

## ESCI 5504W - NEOTECTONICS - Fall 2014 (Earth Science Dept in CSE)

**Registration:** 3 Credits

**Class Meetings:** TTh 1:00-2:15, Room 121 Pillsbury Hall

**Prerequisites:** ESCI 2201 {Geodynamics I} and ESCI 4501 (Structural Geology) or an equivalent courses at another institution

For those taking the course S-N, an S will be considered equivalent to a C- or better; auditors are requested to officially register as a visitor. Grading scale utilizes +/- grades. The assignment of an *Incomplete* requires a **written** agreement between the instructor and student following university policy. Absences or late assignments require documentation of an excuse conforming to university policy. The expected workload is equivalent to three hours of learning effort per credit per week or 9 hours per week for this course.

**Instructor:** *Karen L. Kleinspehn*  
[klein004@umn.edu](mailto:klein004@umn.edu)  
 624-0537 or 624-1333 (dept)

Office hours: Tuesday 2:30-3:30 p.m. or by appt.  
 118 Pillsbury Hall

### Goals of this course

**Scientific objectives:** This course focuses on currently active lithospheric tectonics up through the last 5 million years and emphasizes new developments in the geosciences as well as current issues relevant to global society. Lectures early in this course review geodetic and geophysical methods essential to interpreting neotectonics and are illustrated by global case studies. The latter part of the course utilizes those methods to address questions fundamental to neotectonics, surveying a spectrum of active plate margins. To the degree possible, the scientific content of the course is tailored to the research interests and professional goals of the student registrants.

**Writing component:** Effective writing is a continuously developed ability crucial to the dissemination of scientific thought. The most brilliant of scientific breakthroughs have little impact if they are not communicated successfully. A profound example lies with the birth of 'Modern Geology'. James Hutton presented the founding principles of our discipline in 1788, but in highly opaque prose. Only when his colleague, James Playfair, rephrased and republished those principles in 1802, did our science begin to flourish.

A primary goal of this course is to develop mature professional communication skills, especially writing as practiced in the geosciences. More importantly, effective communication is essential to function as a modern global citizen; thus this course focuses on vital lifelong skills regardless of one's career path. Writing ability is enhanced through abstract writing, short syntheses of lectures, analyses of published articles and a full-length research paper based on a thorough literature review coupled with critical thinking.

### Lecture/Discussion Topics:

**Tue Sept. 2 – Introduction, writing expectations, discuss well/poorly written example reviews**

**Thurs Sept. 4 – Geodesy I – Ground-based and satellite remote sensing (GPS, VLBI, SLR)**

**Tue Sept. 9 – Geodesy II – DEM's & Altimetry (DORIS, LIDAR, SAR, SRTM)**

**Thurs Sept. 11 – Altimetry/Bathymetry & the Geoid (InSAR, Multibeam, Sidescan sonar)**

**HAND OUT PUBLISHED PAPER TO REVIEW**

**Tue Sept. 16 – Seismicity, focal mechanisms & intraplate stresses**

**SUMMARY OF GEODESY & ALTIMETRY LECTURES DUE AT CLASS TIME**

**Thurs Sept. 18 – Seismic refraction & reflection: Application to plate boundaries**

**STATEMENT OF PAPER TOPIC & 5 REFERENCES DUE AT CLASS TIME**

**Tue Sept. 23 – Seismic tomography & anisotropy: Mantle flow and heterogeneities**

**REVIEW OF PUBLISHED PAPER IS DUE AT CLASS TIME**

**Thur Sept. 25 – Discussion of reviewed paper and scientific writing**

**SUMMARY OF SEISMIC LECTURES DUE AT CLASS TIME**

**Tue Sept. 30 – Plate-motion models: Geodesy, mantle hot spots & geomagnetism**

**STUDENTS RESUBMIT PAPER TOPICS**

**Thurs Oct. 2 – Plate-motion driving mechanisms: LLSVP's**

**Tue Oct. 7 – Isostasy vs Denudation: Tectonic Geomorphology**

**EXTENDED OUTLINE OF PAPER, DRAFT ABSTRACT & 10 REFS DUE AT CLASS TIME**

**Thurs Oct. 9 – Low-Temperature Thermochronology: Applications to vertical tectonics**

**SUMMARY OF PLATE MOTION LECTURES DUE AT CLASS TIME**

**Tue Oct. 14 – Lithospheric thermal structure & rheology; Isostatic response to climate**

**SUMMARY OF ISOSTASY/VERTICAL TECTONICS LECTURES DUE AT CLASS TIME**

**HAND OUT PUBLISHED PAPER TO REVIEW Thur Oct. 16 – Continental rifting: Obliquity & volcanic vs non-volcanic margins**

**STUDENTS RESUBMIT EXTENDED OUTLINE OF PAPER/DRAFT ABSTRACT**

**SUMMARY OF THERMAL STRUCTURE/THERMOCHRONOLOGY LECTURE DUE AT CLASS TIME**

**Tue Oct. 21 – NO CLASS – Research conference**

**Thur Oct. 23 – Revision, editing and discussion of writing samples**

**REVIEW OF PUBLISHED PAPER IS DUE AT CLASS TIME**

**Tue Oct. 28 – Extensional core complexes: Marine & continental**

**Thur Oct. 30 – Mid-Ocean Ridges: Slow vs fast spreading**

**DRAFT OF ORIGINAL RESEARCH PAPER IS DUE AT CLASS TIME**

**Tue Nov. 4 – Discussion of reviewed paper and scientific writing**

**SUMMARY OF RIFTING/ CORE COMPLEXES LECTURE DUE AT CLASS TIME**

**Thur Nov. 6 – Subduction initiation**

*SUMMARY OF MID-OCEAN RIDGE LECTURE DUE AT CLASS TIME*

**Tue Nov. 11 – Fate of subducting slabs: Seismic signatures of slab geometries**  
*(STUDENTS RESUBMIT PAPER DRAFTS)*

**Thur Nov. 13 – Subduction erosion and collisional terranes**  
*SUMMARY OF SUBDUCTION LECTURES DUE AT CLASS TIME*

**Tue Nov. 18 – Trench migration vs subduction of continental lithosphere**  
*ORIGINAL PAPER IS DUE AT CLASS TIME*

**Thur Nov. 20 – Wrench Systems in Volcanic Arcs: Strain partitioning**  
*SUMMARY OF SUBDUCTION EROSION/TRENCH MIGRATION LECTURES DUE AT CLASS TIME*

**Tue Nov. 25 – Intracontinental transform plate boundaries**

**Thur Nov. 27 – NO CLASS – THANKSGIVING HOLIDAY**

**Tue Dec. 2 – Oral Presentations of Papers**  
*SUMMARY OF TRANSFORM/WRENCH LECTURES DUE AT CLASS TIME*

**Thur Dec. 4 – Oral Presentations of Papers continued**

**Tue Dec. 9 – Oral Presentations of Papers continued**

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| <b>Grading:</b> 2 published-paper reviews | 20 % (50% writing, 50% scientific content) |
| 10 Summaries of lectures                  | 25 % (70% writing, 30% scientific content) |
| Original research paper                   | 40 % (55% writing, 45% scientific content) |
| Oral presentation of original paper       | 15 %                                       |