SEDIMENTOLOGY (Geology 232)
FALL 2008
Sabin-Reed 101a
Morning: T, Th 10:30 - 11:50 a.m.
Afternoon: T 1:00 - 3:50 p.m.

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Office hrs: *stop by, call or e-mail at any time!*

Course Description: A project-oriented study of the processes and products of sediment formation, transport, deposition and lithification. Modern sediments and depositional environments of the Massachusetts coast are examined and compared with ancient sedimentary rocks of the Connecticut River Valley and eastern New York. Field and laboratory analyses focus on the description and classification of sedimentary rocks, and on the interpretation of their origin. The results provide unique insights into the geologic history of eastern North America.

Course Goals: 1) to be able to go to an unfamiliar outcrop and know what kinds of questions to ask and what types of data to collect; 2) to interpret depositional settings based on rock types and sedimentary structures; 3) to analyze successions of sedimentary rocks in the field and laboratory to interpret the geologic history of an area; and 4) to draw connections between sedimentology and other scientific disciplines and everyday life. These goals are accomplished through working on specially designed field and in-class activities.

Course Web Page: www.science.smith.edu/departments/Geology/Sed/

Course Schedule:

Date		Morning	Afternoon
Th	9/4	Introduction: *Why Sedimentology matters?!*	
T	9/9	Introduction – cont.: *Why Sedimentology matters even more?!*	**Field trip** to Turners Falls: *Rocks with class! (-ification)?*
Th	9/11	Intro to siliciclastic sedimentary rocks: *… "dirt" rolls downhill …*	
Sat	9/13	**Field trip** to Plum Island: Modern siliciclastic depositional environments: *Vamos a la playa!*	
T	9/16	Dynamics of sedimentation: *Where did the "playa" go?* – follow-up	**Field trip** to Turners Falls: Sed structures – *Interesting bedforms!*
Th	9/18	Techniques in Sedimentology: *What to do in the field? How and why?*	
T	9/23	**Field trip** to Chard Pond: *To build or not to build?*	
Th	9/25	Preparation for field trip to New York: *New York! New York!*	
Sat-Sun	9/27-9/28	**Field trip** to New York State: Ancient marine sedimentary rocks: *New York! New York!*	
T	9/30	Chard Pond project: *To build or not to build?* – follow-up	**Field trip** to Pioneer Valley I: *Act locally … Think globally*
Th	10/2	Effective communication of geological information: *Pictures and words*	
T	10/7	No class: GSA Conference	
Th	10/9	Sedimentary structures: *Interesting bedforms!* – follow-up	
T	10/14	No class: Autumn Recess	

Date		Morning	Afternoon
Th	10/16	Terrestrial depositional environments: *... onto the land ...*	
T	10/21	Terrestrial depositional environments: *... onto the land ...* – cont.	**Field trip** to Pioneer Valley II: *Act locally … Think globally*
Th	10/23	Critical reading and discussion of geological information: *Storms and/or Quakes?!*	
T	10/28	**Field trip** to Pioneer Valley III: *Act locally ... Think globally*	
Th	10/30	Laboratory methods in sedimentology: *Cutting and grinding ….*	
T	11/4	Introduction to microscopy: *What is your magnification?*	Visit to Archaeology Class (1-2 p.m.); Petrography of siliciclastic rocks
Th	11/6	Petrography of siliciclastic rocks: *Quartz, quartz everywhere!* – cont.	
T	11/11	Pioneer Valley geology: *Act locally … Think globally* – follow up	Petrography of Pioneer Valley samples: *Act locally … Think globally*
Th	11/13	Plate tectonics and sedimentation: *Big holes in the ground*	
T	11/18	Burial history of the Appalachian basin: *To subside or not to subside? Subside!*	
Th	11/20	Coastal depositional environments: *… over the edge …*	
T	11/25	Marine depositional environments: *... into the sea ...* - cont.	Introduction to Stratigraphy: *Why is the Canyon so Grand?*
Th	11/27	No class: Thanksgiving	
T	12/2	Carbonate depositional environments: *Tropical theme for December*	Petrography of carbonate rocks: *Calcite, calcite everywhere!*
Th	12/4	Carbonate depositional environments: *Tropical theme for December* – cont.	
T	12/9	Geologic history of the Appalachian basin – Basin Analysis: *The Big Picture!*	
Th	12/11	Preparation for the final exam: *New York! New York!*	

The course schedule and procedures are subject to change in the case of unexpected circumstances.

Course Requirements: Attendance and active participation in class meetings and on field trips; Completion of all assignments.

Texts (copies are in the file cabinet in the classroom):

Prothero, D.R., and Schwab, F., 2004, Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy, 2nd edition: W.H. Freeman and Company, New York, 557 p.

Tucker, M.E., 2003, Sedimentary Rocks in the Field, 3rd edition: John Wiley & Sons, New York, 234 p. (optional)

Other Materials:

Field clothes and shoes.

Provided by the instructor: field notebook, rock hammer, acid bottle, eye goggles, hand lens, sediment size gauge, and hardhat.

Assignment schedule (indicates when the assignments need to be completed by):

If needed, you will get updated course and assignment schedules during the semester.

- Readings:

  - P&S = Prothero, D.R., and Schwab, F., 2004, Sedimentary Geology.
  - T = Tucker, M.E., 2003, Sedimentary Rocks in the Field.

  Additional readings are in the file cabinet in the classroom.

Date		*Before class meeting
Th	9/11	• P&S, p. 2-17: Sedimentary rocks: An introduction • T, Ch. 4: Sedimentary rock texture • T, p. 29-40: Sedimentary rock types • P&S, Ch. 5 and 6: Sandstones and conglomerates; Mudrocks
Sat	9/13	Plum Island field trip preparation • P&S, p. 171-182: Barrier complexes • Islands at the Edge: National Geographic, August 1997, v. 192, p. 2-31. • P&S, p. 302-309: Facies; Transgression and regression
T	9/16	• see readings for 9/13 • P&S, p. 45-64: Sedimentary structures • T, p. 83-118, 127-162: Sedimentary structures (browse)
Th	9/18	• T, Ch. 2: Field techniques • P&S, p. 334-338: Measuring and describing stratigraphic sections
Th	9/25	• P&S, p. 212-214, 217-226: Carbonate rocks • T, p. 40-50: Carbonate rocks • T, p. 119-127: Depositional structures of carbonate rocks • P&S, p. 236-262: Carbonate environments • T, p. 112: Figures 8.18 and 8.19; p. 222-223: Tables 8.11 and 8.12
Sat-Sun	9/27-9/28	• see readings for 9/25 • T, Ch. 6: Fossils in the field
T	9/30	Chard Pond stratigraphic column and ideas for discussion
Th	10/2	Chard Pond project draft write-up (optional)
Th	10/9	Chard Pond project final write-up • P&S, p. 45-64: Sedimentary structures • T, p. 83-118, 127-162: Sedimentary structures (browse)
Th	10/16	• P&S, Ch. 8: Terrestrial sedimentary environments • T, p. 213-218: Tables 8.2 to 8.7
T	10/21	• see readings for 10/16
Th	10/23	• Hubert. J. F. and Dutcher, J. A., 2005, Synsedimentary sand pillows on a lacustrine delta slope and sheet-flood deposition of alluvial-fan gravels, early Jurassic, Deerfield basin, Massachusetts: Northeastern Geology and Environmental Sciences: v. 21, p. 18-36.
T	10/28	summary of class discussion
T	11/4	• P&S, Ch. 2: Weathering • P&S, p. 76-81: Sandstone composition • Handout on magma composition and Bowen's reaction series (from Monroe & Wicander: The Changing Earth). • Wampler, J.M., 1997, Mythical influences of crystallization temperature and pressure on the susceptibility of minerals to weathering: Journal of Geoscience Education, v. 45, p. 74-76.
Th	11/6	siliciclastic petrography exercise
Th	11/13	Pioneer Valley petrography • P&S, p. 437-451: Tectonics and sedimentation (skip: Geosynclines, p. 440-442)
T	11/18	• Wilkerson, M.S., and Hsui, A.T., 1989, Application of sediment backstripping corrections for basin analysis using microcomputers: Journal of Geological Education, v. 37, p. 337-340
Th	11/20	Pioneer Valley project – optional draft • P&S, Ch. 9: Coastal sedimentary environments • T, p. 219: Table 8.8

Date		*Before class meeting	
T	11/25	Pioneer Valley project – final • P&S, Ch. 10: Siliciclastic marine and pelagic environments • T, p. 220-221: Tables 8.9 and 8.10. • P&S, p. 39-44: Sediment gravity flows • P&S, p. 189-197: Continental slope and rise sediments examine Grand Canyon display and sample suite • browse through P&S, Ch. 15-18: Stratigraphy; focus on: • p. 305-308: Transgression and regression (review) • p. 317-328: Correlation; and The nature of the control	
T	12/2	• P&S, Ch. 12: Carbonate environments (review) • P&S, Ch. 11: Carbonate rocks (review)	
Th	12/4	carbonate petrography exercise Grand Canyon exercise	
T	12/9	• P&S, p. 424-437: Basin analysis • Hatcher, R.D., Jr., 1989, Tectonic synthesis of the U.S. Appalachians, *in* Hatcher, R.D., Jr., Thomas, W.A., and Viele, G.W., eds., The Appalachian-Ouachita Orogen in the United States: The Geology of North America, v. F-2, p. 511-535. Focus on Figure 9.	
Th	12/11	Appalachian basin exercise	
Fri	12/19	(last day of exams)	take-home final exam — due by 12:00 noon to BG

*There are also other in-class or field activities to complete ***during*** class meetings.

Grades:

- Course participation (in all field and in-class activities): 20%
  - the lowest course participation grade will be dropped
- Chard Pond project: 25%
- Pioneer Valley project: 30%
- Final exam (take-home): 25%

Grading criteria:

Late assignments: 10 % will be taken <u>off for each day</u> overdue.

- For written assignments:

grade	criteria
100	outstanding explanation with superior supporting information; unusual insights and flashes of brilliance; creative and original analyses and thoughts; goes well beyond minimum required for assignment.
90	good solid job on explanation, with excellent support from samples, examples, data, figures, etc.; excellent reasoning or excellent explanations; goes beyond the minimum required for the assignment.
80	good solid job; does what the assignment asks; decent reasoning or explanations; decent support by data, examples, figures, etc.
70	decent explanation but too general ***or*** some inaccuracies or flaws in reasoning ***or*** coverage is accurate but cursory and does not meet the minimum required for a complete answer.
60	does not effectively address assignment; fails to support assertions with data or examples; unclear explanations; inadequate understanding; major flaws in reasoning or explanations.
0	answer missing or does not answer the question

- For course participation (effort to successfully complete field and in-class activities):

grade	criteria
3	great participation!
2	adequate participation
1	inadequate participation
0	student absent

Understanding Grades (modified after J.H. Williams, 1993 by Catherine A. Rigsby):

Grading students' performance in class is not an easy task. People cannot be pigeonholed, but they can and are judged on the basis of their achievements. As such, grades reflect *both effort and achievement*, not effort alone. This is an attempt to explain why different students obtain different results, and to give you an idea of what is expected of you in this and other courses.

The "A" student - an outstanding student:

- *attendance:* has virtually perfect attendance; commitment to the class resembles that of the instructor.
- *preparation:* prepared for class; always does the reading; does not miss deadlines; attention to detail is such that occasionally may catch the instructor in a mistake.
- *curiosity:* shows interest in the class and in the subject; looks up or digs out what she doesn't understand; asks interesting questions and makes thoughtful comments; participates in all class discussions.
- *retention:* has retentive mind; able to connect past learning with the present and does so frequently; brings a background with her to class.
- *attitude:* has a winning attitude; has both the determination and the self discipline necessary for success; shows initiative; does things that she has not been told to do; both values and enjoys learning - it is a priority in her life.
- *talent:* has something special, such as exceptional intelligence and insight, unusual creativity, outstanding commitment and organizational skills, or a combination of these talents; the special talents are evident to the instructor and usually to other students as well.
- *results:* makes high grades on exams and papers - usually the highest in the class; she is pleasure to have in the classroom and her work is a pleasure to grade.

The "C" student - an average student:

- *attendance:* misses class; puts other priorities ahead of academic work; in some cases, her health or constant fatigue (because of poor use of "leisure" time) renders her physically unable to keep up with the demands of high-level performance.
- *preparation:* prepares assignments consistently, but in a perfunctory manner; work may be sloppy or careless; papers typically read like unproved drafts; at times work is incomplete or late; often seeks extension of deadlines.
- *attitude:* not visibly committed to the class or to her education; participates without enthusiasm; body language often expresses boredom; may have exceptional ability, but shows undeniable signs of poor self-management or bad attitude.
- *results:* obtains mediocre or inconsistent grades on exams and papers; has some concept of what is going on, but clearly has not mastered the material.

SAFETY IN THE FIELD

While in the field always use common sense, good judgment, alertness, and follow these straightforward safety rules:

1. Wear appropriate field clothes and shoes.

The primary function of field clothes is to keep you warm, dry, and protected from the sun. In general, you should wear long pants and long sleeves, and have rain gear and spare warm clothing with you in case the weather turns bad. Wear waterproof, sturdy tennis shoes or hiking boots. Use gloves to protect your hands.

In case of warm weather wear white or light colored clothing made of cotton. Wear a hat, use sunglasses, sunscreen, and drink frequently. In cold weather, wear warm clothes and dress in layers with a wind- and waterproof outer layer (avoid cotton clothes in cold or wet weather). Wear a hat, use toe- and hand-warmers, eat and drink frequently.

2. Use the right equipment and use it properly.

Always wear safety glasses while using rock hammers! Use hard-steel hammers with a square head. Hammers should only be used on rock corners that stand a chance of being knocked off. Do not indiscriminately hammer, and do not swing the hammer wildly. Do not hammer at rocks above your head. Use downward blows, and ensure no one is standing close to you. Do not use a hammer to strike another hammer. Instead, use rocks chisels with a soft metal head that can be struck safely. Do not use chisels on solid rock faces; work them into existing fissures.

Avoid spilling acid on exposed skin. Wear hard hats when working at roadcuts where falling debris is a possibility.

3. Avoid risky situations and do not put others at risk.

Do not climb outcrops with others below you. Avoid walking and climbing on slick or slippery surfaces, and under or on top of unstable or overhanging cliffs. Never roll rocks down slopes and never throw them off the top of cliffs. Do not excavate at the base of sand or mud cliffs that might slump. **Use extreme care while crossing roads and working along busy roadcuts.**

4. Protect yourself from insects and poisonous plants.

Use insect repellent. Wear light-colored clothes so that ticks or other insects can be spotted more easily. Have frequent “tick-checks.” Learn to recognize poisonous plants and avoid them.

For more information see: Planning for Field Safety, 1992, by American Geological Institute, Alexandria, Virginia, 197 p. (QE 45 P53)