PLATE TECTONICS
AND ITS GEOLOGICAL CONSEQUENCES

GEOS 613 (3 Credits), Fall, 2012

Lecture: Tuesday and Thursday, 9:45-11:15 **Reichardt 233**

Professor: Wesley K. Wallace **Reichardt 330**

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Office hours: After class, Tuesday/Thursday 2:00-3:00, or by appointment

Textbook: Global Tectonics, Third Edition, Philip Kearey, Keith A. Klepeis, and Frederick J. Vine, Wiley-Blackwell, Oxford, 482 p., 2009.

Supplemental resources at: http://blackwellpublishing.com/kearey/

The concept that rigid lithospheric plates move relative to one another and interact at their boundaries has revolutionized how we think about geological processes and the evolution of the earth, and has led to many new insights about the earth. The concept of plate tectonics has implications for virtually every aspect of geology and geophysics, so this course is designed to provide an introduction to its basic elements and implications for graduate students in any discipline of earth science. The goal of the first part of the class is to outline the basic principles that underlie and led to the concept of plate tectonics. This will provide a foundation for the remainder of the semester, during which the class will explore the geological consequences of plate tectonics, specifically the tectonic character of the various types of plate boundaries and examples of each.

The course is intended to be accessible and relevant to a broad range of geoscience graduate students, so the only course prerequisite is an undergraduate structural geology class equivalent to GEOS 314 Structural Geology or instructor permission. Knowledge of igneous and metamorphic petrology, sedimentary geology, and geophysics will help you to gain more from the class.

I will present the essential information for the class in lectures, so attendance is important. If you must miss a class, be sure to get handouts from me and to get notes from another student who attended class.

A preliminary outline of the course follows, with a schedule of dates and readings. The class probably will depart somewhat from the schedule, depending on student interests and the actual time required to cover various topics.

The text includes the same essential elements as the class, but is organized a bit differently. The chapters that most closely fit the content of the lectures are assigned for reading on the course outline. The lectures and readings will complement one another because some topics that I will emphasize in class are covered only lightly or not at all in the text, and vice versa. Other optional parts of the text address topics that I will not cover in class.

"Student learning outcomes" will include establishing a working knowledge of:

- •the geological and geophysical data and concepts that underpin plate tectonics
- •how and why the plates move and interact
- •plate tectonic evolution from late Proterozoic to present
- •the characteristics of important tectonic settings, including examples from around the globe, past and present

Grades will be based on student preparation and presentation of cross sections across examples of three different tectonic settings:

1. Rift/passive continental margin
2. Subduction zone to magmatic arc
3. Mountain belt

You will choose a modern or ancient example of each of these settings, find references, compile a cross section and evolutionary model, and present your results to the class. I will provide more detailed instructions on these projects soon. Projects are due after each setting is covered in class.

I will grade each project based on both content and presentation, according to specific criteria in the project instructions. Components of your grade include:

Tectonic setting cross-section project: 25% each
Tectonic setting oral presentation: 5% each
Class attendance and participation: 10%

I will provide reasonable accommodation to students with disabilities in cooperation with the UAF Office of Disabilities Services (208 WHITAKER BLDG, 474-5655).

CLASS SCHEDULE

Date	Subject	Reading
	1. Principles of Plate Tectonics	
August 30	A. Global patterns leading to the plate-tectonic concept	1, 5.1
September 4	B. Structure of the crust and upper mantle	2
6	C. Geomagnetic reversals and oceanic anomalies	4.1
	D. Patterns of seismicity	5.2
	E. Hot spots and their traces	5.5, 5.7
11	F. Geometry of plate motion	4.2, 5.3-5.4, 5.6, 5.8-5.11
13	G. Plate motion reconstructions and the supercontinent cycle	3, 11.5
18		
20	I. Driving mechanisms	12
	2. Plate Boundaries	
	A. Divergent	
25	1. Oceanic spreading centers	6
27	2. Continental rifts and passive continental margins	7
October 2		
	B. Convergent	9
4	1. Types, controls, and geological elements	
9	***Presentation of cross sections (rift/passive margin)**	
11	1. Types, controls, and geological elements (continued)	
	2. Elements of convergent plate boundaries	
16	a. Trenches, subduction complexes, forearc basins	
18		
23	b. Arcs: Oceanic vs. continental, evolution, and magmatism	
25	c. Back-arc basins	
	3. Orogenic belts	10
30	a. Anatomy of mountain belts	
November 1	***Presentation of cross sections (subduction zone to arc)**	
6		
8	b. Obduction, ophiolites, and terrane accretion	
13		
15	c. Continent-continent collisions	
20		
22	*No class: Thanksgiving holiday*	
27	C. Transform	8
29	***Presentation of cross sections (mountain belts)**	
December 3-7	*No class: American Geophysical Union meeting*	
December 16	Exam period: 8-10 AM, synthesis of class (or date and time to be arranged)	