Sedimentary Geology EarthSci:3325

Lecture & Lab:	Tuesday and Thursday 2 to 4:50
Instructor:	Dr. Chad Heinzel, Rm. 116 Latham Hall
Office hours:	By appointment and/or open door, Ask lots of Questions!
Email:	chad.heinzel@uni.edu Office phone: 273-6168
Internet:	www.exploreiowageology.org
Text:	Principles of Sedimentology & Stratigraphy (4 or 5th), Sam Boggs Jr
Final Exam:	Wednesday, Dec. 18th 1 to 3 pm

	Lecture Schedule	**Boggs Readings**
Week One (Aug. 26 - 30)	Welcome & the origins of sediments	Intro. Ch. 1
Week Two: (Sept. 2-6)	Sediment Transport and Deposition *No UNI Classes Sept. 2*	Ch. 2
Week Three: (Sept. 9-13)	Sediment Textures	Ch. 3
Week Four: (Sept. 16-20)	Sedimentary Structures	Ch. 4
Week Five (Sept. 23-27)	Siliciclastic Sedimentary Rocks	Ch. 5
Week Six (Sept. 30-Oct.4)	Carbonate Sedimentary Rocks **Exam 1,** *Oct. 5-6, NE IA Quarries*	Ch. 6
Week Seven (Oct. 7-11)	Other sedimentary rocks	Ch. 7
Week Eight (Oct. 14-18)	Depositional Environments Terrestrial	Ch. 8
Week Nine (Oct. 21-25)	Depositional Environments Terrestrial *ISTS-Ames Oct. 22-23*	Ch. 8
Week Ten (Oct. 28-Nov.1)	Depositional Environments Transitional to Carbonate *GSA in Denver*	Ch. 9-11
Week Eleven (Nov.4-8)	Depositional Environments Transitional to Carbonate	Ch. 9-11
Week Twelve (Nov. 11-15)	Lithostratigraphy Seismic, Sequence, & Magnetic Strat.	Ch. 12-13
Week Thirteen (Nov. 18-22)	Bio/Chronostratigraphy **Exam 2**	Ch. 14-16

Week Fourteen (Nov. 25-29)	Wow, this is a lot of time off… *Thanksgiving Break Nov. 25-29*
Week Fifteen (Dec. 2-6)	Basin Analysis, Tectonics, & Sedimentation Ch. 16
Week Sixteen (Dec. 9-13)	Summary week…
Week Seventeen (Dec. 16-20)	Finals week Exam 3/Final exam Wednesday December 15, 1:00 to 2:50

Grading procedure and policies A: X > 93% B: X > 83% C: X > 73% D: X > 60% F<60%

If you earn 90% of the total points you are guaranteed a grade of A-. The lower limit for each grade range will not move up. A curve will not be used in this class.

There will be no make-up exams after the scheduled exams are given. Should you have a scheduled conflict, please visit with me well before the exam date. An unexcused absence during an exam will lead to an automatic zero. Emergencies happen and will be dealt with on a case by case basis, if something does happen contact me!

Approximate point distribution (Lecture)

Challenge questions		20 pts
Pop quiz/s	2 @ 10 pts =	20 pts
Exams	2 @ 120 pts =	240 pts
Final Exam	1 @ 150 pts =	150 pts
Lab assignments	10 @ 20 pts =	200 pts
Field experience	1 @ 80 pts =	80 pts
Participation	40 pts =	40 pts

Approx. total = 750 points

A = 700; B = 625; C = 550; D = 450

Class attendance and participation

Exam questions will reflect and cover: **1)** Lectures, 2) Lecture discussions, 3) Text readings, and 4) Labs. Anything I say or you do is fair game. Attendance is essential.

**If you fail the lab portion of the class you fail the class* (even if you are getting an A in lecture) = Come to lab, participate, and learn. Geology is best learned outdoors and in lab, lectures and reading only prepares you to interpret what you will see. (Seeing is Believing/Learning!)

Academic dishonesty- Is not tolerated on the UNI campus (the campus wide policy will be followed). In addition, you may be tarred and feathered = Do not cheat. You are at UNI to better yourself!

Special Needs: Any students who require special accommodations for learning please let me know (privately) as soon as possible.

A few things to start thinking about…

Sedimentary rocks cover 75% of the Earth's land surface – "their study is the major problem of geology" (Reineck and Singh, Depositional Sedimentary Environments)

Volume of sedimentary rocks:	Muddy	= approx. 50%
	Carbonates	= approx. 30%
	Sandstones	= approx. 20%

Muddy rocks: Are fine grained, alter easily though diagenesis – tell us "low-energy" environments of deposition…
Carbonates: Tectonically not much is happening/ much of their activity lies within the basin of deposition…
Sandstones: An important key to unlocking the Earth's history

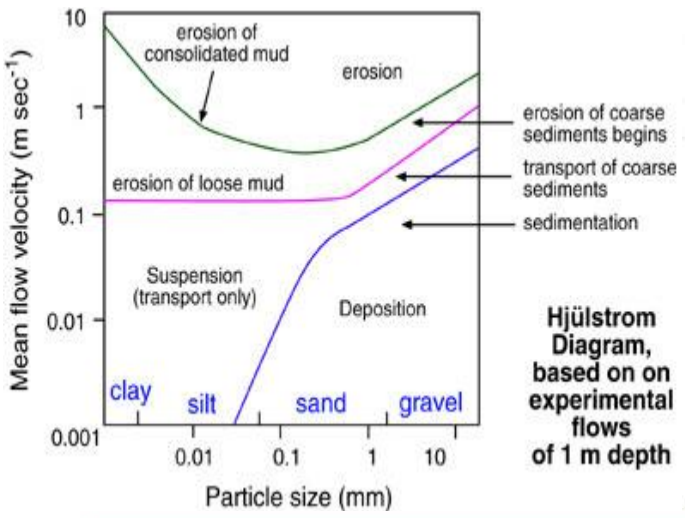
Objectives of this course will be to provide you with an initial skill set that seeks to determine:
a) Provenance (source area – where is the sediment coming from?)
b) Environment of Deposition (EOD)
c) Tectonic framework (setting)
d) Economic potential (mineral, petroleum, coal, water…)

To determine provenance (infracrustal vs. supracrustal or both) - Use petrography, paleocurrents, and paleogeography
To determine EOD – Use sedimentary structures, paleocurrents, fossils, etc.
To determine tectonic framework – Requires the integration of all available data.
To determine economic potential – Requires the integration of all available data.
Seas onto continents (all) because of rapid sea-floor spreading or glaciers melting (transgressions)
Sandstones may contain any igneous, metamorphic, or sedimentary mineral or rock fragment. All may be altered by diagenesis and weathering = We have a lot of work to do and a lot to learn!

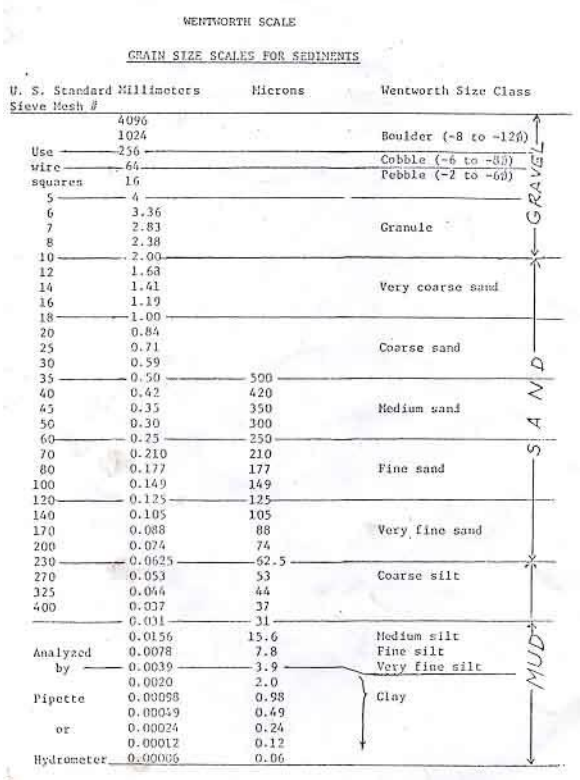
"*The present is the key to the past*" James Hutton – is useful in sedimentology and volcanology. But '**uniformitarianism**' may not hold in the Precambrian due to no land vegetation, little oxygen (early in the Precambrian), and high heat flow/hotter crust (Archean).

What determines the type of sediment that is finally lithified into rock?
a) Source area – rock types
b) Weathering – mechanical vs. chemical vs. biological? Chemical produces clay, quartz, and ions in solution
c) Transportation – (Water, wind, gravity, ice… grain sized carried/deposited)
d) Depocenter (rate of subsidence controls reworking and maturation)
e) Diagenesis – (buried deep or shallow?) (more changes occur deeper as T and P increase

Overall control is determined by tectonics e.g.
a) Source – development of relief
b) Weathering – climatic variability (equatorial position, alpine settings, etc.)
c) Transportation – relief affects slope, velocity, etc.
d) Diagenesis – how much subsidence is occurring?
Some changes in sedimentary rock types through time, as per the following examples:
1. During the Archean there were few stable cratons and therefore, few shallow seas, few quartz sandstones (SiO_2, not enough oxygen to from abundant quartz), and few carbonates
2. Arkoses become abundant after the development of granitic curst at approx. 2.7 Ga (G.a. = billion years ago).
3. B.I.F. (banded iron formations) become abundant at approx. 2.0 Ga when oxygen becomes more abundant. Any ideas where the increased oxygen levels came from?



Hjülstrom Diagram, based on on experimental flows of 1 m depth



Grain roundness & sphericity

Bladed, oblate and prolate grains may become well *rounded* but will never attain high *sphericity*