

Charleton A. I.

Survey
CC Intro to geology

**Geology 110
Spring 1996**

Instructor: Mary Savina
Mudd 164
Office Hours: M 3-4 p.m., W 3:30-4:30 p.m., Th 8:30-9:30

Lab and Class Assistants: Karen Bobbitt, Miles Mercer, Josh Feinberg, Laura Veirs

Geology, broadly defined, is the scientific study of the Earth and planets. In Geology 110 this term, we will focus on several themes related to processes that operate on a global or planetary scale: planetary evolution, climate change, plate tectonics, evolution of life, and the geologic effects of human beings. Most labs will help us build an understanding of the geologic history of southeastern Minnesota, a history that went on for more than one billion years before humans came on the scene. Studying this region should help us come to understand "natural" (i.e. pre-human) processes and rates of processes. In many discussions and reading, we will consider how humans have altered natural systems and changed the rates of some geologic processes. We will also want to consider the future - of the Earth and of humanity. How might natural forces change the present state of the earth? What alternative actions are available to societies concerned about natural hazards or climate change? What can individuals do? These final questions turn out to be ones that will require some knowledge of different cultures and resources, because neither resources, consumption nor environmental problems are equitably distributed across the world or across the U.S.

We will treat these themes and questions in a broad way, concentrating on general understanding rather than on masses of facts. I hope you will develop a sense of the immense scale of geologic processes, both in time and in space. Through lectures and labs, I hope you will come to understand the methods that scientists have used to develop our present understanding of the Earth and planets. You will also gain what I hope will be the rewarding experience of working with other students in the class on several assignments. Throughout the course, but particularly for one project, you will have the opportunity to investigate how the geologic environment affects the lives of people throughout the world. And of course, I hope you will enjoy this course. Please feel free to ask questions and discuss problems with me at any time.

I do not take a traditional approach to introductory geology, and, in fact, I do not assign reading from a traditional text. (See the list of required reading below.) The other section of Geology 110 is using a more traditional text (Skinner and Porter, 1995, **The Blue Planet**: New York, John Wiley, 493 p.) and I encourage you to read sections of it, if you wish.

COMMUNICATING

Please feel free to call my office (x4404) and leave a message on voice mail if I'm not available. I can also be reached on the VAX (MSAVINA). I hope to set up a VAX conference for the course, to permit us to exchange ideas and questions. The VAX is also a quick way for me to communicate with the class. So please get a VAX account if you don't already have one. I may post especially provocative and interesting journal entries to this VAX conference. I will do this anonymously unless you tell me otherwise.

CLASS WORK

There are three class periods and one four-hour lab each week. Written assignments include an individual paper on geology and human society, a group poster project on the geology of southeastern Minnesota and a journal that is to be kept throughout the term. Specific assignment sheets will be distributed for the two papers. Most of the field lab write-ups can be used as illustrations and background material for the poster on southeastern Minnesota. There will be many oral presentations, culminating in a formal group presentation during the final part of the term.

Class periods will have various formats, including lectures, question and answer sessions, discussions, short student presentations, computer problems, films, etc. Because so much of our work in this course is interactive, regular attendance at class periods is important. Please bring Nisbet and Van Andel to every class. If I notice that you are repeatedly absent, you are likely to earn a lower grade for the course. I expect perfect attendance in lab. I see my role as creating an atmosphere for the course in which you can ask questions and learn about geology - from me, from your fellow students, from the reading, and especially from the earth itself. I am not always going to "run the show." However, if it's necessary I will step in to correct some major misconceptions in student presentations (however, in my experience, the content of student reports is generally pretty sound). Sometimes there will not be enough time to hear from every group that has prepared a short report.

Labs: The experience you gain through the laboratory is the most important part of the course. It is essential that you attend lab each week. Unless you are sick or have another very good reason, you must come to the same lab section each week. Because of the geology department comps schedule, several labs may be slightly shorter. Read over the lab exercises before coming to the lab. I encourage you to work together during the lab period and discuss your ideas with each other. Some weeks there will be a short test at the beginning of the lab, based mainly on work in previous labs. These tests will cover the geologic time scale, and rock and fossil identification. Sometimes you will be asked to write a short lab report, due in your journal or separately. During the field labs, you will be working in a group of three or four students. These will be the groups for the final paper on the geology of southeastern Minnesota. On May 18 (Saturday), there is an all-day field trip scheduled to Taylors Falls, a great place to look at the earliest history of southeastern Minnesota. I expect every student not involved in an athletic meet to go on this trip. (If you do have an athletic meet plan to go on May 19 with the other section of Geology 110.)

Participating in discussion: I am committed to trying to help you learn actively in this course. I think asking questions and participating in discussion are important. I'd like to create an atmosphere where we can all see and hear one another. So, I'd like to ask people to face the class when they have something to say. I would also like us to respect each others' opinions. I am not the only one in the room with important insights. I want you to listen and learn from the other members of the class. Aim to be coherent, to express your ideas completely and succinctly, to respond seriously to other ideas, and to relate what you say to geology. I expect that you will come to discussion prepared (doing the appropriate reading in the text and thinking about the issues raised). For some discussions I will ask you to prepare notes on the assigned reading which will be handed in at class.

Many of the issues we will be discussing are difficult problems facing societies. Too many times, individuals and governments have settled on a course of action in ignorance of all of its consequences. We need each person's ideas and knowledge about those consequences in order to avoid them, if possible. In some situations we will find there are no good answers and we have to evaluate alternatives. Being "scientific" includes looking at the human effects of those alternatives. For instance, in evaluating whether nuclear energy or coal burning is the better source of electricity for the next 30 years, we need to consider not only the costs of building, production, and damage to the natural environment, but also the human consequences of these choices. I think we can achieve more by combining our ideas and knowledge than by argument. Remember, too, that you can disagree with a set of ideas presented by another person, without attacking that person.

There are some questions that we can ask about many of the issues we will be discussing. You can use these questions to help you write about this class in your journal:

- 1) Why is this topic geologic? (does the process affect the geologic environment? does the geologic environment affect this process? does a style of geologic thinking help shed light on the way the process operates?)
- 2) What challenged you or surprised you about these ideas or reading?
- 3) What groups of people are affected? How?
- 4) What are some of the choices or alternatives? What are the consequences of doing nothing? or staying on society's present course?

5) What are some of the scientific controversies involved? What evidence has been collected? What further evidence needs to be collected? What information from the past (geologic/archaeological) would be useful to shed an historical light on this problem?

6) What specific actions can individuals take in their own lives relating to this problem? What do you think you will do? (For journals or privately - does not need to be discussed).

Working in groups: Many projects in this course involve group work. I will probably assign groups for large, formal projects, but there will be many informal opportunities to work with other students, too. Each student in a group should be an active participant in the group activities: It is important to carry your weight. It is also important to allow time for discussion among members of a group. Each person should be allowed to participate fully. It's all right to admit to questions and confusion - the other members of your group should help you out.

When you have formed your group, I suggest that all of you meet to set your general goals by asking "Where do we want to get to? What should the final product look like?" Needless to say, this first meeting should take place well in advance of the due date for the assignment! Then decide how best to accomplish what you want. The very best group projects have a coherence among the different parts that requires time together working out common goals and methods.

I believe that the students who present the best, most coherent projects also have the highest standards, learn the most, and have the most fun. They avoid these pitfalls in group work: one person dominating or a few people doing much less work. Please check with me or with one of the lab assistants if you have any questions or problems working in your groups.

Presentations: Each group of four or five students will organize a class presentation near the end of the course on a topic related to the course. Role plays, drama, video and all kinds of visual media are appropriate and encouraged! I am not certain which subjects we will cover in these presentations, but here are some possibilities:

#1: What are some of the economic and ethical problems involved in planning for geologic hazards, such as earthquakes and floods?

#2: How have popular conceptions and misconceptions of evolution affected human societies? What is the geologic evidence that refutes "scientific creationism"? What role does geologic evidence play in different scientific theories of evolution?

#3: How have human activities affected evolution and, through evolution, the Earth?

#4: What are the implications of trends in human population growth and consumption of natural resources for the global geologic and biologic environment?

#5: What kinds of ethical conflicts are professional geologists likely to encounter? How should these situations be handled?

Written work:

The journal: I want you to keep a daily journal of your reactions to the reading, labs, and class periods, as well as your thoughts about the issues raised in the class. Because the class will be going back and forth among the geologic past, present and future, the journal will be one way that you can integrate the course material. Maybe you will find that the ideas from this course relate to other experiences in your life, past or present. I am also interested in hearing about newspaper or magazine articles you see, or discussions you have with other class members and others on campus about issues related to geology. (It's amazing how many issues are related to geology!) On some occasions I will ask for specific feedback to class periods, readings, and discussions. For instance, I will want you to comment on Stephen Jay Gould's convocation address. Your daily entries needn't be long (more than a paragraph or two) unless you want them to be. As I read your journal entries, I will be looking primarily for active involvement with the course material. Please leave sufficient room in the margins and at the ends of your entries for me to write comments and questions. If your handwriting is illegible, you may want to write your entries on a computer and paste them in the notebook. **I will collect the journals every Thursday at 1 p.m.** for comments and grades, which will range from 0 (nothing turned in), 1 (OK), to 2 (great stuff).

I expect that your papers will be typed or printed and that spelling and grammar will be perfect. When reading written work, I look for well-defined questions, good understanding of the subject, careful and complete observations of geologic processes, sound logic connecting the observations to the conclusions, clearly stated conclusions and complete discussion of the implications of the conclusions. You may rewrite the paper on geology and human society. I average the grades for the original paper and the rewrite. If you choose to rewrite the paper, you must resubmit the original paper in addition to the revision.

ASSIGNMENTS AND APPROXIMATE GRADING

Three lab quizzes	9%	
Four lab assignments (lab groups of three)	12%	
Global geo-political paper (ind.)	25%	
Due May 8, 5 p.m.		
Rewrites due June 5, 5 p.m.		
Poster on geology of southern Minnesota (groups of three)		12%
Due May 24, 5 p.m.		
Journal	16%	
Final Presentation June 1, 2-5 p.m		11%
Final Essay May 29	10%	
Class participation 5% (based on self-evaluation and observations of instructors; self-evaluation due on June 5)		

You must attend all labs and complete all assignments in order to pass this course.

If you find you need an extension, you must request one at least three days before the deadline. Late papers will be graded down half a grade for each day late.

REQUIRED MATERIALS

The required textbooks are: 1) Tjeerd H. Van Andel, 1994, **New Views on an Old Planet** [2d ed.]: Cambridge, Cambridge University Press, 439 p.; 2) E. J. Nisbet, 1991, **Leaving Eden**: Cambridge, Cambridge University Press, 358 p. and 3) Stephen Jay Gould, 1989, **Wonderful Life**: New York, W. W. Norton, 347 p.

Other required materials:

10x handlens on a string around your neck
 Clear plastic 6" (15 cm) ruler/protractor with English and metric divisions (C-Thru W-8)
 Hard pencils and sharpener
 Four or five colored pencils
 Small spiral notebook for field notes
 Large spiral notebook for journal

Field labs: bring sunscreen, bug repellent and water

TENTATIVE SCHEDULE OF LECTURES, LABS, AND ASSIGNMENTS:

Week 1 March 25-29

Class Periods: Powers of Ten - thinking globally, universally and temporally; what is science? geologic time

Foundations: Thinking in systems

The earth in the solar system (a working model)

Required lecture on Friday: Convocation by Stephen Jay Gould

- Lab: Planetary geology, part 1; Introduction to system modeling, part 1 (human population growth with STELLA); Introduction to remote sensing (using Adobe Photoshop to make and interpret color composites)
Reading: Van Andel, p. 1-41; Nisbet, xiii - 3; ch. 8 (for Thursday lab); Van Andel, 255-291

Week 2 April 1-5

Class periods: Dating rocks and events
Comparative planetary geology
Carbon cycle on the planets

Lab: Planetary geology, part 2; Systems modeling, part 2: Using STELLA to model the rock and the carbon cycle

Reading: Van Andel, p. 45-65; Nisbet, ch. 2, esp. p. 23-35 by lab time, appendix

Week 3 April 8-12

Class periods: The Climate system on Earth
Field work in geology
Climate and climate change in geologic history

Lab: Spot test on geologic time; Introduction to rocks; Glacial geology and rock types at the Little Chicago gravel pit (sketch, pebble count, and short report due at next lab).

Reading: Van Andel, p. 66-103; Nisbet, ch. 2 (before Monday's class), 3, 4

Week 4 April 15-19 (Mary gone April 19-21)

Class periods: Climate changes in the last 100 years (calculations and presentations)
Discussion of Greenhouse Effect
Using remote sensing for vegetation and climate change

Lab: Spot test on rocks; Describing sedimentary rocks in the field (Stratigraphic section and rock descriptions due at next lab)

Reading: Nisbet ch. 3, 4 (by Wednesday's class)

Week 5 April 22-26

Class periods: Introduction to Plate Tectonics
Plate Tectonics and Igneous Rocks
Plate Tectonics and Earthquakes

Lab: Paleozoic rocks near Northfield (Composite stratigraphic section and rock descriptions due at next lab)

Reading: Van Andel, p. 105-172

Week 6 April 29-May 3 (Geology Department field trip to Southeast Missouri and regional Geological Society of America meetings, April 27-May 3)

Class periods: (Monday is mid-term break)
Sedimentary environments
Energy discussion

Lab: Siting a nuclear waste disposal facility (short response in journal)

Reading: Van Andel, p. 175-251; Nisbet, ch. 5, 6 (by Thursday's lab);

Week 7 May 6-10

Class periods: Energy discussion

Origin of the atmosphere and hydrosphere, oceans through time

Modeling sedimentary environments

Lab: Mapping in the Cannon River Wilderness Park (geologic map, stratigraphic section, rock descriptions and summary due at next lab)

Reading: Van Andel, p. 292-310; Gould, **Wonderful Life**, p. 1-78

Week 8 May 13-17

Class periods: Chemistry and the origin of life

Early Life

Principles of Evolution

Lab: Field Trip to Red Wing; composite stratigraphic section, including units seen at Red Wing and Taylors Falls due at next lab

Reading: Van Andel, p. 311-370; Gould, **Wonderful Life**, p. 79-239

Weekend field trip to Taylors Falls: Saturday, May 18 8 a.m. - 6 p.m.

Week 9 May 20-24 (Mary gone May 22-May 30)

Class periods: Extinctions

Human dimensions of global change

Poster preparation

Reading: Van Andel, p. 371-403; Nisbet, ch. 7, 9

Wonderful Life, by Stephen Jay Gould, p. 240-323

Lab: Fossils, Discussion of **Wonderful Life**; spot test on fossils; poster preparation

Week 10 May 27-29

Class periods: Population discussion

Final essay

Movie: "It's a Wonderful Life" will be scheduled for one of the "Dead" Days.

June 1, 2-5 p.m.: Group Oral Presentations

WED Joints, faults, folds, shears. Read Montgomery, Chapter 11.

FRI summary of work on soils. Finish up structural geology.

October 13—October 17 (No laboratory or field work scheduled for this week.)

MON Mid-term break, no class.

WED Guest lecturer. Seismic hazards. Read Montgomery, Chapter 10.

FRI Ground-water hydrology. Read Montgomery, Chapter 15.

October 20—October 24

FIELD WORK: Cannon River, questions of hydrology. How do rivers work?

MON Surface-water hydrology. Read Montgomery, Chapter 14.

WED Hydrology continued.

FRI Summary of hydrology field work. **Pick up essay question today.**

October 27—October 31

FIELD WORK: Sogn, Wangs Corners, and Stanton; completing the bedrock story.

MON Fossils and the history of life. Read special handout on fossils.

WED Fossils continued.

FRI Summary of work on Sogn, Wangs Corner, and Stanton. Summary of fossils.

November 3—November 7

FIELD WORK: Railroad quarry and road cuts environmental analysis. Read handout on carbonate rocks.

MON Biogeochemical cycles in the oceans and atmosphere. Read Montgomery, Chapter 12.

WED Mountain glaciers. Read Montgomery, chapter 18.

FRI Summary of work on railroad-quarry analysis.

November 10—November 14

FIELD WORK: Little Chicago, exploring glacial deposits.

MON Climate change.

WED Other major global change.

FRI Summary of Pleistocene stratigraphy. Wrap up. **Pick up final essay question.**

Other essential items

Readings: I expect you to read the textbook assignments in anticipation of class. The textbook will be used as a primer of sorts, to give you the background information in advance of class sessions. The essays and other assignments that you do for grades will rely on your understanding of the textbook plus other reading that you do. Students who have done well in the pass tell me that reading the textbook for understanding is really important. There will also be optional readings, Kodachrome slides to view, videotapes, and other materials in the geology laboratory. Do not remove the materials from Mudd 62. I will consider it a breach of academic honesty if I learn that you have removed materials.

Evaluations: You will be asked to write three short essays during the course. The last one will be instead of a final exam. Each essay will be graded according to the standard which I will pass out in class. Each essay will count 15 percent toward your final grade. Your field work will count 55 percent. If you want to do the writing requirement with me, please inform me early in the term.

Laboratory and field sessions: You are required to attend each laboratory and field session. If you cannot attend you must explain your absence to me in advance, if possible. Be sure to dress appropriately for the weather. Bring you handlens and notebook.

Office hours: My office is located in Mudd Hall 162. I try to maintain an open office wherein you can visit me anytime that is convenient to both of us. If you have trouble finding me, first check with Mrs. Bray, the department secretary (x4407). If that does not work try email (ebuchwal), call me at home (645-9823) between 7:30 AM and 9:00 PM, or leave a note for me in the geology office, or on my bulletin board, or call my voice mail (x4403).

Disabilities: If you have a condition that has the potential to adversely affect your success in this class and you think it would help if I knew about it, please tell me. I will do my best to accommodate your special needs.