James Madison University

Department of Geology
And Environmental Science

Syllabus - Geology 230

http://csmres.jmu.edu/geollab/Fichter/Geol230/

EVOLUTION OF THE EARTH

Spring, 2009

CREDIT HOURS:	04	
LECTURE:	Memorial, Room 6125; MWF 9:05-9:55	
LABORATORY:	Memorial, Room 7110; T 1:25-3:20 (Fichter) **OR** Th 11:00-1:00 (Haynes)	
INSTRUCTORS:	Lynn S. Fichter	John Haynes
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OFFICE HOURS:	MW 8-9 TT 8-10; By appointment	
FINAL EXAM:	Monday May 4, 2009 from 10:30-12:30	
TEXTS:	LECTURE: ◊ JMU Copy Center: **Notebook of Lecture Illustrations** LAB: ◊ JMU Copy Center:Fichter, L.S., and Poche', D.J., 1993, **Ancient Environments and the Interpretation of Geologic History**, ◊ A **Handlens**, 10X, purchased from the Geology Club or bookstore.	

WHAT'S THIS COURSE ALL ABOUT?

I'm biased, of course, but I find the study of Earth history one of the most intellectually sweeping, awe inspiring, and intriguing subjects there is. I love it, and I hope that through my enthusiasm I incite your enthusiasm, and intellectual interest too.

The major reason for my bias is the all encompassing nature of the Earth's history. The study of Earth history requires such diverse subjects as astronomy (origin of the planet; asteroid impact theories for extinctions), nuclear physics (both for radiometric dating and to understand the sun's history and influence on the Earth's history), geophysics (the structure of the Earth and its functions), geochemistry (the origin and interrelationships among the various rocks), petrology (the interpretation of rocks), biochemistry, zoology, botany, genetics, ecology, etc.(the origin and history of life) . . . you get the idea.

But, perhaps even more important is the human struggle to come to terms with the Earth. As you are probably aware from recent cases dealing with teaching–or not teaching–creationism and intelligent design in high school science classes, our subject is not values neutral. Indeed, a majority of U.S. citizens believe the Earth is only 6000 years old. Study of the Earth is, and has been since its origin, fraught with struggle and controversy. And this controversy is not just between religious fundamentalists and science. Deep scientific disagreements also exist within the scientific community. Science is not simply fact, it is sociology, and psychology, and philosophy and it is essential that you be aware of this whole other realm of science - the scientific community, and scientific process, and how they work.

Because of this eclectic nature the "pure" scientists sometimes look down their noses at Earth scientists. We, of course, do not always have neat and simple problems that can be enclosed in a laboratory experiment, or described in a mathematical equation.

To a large degree the study of Earth history is a bastard science. Its laboratory is the Earth, (which is not a simple or neat laboratory), and its experimental tools are anything needed to solve the problems. Geology's problems are often frustratingly complex, and it seems that it is almost impossible to talk about any one facet of the origin and evolution of this planet without getting involved in tangential arguments piled one on top of the other. It is like trying to tell a simple short story *("Odysseus made a trip back home to Ithaca")* but continuously getting side tracked into secondary stories along the way until a never ending novel results (*The Odyssey*).

It is practically impossible to avoid these problems with a subject as complex as the whole Earth, and I really don't want to. That is one of the things which makes Earth history so much fun to study. But we are limited, if nothing else, by time. So what are we going to do? To begin we divide our study into three coherent divisions which encompass broadly related ideas, concepts, and/or processes.

- **I. THE ROCK RECORD: its origin and ordering**
- **II. THE EVOLUTION OF LIFE: and its impact on the evolution of the Earth**
- **III. GEOLOGICAL EVOLUTION OF THE EARTH: and all the tectonic theory supporting it**

I hope that you do not expect me to give you all the answers about the Earth's history. The quest of science is to explore the unknown and impose order on the universe. Attempts to impose order is a purely human activity. The natural world does not "know" it operates the way it does, and our models and theories are only our halting attempts to describe the world. What is most important in science are the questions about the unknown the scientists are asking; known facts are not science. If you leave the semester with more answers than questions I have not done my job.

All this is important because it reflects science as it is with all its strengths and weaknesses, and its continuously self-correcting nature. Therefore, I ask you to not accept what I tell you this semester as the gospel truth. Some of the things to be discussed we are fairly confident are close to the truth, but many others are still blurry conjectures. We are in a period of history when knowledge is growing faster than ever before. Many models and theories are proposed, explored, and become obsolete before they can filter down to textbook level. I cannot give you the truth, I can only give you a progress report, an introduction to ideas I hope will intrigue you enough to pursue them on your own after my sphere of influence passes.

COURSE WEB SITE

http://csmres.jmu.edu/geollab/Fichter/Geol230/

I am beginning to faze out the use of web sites for my courses, but the one for Geol 230 is still an active link. But, the site is also beginning to go out of date. Still, there are some items that will be useful to you.

- **Sample Tests**: my tests are likely to be unlike any test you have seen, although they are still Scantron, True-False/ Multiple Choice Tests. It is just that, for example, the multiple choice are not just five choices, but may involve as many as 20 or 25 choices. In this case, one question is spread over 2, or 3 or 4 test numbers. The tests often also involve many figures or diagrams to interpret. So, go take a look at the sample tests. The one’s you take will be almost identical in format, even if the questions may be different.
- **Study Guides**: I used to hand out detailed study guides for each section of the course. These were point by point lists of everything you needed to know. I now advise that the best way to study for tests is to go through the Power Point lectures, but there are older study guides on the site.

COURSE POWER POINTS

S:/Geol230-Evolution of the Earth

Copies of all the power points used in the course are available on the S: drive on the department server. This server is accessible from any computer in the department computer labs, or from any computer in any of the geology class rooms. If you are not familiar with this drive go check it out. It is a drive where you can create a folder of your own, and store files associated with geology courses and projects.

But, many if the profs also make available course materials on the S drive. All the Geol 230 course power points will be place there so you can review lectures, and study for tests. I try to have copies of the power points available before the class we talk about them, but I also often revise lectuers right up until I walk into class, so they may show up later.

Feel free to bring a memory stick and download any of these files and put them on your own computer.

EXAMS, GRADING, AND GRADES

EXAMS. . . are a pain in the neck! You do not like taking them. I do not like grading them. But we are stuck with them, and I think most of us would be lost without them. They have become a custom by which we measure a semester's progress.

But as much as possible I want the time you spend in this class to have as few needless hassles as possible. To aid this I remove as much uncertainty as possible about the things important to you, like . . . *"What do we hav'ta know?"* and *"What are the tests like?"*

☺ *"What do we hav'ta know?"* This course covers a tremendous range of facts and knowledge. After all, the Earth is 4.5 billion years old, and our subject is to come to understand as much about the 4.5 billion year history as we can. In addition, the course undergoes continuous revision. I keep finding new ways to teach things, and new knowledge keeps appearing, so the course keeps evolving.

I used to provide study guides for each section of the course (and older versions - only somewhat out of date) are available at the course web site, but by far the best way to keep up with every thing is to review the power point lectures. They are the most up to date version of of the course subject content, and when I make up tests I sit down with the power point lectures, go through them slide by slide, reminding myself of what we discussed, and make up questions from that.

Thus, the best way to keep up with the material is to download copies of the power points to your own computer, and review after each class the subject matter we have explored. And, when it comes time to study for tests, use the power points as a study guide. If it is in the power point it is fair game for a question. If it is not in the power point, do not worry about it.

☺ *What Are the Tests Like?* Lecture tests are multiple-choice/true-false questions, scantron, computer graded tests. Sample tests for each section of the lecture are available at the course web site. Use them to see how I organize exams and ask questions. I don't want you to waste energy trying to guess what I want. I want you to spend that time doing productive studying and thinking.

My scantron tests are organized differently than any you have likely taken. I will talk more about this when we get close to the first test.

GRADING

☼ **Lecture Tests -** Lecture tests are closed note, closed book tests. What is different is that you will not take the tests during class time. Instead, when it is time for a test we - you and me in discussion - will set aside a 3 or 4 day span for the test. When you are ready to take the test you come to me, I give you a copy of the test and find an empty room to work in. You must take the test in one sitting, but may take as long as you need to take it. Within reason, no time limits. When finished you bring the test back to me. This allows you to take the test at a time you are at your best, and gives you the opportunity to work at your most comfortable and efficient pace. Strict rules you must follow are attached to each test, and are discussed with each test.

- **Grading** - Grading of each test is on a 10 point scale. At the end of the semester all your grades are averaged. At that point your grades are converted to a +/- scale according to the following system. For example, 80-82=B-, 83-86=B, 87-89=B+, and so on.
- **Grade Curving** - I have no aversion to curving test scores when it is appropriate. Curving is done test-by-test. Final grades are not curved.
- **Laboratory Tests** - The first two tests are taken during the laboratory periods; see schedule at end of syllabus. The final lab test is a partial take home and is discussed in more detail later in the semester.
- **Missing Assignments** are averaged as a zero. You must complete all course requirements to receive credit. The final course grade drops one letter grade for each grading category not completed, unless compelling reasons exist for an incomplete.

Lecture Test #1	23%
Lecture Test #2	23%
Final Exam	23%
Laboratory Tests	
Rocks	10%
Fossils	6%
Basin Analysis	15%
	100%

TEXT AND OTHER READINGS

No single text can adequately cover a subject as diverse as this one, and over the years text books have gotten more and more expensive, while supporting the course less and less. I do not confine myself to just the subject matter covered in textbooks. Therefore, I have not ordered a text.

There are times, however, when it is helpful to have supporting readings for some subjects. Therefore, I may assign readings during the semester.

What you will need to purchase from the JMU bookstore is the Lecture Notebook (containing all the diagrams and illustrations used in the course), and the lab book "Ancient Environments and the Interpretation of Geologic History.

IMPORTANT DEADLINES AND DATES

[Dates are approximate and subject to change]

WEEK 1: JAN 1 - JAN 16

WEEK 2: JAN 19 - JAN 23 (no class on Monday: Martin Luther King day)

WEEK 3: JAN 26 - JAN 30

WEEK 4: FEB 2 - FEB 6

WEEK 5: FEB 9 - FEB 130 . . . . **LAB TEST #1**

WEEK 6: FEB 16 - FEB 20 (no class on Tuesday: Assessment Day; do lab study on own)

WEEK 7: FEB 23 - FEB 27

WEEK 8: MAR 2 - MAR 6 . . . . **LAB TEST #2**

SPRING BREAK MAR 9 - MAR 13 (no classes Monday - Friday)

WEEK 9: MAR 16 - MAR 20 . . . . **End lecture test unit one**

WEEK 10: MAR 23 - MAR 27 . . . . **LECTURE TEST #1**

WEEK 11: MAR 30 - APR 3

Section Measuring Field Trip, Saturday April 4

WEEK 12: APR 6 - APR 10 . . . . **End lecture test unit two**

WEEK 13: APR 13 - APR 17 . . . . **LECTURE TEST #2**

Blue Ridge Field Trip, Saturday, April. 18

WEEK 14: APR 20 - APR 24

Black Water Falls Field Trip, Saturday, April 25

WEEK 15: APR 27 - MAY 1 . . . . **LAB TEST #3**

Final Exam Week . . . . FINAL EXAM - Monday May 4, 2009 from 10:30-12:30

LABORATORY SCHEDULE

*(page numbers in "**Ancient Environments and the Interpretation of Geologic History**")*

NOTE THAT MANY OF THE LABS HAVE A PRELIMINARY WHICH IS TO BE READ BEFORE COMING TO LAB. If you do not read it much of the lab will not make sense to you.

Week	Lab	Topic	Pages
WEEK #1 JAN 12 - JAN 16	1	**An Introduction to Rocks, Tectonics and Ancient Environments**	**p 1-8**
		Igneous and Metamorphic Rock Review	**p 9-31**
WEEK #2 JAN 19 - JAN 23 WEEK #3 JAN 26 - JAN 30	2	**Preliminary to Sedimentary Rocks**	**p 32-37**
		Sedimentary Rocks: Classification and Identification	**p 38-68**
WEEK #4 FEB 2 - FEB 6	3	**Preliminary to Depositional Environments and the Evolution of Sedimentary Rocks**	**p 69-80**
		Depositional Environments and the Evolution of Sedimentary Rocks	**p 81-99**

(END TEST UNIT ONE)

Week	Lab	Topic	Pages
WEEK #5 FEB 9 - FEB 13	4	**TEST ON FIRST THREE LABS**	
WEEK #6 FEB 16 - FEB 20 WEEK #7 FEB 23 - FEB 27	5	**Paleontology**	**Appendix F p 280-310**

(END TEST UNIT TWO)

Week	Lab	Topic
WEEK #8 MAR 2 - MAR 6	6	**LAB TEST ON PALEONTOLOGY**

RECESS MAR 9 - MAR 13 ☺ RECESS ☺ RECESS ☺ RECESS ☺ RECESS

Week	Lab	Topic	Pages
WEEK #9 MAR 16-MAR 20	7	**Interpreting Geologic History from Facies Maps**	**p 100-118**
WEEK #10 MAR 23-MAR 27	8	**Preliminary to Sedimentary Tectonics - Part A**	**p 119-135**
WEEK #11 MAR 30-APT 3		**Sedimentary Tectonics Part A: Transgression-Regression, and Isopach (Thickness) Maps**	**p 136-154**
WEEK #12 APR 6 - APR 10	9	**Preliminary to Sedimentary Tectonics - Part B: The Wilson Cycle**	**p 155-172**
		Sedimentary Tectonics Part B: The Integrated Study of Basins and Sourcelands	**p 210-215**
WEEK #13 APR 13 - APR 17	10	**Preliminary to Correlation**	**p 216-221**
		Correlation	**p 216-237**
WEEK #14 APR 20-APR 24	11	**The Analysis of Depositional Basins**	**p 238-252**
WEEK #15 APR 27-MAY 1 [1]		**LAB TEST ON LAST FIVE LABORATORIES**	

[1] The final lab test begins as an in-class project done during that final two labs. The test itself is taken by the class as a whole on Friday afternoon of the last day of classes. Further instructions given at that time.

FIELD TRIP DESCRIPTIONS

There are three scheduled field trips; one is a half-day trip for the laboratory, and two all day Saturday trips required for majors or prospective majors (optional for others).

The all day field trips survey the local geological history and the evidence for it. Geology is a field science; no matter what branch you go into you must at some point become proficient in the field. Doing geology in the field is a very different thing from doing it in the classroom, and it takes a fair amount of experience to learn it. At this level of your education you cannot have too much practice at doing geology in the field.

Saturday, April 4 - Section Measuring Field Trip

This field trip provides some practical experience with observing rocks in the field and recording those observations. The driving time and work take four or five hours. We leave from the Miller Hall parking lot at 8:00 and should return about 1:00. The trip travels west on Rt 33 to Shenandoah Mountain (the large mountain seen as you look west). We divide into three teams and measure 3 different sections, one containing Bouma sequences, one with hummocky sequences, and one with point bar sequences.

Saturday April 18- Blue Ridge Field Trip

We examine the oldest rocks in Virginia (1.2 billion years old), and study some of the evidence by which we have learned that 600 ma the Blue Ridge was a site of active plate rifting which opened the Proto-Atlantic ocean (at that time none of the land east of the Blue Ridge, i.e. the Piedmont, existed yet.)

We leave from Miller Hall parking lot and travel north to New Market, then east on Rt.211 over the Massanutten Mountain to Thornton Gap on the Blue Ridge. Skyline Drive is followed south to Swift Run Gap and Rt.33, and head back to Harrisonburg. Stops are made to look at igneous, sedimentary and metamorphic rocks, along with structural geology.

Departure time - 8:00 a.m. RAIN or SHINE. Return around 4:00. You may pack a lunch but we also stop at a McDonalds in Luray.

Saturday, April 25 - Black Water Falls Field Trip

Field trip begins in the Miller Hall parking lot and goes westward across the West Virginia mountains to Black Water Falls at Davis, West Virginia on the Allegheny Plateau. We see examples of much of the evidence dealing with mountain building processes and the interpretation of the Appalachian Mountains. There are opportunities to collect plant and animal fossils. Aside from the geologic wonders the scenery on this trip is beautiful and well worth the ride.

Departure time - 8:00 a.m.RAIN or SHINE. Return about 6:30 p.m. plus or minus. There are no fast food places in Franklin, so you may want to bring a lunch, but we also stop at a grocery store where you can buy something at the deli. We eat at Germany Valley about 10 miles down the road - spectacular scenery to view while eating and fossil hunting in the hill just behind the overlook.