

Geology 112, Earth History

TEXT: Prothero, D.R, and Dott, R.H., Jr., 2004. Evolution of the Earth, 7th Ed., McGraw-Hill, Inc., New York, NY, 524p. plus Appendix I, II, Glossary, and Index.
Physical Geology references (your text and lab manual from Geology 111).

COURSE OBJECTIVES:

The course serves the Geology and Earth Science majors and minors. Core content includes essential introductory material that provides Geology majors and minors the necessary prerequisite material for Geology 312 Stratigraphy-Sedimentology, as well as the development of the geologic time scale, concepts of deep time and evolution, and a survey of earth history. The course also meets state-mandated content for Earth Science majors, including statistical concepts and applications; and is also part of the old Group Science Major, Geology Emphasis requirement. In addition to the topics noted, for some students this course provides the only exposure to the principles of sedimentary petrology and basic paleontology. This course is the only core curricula course in Geology to examine vertebrate paleontology and paleobotany. Specific objectives include:

1. To briefly review Physical Geology (earth materials and earth processes).
2. To introduce and examine the earth's internal character, processes, and geologic structures within the crust.
3. To outline the geologic time scale, its historic development, the principles upon which it is based (stratigraphy), how rocks and fossils record time, and the superposition of an absolute time scale via dating techniques.
4. To consider methods used to establish the record, the hypotheses formulated to explain what we see in the rock record, including the current plate tectonics model.
5. To examine the rock record and establish the relative sequence of geologic and biologic events (e.g., times of major orogenies, transgressions-regressions, and other physical events, as well as organic evolution such as "first appearances" and extinctions of major life groups), utilizing stratigraphy, lithofacies and biofacies analysis, as well as geologic map interpretation.

Ideally, Historical Geology should come at the end of the student's undergraduate curriculum. As a final course, each person would fit all the pieces of geology into a coherent body of knowledge -- earth history. Unfortunately, our "time" is short, and you will need to call upon some knowledge of earth history in your core courses, so some of that summary information must be "front loaded" into the human computer.

Our ultimate goal is to stimulate independent thought, to pose questions that geologists ask, to formulate and test hypotheses in seeking answers to our questions, and gain some insight into unraveling the geologic record. We want to develop a background of "**what** happened **when**" and develop skills in reconstructing earth history, the "how we know". New terminology will necessitate a body of memory information. Likewise, independent study and interpretation of maps, sections, and diagrams will be required.

Assignment: learn the Geologic Time Scale [handout]

GRADING: Final grades are based on a 90-80-70-60 percent fixed scale or a 10-20-40-20-10 percent curve, which ever gives the student the higher grade for the course. **W-Day** is February 27th.

POINT DISTRIBUTION: (Lecture 65%, Discussion/Laboratory 35%)

Lecture Exam #1	20%	February 11 th (Wednesday)
Lecture Exam #2	20%	March 15 th (Monday)
Quizzes/Homework	5%	Anytime (may include lab as well as lecture)
Lecture Final Exam	20%	April 20 th 8 – 10 a.m. (Tuesday)
Lab Hand-ins & Quizzes	5%	Due Dates TBA
Lab Exam #1	15%	February 5 th (Thursday)
Lab Final Exam	15%	April 15 th (Thursday)

ABSENTEEISM AND ASSIGNMENTS: The student is responsible for the reading assignment for the date listed. It may be easier to “skim” read the assignment prior to lecture, and then read it in detail after the material is covered in lecture. Points on which you are not clear in reading should be brought up during the lecture (office hours if class time is insufficient). Attendance and participation are the student’s responsibility. The fundamental skill to be cultured is note taking --- always have your notebook at hand and in action! Examination performance depends mainly on the student’s knowledge of lecture material (and laboratory exercises for lab.). Absence from quizzes will cost the points unless excused. The instructor’s lecture notes, overheads, and slides will NOT be available for loan. Slide time is not entertainment time (it may be the most critical of note taking times!). If you must miss a quiz/exam, notify instructor before the event to be excused.

FIELD TRIPS, MEETINGS, LECTURES: Field trips may be run in conjunction with this course. Times and places will be announced in class. Likely trips include the beach/dunes, the Grand Rapids Gypsum Mine, and possibly a Saturday trip to either Alpena or Grand Ledge (April 3rd). You are invited to attend other geology course field trips on a space available basis (e.g., GEO 212 & 312 trips—contact the instructors), and possibly a departmental Spring field trip. Several regional professional meetings will have associated field trips. The Michigan Academy of Science Meeting will be March 5th –6th, Grand Valley State University, Grand Rapids, and you are encouraged to attend. This year’s North-Central Geological Society of America Meeting will be in St. Louis, MO, April 1st – 2nd. INCUR, an organization that encourages undergraduate research participation is meeting in Indianapolis in April and include Geology field trips on Saturday, April 17th. Campus events include Science Olympiad (Saturday, March 27th) for which you are asked to volunteer, and Student Scholarship Day on Wednesday, April 7th for which you will given an assignment and encouraged to participate in as a volunteer. Please attend special lectures sponsored by the Geology Department (e.g., Monday seminars), and the Division of Science and Math., TBA. We are interviewing for open positions, and the interviewees will be presenting lectures (times TBA). Please attend these special lectures and visit with the candidates to provide us with your input for the hiring decisions (one of these people will be your future prof.!). Geology Club also will be running events – join and participate.

ADDITIONAL GENERAL REFERENCES FOR HISTORICAL GEOLOGY

- Barnes, C.W., 1980, Earth, Time, and Life: John Wiley & Sons, New York, NY, 583p.
- Condie, K.C. and Sloan, R.E., 1997, Origin and Evolution of Earth: Prentice Hall, Upper Saddle River, NJ, 498p.
- Cooper, J.D., Miller, R.H., and Patterson, J., 1990, A Trip Through Time (2nd Ed.): Merrill Publishing Co., Columbus, OH, 544p.
- Dathe, David, 1993, Fundamentals of Historical Geology: Wm. C. Brown Publishers, Dubuque, IA, 246p.
- Eicher, D.L., and McAllister, A.L., 1980, History of the Earth: Prentice-Hall, Inc., Englewood Cliffs, NJ, 413p.

- King, P.B., 1977, The Evolution of North America (2nd Ed.): Princeton Univ. Press, Princeton, NJ, 189p.
- Lemon, R.R., 1993, Vanished Worlds: Wm. C. Brown Publishers, Dubuque, Iowa, 480p.
- Levin, H.L., 1999, The Earth Through Time (6th Ed.): Saunders College Publishing, Harcourt Brace College Publishers, Orlando, FL, 568p. plus appendices.
- Mintz, L.W., 1981, Historical Geology (3rd Ed.) C.E. Merrill Publishing Co., Columbus, OH, 611p.
- Scientific American, 1976, Continents Adrift and Continents Aground: W.H. Freeman and Co., San Francisco, CA, 230p.
- Seyfert, C.K., and Sirkin, L.A., 1979, Earth History and Plate Tectonics (2nd Ed.): Harper & Row Publishers, New York, NY, 600p.
- Stanley, S.M., 1999, Earth System History, W.H. Freeman and Company, New York, NY, 615p.
- Stanley, S.M., 1993, Exploring Earth and Life Through Time, W.H. Freeman and Company, N.Y., NY, 538p.
- Stearn, C.W., Carroll, R.L., and Clark, T.H., 1979, Geological Evolution of North America (3rd Ed.): John Wiley & Sons, New York, NY, 566p.
- Stokes, W.L., 1982, Essentials of Earth History (4th Ed.): Prentice-Hall, Inc., Englewood Cliffs, NJ, 577p.
- Wicander, R., and Monroe, J.S., 2000, Historical Geology: Evolution of Earth and Life Through Time (3rd Ed.): Brooks/Cole, Pacific Grove, CA, 579p.

Mon.	Jan.	5	Syllabus/Introduction	Text Preface; Text endpapers; Handouts
Wed.	Jan.	7	Introduction: Goals of Historical Geology; Review Physical Geology; Materials- Process-Response; Stratigraphic Principles	Chapters 1-2
Fri.		9	Anatomy of Unconformities	Chapters 2 & 4; Handout
Mon.		12	Lithostratigraphic, Chronostratigraphic; and Chronologic Units	Chapters 2, 4 & 5; Time Scale
Wed.		14	Fundamental Principles; Sedimentary Environments and Facies; Facies Interpretation	Chapters 2-4; Handouts
Fri.		16	Sedimentary Environments/Facies; Sedimentary Rocks and Fossils, Transgressions and Regressions	Chapters 2-4 Handouts
Mon.		19	Fossils; Records of Evolution; Measures of Time; Deciphering Functional Morphology	Chapter 3
Wed.		21	Fossils and Sedimentary Rocks (Continued)	Chapters 3-4
Fri.		23	Absolute Time	Chapter 5
Mon.		26	Relative Time and the Standard Geologic Time Scale	Chapters 4-5
Wed.		28	Earth "Spheres"; Interior Zones; Aesthenosphere; Lithosphere; Hydrosphere; Atmosphere	Chapter 6
Fri.		30	Plate Tectonics & Terrane Analysis	Chapters 6 & 7
Mon.	Feb.	2	Plate Tectonics & Terrane Analysis cont.	Chapter 7
Wed.		4	Plate Tectonics	Chapter 7
Fri.		6	Plate Tectonics in earth history: Evolution, Sediment Types, Basin Fill	Chapter 7 Handouts
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Mon.		9	Precambrian Record: Oldest Rocks; Origin of Life; Obscured Records	Chapter 8

Wed.	11	EXAM #1 (20% of course total)	Chapters 1 through 7,
Fri.	13	Precambrian Record (Continued)	Chapters 8-9
Mon.	16	Precambrian Record (Continued)	Chapters 8-9
Wed.	18	Precambrian Record (Concluded)	Chapters 8-9
Fri.	20	Ediacaran-Cambrian Transition	Chapters 9-10
Mon.	23	Cambrian Record: Sequence Stratigraphy; Diversification; Transgression	Chapter 10
Wed.	25	Ordovician Record: Great Transgression; A Model for Defining Orogenies	Chapter 11
Fri.	27	Silurian [The 27th is last W-day.]	Chapter 12
March	1 – 5	Spring Break (possible dept. field trip)	
Mon. Mar.	8	Devonian	Chapter 12
Wed.	10	Devonian	Chapter 12
Fri.	12	Devonian-Carboniferous Transition	Chapters 12-1
Mon.	15	EXAM #2 (20% of total)	Chapters 8 through 12 in part; and parts of 1 through 7
Wed.	17	Carboniferous [Guest Lecture]	Chapter 13
Fri.	19	Carboniferous: Cyclothems [Guest Lecture]	Chapter 13
[Sat.	20	SCIENCE OLYMPIAD]	
Mon.	22	Permian	Chapter 13
Wed.	24	Life in the Paleozoic	Chapters 10-13
Fri.	26	Life in the Paleozoic-Mesozoic	Chapters 13-14
Mon.	29	Life in the Mesozoic	Chapter 14
Wed.	31	Conclusion of Vertebrate Fossil Record	Chapters 13-15

Fri.	Apr.	2	Mesozoic Physical History	Chapter 14
Mon.		5	Mesozoic History (Conclusion)	Chapter 14
Wed.		7	Mesozoic Physical History [Student Scholarship Day Participation]	Chapter 14
Fri.		9	Plants in the Fossil Record	Chapters 13-16
Mon.		12	Cenozoic History	Chapter 15
Wed.		14	Cenozoic History: Pleistocene	Chapter 16
Fri.		16	Overview: Earth History as a basis to Environmental Geology	Chapter 17
Geology Dept. Picnic			TBA	
Tues.		20	8:00 to 9:50 a.m., FINAL EXAM (20% course total)	

LAB MANUAL: Brice, J.C., Levin, H.L., and Smith, M.S., 2004. Laboratory Studies in Earth History (8th Edition), McGraw-Hill, Inc., New York, NY, 267p. + 3 plates.

DATE	EXERCISE	READING ASSIGNMENT
January 8	Review Rocks and Minerals; Introduction to sandstone and limestone classifications; textural/size analysis (stats: median, mean, mode, standard deviation, mean deviation, skewness, kurtosis)	EXs. 1-3 Review of Earth Materials; Handouts
15	Ancient Sedimentary Environments, Facies & Tectonic Settings (part of exercise will be homework)	EX. 4-5
22	Age Relationships/Unconformities; Rock Units/Time-Rock Units; Ancient Shorelines [part of this exercise will be homework]	EX. 7, 8, 9
29	Sea Floor Spreading & Plate Tectonics [Homework: Radiometric Dating]	Handouts, EX. 6; Bonus game EX. 8
February 5	LAB EXAM #1 (15% of course total)	
12	Plate Tectonics Model & Terrane Analysis cont.	Handouts
19	Fossils, Parts I (bring baggies & labeling supplies)	EX. 10-11
26	Fossils, Part II : Use of Fossils ; Vertebrates	EX. 12-13
March 11	Geologic Maps & Structures 3-Point Problems; Structural Contouring (we will continue working with geologic maps as homework through the remainder of the semester)	EX. 14; Review Phys. Geol. Lab Manual; Handouts
18	Geologic Maps: Interpretation & Application	Handouts [Guest Instructor]
25	Gypsum Mine Field Trip (Tentative) or Regional Geology	Handout EX. 15
April 1	Regional Geology	EX. 16-17
April 8	FIELD TRIP: Lake Michigan Shoreline	EX. 2, 5, 6, Handout
Apr. 15	LAB EXAM #2 (15% of course total)	

In general, the answers to the questions in the manual will be discussed at the end of each lab. However, lab manuals may be called in at the end of any lab for review/grading, and recording. Incomplete work may result in a 5% penalty.