

Evolution of the Earth and Life

Instructor: John Cisne, 2102A Snee, john.cisne@cornell.edu. Office hours: TR ~10:00-11:00 a.m. (between lectures) and after ~3:00 p.m. TWR once lab is under way*.

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Lectures — Tuesday and Thursday, 11:15 a.m., 1120 Snee†

<i>No.</i>	<i>Date</i>	<i>Topic</i>
<i>Introduction</i>		
1	Jan. 22	Why Is It Important to Know About the Earth's Evolution?
2	24	How Has the Earth Remained Habitable?
<i>The Earth's Energy and Materials</i>		
3	29	The Sources: Stars, Atoms, Radioactivity, and Sunlight
4	31	The Solar System, Planets, and the Earth-Moon System
<i>The "How To" of Reading the Geological Record: Tracking Rocks in Four Dimensions</i>		
5	Feb. 5	Geochronology: Calibrating the Time Scale in Historical Periods
6	7	Geochronometry: Calibrating the Time Scale in Years
7	12	Tracking Terranes by Paleolatitude and Paleolongitude
8	14	Uplift, Subsidence, Sea-Level Change, and What Makes Them Go
<i>Plate Tectonics and the (Mostly) Fission-Powered Heat Engine of the Earth's Interior</i>		
9	19	The Endogenic Heat Engine and Mantle Convection
10	21	The Lithosphere as an Evolving System of Tectonic Plates
11	26	The Early Lithosphere
12	28	Continental Growth
<i>Life and the Solar-Powered Heat Engine of the Earth's Surface Environment</i>		
13	Mar. 4	Life, Biogeochemical Cycles, and the Atmosphere
14	6	Ice Ages and Global Climate
15	11	The Carbon Cycle and Global Change
<i>The Two Heat Engines' Interaction: The Last Half-Billion Years of Tectonics and Climate</i>		
16	13	Pangaea's Assembly and the Paleozoic Lithosphere
17	25	Pangaea's Breakup and the Modern Lithosphere
18	27	Tectonics, Climate, Ocean Circulation, Atmospheric Oxygen, and Oil
<i>The Evolution of Life</i>		
19	April 1	Life's Origin
20	3	Organisms: Nature, Diversity, and History
21	8	Evolutionary Processes
22	10	The "Cambrian Explosion" and Its Aftermath
23	15	Vertebrates on Land, ...
24	17	... at Sea (again), and in the Air
25	22	Mammals
26	24	Humans
<i>Wrap-Up</i>		
27	29	The Recent Past and the Foreseeable Future
28	May 1	Remaining Business*

* Or as arranged. †Feel free to mix and match lecture sections, but not lab sections.

No.	Week	Topic	Study Your Lab Notes Beforehand! And Bring 'Em With You!
0	January 22-24	— No lab the first week! —	
1	29-31	Minerals, Rocks, and History I: Plate Tectonics	
2	February 5-7	Minerals, Rocks, and History II: Life's Environment	
3	12-14	Building a Time Scale and Stratigraphic Correlation Chart‡	
4	19-21	Sediments and Sedimentary Environments‡	
5	26-28	Reconstructing Regional Paleogeography‡	
6	March 4-6	Base-Level Change, Sedimentary Basins, and the Lithosphere‡	
7	11-13	Reconstructing Tectonic History‡	
8	25-27	Reconstructing World Paleogeography and Geodynamics‡	
9	April 1-3	Fossils: Biodiversity and Biogeography	
10	8-10	Field Trip Preparation: Cornell's Geological History	
11	15-17	Field Trip to Portland Point	
12	22-24	Field Trip to Taughannock Gorge	
13	29 - May 1	Laboratory Practical Exam	

‡Parts of a cumulative sequence that demonstrates with actual data on classic examples how earth scientists learned to analyze rocks in reconstructing geological history, studying earth processes' operation, and tracing tectonic plates and their interactions; and how, overall, scientists came to appreciate the Earth as a rationally understandable, coherently evolving, and fundamentally predictable system of interrelated components.

Required Reading: Course Notes (packet available at the Campus Store) are intended for reading before lecture and lab. The packet includes *this year's Lab Notes* and *last year's Lecture Notes* and selected **Quiz Keys**. *This year's Lecture Notes* will be available beforehand in lecture and afterwards on the coat racks at the back of the classroom; text-only versions will be available online on **Blackboard**.

Recommended Readings / References / Security Blankets: L.R. Kump et al., *The Earth System*, 2nd edition (Prentice-Hall, 2004); S.M. Stanley, *Earth System History*, 3rd edition (Freeman, 2009). Both are intended for individual use on an as-needed basis. **Both will be on reserve in Carpenter Library.**

Grading: Grades are based on more or less weekly quizzes (40%, roughly five-minute "spot checks" emphasizing current lectures' and labs' major points — only a student's top ten out of more than a dozen quizzes count), weekly laboratory exercises (40%; top ten scores from Labs 1-10 and a few "lab quizzes" intended for those needing a makeup); the laboratory practical exam (10%, emphasizing hands-on work with specimens); and a final exam (10%, a longer-than-usual true/false quiz covering lectures and labs comprehensively within about half an hour). Keys to this and last year's quizzes, and a sample lab practical, will illustrate what to expect.

Other Information: This course covers more material in greater depth than traditional Earth history courses and available textbooks do. The course notes, especially the lecture notes, are very concentrated. Come to class to see and hear what's between the lines so you can decide what and how much you want to jot down to supplement the bare bones. *Because the material is highly cumulative and extensively cross-connected, it is very important to keep up lecture by lecture and lab by lab.* The frequent quizzes are intended to help you do this.

Depending on how the particular week's schedule is unfolding, quizzes may be given in lecture or lab, *so make sure you come prepared.* **Many of the quizzes given in lab include questions intended to make sure students have done the readings for that particular week's lab.**

The quizzes themselves are written to be taken in a few minutes, graded within the day (when keys will be posted electronically), and returned within the week so that you can keep close track of your progress, catch and learn from mistakes before they catch you on the rebound, and do all this with a minimum of anxiety (remember, only your top ten quizzes count), and so that your teacher can more closely track everyone's performance, including his own. To keep the turnaround time as short as possible, **there will be no makeups.** But don't worry. Few students get through the course without missing a quiz or three, which is another reason why so many are given.