

Geology 318 Structural Geology Fall 2016

Meeting times: MWF 1-2:50. Room ES218

Instructor: Elizabeth Schermer **Office** ES 438 **Phone** 650-3658

Office hours: MW 930-1030, F 11-12 and by appointment **Email:** liz.schermer@wwu.edu

Required Textbooks: **Structural Geology** by Fossen; **Lab manual** available at bookstore.

Course Objectives: In this course you will learn to describe and interpret geological structures in the field and laboratory, and from maps. You will acquire skills in pattern recognition and 3-D visualization and learn the basic tools for measuring and analyzing structures. You will also gain a basic understanding of the material properties of rocks and the theory of their mechanical behavior. You will learn about deformation in the earth's crust at all scales from microscopic to plate-tectonic. And I hope that you will enjoy and be intrigued by the beauty of the earth's structures. See [http://www.geology.wwu.edu/dept/visitors/outcomes/318 Outcomes.pdf](http://www.geology.wwu.edu/dept/visitors/outcomes/318%20Outcomes.pdf) for details of program and course outcomes, objectives, and assessment. These are also on the last page of this syllabus and listed on the course Canvas site.

Reading: Reading assignments are to help you understand the lectures and prepare for the laboratory exercises. Please complete the readings before class. Exams will cover material contained in both lectures and reading; the lab exam will cover only material from the lab exercises.

CANVAS will be used for lecture notes and other info. Please check the course site several times a week.

Lab: Lab exercises will introduce you to the analytical tools of structural geology. There are generally two labs each week; exercises are assigned and introduced during class periods, but it is expected that you will need time outside of class to complete the assignments. Some of the exercises will take two periods but that will be indicated in advance. **The completed exercises are due at the beginning of the next class session unless otherwise announced—penalty for late labs is a maximum grade of 75%.**

Field trips: **There are three required 1-day field trips**, tentatively scheduled for Saturday 10/8, Sunday 10/16, and Saturday 10/29. See the lab book for required materials, and the Canvas site for a reminder.

Exams: There will be three exams in the course: 1 lecture midterm, 1 lecture final, and 1 lab final. Make-up exams will not be given except by **prior** arrangement with the instructor.

Disability resources and other concerns: Reasonable accommodation for persons with documented disabilities should be established within the first week of class and arranged through Disability Resources for Students: telephone 650-3083; email drs@wwu.edu; and on the web at <http://www.wwu.edu/depts/drs/> Please contact me in person, by email or phone if you have any concerns about participating in this class.

Grading:

30%	lab exercises
5%	In-class activities (you can miss one activity without penalty)
15%	Lab final
20%	Midterm
25%	Final
5%	Class and field trip attendance and participation

IMPORTANT INFORMATION AND RESOURCES

WWU Policy on Academic Dishonesty: Western Washington University students have an obligation to fulfill the responsibilities of their particular roles as members of an academic community. Honesty is essential to learning. Without it, fair evaluation for all is impossible. Academic integrity is demanded, and academic dishonesty at Western Washington University is a serious infraction dealt with severely. Students shall not claim as their own the achievements, work or arguments of others, nor shall they be a party to such claims.

Integrity: For students, *academic integrity* means challenging yourself, striving for excellence, taking risks and learning from your mistakes, doing your own work, and giving credit whenever you use the work of others. It boils down to caring about your schoolwork and always being honest in carrying it out.

I begin with the assumption that you come to Western and this class with integrity. However, academic integrity and honesty can be challenging due to such things as ignorance, confusion, stress, bad advice, and bad choices. So to help you keep your integrity and good reputation intact, I have resources for you (meaning, by the way, that ignorance will not be an excuse):

- WWU's Integrity Website www.wwu.edu/integrity. It provides all the information you need, including why integrity is important, how to promote it, as well as types of academic dishonesty and how to avoid them, *particularly plagiarism*. It also includes WWU's policy and procedures on academic honesty (appendix D of the WWU Catalog).
- *See me, see me, see me* if you have *any* concerns or questions about academic integrity regarding yourself or your classmates. An ounce of prevention is worth a pound of cure, especially where penalties and one's reputation are at stake. *I am here to help.*

Student Services

Western encourages students to seek assistance and support at the onset of an illness, difficulty, or crisis.

- In the case of a medical concern or question, please contact the Health Center: 650-3400 or www.wwu.edu/chw/student_health
- In the case of an emotional or psychological concern or question, please contact the Counseling Center: 650-3400 or www.wwu.edu/chw
- In the case of a health and safety concern, please contact the University Police: 650-3555 or www.ps.wwu.edu/
- In the case of a family or personal crisis or emergency, please contact the Dean of Students: 650-3775 or www.wwu.edu/dos/contact_us.shtml
- To seek confidential support related to sexual violence, please contact [CASAS](http://www.wwu.edu/casas) (650-3700), the Student Health Center, and/or the Counseling Center. To report sexual violence, please contact University Police, Bellingham Police, and/or the [Title IX Coordinator](http://www.wwu.edu/titleix) in Western's Equal Opportunity Office (650-3307).

Classroom climate

I am committed to establishing and maintaining a classroom climate that is inclusive and respectful for all students. Learning includes being able to voice a variety of perspectives, and classroom discussion is encouraged. While students' expressed ideas may vary and/or be opposed to one another, it is important for all of us to listen and engage respectfully with each other. In this class, I expect all students to make their best efforts to pronounce one another's names correctly, and to respect one another's personal pronouns. If you have questions or concerns related to these expectations, please speak with me.

Absences

In all cases that you will miss class, please contact me before class, or at the earliest possible time thereafter to discuss makeup work. Do not ask "did we cover anything important that day?" or "Did I miss anything?" (The answer is always yes!)

Geology 318 COURSE OUTLINE, Fall 2016

Dates	Monday	Wednesday	Friday
9/19-23	no class	Intro, overview, class logistics Primary structures Read: Ch. 1 (all)	Kinematic analysis & strain Read: Ch 2 (2.1-2.5, 2.7-2.11, 2.13-2.16, 2.22-2.24, 2.30) LAB 1: The strain ellipse
9/26-30	Kinematic analysis & strain LAB 1: Continued Read: Ch 2 (2.1-2.5, 2.7-2.11, 2.13-2.16, 2.22-2.24, 2.30) Get bruntons for Wed	FIELD LAB 1: Using your brunton	Kinematic analysis & strain LAB 2: Strain in rocks Read: Ch. 3 (all)
10/3-7	Dynamic analysis & stress Read: Ch 4	Dynamic analysis & stress Read: Ch 4, ch 5 (5.1-5.7, box 5.1) Lab 3: Jello	Mountain building Washington tectonics and structures; intro to field trip read: FIELD LAB 2 intro, part 3 more brunton practice
FIELD TRIP 1 SAT 10/8: Mapping Rosario Head (FIELD LAB 2, part 3) leave 9 am Read: Deception Pass field trip (FIELD LAB 2) Intro, Part 3			
10/10-14	Dynamic analysis & stress Read: Ch 7 LAB 4: Mohr circles I	Planes in 3-D LAB 5: Stereonets I Read: Appendix B review strike and dip, t&P	Field trip prep: Intro to folds Read: Ch 11.1
FIELD TRIP 2 SUN 10/16 Measuring folds (FIELD LAB 2, part 2) leave 8:00 am Please read Ch 11 (11.1) and FIELD LAB 2, part 2			
10/17-21	Dynamic analysis & stress LAB 6: Mohr circles II Read: Ch. 7	Dynamic analysis & stress Joints and Veins Read: Ch 7, and p. 305	Rheology Read: Ch 6
10/24-28	Geologic map interpretation LAB 7: Structure contours	Field trip prep: Intro to faults Read: Ch 8, 9.1, 9.4	MID TERM EXAM
FIELD TRIP 3 SAT 10/29, Reservation Head leave 9 am Please read ch 8 (8.1-8.3, 8.5); ch 9 (9.1) and FIELD LAB 2, part 1			
10/31-11/4	Geologic map interpretation LAB 10: Fault offset calculations	LAB 9: Constructing structural cross sections Read: Ch. 20 (20.1, 20.2) and lab book information on cross sections	Folds: geometry & mechanics Read: Ch 11 Work on lab 9
11/7-11/11	Lab 9 due Cross section peer review Fabrics: foliation, lineation, Read: Ch 12, 13, 14	Fabrics: foliation, lineation, boudinage, continued Read: Ch 12, 13, 14 Start LAB 12 Geometric analysis of folds on stereonet	VETERAN'S DAY HOLIDAY Revised cross section due
11/14-18	LAB 12, continued: Reread: Appendix B	Lab 11 Cross section #2 Reread lab book information on cross sections	Fault rocks and shear zones Read: Ch 15 Extensional regimes Read: Ch.17
11/21-11/25	Contractional and Strike-slip regimes Read: Ch.16, 18	THANKSGIVING	THANKSGIVING
11/28-12/2	LAB 13: GIS map of Rosario Head	Deformation mechanisms intro Read Ch 10 (10.1, 10.2) Summary and review	LAB FINAL
DEC 6	FINAL EXAM, TUES, DEC 6, 330-530 pm		

Outcomes Assessment for Geology 318
(Structural Geology)

Course Outcomes	Objectives (SWBAT)
<p>1. Understand how two dimensional images (e.g. maps, photographs) can be conceptualized in 3 dimensions.</p>	<p>1.1 Predict the geometry and location of structures at depth or in areas of poor outcrop</p> <p>1.2 Construct a structurally viable cross section across a geologic map</p> <p>1.3 Present and manipulate data using stereographic projection (stereonet)</p>
<p>2. Understand the geometry of geological structures in deformed continental regions.</p>	<p>2.1 Accurately describe in words and a sketch the structural elements in a hand sample or outcrop.</p> <p>2.2 Describe the geometry of structures shown on a map.</p> <p>2.3 Correctly measure, describe, and plot the orientation of a fold or fault on a map and stereonet</p>
<p>3. Understand the relative timing of formation of structures and the kinematics of deformation</p>	<p>3.1 Interpret the structural history of an area given a geologic map and cross section</p> <p>3.2 Determine the orientation of shortening and extension that produced faults, folds, and fabrics in outcrop, hand sample, or photograph</p>
<p>4. Gain a basic understanding of the material properties of rocks and the theory of their mechanical behavior under ductile and brittle conditions from natural and experimental data</p>	<p>4.1 Distinguish between the concepts of stress and strain</p> <p>4.2 Predict the geometry of structures in an extensional, compressional, or strike-slip regime</p> <p>4.3 Distinguish between structures formed under brittle and ductile conditions</p> <p>4.4 Describe the variables that lead to rock fracture and faulting</p>