COURSE SYLLABUS

GEO 5690/6690 Geodynamics

Spring 2019 MWF 8:30–9:20 rm 310

Professor: Tony Lowry (Department of Geology)
- Geology Bldg Room 106 (Phone: 797-7096)
- Email: Tony.Lowry@usu.edu
- Office Hours: MWF 9:30–10:30 am (or by appt)

Teaching Assistant: Harriet Cornachione (Department of Geology)
- Geology Bldg Room 114 (Phone: 541-331-4414)
- Email: harriet.cornachione@aggiemail.usu.edu
- Office Hours: TW 9:30–10:30 am (or by appt)

Course Text: Geodynamics: 2nd Edition. D.L. Turcotte and G. Schubert, Cambridge (NY)
Course Website: http://aconcagua.geol.usu.edu/%7Earlowry/Geodyn/index.html

LEARNING OBJECTIVES

Primary: Internal Earth processes; Geophysical properties of the subsurface; Application of math/physics/chemistry to geological problems
Secondary: Mineral- and rock-forming processes; Tectonics; Natural hazards; Pathways and fluxes of water; Images in geologic investigations; Communicate in written and oral formats

COURSE DESCRIPTION

This course introduces (and surveys current literature on) geodynamics, the study of dynamical processes of the solid Earth. By its nature, geodynamics is rooted in fundamental physics and highly interdisciplinary. The important elements of geodynamics are the same line-up of "Usual Suspects" that you find everywhere in environmental physics: Energy, fluxes of energy and material, and material properties. Energy in the Earth's interior is dominantly thermal, gravitational potential, and strain potential (but others can be important)! Consequently much of this course will deal with inter-relationships of heat transfer, gravity, mass density and mass flux.

The course incorporates both introductory materials and current papers relating to geodynamics of the lithosphere and asthenosphere. Your assignments will include solving problem sets and doing some relatively simple modeling exercises using standard codes (which we will learn together as a group), reading and discussing the physics, measurements and observations informing current papers, and presenting discussion materials on a paper. Graduate students taking the course at 6000-level also are required to develop a semester research project on a topic of your choosing (presumably, something related to your thesis topic). I will attempt to skew the course materials a bit toward the thesis topics and/or interests of students taking the course.

About the professor:
I am a geophysicist. My research focuses on measuring and understanding how and why planets deform, and particularly the rheological relationships that modulate processes of ductile flow, fault slip, earthquakes and volcanism. Elements of my research also have implications for mass transfer in the atmosphere, hydrosphere and cryosphere.

(Very Approximate) Schedule of Topics:

Dates	Topic	Reading
7–11 Jan	Introduction to the course; Intro Lithosphere; Lithosphere as thermal boundary layer: Conductive heat transfer; radiogenic heating	 T&S 132-149
14–18 Jan	Time-dependence (cooling & heating); Temperature and density	T&S 149-162 T&S 171-177 Furlong & Chapman (2013)
21 Jan	MLK Day (no class)	
23–25 Jan	Advective heat transfer processes	T&S 162-171; 179-183 Roy & al. (2009)
28 Jan–1 Feb	Intro Asthenosphere: The adiabat; fluid flow Convection; plumes Asthenosphere = Convection?	T&S 185-190; 226-238 254-261; 266-280 Kellogg & al. (1999)
4–8 Feb	Subduction as downwelling	T&S 244-249; Schmandt & Humphreys (2011)
11–14 Feb	Delamination and drips as downwelling Rheology	T&S 292-323 Becker & al. (2015)
18 Feb	Presidents' day (no class)	
20–22 Feb	 Frictional rheology: seismogenic layer = lithosphere?	Bürgmann & Dresen (2009) T&S 339-355
25 Feb–1 Mar	Flexural Isostasy (Lithosphere as strong layer)	T&S 105-130 Pérez-Gussinyé & al. (2009)
4-8 Mar	Flexural strength as lithosphere	Watts & Burov (2003)
11-15 Mar	(No class: Spring Break)	
18–22 Mar	Rheology; Rheological implications of flexural rigidity	Lowry & P-G (2011)
25–29 Mar	Lithosphere = Tectonic Plate? Viscoelasticity: Asthenosphere from rebound?	Mierdel & al. (2007) T&S 238-241
1–5 Apr	Postseismic deformation: Asthenosphere from rebound?	Willett & al. (1985)
8–12 Apr	Major element chemistry: Lithosphere as tectosphere Geochemistry: Asthenosphere as mixed reservoir	Schutt & Lesher (2006) T&S 410-427

15-19 Apr	Mineral Thermodynamics; Equations of State and lithology	Guerri & al. (2015)
22–24 Apr	Special topics…	
29 Apr	Final Semester Projects Presentations	7:30-9:30

Write-up of Semester Projects Due 1 May at class-time

Updated course schedule and powerpoint lectures will be at http://aconcagua.geol.usu.edu/%7Earlowry/Geodyn/index.html

Grading:	**UG**	**Grad**
Exercises	50%	30%
Class discussions/discussion leads	50%	30%
Semester Project and Presentation		40%

Notice to students with disabilities: Students with physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you have a disability that will likely require some accommodation by the instructor, you must contact the instructor and document the disability through the Disability Resource Center (DRC) in Room 101 of the University Inn, 797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966, preferably during the first week of the course. Any requests for special considerations relating to attendance, pedagogy, taking of examinations, etc. must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative formats--large print, audio, diskette or Braille.