SEDIMENTARY GEOLOGY	Dr. Ken Miller (5-3622)	Dr. Jim Browning (5-2044)	T.A.: Anya Hess
460:300	Room 246 Wright Labs	Room 250	Room 243C
Fall 2020	kgm@eps.rutgers.edu	jvb@eps.rutgers.edu	anya.hess@rutgers.edu

LECT-URE	DATE		LECTURE TOPIC Wright Labs Rm. 231 Tues. and Thu. 10:20-11:40		READINGS	LAB. WEEK	LABORATORY TOPIC Wright Labs Room 339; Fri 1:40-4:40
1	Sep	1	Introduction and Earth Materials & NJ provinces	kgm & jvb			
2		3	Physical Stratigraphy	kgm	Ch. 12	4-Sep	Sediment Geo fundamentals
3		10	Weathering and Soils	jvb	Ch. 1	11-Sep	Coarse-Grained sediments
4		15	Grain characteristics: size, shape, composition	jvb	Ch. 3	18-Sep	Clastic sedimentary rocks
5		17	Rock classification (Siliciclastic)	jvb	Ch. 5		
6		22	Transport and Deposition of Siliciclastic Sediment	jvb	Ch. 2	25-Sep	Sedimentary structures
7		24	Sedimentary Structures and Bedding	ah	Ch. 4		
8		29	Diagenesis and Provenance	jvb	Ch. 5	2-Oct	
		1	**Hour Exam I**				
9	Oct	6	Facies Models	kgm	Ch. 12	9-Oct	Rock Core Description,
10		8	Groundwater and Rivers	jvb	Ch 8.1, 8.2		Lacustrine/Terrestrial Environs.
11		13	Lakes & Introduction to the Newark Basin	kgm & jvb	Ch. 8.4	16-Oct	Chemical Sedimentary Rocks
12		15	Deserts and Glaciers	jvb	Ch. 8.3, 8.5		
13		20	Chemical Sedimentary Rocks	jvb	Ch. 6	23-Oct	Facies correlation
14		22	Marginal Marine Environments	kgm	Ch. 9		
15		27	Marginal Marine Environments	kgm	Ch. 9	30-Oct	
16		29	Shelf, Slope, Marine Environments	kgm	Ch. 10		
17	Nov	3	Deep Marine Environments	kgm	Ch. 10	6-Nov	Sediment Cores, Marine Environs.
		5	**Hour Exam II**				
18		10	Biostratigraphy	jvb	Ch. 14	13-Nov	Gamma-Ray Log Correlation
19		12	Geochronology	jvb			
20		17	Geophysical Logs and Magnetics	kgm	Ch. 13.4	20-Nov	Magnetostratigraphy and Biostratigraphy
21		19	Magnetics and Timescales	kgm	Ch. 15		
22		24	Carbon, Oxygen, Strontium Isotopes	kgm			
23		26	Thanksgiving – NO CLASS	kgm		27-Nov	Lab on Wednesday
	Dec	1	Climate and Milankovitch			4-Dec	Mapping
24		3	Seismics and Sequence Stratigraphy	kgm	Ch. 13		
25		8	Sequence Stratigraphy and Eustasy	kgm	Ch. 13		No Lab
26		10	Basin Evolution	jvb	Ch. 16		

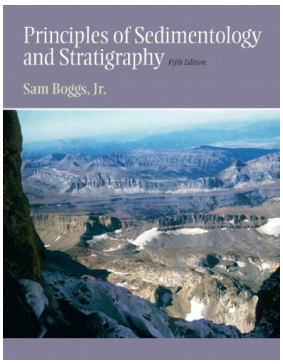
Required Text: Prin. of Sedimentology and Stratigraphy Boggs (any version)

Welcome to Sedimentary Geology!

Welcome to *01 460 330 Sedimentary Geology* that will be taught by Prof. Ken Miller and Jim Browning. The first class is 1:40 PM on Tuesday Sept 1st . **Attendance in this class is required.**
Class starts promptly according to the "atomic clock" (National Institutes of Standards and Technology; https://www.time.gov). Do not be late.

The philosophy of this course is to prepare you to think like a geologist. While this course is fine for minors, it is designed to make you think about sediments, sedimentary rocks, and what they can tell us about environments of deposition and the history of the Earth. This course is the *sine qua non* (indispensable and essential ingredient) for work either in environmental or oil/gas careers.

*****Come to the first class ready to tell us the geological formation(s) and age of strata that underlie your hometown. Use a geological map! (NJ geology maps are on the walls outside of our classroom Room 231. You can also download a geological map of New Jersey here: https://www.state.nj.us/dep/njgs/pricelst/bedrock250.htm). Please turn in a few sentences on your investigation and your citation.



The textbook is supplemental but strongly encouraged. **Principles of Sedimentology and Stratigraphy, Boggs, 5th edition 2012**
ISBN-10:0321643186ISBN-13 available from the bookstore.

Labs: There is lab the first week on Friday.

Exams: There are two hourly exams and a non-cumulative final exam. Every effort must be made to take exams when scheduled. No unexcused make-up exams will be given without WRITTEN documentation from a Rutgers University official. Those with valid written excuses will be allowed to take exams in a common make-up period.

Attendance: Students are expected to attend class; attendance is one of the best prognosticators of a student's performance. If a student cannot attend a class or must leave early, he/she should inform the instructor and ask to be excused.

Leaving Class Early: Really? If you are sick, please feel free to leave and explain later. Otherwise, this is a major class and you better be there.

Personal Conversation: It is rude and disruptive to engage in personal conversation during class. Students who persist in this disruptive behavior may be asked to leave the class and may be penalized as absent. Refusal to leave class once requested will result in disciplinary action at the Dean's level. **Cell phones should be turned off in class.**

Academic Integrity: Our department fully endorses a no-tolerance cheating and plagiarism policy. If you are caught cheating, the instructor may fail you and request disciplinary action.

Your Rights: We are all human and instructors and students both make mistakes. If you feel that you have been treated unfairly, contact the department chair.

Learning goals.

By the end of this course students should be able to:

Acquire the necessary vocabulary to read about sedimentology and stratigraphy
Apply scientific thinking to problems in sedimentology and stratigraphy

Be able to use correct terminology to describe sediments and sedimentary rocks.
Use a suite of observations to interpret the environment of deposition of a facies
Be able to integrate observations and descriptions to create a measured stratigraphic section and interpret environmental changes
Know how to draw and illustrate multiple stratigraphic sections to create a two- or three-dimensional view of the geology of an area
Understand that sediments and rocks exist in the time domain and be able to date and correlate sections from different sedimentary basins
Know how geologists link observations to make paleoenvironmental and paleogeographic reconstructions to provide a history of a region and the Earth

Specific learning goals. By the end of this course, students should:

1. Understand physical and chemical weathering processes; the controls on and rates of weathering; know how soils form and some of the basic controls on their formation

2. Understand the different types and relative abundances of minerals found in sedimentary rocks; the difference between framework grains, accessory minerals, lithic fragments, and cement; understand how to describe sediment texture including grain size, grain shape, sediment fabric, and textural and physical maturity; know how geologists measure, graph, and interpret grain size data and sorting; understand Stokes law

3. Know the difference between laminar and turbulent flow; be able to explain how Reynolds and Froude numbers describe fluid flow; understand how sedimentary grains get entrained and deposited; know what bedforms are and which are formed in different conditions; understand the importance of gravity in transporting sediment; be able to distinguish the different types of gravity flows

4. Be able to classify siliciclastic sedimentary rocks; conglomerates (shape, grain composition, mode of origin, and sorting); sandstone (mineral components, wackes); mudstones

5. Understand the types of bedding and sedimentary structures found in sediment; distinguish primary vs. secondary structures; recognize trace fossils and be able to use them in environmental reconstruction

6. Know the processes that take place following deposition (bioturbation, physical compaction, cementation, recrystallization, solution, mineral replacement, authigenesis); understand how sediments are used to determine provenance

7. Recognize sedimentary facies and understand how to construct a facies model for an environment; know how transgressions and regressions affect facies; know how facies changes and Walther's Law are used in paleoenvironmental reconstruction

8. What is physical stratigraphy; understand and be able to explain formation, group, member, bed, stratotype, correlation, contacts, unconformities, hiatus, transgression, regression, and Walther's Law; memorize the Geologic Time Scale

9. Understand the importance of the hydrologic cycle on the movement of sediments; know the basics of the movement of ground water including D'Arcy's law, porosity, and permeability; understand how river channels form and the types of deposits formed by rivers; understand the different kinds of river channels; understand deposition on alluvial fans

10. Understand lake processes, including stratification and the formation of authigenic and biogenic minerals; know lake sedimentary facies; understand how the Newark Basin formed and the sedimentary processes dominating its deposits

11. Understand why we have deserts and dry lands; understand how sediment transport by wind differs from water transport; know the types of wind deposited sediment; understand glacial, sub-glacial, ice-marginal, and pro-glacial (lakes and eolian) environments and processes

12. What are chemical sedimentary rocks and under what physical conditions do they form; what are the different carbonate minerals; what makes up allochems and orthochems; understand the different types of carbonate reef platforms and the different environments of deposition; Dunham's classification vs Folk's classification; understand non-carbonate chemical sedimentary rocks including evaporites, cherts, iron-bearing rocks, and carbonaceous rocks

13. Understand coastal processes and environments of transgressive coasts; understand how tides, waves and storms interact to form beaches and barrier islands;

14. Understand deposition on regressive coasts including deltas, estuaries, and tidal flats

15. Understand shallow marine shelf facies; understand the significance of hummocky cross stratification and geostrophic flow; understand the difference between relict and palimpsest sediments

16. Understand processes transporting sediment on the continental slope and rise that form canyons including turbidity currents, turbidites, contour currents, contourites, and submarine canyon/fan systems; what are the types of sediments found in the deep sea and the controls on where different types of sediment are found

17. Understand how fossils are used for dating and correlating rocks; understand the importance of first and last appearance datums, index fossils; know the different kinds of zones used

18. Be able to use and apply facies models on geological data

19. Understand how geophysical logs are used for identifying and correlating rocks; Understand how the Earth's magnetic field forms and how it can be used for correlation

20. Understand the basics of radioactive decay and half life; know how radiometric ages can be integrated with other types of data to create a time scale

21. Understand how carbon, oxygen, strontium isotopes are used for correlating rocks; understand what oxygen isotopes in foraminifera reveal about temperature changes; understand the application of strontium isotopic stratigraphy in correlation

22. Understand Milankovitch cycles and how they influence the stratigraphic record

23. Know the basics of seismic profile interpretation

24. Know the basics of sequence stratigraphy including systems tracts

25. Understand how eustasy and tectonics make room for sediments to accumulate