

**UNIVERSITY OF COLORADO AT
BOULDER
(GEOLOGY DEPARTMENT)**

GEOLOGY 4950 - NATURAL CATASTROPHES

FALL 1993 Information sheet

Instructor: Charles Stern

Office: Room 306-D in the Geology building (3rd floor)

Office hours: Tuesdays, Wednesdays and Thursdays between 2:00-3:00 PM, or speak with me after class to arrange a different time.

Required readings: The Geology 4950 course required reading packet will be available soon (hopefully) in the Colorado Bookstore on the hill (estimated cost about \$35 plus tax). Five copies of these packets will also be on 2-hour reserve in the Geology Library, Room 204 of the Geology building.

These packets include copies of a selection of required readings that form the basic background material for this course. They are essentially indispensable. Each class I will pass out a list of questions concerning these readings which will provide some type of indication of the most important material in each reading. Every lecture will have some associated reading.

Grading: Final grades will be based on 3 1-hour exams, tentatively scheduled for Thursday September 23, Tuesday October 26 and Saturday December 11. The exams will draw on material from both the lectures and readings.

COURSE OUTLINE GEOLOGY 4950 - NATURAL CATASTROPHES - FALL 93

I. INTRODUCTION (3 lectures)

- #1. Introduction-mechanics and goals of the class; the dynamic earth
- #2. Geologic time-historical and paleontological records in the time frame of geologic change (Reading; Crises in the history of life, N.D. Newell, Scientific American 2/63)
- #3. Future of the sun-age and future evolution of the sun; novae and supernovas (Reading; Life outside the solar system, S.S. Huang, Scientific American 4/60)

II. THE EARTH'S INTERNAL DYNAMICS

A. Earthquakes (5 lectures)

- #1. Damage caused by quakes (Reading; The motion of the ground in earthquakes, D.M. Boore, Scientific American 12/77)
- #2. Nature of earthquakes I-their causes, detection, magnitude, and global distribution
- #3. Nature of earthquakes II-types of faults and plate tectonics
- #4. Quakes and tectonics of the western US-the San Andreas fault and other earthquake zones in the American west (Readings; Measuring crustal deformation in the American west, T. Jordan and J. Minster, Scientific American 8/88; Finding fault, M.B. Roman, Discover 8/88; Quake replay in the Great Basin, R. Stein & R. Buchnam, Natural History 6/86; A major earthquake zone on the Mississippi, A. Johnston, Scientific American 4/84)
- #5. Earthquake prediction-probability of earthquake recurrence and detection of precursor phenomena (Reading; Predicting the next great earthquake in California, R. Wasson and R. Wallace, Scientific American 2/85)

Hour exam I and review of exam (2 class periods)

B. Volcanic Activity (5 lectures)

- #1. 1980 Eruption of Mt St Helens-case history of a well documented eruption (Reading; The eruption of Mt St Helens, R. Decker & B. Decker, Scientific American 3/81)
- #2. Causes of volcanic activity-the origin of volcanos in the context of plate tectonics (Reading; Volcanos, H. Williams, Scientific American 11/51)
- #3. Volcanic products and hazards-explosive and non-explosive volcanism (Reading; Yellowstone Park as a window on the Earth's interior; R. Smith and R. Christianson, Scientific American 2/80)
- #4. Volcanism and climate-volcanic ash and gas, long range effects of volcanism (Readings; The year without summer, H. Stommel & E. Stommel, Scientific American 6/79)
- #5. Magnitude and frequency of eruptions-predicting effects of future eruptions (readings; Giant volcanic calderas, P. Francis, Scientific America 6/83; Ancient floods of fire, R.S. White, Natural History, 4/91)

- C. Magnetic Reversals (1 lecture)
 - #1. Magnetic reversal-What are they, when have they occurred, when will they occur next, and what are their effects (Readings; Reversals of the Earth's magnetic field, A. Cox, G. Dalrymple, and R. Doell, Scientific American 2/67)
- D. Plate Tectonics (1 lecture)
 - #1. Plate tectonics-overview of terrestrial dynamics, the rates of continental drift, and the impact on climate and sea-level (Readings; Sea floor spreading; J. Hiertzler, Scientific American 12/68; The supercontinent cycle, R.D. Nance, T.R. Worsley, & B. Moody, Scientific American 7/88).
- E. Naturally Occurring Fission (1 lecture)
 - #1. Naturally occurring fission-When did it occur, why, and will it occur again (Reading; A naturally occurring fission reaction, G.A. Cowan, Scientific American 7/76)

Hour exam II and review of exam (2 class periods)

III. EARTH'S EXTERNAL DYNAMIC SYSTEMS

- A. Atmospheric Processes; Ice Ages and the Greenhouse Effect (3 lectures)
 - #1. Ice ages: timing and extent-How much of the earth was covered by ice and when (Readings; The atmosphere, A.P. Ingersoll, Scientific American 9/83)
 - #2. Causes of the ice ages-What causes the ice ages (Readings; What drives glacial cycles?, W.S. Broecker & G.H. Denton, Scientific American 4/89)
 - #3. The greenhouse effect-What is it and what are its possible effects (Readings; Global warming on trial, W.S Broecker, Natural History 4/91; Ice sheets and ice melts, C. Emiliani, Natural History 11/80)
- B. Meteorite Impacts (2 lectures)
 - #1. Meteorite impacts-when have they occurred, how big were the meteorites, will they occur again (Readings; What struck Tunguska?, S.P. Moran, Natural History 2/84; Impact cratering on the Earth, R.A.F. Grieve, Scientific American 4/90; A near miss, S.P. Moran, Natural History 3/81)
 - #2. Meteorite impacts and the extinction of the dinosaurs-what killed the dinosaurs (Readings; What caused the mass extinction? An extraterrestrial impact (W. Alvarez & F. Asaro) or A volcanic eruption (V.E. Curtillot), Scientific American 10/90)
- C. Mass-extinction (1 lecture)
 - #1. Mass-extinctions-their frequency and causes (Readings; The great dying S. Brownlee & D. Overbye, Discover 5/84)

IV. DEPLETION OF NATURAL RESOURCES (1 lecture)

- #1. The next energy crises-the future of the worlds oil resources (Reading Forgotten fundamentals of the energy crises, A.A. Bartlett, American Journal of Physics, v. 469, 1978).

V. FLOODS (1 lecture)

- #1. Floods along the Colorado Front Range-the Big Thompson Canyon flood of 1974 compared to historic and pre-historic floods in Boulder (no reading).

Hour exam III (Final exam period Saturday, December 11, 8:30-10:30 PM)