

Department of Earth & Environmental Sciences
LEHIGH UNIVERSITY

EES 427 Orogenic Belts 3 credits Fall 2014

Professor Dave Anastasio, Office: 109B STEPS Building

Office Hours: Monday 2:00-3:00PM, Thursday 9:00-10:00A, or you can Email your questions or for an appointment dja2@lehigh.edu (preferred), or phone x85117.

Class meets two days weekly, Monday, 9:10-10:30±AM and Wednesday 9:10-10:30±AM in ST551 or ST225.

Coursesite: Papers and course announcements will be posted on the Lehigh's course site system (<http://coursesite.lehigh.edu>). Check the site before class.

Expectations:

You are expected to attend all class meetings. You will be responsible for all material covered in class as well as assigned readings. Course assignments when noted are expected to be your own work otherwise collaborative learning is encouraged.

Course Evaluation:

Problem Sets, Papers, Seminar, Class Participation

Accommodations for Students with Disabilities:

If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center 212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

Academic Honesty:

It is the duty and obligation of students to meet and uphold the highest principles and values of personal, moral and ethical conduct. As partners in our educational community, both students and faculty share the responsibility for promoting and helping to ensure an environment of academic integrity. As such, each student is expected to complete all academic course work in accordance to the standards set forth by the faculty and in compliance with the University's Code of Conduct.

The Principles of Our Equitable Community:

Lehigh University endorses The Principles of Our Equitable Community (<http://www4.lehigh.edu/diversity/principles>). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Field Safety:

Please exercise care on fieldtrips. Wear your seatbelt in transit and load and unload

carefully from vans cognizant of traffic. Dress for the weather and fieldtrip activities. Wear appropriate footwear and hardhats when necessary and safety glasses when hammering on rocks. Always follow faculty and TA instructions. Avoid proximity to steep highwalls in quarries and along road outcrops.

Course Objectives:

Structural Analysis of deformed Earth materials. Deformation can be broken into three main issues that must be considered in sequence: Geometry, Kinematics, and Dynamics. These are questions about what, how, and why deformation occurs. We will do a little of each to know the scope of the problems we are dealing with and as a jumping off point for further research. The course will be topically biased to my own interests and expertise. Learning approaches will be varied from field, to lab, to lecture, to seminars, experiments, problem sets etc. Topics will generally be treated as vignettes or short courses. You will be expected to participate in the classes operation more as the semester evolves from lecture to discussion to student run seminars.

Course outline:

Week 1

August 25 Organizational meeting
August 27 Course Introduction, Structural Analysis
[HW 1. Find a paper worth reading concerning rock deformation pre-1950, find and critically read a recent (2010 or later) paper to report on, write a 1 paragraph summary, ongoing-find a published map where the published cross section is impossible, they are surprisingly common].

Week 2

Sept. 1 Deformation Mechanisms-Diffusion Mass Transfer
Sept. 8 Cleavage, Volume strain

Week 3

Sept. 15 Deformation Mechanisms-Dislocation Creep
[HW2 Deformation maps]
Sept. 17 Deformation Mechanisms-Cataclastic Flow

Week 4

Sept. 22 Ductile Kinematic Methods, Sense of Shear
[HW3 Sense of shear methods]
Sept 24 8:00AM class:Petrofabrics-GSF, LPO, meet in ST141

Week 5

Sept. 29 Brittle Kinematic Methods- Brittle Deformation Zones
[HW4 Faultkin and slip linears]
Oct. 1 Central Appalachians-field trip preparation
Oct. 4 *Saturday Field trip: the deformation of clastic rocks*

Week 6

Oct. 6 *Monday Field trip: Deformation of Carbonate Rocks*
[HW5 Outcrop Structural Analysis-Report]

Oct 8 Salt Tectonics
[HW6 Synsedimentary Halotectonics]

Week 7

Oct. 13 Climate, Erosion, Mountain Building

Oct. 15 Sedimentation and Deposition in Foreland and Piggyback basins and Sand
Box Introduction

Week 8

Oct. 20 I'm away: Experimental Modeling of Deformation
Sand box models Critical wedges and dual vergent orogens- experiment:
displacement pattern variation in response to foreland synkinematic
sedimentation

[HW7 Experimental Setup, Results, and Discussion]
Oct. 22 I'm away: Sandbox Experiment meet in ST81

Week 9

Oct 27 Sand box experiment meet in ST81

Oct. 29 HW7 Presented

Oct. 31- **ExxonMobile short course *Integrated Basin Analysis***
Nov. 2 ExxonMobil Interviews

Week 10

Nov. 3 Deformation Partitioning Partitioning-GPS Geodesy

Nov. 5 Discussion of Fault-Related Folding

Week 11

Nov. 10 Discussion of Deformation Rates

Nov. 12 Discussion of Fluids and Deformation

Week 12

Nov. 17 Discussion of Geomorphology of Deformation

Nov. 19 Discussion of Heterogeneous Deformation, Lithotectonics, and Structural
Inheritance

Week 13

Nov. 24 Student Seminars

Nov. 25 No Class-Thanksgiving Break

Week 14

Dec. 1 Student Seminars, Best paper reports due

Dec. 3 Student Seminars

Lecture Classes and Homework Assignments

Preparation for lecture classes falls mainly but not entirely on me. Preparation readings before class and HW assignments due 1 week after class will be assigned with regularity.

Discussion Classes

Advance preparation for discussion classes is important. It is expected that all students will prepare for class and participate in the discussions.

Best Paper Assignment

Each student will review 4 carefully chosen papers, write a 1 paragraph summary of each paper due the first class period after the 1st of each month. A one-page critique of the best paper is due December 3, 2014 during the last class period.

Student Seminars and Papers

Each student will be responsible for a half of a class period lecture on an orogen of interest. A class reading should be assigned one week prior to your lecture. You will give a ~25 minute lecture on the orogen plus answer class questions. You will write a ~6 page paper plus figures and references on an orogenic process of interest which is due by December 12, 2011. The topic cannot be your thesis or dissertation research but may be related to a topic discussed this semester. This represents an excellent opportunity to write to learn. Orogen selection is due by October 1, 2014 for Student Lectures. Orogenic Process must be selected and approved by November 1, 2014 for Final Papers.