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GEOSCIENCE INFORMATION HORIZONS: CHALLENGES, CHOICES, AND DECISIONS

Edited by

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PREFACE

The Geoscience Information Society (GSIS) was established in 1965 as an independent nonprofit professional society. Members include librarians, information specialists and scientists concerned with all aspects of geoscience information. GSIS has members across the United States and internationally.

GSIS is a member society of the American Geological Institute (AGI) and an associated society of the Geological Society of America (GSA). The GSIS Annual Meeting is held in conjunction with that of GSA; the papers, posters and Society forums are presented as part of the GSA meeting. Oral and poster presentations of the papers in these proceedings were given at the GSA Annual Meeting in Seattle, WA, November 2-5, 2003. Abstracts of these papers can also be found in *Abstracts with Programs – Geological Society of America*, v. 35, 2003.

This proceedings volume is presented in four parts:

I. Papers and abstracts from the GSA Topical Session T48, "Geoscience Information Horizons: Challenges, Choices, and Decisions"
II. Papers and abstracts from the GSA poster session on geoscience information
III. Geoscience Information Society forum and committee reports
IV. GSIS Annual Field Trip summary

The papers are arranged in these proceedings in the order in which they were presented at the Meeting. The authors are solely responsible for the opinions and ideas expressed herein. The editor has made minor formatting, grammatical and spelling corrections in consultation with the authors.

I am grateful to the authors for their contributions, to all of the presenters and forum session chairs, and to Joanne Lerud-Heck, who co-chaired the Topical Session. In addition, all of the GSIS members who worked to make this meeting a success deserve special thanks. Thanks also to two of my colleagues at the University of Illinois Champaign-Urbana Library (UIUC) who read all the papers and offered constructive suggestions: Mary Schlembach, Assistant Engineering Librarian, and Tina Chrzastowski, Chemistry Librarian. I am extremely grateful to Jacquelyn Erdman who did the layout editing for these proceedings. Thanks to Kathryn Thomas, North Dakota State University Government Documents Librarian, and Diana Walter, UIUC, for proof-reading the final camera-ready version.

Lura E. Joseph
GSIS President, 2003-2004

PART I. GSA TOPICAL SESSION T48

GEOSCIENCE INFORMATION HORIZONS: CHALLENGES, CHOICES, AND DECISIONS

Co-conveners:
Lura E. Joseph and Joanne V. Lerud-Heck
November 3, 2003, Seattle, WA, USA

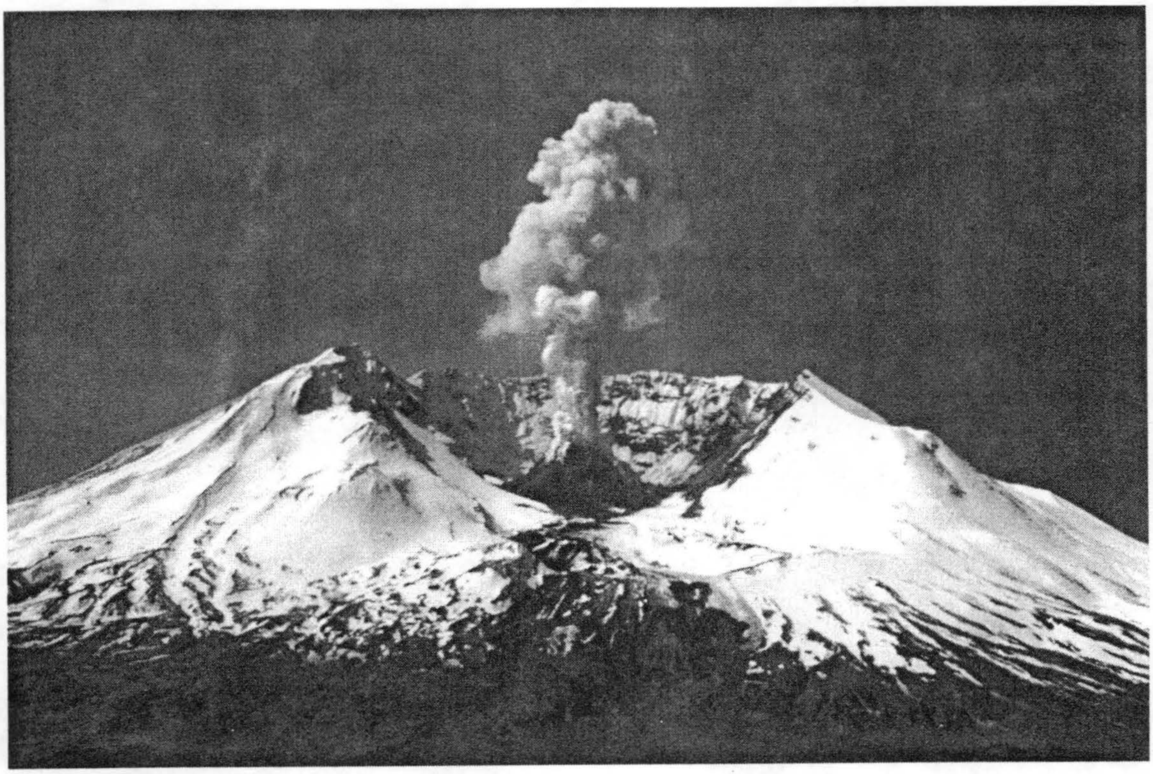

Illustration: Mt. St. Helens, 1984, from Harry's Ridge, used with permission of AGI ImageBank, copyright ©USGS Cascade Volcano Observatory.

INTRODUCTION

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Geoscience information professionals are currently confronted with challenges and opportunities in many areas. New technologies present a variety of choices, and the decisions made will effect geology collections and information users now, and possibly far into the future. Many of the opportunities and challenges exist in the areas of collections and use of collections, and these are the focus of this collection of papers.

The first papers fall into the category of collection development and use. What could be more basic to collections than the survival of the geology library? Connie Manson's paper chronicles the efforts to save a threatened survey library. The next two papers examine the value of specific information resources. Although various individuals have questioned the value of conference proceedings published in journals, results of Michael Noga's study indicate that conference papers in journals are cited as often as research journal articles, and therefore have high value. Charlotte Derksen studied cost and use data related to society monographic series and concluded that these volumes are well used and worth the shelf space and price. One very significant serendipitous finding was the positive impact of analyzing series on amount of use. The next two papers deal with collection development tools. Adonna Fleming's paper discusses vendor selection and consortia agreements and includes a checklist of considerations. The paper by Carolyn Laffoon and Michael Fosmire reports on a study of book reviews in the earth and atmospheric sciences journal literature. There are about 20 to 30 journals with a large number of reviews that can help with collection development decisions in the earth and atmospheric sciences. April Love's paper compares research and publishing patterns in non-traditional vs. traditional geoscience programs. A paper by Michael Fosmire reports on the effective use of information labs for information literacy instruction in the geosciences.

The second group of papers focuses on access to collections. The first four papers deal with electronic format. Sharon Mosher and Robbie Gries report on the proposed multi-society aggregation of geoscience electronic journals. Using extensive data from University of Washington (UW) user surveys, Steve Hiller compares finding and use behaviors of geoscientists and scientists in other fields. Results from the 2001 survey indicates that earth science faculty at UW are active users of the library, and at that time, were more dependent on print resources than most other scientists. Hiller comments that subsequent surveys may find a trend toward heavier reliance on electronic format by geoscientists. Andrea Twiss-Brooks describes linking to the full-text of electronic collections by using SFX technology to facilitate access. Teresa Mullins's paper is a case study of the implementation of the Open Archival Information System Reference Model to manage, access, and archive data sets. The next two papers deal with bibliographic control and access. Patricia Yocum describes a project to improve bibliographic access to USGS Water Resources Investigations Reports. Mary Scott's paper reports on a study of the status of bibliographic control of pre-1900 geoscience literature, a subject of increasing importance as libraries move older material to remote storage. Scott concludes that there is a large amount of pre-1900 geological information, especially outside North America, that should be considered for inclusion in GeoRef or some other electronic database. The last topical paper by Diane Baclawski is a case study of the need to digitally preserve and make accessible a unique earth science collection, and serves as an example of many other similar collections. Finally, a paper by Paulette Bond describing the use of posters in education and outreach is included in Part II, Poster Session.

These interesting and informative papers are the result of the 2003 Geological Society of America Topical Session sponsored by the Geoscience Information Society. It is interesting that nearly all of the speakers chose topics closely related to collection development and access to collections, and many were related to the electronic format. Several point out needs and projects that should be considered by geoscience information professionals in the near future, projects such as increasing bibliographic access to pre-1900 geological information and particular series, and the need for analyzing series. All of the papers are pertinent as we continue to wrestle with challenges and opportunities related to our collections and collection users.

SAVING THE GEOLOGY LIBRARY- A CIVICS LESSON

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Abstract – The Washington state geological survey library was formally established in 1935. Due to severe budget shortfalls, that library was threatened with permanent closure in 2003. That it survived shows that "the system works." How it survived may be a useful example to other organizations facing similar problems.

Preliminary projections, released in December 2002, indicated that Washington state government faced a $2.4 billion revenue shortfall. The Legislature would meet in January 2003, primarily to work on the budget for all state programs. In advance of that, the Governor's proposed budget was released in mid-December 2002. His budget opted to make up the shortfall by cutting all but the most necessary state programs. Those cuts included the Washington state geological survey library and all the Division of Geology and Earth Resources' public information functions. Both librarians would lose their jobs, but what would become of the collection? Would the materials be given to other libraries? Would they be boxed and stored indefinitely? Would they simply be tossed? No one knew.

We immediately fought back. We contacted our external users in industry, academia, and the public about our plight. We could not lobby the Legislature ourselves nor could we tell our supporters what to say. However, we could and did provide our supporters with the information they requested about our situation. We prepared and distributed fact sheets and surveys. We encouraged our supporters to express their opinions to their legislators and to spread the word. Their letters came in a torrent. We heard that the letters were articulate, factual, intelligent, and much appreciated. The cynics are wrong: the system does work. Legislators *do* read their mail and they *do* take it to heart. The Legislature did not fund raises for teachers and they cut many other programs. But they restored $100,000 to our budget, specifically for the library. That $100,000 restored only partial funding for us, so we scrambled to find the rest through various federal grants and other funds. The library lives for at least two more years, when they'll probably go through this all over again.

INTRODUCTION

The Washington state geological survey library was formally established in 1935. Due to severe budget shortfalls, that library was threatened with permanent closure in 2003. That it survived shows that "the system works." How it survived may be a useful example to other organizations facing similar problems.

December 2002 – The Beginning

The Washington State Legislature's budget session would begin in January 2003. Preliminary estimates showed that Washington faced a budget deficit of about $2.4 billion. Crafting the state's budget for the next two years was the Legislature's primary task. In anticipation of that session, the Governor directed all state agencies to examine all their programs closely and to list each of them as high, middle, or low priority. The administrators of the Department of Natural Resources, in cooperation with the State Geologist, provided these rankings for the Division of Geology and Earth Resources (Table 1).

The geology division staff were very concerned about the wisdom of these rankings, believing that no program would go unnoticed with a budget deficit this large. However, they were repeatedly assured that the geology program was simply too small to be noticed so it was unlikely that it would have any significant reductions in funding.

Table 1: Program priorities of the Division of Geology and Earth Resources

High	Geologic mapping (including the state map program, largely funded by the USGS)
Middle	Geologic hazards (earthquakes, volcanoes, landslides, etc., largely federally funded)
Low	Public information (including publication, public interaction, and the geology library)

The rankings for all the Department of Natural Resources' programs were submitted to the Office of Fiscal Management. The Governor used that information to craft his proposed budget, which was released in mid-December, 2002. Given the state's high unemployment rate (among the highest in the nation) and strong public opposition to higher taxes, the Governor's budget proposed to make up the entire $2.4 billion deficit through program cuts. His budget for the Division of Geology and Earth Resources (DGER) provided full funding for the Mapping and Hazards programs, but eliminated all of the Public Information programs, including the geology library, with this language:

Geology - Public Information

This activity involves direct or indirect interaction with the general public, organized groups, and the educational community. Educational activities include support for special events, one-on-one interactions, and group visits by home schoolers. In addition, the division increases the availability of electronic versions of products in easily-accessible formats, and develops additional products directed toward a general audience, including road guides and State Park geologic maps (General Fund-State, General Fund-Private/Local).

General Fund-State funding and associated staffing are eliminated for this activity on an on-going basis. Customers can pursue this information from federal, university, and private-sector sources.

Source: Washington Office of Fiscal Management, December 2002

It is interesting to note that, while the geology library is not specifically mentioned here, the language would abolish the library and eliminate both library positions.

Knowing that this was only the first step in a long process, we immediately went to work.

EFFORTS TO SAVE THE LIBRARY

Staff Reactions

As a state agency, it would be illegal for any staff members to lobby the Legislature or the Governor directly. Information about this situation could be provided as requested however, and it was:

1. Blanket e-mails were sent to hundreds of library users, informing them of the situation and strongly encouraging them to spread the word. Scores of replies were fielded, in every medium, throughout the whole process.

2. The statement that "Customers can pursue this information from federal, university, and private-sector sources" was debunked by comparing the DGER library holdings with other collections. For example, there are 121 monographs about Clark County, Washington in the DGER collection. In checking those monographs in the on-line catalogs of the six Washington state academic institutions, less than half were held at any of those other libraries (Table 2). The University of Washington library had the strongest holdings, but generally had only about 40 per cent of the monographs held at the DGER library. Clearly, library users could "pursue" these materials at other libraries, but they would not find them.

Table 2. The holdings of monographs about Clark County, Washington in the DGER library compared to the holdings in the six Washington state academic libraries.

Library	Number of reports	Percentage of DGER holdings
Washington Division of Geology and Earth Resources library	121	100
Central Washington University	37	30.5
Eastern Washington University	35	28.9
The Evergreen State College	20	16.5
University of Washington	47	38.8
Washington State University	31	25.6
Western Washington University	30	24.8
Any Washington state university	57	47.1

3. The current names and contact information for all the state senators and representatives were compiled and provided, as requested.

4. A fact sheet about the library's collections, users, and services was developed and distributed as requested (Appendix 1).

5. Library literature searches were conducted to gather current information about the value of research libraries for users. One of those papers (Harris and Marshall, 1996) had an excellent questionnaire. That questionnaire was adapted for this situation (Appendix 2) and distributed broadly. More than 150 replies were received. The compiled results were given to Division managers to bolster the case.

6. At every opportunity, people were encouraged to *write their Legislators*. If they thought the geology library and other Division public information programs were a useless waste of tax dollars, they were urged to say so. But if they thought those *were* wise uses of tax dollars, they were urged to say that – but always in their own words. (While some asked for a form letter, that was declined, knowing that such letters would probably be counterproductive.)

7. Division staff contributed to a brochure explaining the Division's programs and services (Appendix 3).

8. These and other materials were posted on a staff member's home website, at http://www.geocities.com/buried_forest/.

The Power of Constituents' Efforts

The most important message from this experience is the power of constituents. Over the years, the DGER library had served a broad spectrum of users and those people rallied to the library's aid. People statewide, from all the user sectors, contacted their legislators by mail, phone, and (or) e-mail. Those advocates included university administrators; educators at all levels; elected county officials; municipal and county workers; federal geologists, biologists, and archaeologists; consulting geologists; retired and current librarians; local business leaders; natural science authors of both technical and popular materials; public interest group lawyers; and many, many more. Many also contacted the Governor, the Commissioner of Public Lands (the elected head of the Department of Natural Resources), and the chairs of the state House and Senate budget committees.

We don't know how many letters were sent, we only heard that the response was massive. We heard back from the Legislature that those communications were informed, articulate, and persuasive. In other cases, supporters lobbied their legislators directly or gave testimony at legislative meetings. Their efforts definitely got the attention of both the House and the Senate.

Other Actions

While the library's supporters were working very hard to keep the library intact and in Olympia, the Department was exploring other ways to save the library.

1. Transferring it to another location

Five of the state universities were considered as hosts for the geology library. The geology department at Central Washington University in Ellensburg was interested in transferring the entire collection to their department but could not provide funds for staffing. Both the University of Washington in Seattle and Washington State University in Pullman were guardedly willing to accept unique materials from the collection but could not accept the entire collection nor keep it intact. The Commissioner of Public Lands offered the entire collection to the President of Eastern Washington University in Cheney (which the university librarian, in conversation with the State Geologist, declined).

Janet Collins, the Map Librarian at Western Washington University in Bellingham, made valiant efforts to save the geology library. She worked very hard, trying to find ways to reconfigure the Map Library to find space to house the entire geology library collection.

2. "Just Digitize It!"

Many DNR administrators were very excited at the prospect of digitizing the entire collection. As they envisioned it, this would be a fast, cheap, and perfect solution: all the materials could be quickly scanned and then posted to the Division's website. They felt there was no need for the physical collection, thus freeing that 1,800 square feet for better uses.

They were disappointed to learn that copyrighted materials could not legally be digitized without royalty payments to the copyright holder. Those materials certainly could not be digitized and posted to a website, nor could they be digitized and copied to compact disk (Jon Olsen, Geological Society of America, personal commun., 2003). The thesis collection and manuscripts have particularly thorny copyright issues. Each university has different copyright policies that have often changed over time and the copyright status for each of the more than

2,000 theses and dissertations in the collection would have to be investigated and verified before they could be digitized.

However, the Department's initiative to digitize the collection continued and they asked the Legislature for $900,000 for the biennium to fund it. (It is unclear how that dollar amount was determined.)

During this same period, some Division staff sought grant funds for the library. A proposal for $30,000 in Library Services and Construction Act (LSCA) funds was submitted but was not funded. A pledge of $50,000 was made from a friendly federal agency specifically to support the library (funds which were later directed to other purposes).

Legislative Actions

In December, 2002 the budget deficit was projected to be $2.4 billion but the May, 2002 number was even worse: a $2.6 billion deficit. The Democratically-controlled House of Representatives was in deadlock, fighting hard to increase revenues rather than eliminate important programs. The Republican-controlled Senate, vowing (like the Governor) to make up the entire deficit through program cuts, released its budget. That document proposed:

1. No tax increases
2. The elimination of many worthy programs
3. The restoration of partial funding – $100,000 for the biennium – for the geology library
4. $900,000 of capital funds to digitize the geology library collection

The House of Representatives, in exhaustion, essentially accepted the Senate's budget. After minor changes, and with the funds for the geology library intact, it was sent to the Governor.

The $100,000 was less than one-third of the previous funding level but it gave the library some funding and, more importantly, "legislative mandate." The $900,000 of capital funds (to be raised by bonds, not by taxes) would ensure the library's survival. While some felt that amount was far less than what it would take to fully digitize the collection, it would go far in digitizing the critical state and federal documents in the public domain. Additionally, close documentation of such a large digitizing project would provide realistic cost estimates to continue such a digitizing program.

We were thrilled! We'd won! The hard work of the many library supporters had succeeded; their letters and testimony had persuaded both houses of the Legislature of the library's value and continuation.

The Governor's Actions

By mid-June victory had apparently been won: the library was saved, both librarians had jobs for the next biennium, and the biggest problem was how to spend $900,000 for digitizing. On June 27, the Governor signed the budget – but line-item-vetoed the digitizing money (because, technically, capital funds cannot be used for such a purpose).

With such little funding available, it was determined that the geology library would continue but with deep cuts. Library staff was reduced from 2.0 FTE to .75 FTE. All paid journal subscriptions were cancelled although some monograph purchases continue. Public access was reduced from 5 days per week to 4 days per week.

CONCLUSIONS

In late 2002, the geology library was proposed for complete elimination. In response, Division of Geology and Earth Resources staff provided information and data to the library's supporters. It was those supporters – that Army of White Knights – who saved the library. Their massive outpouring of vigorous support for the library persuaded the Legislature and the Governor of the library's value.

The most important lesson from this experience however, is that the cynics who say that "one person can't make a difference" are wrong. It is only that one person at a time, many times over, that succeeds.

REFERENCE

Harris, G. and Marshall, J. G., 1996, Building a model business case – Current awareness service in a special library: Special Libraries, Summer 1996, p. 181-194.

Appendix 1.

The DNR Division of Geology and Earth Resources Library: Collection, Services, and User Groups

The Collection

Geologic research is expensive and time-consuming to conduct. Fortunately, the reports of that research typically retain their value and utility for scores of years. However, a single geologic report usually examines only a few aspects of the geology of a given area. To fully understand the geology of an area requires studies of its soils, surficial deposits, bedrock, stratigraphy, paleontology, mineralogy, geochemistry, geochronology, structural geology, hydrology, and geophysics (seismic, gravity, magnetic and other surveys), to name a few. Reports on these subjects are issued by a dizzying and often obscure array of federal, state, and local agencies, universities and research groups, geotechnical companies, and commercial publishers or are published in professional journals.

At the DNR Division of Geology and Earth Resources geology library we aggressively gather all those materials from all those sources and keep them for all to use. We continually seek out materials about Washington geology and add more than 1,000 items about Washington to the collection every year. We intend to have copies of every state, federal, or local document, every journal article, and every conference abstract about the geology, geologic hazards, or mineral resources of the state. As a result, our library has the largest, most complete collection about the geology of Washington State in the world. While some of these materials are also held at other Washington libraries, their collections about Washington geology – even taken together – do not rival ours.

The suggestion in the Governor's proposed budget that these materials are available elsewhere and that "customers can pursue this information from federal, university, and private-sector sources" would only be true if those researchers had infinite time and money, which they do not. A test for materials about the geology of Clark County quantifies that: of those 138 items in the geology library, only 38% are held at the University of Washington, 31% in the merged catalog of Washington State University and Eastern Washington University, 22% at Western Washington University, 20% at Central Washington University, and 15% at The Evergreen State College. Only 48% are held at any Washington state university. Less than 30% are held at the State Library.

While those materials might be available to researchers via interlibrary loan, that is an expensive and lengthy process. The typical interlibrary loan takes two to six weeks, and averages $20 per item. While the cost might be acceptable, the time is not. Consultants generally have hours or days to complete their work. If they had to wait weeks or months for an item, they would go without it and the quality of their work would suffer.

Our library has many unique and exhaustive collections. For example, the periodically updated U.S. Geological Survey topographic maps are invaluable for understanding landform changes, development patterns, and land use. We have the largest collection of those maps of Washington: we have more editions than the University of Washington and even more than the U.S. Geological Survey itself. Dissertations and theses are critical original sources but are usually held only by the originating university. We have copies of *all* these works about Washington geology – more than 2,000 of them – from all universities, internationally.

Because we have gathered these materials in this one place, researchers spend their time with us *using* the materials, not in long, frustrating, money-wasting hours searching for them. For them, time is money, and their time with us is very efficiently spent.

This comprehensive collection is well organized and well indexed. The staff are highly skilled and strive to provide superior reference service to all. The library is used intensively by a broad range of people from industry, government, education, and the public. Those users value the collection and services very highly. The library is an excellent and efficient use of public funds, with clear financial benefit, especially to industry and government researchers statewide.

The Library Users

As a public facility, our library is open to all. These users include:

Geotechnical and engineering industry: These are our most ardent and intense users. They often have very little time to do their studies and certainly cannot afford to do original research. For these companies, time is money. They rely instead on the existing reports. If they can get very rapid, thorough access to that best available science, the validity and defensibility of their work is higher, their clients get a superior product, and the public welfare is better protected. When the companies' work is more efficient, they make a higher profit. Be it information about underground coal mines, hydrogeology, landslide hazards, or a host of other subjects, they come to us because they know we are by far their fastest and most complete source. We are highly responsive to their needs for rapid access and we commonly provide information by fax, e-mail, or PDF. In recognition of how much the geology library is valued by industry, in 1993 the Northwest Geological Society awarded the senior geology librarian its very first Tool of Geology Award for "outstanding contributions to the geotechnical community of the Northwest."

State, local, and federal government: As populations grow and land-use pressures increase, government agencies on all levels need thorough access to geologic and geotechnical information. The mandate to use "the best available science" only increases this need. Like the geotechnical industry, their work would be much more difficult, inefficient, and expensive without ready access to the reports in the geology library. The potential loss of the library would be not just an inconvenience to them but can be viewed as an actual threat to public safety and resource protection. For example, the geology library's extensive collection about known land-slides and unstable slope conditions is of great importance to the Washington Department of Transportation to provide sensible planning and design-level information to them and other public agencies (counties, cities, public utilities). This information is often key to avoiding design errors that devour public dollars and expose the State to unnecessary risk and torte claims.

Ready access to the existing reports can save government money. In 1993, we collected 88 geotechnical reports on the Capitol Campus for the Department of General Administration (GA). Those reports had been contracted by GA from 1952 through 1992 but they had not kept copies and had no knowledge of most of them. Consequently, over the years GA paid for the same studies of the same areas, over and over again. Those 88 reports cost between $440,000 (conservatively) to perhaps $4,000,000. Had they used the reports they'd already paid for, much of that cost would have been saved. Those reports are now available in the geology library and are readily available to GA and to other researchers.

Educators: Our most intense educational users are from smaller colleges (like Evergreen) and from the community colleges. Those college libraries have only meager collections about Washington geology, so the instructors direct their students to us for their research on Washington geology. Those educators know that their students can get their work done far more quickly and thoroughly here than anywhere else. We also assist K-12 students and even the occasional home schooler.

Citizens: Is my house safe from earthquakes? Is this view property I'd like to buy prone to landslides? Citizens frequently come to the Geology Division with these and other questions. We provide general information for them in the library and call on staff geologists to give them more specific information, as needed.

Division of Geology and other DNR staff: Just as with the industry and other government researchers, our staff cannot do their jobs well without efficient access to the existing literature. Without it, they would have to work in ignorance, redo the work at great expense of time and money, or waste precious public dollars chasing the information down. Such inefficiency is especially unacceptable in these budget crisis times.

Internet Access

We also provide information on our website (http://www.wa.gov/dnr/htdocs/ger/index.html):

The Digital Bibliography of the Geology and Mineral Resources of Washington is the index to our full collection. It includes more than 39,000 items and is fully searchable. Since we have the most comprehensive collection about Washington geology in the world, this is therefore the most comprehensive index to Washington geology in the world. New materials are added monthly. In the past 16 months it has received more than 6,300 hits and is on average the 44th most heavily used DNR website. (http://www.wa.gov/dnr/ htdocs/ger/washbib.htm)

The Index to Geologic and Geophysical Mapping of Washington, a PDF version of our former print index, lists more than 2,000 separate maps. This is the most comprehensive index to Washington mapping in the world and is up-dated throughout the year as new maps are received. In the past 16 months it has received more than 5,300 hits and is on average the 52nd most heavily used DNR website. (http://www.wa.gov/dnr/htdocs/ger/mapindex.htm)

Conclusion

The geology library provides substantial benefits to both Washington industry and Washington government, and by extension to all the people of the state. All that, for less than $175,000 per year. What a bargain!

For more information, contact Connie J. Manson, senior librarian at connie.manson@wadnr.gov or 360/902-1472.

Appendix 2.

Questionnaire: The Business Value of the DNR Division of Geology and Earth Resources Library

Please complete and return this questionnaire to Connie Manson, DGER Library, P.O. Box 47007, Olympia, WA 98504-7007 by Feb. 15, 2003. Your replies will help the Division of Geology and Earth Resources (DGER) prepare for the implementation of proposed budget reductions. All individual replies will be kept confidential.

We encourage you to distribute this questionnaire. However, **please do not submit more than one copy per person.**

1. How would you describe your job?
Geologist, hydrologist, engineer, or other earth science professional

__ In government __ Federal __ State __ County __ City
__ In private industry __ Solo practice
__ In a firm with other geologists, engineers, etc.
__ with 1-5 professionals __ with 6-10 professionals
__ with 11-20 professionals __ with > 21 professionals
__Educator __ K-12 __ Community college __ University
Other (please describe) ________________________________

1a. What is your hourly salary
$__________ or billing rate
__________? *Optional*

(Response is optional, but it would help us analyze costs and benefits.)

2. In 2002, how often did you use DGER products or services?
(Please make your best estimate.)

	Never	**1 to 5 times**	**6 to 10 times**	**10 to 20 times**	**More than 20 times**
a. Visited the office or library in Olympia					
b. Contacted the office or library by phone, fax, email, or the Internet					
c. Used the online bibliography					
d. Used the online map index					
e. Read *Washington Geology*					
f. Purchased DGER publications					
g. Used DGER publications					
h. Cited DGER work in publications or reports					

If you answered "never" to all these, please go to Question 15.

3. If you visited the DGER office or library in Olympia in 2002,
   a. About how hours did you spend there (cumulatively) ____
   b. How many miles did you travel, per round trip ________
   d. How many publications did you purchase? _________
   d. What kinds of materials did you use there (e.g., coal mine maps) ____________________

4. For about what percent of your work projects do you use any DGER products or services?

0---------10---------20---------30---------40---------50---------60---------70---------80---------90---------100 %

5. For what kinds of research do you use the DGER library, products, or services? (Check all that apply.)

__ a. geotechnical site analysis
__ b. preparing an EIS
__ c. geologic hazards evaluation
__ d. water resources
__ e. environmental issues
__ f. growth management issues
__ g. land restoration
__ h. habitat issues
__ i. mineral resources
__ j. education and teaching
__ k. school assignments
__ l. mining history or cultural history
__ m. personal research
__ n. other: ____________________________

6. Why do you use the DGER library, products, or services? (Please explain.)

7. As a tool for helping you in your work, how do you rate your experience with the DGER products or services?

	Very poor 1	2	3	4	**Excellent** **5**
a. Working with staff geologists					
b. The library					
c. The online bibliography					
d. The online map index					
e. *Washington Geology*					
f. DGER publications					

8. In 2002 to what extent did the information identified through the DGER library help you in your job?

	Very little 1	2	3	4	**Critically** 5
a. Classic books and/or reports					
b. Theses and other unpublished reports					
c. Journal articles or conference abstracts					
d. Maps					
e. Other (please describe below)					

9. How easy would it be for you to get the materials you need for your job at public libraries or public university libraries?

	Very easy 1	2	3	4	**Extremely difficult** 5
a. Classic books and/or reports					
b. Theses and other unpublished reports					
c. Journal articles or conference abstracts					
d. Maps					
e. Other (please describe below)					

10. How easy would it be for you to get the materials you need for your job without access to the online Bibliography of Washington Geology?

	Very easy 1	2	3	4	**Extremely difficult** 5
a. Classic books and/or reports					
b. Theses and other unpublished reports					
c. Journal articles or conference abstracts					
d. Maps					
e. Other (please describe below)					

11. In 2002, what other indexes did you use to find materials for your work?

	Personal access	Through work	At a library
a. GeoRef			
b. GeoBase			
c. ScienceDirect			
d. Online library catalogs (e.g., UW)			
e. Others (please explain)			

12. In 2002, how frequently did you obtain materials on interlibrary loan for your work?

Never	1 to 5 per year	6 to 10 per year	11 to 20 per year	more than 20 per year

13. In 2002, to what extent did the information identified through the DGER staff, products, or services contribute to your productivity?

	Very little 1	2	3	4	**Extremely** 5
a. Identified critical materials					
b. Obtained critical materials					
c. Found new ideas or methods					
d. Saved time					
e. Avoided duplication of effort					
f. Other (please describe below)					

14. Can you estimate the number of work hours you saved by talking with DGER staff, using the DGER library, or by using other DGER products or services in 2002?

______ hours (Best estimate)

15. In 2002, about how much time did you spend using these other resources to find information for your work? (Please make your best estimate.)

	None	**Rarely** (less than 2 hours per month)	**Occasionally** (2 to 4 hours per month)	**Often** (4 to 8 hours per month)	**Frequently** (more than 8 hours per month)
a. Colleagues and experts					
b. Personal collection of books and journals					
c. Office collection of books and journals (not a formal library)					
d. Company library					
e. Local public library					
f. Local university library					
g. The Internet					
h. Conferences and workshops					
i. Other sources (please describe)					

16. If the DGER staff, library, products, and services were no longer available to you, to what extent would your use of the following methods increase?

	None	**Rarely** (less than 2 hours per moth)	**Occasionally** (2 to 4 hours per month)	**Often** (4 to 8 hours per month)	**Frequently** (more than 8 hours per month per month))
a. Colleagues and experts					
b. Personal collection of books and journals					
c. Office collection of books and journals (not a formal library)					
d. Company library					
e. Local public library					
f. Local university library					
g. The Internet					
h. Conferences and workshops					
i. Other sources (please describe)					

17. If the DGER staff, library, products, and services were discontinued, would your work be affected in any way?
Yes / No (please circle one) Please comment:

18. If you have further comments about this study or suggestions for improving any DGER products, and services, please include them below.

Appendix 3.

What Are the Effects of Eliminating the Public Information Component from the Division of Geology and Earth Resources?

The Division of Geology and Earth Resources (Division) is Washington's geological survey and a part of the Department of Natural Resources (DNR). The Division is a small, highly efficient and productive group that looks out for the health, safety, and economic well being of the citizens of Washington by providing much needed geological information at low cost. One benefit-investment analysis done for another state's geological survey showed about $235 of benefits to the state for every $1 spent by the geological survey. It costs the 6 million citizens of Washington state less than the cost of one postage stamp per person per year to fund DGER.

Governor Locke's proposed 2003-2005 budget has been issued by the OFM. If enacted as is, the portion affecting DNR's Division of Geology and Earth Resources will eliminate 7 FTEs (1/3 of our non-regulatory staff) who have "direct or indirect interaction with the general public, organized groups, and the educational community." Educational activities include support for special events, one-on-one interactions, and group visits by home schoolers. In addition, the division provides electronic versions of many products in easily-accessible formats, and develops additional products directed toward a general audience, including road guides and State Park geologic maps. In fact, however, only about one FTE is devoted to these activities; the rest of the 7 FTEs are devoted to research about Washington's geology and consultations with local governments, state and federal agencies, and the geotechnical community about the history and consequences of unpredictable geologic events, the physical properties of earth materials, and the availability of important resources. This cut is greatly disproportionate to the size of the budget shortfall. The Governor's budget proposal can be viewed at http://www.ofm.wa.gov/budget03/recsum/490rs.htm.

Specifically, the Division's money and staff resources that communicate the results of geologic mapping, geologic hazards, and natural resource information are targeted for elimination. What is the fallout from this loss?

--The Division's geologists produce earthquake hazard maps and hold information workshops to help cities and counties integrate them with their land use and emergency management plans. We also are among the first responders to disasters, documenting the damage in and around Olympia after the Nisqually Earthquake of 2001, as we did for previous earthquakes.

--The Division is on the front line of State information for tsunamis, producing tsunami hazard maps and helping local governments to develop evacuation and emergency management plans. We also participate in the National Tsunami Hazard Mitigation Program to improve tsunami warnings, inundation modeling, and linking responders and planners to pertinent tsunami research (TsuInfo Alert). The Division's geologists represent one of the public's most easily accessible information sources for volcano hazards and volcanism in general. Our geologists map lahars (huge debris flows) from Cascade volcanoes, which present an incalculable risk to large populations. Previous lahars from Mount Rainier inundated the Enumclaw plateau, Auburn, Kent, Renton, and the lower Duwamish as far as the Port of Seattle, as well as the Puyallup River valley through Orting and Puyallup to Tacoma. Others have inundated the Nisqually River Valley to Puget Sound. Lahars from Glacier Peak flow through the Skagit River valley all the way to La Conner. The Division has collaborated with the Cascades Volcano Observatory to date and map these geologic events and also has worked with local governments to produce emergency response plans for each volcano. These data present a much clearer picture of the frequency, magnitude, and extent of past events, and a better understanding of which areas are safe.

--The Division is a recognized leader in landslide hazard identification, mitigation, and emergency response in the state. Our geologists have responded to landslide and debris flow emergencies including Seattle in 1997, Carlyon Beach, Sunset Beach, and Sunrise Beach near Olympia in 1998, and Grand Coulee in 1998, as well as producing new landslide hazard mapping near the Aldercrest landslide near Kelso to assist Cowlitz County with Growth Management planning. Statewide we are age dating and mapping large landslides that likely record ancient earthquakes.

What else will happen?

Since the Governor's budget proposal would eliminate staffing for the Division's public information function, the necessary changes would include:

--Staff geologists would no longer be readily able to advise local governments, companies, or citizens about geologic hazards or other geologic issues. The process of hazard mitigation, however, is an

integrated program of geologic investigation, identification, and assessment coupled with mitigation or avoidance measures. The final implementation step is only effective if we can tailor our products to the needs, capabilities, and strategies of the end user, which requires iterative communication and planning between our staff geologists and local governments.
--The quarterly online journal of pertinent information, *Washington Geology*, would be terminated.
--The library would be permanently closed. The collection, which goes back to the beginning of statehood, would be put in permanent storage. Both librarian positions would be eliminated. To access any of the information now held in the Geology library, the public (or anyone else) will need to visit locations as far apart as Bellingham, Seattle, Spokane, Tacoma, and Olympia in attempts to locate what they need.
--50% of the non-journal collection of the geology library isn't found anywhere else.
--The Library's online products (the Bibliography of Washington Geology and the Index to Geologic Mapping) would not be continued. They might be kept on the Department's website at least for a while, but without updates.
--Division publications would no longer be readily available in print. Only selected materials would be available online.
--All other public information functions would cease. There would be no public outreach, no information available to walk-in visitors, no assistance available to groups such as K-12 students, and no staff available for speaking to interested groups or schools.

We all know the state is faced with a $2.5 billion dollar shortfall this coming biennium. The Governor's budget makes difficult choices for programs statewide. The Legislature will be facing that same budget shortfall, and making those same kinds of difficult decisions when the day is done. However, the Division of Geology and Earth Resources has an important ongoing role to play for the State that has been shown to be cost effective and valuable well beyond the small budget.

CONFERENCE PROCEEDINGS IN GEOSCIENCE JOURNALS: WHAT'S THE USE?

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Abstract – Conference proceedings serve a role in communicating current ideas, interim results, and completed studies to a broader audience than just the conference registrants. They are published as single volumes, parts of monographic series, on CD-ROMs, or on the Web. In some cases, they are published within journals. The value of these journal-published conference papers has been questioned, because 1) they may be considered less valuable than regular journal papers and 2) they increase the size of the journals and perhaps contribute to cost increases. These proceedings get distributed to a wide audience, but subscribers usually do not have a choice on whether they will receive and thereby pay for them. This issue still has relevance with the rise of electronic journal packages, because the price of the packages is often dependent on the price of the constituent journals. If conference proceedings are inflating journal prices, then they are probably inflating journal package prices too.

If conference papers have less long-term value than journal articles, then there should be a difference in their citation patterns. Eight years ago a preliminary study found no significant difference between the citation frequencies of conference papers and research articles that were published during the same year in the same geoscience journals. The study was limited because the data were slowly gathered through CD-ROM searches. The current study examined a larger set of geoscience journals and longer citation periods through searches of the *Web of Science*. Citation frequencies of conference papers in monographic proceedings were also collected. The results show that conference papers in journals are used to the same extent as research journal articles and that some proceedings are used even more.

INTRODUCTION

For several years librarians have questioned the value of conference proceedings published in journals. A search of the PAMnet, an electronic discussion group sponsored by the Physics-Astronomy-Mathematics Division of the Special Libraries Association, reveals several comments on this topic. Bob Michaelson (1999) wrote a representative comment: "Conference proceedings (unrefereed, or refereed to a very low standard – things that they couldn't sell to libraries as separate pieces)." Dana Roth (2000) encouraged "Elsevier to stop publishing conference proceedings as journal issues and return the journal contents to their original function of publishing peer-reviewed research quality articles." Ken Rouse (Holmquist, 2002) expressed similar thoughts on proceedings in journals: "The quality and intensity of the review accorded conference papers that are published in this fashion no doubt varies from conference to conference, depending upon the diligence of the editors, but in general it is assumed that they are held to a lower standard."

Scientists have also expressed their misgivings about proceedings articles in journals. For example, physicist Henry Barschall and professor of physical science Willy Haeberli wrote that "conference proceedings greatly increase the cost of some journals, especially journals that are billed by the volume" (Barschall and Haeberli, 1992, p.79).

Proceedings are not the only materials that are considered journal padding. Dana Roth and Robert Michaelson (2000) thought that the publication of festschriften in journals are also a problem: "Commercial publishers have seized on the scholarly journal as the vehicle of their publication. This unseemly practice, coupled with the publication of conference proceedings, meeting abstracts, and bibliographies are a major factor in the inexorable rise in subscription costs for scholarly journals."

Clearly the quality of articles published in journal proceedings has been questioned, and the publication of proceedings in journals has been considered one of the factors that drive up the cost of journals, particularly from commercial publishers.

METHODOLOGY AND OVERALL RESULTS

This study started with a talk at the 1995 Geoscience Information Society Technical Session, "Information Technology and Services in the Geosciences" (Noga, 1995). Citation frequencies of articles in journals that published proceeding were identified on the *ISI Science Citation Index* on CD-ROM. Unfortunately the searches were very slow, and the study could only look at four journals. The results did not show any difference between the citation patterns of proceedings and non-proceedings articles.

Now *ISI Science Citation Index* is available through the *Web of Science*. This faster Web database offered an opportunity to revisit the issue of proceedings in journals. The current study focuses on the question: *Are proceedings articles in journals used less than the non-proceedings articles in the same journal?* The citation rate is one measure of the use and value of an article. ISI does not collect citations to articles from USGS and other survey publications, several small society journals, and many regional journals. However, the volume of data collected here is considered to reduce these effects.

All the journals in this study had at least one conference proceedings during the sample year. Seventeen journals were chosen (Table 1). They represent most areas of the geosciences. *Global Biogeochemical Cycles* and *Annales Geophysicae* are published by societies, though Springer-Verlag published *Annales Geophysicae* during the sample year. *Pure and Applied Geophysics* is published by Birkhauser. *Geological Journal* is published by Wiley Interscience. *Boreas* is published by Taylor and Francis. *Mineralium Deposita* is published by Springer-Verlag. The rest are published by Elsevier.

The sample year was chosen by identifying the half-life for each journal from *ISI Journal Citation Reports* on the Web from 2002 and picking the closest year in which proceedings were published in that journal. For example, about 50% of the citations to *Global Biogeochemical Cycles* (GBC) in 2002 referred to articles published in 1996 or later. A conference proceedings was published in GBC in 1996, so 1996 became the sample year. This method ensured that there was enough time for articles to be cited.

Citation searches of each sample journal on the *Web of Science* identified the number of times each article was cited through 2003. Extended abstracts, comments and replies, book reviews, and prefaces were excluded from the citation searches.

Three characteristics of the articles were compiled to identify other reasons why an article might have been highly cited. The country of the first author (author affiliation) was identified from the article. If an article title referred to a specific geographic area, then the country was noted. Finally, the primary subject of each article was identified from descriptors in *GeoRef* and *INSPEC*.

Table 1. Sample journals sorted by average number of citations for Proceedings articles

					Average Citations/article		
	Year	**Proc.**	**Total Articles**	**Proc. Articles**	**All**	**Non-Proc.**	**Proceedings**
Global Biogeo Cycles	1996	1	54	9	40	**37**	**54**
Chemical Geology	1995	5	163	43	19	**14**	**33**
Geoch Cosmo Acta	1992	3	322	42	35	**35**	**30**
Lithos	1995	2	46	19	16	**12**	**22**
Boreas	1999	1	40	16	10	**5**	**18**
Precambrian Research	1995	2	81	24	21	**21**	**17**
Tectonophysics	1992	13	390	257	16	**12**	**17**
Palaeo3	1996	2	151	28	12	**11**	**17**
Geological Journal	1990	1	37	24	13	**8**	**15**
Sedimentary Geology	1994	2	110	31	10	**11**	**10**
PAGEOPH 1992	1992	3	71	34	7	**6**	**7**
Annales Geophysicae	1996	2	153	33	7	**7**	**6**
Geomorphology	1998	3	106	32	6	**6**	**6**
Applied Geochemistry	1996	2	167	75	5	**7**	**6**
PAGEOPH 1990	1990	1	107	7	7	**6**	**4**
Mineralium Deposita	1998	1	52	9	6	**7**	**3**
Geothermics	1992	1	71	39	2	**4**	**1**

The last part of the study was a search of citation rates for articles published in twelve monographic proceedings published from 1984 to 1998. These data provide a glimpse of the citation pattern for the standard geoscience proceedings.

Table 1 summarizes the results for the journals. The last three columns compare the citation rate for proceedings articles to the rate for non-proceedings articles and to the rate for all the articles in the sample year. The citation rates of the proceedings articles in the first nine journals are higher than the rates for non-proceedings articles, except for *Geochimica et Cosmochimica Acta* and *Precambrian Research.* There is not much difference in the two citation rates for the rest of the journals, except for *Mineralium Deposita* and *Geothermics*, which had few citations overall.

The next section examines the citation rates for proceedings articles and non-proceedings articles for the specific journals in the study. There is a data summary table for each journal. The citation rates are not reported for some categories because the articles did not form large enough groups for comparison. For example, the citation rates of articles arranged by subject are not reported for Boreas (Table 4).

The appendix shows the citation rates for articles that have the highest number of citations for each journal. The last name of the editor and the letter *P* identify proceedings articles. Articles from non-proceedings thematic issues are noted as well.

SPECIFIC JOURNAL RESULTS

Pure and Applied Geophysics (PAGEOPH)

PAGEOPH tends to publish several proceedings and thematic issues, which are often published as separate monographs. Two years that had proceedings articles were chosen for this study to see whether the choice of sample year influenced the results.

The overall citation rate (7 citations since publication) was the same for both 1990 and 1992. In 1990, there was one small proceedings of papers on deep earth electrical conductivity from the 6th Assembly of the International Association of Geomagnetism and Aeronomy. One of these proceedings papers occurred in the list of 25 highest cited articles (Appendix). The non-proceedings papers had a higher citation rate than the proceedings papers (Table 2), but half of the articles (54 out of 107) in this journal were cited less than 5 times.

Over half of the articles in the 1992 issues of *PAGEOPH* (40 out of 71) were cited less than 5 times, and the citation rates of the proceedings and non-proceedings articles were close (7 citations vs. 6 citations) (Table 3).

Table 2. Citation rate of articles from *Pure and Applied Geophysics* (1990)

PURE AND APPLIED GEOPHYSICS 1990	Number citations	Average citations/article
All journal articles	107	7
All journal articles (excluding high value)	106	6
Proceedings articles	7	4
Non-proceedings articles	100	7
Nonproceedings articles (excluding high value)	99	6
Subject		
seismology	60	7
applied geophysics	14	3
other	33	7
other (excluding high value)	32	5
Author Affiliation		
USA	33	6
other	74	7
other (excluding high value)	73	6
Geographic Area		
any area	24	5
none	83	7
none (excluding high value)	82	5

Table 3. Citation rate of articles from *Pure and Applied Geophysics* (1992)

PURE AND APPLIED GEOPHYSICS 1992	Number citations	Average citations/article
All journal articles	71	7
Proceedings articles	34	7
Non-proceedings articles	37	6
Subject		
seismology	46	8
other	25	5
Author Affiliation		
USA	29	5
other	42	8
Geographic Area		
any area	26	5
none	45	7

Almost half of the articles in 1992 and 14 of the 25 highest cited articles (Appendix) were published in the 3 proceedings. Two papers from seismology proceedings topped the list. One came from a conference on applications of fractals and chaos to earth science problems. The other came from a memorial workshop on mining induced seismicity.

The results for these two years of *PAGEOPH* show that some proceedings are more useful than others. The three proceedings in *PAGEOPH* 1992 were more useful than the single proceedings in *PAGEOPH* 1990. In fact, they included the highest cited articles in that journal during 1992.

Boreas

Over a third of the articles in *Boreas* were part of a proceedings, *Late Quaternary History of Northern Russia and Adjacent Shelves*. The proceedings papers were cited substantially more (18 vs. 5 citations) than other articles in the journal (Table 4). For once, articles on Russia were cited more than articles on other geographic areas (14 vs. 8 citations). The Web of Science indexes few Russian language journals, which would be expected to contain many citations to articles on Russian geographic areas. As a result, the citation count for articles on Russia would be expected to be low.

Papers in *Boreas* by Norwegian authors were cited considerably more than papers from other countries (20 vs. 7 citations). Most of these papers came from the proceedings. Perhaps the location of the conference, Strasbourg, and the lack of Russian authors contributed to the relatively high citation rate of the proceedings articles.

Table 4. Citation rate of articles from *Boreas* (1999)

BOREAS	Number citations	Average citations/article
All journal articles	40	10
Proceedings articles	16	18
Proceedings articles (excluding high value)	15	13
Non-proceedings articles	24	5
Author Affiliation		
Norway	10	20
other	30	7
Geographic Area		
Russia	13	14
other areas or no area	27	8

Lithos

Lithos only had 46 articles in the sample year, 1995, but 19 were part of two proceedings (Table 5). The average citation rate of these articles was considerably higher than the rate for non-proceedings articles. Six of the ten highest cited articles came from these proceedings (Appendix).

The three articles with the most citations were part of a proceedings on picrites, komatites, and their ore deposits. The highest cited article noted that "the introduction of high temperature, high magnesium, komatiitic and picritic magmas into the Earth's upper crust has given rise either directly or indirectly to many of the world's major ore deposits" (Keays, 1995, p.1). Clearly the subject of this proceedings would be of interest to other authors, and use would be expected to be high.

The second proceedings was *The Xenolith Window to the Lower Crust*. As the preface noted, "accidental xenoliths of lower crustal and upper mantle material, dislodged and carried to the surface by mantle derived magmas, provide pieces of a jigsaw which can be used to piece together a picture of a complex crust mantle boundary zone" (O'Reilly and Hensen, 1995, p.155). The topic is timely, and the conference was held in conjunction with an International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) General Assembly and as part of the International Geological Correlation Programme (IGCP) Project 304, "Lower Crustal Process." These characteristics of the proceedings might predict high use.

Geological Journal

Geological Journal had only 37 articles in the sample year. Two-thirds were part of a proceedings. If proceedings articles are not important, then clearly the non-proceedings articles in this journal should stand out. Instead, the opposite trend was observed (Table 6). The average number of citations for the proceedings articles was almost twice that of the non-proceedings articles. Eight out of the ten highest cited articles were from a proceedings on granite (Appendix). This conference proceedings was a festschrift.

Table 5. Citation rate of articles from *Lithos* (1995)

LITHOS	Number citations	Average citations/article
All journal articles	46	16
Proceedings articles	19	22
Non-proceedings articles	27	12
Subject		
Igneous and metamorphic petrology	24	15
other	22	18
Author affiliation		
Australia	8	20
France	8	15
other	30	16
Geographic area		
any area	37	16
none	9	18

Table 6. Citation rate of articles from *Geological Journal* (1990)

GEOLOGICAL JOURNAL	Number citations	Average citations/article
All journal articles	37	13
Proceedings articles	24	15
Non-proceedings articles	13	8
Subject		
igneous petrology	19	18
other	18	7
Author Affiliation		
United Kingdom	13	9
other	24	15

The highest cited paper used the Flamanville Granite from France as an example of a syntectonically expanding pluton. The second highest cited article examined the evolution of granitoid suites after a major orogenesis. These proceedings/festschrift articles were clearly not padding to be forgotten after the birthday of the honoree. Without the top articles from this proceedings, this 1990 volume of the *Geological Journal* would have had 42% less citations.

Palaeogeography, Palaeoclimatology, Palaeoecology (Paleo3)

Articles from the two proceedings in *Paleo3* were cited more than the non-proceedings articles (Table 7). One proceedings focused on the use of biogenic phosphates as paleoenvironmental indicators. The relatively high use of the articles reflects interest in measures of climate change. The other proceedings focused on environmental issues in the Tibetan Plateau and surrounding areas. Though the meeting was held in China, only two of the primary authors came from there. Articles from Asian countries do not get cited as much in the *Web of Science*, because it does not pick up regional non-English journals. The highest cited articles published in *Paleo3* in 1996 had authors from France and the USA.

Global Biogeochemical Cycles

One proceedings was published in *Global Biogeochemical Cycles* during the sample year, and the articles in the proceedings were cited more than the non-proceedings articles (Table 8). The same result holds even if the highest citation value of the proceedings articles and the two highest values of the non-proceedings articles were excluded to keep from skewing the results.

Six of the 25 highest cited articles come from proceedings (Appendix). Two of the three highest cited articles presented a biosphere model, and they had some authors in common. It did not matter that one of the articles was part of a proceedings. It was probably cited because the article contained a useful model.

Table 7. Citation rate of articles from *Paleo3* (1996)

PALAEOGEOGRAPHY PALAEOCLIMATOLOGY PALAEOECOLOGY	Number citations	Average citations/article
All journal articles	150	12
Proceedings articles	28	17
Non-proceedings articles	122	11
Subject		
stratigraphy	73	10
Quaternary geology	47	15
other	30	13
Author Affiliation		
USA	49	14
France	24	14
other	77	10
Geographic Area		
any area	103	11
none	47	15

Table 8. Citation rate of articles from *Global Biogeochemical Cycles* (1996)

GLOBAL BIOGEOCHEMICAL CYCLES	Number citations	Average citations/article
All journal articles	54	40
Proceedings articles	9	54
Non-proceedings articles	45	37
Subject		
Atmospheric science	33	38
other	21	42
Author Affiliation		
USA	26	38
other	28	41

Chemical Geology

Proceedings articles from *Chemical Geology* were used more than non-proceedings articles (Table 9). The highest cited paper from 1995 (Appendix) was not only an article from a proceedings, but it had over 500 cites, which is a very high citation frequency for a geoscience paper. Even when this article was excluded from the calculation, proceedings articles were cited more than non-proceedings articles.

Seven of the top 10 cited articles in *Chemical Geology* were part of proceedings. Five came from a conference, "Chemical Evolution of the Mantle," that was held at the IAVCEI Conference in Australia and cosponsored by the International Union of Geological Sciences (IUGS) Commission on Igneous and Metamorphic Petrology (CIMP). W.F. McDonough was both the editor of the proceedings and the author of its highly cited article on the composition of the earth. Here is a definitive example of an important paper that has been presented at a conference and published in a proceedings. The other four articles from this proceedings that have a large number of citations concern: 1) the nature of the sub-continental mantle, 2) Cretaceous plateau volcanism in the southeast Indian Ocean, 3) an indicator of geochemical processes in the crust-mantle system, and 4) experimental petrochemistry of some elements and implication for core formation and the mantle's earth history. The results show that these were all important geochemical articles.

CIMP sponsored another meeting on the "Evolution of Mafic Magnetism through Time" in France. Only one of the papers that resulted from this conference was highly cited. It presented a new summary of the phase relationships for kornatiite magmas.

Three papers from a meeting on "Analytical Spectroscopy in the Earth Sciences" that preceded the XXVIII Colloquium Spectroscopicum Internationale were cited more than the average for all journal articles in *Chemical Geology* in 1995. Nine articles were cited less than the average, but the three highest cited articles all concerned general geochemistry. The highest cited article, by Li, was an analysis of the measurement of soil contamination.

Table 9. Citation rate of articles from *Chemical Geology* (1995)

CHEMICAL GEOLOGY	Number citations	Average citations/article
All journal articles	163	19
All journal articles (excluding high value)	162	16
Proceedings articles	43	33
Proceedings articles (excluding high value)	42	22
Non-proceedings	120	14
Subject		
geochem of rocks, soils, and sediments	47	29
geochem of rocks…(excl high value)	46	18
general geochemistry	28	18
isotope geochemistry	26	15
geochronology	19	15
economic geology of ore deposits	17	11
other	26	19
Author Affiliation		
USA	28	19
United Kingdom	23	19
France	22	18
Germany	14	19
Canada	14	16
Australia	11	69
Australia (excluding high value)	10	23
other	51	12
Geographic Area		
any area	81	14
none	82	25
none (excluding high value)	81	19

Three papers from a meeting on the processes that link the earth's mantle to the ocean-atmosphere system were among the 25 highest cited articles from this journal. The meeting was sponsored by the European Association for Geochemistry, and it was held in Amsterdam.

Tectonophysics

Tectonophysics is perhaps the best example of a geoscience journal that publishes proceedings. In 1992, there were 13 proceedings, which accounted for two-thirds of the articles (Table 10). Twenty-two of the top 25 cited articles were from proceedings

Table 10. Citation rates of articles from *Tectonophysics* (1992)

TECTONOPHYSICS	Number citations	Average citations/article
All journal articles	390	16
All journal articles (excluding high value)	389	16
Proceedings articles	257	17
Non-proceedings articles	133	12
Nonproceedings articles (excluding high value)	132	12
Subject		
structural geology	174	17
Solid-earth geophysics	60	17
seismology	56	12
igneous petrology	20	24
igneous petrology (excluding high value)	19	13
geochem of rocks, soils, and sediments	18	15
engineering geology	15	16
stratigraphy	15	15
other	32	12
Author Affiliation		
USA	53	16
France	38	17
United Kingdom	32	26
United Kingdom (excluding high value)	31	19
Germany	31	15
Russia	30	9
Australia	29	20
Japan	22	13
Canada	16	13
India	16	8
Spain	13	20
Italy	13	12
Switzerland	12	27
other	85	15
Geographic Area		
Africa	43	14
Australia	28	22
Mediterranean	19	20
Scandinavia	17	12
Italy	12	8
USA	12	12
India	12	12
other area	158	16
none	89	18
none (excluding high value)	88	16

(Appendix). The main exception to this trend was the highest cited article (237 citations), which was not from a proceedings. It was a model on granitic magma transport by fracture propagation, which claimed to have "numerous, far-reaching, petrological and rheological consequences" (Clemens, 1992, p. 339).

Overall, the proceedings articles were cited more than non-proceedings articles. Three of the proceedings were highly cited (Table 11). The top proceedings contained selected papers from the "Geodynamics of Rifting Symposium," which was held in Switzerland in 1990. The articles were edited by Peter A. Ziegler and published in three issues. Two parts were publications of the International Lithosphere Program. Most of the primary authors came from Western Europe and the United States.

C.L. Fergusson and R.A. Glen edited a highly cited collection of papers from a conference on the Lachlan Fold Belt and related orogens. Almost all the first authors were Australian. This is an example of a specialized conference proceedings that receives a lot of use.

The third highly cited proceedings also came from a specialized conference. Enric Banda and Pere Santanach edited a selection of papers from a workshop on the geology and geophysics of the Valencia Trough. This meeting was organized by the Working Group 3 of the International Lithosphere Program.

One little cited proceedings was the "IASPEI (International Association of Seismology and Physics of the Earth's Interior) Symposium on Detail Structure and Processes of Active Margins," which was held in Istanbul and edited by Hideki Shimamura. One article on active margin processes in Antarctica was cited at the average rate for articles published during 1992. The rest were hardly cited at all. Perhaps part of the reason for the low citations was the 2 ½-year delay in publication after the meeting.

Another little cited proceedings was a collection of papers from two special sessions of the "6th Scientific Assembly of the International Association of Geomagnetism," edited by Ralph R.B. Von Frese and Patrick Taylor. The sessions focused on geophysical anomalies of Gondwana and interpretation of long-wavelength magnetic anomalies. Three of the articles were never cited in journals indexed by the *Web of Science*.

The lowest cited proceedings was a conference on geodesy and seismology which was held in Armenia and edited by Boulanger. Thirteen articles were never cited. Only one article, a paper by E. Lo Giudice on very shallow earthquakes and brittle deformation in active volcanic areas, was cited heavily (56 citations). This is a good example of a proceedings which has only one major paper.

Precambrian Research

One of the *Precambrian Research* articles, on studying Neoproterozoic stratigraphy with C-isotopic chemostratigraphy, was cited 174 times (Appendix). It was published in a thematic issue entitled *Sequence Stratigraphy and the Interpretation of Neoproterozoic Earth History*. Other articles from this special issue were also cited highly.

Table 11. Proceedings in *Tectonophysics* (1992)

Editor of Proceedings	No. of Proceedings Articles	% of Proc. Articles cited more than Mean for all Tectonophysics Articles	Mean citations for articles from Proceedings
Altherr	8	37 %	17
Banda	20	60 %	24
Boulanger	30	3 %	3
Ebinger	22	18%	8
Fergusson	23	56%	27
Magloughlin	9	44%	24
Mikumo	23	52%	24
Oliver	22	36%	18
Perroud	8	25%	11
Pesonen	18	5%	10
Shimamura	8	0%	4
Von Frese	14	7 %	6
Ziegler	52	69%	28

Excluding the highest cited article, articles from the two proceedings were cited as much as the non-proceedings articles (Table 12). Only one of the proceedings articles, a review of geochronological constraints on orogenic events in a specific terrane, was among the ten highest articles. It was part of a proceedings of a field workshop on applying geochronology to field-related geological problems.

The other proceedings published in 1995 in *Precambrian Research* focused on the East Antarctic Craton. This conference was formed as an intermediate meeting between the quadrennial International Antarctic Earth Science Symposia. Such a conference might be expected to have fewer citations because its scope was reduced, but the articles were cited at the same rate as other articles in this journal.

Annales Geophysicae

One large proceedings (33 papers) and one small proceedings (4 papers) were published in 1996 in *Annales Geophysicae* (Table 13). The proceedings articles were cited at the same rate as the non-proceedings articles. Only five of the proceedings articles were among the 25 highest cited articles for this journal (Appendix). All were from a workshop of the European Incoherent Scatter Association.

Annales Geophysicae was one the few journals in this study where the citation rate varied much according to the affiliation of the primary author. Papers by German authors were cited 15 times, twice as much as the papers overall (7 citations). *Annales Geophysicae* is published in Germany, and perhaps the editors were more familiar with the work of the German authors, which came mainly from the major research institutes in Germany. In contrast, Russian articles were cited at a low rate (5 citations).

Applied Geochemistry

Proceedings articles from *Applied Geochemistry* were cited at the same rate as the non-proceedings articles (Table 14). The three highest cited articles all came from the same proceedings on environmental chemistry (Appendix). One article focused on the remediation of land contaminated by heavy metals. Another was concerned with heavy metal decontamination by plants. The third article was a study of contamination in the vicinity of smelters in Russia. Most of the papers that cited this article also looked at geochemistry or heavy metal contamination in Arctic environments.

Table 12. Citation rates of articles from *Precambrian Research* (1995)

PRECAMBRIAN RESEARCH	Number citations	Average citations/article
All journal articles	81	21
Proceedings articles	24	17
Non-proceedings articles	57	21
Nonproceedings articles (excluding high value)	56	19
Subject		
structural geology	18	18
geochronology	18	18
stratigraphy	17	33
stratigraphy (excluding high value)	16	24
igneous petrology	13	16
other	15	13
Author Affiliation		
Australia	21	18
Canada	10	27
other	50	19
other (excluding high value)	49	16
Geographic Area		
Australia	22	18
Antarctica	9	16
Canada	8	21
other area	42	22
other area (excluding high value)	41	18
none	0	0

Table 13. Citation rates of articles from *Annales Geophysicae* (1996)

ANNALES GEOPHYSICAE	Number citations	Average citations/article
All journal articles	153	7
Proceedings articles	33	6
Non-proceedings articles	120	7
Subject		
space science	74	7
atmospheric science	72	7
other	7	3
Author Affiliation		
United Kingdom	32	8
Germany	21	15
France	21	6
Russia	12	5
other	67	5
Geographic Area		
any area	13	6
none	140	7

Table 14. Citation rates of articles from *Applied Geochemistry* (1996)

APPLIED GEOCHEMISTRY	Number citations	Average citations/article
All journal articles	167	5
Proceedings articles	75	6
Non-proceedings articles	92	7
Subject		
environmental geology	73	7
isotope geochemistry	25	8
geochem of rocks, soils, and sediments	19	6
hydrogeology	16	7
other	34	5
Author Affiliation		
USA	28	6
United Kingdom	29	7
other	110	6
Geographic Area		
USA	11	5
Poland	10	5
United Kingdom	9	6
other area	69	6
none	68	8

Sedimentary Geology

Two proceedings were published in *Sedimentary Geology* in 1994. The proceedings edited by George Dardis on subglacial processes, sediments, and landforms contained 6 of the top 25 cited articles (Appendix). The articles in the other proceedings were not cited much, though they were part of a session at the 29th International Geological Congress in Japan. Overall, the articles from these proceedings were cited as much as the non-proceedings articles (Table 15).

Articles by British primary authors, from the proceedings edited by Dardis, were cited more than other proceedings articles. The two highest cited proceedings articles concerned the development of new research techniques.

Table 15. Citation rates of articles from *Sedimentary Geology* (1994)

SEDIMENTARY GEOLOGY	Number citations	Average citations/article
All journal articles	110	10
Proceedings articles	31	10
Non-proceedings articles	79	11
Subject		
sedimentary petrology	62	9
Quaternary geology	26	11
other	22	12
Author affiliation		
United Kingdom	22	13
USA	15	8
other	73	10
Geographic area		
any area	85	9
none	25	15

Geomorphology

The articles from *Geomorphology* in 1998 were not cited often (Table 16). There is no difference between the overall citation patterns of the proceedings and non-proceedings articles. There is little difference in the citation patterns according to primary author affiliation, subject, or geographic area. The three proceedings have several little-cited articles, but so does the rest of the journal. One journal issue was a selection of papers from a conference on aeolian environments in Southeast Asia. The editor acknowledged that "the range of topics is eclectic" (Hesp, 1998, p.111). Two of these articles were among the highest cited articles in *Geomorphology* in 1998. One article was an evaluation of models on wind-blown sand on beaches. The other was a study of the aerodynamic maintenance of barchans. Perhaps they were the only "eclectic" articles that had wide application.

Another proceedings concerned climate change in the Mediterranean region. This type of proceedings often has interest to researchers in the geographic area, but one of the papers was among the highest cited articles for this journal from 1998. The authors studied runoff and erosion processes after a forest fire in the Mount Carmel area. Perhaps other researchers were interested in this article because of the discussed processes rather than just the specific region.

A third proceedings also focused on the Mediterranean region, specifically the geomorphic response of the area and other arid areas to climate change. Two of the articles were cited more than the others. These articles focused on processes in arid environments, not just on the specific study areas.

There was a thematic issue on applications of remote sensing and GIS in geomorphology, and again the highest cited article concerned modeling, in this case modeling floodplain inundation with GIS and remote sensing. Another issue had several articles on mass movement in the Himalayas, which might be considered a "hot topic," but the citations to these articles were low.

Geochimica et Cosmochimica Acta

The overall citation rate for proceedings articles in *Geochimica et Cosmochimica Acta* was less than that of non-proceedings articles (Table 17). However, only 13% of the 322 journal articles came from the three proceedings. None of the top 25 cited articles came from proceedings, though a few came from a thematic issue in memory of Robert M. Garrels (Appendix). There were 26 articles in the thematic issue, and 18 were cited less than the average citation rate for all the journal's articles in 1992. This result fits the pattern of festschriften that may have just a few important papers.

Table 16. Citation rates of articles from *Geomorphology* (1998)

GEOMORPHOLOGY	Number citations	Average citations/article
All journal articles	105	6
Proceedings articles	32	6
Non-proceedings articles	73	6
Subject		
geomorphology	60	7
Quaternary science	22	5
Other	23	6
Author Affiliation		
USA	31	6
United Kingdom	13	7
Other	61	6
Geographic Area		
any area	77	5
None	28	8

Table 17. Citation rates of articles from *Geochimica et Cosmochimica Acta* (1992)

GEOCHIMICA ET COSMOCHIMICA ACTA	Number citations	Average citations/article
All journal articles	322	35
Proceedings articles	42	30
Non-proceedings articles	280	35
Subject		
geochem of rocks, soils, and sediments	98	34
isotope geochemistry	54	44
petrology of meteorites and tektites	28	38
hydrochemistry	24	38
mineralogy of non-silicates	19	34
general geochemistry	18	34
igneous and metamorphic petrology	16	21
geochronology	13	34
extraterrestrial geology	13	37
other	39	24
Author affiliation		
USA	186	35
Canada	29	30
France	15	31
Australia	14	31
United Kingdom	14	51
United Kingdom (excluding high value)	13	37
Germany	11	33
other	53	32
Geographic area		
USA	16	26
any area	67	32
none	239	36

Some of the proceedings papers were highly cited. All five articles from a workshop on Mare volcanism and basalt petrogenesis were cited more than the average article from this journal, and two were in the top 25 cited articles in *Geochimica et Cosmochimica* 1992.

Another proceedings contained 23 papers from the Third Biennial Pan-American Conference on Fluid Inclusions. Four of these papers were cited more than the average paper from this journal. The highest cited article presented a method for salinity estimates of fluid inclusions. The majority of articles from this conference were not cited much. Their citation rate did not show any relationship to specific geographic study areas, subjects, or author affiliations. This result fits the expectation that many proceedings articles are not as useful as regular journal articles.

The third proceedings was actually a festschrift. The highest cited article was a paper on the evolution of the earth's mantle by W.F. McDonough. He was also the author of the highest cited article in the 1995 issues of *Chemical Geology*. The citation pattern of the rest of the articles in this proceedings was similar to that of the non-proceedings articles.

Mineralium Deposita

The seven proceedings articles from *Mineralium Deposita* were cited very little (Table 18). They came from the international conference "Formation and Metamorphism of Massive Sulphides" held in Norway, and were edited by Craig. The proceedings was also a festschrift. The highest cited articles in *Mineralium Deposita* came primarily from a thematic issue on the Iberian Pyrite Belt (Appendix).

Geothermics

Geothermics had an overall low citation frequency (Table 19). The citation frequency of the proceedings articles was probably low because the papers referred to examples of the industrial uses of geothermal energy at specific locations. It is interesting to note that only half the papers of the conference were published. They were selected by 4 editors and reviewed by 32 external referees. Still, few citations to these papers were found in the *Web of Science*. The journals that did cite these papers might have been regional journals that are not covered by the *Web of Science*. Perhaps it would have been better to publish this proceedings separately.

Table 18. Citation rates of articles from *Mineralium Deposita* (1998)

MINERALIUM DEPOSITA	Number citations	Average citations/article
All journal articles	52	6
Proceedings articles	9	3
Non-proceedings articles	43	7

Table 19. Citation rates of articles from *Geothermics* (1992)

GEOTHERMICS	Number citations	Average citations/article
All journal articles	71	2
Proceedings articles	39	1
Non-proceedings articles	32	4
Subject		
geothermal	55	2
other	16	4
Author Affiliation		
Iceland	19	2
New Zealand	26	3
other	26	2
Geographic Area		
New Zealand	23	3
other	29	2
none	19	2

Monographic Proceedings

The perception that proceedings are less important than journals was the impetus for this study. If this perception holds, then papers in monographic proceedings should be cited less than regular journal articles. Articles from 13 monographic proceedings (Table 20) were searched in the citation index of the *Web of Science*. The proceedings were randomly selected from the shelves of the MIT Lindgren Library. They span a 15-year period and several subjects in geoscience. Some of the proceedings were cited as a whole, but most of the citations referred to specific papers. Except for one proceedings which had 100 citations per article, the average number of citations was very low (5 citations/article), and lower than the overall journal citation rate (16 citations/article). Bibliographic databases focus more on journal articles than proceedings. Perhaps some of these papers were hidden from users who did not actually examine the proceedings volume. Nevertheless these were all English-language proceedings from major commercial and society publishers.

The articles in the proceedings *Processes in Continental Lithospheric Deformation* had a very high citation rate. Three articles each had over 170 citations in 15 years. This citation rate is much higher than the rate for most journal articles in this study, though the proceedings was published only three years before the oldest journal, *PAGEOPH* 1990. This book was the only proceedings in the sample published by an American professional society, the Geological Society of America.

DISCUSSION

Proceedings are usually considered to be less important than journal articles, as indicated by the comments in the introduction. It follows that proceedings in a journal should be less important than non-proceedings articles in the same journal. This study does not support that expectation, at least for geoscience journals (Table 21).

Table 20. Monograph Proceedings

Title	Pub. Year	Total Cites	Cites/ article
Adsorption of Metals by Geomedia	1998	144	5
Volcano Instability on the Earth and Other Planets	1996	280	11
Hydrocarbon Habitat in Rift Basins	1995	184	11
Pacific Neogene	1992	74	5
Gorda Ridge	1990	132	6
Oceanographic and Geophysical Tomography	1990	25	2
Processes in Continental Lithospheric Deformation	1988	802	100
Geology of Tin Deposits	1988	56	1
Rock and Soil Rheology	1988	1	0
Chemical Events in the Atmosphere and their Impact on the Environment	1986	5	0
Sedimentary Evolution	1985	183	8
Patterns of Change in Earth Evolution	1984	196	9

Table 21. Citation rate for proceedings articles relative to rate for non-proceedings articles

Citation Rate for Proceedings Articles relative to Rate for Non-Proceedings Articles

HIGHER (Citation rate of proceedings articles is 20% higher than citation rate for non-proceedings articles.)
Global Biogeochemical Cycles, *Chemical Geology*, *Lithos*, *Boreas*, *Tectonophysics*, *Paleo3*, and *Geological Journal*

SAME (Citation rate of proceedings articles is less than 20% higher or lower than citation rate of non-proceedings articles.)
Sedimentary Geology, PAGEOPH 1990, PAGEOPH 1992, *Annales Geophysicae*, *Applied Geochemistry*, *Geomorphology*, *Precambrian Research* and *Geochimica et Cosmochimica Acta*

LOWER (Citation rate of proceedings articles is 20% lower than citation rate for non-proceedings articles.)
Mineralium Deposita and *Geothermics*

Perhaps proceedings of international conferences on broad topics would be cited more than other conferences proceedings because there would be a certain amount of selectivity in the acceptance of papers. In this study, several proceedings covered international conferences. One of the highest cited proceedings was McDonough's collection of papers from the IAVCEI in *Chemical Geology*. However, one of the lowest cited proceedings was also an international conference, "Geodesy-Seismology: Deformation and Prognosis," which was published in *Geothermics*. This meeting was held in Armenia, and many of its primary authors were from Eastern Europe and the Commonwealth of Independent States.

One of the conference proceedings in *Sedimentary Geology* was associated with the 29th International Geological Congress in Japan. The articles in this proceedings were cited little, even though this is one of the major recurring conferences in geoscience.

Conference proceedings that were held in connection with international research programs tended to be cited highly. Two examples are the proceedings edited by Ziegler and Banda in *Tectonophysics*.

According to commentary in PAMnet, there should at least be low citation rates for festschriften. This study provided some support for this expectation. The only proceedings in *Mineralium Deposita* was a festschrift, and the papers were cited very little. Most of the papers in the two festschriften in *Geochimica et Cosmochimica Acta* were cited little, but each had at least one highly cited paper. These results fit Paul Bohannan's experience with festschriften where he noted that he did not find interest in any of the papers in a festschrift except the specific article that he wanted (Bohannan, 1969).

An opposite example comes from *Geological Journal*. The highest cited articles in the journal came from a proceedings that was also a festschrift. Perhaps the important factor is not whether the volume is a festschrift, but whether the papers were selected and edited well.

The proceedings that were published in monographs would be expected to have lower citation rates than those in journals, because of lower distribution. This indeed was the result in the group of monographs that were studied. However, one had a very high citation rate. One characteristic that set this proceedings apart from the others was its publication in a major monograph series by one of the most important societies, the Geological Society of America.

CONCLUSIONS

This study shows that geoscience proceedings articles are used. They are cited as much as non-proceedings articles in the same journal. Several editorial prefaces for these proceedings mentioned that only some of the conference papers were chosen for the publication. The editors emphasized that the papers were expanded after the meeting, and there was evidence of some review before publication. If the proceedings articles were accepted at a lower standard than the regular research articles in the journal, then there should have been a noticeable difference in the overall citation rates. The results did not show this.

The geographic area, subject, and primary author affiliation of the articles did not show a clear relationship with the citation rate. However, a conference proceedings dominated by authors from non-Western countries was usually not cited much. Of course, journals from these countries may hold the bulk of citations, but the *Web of Science* does not index much of this literature.

Perhaps the padding of journals with low-quality proceedings occurs more in physics and chemistry journals than in geoscience journals. However, this study does not provide evidence that the proceedings articles in geoscience journals are of general lower quality than other articles, as measured by citations. This study does not support the contention that geoscience journals are expensive because they include extraneous proceedings articles.

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APPENDIX.

Highest Cited Articles for each Journal

Each line lists the number of citations for the article, whether it is part of a proceedings (P), and the editor of the proceedings. Articles that are part of thematic issues are noted also.

PAGEOPH 1990			PAGEOPH 1992			Boreas		
Citations	*P?*	*Editor*	*Citations*	*P?*	*Editor*	*Citations*	*P?*	*Editor*
82			33	P	McGarr	89	P	Larsen
40			29	P	King	45	P	Larsen
29			25			29	P	Larsen
27			23			20	P	Larsen
26			20			19	P	Larsen
20			19			17	P	Larsen
19			19			15	P	Larsen
17			17			12		
16			17	P	King	11		
15			17			10		
14		thematic	16	P	McGarr	9		
13			16	P	Okal	9		
13			16	P	McGarr	8		
12			15	P	McGarr	8	P	Larsen
12			15			7	P	Larsen
12			12	P	King	7	P	Larsen
11			11	P	King	7	P	Larsen
11			11	P	Okal	7	P	Larsen
10			10	P	McGarr	6		
10			9	P	McGarr	6		
10	P	Campbell	9			6		
9			8	P	King	5		
9			8			5	P	Larsen
9			7			5	P	Larsen
8			6	P	Okal	4		

Lithos			Geological Journal			Palaeo Palaeo Palaeo		
Citations	*P?*	*Editor*	*Citations*	*P?*	*Editor*	*Citations*	*P?*	*Editor*
58	P	Campbell	66	P	Atherton	77		
51	P	Campbell	50	P	Atherton	45		thematic
45	P	Campbell	47	P	Atherton	43	P	Longinelli
37	P	O'Reilly	34	P	Atherton	40		
31			26	P	Atherton	40		thematic
31	P	O'Reilly	25			37		
28			24	P	Atherton	36		
28			22			35	P	Gasse
28			16	P	Atherton	34		

Lithos (cont.)			Geological Journal (cont.)			Palaeo Palaeo Palaeo (cont.)		
27	P	Campbell	14	P	Atherton	33		thematic
24	P	Campbell	14	P	Atherton	31	P	Longinelli
22			14	P	Atherton	30	P	Gasse
21	P	Campbell	13			27	P	Gasse
21	P	Campbell	13	P	Atherton	27		
21			12	P	Atherton	27		thematic
21			11	P	Atherton	26		
20	P	Campbell	9			26	P	Longinelli
18	P	Campbell	7			26		thematic
15			6	P	Atherton	23		
15	P	O'Reilly	5			23	P	Longinelli
15	P	O'Reilly	5			21	P	Gasse
13			5	P	Atherton	21	P	Gasse
13			5	P	Atherton	21		
13			4			20		
13			4	P	Atherton	20		

Global Biogeochem Cycles			Chemical Geology			Tectonophysics		
Citations	***P?***	***Editor***	***Citations***	***P?***	***Editor***	***Citations***	***P?***	***Editor***
163			525	P	McDonough	237		
162			70			119	P	Mikumo
157	P	Sahagian	67	P	McDonough	114	P	Ziegler
75			64	P	McDonough	105	P	Mikumo
73	P	Sahagian	63			78	P	Fergusson
68			62	P	McDonough	67	P	Oliver
64			57	P	Ludden	65	P	Ziegler
63			53	P	McDonough	63	P	Ziegler
63			51	P	Jarvis	62	P	Ziegler
61	P	Sahagian	43			59	P	Fergusson
57	P	Sahagian	42			59	P	Mikumo
56	P	Sahagian	40			56	P	Ziegler
56			39	P	Staudigel	56	P	Boulanger
54			38			52	P	Ziegler
52			38			52	P	Ziegler
49			38			51		none
48			38			50	P	Oliver
46	P	Sahagian	37			49	P	Fergusson
43			37			48	P	Banda
38			35			47	P	Pesonen
38			31	P	Staudigel	45	P	Ziegler
37			30			44	P	Banda
37			30	P	McDonough	44		thematic
36			30	P	Staudigel	44	P	Fergusson
33			29			44	P	Fergusson

Precambrian Research			Annales Geophysicae			Applied Geochemistry		
Citations	*P?*	*Editor*	*Citations*	*P?*	*Editor*	*Citations*	*P?*	*Editor*
174		thematic	62			39	P	Fuge
72			45			33	P	Fuge
59		thematic	43			30	P	Fuge
53			39			29		
46			37			27		
43	P	Collins	34			25		
42		thematic	31			25		
39		thematic	27			24		
38		thematic	23			22		
34			21			20		
32	P	Dirks	20			17	P	Fuge
32	P	Collins	19			17		
29			17	P	Alcayde	17		
29			16			16	P	Fuge
29	P	Collins	16	P	Alcayde	16		
28			15			16		
27			15			16		
27		thematic	15	P	Alcayde	15	P	Fuge
25	P	Collins	14	P	Alcayde	15		
24	P	Dirks	13			15	P	Tardy
24		thematic	13	P	Alcayde	14		
24		thematic	12			13	P	Fuge
23		thematic	12			12	P	Fuge
23			12			12	P	Fuge
23	P	Collins	11			12		

Sedimentary Geology			Geomorphology			Geochim Cosmochim Acta		
Citations	*P?*	*Editor*	*Citations*	*P?*	*Editor*	*Citations*	*P?*	*Editor*
57			21			181		
49			18			180		
43	P	Dardis	17			138		
38			17			124		
34	P	Dardis	16		thematic	113		
32	P	Dardis	16	P	Hesp	110		thematic
30	P	Dardis	16	P	Hesp	105		thematic
30			16			102		
28			16			98		
28	P	Dardis	16			98		
27			15			85		
26			14			85		thematic
25			14			83		
25			13		thematic	80		

Sedimentary Geology (cont.)			Geomorphology (cont.)			Geochim Cosmochim Acta (cont.)		
24			12			77		thematic
23			11			74		
19	P	Dardis	11			74	P	Taylor
18			10			72		
17			9			71		
17			9			71		Taylor
16			9			68		
15			9			68		
15			9			67		
14			9		thematic	67		
14			8		thematic	65		

Mineralium Deposita			Geothermics		
Citations	***P?***	***Editor***	***Citations***	***P?***	***Editor***
39		thematic	13	P	Steingrimsson
26			11		
22		thematic	9		thematic
16			9		none
15		thematic	8		thematic
14		thematic	6		thematic
14			5		thematic
12		thematic	5		thematic
11		thematic	5		
11			5		
10		thematic	5		
9		thematic	4		thematic
9			4		thematic
9			4		thematic
8		thematic	4	P	Steingrimsson
7			3		thematic
7	P	Craig	3		thematic
6			3		thematic
6			3		
6			3		
6	P	Craig	3		
6	P	Craig	3	P	Steingrimsson
5			2		thematic
5			2		thematic
5			2		

MONOGRAPHS: FIRM/APPROVAL OR STANDING ORDERS? AN EARTH SCIENCES PERSPECTIVE

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Abstract – Earth sciences libraries abound with monograph series published by societies, research institutes, universities, and government agencies. Some of those published by the societies, for example, the Geological Society of America's *Special Paper* series, the Mineralogical Society of America's *Reviews in Mineralogy and Geochemistry* series, or the American Association of Petroleum Geologists' *AAPG Memoir* series, may take up a lot of shelf space and are unpredictable in publication schedule and/or cost per volume. Librarians are thus faced with uncertainty both in space and in budget planning. Are these series worth the risk?

This study focused on a selected number of established monographic series which were published non-commercially, and broad in geographic scope. Some, published by government agencies, are acquired on deposit, as gifts, or at very low cost. Others, such as the Geological Society's *Special Publication* series, have a more expensive price tag. Cost per year and use of the volumes (as determined by circulation and in-house use records) were examined. The information collected for the selected series was then contrasted with comparable data for commercially published books purchased individually.

This examination of the cost and use data for the society monographic series volumes and the other selected series shows that, by and large, they are well used, and worth the shelf space and purchase price.

PURPOSE OF THE STUDY

In the Spring of 2003, it became clear that Stanford University planned to reduce many budgets, including the library collection budgets. With the continued rise in journal and book prices, it would be necessary to plan carefully how to reduce collection spending. The previous year had already seen a journal cancellation project. Most remaining journals were used heavily enough that it would not be cost effective to cancel them. With few journal titles available to cancel, it became necessary to look at the monograph series (also known as standing orders), as well as to reduce the book purchases.

METHODOLOGY

The first step taken was to try to pull the previous year's price data for all monographic series from the Integrated Library System (ILS). A first look at the data was disappointing. The number of prices in the ILS was inadequate. Monograph series bills apparently are paid in a non-uniform way; some standing orders are paid on the serial record, some are paid on the individual book records and some are part of a membership package from the publishing society. Laborious work on the part of the Earth Sciences Library staff was needed in order to compile reasonably accurate monograph series prices for the most recent six fiscal years. Use data (both circulation and in-house use numbers) were pulled from the circulation system for the same six year period. Because of the number of standing order titles held and the difficulty of pulling the price and use data, the cost effectiveness of most of the 1300 standing orders held by Stanford's Earth Sciences Library had not been evaluated for many years. It was expected that total annual costs of some of the standing order titles would be exposed as being quite expensive and that some of the series would have little or no use. As the cost per use data were evaluated, we were surprised to find that this did not appear to be so. For a number of the titles this was so unexpected that data were pulled again and double-checked.

We were then faced with the question: which then would be the more useful reduction: books or monographic series? Journal price information and use data were then reevaluated and compared with the just retrieved standing order data. The most expensive titles (looking at cost/use) were then marked for cancellation, but this did not yield enough cost effective cancellations.

The next step was to compile the same data for all purchased books, now LC classed as QE, both firm orders and titles acquired by approval plan, during fiscal year 1996/1997 through fiscal year 2001/2002 (the same six years for which the standing order data were retrieved). Circulation and in-house use data for all book volumes for those years were also drawn from the integrated library system. The cost per use was then calculated by dividing the price for each volume by its total use.

The same methodology was followed to find the relative costs of standing order volumes and purchased monographs for Geophysics books. The results were separately tabulated.

RESULTS FOR GEOLOGY COLLECTION

Book Collection

During the six years for which the data were gathered, Stanford purchased 1,044 Geology books (classed in QE) from 453 publishers. Of these publishers, 425 (94%) supplied five or fewer books. Data for publishers supplying six or more books during the course of the study were tabulated separately.

Table I contains the list of publishers (sorted in descending order by the number of books purchased) supplying six or more Geology books during the six year period covered in the study. An examination of this table reveals that the number of titles supplied by any one publisher falls sharply beyond the four most prolific publishers: Springer, Cambridge, Kluwer and Ti Chih Chu Pan She. The average price per volume varied widely from more than $146 (Kluwer and Elsevier) to just more than $7 for one of the Chinese publishers; only five publishers charged more on the average than $100 per volume.

One interesting observation was the multiple uses (an average of 4.5 uses per thesis) received by non-Stanford theses purchased from UMI. When a faculty member or student requests a thesis, the Earth Sciences Library purchases a copy and adds it to the collection, on the assumption that requested theses would be of potential interest to others in the

Table I. Publishers Providing Largest Numbers of Geology Book Titles (Sorted in descending order by number of Geology books supplied)

Pub	Lang	Total Amt paid	# of Vols	Price/ Vol	Tot # of Uses	Cost/ Use
Springer	eng	$4,924	53	$92.91	276	$17.84
Cambridge University Press	eng	$3,660	45	$81.33	414	$8.84
Kluwer	eng	$6,579	45	$146.20	142	$46.33
Ti chih ch°u pan she	chi	$290	41	$7.07	33	$8.79
Prentice Hall	eng	$1,310	22	$59.53	298	$4.40
A.A. Balkema	eng	$2,054	21	$97.83	57	$36.04
Wiley	eng	$2,417	20	$120.85	133	$18.17
Elsevier	eng	$2,346	16	$146.63	56	$41.89
Oxford University Press	eng	$984	16	$61.50	142	$6.93
Blackwell Science	eng	$1,032	15	$68.79	117	$8.82
Science Press	eng	$1,510	15	$100.67	49	$30.82
Thesis/UMI	eng	$611	14	$43.67	64	$9.55
GAC, Winnipeg Section	eng	$142	11	$12.95	28	$5.09
Geological Publishing House	eng	$1,007	11	$91.53	51	$19.74
Columbia University Press	eng	$521	10	$52.14	53	$9.84
Nan-ching ta hsèueh ch°u pan s	chi	$561	10	$56.11	40	$14.03
Princeton University Press	eng	$396	10	$39.63	38	$10.43
UK Stationery Office	eng	$650	10	$65.04	14	$46.45
Zhongguo di zhi da xue chu ban	chi	$322	10	$32.22	14	$23.01
Ke xue chu ban she	chi	$464	9	$51.51	12	$38.63
Academic Press	eng	$630	8	$78.78	113	$5.58
Univ Leicester, Dept Geology	eng	$335	8	$41.89	48	$6.98
Mountain Press Pub. Co.	eng	$103	7	$14.69	23	$4.47
San Diego Assoc. Geologists	eng	$150	7	$21.45	23	$6.53
SEPM Pacific Section	eng	$197	7	$28.11	34	$5.79
Geological Soc India	eng	$208	6	$34.67	25	$8.32
Geological Soc London	eng	$654	6	$109.00	16	$40.88
IGRM, ITGE, Buenos Aires	spa	$270	6	$44.97	78	$3.46

department as well. For the Geology collection this seems on the average to be true; retention of the theses is worth the shelf space.

Looking at the cost per use of the Geology books by the most expensive (by cost per use) publishers (Table II), it became clear that titles from some publishers were a more effective use of collection dollars than were others. One of the most unexpected things revealed by the study was the low amount of use and thus high cost per use of the items purchased from the UK stationery Office (Table II). On the other hand, generally speaking, books acquired from Wiley and Springer seemed to be popular items, well worth the money spent, even though the cost of an individual volume from one of these two publishers was fairly expensive.

An examination of the publishers at the low end of the cost per use spectrum shows that many, but certainly not all, books in this category were published by societies. Publishers from whom six or more titles were purchased during the 6 years of data for which the cost per use was less then $10 are all included in Table III.

Table II. Most Expensive (by Cost/Use) Geology (QE) Book Publishers
(Arranged in descending order of Cost/Use)

Publisher	Lang	Total Amt paid	# of Vols	Price/ Vol	Tot # of Uses	Cost/ Use
UK Stationery Office	eng	$650	10	$65	14	$46.45
Kluwer	eng	$6,579	45	$146	142	$46.33
Elsevier	eng	$2,346	16	$147	56	$41.89
Geological Soc London	eng	$654	6	$109	16	$40.88
Ke xue chu ban she	chi	$464	9	$52	12	$38.63
A.A. Balkema	eng	$2,054	21	$98	57	$36.04
Science Press	eng	$1,510	15	$101	49	$30.82
Zhongguo di zhi da xue chu ban she	chi	$322	10	$32	14	$23.01
Geological Publishing House	eng	$1,007	11	$92	51	$19.74
Wiley	eng	$2,417	20	$121	133	$18.17
Springer	eng	$4,924	53	$93	276	$17.84

Table III. Least Expensive (Cost/Use) Geology Book Publishers
(Arranged in ascending order of cost per use)

Publisher	Lang	Total Amt paid	# of Vols	Price/ Vol	Tot # of Uses	Cost/ Use
IGRM, ITGE, Buenos Aires	spa	$270	6	$45	78	$ 3.46
Prentice Hall	eng	$1,310	22	$60	298	$ 4.40
Mountain Press Pub. Co.	eng	$103	7	$15	23	$ 4.47
GAC, Winnipeg Section	eng	$142	11	$13	28	$ 5.09
Academic Press	eng	$630	8	$79	113	$ 5.58
SEPM Pacific Section	eng	$197	7	$28	34	$ 5.79
San Diego Assoc. Geologists	eng	$150	7	$21	23	$ 6.53
Oxford University Press	eng	$984	16	$62	142	$ 6.93
Univ Leicester, Dept Geology	eng	$335	8	$42	48	$ 6.98
Geological Soc India	eng	$208	6	$35	25	$ 8.32
Ti chih ch°u pan she	chi	$290	41	$7	33	$ 8.79
Blackwell Science	eng	$1,032	15	$69	117	$ 8.82
Cambridge University Press	eng	$3,660	45	$81	414	$ 8.84
Thesis/UMI	eng	$611	14	$44	64	$ 9.55
Columbia University Press	eng	$521	10	$52	53	$ 9.84

Standing Orders – Geology

Data compiled for this part of the study included use and price data for all standing orders received which are classed QE and in which each of the volumes supplied is an individually titled monograph. Also included are series which are classed as Dewey, but would, if reclassed into the Library of Congress class scheme, be classed as QE, e.g. monographic series volumes dealing with (or mostly with) geology topics. Not included are annual reports, same name conference proceedings, and other non-book-like volumes, classed as standing orders by Stanford's Technical Services units. Also not included are data for series which are received on deposit, received on exchange or as gifts.

All of the monographic series included in the study began as noncommercial publications, begun to provide a publishing mechanism for a scientific society, research institution, museum, government agency, or university. Several of the university-published series are actually publishing venues for theses. In recent years publication of a few of these series has been outsourced to commercial publishers, but the sponsorship of the society or agency has been retained.

All of the series treated in this study are classed together, although many of the series are marked for the Technical Services units to analyze, that is provide author, title, and subject headings. A few of the series in the study had not been analyzed.

The information for those series producing eighteen or more volumes during the six year period is included in Table IV. This list may include standing orders which had lapsed and been revived again; thus there may be more volumes attributed to one of the publishers than were published during the study years. A volume was included in the study if it had been purchased and/or paid for during the years of the study.

The use figures for the series volumes from the Polish Geological Institute were surprising. Double checking these results led to a very interesting find. For one of the two Polish series, half of the volumes were used, each 4-8 times; half showed no use. Of those that were used, half were in Polish the rest were in English. Surprisingly, the same held true for those that had no use at all. Further investigation revealed that this series was not marked for analytics, but about half had been mistakenly analyzed anyway upon receipt. All items which were analyzed were used. None of those that were not analyzed were used. As the subjects/titles of the volumes in question were not indicative of expected use, it appears that it was the analytics that made the difference in the amount of use.

Table V lists the twelve standing order publishers whose products cost the least per use. These volumes are clearly cost effective purchases. Only Geology standing order publishers providing ten or more volumes during the six fiscal years under consideration were included in this list.

Table IV. Publishers Providing Largest Numbers of Geology Series Volumes
(Arranged in descending order by number of volumes received)

Series Publishers	Tot Amt Paid	# of Vols	Price /Vol	Tot. # of Uses	Cost /Use
NZ Institute of Geological & Nuclear Sciences	$7,201	154	$47	340	$ 21.18
Geol Soc London	$10,137	67	$151	271	$ 37.41
Geol Soc America	$5,260	61	$86	534	$ 9.85
Alfred-Wegener-Stiftung	$784	35	$22	134	$ 5.85
BRGM	$2,905	32	$91	100	$ 29.05
Technische Universitèat Bergakademie	$1,039	26	$40	181	$ 5.74
Polish Geol Inst	$615	23	$27	78	$ 7.89
Universiteit Utrecht, Faculteit Aardwetenschappen	$2,456	20	$123	73	$ 33.65
Geological Soc Nevada	$770	19	$41	68	$ 11.32
Selbstverlag der Alfred-Wegener-Stiftung	$713	19	$38	56	$ 12.73
Geol Soc India	$1,640	19	$86	94	$ 17.45
E. Schweizerbart'sche Verlagsbuchhandlung in Kommission	$705	18	$39	498	$ 1.41
Mineralog Soc Am	$600	18	$33	138	$ 4.35

Table V. Least Expensive (Cost/Use) Geology Series Publishers

Series Publishers	Tot Amt Paid	# of Vols	Price /Vol	Tot. # of Uses	Cost /Use
E. Schweizerbart'sche Verlagsbuchhandlung...	$705	18	$39	498	$ 1.41
Paânstwowe Wydawn. Naukowe	$209	12	$17	107	$ 1.95
San Bernardino County Museum Association	$220	14	$16	65	$ 3.38
Mineralogical Soc America	$600	18	$33	138	$ 4.35
SEPM, Sections	$765	15	$51	145	$ 5.28
Technische Universitèat Bergakademie	$1,039	26	$40	181	$ 5.74
Alfred-Wegener-Stiftung	$784	35	$22	134	$ 5.85
Bundesanstalt fèur Geowissenschaften...	$392	10	$39	62	$ 6.33
Polish Geol Inst	$615	23	$27	78	$ 7.89
Blackwell Science	$1,032	15	$69	117	$ 8.82
Geological Soc America	$5,260	61	$86	534	$ 9.85
Geological Soc Nevada	$770	19	$41	68	$ 11.32

Comparison of Geology Standing Order Publishers and Firm Order Publishers

The information given in Table VI shows that, during the six years, about the same amount was spent on books acquired via approval plan or firm order, as was spent on standing orders. However, the total use of the standing order volumes approaches three times the use of the books purchased separately. Thus the standing orders, taken together, are much more cost efficient. The use per volume for the more established, longer running (Dewey classed) standing orders is more than three times that of the books. When it is necessary to choose which items to send to offsite storage, it appears from this information that the society published standing orders are a better use of onsite space.

RESULTS FOR GEOPHYSICS COLLECTION

Book Collection

The methodology of evaluating the publishers and the standing orders supplying books for the Geophysics collection followed the same model as that done for the Geology materials. Data used for this study were the purchase prices and use (circulation and in-house use) for the book collection currently shelved in the QC and TN260s (Exploration Geophysics) portions of the stacks, purchased during the six fiscal years 1996/1997-2001/2002.

An examination of the book publisher data for Geophysics provides the following information: the number of publishers (97) providing materials for the Geophysics collection during the six year period indicates a much smaller publisher world than is the case for Geology. However, the largest Geophysics publishers are the same as the largest three in Geology: Springer, followed by Cambridge and Kluwer (see Table VII).

Table VIII lists all of the publishers from whom three or more Geophysics titles were purchased from 1996/1997 through 2001/2002, arranged in order of price per use. Prentice Hall, Oxford, and Cambridge University Press also appear on the list of inexpensive geology publishers. Interestingly, Springer's geology books also averaged $17 per use. On the other end of the spectrum, Balkema, Elsevier and Kluwer also appear on the list of most expensive publishers of geology books.

Table VI. Price and Use Comparison: Geology Firm/Approval Orders Versus Standing Orders

Monograph type	Total Amt Paid	# of Vols	Price /Vol	Tot. # of Uses	Cost /Use	Use/ Vol
Firm and Approval Books	**$65,593**	**1044**	**$63**	**4259**	**$ 15.40**	**4.1**
All Mono Series	**$68,774**	**1117**	**$62**	**11279**	**$ 6.10**	**10.1**
Dewey-Classed Mono Series	*$21,411*	*348*	*$62*	*5145*	*$ 4.16*	*14.8*
LC-Classed Mono Series	*$47,363*	*769*	*$62*	*6134*	*$ 7.72*	*8.0*

Table VII. Publishers Providing Largest Numbers of Geophysics (QC &TN) Books
(Listed in descending order by number of books purchased during the six years of the study)

Publisher	Tot Amt Paid	# of Vols	Price / Vol	Tot # of Uses	Cost/ Use
Springer	$2,165	26	$83	129	$17
Kluwer	$3,011	23	$131	74	$41
Cambridge University Press	$1,895	23	$82	165	$11
Academic Press	$1,041	13	$80	48	$22
Wiley	$1,094	11	$99	79	$14

Table VIII. Publishers Providing Geophysics (QC &TN) Books (Listed in ascending order of cost per use for books purchased during the six years of the study)

Publisher	Tot Amt Paid	# of Vols	Price / Vol	Tot # of Uses	Cost / Use
Princeton University Press	$155	3	$52	77	$2
Prentice Hall	$243	5	$49	39	$6
Oxford University Press	$483	9	$54	72	$7
National Academy Press	$189	8	$24	20	$9
Cambridge University Press	$1,895	23	$82	165	$11
Wiley	$1,094	11	$99	79	$14
Springer	$2,165	26	$83	129	$17
Academic Press	$1,041	13	$80	48	$22
Arnold	$1,322	3	$441	53	$25
theses	$114	3	$38	4	$29
Soc Ex Geophysicsts	$559	4	$140	16	$35
Inter-Research	$145	3	$48	4	$36
Kluwer	$3,011	23	$131	74	$41
Routledge	$1,443	9	$160	35	$41
World Scientific	$314	3	$105	7	$45
Elsevier	$819	6	$137	15	$55
A. A. Balkema	$282	4	$70	5	$56

Standing Orders - Geophysics

The Geophysics Standing order data were pulled from the QC, TN 260s (Exploration Geophysics) and the QE books classed between QE500 and QE615, with volcanology and structural geology volumes omitted. There are no currently held standing order sections in the Dewey Geophysics sections of the Earth Sciences Library. It was no surprise to find the American Geophysical Union (AGU) and the Society of Exploration Geophysicists (SEG) leading the list of Geophysics Standing order publishers by a significant margin regarding number of volumes. It was very surprising to find that the almost $10 cost per use of the SEG standing order volumes (Table IX) was less than one third the average $35 price per use of individually purchased SEG books (Table VIII). Note that a Polish publisher shows up again as producer of a Geophysics series; this series, the volumes of which had not been analyzed, has low use per volume. When all of the standing order data had been tabulated it was surprising to find out how many Polish monograph series were on standing order.

Comparison of Geophysics Standing Order Publishers and Firm Order Publishers

The information given in Table X illustrates that during the six years approximately four times as much money was spent on books purchased through approval and firm orders than was spent for standing order volumes. The cost per volume was greater for books than for standing order volumes. Although the difference between the approval and firm order Geophysics books and standing order volumes isn't as great as the difference between the two types of Geology monographs, the cost per use is still somewhat cheaper and the use per volume is

Table IX. Publishers Providing Largest Numbers of Geophysics Series Volumes (Listed in order of number of monographs supplied during the six years of the study)

Geophysics Series Publishers	Tot Amt Paid	# of Vols	Price/Vol	Tot # of Uses	Cost / Use
AGU	$ 2,880	38	$76	198	$14.55
SEG	$ 2,243	26	$86	231	$9.71
Selbstverlag Fachbereich Geowissenschaften FU	$ 443	12	$37	38	$11.66
Blackwell	$ 781	7	$112	54	$14.46
E Fischer	$ 276	5	$55	26	$10.62
Paânstwowe Wydawn. Naukowe	$ 75	5	$15	7	$10.71

Table X. Price and Use Comparison: Geophysics Firm/Approval Orders Versus Standing Orders

Monograph Type	Tot Amt Spent	# of Books	Cost / Vol	Use	Cost / Use	Use/ Vol
QC Classed Geophysics	*$19,375*	*230*	*$84*	*958*	*$20*	*4.2*
QE Classed Geophysics	*$8,746*	*117*	*$75*	*569*	*$15*	*4.9*
TN Classed Geophysics	*$1,535*	*15*	*$102*	*66*	*$23*	*4.4*
All Geophysics Books Purchased	**$29,656**	**362**	**$82**	**1593**	**$19**	**4.4**
Monograph series	**$7,740**	**107**	**$72**	**673**	**$12**	**6.3**

somewhat greater. Thus the standing orders, taken together, are more cost efficient, although the difference is considerably less than for the Geology books versus standing orders.

CONCLUSIONS

These studies take a lot of time as the data are very dirty; even after many hours have been spent, the data are not clean. Thus an annual study would definitely not be worth the time. However, this study did provide guidelines as where to make cuts in purchases when budgets are overstretched, both regarding specific standing orders to cut and from which publishers to purchase books with the fewer dollars available.

To meet the library needs of the Stanford Earth Sciences programs, within the constraints of a limited library budget, it appears to be more cost effective to keep society published standing orders than to purchase individual monographs, at least for the Geology and the Geophysics parts of the collections. It is not clear that this principle would translate into other disciplines, which are not so rich in a tradition of society published monograph series.

This study revealed that analytics do make a difference in amount of use received, at least where the content warrants. Therefore, all currently received, nonanalyzed monograph series have now been reviewed for appropriateness of requesting analytics. The Earth Sciences Library staff members are now in the process of requesting analytics for additional, carefully selected monograph series.

Books from some publishers were found to be too expensive to continue getting as "books" as part of shelf ready approval plans. Thus, steps are underway to add these names to the list of publishers for which forms rather than books are sent under the approval plans.

ACKNOWLEDGEMENTS

I want to thank Branner Earth Sciences Library staff Ilana Braun and Steve Gendel for the careful work they put into digging up the price and use data and providing numerous reports of the same. Thanks also are due to Peter Kim of Stanford University Libraries' Technical Services for tracking down standing order and package price data.

A GUIDE FOR BUYING ELECTRONIC RESOURCES IN A CONSORTIAL ENVIRONMENT: USING GEOREF AS AN EXAMPLE

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Abstract – Two cultural phenomena have greatly impacted library purchasing trends in the last few years. One, the Internet and its ability to provide instant access to electronic information, which in turn has created a huge demand for libraries to provide their information resources in electronic format; and two, the spiraling downward of library budgets from which to pay for these electronic resources. In other words, the "perfect storm" has struck libraries at hurricane force. In order to survive, libraries have formed consortia to increase their purchasing power while offsetting costs. This in turn creates a "one package fits all" purchasing environment with cost becoming the controlling factor, and in which every member of the consortium has the same resources regardless of their individual needs and users. This should not be the case and libraries need to enter consortial agreements carefully. Libraries need to evaluate the vendor licensing options, service, and stability as well as the cost and product itself. When looking at the product, pedagogical aspects, functionality, currency, and most importantly primary audience need to be considered.

This paper will discuss the pros and cons of consortial purchasing, create a checklist of what to consider when making a consortial agreement and, using GeoRef as an example, compare the different options under which this bibliographic database can be purchased.

INTRODUCTION

Electronic resources have become *the* item in terms of revenues for publishers and vendors. During the 2002 meeting of the National Federation of Abstracting and Information Services (NFAIS), Thomson Corporation, the parent company of Gale Group, publishers of aggregator databases such as Expanded Academic Index (ASAP), InfoTrac OneFile, and General Newspaper Index to mention a few, announced 50 percent of its revenues were based on its electronic products with a estimated growth rate of 15 percent. Chemical Abstracting Service (CAS) stated that 45 percent of its revenues are from their online resources with only 9 percent attributed to print sales (Kaser, 2002). These companies' customers – mostly research libraries – have had to shift huge amounts of their annual materials budgets to obtain these resources and thus, collective bargaining and resource sharing have become a way of life for research libraries.

Resource sharing agreements among American research libraries are not new. Cooperative agreements in terms of borrowing and cataloging have existed since the late 1800's. The University of California initiated an interlibrary loan program in 1898, and the American Library Association began publishing catalog cards around the same time period (Alexander, 1999). Cooperative collection development is another idea research libraries began exploring in the first part of the 20th century. The Triangle Research Libraries Network, one of the first consortia, was formed in 1933 between Duke University and the University of North Carolina (Bostick, 2001). The cost of two world wars and the end of America's period of isolation made it imperative for American research libraries to develop cost saving agreements. The Farmington Plan, developed by American research libraries in the wake of World War II, was formed for the purpose of developing a comprehensive international research collection. This collection would be available to American scholars through interlibrary loan. The plan began with cooperative agreements among the libraries to extensively collect and catalog publications from designated countries and regions. It existed from 1948 until the 1960's. Shared cataloging groups such as the Research Libraries Group (RLG), and the Ohio College Library Center (OCLC) formed in the 1970's (Thomas, 2002). Today most libraries also belong to consortia whose primary function is to help member libraries with the purchase and licensing of electronic resources.

Consortia vary in structure and in the benefits they provide to their members. Consortia function by pooling together funds and negotiating the "best deal" for an electronic resource. Their membership tends to follow political and geographic boundaries, such as a state or a region, and thus they are able to assert their clout while remaining within the legal framework of the licensing process. Libraries often belong to more than one consortium and membership can overlap. For example, all of the publicly funded libraries of a state may belong to one consortium while the academic libraries belong to another as well. Membership itself can be tiered, with full, affiliated and ad hoc options; each having different rights and privileges. Full members pay an annual fee and participate in the decision making process including the selection of the electronic resources and the negotiating of the licensing agreements. Affiliated members tend to be smaller libraries that choose to join in a consortial licensing agreement that has already been negotiated. They pay a per-license fee to the consortium, but have no voting privileges. Informal and ad hoc affiliations also abound. This type of membership is made up of libraries whose geographic area is served by more than one consortium. By not being formally affiliated with any single consortium, these libraries are able to "shop around" for the best price for an electronic resource. Again, as with the affiliated library membership, these libraries have no decision making rights and often pay a slightly higher fee per-license than full and affiliated member libraries.

Consortia provide other services in addition to their shared purchasing power. They also provide legal expertise in terms of copyright and contract law. Many have the technical capability to allow member libraries to develop union catalogs that enable patrons to borrow physical resources across libraries. Consortia may provide use statistics, develop digitization products, and construct archives for physical and electronic collections. In addition, they may provide a forum where members discuss and access information about trends in electronic services such as journal management systems, portals, and federated searching.

NEGATIVE ASPECTS OF CONSORTIA

As mentioned, consortia, due to their presence within a geographic area and their team of legal experts, can negotiate favorable contracts with the publishers or vendors of electronic resources. Whereas these contracts save time and money for individual libraries, the downside is that it becomes an environment of "one resource fits all." Quite often libraries that belong to more than one consortium end up having access to the same electronic resource from more than one vendor, and because of their membership agreements cannot opt out of the contract. In addition, libraries can also end up having a resource that is not suitable for their users.

When joining consortia, libraries need to carefully weigh membership options. As full members, libraries are part of the selection process, a seemingly good thing on the surface, but in reality the biggest, most prestigious library often tends to call the shots. As a consequence, the other full member libraries could end up with resources that don't serve their users or that they can't afford. In order not to get railroaded, full member libraries within a consortium should be similar in terms of budget and users. Otherwise, smaller libraries or those with a different user base should consider an affiliated or ad hoc relationship with the consortium. These two kinds of membership options often give members the ability to pick and choose which contracts they want to become part of.

Consortium members also need to be careful with the actual contract itself. Instability, both in terms of the product as well as the overall economic climate, can have a huge negative impact on libraries that are tied into long term agreements. Publishing is a very competitive business. The vendors, especially the full-text aggregators, are constantly adding and removing journals from their products. A recent example of this is the decision of Sage Publishers to remove their articles from full-text aggregator databases such as EBSCOHost. This left many libraries scrambling to find funds to purchase Sage journals from another vendor, while still being tied into their contracts with EBSCO. Libraries have known for a long time that the electronic format is not permanent, but as budgets continue to tighten, many have no choice but to cancel print in favor of the electronic version. The lesson here is if the vendor and the publisher don't have long term commitments, then the consortium shouldn't consider one either. Also, when times are bad, they are bad for everyone. Consortia representatives need to have business savvy and pay attention to what is going on in the publishing field in terms of stability, financial solvency and trends. Service, both in terms of the consortia as well as the vendors, should be evaluated before making decisions.

Consortia are like any other bureaucracy and the bigger they are the less efficient they become. They sometimes are perceived as "time wasters" even to the point that libraries may initiate their own negotiations for products related to an expiring contract in order to avoid a gap in service. The reasons for this "time wasting" perception can be many. Consortia representatives usually volunteer their service and have full time jobs elsewhere. In poor economic times, the volunteers may have less time to devote to the consortium than in better times when there are plenty of staff members at their regular jobs to keep things going smoothly. Also, consortia can loose direction and stray from their original purpose. With the electronic resource world in constant flux, it is easy to get wrapped up in the next new technology instead of servicing what is in operation now. Adequate staffing, a clear mission statement, and a reputation for getting contracts negotiated on time should all be factors that libraries consider before joining a consortium.

Service expectations from vendors fall into two categories. One, expediency with contract negotiations and a commitment to honor the contract once it has been established; and two, good customer support, especially with technical problems. There is enough overlap of products available from the various vendors that libraries can well afford to shop around for the most reputable one.

POSITIVE ASPECTS OF CONSORTIA

It is evident that consortia have served libraries well, especially in terms of shared electronic resources, from catalogs to full-text aggregators. In fact, consortia have become so successful in the last two decades that according to Thomas Peters, "In the United States the consortial frontier is closed, in that there are no areas left unserved by any academic library consortium" (Peters, 2003, p. 254). In addition, consortia are growing nationally and internationally. There are several national consortia such as The Network Alliance and international ones such as the International Coalition of Library Consortia (ICOLC). The primary function of consortia continues to be the joint purchase of electronic resources. The term "buying club" has often been used in the literature to define consortia and as Jane Subramanian sums up, "Negotiated group purchases many times result in significant price reductions for each participant, sometimes allowing the purchase of some electronic materials that might not other wise be possible especially for smaller institutions with more limited budgets" (Subramanian, 2002, p. 47).

A less recognized, but successful function of consortia is training for librarians, either through teleconferencing or workshops. The Bibliographical Center for Research (BCR), headquartered in Colorado, provides several workshops a year for its member libraries which include 1,065 voting members in 39 states and Canada (BCR, 2004). Their contents vary, but new technology is always popular.

As mentioned, consortia are also good at providing expert knowledge to their members. Their expertise during contract negotiations are well known, but many consortia also provide a forum where members can exchange ideas, discuss issues, and plan for new technology. Arnold Hirshon mentions the future of library consortia is to help with change management. He states that libraries all face the same key issues and by working on them together will save time and resources (Hirshon, 1999). There are several of these types of "think tank" arrangements, such as the Consortium for Educational Technology for University Systems (CETUS). Formed in 1995, it originally included California State University (CSU), City University of New York (CUNY), and State University of New York (SUNY). One of its objectives is to "explore and clarify issues related to the sharing of information resources and the protection of intellectual property" (CETUS, 2004).

Shared archives for physical collections, shared core collections, digitizing projects, portals, digital registries of databases and full-text article linkers such *Gold Rush* developed by the Colorado Alliance of Research Libraries (CARL), are all examples of services that consortia have begun providing based on recent economic trends or new technology. It is too early to judge how successful these new ventures will be; however, there are several shared archives in operation such as the Orbis Cascade Alliance consortium's Regional Library Center, which give all indications of being successful (Orbis, 2004).

CHECKLIST FOR DATABASE PURCHASES IN A CONSORTIA ENVIRONMENT

Things to consider when joining a Consortium:

- ✓ Type of membership
    - o Full membership includes voting rights and database selection as well as additional services.
    - o Ad hoc or affiliated members join as part of a specific purchase, they have no voting rights and often pay a higher rate per licensing agreement.
- ✓ Mission of the consortium
    - o Does its goals best serve your library's needs?
    - o Does it have a good reputation for getting licensing negotiated in a timely manner?

Things to consider when choosing a vendor:

- ✓ How often are the records loaded or updated?
- ✓ Pricing
    - o Can be based on several variables: length of contract, size of user base, and number of simultaneous users.
- ✓ Technical support
    - o Consider time zone differences. Can you only contact them at 2 a.m.?
    - o Check their reputation with other libraries before choosing.
- ✓ Licensing agreements
    - o Are they flexible? Do you have a choice between single year and multi year contracts?
    - o Are they compatible with the laws in your state?
- ✓ Fiscal stability
    - o Is this company making money? If they go out of business their contracts are void; don't be left holding the bag.

Things to consider about the database itself:

- ✓ Primary Users
    - o Students, undergraduate or graduate
    - o Faculty
    - o Professional staff
- ✓ Interface of Webpage
    - o Intuitiveness
    - o Easy to navigate
    - o Uncluttered
- ✓ Compatibility with Hardware/Software
    - o Works well with your library's:
        - ▪ Computer operating system
        - ▪ Proxy server and other security software/hardware
        - ▪ Printing system
        - ▪ OPAC
        - ▪ Journal management system
        - ▪ Open URL linker
        - ▪ Document delivery system
- ✓ Pedagogy
    - o Ask librarians who do instruction for input on teaching aspects.
    - o Functionality in the classroom
    - o Easy to explain
- ✓ Coverage
    - o How many years of data are available?
    - o Are they adding back files?
    - o What is indexed? (Books, theses, journal articles etc.)
    - o Depth of coverage. Are they only covering the primary journals, or are they covering government reports, conference proceedings, etc.?
- ✓ Publisher
    - o How frequently do they provide the data to the vendor?
    - o How well known is their expertise in the subject area?
    - o Are they fiscally stable?
        - ▪ Can they support making full-text articles available to the aggregators, or will that be in competition with their own products?

GEOREF AS AN EXAMPLE

Using the categories in the checklist, the GeoRef bibliographic citation index scores high in terms of coverage and publisher. It is published by the American Geological Institute (AGI), a non profit organization founded in 1948 to provide information in the geosciences to its members consisting of over 100,000 geologists, geophysicists and other earth scientists. AGI began publishing GeoRef in 1966. Today it contains over 2.2 million bibliographic records covering all aspects of the geosciences from mineralogy to marine geology. The database indexes journal articles, books, maps, conference papers, reports and theses. Coverage is from 1785 to the present. Approximately 80,000 records are loaded per year, and a preview database and a new references alert service are also available.

GeoRef comes in several formats, including online, CD-ROM subscription and in print as *The Bibliography and Index of Geology*. The online version of GeoRef is available through the following vendors: Cambridge Scientific Abstracts, Community of Science, Inc., DIALOG, EBSCO, NERAC, OCLC, Ovid Information, Inc., and STN International (AGI, 2004).

The other four categories on the checklist under "database" vary among vendors and need closer inspection. Pedagogy, the interface, and compatibility are all important issues if the primary users are students in an academic library. Undergraduates are new to the research experience and are often intimidated by the variety of the electronic resources available to them. The appeal of the "one stop shopping" that the full-text aggregator vendors provide makes their databases the most popular electronic resources. Soon their interface becomes the most familiar to the new students. Thus, it makes sense to purchase GeoRef from the same vendor that provides your libraries' full-text aggregation. Graduate students and faculty will use GeoRef differently than the undergraduate students, and additional factors such as how often the references are loaded, will also be a factor. For example, Cambridge Scientific Abstracts loads new references biweekly (CSA, 2004), and EBSCO loads theirs on an annual basis (EBSCO, 2004). Professionals in a corporate setting will have a different focus than the academics. Added services such as document delivery, consulting, and training will be important. Compatibility with other hardware and software is important in all settings.

Under the "vendor" category in the checklist, pricing will come into focus once the other criteria have been considered. AGI provides the same data and pricing structure to all the commercial vendors of GeoRef. The different rates customers pay for the database depend on the type of organization, the number of users, and any additional charges the vendor tacks on. Seemingly, since AGI sets the price, it shouldn't vary that much between vendors; however, vendors place great emphasis on their added services and charge accordingly. With GeoRef being available from so many different vendors, it is in the best interest of the prospective customer to "shop around" and negotiate the best licensing agreement available. In addition, potential customers should talk to other members of their consortia to discuss which of the available vendors of GeoRef have a good reputation in terms of technical support. Looking at the consortium the author's library is in, CARL, there is no clear favorite in terms of vendor. Of the eight academic libraries that have online access to GeoRef, the distribution was equal between Community of Science, SilverPlatter through Ovid, Cambridge Scientific Abstracts and EBSCO. In terms of financial stability, the mentioned vendors have good reputations, however, how long Ovid will continue to support the SilverPlatter platform remains to be seen.

CONCLUSION

As budgets for libraries continue to shrink, consortia will have an ever increasing role in library management from the purchasing and storing of collections to the planning and training for new technology. In order to survive as individual institutions, libraries must always consider their user base, their mission and the focus of their collection before becoming involved in consortial agreements.

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BOOK REVIEWS IN THE EARTH AND ATMOSPHERIC SCIENCES JOURNAL LITERATURE

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Abstract – As library budgets continue to lag behind increases in the cost of scholarly information in the geosciences, it becomes increasingly important for librarians to make good choices in collection development. One way to get more information about books to make an informed acquisition decision is through reading reviews, and especially timely reviews. Whereas the major book review indexes only cover geoscience titles sporadically, the authors decided to undertake a full study of the literature in earth and atmospheric sciences to find out which journals contain book reviews, and how old the books are that are reviewed. This study is modeled after the article, "Locating Book Reviews in Agriculture and the Life Sciences," by Kathleen Clark and Brent Mai, and incorporates Lura Joseph's "Sources of Book Reviews in the Geosciences" (http://www.library.uiuc.edu/gex/bookreviews.html). This study examines 263 earth and atmospheric sciences journal titles which include book reviews. Of these, 247 are primarily in earth sciences, with the remaining 16 in atmospheric sciences. For this study, journal issues published in 2002 are examined. Of the journals listed in this study, 42 % review books that are equal to or less than one year old. The reviews average over one page in length and all are signed by the reviewers.

INTRODUCTION

Library budgets are continually shrinking, while costs of materials inexorably increase. Selectors, then, need to make the most of the resources they have to acquire new materials. One way to gain insight into the quality of materials is by consulting book reviews from respected journals.

Clark and Mai (2000) conducted an intensive analysis of book reviews in the life sciences, following up on some previous studies in that subject area. They analyzed the number of reviews and the timeliness of the reviews. However, no such analysis has been done in the earth and atmospheric sciences.

Midway through investigating this project, Lura Joseph (2002) independently created a book review index, based on holdings in the University of Illinois library (http://www.library.uiuc.edu/gex/bookreviews.html). Prior to the creation of this index, the coverage of book reviews in the earth and atmospheric sciences was almost nonexistent. The *Book Review Index* only covers a few earth science journals, while *GeoRef*, the major index in the earth sciences, indexed 24 book reviews during 2002 from two journals, *AAPG Bulletin* and *Tectonophysics*. *Meteorological and Geoastrophysical Abstracts* (MGA) appears not to index any book reviews. General indexes, such as *Current Contents*, tend not to index book reviews either.

Prior to Joseph's web index, there was no place for a librarian to go to see which journals review earth science books, how many they review, and if the reviews are timely enough to be relevant to librarians in making collection development decisions (i.e., if the review comes out years after the book is published, it is often too late to make an acquisitions decision based on that review).

This study provides that kind of information. It provides a guide to the journals that are most likely to be helpful to earth science librarians by providing book reviews.

METHODOLOGY

In order to analyze book reviews, we needed to determine which journals contain reviews. We used a few methods to assemble our universe of journals containing reviews. First, we looked at all the journals that the Purdue University Earth and

Atmospheric Sciences library receives, since they were close at hand. Next, we consulted *Ulrich's International Periodicals Directory*, 37th ed. (1999), which indicates whether a journal contains book reviews. However, many journals that *Ulrich's* states have reviews, in fact did not. Finally, a few months into this study, Lura Joseph's index was announced, and we consulted her index as well.

Once the pool of potential journals was assembled, we needed to examine the individual titles to see how many and what kind of reviews were actually published. We located all the journals available on the Purdue campus, and then set out to determine how to find the rest of the titles. We searched WorldCat to see how many libraries hold each of the titles, and whether any nearby institutions hold the title.

We removed a journal from consideration if it was not held at Purdue and if it had less than thirty holding libraries on WorldCat. We reasoned that, if the journal was not widely held, then it wouldn't be very useful to librarians to know its book review status anyway. We noticed that the University of Illinois at Urbana Champaign (UIUC), only two hours away from Purdue, held almost all of the titles on our list that Purdue didn't hold. We then determined that we would analyze journals from Purdue and UIUC's collections, and make that the basis of our study.

For each journal, we looked at each issue published in 2002, and recorded the number of reviews, the number of issues that contained reviews, the publication year of the book reviewed, whether the reviews were signed, and the overall length of the reviews.

DISCUSSION

The data collected are presented in Tables 1-4. Out of about 260 journals that putatively contained book reviews according to *Ulrich's* and our local collection, 100 actually contained reviews (Table 1). Of those, 55 averaged at least one book review per issue. Only 15 journals reviewed 25 or more books during the entire year. This is markedly less than that in the life sciences as compiled by Clark and Mai (2000), in which nearly twice as often (27%) journals had at least 25 reviews. This indicates less emphasis placed on reviews in the earth sciences or perhaps, a smaller pool of books to review compared to the life sciences.

As to timeliness, 44 journals (44%) reviewed books, on average, within 1 year of publication. Twenty-six journals (10%) had an average of 6 months or less. This indicates a fairly high percentage of timely reviews, and is similar to the findings of Clark and Mai in the life sciences. Overall, the average book review is 1.0 years old (i.e., the book was published the year prior to the year the journal issue was published). The formula used in Table 2 is: if the review covers a book published in 2002, the value assigned is zero; if the review covers a book published in 2001, the value equals one, etc.

Another useful mechanism for finding out about new books is to look at "Books Received" sections of journals. Table 3 indicates the journals with books received sections. Sometimes the "Books Received" section contains short synopses of the books' contents, while in other resources, only the citation is given.

One note about *Nature* as a source for book reviews. Although *Nature* contained approximately 150 reviews in 2002, only 13 of them were in the earth and atmospheric sciences and were mainly related to evolution.

This survey also found a few reviews covering alternative forms of media sources such as internet sites, DVDs, CDs, maps, videos and periodicals. Table 4 lists the journals reviewing alternative forms of media in 2002 along with the number of reviews. Of the 36 alternate media reviews covered, the vast majority (23) were released in 2002, 4 were released in 2001, and 1 in 2000. The remaining 7 were mentioned in *Geography* under "Resources," and consist of a short description without review. *Weatherwise* was the only meteorology journal located with alternative forms of media reviews.

Starting in 2003, Lura Joseph, Geology Librarian at the University of Illinois, Urbana-Champaign, has made available a searchable geoscience book reviews database "Earth Science Book Reviews Database" at: http://g118.grainger.uiuc.edu/gexbookreviews/reviews/. This new searchable database is proving to be very valuable with shrinking library budgets. Previously, no listing of book reviews was available in the geosciences field.

CONCLUSION

A list of journals with book reviews in the earth and atmospheric sciences was compiled, and the number and style of reviews was analyzed. There are about 20 or 30 journals with a large number of reviews (10-20) per year, and these are recommended for regular inspection by librarians who use book reviews to make acquisition decisions in the earth and atmospheric sciences.

Table 1. Journals with Book Reviews in Order by Total Number of Book Reviews Published in 2002.

Journal Title	No. of Issues per vol.	Issues with Reviews	Total Reviews	Average Reviews per Issue
Geochronique (French)	4	4	82	20.50
Choice	13	12	71	5.45
Annals of the Association of American Geographers	4	4	70	17.50
Geography	4	4	69	17.25
Geological Magazine	6	6	55	9.17
Progress in Physical Geography	4	3	50	12.50
Geographical Journal	4	4	49	12.25
EOS, Transactions American Geophysical Union	52	27	44	0.85
Bull. of the Amer. Meteorological Society	12	12	39	3.25
Leading Edge	12	6	38	3.17
Holocene	6	5	35	5.83
Geology Today	6	5	32	5.33
Geotimes	12	10	28	2.33
Weather	12	11	27	2.25
Canadian Mineralogist	6	5	25	4.17
Contributions to Atmospheric Physics	6	5	23	3.83
Mineralogical Magazine	6	5	23	3.83
Meteoritics and Planetary Science	12	6	23	1.92
Geoscience Canada	4	3	20	5.00
Canadian Geographic	6	5	20	3.33
Gems and Gemology	4	4	19	4.75
Mountain Research and Development	4	2	18	4.50
AAPG Bulletin	12	12	17	1.42
Environmental & Engineering Geoscience	4	3	16	4.00
Episodes (Nottingham)	4	4	16	4.00
Earth Surface Processes Landforms	13	7	16	1.23
Economic Geology	8	8	14	1.75
Journal of Geodesy	8	7	14	1.75
Nature	52	13	13	0.25
die Erde	4	3	13	3.25
Hydrological Sciences Journal	6	13	13	2.17
Mineralogical Record	6	2	13	2.17
Palaios	6	6	13	2.17
Lapidary Journal	12	10	13	1.08
Boreas	4	4	12	3.00
Journal of Geoscience Education	5	3	12	2.40
Journal of Sedimentary Research	6	6	12	2.00
American Mineralogist	12	10	11	0.92
Pure and Applied Geophysics	12	1	11	0.92
Climatic Change	16	11	11	0.69
Geomorphology	28	6	11	0.39
Arctic, Antarctic, and Alpine Research	4	4	10	2.50

Journal Title (cont. Table 1)	No. of Issues per vol.	Issues with Reviews	Total Reviews	Average Reviews per Issue
Quarterly Journal of the Royal Meteorological Society	6	3	10	1.67
Antarctic Science	4	3	9	2.25
Limnology and Oceanography	6	5	9	1.50
Weatherwise	6	5	9	1.50
Mathematical Geology	8	6	9	1.13
University of Wyoming. Contributions to Geology	12	5	9	0.75
Hydrological Processes	18	8	9	0.50
Quaternary Science Reviews	22	4	8	0.36
American Paleontologist	4	4	7	1.75
Environmental Geology (International Journal of Geosciences)	4	4	7	1.75
Geomatica	4	3	7	1.75
Northeastern Geology and Environmental Sciences	4	2	7	1.75
Journal of Paleontology	6	3	7	1.17
International Journal of Remote Sensing	24	5	7	0.29
Australian Meteorological Magazine	4	2	6	1.50
Paleobiology	4	2	6	1.50
Geological Journal	4	2	6	1.50
Journal of Geology	6	2	6	1.00
Preview. Australian Society of Exploration Geophysicists	6	5	6	1.00
Geophysical Journal International	12	3	6	0.50
International Journal of Coal Geology	18	4	6	0.33
Sedimentary Geology	34	6	6	0.18
Earth Science Reviews	12	3	5	0.42
Geochimica et Cosmochimica Acta	24	3	5	0.21
Gulf of Mexico Science	2	2	4	2.00
Journal of Glaciology	4	4	4	1.00
Oceanography	4	4	4	1.00
Engineering Geology	12	4	4	0.33
Rock Mechanics and Rock Engineering	4	3	3	0.75
Clays and Clay Minerals	6	3	3	0.50
Seismological Research Letters	6	2	3	0.50
Journal of Petrology	12	2	3	0.25
Catena	20	2	3	0.15
Bulletin of the Geological Society of Denmark	2	1	2	1.00
Polish Polar Research	4	1	2	0.50
Coral Reefs	4	1	2	0.50
Canadian Geographer	6	3	2	0.33
Ground Water	6	2	2	0.33
Sedimentology	6	1	2	0.33
Atmospheric and Oceanic Physics. Izvestiya	7	2	2	0.29
Eurasian Geography and Economics	8	2	2	0.25
Computers and Geosciences	10	2	2	0.20

Journal Title (cont. Table 1)	No. of Issues per vol.	Issues with Reviews	Total Reviews	Average Reviews per Issue
Applied Clay Science	12	2	2	0.17
Atmospheric Research	18	2	2	0.11
Scottish Journal of Geology	2	1	1	0.50
Clay Minerals	4	1	1	0.25
Lethaia	4	1	1	0.25
Proceedings of the Geologists' Association (of London)	4	1	1	0.25
Quarterly Journal of Engineering geology and Hydrology	4	1	1	0.25
G F F	4	1	1	0.25
Journal of Petroleum Geology	4	1	1	0.25
Canadian Geotechnical Journal	6	1	1	0.17
Surveys in Geophysics	6	1	1	0.17
Journal of African Earth Sciences	8	1	1	0.13
Global and Planetary Change	10	1	1	0.10
Quaternary International	12	1	1	0.08
Journal of Volcanology and Geothermal Research	24	1	1	0.04
Tectonophysics	64	1	1	0.02

Table 2. Journals with Reviews in Order by Average Age of Book Reviewed.

Journal Title	Average Age (Years)	Number of Reviews
Contributions to Atmospheric Physics (cont. by Meteorologie Zietschrift)	0	23
Canadian Geographer	0	2
Eurasian Geography and Economics	0	2
Polish Polar Research	0	2
Coral Reefs	0	2
Canadian Geotechnical Journal	0	1
Weatherwise	0.33	9
Nature	0.40	52
Gems and Gemology	0.47	19
Australian Meteorological Magazine	0.50	6
Lapidary Journal	0.54	13
University of Wyoming. Contributions to Geology	0.67	9
International Journal of Coal Geology	0.67	6
Preview. Australian Society of Exploration Geophysicists	0.67	6
Catena	0.67	3
Oceanography	0.75	4
American Mineralogist	0.82	11
Boreas	0.83	12
Sedimentary Geology	0.83	6
Geotimes	0.86	28
Environmental Geology (Intern'l J. of Geosciences)	0.86	7

Journal Title (cont. Table 2)	Average Age (Years)	Number of Reviews
Geomatica	0.86	7
Geography	0.94	69
EOS, Transactions American Geophysical Union	0.98	44
Hydrological Sciences Journal	1.00	13
Arctic, Antarctic, and Alpine Research	1.00	10
Antarctic Science	1.00	9
Journal of Glaciology	1.00	4
Clays and Clay Minerals	1.00	3
Seismological Research Letters	1.00	3
Applied Clay Science	1.00	2
Atmospheric and Oceanic Physics. Izvestiya	1.00	2
Atmospheric Research	1.00	2
Computers and Geosciences	1.00	2
Sedimentology	1.00	2
Bulletin of the Geological Society of Denmark	1.00	2
Clay Minerals	1.00	1
Journal of African Earth Sciences	1.00	1
Lethaia	1.00	1
Scottish Journal of Geology	1.00	1
Surveys in Geophysics	1.00	1
Tectonophysics	1.00	1
Journal of Petroleum Geology	1.00	1
Canadian Mineralogist	1.04	25
Geochronique (French)	1.07	82
Geoscience Canada	1.10	20
Weather	1.11	27
Bulletin of the American Meteorological Society	1.13	39
Journal of Paleontology	1.14	7
Journal of Sedimentary Research	1.17	12
Leading Edge	1.18	38
Episodes (Nottingham)	1.19	16
Journal of Geodesy	1.21	14
Limnology and Oceanography	1.22	9
Geological Magazine	1.24	55
Gulf of Mexico Science	1.25	4
Quarterly Journal of the Royal Meteorological Society	1.30	10
Meteoritics and Planetary Science	1.30	15
Hydrological Processes	1.33	9
Mineralogical Magazine	1.35	23
AAPG Bulletin	1.41	17
American Paleontologist	1.43	7
International Journal of Remote Sensing	1.43	7
Holocene	1.46	35
Palaios	1.46	13
Canadian Geographic	1.50	20

Journal Title (cont. Table 2)	Average Age (Years)	Number of Reviews
Economic Geology	1.50	14
Ground Water	1.50	2
die Erde	1.54	13
Earth Surface Processes Landforms	1.56	16
Annals of the Association of American Geographers	1.60	70
Geochimica et Cosmochimica Acta	1.60	5
Journal of Geoscience Education	1.67	12
Geophysical Journal International	1.67	6
Journal of Petrology	1.67	3
Rock Mechanics and Rock Engineering	1.67	3
Quaternary Science Reviews	1.75	8
Earth Science Reviews	1.80	5
Geology Today	1.81	32
Paleobiology	1.83	6
Environmental & Engineering Geoscience (2001)	1.94	16
Geographical Journal	1.98	49
Climatic Change	2.00	11
Northeastern Geology and Environmental Sciences	2.00	7
Journal of Geology	2.00	6
Engineering Geology	2.00	4
Journal of Volcanology and Geothermal Research	2.00	1
G F F	2.00	1
Quaternary International	2.00	1
Mountain Research and Development	2.06	18
Mineralogical Record	2.08	13
Geological Journal	2.17	6
Geomorphology	2.27	11
Mathematical Geology	2.33	9
Progress in Physical Geography	2.34	50
Pure and Applied Geophysics	2.55	11
Global and Planetary Change	3.00	1
Proceedings of the Geologists' Association (of London)	3.00	1
Quarterly Journal of Engineering geology and Hydrology	3.00	1

Table 3. Number of "Books Received" Listed in Journals.

Journal Title	Books Received
Bulletin of the American Meteorological Society	262
Geological Magazine	112
Organic Geochemistry	104
Geochronique (French)	88
Seismological Research Letters	79
New Mexico Geology	79
Meteoritics and Planetary Science	68
Economic Geology	67

Journal Title (cont. Table 3)	Books Received
Geotimes	58
AAPG Bulletin	50
Nature	49
Geography	37
International Journal of Remote Sensing	29
Canadian Geographic	19
Weatherwise	19
Hydrological Sciences Journal	15
Arctic, Antarctic, and Alpine Research	15
Hydrological Processes	15
Quaternary Research	10
Weather	9
Ice	8
Gems and Gemology	3
Leading Edge	1

Table 4. Journals Containing Alternative Forms of Media Reviews in 2002.

JOURNAL	Internet sites	DVD's	CD's	Maps	Videos	Period-icals
Geochemistry Intern'l	0	0	0	0	2	0
Environmental Geology	2	0	0	0	0	0
Gems and Gemology	1	1	0	0	0	0
Geography	1	0	1	0	0	5
Geology Today	0	0	0	1	0	0
Geotimes	7	3	2	0	0	0
Hydrological Processes	0	0	1	0	0	0
Intern'l J. of Coal Geology	0	0	2	0	0	0
Lapidary Journal	0	0	3	0	0	0
Mineralogical Record	1	0	0	0	0	0
Mountain Research &Dev.	0	0	0	0	2	0
Weatherwise	0	0	0	1	0	0

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PUBLISHING PATTERNS IN THE EARTH SYSTEM SCIENCE DEPARTMENT, A NON-TRADITIONAL GEOSCIENCE PROGRAM AT THE UNIVERSITY OF CALIFORNIA, IRVINE

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Abstract – This analysis will compare publications and research patterns between the University of California, Irvine (UC Irvine or UCI) Earth System Science faculty researchers and more traditional geology departments. Additionally, this analysis will provide insights into the research habits and publication patterns of the Earth System Science (ESS) faculty. The information presented will exemplify specialized collection development experiences in a university library setting as well as highlight current changes in information usage in the geosciences. These changes not only have an impact on library users, but also on those responsible for collection development in support of research. The ESS instruction and departmental research emphasis changes are a dynamic reflection of interests in current issues and global environmental concerns – not static reflections of standard physical science programs.

INTRODUCTION

The UC Irvine, School of Physical Sciences did not have a Geology Department as part of its beginning curriculum in 1965. It wasn't until the late 1980's that the Physical Sciences program began to consider the addition of the geological sciences. Up until then, any geology and soil science materials added to the library collections were selected by bibliographers to support the research and instruction efforts of the Department of Ecology and Evolutionary Biology in the School of Biological Sciences, and rock and soil mechanics in the Department of Civil Engineering.

In 1989, the Dean of the School of Physical Sciences initiated the establishment of a new program in Geosciences, with atmospheric chemistry as the foundation subject area for the new department. Atmospheric chemist Ralph Cicerone was the first chair of the new department. Cicerone was a senior scientist and Director of the Atmospheric Chemistry Division at the National Center for Atmospheric Research in Boulder, Colorado from 1980 to 1989. In 1989 Cicerone was appointed the Daniel G. Aldrich, Jr. Professor of the Geoscience Department at UC Irvine, and chaired the department from 1989 to 1994. In 1994, the department changed its name to Earth System Science to reflect the scope of the department's research focus on global ecology and the interrelationships among the atmospheric, terrestrial and aquatic/oceanic systems.

From 1993-1994 the geosciences program was directed to the Ph.D. degree only. Undergraduate classes were offered as supporting classes to other departments on campus, such as Social Ecology and Ecology and Evolutionary Biology, as well as to satisfy student demands for classes on the greenhouse effect and climate changes. It was not until the 2000-2001 academic year that a major with a Bachelor of Science degree was offered.

It was my assumption that the relatively new program for which I was responsible for collection development had little in common with other academic earth science programs of longer standing. One purpose of this research was to share in greater depth the type of program for which I was responsible with my colleagues in the Geoscience Information Society, since I felt that the UC Irvine Earth System Science program was unique among geoscience departments. The result of the research revealed to me how similar academic geoscience departments have become with the greater emphasis and awareness of the interdisciplinarity and interrelatedness of research interests among the environmental sciences.

METHODOLOGY

The goal of this analysis was to compare UC Irvine with the top five geoscience graduate programs in the United States. To determine what rankings were assigned universities with the top programs, the 2002 edition of *U.S. News and World Report: Best Graduate Schools* was consulted. Those programs with the headings of geology, geophysics and geochemistry were selected for the study. The rankings identified the following top geoscience programs [in order of decreasing rank]:

1. California Institute of Technology [CALTECH]
2. Massachusetts Institute of Technology [MIT]
3. Stanford University [Stanford]
4. University of California, Berkeley [UC Berkeley]
5. University of Michigan, Ann Arbor [U Mich]

Next, the program descriptions provided by each institution were analyzed to determine the similarities and differences. Following that, the next element under comparison was the total number of faculty in the geoscience department at each institution. Each departmental web page was consulted and a total number of faculty calculated. Finally, a list of faculty names was compiled for each of the departments under investigation.

The subsequent step was a consultation of the *Web of Science* database, using each faculty member's name to determine how many journal articles were published in each department during the January 1999 to October 2003 time period.

Following that, the top five journals in which each department published were determined by counting total citations for each journal title cited by each author. Then, the five titles with the most number of citations were selected as the top journals for each department. The analysis also included a calculation of the average number of publications per person for each of the six departments for the time period under review, followed by a comparison of the same journal titles in which all six of the comparison departments published.

RESULTS

Departmental Self Descriptions:

The UC Irvine Earth System Science describes itself as focusing on "Global Ecology" including:

- Atmospheric Chemistry
- Biogeochemical Cycles
- Physical Climate

The CALTECH department is titled: Geological & Planetary Sciences and is involved in research in:

- Geobiology
- Geochemistry
- Geophysics
- Glaciology
- Planetary Astronomy
- Seismology

The MIT geoscience department is called: Department of Earth, Atmospheric & Planetary Sciences. Research is concentrated in the following areas:

- Geology
- Geobiology
- Geochemistry
- Geophysics
- Atmospheres, Oceans & Climate
- Planetary Science

Stanford calls its group The School of Earth Sciences and offers research in:

- Geological & Environmental Sciences
- Geophysics
- Petroleum Engineering
- Interdisciplinary Program in Environment & Resources

The UC Berkeley geosciences are in the Department of Earth & Planetary Science. Their research is focused in the following areas:

- Geochemistry
- Geophysics
- Geodynamics
- Geology
- Atmospheric Science

The U Michigan geoscience department is titled: Department of Geological Sciences, and covers research in:

- Geochemistry, Petrology, Mineralogy
- Geophysics, Tectonics, Structure
- Environmental Geochemistry, Geohydrology
- Oceanography, Sedimentology, Climate Change
- Geobiology, Paleontology

Total Number of Geoscience Faculty for Each Institution:

Institution	# Faculty
UC Irvine	18
CALTECH	35
MIT	40
Stanford	49
UC Berkeley	31
U Michigan	38

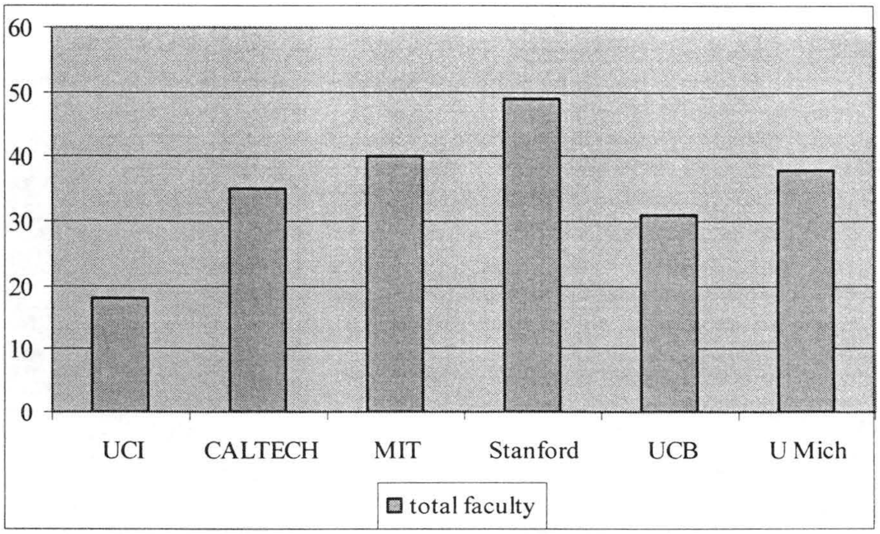

Figure 1. Total number of faculty at each institution

Total Number of Journal Articles Published from January 1999 to October 2003:

Institution	Total # Articles
UC Irvine	310
CALTECH	683
MIT	502
Stanford	753
UC Berkeley	477
U Michigan	496

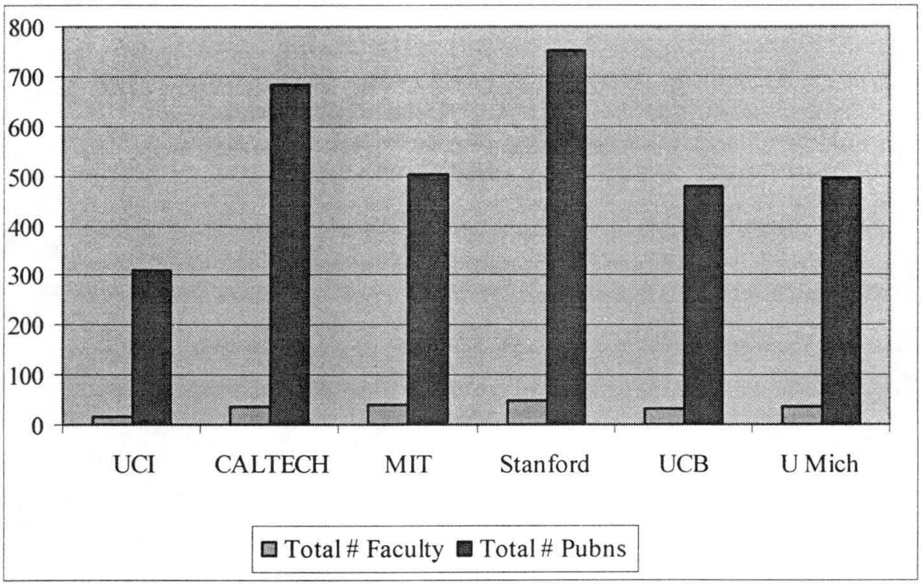

Figure 2. Publication comparison among institutions:

Figure 2 above shows the total number of published journal articles by geoscience faculty for each institution. The size of department does not always mean that there will be an equivalent rate of publication.

The Top Five Journals for Each Department:

UC Irvine:

Journal	# Articles	Avg # Articles per Person
Journal of Geophysical Research--Atmospheres	95	30.65
Geophysical Research Letters	43	13.87
Global Biogeochemical Cycles	12	3.87
Abstr. Of Papers of the American Chemical Soc.	11	3.55
Radiocarbon	9	2.9

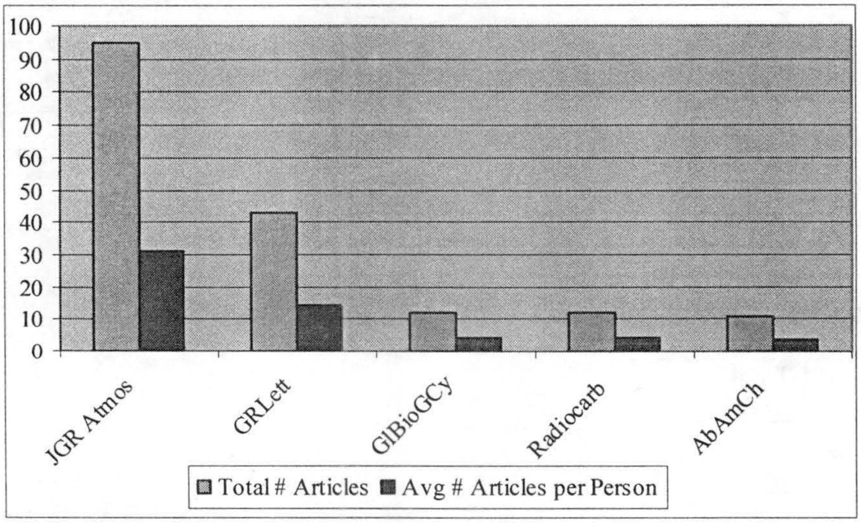

Figure 3. Top five journals for UC Irvine

CALTECH:

Journal	# Articles	Avg # Articles per Person
Astrophysical Journal	138	20.2
Geochim et Cosmochim Ac	50	7.32
Geophysical Research Letters	50	7.32
Journal of Geophysical Research--Solid Earth	35	5.12
Nature	35	5.12

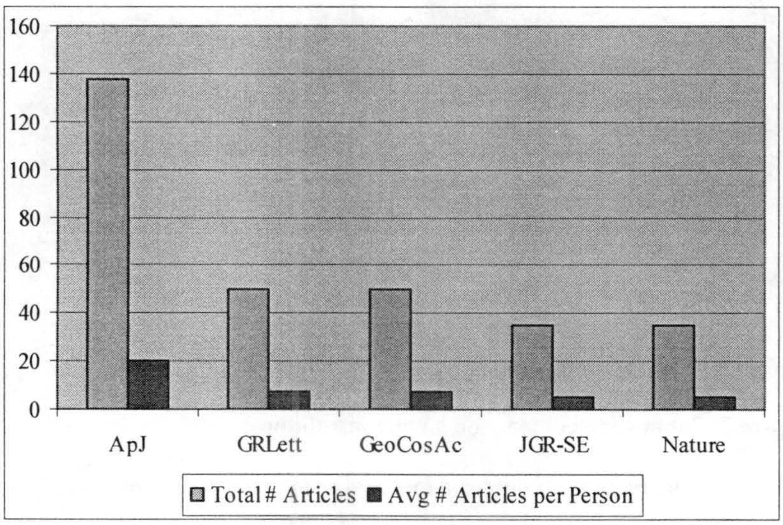

Figure 4. Top five journals for CALTECH

MIT:

Journal	# Articles	Avg # Articles per Person
Journal of Geophysical Research--Solid Earth	39	7.77
Science	35	6.97
Geophysical Research Letters	34	6.77
Earth & Planet Science Letters	25	4.98
Geology	24	4.78

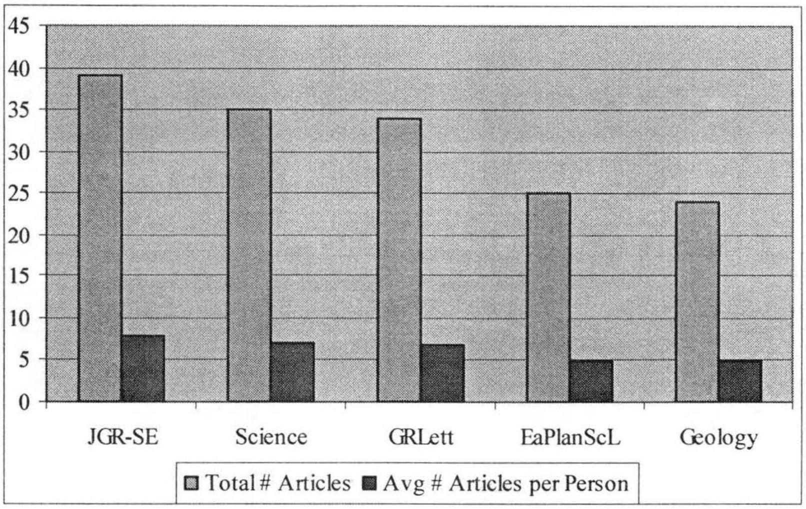

Figure 5. Top five journals for MIT

Stanford:

Journal	# Articles	Avg # Articles per Person
Journal of Geophysical Research--Solid Earth	42	5.58
Geophysical Research Letters	34	4.51
Geochimica et Cosmochimica Acta	32	4.25
American Mineralogist	31	4.12
Nature	29	3.85

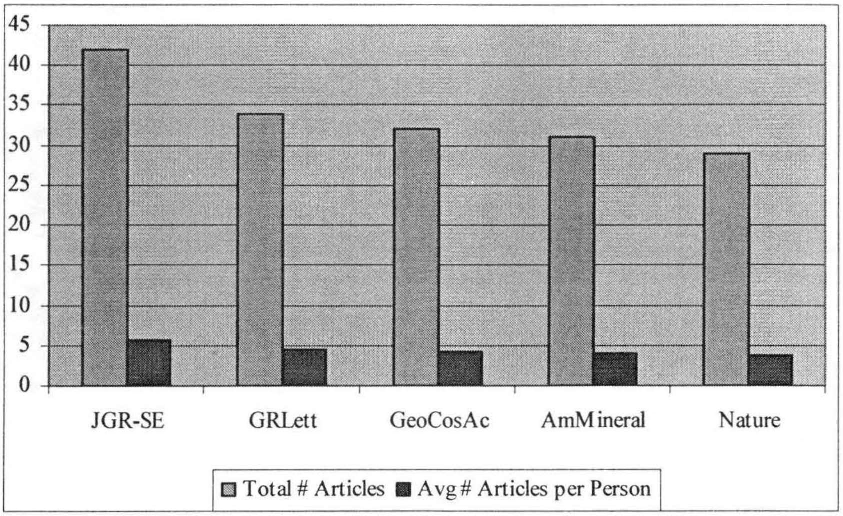

Figure 6. Top five journals for Stanford

UC Berkeley:

Journal	# Articles	Avg # Articles per Person
Geophysical Research Letters	44	9.22
Journal of Geophysical Research--Atmospheres	35	7.33
Journal of Geophysical Research--Solid Earth	29	6.08
Geology	23	4.82
Nature	21	4.4

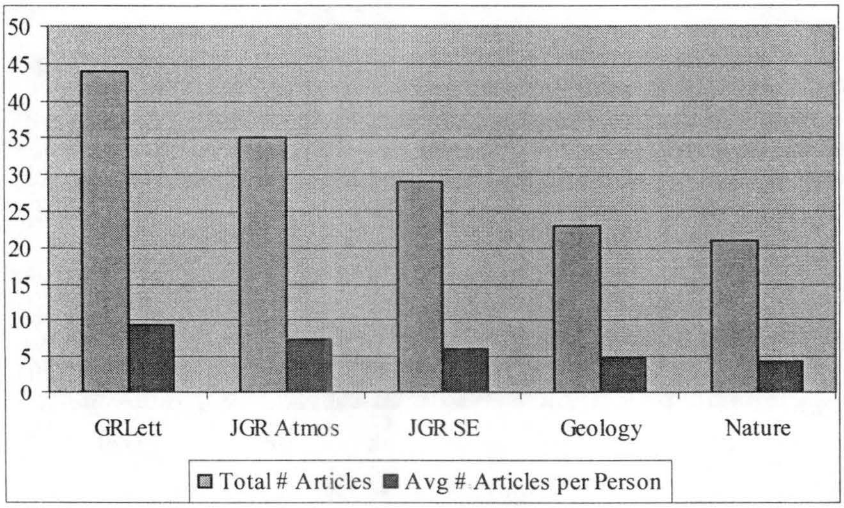

Figure 7. Top five journals for UC Berkeley

U Michigan:

Journal	# Articles	Avg # per Person
Earth & Planet Science Letters	44	8.87
Geochimica et Cosmochimica Acta	36	7.26
Journal of Geophysical Research-Solid Earth	18	3.63
Journal of Nuclear Materials	14	2.82
Tectonophysics	14	2.82

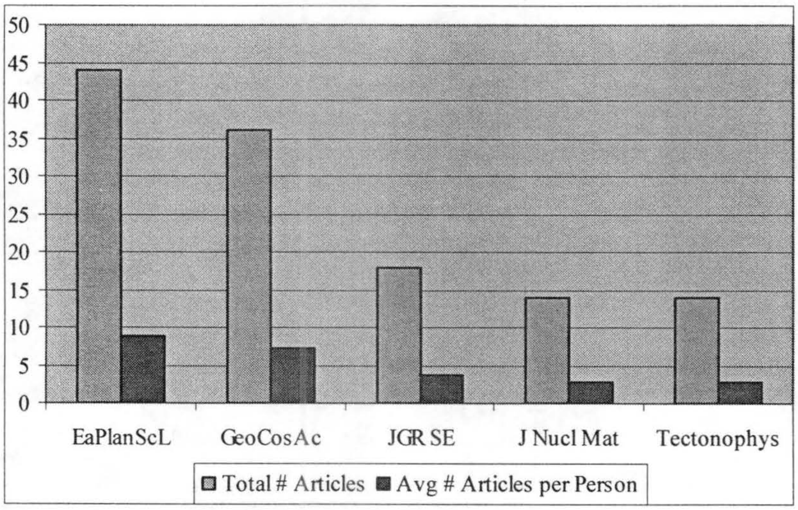

Figure 8. Top five journals for U Michigan

Average Number of Publications per Faculty Member:

The average number of publications per faculty member at each of the six comparison campuses was as follows:

Institution	Average # per Person
UC Irvine	17.22
CALTECH	19.50
MIT	12.55
Stanford	15.67
UC Berkeley	15.39
U Michigan	13.05

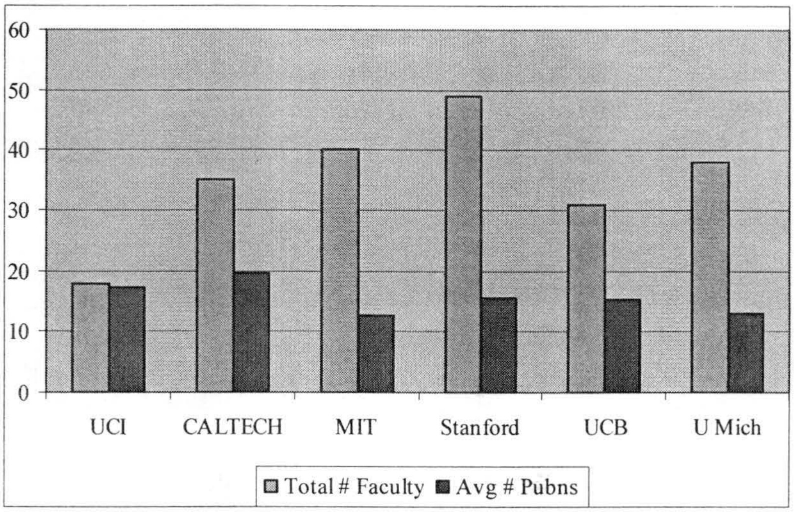

Figure 9. Average number of publications per faculty member

These numbers demonstrate the fact that number of faculty does not necessarily equate with the rate of publication. In the case of the UC Irvine Department of Earth System Science, though the number of faculty in the department is relatively small (18 faculty members), the rate of publication is close to that of CALTECH, which has 35 faculty, and is approximately 51% larger than UC Irvine.

Titles Published in Common:

In Figure 10 below, the three titles in which all of the departments published included: *Journal of Geophysical Research – Atmospheres*, *Geophysical Research Letters* and *Nature*. The numbers of each title for each department reflect the different research foci. UC Irvine emphasizes *Journal of Geophysical Research – Atmospheres* because of the department's emphasis on atmospheric chemistry. The number of CALTECH publications in *Geophysical Research Letters* followed by *Nature* reflects the strong interdisciplinary interest in planetary geology, the term "planetary" including the Earth as well as the rest of the solar system. The comparatively even spread of numbers among the three common titles at MIT also reflects the strong interdisciplinary activities at this department. Stanford has a lower interest in research on atmospheric topics, and has a greater interest in geophysics (*Geophysical Research Letters*) and the interdisciplinary journal, *Nature*. The pattern observed in the data for UC Berkeley looks similar to that of MIT, though the total number for each title is larger than those of MIT. It would seem to me that the research at Berkeley is also strongly interdisciplinary. The University of Michigan has much smaller numbers of articles published in the three common journal titles, and seems to favor the interdisciplinary journal *Nature.* One would conclude that the types of journals where each department published would reflect the research emphasis of each respective program.

	UCI	CALTECH	MIT	Stanford	UCB	U Mich
GRL	43	50	34	34	44	10
JGR-Atmos	95	6	23	1	35	4
Nature	7	35	13	29	21	13

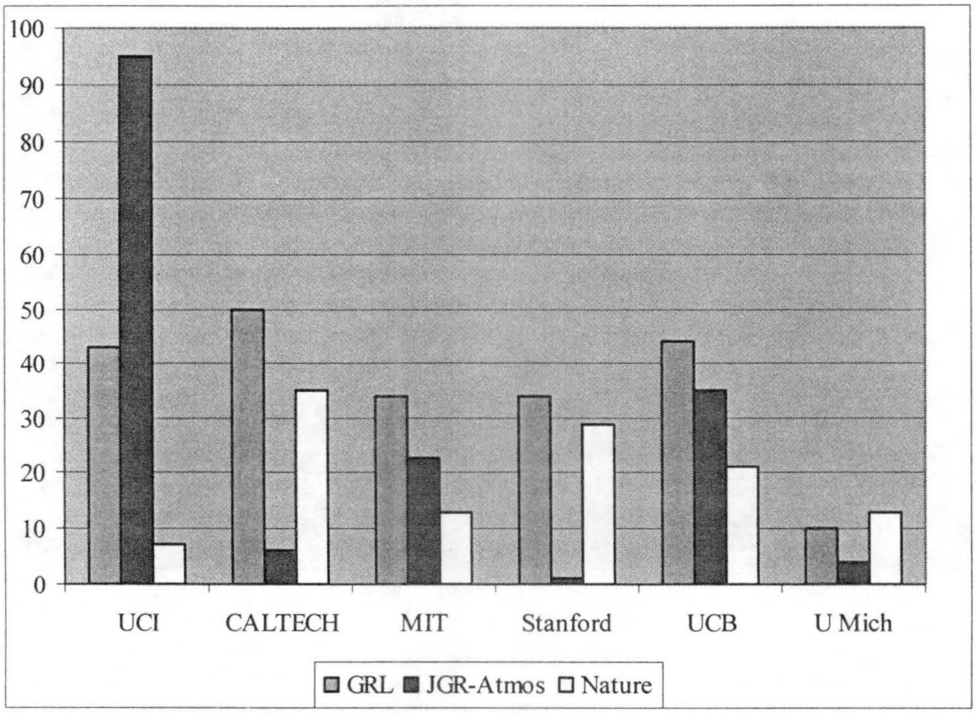

Figure 10. Common journal titles among all institutions

CONCLUSIONS

There is evidence of a strong movement toward increasing interdisciplinarity in the research trends of the top academic geoscience programs in the United States. The interest in the more "traditional" geological subject areas and research technology continues, and is being expanded by not only newly emerging technologies but an awareness of the interrelatedness of all elements within the global closed system of Planet Earth. If one observes the levels of publication for all six institutions in the top three journal titles in common, one can see that each level of publication reflects the research emphases for each program. The UC Irvine Earth System Science faculty members are anticipating that their research efforts will provide them with the groundwork to permit them to predict global climate changes within the next ten years. The Earth System Science program may be new relative to other programs at other academic institutions, yet despite its initial emphasis on atmospheric chemistry, this program matches the general trend of other earth, geophysical and planetary science programs toward increasing interdisciplinarity and cooperation.

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University of Michigan, Ann Arbor - Department of Geological Sciences: http://www.geo.lsa.umich.edu/.

INFORMATION LABS: THE NEXT BEST THING IN INFORMATION LITERACY INSTRUCTION?

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Abstract – As higher education transforms itself from a lecture-dominated enterprise to one that encourages active engagement by the students with the curriculum, librarians have a new avenue for inserting themselves into the educational mission of the university. At Purdue University, the libraries have successfully integrated problem-based learning activities into curricula in several departments. One of the most successful ventures at Purdue has been in the Earth and Atmospheric Sciences (EAS), where, in addition to our regular instructional presence, we have created "information labs" in two courses so far, including the first year survey course taken by all EAS majors.

The information lab takes the place of a regular lab in those classes, and involves the students tackling a research project, solving it, and writing up the results in some format. The lab uses a problem-based learning methodology, where students take ownership of a problem or situation, determine what their learning issues are, and then go about resolving those learning issues to solve their problem. The instructor acts as a guide, answering questions and guiding students through the process of problem solving, rather than standing up front and demonstrating databases for the students. The students work in small groups to facilitate peer learning as well, which has been shown to be a preferred method for students to learn. Since the information lab takes the students through all the steps in the problem-solving process, it naturally addresses each of the ACRL information literacy competencies, providing a well-rounded introduction to information literacy to the students. This paper describes the two information labs that have been created for the geosciences, one in the survey course and one in mineralogy.

INTRODUCTION

There is a growing movement in higher education away from traditional lecturing methods and toward an active, learner-centered approach to education. In order to remain effective partners with subject faculty, librarians need to be able to adapt to changes in instructional techniques, and indeed provide leadership to subject faculty by offering cutting edge techniques for their classroom. One example of learner centered instruction is the creation of Information Labs at Purdue University. Taking the place of one or two regular lab sessions, Information Labs build on the active learning that traditionally takes place in laboratory classes, only in this case the topic is being analyzed by using outside information (outside the course textbook and reserves), rather than from an experimental apparatus.

Traditionally, lecture-based instruction was seen as the best way to transfer information from the instructor's head into the students' brains. However, in this situation, students are passive recipients of information and tend not to be able to explore, grapple with, or try out concepts or techniques until much later, when they've forgotten most of what the lecture was about. Alternatively, in an active-learning environment, students are encouraged to develop their own intuition, build up an idea of how things work within their own conceptual framework, test assumptions, and reconceptualize their conclusions if their predictions don't pan out. By intellectually engaging the content, students are more likely to master the concepts, than in a passive, lecture-driven format.

There are many ways to provide active learning experiences as part of information literacy instruction. *Designs for Active Learning* (Gradowski, Snavely, and Dempsey, 1998), for example, provides a compilation of active learning activities for a variety of situations. For the information labs discussed below, a problem-based learning approach was used to structure the information activities. Macklin (2001) explains the basic framework of problem-based learning applied to information literacy experiences, and Fosmire and Macklin (2002) discuss this and other actual applications of problem-based learning to coursework. For general information on the problem-based learning methodology, Duch, Groh, and Allen (2001) provide excellent examples of problem-based learning applied to science instruction, and Fogarty (1997) has created an easy to read workbook of problem-based learning activities.

In general, the problem-based learning method involves the following steps. The instructor presents a problem or scenario. The students restate the problem to articulate their specific information needs. They determine the key concepts they need to search, locate the information from some databases or print resources, analyze the information they get, synthesize it to form conclusions about their problem, and use the information correctly to present their conclusions to the rest of the class. This method naturally addresses all of the major facets of the Information Literacy Competency Standards (ACRL, 2002).

THE INFORMATION LAB

The specific case of an introductory earth and atmospheric sciences class, required of all majors at Purdue, will be used as an example. A problem is presented to the students. For example,

> *Everyone is talking about global warming. As a legislative aide, you need your boss to stay in power so you can keep your job. Recommend a policy about global warming that will make your congressperson look good and ensure their re-election. Specifically: Your working group has been selected to provide a recommendation concerning X as a possible solution to the global warming situation. For the next lab, prepare a presentation showing why your recommendation should be endorsed by your boss.*

The students are then asked to determine the key concepts of the problem, and to articulate their problem statements. The instructors facilitate this by giving the students a *KND*-type worksheet, that asks, What do you *K*now already? What do you *N*eed to know to solve your problem? What do you need to *D*o to find that information? This sets the stage for the information seeking process. The instructors circulate around the room to facilitate the completion of the KND worksheets, and students work in small groups of around 3-5 members to maximize the level of peer learning that occurs. One group is then asked to present their worksheet to the rest of the class as a model, and the entire class discusses the good points and what is missing, so that everyone learns from each other the best way to start the problem solving process.

Once everyone has a good feel for what it is they are looking for, we let them loose on the Internet to see what they can find. They do some searching and find some web sites that they think they like, with the instructors again milling around to see how the students are doing. We have not yet found a situation where at least one student in the group hasn't done appreciable web searching before, but we do provide links to some popular web search engines just in case. It is during this informal searching process that the instructors can explain concepts of narrowing, focusing results, etc., at the point of need, when students care about those concepts.

The student groups find web sites of interest and write down what they've learned from them. We then pass out a list of criteria for evaluating web sites and ask the groups to exchange papers and evaluate the other group's web sites. This leads to good discussions, since we ask the evaluators to present examples of especially good and bad web sites to the rest of the class, and articulate why they classified them as such.

We duplicate the process, using databases to find journal articles. We provide links to databases for the students and let them start searching. When they run into conceptual problems, or difficulties with the interface, the instructors address those issues at the point of need, bringing in conceptual issues at those times. For example, why does one get so many fewer hits in an article database than a web search engine? How can one use the structure of the database to get better focused and more reasonable results? Mini-lectures on concepts, when the concepts have been brought up by the students as needing clarification, are a way structured instruction can be effectively given. By comparing their results for journals and web sites, the students begin to understand how those publication types are different and the most appropriate uses of each.

By the end of the laboratory session, which takes between two and three hours in total, the students will have determined the nature and extent of their problem and articulated their "learning issues." They have found a handful of web sites and journal articles that inform their problem. All that is left for them to do is synthesize this information and create a presentation for the next lab. We have scheduled this lab the week before our October Break, since there are no lab classes the week of the "Break," so that the students have an extra week to prepare their presentations.

RESULTS

Several measures of success were reached for this information laboratory. First, the course instructors noticed a marked increase in the quality of term papers written for the class, compared to students from previous years who had no formal information literacy instruction. Second, self-evaluations by the students indicated that over 90% felt they could 'Find and Evaluate Information," "Find Scholarly Information," and "Properly Cite Information." Over three quarters could "Apply Skills Learned to Their Final Project," which is an indication that students figured out that there were universal concepts in finding, interpreting, and using information that transcended a specific laboratory exercise. Finally, over half of the students rated the "Information Lab" as one of the top two labs in the course, and many students wrote comments about how much fun they had researching their special topic, and thought the exercise was very relevant to their interests. This is very gratifying, as it is often difficult to interest students in a typical "library lecture."

SCALABILITY

Each year the implementation of this introductory course has changed. The first year, two information labs were taught (one on problem solving and web searching, the other on finding journal articles) to four sections of students. This involved twenty-four contact hours, not including listening to and grading the student presentations (another twenty four hours). The following year, the two information labs were merged into one, halving the amount of contact time needed for the course. Last year, the course TAs were trained to administer the lab, letting them act as the lead facilitators, with a librarian instructor acting as a facilitator and providing backup for the TAs. At the outset the course was very time intensive, but it has become increasingly manageable as more was learned and instructors have become more comfortable with the whole process of problem-based learning.

ADVANCED COURSE

I have extended the information lab concept to more advanced students, creating an information lab for a mineralogy course. In that course, students need to identify an unknown mineral, and write a report on its properties, uses, etc., as a term paper for the class. For this project, students first brainstorm what specific pieces of information they need to find in order to write their report (in a less formal KND process). Then, once they know their "learning issues," I split them up into small groups and give them different kinds of reference works to dig into. The students figure out how the information about their mineral is laid out in the reference work and how much and what kind of information is contained therein. That way the students teach each other about the specialized resources of their field.

Since reference books do not contain all the information the students need for their projects, the class determines what information is left to find, and then goes to the web and the journal literature to find it. Students in this class have already gone through the introductory-level information lab, so this provides a refresher for students in evaluating web sites. As the most popular web sites for minerals are those concerned with spiritual healing properties of minerals and those that are selling minerals, there is ample room for discussions of authority, purpose, and bias for those web sites. And, indeed, finding their way through the more commercial web sites to ones that have more useful information is good practice for all levels of web searchers.

CONCLUSIONS

Information labs certainly promote a hands-on way of learning both information skills and content relevant to the students' course work. The students have self-identified that they enjoy the labs, they learn important information literacy skills, and they can transfer those skills from their immediate assignment to projects that they will encounter throughout their academic careers.

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GEOSCIENCEWORLD: A MULTI-SOCIETY AGGREGATION OF GEOSCIENCE ELECTRONIC JOURNALS

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Abstract – GeoScienceWorld is a multi-society aggregation of geoscience electronic journals currently under development by seven organizations: American Association of Petroleum Geologists, American Geological Institute, Geological Society of America, Geological Society of London, Mineralogical Society of America, Society for Sedimentary Geology, and Society of Exploration Geophysicists. The purpose is to continue the collective mission of disseminating scientific research and information as well as to preserve past scientific literature. The aggregation will consist of peer-reviewed, high quality, regularly appearing, internationally based, earth and space science journals that are published primarily by non-profit professional societies.

The initial launch will feature a Millennium Collection, which will consist of a full-text, online-accessible aggregation of geoscience journals issued from January 2000 forward. Features will include searching of full-text and figure captions for all journals in the aggregation, and of all geoscience literature through GeoRef, and linking between article references and cited articles through CrossRef. The intent is to develop a literature access service linking the Millennium Collection to searchable electronic back issues (pre-2000) of as many society journals as possible. Although initial focus is on journals, the goal is to include or be linked to non-journal material such as digital datasets, books, maps, and other geoscience literature in the future. An electronic journal aggregation should result in a greater integration and exposure of earth science disciplines and an increase in the value and accessibility of scientific society journals to the greater geoscience community, including developing countries. GeoScienceWorld may have the most powerful impact on geosciences in many decades.

INTRODUCTION

As the academic and commercial sectors move increasingly towards relying on the Internet for information, publishers of scientific scholarly journals have recognized the need to put their journals online and to take advantage of the benefits of electronic media such as rapid searching, linking and easy access. Commercial publishers have been the most successful at making the transition to electronic media, but the costs for these new products has been prohibitively expensive for many academic libraries. Scientific society publishers have been slower to move to online journals and as a result have seen an increase in the cancellation of print subscriptions. Many of the smaller societies cannot afford to make the transition to electronic media and are becoming increasingly marginalized. At the same time, academic researchers, students, and professional geoscientists have become accustomed to the benefits of electronic media and preferentially use and publish in journals that are widely accessible online. Unless scientific societies provide the same services as commercial publishers, their usage, and ultimately the quality of research published within them, will decrease markedly.

Scientific societies have a long history of being successful at publishing scientific research. Scientific societies produce high quality prestigious journals and provide an effective and inexpensive outlet for scientific research. A primary mission of scientific societies is dissemination of scientific research and information and advancement of science. Several years ago the leaders of several major geoscience societies recognized the need for collective action to ensure that geoscience society journals continued to meet the changing needs of academic researchers, students, and professional geoscientists. To do so, and to help smaller geoscience societies not yet publishing electronically go online and to preserve past literature, six societies and one institute agreed to develop an online, fully-integrated aggregation of geoscience societies' journals, GeoScienceWorld. These founding organizations are: American Association of Petroleum Geologists, American Geological Institute, Geological Society of America, Geological Society of London, Mineralogical Society of America, Society for Sedimentary Geology, and Society of Exploration Geophysicists.

PURPOSE

The overarching vision of GeoScienceWorld is to advance and promote the geosciences and benefit geoscientists and their societies worldwide, in keeping with the missions of the founding organizations. Goals include increasing the accessibility of the journals within the aggregation, particularly within academia, industry and developing countries, and increasing the overall readership and circulation. The aggregation should optimize the usefulness of these journals through enhanced and quicker, more productive searches and linking between article references and the cited articles. The advantages to authors publishing in these journals will increase, most notably with increased circulation. Furthermore, by interlinking journals across the spectrum of geoscience disciplines, better integration of geoscience research should be achieved. The aggregation also offers a way to increase the accessibility of past literature insuring its preservation and use in the future. More than most other sciences, geological sciences continue to use and reference older publications which provide good basic geologic data. An ancillary goal is to provide a central information site and link for all geoscience society activities, such as field trips, meetings, conferences, short courses, etc.

AGGREGATION FEATURES

The Millennium Collection, when launched, will consist of a full-text, online-accessible aggregation of about 30 geoscience journals with a substantial archive of back issues from January 2000 forward. Features will include linking between article references and cited articles through CrossRef and searching of full-text and figure captions for all journals within the aggregation and of all other geoscience literature through GeoRef. GeoRef will be fully integrated and inter-operable, including its excellent controlled vocabulary. Having GeoRef imbedded will expand the search capability and direct linking to include the vast majority of geoscience literature, not just literature from the participating publishers. Other expected features include HTML and PDF (searchable) full text searches using a controlled vocabulary; the ability to limit searches to subsets; clear identification of journals and societies; public access to all abstracts; and, links to enhanced data sets. With these superior features, the functionality and usefulness of the aggregation will be significantly enhanced beyond anything print or stand-alone online can deliver.

FUTURE GOALS

To meet its stated goals, GeoScienceWorld intends to offer more in the future than the Millennium Collection. Initially GeoScienceWorld will focus on journals published in English, but will later incorporate other languages for worldwide coverage. To make past literature more accessible and preserve it in a form that will ensure its preservation and use, GeoScienceWorld intends to develop a literature access service linking the Millennium Collection to searchable electronic back issues (pre-2000) of most participating societies. As the aggregation grows, we anticipate developing discipline-specific modules that can be purchased separately so that libraries can tailor the aggregation to meet the specific needs of their users. It should be noted, however, that GeoScienceWorld has not chosen to offer a "cafeteria plan" for the Millennium Collection because that defeats many of the aggregation's goals, such as making available to all users a wide spectrum of interlinked geoscience literature, increasing the integration of geoscience disciplines. To accommodate the needs of individuals, a pay-for-view option will be added in the future.

Ultimately GeoScienceWorld envisions including or linking to nonjournal material such as maps, books, conference proceedings, other geoscience literature (USGS, state or foreign surveys, etc.) and all types of geoscience digital data, especially databases developed through the National Science Foundation's GeoInformatics Initiative.

ORGANIZATIONAL STRUCTURE

GeoScienceWorld will be an independent not-for-profit corporation with a board of directors comprised of representatives from participating publishers. It will have a small staff, and all technology and most marketing and sales will be outsourced. The technology model allows flexibility in hosting and seamless and transparent article linking for the user. Journals may be part of a consolidated database aggregated by a single technology vendor or be linked from their silo site to the consolidated database.

ECONOMIC MODEL, PRICING, AND LICENSING

The economic model for GeoScienceWorld takes into account the costs of the technology required to maintain such an aggregation and the costs of the publishers for producing the journal content and balances that with the goal of making geoscience society journals as widely accessible as possible. Thus, the resulting economic model and anticipated prices to libraries are the result of a realistic assessment of the true costs while also taking into consideration what libraries can afford. The aggregation will have a tiered price structure, with different prices for academia, government, industry and not-for-profits, and for different size institutions based on the number of geoscience staff and/or faculty and researchers. Consortia discounts will be allowed, and discounted prices for print subscriptions from individual publishers are anticipated. GeoScienceWorld recognizes the need of the subscriber for perpetual access and of the content provider for non-exclusive licenses. The library site license is modeled on that of GeoRef. A library advisory committee, made up of librarians from universities, colleges, industry, government, and not-for-profit institutions, from both the United States and the United Kingdom, has had significant input throughout the development of the planned aggregation.

In summary, the Millennium Collection will consist of about 30 high quality journals at launch that provide a balanced coverage of the geosciences. Each journal will have a minimum of the current year and one back year, but most will have all back issues to January of 2000. Back issues to January of 2000 will be added for all included journals, with no increase in price, as quickly as possible. GeoRef will be an integral part of GeoScienceWorld and will be completely interlinked and inter-operable. Because many libraries already take GeoRef through other vendors, subscribers to GeoScienceWorld are only required to have a subscription to GeoRef; it can be from GeoScienceWorld or any other GeoRef vendor. Either way, GeoRef will be fully operable from within GeoScienceWorld.

JOURNALS

The aggregation will include journals from across the Earth and space sciences. They will be high quality, regularly appearing, internationally based journals, published in English initially, and later to include other languages. Although the vast majority will be peer-reviewed, publications with non-peer-reviewed technical articles that are indexed by GeoRef may apply for inclusion. The expectation is that the journals will be dominantly published by non-profit scientific societies, but other publishers, such as university presses, may participate. In addition to the founding organizations, which have 14 journals available for inclusion in the aggregation, over 30 additional journals have expressed an interest in potentially participating either in the Millennium Collection or in the near future. The intent is to have approximately 30 journals in the launch collection.

BENEFITS TO LIBRARIES AND USERS

GeoScienceWorld will offer a broad spectrum of geoscience literature in one package with major earth science content interlinked and searchable. The aggregation journals will be among the most common journals already found in academic libraries with geoscience departments. GeoRef will be inter-operable and integrated; back issues of journals will be digitized and interlinked. Thus only one license will be needed for the entire aggregation, and it won't be necessary to try to justify subscribing to each of 30 or more individual society journals plus GeoRef. As the National Science Foundation's GeoInformatics databases are developed, articles within the aggregation using them, including those that first describe them, will be linked to the databases. Additionally, electronic journals will promote enhanced data manipulation that is not possible in print journals, plus the inclusion of digital data including maps, greatly enhancing the usefulness of journal articles.

TIMETABLE

The GeoScienceWorld business plan and economic model was developed in 2003 and approved by all Founding Organizations. Site and electronic licensing agreements have been developed and are under review by the librarian and potential publishers' advisory committees, respectively. A technology vendor has been selected and an Executive Director is being hired. The steering committee for GeoScienceWorld is in the process of raising funds for start up monies and content conversion costs for small societies. Future fundraising efforts will be for digitization of back issues, first back to January of 2000, and then for past issues for those societies without an electronic archive of back issues. There will also be a sponsorship program for libraries in less developed countries. Prices for the aggregation are anticipated in the summer of 2004 with free trials before launch of the Millennium Collection at least by the end of the year.

CONCLUSION

GeoScienceWorld is an electronic geoscience society journal aggregation that represents a historic collaboration between major geoscience societies for the benefit of geoscientists worldwide. Furthermore it will fulfill the mission and goals of most societies by greatly enhancing dissemination of science to a broader audience and thereby advancing the geosciences, fostering scientific research, promoting interdisciplinary science and enhancing the professional growth of society members. Participating in GeoScienceWorld also continues strong commitments towards more inter-society cooperation, recognizing the need for a purposeful and united geoscience voice.

PHYSICAL LIBRARIES AND VIRTUAL LIBRARIES: WHAT'S IMPORTANT FOR GEOSCIENTISTS

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Abstract – The library and information environments have changed substantially during the past ten years. The development of the World Wide Web and subsequent rapid growth of scholarly information and other data, available anytime or anyplace through the internet, have a exerted a profound impact on the way geoscientists find and use the information resources needed for research and teaching. This paper draws upon the extensive survey and user assessment data accumulated at the University of Washington since 1992. These surveys provide sufficient granularity to compare how geoscientists and scientists in other fields find information and use libraries.

INTRODUCTION

The University of Washington (UW) is a large, comprehensive research institution located in Seattle, Washington. Autumn 2003 enrollment figures reported nearly 11,000 graduate and professional students and 27,000 undergraduates. There are also about 3700 teaching and research faculty. Science and engineering faculty represent 26% of the total faculty count with 27% of the graduate and professional students in science and engineering. Another 47% of faculty and 25% of graduate students are in the health sciences, including biomedical programs. The concentration in science, engineering and the health sciences is reflected in a robust research program. The UW ranks first among public universities in the dollar amount of federal research awards with nearly $700 million received in FY 2002-03.

The University of Washington Libraries (UW Libraries) supports the teaching, research and learning programs at UW with library and information resources and services. A large, decentralized library system with 16 campus libraries that house more than 6 million print volumes, the UW Libraries has an annual budget of close to $30 million and about 375 staff. During the past decade the UW Libraries has invested heavily in electronic resources to bring information to the user desktop; approximately 30% of the 2002-03 acquisitions budget was used to purchase those resources. The UW Libraries is recognized for the excellence of collections, services, and programs, most recently receiving the Association of College and Research Libraries (ACRL) Excellence in Libraries award for 2004.

The UW Libraries is known for its extensive work in user needs assessment (Hiller, 2001; Hiller, 2002; Hiller and Self, 2002). Since the first large-scale faculty and student surveys in 1992, the UW Libraries, with strong administrative support and broad-based staff participation, has conducted extensive, ongoing assessment work with the user community. The studies focus on users needs assessment, priorities, library and information use patterns, and user satisfaction with the quality of library services and collections. The UW Libraries has employed a variety of methods to obtain information from faculty and students, including large-scale surveys, targeted surveys, focus groups, observation studies, usability testing, guided interviews, meetings, and both traditional and electronic suggestion boxes. Assessment results guide and inform the development and improvement of services and resources that support the academic community.

UW LIBRARIES TRIENNIAL SURVEYS

The UW Libraries' program of user surveys is unique among academic research libraries. Since 1992, large-scale surveys of students and faculty are conducted on a three year cycle. These triennial surveys have provided invaluable information about how students and faculty use libraries, their library and information needs and priorities, and the importance of and satisfaction with the Libraries during a period of rapid change in the information environment. The large number of faculty respondents (1300-1500 per survey) is sufficient to conduct analysis below the aggregate level at the school and college level.

Surveys for 1992, 1995, 1998, and 2001 were mailed to all faculty (3720 in 2001), and samples of graduate and professional students (1500 in 2001) and undergraduate students (2000 in last survey). Table 1 shows response rates. Survey instruments and basic frequency results can be found at: http://www.lib.washington.edu/assessment/surveys.htm

An earlier paper (Hiller, 2002) examined differences in the 2001 survey results between faculty and graduate students in the sciences and those in other areas such as the health sciences and the humanities and social sciences. The results showed that overall satisfaction and library use did not vary substantially by academic area, but that use patterns, resource importance, and library priorities did, especially when compared to those individuals in the humanities and social sciences. Science and engineering faculty were more likely to use the libraries remotely rather than visit, attached greater importance to online resources such as electronic journals, and their priorities focused on delivering information and library services to the desktop. This paper reviews 2001 survey results from faculty in the sciences and engineering to determine if there are differences in use, importance, satisfaction and priorities by subject fields. In particular, are geoscientists at the University of Washington different or similar in their library and information using behavior and activities than other scientists?

In the 2001 faculty survey, there were six science departments in the College of Arts and Sciences that reported at least 20 faculty respondents. While response rates for the sciences as a whole were similar to those for all respondents (36%), individual departments ranged from 26% in chemistry to 45% in earth and space sciences (Table 2).

Library Locations

Separate science-related branch libraries include Chemistry, Engineering, Fisheries-Oceanography, Forest Resources, Mathematics, and Physics-Astronomy. The "main" library facility houses the humanities-social sciences collections, government publications, special collections, the map collection, and a large science library, the Natural Sciences Library. The latter library contains the primary resources for earth and life sciences. The main library is located within a few minutes walking distance of the earth sciences department, about 5-10 minutes from the psychology department and 10-15 minutes from the zoology department.

Table 1. UW Libraries Triennial Library Use Survey.
Number of Respondents 2001 and Response Rate 1992-2001

	2001 Surveys Sent	2001 Surveys Returned	2001	1998	1995	1992
Faculty	3720	1345	36%	40%	31%	28%
Grad Student	1500	597	40%	46%	41%	56%
Undergrad	2000	497	25%	39%	23%	41%

Table 2. UW Libraries Triennial Library Use Survey.
Science Faculty Respondents by College and Department 1995-2001.

College	**2001**	**1998**	**1995**
Engineering	76	77	75
Forest Resources	28	28	21
Ocean and Fishery Sciences	42	53	41
Sciences (Arts and Sciences)	198	241	215
Chemistry	20(26%)	36	29
Earth and Space Sciences	**24(45%)**	**22**	**18**
Mathematics	26(29%)	32	32
Physics	30(34%)	39	30
Psychology	25(40%)	24	19
Zoology	23(41%)	27	12
Other Sciences (A&S)	50	61	75
Interdisciplinary science	10	9	0
TOTAL Science-Engineering	354	408	352
TOTAL FACULTY RESPONSE	1345	1503	1359
Science-Engineering % of total	26.3%	27.1%	25.9%

Importance

Several questions on the survey asked about importance: information sources needed for work, resource types or formats, and priorities for the library during the next two years (Tables 3-5). In 2001, UW earth scientists were still working primarily with print journals. The Libraries subscribed to the Academic Press Ideal Package but had few other titles in the earth sciences. It is not surprising to find that earth sciences faculty ranked the open Web and electronic journals relatively low in importance for their work. However, when it came to identifying priorities for the future, earth science faculty also gave strong support to delivery of full-text to the desktop and online access to journal backfile.

Table 3. Importance of Information Sources for Work. Mean Scores by department.
Scale of 1 (not important) to 5 (very important).

Department	UW Libraries	Web (non-library)	Colleagues
Chemistry	4.95	4.20	3.90
Earth Science	**4.92**	**3.54**	**3.83**
Mathematics	4.84	3.74	**4.16**
Physics	4.23	4.23	3.83
Psychology	4.96	4.00	3.36
Zoology	4.91	3.70	3.83
Science Mean	4.78	3.92	3.83
Engineering	4.66	3.78	3.54

Table 4. Importance of Resource Types for Work. Mean scores by department.
Scale of 1 (not important) to 5 (very important).

Department	Books	Print Journals	E Journals	Bibliographic Databases
Chemistry	3.90	4.75	4.30	3.90
Earth Science	**4.12**	**4.75**	**3.71**	**4.25**
Mathematics	4.58	4.37	3.68	3.21
Physics	3.73	4.03	3.77	3.70
Psychology	3.68	4.48	4.60	4.20
Zoology	3.96	4.87	4.83	4.48
Science Mean	3.97	4.53	4.18	3.93
Engineering	4.18	4.43	3.87	3.62

Table 5. Library Priorities for Next Two Years.
Percentage of department respondents who identified as library priority.

Department	Full-text to desktop	E-Journal backfiles	Print collection quality	Preservation
Chemistry	80%	80%	50%	35%
Earth Science	**79%**	**71%**	**79%**	**54%**
Mathematics	47%	74%	79%	63%
Physics	60%	80%	60%	43%
Psychology	96%	80%	48%	16%
Zoology	87%	61%	61%	30%
Science Mean	76%	73%	59%	40%
Engineering	72%	68%	63%	41%

Library Use Patterns (Table 6)

Library use results showed that remote use was the preferred method of accessing the library and there was little difference among departments in the percentage of faculty who connected to the library at least weekly. While the percent of faculty who visit in person was lowest in departments located at a distance from their primary library (zoology and psychology), the frequency of physical visits from faculty in departments located in proximity to their libraries was close to the average for all science faculty, except in mathematics and earth sciences. It is not surprising that these departments ranked the importance of print materials higher than the others, given their higher dependency on print resources.

When we look at the reasons why faculty visit the library (Table 7), there is little difference in the frequency of physical visits to find journals, but mathematics and earth sciences faculty visit more often than others to find books.

Remote Use (Table 8)

While there is little difference overall in the frequency of remote use of the library catalog, bibliographic databases, and full-text sources, substantial variation does occur for several departments. Earth science faculty members are slightly more likely to search the library catalog and bibliographic databases, and were less likely to look for full-text sources in 2001.

Table 6. Library Use Patterns. Percentage in each department who use library at least weekly in each category.

Department	Campus Computer	Residence Computer	Visit in Person
Chemistry	85%	35%	45%
Earth Science	**83%**	**42%**	**63%**
Mathematics	68%	32%	84%
Physics	63%	30%	40%
Psychology	92%	56%	*16%*
Zoology	96%	39%	30%
Science Avg.	80%	39%	44%
Engineering	67%	29%	37%

Table 7. Reasons for Visiting Library in Person. Percentage in each group who do so at least weekly.

Department	Find Books	Find Journals	Photocopy
Chemistry	25%	45%	20%
Earth Science	**42%**	**54%**	**33%**
Mathematics	**58%**	42%	5%
Physics	30%	43%	7%
Psychology	4%	40%	16%
Zoology	4%	26%	22%
Science Avg.	27%	41%	15%
Engineering	21%	36%	8%

Table 8. Reasons for Remote Use.

Department	Library catalog	Bib databases	Full-text
Chemistry	60%	50%	85%
Earth Science	**67%**	**77%**	**38%**
Mathematics	68%	33%	33%
Physics	53%	58%	65%
Psychology	64%	83%	76%
Zoology	39%	70%	82%
Science Avg.	53%	57%	63%
Engineering	50%	47%	46%

Satisfaction (Table 9)

In general, overall satisfaction and satisfaction with library services and collections was high and did not vary substantially by department. Responses from faculty in the earth sciences did show higher satisfaction, while those in psychology were the least satisfied.

CONCLUSIONS

Results from the 2001 survey revealed that UW earth science faculty members were very active library users and were more dependent on print resources than most other scientists. Since that survey, the UW Libraries has added such online access to commercial publisher packages as Elsevier Science Direct, Wiley Inter-Science, and Blackwell Science, and to journals published by Geological Society of America, American Geophysical Union, and other scientific societies. Anecdotal evidence suggests that earth science faculty and students are, indeed, using online resources more and visiting the physical library less. Results from our next triennial survey in Spring 2004 should provide data to confirm or deny this trend.

Table 9. Library Satisfaction. Mean scores of science faculty. Scale of 1 (not satisfied) to 5 (very satisfied).

Department	Services	Collections	Overall
Chemistry	4.20	4.00	4.21
Earth Science	**4.61**	**4.48**	**4.61**
Mathematics	4.61	4.28	4.39
Physics	4.25	4.11	4.18
Psychology	4.08	3.71	3.75
Zoology	4.70	4.35	4.52
Science Mean	4.44	4.21	4.33
Engineering	4.26	3.86	4.16

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LINKING TO FULL-TEXT (AND BEYOND) WITH SFX

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Abstract – The University of Chicago Library is committed to providing its academic research and education community with a diverse collection of both print and electronic resources. The electronic collections are remarkable not only for the amount of information available (almost 5,000 electronic journals in the sciences alone), but also for the astounding (and confusing) variety of publisher search interfaces, content organization schemes, and techniques for site navigation. In an effort to provide users with a more intuitive and consistent way to identify means to retrieve content, regardless of format or source, the Library implemented an SFX server solution.

SFX (from Ex Libris) is a linking technology based on the OpenURL protocol (currently a NISO draft standard) for creating customized links among diverse information products. The University of Chicago Library's implementation of SFX to provide better management of electronic resources and improved service to the scholarly community is described. The Library defined its electronic collection, and constructed rules to guide SFX in creating context-sensitive links. These customized links use web-transportable packages of metadata to connect users to resources and services. Links to resources are dynamically generated to provide information about all appropriate online copies. SFX services have also been configured to run searches of the University of Chicago's library catalog to identify holdings in rich print collections and to provide additional services, including automated interlibrary loan request generation. Recent and future developments described include an OpenURL generator/DOI resolver tool and a dynamically generated comprehensive online journal A to Z list.

INTRODUCTION

The University of Chicago Library provided access to its first electronic journal in 1995. The intervening years have seen the electronic journals collection grow from that single title to more than 42,000 titles (approximately 5,000 of these are in the sciences). As the collection grew, so did the need for intuitive, comprehensive and easy-to-use tools for identifying online content available to authorized users. Various approaches to this problem have been tried in the last eight years, with varying degrees of success.

Early efforts consisted mainly of informational tools: simple web pages with an alphabetical list of titles and including links to the home pages for journals and/or publishers. This type of tool solved the so-called "appropriate copy" problem (Caplan and Arms, 1999) and was relatively low-cost, but did not include information about print holdings and required labor-intensive, manual maintenance. Delays in development of cataloging standards for e-journals initially prevented their inclusion in the library catalog. Eventually, URLs were added to the bibliographic record for individual print titles, and new records were created for what was initially a small number of e-only titles. However, the e-journals world was rapidly evolving and provided new challenges. While the original e-journal offerings were mainly from single publishers and accessed from the publishers' web sites, various third-party aggregators (e.g. EBSCOHost) and experimental cooperative publishing ventures (e.g. BioOne) began offering collections of titles, and eventually just collections of articles. The lack of stable URLs, absence of mechanisms for managing MARC records in the library catalog, variant levels of content coverage (not all titles were cover-to-cover), and the difficulty in identifying which journals were in which packages led library staff to implement another tool for providing information about available e-journals: Jointly Administered Knowledge Environment or "jake" (Chudnov, et al., 2000). The jake tool provided information about e-journals that were buried within an aggregator's database, but was awkward and did not always provide access to the "appropriate copy" for the University of Chicago. Database producers also began to provide their own proprietary linking solutions, but these were limited to those publishers with which the producers had negotiated linking agreements. Competitive relationships among publishers resulted in significant gaps in linking in some databases. Some producers provided local customization options, but these options were either difficult or time-consuming to implement, particularly since the University of Chicago Library did not have a single authoritative database of electronic journal holdings. At this point, the development of the OpenURL protocol had developed sufficiently (Van de Sompel and Beit-Arie, 2001) for a commercially available product based on the protocol (SFX) to become available. The University of Chicago signed an agreement in Spring 2001.

IMPLEMENTATION OF SFX

SFX Description and Terminology

SFX is defined as an "institutional service component software to provide context sensitive localized services using OpenURL specification"(Ex Libris, 2003). OpenURL is "a protocol for interoperability between an information resource and a service component that offers localized services in an open linking environment. It is in effect an actionable URL that transports metadata or keys to access metadata for the object for which the OpenURL is provided. The target of the OpenURL is the user's institutional service component (ISC). The remainder of the OpenURL transports the object's metadata" (Van de Sompel et al., 2001). This rather lengthy description is summarized by terms with examples in Table 1.

Additionally, SFX is often described in terms of "sources" and "targets." For example, in e-journals context, a database like GeoRef on SilverPlatter is the "source" and an e-journal like *Journal of Paleontology* via BioOne is the "target." Both the resource and the provider are required to adequately define a "source" or a "target."

Financial and Staff Resources

An SFX implementation is neither simple nor inexpensive. It was only when a critical mass of content (both databases, e-journals, and other resources) was assembled, that the cost and effort required to launch the service was deemed necessary. Initial costs included software and hardware purchases, vendor installation fees and services, and staff training time. Ongoing costs are mainly due to staff time required to maintain and update the SFX database. After the first year, the staff time needed to maintain and update is estimated at 0.5 FTE. The SFX administrator position is combined with the position of electronic resources acquisition coordinator. The combination of these functions is synergistic, and works quite well for the University of Chicago Library organization.

Building the SFX Database

The heart of the SFX solution is the underlying SQL database of information about an institution's electronic resources, both databases ("sources") and full-text resources or services ("targets"). Ex Libris' SFX product comes supplied with a

Table 1. Examples of OpenURL components

Term	Examples
Information resource	Bibliographic indexing or abstracting database
Institutional service component (ISP)	Local University of Chicago SFX server
Localized services	Links to full-text of online articles, online catalog search, interlibrary loan request generation
Actionable URL	Structured URL that contains enough information and instructions to communicate with the ISP
Metadata	Author name, journal title, volume number, ISSN, etc.

"knowledgebase" of resources that was used to populate the local SFX database. The SFX administrator works with local information to fine-tune the database to reflect local holdings. The types of information that had to be locally configured ranged from simple changes to "years/volumes available" to building complete records for resources not represented in the SFX default knowledgebase. As the product matured, SFX continued to add to its knowledgebase and currently provides regular updates that can be batch loaded into the local SFX database. In particular, the coverage for third party aggregators has allowed the local SFX database to provide appropriate links, even in the event of changes in agreements and coverage among the publishers and aggregators. Additionally, the administrator worked on refining "target parsers" – the piece that communicates between SFX and the e-journal site.

Designing the Services provided by SFX

Once the local SFX database is developed, it is necessary to make decisions regarding the services that will be offered. Basic thresholds, like "years/volumes available" are used to determine whether to point to full-text options, or to offer a search of the library catalog, or to initiate an interlibrary loan request. The design of SFX services at the University of Chicago was initially focused on providing information about full-text availability. Eventually, additional services were developed and expanded to provide automated interlibrary loan request generation, search of the library catalog, and searches in additional reference resources (e.g., Ulrich's Directory of Periodicals web edition).

SFX IN ACTION

SFX is by definition context-sensitive and provides for a customized list of possible services that may differ from source to source. However, the following sample screens present a typical series of interactions for a University of Chicago user.

Many (if not most) users begin by searching in an abstracting and indexing database. For those resources that are configured for SFX linking, a button or text link (Figure 1) appears in the resource, in the short display, the full display, or in both places (depending on the resource). The SFX link may appear as a button, a text string or a combination of

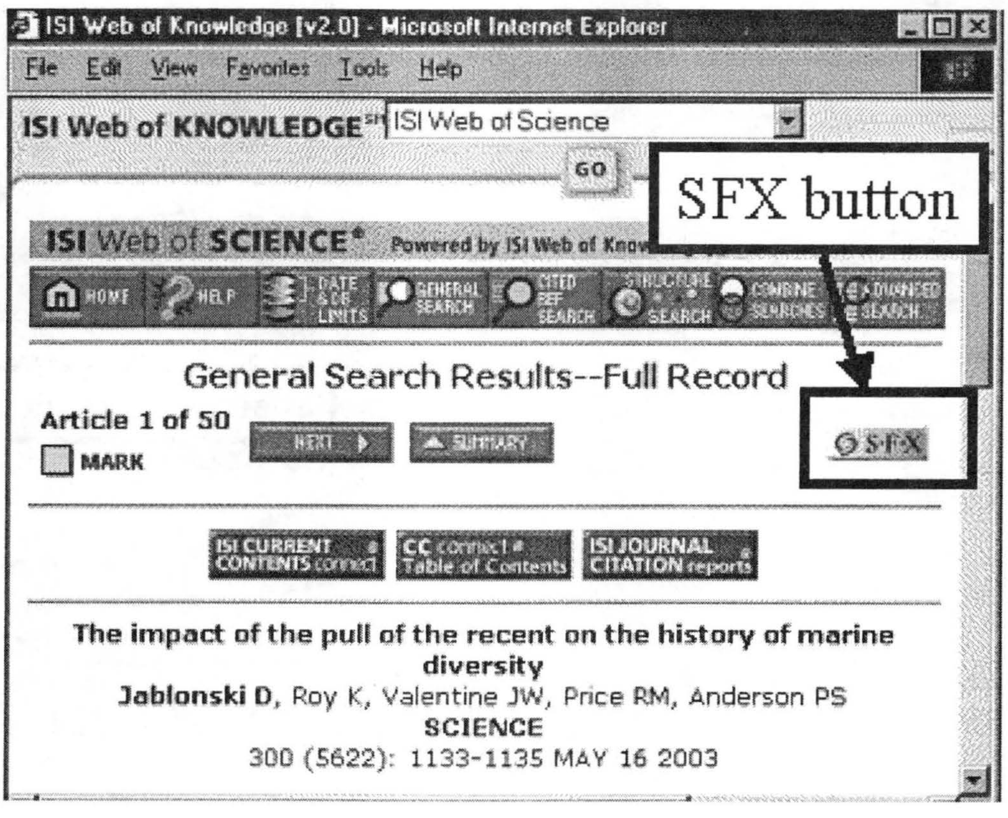

Figure 1. SFX button in electronic resource.

the two. This is usually determined by the limitations of the database producers' interfaces.

Clicking on the SFX link sends an OpenURL to the local SFX server. The OpenURL includes all the metadata needed to construct the appropriate menu of services for a particular reference, and may include elements like journal title, volume, issue, page, ISSN, etc. The user does not see the OpenURL string, but a sample OpenURL is shown here for illustrative purposes:

http://wos6.newisiknowledge.com/CIW.cgi?PR=1/1&chem_source=Abstract&SID=P4W-nD-wadwAAD9oKOc&Func=TransferToPublisher&URL=http%3A//links6.newisiknowledge.com/Links/LinkOut.cgi%3Ftype%3Dwindow%26PID%3DOpenURL%26source_PID%3DWOS%26origin%3Dhttp%253A//wos6.newisiknowledge.com/CIW.cgi%253FSID%253DP4W-nD-wadwAAD9oKOc%2526Func%253DAbstract%2526doc%253D1/1%2526event_logging%253Dno%2526PR%253D1/1%26dest%3Dhttp%253A%252F%252Fgateway.newisiknowledge.com%252Fgateway%252FGateway.cgi%253FGWVersion%253D2%2526SrcAuth%253DOpenURL%2526SrcApp%253DWOS%2526DestURL%253Dhttp%25253A%25252F%25252Fmrflibble.lib.uchicago.edu%25253A8888%25252Fsfx_local%25253F%252526auinit%25253DJ%252526aulast%25253DKnight%252526date%25253D2003%252526epage%25253D307%252526issn%25253D0037-0738%252526issue%25253D4%252526sid%25253DISI%25253AWoK%252526spage%25253D291%252526stitle%25253DSEDIMENTARY%25252BGEOLOGY%252526atitle%25253DTemporal%25252Bchanges%25252Bin%25252Bsubglacial%25252Bmeltwater%25252Bactivity%2525253A%25252Bfield%25252Bevidence%25252Bfrom%25252Bthe%25252Blate%25252BDevensian%25252Bin%25252Bthe%25252Bnorth%25252Bof%25252BIreland%252526volume%25253D160%2526DestApp%253DSFX&PublisherID=University_of_Chicago_open

Once the SFX server receives the OpenURL string, it matches the ISSN portion to records in the SFX database, and consults a list of rules for making decisions about which services to offer. Services may include linking to full-text, searching the online catalog for print holdings, generating an automatic interlibrary loan request (if the journal is not found in the SFX database), etc. The SFX service menu for the reference shown in Figure 1 is given in Figure 2.

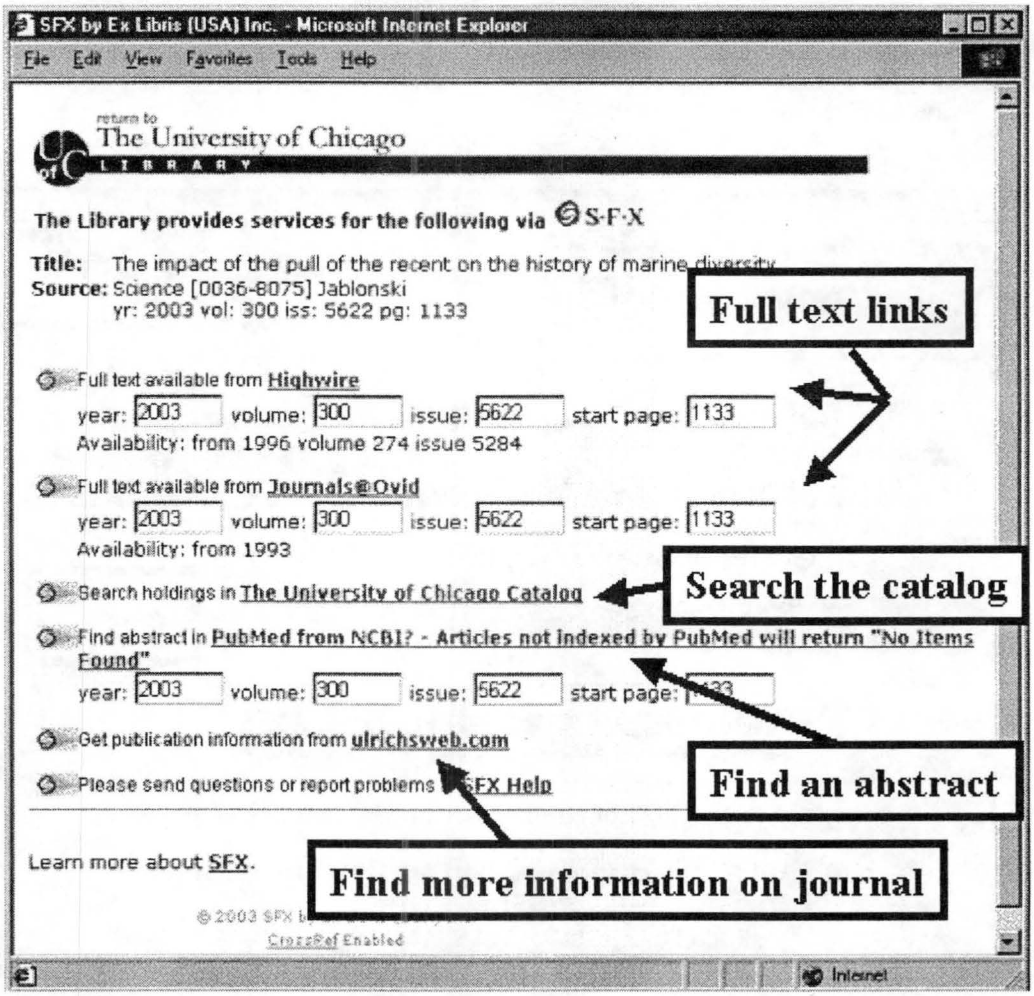

Figure 2. Typical SFX services menu for a journal article.

In the best case, the user selecting a full-text linking option from the menu is taken directly to the article on the publisher's website. At the other end of the linking spectrum, the user may only be directed to the publisher website, and have to navigate through several levels to find the article of interest. Part of the ongoing development of SFX services is in using contacts with various publishers and societies to urge them to provide better OpenURL compatibility in the structuring of their websites.

While linking to full-text is usually the goal of the user, it is when this linking does not occur that SFX shows added value by providing alternative services to the users. For example, in configuring its SFX services, the University of Chicago Library chose to offer an interlibrary loan option whenever a journal reference did NOT allow a link to full-text. (A search of the online catalog is also offered, and it is hoped that users will pursue this option first, since the print collections are extensive). If the user selects the interlibrary loan option, a screen similar to the one in Figure 3 will be produced. Note that several fields are automatically populated, reducing input errors on the part of users. The data in the form is also passed through to the main interlibrary loan software, reducing rekeying by staff.

RECENT DEVELOPMENTS OF SFX

The University of Chicago Library has developed additional resources using the local SFX database of information about the Library's electronic resources. The most popular of these is an A to Z list of electronic journals web page. To produce this resource, the SFX database is used to export a file of e-journals titles, URLs, and years of availability to a searchable, non-relational database (flat file). This database can be searched using a Nand CGI interface (Blair, et al., 2003) developed at University of Chicago. Previously, the electronic journals list was maintained as a static HTML page without searching capabilities. Local programming and development for

Figure 3. Automated ILL form generation

this tool was required, but this demand on resources was balanced against the ongoing, labor-intensive work of maintaining an HTML list of e-journals. This resource accounted for more than half of the requests routed to the SFX server in 2003 (see Figure 4).

The automated interlibrary loan request feature has proved popular with users as well. This tool also required local programming support for development. Interlibrary loan staff report a noticeable increase in requests originating from the SFX service menu, contributing to an overall increase in requests. Since the SFX server is not able to identify titles with local print holdings, it is a known defect that users may request items that are held in print in one or more University of Chicago Library locations. The 5-7 day delivery time for articles has not apparently been a strong enough mitigating factor to convince at least some users to exert themselves to find print volumes. The situation continues to be monitored, and changes may be made as improvements to SFX allow, or as institutional priorities dictate.

Usage statistics for SFX services have been available since the system was implemented. However, early reports are quite crude (although significant improvements to the statistics reporting tools were made late in 2003), and should be interpreted with care. Even with rather primitive reports, it is possible to make some observations about general usage patterns in SFX (e.g., the overwhelming dominance of the e-journals list over other sources). Reports also showed that the Type of SFX service requested is dominated by full-text linking, which accounts for more than 77% of all requests.

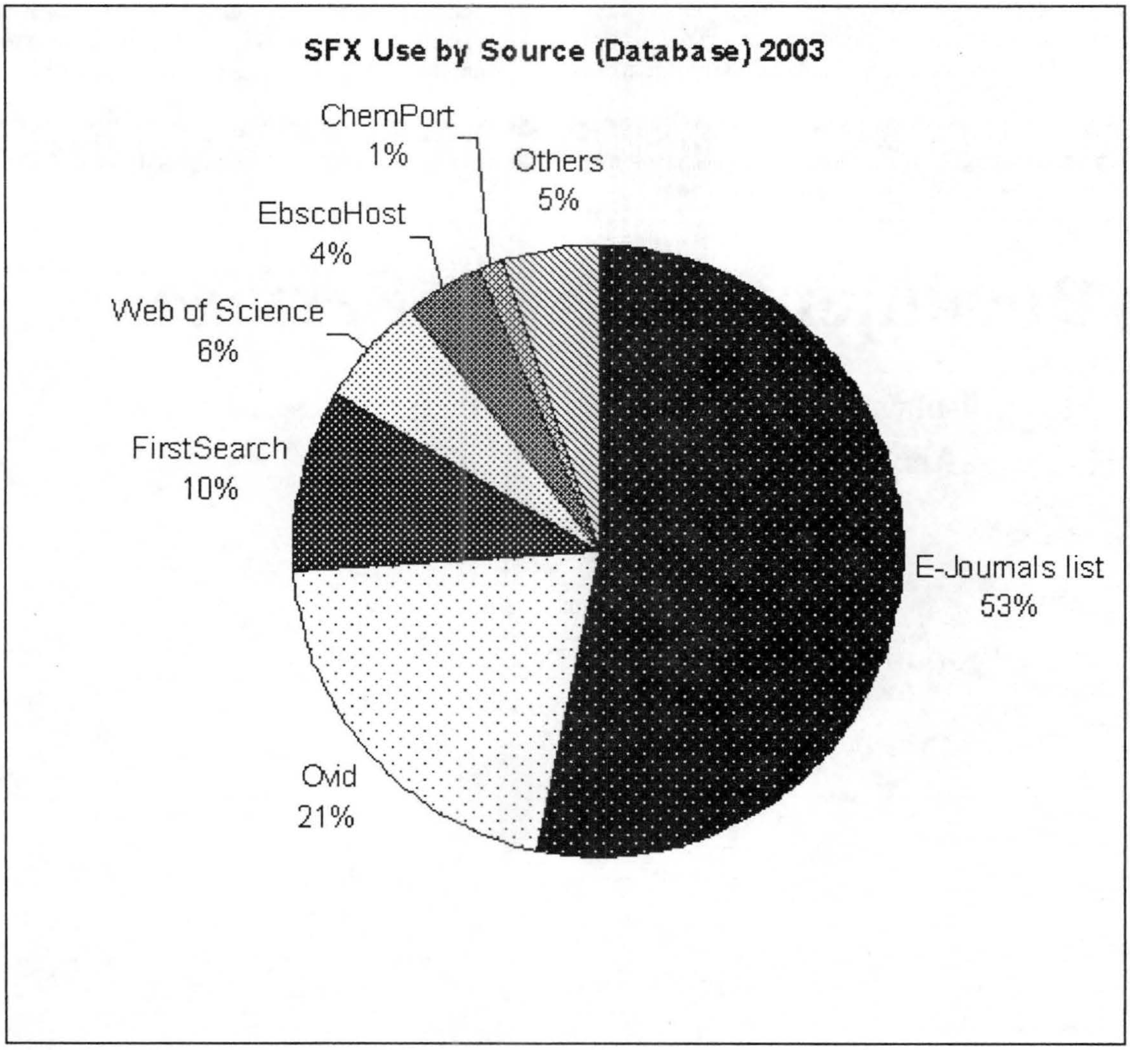

Figure 4. Popularity of the SFX E-Journals List.

FUTURE DIRECTIONS FOR LINKING

In the future, SFX tools may be used at the University of Chicago Library to generate OpenURLs for books and journal articles for use in electronic reserve and/or course management systems. Some institutions have already offered similar services (Lagace, 2003). This possibility is under active investigation for development at the University of Chicago Library. The Library is also discussing with its ILS vendor the desirability of making the online catalog SFX-aware and configured as a source. One could envision a suite of services originating from a bibliographic record within the online catalog: searching a union catalog, identifying a source for purchasing a personal copy, searching for citing references or book reviews, etc. Future services might include download to bibliographic management software or services based on non-bibliographic metadata (e.g., retrieval of safety data on chemicals based on Chemical Abstracts Service Registry Number). Further, if non-bibliographic metadata can be added to the OpenURL protocol standard, one might dream of using geographic coordinates to retrieve information on a particular location, CAS registry numbers to find environmental persistence data in toxicology resources, and more.

Author's note: For those interested, the full set of slides on which this paper is based may be found at: http://www.lib.uchicago.edu/e/su/sci/SFX_GSIS.pdf.

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IMPLEMENTING THE OPEN ARCHIVAL INFORMATION SYSTEM (OAIS) REFERENCE MODEL: NSIDC, A CASE STUDY

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Abstract – Geoscience data sets are the foundation of education and basic and applied research in the geosciences. Their long-term continuity and viability are of great importance to all aspects of society. Open access to data allows researchers to replicate research results and provides greater understanding of the Earth system. With the advent of new sources of remote sensing data and the technical capability of processing large volumes of data, new models for data management, access, and archival [sic] are needed for archives, libraries and cultural heritage institutions to properly manage geoscience data sets. The Open Archival Information System (OAIS) Reference Model, a recommendation by the Consultative Committee for Space Data Systems, was developed in part to define an ISO standard for the long-term preservation of digital information. The National Snow and Ice Data Center (NSIDC), a national data archive with expertise in cryospheric research, is adopting the OAIS reference model because it meets the goals we have set out in our mission statement "to excel in managing data and disseminating information in order to advance understanding of the Earth system."

NSIDC started the process of adopting this model for data stewardship in 2002. At that time a Data Management Policies document was drafted and a Metadata Database project was initiated to unite guardianship efforts across programs and with NSIDC data providers and users. This paper will briefly examine the OAIS model and then discuss the work that NSIDC is doing to implement it. Specific data sets in different stages of acceptance, ingest and archival [sic] will be used to illustrate fundamental concepts. Metadata and data format standards, system architecture, and documentation will be reviewed.

Technological changes have resulted in greater amounts of digital data being available to libraries and users. This includes both born-digital data as well as the increasing conversions of analog to digital data. Traditional archives, museums, libraries and other cultural heritage institutions need to build on traditional archival practices and standards to accommodate the acquisition, processing, access and long-term preservation of these data. The Open Archival Information System (OAIS) Reference Model is a new model of data management capable of supporting these changes.

The National Snow and Ice Data Center (NSIDC) originally chartered by NOAA as a national information and referral center in support of polar and cryospheric research, archives and distributes digital and analog snow and ice data. Seven data centers currently reside under the umbrella NSIDC organization. We are one of nine NASA Distributed Active Archives (DAACs) and we are affiliated with NOAA's National Geophysical Data Center through the NOAA@NSIDC program. The National Science Foundation's data centers are Arctic System Science Data Coordination Center (ARCSS), the Antarctic Glaciological Data Center (AGDC) and the U.S. Antarctic Data Coordination Center (USADCC). The International Arctic Research Center, along with NASA, funds the Frozen Ground Data Center which is housed here, and we are also part of the World Data Center system, functioning as one of three World Data Centers for Glaciology. (We are in Boulder, Colorado; the others are in Cambridge, England and Lanzhou, China.)

What is OAIS? The OAIS Reference Model was developed by the Consultative Committee for Space Data Systems (CCSDS) to help define an ISO (International Organization for Standardization) standard. The CCSDS is made up of member and observer agencies which include, but are not limited to, NASA, the British National Space Centre, the European Space Agency, the National Space Development Agency of Japan (NASDA), NOAA, the U.S. Geological Survey and others. The OAIS Reference Model became ISO Standard 14721:2002 in 2002. Because of NSIDC's close affiliations with some of these organizations, and our need to interact with others on the list, adopting the OAIS Reference Model was advantageous to us. NSIDC, like other archives, is contending with the issue of handling more detailed and larger quantities of digital data on a daily basis.

OAIS is a model for long-term preservation of information that is appropriate for any library, archive, museum or cultural heritage institution. In order to be recognized as an OAIS archive, an institution must merely meet the standards of the reference model. Why adopt the OAIS Reference Model? By specifying particular elements that need to be addressed by every OAIS Archive, the model aids institutions that do not have personnel with a background in archival standards and forces recognition of the importance of standards that address long-term preservation and archiving. The Model also provides a framework for "describing and comparing architectures and operations of existing archives...[and]...describing and comparing different long term preservation strategies and techniques" (OAIS p.1-1). There are no particular implementation requirements to follow, so each institution can set up its own means of meeting the standards. And while this model works well for digital data, it is not limited to them, being appropriate for institutions that archive physical media and physical samples (paper or ice cores, for example).

Mandatory requirements for an OAIS archive are:

- To acquire appropriate data – established by a written collection development policy
- To impose control over data that are adequate for ensuring long-term preservation
- To determine a "designated community" of users of that data
- To ensure that the data are understandable and appropriate for that user community
- To preserve the data to the best of the institution's ability
- To make the preserved data available to the designated community

Librarians and archivists will recognize these as traditional archival functions.

For an OAIS archive, long-term preservation refers to any period of time during which technological change can take place. CCSDS defines it as "a period of time long enough for there to be concern about the impacts of changing technologies, including support for new media and data formats, and of a changing user community, on the information being held in a repository" (OAIS p.1-11). Long-term does not refer to the archive itself and how long it may have been or may stay in existence. Therefore, this model is appropriate for almost all data and every institution. As a NASA DAAC, NSIDC is funded to function as an "active" or short-term archive, with the expectation that long-term archiving of the data will be taken over by NOAA at some point in the future. The need still exists, however, for the preservation of the data in the meantime, as well as the ability to transfer the data in the future with the assurance of their immutability.

The OAIS Reference Model breaks information down into a package consisting of three parts: Content Information, Preservation Description Information, and Packaging Information. Each of these packages also has Descriptive Information that allows it to be accessed and Data Management Information, which tracks its usage. Content Information is made up of the data themselves and Representational Information that shows how the data are formatted. The data might be an electronic journal article, a digital photograph, or a physical entity such as an ice core. Typically, people think of Representational Information as formats and how to read them. Preservation Description Information is necessary to describe the past history of the data and to ensure that they have been unaltered and will remain unaltered in the future. It is comprised of Provenance (the history of the data and where they came from), Reference Information (how the data are identified, such as a title or ID number), Fixity Information (authentication mechanisms), and Context Information (how the data relate to other data and the environment). Packing Information, which includes directory structures and media locations, is comprised of information that relates one media piece to others.

An archive that fulfills the requirements of the OAIS model ensures that all of these five overarching areas are addressed for every accepted data set. This forces discussion about these issues between the data provider and the archive, thus clarifying the roles of both parties. It also facilitates interaction between the archive and the user or "designated community" by ensuring that the community has been identified and that the data are accessible to it.

Because NSIDC is a matrixed organization of various programs and projects, the Center needed to develop data management policies that are stringent enough to guarantee best practices, adhere to standards, and ensure strong and consistent levels of service, yet are flexible enough to adapt to changing programmatic relationships and needs. We also deal with a variety of data types and formats, and must sometimes deal with yearly funding fluctuations. All of these things make adherence to Center-wide standardization a challenge. The OAIS Reference Model facilitates discussions between programs by establishing the basic framework upon which they each can build.

While being a matrixed organization means we face the issues just mentioned, we nonetheless meet the requirements for being an OAIS archive. The first of these was acquiring appropriate data. NSIDC's collection scope states that we will provide long-term data management, including data archival [sic], as an essential part of our mission, and that we will archive both cryospheric data and data from programs or instruments deemed important to the cryospheric community.

Another OAIS Model requirement is to determine a designated community. NSIDC tracks the types of users that request data and information. This helps to ensure that our understanding of our designated user community stays focused over time and that we are following our mission and goals. Our largest user groups are from the research community and higher education, with equal distribution between commercial and government users. K-12 is the smallest, though not insignificant, user group. Most of the K-12 users come to us through our web pages and are not interested in particular data that we archive so much as in information that could be obtained from that data. As a result, we have developed focused web pages to address their frequently asked questions about snow and ice.

NSIDC drafted a Data Management Policies document in 2002 to codify the data management that has always occurred here. Each program/data center had established its own policies. This recent document standardizes the policies and establishes each center's minimum data management requirements. In many cases, Principle Investigators (PIs) are required to deposit their data with an appropriate archive as a condition of their grant funding. Many of these PIs are unfamiliar with archival principles and the necessary information and processes that need to be followed in order for an archive to successfully ingest, process, provide access to, and archive their data. Data transfer agreements disambiguate the rights and responsibilities of both the data provider, such as a PI on an NSF grant, and the archive, such as ARCSS, the Arctic System Science Program. If, for instance, a PI feels it is necessary to withhold their data until their initial findings have been published, this information is documented and followed. NSIDC has traditionally had Operational Agreements (OAs) and Memorandums of Understanding (MOUs) for various aspects of its NASA DAAC contract, but few of the other data centers required formal documentation of the data transfer process. This has now changed.

Various departments at NSIDC are responsible for individual aspects of data management. The individual programs working from the overall NSIDC collection scope and mission statement determine the Content Information. The Long-term Archive group handles the Preservation Description Information. The Packaging Information is the responsibility of the Operations Group. Descriptive Information is provided by the Catalog Team and the Information Services Group, and includes both the creation of DIFs (Directory Interchange Formats, standards of NASA's Global Change Master Directory) for the catalog, as well as related documentation such as user's manuals. By collecting all of the metadata that goes with the data itself, we are able to provide adequate control of the data to ensure its long-term preservation.

NSIDC has always made an effort to collect Preservation Description Information but we have not always followed specific standards or codified various practices *between* data centers. Consequently, provenance information varied from data set to data set and might be complete if it came to us directly from the PI, but not if it came by way of a third or fourth party. Lack of copyright information for non-U.S., grant-funded data is particularly troublesome. Titles for data sets were often not uniform and aliases would creep in as accepted titles. Data set versioning added to the confusion, as did the use of different ID numbers by each data center. With the adoption of the OAIS Reference Model, NSIDC has established a unique identifier, is attempting to follow NASA naming standard conventions, and is developing a search mechanism that will allow both standard titles and aliases to be searched at least by NSIDC personnel.

NSIDC has had an online searchable data catalog since 1995. All records are DIFs (directory interchange format). We also contribute to the Global Change Master Directory (GCMD), NASA's FGDC clearinghouse node. NSIDC also presents metadata in indices, which allow easy searching by the user community. In the past, cataloging of data sets existed in various stages of uniformity and especially suffered from a lack of retrospective conversion for older data sets when new terms, fields or standards were imposed. All of these issues have been addressed with the adoption of the OAIS model.

Future plans:

Since NSIDC adopted the OAIS Reference Model and began to implement its requirements, new data and metadata have adhered to the principles we have set forth in our new Data Management Policies Document. Updating or "converting" older data and metadata, however, will take more resources and, hence, more time. Examples of work that remains to be done in converting old metadata include acquiring rights statements from PIs or contributors of data long held by the Center, whose provenance is sketchy, and updating changing subject terms (what we call "valids") in our data set catalog. The first instance occurred during work on our historic glacier photograph digitization project. Scientists in the field had primarily taken the photographs and there were no copyright restrictions on their use. There are some photographs in the collection, however, that the original PI collected from a variety of sources without collecting or passing on any rights information. The latter example, subject terms, is familiar to anyone who does cataloging. Subject terms are constantly being updated. Keeping up with these changes is time consuming.

With technological changes, as well as changes in standards and their adoption by the user community, data formats frequently must be refreshed. This leads to the question of when to adopt new standards. NSIDC continues to address this issue by having our programmers, archivists, and operations and data management personnel work closely with the archival and data management communities to stay abreast of new developments and their implementation.

The third issue that we will be working on in the future at NSIDC can be termed "Universal intellectual control." Again, this probably sounds familiar to many librarians: there are various departments or groups at NSIDC that deal with individual aspects of acquiring, accessing, managing, distributing, and archiving the data and metadata. In the past, each department had its own databases or filing systems. Much of the metadata the departments were using, whether Content Information, Preservation Description Information or Packaging Information, was duplicated within multiple departments. What might differ was only how they used that metadata to accomplish their respective tasks.

For many years, as at many institutions, NSIDC stored metadata about its holdings in a variety of locations and formats. The User Services department kept their own databases related to usage of data sets and accounting, while the Operations department kept their own databases regarding media location and data refresh dates. The Communications group maintained the data set catalog that allowed users to search for and access the data. Each database contained its own reference information, including IDs, and tracking comprehensive information about a given data set required going to individual departments and piecing the information together.

In 2002, NSIDC began creating a Metadata Database (MD), which will allow access to comprehensive metadata in one location. The MD development team started with the cataloging portion of the database, creating fields from DIFs. They then created an interface and publishing component to the database that allows updates to the NSIDC online catalog, as well as to the GCMD. These pieces of the database were released in early summer 2003. The MD development team is currently gathering specifications for the creation and implementation of the remainder of the metadata fields.

Data centers will continue to add large quantities of data in the foreseeable future, whether by ingesting, distributing and archiving remotely sensed data from new satellites, or by rescuing older analog data sets from basements and attics. They will require more complete international standards to assist in the data management process and to guarantee the long-term continuity and viability of the data. The National Snow and Ice Data Center plans, with the adoption of the OAIS reference model, to be better stewards of the cryospheric data in our care, and to ensure these data will be available to users far into the future.

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http://nsidc.org/about/
OAIS Reference Model:
http://ssdoo.gsfc.nasa.gov/nost/isoas/

USGS WATER RESOURCES INVESTIGATION REPORTS: A CASE STUDY FOR IMPROVING ACCESS

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Abstract – Since 1973 the USGS has published over 4,000 reports in the series *Water Resources Investigation Reports* (WRIR) and deposited copies of the studies in libraries for public use. From the outset the University of Michigan (U of M) Library sought to collect the reports comprehensively. Prior to the digital era limited resources caused the library to catalog only the series title and to record holdings only by the piece number. With rare exceptions, catalog entries were not made for author, title, or subject of individual pieces. Over time, management of the collection became more difficult and access to the individual pieces became more problematic. By the late 1990's attempts by patrons to consult items in the series often required extensive librarian help for what should have been a straightforward, self-service function.

In Spring 2001 the Shapiro Science Library embarked on a project to improve access. The project proceeded in several phases and with multiple goals. The most important of these were achieved by Spring 2003. Among them was providing a separate catalog record for each WRIR number in the U of M collection, thus making each searchable by author, title, subject and keyword from anywhere in the world. Improved bibliographic access also makes items more available for use via interlibrary loan. This paper discusses the need for the project, the challenges encountered, and the solutions adopted. It will be of special interest to institutions considering improvements to their collections of WRIR or other government publications in series.

INTRODUCTION

In 1972 the USGS began issuing items in the series, *Water Resources Investigations,* changed in 1982 to *Water Resources Investigation Reports (WRIR)*. The results of studies done by USGS researchers, sometimes in concert with state and local governments, the reports deal with water in localities throughout the United States. As noted by the USGS, the purpose of the reports is: "To (a) present to interdisciplinary audiences comprehensive or topical interpretive reports and maps that are mainly of local or short-term interest; (b) provide a medium of release for reports and maps that would not be feasible in any other series or journal or that would be published quickly." (USGS Website, http://water.usgs.gov/pubs/, accessed 10/22/03).

Often the reports are the only published record of investigations done on a specific locality and thus have particular value to subsequent researchers, government policy makers, industry, and homeowners. As a research library with global interests, the University of Michigan sought to collect the reports comprehensively via the Federal documents depository program.

LOCAL TREATMENT

Although shared cataloging via OCLC had already premiered in 1973, it had not yet effected major changes in the way serials, and government documents serials in particular, were handled internally at the library. Accordingly, at the University of Michigan the prevailing mode of treatment was applied to *Water Resources Investigation Reports*. This was to catalog the series, assign a Library of Congress (LC) classification number to it, and record only the piece numbers when they arrived. Recording was done manually on Kardex cards. Each physical piece was labeled with the single LC class number modified by the WRIR piece number. Items were shelved together in the LC collection where they were further arranged sequentially by the WRIR piece number. SuDocs numbers were not used.

The system was, of course, place-bound. The only entries in the card catalog were the series cards, including title, corporate author and subject entries. To access a piece the patron, with WRIR number in hand, needed to consult the Kardex to confirm local holdings and then retrieve the piece from the open stacks. Despite these constraints the system worked reasonably well for both inventory control and access. Even though multiple Kardex cards were added over the years, visual inspection could reveal at a glance which items the library held. In relation to the resources and technology available at the time, the treatment selected for handling the WRIR was appropriate. Perhaps the biggest challenge concerned shelving integrity. As the collection grew, maintaining numerical order became more difficult, due both to the quantity of pieces, estimated at over 3,000 units, and to their varying thickness, including many measuring a scant 1/4 inch.

DEVELOPMENT OF A PROBLEM

The major local change and resulting complications for WRIR began in the late 1980's when the library installed its first OPAC. The main series records transferred well from the paper to the digital catalog. Holdings information, however, did not enjoy similar results. Whether it was pre-existing or new, holdings information had to be keyed into the record. Further, in the holdings field, new holdings had to be integrated manually into sequential number order; the software was not capable of this function. In a static or small collection such manual work may be necessary only occasionally if at all. WRIR, in contrast, was a dynamic, prolific series whose pieces were issued not in sequential order but rather when they were ready for publication. Thus, each receipt required careful editing of the holdings data and correct placement of the new number.

Unfortunately, such precise data entry was done inconsistently. Many factors contributed to the condition. Pieces arrived irregularly and individually; recording was usually done by part-time student help; and system demands exceeded the ability of local procedures to handle them. In addition, during much of the 1990's, the attention of salaried staff was directed to work involved in merging four science libraries, including the one which held the WRIR collection. Staff also dealt concurrently with *in situ* renovation of library space to accommodate the merger. In short, the quality of the holdings information became less reliable and less readily accessible. A further complication appeared in the OPAC public mode where only the first 500 lines (later increased to the first 1500 lines) would display for users. Any number listed beyond the current line limit, therefore, required a search in staff mode to confirm local availability.

As the collection grew, so too did difficulties associated with it. Holdings records for the 3,000-4,000 paper pieces the library presumably had were useable but only with concerted effort in staff mode. Some items or their variants appeared to be recorded twice in the holdings field. In other instances two or more copies of the same piece had identical barcodes. Records for other formats, including map, microform, and CD-ROM were separately created along with unique local numbering systems. Shelf maintenance of the text paper collection grew more formidable. Some items were bound together and correctly labeled; others were not. Many were bound singly while others were not bound at all. Holdings might or might not reflect binding status.

The growth of these difficulties coincided with a change in user demand illustrated best in 1999 when the U of M Department of Geological Sciences hired a new hydrogeologist. The professor's research focused on various locales in the USA and often included the need to access WRIR items. Her activity and that of her post-doctoral assistant marked a rise in demand for the collection and a change in the expected entry point to it. Citations the researchers pursued were usually listed by author and locale; sometimes they included the WRIR number. The approach marked a departure from the way the collection had been accessed for twenty-five years. It also suggested that WRIRs might be appearing in more personalized form (by author) and more frequently in reference lists and electronic files than they had previously. Most importantly, because of prevailing conditions and despite conscientious efforts, the hydrogeologists often were unable to access pieces on their own. Library staff mediation became increasingly necessary, complicated, and time-consuming as efforts were made to locate materials on hand or to borrow them via interlibrary loan. In short, what should have been a straightforward, self-service function had become a labor-intensive and costly activity.

INITIAL EFFORTS

The research of one professor's lab was the most conspicuous but by no means only increase in demand for access to the WRIR. Throughout the late 1990's library staff witnessed a growing interest in water conditions and water research among other faculty members, students, and the general public. In Spring 2001 it became clear that the existing system could not be sustained. Corrective action of some kind was required. As a result, the Shapiro Science Library, holder of the WRIR paper collection, embarked on a modest project to improve access to the series.

The initial steps were seemingly simple ones and executed by two especially capable student assistants working under the direction of the geology librarian and the head of the Science Library Bibliographic Support Unit. Efforts focused on four tasks:

1. Review the detailed holdings information and put the numbers in sequential order.
2. Enter new receipts in sequential order.
3. Shelf read the entire WRIR paper collection and put it in order.
4. Inventory the paper collection against the holdings records, identify conflicts and discrepancies and attempt to resolve them.

Although it required considerable time to complete, Step #1 was the easiest to perform and yielded quick improvement. Similarly, adoption of the new recording procedure aided access to new items at least for a time. Unfortunately, once attention moved elsewhere, treatment lapsed into the "old" ways. Meanwhile, shelf reading the WRIR paper collection improved physical access. It also began to reveal more problems with the collection than expected. These became fully obvious with Step #4. Indeed, the number and complexity of problems associated with WRIR and discovered in this phase threatened to overwhelm project resources.

Two groups of problems were identified: 1) those connected with the publications at their source and 2) problems produced locally. The former included publications which were misprinted, erroneously numbered or titled, or bearing a "corrected" categorization without further context. Shipping lists could also give the wrong information which nonetheless was used. Occasionally covers did not match title pages or inspection revealed other bibliographic discrepancies. The second type of problems, those created locally, have been described above. In addition they included pieces which were mis-marked, mislabeled, or double-barcoded and thus mis-recorded. Often, pieces superseded by "corrected" versions remained in the collection but were not distinguished from or related to their successors. Inventory also revealed pieces missing from the stacks as well as pieces in hand not recorded in the OPAC.

INTERMEDIATE EFFORTS

Before long it became apparent that, despite improvements, the WRIR collection required much additional work. In the least, the remediation project needed to be extended into the Fall and Winter terms. Further, it was evident that the current OPAC software, when combined with the traditional recording treatment, would continue to fall short of both staff and user needs. Even recent improvements were at risk of being lost. A new, more robust library management system would likely meet the needs identified but such a system was not expected to be in place for several years. Therefore, library staff began to examine options for improved handling of WRIR holdings records in the near term. These included relying on external, Web-based sources (e.g. the USGS or OCLC) to verify bibliographic information; printing out the OPAC holdings field with its more than 3,000 numbers; and creating an Excel spreadsheet, an EndNote Library or a FileMakerPro database, mounting it on the library's webpage and eventually migrating the data to the new OPAC. Creating and maintaining a separate file would necessarily be in addition to maintaining the official holdings record in the OPAC.

Careful thought and preparation had to precede the decision. A fundamental criterion was to determine what USGS had published in the WRIR series. Was there an authoritative, comprehensive list or source publicly available and preferably, online? Was it exportable and easy to use? Ideally, such a source would be available at little or no additional cost to the library except for staff work. Inquiries to USGS brought encouraging replies and in May 2001 a recent graduate of the U of M School of Information, working part-time, was able to search the USGS Library Web Catalog, download records into EndNote mounted on the library server, sort the file by WRIR number and print lists as needed.

The next step was to inventory the downloaded USGS records against the shelved items and holdings records, reconcile differences emerging, and edit the Endnote library appropriately. Again, while the procedure appeared straightforward in principle, the execution proved complex and filled with surprises. The download from USGS yielded 5588 records for items published 1972-1999 and one item with a 2000 imprint. Inventory revealed that the U of M held approximately 4100 pieces, a holdings rate of only 73%. The 1500 pieces lacking constituted more than a quarter of all items issued. Some of these were reports issued in other formats and held elsewhere in the library. A handful were reports issued only digitally. The vast majority of lacunae, however, were reports issued in paper format. Their absence in the collection constituted a gap of significant proportions for a depository program and one whose cause could never be determined. The inventory also disclosed that the U of M held pieces not in the USGS list. In a sampling of 1358 pieces published 1995-1997 the U of M held 90 pieces (6%) not on the USGS list as it appeared in Summer 2001. A simple extrapolation suggested the total USGS output to be roughly 5945 pieces published, substantially more than the library seemed to hold.

A STANDARDIZED RESOLUTION

In the aggregate the developments described above suggested records, holdings and access problems far more extensive then originally anticipated. Analysis also indicated that a localized solution, although providing improvement, was not adequate for the longer term. Other more global, systematic improvements were needed. Thus, in November 2001, in conjunction with the Serials Cataloging Unit, a major decision was made to change the treatment for all WRIR pieces received henceforth. Although the LC classification number would remain unchanged, each new receipt would be analyzed, entered into the OPAC and OCLC, and made searchable by author, title, series number, and keyword. Applying initially only to a handful of items, the decision signaled containment of the situation to those problems already existing. Though large, those problems could now be viewed as finite and approached systematically.

The subsequent remediation phase required participation of specialists from several additional units in the Library system, including the Monograph Cataloging Unit and the Library Systems Office. Several questions loomed large. Were there OCLC cataloging records for individual WRIR pieces? Could such records be machine-matched with U of M holdings records to determine the extent of overlap? How feasible would it be to import records? Was the technology amenable to do the work? What staff effort would be required? What would costs be? What timeframe would apply? Discussions and preliminary testing over several months yielded encouraging results. Therefore, a full download of all WRIR records found in OCLC via a batch Z39.50 client proceeded. A small program, written in-house by a Systems Office programmer, matched holdings field series numbers in the U of M catalog with the corresponding series numbers given in individual OCLC records. Results were gratifying:

- U of M WRIR numbers checked
  3892
- OCLC match
  3779
- No Match
  113
- Numbers w/ single matches
  3318
- Numbers w/ multiple matches
  461

Most exciting to all involved in the project were the 3318 U of M items which each matched a single OCLC record. Such results meant that, with minimal additional work, thousands of OCLC records could be imported, added to the OPAC, and with great assurance provide individualized access to the bulk of the U of M WRIR collection.

Similarly gratifying was the limited number of items with multiple matches (461) and no matches (113). The former were subsequently reviewed by the monograph catalog librarian who was able to select the best record from those offered. All instances were satisfactorily resolved in this way. Records selected were then slated for addition to the OPAC. The 113 WRIR numbers in the U of M collection not matched with a counterpart in OCLC were also examined manually. This inspection was more intricate but nonetheless successful, locating matches in over fifty instances. The remaining sixty numbers were then referred to Science Library staff for further examination and comparison to physical holdings. Half of these in turn were resolved. The remaining WRIR numbers in paper format, totaling less then thirty, were then sent for original cataloging and addition to the OPAC and to OCLC.

As noted earlier, a comparison of U of M holdings to the 2001 USGS Web list identified approximately 4100 items held at the U of M. Holdings for only 3892 WRIR numbers were compared to OCLC. The difference, roughly 200 items, can be attributed to receipts processed according to the new treatment (analyzed) since November 2001, other formats with separate records in the OPAC, and variant holdings and pieces awaiting disposition.

RESULTS

In September 2002, over 3800 OCLC records for individual WRIR pieces were smoothly uploaded into the U of M Library catalog. Data linking barcodes to individual pieces also transferred, precluding the need to re-link each new catalog record. For the very first time library patrons as well as staff could search individual pieces by author, title, keyword, and series name and number. Users were also able to view search results without restrictions imposed by the software. Indeed, with the library catalog available on the Web, users were empowered to search for holdings from anywhere on and off campus without the need for librarian intervention. Individual records also meant that U of M faculty, students and staff could use electronic services to request loans, loan renewals and delivery of items on campus. In short, access was modernized and made consistent with access afforded other parts of the library collection. It is hardly surprising therefore that an increase in use of WRIR items was observable almost immediately and from parts of the university that had not previously realized the collection existed. Clear, accurate, globally accessible records also made the collection visible outside the university and therefore available for use via interlibrary loan.

Gains were also realized internally in the library. New items are now placed in a mainstream process rather than being diverted into side channels where they risk becoming problematic and costly to resolve. Cataloging copy is usually available upon receipt or shortly thereafter, thus making for speedy addition to the catalog. Because salaried staff rather than part-time student assistants now process WRIR items, treatment is more consistent and errors are much less frequent. Student assistant work has been relieved of a complex responsibility and associated complicated training. Improvements are particularly apparent in Circulation Services where transactions involving WRIR have become straightforward. As a result of the inventory and its remediation work, the physical collection has also seen significant and sustained improvement in shelf maintenance, binding and labeling. Finally, the success of the project has boosted staff morale. For eighteen months, in various configurations, people worked together toward a common goal to raise the quality of service for users and were rewarded with notable achievement.

FUTURE PROSPECTS

Appreciable work remains to be done on the WRIR collection. As noted above, the U of M has significant gaps in its holdings which it aims to fill insofar as possible. As lacunae were identified during the project, the EndNote library of WRIR numbers was annotated accordingly. The resulting desiderata list has proven efficient and is used routinely in reviewing gift offers made on the GeoNet listserv and for soliciting contributions from other libraries. Claiming through DocEX is also possible, as is purchase from GPO and NTIS. Because of tightening library budgets, however, gifts remain the preferred route for augmenting the collection.

Plans also call for reviewing WRIR numbers issued in formats other than paper and adjusting the catalog records as appropriate. Items issued only in digital format on the Web will continue to be identified and referred for addition to the library catalog if absent. Those in CD-ROM format will be noted and similarly added. Items issued in microform pose the greatest challenge because the format is intrinsically problematic and also because local treatment has traditionally handled microforms as a separate collection with unique nomenclature and cataloging. Finally, a thorough comparison of the holdings to the updated and amplified USGS publications list is foreseen at some future date.

CONCLUSION

Technology has given libraries enormous capabilities to collect and maintain the research record and, through systematic efforts, make it available for use. In the case of *Water Resources Investigation Reports,* technology, coupled with a fresh perspective, allowed library staff to replace a long-term treatment with a far more powerful, user-friendly one at a reasonable cost in time and effort. In upgrading to a higher quality of service overall, the library better fulfills its obligation to provide public access to government documents and to support research and teaching in water resources, a subject of growing interest nationwide.

STATUS OF BIBLIOGRAPHIC CONTROL OF PRE-1900 GEOSCIENCE LITERATURE

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Abstract – There are several print bibliographies that cover the geoscience literature before 1900. The *Bibliography of North American Geology* (1785-1948) was incorporated into GeoRef as a special project. However, other non-North American bibliographies, for example, *Repertorium Commentationum a Societatibus Litterariis Editarum,* 1665-1800; The Royal Society (Great Britain), *Catalogue of Scientific Papers* 1800-1900; Agassiz, Louis, *Bibliographia Zoologiae et Geologiae,* 1848; *Catalogus Bibliothecae Historico-Naturalis Josephi Banks; Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie*, 1830-1900; *Bibliographia Geologica*: 1896-1906; and *Annuaire Géologique Universel: Revue de Géologie & Paléontology*, 1885-1896 were not entered into GeoRef. Should they be included? Is coverage of major geological topics and/or journals missing from GeoRef? How accessible is the literature from this time period? As libraries move older material to remote storage, do we have the tools to find and recall this material, particularly the journal literature?

The mathematicians are creating Electronic Research Archive for Mathematics, ERAM, a digital archive of the most important mathematical publications of the period 1868-1942 and a database based on the *Jahrbuch über die Fortschritte der Mathematik.* Is a similar project feasible for the geosciences?

INTRODUCTION

The most recent guide to the geoscience literature was published in 1989 by Wood, Hardy and Harvey and since then the computer has changed how we access information in the library. This paper grew out of a concern that the GeoRef database was not providing the comprehensive coverage that students and faculty assumed. What was missing and what should I do to help them? Also, as I was selecting material to move to the book depository, the concern was retrieval of the literature in the future. How do researchers find references today? Do they rely on GeoRef or other online databases? As we select journal runs to remove from the open shelves, do we consider indexing before we put a title into storage? As reference resources are becoming more and more electronic and the print reference collections are less used, do we move old indexes out of the way to make room for more computers without checking to see if the indexes are available electronically? Do we, as the information specialists, know what we have available in print and how it compares with the online databases? How well do we train our staff, particularly the student staff? When someone wants information on a topic, do we just point to GeoRef? Do we assume that the serious researcher will know what is available in print or will ask? How well are we teaching the researcher of the future to know to ask? In a paper I gave several years ago I talked about reference service as guiding people through the "information swamp." Along the paths are stones, gems of the printed literature that need to be charted on the swamp map as steppingstones. I wonder if we are dumping (into remote storage) the print volumes as boulders might be rolled into the swamp never to be seen again rather than identifying them as "gems" along the way to include on the swamp maps (Scott, 1999).

GeoRef is the major geoscience database. The coverage is back to 1785, but only for North American geology. Coverage for the rest of the world starts in 1933. I hear comments from faculty that GeoRef is not complete, it doesn't have everything, or they can't find what they need. Often, the problem is with older literature or literature from outside North America. I wondered what amount of geoscience literature was not in GeoRef and how large a project it would be to expand the coverage of GeoRef. I was particularly interested in the pre-1900 literature, since some of this is in poor physical condition and the older journal volumes are what librarians like to send to remote storage. It is easier to select a long journal run to move than to select the same number of monograph volumes.

I decided to look at some of the print bibliographies for the pre-1900 geoscience literature, some of the journals from that same time period, and publications of some of the early geologists. The goals were to get an estimate of the amount of literature not included in

GeoRef, identify important bibliographies that should be available for researchers who need pre-1900 literature, and make some recommendations for improving coverage in GeoRef.

BIBLIOGRAPHIES

What print bibliographies or indexes cover this time period, and does GeoRef provide the same access? I identified eight print titles to examine.

Repertorium Commentationum a Societatibus Litterariis Editarum

Compiled by Jeremias David Reuss and published by Dieterich in Göttingen between 1801 and 1821, this sixteen-volume set is a subject index to articles in publications of scientific societies between 1665 and 1800. Volume 1 is Natural History, General and Zoology, and volume 2 is Botany and Mineralogy. Volume 1 did not appear to include any geological references. The mineralogy section (which includes paleontology) in volume 2 contains approximately 1600 entries. The mineralogy section is arranged by subject and geographical headings and then alphabetically within each section. There are 29 references to the Americas. Of these 29, only 8 are included in GeoRef. The set was reprinted in 1961 as Burt Franklin Bibliography and Reference Series no. 29. It has been digitized by The Center for Retrospective Digitization, Göttingen State and University Library as part of the Göttinger Digitalisierungs-Zentrum and is available on the web at:
http://134.76.163.65/agora_docs/216332BIBLIOGRAPHIC_DESCRIPTION.html
These are page images and are not searchable. This is a set that should be added to GeoRef or another database.

Royal Society (Great Britain) *Catalogue of Scientific Papers*

This set was published in 19 volumes for the years 1800 to 1900. It was published in series for different time periods and is arranged by author within each series. The only subject index published was for mathematics. This was published as a successor to Reuss's index, but the coverage was expanded to include periodical literature as well as the publications of the scientific societies. Because this has no subject index, I did not compare it to GeoRef. The Bibliothèque Nationale de France has digitized the volumes as part of Gallica. These are page images and not searchable but are available free on the web at http://gallica.bnf.fr. Paratext, Electronic Reference Publishing will be adding the *Catalogue of Scientific Papers* to their *19th Century Masterfile* database during 2004. As of December 1, 2003, according to their web site 750,000 records were in process of being loaded. For more information go to their web page: http://poolesplus.odyssi.com/contents.htm .

Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie

This journal was published from 1807 to 1949 under various names. The volumes include articles, reviews, abstracts and lists of publications for that year. It includes North American literature that is also included in GeoRef. In the 1894 volume, the new literature section for mineralogy was checked against GeoRef. There were 76 searched and only the 12 that related to North America were found to be in GeoRef. Once the Royal Society *Catalogue* is available online, this title should be compared to it.

Annuaire Géologique Universel: Revue de Géologie & Paleontology

This journal was published from 1885 to 1896 by the Société Géologique de France. The volumes include lists of universities, museums, collections, periodicals, societies and geologists from various countries. Starting with volume 3 it became a bibliography and review of the geology literature for the year. Volume 3 from 1887 includes 2824 geology references and 504 references in the paleontology section. The Glaciers section was checked against GeoRef: of the 33 entries, 4 were in GeoRef. There were some references to North American glaciers that GeoRef did not include, particularly articles that had been published in *Nature*. OCLC lists 20 libraries with this title. The paper in the volumes is brittle. This title should be considered as an addition to GeoRef or another database.

List of Geological Literature Added to the Geological Society's Library

Published from 1894 to 1934 by the Geological Society, this is the predecessor to the Bibliography and Index of Geology Exclusive of North America, 1934-1968, and the Bibliography and Index of Geology, 1969 to date (Ward, et al., 1981). It was published annually and included a subject index. The 1895 volume includes 225 serial titles that were either purchased by the Society, presented to the Society by authors, editors, or publishers, or were obtained by exchange. There is no indication of the volume or issues included. There are about 3000 citations included for that year. This includes North American literature that is already in GeoRef. Because this is the predecessor of the print bibliographies that were included in GeoRef, it is a logical addition to GeoRef.

Bibliographia Geologica: Répertoire des Travaux Concernant les Sciences Géologiques Dressé d'après la Classification Décimale ... Series A and B

This bibliography was published in Brussels, Belgium. Series A, in 9 parts, includes publications before 1896 and Series B, in 7 parts, includes those from 1897-1904. The coverage is worldwide. The entries are arranged according to the Dewey Decimal Classification System. Volume 1 of Series B for the years 1896-1897 was compared to GeoRef and of the approximately 2700 entries, 54 were in GeoRef. A supplement published in 1898 is a list of the 700 periodicals from 39 countries that were included in the bibliography volumes. Of these, 92 titles were published in North America. This is a larger coverage of periodical titles than the Geological Society Library list. These 16 volumes would be a good addition to GeoRef.

Bibliographia Zoologiae et Geologiae. A General Catalogue of All Books, Tracts, and Memoirs on Zoology and Geology

This bibliography by Louis Agassiz, corrected, enlarged, and edited by H.E. Strickland, was published in 4 volumes by the Ray Society between 1848 and 1854, and reprinted by Johnson Reprint in 1968. The preface states that this started as a catalog of works that Agassiz was using for his research but he realized the value of it and, through correspondence with naturalists in Europe, was able to expand it to a catalog of all known works and detached memoirs on Zoology and Geology (Strickland, 1968, p. v.) It is arranged in alphabetical order by author, and there is no subject index. There is a list by country of the publications indexed. I estimate that there are about 20,000 entries but not all are geology. As there is no subject index, this title was difficult to compare to GeoRef. My recommendation is that other bibliographies be added to GeoRef first and that we revisit this title later.

Catalogus Bibliothecae Historico-Naturalis Josephi Banks

This catalog of Sir Joseph Banks's personal library was compiled by Jona Dryander and published in 5 volumes in London by G. Bulmer between 1796 and 1800. It was reprinted by Johnson Reprint in 1966. Banks was the president of the Royal Society from 1778 to 1820. This is a companion work to Louis Agassiz's *Bibliographia Zoologiae et Geologiae.* The volumes are general works, zoology, botany and mineralogy, and each volume has a subject index. Volume 5 has an author index to the other volumes. Volume 4, Mineralogi, includes fossils as well as mineralogy. Each volume is divided into major subject sections and includes a subject index. References appear to be mostly from the 1700's; however, many entries have no date. I estimate that there are about 4600 entries in volume 4. There are 18 entries for North America. Of these only 2 are in GeoRef.

These are printed indexes that provide access to the literature of this time period with varying degree of completeness and subject access. One title does not stand out over the others as the one that should be added to GeoRef. To get the most complete coverage, all the titles will need to be considered.

PERIODICALS

Another approach would be to take the geoscience serials from this time period and index them cover-to-cover. The Geological Society's Library in 1895 lists 299 serial titles that they received that year. Of these, 52 were North American titles. I selected six serial titles to compare to GeoRef. I checked one volume of each against GeoRef.

Bulletin de la Société Géologique de France started in 1830. GeoRef has 106 entries for the years between 1830 and 1900. Series 2, volume 1 for the years 1843-45 contains about 50 articles; none are indexed in GeoRef.

The Quarterly Journal of the Geological Society of London began in 1845. GeoRef has 272 entries for the years between 1845 and 1900. Volume 5 from 1849 includes 39 articles of which 8 are indexed in GeoRef.

Zeitschrift der Deutschen Geologischen Gesellschaft volume 1 from 1849 includes 31 articles. One article on fossil footprints in Pennsylvania is indexed in GeoRef. Between 1849 and 1900 GeoRef has 62 records for this journal.

Geological Magazine volume 1 from 1864 includes approximately 86 articles; 3 of them are included in GeoRef. Between 1864 and 1900, GeoRef has 190 records for this journal.

Journal of Geology volume 1, 1893 contains 42 articles; 4 articles are not indexed in GeoRef. Since this is a North American journal, an assumption would be that it is completely covered by GeoRef. Apparently articles not on North America were not indexed.

Mineralogical Magazine volume 1, 1877, contains 52 articles; 3 are indexed in GeoRef. Between 1877 and 1900, GeoRef has 13 records for this journal.

GEOLOGISTS

As a third test, I took the names of six early British geologists and searched GeoRef for their publications. I only found citations to work they had done in North America.

James Hutton – 1 entry in GeoRef
Charles Lyell – 74 entries in GeoRef
William Smith – 9 entries in GeoRef
Adam Sedgwick – 2 entries in GeoRef
Joseph Prestwich – 1 entry in GeoRef
Roderick Murchison – 9 entries in GeoRef

CONCLUSIONS

The results of this cursory evaluation point out that there is a large amount of the pre-1900 literature for areas outside North America that is not available to GeoRef searchers. Much of this literature is probably indexed in a print index someplace. These indexes may or may not be accessible to the researcher depending on the location of the researcher and the condition of the printed indexes. It would be valuable to have access to this literature in a database such as GeoRef. But is it feasible? Having access to the *Catalogue of Scientific Papers* as part of the *19th Century Masterfile* will be a great start.

In my other position at Ohio State University as the Mathematical Sciences Librarian, I was aware of the Electronic Research Archive for Mathematics Jahrbuch Database project. I wondered if it is feasible for the geosciences to do something similar. The project provides a database based on the *Jahrbuch über die Fortschritte der Mathematik* with links to a digital archive of the most important mathematical publications of the period 1868-1942. The *Jahrbuch über die Fortschritte der Mathematik* was published from 1868 to 1942 and reviewed more than 200,000 mathematical articles. Mathematicians considered some of these publications to still be valuable sources for mathematical research and teaching. They wanted to make the database and the actual resources available to more researchers. The ERAM now includes entries from 1868 to 1931 with links to over 13,000 digital facsimiles. The project is committed to keeping the database available free on the web. For more information see http://www.emis.de/projects/JFM/JFM.html. A resource such as this for the geosciences would be wonderful. It will also take work, cooperation, and money.

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MAKING THE PAST COME ALIVE: BRINGING LEVERETT & TAYLOR & USGS MONOGRAPH 53 TO THE 21ST CENTURY

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Abstract – History repeatedly demonstrates that not all information and science of any given age will survive even one or two centuries. Among the great challenges of current geoscience information are the questions of deciding what information will be preserved, in what format, and what types of digital or other access can be made available to future researchers.

The current situation of the dispersed collections of the glaciologic research materials left by Frank Leverett and Frank Taylor serves to illustrate some of the problems and issues involved when considering future preservation and utilization. At present, the body of their research has survived the last century and exists in a variety of formats in multiple locations with varying degrees of access. Almost none of it has been digitized or transferred to any machine-readable format.

In addition to preserving this unique but disparate group of collections, it should be the objective of the geoscience information community to explore ways to make these collections more useable to researchers. The ultimate goal should not only be survival of the information but the addition of a refined retrieval mechanism, a database that would allow glaciologists enhanced access to the information collected by Leverett & Taylor in the production of United States Geological Survey (USGS) Monograph 53. Ideally the theoretical design of such a database would be more than archival in nature. It should permit correlated access to all parts of the information base by location (a multi-tier field location structure), by date, and by name of glacial feature.

INTRODUCTION

One of the first maxims learned in Geology 101 is from Lyell: "The present is the key to the past." In graduate school students learn the corollary "The past can be the key to the present and the future." It is not surprising then, that what is true for the science of geology is also true for its literature, and for those who keep that literature intact and accessible – the publishers, indexers, and geoscience librarians.

The past, present, and future of geoscience literature have been previously discussed in numerous forums (Ansari, 1990; Blair, 1996; Eaglesfield, 1988; Kelcey, 2001; Noga, 2001). The unique value of various types of geoscience literature has been documented (Dvorzak, 1991; Eaglesfield, 1988; Manson, 1998; Manson, 1999). The challenges and successes of using various types of electronic format to improve access to the literature have been discussed many times over the years (DeFelice, 1997; Haner, 1995; Heiser, 2000; Tahirkheli, 2000; Wick, 1994; Zipp, 1993). In many cases, the role and function of the geoscience library itself will become a question of survival over the next century.

In the midst of all this change and evolution, it is useful to consider several questions about the survival and transmission of geoscience information itself.

Nature of Geoscience Information

First, geoscience information is not a single product or entity, and it may be a disservice to treat it as such. It perhaps should be thought of as an aggregate of subject-specific collections of information and data, records and observations, hypotheses and theories, experiments and models, that over the years have built the body of knowledge that governs our present understanding of the various sub-disciplines that make up geology. Collectively, they are geoscience information, but it is important to recognize the diversity inherent in the whole.

The aggregated nature of geoscience information is important to remember as questions of survival and transmissibility are considered. Not all parts of the information base are equally ready to make the transfer to the next technological platform. Some fields, such as geochemistry, geophysics and hydrogeology, have taken quantum leaps in the last 30 years as new technology has enabled them to utilize computers and the digital formats that support them in advancing the understanding of the earth. Other fields, such as stratigraphy, field mapping, historical geology, regional geology and paleontology, are far more dependent on the historical accumulation of data and records, most of which are still in the original format and have not yet been transferred to any machine-readable format. Other fields, like oceanography and glaciology, are in the middle of the spectrum, relying on older data and records while using new technologies to explore and analyze.

Secondary Considerations

There are some secondary questions to be considered as well:

- Not all information currently available to researchers will survive even the next 50 to 100 years. Who will determine what survives and in what format it will be preserved?
- What factors will determine which geological information will be modified for present and future technological advances?
- As information specialists, what control do we have over the selection of information that will survive into the future?
- How do we keep related information together and viable when it currently exists in various locations and in disparate formats?
- What kind of cost-benefit analysis can we apply to this process to demonstrate the present and future value of past literature?

Principles of Preservation over Time

In historical terms, the question of what information survives is often related to issues of practical or theoretical use, perceptions of value, transmission mode or format, presence of some type of archive, the number of copies in any format, portability of the format, language, and perhaps, finally, the vicissitudes of fortune (i.e. dumb luck). Some combination of these factors may operate for short-term survival, i.e. 50-100 years; most or all of these factors operate when survival exceeds 200-500 years.

The format of the information has obvious ramifications for preservation, especially over the long-term, but information that is regarded as valuable to some group of people with the means to preserve or copy it carries the best chance of long-term survival. History is replete with examples of groups of people who have undertaken to ensure the survival of some body of information by either changing its format or translating it. Much of the ancient thought and philosophies survive today due to the efforts of scribes, librarians, historians, and others over the past 3,000 years. Occasionally, groups in one culture will see value in information that another culture discards; the survival of Greek science and philosophy through the Dark Ages owes more to Arabian curators and translators than it does to medieval scribes.

Technological innovation in format or dissemination may be used to prolong the life span of a given body of information, either intentionally or unintentionally. Frequently, each technological advance improves the access and retrieval capability of the body of information. The medieval practice of adding glosses to texts to supplement/explain the information actually enhanced the information contained with the text. Gutenberg's basic printing technology made it comparatively easy to add refinements like tables of contents, title pages, and illustrations. Computerized printing and editing have made subject and author indices commonplace and expected additions to the basic information included in the book or journal. Computer databases have enhanced access to disparate bodies of information in various formats, making large blocks of data available to increasingly wider groups of users.

But what of the information that is not recognized as being of value to the primary information gatekeepers of each culture, the data that is not transferred or translated onto the next information technology platform, the theories and hypotheses that do not correspond with accepted belief, the descriptions of technologies that appear outdated or too limited in their applications?

To borrow from paleontology, natural selection has a role to play here, not only in the evolution of species, but also in the evolution of knowledge validated by experience and observation. Not all information will survive. Not all information should survive. Not all information can survive.

Preservation through Usage

Who determines what information will be transferred to the following generations? In most cases, it is the people who use the information at a given point in time. Effectively, this could be called transfer or preservation by continuous and/or repeated use.

It is important to note that usage can be an ephemeral process, subject to trends, fads, interpretations, modifications, theoretical revolutions and other transitory phenomena that change the interpretation of the basic facts as the science advances and evolves. The basic hypotheses used by one generation of researchers to explain observations may be regarded as fanciful or mythological by the great-great-grandchildren of those researchers. That does not make the original data set obsolete; the data points may still be useful; they may be used again at a later point with a different theoretical base. One of the great dangers of preservation by usage is that many good data sets and technologies are lost because there is no current theoretical use or validation for the data set. History may never record how many times someone first thought the world was round, but the idea was lost in Europe for many hundreds of years. The techniques of making Damascus steel have been lost for centuries and, presently, the technology cannot be replicated. Obviously not all information meets the current usage test for transfer.

Preservation by Gatekeepers

There is another transfer/preservation alternative that is more frequently employed in non-scientific fields by artists, historians, museum curators, and archivists. Even though an object or information set may not be currently in use, it is considered for preservation because of its historical, philosophical or aesthetic value. These people effectively become the gatekeepers to the past by their selection (or non-selection) of what will be preserved and transferred. The geoscience information community should include their role as gatekeepers in planning for the future.

THE LEVERETT-TAYLOR RESEARCH COLLECTIONS

The Leverett-Taylor glacial studies materials can be used as a case study to illustrate many of the problems and questions mentioned above. Although the Leverett-Taylor research is primarily of value to glaciologists and geomorphologists, their research also includes primary data on water and soil resources.

Current Status

The Leverett-Taylor materials presently exist in a variety of formats and in multiple locations. Almost none of them are in any type of machine-readable, digital, or electronic format. Access to the information stored in these various formats is also generally restricted to on-site use. Although researchers usually can locate the published USGS Monographs at a depository library, most of the other information resources are not generally accessible unless a researcher chooses to become a part-time historian/archivist. Currently, researchers have to be detectives to locate most of these resources. Additionally, archival-quality index/retrieval standards are not nearly as functional to a research geologist as GeoRef or MARC indexing.

The various parts of the Leverett-Taylor collections may be summarized as follows:

USGS Monograph 53

USGS Monograph 53, *The Pleistocene of Indiana and Michigan and the History of the Great Lakes,* was published in 1915. It was the third in a series of USGS Monographs that described and deciphered the trail of the last Wisconsinan glacial retreat from the Ohio River north to Canada. It was the product of over 30 years of detailed field mapping in nine states and Canada, and much of the work was done on foot or on horseback. It was also a cooperative project, integrating the fieldwork of geologists from the USGS, various state surveys, and the Canadian Geological Survey.

Monograph 53 and its preceding studies, Monographs 41 and 38, are famous as the "gold-standard" basic reference materials for researchers studying the Quaternary in North America. They are a unique compendium of data that is still used by geographers, hydrogeologists, glaciologists, engineers, and soil scientists. The Monographs are presently only available in the original printed book format with maps as published by USGS in 1915.

Field Notebooks

Leverett and Taylor also left numerous field notebooks recording the daily observations and data from their various field seasons. Leverett has 300 field notebooks on file with the USGS Field Records Library in Boulder, Colorado; Taylor has a smaller number, which now reside in the National Archives. They are handwritten in various types of notebooks, although some of Leverett's notes were typed and revised under his supervision. The notebooks have not been published and are only available for inspection and research at the USGS Field Records Library, where staff will make copies, and at the National Archives.

Letters

Leverett and Taylor also left an extensive correspondence in the form of letters from 1890 to

1937. The correspondence includes numerous letters between the two men as they exchanged information, recorded observations, and collaborated on their research. The correspondence also includes notes and letters from other prominent geologists, including Gilbert, Chamberlin, Spencer, Fairchild, Lane, Goldthwait, Winchell, and Tyrrell. Presently the surviving letters are scattered among libraries and archives in various locations. Michigan State University (MSU) is fortunate to have 1100 of these letters and many of Taylor's original hand-written reports. Other collections can be found at the Bentley Library at the University of Michigan, the University of Chicago Library, and in several libraries in Ohio and Indiana. Most of these letters have never been published. Most are available as archived documents only, without any retrieval access except author, date and, occasionally, general subject.

Maps

Leverett and Taylor also made maps as a part of their research. Some of these maps have been published as part of various government or serial publications. Others were included in the field notebooks. Still others can be found in the various collections of letters or in places where Leverett worked. MSU owns very few of the detailed topographic quadrangles showing the glacial features Leverett identified and mapped. Most of these other previously unpublished maps are available for inspection at their home location. Many are in need of preservation.

There are, undoubtedly, other resources related to glacial studies in the Midwest stored in files and shelves in various libraries, archives and geological surveys. Although the bulk of the Leverett-Taylor material discovered so far is located in Michigan, Ohio, Indiana, Illinois, Wisconsin, and Colorado, it is likely that other materials may be found in other states.

QUESTIONS FOR THE FUTURE

- Given the current situation of this group of collections (and there are many other comparable situations for other collections all over the world), is it likely that the data and information contained in these very different collections will survive another hundred years?
- Will they be accessible to anyone, even an historian or archivist?
- Will the data contained in the various formats be useful in the future?
- Is it possible to replicate the field studies so that it would not be necessary to convert the original data?
- If not, what resources would it take to convert the data/information to an electronic format?
- How can information specialists improve index-retrieval access to these collections during the conversion process?

Unfortunately there are no ready answers currently available for these questions.

Given the disparate nature of the various parts and formats of the Leverett-Taylor materials, it is extremely unlikely that most of the collection will survive in useable condition for another hundred years. Monograph 53 is widely available in depository libraries and USGS has recently announced plans to scan the contents of the Monograph series, so this piece stands the best chance of survival. Without preservation, the letters that are currently in archives of some type may be too brittle to be handled in another fifty years. Transferring the various collections of letters, field notebooks and maps to a digital format will require extensive funding and cooperation between state and private institutions.

Unfortunately, the majority of potential users of this data are not aware of its existence. Aside from Monograph 53, the principle of preservation by continued usage probably will not apply to the rest of the collections.

Therefore, it is left to the gatekeepers of geoscience information to determine the potential value of this material to future research and to engage in the process of deciding what will be preserved, how it will be done, what format will be employed and what access-retrieval options could make the transferred information more functional to researchers.

THE IDEAL SOLUTION

(If wishes were horses, beggars would ride!)

For the moment, two assumptions will be made. First, all things are possible in an expanding universe. Second, "Fortuna favet fortibus," that is, fortune favors the brave!

The following section discusses a hypothetical project that would not only incorporate the preservation of the Leverett-Taylor materials, but would also implement the addition/integration of an information retrieval structure during the preservation process. The final objective of the project would be to make the information stored in various locations readily accessible to researchers one hundred years from now.

In addition to preservation, the basic concept of the project would be to add value to the information by constructing a database that would cross-link the content of Monograph 53 with the data included in the letters, field notebooks and maps. The unifying index for all parts would be location identifiers, including at least four tiers of geographic fields (state, county, towns, and township-range) and glacial feature. Additional index fields could include author, date, and other fields appropriate to the type of material. It might even be possible to include a GIS overlay on the geographic data.

Database Construction Parameters

Such a database would need to include the following points:

1. A pre-project evaluation process that includes an understanding of the research value of the information/data and the uniqueness of the data to be converted

Despite their age, the Leverett-Taylor materials still have value for current and future research.

- In the first place, no one could completely replicate the time and effort involved in their thirty years of fieldwork.
- Second, even with modern mapping techniques like enhanced Digital Elevation Mapping, not all the data they recorded can be duplicated.
- Third, not all the surface features they mapped are presently in existence. Many kames, eskers, and moraines have been mined out of existence. The sand and gravel contained in the 30-40 miles of the Mason Esker in central Michigan have provided roadbed aggregate for the highways throughout central Michigan. Most of the beach shorelines from the Wisconsinan Great Lakes that were located near Detroit, Toledo and Chicago are now under concrete. Not only is the Leverett-Taylor study not replicable, but some of the original features are gone forever.

2. Consideration of preservation and copyright options

Obviously, any material over one hundred years old will require some preservation work. Surprisingly enough, much of the material is still in rather good condition for its age. The maps retain their colors very well. Most of the letters are in good to very good condition. The field notebooks have been carefully preserved by USGS, but they show the effect of being written in a variety of settings and situations. Copyright issues would also need to be explored.

3. Proper design of an index/retrieval structure for the data that would be functional for scientific needs

In the process of converting the data/information to digital format, it would be advantageous to go beyond the requirements of the archivist and historian to provide a research-oriented, searchable index structure – a database that would provide references to and from Monograph 53, cross-linked with the data points in the letters, maps, and field notebooks.

Obviously, the data in each format are constrained by the organizational nature of the format itself. For example, Monograph 53 could easily be searched by location (state, county, township section and range) and glacial feature. The letters have a natural organization by date (year, month and days), author, and addressee, but could also be searched by location (state, county, town, township section and range) and by glacial feature and subjects. The field notebooks by Leverett could be searched by date (year, month and days), location (state, county, town, township section and range) and by glacial feature. The maps are naturally retrievable by quadrangle name, but could also be indexed by location (state, county, town, and township section and range) and by glacial features.

After consulting with current glacial and geomorphologic researchers in Michigan, the most functional database should allow retrieval by a multi-tiered location index and by name of glacial feature. Author, date, and subject access could be of secondary importance.

4. Consideration of digital format options

Since the information collected by Leverett, Taylor and others currently resides in different print formats (letters, notebooks, books, maps, etc.), any digital conversion project would need to investigate either digital options that can accommodate more than one format or more than one digital option. While books and maps can be scanned with relative ease, hand-written letters and field notebooks may not be able to be scanned. The content may not be reproduced in sufficient clarity to be legible. Hand-written materials may require translation, key stroking, and editing to move them into machine-readable format.

5. Cooperative and collaborative agreements between institutions

Such a project would require collaboration and cooperation at several levels between institutions. In addition to making their respective collections available and accessible, institutions and libraries would require agreement on format options, preservation options, funding options, level of staff involvement, and degree of financial contribution. The leadership of the institutions involved would need to be fully committed to the project.

6. Resources to convert data to digital format

To convert even part of the Leverett-Taylor collections into digital format would require a substantial commitment of time, money, and personnel resources.

CONCLUSIONS

As geoscience information specialists, we are in the midstream of a river of technological innovations that are changing preferred avenues of access to and retrieval of the research literature. In another 10-20 years, most of our students will be unfamiliar with many types of print resources. We have been guardians, preservationists, and facilitators of access to geo-information. Will our traditional roles be enough to keep the heritage of literature alive during the coming century? What role do we have in selecting what information will make the transition to whatever digital format becomes the "standard"? Can we take an active role in providing index and retrieval enhancements to traditional means of archiving older data so that future geologists do not need to become detectives to track down disparate collections in various formats?

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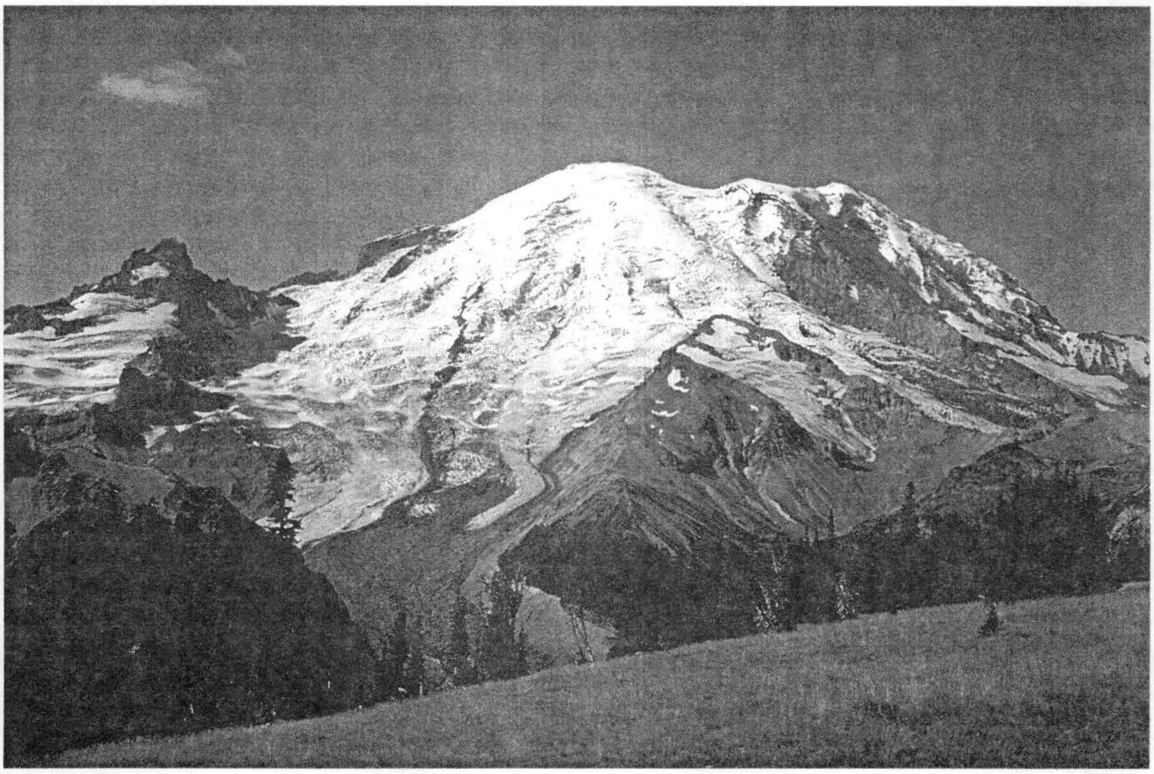
PART II. GSA POSTER SESSIONS:

GEOSCIENCE INFORMATION/COMMUNICATION



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ON THE DEVELOPMENT OF A STATEWIDE LANDSLIDE INVENTORY

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Abstract – A statewide, GIS-based landslide inventory is the first major step in Washington State's development of a Landslide Hazard Zonation database. This new, publicly available dataset provides land managers and researchers with a powerful piece of information in a format that can be queried and updated. Having this data as a GIS-based product allows queries to be mapped, adding the spatial component to queries aiding in land management decisions and forest regulation. The first public draft of the landslide inventory is a compilation of the individual efforts of many timber, tribal, state, and federal agents. When the landslide inventories were collected, few authors used a standard format for data collection. Variances in naming conventions, data collection protocols, quantity and quality of data were identified. To compile these data, a common data architecture was developed. The individual inventories were normalized to the data architecture by creating a decision table for every item in the original data to the values in the compiled data. Each decision table was reviewed for consistency. In some instances, the original author collected very little information related to each landslide. Where the original data was incomplete, the missing data values were calculated from existing data layers using GIS's overlay abilities. The database itself is composed of two spatial attributes (polygon and arc), and two tabular attributes (unique number and type of feature). The unique number is related to a database of information about each landslide, such as data source, landslide process, landform, delivery, land use, size, and original number (to allow a user to link the data back to the original dataset). The inventory contains detailed information on both deep seated and shallow landslides. Deep-seated landslides have a separate related table (via the unique number) that contains information specific to that type of landslide (e.g. level of activity). The data is publicly available on request to the WA-DNR Forest Practices Division, via compact disc. In the near future, this data will be available via web download and web-based mapping on the WA-DNR FPARS website. Further updates to this data are ongoing through the Landslide Hazard Zonation Project and by submission of data (electronic or paper) to the LHZ Project Leader.

ANALYSIS OF HAZARD, VULNERABILITY, POPULATION, AND INFRASTRUCTURE

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Abstract – The Pacific Rim, the so-called "Ring of Fire," is a region subject to many different natural hazards that occur with varying patterns of frequency and intensity. Although the number and size of most natural hazards in the Pacific Rim region have not dramatically increased during the last century, the frequency and magnitude of natural disasters have. Exploding populations and unprecedented urban development within the past century have helped fuel this increase in the number and severity of disasters. Moreover, networks of people, information, and commodities now traverse great distances to serve even larger concentrations of people. Understanding the risks posed by these increasingly connected populations by natural hazards therefore requires an expanded regional analysis. To better understand the "future of disasters," we calculate the potential impact of five significant natural hazards: earthquake, flood, tropical storm, tsunami and volcanic eruption and assess the vulnerability of each of two elements that are at risk: people and infrastructure. These two assessments reflect different repercussions from natural disasters: losses of life and disruption of economic activity. Because population and infrastructure are distributed heterogeneously across the Pacific Rim region, two contrasting portraits of risk emerge: human populations are most vulnerable and most at risk in "developing" countries while high-valued infrastructure is at risk in "developed" countries. We also propose the addition of another component in the measurement of risk, a measure of interconnectivity or interdependence - the dynamic linkages of people, information and commodities in a globalized social and economic system. In the future, because of globalization, the spatial reach of local disasters will increase.

GEOSCIENCE ENCYCLOPEDIAS: A SELECTED LIST AND GUIDE FOR THEIR FURTHER IDENTIFICATION

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Abstract – Encyclopedias constitute a major genre of reference material available in most libraries. Even so, they are often underused, especially for instructional purposes. Although the *Encyclopedia of Earth Sciences Series* edited by Rhodes Fairbridge is well known, many geoscientists are unaware of the number and range of specialty encyclopedias in their field and the potential they offer for instructional activities.

In part, this is explained by the lack of a comprehensive list of subject encyclopedias or a quick way of isolating them using library or commercial catalogs. Several methods, alone or in combination, can be used to identify many subject encyclopedias available in North American libraries. These methods were used to generate a list of approximately 250 encyclopedias with significant geoscience content published since 1980.

Once titles have been selected, they can be effectively used by instructors for classroom preparation, and by students to clarify and extend textbook explanations, select project topics, and complete assignments. An abridged bibliography of geoscience related encyclopedias and an explanation of the list's construction are presented.

Note: The complete version of this project was published as "Geoscience Encyclopedias and Their Potential for Classroom Instruction," Journal of Geoscience Education, Vol. 51 (5), (November 2003), pp. 512-520. The final page, containing Appendix 2 (Encyclopedia of Earth Sciences Series), was inadvertently omitted by the publisher. It appears as an errata in Vol. 52 (1), (January 2004), p. 97.

A PICTURE OF SPRING PROTECTION-POSTERS IN EDUCATION AND OUTREACH

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Abstract – Florida's springs are a cultural and environmental treasure. The motivation to protect them is widespread. Two posters have been produced at the Florida Geological Survey as part of a spring protection effort led by the Department of Environmental Protection. Both posters have as their focus a large color illustration of a Florida landscape with a cross-section view of the hydrogeology that is associated with the landscape. A spring is a prominent feature of both the landscape and the cross-section. This format was chosen so that the relationship of surface water to groundwater and the subsurface movement of groundwater could be illustrated. Illustration is used in an attempt to overcome the difficulty that non-geoscientists experience in conceptualizing subsurface rock layers and the groundwater resources they contain. *Protecting Florida's Springs* presents fundamental elements of the hydrogeology of springs. *Land Use and Spring Protection* emphasizes a distribution of land use activities that planners expect will provide maximum protection for the spring and was based on the technical illustration, *Overlay Protection District*. Because of their versatility and popular appeal posters remain a valuable part of education and outreach efforts at the Florida Geological Survey.

INTRODUCTION

Florida's springs are a treasured part of the state's environmental heritage. Active citizen involvement in spring protection is essential in Florida, a state where population growth is estimated at 4,000 to 6,000 new permanent residents per week (Morris and Morris, 2001). Springs represent a discharge of groundwater which flows through pore spaces, fractures and conduits in the subsurface. The largely hidden nature of groundwater is one of the primary challenges for designers of products used in education and outreach associated with spring protection. Another difficulty to be considered is that protection of a spring involves protection of groundwater in areas ostensibly remote to the spring. Additionally, the scale of a springshed or spring recharge basin (Copeland, 2003) (on the order of kilometers) defies the use of still photography if an integrated "picture" of spring protection is to be developed. Illustration can be used to assist in the visualization process.

A citizen's understanding of groundwater protection must be based in part on knowledge of the relationship between the surficial expression of common geologic features and the underlying hydrogeology. This sort of intuitive knowledge may be obtained in some areas by everyday observations of rocks exposed in road cuts or more natural settings. Florida, however, is a state that is characterized by low topographic relief (Schmidt, 1997) so that even common features such as layered rocks and fractures are rarely seen. Sinkholes (arguably the state's must common topographic feature) generally contain slump material that obscures their relationship to the underlying limestone.

Illustration is used as an aid in conceptualizing subsurface rock layers and the groundwater resources they contain. The surficial expression of a spring is shown both in its environmental and cultural context (plan view) and in its hydrogeologic context (cross-section view). This juxtaposition of hydrogeologic and environmental/cultural information presents a viewer with the explicit relationship between surficial features (and activities occurring at the earth's surface) and the area's hydrogeology.

Stratigraphy associated with springs was generalized to include three layers. The deepest rock layer shown is limestone. It represents the carbonates of the Floridan aquifer system (Scott, 1992). Limestone layers are shown as pale grey with a light layer of turquoise and the upper surface is irregular to emphasize the effects of karst processes. Turquoise is used to suggest the presence of water in pore spaces in carbonate rocks. Hydrogeologic features were emphasized in rendering the aquifer system. Vertical and horizontal fractures are shown as lines. Enlarged fractures are water-filled and are shown merging with large conduits that produce spring flow. Various shades of aqua are used to give an impression of water flow through fractures and conduits.

The intermediate confining unit which also functions in some areas as the intermediate aquifer system is shown above the limestone of the Floridan aquifer system. This unit corresponds to the Hawthorn Group, a complex unit characterized by green clays mixed with varying proportions of phosphate, sand and carbonates (Scott, 1992). The intermediate confining unit is shown in green with grey carbonate lenses. A confining unit is essential to the existence of a spring and the intent is to illustrate its complexity and emphasize its importance.

The layer shown above the intermediate confining unit on both posters represents surficial sediments. In much of Florida these sediments contain varying proportions of sand and clay. Locally, where sand predominates, they may serve as a surficial aquifer system (Scott, 1992). These layers were shaded using tones of orange, brown, and yellow to suggest the presence of iron oxides in quartz sand and clay layers.

PROTECTING FLORIDA'S SPRINGS

The poster entitled *Protecting Florida's Springs* (Fig.1) focuses on fundamental elements of the hydrogeology of springs (Bond, 2002a). Text was modified from a previous poster (Florida's Hydrogeologic Environment) that emphasized hydrogeology and the water cycle (Bond, 2002b). Pertinent technical terms were explained in the poster text in light of the educational intent for that product. In the modification process many technical terms were deleted on the advice of a stakeholder who felt strongly that the terminology would provide a barrier to usage for general citizens. That aspect of modification was intensely debated. In the end the stakeholder prevailed. Earth scientists felt strongly that technical terms placed as labels on the drawing enhanced the educational value of the poster. A stakeholder (not a geologist) equated technical terminology with jargon and argued that the message was effectively conveyed by the illustration itself.

In this poster (Fig. 1) a major spring is shown in the context of land use activities commonly associated with urbanization in Florida. The distribution of land usage was not intended to illustrate spring protection efforts but rather to suggest the potential for negative impacts associated with daily activities. This poster has come to be used by presenters with various messages and the depiction of land use with a sort of neutral message has maximized flexibility of this product. Presenters use the illustration as a platform for discussion of spring protection from their individual viewpoints.

The cross-section view is used to relate hydrogeology to activities at the earth's surface (Fig. 1).

Figure 1. The poster, *Protecting Florida's Springs,* uses a cross-section view to relate hydrogeology to activities at the earth's surface.

A sinkhole is shown connecting the earth's surface with the underlying Floridan aquifer system. Recharge is labeled and an arrow indicating its movement into the sinkhole is shown. A municipal landfill is shown related to the stratigraphic and hydrogeologic materials in which it is constructed. An underground storage tank is situated in sediments that make up the surficial aquifer system. It is essential to establish the relationship between the earth's surface which is familiar and it's subsurface which is largely unknown to much of the population who are not earth scientists. Out of sight, out of mind is not an acceptable premise for spring protection.

THE TRANSITION FROM TECHNICAL ILLUSTRATION TO POSTER

Overlay Protection District (Fig. 2) is a technical illustration showing zoning and land use considerations in a springshed (One Thousand Friends of Florida, 2002). The illustration was prepared based on input from individuals in various disciplines involving planning, water resources, agriculture, golf course design, and the environment. Initially two drafts containing the same information were prepared: a map view and an oblique aerial view. A small group of project supervisors, two planners, and two environmentalists chose the oblique aerial view over map view. The oblique aerial view maximizes ease of interpretation while a map view representation is more difficult for many people to understand. The oblique aerial view is also visually pleasing and thus invites readers to take a longer look and (hopefully) absorb more of its content.

The technical illustration was undertaken to give visual substance to planning decisions devised in order to maximize spring protection in the context of an urban area. Although geology was not the focus of this illustration, it was necessary to indicate the relationship of sinkholes to the spring via subsurface conduits. In a karst terrain it is essential to convey the vulnerability of waters flowing through subterranean caves or conduits to pollution. Conduits were indicated by dashed lines with arrows suggesting the direction of water flow. The spring, as the focus of the illustration, was shown at its center. Water flow from it is indicated by line work. The technical illustration was constrained finally both by size and the amount of information that had to be included.

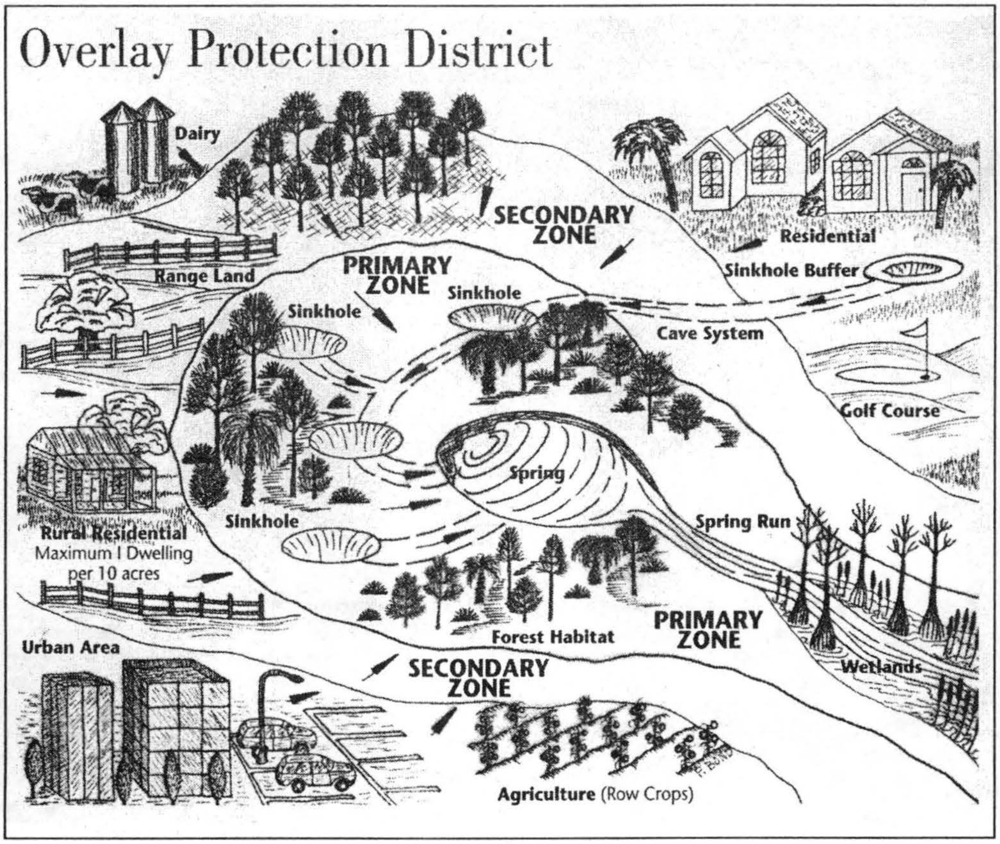

Figure 2. *Overlay Protection District* illustrates zoning and land use considerations in a springshed.

LAND USE AND SPRING PROTECTION

The aim of the poster, *Land Use and Spring Protection* (Fig. 3) was to extract concepts from the technical illustration and adapt them to poster format. Best management practices information was incorporated representing a substantial extension of material presented previously. Land use planning decisions and best management practices information were related to hydrogeology (including a spring) using a cross section view. Poster format allows the use of color and a larger size format to both enhance the visual appeal of the finished product and incorporate additional information.

The poster, *Land Use and Spring Protection,* focuses on a distribution of land use activities that planners hope will provide maximum protection for the spring. Lines separating zones, which appeared on the technical illustration (Fig. 2), were omitted from the poster (Fig. 3) based on input from geologists. The placement of land usages was, however, preserved. Rationale for placement of various land use activities is treated in the short text at the lower part of the poster.

In this illustration a major spring and spring run (a stream that has its origin in a spring (Copeland, 2003)) along with its associated wetlands are shown in their subsurface hydrogeologic context. Sinkholes are also shown scattered around the area. Some are related to the spring by conduits in the cross-section view. Sinkholes are a problematic aspect of the springshed. Pollutants may be introduced directly into the aquifer through them even though they are ostensibly distant from the spring. Three sinkholes are shown in the cross section view to emphasize the manner in which sinkholes may be connected to springs.

Best management practices are pictured in order to emphasize positive roles for individuals, municipalities, and industries in spring protection. Research has shown that land use can result in threats to both the quality and quantity of water flowing from springs (One Thousand Friends of Florida, 2002). It is thought that the poster will be a more effective teaching vehicle if users see themselves pictured as part of the solution rather than the problem.

Figure 3. The poster, *Land Use And Spring Protection,* relates land use planning and best management practices to hydrogeology using a cross-section.

DISCUSSION

Spring protection is the focus of an innovative campaign initiated by the Florida Department of Environmental Protection. Florida's population growth makes citizen education an essential element of the spring protection effort. The low topographic relief that characterizes Florida and the fact that groundwater is a largely unseen resource complicate education efforts. Illustration has been used successfully to show a spring in both its hydrogeologic context using a cross-section view and also in its environmental/cultural context using plan view. An effort has been made to show lithologic units in colors that are fairly realistic to facilitate its use by earth scientists.

The first poster in this series, *Protecting Florida's Springs,* emphasizes general aspects of the hydrogeology of springs. Technical terminology has been kept to a minimum on the advice of stakeholders. Illustration is used to assist in the visualization of hydrogeology and its relation to human activities. Human activities such as mining, agriculture, and waste disposal are typical of what one might see associated with an urban area in Florida. In this poster a brief text explains how spring flow originates and how human activities have the capacity to impact it both positively and negatively. The brief text and the detailed illustration allow for open-ended presentations involving this product.

The second poster in the series, *Land Use and Spring Protection,* had its origin in a technical illustration of a land use plan designed to maximize spring protection in Florida's karst environment. In moving from technical illustration to poster, hydrogeology was added using a cross-section view. Best management practices were illustrated and highlighted in the text in order to emphasize a positive and proactive role for citizens in spring protection. An effort was made using color and design to make both poster illustrations interesting and attractive. It was felt that the message would be conveyed most effectively if users were inclined to linger over the information presented in the poster. Posters are an important part of education and outreach efforts at the Florida Geological Survey. They have been used successfully in presentations to groups of all ages. When mounted on foam-core board, posters are easily used in outreach events held at unconventional venues. A short text with references allows stand-alone use in class rooms, state parks, and municipal and state offices. Digital versions of the illustrations are regularly incorporated into talks allowing the presenter maximum flexibility in commentary. Visually appealing posters that convey clear, positive, and accessible information are a cost-effective means of reaching diverse audiences.

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PART III. GEOSCIENCE INFORMATION SOCIETY

FORUM AND COMMITTEE REPORTS

Illustration: Cascade volcanoes, used with permission of AGI ImageBank, copyright © Martin Miller, University of Oregon.

GSIS 2003 Annual Meeting, Seattle, WA
Schedule of Events

Sunday, November 2

8:00 a.m.-11:50 p.m. Geoscience Information/Communication Discipline Oral Session (AESE): Challenges in Geoscience Publishing; Perspectives of Communicating Geoscience to Scientists and to the General Public, Washington State Convention and Trade Center 204.
8:00 a.m.-12:00 p.m. Geoscience Information/Communication Posters, Washington State Convention and Trade Center Hall 4-F.
12:30 p.m.-3:30 p.m. GSIS Executive Board Meeting, Sheraton Cedar.
4:00 p.m.-6:00 p.m. GSA Presidential Address & Awards Ceremony, Washington State Convention and Trade Center.
6:00 p.m.-8:30 p.m. GSA Welcoming Party & Exhibit Hall Opening, Washington State Convention and Trade Center.

Monday, November 3

8:00 a.m.-12:00 p.m. GSIS Topical Session T48 (Session No. 76): Geoscience Information Horizons; Challenges, Choices, and Decisions, Washington State Convention and Trade Center 3B.
2:00 p.m.- 4:30 p.m. Collection Development Issues Forum, Sheraton Aspen.
5:30 pm.- 7:30 pm. GSA Alumni Night

Tuesday, November 4

8:30 a.m.-11:30 a.m. GeoRef/Digital Forum, Sheraton Aspen.
12:00 p.m.- 1:30 p.m. GSIS Luncheon & Awards, Sheraton West Ballroom B.
1:30 p.m. - 4:30 p.m. GSIS Business Meeting (Beverages courtesy of Springer-Verlag), Sheraton Aspen.
7:00 p.m. - 9:30 p.m. GSIS Reception (Sponsored by Elsevier) and Silent Auction, Sheraton Aspen.

Wednesday, November 5

8:30 a.m. - 10:30 a.m. Preservation Forum, Sheraton Aspen.
1:30 p.m. - 3:30 p.m. Professional Issues Forum & Wrap-up, Sheraton East Ballroom.

Thursday, November 6

8:30 a.m. - 11:30 a.m. Field Trip Part 1: Glacial Geology & Seismic Hazards of the Puget Sound, Ferry.
11:30 a.m. - 1:00 p.m. Field Trip Part 2: Lunch (on your own), Pioneer Square.
1:30 p.m. - 3:30 p.m. Field Trip Part 3: Seattle Underground Tour, Downtown Seattle

Other meetings of interest:

T33 Beyond Google: Strategies for Developing Information-Literate Geoscience Students (Posters) (Geoscience Educators) Tuesday, 11/4, 8:00 a.m.-12:00 p.m.

T45I Geological and Geophysical Databases: What We Have and What We Need. I. Tuesday, 11/4, 8:00-12:00.

T45II Geological and Geophysical Databases: What We Have and What We Need. II Tuesday, 11/4, 1:30-5:30.

T47 Design & Development of XML-based, Discipline-Specific, Geological Markup Languages, and Development of Applications, Tuesday, 11/4, 8:00 a.m.-12:00.

T49 The National Geologic Map Database (Posters), Monday, 11/3, 1:30-5:30.

Paper No. 101-7 The Heringen Collection of the US Geological Survey Library, Monday, 3:00 p.m.-3:15 p.m., Convention & Trade Center 210, by Lee Hadden.

Earth Science Week meeting: Hosted by AGI staff. Monday, November 3, 2003 from 1-3pm in the Sheraton West Ballroom A. Discussion: This year's Earth Science Week and suggestions to improve the week in the future.

GSIS 2003 Awards

Best Paper Award:
Charlotte R. M. Derksen
"USGS publications: Current access via the Web and via catalogs"
GSIS Proceedings, 2002, v. 32, p. 107-116.

The Ansari Best Reference Work Award:
Paul Murdin (Editor-in-Chief)
Encyclopedia of Astronomy and Astrophysics, 2001
Publisher: IOP Publishing Ltd. and Nature Publishing Group

Outstanding Website Award:
Dr. Sam Gon III
A Guide to the Orders of Trilobites
http://www.aloha.net/~smgon/ordersoftrilobites.htm

GeoRef Advisory Committee

The GeoRef Advisory Committee met on November 1 during the GSA Annual Meeting in Seattle. The Committee provides input to the American Geological Institute on information products and services for the geoscience community, in particular issues connected with the GeoRef database.

Sales and distribution: Revenues from print sales of the *Bibliography and Index of Geology* have remained steady; continuation of the print version has been approved for yet another year. GeoRef director Sharon Tahirkheli has investigated the feasibility of distributing a CD-ROM version in lieu of the monthly print issues, but foreign customs regulations/charges make this option impractical at present. Other cost-saving measures will be considered. No increases in AGI's GeoRef royalty fees are planned for 2004, though GeoRef vendors set their own pricing for the database. Subscribers are reminded to "shop around"! The Advisory Committee recommended that the old "GeoRef Newsletter" be revived in an online format, to improve communication between AGI and GeoRef users. GeoNet was suggested as a vehicle for distributing such a newsletter. (Permission for using our discussion list for this purpose was subsequently approved by the GSIS Executive Board.) A self-subscribe link on the GeoRef web site was also suggested.

GeoScience World: The Committee approved a statement endorsing the full integration of GeoRef into *GeoScience World* – the forthcoming e-journal aggregate. Reference lists in the constituent journals will be linked to GeoRef records. (GeoRef is currently loading DOIs into its records, but not all vendors have implemented these yet.) GSW will offer users two modes of searching: full-text searches of journal articles and bibliographic searches of GSW's own, yet to be specified GeoRef interface. Institutions will have the option of subscribing directly to the GSW "brand" of GeoRef, or continuing their subscriptions through current GeoRef vendors. In the latter case, subscribers will be able to search GeoRef both ways, i.e., using their vendor's search interface *and* the new GSW platform.

Coverage: GeoRef coverage of theses and dissertations remains incomplete, particularly in areas on the edges of geoscience. Reliance on *Dissertation Abstracts* has resulted in missing some entirely, and some major schools have not been reporting to GeoRef. Continued direct solicitation of these departments seems the only practical way to obtain the needed information. The dropping of print deposit requirements by some universities in favor of digital dissertation archives has exacerbated the situation. Petroleum engineering, remote sensing, and oceanography are disciplines currently treated only selectively by GeoRef. For example, *JGR-Oceans* is indexed cover-to-cover, but not other ocean science journals. Though some users have complained, the Committee discussed how much additional GeoRef coverage is actually warranted, given that some of these fields are already well covered by other databases. Sharon plans to consult with IAMSLIC to gain a better understanding of the needs of the marine science community.

GeoRef's treatment of meeting abstracts was a topic of vigorous discussion. While GSA *Abstracts with Programs* and extended abstracts such as SEG's are given "priority" status for indexing, the Committee pointed out that other abstracts (notably those from AGU meetings) take years to find their way into GeoRef. Sharon was urged to find ways to improve the timeliness of incorporating these references into the database – for example, by foregoing subject indexing (assignment of descriptors) for all but extended abstracts. GeoRef staff expressed reservations about comprising the integrity and perceived value of the database by departing from its traditional level of indexing in the interest of expediency. Sharon agreed to take the matter under advisement, adding that machine-aided indexing might be another route worth exploring.

GeoRef staff have been looking closely at the publications of several state surveys and are concerned that many CD-ROM publications are not widely distributed and are not being captured in GeoRef. Local/regional societies and sections of national societies have similar problems – not to mention web-based publications. Sharon is working with John Steinmetz (president of the Association of American State Geologists) in encouraging better reporting of these materials.

Bibliographic software compatibility: Certain GeoRef document types (conference papers and special journal issues) continue to pose difficulties for exporting to reference management software such as EndNote. Examples of failed loads have been compiled and software vendors will be contacted in an effort to rectify the problem.

Vendor updates: The frequency with which GeoRef is reloaded varies greatly from one vendor to another. (For a current list of providers, see *http://www.agiweb.org/georef/index.html*) New records are added bi-weekly, but corrections to existing records become available to end-users only following reloads of the database. While some vendors (e.g., OCLC) use "constant correction" updates from AGI, others have not reloaded GeoRef in more than four years.

Other database projects: The *Groundwater and Soil Contamination Database* is now being sold directly by AGI on an online subscription basis. Web subscriptions are also being offered to the *Antarctic Bibliography* and the *Bibliography on Cold Regions Science and Technology*. (Unlike the Groundwater database, which is entirely a subset of GeoRef, the latter two files contain a substantial amount of unique information.) AGI has signed a contract with Geoscience Australia whereby that organization will index Australian publications not currently picked up by GeoRef; in exchange, AGI will produce a specialty subset of GeoRef consisting of literature published in or about Australia. The IUGS "Multilingual Thesaurus of Geosciences" Working Group has been reactivated, and will work on updating the Thesaurus and possibly licensing an electronic version – currently the publication is available in print only. AGI has also signed a one-year contract with the USGS for continuation of the USGS Publications database and tracking of non-Survey publications by USGS authors. The lack of a Survey-wide centralized publications authority continues to make the task a challenging one.

A closing point: *50 million* GeoRef records were viewed on the web in 2003. An impressive statistic by any measure!

Respectfully submitted,

Shaun J. Hardy

GSIS Collection Development Issues Forum

November 3, 2003

Chair, Charlotte Derksen

I. **GeoScienceWorld.** Speaker: Sharon Mosher, University of Texas at Austin, Member – Geoscience World planning group

It was the vision of the planning group members that geoscience societies would work together to bring up GeoScienceWorld. Literature, present and past, would be accessible together, with articles from the different journals linked together. They are working with vendors try to make it as inexpensive as possible for libraries. Subscriptions prices will be set in a four-tiered structure, with tiers based on number of geoscience research scientists. The next to largest group (tier) can expect to pay essentially the full price. GeoScienceWorld is being designed so that GeoRef is an integral part of it. There is a library advisory committee.

After her initial short presentation, Sharon opened the floor to questions. She provided the following answers to questions from the group.

Six societies (American Association of Petroleum Geologists, Geological Society of America, Geological Society of London, Mineralogical Society of America, Society for Sedimentary Geology, and Society of Exploration Geophysicists), plus the American Geological Institute comprise the founding members.

Interlibrary loan would be allowed.

Library walk-ins would be allowed access to Geoscience World; libraries would not be expected to filter out walk-ins.

It is expected that there will be a decrease in print subscriptions.

The Copyright policy will be standard for electronic journals.

Single user pay-per-view is planned for the future (although won't be implemented immediately).

It is planned to make a link directly to the GeoRef document delivery service.

Proxy browser service will be allowed.

Geoscience World will expect to archive current year and previous year, with the aim of eventually going back (at least) to 2000 for all journals in the package.

"How will the switch over subscription from one provider to GSWorld be timed?" Answer: the fiscal year will be the academic year.

The suggestion was then made from the group to bring up GSWorld in the Fall of 04 for a free trial period, with subscriptions to begin in January '05. The goal might be to have prices set in the Spring of 2004, followed by a trial period, then launch GSWorld at the beginning of the year. Separate tiers for academics, not for profit, companies, individuals, etc. are planned.

Interested institutions may request a month's free trial at any time after the collection is functioning.

Current plans are that institutions will need to subscribe to the whole collection of thirty journals. The founders' vision is to promote integrated research across the discipline. To make this feasible they have tried to set the package price as low as possible. Small for-profits may be able to subscribe on behalf of a university in a third world country.

Document Delivery as a Collection Development Tool. Speaker: Sharon Tahirkheli, GeoRef, American Geological Institute

GeoRef document delivery service is designed to find those things that you do not own. In addition to journal articles, the service can also provide theses, maps, and conference proceedings. GeoRef arranges for indexing with government agencies in other countries, such as Australia, China, Russia, Germany, Spain, New Zealand, France; document delivery is built into the exchange agreements.

Color copying is available, also purchase of black and white maps up to 3' x 4' in size, and color maps up to 11" x 17". The document delivery service can also produce maps from digital files, e.g. USGS Open-file Reports. The ability to request digitization of maps is also available. Prices are customized to the job; charge is by the square foot. Some of these documents could be expensive.

Photocopies of theses not available via UMI can be requested, including Masters Theses. Requests for copies of European theses would be considered on a case by case basis.

Proposal For A Core List Of Geoscience Books. Presenters and Discussion Leaders: GSIS Members: Shaun Hardy, Carnegie Inst. of Washington, and Dena Hanson, Cook Children's Medical Center.

A core list for Earth Sciences sounds like a great thing, but no one knows of a current list. What would it take to build a list for a liberal arts college? Up-to-date core lists are available in astronomy and environmental science. Most geology lists are from the 1980's or earlier. The Best Books for University Libraries set has 37 pages in the geology section. This might be good tool for those building the list. There is no journal recent literature.

SLA-PAM Division members did the online Astronomy list. An explanation of why it was needed and a description of the scope are included with the list. Entries are accessed by author and subject indices.

Water Resources "library resources" was compiled by the EPA library staff. Subject orientation, as well as a list, are provided. The subjects are defined.

The huge Chemistry core list is linked to the journal of Chemical Education. Some entries may be relevant to the earth sciences. There are no annotations, but there are links to publishers' subscription pages.

Considerations for building an up-to-date Earth Sciences Core List:

- Who the list would be for:
  - Librarians: 4 year Colleges, Community colleges, Secondary schools, Public Libraries
  - Educators: High School teachers, Undergraduate faculty
- Suggested scope:
  - Topical coverage
  - Formats: Books, Serials, Maps, Electronic Resources
- Availability? In print only? Or Out of print / classics?
- Format of entries: Bibliographic citations, Annotations, Price information, Links to external web sites (e.g. publishers descriptions, bibliographic databases)
- Arrangement of entries? By format of publications (encyclopedias, etc)? By discipline? By LC classification? By author?
- Inclusion criteria: How many titles to target?
  - Will need formal selection guidelines, to be able to respond to lobbying by faculty publishers and authors
  - Be prepared for donations of review copies
- Where and how to publish? Print online or both? In a library professional journal? In a geoscience/education journal?
- Other considerations: Copyright considerations – who owns? Update frequency?
- Goals of a GSIS Sponsored Core List Project
  - Assist librarians with collection development
  - Assist educators with selecting texts
  - Provide opportunity for collaboration among members
  - Raise visibility of GSIS
- What's needed?
  - Working group of 6-10 members:
    - 1-2 Editors/coordinators
    - 5-8 contributors/compilers
  - Solicit interest at Business Meeting, via GeoNet and Newsletter
  - Define target audience, scope, format, arrangement, inclusion criteria, methods of publication and frequency of revision
  - Submit publication proposal for GSIS Board approval
  - Compile entries publish and promote.

Journal Prices 2003: Presenter: GSIS Member: Michael Noga, MIT
(Appeared in GSIS Newsletter)

EarthScape Discussion: Presenters: Lisa Fish and Karen Desiderio, Columbia University

Latest developments:
EarthScape is an experiment funded by NSF and SPARC and produced by Columbia University Press and libraries and computer services.
It now comprises hundreds of thousands of text and web resources. Content has changed; focus is now threefold: Teaching, Learning, Policy and Research.
EarthsScape is financially self-sustaining.

Teaching: Earth System Science Education resources for teachers, including a Climate change module. ES provides resources, syllabi, and an instructor's guide (link to text book), as well as links to articles, conference proceedings.

Learning: Resources for students include e seminars, videos of Columbia faculty giving lectures, a forum for student writing, as well as basic reading – adaptations from text books. Other resources include quick answers – links to FAQ's and glossaries, and "ask the specialist."

Policy materials are in a "database" known as Columbia International Affairs Online (CIAO). Users can explore by topic or by contributing institution. Different points of view on policy issues are presented.

Research: **EarthScape is not for researchers but for teachers, providing information that they can use in teaching.**

The program is sustained by institutional subscribers. The University of CA systems and MIT are both subscribers. There are more high school subscribers, as the focus has changed to high school earth sciences. A tiered subscription plan is in place, based on the number of full time students 2,500-30,000 from $495-$995. There is a flat fee for high schools of $295.

New Functionality Developments:
- There are now Marc records for all resources for subscribing libraries.
- User statistics are available and will be project counter compliant by Winter 2003.
- The release of a new User Guide is planned for Winter 2003.
- A Mellon grant has been provided to do a user survey to evaluate the site.

New Content Projects underway:
- Advanced-placement environmental science course
- Wiley online workbook project for Dynamic Earth text
- Environmental legislation chronological database

Geobase discussion – a group discussion:

Many GSIS members at the Forum reported that their respective institutions are subscribing, most through consortial or package agreements.

Announcement: *Mineralogical Abstracts* is now available online: GSIS Member: Jim O'Donnell, CalTech

Working with Acquisitions departments – a group discussion:

Some acquisitions departments are getting material much faster. Pay by credit card. E-bay? Shelf ready purchases? Harrassowitz, Yankee, Casolini.

AGU: Whatever you have now you will keep as far as back issues.

Notes taken by Suzanne Larson and Jane Ingalls and compiled by Charlotte Derksen, GSIS Collection Development Committee Chair.

GeoRef Users' Group/Digital Database Forum

November 4, 2003

Adonna Fleming
Chair, GSIS Digital Data Committee

Nancy Blair
Chair, GSIS GeoRef Users' Group Steering Committee

The GeoRef Users Group and the Digital Data Committee combined efforts and presented the GeoRef/Digital Forum at this year's annual GSIS meeting in Seattle on November 4th from 8:30 -11:00 a.m. The respective chairs, Nancy Blair and Adonna Fleming, co-chaired the meeting.

GeoRef Forum, reported by Nancy Blair, chair.

The GeoRef Users Workshop has been a part of the GSIS program for several years. This year the group joined the Digital Issues Forum, chaired by Adonna Fleming, with a briefer program featuring a review of progress for 2003 presented by Sharon Tahirkheli of the American Geological Institute. The presentation included information on broadening the world coverage of indexing, the status of reloads by vendors, and pricing. A major project for serving earth science electronic journals, GeoScienceWorld, will incorporate GeoRef for searching.

Digital Database Forum, reported by Adonna Fleming, chair

"Digital Issues: A roundtable discussion about issues concerning electronic resources in terms of collection, preservation, access and connectivity" was the topic of the Digital Data Committee's portion of the Forum. Two issues were brought forward as the focus of the discussion, the first, concerned "article linker " software and how it was being used by the represented libraries and which were the best products; the second, brought up the old adage of "print versus electronic " and was discussed in terms of the new Elsevier proposal which is offering discounts to libraries that purchase the "electronic only" versions of its journals.

"Article linker " software is a fairly new tool in the electronic world of libraries. It allows for libraries to manage the ever increasing complexity of electronic access to full-text articles from journals, magazines and newspapers. Using OpenURL protocol this software allows library patrons to connect from an online abstracting or indexing database to the full-text of the article across different platforms and vendors. Accurate metadata at both the source and the target are required for the process to work. When a patron clicks on the source, a bibliographic citation in a database such as Elsevier's ScienceDirect, the article linker software directs the patron to a page which lists all of their library's available access points for finding the full-text of the article. By clicking on one of these links, known as the target, the patron is then given access to the article. Based on how much information the publisher has put in the metadata of the article's record, the patron is connected to the article through different levels of access. They connect either through the title page of an electronic journal from which they must search again for the article, or to the volume and issue level of which the article appears in, or in the best circumstance, directly to the article level. The latter case requires the publishers to use persistent URL protocol or a digital object identifier (DOI).

There are several commercial vendors of article linker software, some of them include: Ex Libris's SFX, SIRSI's OpenURL Resolver, Endeavor's LinkFinder Plus, and SerialsSolutions. Many of the representative libraries in the audience are using the Ex Libris SFX product and found it to be working satisfactorily. The audience expressed the importance that publishers such as Elsevier and AGU need to create records with persistent URLs or DOIs in order for the software to work. Also mentioned were the works universities publish electronically; these too need to have DOIs and it was recommended that librarians who are working on digitization projects direct their authors to the URL for the international DOI registry at http://www.doi.org/. The second discussion topic evolved over the issue of electronic only access to some journals. With increasing budget constraints, academic libraries are looking to cut costs anywhere, and one emphasis is to go with electronic only access to journals, thus saving money on processing and storage. Many librarians in the audience opposed this idea as being short sighted, and felt that permanent print archives are still important. They were particularly hesitant to cancel print subscriptions to commercial publishers but would be more willing to do so with journals published by societies. The audience's opinion coincides with that of the librarian profession as a whole, in that the commercial publishers are slow to recognize the importance of the library's role in archiving electronic data. In particular, the new Elsevier proposal to give discounts to libraries who switch to electronic only subscriptions on some of their journals was discussed, and none of the representative libraries were canceling their print versions, but instead were going with higher cost of accessing both formats.

Preservation Forum

November 5, 2003

Mary Scott
Chair, Preservation Committee

The committee's web pages have been revised and they are now linked from the GSIS web page. Check them out and send comments and suggestions to the committee.

PRESERVATION ACTIVITIES AT EARTH SCIENCES INFORMATION CENTRE, NATURAL RESOURCES CANADA, reported by Pauline MacDonald:

Logan Legacy Fund: The Logan Legacy Fund was established in 1992 to coincide with the 150th anniversary of the Geological Survey of Canada. It is administered under the umbrella of the Canadian Geological Foundation and is a unique initiative of a government agency seeking private funding for library preservation. The first five years of fundraising were highly successful but there has been a gradual decline and active fundraising ceased in the year 2000, though there are still occasional donations. Over $100,000 has been donated since 1992.

Preservation activities: Between 1992 and 1995 all the personal collection of Sir William Logan was conserved. This contained more than 100 volumes, maps or manuscripts. Work depended on condition of the volume. Some were completely rebound, cleaned, etc., and others were repaired and given minor treatment. All were de-acidified. In subsequent years attention was given to the exploration collection (largely 17th century works pertaining to exploration of North American continent, containing natural history, botany and geology). A complete assessment was performed as to what was required in terms of conservation work. All works received minimum treatment, and leather dressing or minor repairs were undertaken. There is ongoing work for complex conservation treatment of items in this collection. A collection of original paleontological drawings by A. Lambe published in late 1800s were individually cleaned and remounted on acid-free stock. Special storage containers were created for them.

Evaluation of collection: An expert examined the rare collection and developed brief reports on the historical significance of the collection as well as monetary value. This helps us to establish priorities in conservation work and is also useful in developing exhibits and displays.

Photo Collection: The Earth Sciences Information Centre holds some 500,000 images (negatives and glass plates) dating from the late nineteenth century. Basic conservation work is on going as well as improved indexing and cataloguing for this collection. There have been collaborative projects to digitize images and more than 5,000 are now in the database. Images are stored at 600 dpi to meet archival requirements.

UPDATE ON U.S. GEOLOGICAL SURVEY PRESERVATION ACTIVITIES, reported by Nancy Blair:

Photographs from the Library's 16,000 to 19,000 photos are being digitized and the originals turned over to the National Archives. Professional papers no. 1-75 , the early Annual Reports, reports dealing with earthquakes up to 1965, and reports on National Parks have been digitized. These are now on CDs and DVDs and are ready to be to put up on the web but software needs to be developed to do this, and they are waiting for money. Plans are to do the Open File reports, geologic folio series, more Professional Papers and the Monograph series next.

THE NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL CONFERENCE GUIDEBOOKS, reported by Thelma Thompson:

The NEIGC is over 100 years old, and the reports of some early meetings were published in *Science Magazine*. A group comprised of individuals from the Universities of New Hampshire and Vermont and Dartmouth College is initially looking at digitizing guidebooks that are out of copyright and out of print. This project would be part of a larger effort to establish a place-based resource for geology of northern New England. They are seeking funding from NSDL and coordination with DLESE as well as some K-12 educational partners to augment existing support from university-level professors. They want to provide GIS-based glossarial searching as one means of collection access.

OTHER DIGITIZING PROJECTS:

Penn State: microfilming and digitizing the 2nd Pennsylvania Geological Survey publications (1870-1890s). There are about 80 texts. They have $20,000 for the project. They have also de-acidified one copy of the 4th Survey publications.
Caltech: digitizing old technical report series, also archiving the faculty self published documents.
Stanford: digitizing old geology field class notebooks.
Gemological Institute of America: digitizing over 27,000 slides from their collection. These will be available for in-house use next year, no public access yet.
University of Chicago Libraries: now include digitization as an option for preservation.
University of Colorado: air photos of Colorado.

Professional Issues Forum

GSIS Annual Meeting, Seattle, WA

Wednesday, Nov. 5, 2003

Topics discussed at the 2003 Professional Issues Forum included copyright issues, citation of geoscience data, the future of electronic publishing in the geosciences, and other questions.

Shaun Hardy initiated a discussion on **copyright issues.** He is frequently approached by faculty and students needing information on what is legitimate regarding distribution of electronic publications. He wanted to be able to indicate what each journal publisher would allow, and produce a list that would enable students to link to sites with copyright information. Discussion of the issues included suggestions that it is very important for users to get the author's permission, which covers any challenges to misuse; that writers have options for what they agree to regarding copyright and should stick up for themselves; that one's institution's intellectual property policies should be checked; and that writers should be encouraged to attend writing workshops where copyright is discussed. It was pointed out that if you comply with the provisions and guidelines of the Teach Act, you will be protected. There was also discussion regarding what problems libraries were having with electronic reserves and copyright. Were files being deleted when the term ended? It was also mentioned that European copyright is much more complex than U.S. copyright and difficult to deal with.

Marie Dvorzak, a member of the Task Force on Citation of Geoscience Data, led a discussion on the report of the task force. The Website for the report is available from the GSIS Web page with a link to the National Research Council report. Marie requested comments from GSIS members on the work of the task force and on the issue of citing geoscience data, which includes non-print collections such as fossils, rock specimens, cores, data sets, etc. She said they are hoping to convince the USGS to include these citations in their publications. That would set a very strong precedent, but so far they have not been interested. She suggested that librarians encourage their faculty to consider citing collection data.

Lisa Fish, who is facing space and consolidation planning, asked what the group thought would be the future of electronic publishing in the geosciences. A lively discussion resulted in several good suggestions for her.

Other issues included a question on what librarians are doing with old 5 ¼ floppies and the problem of Web sites included in books being locked up by the first user who logs on and creates a personal password. Participants were asked if their libraries were doing federated searching. No one was. In response to an inquiry on the progress of the USGS retrospective cataloging, Nancy Blair stated that they are getting there drawer by drawer and had just finished the non-series materials.

Lura Joseph led the meeting wrap-up. Everyone felt it had been an excellent meeting. There was interest in having late afternoon or early evening meetings next year to enable participants to attend some of the other events and professional papers. Claren Kidd reported that the silent auction netted $601.00 and that the committee would review what were the popular items in order to suggest types of contributions next year. It was suggested that self-introductions be included on the agendas of all the sessions, not just the business meeting.

Sally Scott, PIF Chair

PART IV. 2003 GSIS FIELD TRIP SUMMARY

SEISMIC IN SEATTLE!

Illustration: Seattle skyline, © Lura Joseph, 2004

2003 GSIS Field Trip Summary
Seismic in Seattle!

Report by Connie Manson

The Geoscience Information Society's annual meeting field trip was held Thursday, November 6th, 2003. It was an unusually nice day (for Seattle, for the first week of November), not the gray, blustery, chill, rainy day that was expected, but a crisp sunny day with sparkling blue skies. Cool, but not uncomfortably so. Perfect!

The first half of the trip was on a Washington State ferry, from Seattle across Puget Sound to Bremerton. Along the way, Matt Brunengo, a geologist with GeoEngineers, gave us a running commentary about the geology. The ferry route goes right over the Seattle fault which runs east-west from about Bremerton in Kitsap County to about 10 miles east of Seattle. Recent studies indicate that the most recent earthquake on that shallow crustal fault occurred about 1100 YBP and had an estimated magnitude of about 7.5. (A recurrence of such an event could produce a Kobe-style earthquake.) Recent LIDAR imagery has produced amazingly detailed maps that show surface traces of the fault. The ferry went right past Restoration Point, which studies show was uplifted about 2 meters by the 1100 YBP event.

From the ferry, we could see the highly unstable shorelines. During glacial time Puget Sound was completely filled with glaciers (to a maximum height of more than one mile above sea level). As the glaciers receded, the northern exit of the Sound was ice-dammed, creating Glacial Lake Russell. The melt waters drained to the south past Black Lake in Olympia to empty into the Chehalis River. The lake sediments laid down the thick clay deposit now known as the Lawton Clay. Further glacial melting laid down thick sand layers and finally till. Those uncompacted Recent sediments, now forming the shoreline of Puget Sound, are prone to frequent, sometimes catastrophic, landslides.

Going west, from Seattle to Bremerton, we could see the tectonically uplifted Olympic Mountains. On the return trip, we were treated to a stunning, sunny view of the Seattle skyline.

The ferry returned us just a block from the oldest part of Seattle, Pioneer Square, where the earliest European settlers lived in the 1850's. After a nice lunch at the Trattoria Mitchelli, a Seattle favorite, we tromped off to "do" the Seattle Underground Tour.

The underground tour is literally underground. It winds though what had been the first floors of many Pioneer Square area buildings. (To rebuild after the Great Seattle Fire of 1889, the area was filled in so that former second stories were at street level and what had been street level floors are now underground.) During the Alaska gold rush, Seattle was a major supply station for the prospectors: local merchants supplied them for the trip, and then relieved them of their earnings when they returned. During the tour (inspired by *Sons of the Profits*, by Bill Spiedel), we learned that Yesler Avenue was the original Skid Road (so-called because they skidded the logs from the top of the hill, down Yesler, to Elliott Bay). We heard about toilets that (ahem) flushed backwards when the tide came in, and (how odd) that in a bustling, gold rush town, with such a high percentage of single young men, most of the few single young women were employed as "seamstresses."

All in all, the GSIS members had a great day to unwind after the packed annual meeting, to network, and just have fun.

Editor's note: We are very grateful to Connie Manson for arranging the field trip details, and to Matt Brunengo for leading the Puget Sound portion of the trip.

AUTHOR INDEX

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