Plate Tectonics (GE398) Syllabus  
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1. Instructor
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2. Prerequisite: GE231 Structural Geology

3. Text  
Since most of the course will deal with material from the primary literature, there is no required textbook. However, you might want to consider purchasing the following: Moores, E.M., and Twiss, R.J., 1995. Tectonics: W. H. Freeman & Company, New York, 415 p. This textbook will be on reserve in the Science Library.

I will put PDF’s of papers to be covered in class on the course website (http://www.colby.edu/academics_cs/courses/GE398/). If PDF’s are not available, I will make photocopies and hand them out in class. Any Power Point presentations developed by your classmates will also be made available on the course website.

4. Course objectives
This is a primary-literature-synthesis course designed to guide you through the topic of plate tectonics from the development of the theory to some modern-day theories on crustal growth and plate-boundary interactions. By the end of the course you should be able to: 1) piece together a broad-scale interpretation of the evolution of an active or ancient plate boundary using data and interpretations gleaned from the primary scientific literature and 2) use basic thermochronologic, geophysical, geological, and geospatial data sets to interpret plate boundary interactions and the growth of mountain belts at some active plate boundaries. In addition to these geoscience-centric goals, this course is also designed to improve your verbal communication skills and provide you with experience in accessing, reading, and assimilating scientific literature.

5. Course structure
5.1. Regular class meetings
The “lecture” component of this course is designed around student interpretation, presentation, and discussion of material from the primary scientific literature. It is up to you to read and interpret papers and book chapters on the various topics covered in the course and then present the material to the rest of the class as either a formal lecture or an in-class activity. Of course, I will be available to help you with this. For the most part, we will approach the subject of plate tectonics using a case-study format wherein we examine and compare features from active and ancient plate boundaries from around the world. For each topic, I will give you some over-arching questions that you should consider when thinking about each paper and book chapter. We will then look at a series of papers on the topic/area. Each paper will be assigned to a student(s) who is/are responsible for presenting that material to the rest of the class. Before class you should read the abstract and conclusions of each paper and familiarize yourself with the figures. During class, you are expected to take notes and ask questions. Once
all of the papers on a given topic have been covered, we will devote a final class period to an instructor-mediated brain-storming discussion of how the theories and data from each of the papers relate to each other. The goal of these discussions is building a broad-scale picture of the topic by integrating all of the studies together. Afterwards each of you will write a short summary paper on the topic.

5.2. Summary papers

The summary papers are designed to: 1) make you assimilate all of data and ideas on each topic and 2) help improve your written communication skills through peer-editing and rewriting each assignment. Papers should be ~1000 words long and use in-text citations of material covered in class with an abbreviated reference list at the end. A rough draft of the papers will be due the class period after the brain-storming discussion. We will exchange papers and go through at least two rounds of peer edits. The final drafts are due the following class period.

5.3. Laboratory class meetings

The laboratory component of this course is designed to give you experience working with some of the data and techniques used in analyzing plate motions, reconstructing past plate configurations, and understanding how deformation is accommodated at plate boundaries. Laboratory topics will include vector analysis of plate motions, thermochronology, interpretation of ocean-floor morphology, interpretation of ocean-floor magnetic data, interpretation of modern-day geospatial data, and geologic interpretations of belts of exotic terranes.

6. Assessment

Assessment for this course is based on your performance in: 1) reading, interpreting, and presenting the papers in class; 2) analyzing and synthesizing information from these papers in order to provide a concise written report on each topic, and 3) the laboratory exercises.

7. Attendance and academic dishonesty policies

Attendance of all classes is required. Don’t cheat. I am really intolerant of academic dishonesty. I will follow College policies on attendance and academic dishonesty. These can be found in the College Catalogue and the Student Handbook.

8. Tentative course schedule

8.1. Lecture Schedule

1. The recognition of plate tectonics and the early history of plate tectonic theory. Important questions include: What data-sets allowed us to recognize tectonic plates, plate motions, and the three major classes of plate boundaries? What technological advances were needed to collect these data and make these observations?

2. Growth of oceanic crust: Testing the ophiolite model at fast- and slow-spreading mid-ocean ridges. Important questions include: How is oceanic crust formed at different classes of spreading ridges (fast vs. slow), and what are the major mechanisms involved in crustal growth in these two environments? What would a crustal cross section (Ophiolite) from each of these two spreading environments look like, and how do these cross sections compare with the classic ophiolite stratigraphy?

3. Continental extensional tectonics: Case study of the Basin and Range province in North America. Important questions include: What is the dominant crustal extension
mechanism in the Basin and Range province? How does the architecture of crustal extension in this area compare to oceanic divergent plate boundaries?

4. Continental transform boundaries: Case study of the San Andreas system in California. Important questions include: What controls slip along the San Andreas Fault, and why are there apparent seismic and aseismic segments? How is strain partitioned at this plate boundary?

5. Subduction tectonics and great earthquakes (magnitude $\geq 8$). Important questions include: How do factors such as the plate convergence rate and the age (temperature) of the subducted lithosphere affect subduction zone mechanics? What is required for the generation of great earthquakes at subduction zones, and should we worry about a great earthquake in the Pacific Northwest?

6. Continent-continent collision: Case study of the India-Asia collision and the evolution of the Himalayas and the Tibetan Plateau. Important questions include: Is continental subduction occurring in this system? What is the mechanism for maintaining the Tibetan Plateau? What roles are "escape tectonics" and "channel flow" playing in accommodating crustal shortening in this region?

8.2. Laboratory schedule

1. Introduction to map projections and making a map of the Earth’s plates and plate boundaries.

2. Analyzing relative and absolute plate motions.

3. Interpreting sea-floor morphology.

4. Interpreting sea-floor magnetic data.

5. Interpreting the morphology of the Basin and Range province and a comparison with GIS-derived plate velocities.

6. Thermochronology in tectonic/structural analysis: Case study from the Ruby Mountains and East Humboldt Range, Nevada.

7. Sedimentary basins and plate tectonics.

8. Metamorphic petrology and subduction/arc tectonics.

9. Tectonic analysis of oceanic-affinity accreted terranes: Case study of the Klamath Mountains Province, California and Oregon.

10. Tectonic analysis of Maine.