

## Syllabus - Geology 230

<http://geollab.jmu.edu/Fichter/Geol230/Geol230.html>

# EVOLUTION OF THE EARTH

Spring, 20xx

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**CREDIT** 04

**HOURS:**

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**BUILDING:** Miller Hall

**LECTURE:** Room 209; MWF 9:05-9:55

**LABORATORY:** Room 208; T 12:30-2:20 OR Th 2:00-4:00 (see your individual schedule)

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**INSTRUCTOR:** Lynn S. Fichter

**OFFICE:** Miller Hall, Room No.233

**OFFICE PHONE:** 6531

**E-MAIL** FICHELTS@JMU.EDU

**OFFICE HOURS:** MW 10-11 TT 8-10; By appointment

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**FINAL EXAM:** Friday, May 4 from 8:00-10:00

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**TEXTS:** LECTURE:

◇ Notebook of Lecture Illustrations (JMU Copy Center)

LAB:

◇ Fichter, L.S., and Poche', D.J., 1993, Ancient Environments and the Interpretation of Geologic History, 3rd Edition, Macmillan Publishing Company, 310 pages.

◇ A Handlens, 10X, purchased from the Geology Club or bookstore.

**LABORATORY VOUCHERS:** This semester the university is assessing a charge for chemicals and other consumable items used in laboratory courses. Consequently, during the first two weeks of classes, each student in this course must obtain a paid "laboratory voucher" from the bookstore. Failure to obtain a voucher will lead to administrative withdrawal.

## 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.

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 which 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://geollab.jmu.edu/Fichter/Geol230/Geol230.html>**

The web site above supports this course. It includes study guides for each test, a sample test for each section, and numerous links to other sites that support the course, such as solutions to homework problems, and review materials for parts of the course people usually have lots of questions about.

This web site is fluid, and may change as the semester proceeds. If there are things you need or want to have available at the site just let me know and I will get them up. This might include, for example, labeled versions of illustrations that in your Lecture Notebook are blank, or links to particular sites that might be useful, or solutions to lab problems.

Note that some of the links require that the computer have an Adobe Acrobat reader on it. Most or all computers on campus have this. And if it does not, or yours does not, Netscape should direct you to download a free plugin Adobe reader. Also, see course web page for a link to Adobe to download the reader to your own computer.

## EXAMS, GRADING, AND GRADES

**E**XAMS. . . 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 will remove as much uncertainty as possible about the things important to you, like . . . *"What do we hav'ta know?"* and *"What will the tests be like?"*

☺ ***"What do we hav'ta know?"*** So you do not have to guess at what is important to me I will tell you exactly what you have to know. At the beginning of each third of the semester (i.e. The Rock Record, The Evolution of Life, and The Evolution of Mountain Ranges and Phanerozoic Evolution of North America) a study guide will be made available on the course web page. Each study guide is a specific, point by point lists of what you are responsible for. Anything on that list may appear on an exam; if it is not on that list it will not be on an exam.

I do this for a number of reasons. First, it is only fair that you know what you are expected to know rather than being kept in the dark. Second, I hope I can save you the trouble of memorizing large quantities of nitpicking facts (many of which can be easily looked up) in the fear I may ask them. Third, maybe if I get you away from fact grubbing you will become interested in the

important processes which are really the essence of geology, and make it much more interesting and enjoyable to study.

- ☺ ***What Will the Tests Be Like?*** I prefer tests that are short answer/essay (including discussions, explanations, lists, interpretations, diagrams, charts, etc.) and critical reasoning problems. If the class is large, however, I shift over to multiple-choice/ true-false questions, and computer grading. I will not make this decision until I see how big the class is. Most likely, the test will be a combination of computer graded with a few short answer/essay questions.

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.

- ☺ When I do ask for written answers what I am looking for is answers that are clear, concise, and definitive, written like the answers to the critical reasoning problems. They should boil all the information dealing with that question down to its essence. Sometimes this is a problem during grading for it is not unusual to have two answers which are both factually accurate, but one is muddled and unsure while the other is sharp and clear. It may seem unfair to penalize the muddled answer when it is basically correct in content. Yet, the two answers are not equal.

In science, as in many other fields, the quality of writing (clarity, good organization, correct grammar) is as critically important as what is being said. No matter what you want to do professionally your ultimate success will depend on writing well. Therefore, I give full credit only to those questions which are accurate and well written. Factually correct, but muddled answers receive less than full credit.

## GRADING

- ⚙ **Lecture Tests** - Lecture tests are closed book take home. Typically a two or three day period is provided and you may take the test at any time during that period. 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 will be 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 . . . . .             | 20%  |
| Lecture Test #2 . . . . .             | 20%  |
| Final Exam . . . . .                  | 20%  |
| Critical Reasoning Problems . . . . . | 10%  |
| Laboratory Tests                      |      |
| Rocks . . . . .                       | 10%  |
| Fossils . . . . .                     | 5%   |
| Basin Analysis . . . . .              | 15%  |
|                                       | 100% |

## TEXT AND OTHER READINGS

**N**o 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 assigned a text book this semester.

There are times, however, when it is helpful to have supporting readings for some subjects. Therefore, I may assign readings during the semester. I will also list such readings on the course web site. Copies of readings are stored on the shelves in Room 209. Because many people need access to the them READINGS MAY NOT BE REMOVED FROM ROOM 209.

**T**wo exceptions. IF there is a class meeting in Room 209 when you want to read a paper you may take it to another room, for that hour only, and only if you leave a note on the board indicating who has it, where, and when. You may also take a reading from the room to photocopy for yourself.

**R**emoving readings so that others do not have access to them is a cheating offense and persons doing it will be turned in to the Honor Council.

## CRITICAL REASONING EXERCISES

**T**o be a scientist one of the things you must learn is to examine evidence critically, establish a line of reasoning, and reach a conclusion or interpretation. What's more, you need to do this in writing so that it will stand up to critical review.

There is only one way to learn this - practice, practice, practice. For many of the lectures through the semester you will be given one or more exercises to solve as homework. In general there are lots of these exercises early in the semester, and they taper off toward the end. The procedures for the problems are as follows:

- ☞ Problems are handed out one class and due back the next, unless there are specific instructions to turn them in some other time. I keep a record of all the problems you complete and turn in and return them to you the next class.
- ☞ Problems not turned in by the ***end of class*** the day they are due will not be accepted.
- ☞ At the end of class I will post my answers in the hall case across from my office, beside room 232. I will leave them up for a few days, and then remove them. However, you may come to my office to see my solutions at any mutually convenient time.
- ☞ Once your problems are returned to you, you should check your written solutions against my solution in the key. In effect grade yourself on how well you did. If you and I have radically different solutions and you do not understand why, turn around and knock on my door because we need to talk.

If your answers are close to mine but not quite there then try to figure out what will be required to write yours so that they are better.

If your answer matches mine, congratulations, you understand well.
- ☞ Grading: CR problems are 10% of your final grade. If all assigned CR problems are completed it equals 100% of that 10%. One missing problem = 95%. Two missing problems = 90%. Three missing problems = 85%, etc.

## ☹️ **PLAGIARISM** ☹️

***PLAGIARISM is the use of someone else's work as if it were your own.***

As you may or may not know, I have been teaching this course for a long time, about 25 years. It is one of my favorite classes, and over the years it has undergone a lot of evolution. Nonetheless, there are a lot of things about this course which have not changed much, or which have not changed in the past few years. And because every geology major has been through this class there are probably a lot of old assignments, critical reasoning problems, lab exercises, etc. floating around the department. If they are handy to you it will probably be tempting to look at them, or use them to help doing your own work. Doing so, however, would largely defeat the purpose of taking the course, which is to become the best scientist and geologist that you can.

The subject matter is not the most important thing going on in this class, it is secondary. There is a hidden agenda specifically and deliberately built into every part of this class. It includes such things as gaining deeper insight into the scientific analysis of ideas, intellectual discipline, and self confidence, as well as such skills as critical observation and the analysis and evaluation of scientific evidence. You are not directly graded on most of this, and perhaps only after the semester is over will you notice that you have improved in these skills. But because the class is organized to foster the hidden agenda, it is relatively easy to get away with using other people's materials from past semesters. But you may not.

**YOU ARE EXPRESSLY FORBIDDEN TO READ OR USE ANY PREVIOUSLY WRITTEN CRITICAL REASONING PROBLEMS, LAB ASSIGNMENTS, ETC.. I CONSIDER THEIR USE AN HONOR VIOLATION AND WILL TURN CASES OVER THE HONOR COUNCIL.**

The object here is for you to learn to read critically, think logically, and write clearly. To do this you must struggle alone, or in consultation with me or other advisors. I will give you all the support and help I can but you must be willing to first take the journey.

As for working with your classmates, I expect your work to be yours and personal. You may discuss assignments with classmates but when it comes time to write assignments you must sit and work alone, with your own thoughts.

**IMPORTANT DEADLINES AND DATES**

[Dates are approximate and subject to change]

**WEEK 1:** JAN 8 - JAN 12**WEEK 2:** JAN 15 - JAN 19**WEEK 3:** JAN 22 - JAN 26**WEEK 4:** JAN 29 - FEB 2**WEEK 5: FEB 5 - FEB 9** ..... **LAB TEST #1****WEEK 6:** FEB 12 - FEB 16**WEEK 7:** FEB 19 - FEB 23**WEEK 8: FEB 26 - MAR 2** ..... **LAB TEST #2****RECESS** MAR 5 - MAR 9**WEEK 9:** MAR 12 - MAR 16 ..... End lecture test unit one**WEEK 10: MAR 19 - MAR 23** ..... **LECTURE TEST #1****WEEK 11:** MAR 26 - MAR 30

Section Measuring Field Trip, Saturday March 31  
(alternate day for bad weather, April 7)

**WEEK 12:** APR 2 - APR 6 ..... End lecture test unit two**WEEK 13: APR 9 - APR 13** ..... **LECTURE TEST #2**

Blue Ridge Field Trip, Saturday, April. 14

**WEEK 14:** APR 16 - APR 20

Black Water Falls Field Trip, Saturday, April 21

**WEEK 15: APR 23 - APR 27** ..... **LAB TEST #3****Final Exam Week** ..... **FINAL EXAM** - Friday, May 4 from 8:00-10:00

**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 #1                                                  | JAN 8 - JAN 12  | 1 | <div>An Introduction to Rocks,<br/>Tectonics and Ancient Environments<p>p 1-8</p></div> <div>Igneous and Metamorphic Rock Review<p>p 9-31</p></div>                                                        |
| WEEK #2                                                  | JAN 15 - JAN 19 | 2 | <div>Preliminary to Sedimentary Rks.<p>p 32-37</p></div> <div>Sedimentary Rocks: Classification<br/>and Identification<p>p 38-68</p></div>                                                                 |
| WEEK #3                                                  | JAN 22 - JAN 26 |   |                                                                                                                                                                                                            |
| WEEK #4                                                  | JAN 29 - FEB 2  | 3 | <div>Preliminary to Depositional Environments<br/>and the Evolution of Sedimentary Rocks<p>p 69-80</p></div> <div>Depositional Environments and<br/>the Evolution of Sedimentary Rocks<p>p 81-99</p></div> |
| (END TEST UNIT ONE)                                      |                 |   |                                                                                                                                                                                                            |
| WEEK #5                                                  | FEB 5 - FEB 9   | 4 | TEST ON FIRST THREE LABS                                                                                                                                                                                   |
| WEEK #6                                                  | FEB 12 - FEB 16 | 5 | Paleontology                                                                                                                                                                                               |
| WEEK #7                                                  | FEB 19 - FEB 23 |   | Appendix F p 280-310                                                                                                                                                                                       |
| (END TEST UNIT TWO)                                      |                 |   |                                                                                                                                                                                                            |
| WEEK #8                                                  | FEB 26 - MAR 2  | 6 | LAB TEST ON PALEONTOLOGY                                                                                                                                                                                   |
| RECESS MAR 5 - MAR 9 ☺ RECESS ☺ RECESS ☺ RECESS ☺ RECESS |                 |   |                                                                                                                                                                                                            |

|          |                              |    |                                                                                                     |                  |
|----------|------------------------------|----|-----------------------------------------------------------------------------------------------------|------------------|
| WEEK #9  | MAR 12-MAR 16                | 7  | <b>Interpreting Geologic History<br/>from Facies Maps</b>                                           | <b>p 100-118</b> |
| WEEK #10 | MAR 19-MAR 23                | 8  | <b>Preliminary to Sedimentary<br/>Tectonics - Part A</b>                                            | <b>p 119-135</b> |
| WEEK #11 | MAR 26-MAR 30                |    | <b>Sedimentary Tectonics Part A:<br/>Transgression-Regression, and Isopach<br/>(Thickness) Maps</b> | <b>p 136-154</b> |
| WEEK #12 | APR 2-APR 6                  | 9  | <b>Preliminary to Sedimentary<br/>Tectonics - Part B:<br/>The Wilson Cycle</b>                      | <b>p 155-172</b> |
|          |                              |    | <b>Sedimentary Tectonics Part B: The<br/>Integrated Study of Basins and<br/>Sourcelands</b>         | <b>p 210-215</b> |
| WEEK #13 | APR 9 - APR 13               | 10 | <b>Preliminary to Correlation</b>                                                                   | <b>p 216-221</b> |
|          |                              |    | <b>Correlation</b>                                                                                  | <b>p 216-237</b> |
| WEEK #14 | APR 16-APR 20                | 11 | <b>The Analysis of Depositional Basins</b>                                                          | <b>p 238-252</b> |
| WEEK #15 | APR 23 - Apr 27 <sup>1</sup> |    | <b>LAB TEST ON LAST FIVE LABORATORIES</b>                                                           |                  |

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<sup>1</sup> The final lab test is done partially as a take home and partially in the laboratory during the last week of class. You will begin the take home part during the lab of WEEK #14. Further instructions will be given at that time.

## FIELD TRIP DESCRIPTIONS

**T**here 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).

**T**he 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, March 31 - Section Measuring Field Trip  
(alternate day for bad weather, April 7)**

**T**his 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 will leave from the Miller Hall parking lot at 8:15 and should return about 1:00. The trip will travel west on Rt 33 to Shenandoah Mountain (the large mountain seen as you look west). We will 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 14 - Blue Ridge Field Trip**

**W**e will 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 will be followed south to Swift Run Gap and Rt.33, and head back to Harrisonburg. Stops will be made to look at igneous, sedimentary and metamorphic rocks, along with structural geology.

Departure time - 8:30 a.m. RAIN or SHINE. Return around 4:00. You may pack a lunch but we will also stop at a McDonalds in Luray.

**Saturday, April 21 - Black Water Falls Field Trip**

**F**ield 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 will see examples of much of the evidence dealing with mountain building processes and the interpretation of the Appalachian Mountains. There will be 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 - 8:30 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 will also stop at a grocery store where you can buy something at the deli. We will 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.