

Exploring Geology on the World-Wide Web – Marine Geology and Oceanography

Brian John Exton
Department of Geological Sciences
University of Texas
Austin, Texas 78712
e-mail: bexton@mail.utexas.edu

Keywords: Earth science – teaching and curriculum.; education – computer assisted; marine geology and oceanography.

INTRODUCTION

In recognition of the importance of the marine environment, the United Nations declared 1998 the International Year of the Ocean. This designation provided individual organizations and governments with an important opportunity to raise public awareness and understanding of the ocean and related issues. Some of the web sites listed below were specifically designed as products of this international effort, while many others were inspired to improve their content. As a result, you can now find information on a variety of related topics, including the topography or shape of the ocean floors, the distribution and type of bottom sediments, the composition and structure of the underlying rocks, and the geologic processes that have been at work throughout the seafloor's history.

Plate tectonics, seismology, volcanology, and geophysics were covered in previous columns and are treated only briefly here. Coral reefs and sedimentology are also covered only briefly, as they are subjects I will cover in future columns. Previous topics of this column and their corresponding hypertext links are available from the web page listed below. All of the URL addresses in the current article will be available on the publication date of the *next* issue of the journal. Please visit:

<http://www.geo.utexas.edu/bexton/jge/jge.htm>

PROFESSIONAL ORGANIZATIONS

International Oceanographic Foundation

<http://www.rsmas.miami.edu/iof/>

Contains a nice overview of the diverse aspects, challenges, and opportunities that comprise a career in marine science.

American Society of Limnology and Oceanography

<http://aslo.org>

Promotes the interests of limnology, oceanography, and related sciences.

GENERAL INFORMATION

UNESCO – International Year of the Ocean

<http://ioc.unesco.org/iyo/>

The official United Nations Year of the Ocean web site. The Classroom section contains literally hundreds of activities subdivided in a number of themes. A great place to start surfing.

NOAA – International Year of the Ocean

<http://www.yoto98.noaa.gov/>

Another great Year of the Ocean site from the National Oceanographic and Atmospheric Administration.

Oceans Australia

<http://oceans.ninemsn.com.au/>

Year of the Ocean website from Australia. Nice design elements.

USGS – Western Region Coastal and Marine Geology

<http://walrus.wr.usgs.gov/>

A very nice site that by its own definition can "accommodate visitors with a wide range of educational backgrounds, from kids in elementary school to adults with little or no background in geology to professionals in geology and other earth sciences."

Ocean Drilling Program (ODP)

<http://www-odp.tamu.edu/>

The Ocean Drilling Program (ODP) conducts basic research into the history of the ocean basins and the nature of the crust beneath the ocean floor.

Joint Oceanographic Institutions – Education

<http://www.joi-odp.org/JOI/Education/Education.html>

Slides and a downloadable manual (in PDF format) present scientific concepts used during an oceanographic research expedition to explore the geologic, climatologic, and oceanographic history of the Indian Ocean basin and nearby Himalayan Mountains.

TOPEX/Poseidon Satellite Home Page

<http://topex-www.jpl.nasa.gov/>

Learn more about the TOPEX/Poseidon satellite, which measures global sea level.

NOAA – Marine Geology & Geophysics Division

<http://www.ngdc.noaa.gov/mgg/mggd.html>

Information on extensive bathymetric, marine sediment, and trackline geophysical databases in both coastal and open ocean areas.

Smithsonian Institution – Ocean Planet Exhibition

<http://seawifs.gsfc.nasa.gov/oceanplanet.html>

This electronic online companion exhibition contains all of the text and most of the panel designs and images found in the Ocean Planet traveling exhibition. Lots of great introductory material.

University of Washington – School of Oceanography

<http://www.ocean.washington.edu/outreach/>

Educational Outreach website, containing links to an interactive marine geological cruise, the REVEL Program, and the Exploraquarium.

NASA – Oceanography from the Space Shuttle
http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/OCDST/shuttle_oceanography_web/oss_cover.html

This NASA site contains some very interesting pictures of oceanic phenomena, such as spiral eddies and wind effects, taken from the Space Shuttle.

JPL – Physical Oceanography
<http://podaac-www.jpl.nasa.gov/>

General data archive site, but with additional links for teachers and students. Check out the Physical Oceanography from Space tutorial.

Exploring the Ocean Planet
<http://www.mbari.org/~oreilly/schoolPresentation/intro/>

A brief overview of the oceans and the fascination that it holds for all of us, prepared by Tom O'Reilly at the Monterey Bay Aquarium Research Institute.

RESEARCH INSTITUTIONS

Woods Hole Oceanographic Institution
<http://www.whoi.edu/>

Home page for one of the top oceanographic research institutions in the world. Lots of great links on the K-12 Resource page.

Scripps Institution of Oceanography
<http://sio.ucsd.edu/>

Scripps Institution of Oceanography is another leader in the study of oceanography.

Scripps – Oceanography on the Net
<http://scilib.ucsd.edu/sio/instl>

A lengthy list of links to oceanography and marine geology resources.

Monterey Bay Aquarium Research Institute
<http://www.mbari.org/itd/education/webpages.html>

Interesting information on the activities of the Monterey Bay Aquarium research staff.

Virginia Institute of Marine Science
<http://www.vims.edu/bridge/>

The Bridge is a collection of very useful online resources for ocean sciences education.

Scotiabank Marine Geology Research Laboratory
<http://opal.geology.utoronto.ca/marinelab/>

The focus of the Scotiabank Marine Laboratory is on scientific study of the deep ocean floor and the development of new technologies for marine exploration.

University of Newfoundland – Marine Institute
<http://www.ifmt.nf.ca/minet.htm>

Network of educational topics, including lesson plans and activities for teachers.

Rutgers Institute of Marine and Coastal Sciences
<http://marine.rutgers.edu/pt/home.htm>

Teacher resources and activities from Project Tomorrow at the Rutgers Institute of Marine and Coastal Sciences.

The Jason Project
<http://www.jasonproject.org/jason.html>

Learn more about this non-profit educational organization and its innovative web-based curriculum. Founded by explorer Bob Ballard, who among other things, located the Titanic's final resting place.

CARBONATES AND REEFS

Carbonates

[http://www.science.u bc.ca/~geol202/sed/carb/carbhome.html](http://www.science.ubc.ca/~geol202/sed/carb/carbhome.html)

Detailed information on carbonates in support of the Introduction to Petrology course taught by Michelle Lamberson at the University of British Columbia.

Virtual Reef Lecture

<http://www.brookes.ac.uk/geology/8313/reeflect.html>

An online reef lecture prepared by Roger Suthren at Oxford Brookes University.

Reef Education Network

<http://www.reef.edu.au/>

A great reef site for students. Visitors can gather information by using their own personal electronic notebook!

COASTAL PROCESSES

U.S. Coastal Seafloor Images

http://www.ldeo.columbia.edu/us_margins/index.htm

Absolutely beautiful coastal seafloor maps produced by Columbia University's Lamont-Doherty Earth Observatory.

Panoramas of the Seafloor

<http://www.sciam.com/0697issue/0697pratson.html>

Link to a Scientific American article about modern sonar techniques and the mapping of the continental margins of the U.S.

USGS – Coastal and Marine Geology Program

<http://marine.er.usgs.gov/>

Click on Web Highlights to see a wide array of interesting research programs currently being conducted.

USGS – Coastal Ocean Modeling

<http://crusty.er.usgs.gov/>

Information on Coastal Ocean Modeling at the USGS Woods Hole Field Center. Video animation: included.

EL NINO

NOAA – El Nifio Home Page

<http://www.ogp.noaa.gov/ensol>

Everything you ever wanted to know about the El Niño – Southern Oscillation (ENSO), and more!

USC – Sea Grant Program

<http://www.usc.edu/go/seagrant/elnino/link.html>

Extensive list of links related to El Niño.

NASA/Goddard Space Flight Center – El Niño Primer

<http://nsipp.gsfc.nasa.gov/enso/index.html>

This NASA-sponsored primer on El Niño is available in six different languages!

DEEP SEA HYDROTHERMAL VENTS

NOAA – Vents Geology Program

<http://www.pmel.noaa.gov/vents/geology/geology.html>

Check out the recent activity at Axial volcano. Cool video and sound clips.

NOVA (PBS) Online – Into the Abyss

<http://www.pbs.org/wgbh/nova/abyss/>

Follow an ambitious oceanographic expedition to retrieve one or more black smokers from the Juan de Fuca undersea ridge.

American Museum of Natural History – Black Smoker Expedition

<http://www.amnhonline.org/expeditions/blacksmokers/home.html>

Another great site dedicated to the 1998 expedition to the Juan de Fuca undersea ridge.

Pillow Lavas

<http://citt.marin.cc.ca.us/ring/plpage.html>

Photographs and videos of pillow lavas, assembled by Kathy Klingensmith at the College of Marin in California.

PLATE TECTONICS

USGS – This Dynamic Earth

<http://pubs.usgs.gov/publications/text/dynamic.html>

[#anchor10790904](#)

Online edition of the book, *This Dynamic Earth*, by W. Jacquelyne Kious and Robert Tilling. A great tutorial on plate tectonics.

USGS – Plate Tectonics and Seafloor Spreading

<http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/framework.html>

Interesting information and links related to plate tectonics.

Plate Motion Calculator

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

A program for calculating present-day tectonic plate motions from the Ocean Research Institute at the University of Tokyo.

SEDIMENTOLOGY

Duke University – Sedimentary Structures

<http://geo.duke.edu/ss/ss.htm>

This site contains a wealth of thumbnail images of sedimentary structures that link to larger formats and descriptions. Primarily designed to allow students enrolled in *Geology 110; Stratigraphy/Sedimentology* at Duke University to review slides shown in class.

USGS – Bedform Sedimentology

<http://walrus.wr.usgs.gov/docs/seds/sedimentology.html>

Online support material for the book *Cross-Bedding, Bedforms, and Paleocurrents* by D.M. Rubin. Contains text, images, and movies, as well as downloadable simulation software.

SONAR

Acoustics and Sonar

<http://www.marine-group.com/acoustic.htm>

A wonderful tutorial on the processing and interpretation of sidescan sonar data. Includes a number of sonar examples. Site courtesy of The Marine Group.

GLORIA Sidescan Sonar Atlas and Data

Geologic maps showing an interpretation of deep-water parts of the U.S. Exclusive Economic Zone in the Atlantic Ocean.

TIDES, CURRENTS, AND WAVES

National Ocean Service – Our Restless Tides

<http://www.opsd.nos.noaa.gov/restlesl.html>

A brief explanation of the basic factors responsible for producing tides and tidal currents.

The Gulf Stream

<http://kl2.njin.net/curriculum/oceans/gulfstream.html>

A demonstration web site from the state of New Jersey for the National Science Foundation, covering many different aspects of the Gulf Stream.

NASA Observatorium – Tsunami: The Big Wave

<http://observe.ivv.nasa.gov/nasa/exhibits/tsunami/tsun-start.html>

An excellent tutorial on the formation of tsunamis. Be sure to take the quiz at the end!

Tsunami!

<http://hnrww.geophys.washington.edu/tsunarnihnrelcome.html>

Primarily for the general public, includes information about the mechanisms of tsunami generation and propagation, the impact of tsunamis on humankind, and the Tsunami Warning System.

COURSE INFORMATION

University of Washington

<http://www2.ocean.washington.edu/oc540/>

Graduate-level course notes for *Oceanography 540: Marine Geological Processes* taught by Russell McDuff at the University of Washington.

University of Arkansas

<http://comp.uark.edu/~sboss/margeol.htm>

An exceptional supporting site for the course *Marine Geology 5533* taught by Stephen Boss at the University of Arkansas. Includes lecture notes with graphics, review files, and a hot list to several pertinent links.

University of Georgia

http://www.arches.uga.edu/~rfreeman/%27GLY409_home.html

Lecture notes and sample exams for the course *Marine Geology* taught by Raymond Freeman-Lynde at the University of Georgia.

San Jose State University

<http://geosunl.sjsu.edu/~dreed/menu.html>

Supporting materials for the course *General Oceanography* taught by Don Reed at San Jose State

University. Also contains a very nice collection of interactive exercises.

University of Pittsburgh

<http://www.pitt.edu/~bpeer/home.html>

Home page for the course *Physical Oceanography*, maintained by Brian Peer at the University of Pittsburgh.

Maine Maritime Academy

<http://bell.mma.edu/~jbouch/OS211.html>

Marine Geology coursepage maintained by Joceline Boucher at the Corning School of Ocean Studies. Very nice lecture notes and slides are available for download as *PowerPoint* files.

MISCELLANEOUS

Alfred Wegener Institute - Sea Ice Tutorial

<http://www.awi-bremerhaven.de/Eistour/index-e.html>

Very interesting material on the physical and ecological aspects sea ice.

Ophiolites

<http://www.redwoods.cc.ca.us/sciweb/depts/science/earth/smith/smith.htm>

<http://jersey.uoregon.edu/~mstrick/GeoTours/Josephine%20Ophiolite/JoOphiolite.html>

Two very different (but equally informative) virtual field trips through one of the world's best exposures of oceanic crust, the Josephine Ophiolite in California.

Why is the Ocean Salty?

<http://www.ci.pacifica.ca.us/~pacific/NATURAL/SALTY/salty.html>

You may never know the answer to this question unless you visit this site!

Law of the Sea

<http://www.tufts.edu/fletcher/multi/marine.html>

Comprehensive index of multilateral treaties concerning the marine environment. Of primary interest is the text for the 1982 United Nations convention on the Law of the Sea.

SUMMARY

The ocean bottom has been likened to a simple conveyor belt of basalt. At its greatest depths it is covered by a gentle rain of organic matter. Near the shallow margins of the continents, on the other hand, it is drenched by a steady siliciclastic downpour. Taken as a whole, the marine world is a relatively homogeneous place compared to terrestrial environments, yet we know so little of the ocean and the processes at work above and below the surface. There are still many mysteries to be solved, and it's high time we got to the *bottom* of it (pun intended!). The sites listed above represent the best of what we know and will inspire students to learn even more about this last frontier on Earth.

WEB TIP OF THE MONTH

Tired of looking for something on the Internet without success? Check out this excellent tutorial on search strategies from the Teaching Library at the University of California at Berkeley!

<http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/FindInfo.html>

Miscellaneous Announcement

The Earth and Space Science Technological Education Project (ESSTEP) announces its third season of teacher professional-development workshops. This NSF-funded project is a joint effort of the Geological Society of America, Cypress College, and the Space Science Institute, providing secondary and college faculty with training and support for optimal classroom use of computer and information-based technologies in earth, space, and environmental sciences. Faculty apply two- to four-person, multi-grade level, geographic-area teams and must commit to participation in two consecutive summer workshops. Hands-on training in Global Positioning Systems, Geographic Information Systems, Image Processing, and Multimedia are interwoven with field experiences and discussions about standards, assessment of student learning, and effective teaching practices. The workshop teaching approach is inquiry-based and designed to model a variety of teaching strategies. Participants receive a \$600 stipend year one and \$300 in year two, in addition to room and board. Continuing education credits are available.

Workshops this summer are scheduled for July 6-17, 1999, in Boulder, Colorado, and July 26-August 7, 1999, in Williamsburg, Virginia. For more information and an application, contact Holly Devaul, The Geological Society of America, 3300 Penrose Place, Boulder, CO 80301, 303-447-2020 ext.150, hdevaul@geosociety.org Applications are due March 1, 1999.