

An Introduction To Geoscience Education Resources on the Internet

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Abstract

There is an abundance of material on the Internet which is of potential interest to individuals involved in higher education in the Geosciences. The challenge is in how to make judicious use of the material and how to help develop this skill for students. Experiments conducted during the fall semester, 1994, lead to the conclusion that structured assignments are preferred rather than Internet "surfing".

Key Words: Internet, Geoscience Education

"The challenge of using the Internet effectively is not in finding information. The challenge is in finding information that you are interested in while avoiding the rest." (Newby, 1994, p. 1).

"This enormous flow of information (and junk) is an opportunity and a challenge; namely, how do you drink from a fire hose?" (Treloar, 1993, p. 1).

[This paper was published in **Computers and Geosciences** (Vol. 21, No. 6, pp. 817-824) as a part of the Special Issue on the Internet. The author has modified the original paper to take advantage of its "on-line" format. Double clicking on blue text will take the reader to the indicated WWW resource and red links lead to sections in this text. Changes (enclosed in []) were made to the original paper only in the few cases in which references were no longer available on the Internet or where the inclusion of new Internet resources seemed desirable; only nine of the Internet resources were not available some 15 months after the paper was submitted for publication. A **world wide web version** of this paper is also available.]

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Preface

During the past three months (July, August and September, 1994) the author has grappled with how to incorporate "Information Technology" (IT)/ "Internet Resources" (IR) into the **Department of Geosciences** curriculum at the University of Houston in general and into a graduate level course in Geological Analysis in particular. The same general searching for "the best way to take advantage of something new" accompanied the university's purchase of a Univac 1108 in the early 1970s and the relatively rapid evolution and widespread availability of micro computers in the mid 1980s.

The first event resulted in a few new computer users among the faculty. As pertinent mainframe software became available (in particular that published by the Kansas Geological Survey) several faculty who had not used the computer developed a twinge of interest. Often, however, this itch was satisfied by asking one of their colleagues to "obtain, modify, and run" the software for them. Many students, however, quickly expressed an interest in at least becoming aware of how computer programming skills could help them with their research projects. The author's version of Geological Analysis, in fact, was introduced in 1972 in response to student demand for access to campus mainframe resources.

The second event resulted in a definite change in the computer literacy of the faculty (many of whom had lived through the first event at the University of Houston). Most of the faculty now use computers for the more mechanical aspects of their day-to-day activities; word processing, reference list databases, etc. We have noticed (as have many organizations) the decline in the need for secretarial help (primarily for typing manuscripts, proposals, and class materials) and have been able to redirect staff salaries into other positions. All of our faculty and staff use e-mail as the Geosciences Department has chosen it as the preferred vehicle for dissemination of information. The rate of incorporation of the "Technology" part of "Information Technology" into our classrooms, however, lags behind the increase in personal use of computers. In part this reflects the fact that the majority of our faculty do not make major use of these technologies in their own research activities and the reality that the campus infrastructure for disseminating knowledge, hardware, software, and training is quite modest.

While not a futurist, the author has convinced himself that the almost unbelievable connectivity afforded by the Internet will have a much greater impact on education than has the development of the technology. The focus will shift from "Technology-dominated Information Technology" to one where "Information" is at least co-equal with "Technology". In fact, an initial over-emphasis on the information aspect may well have the greatest impact on geoscience education.

The following comments and musings are those of the author, who accepts full responsibility for the selection of materials included as resources. Omission of a reader's "favorite Internet site" or "best introduction to the Net" in no way should be interpreted as a negative comment on that resource by the author. This article does not represent a consensus of opinions drawn from a random sample of instructors. It is based on the author's experiences in attempting to introduce seven graduate students in Geological Analysis (Fall Semester, 1994) to the potential usefulness of the Internet as a source of information. Although the author uses Macintosh computers, PC users could just as easily have been accommodated. The paper by Dare and Woronow in this issue (1995) discusses PC Internet tools and their sources.

Those who are just starting to explore the Internet most likely will pass through a stage where so much information is so readily available that it is easy to be overwhelmed (drinking from the fire hose). For some, this stage will be of short duration whereas for others it will go on and on and on. Some will get lost in the minutia of the web whereas others will quickly come to accept the Internet as just another tool one uses to gather and disseminate knowledge.

Introduction

The focus of this article is on educational resources for students in college. However, the nature of the transition from high school into college suggests that at least some of the resources found at K through 12 Internet sites will have some utility in the college environment. Also, as colleges "inherit" the products of the high schools it is incumbent upon the colleges to be aware of the skills (and deficiencies) that the students bring to the campus.

Primary and Secondary school teachers in a computing oriented environment have access to an abundance of Internet-based materials ranging from text files to images to lesson plans to software packages and beyond. During the past decade there have been numerous local, regional, state and national initiatives designed to introduce teachers to computing and computer use via the Internet. For example, in 1993, NASA sponsored a national summer workshop for teachers which resulted in the production of the manual "A Teacher's Guide to Using the Internet" (Szady, 1993). This document, which provides a broad overview of how secondary teachers can make use of the Internet is available on the **NASA** gopher server.

The Texas Education Network (TENET) was established to provide an efficient means of disseminating information and material for kindergarten through high school teachers in Texas and many states have introduced similar Internet sites. The **TENET** gopher site, although not unique, is one example of how K-12 teachers can take advantage of the Internet: In most states there are Internet servers which focus on local teachers, students and issues. The Texas **Armadi11o** WWW server is a project of the Houston Independent School District. Armadillo was designed to meet the needs of middle school teachers who wanted to make use of multimedia materials in their classrooms.

Underlying many of these initiatives was the belief that the teachers had to be comfortable with Internet tools before introducing them to their classes. Although there are some exemplary reports of K through 12 success, in many areas progress has been slow and expensive with many districts simply unable to afford the investment needed for the purchase of computers, the construction of local area networks, and the Internet connections themselves. Robin (this issue, 1995) chronicles some of difficulties encountered in establishing training programs for the K through 12 teachers. In spite of the difficulties, it is evident that more students are graduating from high school with at least an appreciation for the power of the Internet than ever before and this trend should continue. Faculty teaching in college must be prepared to take advantage of these skills but also be prepared to provide instruction for students who are deficient. [In the fall semester of 1995, 30 of the 44 non-science majors in the author's honors section of Physical Geology had computers at home and 16 had Internet access.]

It appears that relatively little effort has been directed towards the need of college and university instructors for introductions to the Internet. Perhaps the consensus has been that these individuals do not need national, state and local initiatives to spark their interests. However, an announcement recently circulated noting that there would be a low-cost short course on "Internet Use" as a part of the Geological Society Annual Meeting in Seattle, Washington in October, 1994, is encouraging.

At the University of Houston, students who arrive expecting to find tools and facilities comparable to those in their high schools are often disappointed to learn that although the hardware and software are available, the professors may be less sophisticated than they are in the use of these tools. Several colleagues have been "pushed" onto the Internet by a group of demanding students, clearly a win-win situation (at least in the author's opinion).

Introduction To The Internet

There is no paucity of information about the Internet. In July, 1994, the author counted 31 different books with Internet in their titles at a local bookstore. In September, 1994, the same store devoted more than three times the shelf space to these books which by then numbered more than 100 different titles. The problem is not one of availability but one of discernment; again, the fire hose analogy. Many of the best sources (clearly the author's opinion) are to be found on the Internet itself.

The National Center for Supercomputing Applications (NCSA), a major developer of applications for the World Wide Webb (WWW) is a good source of documentation about many Internet related topics.

A paper titled "Accessing and Delivering Geoscience Information via the Internet" by **Paul Browning** (1994) provides an Internet Introduction from the point of view of a geologist trying to influence his organization and colleagues to become Internet-literate. Browning (1994, p. 1) notes that "part of the problem (in the UK) is the generation gap that exists between IT-illiterate managers and younger staff. The MIS (Men In Suits) who hold the purse strings don't really see the need to invest in information technology as they don't use it themselves... Another part of

the problem is that too many (of the non quantitative geoscientists) don't know what they are missing - "I can do everything I need on my Mac" - they don't appreciate that their Mac could be a small window onto a very big world" if appropriately networked and so they fail to lobby for a proper level of computing provision." The author has adopted the MIS acronym and is in the process of aiding its dissemination in this country.

The "Directory of Directories on the Internet" (Newby, 1993) is a guide to information sources in general and is a useful companion to the specialized resources noted in this article. Newby (1993) has assembled by subject what he considers to be well maintained Internet sites which have numerous links to other sites.

Software Requirements

As noted previously, this paper focuses on the Macintosh family of microcomputers (see the companion paper by Woronow and Dare, 1995, for a description of comparable software for the PC). Software requirements include the following (most of which is available on the Internet):

- a. software that allows the Macintosh to communicate with Internet sites such as MacTcp;
- b. browsers such as MacWeb, Mosaic, TurboGopher, Fetch, and NewsWatcher, which allow the user communicate with each site;
- c. and accessory programs such as JPEG View for downloading images, Sound Machine for playing recorded messages, Eudora for sending and receiving e-mail, HyperCard Player for viewing HyperCard stacks, Stuffit for unpacking compressed files, and Anarchy for searching ftp directories.

The software listed in Table 1 was installed on each of the computers set up for the use of the author's students in Geological Analysis . Current versions and sources (October, 1994) are given although the author cannot confirm that all are the primary sources, or that all sites will exist at the time of publication of this issue. Most organizations which allow Internet access have trained staffs that can help in the procurement of software resources.

Table 1

Internet Software for the Macintosh

Anarchie	Dropstuff
Eudora	Fetch - 2.12
Graphic Converter	JPEG
Mosaic - 2.00	Netscape - 1.1
Newswatcher	Simple Player
Sparkle	Sound Machine
Stuffit	Telnet - 2.7
Turbogopher - 2.0	

Excellent users guides/tutorials for TurboGopher, Mosaic, and Eudora can be downloaded from the NCSA Education home page at **User Guides**

The Internet explorer quickly learns that there are often multiple sites from which the same information can be obtained. For example, NCSA maintains an FTP server which contains all the tutorials noted above as well as An Incomplete Guide to the Internet at **NCSA Guides**.

Introducing Internet Resources

[An interactive introduction to the Internet has been prepared for the readers of Computers and Geosciences as part of the "Another Node On the interNet" home page (**ANON**). This material was not available at the time of publication of the paper. Readers with little experience with Internet Resources are encouraged to follow this link at their leisure.]

An Internet Scavenger Hunt

In the past the author used word processing as an introduction to the Macintosh for the first class exercise. This year, however, an Internet Scavenger Hunt using TurboGopher as the Internet browser, served as an introduction to both the operation of the computer and the Internet. In constructing this assignment the author was undoubtedly influenced by The Internet Hunt which was managed by Rick Gates, a self-described "Student & Lecturer" at the University of Arizona. This site is no longer maintained. A self-designed "hunt" forces the instructor to be familiar with the "solutions and pathways". Following a short lecture on the Internet in general, Internet tools and Anarchy and Veronica search queries, the students were given a copy of a Gopher Manual and several questions designed to force the class to perform searches and download software and images. For example:

- a) What is Project "**Blue Skies**"? Download a copy of the "Blue Skies" software and try it out. Blue Skies

A useful gopher site uncovered by one class member, gives access to **Search For Gophers** which proved helpful in locating some of the requested information: Search Gophers By Name [An introduction to searching on the World Wide Web - WWW - is given at **Searching WWW**]

Semester Project

A semester long project was designed to give the students the opportunity to regularly obtain information from the Internet, create a database, and interpret the observed variations using skills and tools introduced in the course. A final report will be handed in at the end of the semester which is to include graphical displays and analyses of the variations present. Although there are numerous data sets which would be of potential interest to geosciences, the author selected daily weather data for seven Texas cities. These data were accessed via TurboGopher from Rice University at **Weather**.

Each data set includes the following variables, and collections were made for an eight week period:

1. daily high temperature
2. daily low temperature
3. normal high for that day
4. normal low for that day
5. rainfall for that day
6. total precipitation for year
7. normal year to date precipitation
8. time of sunset
9. time of sunrise

Students were asked to record at least 5 observations per week and were encouraged to cooperate in gathering the data. Each student built a small database and, at the end of the semester, was required to present an analysis of the data including the design of displays illustrating variations in temperature (variables 1-4), precipitation (variables 5-7) and sunrise/sunset (variables 8-9) for about 10 weeks of observation. Although the initial response from the students was one of mild (to be generous) interest, the exercise seems to have accomplished its goal of illustrating the variety of applications that can be brought to the analysis of a data set. After several days students realized that some of these sites do not consistently report the same information daily. This was their first experience with one of the most frustrating aspects of the Internet. No organization is forced to maintain an Internet server and, to the author's knowledge, no organization is paid to maintain a server. Should an organization decide that their investment is not paying off, a site can literally disappear overnight.

News Groups - Usenet

After about a month the class was given access to Newswatcher 2.0 to read and post messages to one of the more than 3,800 [now more than 6,000!] existing Usenet groups. In general, access to these groups via the Internet browsers previously discussed is limited to summaries posted by some site managers. Many organizations which provide Internet access allow their employees to read Usenet groups but deny access to "outsiders". Although you may find a site on the Internet which provides

access, this is often a temporary privilege. The best solution is to ask your organization to support a Usenet site; the organization provides a host computer which receives periodic updates from the Usenet site managers.

Most of the students in Geological Analysis elected to read the group **news:sci.geo.geology**, although they were not restricted to that group. Students were encouraged to post intelligent questions/answers, although some preferred to play the role of an information voyeur. Each student was asked to post a question related to their research project and to submit a summary of responses received over a two week period. The class discussion proved interesting with the consensus that this is a potentially useful way to gather information, although, all recognized that the veracity of the responses was highly variable. As more geoscientists routinely scan these newsgroups and respond when appropriate, the quality of this source of information will probably increase. In September, 1994, there were some 40 new messages posted per day during a two week period; it would appear that the interest in this group is increasing.

A "Weekly USGS Quake Report" is published in **sci.geo.geology** by Andy Michael which consists of at least six separate reports which cover different geographic regions where seismic activity was recorded. Double-clicking on the file icon present near the top of the page downloads an image file which contains a map with locations of the epicenters and their magnitudes for each region. These files can be viewed with JPEG (Table 1). A colleague at the University of Houston begins each lecture in Physical Geology with an Earthquake update using overheads prepared from these images, thus taking advantage of a common interest in disasters. In addition to the Usenet group **sci.geology.geo** noted above, other groups that may be of immediate interest to geoscientists are:

- sci.geo.eos**
- sci.geo.fluids**
- sci.geo.hydrology**
- sci.geo.meteorology**
- sci.geo.oceanography**
- sci.geo.petroleum**

The "inner workings" of Usenet may be of interest to some readers. A reader or committee of readers can propose the creation of a new group and readers then vote on whether or not the proposed group would serve any useful function. In August, 1994, Usenet conducted a poll of the readership to assess the level of interest in establishing a petroleum geology news group. The objectives of the group were "intended to provide an electronic communication venue for specialists of varying backgrounds employed by, or associated with, the oil and gas industry. An important secondary objective is to encourage global communications between technical experts, managerial staff, government and environmental organizations and the general public." Truly, a set of sound objectives. Anyone who has tried to set up a new "working group" of a national organization using telephones, snail mail, and conferences will probably be impressed with the apparent ease with which this new group was announced, voted upon, and approved within about four months. A total of 1284 YES and 18 NO votes were recorded during the 22 day polling phase. These 1302 individuals represented 259 organizations: oil companies (45%), Academic Research Centers (21%), Service Companies (17%), Government Organizations (4%) and Other Organizations (13%). It will be interesting to watch the evolution of these geoscience-related news groups.

As there is no censorship of any of these news groups, a lot of junk mail gets posted. In all fairness, of course, what I consider "junk" may be someone's treasured trivia. The reader must keep in mind that these postings are ephemeral; most site managers purge postings after a few days. However, all postings include the e-mail address of the individual who posted the message and the reader can always attempt to confirm a comment or reference source by directly corresponding with the sender. In fact, NewsWatcher and Netscape offers the user the option of posting to the news group or directly to the sender. Internet etiquette urges the originator to summarize directly received responses for the benefit of the readership. As with life in general, let the reader/user beware.

Many of the news groups regularly publish Frequently Asked Questions (FAQ) which not only provide good introductions but often contain valuable information on new servers or changed addresses. Frequently Asked Questions for the geosciences by Phil Ingram are available at **Part 1** and **Part 2**.

Favorite Points of Internet Insertion

About half way through the course the author introduced the Internet browsers Mosaic and Netscape (see Table 1). These navigation tools have the advantage (over Fetch and Turbogopher, for example) of allowing access to FTP, gopher, Usenet (with the limitations noted previously) and WWW sites as long as the address (URL -Uniform Resource Locator) is known. By this time the students had become aware of the importance of a structured approach in the listing of resources; that is, the organization of the information and the ease with which information can be located is of co-equal importance to the information itself. Most users of the Internet can relate to the frustration of "knowing that something exists but I cannot remember where I found it.

The **Planet Earth Home Page** offers the user almost instant access to up-to-date information of interest to geoscientists as well as to the tools and lists needed for maneuvering over, under, around and through the Web. [In the original version of the paper a summary of the contents of Planet Earth was given as Table 2. This source has changed its format and the reader is encouraged to browse by following the link given above.]

A Brief Survey of Internet Resources for the Geosciences

Each student was asked to keep a list of interesting geoscience nodes on the Internet for periodic discussion in class. The following discussion of resources is drawn in part from the experiences of the class.

For the purpose of this article, Internet resources will be divided into:

- geosciences references to the Internet
- software
- images
- data sources
- geoscience-oriented home pages

A few examples of each resource type follow, with the Internet site where the resources can be obtained. When known, the primary source or site is given. Again, these examples are not intended to represent anything more than their utility to the author and his class.

Geoscience References

One of the best lists of Internet information for the geosciences is the paper **Online Resources for Earth Scientists** by Bill Thoen (see this issue). This source first appeared in 1992 and has been updated several times. Material is well organized and this should be one of the first reference acquisitions for the user's library.

Another useful source of geoscience references is **The Virtual Earth** by Phil Ingram (see this issue).

A Biologists Guide to the Internet by Una Smith, 1993) is referenced here because many paleontologists will find some of the sites of interest.

Rice University maintains an active, well organized gopher site. Once a we the RiceInfo gopher site managers execute a program (linkmerge) which automatically merges selected directories of links at a number of institutions (many of which have numerous links to other gopher and WWW servers).

The gopher server maintained by the Department of Geology at the **University of Texas at El Paso** was recommended by the class as a good site to check periodically. Like the Rice University site described above, the UT El Paso site seems to be maintained on a regular basis.

Software Sources

There are a large number of software packages of the freeware or shareware variety which can be downloaded from an FTP, Gopher, or WWW site. One of the most popular gopher sites is the archive at **Stanford University**. There are literally thousands of programs stored at this gopher site. However, the site managers now (August, 1994) ask that users connect to one of the more than 30 "mirror sites" because the load

at Stanford has become too large. Managers at these "mirror sites" regularly update their software archive from Stanford. The Massachusetts Institute of Technology "mirror site" updates all of the Stanford entries once a day.

Most of the files stored in these archives are compressed to save space. A good discussion of the software needed to reconstruct compressed files is given in Perkins (this issue, 1994). Perhaps the easiest to work with are those whose names end with the suffix ".sea" which is the acronym for self-expanding archive. Double clicking on the file name or icon unpacks the compressed file.

There are several programs of potential interest to geoscience instructors available via the Internet. **Crystal View 1.0** is a public domain application for drawing and manipulating unit cells on the Macintosh. Included in the folder is a set of exercises which could be given out in crystallography/mineralogy. **MacMolecule 1.7** is a program designed for creating 3D-images of molecules for use in teaching molecular structure to students of biology, chemistry, and allied fields. There is a companion file containing nearly 100 MacMolecule images. The combination of the application and the files is good reference material for undergraduate and graduate students. [Instructors should check out The **UK Earth Science Courseware Consortium**]

An interesting file of the chemical formulas of the 3,507 valid **mineral species** is available in an ASCII (plain text) version. Students in the beginning mineralogy class were given access to these data stored in a small database management program (Microsoft Works) which allowed them to play the "what if game". For example, what minerals contain the elements As, Sb, and Ti? The answer is Hemloite(As,Sb)₂(Ti,V,Fe)₁₂O₂₃(OH). Or, how many minerals contain both As and Sb? 53 according to the file. Is this a valuable resource? During the past 29 years the author has been asked similar questions and had to resort to thumbing through several texts, buying time by mentioning the few that he was aware of. Assuming that this file is accurate (a common assumption that the user must evaluate for all sorts of information), this little file has its place.

Images

There must be hundreds of thousands of images stored on the Internet at any one time and the user could quickly fill up a hard disk unless some care is taken, as many these images take up more than several hundred kilobytes. Electronic Picture Books (requiring the commercial application HyperCard player) are the products of the "Exploration in Education" (**ExInEd**) team of the Special Studies Office of the Space Telescope Science Institute. In September, 1994, there were nine Picture Books (including The Impact Catastrophe that Ended the Mesozoic Era, Images of Mars, and the Planetary Systems) that can be downloaded. Several of these relatively large packages (each is several megabytes) will be placed on a server and made available to students taking Physical Geology at the University of Houston as supplements to present class materials. They are well written and the images are superb.

There are several NASA WWW, gopher, and ftp servers on the Internet. The **NASA** home page provides hypertext links to a number of sources including **Online Educational Resources**. This source links to the **NASA JSC Digital Image Collection** which contains a large collection of images which can be selected by NASA index code, longitude, latitude, and mission. Another useful link is to the **NSSDC Photo Gallery** which offers selected images arranged by planet.

Data Sources

An Index of **USGS Servers** provides links to more than 40 USGS branches and divisions including the Cascades Volcanic Observatory, the Branch of Sedimentary Processes, and the Distributed Spatial Data Library. The National Geophysical Data Center - **NGDC** - recently announced their GOLD system (Geophysical On-Line Data) as "Pure GOLD on the Information Superhighway" (U.S. Government Printing Office, 1994, 575-973). NGDC is the home for activities in the fields of marine geology and geophysics, solid earth geophysics, solar-terrestrial physics, paleoclimatology, ecosystems, and environmental data. In addition the user can access the NGDC Bulletin Board by calling (303) 497-7319.

Geosciences-Oriented Home Pages

During the past four months there has been a rapid increase in the number of geoscience sites and by the time this issue is published there will probably have been a ten-fold increase. An increasing number of documents are being posted to the Internet which could serve as exercises and/or supplements to geosciences courses. **Paleontology Without Walls** (University of California at Berkeley) illustrates the effectiveness of combining hypertext (links to relevant Internet resources activated by double clicking on key words) with images. The reader can select from topics dealing with phylogeny, the geologic time scale and the history of evolutionary thought. Each of these could be incorporated into courses such as physical and historical geology, paleontology, and stratigraphy as supplementary material.

The **United States Geological Survey Education Resources** home page offers access to several demonstration texts. "Understanding Our **Planet Through Chemistry** ", provides a good introduction to the application of chemistry principles and applications which is suitable for an introductory physical geology course.

World -Wide Volcanism from NASA provides a "clickable map" for locating up-to-date information on active volcanoes.

The **National Water Research Institute** has set up a WWW server devoted to groundwater issues. The site manager (Andrew Piggott) hopes to make this a compendium of on-line groundwater modeling and analysis software; that is, a set of links to programs that are publicly available via anonymous FTP and WWW servers (personal communication, August, 1994). As this is a very recent site (August, 1994), its evolution will be relatively easy to follow. Such meta-lists or "list of lists" are very powerful and if they are maintained on a regular basis these home pages will become popular within their domain.

It is interesting to speculate as to the half-life of WWW sites. Will the organization supplying the server continue to feel that they are making a good investment by keeping the site on the Internet? What benefit will the readers derive from the site? The Texas Center for Superconductivity at the University of Houston (**TCSUH**) recently initiated a WWW site

which describes its research activities, personnel, and facilities. This site offers the reader the opportunity to subscribe to the TCSUH Newsletter and order reprints (following a keyword search) using the "forms" option, which is supported by Mosaic 2.0 b6 - Table 1) but not by earlier versions. The "forms" feature adds the element of interaction between the reader and the site and its incorporation into WWW sites will probably increase as organizations discover that this is a relatively inexpensive way to both disseminate and gather information.

Conclusions: Assessment and Future Plans

It appears that each student in the class "trained" at least one friend to use Internet resources during the semester. In fact, our system administrator was asked to add the software listed in Table 1 to two more machines to avoid waiting in line. Several faculty colleagues have become Internet-activated and in part their activation can be related to an increase in student use of these resources.

The exercises noted above (the Internet Scavenger Hunt, the semester project and using Newswatcher to obtain information about a specific question) seem to have accomplished the underlying objective of illustrating the potential usefulness of Internet resources, when tempered with the realization that it is indeed difficult to drink from a fire hose.

Although one could simply install the software and announce its availability, a more structured approach as outlined above, provides a framework which focuses on specific assignments. Users will explore on their own no matter what approach is used and the sense of discovery will be stimulating. However, mindlessly wandering through the web without an objective may be a deterrent to the ultimate judicious use of the Internet as a resource.

The biggest criticism came from the class itself. Namely, why wait until the graduate level to introduce these topics? As a result of this input the author plans to offer a one hour special problems course in the spring semester of 1995 for freshman and sophomore geoscience majors in which the focus will be split between computing applications and an introduction to the Internet.

[The author has developed a set of WWW resources for his honors section of **Physical Geology** (Fall, 1996) course. Comments and suggestions will be appreciated.]

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