchers on the lecture circuit. Also the telephone is constantly humming between laboratories. Faculty members are in constant contact with each other, by phone, by letter, and by attending relevant conferences.

Quality editing becomes even more important, bearing these facts in mind. The news value of a paper may be diminished by the constant contact between workers in a field, but it becomes more important that the paper is well-considered, well-written, and well-presented when it does appear. The impatience created by the titillation of hearing "some of the facts" but not "all of the facts" means that rapid publication becomes very desirable.

The responsibility for maintenance of high quality in geoscience publishing rests with all of us. Unless the geoscientist writes clearly and succinctly, unless the editor chooses referees wisely and edits carefully, unless the publisher has flair for presenting and formatting a work, unless the librarian selects material wisely, and unless the user reads critically, the geoscience literature will suffer. As Konigsson (1977) has stated in his article on geoscience publishing in Sweden, geoscience is one of the descriptive sciences and as such, the science depends on the literature for its vitality.

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GEOSCIENCE PUBLISHING FROM THE GEOLOGIST'S VIEW

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Abstract: Geoscientists voice a number of complaints and problems related to publishing. The review procedure is slow and unpredictable, and too few young, new reviewers are involved. Currently fashionable topics are overemphasized, and increasing numbers of highly specialized journals cause fragmentation of the discipline. Very poor papers are being published, most of which are far too long. Authors should accept more responsibility for reviewing and preparation of camera-ready copy, and referees should not be asked to perform simple copy editing. While improving the quality of journal articles, we should relax standards for abstracts, intended for the dissemination of novel or unproven ideas. The pressures on young researchers to publish must somehow be reduced in order to encourage more complete, scholarly work.

By the very nature of speaking last, much of what I had to say has already been said. Therefore, I will make my remarks very brief, so that we can get to the discussion fairly quickly.

Since I was asked to give this little talk, I have been phoning a number of people to get some idea of what are the gripes and woes of various portions of the geoscience community. Today, I would like to list very quickly a summary of these complaints and then make some suggestions as to how these problems might be tackled.

The review procedure is a primary problem. There is a very great disenchantment with reviewing, generally, at the moment. People complain not only about indecent, irrational treatment, but also about intolerable slowness. I've heard some extraordinary horror stories over the last six months of reviewers who have held papers for over a year. I would lay the blame for this situation at the door of the editors of journals who do not seem to be able to control their recalcitrant reviewers, as the previous speaker called them.

There is also a problem of an emerging dogma of entrenched ideas. People are complaining that the present paradigm is the dominating paradigm. In particular, in my field of plate tectonics, people are complaining very bitterly, and I think rightly so, that any paper that doesn't have the words "plate tectonics" in the title is not getting published. A lot of very good material is being rejected because of this. There is a small reviewing elite emerging. I suppose by the very nature of the science this will happen but, as Ward Neale has just remarked, there is an absence of young reviewers who are often much closer to the mainstream of science than some of the older workers.

Many researchers feel that there is a large quantity of really poor stuff being published. There are too many papers, many of which are replete with some fairly weird material. Things that are not simply a matter of opinion but are demonstrably wrong are becoming entrenched into the literature, particularly in the field of plate tectonics. The basic problem is that papers are hawked around the journals until inevitably they are published.

Most papers are far too long. Perhaps journal publishers could use the page charge system to shorten papers. Lastly, we see a proliferation of journals with inadequate refereeing standards; Parkinson's Law seems to be taking over, in that the number of journals is expanding to meet the enormous quantity of material being produced. It is really time that we started worrying about the quality of journals, generally.

Here are a few suggestions for dealing with these problems. First, I think that we need to realize that we're losing sight of what geology is as a science. One of the very great powers of geology is its integrated, synthetic nature. It seems to me that there are far too many speciality journals emerging; a very small elite minority read this journal and another small elite minority read that journal and "never the twain shall meet!" There are plenty of good general journals of our geological societies that are prepared to take good material in any field. There are too few of the old-fashioned, and I use "old-fashioned" in the best sense, general journals of the kind that one thumbs through, looking mainly for material in one's own field, and sees a paper that may be way off base as far as one's field is concerned but may have some eventual relevance or may simply be of broad educational interest. I think we should not lose sight of geology as an integrated science, especially nowadays with the advent of some of the broad unifying hypotheses.

There is a very great need for author-prepared copy, and I think that more responsibility for initial reviewing by the author and his or her colleagues is very important indeed. The Lamont-Doherty Geological Observatory has a very good system of internal reviewing, and nobody seems to mind that his or her paper is hit very hard by somebody just down the corridor. This eliminates, in my opinion, many of the problems of editing. When I get internally reviewed papers from Lamont to look at, they are usually in excellent condition. So, if every institution could get a system going that would ensure, as far as possible, that papers coming out of that institution were as near publication quality as possible, in particular going toward author-prepared copy, it would be better for everybody.

As far as refereeing is concerned, I think that less responsibility for the direct editing work should be laid at the door of the referees. We should have a system whereby the referee judges the scientific validity or excellence of the paper, and simple stylistic and grammatical editing is the responsibility of editors and their staff. I would like to feel comfortable in sending a paper back saying, "This is a super paper, publish it, but there are a lot of minor but time consuming things that need doing to it." If one reviews five or six papers a month, minor editing becomes a substantial chore.

Refereeing standards must be increased for journals but, on the other hand, relaxed for the abstract system. I think that we should use abstracts more for the promulgation of new and unorthodox ideas. We should have many more abstracts and short communications such as those that are presented at national meetings where ideas are hawked around, but we should demand more scholarly standards as far as the finally published material is concerned.

Lastly, we have the problem of pressure to publish, particularly to publish incomplete work quickly. This raises the whole question of tenure and promotion, criteria and standards. We now have a situation where the publish-or-perish syndrome has become very detrimental to science. Young people are being encouraged to publish large quantities of incomplete material. We must encourage a new attitude towards tenure and promotion in which long-term scholarly work is viewed as important as a stream of short papers.

PART II

TECHNICAL SESSION:

GEOSCIENCE INFORMATION PROCESSING AND MANAGEMENT

A GEOLOGICAL AND GEOTECHNICAL DATABASE FOR URBAN DEVELOPMENT[1]

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Abstract: Geological and geotechnical information is often required by engineers, planners and earth scientists in the study of and the planning of the urban environment. The Urban Geotechnical and Geological Database Project undertakes to make this information more readily available in a useable form for the three northern urban centres of Sault Ste. Marie, Sudbury and Thunder Bay. The basic information is obtained from existing engineering borehole logs. The geotechnical data banks, begun for each of these cities by the Geological Survey of Canada in 1972, are being incorporated into the database. The basic collection to update the initial data bank holdings has been completed for each city. Over 1,100 reports have been obtained from the three urban centres. Computer based techniques for retrieving the information by borehole reference keys, location and soil type have been developed at the University of Waterloo. Data products will include computer listings of borehole logs in a format similar to the original borehole record. Computer data location maps can be produced to be used in conjunction with the data listings. These techniques, as well as procedures to update and maintain the information, are being incorporated in the database for the three northern cities. Considerable public interest has been shown in this project which suggests the need and the use of such data if made available to the public in a useable form.

Introduction

The basic purpose of a geotechnical and geological database for urban areas is to allow greater accessibility to such data to aid in future urban research and development. A certain store of such data, readily available and easily interpreted by the user, can aid the municipal planner, the con-

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[1]This paper is published with the permission of the Director, Ontario Geological Survey, Toronto.

sulting engineer, the developer, and the academic researcher. Geotechnical and geological information available for an urban area ranges from general geological maps of the area to borehole logs from site investigations. Although regional geological studies provide basic information on the character of the terrain, detailed data contained in engineering borehole logs are particularly useful in the planning as well as in the engineering of projects. These data cannot replace the need for site investigations, but they can aid in the preliminary stages of planning and engineering. They can assist the investigator in anticipating the conditions of a site, the drilling equipment required, and the number, depth, and placement of test holes.

However, the use of these data is generally lacking in subsequent engineering and planning projects in our urban centres. The task of accumulating this information is considerable. There is no central registry for such information. Detailed geological and geotechnical data remain scattered, or if collected, largely unorganized in most urban centres. Although public appreciation of subsurface data is growing, the collection of such data cannot easily be undertaken by the private sector.

Not only must some means to collect the data be developed, but also techniques to handle this information are required. The method of data storage, the time required to search and obtain information for users, and the style of data presentation all inhibit the utilization of the data. The techniques of data management are dependent on the resources available, the amount and type of data for storage, and the method of output required by the potential users. The amount of borehole data for a city is already considerable and will continue to grow. These data are also complex. Manual library techniques are, therefore, not desirable for such information. Computerized data management methods have been recently developed which are suitable for storing, manipulating, and displaying subsurface information.

The purpose of this paper is to outline a current project of the Ontario Geological Survey (OGS) to develop a publicly available geological and geotechnical computer-base database system for three urban centres in northern Ontario. The three cities as shown in Figure 1 are Sault Ste. Marie, Sudbury, and Thunder Bay. The techniques of data collection, coding, storage, and display were largely from the experience gained in setting up a similar database for the area of the Regional Municipality of Waterloo. In this paper, the background of the present project will be given, followed by the methodology

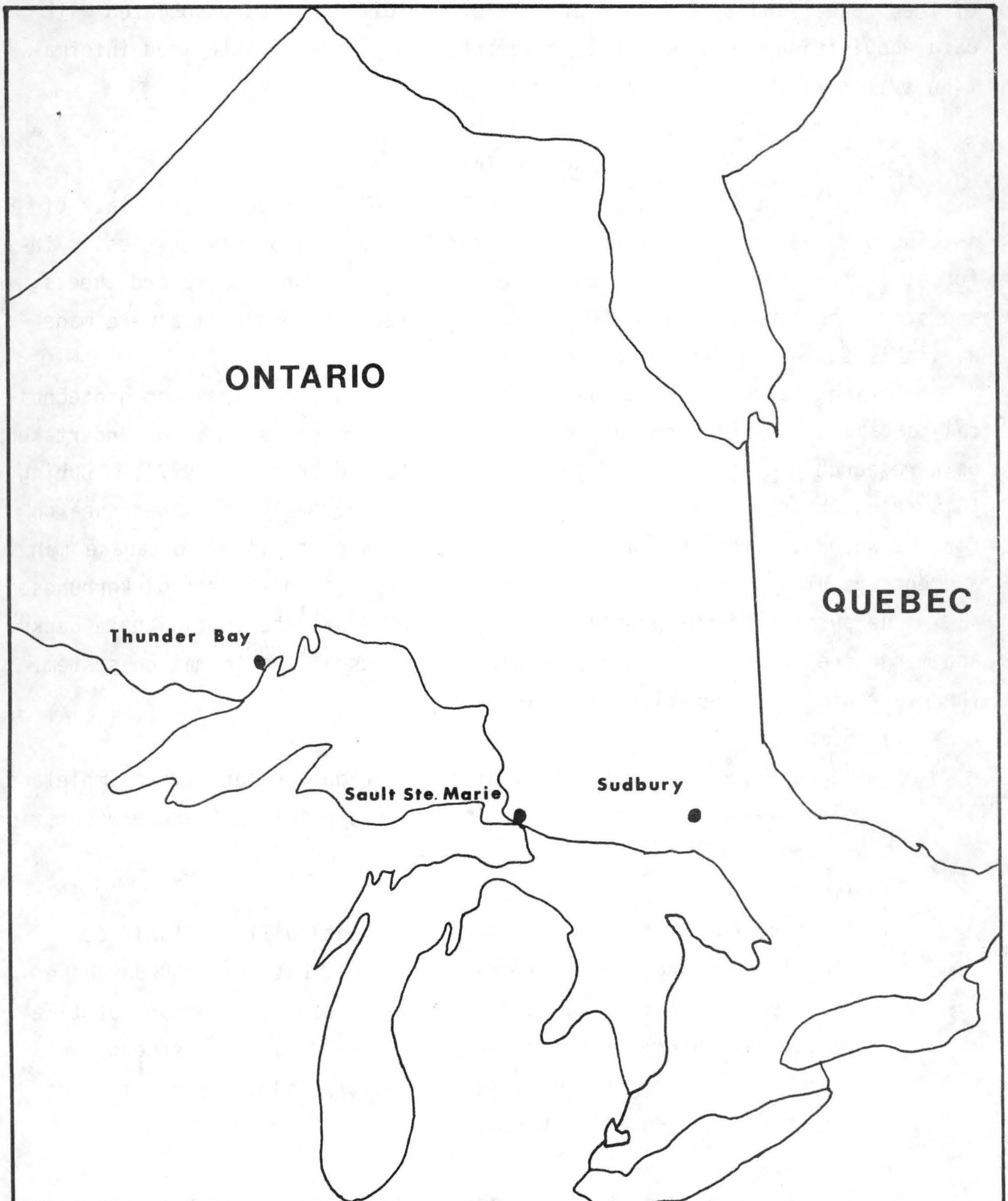

Fig. 1. Location of study areas

of the project and a statement of some of the difficulties associated with data acquisition. Finally, the implementation of the computerized information system will be presented.

Background Information

In 1972, the Geological Survey of Canada (GSC) undertook the task of setting up urban geological data banks for Canada's major communities. Information from borehole logs was collected, recorded on data record sheets, and stored on magnetic tape. Data for the three northern cities were made available to the OGS early in 1978.

During the period 1975-1977, the testing of a geological and geotechnical database, using a generalized database management system was undertaken as a research project at the University of Waterloo (Fenton, 1977). During this research, the needs of the user community were analyzed. The research for the Waterloo area indicated that the use of a generalized database management system adequately met the needs of users with different backgrounds.

The purpose of the present project is to update the initial data banks and merge the information into an efficient and useable information system. The overriding considerations in this project are:

1) Simplicity

   Because the data will be handled by various personnel, a simple and clear method of data collection, coding, retrieval, and presentation is required.

2) Time

   The concern about time is not that the data will be itself constantly changing and therefore incomplete, but that the database will need mechanisms to be regularly updated. The amount of time to add new information and manipulate the data must be kept to a minimum. Further, the data must be easily and quickly retrieved for those who request information.

3) Cost

   The method used in such a program must be justifiable in the terms of costs which in many aspects are related to the amount of time required to develop the information system.

Data Collection

The data collection for three cities of Sault Ste. Marie, Sudbury, and Thunder Bay began in late January of 1978. Contacts were established with organizations, etc. which held data which could be included in the database These contacts were, in general, not only the present sources of data but in the future will likely be both the users of and contributors to the database Approximately one hundred organizations were directly contacted. Over 1,100 reports containing borehole information were obtained for the three cities from forty-six local and five Toronto sources. These sources included government agencies at all three levels, engineering consulting firms, architects, and developers. Some of the data which had been already computerized were also obtained to aid in the process of data validation before merging of the information occurred.

The areas included in the search for the data varied for each urban area. For Sault Ste. Marie and Thunder Bay, the data boundaries were established to extend just beyond the municipal boundaries. With the establishment of regional government in Sudbury, the regional boundary was designated the geographical boundary of the data collection, an area of over 11,000 square miles.

Problems encountered during the data collection period included difficulties in locating the information and the question of ownership of the reports. The clients or owners could not always immediately be located because the associated firms changed names, merged, or dissolved. Two methods were used to obtain the information needed to update the data banks. Whenever possible, the soil investigation reports were obtained directly from those who retained the data (government agencies, engineering firms, architects, developers). In several instances, the engineering consulting firms, the major sources of these data, would not release these reports without the permission of the owners of the data. In this situation, the owners of the information (who are usually the clients of the engineering firms) were sent a letter explaining the project and a form which would authorize the release of the geotechnical information. Approximately 200 letters were sent with over 90% of the forms authorizing the release of the data returned. The majority of forms not returned related to the problem of locating the owner of the report(s) involved. Upon receiving the authorizations, the engineering firms retaining the information were again contacted and the reports were obtained. An estimated 95% of the available data for the three cities for the period of 1972-1977 has been obtained. Sault Ste. Marie and Thunder Bay both have approximately 250 reports to be included in the database, while Sudbury has over 550 such reports.

Computerization of the Data

Considerable headway has been made in the methods of storing, retrieving, and manipulating geological and geotechnical data during the last decade. Fixed field data are not so crucial, with decreasing computer storage costs and the availability of better techniques for manipulating unformatted text. Further, generalized data management systems have been developed which can handle most database applications. With the experience gained from the Waterloo geotechnical database, the factors to be stressed in the development of the information system are:

1) an input data record by which the coder can easily transfer the information from the original borehole to the data record
2) a management system which has continuing computer personnel support, has on line explain or help facilities, has good documentation, has both on line and batch facilities, and has good capabilities for manipulating the data for output
3) a variety of output forms which the user can choose depending on his needs and/or his technical background

Although a specialized data management system could be developed to handle all of these situations, the time and personnel involved would be considerable. Use of a generalized data management system can take advantage of the development of a system which is well documented, has user aids, and will likely have on-going computer personnel support. More time is left to the developer of the particular application on how to best organize and develop the database.

The data collected in 1972 were stored using a data record with fixed fields and mnemonic codes. Many problems can occur with such a record sheet, not only during the coding stage but also during data entry. These errors rarely can be detected by data validation techniques. Further, use of the data record sheet for manual retrieval purposes is difficult without a good knowledge of the codes involved. For these reasons, an input record largely resembling an engineering borehole record has been adapted for use in this project. The style of the input record is illustrated in Figure 2. Origi-

Ministry of Natural Resources
Ontario

ONTGAIS DATA RECORD

FILE NO. ________________

DATE ________________

RECORD NUMBER ________ (Col 1) CARD 00 (6)

N.T.S. MAP (8) ____________

UTM ZONE (16) ___

EASTING (18) _________

NORTHING (24) __________

LOCATION PRECISION (31) _______ ft.

REFERENCE (35, 51) ________________

DATE (M/Y) (49) _____________

SURFACE ELEV (53) _________ ft. ASL

METHOD (59) ___ PURPOSE (61) ____

PENETRATION: HAMMER (63) _____ lb.

DROP (66) ______ in.

SPOON DIAM (69) ____ in.

RELIABILITY (72) _______

BOTTOM OF HOLE (depth) (74) ________ ft.

DEPTH TO BEDROCK (78) __________ ft.

RECORD NUMBER	CARD	DEPTH	SOIL TYPE	DESCRIPTION (Colour, % Grain Size, Physical & Chemical Properties, Structure, Genetic.)	ATTERBERG DEPTH	ATTERBERG PL	ATTERBERG M C	ATTERBERG L L	PENETRATION DEPTH	PENETRATION BL/FT	WATER (depth)
Maximum Char/Line: 5		6	16	27	4	3	3	3	4	3	4
	01										
	02										
	03										
	04										
	05										
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	10										
	11										
	12										
	13										
	14										
	15										
	16										
	17										
	18										
	19										
	20										
Column: 1	6	8	14	30	57	61	64	67	70	74	77

COMMENTS ____

____

Fig. 2. Input data record.

nally developed by the GSC, this data record has two major parts:

1) the general information section which includes such items as the report reference, the date of drilling, the type of hole and the location of the borehole
2) the actual borehole information which includes the soil or bedrock type, description of each strata and any variable, Atterberg limits, penetration resistance, and water level data.

Information for as many of the fields as possible indicated in Figure 3 is obtained and stored for each borehole record. While some of the fields are stored as numeric and mnemonic codes, fields such as soil type and soil description are left as unformatted text.

This data record permits a simple means of transferring the borehole information and is itself easily interpreted by the user of the data. This record sheet can also be used in presenting the information to users until the computer retrieval system is operational. Little in the way of interpreting the borehole information is done. The original factual information is stored so that the user can make his own assessment of the data. The boreholes are located using the UTM grid reference system with the facility of interpreting these figures to longitude and latitude if required.

Searching and Retrieving Information

The components of the database system under development include not only storage facilities but also search, retrieval, and display of the data. The data will be managed by the generalized database management system, SYSTEM 2000, which is marketed by MRI Systems Corporation. Access to the database under SYSTEM 2000 can be either in batch or interactive environment with the same set of commands available in both modes. The database is operated on the IBM 370/168 computer at the Ministry of Government Services, Toronto, Ontario. The data search, retrieval, and display operations which are under development are illustrated in Figure 4.

Through the interactive mode, the facilities to search, retrieve, and modify the database are all possible. Specifically, in immediate access mode, the user of the database can:

1) add, change or remove data in the database
2) obtain arithmetic statistics about the data values contained in the database

Section 1: General Information

- Record Number (Key)
- Data Added
- Report Reference (Key)
- Report Reference Date
- Related References (repeating information)
  - Related Reference Number
  - Related Reference Data
- Method
- Purpose
- Reliability
- Penetration: Hammer
  - Drop
  - Spoon
- Location Precision
- UTM Zone
- NTS Map Number (Key)
- Easting (Key)
- Northing (Key)
- Surface Elevation
- Bottom of Hole
- Depth of Bedrock
- Comments (unformatted text)

Section 2: Borehole Log Information

- Soil Log (repeating information)
  - Soil Type (Key)
  - Soil Depth (depth at which soil type begins)
  - Soil Description (unformatted text)
- Atterberg Tests (repeating information)
  - Atterberg Depth
  - Plastic Limit
  - Moisture Content
  - Liquid Limit
- Penetration Tests (repeating information)
  - Penetration Depth
  - Blows Per Foot
- Water Table (repeating information)
  - Water Table Depth

Fig. 3. Fields of the Data Record

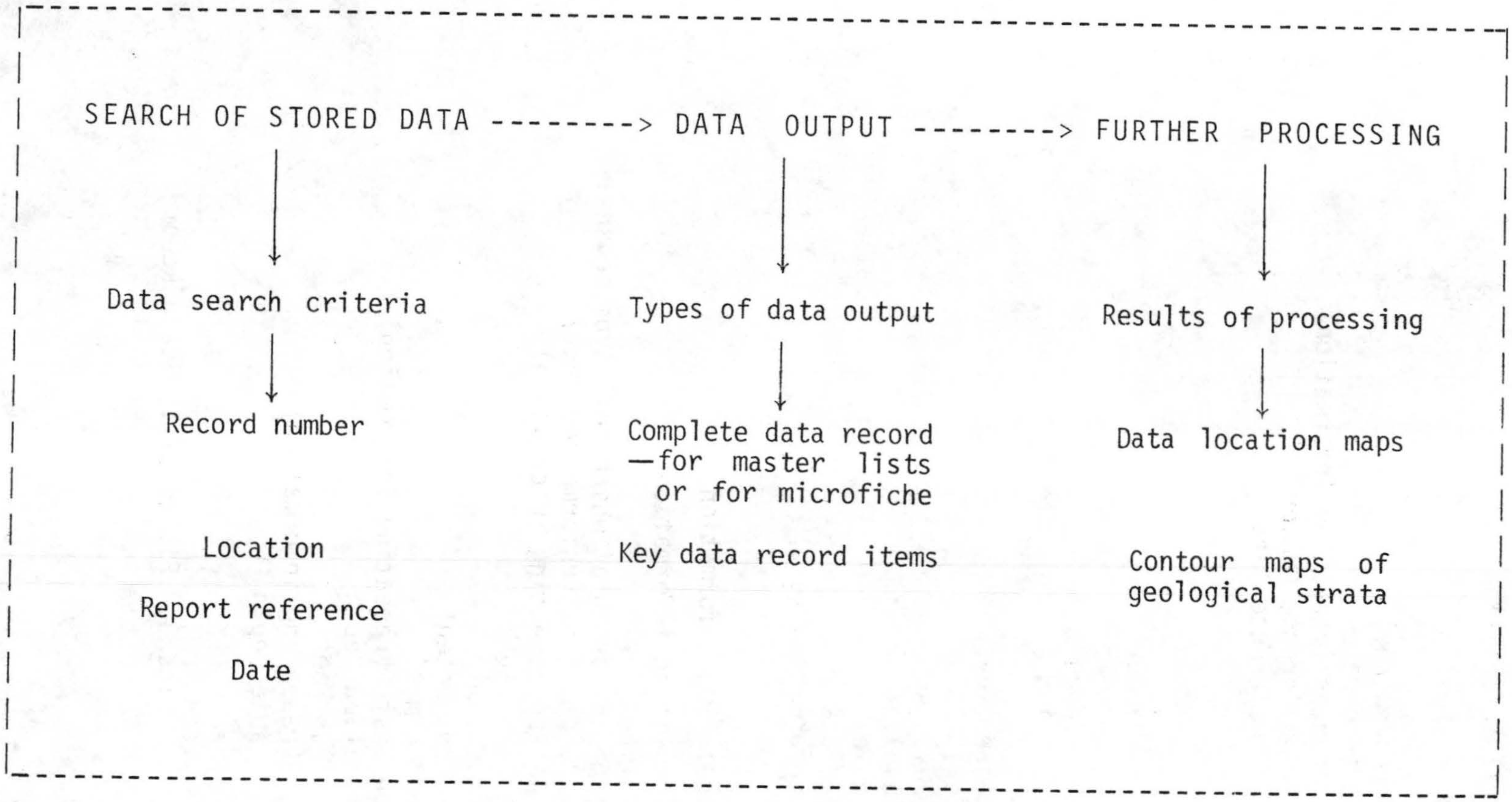

Fig. 4. Data Retrieval and Presentation

3) interactively browse the data
4) zero in on specific data by carrying forward results from one retrieval to the next
5) format the retrieval data
6) define arithmetic expressions to generate the required output.

To access the information readily, searching and extracting the data on certain key items are required. Most of the requests for information can be retrieved by using the item such as the borehole identification number, the location parameters, the report reference number, and the soil types recorded in the borehole log. Indexes will be built on these items which are indicated as 'keys' in Figure 3 and will allow quick retrieval of the data records.

Output of the Information

In conjunction with the database, various output listings and maps will be required as shown in Figure 4. Two kinds of output programs are necessary: one which will transform the data records from its internal storage form to formats required for data listings, one example being a format akin to the input data record; and the other which will take the locations of the boreholes and produce maps of the data records retrieved from the database. Data location maps will be produced for the entire database. As well, production of data point maps and contour maps of particular parameters of interest, such as the depth of bedrock, will be possible.

Operation of the Geotechnical and Geological Database

There are various ways of searching and retrieving information from the database. For those with access to a terminal, the search for information can be most easily done using the immediate access facilities of SYSTEM 2000. However, methods to locate manually and retrieve the desired information are possible with the use of data location maps and master lists of the database. The data record number will be printed beside each borehole location on the data location maps. The user can then locate these data record numbers in the master lists. This method of obtaining specific boreholes of interest can also be used to find information quickly with on line retrieval methods. The user will also be able to specify the data to be retrieved by giving the UTM grid co-ordinates as boundaries for the data search. With this information the data records can be retrieved and an output listing can be produced. As well as producing master lists of the databases, microfiche of the data records will be produced. The use of microfiche with the data location maps will also allow users to browse the database information manually.

Conclusion

The objective of this project is to provide for the accessibility of geological and geotechnical data to the general public. These databases cannot in any way curtail the need for site investigations. However, important decisions can be made by using these data if the means to collect the information regularly are established, methods to store, search and retrieve the data easily are developed, and lastly methods of data presentation are designed which are easily understood by various users.

Reference

Fenton, S.L.A. 1977. A Geological and Geotechnical Computer-Based Information System for Engineering and Planning. M.A. thesis, University of Waterloo.

MANUAL LITERATURE SEARCHING IN THE GEOSCIENCES: A COMPARATIVE USER CONVENIENCE STUDY OF INTERNATIONAL INDEXES[1]

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Abstract: The structural principles and the physical, printed version of five international reference publications of specific interest for geoscientists are discussed. The format of Bibliography and Index of Geology over the years is reviewed in some detail, and comparisons made with Geotitles Weekly, Science Citation Index, Bulletin Signalétique--Bibliographie des Sciences de la Terre, and Zentralblatt für Geologie und Paläontologie. Their subject indexes vary from an alphabetical, partly controlled three-level vocabulary, through the Permuterm index to a systematic, numerical index, and are not all equally convenient to consult. Their philosophy, structure, type of subject terms, layout, updating, frequency and cumulations make a difference in their readability and accessibility. The way the five reference works meet the expectations of the modern user is discussed. Their coverage of language, subject fields and types of publications are compared, as well as their actuality, i.e. the time lag between the original publication dates and the appearance of the citations in the respective reference indexes.

"Information scientists have tended to concentrate on developing information retrieval systems which in theory have a good performance and paid less attention to such factors as the general appearance of an index and its consequent psychological impact on the user" stated J. F. Drage (1969) in The Indexer. This conclusion is still valid today.

Some reference indexes we find convenient and quick to use; others mean too much page flipping and too many dead ends. Our expectations are high; we compare and establish preferences for certain systems and types of indexing and wish that our favourite index were easier to use.

In the present paper I will first examine the structure and convenience of Bibliography and Index of Geology, with comparisons to its British, French and German equivalents, and then comment on the subject, language and publication coverage, as well as the actuality (or time lag) of these indexes. Science Citation Index is referred to for special topics. The geo-

[1]Hawaii Institute of Geophysics, Contribution No. 925.

science parts of the Russian Referativnyi Zhurnal and the Japanese Kagaku Gijutsu Bunken Sohuku have not been included in this study. Comments are based partly upon informal user interviews at the University of Hawaii and Hawaii Institute of Geophysics, partly upon my own studies and experiences. I thank the publishers of the German Zentralblatt für Geologie und Paläontologie and Zentralblatt für Mineralogie and of the French Bulletin Signalétique for their kind assistance in providing material for this study.

The appearance and the layout of Bibliography and Index of Geology have changed in many ways over the years: the subject fields have increased from 21 to 29, and the subject indexes have had frequent face-lifts. Changes are signs of editors who are alive and alert, I suppose--which is to be appreciated. A few radical revisions are easier to take, though, than annual small alterations which confuse and annoy.

The Bibliography and Index seems in scope and contents to be close to the ideal index for a comprehensive geoscience library, at least in the part of the world where English is the main language. Yet I find that it is primarily used for retrospective searches in my library. The reason most often given is that an index published so long after the original publications has lost its value as a current-awareness tool. Its annual indexes--prior to 1977, I hasten to add--are found fairly satisfactory, and the cumulations most preferred are those where the reference to the main bibliography consists only of an author's name, without any visually disturbing figures for month, interest field or citation number. Last year's cumulation of the indexes only, not of the bibliography itself, has had a cool reception. I would call it a great inconvenience.

The attitudes to the three-level subject index of Bibliography and Index of Geology vary. Users familiar with the thesaurus from GeoRef searches feel most comfortable with the system, while those who spend hours over manual searches are less enthusiastic. During the first few years the index had a large number of alternative terms on the second level and few on the third. References were easy to find and to browse through, since each entry was relatively simple in construction; we had an index with high recall. In 1972 it was radically changed: the second-level terms became more general, and their number was greatly reduced; the specific information was pushed down into the third level, which swelled to an uncomfortable size. The result was an index with high precision but necessarily lower recall than the pre-1972 version. The next drastic change (in 1978) to a single third-level term, followed by the publication title, is much appreciated. It gives an index easy to look at, with a useful and practical balance between precision and recall. I find this a great convenience.

The structure of Geotitles Weekly is entirely different, with the bibliographic entries listed according to a numerical classification--not always convincing in its structural logic but simple to use. The classification is detailed enough to serve as its own subject index without the inconvenience of constant page flipping between index and main bibliography, and the frequent cross references add to its usefulness. The main entries are visually troublesome, however, with too many shifting type settings.

As much as I like the idea and the concepts behind Science Citation Index, its special reference and verification uses, and its multi-disciplinary character, I dislike equally its Permuterm subject index, which with a combination of two often uninformative subject terms, throws the user into a wild chase from page to page.

In Bulletin Signalétique the geosciences are spread out over at least ten separate sections. Why separate paleontology and stratigraphy and remove geophysics (including volcanology!) from the other geosciences? Each section is divided into subject areas where citations are arranged, somewhat inconveniently, by accession number. The abstracts are in French, short and indicative. Subject indexes in the monthly issues are easy to read, with a three-level controlled vocabulary. A separate earth sciences thesaurus gives useful translations of the descriptors into German and English.

The structure of the two German indexes, Zentralblatt für Geologie und Paläontologie and Zentralblatt für Mineralogie, is similar, with main entries arranged by accession number under fairly narrow subject fields. Three out of four abstracts are the authors' own. The subject index of Part I of the geology/paleontology index is a keyword register, with second-level terms in code--space-saving and easy to read but not to understand. The publication titles are in lower-case type; in German this is especially unfamiliar to the eye and slows down reading.

To me, none of the geoscience indexes has an ideal structure. My favourite index would be one where I could go directly to the main bibliographic entries, as in Geotitles Weekly, but with the entries arranged under alphabetical subject headings in a controlled vocabulary instead of a systematic classification. Two or three entries per citation do enlarge the main bibliography, but then no subject index is needed. A separate thesaurus with a purely alphabetical, as well as a structured alphabetical, section is necessary and can take care of general cross references. If this reminds anyone of Index Medicus, it is no accident. Many years of constant use have convinced me of the excellence of that index. Several of the geoscience indexes separate certain types of publications (such as monographs, conference papers, etc.) from the main bibliography--I would give three cheers and a red rose to the editor who would also single out the review articles, which to me are the most important publications of all!

Figure 1 and Tables 1-3 in the Appendix show correlations of subject fields and statistical figures for subject, language and publication coverage for the various indexes. They will only be referred to in a general way and are just meant to give background data. Figure 1 shows the classification schemes for the geosciences in the indexes reviewed; I have translated the French and German subject headings into English to facilitate comparisons. In Table 1, I have separated the individual classification numbers of the foreign indexes to match the 29 fields of interest in Bibliography and Index of Geology. Table 2 is based on these subject correlations and gives absolute and relative subject coverage for the indexes. Table 3 is based partly on figures from the literature, partly on my own findings. Relative language distribution of serials indexed and of actual citations are given for each index, for English, French, German, Russian, and other languages. Relative figures for publications' coverage are based on counting citations and divided into six types: journal articles, monographs, papers in collected works, report papers, symposia papers, and theses. Actuality figures show the publication year of the materials indexed. The figures for the British, French and German indexes are merely indicative, since they are based only on spot counts, but the trends are clear. I refer to the tables for details, and will here touch upon just a few special features.

Bibliography and Index of Geology with its nearly 50,000 yearly literature citations appears particularly strong in extraterrestrial geology, applied and general geophysics, engineering and environmental geology, surficial geology, and parts of economic geology. It has a fair coverage of various types of publications; if monographs are under-represented, that is a weakness shared with the other indexes. About 60% of the serials indexed in the Bibliography and Index in 1977 were in English, as were 75% of the actual citations. The figures vary with the subject field: a check-up in GeoRef showed that the Russian percentage in geophysics was double that of Russian in the total data base. In an actuality study I did of Bibliography and Index of Geology and Science Citation Index as part of another project, by picking out a key article from each of fourteen leading geoscience journals, I found that the time elapsed between the original publication of the key article to its citation in Bibliography and Index varied from three to thirteen months, with an average of six months. Science Citation Index had a time lag of only one-five months for the very same articles, with two months as an average, and curiously enough a different ranking order for the fourteen articles.

Geotitles Weekly claims to be the most comprehensive geoscience index and certainly has an impressive number of citations. Report papers make up a high percent, however, and most come from Government Reports Announcements and Index of NTIS. I question the need for such a comprehensive British edition of the Weekly Government Abstracts in earth sciences. If more than half of the citations represent report and symposia papers, that leaves around 40,000 yearly references to more readily available publications, a figure comparable to that of Bibliography and Index of Geology. Russian journals are better covered than in the Bibliography and Index, though, and Geotitles Weekly's areas of strength are others, both in relative and absolute figures: petrology, marine geology, stratigraphy and historical geology, and structural geology.

Bulletin Signalétique, Section 120, where geophysics is found, gives a substantial number of references in oceanography and in both solid-earth and seismic geophysics. A high percentage of Russian references and, lately, a quick production have made this section an important information source for Russian geophysical literature. It does not, however, cover applied geophysics, and Bibliography and Index remains the most valuable tool here. Bulletin Signalétique as a whole, with all of its 52 sections, has a good language balance between the journals indexed, reflecting its continental European cooperation in editorship and production.

The most important fields of Zentralblatt für Geologie und Paläontologie stand out: English-language invertebrate paleontology and German economic geology. Geophysical literature is not touched at all, and symposia papers are poorly covered, but the most disturbing feature of this index is still its long production time. Informative abstracting is a time-consuming business, and the German indexes are the only ones in this study that are manually produced and not derived from a data base.

Zentralblatt für Mineralogie has, all the same, become impressively up-to-date. It cuts a narrow but deep slice of the literature, and its Part I is by far the most valuable key to the literature of crystallography and mineralogy. English, French, German and Russian journals are all well covered, other languages hardly at all. Part II is particularly strong in Russian petrography and geochemistry.

So, where does all this take us? It would have been fun to do comprehensive, comparative, computerized statistics on a much larger sampling of material--but there is only one life!

We have always suffered from the existence of too many mismatching indexes in the geosciences. The new international association will, we hope, serve as a catalyst for worldwide cooperation! Producer and consumer interests do not always coincide, though; the consumer's dream would be an internationally coordinated geo-info network, a multi-media on-line deliverer of materials as well as information. It might be a three-generations' dream; in the meantime we have to structure and use our index collections in a more traditional manner. With a cost of up to two and a half cents per printed citation, we should know what we need, what we get, and whether it is of any use to us. Availability and accessibility of the indexed literature are both problematic issues.

And we must ask ourselves: if index so-and-so is consulted x times a year at a subscription cost of $n, is that good economy? If not, what can we do about it? Educate and stimulate to more extensive use? Cancel our subscription and rely upon the library next door? Depend on computer searches altogether? Or inform the publishers of our preferences and hope that they value user feedback?

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Hawkes, H. E. 1967. Geology. Library Trends, v. 15, p. 816-828.

Lea, G., Diment, J., and Harvey, A. P. 1973. Geological literature. In Encyclopedia of Library and Information Science, v. 9, p. 309-364.

MacKay, J. W. 1975. Sources of Information for the Literature of Geology; an Introductory Guide. London: Geological Society.

APPENDIX

Bibliography and Index of Geology

1. Mineralogy & Crystallography
2. Geochemistry
3. Geochronology
4. Extraterrestrial Geology
5. Petrology, Igneous & Metamorphic
6. Petrology, Sedimentary
7. Marine Geology & Oceanography
8. Paleontology, General
9. Paleontology, Paleobotany
10. Paleontology, Invertebrate
11. Paleontology, Vertebrate
12. Stratigraphy, Historical Geology & Paleoecology
13. Areal Geology, General
14. Areal Geology, Maps & Charts
15. Miscellaneous & Mathematical Geology
16. Structural Geology
17. Geophysics, General
18. Geophysics, Solid-earth
19. Geophysics, Seismology
20. Geophysics, Applied
21. Hydrogeology & Hydrology
22. Engineering & Environmental Geology
23. Surficial Geology, Geomorphology
24. Surficial Geology, Quaternary
25. Surficial Geology, Soils
26. Economic Geology, General & Mining
27. Economic Geology, Metals
28. Economic Geology, Non-metals
29. Economic Geology, Energy Sources

Bulletin Signalétique

120: A. Solid Earth Geophysics

161: A. Crystallography

220: A. Mineralogy
B. Geochemistry
C. Isotope Geochemistry & Geochronology
D. Lunar and Planetary Geology

221: A. Metals & Non-metals, Economic
B. Economic Geology & Mining

222: A. Igneous and Metamorphic Rocks

223: A. Sedimentary Rocks
B. Marine Geology

224: A. Stratigraphy and Paleogeology
B. Areal Geology
C. General Geology, Methodology, Instrumentation, Mathematical Geology, Geoscience Information

225: A. Tectonics and Structural Geology

226: A. Hydrology
B. Engineering Geology
C. Surficial Geology

227: A. Paleontology

Geotitles Weekly

1000 General Publications
2000 Regional Geology
3000 Applied Geology
3300 Exploration
3600 Engineering Geology
3800 Oceanology
3900 Energy Sources
4000 Mineral Deposits
4150 Ore Genesis
4200 Metallic Deposits
4500 Non-metallic Deposits
4900 Water
5000 General Geology
5100 Mineralogy
5400 Petrology
5500 Sedimentology
5600 Paleontology
5700 Invertebrate Paleontology
5800 Micropaleontology
5900 Vertebrate Paleontology
6600 Geochemistry
6800 Geophysics
6900 Geomathematics
7000 Physical Geology
7100 Tectonics
7300 Structural Geology
7400 Geomorphology
7500 Historical Geology
7550 Geochronology
7600 Stratigraphy
7700 Paleogeology
8000 Methodology
8500 Equipment
9000 Geoscience Information
9900 Geotitles Weekly Indexes

Zentralblatt für Geologie und Paläontologie

I General, Applied, Areal & Historical Geology

1 General Geology
1.1 General
1.2 Exogenic Geology
1.2.1 Terrestrial Geology
1.2.2 Marine Geology
1.2.3 Sediments & Sedimentary Rocks
1.3 Endogenic Geology
1.3.1 Structural Geology
1.3.2 Magmatism & Metamorphism
1.3.3 Igneous & Metamorphic Rocks
1.4 Soil & Rock Geochemistry

2 Applied Geology
2.1 General
2.2 Hydrogeology
2.3 Engineering Geology
2.4 Economic Geology & Mining
2.5 Environmental Geology

3 Areal Geology

4 Historical Geology
4.1 General
4.2 Paleogeography
4.3 Geochronology
4.4 Historical Geology & Stratigraphy

5 Miscellaneous

II Paleontology

1 General Paleontology

2 Paleozoology
2.1 Cenozoic Faunas
2.2 Invertebrates
2.3 Vertebrates

3 Paleobotany

Zentralblatt für Mineralogie

I Crystallography and Mineralogy

1-4. Crystallography. Crystal Physics & Chemistry
5. Amorphous Materials
6. Special Mineralogy
7. Gemmology
8. Areal Mineralogy
9. Meteorites & Tektites

II Petrography, Technical Mineralogy, Geochemistry & Geology of Mineral Deposits

A. History and Biography
B. Monographs & Symposia & Collective Works
C. Generalia
D. Methodology & Statistics
E. Experimental & Theoretical Geochemistry
F. Elements
G. Minerals
H. Isotopes
I. Geochronology
J. Lunar & Planetary Geochemistry
K. Mantle & Inner Earth
L. Igneous Rocks
M. Mineral Deposits of Magmatic Origin
N. Metamorphic Rocks
O. Mineral Deposits of Metamorphic Origin
P. Sedimentary Rocks and Deposits
Q. Soil & Erosion
R. Water Chemistry
S. Gases
T. Organic Geochemistry
U. Geochemical Prospecting & Exploration
V. Environmental Geochemistry
W. Areal Geochemistry

Fig. 1. Subject classification schemes of the reference indexes, with main subject divisions for the geosciences.

TABLE 1

CORRELATION OF SUBJECT CLASSIFICATIONS OF THE INDEXES

Bibliography & Index of Geology	Geotitles Weekly	Bulletin Signalétique	Zentralblatt f.Geologie u. Paläontologie	Zentralblatt f.Mineralogie
1. Mineralogy & Crystallography	5100-5300	161:A-C, 220:A	-	I:1-9
2. Geochemistry	6600-6700	220:B	I:1.4	II:A-W
3. Geochronology	7550-7570	220:C	I:4.3	II:I
4. Extraterrestrial Geology	7010-7030	220:D	I:3.9	II:J
5. Petrology, Igneous & Metamorphic	5400	222:A	I:3.2-3	II:L-O
6. Petrology, Sedimentary	5500	223:A	I:1.2.3	II:P
7. Marine Geology & Oceanography	3800	223:B, 120:A,B	I:1.2.2	II:R.3
8. Paleontology, General	5600	227:A	II:1	-
9. Paleontology, Paleobotany	5970	227:A	II:3	-
10. Paleontology, Invertebrate	5700	227:A	II:2.2	-
11. Paleontology, Vertebrate	5900-5960	227:A	II:2.3	-
12. Stratigraphy, Historical Geology & Paleoecology	5630, 7600, 7500-7540	224:A, 227:A	I:4.1-2, I:4.4-7	-
13. Areal Geology	2000	224:B	I:3	I:8, II:W
14. Areal Geology, Maps, & Charts	2100-2500	224:B	I:3	-
15. Miscellaneous & Mathematical Geology	8000, 9000 6900	224:C	I:5, I:1.1	II:A,C,D
16. Structural Geology	7100-7300	225	I:1.3.1	-
17. Geophysics, General	6800	120:C	-	-
18. Geophysics, Solid-earth	6830-6890	120:A	-	-
19. Geophysics, Seismology	6810-6820	120:A	-	-
20. Geophysics, Applied	3340	-	-	-
21. Hydrogeology & Hydrology	4900	226:A	I:2.2	II:R
22. Engineering & Environmental Geology	3570, 3600	226:B	I:2.3 & 5, I:2.2.1	II:V
23. Surficial Geology, Geomorphology	7400	226:C	I:1.2.1	II:Q
24. Surficial Geology, Quaternary	7460	226:C	I:1.2.1	-
25. Surficial Geology, Soils	7410	226:C	I:1.2.1, I:1.4	II:Q
26. Economic Geology & Mining	3300-3550	221:B	I:2.4.1	-
27. Economic Geology, Metals	4150, 4200	221:A	I:2.4	II:M,O
28. Economic Geology, Non-metals	4500-4800	221:A	I:2.5	-
29. Economic Geology, Energy Sources	3310, 3900 4000-4100	221:A,B	I:2.3-4	-

NOTE: Individual classification numbers of the foreign geoscience indexes are matched to the 29 fields of interest in Bibliography and Index of Geology. For example, corresponding to 4. Extraterrestrial geology in B&IG, are: 7010-7030 in Geotitles Weekly, 220:D in Bulletin Signalétique, 3.9 in Zentralblatt für Geologie und Paläontologie, Pt. I, and J in Zentralblatt für Mineralogie, Pt. II.

TABLE 2

SUBJECT COVERAGE OF THE REFERENCE INDEXES

Bibliography & Index of Geology Subject Fields	Bibliography & Index of Geology Ref./Year	%	Geotitles Weekly Ref./Year	%	Bulletin Signalétique/120 Ref./Year	Zentralblatt f.Geologie u. Paläontologie Ref./Year	%	Zentralblatt f.Mineralogie Ref./Year	%
1. Mineralogy & Crystallography	2050	4.5	2500	4.0	-	-	-	8250	76.0
2. Geochemistry	3050	6.5	3700	5.0	-	50	0.5	1000	9.0
3. Geochronology	450	1.0	1250	2.0	-	110	1.0	50	0.5
4. Extraterrestrial Geology	1700	3.5	350	0.5	-	90	1.0	150	1.0
5. Petrology, Igneous & Metamorphic	3050	6.5	8700	12.5	-	480	6.0	250	2.5
6. Petrology, Sedimentary	1850	4.0	4300	6.0	-	180	2.5	50	0.5
7. Marine Geology & Oceanography	1250	2.5	4600	6.5	2650	80	1.0	50	0.5
8. Paleontology, General	250	0.5	950	1.5	-	110	1.0	-	-
9. Paleontology, Paleobotany	500	1.0	350	0.5	-	80	1.0	-	-
10. Paleontology, Invertebrate	1450	3.0	3200	4.5	-	2030	24.0	-	-
11. Paleontology, Vertebrate	750	1.5	1050	1.5	-	110	1.0	-	-
12. Stratigraphy, Historical Geology & Paleoecology	2900	6.5	9000	13.0	-	990	12.0	-	-
13. Areal Geology	500	1.0			-			250	2.5
14. Areal Geology, Maps & Charts	600	1.5	2300	3.0	-	360	4.5	-	-
15. Miscellaneous & Mathematical Geology	650	1.5	3000	4.0	-	320	4.0	650	6.0
16. Structural Geology	1750	4.0	9800	14.0	-	270	3.0	-	-
17. Geophysics, General	850	2.0	300	0.5	550	-	-	-	-
18. Geophysics, Solid-earth	1100	2.5	1650	2.0	1500	-	-	-	-
19. Geophysics, Seismology	1600	3.5	1800	2.5	1200	-	-	-	-
20. Geophysics, Applied	2600	6.0	600	1.0	-	-	-	-	-
21. Hydrogeology & Hydrology	1700	4.0	1900	2.5	-	530	6.5	100	1.0
22. Engineering & Environmental Geology	4750	10.5	1600	2.0	-	610	7.5	10	
23. Surficial Geology, Geomorphology	1200	2.5	350	0.5	-			20	
24. Surficial Geology, Quaternary	2250	5.0	350	0.5	-	650	8.0	-	0.5
25. Surficial Geology, Soils	650	1.5	600	1.0	-			10	
26. Economic Geology & Mining	650	1.5	5050	7.0	-	920	11.0	-	-
27. Economic Geology, Metals	2650	6.0	250	0.5	-	110	1.0	20	
28. Economic Geology, Non-metals	600	1.5	100	-	-	200	2.5	-	-
29. Economic Geology, Energy Sources	2000	4.5	1350	2.0	-	90	1.0	-	-
Total	45,350	100.0	70,950	100.0	5900	8,350	100.0	10,860	100.0

NOTE: The absolute and relative subject coverage for Bibliography and Index of Geology is based on accurate countings over six months, with corresponding figures for Geotitles Weekly, Bulletin Signalétique, Zentralblatt für Geologie und Paläontologie, Pt. I-II, and Zentralblatt fur Mineralogie, Pt. I-II. The tables give an estimated number of references per year for each index within the 29 fields of interest of the B&IG classification, and percentages for subject distribution within each index. For example, Bibliography and Index of Geology is calculated to have 1700 references yearly in Extraterrestrial Geology, that is 3.5% of its total references, while corresponding figures for Geotitles Weekly are 350 references and 0.5%.

TABLE 3

LANGUAGE COVERAGE, PUBLICATION COVERAGE, AND ACTUALITY OF THE INDEXES

Bibliography	Serials-- Language Coverage		Citations-- Language Distribution		Publications Coverage	Actuality (Time Lag)
Bibliography & Index of Geology	1977 (1420)* E = 59% F = 13% G = 7% R = 4% O = 17% 100% N. Am. 26%	1976 (1500) E = 60% F = 9% G = 8% R = 5% O = 18% 100% N. Am. 26%	1977-1978 (3000) E = 77% F = 5% G = 3% R = 7% O = 8% 100%		1978 (650) a. Journal art. 69% b. Monographs 1% c. Papers in coll. works 3% d. Report papers 13% e. Symp. papers 8% f. Theses 6% 100%	Jan. 1978 (700) 1977 55% 1976 23% 1975 15% 1974 3% Pre-1974 4% 100%
Geotitles Weekly	1977 E = 58% F = 15% G = 6% R = 9% O = 12% 100% N. Am. 26%	Lea, 1973 (3582) E = 62% F = 8% G = 8% R = 4% O = 12% 100% N. Am. 27%	Charles, 1972 (1300) E = 73% F = 3% G = 4% R = 15% O = 5% 100%		1977 a. 22% b. 1% c. 0% d. 40% e. 36% f. 5% 100%	1977 (250) 1977 38% 1976 12% 1975 41% 1974 6% Pre-1974 3% 100%
Bulletin Signalétique	1978 (17,000) E = 40% F = 20% G = 10% R = 9% O = 21% 100%		MacKay, 1975 (379) E = 34.8% F = 12.1% G = 7.7% R = 29.0% O = 16.4% 100.0%	1978 Geophys. (865) E = 47% F = 9% G = 2% R = 37% O = 5% 100%	1978 Geophys. (865) a. 72.0% b. 2.0% c. 4.0% d. 11.0% e. 10.5% f. 0.5% 100.0%	Jan. 1978 Geophys. (865) 1977 83.5% 1976 15.0% 1975 1.2% 1974 0.3% 100.0%

*Refers to the number of items analyzed.

TABLE 3--Continued

Bibliography	Serials-- Language Coverage		Citations-- Language Distribution		Publications Coverage		Actuality (Time Lag)		
Zentralblatt f.Geologie u. Paläontologie	1977:I (90)	1977:II (128)	1977:I (267)	1977:II (200)	1977:I (267)	1977:II (200)		1977 I (267)	1977 II (Oct.) (200)
	E = 10%	E = 37%	E = 25%	E = 59.0%	a. 78.5%	a. 69.0%	1977	0%	6.5%
	F = 0%	F = 11%	F = 2%	F = 10.5%	b. 2.5%	b. 8.0%	1976	56%	48.0%
	G = 90%	G = 15%	G = 73%	G = 12.0%	c. 4.0%	c. 12.0%	1975	28%	28.5%
	R = 0%	R = 9%	R = 0%	R = 3.5%	d. 10.0%	d. 8.5%	1974	14%	12.5%
	O 0%	O = 28%	O = 0%	O = 15.0%	e. 0.5%	e. 2.5%	1973	1%	2.0%
	100%	100%	100%	100.0%	f. 4.5%	f. 0.0%	1972	1%	2.5%
	N. Am. 2%	N. Am. 19%			100.0%	100.0%		100%	100.0%
Zentralblatt f.Mineralogie	1977:I (50)	1977:II (37)	1977:I (450)	1977:II (410)	1977:I (450)	1977:II (410)		1977 I April (450)	1977 II Feb. (410)
	E = 64%	E = 27%	E = 70%	E = 58.0%	a. 100%	a. 79.0%	1977	100%	63%
	F = 14%	F = 0%	F = 10%	F = 1.5%	b. 0%	b. 1.5%	1976	0%	37%
	G = 20%	G = 9%	G = 14%	G = 4.5%	c. 0%	c. 14.5%		100%	100%
	R = 2%	R = 64%	R = 6%	R = 36.0%	d. 0%	d. 5.0%			
	O = 0%	O = 0%	O = 1%	O = 0.0%	e. 0%	e. 0.0%			
	100%	100%	100%	100.0%	f. 0%	f. 0.0%			
	N. Am. 18%	N. Am. 9%			100%	100.0%			
Comparative Studies	Hawkes (1967) on Geol. World Liter., 1961 (340)		Craig (1969) on Citations from 10 American Geological Journals		Hawkes (1967) on Geological World Publications				
	E = 27%	Manheim (1972)	E = 87.3%		a. 53%				
	F = 11%	E = 30%	F = 3.2%		b. 5%				
	G = 11%	R = 50%	G = 1.5%		d. 25%				
	R = 30%		R = 1.2%		e. 17%				
	O = 21%		O = 6.8%		100%				
	100%		100.0%						
	N. Am. 18%								

NOTE: This table includes language distributions for serials indexed and for actual citations, coverage in percentages of various types of publications, and figures for actuality (or time lag) for each index. For example, of all 17,000 serials in the Bulletin Signalétique-system, 40% are in the English language, 20% in French, 10% in German, 9% in Russian, and 21% in other languages. Of 1300 citations counted in Geotitles Weekly by Charles of Geosystems, 73% were reported to be in English, 3% in French, etc. Of the 450 items in the April 1977 issue of Zentralblatt für Mineralogie, Pt. I, 100% were journal articles, and 100% were published in 1977.

BLACK SHALE BIBLIOGRAPHY AND AN OPEN-FILE REPOSITORY FOR EASTERN GAS SHALES PROJECT PUBLICATIONS

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Abstract: The United States Department of Energy (DOE) is supporting many investigations aimed at solutions to the energy problem. Among them is a program called the Eastern Gas Shales Project (EGSP) intended to stimulate gas production from this extensive rock body. Personnel of industrial companies, research laboratories, research centers, geological surveys, both federal and state, and universities in twelve states (CA, DC, KY, NM, NY, NC, OH, PA, TN, VA, WA, WV) are involved in the Eastern Gas Shales Project. Each of the EGSP investigators needs quick access to findings of the other investigators and to published data on the Devonian black shale. Two programs which meet these needs, also funded by DOE, are the topic of this paper. They are: (1) an open-file repository of all documents published by Eastern Gas Shales investigators. These documents (reports, maps, microforms) are available for on-site use or interlibrary loan; (2) a comprehensive annotated bibliography compiled by searching the manual bibliographies and the on-line data bases. The bibliography will be international in scope and cover all aspects of the Devonian shales. Plans are to publish the bibliography when the searching is completed.

It is a well known fact that the United States has an energy shortage. Although coal appears to be in ample supply, there are many environmental and pollution problems. The country has depended upon natural gas and oil; however, many of the larger, older oil and gas fields have produced for years, and their present output is getting low. This production must be replaced by finding new oil and gas fields which are economically recoverable. The "easy" oil and gas has been found; much of the rest lies in remote areas or hostile environments. However, there are oil shale deposits, still untapped, which could provide needed liquid fuel for future years. Since 1860, we have been aware of shale oil deposits and recognized their potential value. However, from 1860-1976, with the "easy" oil and gas available, the need to explore and tap these deposits has not existed. The need is now here and, next to coal, oil shale is the United States' largest fossil fuel resource. Shale oil is a national energy resource of enormous proportions, and it is essential that we explore these oil shale deposits. The U.S. Department of

Energy (DOE), formerly the Energy Research and Development Administration (ERDA), is funding scientific research and assisting industrial laboratories and companies to explore and energize oil shale deposits and to develop technology, on the premise that oil shale will be the source of the economically feasible liquid syn-fuel which the nation needs.

With these thoughts in mind, the purpose of this paper is twofold: (1) to provide awareness of a bibliography now in process which cites published and unpublished literature on geologic aspects of black (hydrocarbon-bearing) shale. Manual and automated data bases have been and are being searched to compile the bibliography which will be stored on tape for retrieval on a CRT terminal. The immediate primary users are researchers from several states, involved in an Eastern Gas Shale Project (EGSP) funded by ERDA/DOE. (2) to provide awareness of the availability of the open-file repository for EGSP publications at the Geology Library, University of Kentucky.

Researchers in twelve states are dealing with various aspects of gas stimulation from black shale, including location, stratigraphy, mechanical and chemical properties, and applicable technology of hydrocarbon-bearing shales. As an investigator finishes a report or a document, whether it is a periodic report, map, cross section, technical publication, or other item of interest, two copies are sent to the open-file repository at the University of Kentucky. These documents are catalogued, cards produced and filed, and the documents shelved. They are then accessible to students, geologists, and researchers in the area as well as available on interlibrary loan. An acquisitions/accessions list of these documents is being produced and mailed to those interested.

Research at 21 institutions and laboratories is being conducted in twelve states and the District of Columbia. Holding these resource contracts are: Alfred University; Battelle Columbus Laboratories; Chenevert and Associates; Environmental and Regional Research Associates, Inc.; Illinois Geological Survey; Indiana Geological Survey; Juniata College; Morgantown Energy Research Center (MERC No. 1 and MERC No. 2); Mound Laboratory; State University of New York; Regents Research Fund, Inc.; Ohio Department of Natural Resources; Pennsylvania Topographic and Geological Survey; Tennessee Department of Conservation, Division of Geology; United States Geological Survey; University of Cincinnati; University of Kentucky Research Foundation; University of North Carolina; West Virginia Geological Survey; and West

Virginia University.

Work is also being done under U.S. DOE technology contracts by laboratories and companies in the states of Ohio, West Virginia, California, New Mexico, and Washington. These institutions are: American Exploration Co./ Vescorp Industries, Inc.; Columbia Gas System Service Corporation; Consolidated Gas Supply Corporation; Lawrence Livermore Laboratory; Los Alamos Scientific Laboratory; Petroleum Technology Corporation; Sandia Laboratories; Stanford Research Institute, and West Virginia University.

The open-file repository has a copy of each quarterly and annual report of the technology and resources contractors as well as two copies of each document reporting the research, whether the final format is microcard, microfiche, well logs, map, or hard copy. Just under 200 documents are presently in the repository. More than 120 are reports, and the others are maps, well logs, and cores on microcards or microfiche.

When the arrangements were being made for the open-file repository at Kentucky, a representative from the Energy Research Development Administration made an on-site visit. Participants agreed to provide a temperature controlled room for the repository and to furnish a map cabinet, file drawers, desks, and chairs. The Department of Energy would supply the funds for the needed shelves, a small card catalog cabinet, and other necessary equipment and supplies. A budget was drawn up which included the salary for a graduate research assistant for ten hours per week during the school year and 37 1/2 hours weekly during the summer months. Five percent of my salary as the Principal Investigator (P.I.) would be paid annually from the project.

Total funds for the first year of operation were just under $10,000.00 for the open-file repository project. The second year's expenses should not run quite as much, as the shelving, the card catalog cabinet, and a large stapler were one-time costs. However, due to the bookkeeping and clerical records necessary for the project, a ten hour per week part-time clerical position has been included in the continuation proposal for the second year. As with any government contract, monthly, quarterly, and annual reports are required from the P.I.

The map cabinet and file drawers furnished by the University were a drab olive green. We painted these a bright blue and ordered shelving in off white, with one double-faced range in blue. These colors give the repository library a cheerful appearance. A hanging planter has been placed in the room, as well as two other potted plants. Colorful book ends and Princeton files were chosen with blue predominating. The open-file repository is a bright, attractive, small library containing a specialized collection, where the documents are easy to locate and use.

Upon receipt of the documents, a staff member stamps them to indicate that they are a part of the Kentucky EGSP collection, files transmittal sheets, and begins cataloging, using Library of Congress format on the cards. Added entries are determined and cards are typed for both main entry and tracings. An example appears in Figure 1.

```
O.F.-005
KY.     Renton, John J.
EGSP          Some practical considerations in x-radi-
        ology, by John J. Renton. Morgantown, W. Va.,
        1977, U.S. Department of Energy, Morgantown
        Energy Research Center.

              27 p., append. Al-A5. MERC/SP-77/7.
        Available from National Technical Information
        Service. Springfield, Va.

              1. X-radiology. 2. Devonian shale.
        3. Shale. 4. Economic geology. 5. Fossil
        Energy. I. Title. II. Eastern Gas Shale
        Project (EGSP).     III. West Virginia
        Geological Survey.
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Fig. 1. Typical Main Entry for the Repository Collection

After being catalogued, the document is placed in a pressboard binder, if necessary, and a label attached denoting the accession number which is the shelving or location device. This accession number has already been assigned before the document reaches the Kentucky open-file repository.

The Morgantown Energy Research Center (MERC) in Morgantown, West Virginia serves as a clearinghouse for all of the Eastern Gas Shale publications. MERC personnel assign each document an accession number and route two copies to the Kentucky repository. Plans are underway to establish repositories in two or three additional states. These states have been chosen but are not funded at this time. The purpose of assigning the accession numbers at MERC is that each document will bear the same accession number in each open-file repository.

Processing continues with typing a card and pocket for each document and pasting the pocket in the inside back cover, along with a date-due slip. The document is now ready for on-site use or interlibrary loan circulation.

To date, we have loaned material to researchers in Tennessee, Virginia, Ohio, Florida and in many areas of Kentucky. Requests for accession lists have come from New York, Georgia, Colorado and Kentucky. Most requests have been received from Kentucky, as Kentuckians are aware of the repository.

The repository is being used and should continue to be valuable to researchers "to keep one from reinventing the wheel" or working months on a problem only to discover that someone else has already solved that particular question. Repository documents should also enable a researcher to build upon work already completed by others and, hopefully, within a few years, an economically feasible method of extracting gas from oil shale will be found.

The second program, the comprehensive annotated bibliography is of most value to researchers in the Eastern Gas Shale Project, however, others use the files from time to time as well. This project also takes five percent of my time as Principal Investigator; in addition, a graduate research assistant works 16 hours per week during the school year and 37 1/2 hours weekly during the summer. There are presently more than 1600 citations on 3 x 5 cards filed alphabetically by author and giving complete bibliographical information. About 300 of these 1600 have annotations at this time. Most of these have been found by doing manual searches of bibliographies in the geological literature. We've searched the old GSA <u>Bibliography and Index of Geology Exclusive of North America</u> and the USGS <u>Bibliography and Index of North American Geology</u> volumes as well as the current <u>Bibliography and Index of Geology</u>. One automated search was done on GEOREF, resulting in 758 citations. We had already found many of these in our manual searching, however, some of them were useful. We had included $250.00 in the budget for data searches and this search cost $150.00. I made an error in submitting the search, however. I did not ask for the printout to be arranged alphabetically by author. Therefore, it was necessary to cut apart each citation and staple each to a 3 x 5 card in order to organize and check against the citations already in the files. If you do a search, be sure to request that your printout be alphabetized by author.

In mid-August of this year, we were asked to submit the citations in our files on typed sheets to be reproduced and distributed to 100 researchers at a fall professional meeting. We had about five days to type the preliminary listing of citations and to send it to Morgantown for reproduction and binding. We scrounged additional typewriters and typists from the Department of Geology and the Library system at the University and typed the citations from unproofed cards and the preliminary bibliography was reproduced and distributed. It consisted of 152 pages. There are copies here for those of you who may be interested in the subject. Additional copies are available, and if you will send your name and address, I'll be glad to send you a copy.

The final bibliography should be completed with annotations in 1980. It will be cross referenced geographically and chronologically. It will provide a readily available source of published and unpublished information regarding location, stratigraphy, mechanical and chemical properties, applicable technology, etc. of hydrocarbon shales. The bibliography will be world-wide in scope and should be easily stored on tape or disc for retrieval. We anticipate that this annotated bibliography will be of value to the geologic community.

STATUS OF INFORMATION EDUCATION FOR GEOSCIENTISTS
IN THE UNITED STATES AND CANADA

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Abstract: From January to March, 1978 a survey of 465 colleges and universities was conducted to determine the status of information education for geoscientists in the United States and Canada. The survey was designed to determine location, scope and content of existing information education programs for geoscience students. Topics covered included length of time programs have existed, number and level of students who receive instruction, frequency and format of programs, and orientation of course content. Replies from libraries and geoscience departments indicate a wide variety of programs exist now or are planned for the future. A response rate of 87% is in itself an indication of high interest in information education programs.

Introduction

Geoscience information systems and the body of geoscience literature are vast in scope and complexity. A great deal of information is available to the proficient user who knows how to find it, but how are these information retrieval skills taught? The information specialist has a role to play in this part of the educational process. In addition to developing the technology to control and disseminate information, geoscience information specialists are teaching people how to use information systems. In the United States and Canada, this sort of teaching, commonly called library instruction, is being fostered by several library associations. For instance, within the American Library Association, two separate groups were formed in June 1977 to promote library instruction. One of them, the Bibliographic Instruction Section of the Association of College and Research Libraries, specialized in academic libraries. In addition, agencies such as the Council on Library Resources have provided thousands of dollars in grants to libraries developing instruction programs. This report reviews what is being done to teach geoscience students how to find information in their field.

Methodology

From January to March 1978 a survey was conducted of librarians and professors at colleges and universities which grant degrees in geosciences. It was assumed that these institutions would have the primary concern for the education of geoscientists. The American Geological Institute's Directory of Geoscience Departments in the United States and Canada (1977) was used to identify 465 institutions which grant degrees in the geosciences. In this directory, the term "geoscience" is defined broadly to include not only geology and other earth sciences, but also mining, planetary science, environmental sciences and oceanography. Each institution was assigned a three-digit identification number. This number was put on all questionnaires before they were mailed, and it was used for sorting out responses and controlling data. The survey was done in two parts, with two questionnaires. Questions in both were coded for easy tabulation.

The first questionnaire was called the "Preliminary 1978 Survey of Information Education for Geoscience Students in the United States and Canada." Its purpose was to identify persons in both academic departments and libraries who are actively involved with providing library instruction for geoscience students. This questionnaire also included questions about the institutions' geoscience collections and the availability of computer searching of bibliographic data bases. 403 institutions (87%) responded.

The second questionnaire, called the "1978 Survey of Formal Library Instruction Programs for Geoscience Students in the United States and Canada," was sent to 279 institutions which had some sort of systematic or formal program of library instruction for geoscience students. It was designed to gather specific information about the library instruction offered. 167 institutions (60%) responded.

Results from the First Questionnaire

A few institutions replied that they had dropped their geoscience programs, so not all of the responses were applicable. However, 465 is used throughout this report as a reference figure, since that was the number of geoscience departments identified in the A.G.I. directory. Of the 395 usable replies, 352 (89%) reported that the library instruction is offered by the library, and 81 (21%) reported that it is offered by a geoscience department.

Institutions were asked to indicate the kinds of library instruction offered. Where such instruction is given in libraries, 322 institutions reported that it is available informally to individual students on request, and 293 said it was given as a normal part of reference/information service to individuals. For the purpose of evaluating survey results, this kind of informal teaching was not considered part of a consciously developed program. More formal efforts are summarized in Table 1.

TABLE 1

TYPES OF INSTRUCTION OFFERED BY LIBRARIES

Type of Instruction	Number of Institutions Reporting	% of 395	% of 465
Tours of facilities	287	73	62
Lectures in library	195	49	42
Lectures in classroom	109	28	23
Library exercise	72	18	15
Single-session; specific course needs	212	54	46
Multi-session sequence	23	6	5
Semester-long course	21	5	5
Course-related instruction	33	8	7

Academic departments also give library instruction, but to a lesser degree than libraries. Their information instruction includes referring students to specific books or authors (64 institutions) and referring students to indexes, abstracts and other bibliographic research tools (70 institutions). More formal efforts by geoscience departments are listed in Table 2.

Information about the institutions' geoscience library collections was requested to learn if the occurrence of library instruction is related to the complexity of facilities. Can library systems which have multiple facilities to staff also afford staff for library instruction? The survey shows a sub-

TABLE 2

TYPES OF INSTRUCTION OFFERED BY GEOSCIENCE DEPARTMENTS

Type of Instruction	Number of Institutions Reporting	% of 395	% of 465
Instructors bring individual students to library	40	10	9
Instructors bring class to library; demonstrate publications	38	10	8
Instructors bring class to library; demonstrate catalogs & library tools	31	8	6
Formal course taught by member of the department	10	3	2

stantial amount of involvement by all types of libraries, but library instruction is somewhat less prevalent in systems which have at least one geoscience library with additional geoscience collections in other libraries. The difference is not great, about 7%, but it increases for types of library instruction which require heavier staff involvement (credit courses, seminars, etc.). Occurrence of library instruction programs in various types of libraries is given in Table 3.

Formal library instruction programs and computer searching of bibliographic data bases are services which have become more common in academic libraries in the last ten years. How likely is it for an institution to have both computer searching and library instruction? Of the 235 institutions which have computer data-base searching 219 (93%) also offer library instruction. Some characteristics of these computer services are listed in Table 4.

Survey results indicate that formal library instruction by library staff is more likely to occur at universities with graduate programs than at four-year colleges. Conversely, formal library instruction at colleges is more likely to be given by staff of a geoscience department.

When asked what kinds of library instruction were offered, most respondents took the word "offered" quite literally. In some cases, students don't

TABLE 3

INSTRUCTION OFFERED BY VARIOUS TYPES OF LIBRARIES

Institutions Where the Library's Geoscience Collection Is	Number of Respondents	Number Giving Library Instruction	% Giving Library Instruction
A separate geoscience library	34	31	91
At least one geoscience library with additional collections as part of a science and/or general library	35	29	83
Part of a science and/or a general library	326	293	90

TABLE 4

COMPUTER SERVICES IN ACADEMIC LIBRARIES

Service	Number of Institutions Reporting	% of 235	% of 465
By mail request only	39	17	8
On-line	176	75	38
Off-line	100	43	22
Requester present for search	137	58	29
Requester not present for search	129	55	28
Search done in a geoscience library	11	5	2
Search done in a non-geoscience library	147	63	32
GeoRef searched	125	53	27

take advantage of what is available. Often, librarians are willing to give instruction, but only when someone requests it; they don't always take the initiative. Nevertheless, it's clear that most libraries answering the survey felt a responsibility for teaching students how to use library materials.

Results From the Second Questionnaire

The second questionnaire was sent to 279 institutions which indicated in the first questionnaire that they offered some kind of formal library instruction for geoscience students. 167 (60%) institutions replied. Information was requested regarding type of instruction, course credit given, level and number of students taught, course content and types of teaching materials.

A variety of instruction is offered with tours of library facilities being the most common and semester-long courses with weekly sessions being least common. Types of instruction are summarized in Table 5. Only eleven institutions reported having a semester-long course, and six of them actually were designed for the general student body, not geoscience students. Only five semester-long courses of library instruction were specifically for geoscience students. All of them are given for academic credit by a geoscience department. Two are taught by professors, and three are taught by librarians.

In most institutions students are given academic credit for library instruction. Where credit is granted, it can be from a geoscience department, a library school, an education department, an English department, etc. Rarely is credit granted by a library, since most institutions view libraries as service units which cannot grant academic credit.

What proportion of geoscience students in the United States and Canada actually receive library instruction? The latest data available on enrollment are for the 1975/76 academic year. According to a report prepared by the American Geological Institute (1977) for the U.S. Geological Survey, the total 1975/76 enrollment for all geoscience fields including freshmen through doctoral candidates, was 26,987. How many of these students received library instruction? The answer seems to be that we don't really know. Most institutions could not provide statistics for that year, and many which did could not separate out their geoscience students from other students. The figures given here are edited and probably inflated. A generous estimate is that 1,935 geoscience students received library instruction in 1975/76, which is just 7.2% of the geoscience student population.

TABLE 5

LIBRARY INSTRUCTION FOR GEOSCIENCE STUDENTS

Type of Instruction	Number of Institutions Reporting	% of 167	% of 465
Tours of facilities	139	83	30
Lectures in library	102	61	22
Library exercise	51	31	11
Single session; specific course needs	109	65	23
One or more sessions as part of a general program of library instruction	34	20	7
One or more sessions as part of a geoscience course	39	23	8
Multi-session sequence (mini-course, seminars, etc.)	15	9	3
Semester-long course with weekly sessions	11	23	2
Course-related instruction (library component planned by library & geoscience department staff)	23	14	5

Conclusions

The survey indicates there is interest in information education for geoscience students throughout the United States and Canada. However, there are few well-developed instruction programs. Most of the interest is among librarians, but librarians usually do not take the initiative in promoting information education. Again and again returns carried phrases like "given at the instructor's request." One librarian said, "Our instructional program is initiated by requests from the faculty." Unfortunately, geoscience professors do not always recognize a need for information education. As one geology dapartment chairman said, "Students are expected to know how to use a library." And so, students sit in the middle, receiving little if any library instruction.

The responsibility for giving and promoting information education needs to be shared by information specialists and geoscience faculties. Information specialists know bibliographic systems and information control; they could be teaching students to use information sources. However it's the professors who give students a sense of what is important and what should be learned. There is a world of difference between the professor who says students are expected to know how to use a library and the professor who teaches a course on information sources. There needs to be understanding support and a strong partnership between the two professions.

To summarize, work in geoscience information education has begun, and if the trend of the last few years continues, it may be a common part of geoscience education in the 1980's.

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GEOLOGICAL MAP ACQUISITIONS: A GUIDE TO THE LITERATURE

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Introduction

The problems relating to the acquisition of geological maps are discussed in an earlier paper by Diment & Schroeder (See Section 1). In this paper a geological map is defined and the history of geological maps briefly outlined from the 18th Century to the present day. The status of geological mapping today is discussed. The problems of acquiring geological maps are reviewed including the lack of adequate bibliographical tools and the nature and form of map publication. The problem of maps published in journals and books is highlighted. It is suggested that the most serious problem of bibliographical control is the lack of adequate bibliographical details on the maps themselves, and a call is made for improved bibliographical standards at the publishing stage. The literature relating to geological map acquisitions is very scattered and wideranging in nature. This present work attempts to provide a basic guide to this literature.

This guide is intended to act as a supplement to the excellent guides to the general cartographic literature and sources provided by the papers by Stephenson (1970) and Wise (1977), listed in Section 1, and does not duplicate the references contained in these papers.

The guide is divided into five sections:

- Section 1 General references on acquisitions and map librarianship papers.
- Section 2 Guides to the literature of geology which include useful sections on maps.
- Section 3 Cartobibliographies of geological maps, publishers' catalogues and lists and map retailers' catalogues. These are arranged by continent and then alphabetically by country.
- Section 4 Serials, including both primary journals and abstracting and indexing journals.
- Section 5 Directories of map collections.

1. General

This section includes general references on geological map acquisitions and pertinent references on general map librarianship.

British Standards Institution. 1975. Recommendations for Bibliographical References to Maps and Charts. Part 1: References in Accessions Lists. British Standard 5195, Part 1. London: British Standards Institution. 7p.

British Standards Institution. 1977. Recommendations for Bibliographical References to Maps and Charts. Part 2: References in Books and Articles. British Standard 5195, Part 2. London: British Standards Institution. 6p.

Canada. Department of Energy, Mines, and Resources. Departmental Map Library. 1972. List of Map Sources. Ottawa. 31p.

A very useful compilation which includes some 250 addresses as follows:

1. Canadian government mapping agencies.
2. Canadian provincial government mapping agencies.
3. Canadian universities.
4. Canadian private mapping agencies.
5. National mapping agencies throughout the world.
6. United States federal mapping agencies.
7. Private mapping agencies throughout the world.
8. International organisations.
9. Dealers in out of print maps and atlases.
10. Dealers and publishers of three dimensional maps and globes.

Diment, J. A., and Schroeder, J. 1979 (in press). Bibliographical control of geological maps. In Proceedings of the First International Conference on Geological Information, London, April, 1978. Edited by A. P. Harvey and J. A. Diment.

The problems of geological map acquisitions are discussed in the first part of this paper.

Drazniowsky, R. 1975. Map Librarianship: Readings. Metuchen, New Jersey: Scarecrow Press. 548p.

Section 4 is devoted to map bibliographies and acquisitions.

Dunham, K. C. 1967. Practical geology and the natural environment of man: 1. Continents and islands. Journal of Geological Society of London, v. 123, p. 1-24.

Includes a review of the status of geological mapping throughout the world and an index map of world geological maps published between the scales 1:250 000 and 1:1 000 000.

Falk, A. L., and Miller, R. L. 1975. Worldwide directory of national earth-science agencies. U.S. Geological Survey Circular, no. 716. 32p.

An invaluable listing of governmental earth science organisations whose functions are similar to those of the U.S. Geological Survey.

Geologists Year Book 1977. 1977. Dorset: Dolphin Press. 300p.
Lists the addresses of national government geological agencies, museums, societies and university departments.

Larsgaard, M. 1978. Map Librarianship: An Introduction. Littleton, Colorado: Libraries Unlimited. 330p.

Nichols, H. 1976. Map Librarianship. London: Bingley. 298p.
Includes two chapters relevant to the problems of acquisition: Chapter 2 covers aids for tracing and buying modern maps, and Chapter 3 includes bibliographical notes on selected official mapping services.

Schorr, A. E. 1974. Map librarianship, map libraries and maps: a bibliography 1921-1973. Bulletin Special Libraries Association Geography and Map Division, no. 95, p. 2-35.
Supplement 1, issued in Bulletin No. 107, 1977, p. 2-18.

Schorr, A. E. 1974. Written map acquisition policies in academic libraries. Bulletin Special Libraries Association Geography and Map Division, no. 98, p. 28-30.

Sources of Information and Materials: Maps and Aerial Photographs. A Reference Book. 1970. Washington, D.C.: Association of American Geographers. 159p.
Includes an annotated bibliography, list of statistical data sources, details of all forms of maps and atlases and a very useful list of map agents and commercial firms in the United States.

Stephenson, R. W. 1970. Published sources of information about maps and atlases. Special Libraries, v. 61, p. 87-112.
Includes: a list of geographical journals containing lists and/or reviews of maps and atlases; a list of national bibliographies containing references to maps; a list of selected map and atlas accessions lists, a selected list of dealers in out of print maps and atlases; a list of map publishers and sellers--including many of the geological surveys.

Treude, M. 1978. Maps and atlases: basic reference bibliography. Bulletin Special Libraries Association Geography and Map Division, no. 111, p. 32-37.
Includes general directories, bibliographies of collections and other acquisition sources.

U.S. Geological Survey. 1965. Sources of Maps. M.I.O.-7. Washington, D.C.
A selected list of commercial map publishers and their addresses.

Watkins, J. B. 1967. Selected Bibliography of Maps in Libraries. Syracuse: Syracuse University Libraries. 18p.
Includes a section on acquisitions, although now rather out-of-date.

Wise, D. A. 1976. Cartographic acquisitions methods. Bulletin Special Libraries Association Geography and Map Division, no. 103, p. 13-19.

Wise, D. A. 1977. Cartographic sources and procurement problems. Special Libraries, v. 68, p. 198-205.
A very useful guide to the cartographic literature and sources. Includes an appendix on dealers in out of print maps in the U.S. Other appendixes are available from the author including a list of accessions lists from map libraries, a list of geographic and cartographic journals, a list of national bibliographies including maps, and a list of cartobibliographies.

Wise, D. A. 1978. Cartographic sources and procurement problems. Appendix C. Selected list of international dealers in out of print maps and atlases. Bulletin Special Libraries Association Geography and Map Division, no. 113, p. 65-68.

2. Guides to the Literature

Lock, C. B. M. 1969. Modern Maps and Atlases. London: Bingley. 619p.
A very useful work on twentieth century maps (up to 1968). This work includes the names of the official surveys and major map publishers with a brief outline of their programme, including details of geological maps.

Lock, C. B. M. 1976. Geography and Cartography: a Reference Handbook. London: Bingley. 762p.
A combined and revised edition of Geography a Reference Handbook and Modern Maps and Atlases.

Martin, E. L. 1973. Geological maps. In Use of Earth Sciences Literature, p. 122-150. By D. N. Wood. London: Butterworths.
Briefly outlines the history of geological maps; describes the main types of geological maps and guides to them. Includes a useful select regional list of geological maps and map series.

Pangborn, M. W. 1972. Geologic maps. In Geologic Reference Sources, p. 351-436. By D. C. Ward and M. Wheeler. Metuchen, New Jersey: Scarecrow.
A very useful selected bibliography of modern books, atlases and maps.

3. Cartobibliographies

This section includes cartobibliographies of geological maps and publishers' catalogues and lists arranged by country within continent divisions. Map retailers' catalogues are also included; these are denoted by an asterisk (*).

3.1 World

Alexander, G. L. 1971. Guide to Atlases: World, Regional, National, Thematic. An International Listing of Atlases since 1950. Metuchen, New Jersey: Scarecrow. 671p.
Includes details of 22 geological atlases.

Alexander, G. L. 1977. Guide to Atlases Supplement: World, Regional, National, Thematic. An International Listing of Atlases Published 1971 through 1975 with Comprehensive Indexes. Metuchen, New Jersey: Scarecrow. 362p.
Includes details of 14 geological atlases.

Commission for the Geological Map of the World. 1971—. Liste de Cartes Geologiques Nationales et Internationales.
A useful series giving details of continental and national maps. The references are arranged alphabetically by country and then by increasingly detailed scale. The addresses of the places where the maps may be purchased are given at the end of each list. The cost of the maps is given at the end of the reference.

*Geo Katalog International. 1973—. Stuttgart: Geo Center.
Currently a looseleaf catalogue with index maps; includes a section on geological maps and atlases. Geographical arrangement.

*Geokartenbrief: New Maps, Guides and Atlases. 1976—. Stuttgart: Geo Center.
Includes details of geological maps and atlases. Formerly Kartenbrief.

Kallenbach, H. 1975. Verzeichnis der Ausländischen Geologischen Karten in Ausgewählten Kartensammlungen der Bundesrepublik Deutschland. Kartensammlung und Kartendokumentation 10. Berlin: Verlag Kiepert K. G. 95p.

Scientific Maps and Atlases Catalogue 1976. 1976. Paris: Unesco. 44p.
Comprehensive catalogue for all the geological map series issued by Unesco, with index maps.

*Telberg Map Depository Catalog. New York: Telberg Book Corporation.
Telberg specializes in geological maps and in maps produced in the Soviet Union.

Unesco series of geological maps of the world. 1970. Journal Geological Society of India, v. 11, p. 409-410.

Warren, C. R., et al. 1969. A descriptive catalogue of selected aerial photographs of geologic features in areas outside the United States. U.S. Geological Survey Professional Paper, no. 591. 38p.
Includes photographs that illustrate geologic features in Antarctica, South and Central America, southwest Pacific, Iran, Japan, Arabian peninsula, Pakistan, and mainland China. The photographs may be ordered from the Map Information Office, U.S. Geological Survey. Photographs of the United States and Puerto Rico are listed in Denny, C. S., et al. (1968) in Section 3.

Winch, K. L. 1976. International Maps and Atlases in Print. 2d ed. New York: Bowker, 1976. 866p.

A very useful bibliography of maps in print arranged by Universal Decimal Classification and including a section on geological maps. Map indexes and a gazetteer-index are also included.

3.2 Africa

Commission for the Geological Map of the World. 1971. Liste de Cartes Géologiques Nationales et Internationales. 3. Afrique. Paris. 17p.

Inventory of available geological maps: Africa. 1975. Geological Newsletter, no. 2, p. 199.

Algeria

Inventory of available geological maps: Algeria. 1973. Geological Newsletter, no. 2, p. 174.

Merabet, O. 1971. Bibliographie geologique annuelle de l'Algérie no. 13 (1967-1968). Bulletin Service Geologique de l'Algérie, no. 41, p. 231-261.

Section C lists the recent geological maps of Algeria. Earlier bibliographies for Algeria also appear in the Bulletin series but in these the maps were not listed separately.

Service Geologique de l'Algérie. 1965. Liste des Publications du Service Geologique de l'Algérie. Directions des mines et de la Geologie, Alger. 30p.

Section III gives details of all the geological maps published by the Survey including map indexes showing availability.

Angola

Estado actual e perspectives da cartografia geologica de Angola. 1973. Memoria Dir. Prov. Serv. Geol. Min., no. 12, p. 1-13.

A detailed review of geologic mapping in Angola including five index maps.

Botswana

Botswana. Geological Survey Department. 1974. List of Publications as of July 1974. 3p.

Includes a list of the geological maps currently available as well as those in press and those issued with other publications.

Inventory of available geological maps: Botswana. 1973. Geological Newsletter, no. 3, p. 262.

Burundi

Inventory of available geological maps: Burundi. 1969. Geological Newsletter, no. 3, p. 297.

Cameroun

Inventory of available geological maps: Cameroun. 1974. Geological Newsletter, no. 1, p. 79.

Egypt

Inventory of available geological maps: Egypt. 1976. Geological Newsletter, no. 2, p. 197.

Ghana

Inventory of available geological maps: Ghana. 1975. Geological Newsletter, no. 4, p. 386.

Kenya

Inventory of available geological maps: Kenya. 1971. Geological Newsletter, no. 3, p. 230.

Libya

Inventory of available geological maps: Libya. 1975. Geological Newsletter, no. 1, p. 104.

Inventory of available geological maps: Libya. 1978. Episodes, no. 2, p. 52.

Madagascar

Inventory of available geological maps: Madagascar. 1972. Geological Newsletter, no. 3, p. 238.

Service Geologique de Madagascar. 1971. Catalogue des Publications du Service Geologique de Madagascar. Tananarive. 27p.
Includes a comprehensive list of geological maps of Madagascar and eight map indexes.

Malawi

Malawi. Geological Survey Department. 1974. Publications and Maps of the Geological Survey of Malawi. Zomba. 6p.
Comprehensive list of geological maps of Malawi including a map index.

Ray, G. E. 1969. Progress report on geological mapping in northern Malawi. Research Institute of African Geology, 13th Annual Report, p. 17-19.

Morocco

Morocco. Division de la Géologie. 1977. Catalogue des Publications de la Direction des Mines de la Geologie et de l'Energie. Rabat. 130p.
Includes a comprehensive list of geological maps of Morocco with map indexes.

Inventory of available geological maps: Morocco. 1970. Geological Newsletter, no. 2, p. 217.

Nigeria

Inventory of available geological maps: Nigeria. 1977. Geological Newsletter, no. 2, p. 194.

Rwanda

Inventory of available geological maps: Rwanda. 1969. Geological Newsletter, no. 3, p. 297.

Senegal

Inventory of available geological maps: Senegal. 1976. Geological Newsletter, no. 4, p. 375.

South Africa

Inventory of available geological maps: South Africa. 1969. Geological Newsletter, no. 4, p. 439.

Sudan

Geological Survey of Sudan. 1973. Available Publications. Khartoum. 3p.
Lists current geological maps of the Sudan.

Vail, J. R. 1971. Geological map compilation programme Sudan Republic. 1971. Research Institute of African Geology, 15th Annual Report, p. 12-14.

Swaziland

Inventory of available geological maps: Swaziland. 1969. Geological Newsletter, no. 1, p. 95.

Inventory of available geological maps: Swaziland. 1978. Episodes, no. 2, p. 53.

Tanzania

Bibliography of the geology and mineral resources of Tanzania to December 1967. 1969. Bureau of Resource Assessment and Land Use Planning Research Notes, no. 5c. 250p.
The geological maps are listed in the main part of the bibliography by author but they are also well indexed in the subject index.

Inventory of available geological maps: Tanzania. 1976. Geological Newsletter, no. 3, p. 282.

Tunisia

Inventory of available geological maps: Tunisia. 1968. Geological Newsletter, no. 1, p. 101.

Memmi, L. 1972. Carte geologiques, hydrogeologiques et minières [Tunisia]. Centre de Recherches sur les Zones Arides Serie Geologie, no. 13, p. 617-632.
A comprehensive list of the geological maps of Tunisia with map indexes.

Zaire

Inventory of available geological maps: Zaire. 1969. Geological Newsletter, no. 3, p. 295.

Inventory of available geological maps: Zaire. 1969. Geological Newsletter, no. 4, p. 443.

Zambia

Inventory of available geological maps: Zambia. 1976. Geological Newsletter, no. 4, p. 377.

3.3 Asia

Commission for the Geological Map of the World. 1973. Liste de Cartes Géologiques Nationales et Internationales. 7. Asie. Extrême Orient. Paris. 9p.

Commission for the Geological Map of the World. 1973. *Liste de Cartes Géologiques Nationales et Internationales*. *10. Moyen-Crient*. Paris. 6p.

India

Inventory of available geological maps: India. 1972. *Geological Newsletter*, no. 4, p. 337.

Indonesia

Geological Survey of Indonesia. Geological Mapping Division. [n.d.] *List and Index of Published and Unpublished Geologic Maps of Indonesia*. Bandung. 13p.

A very useful work which includes maps published in journals as well as unpublished maps held in reports by the Survey.

Inventory of available geological maps: Indonesia. 1976. *Geological Newsletter*, no. 3, p. 279.

Purbo-Hadiwidjojo, O. M. M. 1970. Documentation on the geology of Indonesia. *Special Publication Direktorat Geologi*, no. 3, p. 13-15.

Includes a review of geological map publishing in Indonesia.

Sukamto, R. 1973. Geologic mapping in Indonesia at present. *Bulletin Geological Survey of Indonesia*, v. 3, no. 1, p. 9-14.

Includes a review of mapping back to 1850, as well as a detailed account of the present state of the art succinctly summarized in map form.

Iran

Inventory of available geological maps: Iran. 1974. *Geological Newsletter*, no. 4, p. 326.

Israel

Ginzburg, D. 1976. *An Inventory of Geological Maps of Israel*. 2 vols. Jerusalem: Geological Survey.

A very comprehensive listing of geological maps of Israel including those in journals and theses. Sixteen index maps are included.

Inventory of available geological maps: Israel. 1969. *Geological Newsletter*, no. 2, p. 169.

Inventory of available geological maps: Israel, 2nd ed. 1977. *Geological Newsletter*, no. 4, p. 390-393.

Japan

Geological Survey of Japan. 1977. Index to the Geologic Maps of Japan. Tokyo. 1 sheet.
A composite map index to the major Japanese geologic map serials.

Geological Survey of Japan. 1977. Publications of the Geological Survey of Japan. 4th ed. Tokyo.
Comprehensive list of geological maps of Japan, p. 109-126.

Inventory of available geological maps: Japan. 1973. Geological Newsletter, no. 1, p. 72.

Jordan

Inventory of available geological maps: Jordan. 1977. Geological Newsletter, no. 3, p. 287.

Malaysia

Gobbett, D. J. 1968; 1970. Bibliography and index of the geology of West Malaysia and Singapore. Bulletin Geological Society of Malaysia, no. 2, 152p.; no. 3, p. 115-129.
Appendix 2 includes geological maps of West Malaysia.

Inventory of available geological maps: Malaysia and Brunei. 1972. Geological Newsletter, no. 1, p. 60.

Saudi Arabia

Inventory of available geological maps: Saudi Arabia. 1972. Geological Newsletter, no. 3, p. 241.

Sri Lanka

Inventory of available geological maps: Sri Lanka. 1971. Geological Newsletter, no. 4, p. 320.

Thailand

Inventory of available geological maps: Thailand. 1972. Geological Newsletter, no. 1, p. 64.

USSR

Inventory of available geological maps: USSR. 1974. Geological Newsletter, no. 3, p. 247.

3.4 Australasia (Including Antarctica)

Commission for the Geological Map of the World. 1973. Liste de Cartes Géologiques Nationales et Internationales. 8. Australie-Oceanie. Paris. 7p.

Antarctic

Australia. Department of National Development. 1969. Catalogue of Topographic Maps, Aeronautical and Hydrographic Charts of the Antarctic. Canberra. 149p.

Compiled on behalf of Scientific Committee on Antarctic Research.

Inventory of available geological maps: Antarctica. 1971. Geological Newsletter, no. 2, p. 149.

Australia

Australia. Department of Minerals and Energy. Bureau of Mineral Resources, Geology, and Geophysics. 1974. Pictorial Index of Activities to 31st December 1973. Canberra. 34p.

A very comprehensive guide to the state of geologic mapping in Australia, Papua New Guinea, and Antarctica.

Australia. Department of Minerals and Energy. Bureau of Mineral Resources, Geology, and Geophysics. 1973. Publications, Part 11: Maps. Canberra. 83p.

A comprehensive catalogue with map indexes.

Denham, D., et al. 1977. What maps are needed now? BMR Journal of Australian Geology & Geophysics, v. 2, p. 253-269.

A detailed review of the state of the art of geological mapping in Australia with indexes.

Inventory of available geological maps: Australia. 1977. Geological Newsletter, no. 3, p. 291.

New South Wales

New South Wales. Department of Mines. 1974. List of Publications. Sydney. 41p.

Comprehensive list including geological maps. No map indexes.

Papua New Guinea

Inventory of available geological maps: Papua New Guinea. 1978. Episodes, no. 1, p. 43-44.

Queensland

Geological Survey of Queensland. 1972(?). List of Publications and Reports 1879-1972. Brisbane. 37p.
Includes geological maps.

South Australia

South Australia. Department of Mines and Geological Survey. 1976(?). Publications. Sydney. 4p.
Comprehensive list including geological maps.

Western Australia

Geological Survey of Western Australia. 1977. Publications Catalogue. East Perth. 35p.
Comprehensive catalogue with a map index.

New Zealand

Inventory of available geological maps: New Zealand. 1970. Geological Newsletter, no. 3, p. 305.

3.5 Europe

Brabb, E. E. 1969. Availability of geologic maps in some western European countries. Bulletin American Association of Petroleum Geologists, v. 53, p. 1121.
Lists maps for Austria, Belgium, France, Great Britain, Italy, and Switzerland.

Commission for the Geological Map of the World. 1972. Liste de Cartes Géologiques Nationales et Internationales. 9. Europe. Paris. 20p.

Commission for the Geological Map of the World. 1972. Liste de Cartes Géologiques Nationales et Internationales. 11. Alpes, Bassin Méditeranéen et Régions Adjaceinte. Paris. 17p.

Austria

Austria. Geologische Bundesanstalt. 1974. Verzeichnis der Lieferbaren Veröffentlichungen aus dem Verlag der Geologischen Bundesanstalt. Vienna. 52p.
Comprehensive list of maps issued by the Geological Survey of Austria. Includes indexes.

Inventory of available geological maps: Austria. 1968. Geological Newsletter, no. 4, p. 84.

Belgium

Inventory of available geological maps: Belgium. 1969. _Geological Newsletter_, no. 4, p. 436.

Service Geologique de Belgique. 1967. _Publications Géologiques sur la Belgique_. Brusselles. 4p.
Gives details of the geological maps of Belgium that are currently available. No indexes.

British Isles

Bassett, D. A. 1967. _A Source Book of Geological, Geomorphological and Soil Maps for Wales and the Welsh Borders (1800-1966)_. Cardiff: National Museum of Wales. 239p.
An invaluable guide to the maps of Wales. It is arranged in three sections. Section 1 is an historical review of geological mapping. Section 2 lists maps and charts including maps published in journals, monographs, and books as well as those published by the Geological Survey and Soil Survey. Section 3 includes a bibliography and indexes.

Great Britain. Department of Industry and Commerce. _List of Memoirs, Maps, Sections etc. Published by the Geological Survey to February 1962 (Ireland)_.
Comprehensive list with map index.

Great Britain. Institute of Geological Sciences. 1977. _Government Publications_. _Sectional List 45_. London. 42p.
Includes the one-inch sheet memoirs. For details of the geological maps issued by the Institute see the annual catalogue of the Ordnance Survey and the _Geological Report_ of the Ordnance Survey issued quarterly.

Great Britain. Ministry of Defence. Hydrographic Department. _Catalogue of Admiralty Charts and Other Hydrographic Publications_. Taunton.

Great Britain. Ordnance Survey. _Geological Report_. Southampton.
A quarterly listing of geological maps of the United Kingdom issued by the Ordnance Survey for the Institute of Geological Sciences.

Great Britain. Ordnance Survey. _Map Catalogue_. Annual. Southampton.
The Ordnance Survey publishes most geological survey maps for the Institute of Geological Sciences and these are included in this catalogue with the exception of the six inch maps. The information on geological maps is updated quarterly in _Geological Report_. Information on topographic maps is updated monthly in _Publication Report_.

Inventory of available geological maps: Great Britain. 1969. _Geological Newsletter_, no. 3, p. 288.

Inventory of available geological maps: Ireland. 1973. _Geological Newsletter_, no. 1, p. 70.

Cyprus

Inventory of available geological maps: Cyprus. 1977. Geological Newsletter, no. 1, p. 91.

Czechoslovakia

Bibliography and Index of Engineering Geology Mapping. Part 1: Czechoslovakia, German Democratic Republic, Hungary, Poland. 1970. Prague: Geofond. 66p.

Czechoslovakia. Ustredni Ustav Geologicky. 1971. Katalog Knitznich a Mapovych Publikau. Prague. 219p.
Catalogue of the publications and maps of the Geological Survey of Czechoslovakia. No map indexes.

Inventory of available geological maps: Czechoslovakia. 1968. Geological Newsletter, no. 2, p. 109.

Denmark

Geological Survey of Denmark. 1971. Fortegnelse over Skrifter (List of Publications) 1890-1971. Copenhagen. 32p.
Comprehensive list of publications published by the Survey including details of the geological map series with map indexes showing the state of progress of geological mapping.

Inventory of available geological maps: Denmark. 1975. Geological Newsletter, no. 3, p. 287.

Faroe Islands

Inventory of available geological maps: Faroe Islands. 1971. Geological Newsletter, no. 1, p. 70.

Finland

Inventory of available geological maps: Finland. 1975. Geological Newsletter, no. 4, p. 391.

France

France. Bureau de Recherches Géologiques et Minieres. 1978. Catalogue des Publications. Orleans. 76p.
A comprehensive catalogue of the publications of BRGM and other publishers in the earth sciences. Includes details of all the geological maps published together with the map indexes. A list of the principal distributors throughout the world is also given. This catalogue is updated annually.

Inventory of available geological maps: France. 1968. Geological Newsletter, no. 3, p. 115.

Germany

Geologisches Landesamt Nordrhein-Westfalen. 1973. Veröffentlichungen des Geologichen Landesamtes Nordrhein-Westfalen. Krefeld. 8p.
Lists geological maps of Nordrhein-Westfalen. Includes indexes.

Geologisches Landesamt Schleswig-Holstein. 1977. Kartenverzeichnis, Stand: 1 Juni 1977. Kiel. 19p.
Comprehensive list with map indexes.

Germany. Bundesanstalt für Geowissenschaften und Rohstoffe. 1976. Verzeichnis Verkäuflicher Veröffentlichungen. Hannover. 45p.
Includes comprehensive list of German geological maps as well as soil maps issued by Niedersächsisches Landesamt für Bodenforschung. Includes indexes showing state of progress of mapping.

Inventory of available geological maps: West Germany. 1971. Geological Newsletter, no. 1, p. 70.

Schamp, H. 1961. Ein Jahrhundert amtlicher geologischer Karten. Verzeichnis der amtlichen geologischen Karten von Deutschland und Nachweis ihrer Standorte in Bibliotheken und Instituten. Berichte zur Deutschen Landeskunde, Sonderheft 4. Bundesanstalt für Landeskunde. 536p.

Greece

Greece. Institute for Geology and Subsurface Research. 1970. List of Publications. Athens. 9p.
Includes list of geological maps currently available with a map index.

Inventory of available geological maps: Greece. 1969. Geological Newsletter, no. 2, p. 171.

Hungary

Inventory of available geological maps: Hungary. 1969. Geological Newsletter, no. 1, p. 91.

Iceland

Inventory of available geological maps: Iceland. 1971. Geological Newsletter, no. 4, p. 322.

Italy

Inventory of available geological maps: Italy. 1967. *Geological Newsletter*, no. 1, p. 64.

Selli, R. 1970. Les institutions géologiques Italiennes et la nouvelle carte géologique d'Italie. *Annales Institut Geologie Publ. Hungarici*, v. 54, p. 223-235.
A review of the geological institutions in Italy including universities, the Conseil National des Recherches, the Geological Survey, other government bodies, academies, and societies as well as private organizations. It examines the role of these organizations in the development of the new geological map of Italy.

Luxembourg

Inventory of available geological maps: Luxembourg. 1972. *Geological Newsletter*, no. 4, p. 336.

Netherlands

Bibliografie van in Nederland Verschenen Kaarten (Bibliography of Maps Published in the Netherlands) 1975. 1977. Koninklijke Bibliotheek. 103p.
The first of what is intended to be an annual publication, this bibliography includes printed maps and atlases in the collection of the "Depot van Nederlandse Publikaties KB" deposit and all the maps of private publishers and public agencies producing large numbers of maps are covered. Includes a list of addresses of publishers whose maps are included in the bibliography.

Inventory of available geological maps: The Netherlands. 1968. *Geological Newsletter*, no. 2, p. 107.

Netherlands. Geological Survey. 1972. *Publications*. Haarlem. 14p.
Comprehensive list of geological maps included with map indexes showing the state of progress of geological mapping. This is updated in the *Jaaruerslag Rijks Geologische Dienst*, 1976, p. 46-52.

Norway

Inventory of available geological maps: Norway. 1976. *Geological Newsletter*, no. 2, p. 199.

Poland

Inventory of available geological maps: Poland. 1970. *Geological Newsletter*, no. 4, p. 427.

Portugal

Inventory of available geological maps: Portugal. 1967. Geological Newsletter, no. 1, p. 66.

Inventory of available geological maps: Portugal. 2d ed. 1977. Geological Newsletter, no. 4, p. 388-390.

Roumania

Inventory of available geological maps: Roumania. 1967. Geological Newsletter, no. 4, p. 127.

Spain

Inventory of available geological maps: Spain. 1973. Geological Newsletter, no. 4, p. 351.

Sweden

Inventory of available geological maps: Sweden. 1976. Geological Newsletter, no. 1, p. 107.

Sveriges Geologiska Undersokning. 1977. Geological Maps and Publications. Stockholm. 51p.
An excellent list of all the geological maps issued by the Swedish Geological Survey including map indexes showing the state of progress of mapping.

Switzerland

Inventory of available geological maps: Switzerland. 1968. Geological Newsletter, no. 1, p. 94.

Turkey

Mineral Research and Exploration Institute of Turkey. 1977. List of Publications. Ankara. 11p.
Includes geological maps of Turkey currently available.

Inventory of available geological maps: Turkey. 1975. Geological Newsletter, no. 3, p. 286.

Yugoslavia

Inventory of available geological maps: Yugoslavia. 1973. Geological Newsletter, no. 3, p. 264.

3.6 North America

Hall, V. S. 1975. Selected North American environmental maps 1969-1975. Bulletin Special Libraries Association Geography and Map Division, no. 101, p. 2-31.

Matthews, W. H., comp. 1965. Selected Maps and Earth Science Publications for the States and Provinces of North America. Earth Science Curriculum Project Reference Series RS4. Englewood Cliffs, New Jersey: Prentice Hall. 42p.
A very useful list of geological maps with the addresses of the state geological surveys and other publishers on p. 23-42.

Matthews, W. H., ed. 1969(?). Selected Guides for Geologic Field Study in Canada and the United States of America. Earth Science Curriculum Project Reference Series RS9. Englewood Cliffs, New Jersey: Prentice Hall. 56p.
Includes geological maps, sections and profiles.

3.6.1 Canada

Alberta Research Council. 1978. Maps. Edmonton. 8p.
Currently available maps with an index map.

Alberta Research Council. 1976. List of Publications 1976. Edmonton.
A comprehensive list of maps issued by the Council appears on p. 15-18. No indexes.

Allen, D. 1972. Geomorphological maps of Canada: a bibliography on Canadian Federal Government maps. Bulletin Special Libraries Association Geography and Map Division, no. 90, p. 25-43.

Bostock, H. S. 1968. A catalogue of selected airphotographs. Geological Survey of Canada Paper, no. 67-48. 163p.
Catalogue of 726 airphotographs of geomorphologic phenomena in Canada (excluding those held in the Geological Survey of Canada collection). Details are given for ordering the photographs. Subject classification is given.

Canada. Department of Energy, Mines and Resources. Earth Physics Branch. 1975. Index of Geophysical Publications, Series and Contributions to December 1974. Ottawa. 92p.
Comprehensive index of all the geophysical maps issued up to December 1974.

Christie, R. L. 1977. Publications on the geology of the Arctic Islands (District of Franklin) by the Geological Survey of Canada. Geological Survey of Canada Paper, no. 76-28. 37p.
Includes a section on geological maps. Updated regularly.

Clark, P. F., et al. 1978. A guide to obtaining information from the U.S. G.S. U.S. Geological Survey Circular, no. 777. 36p.

Faessler, C. 1947. Cross-index to the maps and illustrations of the Geological Survey and the Mines Branch of Canada 1843-1946. *Universite Laval Contribution Géologie et Minéralogie*, no. 75. 525p.
A very useful cartobibliography for Canadian geological maps with author and subject indexes.

Geological Survey of Canada. *List*. *Aeromagnetic Maps*. Ottawa.
Monthly listing of aeromagnetic maps.

Geological Survey of Canada. 1970. *Index of Publications, 1959-1969*. Ottawa.
Updates the index compiled by Rice (1965); see also Griffin (1975). A section on maps appears on p. 36-84.

Geological Survey of Canada. *Monthly Information Circular*. Ottawa.
Lists all new publications of the Survey (except the Geophysical Series), including map sheets and new map indexes.

Gregory, D. J. 1975. *Bibliography of the Geology of Nova Scotia*. Halifax: Nova Scotia Department of Mines.
Appendix III is a map index, p. 221-237.

Griffin, P. J. 1975. *Index of Publications, 1959-1974*. Ottawa: Geological Survey of Canada.
Updates earlier indexes to include maps published up to 1974. A section on maps appears on p. 57-83.

Index of township and area claim maps in Ontario. 1967. *Ontario Department of Mines Miscellaneous Paper*, no. 15. 79p.

Index of township and area claim maps in Ontario. 1970. *Ontario Department of Mines Mining Lands Publication*, no. 3. 97p.

Inventory of available geological maps: Canada. 1972. *Geological Newsletter*, no. 2, p. 147.

Johnston, A. G. 1961. *Index of Publications, 1845-1958*. Ottawa: Geological Survey of Canada.
Comprehensive list of maps published by the Survey, p. 161-251, accompanied by a price list which indicates those maps that are available.

Kupsch, W. O. 1973. Annotated bibliography of Saskatchewan geology (1923-1970). *Department of Mineral Resources, Saskatchewan Geological Survey Report*, no. 9.
Includes details of geological maps and a map index.

Leidemer, N. L. 1974. *Geology of Halifax County: A Selective Bibliography*. Halifax: Dalhousie University Library. 57p.
Includes a section on geological maps.

Manitoba. Department of Mines, Resources and Environmental Management. 1972. Geological Publications Catalogue. Winnipeg. 26p.
Includes comprehensive list of geological maps published by the Department. No indexes.

Mullins, W. J., et al. 1969. Map index: geological, geophysical, and related maps to December 3, 1969. Newfoundland Department of Natural Resources, Geological Section, Information Circular, no. 13. 59p.

New Brunswick. Department of Natural Resources. 1975(?). Supplementary List of Available Plates. 33p.
List of geological maps of New Brunswick available from the New Brunswick Department of Natural Resources. Includes price.

Nova Scotia. Department of Mines. 1976. Publications Currently Available. Halifax. 1p.
Includes geological maps.

Ontario. Department of Mines. 1966. List of publications: Volume 1, 1891-1965. Bulletin Ontario Department of Mines, v. 25. 112p.
Includes all the geological maps published by the Department.

Ontario. Department of Mines. 1973. List of publications, 1966-1972. Bulletin Ontario Department of Mines, supplement to v. 25. 86p.

Ontario. Ministry of Natural Resources. List [of Publications]. Ottawa.
Published monthly; announces new government publications of Ontario including geological maps.

Quebec. Department of Natural Resources. 1974. Published Geological Maps. 57p.
An index of the geological maps published by the Department.

Quebec. Ministere des Richesses Naturelles Direction de l'Information. 1972. Repertoire des Publications.
Comprehensive list of published geological maps of Quebec, p. 73-94.

Rice, H. M. A. 1965. Index of Publications, 1959-1964. Ottawa: Geological Survey of Canada.
This updates the index compiled by Johnston (1961). See also Griffin (1975).

Root, J. D. 1973. Index to current geological, soil, and groundwater maps of Alberta. Alberta Research Council Report, no. 73-4. 32p.

Saskatchewan. Department of Mineral Resources. 1975. Catalogue of Maps and Publications 1975. Regina. 103p.
Comprehensive list of geological maps of Saskatchewan with very useful map indexes.

3.6.2 Greenland

Geological Survey of Greenland. 1978. Geological Maps and Quaternary Maps of the Geological Survey of Greenland. Copenhagen. 2p.
Currently available maps with index map.

Geological Survey of Greenland. 1976. List of Publications. Copenhagen. 18p.
Lists geological maps currently available.

Inventory of available geological maps: Greenland. 1971. Geological Newsletter, no. 2, p. 156.

Watt, S. 1976. Maps produced by Grønlands Geologiske Undersøgelse. Polar Record, no. 18, p. 92-95.

3.6.3 United States

Albertson, G. H. 1963. Geologic Index to the Publications of the United States Geological Survey and the Hayden, King, Powell, and Wheeler Surveys. Denver: Geological Publishing Company. 113p.
Updated with annual supplements.

American Geological Institute. 1978. Maps and Geological Publications of the United States: a Layman's Guide. Washington, D.C.: American Geological Institute. 57p.
More than 2000 entries arranged by state. It gives additional sources of information and an address list of publishers.

Andriot, D., et al. 1975. Guide to U.S. Government Maps. Vol. 1: Geologic and Hydrologic Maps. Vol. 2: Location Index. McLean, Virginia: Documents Index. V. 1, 432p. V. 2, 309p.
This is the first in a series covering the geologic and hydrologic maps published by the U.S. Geological Survey through December 1974. It is updated annually. This list cumulates the entries in publications of the Geological Survey 1879-1961 and 1962-1970, the annual supplements for 1971-1973, and the monthly lists of New Publications of the Geological Survey.

Denny, C. S., et al. 1968. A description catalog of selected aerial photographs of geologic features in the United States. U.S. Geological Survey Professional Paper, no. 590. 79p.
Includes photographs that illustrate geologic features in the United States and Puerto Rico. The photographs may be ordered from the Map Information Office, U.S.G.S. Photographs of the rest of the world are listed in Warren, C. R., et al. (1969).

Geological Society of America. 1974. Publications Catalog 1973-1974. Boulder: Geological Society of America. 83p.
Includes a comprehensive list of all geological maps published by the Society with details of availability. This information is updated regularly in the Mini Catalog series.

Inventory of available geological maps: U.S.A. general maps. 1970. Geological Newsletter, no. 3, p. 309.

Kline, N. M. 1974. Catalogs of state geological survey publications: a source list. Bulletin Special Libraries Association Geography and Map Division, no. 98, p. 55-59.
A very useful list of catalogues for U.S.A. surveys. All the catalogues listed are available free of charge.

Long, H. K. 1971. A Bibliography of Earth Science Bibliographies of the United States of America. Washington, D.C.: American Geological Institute. 19p.
Useful for map acquisitions as it includes some catalogues of publications as well as some bibliographies which include maps.

Low, Jane Grant-MacKay. 1976. The acquisition of maps and charts published by the United States Government. University of Illinois Graduate School of Library Science Occasional Papers, no. 125. 36p.

U.S. Geological Survey. Geologic Map Indexes [United States]. Washington, D.C.
These indexes are arranged by state and include maps published by the U.S. Geological Survey, state and commercial organizations, universities, and professional societies. Open file maps of the U.S.G.S. are also included. All maps included are at the scale 1:250 000 or larger. Maps in journals and books are included. These indexes are listed in the U.S.G.S. publications catalogues, and also in Andriot.

U.S. Geological Survey. New Publications of the Geological Survey. Washington, D.C.
A comprehensive monthly list of surveys, books, reports, and maps. These lists have been cumulated in Andriot (1975).

U.S. Geological Survey. 1964. Publications of the Geological Survey, 1879-1961. Washington, D.C.
An invaluable guide to the maps issued by the Survey.

U.S. Geological Survey. 1972. Publications of the Geological Survey, 1962-1970. Washington, D.C. 586p.
A supplement to the earlier catalogue issued by the Survey. Updated monthly in New Publications of the Geological Survey.

U.S. Geological Survey. Reports and maps of the Geological Survey are released only in the open files. These maps are listed annually in the Circular series of the U.S.G.S. since 1946 as follows:

Year	Circular	Year	Circular	Year	Circular	Year	Circular
1946-47	56	1955	379	1962	473	1969	618
1948	64	1956	401	1963	488	1970	638
1949-50	149	1957	403	1964	498	1971	648
1951	227	1958	412	1965	518	1972	668
1952	263	1959	428	1966	528	1973	696
1953	337	1960	448	1967	548	1974	706
1954	364	1961	463	1968	568		

Alabama

Geological Survey of Alabama. 1976. Index and List of the Publications of the Geological Survey of Alabama and the State Oil and Gas Board. University, Alabama. 69p.
Comprehensive list including geological maps. Updated regularly.

Alaska

Alaska. Department of Natural Resources. Division of Geological and Geophysical Surveys. 1975. Aeromagnetic maps of Alaska quadrangles. Information Circular, no. 20. 4p.
Includes an index map.

Alaska. Department of Natural Resources. Division of Geological and Geophysical Surveys. 1972. Alaska map information. Information Circular, no. 16, 2p.
Includes details of maps and addresses of distributors.

Arizona

Arizona. Bureau of Mines. 1975. List of Available Publications. Tucson. 6p.
Includes a section on geological maps.

California

California. Division of Mines and Geology. 1975. List of Available Publications. Sacramento. 29p.
Comprehensive list with map indexes.

Colorado

Bibliography and index of Colorado geology 1875-1975. 1976. Bulletin Colorado Geological Survey, v. 37. 488p.
Geological maps are included in the subject index.

Colorado Geological Survey. 1977. Publications of the Colorado Geological Survey. Denver. 18p.
Comprehensive list with a map index.

Connecticut

Pess, L. F., et al. 1972. Geologic and hydrologic maps for land-use planning in the Connecticut Valley with examples from the Folio of the Hartford North Quadrangle, Connecticut. U.S. Geological Survey Circular, no. 674. 12p.

Delaware

Delaware Geological Survey. 1972. List of Publications. Newark. 8p.
Includes geological maps. No indexes.

Florida

Florida. Bureau of Geology. 1977. List of publications. Bureau of Geology Information Circular, no. 87. 48p.
Comprehensive list with map indexes.

Georgia

Georgia Geological Survey. 1974. List of Publications. 15th ed. Atlanta.
Includes a section on geological maps. No indexes.

Illinois

Illinois State Geological Survey. 1963. List of Publications. Urbana.
Comprehensive section on geological maps including indexes, p. 49-64.

Kansas

Bibliography and index of Kansas geology through 1974. 1977. Bulletin Kansas Geological Survey, no. 213. 183p.
Includes geological maps in the subject index.

Kansas Geological Society and Library. 1978. Publications and Services. Wichita. 8p.
Comprehensive list including geological maps.

Kansas Geological Survey. 1977. List of Available Publications. Lawrence. 23p.

Louisiana

Louisiana Geological Survey. 1975. Publications of the Louisiana Geological Survey. Baton Rouge. 25p.

Maine

Hussey, A. M. 1974. Bibliography of Maine Geology 1672-1972. Augusta: Bureau of Geology. 269p.
Includes separate indexes to the maps.

Maine Geological Survey. 1976. Publications of the Maine Geological Survey. Augusta. 2p.
Comprehensive list of maps. No indexes.

Maryland

Maryland Geological Survey. 1976. List of Publications. Baltimore. 26p.
Comprehensive list including maps. Addenda to this list issued in January 1977.

Michigan

Index of maps in Geological Survey publications. 1956. Michigan Geological Survey Division Publication, no. 50, p. 97-111.

Michigan. Department of Natural Resources. 1978. Publications Available from the Geological Survey Division. Lansing. 9p.
Includes geological maps and charts.

Minnesota

Goebel, J. E. 1976. Quaternary geologic map index of Minnesota. University of Minnesota Report of Investigations, no. 15. 22p.
This list is a guide to the maps being used to produce the Quaternary Geologic Map of Minnesota. The references are located and identified on an index map.

Mississippi

Mississippi Geological, Economic, and Topographical Survey. 1977. List of Publications. Jackson. 23p.
Comprehensive list of publications including maps and cross sections.

Missouri

Missouri Geological Survey. 1975. List of Publications. Rolla. 51p.
Comprehensive list. No map indexes.

Stout, L. N. 1969. Index to Missouri areal geologic maps 1890-1969. Missouri Geological Survey and Water Resources Information Circular, no. 22, 67p.

Nevada

Lutsey, I. A. 1971. Geologic map index of Nevada 1955-70. Nevada Bureau of Mines and Geology Map, no. 42. 1p.

Nevada. Bureau of Mines and Geology. 1976. Publications of the Nevada Bureau of Mines and Geology. Reno. 12p.
Includes geological maps. No map indexes.

Prince, R. W. 1945. Bibliography of geologic maps of Nevada areas. University of Nevada Bulletin, Geology and Mining Series, no. 43, p. 189-201.

New Mexico

Koehn, M. A., and Koehn, H. H. 1973. Bibliography of New Mexico geology and mineral technology 1966 through 1970. New Mexico Bureau of Mines and Mineral Resources Bulletin, no. 99. 288p.
Geological maps are listed in the subject index.

New Mexico. Bureau of Mines & Mineral Resources. 1976. Publications Available. Socorro. 34p.
Includes geological maps and index maps.

New Mexico Geological Society. 1977. Publications. Socorro. 2p.
Includes geological maps.

Robertson, J. M. 1976. Annotated bibliography and mapping index of Precambrian of New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin, no. 103. 90p.
Includes two useful map indexes for New Mexico.

North Dakota

North Dakota Geological Survey. 1977. List of Publications March 1977. Grand Forks. 39p.
Comprehensive list including geological maps.

Ohio

Ohio Geological Survey. 1974. Publication List. Columbus.

Oklahoma

Branson, C. C., and Jordan, L. 1961. Index to Geologic Mapping in Oklahoma 1: 1 000 000. Norman: Oklahoma Geological Survey. 5 sheets.
Supplements issued in 1964 and 1967.

Oklahoma Geological Survey. 1973. List of Available Publications. Norman. 16p.
Includes geological maps and atlases.

Oregon

Corcoran, R. R. 1968. Index to published geologic mapping in Oregon 1896-1967. *Department of Geology and Mineral Industries Miscellaneous Paper*, no. 12. 20p.

Oregon. Department of Geology and Mineral Industries. 1975. *Publications List*. Portland. 4p.
Comprehensive list including geological maps. No map indexes.

Roberts, M. S., et al. 1973. Bibliography of the geology and mineral resources of Oregon. *Bulletin Department of Geology and Mineral Resources*, v. 78. 199p.
Geological maps are listed in the subject index.

South Carolina

South Carolina Geological Survey. 1977. Catalog of geologic publications. *South Carolina Geological Survey Circular*, no. 1. 26p.
Includes geological maps. No map indexes.

South Dakota

South Dakota Geological Survey. 1976. *Publications of the South Dakota Geological Survey*. Vermillion. 23p.
Includes geological maps and a map index.

Tipton, M. J. 1966. Bibliography of reports containing maps on South Dakota geology published before January 1, 1959. *South Dakota Geological Survey Circular*, no. 33. 71p.

Tennessee

Tennessee. Division of Geology. 1970. *Status of Detailed Geologic Mapping in Tennessee*. Nashville.

Tennessee. Division of Geology. 1977. *List of Publications*. Nashville. 33p.
Comprehensive list including many geological maps. No map indexes.

Texas

Brown, T. E. 1963. *Index to Areal Geologic Maps in Texas 1891-1961*. Austin: University of Texas. 20p.

Texas. Bureau of Economic Geology. 1975. *Publications*. Austin. 22p.
Includes geological maps and charts and an index map for the *Geologic Atlas* series.

Utah

Buss, W. R., and Goeltz, N. S. 1974. Bibliography of Utah geology 1950 to 1970. Bulletin Utah Geological and Mineral Survey, v. 103. 285p.
Geological maps are included in the subject index.

Virginia

Virginia. Division of Mineral Resources. 1976. List of Publications. Charlottesville. 38p.
Comprehensive list including geological and geophysical maps and map indexes.

Washington

Washington. Division of Geology and Earth Resources. 1976. Geologic Publications. Olympia. 35p.
Includes geological maps. No map index.

West Virginia

West Virginia Geological Survey. 1976. Publications. Morgantown. 43p.
Includes geological maps. No map indexes.

Wisconsin

Wisconsin. Geological and Natural History Survey. 1974. Publications of the Geological and Natural History Survey. Madison. 29p.
Includes geological maps. No map indexes.

Hanson, C. R. 1975. Earth science maps of Wisconsin 1818-1974: A bibliography and index. Wisconsin State Cartographers Office, Information Circular, no. 1, p. 1-15.

Wyoming

Geological Survey of Wyoming. 1975. Publications Available from the Geological Survey of Wyoming. Laramie. 8p.
Includes sections on printed geological maps and unpublished maps.

Wyoming Geological Association. 1967. Publications of the Wyoming Geological Association 1946-1966. Casper. 85p.
Includes geological maps and charts.

3.7 South and Central America

Commission for the Geological Map of the World. 1973. Liste de Cartes Géologiques Nationales et Internationales. 5. Amérique du Sud. Paris. 8p.

Pan American Union. Department of Economic Affairs. Natural Resources Unit. 1964- . Annotated Index of Aerial Photographic Coverage and Mapping of Topography and Natural Resources. Washington, D.C.
Includes geological map coverage for nearly all the Latin American countries.

Smith, H. W. 1969. Sources of geological information in Latin America. XIV Seminar on the Acquisition of Latin American Library Materials Working Paper, no. 4. 23p.
Includes a very useful list of geological maps.

Sullivan, H. B. 1922. A Catalogue of Geological Maps of South America. New York: American Geographical Society. 191p.
Includes maps in journals and monographs.

Argentina

Catalogo Cartografico de la Republica Argentina. 1967. Buenos Aires: Editotrial Universitaria de Buenos Aires. 273p.
Includes a section on geological maps of Argentina.

Buenos Aires. Comision de Investigacion Cientifica. 1961. Bibliografia Geologica y Cartografica de la Provincia de Buenos Aires. La Plata. 145p.
First supplement 1961-1963 issued in 1964.

Inventory of available geological maps: Argentina. 1967. Geological Newsletter, no. 3, p. 92.

Maran, D. R. 1975. Catalogo de Publicaciones del Servicio Nacional Minero Geologico. Buenos Aires. 293p.
Includes geological maps.

Bolivia

Barth, W. 1972. Die geowissenschaftliche Literatur Boliviens in den Jahren 1960-1971: Ein Uberblick (Geoscientific literature of Bolivia: Review 1966-1971). Zentralblatt für Geologie und Paläontologie, pt. 1, p. 100-130.
Section 6 includes references on maps and aerial photographs.

Brazil

Inventory of available geological maps: Brazil. 1974. Geological Newsletter, no. 2, p. 167.

Inventory of available geological maps: Brazil. 1974. Geological Newsletter, no. 3, p. 245.

Chile

Chile. Instituto de Investigaciones Geologicas. 1974. Publicaciones (1957-1974). Santiago. 15p.
Includes geological maps.

Inventory of available geological maps: Chile. 1967. Geological Newsletter, no. 3, p. 90.

Colombia

Colombia. Instituto Nacional de Investigaciones Geologico Mineral. 1970. Publications for Sale. Bogota. 1p.
Includes a geological map series.

Inventory of available geological maps: Colombia. 1967. Geological Newsletter, no. 2, p. 103.

Ecuador

Inventory of available geological maps: Ecuador. 1967. Geological Newsletter, no. 2, p. 103.

El Salvador

Humphreys, A. P. 1973. A Bibliography of the Geology Relating to El Salvador, Central America (1576-1973). Horsham, Sussex: By the Author. 51p.
Includes an index of geological maps.

French Guyana

Inventory of available geological maps: French Guyana. 1977. Geological Newsletter, no. 2, p. 108.

Guyana

Guyana. Geological Survey Department. 1972. List of Publications and Maps. Georgetown. 23p.
Comprehensive list including geological and geophysical maps.

Inventory of available geological maps: Guyana. 1967. Geological Newsletter, no. 2, p. 105.

Mexico

Inventory of available geological maps: Mexico. 1977. Geological Newsletter, no. 3, p. 233.

Panama

Inventory of available geological maps: Panama. 1977. Geological Newsletter, no. 2, p. 193.

Peru

Inventory of available geological maps: Peru. 1977. Geological Newsletter, no. 1, p. 89.

Surinam

Inventory of available geological maps: Surinam. 1967. Geological Newsletter, no. 2, p. 107.

Trinidad and Tobago

Inventory of available geological maps: Trinidad and Tobago. 1967. Geological Newsletter, no. 2, p. 110.

Venezuela

Inventory of available geological maps: Venezuela. 1976. Geological Newsletter, no. 1, p. 101.

4. Serials

This section includes geological journals, both primary and secondary, which have useful information on geological maps. For more general cartographic and geographical journals see the list in the paper by Wise (1977).

Association of African Geological Surveys. Information and Liaison Bulletin.
A very useful information bulletin which includes detailed progress reports of the activities of the various African geological surveys as well as a bibliography of geological publications on Africa.

Bibliography and Index of Geology. Washington, D.C.: American Geological Institute.
Issued monthly. Section 14 covers geological maps and charts.

Bulletin Signaletique. Bibliographie des Sciences de la Terre. Section 221. 1972- . Paris: Bureau de Recherches Géologiques, Centre National de la Recherche Scientifique.

Geological maps are included in Section 224, Stratigraphy, regional geology, and general geology.

Commission for the Geological Map of the World. Bulletin. No. 1- . 1964- .

A very useful bulletin reporting the progress of the various projects undertaken by the Commission.

Earth Sciences News. No. 1- . 1971- .

Werner Kniebes Versandbuchhandlung, TiHmoos geological maps are listed in Section 2.

Episodes. 1978- . Ottawa: International Union of Geological Sciences. [Formerly Geological Newsletter].

Includes a section on new maps as well as comprehensive listings and indexes by country of maps available.

Geo Abstracts G. Remote Sensing, Photogrammetry and Cartography. 1974- . Norwich, England: Geo Abstracts, Ltd.

Includes information on geological maps.

Geotimes. 1956- . Washington, D.C.: American Geological Institute.

Includes a selective monthly listing of important map accessions received by the U.S. Geological Survey Library.

Geotitles Weekly. 1969- . London: Geosystems.

Section 2200 covers geological maps; other sections include geophysical maps (2400) and resource maps (2500).

National Cartographic Information Center. Newsletter. No. 1- . 1975- . Washington, D.C.: U.S. Geological Survey.

The National Cartographic Information Center is not a library or depository of cartographic products, but it organizes and distributes information about the products available from government agencies and commercial firms. The NCIC has produced a six-page xerox list of map sources which is available direct from the Center, as well as a list of state cartographic information offices available from NCIC's Users' Services.

New Zealand Mapkeepers Circle. Newsletter. No. 1- . 1977- . Palmerston North: Department of Geography, Massey University.

Selected List of Maps, Atlases and Gazetteers. Ottawa: Department of Energy Mines and Resources.

Acquisitions list of the departmental library.

Special Libraries Association. Geography and Map Division. Bulletin. No. 1- . 1947- .

A very useful bulletin including original papers, book reviews, and lists of new maps.

Western Association of Map Libraries. Information Bulletin. V. 1- . 1969- .
A very useful bulletin listing new maps and publishers' catalogues as well as original papers and book reviews, often on geological topics.

World Cartography. V. 1- . New York: United Nations.
The status of world topographic mapping is reviewed in Volume X, p. 1-95. This review is in two parts: Part 1 is a statistical summary, and Part 2 is an inventory of world topographic mapping. The names and addresses of national cartographic agencies are given in Annexe 2.

5. Directories of Map Collections

Diment, J. A. 1978. Geological directory of the British Isles. A guide to information sources. Miscellaneous Paper Geological Society of London, no. 10. 109p.
Includes details of geological libraries with map collections.

Map Collections in the United States. A Directory. 1970. New York: Special Libraries Association. 159p.

Rauchle, N. M., and Alonso, P. A. G. 1977. Directory of Map Collections in Australia. 2d ed. Canberra: National Library of Australia. 85p.

Ristow, W. W. 1976. World Directory of Map Collections. Munich: Verlag Documentation.

Winearls, J., and Tessier, Y. 1969. Directory of Canadian Map Collections. Ottawa: Association of Canadian Map Libraries. 72p.
Lists some 87 map collections in Canada.

COLLECTION DEVELOPMENT
IN A GEOLOGY-GEOPHYSICS RESEARCH COLLECTION

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Abstract: How does one decide what materials to purchase for a research level collection in geology and geophysics? The first step is to detail the needs the collection must meet in a structured manner. This paper provides a rational scheme for gathering data about the primary needs the collection must meet and a structure for relating these needs to the library collection.

In a university library the primary goal is support of the teaching and research of the faculty and graduate students. The teaching has documentation: the curriculum appears in the university catalog, at least, and it can be analysed and quantitatively related to the collection (as John Kossey has done for a general college collection). Research is usually less well documented but no less important. Research interests can be documented by means of a structured interview with each faculty member.

Subjects discovered from these investigations can, with some difficulty, be mapped into the Library of Congress classification scheme. This allows comparisons with overlapping collections and evaluation of the existing collection.

Once needs are determined, one reaches the second step: acquiring materials to satisfy the needs. Trends in publishing both in and out of the field influence the availability of materials. For example, the U.S. Geological Survey publishes an increasing number of reports as Open File Reports or as National Technical Information Service (NTIS) reports. These have significant prices and are not available as depository items. This is an alarming trend for collection development and the public accessibility of information produced at public expense.

Introduction

How does one decide what materials to purchase for a research level collection in the geosciences? Selection should be based on a collection development policy which takes into account: 1) the needs of the users of the collection; 2) priorities for meeting the needs of the users and supporting existing collections; 3) the organizational environment in which the collection functions (administrative structure, purpose of the collection, budgetary support, interrelated collections, space, access to materials in other organizations such as the Center for Research Libraries); 4) publishing output in the geosciences and special characteristics of the publications of the field; and 5) constant feedback from all these areas.

In this paper we will discuss guidelines for the creation of a collection development policy, how to quantify the analysis of users' needs upon which a collection development policy is based, and the geoscience publishing field, its peculiarities, its trends, and their relationship to collection development.

Guidelines for Developing a Collection Development Policy

A written collection development policy will aid in communication and cooperation with users, with administrators, and with other libraries, as well as help with day-to-day selection decisions.

What should this policy include? The Collection Development Committee of the Resources and Technical Services Division of the American Library Association (1977) has published "Guidelines for the Formulation of Collection Development Policies." The Committee's intention was to "identify the essential elements of a written statement of collection development policy and to establish standard terms and forms for use in the preparation of such policies."

These Guidelines recommend the following elements of a collection development policy statement:

1) Analysis of general institutional objectives, including: clientele to be served; general subject boundaries of the collection; kinds of programs or user needs supported (research, instructional, recreational, general information, reference, etc.).
2) General priorities and limitations governing selections, including: forms of material collected or excluded (e.g. maps, microforms, manuscripts); languages collected or excluded; geographical areas collected or excluded; chronological periods collected or excluded; degree of continuing support for strong collections.
3) Detailed analysis of collection development policy for subject fields. The Guidelines recommend a breakdown of about 500 Library of Congress classification scheme subject classes and suggest that for each subject the level of collecting intensity codes should be indicated.

Five levels of collecting intensity are defined in the Guidelines:

A. Comprehensive level. A collection in which a library endeavors, so far as is reasonably possible, to include all significant works of recorded knowledge (publications, manuscripts, other forms), in all applicable languages, for a necessarily defined and limited field. This level of collecting intensity is that which maintains a "special collection"; the aim, if not the achievement, is exhaustiveness.

B. Research level. A collection which includes the major source materials required for dissertations and independent research, including materials containing research reporting, new findings, scientific experimental results, and other information useful to researchers. It also includes all important reference works and a wide selection of specialized monographs, as well as a very extensive collection of journals and major indexing and abstracting services in the field.

C. Study level. A collection which is adequate to support undergraduate or graduate course work, or sustained independent study; that is, which is adequate to maintain knowledge of a subject required for limited or generalized purposes, of less than research intensity. It includes a wide range of basic monographs, complete collections of the works of more important writers, selections from the works of secondary writers, a selection of representative journals, and the reference tools and fundamental bibliographical apparatus pertaining to the subject.

D. Basic level. A highly selective collection which serves to introduce and define the subject and to indicate the varieties of information available elsewhere. It includes major dictionaries and encyclopedias, selected editions of important works, historical surveys, important bibliographies, and a few major periodicals in the field.

E. Minimal level. A subject area which is out of scope for the library's collections, and in which few selections are made beyond very basic reference tools.

For each subject area collected, the Guidelines suggest noting languages, geographical areas or form included or excluded as well as the appropriate collecting intensity codes.

The structure proposed by the Guidelines is a workable one for a geoscience collection development policy. But in applying the Guidelines to create a collection development policy for a geoscience collection, difficulty arises in the suggested list of subject areas. The suggested level of breakdown of the LC classification scheme is to the level of the QE's (all of Geology). A biology collection which includes vertebrate paleontology to the research level and no other QE's would rate its collection as "QE: B level," the same way a geoscience collection which collects to the research level in most areas of the QE's and is quantitatively much larger would be noted. Therefore, if we wish to use the Guidelines to structure a policy specifically for a geoscience collection, there is need for a more detailed breakout of geoscience subjects.

Even with more detail, the policy is just a beginning, however. It must be constantly tested against the money available to fulfill it, the realities of the output of the geoscience publishing world, and changes in user needs.

Quantifying User Needs

The Guidelines assume that you can identify the needs of the collection's users:

> Libraries should identify the long- and short-range needs of their clientele and establish priorities for the allocation of funds to meet those needs. A collection development policy statement is an orderly expression of those priorities as they relate to the development of library resources.

The quality of the collection development policy thus depends on the quality of the needs assessment on which it is based. Usually the librarian assesses needs in a qualitative manner. Those who are more vocal about the collection or more active in submitting order requests may seem to have more need.

A more quantitative approach to relating the collection to the curriculum and research it is supposed to support would probably improve the collection development policy and the quality of the collection.

John Kossey (1977) has described a quantitative approach to collection analysis which he has applied to the entire library collection of a small four-year liberal arts college, a collection whose main purpose is to support the curriculum. Kossey assigned classes from the LC classification scheme to all the courses listed in the college catalog (but using only a single class, QE, for geology in his small institution). This provides a quantitative relationship between the curriculum and the library collection.

The purpose of a research library like the Geology-Geophysics Library at UCLA is not only to support the curriculum but also to support research. Thus, not only is an analysis of the curriculum similar to Kossey's study required, but also such a study would have to be expanded to include research interests of the faculty and graduate students.

Many academic departments produce a formal annual report of research. One could analyze this or similar documentation of research in the same manner as Kossey did the college catalog. If such documentation doesn't exist, similar information can be generated by conducting structured interviews with faculty and researchers. Using existing documentation would be less time consuming, but the interview method has the potential advantage of improving communication from direct contact between the faculty and the library.

Geoscience Publishing

In developing a collection for any subject one must take into account the nature of publishing in the field. For instance, what is a "research" collection in modern American literature compared to one in seismology? The forms of publications, the publishers, the amount of material published each year vary from field to field. The nature of the field is something not directly included in collection development policies, but nevertheless an integral part of collection development.

Milo Dowden (1978) provided a summary of monographic trade publishing in geoscience in the Geoscience Information Society's symposium on geoscience publishing. Figures for the number of trade titles in geoscience published each year and their average prices are often combined with the sciences in general, so Dowden's paper is particularly helpful. But even though Dowden reported the earth sciences to have the highest average price for monographs last year, the difficulties of geoscience publishing occur with the nontrade publishers rather than the trade publishers.

Many of the important geoscience publishers are nontrade publishers: local, regional, national and international geological societies and government agencies. The publications of nontrade publishers don't appear in Books in Print and are usually not advertised widely. Thus, it takes more effort and knowledge to be aware of them, the first step in the selection process. Many of these same publishers don't accept standing orders, don't encourage dealers to handle their publications by giving discounts, or require prepayment. Thus the verification, ordering, and invoicing process is more complicated and costly for geoscience than for many other fields because of the large proportion of nontrade publications.

The importance of nonbook formats is also a characteristic of the field. Often the most important geological publication on some area is a map or a guidebook, is on microfiche, or is an Open-File Report.

The problems of selecting and acquiring maps and guidebooks are numerous and well-documented by Diment (1978) and by Wallace (1978). The acquisition of guidebooks has been greatly aided by the Geoscience Information Society's own Union List of Geologic Field Trip Guidebooks of North America. Microforms are suddenly more important in geoscience with the change in 1979 of the GSA Bulletin, one of the major journals in the field. Beginning in 1979, the GSA Bulletin will be in two parts, Part I extended abstracts published in hard copy and Part II the full papers on microfilm or microfiche exclusively.

As the nontrade publishers require special procedures in order to select and acquire their materials, so also do nonbook formats require special handling, storage and equipment. Most of these difficulties have short-term collection development effects, but sometimes a change in policy or format occurs whose effects on collection development are more long-range and subtle. A recent change in the accessibility of Open File Reports of the U.S. Geological Survey is such a change.

The review process which formal USGS publications go through is both rigorous and time-consuming. From completion of a paper to its publication as a USGS Bulletin or Professional Paper can easily take two years. When the Survey wants to make its work accessible without going through the review process (because the material is in high demand, or is ephemeral or is judged to be of local interest) it announces in New Publications of the Geological Survey that the material is available in open files in specified USGS Libraries and Public Inquiries Offices. Until October, 1977, those interested in these Open File Reports were expected to go to those offices to see the material; they couldn't order it from the USGS.

Beginning in October, 1977 it became possible to purchase these reports. The Survey set up the Open File Service Section in Denver and began giving microfiche and hard copy order information in New Publications. One can now get these reports, but only by prepayment and not all reports are available.

On the one hand, this is a helpful move on the part of the USGS to make the Open File Reports more accessible. But for a geoscience librarian there is now a growing body of relatively expensive material to be considered for selection. Purchasing these reports cuts into acquisitions funds for other materials. To continue to be "research" level suddenly means a larger commitment of funds.

Also, more and more reports are being released as Open File Reports rather than going the long route of formal publication. According to John Heller (1978), Chief of the Central Region Publication Division of the USGS:

> If you exclude topographic maps, in 1976 only about 13 percent of USGS reports were formally published by the USGS. About 64 percent were published in professional journals outside the Survey, and the remaining 23 percent were released short of formal publication through NTIS, as USGS open-file reports or in other informal-report series such as the Water Resources Investigation series. As publications costs rise and as pressure grows for more rapid release of reports, a larger percentage of Survey reports are being released in the open-files and by other informal means in advance of or in lieu of formal publication.

The formal publications of the USGS have traditionally been included in the Superintendent of Documents depository program and as such have been free to member libraries across the country who agree to house them and make them available to the public. The Open-File Reports are not included in the depository program. According to Mr. Heller, "open-file reports are informal reports that are not prepared to the standards of formal publications, and they are not intended for mass production or distribution (i.e. a large depository system outside the USGS)." As more and more of the USGS material appears "informally," over the long term a smaller proportion of the published output of the USGS will be freely available to libraries and thus to the public even though the impetus for establishing the Open File Service Section was to increase accessibility.

The Open File Report Series is both an example of difficulty in selection and acquisitions peculiar to geoscience, and also a trend in the field which can influence collection development.

Summary

Establishing a collection development policy is the first step toward rational collection development in a geoscience collection. It must be based on an assessment of user needs, and the better that assessment is, the better the collection development policy will be. In addition, the librarian will need to assess geoscience publishing and keep in touch with trends in the field. Changes in the publishing output or in user's needs should feed back into the collection development process, either at the point of policy revision or in the budgeting process, where the collection development policy is matched against the dollars available and the output of literature.

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PROPOSAL TO ESTABLISH INTERNATIONAL FEDERATION OF GEOLOGICAL DOCUMENTATION SERVICES

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Abstract: Papers presented at the first International Conference of Geological Information, held in London 9-12 April 1978, illustrate the wide range of content, form, and application of geological information. State-of-the-art reports from eight countries and delegations from an additional twelve confirm a general international interest in such information. However, existing mechanisms for accessing geological information resources on an international basis are restricted and uncoordinated. Effective utilization of these resources will depend on the development, operation, and international coordination of geological documentation systems; yet an international program for geological documentation does not exist. The most practical means for bringing such a program into being would be through the establishment of an "International Federation of Geological Documentation Services," organized to promote and manage international activities and programs, with representation from all services, societies, unions, and other organizational entities responsible for, or interested in, geological documentation.

International Conference on Geological Information

The first major international meeting devoted entirely to the subject of "geological information" took place in London, 9-12 April 1978. As one of the major cosponsors, along with the Geological Information Group of the Geological Society of London, the Geoscience Information Society can take pride in the role it played to initiate, organize, and conduct what from all accounts was a well organized and much appreciated meeting, attended by 190 participants from 22 countries (Walker, 1978; Burk, 1978b, Beavington, 1978).

The main aims of the conference were to determine and assess the current state-of-the-art in geological information activities on a global basis and to promote international cooperation. The conference was divided into sections that included: national reviews on eight countries; the description of various aspects of geological documentation, such as publication, indexing, data management and on-line retrieval; examples of the application of information handling to applied geology, with particular reference to non-renewable resources; the description of documentation activities in specialized areas such as remote sensing and maps; user viewpoints as expressed by publishers, librarians, academicians and those from developing countries; and a final session on the question of establishing a suitable mechanism or organization to promote increased international cooperation. Papers presented at the conference will be published during 1979 (Harvey and Diment).

Organizing Committee

Immediately following the conference on 12 April, an ad hoc "International Conference on Geological Information Organizing Committee" met to deal with two resolutions passed by the conference delegates:

1) To arrange for the next International Conference on Geological Information, and
2) To compile a report for that meeting concerning the desirability and feasibility of establishing a "Federation of Geological Information Organizations."

Since this first meeting of the Organizing Committee, standing representatives have been appointed, or are expected to be appointed, by the following organizations:

1) Asociacion Latinoamericana de Editores en Geosciences (ALEGEO)
2) Association of Earth Science Editors (AESE)
3) Australian Geoscience Information Association (AGIA)
4) Committee on Geological Documentation, International Union of Geological Sciences (CGD)
5) Committee on Storage, Automatic Processing and Retrieval of Geological Data, International Union of Geological Sciences (COGEODATA)
6) Association of Editors in Science in Southeast Asia, Australasia and Oceania (EDITEAST)
7) European Association of Earth Science Editors (EDITERRA)
8) Geological Information Group, Geological Society of London (GIG)
9) Geoscience Information Society (GIS)

Delegates to the London conference generally expressed support for the idea of a federation of organizations concerned with geological information (Beavington, 1978), but they recognized the need for more background information on matters such as the number and nature of organizations that might be interested, the overall level of support for the concept, and organizational alternatives, before a final recommendation could be developed. Notwithstanding the lack of this critical information, this paper presents a case for establishing such a federation; it may be viewed as the rationale for tabling the proposal at the London conference and as a point of departure for the Organizing Committee in carrying out its feasibility study.

Current Geological Documentation Activities

"Documentation" may be defined as those activities associated with the creation of recorded information and the subsequent control, analysis, and dissemination of knowledge concerning recorded information (Burk, 1979). As applied to the work of geologists and their supporting organizations, the term could refer, at one extreme, to methods used to record primary geological observations and measurements in a field notebook, on through to preparing manuscripts, publishing, and the development of bibliographies and indexes and, at the other extreme, the publication of a two-page entry on "geology" in an encyclopedia. However, in the context of this proposal, I am restricting the term "documentation" to the identification and indexing of recorded geological information, and the management, dissemination, and utilization of the resulting secondary or bibliographic data. By "recorded information," I include not only the literature, but also theses, other unique public documents, machine-readable data bases, geological samples and cores, and indeed any information recorded in a preservable medium.

An examination of the documentation activities reported by various countries at the London conference indicates that in nearly every case, the major national documentation centre for geology is linked, or is in the process of being linked, with some kind of national or international network. Each national centre is reaching outward for additional sources, markets and channels of communication. Briefly, this is the situation for countries with known active national programs:

United States of America. The American Geological Institute (AGI) manages one of the world's major international secondary services, GeoRef (Rassam, 1978). AGI has recently embarked on a feasibility study for development of a network: "Designing an experimental cooperative network for sharing information and data resources in geology" is intended to help AGI learn if new information and communication technology, primarily used on a large-scale, national level, can be applied as effectively for improving information and data exchange within small specialized research communities--specifically within the state geological surveys of North Dakota, Iowa, Utah, Minnesota, and Alabama (McCormick, 1978).

Canada. The Canada Centre for Geoscience Data, Department of Energy, Mines and Resources, in cooperation with most relevant federal and provincial government agencies, is developing a national bibliographic file, the Canadian Index to Geoscience Data. Document identification and indexing are carried out on a decentralized basis with eleven contributing agencies, operating within the context of a broadly based national referral system (Burk, 1978a).

France. The Centre de Documentation Scientifique et Technique and the Bureau de Recherches Géologiques et Minières jointly publish the Bulletin Signalatique--Bibliographie des Sciences de la Terre. Since 1968 the geological surveys of several European countries, including Czechoslovakia, the Federal Republic of Germany, Spain, Hungary, Poland, Romania, and Finland, have agreed to develop a common bibliographical data base for geology.

Federal Republic of Germany. The Geological Documentation Service operates within the framework of the national "Information and Documentation Program," which has rationalized the relationship and responsibilities of all scientific and technical information activities in the country (Institute for Documentation, 1976). Managed by the Federal Institute for Geosciences and Natural Resources, it is responsible for German-language literature from West Germany, East Germany, and Austria. An operational agreement with the French Bureau de Recherches Géologiques et Minières provides for bilingual computer translation programs and the exchange of French and German bibliographic information.

United Kingdom. Geosystems, a private company, provides the major bibliographic service from the United Kingdom (Lea, 1978). Their coverage of the world's geoscience literature is based to a large extent on access to the exceptional concentration of major libraries in the greater London area.

Australia. The Australian Mineral Foundation has recently initiated the Australian Earth Sciences Information System and currently coordinates development of a national bibliographic file, with coverage of both published and unpublished material (Parkin and Tellis, 1977). The system operates on the basis of cooperation with a large number of Australian organizations.

U.S.S.R. I have no recent information on geological documentation activities in the Soviet Union. However, it can be assumed that activities there remain at their usual high level, with responsibility for coverage of the world's largest national landmass (8.65 million square miles).

Evidence of Need for Cooperation

The London conference had as one of its aims the promotion of increased international cooperation in the field of geological information. What evidence do we have of this need? If there were greater cooperation, what benefits might accrue? Unfortunately, we do not have all the necessary information to analyze these questions; below is a review of some of the factors that should be considered.

Coverage. The major objective of any geological documentation service is comprehensive and accurate coverage with respect to some defined geographic area and/or topic. Given the diversity of sources of geological information, it is clearly not practical for a single organization to approach complete coverage on an independent basis (Lea, Diment and Harvey, 1973).

Compatability. In order to achieve better coverage, some organizations exchange bibliographic records, and most others would like to. However, before any operational success can be achieved, compatability on both the intellectual and technical levels must be achieved (Mulvihill, 1976; Mulvihill and Rassam, 1979).

Economics. The cost of capturing the bibliographic data for a single document appears to range between $10 and $20, and the annual worldwide production of geological documents ranges between 50,000-100,000. While improved technology and methods can be expected to lower these costs somewhat, the work is basically labour-intensive and therefore dramatic overall cost reductions cannot be expected. The only effective approach to minimizing or reducing costs lies in cooperative programs that will ensure nonduplication and promote the sharing of resources.

Information Technology. The computer-telecommunications revolution continues to provide managers of documentation centres with greater scope and flexibility in the management of their data bases and in the provision of services. However, much of the technology is highly specialized and "bibliographic data management" does not occupy a prominent segment of the commercial marketplace. It is therefore often difficult for information managers to determine what tools, practices and systems have in fact been applied effectively and where or how they may be obtained; improved "technology transfer" would be beneficial.

These various factors, individually and collectively, can have a major impact on the viability of a documentation service. The dollars and cents question is: Would improved international cooperation effectively address these areas and thereby benefit those concerned? Who would benefit most? Who least? To what extent?

Alternatives for Achieving International Cooperation

In order to reach a decision on the best mechanism for achieving international cooperation, the objective or purpose of such cooperation must be defined and agreed upon. This decision will dictate the level of cooperation desired, which could range through the following possibilities:

1) Exchange of information on activities
2) Development and adoption of common standards, objectives, or procedures.
3) Experimental and operational exchange of bibliographic data.
4) Coordination of bibliographic services.
5) Unification of bibliographic services.

Among the alternative organizational structures available to promote cooperation at the required level are: 1) Professional associations; 2) National or intergovernmental organizations; and 3) Nongovernmental federations of individual organizations (Data for Development, 1977).

Alternatives among the "professional associations" include existing societies (e.g. Geoscience Information Society, American Society for Information Science), existing international organizations (e.g. International Union of Geological Sciences, International Federation of Documentation) and the proposed "International Association for Geological Information," as discussed at the London conference.

If a "national or intergovernmental" approach were sought, the principal alternatives appear to be through Unesco's Division of the General Information Programme, or other United Nations agencies dealing with natural resources or the environment.

Finally, the options available through the "federation" approach would include existing international organizations such as the Abstracting Board of the International Council of Scientific Unions (ICSU-AB) and the International Union of Geological Sciences, through its Committee on Geological Documentation. The international federation proposed here would be an organization in this category.

Proposed International Federation of Geological Documentation Services

Although the critical decision has not been reached on an appropriate objective for international cooperation and more background information on existing services is required, nevertheless it is my personal judgement at this time that the optimum solution for achieving the cooperation we seem to want lies in the establishment of a new "International Federation of Geological Information Services." This opinion is based on the following considerations:

1) The most immediate need in the field of geological documentation is for rationalization of the compilation of bibliographic data on the world's literature in geology.
2) There already exist numerous professional associations that meet the needs of individual professionals. What is required now is a greater degree of cooperation on an operational level and the initiation of worldwide projects in the field of geological documentation.
3) Moral and financial support for the establishment of a new organization will be more readily forthcoming if the projected cost-effectiveness and other benefits are apparent, as would be the case in an operationally oriented organization.
4) A review of worldwide activities in geological documentation indicates that nearly all services and activities are already reaching out on a regional, national, or multinational basis. A structural mechanism is needed to link them together internationally.

The purpose of such a federation would be the promotion of international programs in geological documentation in support of geological research and development and the management of natural resources. The principal activities would be the exchange of information on developments of mutual interest; the development, testing, and use of methods and standards that would promote the exchange and use of bibliographic and related data; and, finally, the development of programs that would provide for the rationalization of bibliographic data collection, its exchange, and management. Financing could be anticipated through modest membership dues and through contractual support from appropriate governmental and nongovernmental organizations.

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APPENDIX A

GEOSCIENCE INFORMATION SOCIETY

HISTORY:

Founded November 5, 1965, in Kansas City; incorporated in March 1966 in the District of Columbia.

PURPOSE:

To initiate, aid, and improve the exchange of information in the earth sciences through mutual cooperation among librarians, earth scientists, documentalists, editors, and information specialists.

MEMBERS:

More than 200.

MEMBERSHIP:

Open to persons and organizations whose professional activities are related to geoscience or who are interested in the purpose of the Society.

DUES:

$12 (individual), $25 (institutional), $100 (sustaining).

MEETINGS:

Annual, with that of the Geological Society of America.

PROGRAMS:

The management, organization, and dissemination of geoscience information.

PUBLICATIONS:

A directory of geoscience libraries, a union list of field-trip guidebooks, proceedings volumes, and the GIS Newsletter (6 times a year).

ADDRESS:

In care of the American Geological Institute, 5205 Leesburg Pike, Falls Church, VA 22041. Telephone: (703) 379-2480.

APPENDIX B

PUBLICATIONS OF THE GEOSCIENCE INFORMATION SOCIETY

PROCEEDINGS

V. 1 (1966, 1967 meetings), 1969. R. W. Graves, ed. Handling Geoscience Data and Information. OP

V. 2 (1971 meeting), 1972. R. W. Graves, ed. Toward the Development of a Geoscience Information System. $ 3.00

V. 3 (1972 meeting, Minneapolis), 1973. H. K. Phinney, ed. [no title]. $ 6.00

V. 4 (1973 meeting, Dallas), 1974. M. W. Wheeler, ed. Geoscience Information. $12.00

V. 5 (1974 meeting, Miami Beach), 1975. J. L. Morrison, ed. Geoscience Information. $12.00

V. 6 (1975 meeting, Salt Lake City), 1976. V. S. Hall, ed. Retrieval of Geoscience Information. $15.00

V. 7 (1976 meeting, Denver), 1977. J. G. Mulvihill, ed. Geoscience Information. $15.00

V. 8 (1977 meeting, Seattle), 1978). R. D. Walker, ed. Geoscience Information Retrieval Update. $15.00

V. 9 (1978 meeting, Toronto), 1979. J. H. Bichteler, ed. Geoscience Information: Publication - Processing - Management. $15.00

DIRECTORY OF GEOSCIENCE LIBRARIES: U.S. AND CANADA. 1974. 2d ed. R. W. Walker and D. Parker, eds. $ 5.00

ENVIRONMENTAL GEOLOGY IN THE PITTSBURGH AREA. 1971. R. D. Thompson, ed. Geological Society of America Field Trip Guidebook No. 6. $ 5.00

GEOLOGICAL FIELD TRIP GUIDEBOOKS OF NORTH AMERICA, A UNION LIST INCORPORATING MONOGRAPHIC TITLES. 1971. 2d ed. (available directly from the publisher; make checks payable to: Phil Wilson Publishing Co., P.O. Box 13197, Houston, TX 77019). $20.00

GIS NEWSLETTER. 6 issues/year. $12.00

Ordering Information:

Orders must be prepaid. Make check payable to Geoscience Information Society and mail to:

Geoscience Information Society
c/o American Geological Institute
5205 Leesburg Pike
Falls Church, VA 22041