Course Syllabus

Interpreting Earth History
Spring 2012

Instructor: Andy Moore, x1672, moorean@earlham.edu
We meet MWF 9-9:50 and R 1-4 PM in Dennis 314

Text: MacDougall's *Brief history of planet Earth*, Dixon's *Atlas of life on Earth*, Davis' *Cincinnati fossils*. There will be plenty of other readings to go with.

Office Hours: Whenever you find me in; if you'd like to ensure I'm in, my weekly schedule is posted outside my door. Mark off a box on the schedule and put your name in it, and I'll know to meet with you when you've marked (and it doesn't hurt to tell me you've done it so I can put it on my calendar!).

Grading:	Quizzes	15%
	Homework	20%
	Labs	20%
	Fossil Quizzes	15%
	Presentations	15%
	Essays	15%

Labs: Ok, we're going to try something here, so bear with me. The first half of the semester, labs are inside—it's cold, and we have stuff to learn that's better learned inside. After that, however, we'll be outside, attempting to interpret the geologic history of eastern Indiana. Two problems, though—one, it's really flat around here, so we won't get a lot of practice with interpreting structures. Two, it's still winter, so the weather is dicey from week to week. I'll try to have us out as often as we can (meaning when the outcrop isn't actually covered in snow). DRESS ACCORDINGLY!

Field Trip: We've got a required field trip, probably in early April (I *promise* I'll get the date nailed down as fast as I can), to Madison (Indiana), and we can be sure the weather will be variable. We're going as part of the outside labs, so we're looking at rocks that are the same age as the ones around here, but are a little bit different. Plan on spending the day outside, and bringing your field gear with you.

Lab equipment: There are a few things I want you to have with you every time we do a lab. If it's indoors, you should bring a protractor, a calculator, pencils and pens, a set of colored pencils, and a notebook just for writing up labs. Every time. I can't promise you'll use them every time, but I can't promise you won't, either. If lab is outside, you need to bring weather appropriate shoes and clothing, a Sharpie, your fieldbook (I'll issue you one), the ability to write in that book, and the ability to carry that fieldbook where you can write in it.

Fossil Quizzes: So, in order to do the project outside, we need to be familiar with the local fossils. And not just in a "neat, it's a brachiopod" kind of way. So, I've got 45 fossils we need to memorize (just like the famous tree quiz in Eco Bio), and we're going to have 9 a week over the first seven weeks or so (I'll give us a week in between in the beginning). All

of the fossils can be found in *Cincinnati Fossils*, and I'll make sure to show you actual samples of each one. As is common in geology, you need to be able to identify the *genus*, but not the *species*. We'll talk…

Midterms: OMG, there aren't any! I'm going to try this class without exams this year. Here's what's taking their place…

Quizzes: Unfortunately, there is a (very!) little memorization required for this class, and it needs to be done fairly quickly. There will be three quizzes on this material; the first will cover the geologic time scale, and it'll be about 15 minutes during the class noted on the class schedule. The *second* quiz will be on the states and provinces—I need to know you know where I'm talking about when we talk about the Permian of New Mexico. The third quiz is on world geography, for similar reasons.

Homework: So one of the big things I want to stress in this class is not just the "what we know" about Earth's history, but the "why we think we know what we think we know" part. In that vein, I have a series of homework sheets about regional geology in the US. We're doing them, and more importantly, each of you in turn will be responsible for going over them with the class. Sign up shortly!

Lecture: Instead of me lecturing at you *ad nauseum*, one of the skills we're going with in class is having you speak to your classmates about some of the important events in Earth history. I've divided up the events into groups (tectonic, evolution, and other) and each of you will talk to the class for about 20 minutes about one of each. Grading is "Dancing with the Stars" style—class evaluation is half the grade, my evaluation is the other half.

Essays: About four times during the semester, I'd like you to read a paper or two I've got on some aspect of Earth history, and I'd like you to write a SHORT (meaning four paragraphs) essay in answer to a question about that reading. We'll talk more on four paragraph essays, but suffice it to say the point is to practice writing concise answers.

Academic Integrity: Please do your own work in this class. You'll be working together on lots of things, but each person has to turn in his or her own work. If you're unsure about what this means, please come and ask! For more information on Earlham's academic integrity policy please see:
http://www.earlham.edu/curriculumguide/academics/integrity.html

Academic Accommodation: I'll do my best to provide an environment conducive to learning. If you need more accommodation, please contact the Center for Academic Enrichment (765) 983-1341 or http://www.earlham.edu/~sas/support/

Help: Should you need help, please drop by my office or email me. You're guaranteed to find me in during office hours, but you may get me elsewhen. If you want to set up a different time, give me a call, email me, or talk to me after class. ***If something in class doesn't make sense….ASK.***

Week	Topic(s)	Due Dates	Notes
Jan. 11-13	Introduction to Earth History LAB: Plate tectonics review		
Jan. 16-20	Interpreting earth history: sediments & fossils LAB 1: Sedimentary rocks & stratigraphic columns	First fossil quiz (take 1) (19th)	Archean worksheet (16th)
Jan. 23-27	The Hadean LAB 2: Geologic maps	Time quiz (25th) (take 2) (26th) Lab 1 due (26th)	Proterozoic (23rd)
Jan. 30-Feb. 3	The Archean LAB 3: Project 1, interpreting earth history	State quiz (31st) 2nd quiz (2nd) Lab 2 due (2nd)	Proterozoic 2 (30th)
Feb. 6-10	The Proterozoic LAB 3: Project 1, interpreting earth history	Global geog. quiz (8th) 3rd quiz (9th)	Cambrian (6th)
Feb. 13-17	The early Paleozoic, tectonic evolution NO LAB	Lab 3 due (15th)	Ordovician (13th) NO CLASS (17th)
Feb. 20-24	The early Paleozoic, biologic evolution LAB 4: Project 2	4th quiz (23rd)	Silurian (20th)
Feb. 27-Mar. 3	The late Paleozoic, tectonic evolution LAB 4: Project 2	5th quiz (2nd)	Pennsylvanian (27th)
Mar. 6-10	The late Paleozoic, biologic evolution LAB 5: Fairfield Causeway	Lab 4 due (9th)	Pennsylvanian 2 (6th)
Mar. 13-17	SPRING BREAK		NO CLASS (all week)
Mar. 20-24	Paleozoic climatic evolution LAB 6: Fairfield Causeway II	Lab 5 due (23rd)	Jurassic (20th)
Mar. 27-31	The Mesozoic, tectonic evolution LAB 7: SR-1	Lab 6 due (30th)	Cenozoic (27th)

Apr. 3-7	The Mesozoic, biologic evolution LAB 7: SR-1		
Apr. 10-14	The Mesozoic, climatic evolution LAB 8: US 27 & Thistlethwaite	Lab 7 due (13th)	
Apr. 17-21	The Paleogene LAB 9: Water treatment plant	Lab 8 due (20th)	
Apr. 23-27	The Neogene LAB 10: Complete the Ordovician project	Lab 10 due (27th)	

This is a class about synthesis. It has to be—consider that most history classes cover a period spanning no more than a few hundred years, and focus on a spatial area generally no larger than a continent. In these same 15 weeks, we are compelled to cover a span at least 10,000,000 times as long, and covering the entire globe. Like any history class, however, we're going to rely on a mix of primary and secondary sources. In our case, the primary source is rock; we'll interpret that rock, and try to get a sense of what happened in our own backyard 450 million years ago. Mostly, however, we'll rely on secondary sources—usually someone writing about what they've found in *their* backyard, and what they think it means. To be part of this debate, just as in a history class, is to take part in unraveling a fantastic story, and one that keeps changing each year as more people take part.

Because there are so many places to talk about, and so much time to look at, we need a variety of books (and readings, and films). It will be up to you to keep track, and to try to synthesize them into a coherent whole. I've assigned three books to you: the first, MacDougall's *A short history of planet Earth*, should act as your backbone. Read it before anything else, and then fill in the details with the other sources. It's a little dated (it was first published in 1996), and it's written for a popular audience, so it's a little light on the details. But! It's an ideal framework. The next book I'd read is Redfern's *Origins*. It's a beautiful book, and gives a good look at a number of vignettes in Earth's history, particularly in North America and Europe. I'll fill in more vignettes with many readings from recent articles in *American Scientist* and *Scientific American*. We'll also read some "professional" journal articles later in the course. I've got a few copies of Dougal Dixon's gorgeous *Atlas of life on Earth* in the back of the classroom; it's probably the best description of the evolution of life I've ever seen. Last, I'm planning to show all of the episodes from BBC's *Walking with…* series, in chronological order. So, this data can also be added to your synthesis.

I'll go through Earth's history from its beginning to now, and we'll talk about how we subdivide that time. I'd recommend starting a notebook (probably one with detachable pages, like a 3-ring or a Circa, rather than a bound book or a spiral) and writing down what new things you learn about the Cambrian (when we get to that time) or the Triassic (in its proper time). There will be a lot of information! Like few other classes, you'll get out of this class what you put into it—we're telling the longest and most amazing story ever, but there are simply too many pieces to tell at any one time. It will be up to you to put the pieces together. In each case, try not only to assemble the pieces, but to ask the two vital questions "how do we know what we think we know?" and "where does our knowledge end?".

What about the last book? I've assigned Meyer and Davis' *A sea without fish* as a means of our talking together about how to take part in finding new chapters of Earth's history. We sit, believe it or not, on one of the greatest troves of fossils in the entire world, for any time in Earth's history. I'd like to use *A sea without fish* to help explain *how* people tell the history of the Earth, and then go out to a number of places around Indiana, Kentucky, and Ohio, and tell the story ourselves (we'll go as far away as Virigina, I hope!). Read it when you can (assiduously avoiding Chapter 2, which is fantastically boring), and use it as your fossil guidebook as well.

GOALS:

Students should be able to give a brief account of major events in Earth's history, and explain how these events affect life today.

Students should be able to interpret Earth history from a geologic map.

Students should be able to formulate a plan for analyzing an unfamiliar outcrop, and should be able to interpret geologic history from data gathered at that outcrop.

Students should be able to keep a geologic notebook in a manner that allows other geologists to understand their work.

Students should become comfortable speaking in front of a group of their peers.

Students will gain experience writing concise, short, explanations.

SKILLS INVENTORY:

For each of the following statements, circle the statement that best fits your confidence in your ability, as follows:

1 very confident
2 fairly confident
3 I think I can
4 I don't think I can
5 I know I can't/I don't understand the question

1. I can recite the periods of the Phanerozoic in order

   1 2 3 4 5

2. I understand the tectonic significance of greywacke

   1 2 3 4 5

3. I know when land plants evolved

   1 2 3 4 5

4. I know several hypotheses for why trilobites went extinct at the end of the Permian, and can devise tests to tell one from the other

   1 2 3 4 5

5. I understand why North America's response to the K/T impact was different from Australia's

   1 2 3 4 5

6. I know what Rodinia is, and why it's important

   1 2 3 4 5

7. I can identify *Anomalocaris*

   1 2 3 4 5

8. I have a plan in mind when I approach an outcrop for the first time

   1 2 3 4 5

9. I know why salt formed in the Great Lakes area, and when

   1 2 3 4 5

10. I know why coal formed in Pennsylvania and West Virginia, and when

    1 2 3 4 5

11. I can interpret geologic history of an area from a geologic map

    1 2 3 4 5

12. I can read a geologic map

    1 2 3 4 5

13. I know what good geologic field notes look like, and am comfortable with others reading my field notes.

    1 2 3 4 5

14. I'm comfortable speaking in public

    1 2 3 4 5

EVALUATION: One of the big challenges I've been facing in this class recently is that it's becoming increasingly heterogeneous. The class contains a mix of environmental studies majors (because our environmental studies major requires two science classes in the same department, and this is the logical next class after physical geology), students looking to fulfill a science general education requirement (because this class doesn't fill as rapidly as lower-level classes, and because it is unique in our 300-level offerings in fulfilling science gen ed), and our own majors. As a result, it's hard to know what the "point" of the class is. Is it to provide content about Earth's history? Is it to show non-majors how science works? Is it to provide a deep historical basis for what our environmental students are learning about global change?

I decided to make the class more locally based (by introducing a research component on local outcrops in the back half of the class), and to make the main "transferrable" skill oral presentation. This last one was scary—it meant that I had to turn over control of content to student presenters, rather than lecturing. Things that fell logically from those decisions were a focus on local fossil ID (the fossil quizzes alluded to in the syllabus) and a decision not to have exams (because I really didn't know the quality of information I'd get from student presentations).

The lack of exams was a mistake. Student presentation quality was overall quite good (sidebar—I presented the Hadean and Archean. Students presented from the Proterozoic on, in 2 20-minute sessions per class. I had 10 minutes to follow up on whatever I thought needed it, and I took a full class session at the end of each Era to summate), so I could have supported exams (especially take-home essay exams), and it would have kept students in the game a little longer. Next year I'll probably get rid of essays in favor of exams.

The presentations weren't worth enough. They're a major part of the class, yet they're worth the same as a bunch of fossil quizzes. Next time they'll probably be worth double. I also need to schedule some more time early in the semester to go over what a talk looks like, and to explain better what I expect from the research project.