Proceedings of the 47th Meeting
of the Geoscience Information Society

November 3-6, 2012
Charlotte, North Carolina

GEOSCIENCE INFORMATION: INVESTING IN THE FUTURE

Edited by
Robert Tolliver
with assistance from
Richard Huffine

Proceedings
Volume 43
2012
Geoscience Information Society

GEOSCIENCE INFORMATION SOCIETY

ISSN: 0072-1409

For information about copies of this proceedings volume or earlier issues, contact:

Publications Manager
Geoscience Information Society
c/o American Geosciences Institute
4220 King Street
Alexandria, VA 22302-1502 USA

or consult the GSIS Website at: www.geoinfo.org

Cover photo: Charlotte from atop Duke Energy Center. Photograph by James Willamor, reproduced under a Creative Commons license (CC:BY-SA 2.0) Photo taken May 13, 2012. Retrieved May 11, 2014.

TABLE OF CONTENTS

PREFACE

The Geoscience Information Society (GSIS) was established in 1965 as an independent nonprofit professional society. Members include librarians, information specialists, publishers and scientists concerned with all aspects of geosciences information. Members are based in United States, Canada, Australia, Sweden, Taiwan and the United Kingdom.

GSIS is a member society of the American Geosciences Institute and is an associated society of the Geological Society of America. The GSIS annual meeting is held in conjunction with the annual GSA meeting, and the papers, posters, and forums presented are a part of the GSA program.

Oral presentations of the papers provided in these proceedings were given at the 2012 annual meeting of the Geological Society of America held in Charlotte, North Carolina November 5-9, 2012. The papers are arranged in the order in which they were presented. Where the entire paper is not available due to publishing conflicts, the abstract is provided with the permission of GSA. Posters were presented all day with authors available for discussion during a two-hour session.

The proceedings in this volume are divided into three parts:

1. Oral papers presented at the GSA Technical Session No. 142: Investing in the Future

2. Special Topics Paper

3. GSIS Meeting Supplemental Materials.

Thanks to all of the paper and poster presenters, the leadership of GSIS, and to the session conveners/proceedings editors who have preceded us for their hard work in the name of the Society and their contributions to our profession.

Robert Tolliver
GSIS Technical Sessions Convener 2012

Richard Huffine
GSIS Publications Manager, 2012-2014

Part 1: GSA Topical Session No. 142

Geoscience Information:
Investing in the Future

Technical Session Convener

Robert Tolliver
November 6, 2012
8:00 a.m. - 12:00 p.m.

INVESTING IN THE FUTURE OF GEOSCIENCE RESEARCH SERVICES

HUFFINE, Richard
Library Director
U.S. Geological Library
12201 Sunrise Valley Drive, MS 159,
Reston, VA 20192
rhuffine@usgs.gov

Abstract- The future of Geoscience Information is reliant on institutions investing in their workforce and developing the skills of their employees to meet the ever-changing and largely complex epxpectations of geoscience researchers. This presentation will provide approaches to skill development to keep geoscience information service providers relevant and prepared for the onging and future challenge of meeting the research needs of geoscience institutions. The virtualization of geoscience research will also be addressed as a driver of change and an opportunity to provide new and needed skills to researchers in the field.

The Challenge

As a scientific discipline, the geosciences are struggling to recruit and retain new research professionals.[1] At the same time, information professionals are aging and are not always being replaced[2], especially in the traditional roles we have had for them in the past. As scholarly communications have become largely digital and online, demand for research services have either fallen greatly or been relegated to the fulfillment of document delivery requests and searching for the rare and obscure. While these are valuable services, the opportunities for advances in geoscience research lay in strategically deploying information science principles to new approaches of collecting, managing, analyzing and interpreting research data and information. It is my belief that the future of research in the geosciences will be a combination of the best of both professions – geoscientists and information professionals. Some call this nexus of experience geoinformatics.[3]

There are many different things that can be learned through geoinformatics, including:
- Correlations between research in different geographic locations
- Implications of research in one discipline on the foundations of other disciplines (e.g. paelobotany and climate change)
- Significant relationships among various environmental factors (e.g. deposition, bioaccumulations, transport)

[1] Gonzales, L.M. and C.M. Keane. *Who Will Fill the Geoscience Workforce Supply Gap?* Environ. Sci. Technol., 2010, 44 (2), pp 550–555. DOI: 10.1021/es902234g
[2] Lenzini, R.T. Graying of the Library Profession. Searcher, 2002, 10 (7), p. 88
[3] Prakash, A. *Introducing Geoinformatics for Earth System Science Education*. Journal of Geoscience Education, Nov 2006, 54 (5), pp. 555-560

Strategies

If we accept the premise that future advances in geoscience research will be predicated on the effective use of information science principles and practices, then we need to explore approaches to putting these pieces together. Effective research institutions will establish these linkages – between the geosciences and information sciences early and will reinforce those connections in a number of ways. First, the connection between good scientific results and good information management is simply mandatory.

If the leaders of our institutions accept poor documentation and minimal or limited metadata in data collection efforts, then they will have to accept the limited utility of the research outputs of their institution in the future. Advances in data integration and "Big Data" projects assume that research data is well documented and can be compiled, compared, and merged with other data sources without substantial review and re-interpretation.

As information professionals we need to begin making the connections between information management and data management and connect those practices to the future research potential in the minds of researchers, academics, and the staff of funding organizations.

Researchers and the information professionals that support them are joining forces on a number of fronts today. The push for open access to both publications and data is one of those fronts. But open access alone will not ensure the free flow of information and the ability to re-use data in the future. The real fight isn't just about "open access" – it is about transparency throughout the research process. If our shared efforts only result in making outputs available, without the substantial work that underlies those outputs to normalize, interpolate and extrapolate data, re-use of that data will be practically impossible.

Engaging the Next Generation

Both disciplines (geosciences and information sciences) need to begin to engage the next generation of our workforce when they are in high school, if not earlier. We need to lay a foundation for basic science and fundamental understanding of information before students begin to develop bias either for or against our professions. By working together, the next generation geoscientist will inherently be better at collecting, documenting, and managing specimens and data.

The exploration of the geosciences by young people offers them a connection to the land and sea and supports their growth as ecologically conscious adults. Looking at information sciences in the context of the geosciences can instill a strong appreciation for data, information, knowledge and judgement – the components of the information hierarchy. The geosciences also inherently demonstrate the value of history, samples, data collection and methodology – all components that make the practice of information sciences stronger in a variety of applications.

Demonstrating Value Across the Life Cycle

In order to create the synergy needed for both disciplines, information management needs to embed itself in the lab, the Center, and the community of research across the variety of research being conducted in the geosciences. Information professionals should be engaged at each stage of research – not delegated to specific tasks but engaged in each challenge and supporting good practices by everyone on the team. The life cycle of a project can be mapped out explicitly and requirements identified at each stag, including:

- Literature reviews
- Metadata management
- Documentation, and
- Project summaries and narratives

The USGS has developed a data life cycle model to use in talking with researchers about engagement

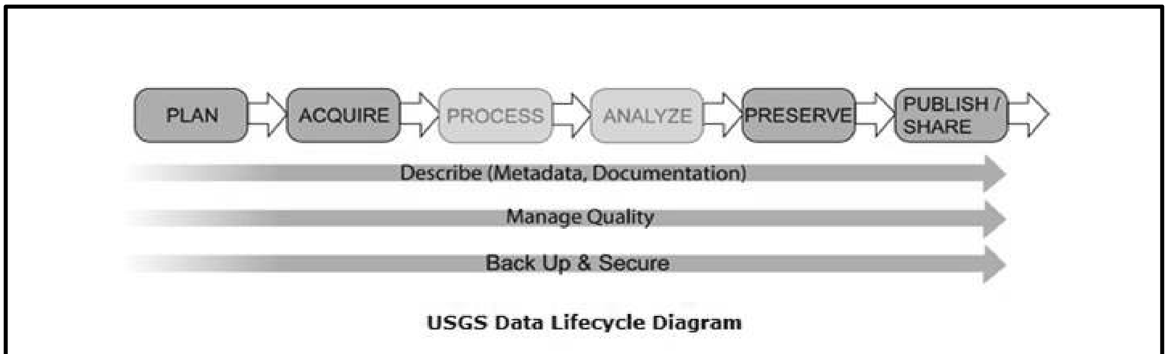


Figure 1. Diagram depicting the USGS data lifecycle.[4]

Each of these activities needs input and support from an information science professional and all of them should be addressed throughout a project, not merely at the beginning or end. Optimally, this engagement should start in the proposal process and include a request for resources to support data collection, management, and archiving.

Alignment with the Organization

Without a commitment to linking geoscience research and information management, it is far too easy to waste resources and recreate the wheel over an over. To avoid this, both functions need to continually link their activities to the mission of the parent organization. Geoscience research that doesn't support the mission can distract employees, partners, and the leadership. Likewise, information services that don't align to the mission can be deemed superfluous and ultimately be eliminated.

USGS Experiences

[4] Data Life Cycle Overview. USGS Data Management Website. http://www.usgs.gov/datamanagement/why-dm/lifecycleoverview.php. Accessed April 24, 2013.

The U.S. Geological Survey (USGS) is a complex research organization, comprised of over thirty programs, more than 1,000 research-grade scientists, and at least sixty different Centers geographically distributed across the United States. Within that context, the practice of both geoscience research and information science is highly distributed and the best practices of each researcher, team and Center can vary greatly. While the USGS has not universally applied the principals presented in this paper, there are a number of examples in the Bureau that deserve to be highlighted here and that could be replicated in other contexts.

Community for Data Integration[5]

The USGS has developed a successful approach to cross-pollination between geoscientists and information professionals. Using a voluntary effort that encourages staff from across the Bureau to collaborate and share approaches to their information management issues, the Community for Data Integration has grown over the past four years from about 60 internal staff to over 400 partners. Sample efforts that have crossed disciplines include documenting the data life cycle, exploring opportunities in the Semantic Web, fostering citizen science, and collaborative mobile application development.

Science Data Coordinators[6]

On outcropping of the Community for Data Integration, the Science Data Coordinator Network has identified contacts in each USGS Region as liaisons on research data issues. The Network pairs information professionals from the USGS Core Science Systems Mission Area with these regional contacts in order to give them support as questions or issues arise about data management.

Engaging High School Students

USGS has been a supporter of Geoforce[7] in Texas for several years. This innovative program works with students, many of whom will be the first in their families to attend college. Geoforce engages students early in high school and graduates of the program even return to serve as counselors. USGS is also working to engage science educators in Virginia to create a similar program on the campus of James Madison University. [8]

---

[5] The Community for Data Integration: Implementing the USGS Data Integration Strategy, USGS @ccess Newsletter, Fall 2011. http://www.usgs.gov/core_science_systems/access/p1111-5.html. Accessed April 24, 2013.

[6] Science Data Coordinator Network (SDCN), http://www.usgs.gov/datamanagement/partners/SDCN.php. Accessed April 24, 2013.

[7] GeoFORCE - Jackson School of Geosciences - The University of Texas at Austin. http://www.jsg.utexas.edu/geoforce/. Accessed April 24 2013.

[8] Lyttle, P. Hooray for YIPEES! USGS @ccess Newsletter, Fall 2012. http://www.usgs.gov/core_science_systems/access/fall_2012/article-2.html. Accessed April 24, 2013

Training the next generation

USGS Libraries have been hiring summer interns as well as library science graduate students.[9][10] These programs provide both a practical introduction to earth science research and new insights into the strategies and technologies available to support research. USGS Libraries have also developed a series of online training modules for USGS researchers. The modules are integrated into the employee learning system in the Survey and covers everything from a basic introduction to research to specific training in how researchers can access the electronic resources made available to them through the USGS Libraries Program.

USGS Powell Center for Analysis and Synthesis[11]

One of the most forward-thinking strategies for integrating earth sciences with information sciences, the USGS has created a virtual Science Center in Fort Collins, Colorado with that singular mission. The Survey is funding engagement between geoscientists and information science professionals for scientific discovery and problem solving. This effort has caught the attention of the National Science Foundation as well.[12] The virtual Center funds integrated teams of researchers, utilizing large collections of available data, to approach challenges in their fields from a data-centric approach.

Science Strategy Plans[13]

Every USGS Mission Area has developed plans that demonstrate their overlap across their Missions as well as the opportunities they see for data integration and interoperability.

Core Science Systems Mission Area[14]

Another example of their understanding of the intersections of all of the science disciplines is the creation of an integrated mission area in 2010. This new Mission Area combines the core components needed to support interdisciplinary science:

---

[9] Huffine, R.L. Environmental Stewardship Interns in the USGS Library. USGS @ccess Newsletter, Fall 2012. http://www.usgs.gov/core_science_systems/access/fall_2012/article-6.html. Accessed April 23, 2013

[10] Raabe, E. an L. Bartz. Summer Interns Help Organize USGS Library and Map Collections in St. Petersburg, Florida. Soundwaves Monthly Newsletter. Sept/Oct 2011. http://soundwaves.usgs.gov/2011/10/staff.html Accessed April 21, 2013.

[11] John Wesley Powell Center for Analysis and Synthesis. http://powellcenter.usgs.gov/ Accessed April 21, 2013.

[12] Consortium of Universities for the Advancement of Hydrologic Science, Inc. Announcement of joint USGS/NSF funding, posted November 10, 2011. http://www.cuahsi.org/docs/DC-PowellCenter-20111110.pdf Accessed April 23, 2013.

[13] Start with science. http://www.usgs.gov/start_with_science/ Accessed April 23, 2013

[14] USGS Core Science Systems website. http://www.usgs.gov/core_science_systems/ Accessed April 23, 2013.

- Mapping (geologic and topographic)
- Collections (libraries, rock core samples, data preservation)
- Analysis (informatics, synthesis, collaboration, standards)[15]

Opportunities

Not every institution can approach the intersections of science and information the way the USGS has. But for those institutions that have a clear mission of advancing science, it is absolutely critical that they consider how their information science practices support that mission. Beyond these examples though, there is an outer realm of these disciplines.

The geosciences are a wonderful playground for exploring the broadest application of new strategies in information science. From visualization to data mining, the information sciences offer geoscience researchers a broad selection of techniques for reaching new understanding about our earth and how it is changing. USGS researchers are experimenting with these techniques and inviting their information professionals to the table to propose and experiment on new strategies for scientific research and investigation.

By pairing information science skills with those of researchers in other disciplines of science, the geosciences can demonstrate where future investment is needed. Data collection, analysis, and synthesis have long been staples of geoscience research but new strategies can offer new insights. Information scientists may also change the direction of information science in the process.

Questions

I want to leave you with several questions to ponder as you consider the implications that these examples may provide:

- Can this model be adapted in all of the geosciences sub-disciplines?
  - Prospecting and development
  - Stratigraphy and groundwater analysis
  - Climate and global change research

- How do we expand this model in our disparate organizations?
  - Other government agencies (federal, provincial, local)
  - Academic institutions
  - Private companies

- Are you ready to model these ideas in your own organization?

[15] Core Science Systems – Mission Overview. USGS Fact Sheet 2012-3009. February 2012. http://pubs.usgs.gov/fs/2012/3009/contents/FS12-3009.pdf Accessed April 21, 2013

FINDING FRACK FACTS: THE LITERATURE OF HYDRAULIC FRACTURING

FOOTE, Jody
Youngblood Energy (Geology) Library
University of Oklahoma
100 E. Boyd, Norman, OK 73072
jbfoote@ou.edu

Abstract - Hydraulic fracturing is an engineering process used to access previously unreachable reservoirs of oil and gas. "Fracking" has generated a broad spectrum of interest, debate, speculation, and opportunities, as evidenced by a significant growth in publishing and reporting, from the peer-reviewed petroleum engineering literature to newspaper articles and scripts of prime-time television dramas. This study examines trends in publishing on hydraulic fracturing, including databases, journals, publishers, and websites that focus on its geological, engineering, and environmental aspects.

INTRODUCTION

This paper is based on an article about hydraulic fracturing entitled, "Reviews of Science for Science Librarians: Hydraulic Fracturing: Geological, Engineering, and Environmental Literature," published in *Science & Technology Libraries* in 2011. It was co-written by James Bierman, the Engineering librarian at the University of Oklahoma, Christy Kulp, the Science librarian at OU, and Jody Bales Foote, the OU Geology librarian. The article appears in vol. 30, no. 4, pp. 326-342 of the journal.

The article is part of a series, "Reviews of Science for Science Librarians," begun by journal editor Tony Stankus. The series is intended to help science librarians "get up to speed" on a specific area of science they are not familiar with. Each article in the series provides an introduction to the topic, relevant definitions, and background and historical information. The focus of the article, however, is on the information sources on the subject. This includes relevant databases to search, primary journals where research on the topic is being published, major monographs written on the subject, important websites to consult, and publishing trends. Some of the articles in the series also include lists of major authors who have written on the subject. The bibliographies at the end of these articles are useful in providing additional sources to consult. The "Reviews of Science for Science Librarians" series has addressed such topics as zoonotic tuberculosis, graphene, coal science and technology, and the grizzly bear.

METHODOLOGY

The three authors divided the subject of hydraulic fracturing into three topical areas to explore: geological, engineering, and environmental. The geology librarian at OU took on the geological area, the engineering librarian handled the engineering aspects of the topic, and the science librarian worked on the environmental section. The intent was to introduce the reader to the subject (definition, background, and history), direct the reader to the primary databases to use in searching for literature on hydraulic fracturing, show the reader where the literature can be found (journals and publishers), and identify trends and emerging questions. Hydraulic fracturing is not a new technique in engineering, but recent developments have brought it to the forefront and have increased the amount of literature on the subject.

RESULTS

Searching for literature on the engineering and geological aspects of hydraulic fracturing proved to be more straightforward than searching for the environmental literature on the topic. The GeoRef database was searched to examine the geological aspect of hydraulic fracturing. GeoRef includes more than 3.4 million references to geoscience journal articles, books, maps, conference papers, theses, and federal, state, and international geological survey publications. The subject heading "hydraulic fracturing" was used to search GeoRef, along with limiting the search to scholarly journals and including all languages. The search yielded 2,058 results. Search results of GeoRef (Figure 1) showed very little written on the topic until the 1970's. The 1980's and 1990's produced a large number of citations, with a high number culminating in 2006.

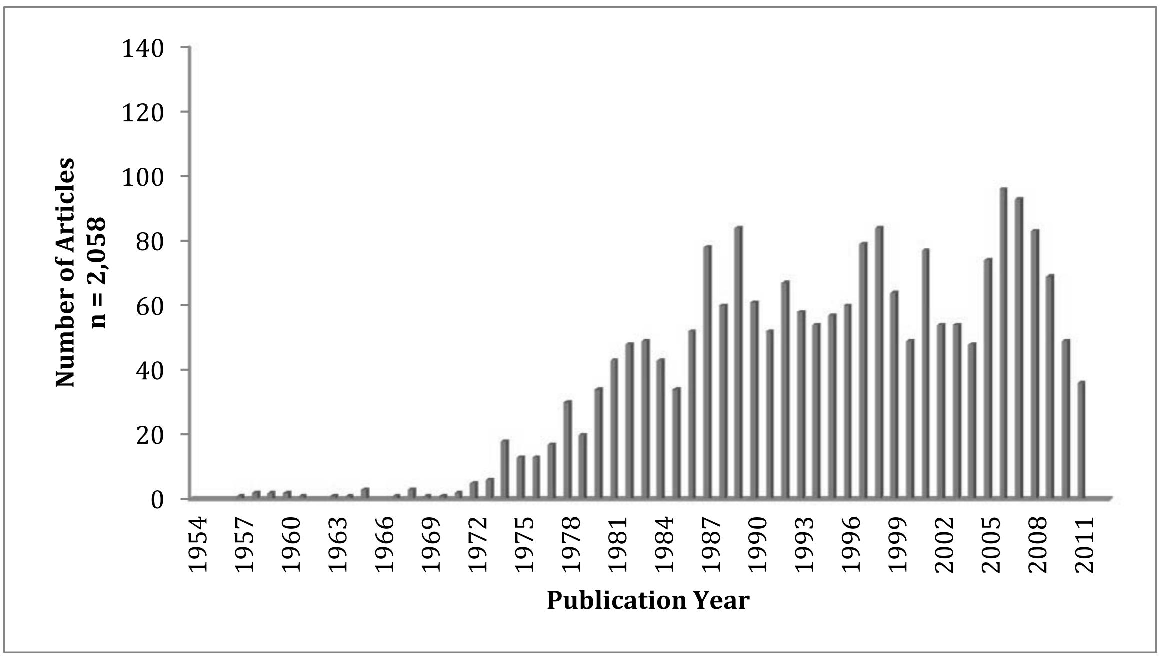


Figure 1 Number of articles retrieved in GeoRef using the subject heading "hydraulic fracturing," 1954 to 2011. ©Taylor and Francis

Compendex, a comprehensive engineering database of more than 15 million records, was searched for the engineering aspect of hydraulic fracturing. The search of Compendex used the subject heading "hydraulic fracturing," limiting to scholarly journals written in all languages. This search yielded 1,557 results. Figure 2 shows the number of articles on hydraulic fracturing found in the Compendex database by year. A small number of articles was produced in the 1950's and 60's, followed by almost no literature from 1970-

1990. The decade of the 1990's saw a large jump in publishing on the topic, with a continued increased in the number of scholarly journal articles in the decade of the 2000's. The difference in search results between GeoRef and Compendex could be attributed to a difference in how indexers at the two databases defined and applied the term hydraulic fracturing.

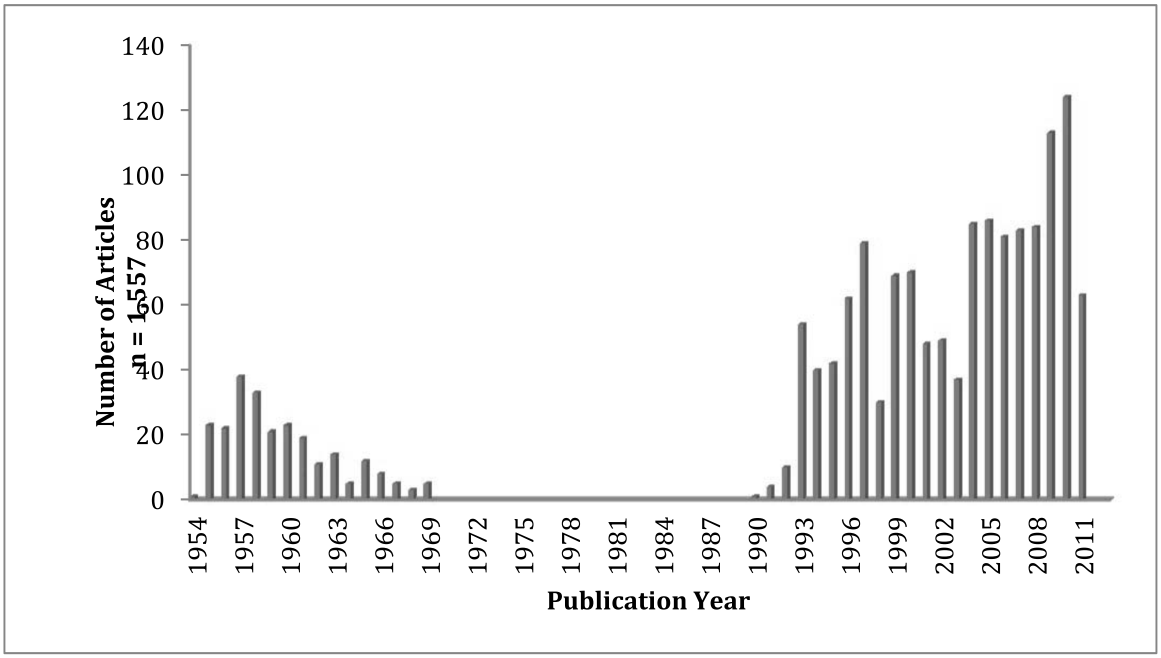


Figure 2 Number of articles retrieved in Compendex using the subject heading "hydraulic fracturing," 1954 to 2011. © Taylor and Francis

Several other databases could also be useful in discovering literature on hydraulic fracturing. AAPG Datapages (American Association of Petroleum Geologists), GeoScienceWorld, OnePetro (Society of Petroleum Engineers), Petroleum Abstracts, Web of Science, NTIS (National Technical Information Service), U.S. Patent and Trademark Office Database, and Google Scholar all provided many references on the subject. Some of these databases, however, do not use controlled vocabulary, making it more difficult to find relevant citations.

The most highly cited journals and publishers in the Compendex and GeoRef databases were noted in the article. Figure 3 shows the ten most highly cited journal titles from the GeoRef searching, and Figure 4 shows the ten most highly cited journal titles from the Compendex searching. A comparison of the lists shows there is overlap in the two databases. Three journal titles appeared on both the GeoRef and the Compendex lists.

Journals	Number of Articles
JPT: Journal of Petroleum Technology	118
International Journal of Rock Mechanics and Mining Sciences	107
Oil and Gas Journal	98
Journal of Geophysical Research	74
International Journal of Numerical and Analytical Methods in Geomechanics	32
Journal of Canadian Petroleum Technology	32
American Association of Petroleum Geologists (AAPG) Bulletin	31
DuanKuai Youqitian (Fault-Block Oil & Gas Field)	28
Canadian Geotechnical Journal (Revue Canadienne de Geotechnique)	26
Quarterly Review of Methane from Coal Seams Technology	26
Publishers	
Society of Petroleum Engineers	
PennWell	
American Geophysical Union	
Elsevier	
Wiley	

Figure 3 The most highly cited journals and publishers in GeoRef for a search using the subject heading "hydraulic fracturing." © Taylor and Francis

Journals	Number of Articles
JPT: Journal of Petroleum Technology	138
International Journal of Rock Mechanics and Mining Sciences	99
Yanshilixue Yu Gongcheng Xuebao/Chinese Journal of Rock Mechanics and Engineering	73
Oil and Gas Journal	69
SPE Production and Facilities	68
Neftyanoe Khozyaistvo	50
World Oil	48
Journal of Petroleum Science and Engineering	43
Tianranqui Gongye/Natural Gas Industry	35
Petroleum Engineer	32
Publishers	
Society of Petroleum Engineers, SPE	
Elsevier	
Academia Sinica	
Society of Exploration Geophysicists	
Science Press	

Figure 4 The most highly cited journals and publishers in Compendex for a search using the subject heading "hydraulic fracturing." © Taylor and Francis

The environmental aspect of hydraulic fracturing proved to be the most challenging part of the study. This is due in part to the multidisciplinary nature of environmental literature and to the large number of popular sources found on the environmental effects of hydraulic fracturing. Searches of LexisNexis and Newspaper Source Plus showed an increased growth of news articles on hydraulic fracturing in recent years. (Figure 5) Many independent news organizations, watchdog groups, and nonprofit organizations have written about hydraulic fracturing. Much of this information is available through their individual websites. The Environmental Sciences and Pollution Management database was searched for scholarly literature on hydraulic fracturing. The number of peer-reviewed studies was limited, although academic research is now beginning to emerge.

Source of indexed news articles:	**2008**	**2009**	**2010**	**2011 (thru May)**
LexisNexis	7	37	174	120
Newspaper Source Plus	8	70	292	163
ProPublica (Independent news agency)	12	40	29	25

Figure 5 Number of news articles addressing hydraulic fracturing from 2008 to May 2011.

CONCLUSION

Geological and engineering research on hydraulic fracturing is better represented in scholarly literature than environmental research. Academic research on fracking is now emerging in the environmental literature. Environmental literature from popular sources and non-profit groups predominates. Information on hydraulic fracturing may be shaped by opposing interests: financial, political, and environmental.

THE OREGON SPATIAL DATA LIBRARY IN CONTEXT

WIRTH, Andrea A.
University Libraries, Oregon State University
121 The Valley Library
Corvallis, OR 97331
andrea.wirth@oregonstate.edu

AVERY, Bonnie
University Libraries, Oregon State University

REMPEL, Marc
University Libraries, Oregon State University

and

WALSH, Kuuipo
College of Earth, Ocean, and Atmospheric Sciences
Oregon State University
Corvallis, OR 97331

Abstract - The Oregon Spatial Data Library (OSDL), Oregon's geospatial clearinghouse, provides a method for sharing public domain geospatial data at no cost to users. The OSDL, built on the foundation established by earlier collaborations between Oregon State University Libraries (OSUL), the Institute for Natural Resources (INR), and state agencies is one of several portals that make up the Oregon Explorer: Natural Resources Digital Library. As with other state data clearinghouses, a national commitment to providing framework layers provided the basis for the OSDL. Framework layers, established by the Federal Geographic Data Committee, include geodetic control, cadastral, orthoimagery, elevation, hydrography, administrative units, and transportation. Although these layers represent the basic elements of the clearinghouses, how does the technology stack up to facilitate discovery and use of the data provided? We review the findings of a study conducted in 2011-2012 that sought to place the OSDL in the context of its national peers. Taking the perspective of the novice user (perhaps a student assigned to find and import data into a GIS and conduct basic analysis), this study reviewed user-centric characteristics of state geospatial clearinghouses. These characteristics were: keyword search options; availability of training or documentation; ease of access to metadata; presence of locally unique data; and calls for data or metadata contributions. The analysis showed that the states varied widely in the tools provided to help users. Several recommendations and future scenarios for the OSDL are provided. They include continued work with partners to increase the amount of quality data made available, re-purposing of existing tools to facilitate discovery and download, and better integration of with online mapping in Oregon Explorer. This presentation is based on an article published in the summer 2012 volume of Issues in Science and Technology Librarianship.

PAPERSAURS: SURVIVORS OF THE P/D (PAPER/DIGITAL) BOUNDARY

SCOTT, Mary W.
Geology Library, The Ohio State University
180 Orton Hall
155 S. Oval Drive
Columbus, OH 43210,
scott.36@osu.edu

Abstract - "Going digital" is a trend as libraries have moved into the 21st century. As libraries go digital there is also a move to downscale print collections that are replaced by the digital. But lurking in the print collections are "papersaurs" (print items that should continue to be preserved in print). These need to be discovered before they become extinct. Are there some common characteristics that can be used to identify a "papersaur"?

INTRODUCTION

"Once created, permanent and durable paper copies…will endure for hundreds of years, barring disaster or vandalism. To date no one can prove that any digital version will survive and be accessible beyond a few decades…" (Gertz, 2000, p.97) If this statement is true, then why are we experiencing pressure to withdraw print books from our collections and rely on electronic versions, or to only purchase the electronic version of a new book? There are some books that always need to be available in print. These are the papersaurs that geoscience librarians should be selecting to retain in print.

LEGACY PRINT COLLECTION

We should be thinking of developing a *legacy print collection* as a core of the retained print collection. This is the collection of *papersaurs*, those books that are available for use in print and should be kept in print. There are numerous reasons why print is preferable to digital for these select titles including large folded maps or plates, movable parts, and images or other material not easily used in digital form. In 1992 the Research Libraries Group Preservation Committee published a list of considerations for retaining items in original format as part of the *RLG Preservation Microfilming Handbook*. (RLG Preservation Committee, 1992) Adapting some RLG considerations with some of my own from my experience as a collection manager, I developed six types of books (papersaurs) to consider and have listed some criteria with examples to provide some guidance. The six are:

1. Rare and/or classic books
2. Unique books
3. Books with bookplates or autographed by the author
4. Books produced locally or about your region
5. Books to support local research and teaching
6. Reference books

Rare and/or classic books

<u>Criteria</u>

1. Anything published before 1900. These should be kept at least through the first weeding of a collection. A second, careful, evaluation should be made of these books. Consult your rare book or special collections staff for local guidelines.

2. Intrinsic Importance–How important is the book to the geosciences?
   How do you recognize this? A couple of sources for guidance:
   The Geology of North America: an overview (Bally, Palmer and Decade of North American Geology Project, 1989)
   The earth inside and out: some major contributions to geology in the Twentieth Century (Oldroyd, 2002)

   Examples:
   Holmes, A., 1913, *The age of the earth* (Holmes, 1913)

   Atwood, W.W., 1940, *The physiographic provinces of North America* (Atwood, 1940)

   Grabau, A.W., and Shimer, H.W., 1909, *North American index fossils, invertebrates* (Grabau and Shimer, 1909)

   University of Tasmania Geology Dept., and Carey, S.W., 1956, *Continental drift; a symposium; being a symposium on the present status of the continental drift hypothesis* (University of Tasmania.Geology Dept and Carey, 1956)

3. Historical artifacts
   What are historical artifacts you might find in your library? These are probably going to be different for each librarian. Think about the mission, collection policies, and history of your library. In some cases there will be usable digital copies of these, but the book has historical value as a printed book. Early reports on the geology of your state or area are a group of books to consider saving.

   Examples:
   Books from the library of Edward Orton, Sr.

   Report of the geological survey of Ohio, (Geological Survey of Ohio, 1873; 1893)

   The tentative or named formation correlation charts for various states compiled by M. Grace Wilmarth. For example: *Tentative correlation of the named geologic units of Ohio* (Wilmarth and Geological Survey, 1930)

   USGS Monograph volumes and atlases (Geological Survey, 1882; 1929)

   Geologic atlas of the United States folios published by the US Geological Survey (Geological Survey (U.S.), 1894; 1945)

4. Books by prominent geologists
   Books on the history of geology can help identify important geologists and their contributions to the geosciences and their publications.

   Examples:
   James Dana – any books he wrote

Leopold, L.B., 1964, *Fluvial processes in geomorphology* (Leopold, 1964)

Dunbar, C.O., and Rodgers, J., 1957, *Principles of stratigraphy* (Dunbar and Rodgers, 1957)

5. Fieldtrip guidebooks
   Retain guidebooks produced by local organizations as well as those for trips in your area. If you don't who will?

   Examples:
   Geology Division of the Ohio Academy of Science Field Trip Guidebooks

   Ohio Inter-colligate field trip guidebooks

   Ohio Geological Society guidebooks

   Friends of the Pleistocene guidebooks

6. Books with limited holdings on OCLC
   If there are fewer than ten locations on OCLC in the United States, I would keep my copy.

   Example:
   Hanchen, Y., 1986, *Xinjiang's gems and jades = Xinjiang baoshi he yushi* OCLC number: 18587101

Unique Books

These are books that don't scan very well, can't be scanned, or if they are scanned are difficult to use in digital form. There might be something unique about the book that makes it important to keep it as a print item.

Criteria:

1. Books with maps or plates as folded pages in the text, in a pocket in the back, or as a separate box of maps. The Google book project is not unfolding maps or taking maps out of a pocket to scan them. Being able to use a map beside the text is useful.

   Example:
   Krasheninnikov, V.A., and Hall, J.K., 2005, *Geological framework of the Levant* (Krasheninnikov and Hall, 2005)

2. Unique items in the book. I have a book that has movable paper dials on a couple pages. There is no way to reproduce this digitally, at least not yet.

   Example:
   Kircher, A., Alexander, L., Janssonius van Waesberge, J., Matham, T., and Schor, J.P., 1678, *AthanasiiKircheri e Soc. Jesu Mundus subterraneus : in XII librosdigestus; quo divinumsubterrestris mundi opificium, miraergasteriorumnaturae*

in eodistributio, verbo…. (Kircher et al, 1678)
(This has moveable dials on pages 165 and 167.)

3. How would you scan overlays or a book with aerial photo stereo pairs and make them usable digitally?

   Example:
   Norell, W.F., 1970, *Air photo patterns of subsurface mining in Ohio* (Norell and Ohio, 1970)

4. Think about displays and exhibits. Having an actual book in the display has a different impact on the viewers than the scanned image of a page. On National Fossil Day there was the table full of fossil books displayed for people to browse. It was more fun than handing out a list of links.

Books with bookplates or autographed by the author

These could be grouped with historical artifacts but I grouped them here, because they can be old or new. For example, each year the Ohio State University Libraries honor faculty members who receive tenure or promotion by putting a bookplate in a book that they select as having some significance to them.

Our policy is that if the book has a bookplate, we keep it. We are also adding notes to the catalog records about the bookplates so we can find the books that contain them. In addition to bookplates, watch for author autographed books.

Figure 1. Examples of bookplates from the Ohio State University Libraries.

Books produced locally or about your region

Criteria:

1. Local materials such as guidebooks or conference proceedings
2. Books by local authors, local publishers, state agencies, museums, societies, clubs, university departments
3. Theses and dissertations

Examples:

Darbee, J.T., and Recchie, N.A., 2009, *Little Cities of Black Diamonds* (Darbee and Recchie, 2009)

Hunt, T. S., 1874, *The coal and iron of southern Ohio: considered with relation to the Hocking Valley coal field and its iron ores, with notices of furnace coals and iron smelting, followed by a view of the coal trade of the West* (Hunt, 1874)

Engineering Society of Akron, Committee on Geology, and LaDue, W.R., 1921, *Report on the geology of the Akron district* (Engineering Society of Akron.Committee on Geology and LaDue, 1921)

Szava-Kovats, G.S., and Mueller, I.I., 1964, *Notes for an introductory course in map projections*; manuscript based on the lectures of Ivan I. Mueller, (Szava-Kovats and Mueller, 1964)

Reports of the OSU Mapping and Charting Laboratory

Books to support local research and teaching

Criteria

1. Knowing which classes have a paper or poster requirement helps to decide what to retain on site for quick use by the students.
2. What are faculty and students working on? Where is their research? What are their needs? I know my school has a field camp in Utah, works in Antarctica, and goes to the Bahamas each spring break; so I will keep books for these areas.
3. The paleontologists are big users of print materials but geophysicists prefer electronic, so keep in touch with your primary users, their research and their changing needs.

Reference Books

Criteria

1. Think about what is on your reference shelves and what do you use and what to others use and why. If it is online or you could get it online, would people use it online? Why or why not?
2. Old bibliographies can be useful, particularly if they contain references that are not included in online databases such as GeoRef. (Scott, 2003)
3. Stratigraphic lexicons, particularly those of countries outside North America may or may not be online so evaluate carefully.

Examples:
Moore, R.C., Teichert, C., Joint Committee on Invertebrate Paleontology, and Geological Society of America, 1953, *Treatise on Invertebrate Paleontology* (Moore et al, 1953)

Geological Survey of Canada,1900, *General index to the Reports of progress, 1863 to 1884*. (Geological Survey of Canada and Dowling, 1900)

Lexique stratigraphique international (Anonymous1956)

CONCLUSION

Remember that books still under copyright (usually those published after 1923) are not readily available digitally. These may be a large percentage of your collection so decisions to retain on your shelves, send to remote storage, or completely withdraw are challenging and will take time. Talk with your users, listen to what they have to say, but don't promise anything. A good collection development policy should include a retention plan. As we cross the paper/digital boundary with our library collections, we need to move with caution and not throw out the papersaurs with the paper trash. It has been suggested that "Academic librarians will have created a new profession for themselves – 'rare book engineers'" because of all the copies of books they are discarding." (Storey, 2011, p.82)

References

Anonymous1956, Lexique stratigraphique international: Paris, Centre national de la recherche scientifique, .

Atwood, W.W., 1940, The physiographic provinces of North America: Boston; New York etc., Ginn and company, p. 535, [1].

Bally, A.W., Palmer, A.R., and Decade of North American Geology Project, 1989, The Geology of North America :an overview: Boulder, Colo., Geological Society of America, p. 619.

Darbee, J.T., and Recchie, N.A., 2009, Little Cities of Black Diamonds: Charleston, S.C., Arcadia, p. 127.

Dunbar, C.O., and Rodgers, J., 1957, Principles of stratigraphy: New York, Wiley, p. 356.

Engineering Society of Akron.Committee on Geology, and LaDue, W.R., 1921, Report on the geology of the Akron district: Akron, O., S. N., p. 35.

Geological Survey, 1882; 1929, Monographs of the United States Geological Survey: .

Geological Survey (U.S.), 1894; 1945, Geologic atlas of the United States: .

Geological Survey of Canada, and Dowling, D.B., 1900, General index to the Reports of progress, 1863 to 1884: Ottawa, Printed by S.E. Dawson, p. 475.

Geological Survey of Ohio, 1873; 1893, Report of the Geological survey of Ohio.. Columbus, Nevins & Myers, state printers, .

Gertz, J.E., 2000, Selection for preservation in the digital age: an overview: Library Resources & Technical Services, v. 44, p. 97-104.

Grabau, A.W., and Shimer, H.W., 1909, North American index fossils,invertebrates: New York, A. G. Seiler & company, .

Holmes, A., 1913, The age of the earth: London; New York, Harper & Brothers, p. 195, [1].

Hunt, T.S., 1874, The coal and iron of southern Ohio: considered with relation to the Hocking Valley coal field and its iron ores, with notices of furnace coals and iron smelting, followed by a view of the coal trade of the West: Salem, Mass., Naturalists' agency, p. 78.

Kircher, A., Alexander, Leopold, Janssonius van Waesberge, J., Matham, T., and Schor, J.P., 1678, Athanasii Kircheri e Soc. Jesu Mundus subterraneus :in XII libros digestus; quo divinum subterrestris mundi opificium, mira ergasteriorum naturae in eo distributio, verbo Pantamorphon [Greek work romanized] Protei regnum, universae denique naturae majestas & divitiae summa rerum varietate exponuntur, abditorum effectuum causae acri indagine inquisitae demonstrantur, cognitae per artis & naturae conjugium ad humanae vitae necessarium usum vario experimentorum apparatu, necnon novo modo & ratione applicantur: Amstelodami Amsterdam, Netherlands, Apud Joannem Janssonium Ã Waesberge & filios, .

Krasheninnikov, V.A., and Hall, J.K., 2005, Geological framework of the Levant: Jerusalem, Historical Productions-Hall, .

Leopold, L.B., 1964, Fluvial processes in geomorphology: San Francisco, W. H. Freeman, p. 522.

Moore, R.C., Teichert, C., Joint Committee on Invertebrate Paleontology, and Geological Society of America, 1953, Treatise on invertebrate paleontology: New York, Geological Society of America, .

Norell, W.F., and Ohio, 1970, Air photo patterns of subsurface mining in Ohio: Columbus, OH, Ohio Dept. of Highways, .

Oldroyd, D.R., 2002, The earth inside and out: some major contributions to geology in the twentieth century: London, Geological Society, p. 369.

RLG Preservation Committee, 1992, **The Book as Object**, *in* Elkington, N.E., ed., **RLG preservation microfilming handbook**: Mountain View, CA, Research Libraries Group, p. 62-64.

Scott, M.W., 2003, Status of bibliographic control of pre-1900 geoscience literature: Geoscience Information Society Proceedings, v. 34, p. 105-108.

Storey, C., 2011, Bibliobabble? The surge towards a print→less e-library recasts academic librarians as “rare book engineers”: Library Management, v. 32, p. 73-84, doi: 10.1108/01435121111102593.

Szava-Kovats, G.S., and Mueller, I.I., 1964, Notes for an introductory course in map projections; manuscript based on the lectures of Ivan I. Mueller: Columbus, Ohio State University, Dept. of Geodetic Science, .

University of Tasmania.Geology Dept, and Carey, S.W., 1956, Continental drift; a symposium;being a symposium on the present status of the continental drift hypothesis, held in the Geology Department of the University of Tasmania, in March, 1956. Convener: S. Warren Carey: Convener, Hobart, p. 363.

M.G. Wilmarth, and Geological Survey. , 1930, Tentative correlation of the named geologic units of Ohio: .

BEYOND TRADITIONAL PRINT RESOURCES: ACCESSING INFORMATION ABOUT GEOSCIENCE COLLECTIONS

PROSSER, Cynthia L.
Science Collections & Scholarly Communication
Science Library
University of Georgia Libraries
Athens, GA 30602
cprosser@uga.edu

Abstract - Geoscience information utilizes many formats - ranging from field notes, maps, and books to rock and water samples, animal specimens, and electronic files. Having the proper tools for access is an important facet of making geoscience collections available. The proper tool can provide insight into and information about a collection as well as allowing individuals to view or interact with the collection from afar. Access to a given collection can range from traditional onsite paper finding aids to in-depth websites showcasing highlights through the use of emerging forms of technology. Advances in technology also permit access to rare, fragile items that cannot be handled on a regular basis.

Geoscience collections are comprised of a variety of materials, items, and objects. These may include publications such as books, journals, maps, cross sections, and aerial and satellite photographs. Also, they may include reports from analyses or experiments including seismic data, seismic sections, and x-ray diffraction graphs. Collections may contain components or be comprised of personal papers including field notes, field books, photographs, slides, films, and various assorted personal papers. Samples including rocks, minerals, and fossils, as well as processed samples such as thin-sections and petrographic slides, are another element found in collections. Display specimens, such as are seen in museums, comprise yet another type of geoscience collection.

Various institutional entities can house these collections. Libraries are one of the most prevalent locations whether it is an academic, public, institutional, corporate, special collections, or individual library. Archives, ranging from university departments to institutions, are another potential and customary location. In addition, museums are established centers having both display and research portions of the collection.

Discovering the existence and/or contents of these collections may not be as straight forward as one would hope, but there are several ways they can come to light. While it is easy to surmise that a library would have access to resources such as books and journals, items that are more esoteric or ephemeral are less routinely amassed and tend to be housed in specialized collections. These collections and resources can become known through a variety of ways.

A mention of it could be made in a news article, in a blog, through the invisible college, or perhaps through one's use of social media. One could visit the location to search and to view a collection in person. Alternately, one could conduct an online search with a favorite search tool, whether using an abstracting and indexing service, such as GeoRef, or Google, Bing, Yahoo, Twitter, etc.

Finding aids are the key to the contents of a collection and these have been in transition. With the increase of electronic access and storage resources, finding aids have moved from paper formats, such as card catalogs and printed listings, to static electronic listings and indices, to interactive databases that permit customized searching. The ability to search the contents of a collection via the World Wide Web permits the researcher to do just that without traveling to the location of the collection – a potential savings of time, money, and effort, in the event the collection does not contain the needed resources. Traditionally, the organizing, defining, labeling, and cataloging of a collection, as well as the terms used therein, have been handled and controlled by the keepers of the collection. With the rise of social media and other participatory software, the users have been able to contribute to these efforts through wikis and tagging, and ultimately to the wider dissemination of the existence of various items. Many times, these electronic, remote, dynamic, and crowd-sourced methods will lead to additional discovery of various resources.

Although not all finding aids have made the transition from static paper formats to dynamic electronic formats, many institutions have made use of one or more technological advances.

These technological advances have allowed finding aids to transition from paper formats such as card catalogs and printed indices, through static electronic indices, to dynamic online databases. Abstracting and indexing services, also, have experienced this migration. Wikis permit active editing by some or all researchers, allowing individual contributions to the classification of the collection. Tagging records in databases with terms that are unique to specific research projects provide an additional layer of classification for discovery. Tag clouds of the most associated words with items and/or collections offer a visual representation of the collection's contents. Exciting benefits of these newer techniques permit a wider collaboration among collection keepers and researchers as well as bringing the wealth of the collection to a wider audience.

USING SOCIAL MEDIA TO CONNECT WITH USERS

MUSSER, Linda R.
Fletcher L. Byrom Earth & Mineral Sciences Library
Pennsylvania State University
105 Deike Building, University Park PA 16802 USA
814-863-7073; lindamusser@psu.edu

Abstract - According to the Pew Internet & American Life Project, over 66% of American adults who use the Internet use social media. For adults less than 30 years old, the percentage jumps to 86%. Tools such as Facebook and Twitter allow users to communicate quickly and easily with friends and family as well as with others with similar interests. Such widely accepted communication media offer many opportunities to provide useful information services, connect with current and potential users, and to build communities regardless of geographic boundaries.
A brief overview of Twitter will be provided followed by examples of how it can be used to promote your organization. Sources for content (tweets), ways to share responsibility for developing content, policies, and assessment of the impact and reach of your Twitter feed will be described. Leveraging the Twitter feed for other purposes and venues will also be discussed. While few will ever have the reach of pop culture icons such as Lady Gaga in the social media sphere, tools such as Twitter can be a valuable means to put a more personal face before your users.

INTRODUCTION

As of December 2012, sixty-seven percent of American adults who use the Internet use social media (Pew Internet & American Life Project, 2013). Whereas businesses routinely use social media to connect with users, many professional organizations have been slow to participate in this venue, perhaps daunted by the learning curve or deeming the focus to be on the 'social' aspect rather than an appropriate medium for professional communication. Whatever the reason, with such a high rate of usage this medium offers myriad opportunities to connect with users and to communicate your organization's message. At a time when there is great competition for people's attention, it behooves organizations to meet users where they are congregating; in this case, online at social media sites.

ABOUT SOCIAL MEDIA

There are many definitions of what constitutes social media ranging from the very complex to the simple "tools for two-way communication" (by which definition the telephone would qualify as a social media tool!). Meredith Farkas (2007) provides one of the better definitions, stating that social media meet two of the following conditions:

- It allows people to communicate, collaborate and build communities online.
- It can be syndicated, shared, reused or remixed, or it facilitates syndication.

- It lets people learn easily from and capitalize on the behavior or knowledge of others.

Examples of social media technologies include blogs, wikis, instant messaging services, podcasts, image and video sharing services, and social networks (see Figure 1). The reasons organizations choose to use social media vary and include: engagement, outreach, marketing, networking, communication, visibility, and to be cutting edge. The U.S. Geological Survey, for example, uses Twitter as a means to communicate to the public on issues related to the earth sciences. It also makes use of the medium in order to gather real-time, anecdotal information about earthquakes as reported by Twitter users (USGS, 2012).

Facebook	Twitter	Wikipedia	Pinterest
Tumblr	YouTube	Flickr	Instagram
Digg	LinkedIn	Redit	Ning
Del.icio.us	StumbleUpon	Foursquare	Google+

Figure 1: Examples of social media tools

USING SOCIAL MEDIA

The first step in developing a social media presence is to define the type of communication and conversations you want to develop with your intended user group. At this point, you need to define the user group that is your target audience. It is also important to decide whether you want to encourage interaction and feedback from your user group or if the communication will largely be one-way, as this will influence the type of posts created. For example, if user interaction is not a primary focus then it is unlikely that you would want to ask questions in your posts. Guidelines for individual posts are extremely helpful and provide a baseline that can also be used to assess your endeavor later on. Typical guidelines cover what type of materials to include or exclude, how frequently to post messages, the desired tone of the communique (e.g., casual or formal), what is appropriate to re-post (i.e., content from others), and what other social media sites and channels to connect or point to. Examples of materials to cover might include events, announcements, user news, staff news, and subject specific news of interest to your user group. Having regular posts is important to attract and retain the interest of potential followers. It is also important to publicize relevant posts from related organizations as this helps you become part of the network of communication sources in your field. For similar reasons it is useful to become a follower, via social media, of related organizations and individuals.

With over 500 million participants, Twitter is one of the most popular and widely used social media tools today. It is a quick messaging service that allows users to send and read text messages up to 140 characters. Individuals, businesses, government and other organizations all make use of this particular tool which makes it useful for illustration. Writing posts is a skill that comes naturally to some but can be learned by anyone. Twitter is one of the more challenging social media environments for writers, however, given the 140 character limit. Some handle the challenge by resorting to abbreviations or acronyms (e.g., ‘u’ instead of ‘you’), which lends a more casual air to the post than some might desire. It is possible, however, to write an engaging Twitter post that does not utilize such shortcuts. The best posts are engaging and specific (see Figure 2); inclusion of links to websites and photographs are highly engaging and therefore desirable to include. A URL shortening tool is almost always required. In cases where the same information is to be announced using another social media tool, such as Facebook, it is usually desirable to re-write the post for that medium as Twitter so severely limits the length of the posting. Below are several examples (with URLs removed) of the same information written for use on Facebook and on Twitter (Grier, 2012).

- **Facebook:** So you finally picked a major…but what does an accountant really do? What’s working in healthcare actually like? What companies should I be looking at with my degree in supply chain? Learn about the industry of your choice (and more) on IBISWorld.
- **Tweet:** Picking between 160 majors and 14 colleges? Check out IBISWorld a comprehensive look at every industry imaginable.

- **Facebook:** Trying to narrow down where to send your resume? Check out IBISWorld for the main players in your industry of choice (and their main competitors!). Get market performance, key statistics, and a full executive summary all in one place.
- **Tweet:** Not sure where to send your resume? Check out IBISWorld for the main players (and competitors) in your industry.

- **Facebook:** Getting ready for your internship or co-op? Make sure to brush up on your Microsoft Excel skills before your first day. Come check out our how-to guides to show everyone at your internship why WE ARE… #1 in recruiting!
- **Tweet:** Need to brush up on Excel skills for your internship? Come check out our how-to guides before your first day!

1. The new issue of Sports Illustrated has arrived.
2. The October 3 issue of Sports Illustrated just arrived!
3. Philly fans rejoice! Get into the post season with “Baseball Heaven” article on the Phillies in the new 10/3/11 issue of Sports Illustrated.
4. Phillies in the playoffs! Great article and photos in new (10/3/11) issue of Sports Illustrated. #Phillies

Figure 2: Composing an engaging Twitter post – The same information conveyed in order of increasing quality of post. While both #3 and #4 are good posts, the latter also employs a hashtag, “#Phillies” to aid in retrieval of the post. Hashtags are a type of subject tag that users can include in their Tweet to facilitate retrieval and grouping

with related Tweets. For example, the hashtag for posts related to the 2012 Geological Society of America annual meeting was #GEO2012.

MANAGING THE PROGRAM

Once a social media program has been established, it is important to not only allot time but also to assign responsibility for the program to one or more individuals. It is possible to share the effort of sustaining the program by engaging all staff in identifying ideas for posts, having one or more people write the posts, and having one or more people actually schedule and upload the posts. (Tools such as HootSuite and TweetDeck can greatly facilitate this process.)

As mentioned earlier, it is useful to leverage your communication efforts for multiple purposes. For example, while it is preferable to write a post specifically for the Facebook environment, it is possible to have a Twitter post automatically copied to your organization's Facebook page (and vice versa). Tweets can be broadcast via RSS to a webpage, or to a digital sign (via software tools such as VisibleTweets or TweetWall). Finally, it is important it assess your efforts. While engaging in social media does not take a lot of time, it does utilize time that might be spent doing other activities, therefore it should be evaluated as to whether it is achieving the goals which were set at the beginning of the project. How will success be measured? By the number of readers or followers? By the quality of the posts? By click throughs? A wide variety of metrics are being used commercially to measure efficacy but not all will be relevant to every endeavor. These metrics include: volume, influence, frequency, relevance, engagement, reach, and impact. Some of the social media management tools such as HootSuite and TweetDeck have some metrics built in but most metrics can be gathered using other free tools as well. Some other popular assessment tools include: Google Analytics, TweetStats, and Twitter Counter.

In conclusion, competition for people's attention is fierce and social media provide an inexpensive, accessible means to communicate and connect with users. Not only does the presence of social media tools on your website have a positive impact on the perceived service quality of your organization (Chua and Goh, 2010), but engaged users are more likely to become supporters.

REFERENCES

Chua, Y.K. and D.H. Goh, 2010, A study of Web 2.0 applications in library websites: Library & Information Science Research, v.32, no.2, p.203-211.

Farkas, Meredith G., 2007, Social software in libraries - building collaboration, communication, and community online: Medford, N.J., Information Today, 320 p.

Grier, Emily, 2012, personal communication.

Pew Internet & American Life Project, 2013, The demographics of social media users – 2012: Washington, D.C.
http://pewinternet.org/~/media/Files/Reports/2013/PIP_SocialMediaUsers.pdf

U.S. Geological Survey, 2012, Twitter Earthquake Detector (TED).
http://recovery.doi.gov/press/us-geological-survey-twitter-earthquake-detector-ted/

MAKING M.A.G.I.C. (THE MID-ATLANTIC GEO-IMAGE COLLECTION)

ROHRBACK-SCHIAVONE, Robin
Geology, Northern Virginia Community College
8333 Little River Turnpike, M.S.E. Division, Annandale, VA 22003
rcr267@email.vccs.edu

PITTS, Alan
Geology Program, AOES Department, George Mason University
4400 University Drive, Fairfax, VA 22030

JOHNSON, Chris
Geology Program, AOES Department, George Mason University
4400 University Drive, Fairfax, VA 22030

and

BENTLEY, Callan
Geology, Northern Virginia Community College
8333 Little River Turnpike, M.S.E. Division, Annandale, VA 22003

Abstract - The Mid-Atlantic Geo-Image Collection (M.A.G.I.C.) is a growing repository of gigapixel-resolution geologic imagery designed to be a resource for geoscience professionals, educators, students, and enthusiasts. GigaPan images permit visual examination of geologic features on a computer screen with a high level of detail, comparable to that which can be seen in the field or in the lab. The images maintain a high level of resolution through every level of magnification. The medium is unique in the combination of context and detail it provides. Advantages of the geological GigaPans include:

- Physically disabled students can participate in virtual field trips.
- Instructors can bring inaccessible outcrops into the classroom.
- Students can zoom in on hand samples without need for expensive microscopes.
- Widely separated professionals can “share” samples virtually.
- The images are free to use, print and tag, and instantly accessible via the Internet.

M.A.G.I.C. currently includes suites of images focused on Hamilton College’s Snowball Earth Educational Rock Sample Suite, Eocene invertebrate fossils from Florissant Fossil Beds, AND sediment samples from around the world, in addition to many folded and faulted outcrops along Corridor H through the Valley and Ridge Province of West Virginia AND select outcrops and hand samples from the Blue Ridge and Piedmont Provinces of Virginia. Additional suites of thematically-related GigaPans will be added over the coming year.

HIDDEN WATER: SALT LAKE COUNTY, UT DRAINAGES, A PART OF THE WESTERN WATERS DIGITAL LIBRARY

LOVE, April M..
Research and Learning Services
J. Willard Marriott Library, University of Utah
295 South 1500 East, Salt Lake City, UT 84112-0860
april.love@utah.edu

and

MORROW, Anne
Digital Ventures
J. Willard Marriott Library, University of Utah
295 South 1500 East, Salt Lake City, UT 84112-0860

Abstract - Hidden Water unveils surface water systems on the east side of Salt Lake Valley, both culinary and irrigation. The web site follows the seven major streams of the Wasatch Front, plus minor ones, and tracks that water from headwaters to the Jordan River and then the Great Salt Lake. It intermixes contemporary photographs with historical photographs from several archives showing earlier uses and diversions of water. The web site documents how stakeholders utilize the water with treatment plants, hydropower plants and irrigation ditches. In turn, these public, recreational and commercial uses flow from water rights dating back to territorial days. The term "hidden water" refers to our tendency to take our water system for granted. We turn a tap and expect the water to flow. Where water comes from and how it's delivered is "hidden" to us. Somehow, it crosses a jumble of political divisions and property lines and arrives at our taps. The intention of the 'Hidden Water' web site is to make that system visible and transparent.

THE PROPOSED CUAHSI WATER DATA CENTER: EMPOWERING SCIENTISTS TO DISCOVER, USE, STORE, AND SHARE WATER DATA FROM MULTIPLE SOURCES

ARRIGO, Jennifer S.
CUAHSI, 196 Boston Ave. Suite 3800
Medford, MA 02155
jarrigo@cuahsi.org

COUCH, Alva L.
CUAHSI, 196 Boston Ave. Suite 3000
Medford, MA 02155

HOOPER, Richard P.
CUAHSI, 196 Boston Ave. Suite 3000
Medford, MA 02155

and

POLLAK, Jonathon
CUAHSI, 196 Boston Ave. Suite 3000
Medford, MA 02155

Abstract - The proposed CUAHSI Water Data Center (WDC) will provide production-quality water data resources based upon the successful large-scale data services prototype developed by the CUAHSI Hydrologic Information System (HIS) project, providing time series data collected from sensors primarily (but not exclusively) in the medium of water. The WDC's missions include providing simple and effective data discovery tools useful to researchers in water-related disciplines, and providing simple and cost-effective data publication mechanisms for researchers. The WDC's activities will include:

1. Rigorous curation of the water data catalog already assembled by the HIS project.
2. Data backup and failover services for "at risk" data sources.
3. Creation and support for ubiquitously accessible data discovery and access.
4. Partnerships with researchers to extend the state of the art in water data use.

The WDC will serve as a knowledge resource for researchers, and will interface with other data centers to make their data more accessible to water researchers. The WDC aims to address some of the grand challenges of accessing and using water data, including:

- **Cross-domain data discovery:** different scientific domains refer to the same kind of data using different terminologies, making discovery of data difficult for researchers in other disciplines.

- **Cross-validation of data sources:** much water data comes from sources lacking information on quality control; such sources can be compared against others with rigorous quality control.
- **Data provenance:** the appropriateness of data for use in a specific model or analysis often depends upon the exact details of how data was gathered and processed.
- **Contextual search:** discovering data based upon geological (e.g. aquifer) or geographic features.
- **Data-driven search:** discovering data that exhibit quality factors that are not described by the metadata.

Many major data providers (e.g. federal agencies) do not have the mandate to provide access to data other than their own. The HIS has assembled data from more than 90 different sources, thus demonstrating the promise of this approach. Meeting the grand challenges listed above will greatly enhance scientists' ability to discover, interpret, access, and analyze water data from across domains and sources to test Earth system hypotheses.

INTRODUCTION

"Water is everywhere." This sentiment underscores the importance of instilling hydrologic and earth science literacy in educators, students, and the general public, but also presents challenges for water scientists and educators in distributing, accessing, and interpreting water data. Scientific data about water is collected and distributed by many different sources, from federal agencies, to scientific investigators, to citizen scientists. As competition for limited water resources increases, increasing access to and understanding of the wealth of information about the nation's and the world's water will be critical.

The CUAHSI-Hydrologic Information System (HIS) is a web based system for sharing hydrologic data that can help address this need. Looking towards the future, the Water Data Center will build upon this large prototype – developed over the last decade - to create and maintain production quality water data resources.

BACKGROUND AND DEVELOPMENT OF CUAHSI HIS

The WDC represents the culmination of five years of work of the CUAHSI community in making water data accessible, including supporting standards for water data access (WaterML (Zaslavsky et al., 2007) and WaterOneFlow services), a software embodiment of those standards (the CUAHSI Hydrologic Information System (CUAHSI HIS)(Horsburgh et. al. 2010, 2011; Tarboton et al. 2009, 2001), best practices for data categorization and discovery (including the data ontology developed by the CUAHSI Ontology Project(Zaslavsky et al. 2012)), and best practices for water data publication (including the Observations Data Model (Horsburgh et al. 2008)).

Better discovery and access to data were identified as key community needs in surveys (Bandaragoda et al. 2006) during the early 2000s, particularly since the interdisciplinary water research community uses data about water coming from different sources and in many different forms. CUAHSI HIS was developed in order to meet these needs. To develop a truly integrative understanding of water within the Earth system, scientists and researchers needed to discover, to access and to successfully interpret and use water data from diverse sources and disciplines. The technology upon which CUAHSI HIS is built was developed under a Geoinformatics research grant (EAR-0622374) led by Dr. David Maidment at the University of Texas at Austin.

Today the system consists of three components: a centralized catalog (HydroCatalog) that indexes and supports discovery of approximately 70 terabytes of hydrologic data available in standardized form, a freely available open source server software stack (HydroServer) that allows anyone to establish a data server and publish data in HIS, and an open source, freely available desktop client program (HydroDesktop) that interacts with HydroCatalog and HydroServers to discover, access and support the integrated analysis of hydrologic data from multiple sources.

The software elements are all open source and developed through an open development process with community code repositories (http://hydrodesktop.codeplex.com, http://hydroserver.codeplex.com, http://hydrocatalog.codeplex.com) that facilitate community use of and contributions to this code catalyzing an ecosystem of software development activity around this system.

HIS uses a "Service-Oriented Architecture (SOA)" like those mandated by US government agencies for distribution of government-collected data. The SOA provides an environment similar to search engines like Google (Figure 1a), but specifically for water data sources (Figure 1b). The components of the system are exposed through web services: a method of communication between two electronic devices over the internet (arrows in Figure 1). HIS uses three categories of services: data services, which convey the data; metadata services which convey metadata about specific collections or series of data; and search services, which enable search, discovery and selection of data and convey the metadata required for accessing the data using data services.

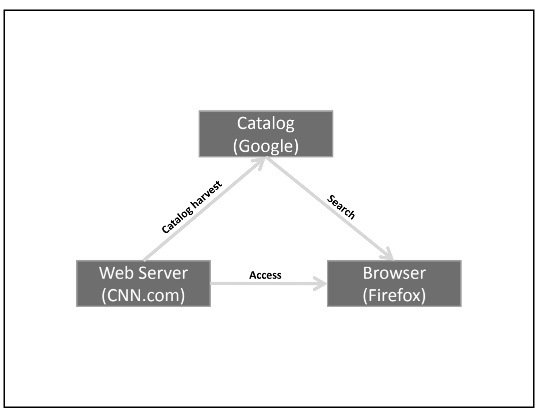


Figure 1a: Operation of a Web Browser

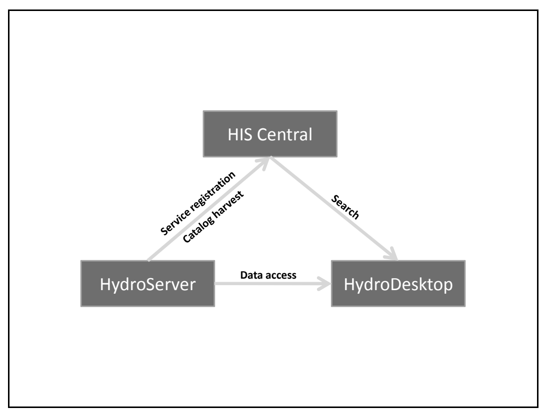


Figure 1b: Relationships in HIS system

Thus, to access data in HIS, a *user* opens a client on his/her computer to search for data. The client uses search services to search the Catalog, which communicates with the data sources through metadata services, and returns a search result to the client. The user then selects the data from the search result, and the data are conveyed via data services directly from the data sources to the client.

OUTCOMES OF THE CUAHSI-HIS PROJECT

Today, after a decade of work beginning with community surveys and pilots and through the research phase of the project (Figure 2), the result of CUAHSI HIS project is a prototype system aligned with community needs and poised for a smooth and accelerated transition from the research phase to an operational service for the community.

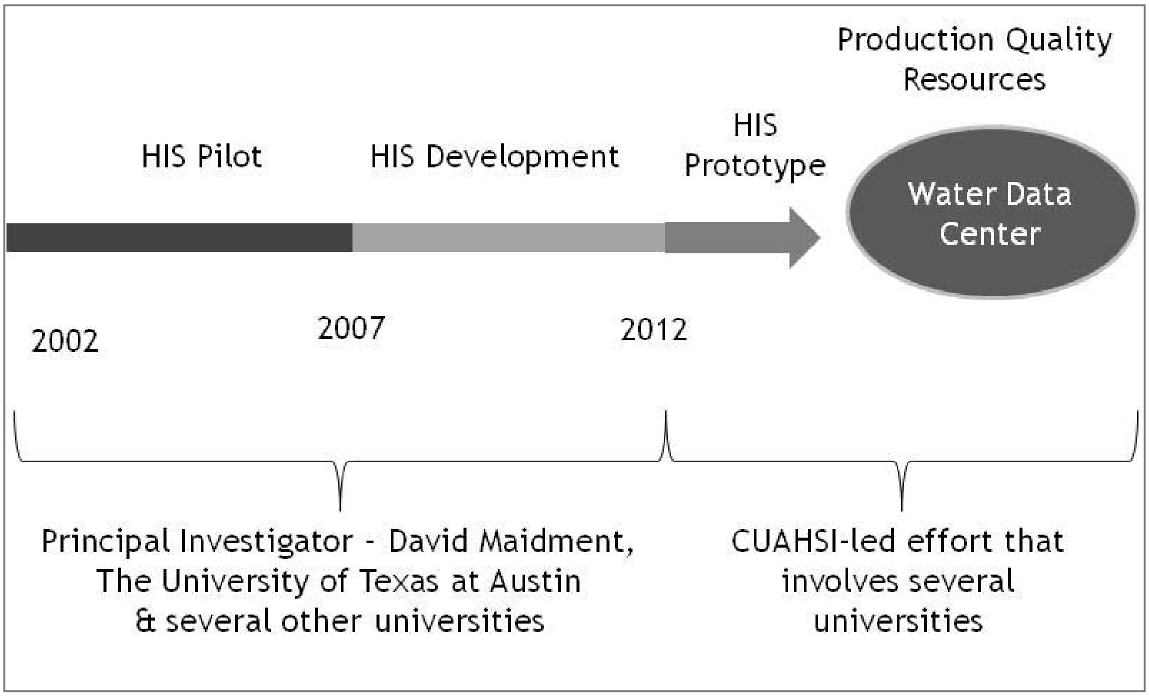


Figure 2: Development Timeline of CUAHSI HIS and the Water Data Center

During the research phase, CUAHSI provided community oversight on development priorities through its Informatics Standing Committee and represented HIS and the water science research community in coordination with the project team with federal data providers, at intergovernmental panels and with NSF. CUAHSI provided a venue for the university water research community to approach federal agencies in a coordinated manner, and negotiated Memoranda of Understanding with federal data providers. In 2009, CUAHSI added a user support specialist to its permanent staff to assist in coordinating activities amongst the project team and to assisting in testing, promoting, and supporting versions of the HIS software stack, as well as providing support to end users of HIS during the prototype phase.

Today CUAHSI – HIS maintains the largest water metadata catalog in the world, at the San Diego Supercomputing Center and enables search and access of data from over 95 hydrologic data sources including over 25 universities, state and provincial agencies, and multiple federal agencies. Several large federal data repositories important to water researchers, including services from USGS, NOAA, NASA and the EPA, are accessible via the system. The services-oriented architecture enables different data access clients to be customized for specific purposes. Currently, the main data access client is HydroDesktop (Figure 3), a program for the Windows environment that combines an open-source GIS package with a data discovery client that searches the HIS Central catalog.

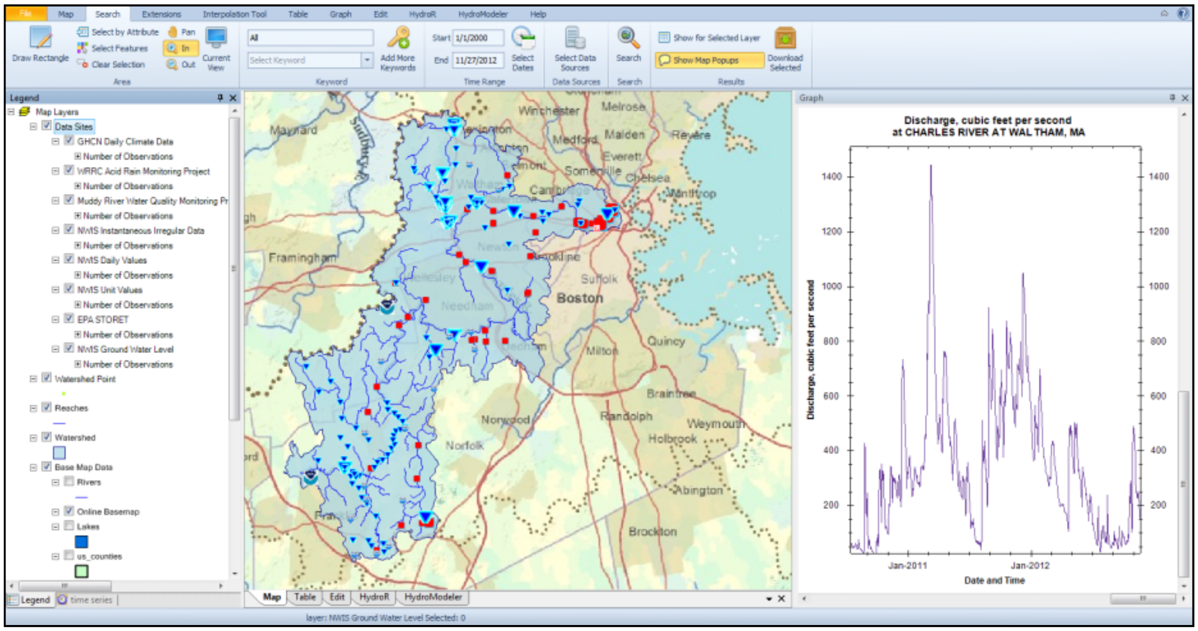


Figure3: HydroDesktop integrates GIS analysis and functions with time series data search, download and analyses.

HydroDesktop searches for data by:

- Geography (Bounding box or GIS Coverage)
- Time
- Property Measured
- Data Source

GIS Coverages included with HydroDesktop download:

- Political Boundaries (Country, U.S. State, U.S. County)
- HUC8
- Ability to delineate watersheds using EPA web services

The CUAHSI HIS system has seen increasing adoption by the water science community over time, with 23 new services registered by data providers in 2012 (Figure 4), and interest and cooperation from government agencies to make their data available through the system. There has been significant growth of the system use by users downloading and analyzing data as well: number of time series downloaded has increased from 132,054 in 2009 to 9,771,920 in 2012 (Figure 5), and the number of downloads of HydroDesktop increased from 110 for version 1.0 to 5099 for version 1.4.

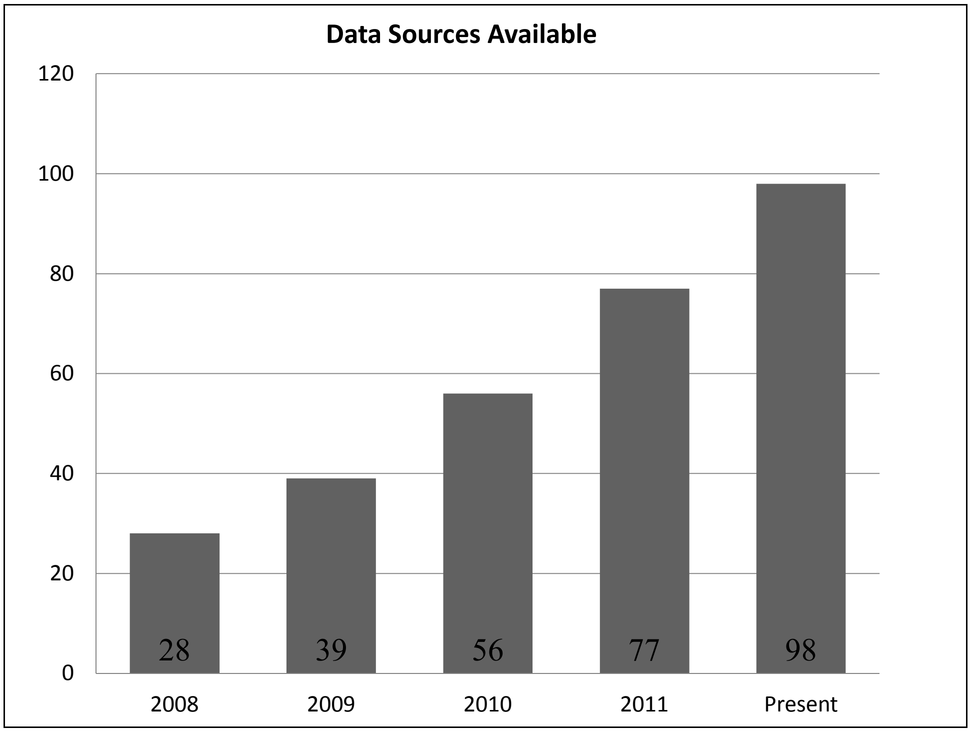


Figure 4: Growth in registered services in HIS Central

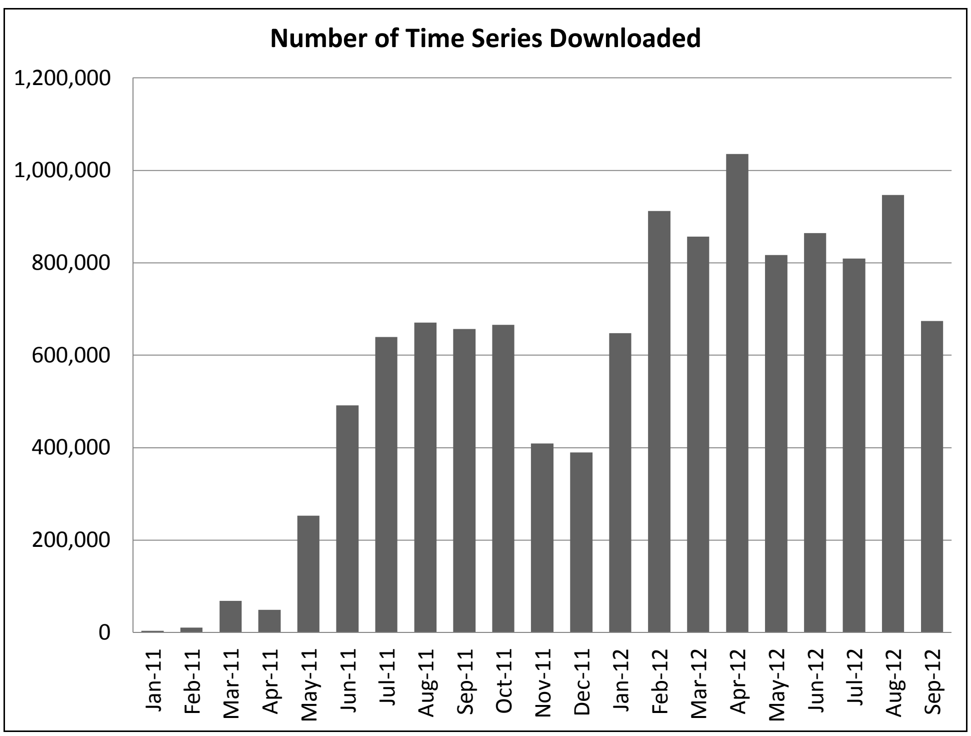


Figure 5: Monthly download requests from HIS

At the end of the prototype phase, CUAHSI Hydrological Information System (CUAHSI HIS) has been successful in creating and promoting community governance of infrastructure needs of hydrology researchers and those in related disciplines, including:

- Standards for hydrological time-series data interchange (WaterML, WaterFlowOne Services).
- An open-source reference implementation of a WaterFlowOne service (CUAHSI HIS HydroServer).
- Wrappers that convert non-WaterFlowOne services to WaterFlowOne form.
- Access to US Government Databases based on standards
- A comprehensive catalog of hydrological data sources (CUAHSI HIS HydroCatalog).
- A powerful GIS-based user application for data discovery and download (CUAHSI HIS HydroDesktop).

THE CUAHSI WATER DATA CENTER

With the development phase ending at the end of 2012, CUAHSI's role as a community organization is to maintain and operate this system long term through a proposed Water Data Center (WDC). A proposal for CUAHSI to operate the Water Data Center has been recommended for funding by the National Science Foundation (as of March 1, 2013). The planned implementation of the WDC will take lessons learned from the CUAHSI – HIS experience to better meet critical community data needs.

The CUAHSI HIS project provided a compelling blueprint for how hydrological data can be disseminated, but has also given us evidence of several crucial needs beyond the scope of the original project, including the needs for:

- A permanent centralized resource for dissemination of data from hydrological data sources.
- An easy to use, highly portable data discovery client usable on all computing platforms.
- Robust and ongoing processes for user support of hydrological researchers desiring to learn how to access the sources.
- Robust and ongoing processes for ongoing data catalog curation and catalog quality assurance.
- Seamless and easy to use data publication services that do not require researchers to administer their own web services.
- Professionally curated data products of use to hydrological researchers.
- Professional-quality software maintenance and upgrades for the software subsystems that provide the above capabilities.

The proposed Water Data Center (WDC) will be a virtual deployment of CUAHSI HIS to the Microsoft Azure cloud and will include support personnel for software development, data curation, and user support. The primary mission of the CUAHSI Water Data Center (WDC) is to empower scientists to discover, use, store, and share water data from multiple sources to address integrative grand challenge questions in water science. Its secondary mission is to advance hydro-informatics through participation in standards definition, refinement, and adoption, as well as user training and support.

The WDC will expand and "harden" the current CUAHSI HIS System and will provide access to diverse data holdings in a consistent format using a standards-based, services-oriented architecture (Figure 6). A metadata catalog is the entry point to allow data clients to discover data across multiple university and government data providers. The key services that the WDC will provide include curation of the metadata catalog, translation among standard formats to provide data to water scientists in a consistent and convenient format, support for scientists for publishing and/or discovering data, and participation in the standards-setting processes relevant to the data services deployed by the WDC.

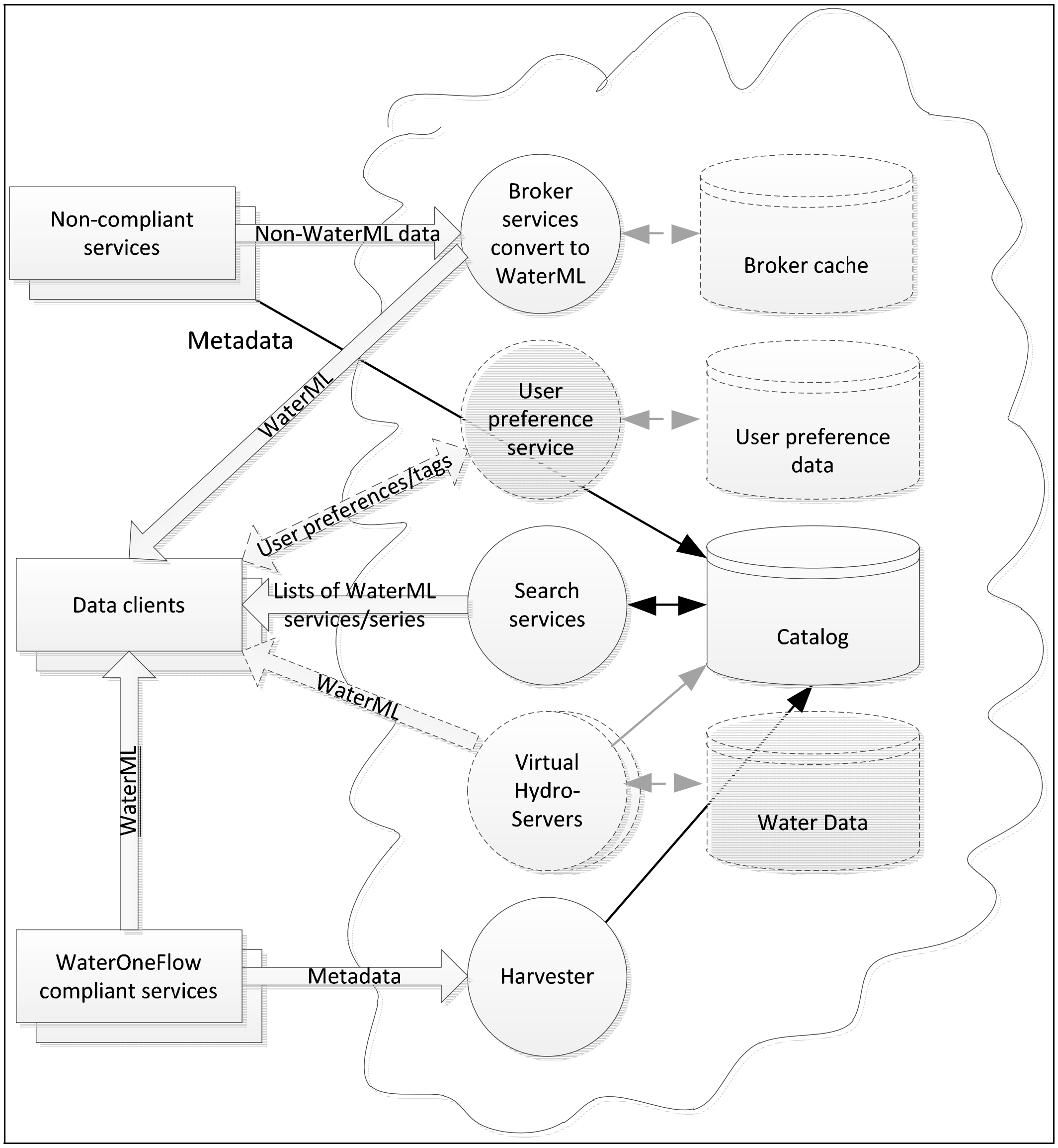


Figure 6: Existing (solid line) and proposed (dotted line) components of the HIS system to be supported by the WDC.

A COMMUNITY FACILITY

Over the next two years, the CUAHSI WDC will have completed the engineering and hardening of HIS under a separate NSF grant (recommended for funding as of 2/1/2013) and will be a fully operational facility. In addition to the engineering of the SOA system, the CUAHSI WDC will achieve its mission by extending the capabilities and support of the current system and:

- provide simple and effective data discovery tools useful to researchers and educators in a variety of water-related disciplines

- provide simple and cost-effective data publication mechanisms for projects that do not desire to run their own data servers, and provide long term archiving of university research data

- provide educational and outreach resources that focus on data-driven and place-based learning

- work with government data providers and decision-makers to broker government data sources and to develop data standards to make more water data more easily accessible to the water research and education community.

- develop alternative data discovery interfaces such as web-based search clients and mobile applications that enhance the accessibility of water data by diverse audiences (Figure 7).

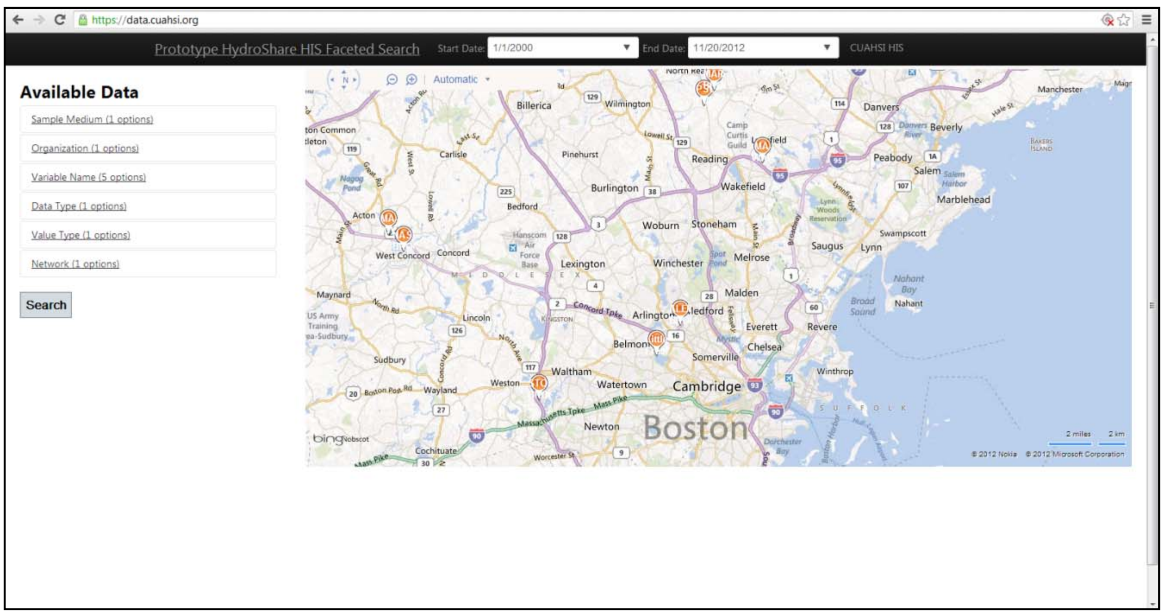


Figure 7: A prototype "faceted search" web-based client that allows users to refine search results by specifying one "facet" of the metadata to filter at a time. The use of almost all metadata fields as search filters greatly speeds data discovery for specific geographic regions and quickly indicates the extent of data of interest.

The vision is of the Water Data Center that not only provides production-quality services, but is truly a community facility and enables new research, collaborations, and understanding. The proposed center will take advantage of technological advances, such as cloud computing and ubiquitous web access, to fundamentally alter the way earth scientists conduct their research and educate the next generation of water scientists, and develop a more complete understanding of the Earth System through data. Thus the WDC is not just a data repository or software development effort: it is a coupled empowerment-centered effort that integrates standards, data, and software to serve the needs of Earth and environmental scientists, and establishes relationships (Figure 8) to serve those needs:

- The WDC will give water researchers (1) new ways to discover, download, combine, and reuse data. These ways are informed by cutting-edge research projects supported by the WDC (See (3)) and then distributed to all researchers.
- Water research subscribers who store their private working data in the WDC (2) receive additional benefits, in the form of advanced data management and sharing capabilities. When the subscription ends, the data becomes publicly available to all.
- Water research partners (3) specify new data products and services that enable advanced research and are provided by the WDC, both to the partners and – eventually – to all water researchers where applicable.
- Vendor partners (4) receive managed publication and data management interfaces for their measurement products, which allow researchers to enjoy "plug-and-play" convenience when setting up new sensors. Other vendor partners may receive managed discovery plug-ins for their products that understand WaterOneFlow services.
- The water research community (5) provides governance of the WDC through the CUAHSI Board, its Informatics Standing Committee, and its User Committee (http://www.cuahsi.org/governance.aspx).
- The WDC exchanges data, best practices, and software with other Geo data centers (6), including time-to-space and space-to-time conversions for both WDC and other data sources.
- The WDC keeps government data providers and decision-makers (7) informed of community needs, new standards, and emerging technological trends.

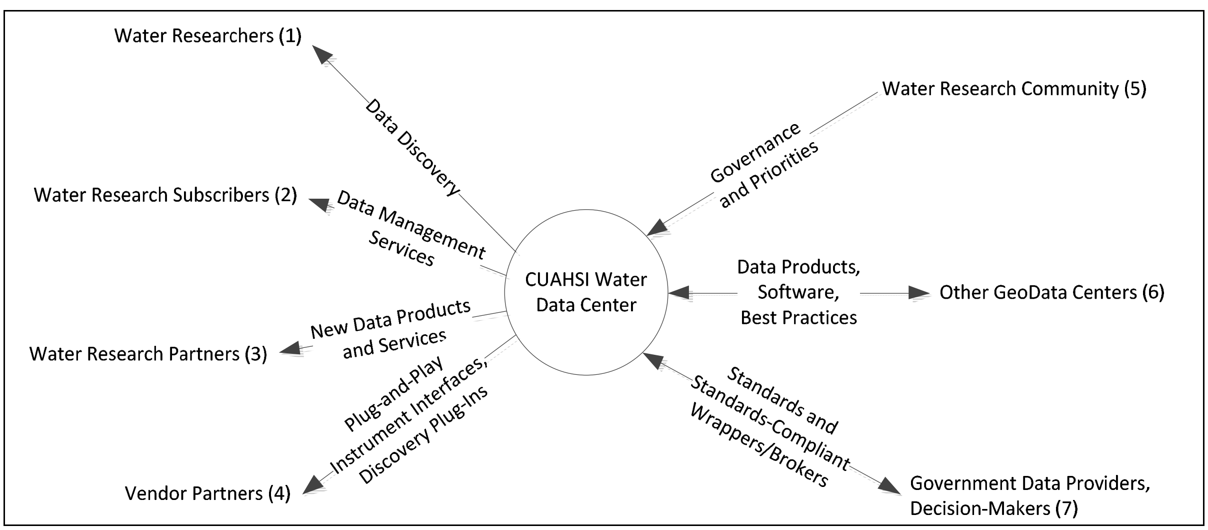


Figure 8: Relationships between the Water Data Center and key clients and stakeholders.

The Water Data Center is not simply an embodiment of CUAHSI HIS; it is instead an embodiment of the community-driven “feature lifecycle” processes that resulted in CUAHSI HIS (Figure 9). As when developing CUAHSI HIS, a feature or service starts out as a need of a single scientist or a small group, leading to a proposal to the community. Community-approved proposals turn into partnerships with the proposers which – together with seed development funding from outside the WDC's operating budget – lead to prototype services to satisfy the need. Prototypes that demonstrate broader applicability and usefulness to the community are then chosen by the community for general deployment. Thus, the services assured by the WDC naturally evolve over time to serve new needs via a community-driven governance process.

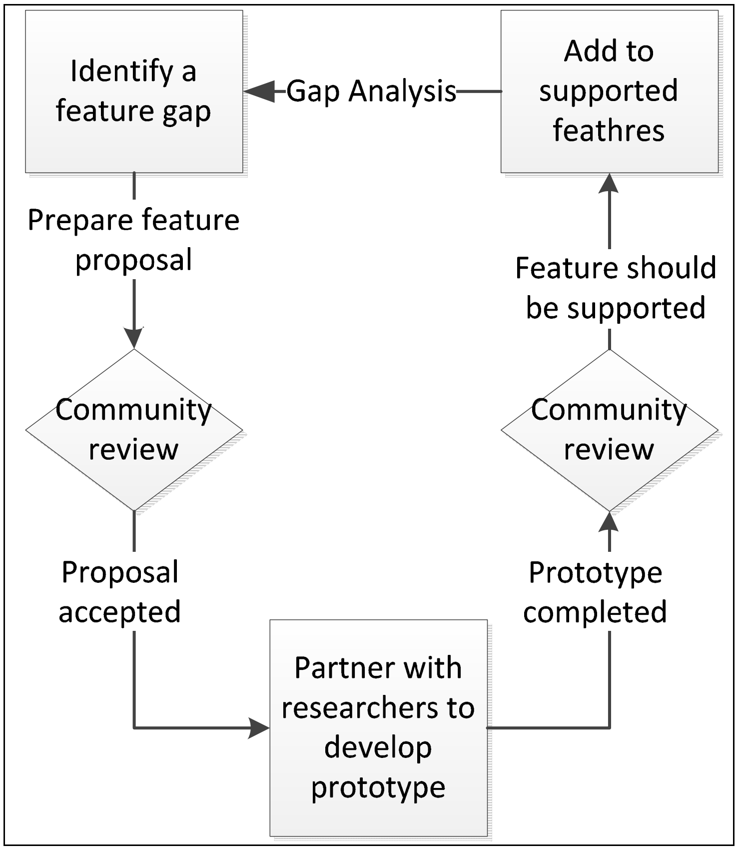


Figure 9: The CUAHSI HIS feature lifecycle.

CONCLUSION

The WDC will build upon the foundations of and knowledge gained from the CUAHSI –HIS project to provide high-reliability data discovery and download services, substantively improved search performance, data management services, and curation processes for standards, software, and data catalogs. Other key elements of the WDC's activities will include software engineering, performance tuning, and implementation of processes for data curation and user support. These basic elements will allow the WDC to provide water researchers the state of the art in water data discovery, download, and data fusion.

The proposed WDC will be a transformational influence upon the water-related sciences. It will take a leadership role for hydro-informatics by serving as a center of expertise for water data and as an embodiment of "best practices" for water data access and use.

ACKNOWLEDGEMENTS

This work has been supported by National Science Foundation grants EAR 07-53921 to CUAHSI and EAR 06-22374 to the University of Texas. CUAHSI HIS has been developed by a large team of colleagues from the University of Texas, San Diego Supercomputing Center, Utah State University, Idaho State University, Drexel University, City College of New York, and University of South Carolina

REFERENCES

Bandaragoda, C., D. G. Tarboton and D. R. Maidment. 2006. “Hydrology's effort towards the Cyberfrontier,“ EOS, 87(1): 2, 6, doi:10.1029/2006EO010005.

Horsburgh, J. S., D. G. Tarboton, D. R. Maidment and I. Zaslavsky, (2011), "Components of an environmental observatory information system," Computers & Geosciences, 37(2): 207-218, http://dx.doi.org/10.1016/j.cageo.2010.07.003.

Horsburgh, J. S., D. G. Tarboton, K. A. T. Schreuders, D. R. Maidment, I. Zaslavsky and D. Valentine, (2010), "Hydroserver: A Platform for Publishing Space-Time Hydrologic Datasets," 2010 AWRA Spring Specialty Conference Geographic Information Systems (GIS) and Water Resources VI, Orlando Florida, American Water Resources Association, Middleburg, Virginia, TPS-10-1, http://www.awra.org/tools/members/Proceedings/1003conference/doc/abs/JefferyHorsburgh_7cb420e3_6602.pdf

Horsburgh, J. S., D. G. Tarboton, D. R. Maidment and I. Zaslavsky, (2008), “A Relational Model for Environmental and Water Resources Data,” Water Resour. Res., 44: W05406, doi:10.1029/2007WR006392.

Tarboton, D. G., D. Maidment, I. Zaslavsky, D. Ames, J. Goodall, R. P. Hooper, J. Horsburgh, D. Valentine, T. Whiteaker and K. Schreuders, (2011), "Data Interoperability in the Hydrologic Sciences, The CUAHSI Hydrologic Information System," Proceedings of the Environmental Information Management Conference 2011, 132-137, http://eim.ecoinformatics.org/eim2011/eim-proceedings-2011/view.

Tarboton, D. G., J. S. Horsburgh, D. R. Maidment, T. Whiteaker, I. Zaslavsky, M. Piasecki, J. Goodall, D. Valentine and T. Whitenack, (2009), "Development of a Community Hydrologic Information System," 18th World IMACS Congress and MODSIM09 International Congress on Modelling and Simulation, ed. R. S. Anderssen, R. D. Braddock and L. T. H. Newham, Modelling and Simulation Society of Australia and New Zealand and International Association for Mathematics and Computers in Simulation, July 2009, 988-994, http://www.mssanz.org.au/modsim09/C4/tarboton_C4.pdf

Zaslavsky, I., D. Valentine, R. Hooper, M. Piasecki, A. Couch, and A. Bedig, (2012), "Community practices for naming and managing hydrologic variables," in Proceedings of the AWRA Spring Specialty Conference on GIS and Water Resources, New Orleans, LA, March 26 - 28, http://his.cuahsi.org/documents/IlyaZaslavsky_51e7c422_7956.pdf

Zaslavsky, I., D. Valentine, and T. Whiteaker (2007), CUAHSI WaterML, Open Geospatial Consortium Discussion Paper.
http://portal.opengeospatial.org/files/?artifact_id=21743

MAPPING A NEW INFORMATION LANDSCAPE: LIBRARY/GEOLOGICAL SURVEY COLLABORATION IN GEOLOGICAL SURVEY AGENCY DATA STEWARDSHIP AND ACCESSIBILITY

RAUBER, Carolyn M.
University Libraries, University of Minnesota
108 Walter Library, 117 Pleasant Street SE, Minneapolis, MN 55455
cmrauber@umn.edu

and

THORLEIFSON, Harvey
Minnesota Geological Survey, University of Minnesota
2642 University Ave. W, St. Paul, MN 55114
thorleif@umn.edu

Abstract - Geoscience information is needed to inform issues related to energy, materials, water, and hazards, as well as preservation and appreciation of our natural heritage. Geological survey agencies are essential services with a jurisdiction-wide, long-term mandate to maintain, build, and make available needed public geoscience information. Surveys previously focused on mapping, research, and publication; while Libraries focused largely on acquisitions, holdings, and circulation. Currently, information science professionals at Libraries and geoscientists at Geological Surveys are both shifting to a focus on facilitation of access to digital information, opening collaborative opportunities.

The Minnesota Geological Survey (MGS) is among the one-third of US state geological surveys that are University-based, resulting in a natural partnership with the University Library. In past Library-Survey collaboration, all 45,000 pages and 650 maps published by MGS since 1872 were scanned and web-enabled in a Library-hosted institutional repository, along with GIS files. The entry points for publications' page and map content include not only keywords, authors, and titles, but also location, with spatial footprint visualizations against a map interface.

This work demonstrates that initial distinctions between the Survey's publications, sample collections, datasets, and archives must be reimagined; all are now regarded as databases that can be queried and assigned georeferencing metadata and other common database protocols. We plan to migrate all Survey databases to Open Geospatial Consortium-compliant spatial web services, although effort will be needed to influence and accommodate data standards developed elsewhere. A renewed comprehensive database audit is underway to identify priorities for further database preparation in anticipation of common format and accessibility protocols.

Appreciation is expressed to our Library, Survey, and partner agency colleagues for their many roles in this activity.

INTRODUCTION

The Minnesota Geological Survey (MGS) was established and entrusted to the University by an act of state legislature in 1872 (Minnesota Geological Survey, 2013). When the Department of Geology was founded in 1874, it included the MGS. Newton Horace Winchell, the first Minnesota Geological Survey Director, also taught classes as Professor of Geology and Mineralogy. According to Winchell, the Survey's position at the University strengthened its role as a public educator, allowing it to "radiate information concerning the natural features of the state, and … all collections of natural history that should otherwise be brought to light" (Winchell, 1889). In the past, providing Survey maps and publications to libraries and making them available for purchase has been sufficient to fulfill its mandate, but this is no longer an adequate means of accessibility.

The MGS has partnered with the Library to seize new opportunities to make geological informational available to its users. In 2007, the Library and MGS began a collaborative project to scan and upload all Survey publications to the University's institutional repository. This project represented a desire on the part of the Survey to move toward an open-access model of publication, which is now fully implemented (Johnston and Thorleifson, 2012). Not only are all Survey publications from 1872 to present publically available for download through the University's institutional repository, the University Digital Conservancy (UDC), but all new publications are also digitally published there by Survey staff (University of Minnesota, 2009).

With all of the publications online and available, MGS and the Library want to provide similar access to their public datasets. The MGS hosts many data sets that have scientific, industrial, and historic value. Three data sets are currently archived in the UDC, and two of those have associated interactive browser-based GIS applications to provide additional spatial visualization. However, the data sets are not uniform in their format, completeness, or accessibility, which presents a challenge for preservation efforts. This paper presents a combination of conceptual and practical propositions for approaching the stewardship of complex geoscience data sets; provides the details of a preliminary audit of Survey data assets conducted in fall 2012; and identifies future directions for this project.

MGS COLLECTIONS AND ACCESSIBILITY

The MGS is responsible for collecting, maintaining, and sharing a wealth of unique information assets related to the geology of Minnesota. The geological information stewarded by the MGS is of interest to many parties in Minnesota and across the country, including, but not limited to, university researchers, health officials, government agencies, as well as a number of private consulting firms that are in the environmental, engineering, construction, mining and energy industries. As a result, the MGS has an obligation to make these collections as widely accessible as possible. MGS must also do this in a responsible way with a long-term vision, which required us to ask: what do we mean by “collection” and “accessible”?

It made sense to conceptualize the MGS data and collections as discrete format- or type-specific, and we originally assigned each collection to a broad category. In a previous assessment, the holdings of MGS were categorized by type: publications, physical collections, and derived and indirect data (Thorleifson, 2009). The publications included maps, reports, atlas series, bulletins, and any paper-based output of the Survey. Physical collections included hand samples, thin samples, sediment samples, cuttings, and drill cores. Data included geochemical, sediment, aeromagnetic, and gravity measurements; some were georeferenced and mapped in GIS software and some were not. The latter two categories included material collected from geological surveys at a state and federal level, information from other state agencies, geological data from water well drilling, and data from mineral exploration (Thorleifson, 2009), and even though standards are in place for the proper collection (Minnesota Department of Health, 2008), these collections are extremely heterogeneous and difficult to conceptualize, much less apply straightforward standards of accessibility.

When it comes to accessibility outcomes, we looked no further than the MGS publications collection in the UDC, and the tools that were created and used to access it. All 45,000 pages of MGS publications and 650 maps are stored and safely archived on the UDC. The entire collection is open access; there are no administrative barriers to downloading the full text of publications. However, making the content free and available was not sufficient, and several tools were created to facilitate discovery of those collections. The Library hosts the content, but search tools were built for the MGS website, since users would go there first. Three tools were created, each serving a different purpose.

First, from the MGS Publications page on the MGS website (Figure 1), visitors can perform a full-text search. All documents in the collection have been indexed and are full-text searchable. This provides a granular level of access that does not rely on the accuracy of a few people applying keywords, or on how descriptive the title and abstract are. Second, on the same page, visitors can browse by series. Each series title can be clicked and expanded, and the titles are arranged in chronological order. Each link leads to a record and the full text in the UDC.

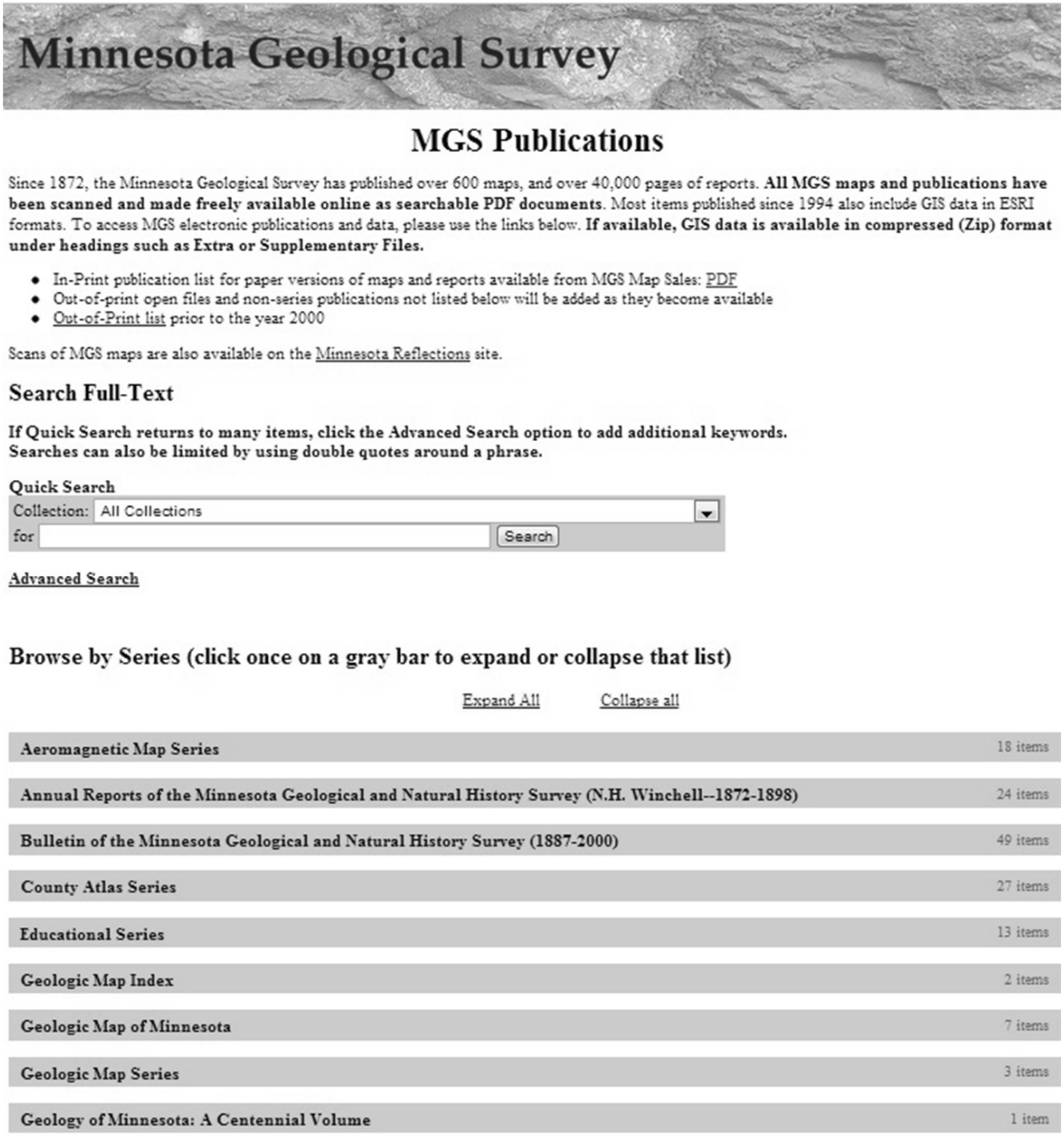


Figure 1: MGS Publications portal on the MGS website.

Third, all maps and publications are georeferenced and are searchable by location using the browser-based ArcGIS application. The MGS website provides a link to "Search by Location," which directs users to a map titled "MGS Maps and Reports by Area" (Figure 2). This interface provides users with the opportunity to select an area on the map and access links to the MGS maps and publications available for that area. Once a publication is selected, a window appears, in which a link to the UDC is available. Though title and full text search is not available through this interface, the page is accessed an average of 40-50 times per month, indicating that users find the spatial search valuable as a discoverability tool. In a practical sense, a spatial search is ideal for users who do not know the specific title or series they want, but do know what region the information covers. In a larger sense, however, the MGS has a defined state jurisdiction and produces content that is often georeferenced and based on points in space. As a result, this service is critically relevant for the MGS, and must be integrated into all its services.

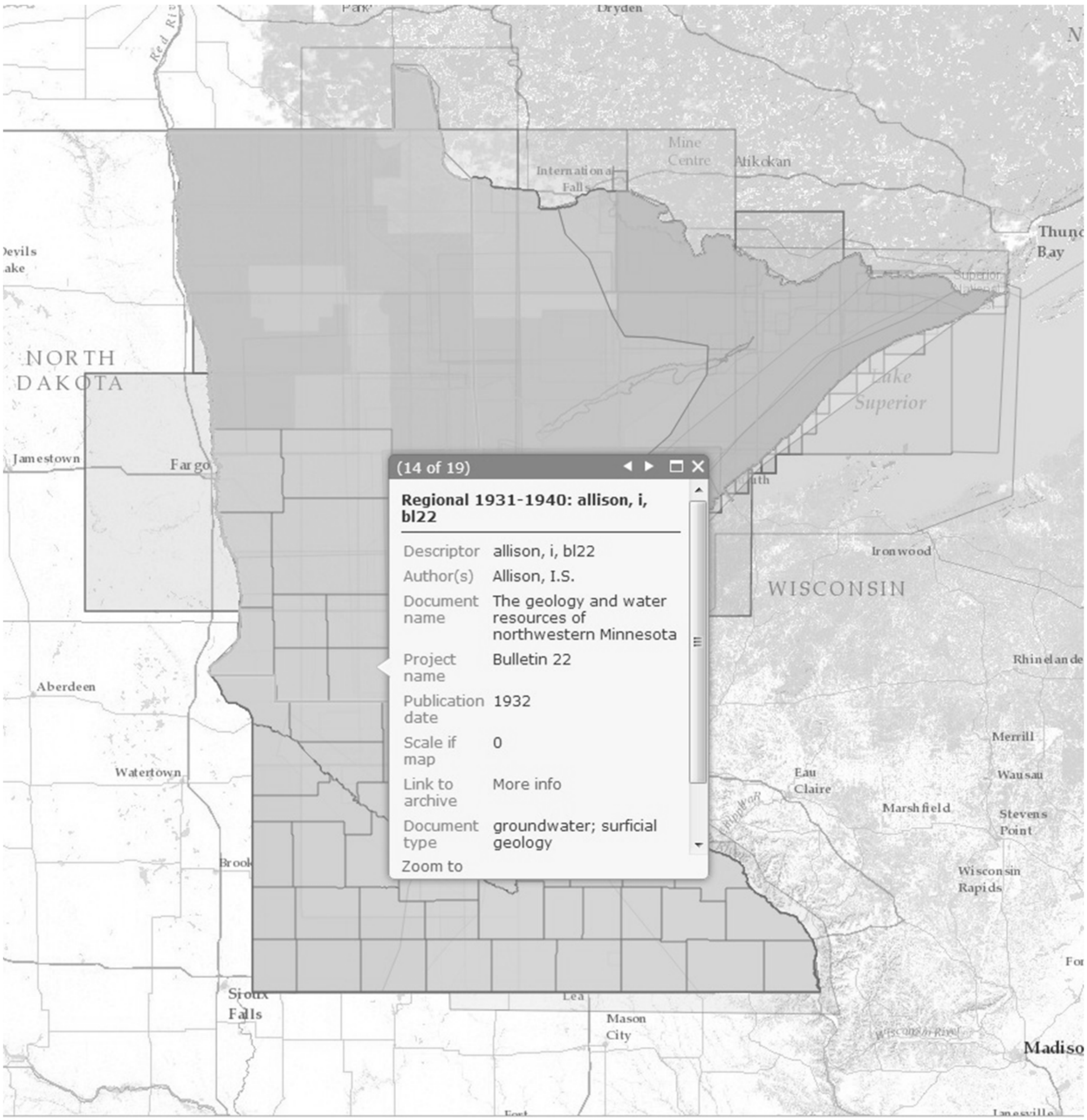


Figure 2: Screenshot from ArcGIS map "MGS Maps and Reports by Area." A region is selected and a publication for that region is highlighted.

Open access and robust means of discoverability are two major features of this successful project, and the download statistics from the UDC demonstrate that users are finding and downloading MGS publications at a steadily increasing rate (Figure 3). The publications receive greater exposure than they ever would offline, and it is clear that other MGS collections would benefit if they were accessible like the publications.

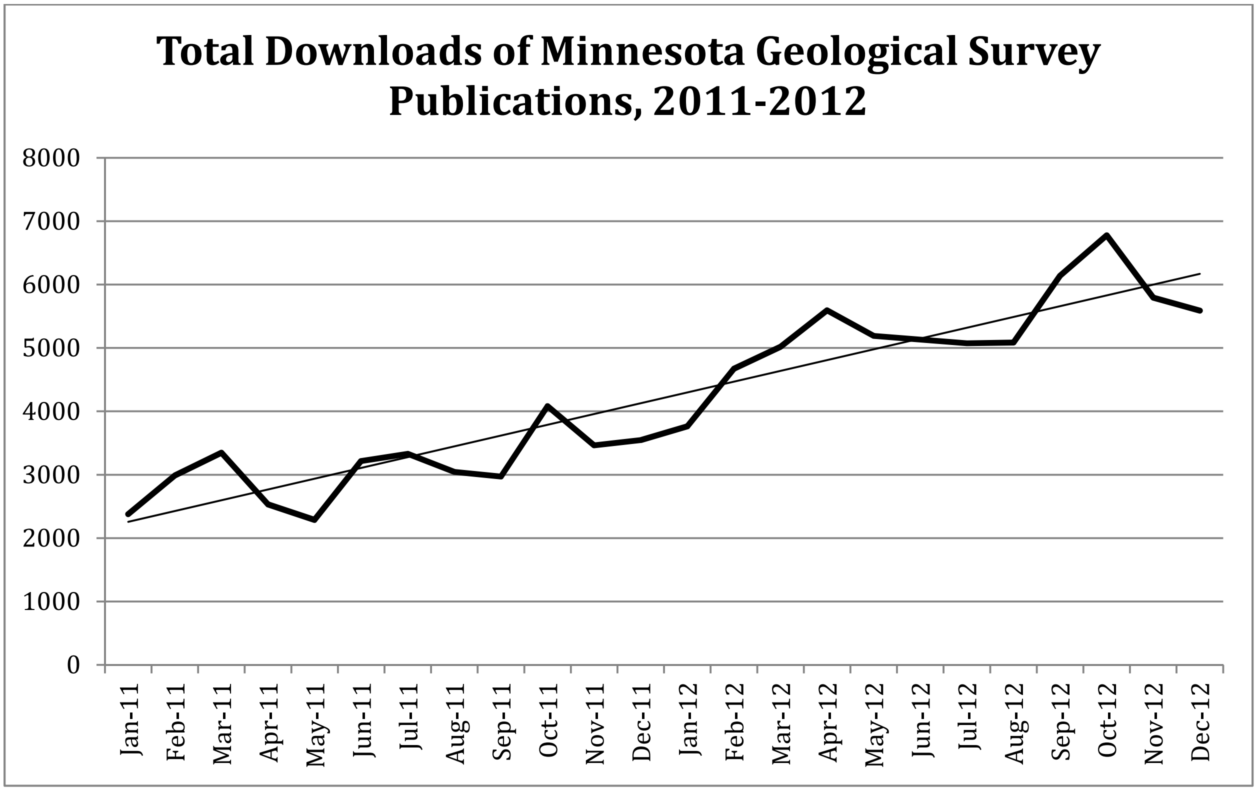


Figure 3: Total MGS Collection downloads from January 2011 to September 2012 with trendline. The June 2012 data point was not included in this graph; the site indexers were offline during that month.

MGS Data Sets

Movement toward open geoscience data is occurring on a national and international level. The National Geological and Geophysical Data Preservation Program was established by law in 2005, with a vision of linking geoscience data repositories and implementing a set of standards for preservation, curation, and access (United States Geological Survey, 2013). The Open Geospatial Consortium is an independent organization developing standards for geoscience information architecture that will enable interoperability between systems and allow information and data to be shared easily (Open Geospatial Consortium, 2013). We can only expect to see more systems that are designed to enable the search and reuse of geological data sets.

Some Survey data are posted on MGS servers as layer files and are opened with the Environmental Systems Research Institute's (ESRI) ArcGIS program. The data are also available as a web-enabled map service through ESRI's ArcMap application. The map service is interactive, browser-based, and does not need additional programs to use, which makes it a good way to share these data sets.

Three MGS data sets are also available for download through the UDC: the Aeromagnetic and Gravity Database, the Rock Properties Database, and the Karst Features Database. All the required and supplementary components of the database are archived, including associated grids and GIS files. The UDC does not have the capability to visualize or map these data sets, so this approach is suboptimal. However, the data sets are still in high demand through the UDC (Figure 4). Downloads of the data far outpace the number of requests the MGS receives for a DVD containing the same data.

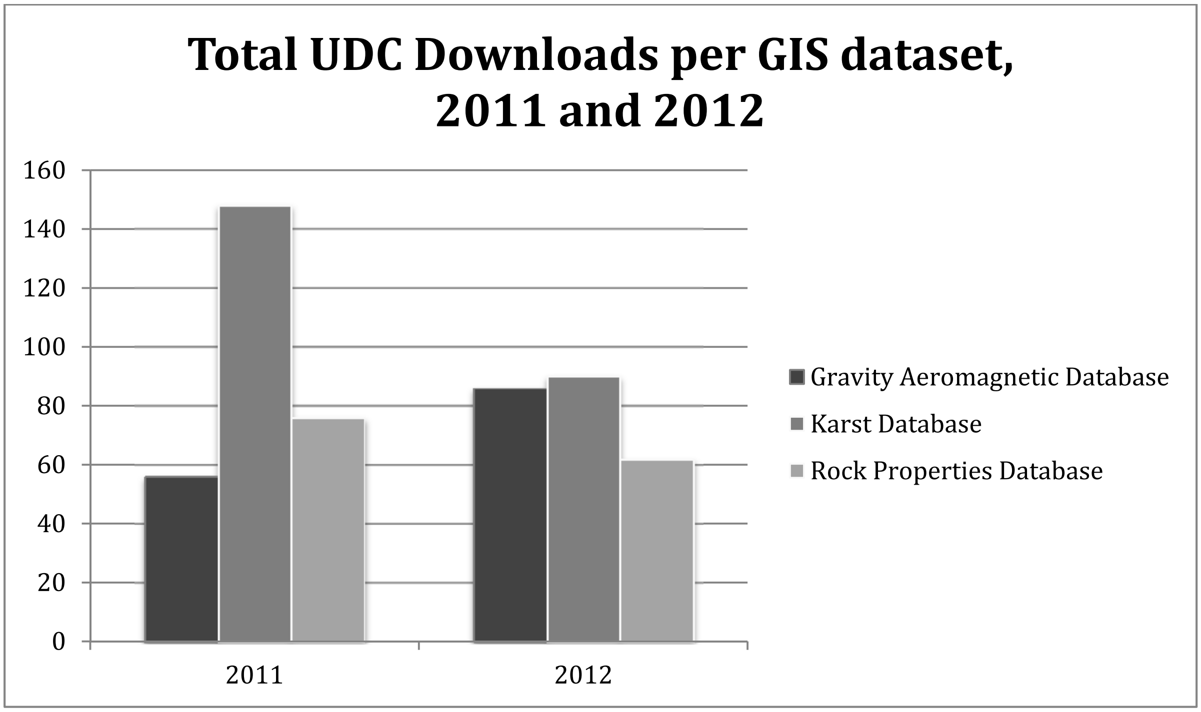


Figure 4: Total UDC downloads for each of the three databases over two years. The June 2012 figures are not included in the totals because site indexers were offline.

Though the MGS has made progress making some data accessible online, there are still many data sets that are not web-enabled, and some are in inaccessible formats. The MGS sees a demand for their data from a variety of sources, including scientists, industry, and many other entities. They are inherently very valuable and the MGS has a mandate to make this information accessible to the public.

Rethinking MGS Collections

Thus far, this challenge has been handled in a piecemeal way, and was somewhat impeded by language. For example, certain data collections can be called "databases" in the sense that data are contained in a series of tables and relationships that can be easily queried and web-enabled. The County Well Index is one of these databases; it describes water well locations, depth of wells, and geological information. It is a database that is important to public health in Minnesota. Since this data sets is crucial to public health, it is online, mapped, and easily accessible, with routine backups and maintenance. This is true for other data sets that are contained in databases; however, some are not even "databases," strictly speaking, but a collection of measurements that cannot be searched, or a series of readings that now only exist in Word documents. Discussions about the MGS's data collections often stumbled over these distinctions, and only served to deepen the complexity of the problem. The impulse to categorize each item in the collection, while common in libraries-based thinking, proved to be an impediment to thinking about the future directions of the MGS data assets as a whole.

We needed to fundamentally rethink how we talk about the MGS collections. It has been useful to focus on the differences between a paper map series, values of rock density at a point in Minnesota, and a drill core, because they needed to be stored and accessed in different ways. When people look at map cases, analog or digital storage media, and large off-site facilities, it is very easy to see the distinctions. However, when the MGS made the decision to put both their publications and data sets in the UDC, they also implied that these two pieces of information were not so different after all.

Rather than thinking about the MGS's information assets by what separates them, the MGS is now thinking about how they want to interact with or use them, and have converged on at least three interactions they eventually want to have with all MGS collections. First, they want to discover items and groups of items in a collection, and the collection should be organized in such a way to facilitate search and discovery. Second, they want to query each of the collections, and even more than one collection at once. Third, they want the collections to be open access, as much as we can, and have as few barriers to the actual information as reasonably possible.

We now think of all MGS collections, including the data, physical samples, and the publications, as databases. This is the most appropriate way to conceptualize them, even if they are not digital or currently organized in a traditional database structure. While this way of thinking is not necessarily new for the Library, which is accustomed to organizing information of disparate formats in structured and searchable ways, this is a significant change for the Survey. By encouraging the MGS staff and data managers to think of all information assets as databases, we can define a vision and a set of goals for those collections that are not yet publically accessible.

A Vision and Plan

Since we want to apply the same discovery and access criteria to all the Survey's information assets, we developed a vision intended to guide future decisions regarding these collections.

<u>Web Service</u>

Every database will be a web service, or have a significant web service component. Users should be able to see, through the MGS website, what databases the Survey maintains, have the capability to manipulate those data through their browser, and download copies of the data for use in research or work. Furthermore, the Survey should project a consistent outward face to their users, so they are not required to learn multiple interfaces to interact with different databases.

Map Interface

MGS databases will be spatial information services. Not only is a map interface appropriate for the type of information the MGS produces, but it provides a more robust search experience for the user.

Standardized

Standards generally enhance the interoperability among systems, and many standards for geoscience information are in development. The MGS would like to carefully evaluate and adopt an appropriate set of geospatial information standards and apply them to its databases. We would like the databases to be open and interoperable, both internally and externally.

Other Considerations

This vision is useful to keep us on track and focused on the big picture, but we are aware of other important considerations we must face as well when proposing any change in the delivery of data services. There are more than those listed here, but these are four of the big questions we are asking ourselves as we move forward.

Audience

We must do a thorough analysis of our users and should consider developing use cases or a data curation profile for MGS databases, such as the ones developed at Purdue University (Brandt and Carlson, 2012). Our goal is to make these databases open to the public, but our discovery services should also be customized to the particular audiences from which we would expect highest use.

Notifications

Currently, there is no way to notify the MGS data service users of updates, unless they receive a direct request for data. Staff can follow up on requests and send notice of updates, but otherwise, users of the web services are, for practical purposes, anonymous. Will we want to notify our users individually of news and updates regarding data services? Will that require tracking our users, or requiring a simple free log-in? Would that create an unwanted barrier? These are questions we will have to answer.

Persistence

Occasionally, an online database will go offline temporarily because of changes to the server. Updates or even moving a file can break the system and send staff looking for the cause of the problem. We will need to think about persistence of these resources far into the future. How should we ensure the stability of our databases, even if the manager retires or the server is upgraded?

Harvesting

Would we want to make our databases available for harvesting? We have to once again think about information system standards and the standardization of our data, but in general, if we would be willing to allow others to mine MGS data for use in other future projects.

PILOT DATABASE AUDIT

We had our grand vision for all MGS databases, but in reality, we knew that the MGS databases we managed by different people and no one staff member at the time had a good sense of what each database contained, how big it was, and even whether they could be accessed. To remedy this, first we took an inventory of all the databases at MGS, and then conducted a pilot audit of three databases.

Inventory

The MGS had conducted an assessment of its data collections in 2009 for the National Geological and Geophysical Data Preservation Program, which gave us a starting point to create an inventory.

Geological databases:

- Water well records (County Well Index)
- Geochronology
- Geological observations
- Geotechnical data
- Hydrogeological data
- Images
- Karst features data
- Mineral exploration files
- Outcrops
- Sediment texture and lithology

Geophysical databases:

- Aeromagnetic data
- Airborne gamma ray spectrometry
- Borehole geophysics index
- Gravity
- Rock Properties
- Seismic soundings

Geochemical databases

- Groundwater geochemical data
- Soil geochemical data
- Till geochemical data

Based on this inventory, we created a complete list of database managers at MGS. For the nineteen databases we identified, there were nine people total listed as managers. We also attempted to prioritize the databases by how well they meet our three goals (online, mapped, and open access). We chose three databases from the inventory based on how well or poorly they meet those criteria: the water well records, gravity databases, and seismic soundings represented three points of that spectrum.

Audit

The water well records, or County Well Index (http://www.health.state.mn.us/divs/eh/cwi/), are available in a stable online resource hosted by the Minnesota Department of Public Health. It can be searched using a map interface. The gravity database is also online (http://mgsweb2.mngs.umn.edu/MGSGravity/), has a map interface, but occasionally experiences downtime after server upgrades. The seismic soundings database is not online and is only accessible by a few at the MGS. The measurements were analyzed with a proprietary product that has limitations on output. One of its primary outputs is a series of Word documents that contain the data. Nothing is georeferenced or mapped, and it is not accessible to the public.

The audit would consist of one interview with the database manager. We would ask a predetermined set of questions chosen to give an overall assessment of a particular database. These questions fall into four broad categories: general information, audience, storage, and anticipated updates.

1. Database name
2. Database content (A general, non-technical description.)
3. Primary contact (Usually the manager.)
4. Who is the intended audience or primary user?
5. How can users access the data?
6. What software requirements are required to view or manipulate the data?
7. Where are the data stored?
8. Total storage (Required by the database, in megabites or gigabites.)
9. Data format
10. Total number of records
11. Date last updated
12. Anticipated update frequency
13. Are the data mapped or georeferenced? (Yes/No)
14. What enhancements will be made to this database when time/money is available?
15. Supplemental question: List of fields in the database

Preliminary Results

We have identified several challenges that lie ahead for this audit and this project in general, from this small pilot audit.

In this small sample of databases, at least five software programs – ESRI ArcMap, Microsoft Access, Excel, Word, Grilla (http://www.tromino.eu/prodsel.asp?cat=3), and an internet browser, are used to manipulate data, and all, except a browser, are proprietary. If we are to web-enable these databases, we may find that only one type of software can read the file, and it does not play well with others.

We have also uncovered information about potential users. Many MGS databases, such as the gravity database, are used by members of the private sector – mineral exploration and mining companies – who do not want us to know they are using our data, or for what purposes. If we do consider putting a system in place to notify users of major database updates, we will need to accommodate this audience.

Finally, we will be able to assess the time requirements and costs of improving these databases based on the recommendations the managers provide, and be able prioritize them with justifications.

FUTURE DIRECTIONS

In the immediate future, we will be completing this audit and begin discussing priorities. MGS recently hired an information technology specialist who will be an invaluable part of this project, and we will be working together with her. She will be able to provide guidance on the technical aspects of this project, and we are grateful for her expertise.

Once the audit is complete, we can develop a concrete plan for upgrading the databases, adopting standards, and finding appropriate information systems to deliver them to the public.

CONCLUSIONS

The UDC publications collection has been a model and guide for thinking about the accessibility of other MGS collections, but we also had to radically change how we think about the Survey's diverse information assets. All MGS collections are now considered databases to be georeferenced and made searchable, and this way of thinking has been critical to our development of a long-term vision. The Library and Survey found that this project is more fertile ground for collaboration, and look forward to the continuation of this project.

References

Brandt, D.S., and Carlson, J., 2012, Data Curation Profiles: http://datacurationprofiles.org/ (accessed February 2013).

Johnston, L., and Thorleifson, H., 2012, Open access geology: Using the institutional repository to host state geological survey publications, *in* Proceedings of the Geoscience Information Society, Geoscience Information Society, Denver, CO.

Minnesota Department of Health, 2008, Minnesota Administrative Rules: https://www.revisor.mn.gov/rules/?id=4725.1851 (accessed February 2013).

Minnesota Geological Survey, 2013, Minnesota Geological Survey: http://www.mngs.umn.edu/index.html (accessed February 2013).

Open Geospatial Consortium, 2013, OGC Vision, Mission, and Goals: http://www.opengeospatial.org/ogc/vision (accessed February 2013).

Thorleifson, H., 2009, Assessment of preservation needs and long-range plan for geologic collections and data in Minnesota. University of Minnesota.

United States Geological Survey, 2013, National Digital Catalog: National Geological and Geophysical Data Preservation Program: http://datapreservation.usgs.gov/catalog.shtml (accessed February 2013).

University of Minnesota, 2009, University of Minnesota Digital Conservancy: http://conservancy.umn.edu/ (accessed February 2013).

Winchell, N.H., 1889, The History of Geological Surveys in Minnesota: Bulletin of the Minnesota Geological and Natural History Survey, v. 1, no. 1.

NATIONAL GEOTHERMAL DATA SYSTEM: STATE GEOLOGICAL SURVEY CONTRIBUTIONS TO DATE

ALLISON, M. Lee, RICHARD, Stephen M., CLARK, Ryan, LOVE, Diane S., PATTEN, Kimberly, COLEMAN, Celia, CAUDILL, Christy, MATTI, Jordan, PAPE, Esty, and MUSIL, Leah

Arizona Geological Survey
416 W. Congress, #100
Tucson, AZ 85701-1381
lee.allison@azgs.az.gov

Abstract - In collaboration with the Association of American State Geologists, the Arizona Geological Survey is leading the effort to bring legacy geothermal data to the U.S. Department of Energy's National Geothermal Data System (NGDS). NGDS is a national, sustainable, distributed, interoperable network of data and service (application) providers entering its final stages of development. Once completed, the geothermal industry, the public, and policy makers will have access to consistent and reliable data, which in turn, reduces the amount of staff time devoted to finding, retrieving, integrating, and verifying information. With easier access to information, the high cost and risk of geothermal power projects, especially exploration drilling, is reduced. This presentation focuses on the scientific and data integration methodology as well as State Geological Survey contributions to date.

The NGDS is built using the U.S. Geoscience Information Network (USGIN) data integration framework to promote interoperability across the Earth sciences community and with other emerging data integration and networking efforts. Data provenance is central to USGIN and focuses on allowing data providers to maintain and house their data rather than submitting it to a central data repository.

After concluding the second year of the project, we have nearly 800 datasets representing over 2 million data points from the state geological surveys. A new AASG specific search catalog based on popular internet search formats enables end users to more easily find and identify geothermal resources in a specific region. Sixteen states, including a consortium of Great Basin states, have initiated new field data collection for submission to the NGDS. The new field data includes data from at least 21 newly drilled thermal gradient holes in previously unexplored areas.

Most of the datasets provided to the NGDS are being portrayed as Open Geospatial Consortium (OGC) Web Map Services (WMS) and Web Feature Services (WFS), meaning that the data is compatible with a variety of visualization software.

REDUCING THE RISK OF GEOTHERMAL DEVELOPMENT THROUGH THE PROVISION OF GEOTHERMAL DATA AND INFORMATION

ANDERSON, Arlene F.
U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy
Geothermal Technologies Program, 1000 Independence Ave
Washington, DC 20585
Arlene.Anderson@ee.doe.gov

Abstract - How will the provision of geothermal and geosciences data and information through a National Geothermal Data System reduce the risk of geothermal development? Deloitte LLP stated that while there have been a series of attempts at, and plans for, organizing existing data on geothermal resources in the U.S. and specifically across the western states, the accuracy, reliability, and general availability of the information remains disjointed, haphazard, or unavailable. The provision of geothermal and geosciences field data can reduce uncertainty and increase investor confidence in geothermal development.

The National Geothermal Data System will supply data to the public through a web application that will encourage investors, developers, researchers, educators, regulators, and interested members of the public to access the information generated from U.S. DOE investments in geothermal research, development and demonstration efforts, as well as other public and private sources of geothermal information.

In it's May 2011 Strategic Plan, DOE states that "...success should be measured not when a project is completed or an experiment concluded, but when scientific and technical information is disseminated. Beyond broad availability of technical reports, e-prints and multimedia, and publication in peer-reviewed journals, open access to experimental data and analysis codes is increasingly important in policy-relevant research areas. The Department will establish guidelines for use with both grants and contracts to ensure appropriate access to, and retention of, scientific data and analysis methods. In more applied areas, knowledge of what did not work can be of equal value with positive results, for that can prevent the misapplication of significant private resources...".

In line with DOE's strategic objectives, DOE's Geothermal Technologies Program is providing access to its geothermal project information through the Geothermal Projects Database and the DOE Geothermal Data Repository (DOE-GDR). The DOE-GDR is intended to be one of many nodes on the National Geothermal Data System currently under development. This paper describes plans for the National Geothermal Data System and the requirements for providing data to DOE's "node" on the National Geothermal Data System.

COMPUTER-BASED TOOLS FOR OPTIMIZING PRESERVATION, ACCESS, AND USABILITY OF GEOLOGICAL COLLECTIONS

TIMM, Sarah
Research and Collections, Virginia Museum of Natural History
21 Starling Avenue
Martinsville, VA 24112
sarah.timm@vmnh.virginia.gov

Abstract - The geological community houses many geological collections in a variety of settings. As geological localities all over the world are being shut down, reclaimed, and exhausted, the consequences of not caring for our geological collections are increasing significantly. If something is not done soon, the geological community as a whole risks the chance of losing these very valuable specimens forever. In response to this demonstrated need the Collections Profiling Guide and the digital record keeping system, EGEMS, were designed to make managing geological collections easier.

INTRODUCTION

For years the accumulation of geological materials in institutional and individual collections has continued without sufficient thought to long-term preservation, access and usability. Now these collections are at a pivotal point: with storage limits being exceeded and limited funding for collections management, geological materials are becoming endangered. If action is not taken to preserve these collections now, then there is great risk of losing them forever.

The Unheard Message

This message, unfortunately, is not new. A decade ago, the Board on Earth Sciences and Resources wrote a book titled "Geoscience Data and Collections: National Resources in Peril". Their message was clear "*Many [geoscience collections] could act as invaluable resources in the future but immediate action is needed if they are to remain available. Housing of and access to geoscience data and collections have become critical issues for industry, federal and state agencies, museums, and universities. Many resources are in imminent danger of being lost through mismanagement, neglect, and disposal*". This message is as true today as it was in 2002, and it raises the question: Why is nothing being done to better preserve geological collections?

Hearing the Message - A New Set of Tools

A potential answer is that the tools required to enable institutions with limited resources to better preserve their collections and the data associated with them have been missing. Especially in universities where over the years collections comprised of thesis samples, synthesized research materials, and teaching collections have grown to overwhelming sizes (Figure 1), the question of long term preservation is becoming a problem.

Figure 1: Photographs depicting disorganization of geological collections in a university setting

Over the past few years I have been working to develop user-friendly tools with the intention of making the management of geological collections easier. Since the first useful tool when beginning any task is a set of instructions, or guidebook, I created the Collections Profiling Guide. It is a step-by-step guide to identifying the most valuable specimens in a collection and determining their appropriate level of care. The guide, however, is only half the solution. Once it is clear where to begin, the question becomes, how best to ensure long term preservation of the collection? Taking into consideration that labels can fade and deteriorate overtime, and given that in many cases storage space is limited and part of the collection may at some point need to be re-located, digitizing the specimen information is the easiest way to ensure it is preserved and ready to be easily transferred. Since no simple program for digitizing geological collections existed I developed a program called EGEMS. EGEMS has a simple, easy-to-use interface, allows for storage of many data types (text, audio, documents, etc) and has a multi-field search to aid users in easily finding information quickly. My hope is that these tools revolutionize the way all geological collections, and the data associated with them, are cared for, resulting in the optimization of their long term preservation, access, and usability.

COLLECTIONS PROFILING GUIDE

Prioritizing care for any collection is vital to ensure its survival. The Collections Profiling Guide was created to help simplify a potentially daunting task and provide tips on how best to care for a geological collection long term. A couple of questions guide the user to identify which areas in the collection should be cared for first thus taking any stress away from the prioritizing process.

The questions are simple (Figure 2), and once answered they provide a clear plan of action for best managing a geological collection. An example is given below of how to use this guide in prioritizing care for a geological collection. In this example the collection is used primarily for classroom demonstration, and it has deteriorating specimens from extinct localities (Figure 3). Given this information the educator can use his/her resources more wisely making conscience decisions to ensure the collection is well cared for.

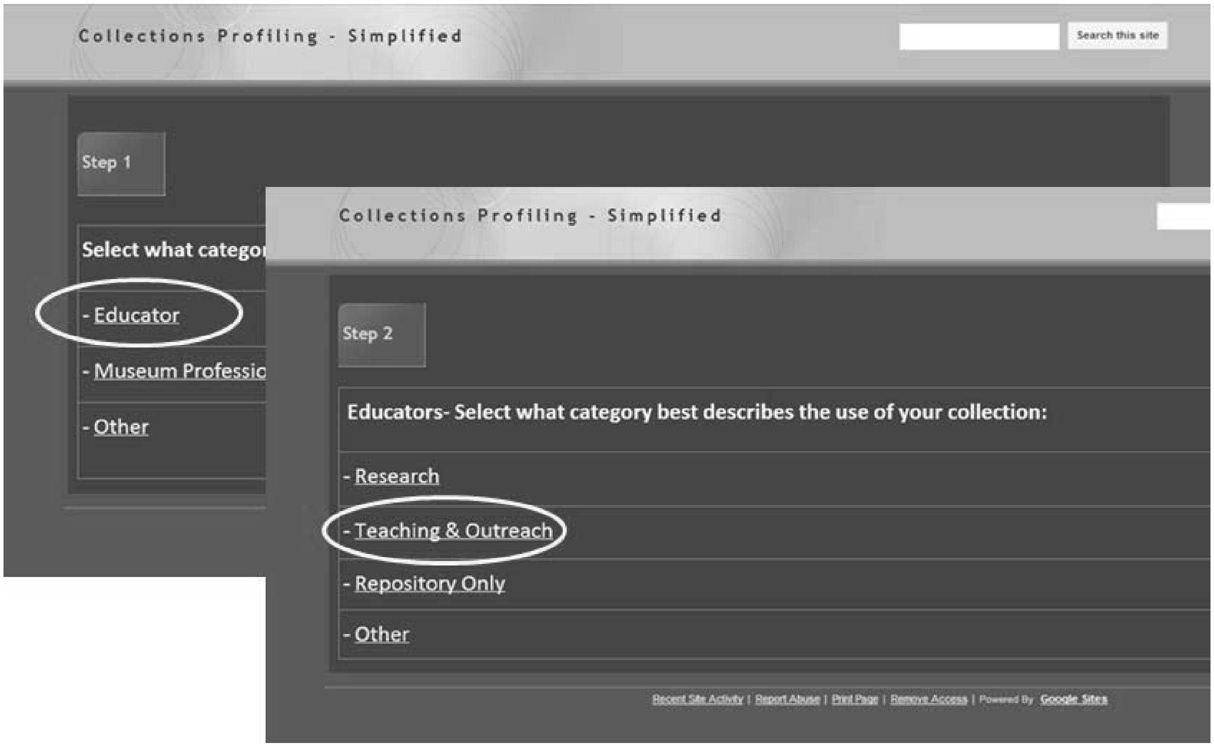


Figure 2: Example steps 1 & 2 of the Collections Profiling Guide

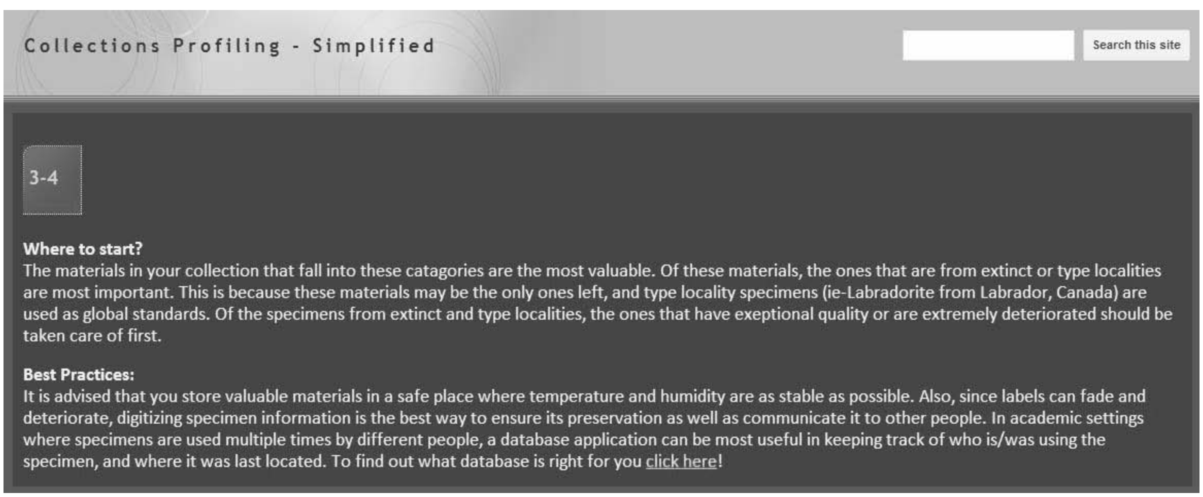


Figure 3: Example step 3 for the Collections Profiling Guide

EGEMS

EGEMS is the first digital record keeping system developed specifically for geological materials. As a result EGEMS has many capabilities that other digital record keeping systems do not. Also, because EGEMS was designed by a geologist familiar with collections management, the system is intuitive and does not require a user-manual. Detailed below are some of the capabilities EGEMS has.

EGEMS has three screens for entering/viewing data so that depending on how much information the user wishes to enter/view at one time they may choose the Full Screen, Quick Screen, or Browse Screen. The Home Screen (figure 4) provides access to all of these screens, as well as a number of "other screens" including the Address Book and a History of Changes. EGEMS also has pre-set accounts created for different levels of security. Depending on which account a user is assigned, there are some screens (such as the Account Screen) and some fields (such as value and location) that may not be accessible. The "full user" account has complete access to all EGEMS offers, including managing account privileges.

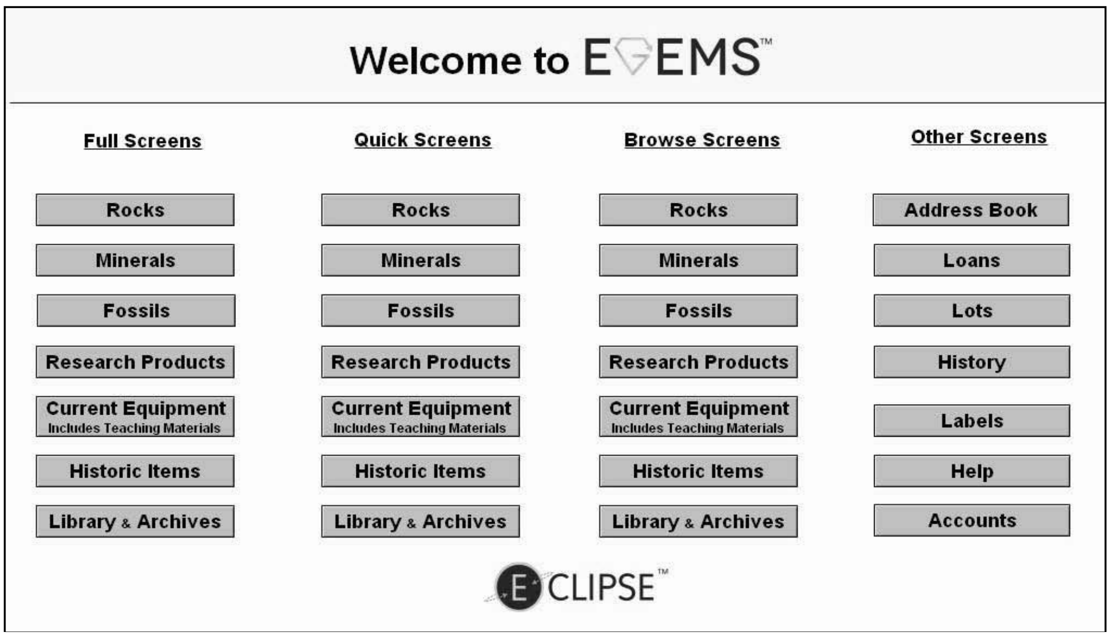


Figure 4: EGEMS Home Screen

In EGEMS the Full Screen (Figure 5) displays all of the information for one record. This information is split across various tabs so as not to overwhelm the user and to guarantee the easiest way of finding information again in the future. Most of the screens also have a navigation bar at the top which allows easy access to the other screen types as well as the home screen, address book, search function, new record button, and the import button. The Full Screen is the only screen with the easy data import button.

If the user already has data digitized they will appreciate the easy data import feature (Figure 6) as there is no need to re-type anything. The import button on the Full Screen will bring the user to an import set-up, and if importing from excel, the column names will conveniently appear so the user can match them to the corresponding fields in EGEMS. Also, after importing their data, EGEMS will automatically go through each of the drop-down menus and update them with any new values as well as delete any duplicate values.

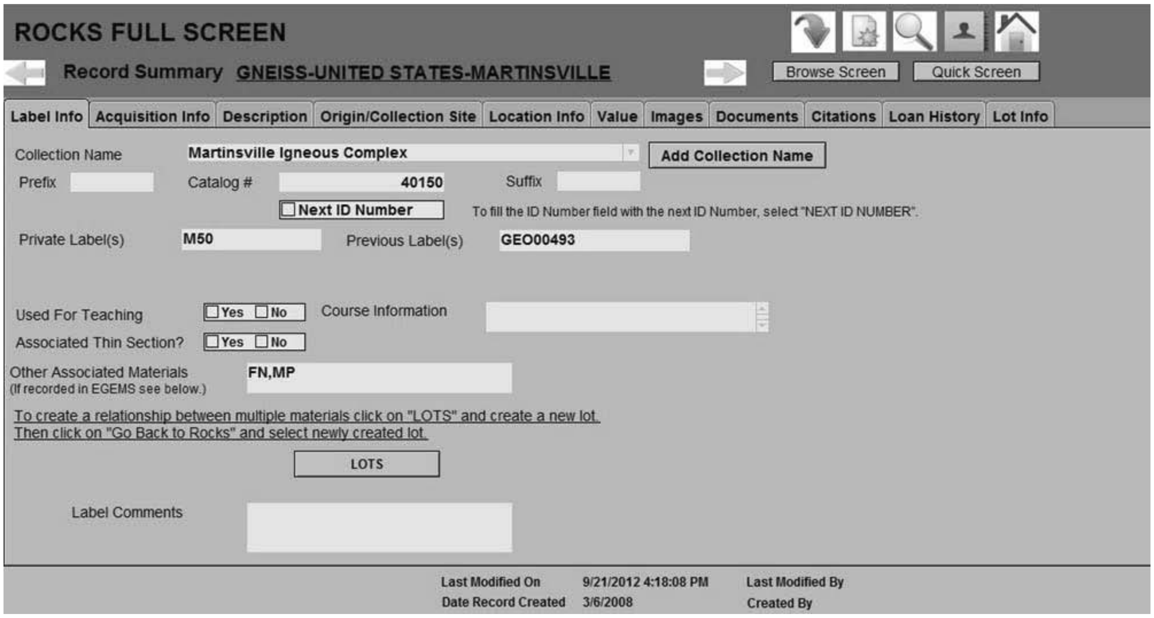


Figure 5: EGEMS Full Screen for Rock Material

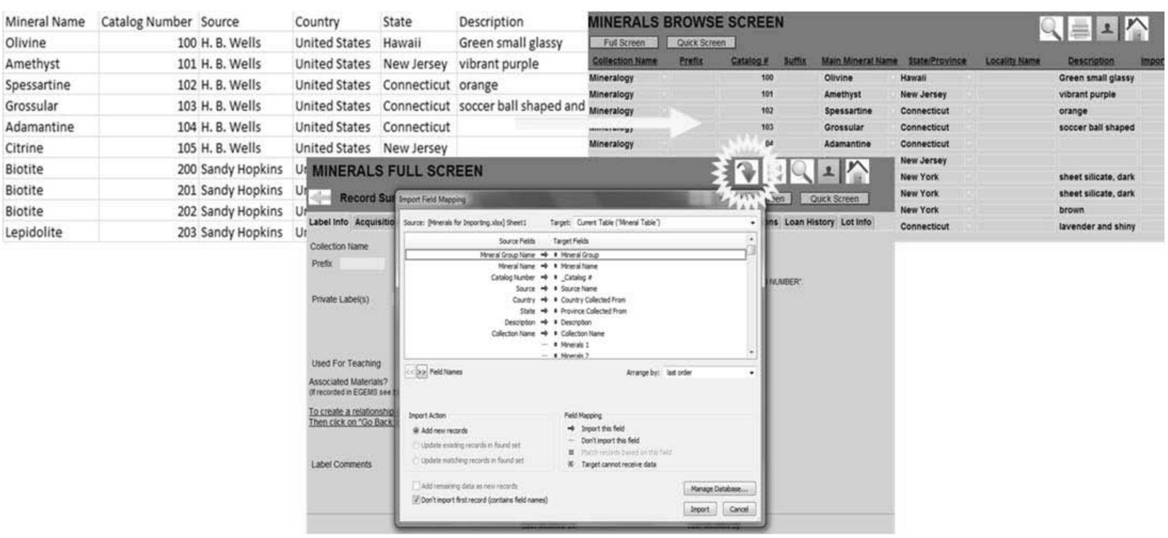


Figure 6: Easy data import button and import example

It is just as simple to export data from EGEMS as it is to import data. This can be extremely useful in providing key statistics to ensure and potentially increase funding. For example, exporting usage data such as the number of loans created per year, from EGEMS into Excel, makes it easy to take tables of numbers and create easy-to-read graphs (Figure 7). EGEMS also allows for exporting in other formats such as pdfs.

Figure 7: Example graph of data exported from EGEMS

The Quick Screen (Figure 8) shows only the essential information associated with a particular specimen. This can be especially useful when entering large amounts of data in a short amount of time. Also, on either the full or quick screen, if the user right clicks, a menu will pop up with an option to “duplicate record.” This is a great feature for a user entering data for similar samples. The “duplicate record” function will create a new record that has all of the same information as the previous record already filled in. Then the user can choose the fields he/she wishes to change.

Figure 8: EGEMS Quick Screen for Rock Material

The Browse Screen (Figure 9) lists all of the records for a particular material. As a result, this is the most ideal place to begin when performing a search. Also, once the user has performed a search on the browse screen, he/she may select the row of the specimen they are interested in and then click on the "Quick Screen" or "Full Screen" to see more information about that particular specimen

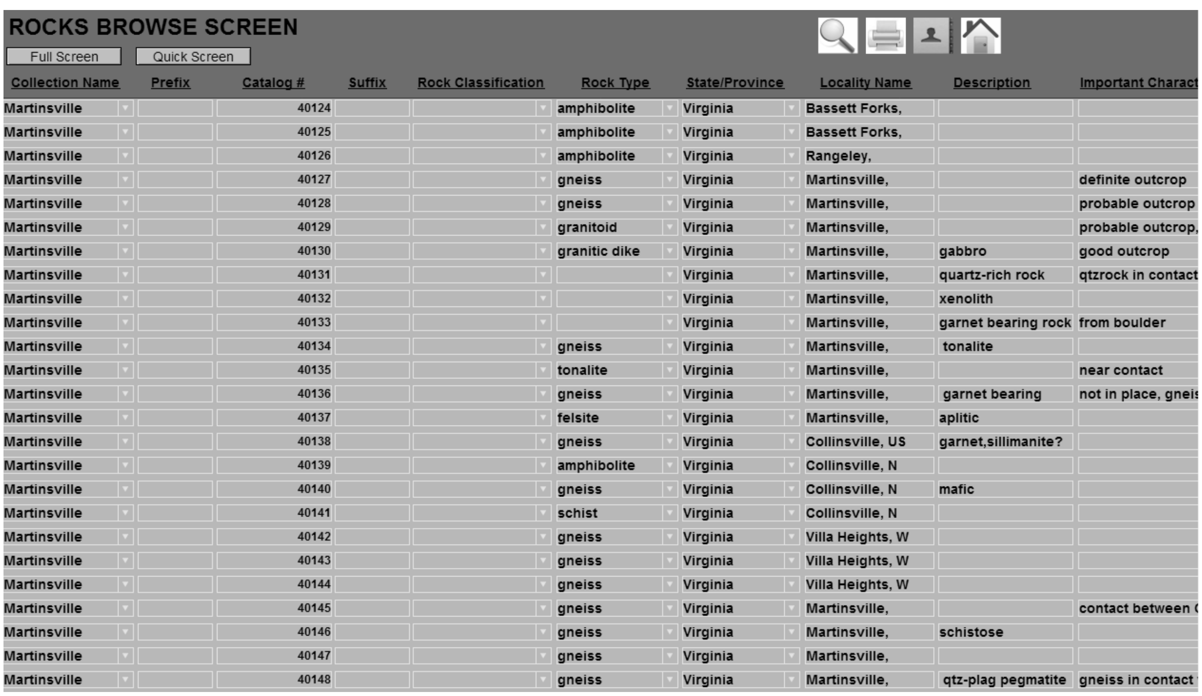


Figure 9: EGEMS Browse Screen for Rock Material

In addition to the more commonly known materials (Rocks, Minerals, Fossils) EGEMS also has the capability to store information for other materials such as Research Products.

Research Products are geological materials that can be used for future research purposes or were derived from pre-existing research projects. Examples include: thin sections (polished or covered), billets, experimental powers, synthesized materials, etc. When information for these are fully filled in they act as a recipe that can be re-created in the future (Figure 10). Most of the fields for Research Products in EGEMS are new to digital record keeping systems everywhere.

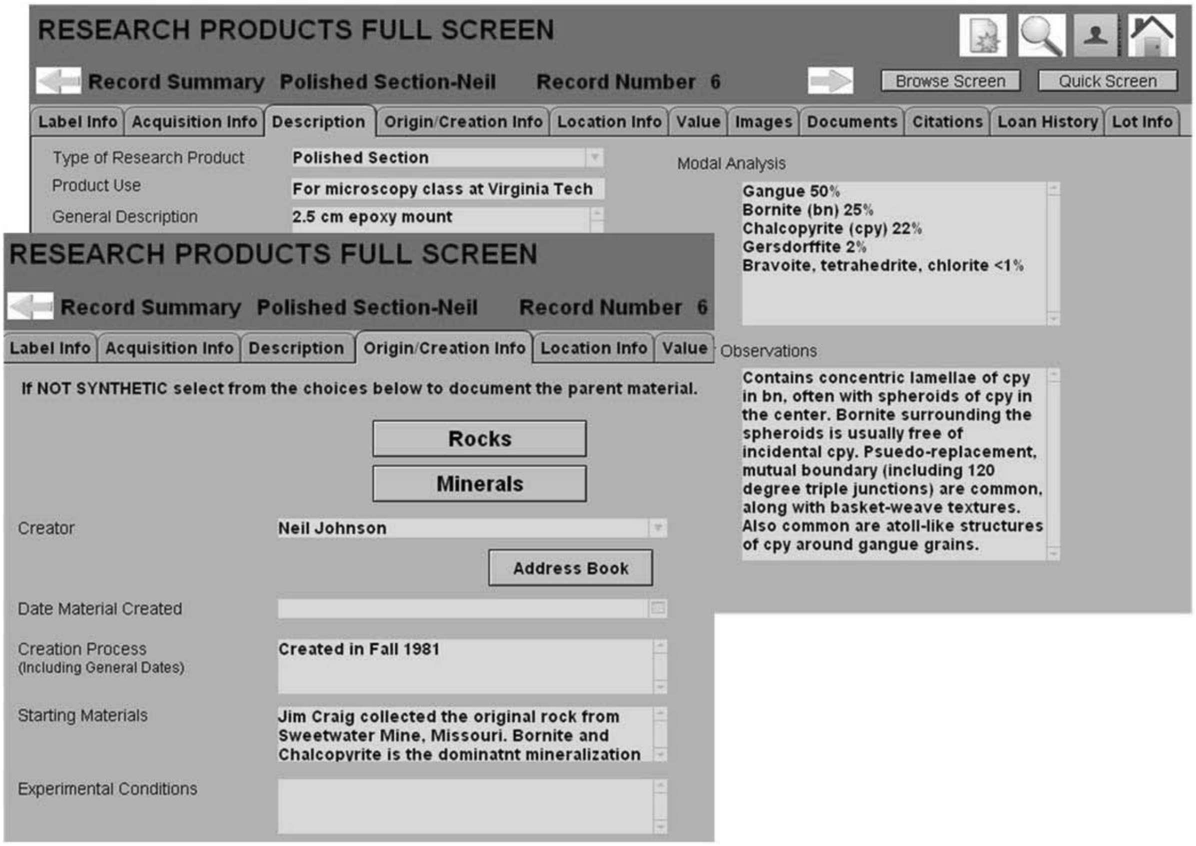


Figure 10: Example record for Research Product Materials in EGEMS

EGEMS also has the ability to store and browse images (Figure 11) and documents (Figure 12). This can aid in communicating to future geologists information such as what a specimen looks like, if any research has previously been done on the specimen, and what publications the specimen is associated with.

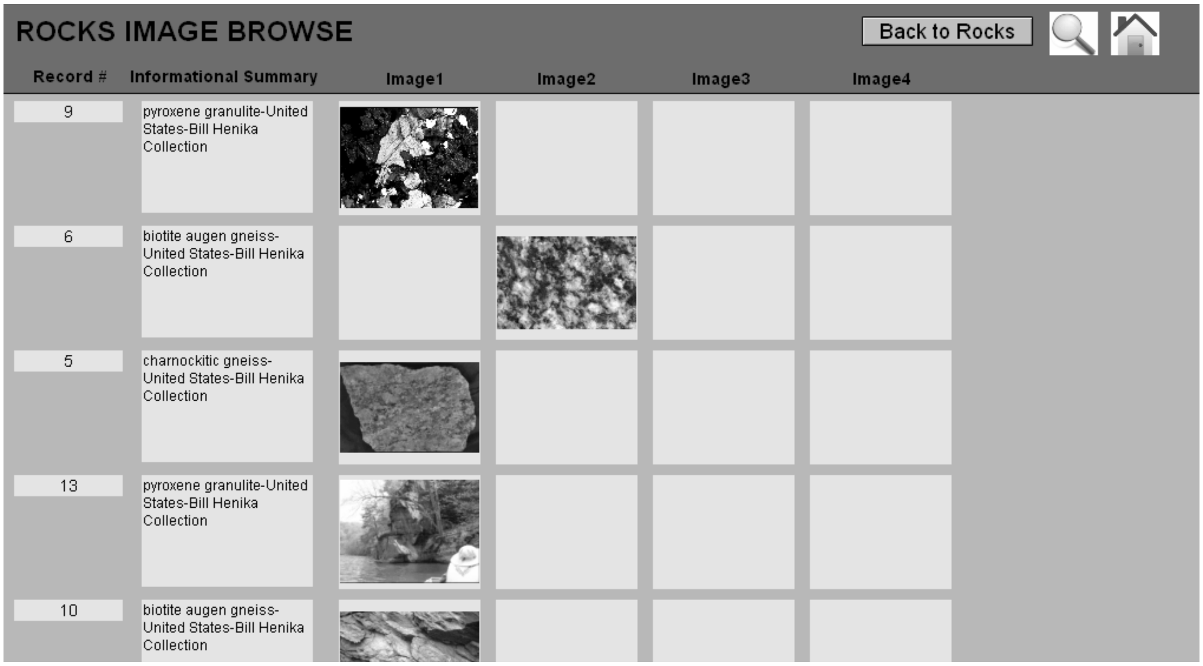


Figure 11: Image Browse for Rock Materials in EGEMS

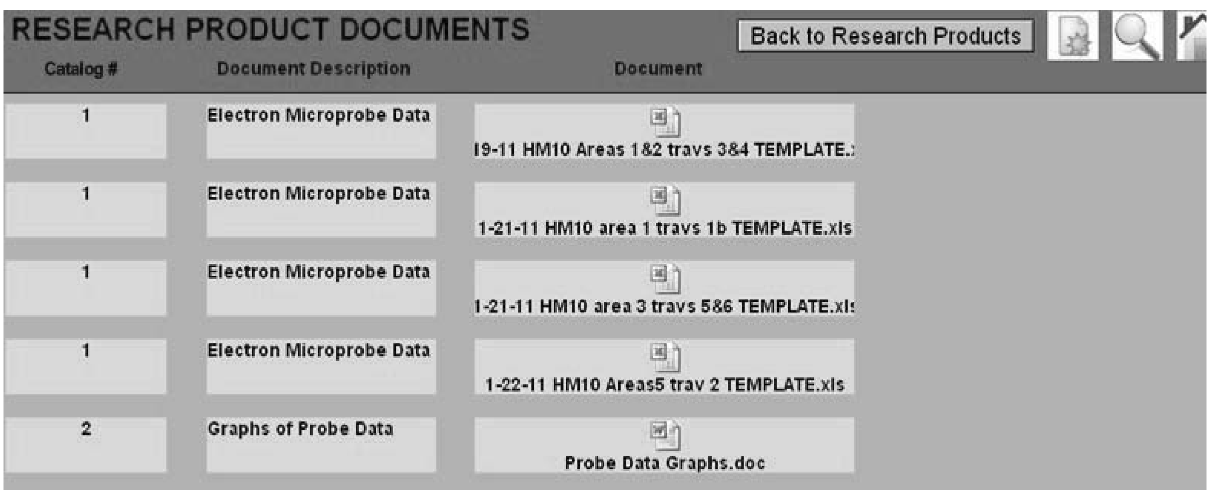


Figure 12: Document Browse for Research Product Materials in EGEMS

In addition to the unique functions mentioned above, EGEMS also has more basic capabilities such as linking GPS coordinates to specimen records, printing tray labels, and storing contact information. The combination of these unique and basic features is what allows EGEMS to meet such a wide variety of needs and since EGEMS was designed specifically for the geological community it has an intuitive user interface that anyone familiar with geological materials should easily be able to use.

CONCLUSION

As access to geological localities becomes more and more restricted, the importance of our collections and the cost of not preserving them increases significantly. If these irreplaceable collections and the data associated with them have any hope of surviving for future research, education, and display, then action is required now. These tools have been designed to make managing geological collections easier, but they can only be effective if the geological community listens and responds to this message.

ACKNOWLEDGEMENTS

I would particularly like to thank the Virginia Tech Department of Geosciences, especially Dr. Bob Tracy and Llyn Sharp for all of their support and everything they have done to help make EGEMS possible. I am also very grateful to the Virginia Museum of Natural History, specifically Dr. Jim Beard and Dr. Alton Dooley for their confidence and encouragement.

REFERENCES

Committee on the Preservation of Geoscience Data and Collections, Committee on Earth Resources, National Research Council. *Geoscience Data and Collections: National Resources in Peril*. Washington, D.C.: National Academies, 2002.

"Product Info." *EGEMS Website*. <http://www.eclipseservices.biz/product_info/index.html>.

Timm, Sarah L. "The Generation and Management of Museum-Centered Geologic Materials and Information." Thesis. Virginia Tech, 2012.

PART 2: Special Topics Paper

OPEN ACCESS PUBLISHING IN THE GEOSCIENCES: CASE STUDY OF THE DEEP CARBON OBSERVATORY

Shaun J. Hardy
DTM-Geophysical Laboratory Library
Carnegie Institution for Science
shardy@ciw.edu

Abstract – Surveys of geoscientists' attitudes toward open access (OA) publishing have indicated strong support for the ideal of making the results of research accessible to the broadest audience possible, free of charge. While self-archiving ("Green OA") is more prevalent in the Earth sciences than in any other scientific discipline, the number of peer-reviewed geoscience papers in fully open access ("Gold OA") journals is only around 7% of the total number published each year. Lack of awareness of OA publishing options available to them may be a hindrance to OA adoption for many geoscientists.

To better understand authors' publishing preferences relative to OA, the present study was conducted on publications by researchers associated with the Deep Carbon Observatory – an international, multi-disciplinary community of geochemists, geophysics, and geobiologists studying the role of carbon in the deep Earth. The results showed minimal adoption of open access by DCO authors to date. Only two Gold OA journals (3.4%) were among the top 58 journals in which they published research during 2005-2012, and those accounted for less than 1% of the papers in the overall study sample. Lists of topically-relevant OA journals, as well as information on subscription-based geoscience journals that offer sponsored access options, were compiled to assist DCO leadership in their stated goal of encouraging participants to make greater use of OA publishing opportunities.

THE CURRENT LANDSCAPE OF OPEN ACCESS

"Open access" (OA) journals are typically understood to mean those that "use a funding model that does not charge readers or their institution for access" and permit users to "read, download, copy, distribute, print, search, or link to the full texts of these articles" (Directory of Open Access Journals, 2013). In their purest form, known as "Gold Open Access," such journals (e.g., *PLoS ONE* and *Biogeosciences*) provide immediate, free access to all of their articles on the publisher's own website. However, Gold OA is only one part of a spectrum of access types that also includes:

> "Delayed Open Access" – Journals that provide free access to articles after a certain embargo period (typically 6-12 months) has passed; newer articles require a subscription. Examples include *Proceedings of the National Academy of Sciences* and *Astrophysical Journal*.
>
> "Hybrid Open Access" – Journals that provide free access to only certain articles, usually based on the author paying an optional OA processing fee.

Such “sponsored article” arrangements go by various names such as Author Choice, Author Select, and Open Choice. Many commercial and society publishers offer this option. (See Table 3.)

“Green Open Access” – Journals that permit authors to post versions of their articles for free access on personal/institutional websites, in institutional repositories, or in disciplinary repositories (e.g., arXiv, PubMed Central) at the time of publication. Such self-archived versions are typically *preprints* (manuscripts prior to refereeing) but may also be *postprints* (final drafts after refereeing) or even the publisher’s final PDFs.

More than 8280 “free, full text, quality controlled” OA journals were being published worldwide as of October 2012, according to the *Directory of Open Access Journals*. Some six hundred OA titles are numbered among the 12,000 “high impact” journals currently indexed by the Web of Science. Scholarly societies play a significant role in the OA landscape. At the end of 2011, 530 scholarly societies were publishing 616 full-text OA journals – 78% in science, technology, and medicine (Suber, 2011). By September 2012 the tally had topped 600 societies and 700 journals (Suber, 2012). For the past decade, OA publishing has been growing at an astonishing annual rate of 18% in the number of OA journals and 30% in the number of published articles (Laakso et al., 2011).

OPEN ACCESS PUBLISHING IN THE GEOSCIENCES

Overview

While the biological and biomedical sciences have been strongly identified with the establishment and proliferation of the open access movement, the role of OA in the geosciences is significant.

As of October 2012, the *Directory of Open Access Journals* listed some 579 journals in its “Earth and Environmental Sciences” category, representing around 7% of the eight thousand total titles reported. (This category includes geography, oceanography, and meteorology.) The primary bibliographic database for the geosciences, GeoRef, currently indexes around 180 OA journals and series among the ~3000 titles it covers. To merit inclusion in GeoRef, OA journals must “appear to provide stable open-access to current issues, have multiple issues available for use, and appear to plan to continue to be available in an open manner” (American Geosciences Institute, 2013).

Björk et al. (2010) found that 20% of the peer-reviewed scientific literature published in 2008 was openly accessible on the web: 8.5% on publishers’ sites and 11.9% as full-text versions in repositories and on personal and departmental websites. However, their results revealed significant differences between fields (Figure 1). Of all the major disciplines represented, the Earth sciences had the highest percentage (33%) of articles freely available on the web. (Chemistry and chemical engineering had the lowest, at 19%.) Much of the share of open access geoscience literature consisted of self-archived publications in Green OA repositories (25.9%). Only 7.0% of the papers were in Gold OA journals.

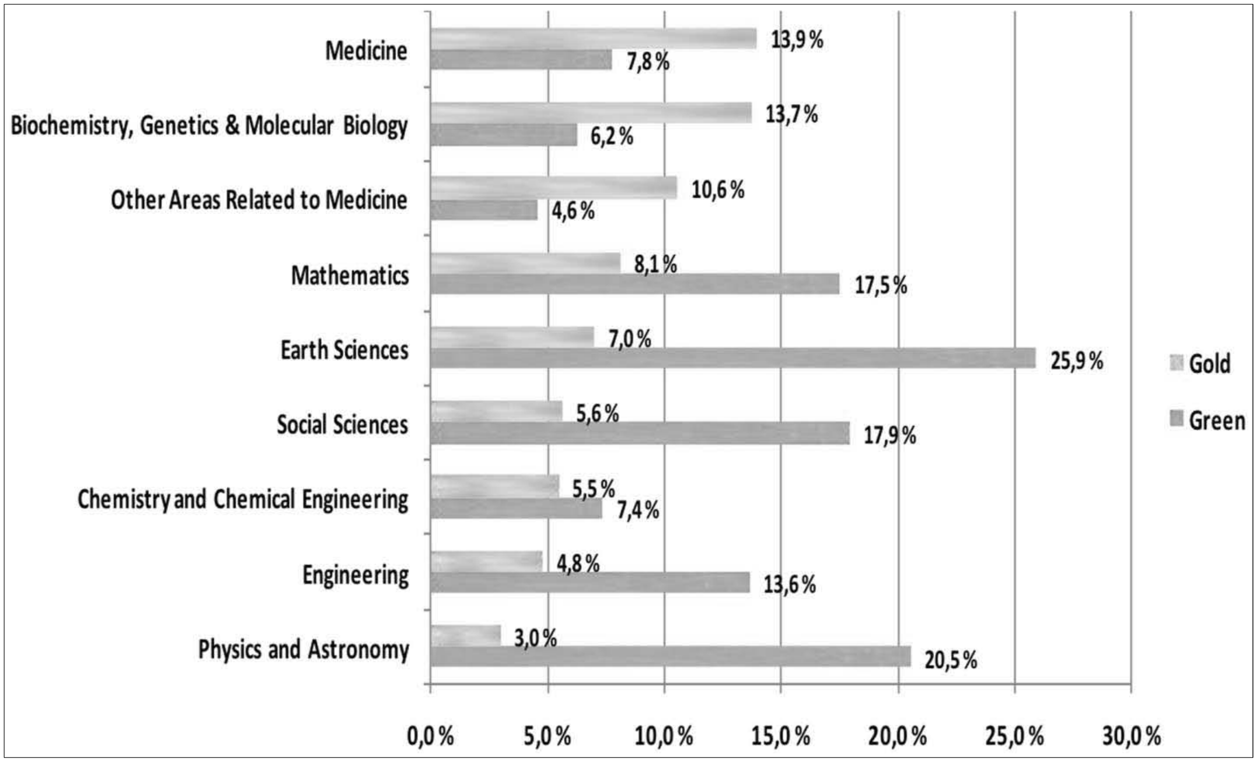


Figure 1. Percentage of 2008 peer-reviewed articles that were openly accessible in 2009, by discipline (from Björk et al., 2010).

Geoscientists' Attitudes Toward Open Access

The European Commission-sponsored "Study of Open-Access Publishing" (SOAP) surveyed 1.5 million researchers in 2010 (Dallmeier-Tiessen et al., 2011). One of the primary goals of SOAP was to better understand researchers' attitudes toward OA and their experiences with it. Of the 38,358 respondents who had published at least one peer-reviewed journal article in the past five years, 1485 were earth scientists (3.9% of the total). 90% of these geoscientists – and 89% of the respondents overall – considered open access publishing to be beneficial for their research fields. 53% of the respondents reported having published at least one OA article. Yet overall, only around 10% of research papers are being published in OA journals today.

To try to understand this disconnect between researchers' support of OA publishing in principle and the modest share of the literature actually represented by OA, SOAP collected data on specific reasons why respondents decided *not* to publish in OA journals. The top barriers cited by geoscientists were lack of funding (38%) and the perception that OA journals in the field were not of good quality or lacked impact factors (32%). While these two factors dominated the responses in all fields, strong disciplinary differences were evident: among astronomers and space scientists, journal quality was the dominant concern (49%), while in the biological sciences lack of funding (59%) topped the list.

CASE STUDY: DEEP CARBON OBSERVATORY

Study Rationale

To gain additional insight into the OA publishing practices of geoscientists, the present study was undertaken among participants in the Deep Carbon Observatory (DCO) – a ten-year, international, multi-disciplinary project initiated in 2009 with funding from the Alfred P. Sloan Foundation. The mission of DCO is to transform our understanding of the role of carbon on Earth, particularly in the deep interior, which may hold 90% of the planet's total carbon inventory. DCO investigations focus on the chemical, biological, and physical properties of carbon; where it is found; and how it affects life on Earth. More than 500 researchers in 20+ countries are currently participating in DCO initiatives, which are organized into four research "directorates": Reservoirs and Fluxes; Deep Life; Deep Energy; and Extreme Physics and Chemistry.

Ready access to DCO leadership (its secretariat is headquartered in my building at the Carnegie Institution in Washington, DC), their express interest in open access publishing, and the international character of its research community made DCO a desirable case study. From its inception, DCO has made an explicit commitment to open access:

> "DCO scientists should make every effort to publish in online open access journals such as the Public Library of Science (PLoS) and other open access avenues so that DCO research results are accessible to the broadest scientific audience possible, including scientists from countries where access to paid journal subscriptions is limited. Publishing in such journals committed to making scientific literature available as a public resource allows users to download, print, or reuse individual articles and collections with proper attribution." (Hickox, Crist, and Collins, 2012, p. 53.)

To understand where deep carbon research is being published, and the extent to which DCO scientists have already opted for open access, the journal articles of members of the "scientific steering committee" of each directorate were analyzed. Each committee consists of 10-11 researchers who are recognized authorities in their fields and who have extensive publishing records. Using Web of Science, each author's publications for 2005-2012 were tallied and the journals containing them ranked by frequency. The start of the study period predates the inception of DCO by several years, but was chosen to provide a sample of at least ~300 papers per directorate.

Results

The top 25 journals for each directorate are listed in Table 1. Considerable differences between directorates in the distribution of “core” journals are evident. In Reservoirs and Fluxes (geochemistry, volcanology, mineralogy, and petrology), just six journals garnered nearly half (47%) of the total papers in the sample. Similar results are seen in Extreme Physics and Chemistry (mineral physics, materials science, and physical chemistry), where eight journals hold 48% of the papers. In contrast, the more biologically-oriented literature of the Deep Life directorate (microbiology, biochemistry, biophysics, and biogeochemistry) is less centralized: all 25 titles listed still account for just 55% of the total articles published during the study period. Deep Energy (hydrocarbons, fuels, carbon cycle) represents an intermediate case.

The number of OA journals identified in the sample was surprisingly small. No Gold OA titles were among the top ten journals in any directorate, and only three Delayed OA titles turned up (Figure 2). In fact, the entire list of 58 journals that garnered at least 1% of the articles within any directorate contained only two Gold OA journals (*Biogeosciences* and *Geochemical Transactions*) and five Delayed OA ones *(Applied and Environmental Microbiology, Astrophysical Journal, Biophysical Journal, Journal of Bacteriology,* and *Proceedings of the National Academy of Sciences)*. The Gold OA journals contained 12 articles, representing just 0.8% of the papers in the total study sample.

	Reservoirs and Fluxes	Deep Life	Deep Energy	Physics & Chemistry
1	Earth Planet. Sci. Lett.	Appl. Environ. Microbiol.	Geochim. Cosmochim. Acta	Phys. Rev. B
2	Geochim. Cosmochim. Acta	Biophys. J.	Earth Planet. Sci. Lett.	Phys. Rev. Lett.
3	Am. Mineral.	Environ. Microbiol.	Int. J. Syst. Evol. Microbiol.	Earth Planet. Sci. Lett.
4	Chem. Geol.	Geochim. Cosmochim. Acta	Chem. Geol.	J. Chem. Phys.
5	Contrib. Mineral. Petrol.	Org. Geochem.	G-Cubed	Am. Mineral.
6	J. Petrol.	PNAS	Geology	J. Phys. Chem. B
7	G-Cubed	Geomicrobiol. J.	J. Phys. Chem. C	Appl. Phys. Lett.
8	J. Volcanol. Geotherm. Res.	ISME J.	Science	J. Phys. Condens. Matter
9	Science	ChemPhysChem	Environ. Microbiol.	PNAS
10	Geology	J. Phys. Chem. B	FEMS Microbiol. Ecol.	High Pressure Res.
	JGR - Solid Earth		PNAS	
	Nature			

Figure 2. Top ten journals in each DCO directorate. Delayed open access titles are highlighted. (Two of the lists contain more than ten titles due to ranking ties.)

The situation with Hybrid OA was quite different. All but five of the 58 journals in Table 1 offer some form of “sponsored” open access via payment of optional article processing fees. It is not known how many of the individual articles in the sample were actually sponsored through this method, as article-level analysis was beyond the scope of the present study. Anecdotal evidence gathered through personal communication with authors suggests that number is minimal. Broad-based studies indicate that overall uptake among major hybrid journals is small, with only 1%-2% of articles being sponsored (Björk and Solomon, 2012).

Advocating for Open Access

At the invitation of DCO leadership, a "primer" on scholarly open access was prepared for distribution to the DCO research community. The goal was two-fold: to foster understanding among researchers of what OA is and how it works; and to make potential authors aware of publishing options (e.g., Gold OA journals) they might not have considered previously. The results of this study indicate that most of DCO's research output is currently published in traditional, subscription-based journals. To realize the organization's stated goal of supporting OA, DCO authors can either continue to publish in their preferred journals (many of which offer sponsored access, as discussed below) and pay the associated article processing charges; opt to publish new work in fully open access journals (though again, most require payment of article fees); or exercise their rights to self-archive, where permitted, in a systematic way.

Since perceived lack of quality was found by the 2010 SOAP study to be one of the major obstacles to OA adoption by geoscientists, only journals that were peer-reviewed, international in scope, and from reputable publishers with established track records were included in the list of OA titles compiled for DCO consideration (Table 2). Impact factors were included, when available, in order to demonstrate that many OA journals fare well against subscription-based competitors. Article processing fees were also tabulated and found to vary widely, from $31/page to $3000/article. The list is not intended to be exhaustive, but represents a selection relevant to DCO's core focus on geophysics, geochemistry, geobiology, and energy. Hybrid journals are well represented in the offerings of geoscience and related publishers (Table 3).

As in the case of fully open access journals, article processing fees in the hybrid journals investigated spanned an enormous range – from a low of around $250/page to a high of $5000/article. A recent innovation by some of these publishers has been the introduction of "membership" plans that offer discounts on article processing charges to authors in organizations that prepay flat, annual fees. Examples include the Royal Society's Membership Programme and Liebert's Author Advocacy Program.

Green OA provides opportunities for authors to post their works online, typically in institutional or subject repositories. Wirth (2009) reviewed both the advantages and caveats connected with self-archiving and identified useful resources for "green" authors. While still small, the number of discipline-based repositories in Earth and planetary sciences is growing. Only 28 such repositories existed worldwide in early 2010 (Wirth, 2009). As of March 2013, the *Directory of Open Access Repositories* listed 45.

ROLES FOR GEOSCIENCE LIBRARIANS

Geoscience librarians can play important roles in the OA movement in the areas of education, assessment, and advocacy. Librarians can debunk persistent myths ("OA is free", "OA has no peer review", etc.) and point authors to valuable sources of information on institutional deposit mandates (e.g., ROARMAP), funding agency requirements (SHERPA/JULIET), and self-archiving policies (SHERPA/RoMEO) – all particularly important in a discipline like the geosciences whose literature already has a considerable Green OA component. They can provide recommendations on OA titles, costs, and impact metrics as shown here, as well as cautionary advice on "predatory" publishers (Beall, 2013). Many librarians are already working with institutional repositories; advocating for stronger deposit policies and making users aware of relevant disciplinary repositories are natural extensions.

Emerging OA funding models are providing librarians with new opportunities for engagement in outreach and administration. More than two dozen university libraries in North America have already established special open access publishing funds to support authors' article processing fees as a means of encouraging publication in OA journals (SPARC, 2013). Developing policies for implementation and management of these funds and helping authors make well-informed use of them draws on expertise that librarians can provide. Participation in large-scale consortial initiatives like SCOAP3, which aims to facilitate open access to peer-reviewed articles in high-energy physics through re-engineering the funding model of the discipline's core journals, is yet another way to contribute professionally.

CONCLUSIONS

The discrepancy between geoscientists' supportive attitude toward open access in principle and their actual choices on where to publish their work is evidenced by the example of the Deep Carbon Observatory. This apparent disconnect provides meaningful opportunities for geoscience librarians to engage authors in dialogue about open access. While limited in scope, the sample considered here provides useful insights into the current locus of published deep carbon research and may be a reasonable indicator of the publishing choices of the DCO community (geochemists, geophysicists, and geobiologists) at large. It is hoped that through education and advocacy efforts considerably more DCO scientists will choose to submit papers to OA journals or at least actively self-archive them. Geoscience librarians can play a significant role in influencing geoscientists' understanding of OA publishing and the new options it presents to them.

ACKNOWLEDGEMENTS

I thank Louise Deis, Princeton University Library, for her assistance in compiling the impact factors reported here, and many colleagues who provided valuable feedback on this presentation at the 2012 GSIS Professional Issues Forum. I also thank Dr. Craig Schiffries, DCO Director, for useful discussions and for having suggested this study.

REFERENCES

American Geosciences Institute, 2013, GeoRef: Open-access journals/series: http://www.agiweb.org/georef/about/openaccess.html (accessed March 3, 2013).

Beall, J., 2013, Beall's list: Potential, possible, or probable predatory scholarly open-access publishers: http://scholarlyoa.com/publishers/ (accessed March 3, 2013).

Björk, B.-C., and Solomon, D., 2012, Open access versus subscription journals: a comparison of scientific impact: BMC Medicine, v. 10, 73, doi:10.1186/1741-7015-10-73.

Björk, B.-C., et al., 2010, Open access to the scientific journal literature: situation 2009: PLoS ONE, v. 5(6), e11273, doi:10.1371/journal.pone.0011273.

Dallmeier-Tiessen, S., et al., 2011, Highlights from the SOAP project survey. What scientists think about open access publishing: http://arxiv.org/abs/1101.5260 (accessed March 3, 2013).

Deep Carbon Observatory, http://deepcarbon.net (accessed March 3, 2013).

Directory of Open Access Journals, http://www.doaj.org/ (accessed March 3, 2013).

Hickox, S., Crist, D., and Collins, T., 2012, Deep Carbon Observatory: Recommendations for a comprehensive scientific community and public engagement plan, revised June 2012.

Laakso, M., et al., 2011, The development of open access journal publishing from 1993 to 2009: PLoS ONE, v. 6(6), e20961, doi:10.1371/journal.pone.0020961.

Mary Ann Liebert, Inc., 2013, Liebert Author Advocacy Program: http://www.authoradvocacy.com/ (accessed March 3, 2013).

OpenDOAR, the Directory of Open Access Repositories, http://www.opendoar.org/ (accessed March 3, 2013).

Royal Society Publishing, 2013, Royal Society membership programme: http://royalsocietypublishing.org/site/librarians/membership.xhtml (accessed March 3, 2013).

SCOAP3, Sponsoring Consortium for Open Access Publishing in Particle Physics, http://scoap3.org/ (accessed March 3, 2013).

SPARC, 2013, Campus-based open-access publishing funds: http://www.arl.org/sparc/openaccess/funds/ (accessed March 3, 2013).

Suber, P., 2011, Open access journals from society publishers: SPARC Open Access Newsletter, no. 162, December 2, 2011, http://legacy.earlham.edu/~peters/fos/newsletter/12-02-11.htm#societies.

Suber, P., 2012, Tectonic movements toward OA in the UK and Europe: SPARC Open Access Newsletter, no. 165, September 2, 2012, http://legacy.earlham.edu/~peters/fos/newsletter/09-02-12.htm#uk-ec.

Wirth, A. A., 2009, Open access opportunities in the geosciences: "Green OA": Geoscience Information Society Proceedings, v. 40, p. 96-101.

PART 3: GSIS Meeting Supplemental Materials

2012 Annual Meeting
Charlotte, North Carolina

November 5-9, 2012

Sch**edule**
Geoscience Information Society Annual Meeting
Charlotte, NC

Saturday, November 3, 2012		
Time	**Session**	**Location**
9:15AM –4:45 PM	Geoscience Librarianship 101 Pre-registration required–e-mail: cpmcleod@wustl.edu	Atkins Library, University of North Carolina – Charlotte Room1500
1:30 PM – 4:30 PM	GSIS Executive Board Meeting	Hyatt House (meet in Lobby)
5:00 –7:00 PM	Early Bird No-Host Dinner & Newcomers Meet-n-Greet	Carolina Ale House 201 South College Street, Suite 100 Charlotte, NC 28244

Sunday, November 4, 2012		
Time	**Session**	**Location**
9:00 AM -12:00 PM	GSIS Business Meeting	Westin, Harris Room, 2nd Floor
12:15-1:15 PM	GSA Presidential Address & Awards Ceremony	Convention Center
2:00 –6:30 PM	Exhibits Open	Convention Center

Monday, November 5		
Time	**Session**	**Location**
12:15-1:15 PM	GSA Awards Ceremony	Convention Center 201AB
1:30 -3:30 PM	GSIS Professional Issues Roundtable Discussion sponsored by the Geological Society of London	Westin, Kings Room, 2nd Floor

Tuesday, November 6		
Time	**Session**	**Location**
8:00 AM - Noon	GSIS Technical Session sponsored by Elsevier	Convention Center
12:00 Noon – 1:30 PM	GSIS Luncheon (Ticketed Event)	Westin, Tryon Room, 2nd Floor
1:30-3:30 PM	GSIS Information Resources/Vendor Update	Westin, Providence Ballroom 3 (1st Floor)
6:00 -9:00 PM	GSIS / GSA Geoinformatics Division Joint Reception & GSIS Awards	Westin, Independence Room, 2nd Floor

Geoscience Information Society 2012
Annual Business Meeting

Sunday November 4, 2012, 9:00-12:00 pm
Westin Harris Room, Charlotte, NC

Agenda

Attendees: Lisa Johnson, Cynthia Prosser, Bonnie Swoger, Kay Johnson, John Hunter, Jody Foote, Dorothy McGarry, Claren Kidd, Carolyn Rauber, Lura Joseph, Amanda Bielskas, April Love, Rusty Kimball, Robert Tolliver, Linda Musser, Clara McLeod, Paula Rucinski, Dona Mary Dirlam, Dena Fracolli Hanson, Lisa Dunn, Carol La Russa, Andrea Twiss-Brooks, Suzanne Larsen, Shaun Hardy, Richard Huffine, Kate Dagherty, Kevin Lindstrom, Michael Noga (28)

I. Call to order (Lisa Johnston) 9:17

II. Introduction of Executive Board

a. President (Lisa Johnston)
b. Vice President , President-Elect (2012), Linda Zellmer
c. Vice-President, President-Elect (2013), Amanda Bielskas
d. Secretary and Secretary Elect, Cynthia Prosser
e. Treasurer, Angelique Jenks-Brown
f. Immediate Past-President, Kay Johnson
g. Newsletter Editor, Bonnie Swoger
h. Publications Manager, Richard Huffine

III. Welcome and General Introductions (Lisa Johnston)

a. GSIS booth is at Booth 604
b. There is a signup sheet to volunteer at booth

IV. Approval of the Agenda - approved

V. Approval of the Annual Business Meeting Minutes 2011 (October 9, 2011)

a. John Hunter - moved
b. Rusty Kimball - seconded
c. Approval by the membership

VI. Reports

a. GSIS general (Lisa Johnston)
    a. Quarterly schedule newsletter: March, June, September, December
    b. Transitioning the website to Courtney Hoffner, the newsletter to Bonnie Swoger, and Publications to Richard Huffine
    c. Thank you to Amanda Bielskas for serving and planning for Denver
    d. Thank you to Cynthia Prosser for continuing as Secretary.
    e. Implementation of PayPal – thank you to Rusty Kimball.

        IV. It is linked off the Membership page of the website
    f. A new way to archive our digital materials – Wiki, closed secure place to post and keep documents, minutes, notes, etc.
        IV. Anne Huber and Rusty Kimball working on it.
        V. Rusty has agreed to chair committee.

b. Financial (Angelique Jenks-Brown)
    a. Financial balance is currently up.
    b. The report may be viewed in the 2012 Newsletter.

c. 2012 conference (Linda Zellmer)
    a. VP tries to do fundraising
    b. 5 sponsors this year – Elsevier, GIA(thank you for breakfast), GSW, AAPG, Geological Society of London. Thanks to All!
    c. Our program ends Tues night with Awards Ceremony/Reception with GeoInformatics
    d. No formal field trip this year.
    e. Unofficial field trip to Reed Gold Mine on Wednesday – Kay Johnson

d. Archives (Anne Huber sent a note to Bonnie Swoger that there was no report)

e. Awards Certificates (Lisa Johnston)

f. Exhibits (Dona)
    a. Poster in memoriam for 6 geolibraians that have been affiliated with GSIS
    b. Issues with physical set up and take down of the display – possibly create a Facebook page explaining how to do it.
    c. Signup sheet for volunteers to work in the Booth is in the Booth.
    d. Getting many questions regarding what is GSIS all about – this year's display will hopefully address those types of questions.

g. Membership (Cynthia Prosser filling in)
    a. The Membership Committee is working on updating the GSIS Information Brochure, with the goal of having it ready for the meeting in Charlotte. We are also planning on a face-to-face meeting in Charlotte.
    b. GeoLiterary Society lurk on the listserv
    c. GSA in Vancouver in 2014
    d. Do we have funds for international sponsorship – refer to the International Initiatives Committee

h. Best Paper Award (Carol La Russa sent report)

a. Lisa Johnson – Open Access Geology: Using the Institutional Repository to Host State Geological Survey Publications. The paper will be published in volume 41 of the Proceedings of the Geoscience Information Society and was based on a paper given at the 2010 meeting of the Society.
b. Thank you to the committee: Carol La Russa, Chair, Lisa Adamo, John Hunter, Michael Noga, Cynthia Prosser, Nancy Sprague.

i. Guidebooks (Erin Palmer)
    a. Mickelson, D. M., Maher, L. J., & Simpson, S. L. (2011). *Geology of the Ice Age National Scenic Trail*. Madison: The University of Wisconsin Press. The Guidebook is available in both paper and ebook formats and can be ordered from The University of Wisconsin Press: http://uwpress.wisc.edu/books/4650.htm.
    b. Linda Musser will be giving the award this year
    c. The Geology of the Ice Age – University of Wisconsin Press
    d. Neither the authors nor the publisher is at the meeting
    e. Thank you to the committee: Erin Palmer, Chair, Amanda Bielskas, Jody Foote, Lura Joseph, April Love, Linda Musser, Thelma Thompson, Louise Zipp

j. Nominating (Kay's report)
    a. Jan Heagy again instrumental in this year's process.
    b. Used electronic balloting for the second year and all was successful.

k. Best Reference Work Award (No chair)
    a. Yeats, R. S. (2012). *Active faults of the world*. Cambridge: Cambridge University Press.
    b. Thank you to the committee: Michael Noga, Acting Chair, John Hunter, John Kawula, Diane Taylor Harding.

l. Information Resources (no chair)

m. Preservation (no chair)

n. Distinguished Service Award (Patricia's report)
    a. No award given this year
    b. Patricia is stepping down this year, so we will need a new Chair.

o. International Initiatives (no chair)
    a. Maxine is on sabbatical this year
    b. Contact Dorothy McGarry if interested in working on this committee

p. Best Website (Robert Tolliver)

    a. SERC Science Education Resource Center at Carleton College: http://serc.carleton.edu/index.html
    b. Bob Tolliver, Chair, John Kawula, Connie Manson and Bonnie Swoger.
    c. The Awards are posted in the booth and then the winners may take the announcement home with you after the meeting
    d. Thank you to the Committee: Bob Tolliver, Chair, John Kawula, Connie Manson, Bonnie Swoger.

q. Auditor (Miriam Kennard)
    a. Everything in order

r. Geonet Moderator (Louise Deis)
    a. There has been a bit of spam getting through, and even though some of it was rather offensive, I haven't deemed it necessary to try to filter all contributions to Geonet. We can filter out certain domains or addresses, and have done so.
    b. Geonet archives on a Princeton computer has existed since April 28, 2011. Currently, we have access to the months from March, 2012 to date. The University is expecting to migrate to a better listserv program in the near future. They have had to move all older archives to another computer to better response time, but I have asked that ours be restored. The earlier Geonet archives can be found from this link at Purdue: https://lists.purdue.edu/mailman/listinfo/geonet

s. GSIS Newsletter Editor (Bonnie Swoger)
    a. Some bumps in the transition but things are working out.
    b. Moved this year to a quarterly format: March, June, September, December
    c. Please send reports and info to Bonnie for inclusion in the Newsletter.
        IV. You get to keep copyright for what you submit, we are just asking for permission to distribute it in the newsletter
        V. Any news of happenings at your library let Bonnie know for inclusion
        VI. Perspectives on information in the Geoscience universe such as the AGU/Wiley package/offering
        VII. When submitting a picture, give Bonnie the details of what the picture is about, who is in it, etc.
    d. Working with Lori Tschirhart to increase number of reviews in the newsletter
    e. GSW put out their Mobile app – a review is in the newsletter

f. Linda Zellmer did try to get Wiley to come to the Information Resources Session but unfortunately it didn't work out – the session is filled with our sponsors.
g. Submittals due by December 1st for the December newsletter
h. The current distribution model is individual copy sent to members.
i. Contact Bonnie at: swoger@geneseo.edu

t. GSIS Newsletter Reviews Editor (Lori Tschirhart)

u. Publications Manager (Ellie Clement -2012, Richard Huffine -)
   a. Thank you Ellie.
   b. 2010 is done put not out
   c. 2011 is almost done and soon will be out
   d. 2010/2011 single pub or do separate volume? Discuss in New Business
      IV. Do you see any issues with binding them together?
   e. Soon close the books on 2010 and 2011
   f. Try and get 2012 out a efficiently as possible
   g. Communicate with the participants about what is expected and needed to produce the proceedings
   h. Ask those that should get a copy if they really want a copy or do they want to opt out
   i. The money is already budgeted regardless of decision
   j. Cataloging the 2 together would be a problem for cataloging

v. Publicity Officer (Adonna Fleming)
   a. Announcements went out over various listservs for the Awards and GEO101.

w. Webmaster (Courtney Hoffner)
   a. Potentially getting email accounts for the Society.
   b. Considering a dedicated email connected to the position for continuity across changing officers and chairs.
   c. Lisa Johnson working with Courtney to see what is involved.

x. GSA Topical Session Convener (Robert Tolliver)
   a. Tuesday Morning, 8 AM, Session no. 142
   b. T80: Geoscience Information: Investing in the Future
   c. Several specific to Library data management and museums
   d. Did not have enough submissions for the poster session to make.

y. Geoscience Librarianship 101 (Clara McLeod)
   a. Held at University of North Carolina, Charlotte – Alison Bradley

b. Instructors – Linda Zellmer, Amanda Bielskas, Hanna Winkler, Megan Sapp Nelson – was not able to come due to a new family member arrival. Her section presented by with Megan's slides
c. 9 attendees
d. Certificate given this year – Jan Heagy designed them.
e. Looking into ways to get the information out to those who are unable to attend
    IV. Maybe put the content on a CD and sell it to those who cannot come
f. Interested in someone taking on the role for announcing and getting the word out
g. Targeting list-serves
h. Lura Joseph – Thank you to Clara for all her hard work.
i. Can we get Auraria again for next year in Denver? Lisa Dunn will contact the appropriate people and try to get it.

z. GSIS participation in AGI Member Society Council
    a. AGI Harriet Wallace Scholarship Selection Committee, Mary Scott 2012-2014 – Harriet was Mary's first mentor.
    b. AGI is managing the award.
    c. It is for a woman getting a PhD in geology.

aa. CUAC (Clara McLeod or Linda Musser)
    a. Still pulling the minutes together
    b. Minutes posted on the website
    c. Saw a preview the new geologic map catalog
    d. Review the catalog for choice (Linda Zellmer)
    e. Fdc – data archiving org by the people of LOC open to anyone. contact Linda if interested in serving

bb. Other Representation at Meetings?

cc. GSA publications (Michael Noga)
    a. scanning all their monographs back to the beginning

dd. GEOREF advisory council (Richard Huffine)
    a. Working with Bonnie Swoger to get the report to the newsletter on a regular basis
    b. GSIS is well represented
    c. If you have input contact Richard
    d. GeoLex references are not all in GeoRef – only things that are in the earth sciences are in GeoRef, i.e. AGU doesn't have all their content in GeoRef because some of their content is not considered earth sciences

ee. Let Lura Joseph know if you have a guide book added to your collection ff. USGS still accepts guidebooks into their collection

gg. Send in the guidebooks

hh. Central Canada guidebook repository? USGS would be happy to have any

IV. Old Business

V. New Business

a. Publications and the GSIS Proceedings (Richard Huffine)
    i. Is there a guidebook for the Publications Manager – if so, I would like to see it
    ii. Come to a strategic decision for handling it
    iii. How do we treat the proceedings as
    iv. This is a resource that has a history and a future.
    v. What do you want to do with it – do we want to go digital
    vi. There are a couple of different models
    vii. Initially starting this in an Institutional Repository
    viii. Make pdf available in an Institutional Repository – anything we put there will be available, some are even journalized services, indexed in GeoRef, 1 home for it, we can set up it up to work, need to find someone to host, cost would be minimal under this model, work with creators to set up the appropriate flow – needs to be more than just a host space but has to have a journal service on top of it. PLOS is an example. Must be able to resolve to a doi and ISSN.
    ix. GSW – talked with Highwire press. Happy to speak with Richard. GSW would need to be approved to be added.
    x. Option 2 – open access model, the world can view without a fee, GSW does not have an Open Access journal , so we would the first, Highwire has priced this out, not management of subscriptions, submit the info in a regular manner, have to commit to 2000 forward, upfront cost $2800, possible that the society has the resources, digitize and load, fee every year for access $6000
    xi. Option 3 – we enter in GSW as a publisher, we will be participating in the revenue sharing, annual commitment $600, we would be a small shareholder in GSW, we could pay more if we wanted enhancements, giving access to only subscribers, not open access, available to all GSW subscribers, members only link for member access, and we can continue sell individual copies or outside GSW
    xii. Option 4 – go directly to a publisher to arrange a platform, we would have to manage that
    xiii. Suzanne Larsen – we should do what we can to make it OA, perhaps stopping the print copy all together
    xiv. Amanda Bielskas we have a IR with OJS –we need to talk
    xv. The society is currently losing money on the Proceedings

xvi. Lisa Dunn – OA, can we put it on our website and can Google find it as a pdf, consider the cheap and stupid (easy?, non-fancy?) solutions.
xvii. Our research is important and will continue to be.
xviii. Should we consider ourselves as a monographic series?
xix. Michael Noga:
   1. A card for Charlotte going around.
   2. Can see abstracts in GSW?
   3. Would love to see the time sensitive papers put up rapidly.
xx. Lisa Johnson:
   1. Now sending the paper in after the conference.
   2. Require or suggest that the papers be submitted before the conference?
xxi. Linda – what is our liability regarding platform upgrades, could we be assessed for further funds for upgrades in the future?
xxii. Lisa Dunn – Highwire does do this.
xxiii. What if GSW leaves Highwire?
xxiv. Linda Musser – in support of OA, do we have it not only for the proceedings but try to make it more of a regular journal.
xxv. Lura Joseph – what if you need a peer review article to count, is there a way to make it peer review?
xxvi. Andrea Twiss-Brooks: Do a hybrid? Have both peer review and not peer review in it.
xxvii. Overall sense in the room
   1. Whatever we do, we do want it OA,
   2. Like blended model of both peer review & not peer review.
   3. Could go monographic,
   4. Have it citable in a consistent way,
   5. Will be indexed in GeoRef
xxviii. GeoRef does capture doi and url, but that info can be stripped out by the provider (e.g. EBSCO, ProQuest, etc.)
xxix. Lisa Dunn – Are we assuming that it will no longer be it in print?
xxx. Richard – Place it in a print on demand service, but it would no longer be paid for by GSIS for a print copy
xxxi. We need to commit to a digital copy. Whether to continue print is a different question.
xxxii. Lisa Dunn – We do not have the resources to do both without raising membership fees.
xxxiii. Suzanne Larsen – just say we are going digital, include color and include links within the paper
xxxiv. Richard is more than willing to shepherd us through this process
xxxv. The Board will let the membership know what is happening. What decisions are being made, etc.

b. Update on Ansari Award
   i. Lisa Johnson read the report – ask Lisa for it

ii. Is there a similar balance associated with the other awards?
iii. Both of the awards are in separate accounts
iv. A similar report was sent to Mary Ansari, but without the logistical questions.
v. We should give her the opportunity to extend the award.
vi. Suggestion to keep the name but let others donate to fund.
vii. Suzanne Larsen – agree, formal statement about the award to her from the president, don't take money out of the award funds for the admin, keep her name on it
viii. Linda Musser – generally agree – I'm not convinced that her name needs to stay on the award, especially if others can donate to it, if someone endows an award that would be different.
ix. Richard Huffine – Executive Board create an award committee, with sub committees. Would like to look at the awards at a higher level, addressing them at a policy level, it is an important part of what we do, and come up with some criteria to honor folks
x. Suzanne Larsen – the money awards – there are 2, they are the 2 Ansari awards
xi. Concerns were raised about having an award sponsored by a company – general agreement among those here.
xii. There is a need for someone to monitor the gifts we receive and the awards – donor relations
xiii. Carolyn Robert - Is there another way to honor a donor without necessarily naming the award for them? And to continue to honor them even if they are no longer funding it.
xiv. Michael Noga – make a motion for the board to find someone to fill this position. Including managing the certificates.
xv. Richard Huffine – consider a finance committee to handle and look at, managing the finances, looking at conference costs, and helping to determine the cost in various cities.
xvi. Lisa Dunn – the treasurer is supposed to monitor the finances.

c. GSIS Wiki and digital archives (Bonnie Swoger/Lisa Johnson)
    i. Piloting PBWiki to organize our documents
    ii. Example – Technical convener collects the copyrights and deposits them in the Wiki, so that the convener does not have to keep it forever.
    iii. Bonnie Swoger is currently managing it.
    iv. Members page
    v. Newsletters open to all? – should we start to use the newsletter as a vehicle to let people know what we are doing and as outreach? It is a benefit to membership. Thoughts on making it OA on the website?
    vi. Shaun Hardy – supports OA but with an embargo –too many disincentives to join GSIS.

vii. Kay Johnson – the same argument made about the Proceedings last year.
viii. Lisa Dunn – quick survey on what is the greatest value to membership, greatest benefit, etc.
ix. Richard Huffine – some organizations you must be a member to be on the listserv and the newsletter is more blog on the website.
x. Lisa Johnson – like the idea of closing the listserv, continuing the discussion.

d. 2013 GSA Conference (Amanda)
i. Next Year - In Denver, October 27 – 30, 2013.
ii. Like Amanda know if you have any suggestions.
iii. 125th Anniversary of GSA

VI. Other items – The passing of the gavel

VII. Adjourn – we are adjourned.

VIII. Reports

Membership
Cynthia L. Prosser, GSIS Secretary &Membership Committee Acting Chair
The Membership Committee is working on updating the GSIS Information Brochure, with the goal of having it ready for the meeting in Charlotte. We are also planning on a face-to-face meeting in Charlotte. The 2012 Membership Directory was produced this summer and sent to the membership in August. It has continued to be updated as several more memberships have been received since Labor Day.

Best Paper Award Committee
Carol J. La Russa (Chair); Lisa Adamo; John Hunter; Michael Noga; Cynthia Prosser
The GSIS Best Paper Award Committee completed its selection process and chose Lisa Johnston's and Harvey Thorleifson's article titled "Open Access Geology: Using the Institutional Repository to Host State Geological Survey Publications" for this year's Best Paper Award. The paper will be published in volume 41 of the Proceedings of the Geoscience Information Society and was based on a paper given at the 2010 meeting of the Society.

Nominating
By Kay Johnson, Chair, GSIS Nominating Committee
The committee of Jan Heagy, Kay Johnson, and Dena Hanson were successful in soliciting nominations and holding the election. This is the second year GSIS distributed an electronic ballot; thanks to Jan for distributing and tallying the ballot. The membership voted in Amanda Bielskas, Columbia University, as the new GSIS Vice President/President Elect and Cynthia Prosser, University of Georgia, for another term as GSIS Secretary. Congratulations to both winners! Thank you to the

committee for all of your hard work, to the nominees for their willingness to service GSIS as officers, and to the membership for exercising their voting privilege. Congratulations, Amanda and Cynthia!

Best Paper Reference Work Award Committee
Michael Noga; Dianne Taylor-Harding; John Hunter
The Mary B. Ansari Best Reference Work Award committee is pleased to announce the winner of the Best Reference Award 2012:
"Active Faults of the World" by Robert Yeats
http://www.amazon.com/Active-Faults-World-Robert-Yeats/dp/0521190851

Distinguished Service Award
Patricia Yocum, Chair
The Mary B. Ansari Distinguished Service Award was established in 2005 to recognize and honor significant contributions to the geoscience information profession. Since its inception the award has been underwritten by a $5,000 bequest from Mrs. Ansari and has been given to seven individuals. Each year GSIS has publicized the award and the recipient's accomplishments in the library and geoscience communities.

Award recipients have been selected through nominations and subsequent consideration by the GSIS Distinguished Service Award Committee. This year, 2012, marks a hiatus in selecting a recipient while effort was invested in reconstructing the award's history, collecting documents and crafting a detailed procedural packet to aid the work of future committees. A set of pertinent questions stemming from the work has been forwarded to the Executive Board for consideration. The next award is anticipated to be next made in 2013.

Best Website Award Committee
Bob Tolliver (Chair); John Kawula; Connie Manson; Bonnie Swoger
The Geoscience Information Society Website Committee has selected the Science Education Resource Center (SERC) at Carleton College as the recipient of the 2012 Best Geoscience Website Award. SERC's website provides access to resources for improving education in the geosciences and other areas of science and technology. There website can be found at: http://serc.carleton.edu/index.html

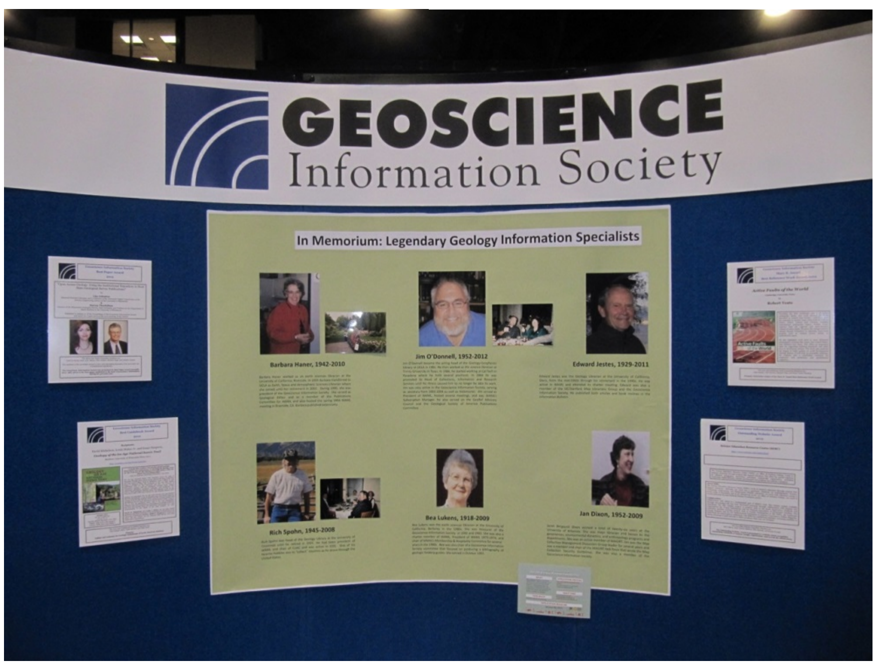
Best Guidebook Award: David M. Mickelson, Louis J. Maher Jr., and Susan L. Simpson, for Geology of the Ice Age National Scenic Trail, University of Wisconsin Press, 2011. (no one was present to accept)

Linda Zellmer (L) received the gavel from Lisa Johnston®

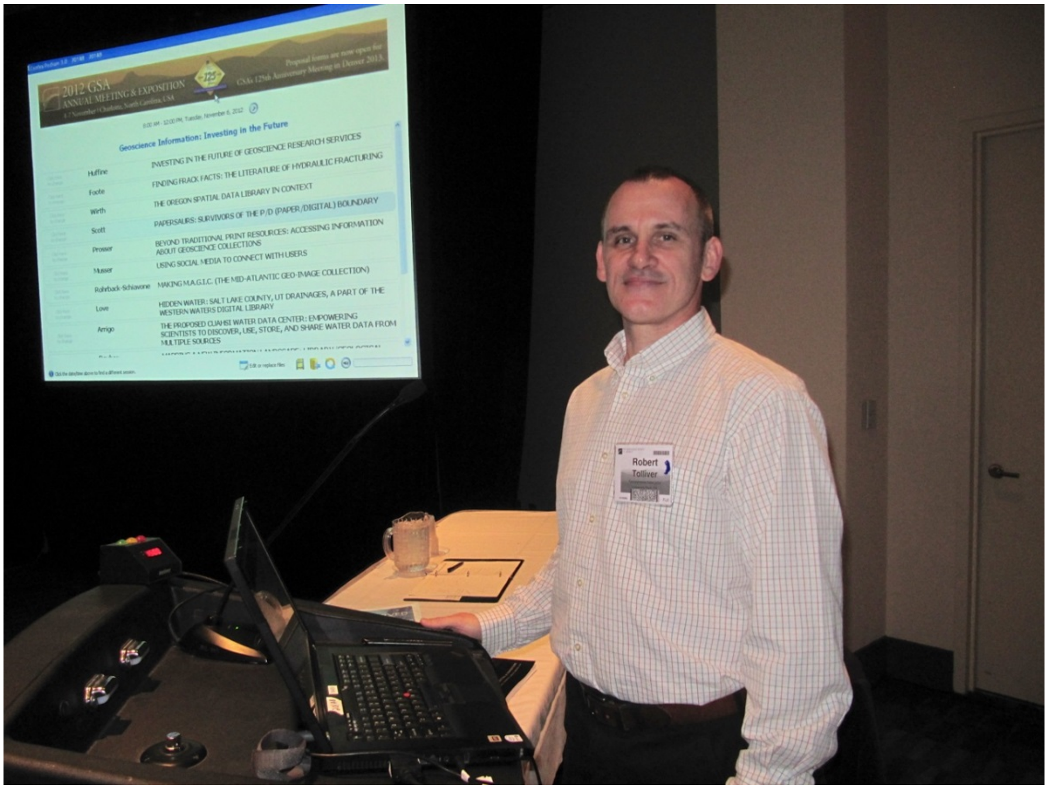
The 2013 Executive Committee. Front row (L to R): Amanda Bielskas, Richard Huffine, Kay Johnson. Back Row (L to R): Cynthia Prosser, Lisa Johnston, Linda Zellmer, Bonnie Swogger.

:John Hunter at the GSIS Booth

(L to R): Jody Foote,. Lisa Dunn, Suzanne Larses and Kay Johnson working the Exhibit Hall



The 2012 GSIS Booth: A tribute to past members.



Technical Session; Robert Tolliver

Clara McLeod (L) thanks Geoscience Librarianship 101 instructor Linda Zellmer (R)

Geoscience Librarianship 101 presenters were honored at the luncheon – (L to R):Hannah Winkler, Amanda Bielskas, Linda Zellmer, Andrea Twiss-Brooks, Lura Joseph, Clara McLeod, and Shaun Hardy

Clara McLeod (R) thanks Geoscience Librarianship 101 instructor Lura Joseph (L)

Lisa Johnsron (L) and Michael Noga (R) announce the winner of the Ansari Best Reference Work Award

Lisa Johnston (L) accepts the Best Paper Award from Carol LaRussa (R)

Robert Tolliver (L) presents the Best Website Award to Cathryn Manduca (R)

Clara McLeod (R) thanks Geoscience Librarianship 101 instructor Lisa Johnston (L)

April Love (L) and Jody Foote (R) announce the winner of the Best Guidebook Award.

Clara McLeod (R) thanks Geoscience Librarianship 101 instructor Andrea Twiss-Brooks (L)

AUTHOR INDEX