

NYU
A 12.0001
EARTH SYSTEM SCIENCE
Fall 1993

Sarvey
NYU ESS
PROF. RAMPINO
Dept. of Earth System Science

Class meets Tuesday and Thursday, 9:55-11:10 in Room 520 Main Hall.

Lectures: Prof. Michael R. Rampino (Department of Earth System Science, formerly the Department of Applied Science). Office—Rm. 501, Barney Bldg., 34 Stuyvesant St. (near the corner of 9th St. and 3rd Ave.); Phone: Office: 998-8995; Fax: 995-3820; Home Phone: 242-0929; Home Fax: 255-2739).

Special Lectures: Prof. Tyler Volk (Department of Earth System Science).

REQUIRED READING:

Healing Gaia, James E. Lovelock (Harmony Books, 1991, \$25).

The History of Earth, W. Hartmann and R. Miller (Workman, 1991, paper, \$19.95).

Planet Under Stress, C. Mungai and D. McLaren, eds. (Oxford, 1991, paper, \$24.95)

I will hand out Fact Sheets and Study Guides to help you keep up with the facts and concepts of the course.

OPTIONAL READING:

The Nemesis Affair, David Raup (Norton, New York, 1986, paper, \$7.95).

Earth System Science is a basic course that 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 will emphasize current problems, e.g. the greenhouse effect from increasing atmospheric carbon dioxide, deforestation, and depletion of the ozone layer.

COURSE OBJECTIVES: The aim of the course is to give students a new view of the Earth as an integrated system. This requires a survey of the dynamic interactions of the atmosphere, oceans, solid earth, and living things. Global observations, new technologies, and quantitative computer simulations have just recently given us the capability to probe these processes. At the same time, greater knowledge of the history of the Earth and other planets provides evidence for the long-term co-evolution of physical and "biogeochemical" systems.

The course material includes up-to-the-minute studies that attempt to forecast the global changes that will occur in the coming decades, both naturally and in response to large-scale human activity. The subject matter ranges, therefore, from cosmic questions such as why the Earth is suitable for life, and why the dinosaurs became extinct, to timely problems such as the global environmental effects of our everyday activities. As you will see, these issues are not unrelated.

COURSE REQUIREMENTS: The grading in the course will be based on performance in three exams. Homework problem sets will also be assigned. Note that 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.

POLICY ON ATTENDANCE & MAKEUP EXAMS.: Students are expected to attend the class, as some class material will not be covered completely in the readings. Make-up exams must be scheduled **in advance** for students with a valid excuse (illness, family emergencies) for missing an exam.

Note exam dates now: 10/12, 11/16, and Final (week of Dec. 15-22).

SYLLABUS

9/9 and 9/14

Intro: The Cosmic Setting of the Earth. Scientific evidence relating to the Earth's place in the Universe. The origin and early history of the Earth and its Moon. The Faint Young Sun Problem.

Reading: Fact Sheet 1; Hartmann, p. 1-33;

9/16

Goldilocks. A comparison of the Earth, Mars & Venus. Why is the Earth comfortable, Mars too cold, and Venus too warm? Habitable zones around stars. Geologic activity on the terrestrial planets. The origin of atmospheres and oceans.

Reading: Lovelock, p. 9-34. Fact Sheet 2

9/21

Inside the Earth. The basic composition and structure of the Earth. The core, mantle, and crust. Volcanism, and the internal workings of the Earth. Convection currents in the earth's interior. Continental drift.

Reading: Hartmann, p. 35-57. Lovelock, p. 47-49; Mungal, Chap. 1.

9/23

Moving Continents. The opening and closing of ocean basins. The theory of plate tectonics. History of plate motion. The great geological cycles.

Reading: Hartmann, p. 60-71, 128-139. Fact Sheet 3

9/28—Prof. Volk

Cycles of Important Elements: Carbon and Oxygen: Elements important for life. The biogeochemical cycles of carbon and oxygen.

Reading: Hartmann, p. 96-109, Lovelock, p. 89-132. Fact Sheet 4.

9/30—Prof. Volk

Cycles of Important Elements: Nitrogen, Phosphorus, Sulfur: The nitrogen, phosphorus, and sulfur cycles. Ocean chemistry of nitrate and phosphate as major nutrients.

Reading: Handouts