Marine Tectonics – Spring 2012

Instructors: Gail Christeson (gail@ig.utexas.edu, 471-0463)
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Resource: Global Tectonics, 3rd Edition, Kearey, Klepeis and Vine. ISBN: 978-1-4051-0777-8, Wiley-Blackwell Publishers, 2008.

Meetings: GEO 3.222 at 2-3:30 on Tuesdays and Thursdays (lectures and in class exercises)

Office hours: 1:00-2:00 Tuesdays, 2:00-4:00 Wednesdays, EPS 1.148 (UTIG Office near academic advising offices)

Assignments:

- In-class Exercises
- Problem Sets
- Class Debates
- The final project will consist of both an oral presentation and a written report.
    - Graduate students will prepare a report presenting original analysis of data (e.g., seismicity, potential fields, GPS, bathymetry) along a plate margin of their choice. The data are likely to derive from publications; however, analysis and synthesis of data should represent the student's work.
    - Undergraduates will synthesize three or more journal articles about a plate margin of the student's choice, based on multiple techniques to understand the tectonics of the area. The written report should be 3-5 pages of text and include figures from and references to the journal articles.

Grading:

- In-Class Exercises and Debates 30%, Problems sets 40%; final project is 30%.
- There are no in-class exams or final exam.

Schedule

Week 1
17 January (Tu) – Course introduction, History of Plate Tectonics (Christeson)

19 January (Th) – Plate kinematics 1: plate boundaries and relative motions (Gulick)
Plate Kinematic Problem Set

Week 2
24 January (Tu) – Plate kinematics 2: plate tectonics on a sphere (Hayman)
In-Class Exercise- Euler poles

26 January (Th) – Lithosphere-Asthenosphere, rheological definition (Hayman)
In-class Exercise- Lithosphere Strength
Debate Topic Assigned

Week 3
31 January (Tu) – Driving forces of plate tectonics and tectonics on other planets (Gulick)
Debate on slab pull, ridge push, and how subduction starts

2 February (Th) – Geophysical Techniques 1: Earthquakes and fault-slip (Hayman)
In-class Exercise- Focal Mechanisms and Earthquakes
Plate Kinematic Problem Set Due

Week 4
7 February (Tu) – Geophysical Techniques 2: Seismic reflection and refraction (Christeson)
Seismic Velocity Modeling Problem Set

9 February (Th) – Geophysical Techniques 3: Potential Fields and Seafloor Mapping (Christeson)
In-class Exercise- Magnetic Lineation Interpretation

Week 5
14 February (Tu) – Geophysical Techniques 4: Geodetics, Paleoseismology, and Ocean Drilling (Gulick)
In-class Exercise- Coral and GPS Geodesy

16 February (Th) – Rifting 1: Isostasy and Crustal Extension (Hayman)
In-Class Exercise- Isostasy
Debate Topic Assigned

Week 6
21 February (Tu) – Rifting 2: Rifting Processes (Hayman)
Debate on Pure Shear versus Simple Shear
Seismic Velocity Modeling Problem Set Due

23 February (Th) – Seafloor Spreading 1: Structure of Ocean Crust (Christeson)
Google Earth Problem Set

Week 7
28 February (T) – Seafloor Spreading 2: Mid-Ocean Ridges and Spreading Rates (Hayman)
In-class Exercise- Seafloor Spreading

1 March (Th) – Seafloor Spreading 3: Ridge Upwelling and Accretion of Ocean Crust (Christeson)
In-class Exercise- Ridge Segmentation

Week 8
6 March (Tu) – Subduction Zones I: Structure of Convergent Margins (Gulick)
Subduction Interpretation Problem Set
Debate Topic Assigned

8 March (Th) – Subduction Zones II: Fluids in Subduction Zones (Hayman)
Debate on Importance of Fluids in the Subduction Interface
Google Earth Problem Set Due

SPRING BREAK- No Class

Week 9
20 March (Tu) – Subduction Zones III: Earthquake and Tsunami Hazards (Gulick)
Explanation of Final Projects

22 March (Th) – Subduction IV: Ground-truthing Subduction Margins (Gulick)
In-class Exercise- Benioff Zones

Week 10
27 March (Tu) – Slab Rollback, Backarc Spreading and Basins (Christeson)
In-class Exercise- Backarcs
Debate Topic Assigned

29 March (Th) – Hot Spots & LIPs (Christeson)
Debate on the Plume Hypothesis
Subduction Interpretation Problem Set Due

Week 11
3 April (Tu) – Transform Faults and Fracture Zones (Christeson)
Caribbean Problem Set

5 April (Th) – Strike-slip Plate Margins, Strain Partitioning and Geohazards (Christeson)
In-class Exercise- Sumatra Strain Partioning

Week 12
10 April (Tu) – Microplates and Triple Junctions (Gulick)
In-class Exercise- Defining a Microplate

12 April (Th) – Plate Boundaries in Transition (Gulick)
In-class Exercise- Gonave Microplate
Debate Topic Assigned

Week 13
17 April (Tu) – Climate-Tectonics Linkages (Gulick)
Debate on Tectonics versus Climate in Orogenesis
Debate Topic Assigned

19 April (Th) – Plate Tectonics over time (Hayman)

Debate on when Tectonics Started on Earth
Caribbean Problem Set Due

Week 14
24 April (Tu): Undergraduate Student Final Topic Presentations

26 April (Th): Undergraduate Student Final Topic Presentations

Week 15
1 May (Tu): Graduate Student Final Topic Presentations

3 May (Th): Graduate Student Final Topic Presentations
All Students Written Final Report Due by Midnight Electronically