

**Ursinus College**  
**Earth Around Us (ENV102A, GEOL102A)**  
**Spring 2013**

**Instructor:** Sarah A. Willig, PhD

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**Cell Phone:** 484-571-4213

**Class Time and Place:** Mondays and Fridays 1:30-2:45 in Pfahler 207

**Lab Time and Place:** Mondays 9:00-11:50 in Pfahler 108 with three Monday morning field trips after spring break meeting at vans parked next to the New Dorm

**Office Hours:** I am available to meet by appointment before class or after class on Mondays and Fridays

**Purpose and Approach:** Earth Around Us is an introductory physical geology course that will provide an overview of this fascinating and important field of study. We will begin with a discussion of plate tectonics, the unifying theory in geology, and a review of earth materials including minerals and rocks (igneous, sedimentary, and metamorphic). We will then investigate processes driven by the internal energy of the earth including volcanism and earthquakes and those driven by the sun which powers the water cycle including landslides and subsidence, river flooding, and coastal flooding. Individual student presentations of case histories of different geologic disasters will deepen our understanding of these processes that prove hazardous when humans are present. We will also discuss arid landscapes, glaciation, geologic time, evolution, and global climate change. Throughout the course we will work on developing topographic and geologic map reading skills. The course will culminate with students applying material learned during the semester to individual presentations of home. Monday and Friday lecture material based largely on the required textbook will be coordinated with Monday labs drawn principally from the required lab manual. In addition to indoor labs, there will be three Monday morning field trips during the second half of the course to nearby sites to further our understanding of the local geology. The ultimate goal of the course will be to increase awareness of the critical role that geology plays in our lives. Please note that this course does not satisfy requirements for the Environmental Studies major.

**Required Textbook and Lab Manual (available in campus bookstore):**

1. *Essentials of Geology*, 11<sup>th</sup> edition, 2012 by Frederick K. Lutgens, Edward J. Tarbuck, and Dennis Tasa, Pearson Education, ISBN-0321714725. A copy is on reserve in the library.
2. *Laboratory Manual for Physical Geology*, 8<sup>th</sup> edition, 2013 by Jones and Jones, ISBN-978-0-07-352413-9
3. The syllabus and Powerpoint presentations will be posted on Blackboard

**Requirements:**

1. Attendance of all classes, labs, and field trips. If I have to cancel class or a field trip due to bad weather, I will communicate with you by email that morning.
2. I will communicate with you by email so please be sure to check it for class messages on a regular basis

3. Laboratory and homework assignments, points will be deducted for late submissions (15%)
4. Two lab quizzes on identification of igneous rocks, sedimentary rocks, and metamorphic rocks (5%)
5. Three two-page field trip reports due on the Monday following the field trip and to be submitted electronically to [swillig@ursinus.edu](mailto:swillig@ursinus.edu). Each report should include 1) an engaging Title, 2) an Introduction that summarizes background information and provides location and purpose of trip, 3) the Body of the paper that presents a sequential review of each stop with a discussion of what we did, what you observed, and your analysis, 4) a Conclusion, and 5) References if used. Field trips are required. If extenuating circumstances do not allow you to attend, the alternative is a carefully referenced 5-page paper on a relevant approved topic that will be due on the same date as the field trip report. Make-up field trips will not be available. All students must ride in college vans. I will need the help of two to three students who are certified to drive college vans or willing to get certified through Sandy Brown filling in for Liz Robb and available at [lrobb@ursinus.edu](mailto:lrobb@ursinus.edu) Smoking is not permitted on field trips. Long pants, socks, and closed-toed shoes with a sturdy tread (hiking boots are best) are required on all trips (no sandals or shorts) to protect legs and feet. (15%)
6. Test 1 on 2/22 (10%)
7. Test 2 on 4/12 (15%)
8. Test 3 on 4/26 (10%)
9. Individual student presentation (20 minutes) on geologic disaster (10%)
10. 5-page paper on geologic disaster due on Monday 5/6 by Noon, submit electronically to [swillig@ursinus.edu](mailto:swillig@ursinus.edu) (10%)
11. Individual student presentation (10 minutes) on home location, physiographic province, topography, geology, geologic hazards, and geologic resource (10%)
12. Completion of STPQ evaluation form

***Expectations:***

1. Attendance of all classes, labs, and field trips
2. Arrival in labs, in class and at vans for field trips on time
3. Communication with me by email or phone in advance of class, lab, or field trip if you are unable to attend due to illness or other extenuating circumstance
4. In the event that class is missed, please contact me to find out what material needs to be completed.
5. As stated above, in the event that a field trip is missed, the make-up assignment will be completion of a carefully referenced 5-page paper on a relevant approved topic due at the same time as field trip report submissions (one week after the Monday field trip).
6. Submission of all assignments on time, **points will be deducted from late submissions.** If you will be missing class and know this ahead of time, please leave your work in my mailbox in Monica Giancarlo's office in Pfahler 203. All laboratory assignments should be submitted as hard copies. For problems requiring calculations, please show your work to receive maximum credit. Field trip reports should be submitted electronically to [swillig@ursinus.edu](mailto:swillig@ursinus.edu)
7. Polite, respectful behavior in class

8. Laptop use for activities not related to class is not permitted. You should bring your laptop to class as we will be using it to complete some tasks. However, aside from this use, I ask that you refrain from using your laptop and pay attention to whomever is speaking (myself or students). Since our class time is relatively short, I'll need everyone's full attention.
9. Adherence to rules regarding **Academic Honesty** as explained in the *Ursinus College Student Handbook 2012-2013 (pages 13-15)*

### **Course Schedule as of 4/26/13 (to be updated and revised as semester proceeds)**

#### **Mon 1/14**

##### Lab (meet in Pfahler 108)

Welcome and Review of Syllabus

Dr. Leah Joseph will introduce 6-unit module "Human's Dependence on Earth's Mineral Resources"

Completion of Mineral Identification Lab (please bring lab manual to class, in advance read Chapter 1 Properties of Minerals, pages 2-11, and Chapter 2 Mineral Identification, pages 25-30)

##### Class (meet in Pfahler 207)

*Lecture Topic:* Introduction with focus on Plate Tectonics

*Reading in Essentials of Geology:* Chapter 1 An Introduction to Geology

##### Assignment for Friday to prepare for Unit 1

In folder on Blackboard, review Mineral Resources Powerpoint, The Rock Cycle Powerpoint, Mineral Resources Background Reading, and Mineral Resources Glossary

#### **1/18**

##### Class: Unit 1 "People, Products, and Minerals"

Complete Minerals and Products Sheet

Complete Reading Reinforcement Sheet

Complete Economic Development and Resource Use Sheet

Sign up for a mineral to complete concept map for to be turned in on Friday Mon., 1/28

*Reading in Essentials of Geology:* Chapter 2 Matter and Minerals

##### Assignment for Monday to complete Unit 1 and prepare for Unit 2 and Unit 3

Complete Population, Economic Development, and Mineral Resource Use Sheet (submit on Monday)

In folder on Blackboard, review Rare Earth Element Powerpoint and From there to here: The Mining Process Powerpoint and Background Information – Mining and Mining Methods and Glossary - Mining

#### **Mon 1/21**

##### Lab: Unit 2: Boom and Bust and Unit 3: Mining and Mining Impacts

Complete Concept Map

Complete Sheet on Supply, Demand, and Price for Rare Earth Elements  
Complete Muffin Exercise

Class: Unit 3

Complete Ore Grades, Waste, and Remediation Activity Sheet

Assignment for Friday to complete Unit 2 and 3 and prepare for Unit 4

Read “The Secret Ingredients of Everything” by Tim Folger, National Geographic

Read “Natural Capitalism” from page 49 from “A striking case study” to the middle of page 51 just before “How Much Water is There” and create a concept map for the process of obtaining a can of soda

In folder on Blackboard, review How sedimentary processes create mineral resources Powerpoint and Concept Map: Sedimentary Rocks and Processes

**Fri 1/25**

Class: Unit 4 Mineral Resources Created by Sedimentary Processes

Complete Activity Sheet for Review of Sedimentary Processes

Complete Activity Sheet for Mining Sand

Complete Activity Sheet for Mining Salt

Assignment for Monday to prepare for Unit 5 and Unit 6

Review Powerpoint (Mineral resources of igneous and metamorphic origin) on Blackboard

Watch the two videos on YouTube and answer the following questions:

<http://www.youtube.com/watch?v=rFHtVRKoaUM>

Video questions

1. Based on video #1, briefly and in your own words describe how “black smokers” form. Why are they important from a mineral resources standpoint?
2. Create a concept map showing how sulfide mineral deposits are formed from igneous activities. Your concept map should show:
  - i. Where the water (the “hydro” part of the hydrothermal fluids) comes from
  - ii. The source of heat (the “thermal” part of the hydrothermal fluids)
  - iii. The source of the metals picked up by the hydrothermal fluids
  - iv. Where the metals are deposited

Use the PowerPoint presentation slides as necessary.

Complete required reading for your Group to be determined on Blackboard

**Mon 1/28**

Lab: Unit 5: Metallic Sulfides: Resources Created by Igneous and Metamorphic Processes and 6: Mining, Society, and Decision-Making

Complete sheets for Unit 5

Meet with your group to complete questions for Unit 6

Class: Unit 6

Complete and submit write-up  
Submit concept map for your mineral

**Fri 2/1**

Class: Completion of Module on Human Dependence on Mineral Resources

**Mon 2/4**

Lab: Igneous Rock Identification (Ch 3 in Lab Manual) and Volcanism Lab (handout)

Class:

*Lecture Topic:* Cascade Volcanism

*Activity:* Look at Porter Mineral Collection

*Reading in Essentials of Geology:* Chapter 3 “Igneous Rocks and Intrusive Activity” and Chapter 4 “Volcanoes and Volcanic Hazards”

**Fri 2/8**

Class

*Activity:* Re-enactment of Decision-Making for Royal Gardens Subdivision

*Lecture Topic:* Hawaiian Volcanism

*Reading in Essentials of Geology:* Chapter 4 “Volcanoes and Volcanic Hazards”

Assignment for Monday

Prepare for Igneous Rock Quiz on Friday 2/15, a box of the samples will be in the cabinet below the sink at the back of Pfahler 207

Read through Chapter 5 “Metamorphic Rocks” in Lab Manual and Chapter 6 “Topographic Maps and Digital Elevation Models” in the Lab Manual

**Mon 2/11**

Lab: Identification of Metamorphic Rock Samples (Chapter 5 in Lab Manual) and Topographic Map Lab (Chapter 6 in Lab Manual)

Class: Student Presentations of Volcanic Eruptions

Ben: Mt. Vesuvius 79AD

Joe: Krakatoa 1883

Jack: Iceland 2010

**Fri 2/15**

Lab: Quiz on Identification of Igneous Rocks

*Lecture Topic:* Earthquakes

*Reading in Essentials of Geology:* Chapter 14 Earthquakes and Earth’s Interior

Assignment for Monday

Prepare for Metamorphic Rock Quiz on 2/18, samples will be in boxes in the cabinet below the sink at the back of Pfahler 207

Read Chapter 16 “Earthquakes” in Lab Manual

**Mon 2/18**

Lab: Quiz on Identification of Metamorphic Rocks

Earthquake Lab (Ch 16 in Lab Manual)

Student Presentation of Earthquakes

Vince: Chile Quake 1960

Michael K.: 1964 Alaska Quake

Class: Student Presentations of Earthquakes

Riley: Indian Ocean Tsunami 2004

Carolyn: Haiti Quake 2010

Jordan: Japan Quake 2011

**Fri 2/22**

**Class: Test 1 on Material Covered from start of semester through Monday 2/18**

**Mon 2/25**

Lab: Ch 8 in Lab Manual Streams and Humid-Climate Landscapes

Class

*Lecture Topic: River Systems and Floods*

*Reading in Essentials of Geology: Chapter 9 Running Water*

**Fri 3/1**

Class:

*Lecture Topic: Landslides and Subsidence*

*Reading in Essentials of Geology: Chapter 8 Mass Wasting: The Work of Gravity*

**Mon 3/4 Spring Break**

**Fri 3/8 Spring Break**

**Mon 3/11**

Lab: North Campus Walk, meet in Pfahler 108, dress warmly and just bring pencils and a clipboard or other hard surface to write on, wear sturdy shoes with a tread

Class

Summary of Campus Walk, please bring your laptops

**Fri 3/15**

Class: Student Presentations of Landslides and Subsidence

Raina: Vaiont Dam Disaster 1963

Brett: Venezuela Debris Flows 1999

John: La Conchita 2005

Nick: Mexico City Subsidence

**Mon 3/18**

Lab: Chapter 11 on Sea Coasts

Class: Student Presentations on River Floods

Mark: Johnstown Flood 1889

Elisha: Hurricane Agnes 1972

Hillary: Kinzua Dam

Nana: Mississippi River Flood

Nile: Hurricane Irene 2011

**Fri 3/22**

Class

*Lecture Topic: Coastal Landscapes*

*Reading in Essentials of Geology: Chapter 13 Shorelines*

**Mon 3/25**

Lab: Geologic Time

Class: Student Presentations on Coastal Floods

Chris: Northeaster 1962

Michael: Hurricane Katrina 2005

Bryn: Hurricane Sandy 2012

Shawn: Bangladesh

**Fri 3/29**

Class :

*Lecture Topic: Geologic Time*

*Reading in Essentials of Geology: Ch 18 Geologic Time and Ch 19 Earth's Evolution through Geologic Time*

Free the Elwha

**Mon 4/1**

Lab: Field Trip to Valley Forge (meet at vans parked next to New Dorm at 8:55 so we can leave promptly at 9:00, we will return by 11:45, dress for weather and wear sturdy shoes with good tread)

Class:

*Campus Sculpture Walk and Presentations*

Bryn: 2 The Watchers

Vince: 5 Sitting Figures

Jack: 7 Three Electras

Nile: 10 Cloaked Figure IX

Mark: 11 Seated Woman

Riley: 19 Rebirth

Elisha: 20 Granite/Marble Columns

Nana: 21 Love  
Raina: 22 Upheaval II  
Nick: 28 Lazy E  
Joe: 29 Bearkeeper  
Mike K: 31 Zacharius Ursinus  
Carolyn: 32 The Reader  
Jordan: 33 Temple  
Brett: 38 Bolt  
Shawn: 49 Weeping Walls  
Mike I.: 53 Sitting Figure  
Chris: 56 White Marble Bench  
Hillary: Gardening Lady  
Ben: Exclamation Mark  
John: I Set Before You This Day

#### **Fri 4/5**

##### Class

Summary of Valley Forge Trip and Sculpture Walk

*Lecture Topic:* Glaciated Landscapes

*Reading in Essentials of Geology:* Chapter 11 Glaciers and Glaciation

#### **Mon 4/8**

Lab: Field Trip to Phoenixville (meet at vans parked next to New Dorm at 8:55 so we can leave promptly at 9:00, we will return by 11:45, dress for weather and wear sturdy shoes with good tread)

Class: Chapter 10 on Glaciation in Lab Manual

#### **Fri 4/12**

**Class: Test 2 on material covered from 2/25 through 3/25 excluding geologic time**

#### **Mon 4/15**

Lab: Field Trip to Spring Mountain and Central Perkiomen Valley Park (meet at vans parked next to New Dorm at 8:55 so we can leave promptly at 9:00, we will return by 11:45, dress for weather and wear sturdy shoes with a good tread)

##### Class

*Lecture Topic:* Periglacial Features

#### **Fri 4/19**

Class: Home Presentations

##### **Coastal Plain Province**

*Outer Coastal Plain*

Chris: Ocean City, NJ

Vince: Millville, NJ

*Inner Coastal Plain*  
John: Cherry Hill, NJ

**Piedmont Province**

*Upland Section*  
Riley: Great Falls, Virginia  
Nana: Damascus, MD

**Mon 4/22**

Lab: Home Presentations  
Nile: Lower Merion, PA  
Mark: Huntingdon Valley, PA

*Lowland Section*  
Mike I.: Downingtown, PA  
Jordan: Downingtown, PA

*Gettysburg-Newark Lowland Section*  
Bryn: Lower Gwynedd, PA  
Shawn: Yardley, PA  
Ben: Short Hills, NJ  
Jack: Chatham, NJ

**Ridge and Valley Province**

*Great Valley Section*  
Elisha: West Reading, PA

*Susquehanna Lowland Section*  
Nick: Williamsport, PA

**Appalachian Plateaus Province**

*Anthracite Upland Section*  
Mike K.: St. Clair, PA

Class: Home Presentations  
Hillary: Scandia, PA

**New England Province**

*New England Uplands*  
Raina: Manhattan, NY  
Carolyn: Bedford Hills, NY  
Brett: Rye, NY  
Joe: Norwalk, CT

**Fri 4/26**

**Class: Test 3 on material covered from 3/25 (geologic time) to 4/22**

**Mon 5/6 by Noon**

Electronically submit geologic disaster paper based on class presentation

**RESEARCH PROJECTS**

**I. Individual Student 15-minute Presentation on Geologic Disaster and 5-page Research Paper due on date of final exam to be determined**

To deepen our understanding of geologic hazards, each student will select a disastrous event – a volcanic eruption, an earthquake, a landslide, a subsidence event, a river flood, or a coastal flood – and present key information through a 15-minute class presentation. For each event, include the following factors as they may be relevant. In addition, be sure to provide an outline at the beginning of your presentation and a summary slide at the end.

1. Location – use maps and photos (Google Earth/Google Map) to show location of event and areas affected
2. Tectonic Setting if important – use a map of tectonic plates to show relative motion
3. Topography – use topographic maps to show character of area involved, note elevations and directions
4. Geology Maps – use geologic maps to show character of underlying material
5. Climate/Weather
6. Timeline – generate a timeline indicating key events in sequence
7. Nature of Event– photos, both ground level and aerial, effectively convey conditions before, during and after event, more and more video is available on YouTube and other places as well
8. Effects – discuss effects on environment and humans temporally (short- and long-term) and spatially (local and more distant, some may be global)
9. Lessons Learned
10. References (be sure to use multiple sources). Please include the source of all figures and photos you use directly on the slide.

The accompanying 5-page research paper (it can be longer if necessary) due on the date of the final exam should include the information listed above as well as:

- a) an Engaging Title
- b) an Introduction that clearly states what the paper will cover
- c) Text which should include factors above (1-8) and figures and photos. Be sure to label all figures and photos (Figure 1, Photo 1) and provide a caption and the source below each. In the text, actively refer the reader to the relevant figure as you proceed (see Figure 1).
- d) Conclusion
- e) References, insert sources into the body of the text where appropriate as you go, be sure to provide a source for all information that is not common knowledge

## **Getting Started**

[http://www.usgs.gov/hazards/#realtime\\_info](http://www.usgs.gov/hazards/#realtime_info) USGS (United States Geological Survey) Natural Hazards Gateway, can access information about earthquakes, tsunamis, volcanoes, landslides, and coastal floods

<http://www.fema.gov/index.shtm> FEMA (Federal Emergency Management Agency)

<http://earthobservatory.nasa.gov/NaturalHazards/> NASA (National Aeronautics and Space Administration) Earth Observatory, incredible images

<http://www.ngdc.noaa.gov/hazard/> NOAA (National Oceanic and Atmospheric Administration) National Geophysical Data Center Natural Hazards Data, information about earthquakes, tsunamis, and volcanoes

<http://www.unisdr.org/> “International Strategy for Disaster Reduction”, a United Nations program

<http://environment.nationalgeographic.com/environment/natural-disasters/?source=NavEnvND>

National Geographic has incredible photos, stories and videos

[www.earthweek.com](http://www.earthweek.com) “A Diary of the Planet”, you’ll find very interesting material here

## **Volcanic Eruptions (I will compare and contrast Hawaiian and Cascade volcanism)**

1883 eruption of Krakatoa resulting in devastating tsunami (excellent book by Simkin and Fiske)

1902 eruption of Mont Pelee resulting in pyroclastic flow destroying village and inhabitants of St. Pierre

1985 eruption of Nevado del Ruiz in Colombia resulting in lahar that killed thousands many miles from crater

ongoing eruption of Montserrat in the Caribbean

2010 Icelandic eruption that disrupted air travel

many others

<http://www.volcano.si.edu/> Smithsonian Global Volcanism Program, maintains global catalogue of volcanoes

<http://volcanoes.usgs.gov/> USGS Volcano Hazards Program

<http://volcano.oregonstate.edu/> “Volcano World” administered by Oregon State University

## **Earthquakes (and Tsunamis) (I will discuss the 1906 and 1989 Quakes on the San Andreas Fault)**

1811-12 New Madrid, MO Quakes, interesting intraplate quakes, Mississippi River changed direction temporarily

1886 Charleston, SC Quake, another intraplate quake

1960 Chile Quake, largest recorded magnitude quake caused tsunami

1964 Alaska Quake, second largest recorded magnitude quake, also caused tsunami

1994 Northridge Quake, extensively studied

1999 Izmit Quake, Turkey, on North Anatolian Fault, “sister” fault to the San Andreas

2001 Gujarat, India

2004 Andaman-Sumatra Quake (Indian Ocean Tsunami)

2005 South Asia Quake

2008 China Quake

2010 Haiti Quake

2011 Japan Quake  
many others

<http://www.iris.edu/quakes/quakes.htm> information on earthquakes from IRIS (Incorporated Research Institute for Seismology), features “Teachable Moments”

<http://www.tsunamiwave.info/> International Tsunami Information Centre

<http://nctr.pmel.noaa.gov/> NOAA Center for Tsunami Research, has a number of Youtube tsunami videos

### **Landslides**

Venezuela debris flows 1999

La Conchita, CA 2005

Vaiont Dam, Italy Disaster 1963

many others

[http://landslides.usgs.gov/recent/ls\\_news.php](http://landslides.usgs.gov/recent/ls_news.php) “Landslides in the News”

<http://www.landslideblog.org/> analysis of landslides around the world by David Petley

### **Subsidence**

San Joaquin Valley, CA subsidence due to groundwater pumping

China

Mexico City

<http://water.usgs.gov/ogw/subsidence.html> USGS Groundwater Information

<http://pubs.usgs.gov/circ/circ1182/> USGS publication “Land Subsidence in the United States”

### **River Floods**

1889 Johnstown Flood, David McCullough has book on this event

Mississippi River Flooding, 1927, 1993

Local river flooding, Hurricane Agnes (1972), 1996 (blizzard followed by thaw), Hurricane Floyd (1999), Hurricane Ivan (2004), April 2005, June 2006, October 2010, Hurricane Irene 2011

Pakistan 2010

Australia 2010-2011

many others

<http://waterwatch.usgs.gov/index.php?id=ww> USGS Water Watch

<http://floodobservatory.colorado.edu/> Dartmouth Flood Observatory

### **Coastal Floods**

Numerous hurricanes, Hurricane Katrina, Hurricane Sandy, and northeasters (Ash Wednesday 1962 was big one on East Coast)

<http://marine.usgs.gov/> USGS Coastal and Marine Geology Program

<http://hurricanes.noaa.gov/> NOAA National Hurricane Center

## **II. Individual Student Home Presentation (12-15 minute presentation)**

The course will conclude with each student gathering and presenting information on his/her home to include the following as well as an outline at the start and a summary at the end.

- 1) Home Location – provide a Google Earth image and/or map to show the location of your home
- 2) Physiographic Province – determine and provide an image of the physiographic province in which your home is located, describe the general characteristics of the physiographic province
- 3) Topography – provide topographic mapping of your home and discuss the elevation and other relevant information shown on the map such as nearby streams
- 4) Geology – provide a geologic map of your home and discuss the characteristics of the underlying material, be as specific as possible providing the name of the formation and its constituents geologic materials (rocks)
- 5) Geologic Hazards – discuss one or more geologic hazards in the vicinity of your home
- 6) Mineral or Rock, Fossil Fuel, Soil, or Water resources – discuss one or more geologic resources in the vicinity of your home (may be historic)
- 7) References – provide references, in addition, provide the source of each image on the slide

**Resources (paste links into browsers), please find additional ones, let me know if you need help**

### **For VA**

Physiographic Provinces of Virginia

[http://web.wm.edu/geology/virginia/provinces/phys\\_regions.html?svr=www](http://web.wm.edu/geology/virginia/provinces/phys_regions.html?svr=www)

Geology of Virginia

<http://web.wm.edu/geology/virginia/?svr=www>

### **For MD**

Physiographic Provinces of Maryland

<http://www.mgs.md.gov/coastal/maps/g1.html>

Maryland Geological Survey

<http://www.mgs.md.gov/>

### **For NJ**

Physiographic Provinces of New Jersey

<http://www.state.nj.us/dep/njgs/enviroed/infocirc/provinces.pdf>

NJ Geo-Web

<http://www.nj.gov/dep/gis/geoweb splash.htm>

**For PA**

Interactive Geology Map of PA

<http://www.gis.dcnr.state.pa.us/maps/index.html?geology=true>

Landforms of Pennsylvania

<http://www.dcnr.state.pa.us/topogeo/field/map13/index.htm>

**For NY and CT**

Geomorphic Provinces and Watersheds of the New York Bight Watershed

[http://library.fws.gov/pubs5/web\\_link/text/geolsect.htm](http://library.fws.gov/pubs5/web_link/text/geolsect.htm)

Physiographic Province Map

[http://library.fws.gov/pubs5/web\\_link/images/fig03a.jpg](http://library.fws.gov/pubs5/web_link/images/fig03a.jpg)

Bedrock Geology Map of NYC

<http://www.geo.sunysb.edu/reports/ny-city/map.htm>

there is a NYC geology map in here

New York City Geology

<http://research.amnh.org/eps/nycgeology>

History of New York Geology

<http://www.newyorknature.net/Geology.html>

Southeastern New York Geology Map

[http://geology.about.com/library/bl/maps/n\\_statemap\\_NYSE2500.htm](http://geology.about.com/library/bl/maps/n_statemap_NYSE2500.htm)

Connecticut Geologic Survey

<http://www.ct.gov/deep/cwp/view.asp?A=2701&Q=487928>