

FUNDAMENTALS OF PLATE TECTONICS
Fall Semester 2006-07

Geological Sciences G554
Section 27716
3 Credits
Website: <http://www.indiana.edu/~tecton>

CLASS MEETINGS:

Thursday 11:15-2:15
Room 416, Geology Building

INSTRUCTOR:

Michael Hamburger
415 Geology Building
Telephone: 855-2934

Office Hours:
Tuesday 1:30-2:30 PM
Thursday 2:15 – 3:00 PM

DESCRIPTION:

The first portion of this course emphasizes the new synthesis of observations from marine geology and geophysics, paleontology, seismology, paleomagnetism, petrology, and structural geology that led to the development of plate tectonic theory. The second portion will focus on the theory's application to fundamental problems of continental and marine geology. The prerequisites for the class are G323 (Structural Geology) and G334 (Stratigraphy) and graduate standing. No previous geophysics coursework is required.

COURSE GRADES:

The course grade will be based on written exercises (30%), a mid-term exam (30%), a final paper (30%), and a class presentation (10%). The final grade will be based on a curve of the numerical sum.

FINAL PAPER:

In lieu of a final examination, each student will prepare a paper on some aspect or application of plate tectonic theory. The paper should be a well written, thoroughly researched summary of a current problem in plate tectonics, using primary scientific papers (not textbooks) as sources. The paper should incorporate materials from a variety of disciplines. Topics must be approved by the instructor on or before 9 November (11th week). A one-two paragraph "Statement of the Problem," an outline of the paper, and a list of key references are due on 21 November (13th week). The completed, typed report is due on 11 December (first day of exams). Credit will be deducted for late submission of papers.

PRESENTATION:

The final paper will be accompanied by a brief (15-20 minute) presentation of your work. The presentation should be a clear, concise, and well presented summary of your findings, using overhead transparencies and blackboard where necessary. The form should be that of a review paper given at a scientific meeting.

TEXTBOOKS:

The readings for the class are from two main sources. Both are considered required texts, and should be available at the local bookstores. They are both on reserve in the Geology library.

The first is a new textbook that is an excellent review of geological and geophysical observations associated with global tectonic processes:

Kearey, Philip, and Vine, Frederick J.
Global Tectonics, 2nd ed.
Boston, Blackwell Scientific, 1996

The second is a useful "how to" manual for solving plate tectonics problems:

Cox, Allan, and Hart, Robert B.
Plate Tectonics: How it Works
Palo Alto, Blackwell Scientific, 1986

READING LIST & FIGURES:

An extensive bibliography of papers related to each study topic and a set of key figures used in the lectures will be provided. You may want to include these in a loose-leaf notebook with your lecture notes.

COURSE SCHEDULE:

The tentative course schedule is attached.

BIBLIOGRAPHY:

A general bibliography of books on plate tectonics and continental drift is also attached. The final section of the list includes several "popular" books that are useful in providing a general overview of the subject. Those marked [R] should be on reserve in the Geology Library.

SYLLABUS

Reading assignments refer to K/V (Kearey & Vine) and C/H (Cox & Hart) texts

<u>Week</u>	<u>Date</u>	<u>Subject</u>
1	August 31	Introduction: Historical Perspective Internal Structure of the Earth <i>Reading: K/V Chap. 1, Chap. 2.2-2.3, 2.8-2.12</i>
2	September 7	Continental Drift: Evidence from Paleontology, Climatology, and Stratigraphy Paleomagnetism and Magnetic Field Reversals <i>Reading: K/V Chap. 3; C/H Chap. 8</i>
3	September 14	Polar Wander Curves Marine Magnetic Anomalies <i>Reading: K/V Chap. 4; C/H Chap. 9</i>
4	September 21	Sea Floor Morphology and Structure: Observations from Marine Geology and Geophysics <i>Reading: K/V Chap. 2.4 - 2.6, Chap. 6</i>
5	September 28	Oceanic Heat Flow and Topography of the Sea Floor Transform Faulting <i>Reading: K/V Chap. 2.13, Chap. 7</i>
6	October 5	Earthquakes and Focal Mechanisms along the Mid-ocean Ridge/Transform Fault System Earthquake Distribution and Focal Mechanisms <i>Reading: K/V Chap. 2.1; C/H Chap. 6</i>
7	October 12	Plate Subduction and Convergent Plate Tectonics Geological Processes in Subduction Zones <i>Reading: K/V Chap. 8.1-8.6</i>
8	October 19	Tectonics of Forearc and Backarc Environments Hotspots and Absolute Plate Motion <i>Reading: K/V Chap. 5.4, Chap. 8.7-8.10</i>
9	October 26	Geometric Constraints on Plate Motions Euler Poles and Instantaneous Plate Velocities <i>Reading: K/V Chap. 5.1-5.5; C/H Chap. 2-4</i>
10	November 2	Direct Measurements of Plate Motion Finite Plate Rotations Driving Forces of Plate Tectonics: Mantle Convection <i>Reading: K/V Chap. 5.6-5.8, Chap. 10; C/H Chap. 7, 10</i>
	November 4-5	Mid-term Examination (take-home)

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| 11 | November 9 | Plate Tectonics and Magmatism:
Mid-ocean Ridges, Oceanic Islands, Hotspots, Island Arcs
<i>Reading: Condie, Chap. 7</i>
Final Paper Topics Due |
| 12 | November 16 | Continental Rifting & Evolution of Passive Continental Margins
Plate Tectonics and Orogenesis: Stratigraphy/Structure of
Mountain Belts
<i>Reading: K/V Chap. 6.2, Chap. 7.6, Chap. 9.1-9.4</i> |
| 13 | November 23 | No class (Thanksgiving!)
Final Paper Outlines Due |
| 14 | November 30 | Subduction vs. Collisional Orogens
Complex Plate Boundaries: "Microplate Tectonics"
Tectonostratigraphic Terranes
<i>Reading: K/V Chap. 9.5</i> |
| 15 | December 7 | Complex Plate Boundaries: "Microplate Tectonics"
Tectonostratigraphic Terranes
<i>Reading: K/V Chap. 9.5</i> |
| 16 | December 11 | Exam Week: Final Papers Due
Student Presentations |