Prof. Richard Heermance
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-electronic class information available on Moodle

Lecture Tuesday/Thursday 12:30-1:45, Lab Thursday 2:00-4:45, Rm LO1212

COURSE OBJECTIVES

This course will cover the theory and methods useful for interpreting layers of rock, called strata. Class lectures will be combined with paper reviews, field investigations, and in-class laboratory assignments where you will be introduced to a variety of methods applied to stratigraphic studies. The major objectives of the course are:

1) Interpret sedimentary environments from rock types.
2) Learn how to interpret a stratigraphic section for basin analysis.
3) Develop proficiency in creating a stratigraphic section from field outcrops.
4) Improve ability to read and comprehend scientific literature.

TEXTS AND MATERIALS

Required:

Boggs, S., 2012, Principles of Sedimentology and Stratigraphy, Fifth Edition: New Jersey, Pearson Education, Inc., 585 p.

Tucker, M.E., 2011, Sedimentary Rocks in the Field (fourth edition): West Sussex, John Wiley and Sons, Ltd., 275 p.

CLASS STRUCTURE

Learning will be accomplished through the combination of lecture, paper review, fieldwork, and laboratory work. Although the grades will be separated into two parts, the class and lab will be integrated to maximize time efficiency.

LABS

Laboratory assignments will take place from 2-4:45 PM Thursdays. The class will meet EVERY WEEK unless you are told otherwise. On field-trip days the labs will be combined with class in order to maximize time in the field. Lab write-ups are due on the following Thursday at the beginning of class, unless instructed otherwise.

FIELD TRIPS

There will be two multi-day weekend field trips. Dates are indicated on the attached schedule. Other field-trips will take place from 12:30-4:45 Thursdays during class and lab time. All field trips are required, and reports are due as described in the syllabus. We will leave for field trips promptly at 12:30 from the loading dock.

ACADEMIC HONESTY

Group work and discussion is strongly encouraged. All written assignments and exams, however, must be done entirely by each student unless otherwise instructed. Ideas that arise from collaboration should be individually evaluated in the write-up. Any data presented from outside readings should be clearly referenced. Honor code violations will result in automatic NO CREDIT.

GRADING

Lecture (3 units)*

- paper reviews……20%
- in class quizzes, classwork, and attendance…….…….....10%
- midterm exam…….…….....20%
- final exam ……...…..20%
- Orocopia Field Trip Report …….…….…….....30%

Lab

- Vasquez Rocks Report (2 field trips & lab B).....25%
- Lab A: Contacts, Formations, and Stratigraphic Relationships.....10%
- Lab C: Stratigraphic Correlation.....10%
- Lab D: Fence Diagrams & Isopachs.....10%
- Red Rock Canyon Report.....25%
- Lab E: Sequence Stratigraphy.....10%
- Lab F: Subsidence Analysis and Magnetostratigraphy.....10%

*Graduate students will be required to complete additional or modified projects in addition to the material listed here. Instructions for each assignment will be posted on Moodle.

Grades will be based on a class curve. At a minimum, the following percentages will correspond to each grade, although the cutoff percentage could decrease depending on the curve.

93-100 %	A	72-78%	C
90-93 %	A-	70-72%	C-
88-90%	B+	67-70%	D+
82-88%	B	63-67%	D
80-82%	B-	60-63%	D-
78-80%	C+	<60%	F

Grades of Incomplete are extremely rare and can only if be given if the student meets ALL the requirements set forth in University policy for Incompletes, including 1) has a passing grade in the work completed, 2) has completed a substantial portion of the work in the course, and 3) is able to complete the remaining work independently, with minimal assistance from the instructor. An Incomplete shall not be assigned when a student would be required to attend a major portion of the class when it is next offered.

PAPER REVIEWS

Scientific advances occur due to individual and collaborative research that is presented in peer-reviewed scientific journal articles. One aspect of this course will be the review of pertinent articles related to stratigraphy. During this semester, you will each turn in page (maximum!) reviews of scientific literature. Your review should include the following:

1) The first paragraph should state the paper purpose and the hypothesis tested. How do the authors test their hypothesis?
2) Second paragraph should summarize the data and results of the research.
3) Third paragraph should state the implications of the research.
4) Last paragraph should be your own thoughts on the paper. What are the weaknesses, in your opinion?
5) Conclude the review by writing 2 questions about the paper? These questions should be based on what you think the problems may be with the author's interpretation.

The one-page review should elucidate your understanding of the paper. The review will be graded on completeness and grammar, and will be turned in digitally in "Turnitin" via Moodle.

PAPER REVIEWS (posted in Moodle as necessary)

DeCelles, P.G., Gray, M.B., Ridgeway, K.D., Cole, R.B., Pivnik, D.A., Pequera, N., and Srivastava, P., 1991, Controls on synorogenic alluvial-fan architecture, Beartooth Conglomerate (Palaeocene), Wyoming and Montana: Sedimentology, v. 38, p. 567-590.

Paper #2

Heermance, R. V., Pullen, A., Kapp, P., Garzione, C., Bogue, S., Ding, L., and Song, P., in press, Climatic and tectonic controls on sedimentation and erosion during the Pliocene–Quaternary in the Qaidam Basin (China): Geological Society of America Bulletin.

Heller, P. L., C.L., A., Winslow, N. S., and Paola, C., 1988, Two-phase stratigraphic model of foreland-basin sequences: Geology, v. 16, p. 501-504.

Burbank, D. W., Beck, R. A., Raynolds, R. G. H., Hobbs, R., and Tahirkheli, R. A. K., 1988, Thrusting and gravel progradation in foreland basins: A test of post-thrusting gravel dispersal: Geology, v. 16, p. 1143-1146.

Heller, P. L., Angevine, C. L., Paola, C., Burbank, D. W., Beck, R. A., and Raynolds, R. G. H., 1989, Comment and reply on "Thrusting and gravel progradation in foreland basins: a test of post-thrusting gravel dispersal": Geology, v. 17, no. 10, p. 959-961.

Some pointers for reading a scientific paper (from S. Porter, UCSB)

- *Read introduction and conclusions first. Don't try to read the whole thing in one sitting. Read part, let it rest, and then go back to the paper to complete it.*
- *Make special note of who the authors are. What are their qualifications? What are potential conflicts of interest? (I'd be very wary of a paper on evolution if it came out of the Institute for Creation Research; likewise for a paper on climate change coming from an oil company.)*
- *Make special note of when the paper was published, and in what journal it was published. Has the paper been subject to peer-review? (You can assume all mainstream journals, such as those you find on the UCSB e-journals website, are peer-reviewed.)*
- *Pay close attention to the figures and tables and their captions.*
- *Don't get bogged down in the details. Don't give up if you don't understand the Materials and Methods Section or you fall asleep during the Results Section! As with the novel Moby Dick, it's often better to read different parts of a paper at different paces.*
- *Don't shut down when you come across math. Read through the equation slowly; what's the relationship between different variables? Often it's easier than you think!*
- *If you're new to a subject, the jargon may get to be too much. Keep a dictionary (preferably a geology dictionary) or Google on hand. Usually Wikipedia.org comes through in a pinch.*
- *Be an active reader, not a passive one. This means you should:*

Ask yourself big-picture questions:

- *What's the main point of this paper?*
- *How do the authors prove – or try to prove -- their point?*
- *What is the hypothesis they want to test?*
- *What are the results?*
- *How do the authors interpret these results?*
- *What are the implications of these interpretations?*
- *What are the potential weaknesses of this paper? (The answer, by the way, is hardly ever 'none'. And you don't always have to be an expert to spot weaknesses. Often all you need is the ability to think logically.)*

Take notes, even if it's just a few lines. Try your best to write in your own words. This will help you digest the information and remember it.

When you're done, call your mother/significant other/friend/roommate/ coworker and tell him/her you just read a really interesting/stupid/ brilliant/crazy paper. Then tell him/her what the paper was about. Succinctly. Don't cheat by looking at your notes or the paper itself. If you can't do this without cheating, you didn't understand the paper. Go back and study it again.

Week	Dates	Tuesday	Thursday	Lab	Readings
1	Jan 21-27	Sedimentology Review (Tucker)	*Vasquez Rocks Field Trip #1*		Tucker, ch 1-5
2	Jan 28-Feb 3	Sedimentary Stuctures & North American Stratigraphic Code	North American Stratigraphic Code & Lithofacies	LAB A: Contacts, Formations, and Stratigraphic Relations	Boggs, Ch 12., Appendix C **Decelles et al. (1991)**
3	Feb 4-10	Techniques in Stratigraphic Analysis **DeCelles review DUE**	*Vasquez Rocks Field Trip #2*		Tucker, Ch 7 Boggs Ch 16.6
4	Feb 11-17	Lithofacies Interpretation	Lithofacies Interpretation	LAB B: Adobe Illustrator & Construction of Statigraphic Columns	Tucker ch 8 & Boggs ch 5-11
5	Feb 18-24	Lithofacies Interpretation **Vasquez Rocks Final Report Due**	*Mystery Field Trip*		Tucker ch 8 & Boggs ch 5-11
6	Feb 25 - Mar 3	Stratigraphic Correlation **Mystery Field Trip Report DUE**	Stratigraphic Correlation and Chronostratigraphy	LAB C: correlation	Boggs Ch 12.3, 12.6, and 15 **Paper #2 (TBD)**
7	Mar 4-10	Chronostratigraphy & Correlation cont. **paper #2 DUE**	Chronostratigraphy & correlation cont.	LAB D: Fence Diagrams and Isopachs	Boggs, Ch 15
8	Mar 11-17	Biostratigraphy	Biostratigraphy	NO LAB: exam review	Boggs, Ch. 14
9	Mar 18-24	**Midterm Exam**	Exam review and field trip prep.	*Red Rock Canyon Weekend Field Trip*	
10	Mar 25-31	Seismic & Sequence Stratigraphy	Seismic & Sequence Stratigraphy	LAB E: Sequence Stratigraphy	Boggs, Ch 13.1-13.3
11	Apr 1-7	Chemostratigraphy and Climate Cycles	Chemostratigraphy and Climate Cycles	NO LAB: Talk at 2 PM **Report due 5 PM, Friday**	Ch 12.4 **Heermance et al.(2013)**
Spring Break (April 6-14)					
12	Apr 15-21	Magnetostratigraphy **Heermance et al. review DUE**	*Orocopia Mountains Field Trip*		Boggs, 13.4
13	Apr 22-28	Subsidence	Subsidence	LAB F:: Subsidence Analysis and magnetostratigraphy	Ch 16
14	April 29-May 5	Basin Analysis, Tectonics, and Sedimentation	Basin Analysis, Tectonics, and Sedimentation	NO LAB: Work on Orocopia report	Ch. 16 **Heller & Burbank (3 papers)**
15	May6-May12	Basin Analysis, Tectonics, and Sedimentation **Heller and Burbank papers due**	Basin Analysis, Tectonics, and Sedimentation	NO LAB Orocopia Reports due May 10 @ 5 PM	Ch. 16
FINAL EXAM (take-home) DUE May 16 @ 5 PM					