

Plate Tectonics – GEY 443/643 - Fall 2005
Room LFG 202 – MW 2:30 – 3:45 pm

Instructors: Michael Wells & Catherine Snelson

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Required Text: Global Tectonics by Philip Kearey and Frederick J. Vine
Supplementary Text: Plate Tectonics by Allan Cox and Robert Brian Hart (on reserve)
Tectonics by Eldridge M. Moores and Robert J. Twiss (on reserve)

Purpose of this Course

This course is designed as a study of the Earth's origin, age, thermal, and magnetic history. In addition, you will develop an understanding of the dynamics and internal structure in the Earth. Topics also include mechanisms and geometric constraints of plate motion as well as a review of motions of plates in the past.

Course Objectives – to acquire an understanding of the following:

1. Internal Structure of the Earth
2. Nature of Plates
3. Paleomagnetism
4. Plate Motions
5. Plate Boundaries

Grading:

Homework	20%
Midterm Exam	30%
Class Participation	20%
Final exam	30%

Material for the both exams will focus on lecture, textbook and article readings, and discussion topics covered since the previous exam. The final will not be comprehensive. This syllabus is subject to change.

Succeeding!

The textbook, Global Tectonics, is required for the course. Reading assignments for the lecture are listed by date on the accompanying course outline. In addition to the principal textbook, there will be readings from the supplementary textbooks and articles to be assigned. Please read the appropriate assignments before coming to the lecture. Material will be presented in lecture that is not covered in the textbook, so don't miss class! To promote interactive learning, class participation is not only strongly encouraged but required. In the later half of the class, we will discuss several important scientific articles in a seminar format, and each graduate student will have the opportunity present and to lead a class discussion.

Logistics and Policies

1. Participation:

You are expected to be an active participant in the course and much class activity will involve group discussions. Throughout the semester we will have various guest speakers who will expect questions and discussion from you as an audience.

2. Attendance

Class attendance is required.

3. Cheating, Plagiarism, and Academic Dishonesty

You are required to be familiar with university policies and procedures in the current UNLV Undergraduate Catalog. Importantly, we follow the policies on Cheating, Plagiarism, and Academic Dishonesty that are stated in the most recent UNLV Undergraduate Catalog. In the hopes of deterring incidents of cheating and/or plagiarism this class employs a "**zero tolerance**" policy meaning that if a student commits cheating or plagiarism they receive a grade of F for the class.

4. Copyright Issues

The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. **YOU ARE INDIVIDUALLY AND SOLELY RESPONSIBLE FOR VIOLATIONS OF COPYRIGHT AND FAIR USE LAWS. THE UNIVERSITY WILL NEITHER PROTECT YOU NOR DEFEND YOU NOR ASSUME RESPONSIBILITY FOR EMPLOYEE OR STUDENT VIOLATIONS AND FAIR USE LAWS.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability as well as disciplinary action under University policies. To familiarize yourself with copyright and fair use policies, the University encourages you to visit its copyright web page at: <http://www.unlv.edu/committees/copyright>.

5. Disability Services (DS)

The UNLV Disability Resource Center (DRC) houses the resources for students with disabilities. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC), Room 137. Their numbers are: (702) 895-0866/Voice; (702) 895-0652/TDD; and (702) 895-0651/Fax. For additional information please visit <http://www.unlv.edu/studentlife/drc>.

6. Writing Center

Students are welcome to use the UNLV Writing Center free of charge. Consultants can assist students at all stages of the writing process. Students may make appointments by calling the center (895-3908) or in person at FDH-240. The center can be particularly helpful when you are writing or rewriting your lab field reports.

7. Religious Holidays

As a general rule, a student missing a class or laboratory assignment because of observance of a religious holiday shall have the opportunity to make up missed work. You must notify me by the last day of late registration to be assured of this opportunity. If this pertains to you, a clear deadline will be set for completion of work.

8. Nondiscrimination - The University of Nevada Las Vegas does not discriminate on the basis of race, color, creed, religion, national or ethnic origin, gender, age, sexual orientation, disability, or veteran status.

9. Official Extracurricular Activity

All students who represent UNLV at an official extracurricular activity shall have the opportunity to make up assignments, but you must provide official written notification to me no less than one week prior to the missed class(es).

10. Learning Environment

The classroom is intended to be a place of learning. As such and as specified in the UNLV Undergraduate and Graduate Catalogs, no pagers, cell phones, or other potentially disruptive devices are allowed in either lecture or the laboratory.

CLASS SCHEDULE

Wk	Date	Lecture Topic	Lecturer	Reading Assgn.
1	Aug. 29	Introduction of Plate Tectonics – What is a Plate	Snelson & Wells	
	Aug. 31	Earthquake Seismology	Snelson	2.1
2	Sept. 5	Labor Day – No Class		
	Sept. 7	Velocity Structure of the Earth	Snelson	2.2
3	Sept. 12	Composition of the Earth	Snelson	2.3-2.9
	Sept. 14	Lithospheric Deformation	Wells	2.10
4	Sept. 19	Driving Mechanism of Plate Tectonics I	Wells	Ch. 11
	Sept. 21	Driving Mechanism of Plate Tectonics II	Wells	Ch. 11
5	Sept. 26	Isostasy, Flexure, and Heat Flow	Snelson	2.11-2.13
	Sept. 27	Paleomagnetism and Apparent Polar Wander Paths	Snelson	3.6
6	Oct. 3	Sea Floor Magnetic Anomalies and Seafloor Spreading	Snelson	Ch. 4
	Oct. 5	Kinematic Framework, 2-D Plate Motions	Wells	C&H Chp. 2
7	Oct. 10	Triple Junctions, Velocity Triangles	Wells	C&H Chp. 2; 5.9
	Oct. 12	Plate Motions of a Sphere	Wells	C&H Chp. 3, 4
8	Oct. 17	GSA – Salt Lake, UT – No Class		
	Oct. 19	GSA – Salt Lake, UT – No Class		
9	Oct. 24	Modeling and Measuring Relative and Absolute Plate Motions	Wells	C&H Chp. 7
	Oct. 26	Mid-Term Exam		
10	Oct. 31	Oceanic Ridges	Snelson/Wells	Ch. 6
	Nov. 2	Transform faults and Fracture Zones	Snelson/Wells	Ch. 7
11	Nov. 7	Subduction Zones	Snelson/Wells	Ch. 8
	Nov. 9	Andean-type Mountain belts	Snelson/Wells	9.1-9.2
12	Nov. 14	Collisional Mountain belts	Snelson/Wells	9.3
	Nov. 16	Continental Rifts	Snelson/Wells	Ch. 10
13	Nov. 21	Special Topics	Students	
	Nov. 23	Special Topics	Students	
14	Nov. 28	Special Topics	Students	
	Nov. 30	Special Topics	Students	
15	Dec. 5	Special Topics	Students	
	Dec. 7	Special Topics	Students	
16	Dec. 14	Final Exam – 3:10 – 5:10 pm		

e.g., Ch. 6, 5.9: reading in Kearey and Vine; C&H Ch. 10: reading in Cox and Hart

Format for Last 3 Weeks of Class - Special Topics

The last three weeks in the course will consist of a series of presentations followed by discussions of required literature readings on “special topics”; selected based on their controversial nature, recent contribution/recognition and/or timely and significant interest to the plate tectonics community. Participants, together with one fellow student, will pick a special topic from the provided list. This topic will be researched, and a team presentation of about 40 minutes will be given to the class as an overview, followed by discussion. The presenters will assign two papers for the class to read on this topic.

List of Special Topics

- Strength of the lithosphere
- Shear-wave splitting and seismic anisotropy
- Mantle Convection, whole versus layered convection and chemical stratification
- Core-Mantle Boundary interactions
- Delamination of lower crust and mantle lithosphere
- Causes and consequences of Flat Slab subduction
- The great Sumatran earthquake and its consequences

Special Topics

- **Strength of the lithosphere. A couple (if distinct) of recent papers by James Jackson**

Maggi, A; Jackson, J A; McKenzie, D; Priestley, K, 2000, Earthquake focal depths, effective elastic thickness, and the strength of the continental lithosphere *Geology*, vol.28, no.6, pp.495-498, Jun 2000

Jackson, James, 2002, Strength of the continental lithosphere; time to abandon the jelly sandwich? *GSA Today*, vol.12, no.9, pp.4-10

Jackson, James, 2002, Faulting, flow, and the strength of the continental lithosphere, *International Geology Review*, vol.44, no.1, pp.39-61.

Jackson, James Velocity fields, faulting, and strength on the continents, 2004, Editor: Karner, Garry D; Morris, Julie D; Driscoll, Neal W; Silver, Eli A Publisher: Columbia University Press, New York, NY, United States (USA) Pages: 31-45

Jackson, J A; Austrheim, H; McKenzie, D; Priestley, K, Metastability, mechanical strength, and the support of mountain belts, *Geology*, vol.32, no.7, pp.625-628.

- **Shear-wave splitting results from beneath transform faults**

Molnar, Peter, Anderson, Helen J., 1999, CONTINUOUS DEFORMATION VERSUS FAULTING THROUGH THE CONTINENTAL LITHOSPHERE OF NEW ZEALAND *Science*, 0036-8075, October 15, 1999, Vol. 286, Issue 5439

Moore M, England P, Parsons B., 2002, Relation between surface velocity field and shear wave splitting in the South Island of New Zealand: *JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH* 107 (B9): Art. No. 2198 SEP 2002

Scherwath M, Stern T, Melhuish A, et al., 2002, Pn anisotropy and distributed upper mantle deformation associated with a continental transform fault: *GEOPHYSICAL RESEARCH LETTERS* 29 (8): Art. No. 1175 APR 15 2002

Little TA, Savage MK, Tikoff B, 2002, Relationship between crustal finite strain and seismic anisotropy in the mantle, Pacific-Australia plate boundary zone, South Island, New Zealand: *GEOPHYSICAL JOURNAL INTERNATIONAL* 151 (1): 106-116 OCT 2002

- Mantle Convection, whole versus layered convection and chemical stratification
- Core-Mantle Boundary interactions
- Delamination of lower crust and mantle lithosphere
- Flat Slab subduction
- Earth Wobble and Great Quakes