

Course Syllabus for Geology 438/638 - Basin Analysis

Instructor: Dr Bernard Coakley
348 NSF
bernard.coakley@gi.alaska.edu
474-5385

Class Hours: TTh 11:30-13:00

Location: 234 NSF

Office Hours: TTh 13:00-14:00 or by appointment

Textbook:

Allen and Allen, 2005, Basin Analysis, Blackwell, 2nd Edition, 550 p.

Supplementary Texts;

Oreskes, 1999, The Rejection of Continental Drift, Oxford, 420 p.
Watts, 2002, Isostasy, Cambridge, 458 p.

Course Objectives;

Sedimentary basins are formed in a variety of geologic settings. Basins formed in a particular tectonic context (compressive, extensional or strike-slip) share certain characteristics. Knowing the regional tectonics, we can make useful predictions about the sedimentary fill of a basin. Conversely, for ancient basins, if we understand the basin fill, we can make useful statements about the ancient tectonic setting.

Basins are created and filled by coupled processes that cause subsidence and generate and deliver sediment to the basin. Even while it accumulates, the sedimentary fill is modified by compaction as well as the transport of heat and reactive fluids through the rock matrix.

To read the basin fill as a record of tectonic and sedimentary events, it is necessary to understand how these processes create the sedimentary record in each basin. This course will cover these processes and their interactions, as understood from various observational data sets (sedimentary and geophysical), as well as the quantitative forward and inverse models commonly used to extract or constrain basin history.

Requirements:

This course will require a term paper and presentation on the basin of your choice. Graduate students will be expected to hand in a 20 page paper with significant data analysis. Undergraduates will be expected to hand in a 10 page description of a sedimentary basin. The final paper and presentation will be developed with guidance, through a series of intermediate steps;

- A Brief Proposal (due 4rd week of the course) – returned with comments; no grade.
- An Annotated Bibliography (due the 8th week of the course) – 15% of the final grade.
- A First Draft (due the 12th week of the course) – returned with comments; no grade
- A Final Paper and Presentation (due at the final exam) – 40% of the final grade.

Lecture Schedule

Reading Assignments

January

Th 19 Cancelled

Te 24 Introduction to the course/The Development of Geosynclinal Theory.
Oreskes, 9-53

Th 26 Basins in the Plate Tectonic Environment 1.0 – 1.4.1

Te 31 State of the Lithosphere – Isostasy Watts, 1-47
2.0 – 2.1.4

February

Th 2	State of the Lithosphere – Heat Flow and Convection	2.0 – 2.2.6
Te 7	State of the Lithosphere – Strength and Rheology	2.2.7 – 2.4.6
Th 9	Basins due to Stretching <i>Brief Proposal Due (no grade, return comments)</i>	3.0 – 3.4.2
Te 14	Basins due to Stretching II	3.5 - 3.8.4
Th 16	Basins due to Flexure	4.0 – 4.3.3
Te 21	Basins due to Flexure II	4.4 – 4.6.3
Th 23	Mantle Dynamics	5.0 – 5.2.4
Te 28	Strike – Slip Basins	6.0 – 6.3.5

March

Th 2	Erosion/Weathering	7.0 – 7.4.4
Te 7	Sediment Delivery	7.5 – 7.5.4
Th 9	<i>Mid-Term Exam (20% of the final grade)</i> <i>Annotated Bibliography Due (15% of the final grade)</i>	
Te 14	Spring Break	
Th 16	Spring Break	
Te 21	Basin Stratigraphy	8.0 – 8.2.4
Th 23	Patterns of Sedimentation	8.3 – 8.4.2
Tu 28	Depositional Systems	8.5 – 8.5.5.1
Th 30	Depositional Style and Basin Setting	8.6 – 8.6.3

April

Tu 4	Subsidence and Thermal History	9.0 – 9.3.5 Watts 285 - 325
Th 6	Thermal History	9.4 – 9.6.4
Tu 11	Measuring Thermal Maturation	9.7 – 9.9
Th 13	Petroleum Plays <i>1st draft of paper due (optional, no grade)</i>	10.0 – 10.6.3
Tu 18	Passive Margins	
Th 20	Gulf Coast	
Tu 25	Colville Trough	Coakley and Watts 1991
Th 27	Michigan Basin – How Many Mechanisms?	Coakley and Gurnis 1995 Coakley et al., 1994

May

Tu 2	<i>Case Studies Presentations #1 (20% of final grade)</i>	
Th 4	<i>Case Studies Presentations #2</i>	
Th 11	10:15 – 12:15 <i>Final Exam (25% of the final grade)</i> <i>Final Draft Due (20% of the grade)</i>	