



V36.0200
EARTH SYSTEM SCIENCE
PROF. RAMPINO
Spring 2008

Class meets Tuesday/Thursday, 11:00-12:15, Room 208 Silver

Lectures: Prof. Michael R. Rampino (Earth & Environmental Science Program, Department of Biology). Office: 1157 Brown Bldg.; Office phone: 998-3743; fax: 995-3820 Home phone: 212-375-1508; e-mail: mrr1@nyu.edu or mrampino@giss.nasa.gov

Earth System Science examines our current view of the Earth, in its cosmic setting, as a system involving interactions among the atmosphere, oceans, solid earth, and life. Emphasis is placed on the dynamics and evolution of these systems over time, and predictions for the future. The subject matter includes new observations from space; geophysics and plate tectonics; the circulation of the oceans and atmosphere; cycles of elements essential for life; the co-evolution of climate and life on Earth over the past 4,500 million years; and the Gaia Hypothesis. The course will emphasize current global environmental problems, e.g. the greenhouse effect from increasing atmospheric carbon dioxide and other gases, the effects of deforestation, and the depletion of the stratospheric ozone layer.

REQUIRED READING:

Earth Science: Understanding Environmental Systems, McGraw Hill, 2002, paper.

T rex and the Crater of Doom, Walter Alvarez (any paperback version).

COURSE REQUIREMENTS: The grading in the course will be based on performance in the two exams (midterm and final) and several homework assignments. A great deal of factual information and a number of new concepts will be introduced in this course; it is essential to keep up in the readings and to attend the lectures.

POLICY ON ATTENDANCE: Students are expected to attend the class, and you are forewarned that some class material will not be covered completely in the readings

SYLLABUS

- **Week 1 (Week of 1/15)**

The Earth as a System: Introduction to Earth System Science; Solid Earth, Atmosphere, Hydrosphere and Biosphere; Some examples of the Earth as a complex system. Frontiers of ESS research.

Reading: Spencer, p. 3-12.

The Cosmic Setting of the Earth: Earth's place in the Universe. Stars and Galaxies.

Reading: Spencer, Chapter 22. Complete Review Questions

- **Week 2 (Week of 1/22)**

The Origin of the Solar System: Early history of Earth and its Moon.

Reading: Spencer, Chapter 21. Complete Review Questions

Why is Earth Habitable? The Goldilocks Problem: Why is Earth comfortable, Mars too cold, and Venus too warm?

Reading: See Blackboard Site

- **Week 3 (Week of 1/29)**

The Solid Earth: The composition of Earth; The Rock Cycle

Reading: In-Class Handouts.

The Earth's Structure; Earth's magnetic field. The internal workings of Earth.

Reading: Spencer, Chapter 3. Complete Review Questions.

- **Week 4 (Week of 2/5)**

Architecture of the Earth: The theory of plate tectonics. History of plate motion. The great geological cycles.

Reading: Spencer, Chapter 5. Complete Review Questions.

Volcanoes and Earthquakes

Reading: Spencer, Chapters, 6 and 7. Complete Review Questions)

- **Week 5 (Week of 2/12)**

Trip to Hall of Earth Science (AMNH)

Notes will be on the Blackboard Site.

The Atmosphere I: Structure and composition of the Earth's atmosphere.

Reading: Spencer, Chapter 11. Complete Review Questions.

- **Week 6 (Week of 2/19)**

Winds and Weather: Circulation of the atmosphere; Global wind system. The Earth's present climate. Monsoons, typhoons, and El Niños.

Reading: Spencer, Chapter 12. Complete Review Questions.

- **Week 7 (Week of 2/26)**

The Oceans: The Water Planet: The composition of the oceans. Basic ocean chemistry. Why the sea is salty.

Reading: Spencer, Chapter 8. Complete Review Questions.

- **Week 8 (Week of 3/5)**

The Restless Sea: The surface and deep circulation of the oceans. Ocean current systems.

Reading: Spencer, Chapters 9 and 10. Complete Review Questions.

***TAKE-HOME MIDTERM HANDED OUT**

- **Week 9 (Week of 3/12)**

SPRING BREAK!!

- **Week 10 (Week of 3/19)**

The Biosphere: Life's origin and early history of life on Earth.

Reading: See Blackboard Site

***TAKE-HOME MIDTERM DUE.**

- **Week 11 (Week of 3/26)**

A Brief History of Life: Highlights in the evolution of life on Earth. Changes in biologic diversity over time. Feedback between life and atmospheric composition.

Reading: See Blackboard site for Notes.

- **Week 12 (Week of 4/2)**

Comet and Asteroid Impacts in Earth History: External vs. internal causes of geologic changes. What killed the dinosaurs?

Reading: **T rex and the Crater of Doom, by Walter Alvarez (any paper copy)**

- **Week 13 (Week of 4/9)**

Climate and Life: Climate change on various timescales. Snowball Earth. Greenhouse and Icehouse worlds. The effects of continental drift on climate and life.

Reading: Spencer, Chapter 13. Complete Review Questions

- **Week 14 (Week of 4/16)**

Climate and the Earth System: Biogeochemical cycles of Carbon. Oxygen, and Earth's climate.

Reading: Spencer, Chapter 20. Complete Review Questions.

- **Week 15 (Week of 4/23)**

Global Warming and Earth's future: Some of the problems of population growth, energy use, and the carbon dioxide greenhouse effect; Detecting the current greenhouse warming in climate records. What's in store?

Reading: Spencer, Chapter 14. Complete Review Questions.

- **Final Exam Period (5/2 to 5/9)**