

## STRUCTURAL GEOLOGY

**GEOS 314 (4 Credits), Spring, 2006**

**Lecture: TuTh 9:45-11:15, Natural Sciences Building 233**

**Lab: Th 2:00-5:10, Natural Sciences Building 233**

**Professor: Wesley K. Wallace, Natural Sciences Building 330, 474-5386**

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**Office hours: After class, M 3:00-4:00, or by appointment**

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**Textbook: Earth Structure: An Introduction to Structural Geology and Tectonics, 2nd edition, by Ben van der Pluijm and Stephen Marshak, WW Norton & Co. , 2004.**

This class provides an introduction to structural geology and tectonics. The main objective of the course is not to turn you into a structural geologist, but to provide you with the basic, practical knowledge of structural geology and tectonics that is required in all fields of geology. Consequently, the lectures and labs will focus on characterizing and interpreting the natural structures that you will encounter as a geologist or geophysicist, the concepts needed to understand those structures, and the tectonic environments in which they may be found. Labs will emphasize working with tools and techniques that can be applied in the field, particularly geologic maps.

The class will be letter graded, based on the following criteria:

**Exams (50%):** Exams will be based mainly on the content of the lectures, so your attendance in class is essential. I assign reading to supplement the lectures because I cannot cover everything in the lectures and you probably won't really learn important concepts if you only hear them once in a lecture. Some exam questions will be based on the reading so you should keep up with reading assignments. The three exams will each be based mainly on the material covered between exam periods. However, a part of each exam may include questions from the material covered by the previous exam. I will review some answers in class after an exam, so you must arrange make-up exams prior to the scheduled exam period.

**In-class exercises/homework (10%):** These short exercises will provide hands-on experience with important concepts discussed in lecture. Complete whatever you do not finish in class as homework.

**Laboratory (35%):** The laboratory covers material essential to understanding structural geology, and is an important supplement to the lectures and reading. It is very important that you attend lab so the TA can introduce the material essential to complete each lab and so you can ask questions of the TA while working on the lab. By its nature, the lab work is very time consuming. You should expect to spend additional time working on labs outside of the assigned lab periods. Additional information on labs will be provided during the first lab period.

**Field trip (5%):** You are required to participate in a field trip late in the class so that you will have an opportunity to see some actual structures in the field and apply some of the concepts and techniques you have learned in the class. Unlike some other places, Alaska's climate allows us only a short time to experience structural geology in the field. You have three-months' notice of the date of this field trip, so you should have no excuse for missing it.

**Structural Geology (GEOS 314), W.K. Wallace, Spring, 2006**

**Page 2**

### Class Schedule

<u>Date</u>	<u>Class</u>	<u>Reading</u>	<u>Lab</u>
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19 January	Introduction to class Introduction to plate tectonics	Chapter 1 Chapter 14	No lab
24 January	Plate tectonics and structural environments		
26 January	No class		No lab
31 January	Nontectonic structures Introduction to tectonic structures	Chapter 2	
2 February	Strain in rocks 1	Chapter 4	Lab 1: Plate tectonics
7 February	Strain in rocks 2		
9 February	Stress	Chapter 3	Lab 2: Simple shear
14 February	Behavior of materials 1	Chapter 5	
16 February	Behavior of materials 2		Lab 3: Strain analysis
21 February	Deformation mechanisms	Chapter 9	
23 February	<b>Exam 1</b>		Lab 4: Dips of surfaces
28 February	Folds: Geometry and classification 1	Chapter 10 (p. 238-257)	
2 March	Folds: Geometry and classification 2		Lab 5: Cross sections and stereographic projections
7 March	Fold mechanics 1	Chapter 10 (p. 257-269)	
9 March	Fold mechanics 2		Lab 6: Folds
14 March	<b>Spring break</b>		
16 March	<b>Spring break</b>		
21 March	Penetrative structures 1	Chapter 11	
23 March	Penetrative structures 2	Chapter 12	Lab 7: More folds
28 March	Faults: Character and classification	Chapter 8	
30 March	Fault mechanics 1	Chapter 6	Lab 8: Fabrics

Class Schedule (Continued)

<u>Date</u>	<u>Class</u>	<u>Reading</u>	<u>Lab</u>
4 April	Fault mechanics 2		
6 April	<b>Exam 2</b>		Lab 9: Faults
11 April	Fault rocks and fractures	Chapter 7	
13 April	Settings: Contractional 1	Chapter 17	Lab 10: Low-angle faults
18 April	Settings: Contractional 2	Chapter 18	
20 April	Settings: Contractional 3		Lab 11: Regional synthesis
22 April	Field trip (required)		
25 April	Settings: Extensional 1	Chapter 16	
27 April	Settings: Extensional 2		Lab 12: Field observations
2 May	Settings: Strike-slip 1	Chapter 19	
4 May	Settings: Strike-slip 2		Lab 13: Cross sections
11 May	<b>Exam 3</b> (8:00-10:00)		

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**SUPPLEMENTARY READING FOR LAB**

The assigned readings from the text (Earth Structure: An Introduction to Structural Geology and Tectonics, van der Pluijm and Marshak) will be helpful for labs that cover the same topics (e.g., strain, folds, faults). A section from a different text (Structural Geology of Rocks and Regions, by Davis and Reynolds, 2nd edition, 1996, Wiley) provides additional information specifically useful for lab. This section is called "How to function in the field, and how to reduce the data" (p. 626-737). A xerox copy of this section is available from the TA for you to copy.

Below is a summary of the pages of this section that may be helpful for specific labs:

Lab 4	p. 684-691	Orthographic projection, including 3-point problems and true and apparent dip.
	p. 672-673	Apparent dip nomogram
Lab 5	p. 669-679	Cross sections
	p. 635-639	Geologic maps
	p. 691-704	Introduction to stereographic projection
Lab 6	p. 679-683	Structure contour maps
	p. 708-714	Rotation using stereographic projections
Lab 7	p. 704-708	Contouring stereographic projections
Lab 9	p. 714-717	Fault slip using orthographic and stereographic projection
Lab 12	p. 640-644	Field notes
	p. 662-669	Measuring attitudes with a compass

**It would be useful for you to read this entire section prior to field camp.**