Exploring Geology on the World Wide Web – Geophysics, Plate Tectonics, and Structural Geology

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INTRODUCTION

This issue's column is a mixed assortment of World-Wide Web resources for learning about geophysics (excluding seismology, which was discussed in the previous issue), plate tectonics, and structural geology. Compiling sites for this column proved somewhat challenging since many sites are too technical for those not actively involved in research in these areas. I attempted to choose sites which were not too technical yet provided useful information for both the student and the instructor.

All of the URL addresses in this article are available as hypertext links from a Web page I maintain at: **http://www.geology.uiuc.edu/~schimmri/geology/geology.html**

Connecting to the resources below from this single Web page will save you a substantial amount of typing. Also, due to the lead time between the writing of this article and its publication, along with the volatile nature of the World-Wide Web, URL addresses may change periodically and the Web page will be maintained to reflect any such changes in the resources described below, whereas the printed copy may go out of date.

An increasing number of sites, including some listed below, maintain information encoded as Adobe Acrobat PDF (Portable Document Format) files. For information on PDF files, and how to view them, connect to the Acrobat page at:
http://w1000.mv.us.adobe.com/Acrobat/

TECTONICS

The following are some general resources for learning about plate tectonics – the unifying theme of modern geology.

Active Tectonics

http://www.muohio.edu/tectonics/ActiveTectonics.html

The Active Tectonics Initiative is dedicated to understanding the deformational processes that currently shape the earth and threaten human life and property. Their web site is hosted by Miami University of Ohio and contains information about the Initiative and neotectonic processes.

Plate Motion Calculator

http://manbow.ori.u-tokyo.ac.jp/tamaki-html/plate_motion.html

This is an on-line program at the Ocean Research Institute at the University of Tokyo for calculating present-day tectonic plate motions. Plate motions may be calculated with respect to each other or with respect to an absolute hot-spot reference frame.

Plate Tectonics

http:Nwww.seismo.unr.edu/ftp/pub/louie/class/100/plate-tec tonics.html

This site features several Web pages of tutorial material from the University of Nevada at Reno's Seismological Laboratory. Topics covered are the earth's interior and plate tectonics in addition to the information on seismology and earthquakes as discussed in my previous column. These are interesting pages with many high-quality images (making the site a bit slow but well worth the wait).

Tectonic Plate Motion
http://cddis.gsfc.nasa.gov/926/slrtecto.html

This site, maintained by NASA, contains information on how various space geodetic technologies (for example, satellite laser ranging, very long baseline interferometry, and global positioning systems) are used to track present-day tectonic plate motions.

SEA FLOOR STUDIES

Following are a few resources for learning about how geophysics has been used to investigate the deep sea and has provided evidence and support for plate-tectonic theory.

World Data Center
http://www.ngdc.noaa.gov/mgg/aboutmgg/wdcamgg.html

The National Geophysical Data Center (NGDC) of the National Oceanic and Atmospheric Administration (NOAA) maintains an archive of geology and geophysical data collected from the world's sea floors. Information is available on how to obtain bathymetric, magnetic, gravity, and geothermal data in addition to geological cores and samples.

JOIDES
http://servant.geol.cf.ac.uk/www_jo~1/joides~1.htm

The Joint Oceanographic Institutions for Deep Earth Sampling maintains information on its on-going research, the history of the Ocean Drilling Program, and an on-line version of JOIDES Journal.

LDEO
http://www.ldeo.columbia.edu/

The Lamont-Doherty Earth Observatory maintains a large amount of high-quality information and graphic images of their many on-going research projects in marine geology and geophysics.

Marine Geophysics
http://www.ngdc.noaa.gov/mgg/othermarine/othermarine.html

This is a general resource list for Web sites on marine geology and geophysics maintained by the National Oceanic and Atmospheric Administration (NOAA).

Ocean Floor Tectonics
http://triton.ori.u-tokyo.ac.jp/~tamaki/ref_search3.html

This is an on-line program by Kensaku Tamaki of the Ocean Research Institute at the University of Tokyo that allows you to search for papers on ocean floor tectonics by journal, keyword, or geographic area.

RIDGE
http://copper.whoi.edu/

The Ridge Inter Disciplinary Global Experiment at Woods Hole Oceanographic Institute maintains a site containing information about the program and an interesting image gallery of volcanic topography at the mid-Atlantic ridge.

GEOPHYSICS

Following is a mixed assortment of resources on various aspects of geophysics. Unfortunately, there is not much tutorial information on the Web about these topics and many subjects (for example, U-Pb radiometric dating) are not represented.

Earth's Interior
http://bang.lanl.gov/solarsys/earthint.htm

This brief tutorial on the interior of the earth, along with some information on plate tectonics, is part of a larger Web tour called Views of the Solar System at Los Alamos National Laboratory. This is an interesting site with informative graphic images.

Exploration Geophysics
http://sepwww.stanford.edu/seg/consort.html

This site, maintained by the Society for Exploration Geophysics, is a listing of all known academic consortia, university research groups, institutes, and government laboratories doing nonproprietary exploration geophysics research with links to their Web pages.

Geophysics Resources
http://www.eas.yorku.ca/eas/IRL4G/Default.html

This is a very comprehensive Internet resource list for geophysicists maintained by Nobuhiro Furuse. Links to resources are listed alphabetically and by country.

Middle East
http://www.geo.cornell.edu/geology/me_na/main.html

The Cornell Middle East and North Africa Project at the Institute for the Study of the Continents at Cornell University maintains geophysical information about interesting tectonic areas in the Middle East and North Africa. Available information includes the geology of the areas, digital maps, seismic refraction profiles, gravity surveys, and earthquake focal mechanisms.

NGDC
http://www.ngdc.noaa.gov/ngdc.html

The National Geophysical Data Center is a part of the National Oceanic and Atmospheric Administration (NOAA) and maintains a large amount of information on solid-earth geophysics and marine geology and geophysics (among other things). Information and graphic images of topography, magnetic, gravity, and geothermal data are available.

PaleoMag
ftp://mantle.colorado.edu/pub/PaleoMagl

This is an archive of free programs for performing paleomagnetic analysis on the Macintosh by Craig Jones at the University of Colorado at Boulder. The

programs are easy to use and come with a user manual and test data.

Radiocarbon
http://www2.waikato.ac.nz/c14/webinfo/index.html

Extensive information about radiocarbon dating from the Radiocarbon Dating Laboratory at the University of Waikato in Hamilton, New Zealand. This site has all you would ever want to know about the theory, practice, and applications of radiocarbon dating and how the method has been used to construct the chronologies of the late Pleistocene and Holocene epochs.

Samizdat Press
http://landau.Mines.EDU/~samizdat/

Samizdat Press has several Postscript-format books and lecture notes that are available free of charge. Some titles include Continuum Mechanics, Theoretical Seismology, and Theory of Seismic Imaging.

GEOTECTONICS AND STRUCTURAL GEOLOGY

There are not a lot of resources on the World Wide Web strictly devoted to structural geology. The structural-geology resource page listed below is a site I specifically created because of this lack of information on the Web.

Salt Tectonics
http://www.utexas.edu/research/beg/giovanni/

Information on salt tectonics by Giovanni Guglielmo, a research associate at the Applied Geodynamics Laboratory at the University of Texas at Austin. Guglielmo studies the movement of salt bodies in sedimentary basins and how they act as structural traps for petroleum. This site has some neat three-dimensional images and animations.

Structural Geology
http://hercules.geology.uiuc.edu/~schimmri/geology/structure.html

This is an index of links to various resources that are of interest to structural geologists. Categories of links include data sets and bibliographies, computer software, commercial products and services, organizations, research information, upcoming meetings, academic groups, and home pages of structural geologists. Most of the resources here will only be of interest to instructors and those doing research in structural geology.

ON-LINE COURSES

In searching the Web for on-line courses, I only located three for geophysics, tectonics, and structural geology. Instructors interested in setting up their own Web pages for courses they teach may wish to examine these sites for useful ideas.

Geophysics and Geotectonics
http://www.geo.cornell.edu/geology/classes/intro388.html

Information about the course Geophysics and Geotectonics (GS-388) taught by Bryan Isacks at Cornell University. In addition to the syllabus and assigned readings, there are also a number of course notes and lab instructions available as PDF files.

Global Dynamics
http://www.geosci.unc.edu/classes/Ge o120/G120. html

Information about the course Principles of Global Dynamics (Geo-120) taught by Jose Rial at the University of North Carolina at Chapel Hill. This site has an interesting tutorial composed of text, hypertext links, and images that would be of interest to students.

Structural Geology
http://www.geo.cornell.edu/geology/classes/RWA/
G_326/GEOL32 6.html

Information about the course Structural Geology (Geol-326) taught by Richard Allmendinger at Cornell University. In addition to the syllabus and assigned readings, there are also a number of images showing various structural features.

PROFESSIONAL ORGANIZATIONS

A few professional organizations for researchers in geophysics, tectonics, and structural geology have information on the Web. While these sites may not be of great interest to beginning students, instructors may find some useful information and may wish to join the Internet mailing lists many of them offer.

American Geophysical Union
http://www.agu.org/

The American Geophysical Union (AGU) maintains a large Web site featuring information about the organization and its various publications and twice-yearly meetings. Abstracts for the meetings are available on-line as are the contents of recent AGU journals including the Journal of Geophysical Research, Geophysical Research Letters, Reviews of Geophysics, Tectonics, and Geotectonics (a translated Russian journal).

Canadian Tectonics Group
http:Ncraton.geol.brocku.ca/ctg.html

The Canadian Tectonics Group (CTG) maintains a Web site containing information about their organization, mailing list, newsletter, and upcoming meetings. There are indications that job listings, software archives, and structural-geology images will be included at some point in the near future.

International Association of Structural/Tectonic Geologists
http://info.mcc.ac.uk:80/Geology/IASTG/

The IASTG publishes a newsletter that may be of interest to some instructors, and new members receive a discount when subscribing to the Journal of Structural Geology.

Society of Exploration Geophysicists

http://sepwww.stanford.edu/seg/

The Society of Exploration Geophysicists (SEG) maintains a Web site for information on their organization along with information on upcoming meetings and Society publications including abstracts from back issues of the journals *Geophysics* and *The Leading Edge*. From this site, one may also reach the Web pages for the Canadian and Australian SEG Web sites.

Tectonic Studies Group

http://www.dur.ac.uk/~dgl0www/TSG/tsghome.html

The Tectonic Studies Group (TSG) is based in the United Kingdom, administers the Geo-Tectonics mailing list, and maintains a listing of European conferences on tectonics and structural geology. There is little here of interest to beginning students, but instructors may wish to join the mailing list.

DISCUSSION

Many of the resources listed above will primarily be of interest to instructors wishing to obtain teaching materials for geophysics and plate tectonics. The National Geophysical Data Center (NGDC) and the National Oceanic and Atmospheric Administration (NOAA) are the places to go for on-line and CD-ROM data sets that may be used in the classroom. The JOIDES, Lamont-Doherty, and RIDGE sites contain much background information about historical and ongoing research in marine geology and geophysics, which may also be of interest. Keeping abreast of the latest research in these areas is best done by joining one of the professional organizations listed and subscribing to their newsletters and Internet mailing lists.

Sites that may be of particular interest to beginning students are those with tutorials on neotectonics, plate tectonics, ocean-floor tectonics, the earth's interior, radiocarbon dating, and global dynamics. Interesting images include the computer-generated U.S. continental margin sea floors from Lamont-Doherty Earth Observatory, volcanoes at the mid-Atlantic ridge from the RIDGE Web page, various types of geophysical dataset images at the NGDC, cross sections of the lithosphere in the Middle East and North Africa, and the animations illustrating salt tectonics.

The plate-motion calculator at the University of Tokyo is fun to play with. Do you want to know the velocity and direction your hometown is moving with respect to the absolute hot-spot reference frame? Are you interested in how fast Africa and North America are moving apart from one another? While the theory behind the model calculations will be beyond most students, the program itself is fairly easy to use.

More advanced students may benefit from downloading the paleomagnetism programs and learning about paleomagnetic data analysis. Stereonet, paleostress, and rose-diagram-analysis programs may also be downloaded from the structural-geology resources site. Those who wish to research topics in geophysics and tectonics in more detail may use the Ocean Floor Tectonics bibliographic search program for relevant journal papers.

My next column will focus on resources available on the World Wide Web for learning about volcanology along with some igneous and metamorphic petrology.