

# Exploring Geology on the world-wide web – invertebrate Paleontology and Evolution

Steven Henry Schimrich  
Department of Geology  
University of Illinois  
Urbana, Illinois 61801  
s-schim@uiuc.edu

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## INTRODUCTION

This issue's column will focus on World-Wide Web resources for learning about invertebrate paleontology, paleobotany, and evolution. This is essentially a continuation of last month's discussion of Web resources for dinosaur and vertebrate paleontology information.

All of the URL addresses in this article are available as hypertext links from a Web page I created 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.

## GENERAL EXHIBITS

There are several invertebrate paleontology exhibits, of varying quality, currently available on the Web. While some present only images, others arrange their images around a unifying theme such as phylogeny or geologic age.

### St. Louis Science Center

[http://slsc.wustl.edu/~slsc/docs/mod3/mod3\\_2/mod3\\_22/ep1000m.htm](http://slsc.wustl.edu/~slsc/docs/mod3/mod3_2/mod3_22/ep1000m.htm)

This is a virtual exhibit at the St. Louis Science Center with some basic information about the geologic periods and fossils represented in Missouri. Unfortunately, as seems to be the trend in museums today, most of the descriptions are brief one-sentence blurbs without much substance. It's worth a peek but not much else.

### Wayne State University

#### College of Science Museum of Natural History

<http://gopher.science.wayne.edu/animals/fossil/index.html>

This is an archive at the Museum of Natural History at Wayne State University College of Science in Detroit which contains several fossil images. While the descriptions of these images are somewhat sketchy at present, there is a promise to provide more information in the near future. This is a good site to visit if you're interested in collecting some fossil images.

### Hunterian Museum

<http://www.gla.ac.uk/Museum/HuntMus/earth/index.html>

The Hunterian Museum at the University of Glasgow in Scotland offers an overview of the history of

life along with some fossil images. There are also some interesting temporary exhibits on microfossils and conodonts that are worth visiting.

### University of California at Berkeley Museum of Paleontology

<http://ucmp1.berkeley.edu/exhibittext/phylogeny.html>

The Museum of Paleontology at the University of California in Berkeley (UCMP) is arguably the best virtual exhibit for paleontology on the Web. This is the Phylogeny entrance to the exhibit that will allow access to all of the exhibits. From any point within the museum, you can take a Web lift to any specified taxon, geologic period, or glossary topic. While parts of the museum are still being built, there is an extremely large amount of information here about various organisms, biological evolution, paleoenvironments, geology, and tectonics. The images alone are worth the visit.

<http://ucmp1.berkeley.edu/exhibittext/evolution.html>

You may, if you prefer, enter the Evolution entrance to the UCMP. This page contains information about Charles Darwin, some biographies of scientists who helped develop modern evolutionary theory, and links to online versions of *Voyage of the Beagle* and *The Origin of Species*.

### Royal Tyrrell Museum

<http://www.cuug.ab.ca:8001/VT/tyrrell/tyrelmp1.html>

The Royal Tyrrell Museum in Alberta, Canada specializes in dinosaur fossils but also has a very good invertebrate paleontology exhibit. You can use the clickable museum map to begin your tour anywhere in the museum and systematically follow the arrows through the exhibits that present lots of high-quality information and many wonderful images.

## SPECIFIC ORGANISMS

The following resources present various types of specialized information about selected fossil invertebrates. Hopefully, in the future, more paleontologists will set up Web pages about the organisms they study.

### Crinoids

<http://141.218.91.93/crinoid/zcrinoid.html>

The BioQUEST Curriculum Consortium is developing an interactive educational software project detailing the process by which paleontologists reconstruct

paleoenvironments from fossil crinoids. These Web pages briefly describe the fossil crinoid collection at Beloit College in Wisconsin and outline the goals of the project. This is an informative site with some interesting images.

### Diatoms

<http://www.indiana.edu/~diatom/diatom.html>

Present general information about diatoms from the Biology Department of Indiana University. This information was contributed by biologists studying modern diatoms but there is some material here that may be of interest to those interested in fossil diatoms as well.

### Microfossils

<http://www.cs.uwindsor.ca/meta-index/mcat/html-docs/woop.html>

Information from Dr. Cyril Rodrigues of the Department of Earth Sciences at the University of Windsor in Ontario describing Quaternary Foraminiferida and Ostracoda from the Gulf of St. Lawrence. This is a professional-looking site with many high-quality images of microfossils.

### Radiolarians

[http://mindlink.bc.ca/Fabrice\\_Cordey/](http://mindlink.bc.ca/Fabrice_Cordey/)

A series of Web pages from Dr. Fabrice Cordey of the Geological Survey of Canada with large amounts of information on radiolarian biostratigraphy as it relates to unraveling geological and tectonic evolution of the Canadian Cordillera. This is a well designed informative site on a single topic.

### Trilobites

<http://www.ualberta.ca/~kbrett/Trilobites.html>

A Web page with information and images of trilobites from Kevin Brett, a PhD student studying trilobites at the Department of Geology at the University of Alberta in Edmonton.

## FOSSIL LOCALITIES AND COLLECTING

The following are Web sites containing information about famous fossil localities and some general information about fossil collecting.

### Burgess Shale

<http://www.geo.ucalgary.ca/ybsrfl.html>

Web page for the Yoho-Burgess Shale Research Foundation. The Burgess shale is world-famous for its middle Cambrian soft-bodied fauna but this site contains little information about the paleontology and would mostly be of interest to those planning a visit to the Field area in British Columbia, Canada.

### Collecting

[gopher://ftp.std.com/11/associations/Rocks-and-Fossils/](mailto:gopher://ftp.std.com/11/associations/Rocks-and-Fossils/)

The gopher server for the Rocks-and-Fossils Internet mailing list. There is information here on fossil collecting localities around the world along with much other information contributed by members of the mailing list which is relevant to the hobby of mineral and fossil collecting.

### FAQ

<http://ucmpl.berkeley.edu/FAQ/faq.html>

The acronym FAQ stands for "frequently asked questions" and this Web page at the University of California at Berkeley Museum of Paleontology answers quite a number of common questions about paleontology and fossil collecting.

### Mazon Creek

[http://www.museum.state.il.us/exhibits/mazon\\_creek/](http://www.museum.state.il.us/exhibits/mazon_creek/)

This virtual exhibit, at the Illinois State Museum in Springfield, is devoted to the world-famous Mazon Creek soft-bodied fauna found in the Pennsylvanian-age Francis Creek Shale just south of Chicago. This site has some interesting images and information about some unique fossil organisms.

### Mohawk Valley

<http://l/zircon.geology.union.edu/Gildner/stack.html>

An informative virtual exhibit created by Dr. Raymond Gildner of the Department of Geology at Union College in Schenectady, New York. The exhibit discusses the paleoecology of the middle to late Ordovician as reflected in the stratigraphy and paleontology of strata within the Mohawk River Valley of central New York. This site has a great deal of information, references, and images and is well worth examining.

## MISCELLANEOUS

The following are Web pages devoted to assorted specialized topics in invertebrate paleontology and paleobotany.

### Ichology

<http://www.emory.edu/GEOSCIENCE/HTML/TFW3.HTML>

A Web page with interesting information on ichnology, the study of plant and animal traces, at the Geosciences Department of Emory University in Atlanta. This Web site also maintains a trace fossil database with unique images of some common trace fossils.

### Origins

<http://rumba.ics.uci.edu:8080/>

This Web page is maintained for *talk.origins* - an Internet newsgroup for the discussion of biological and physical origins. Particularly interesting are the files in the archives refuting various aspects of young-earth Biblical creationism, the links to many creation/evolution resources on the Internet, and the images of evolutionarily interesting fossils.

### PaleoNet

<http://www.nhm.ac.uk/paleonet/index.html>

Web page for the PaleoNet listserv with information on mailing lists in paleontology and links to assorted resources on the Internet of interest to paleontologists.

### **paleontological Research Institution**

<http://www.english.cornell.edu/pri/pri1.html>

The Paleontological Research Institution (PRI) was founded in 1932 by Cornell geologist Dr. Gibert Harris in Ithaca, New York. This Web page is currently under construction but shows great promise for the future, judging by the proposed structure of their Web services that will include collection images and virtual education programs.

### **Palynology**

<http://www.geo.ucalgary.ca/~macrae/palynology.html>

Information about palynology, the study of fossil pollen and spores, at the University of Calgary in Alberta, Canada. The page is under construction but there are already some images and information about Cretaceous-age spores and pollen.

### **Reefs**

<http://www.uni-stuttgart.de/UNIuser/igps/researchfiles/reefgroup.html>

Information from the reef group of the Department of Geology and Palaeontology at the University of Stuttgart in Germany which studies the paleoecology of Jurassic, early Paleozoic, and modern reefs. This is an interesting Web site with a lot of scientific information, references, and images.

### **Tree of Life**

<http://phylogeny.arizona.edu/tree/phylogeny.html>

Navigate through a phylogenetic tree of life at this Web site affiliated with the Department of Ecology and Evolutionary Biology at the University of Arizona in Tucson. Each Web page corresponds to a clade that displays a phylogenetic tree, a discussion of the clade, an image of an organism, and links to information about the clade on the Internet. While this site is currently under construction and has thus far concentrated on modern organisms, it's a wonderful resource and it shows great promise for the future.

### **PALEONTOLOGY DATABASES**

These are links to Web pages that allow you to perform interactive keyword searches of several types of invertebrate paleontology and paleobotany catalogs and databases.

#### **Brachiopods (NMNH)**

<http://nmnhwww.si.edu/gopher-menus/ThePaleobiologyFossilBrachiopodTypeRegister.html>

The *Fossil Brachiopod Type Register* of brachiopod specimens in the Department of Paleobiology at the Smithsonian Institution National Museum of Natural History (NMNH) in Washington, D.C.

#### **Invertebrate (FLMNH)**

<http://www.flmnh.ufl.edu/docs/departments/invertpaleo.htm>

The *Invertebrate Paleontology Type Collection Database* of specimens in the invertebrate paleontology

collections of the Florida Museum of Natural History (FLMNH) in Gainesville. The bulk of the collection consists of Cenozoic mollusks of southeastern North America and the circum-Caribbean.

#### **Invertebrate (UCMP)**

<http://ucmpl.berkeley.edu/collections/invert.html>

The *Invertebrate Type Collection Catalog and Index* of invertebrate specimens at the University of California Museum of Paleontology (UCMP) in Berkeley.

#### **Microfossils (UCMP)**

<http://ucmpl.berkeley.edu/collections/micro.html>

The *Microfossil Type Collection Catalog and Index* of microfossil type specimens at the University of California Museum of Paleontology (UCMP) in Berkeley. This Web site also has several environmental scanning electron microscope images of foraminifera.

#### **Plants (IOP)**

<http://sunrae.uel.ac.uk/palaeo/pfr2/pfr.htm>

The *Plant Fossil Record Database* of the International Organisation of Palaeobotany (IOP) in London. The database contains over 10,000 extinct genera of plants and may be searched in various ways.

#### **Plants (NMNH)**

<http://nmnhwww.si.edu/gopher-menus/ThePaleobiologyFossilPlantandAlgaeTypeRegister.html>

The *Fossil Plant and Algae Type Register* of plant specimens in the Department of Paleobiology at the Smithsonian Institution National Museum of Natural History (NMNH) in Washington, D.C.

#### **Plants (UCMP)**

<http://ucmpl.berkeley.edu/collections/plant.html>

The *Paleobotany Type Collection Catalog and Index* of over 8,000 type specimens of fossil plants at the University of California Museum of Paleontology (UCMP) in Berkeley.

### **PROFESSIONAL ORGANIZATIONS**

Finally, some Web pages of professional organizations for paleontologists.

#### **American Association of Stratigraphic Palynologists**

<http://Nopal.geology.utoronto.ca:80/AASP/>

The AASP is an international organization to promote the science of palynology. Their Web page provides information about the association and its activities, access to palynological data, abstracts from their journal *Palynology*, and an online version of the *AASP Newsletter*.

### International Organisation of Palaeobotany

<http://www.uel.ac.uk/palaeo/>

The IOP is a London-based international organization devoted to the study of past environments and the science of palaeobiology. Their Web page provides information about the organization and their activities, online access to the IOP Newsletter, a Palaeo Chat bulletin board, and access to the Plant Fossil Record Database.

### Palaeontological Association

<http://www.nhm.ac.uk/paleonet/PalAss/PalAss.html>

The Palaeontological Association is a U.K.-based international organization for paleontologists. Their Web page provides information about the association and its activities and online access to the Palaeontology Newsletter.

### Paleontological Society

<http://www.uic.edu/orgs/paleo/homepage.html>

The Paleontological Society is an international organization for the advancement of the science of paleontology. Their Web page provides information about the society and its activities, links to other paleontological resources on the Internet, and online access to the Society's newsletter Priscum.

## DISCUSSION

Many of the sites mentioned above are in the process of being constructed. While some do not have a lot of information at present, they may have more to offer in the future and should be regularly visited if you're interested in the material.

Virtual museum tours, such as those offered by the University of California Museum of Paleontology and the Royal Tyrrell Museum, along with a set of questions could be assigned as an outside learning resource for students. Some examples of questions might be to define the geologic age range of the trilobites, to explain the term "Cambrian explosion," to discuss why horseshoe crabs are considered living fossils, to explain the differences between brachiopods and mollusks, or to define the term "Vendian animals." Many more could easily be compiled by browsing through the exhibits. Instructors, should, however, guard against plagiarism since students may be tempted to copy

information word-for-word from displays. Many of the exhibits also have beautiful fossil images that the instructor may want to download for demonstrations or quizzes.

The Web pages for the crinoid project, radiolarian biostratigraphy, Mohawk Valley paleontology, and the Stuttgart reef group accurately reflect how professional paleontologists work and how fossil organisms can be used to better understand Earth's past environments. Instead of simply showing "pretty" pictures of fossils, instructors should consider teaching students about the science of paleontology and why paleontologists study fossils. For the same reason, it may be interesting to visit the Web pages of professional organizations for paleontologists. Finally, along with the online information at these Web sites, there are additional references for further reading that some students may wish to pursue.

Several of the sites have information on topics in paleontology that are usually not taught in beginning earth-science or paleontology courses. One example is microfossils that are widely used by paleontologists employed by the petroleum industry and studied for the information they yield on paleoclimates. Also interesting are the Web sites discussing palynology, ichnology, paleobotany, and the unique Mazon Creek organisms.

Although it may prove too controversial for some, the *talk.origins* archives are an interesting and useful source of information for those wishing to discuss creation/evolution issues in the classroom.

The paleontology databases may mostly be of interest to advanced students although they may be used to search for examples of fossil organisms studied. For example, the Mazon Creek flora includes the seed fern *Sphenopteris* along with an image. It may be interesting to search for this genus in the IOP Plant Fossil Record Database, the Smithsonian NMNH Fossil Plant Register, and the UCMP Paleobotany Type Collection Catalog. The IOP database, for example, lists three specimens of this genus from the Carboniferous of Poland and the Smithsonian NMNH lists over 50 species in their collections.

My next column will move away from paleontology and discuss the many resources available on the World-Wide Web for learning about earthquakes and seismology.

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