

**ERTH 309 - SEDIMENTOLOGY AND STRATIGRAPHY - SPRING 2022****4 Credit Hours. Course Prerequisite: ERTH 200****Lecture: Online Synchronous Mon & Fri 10:30-11:20; In-person Wed 10:30-11:20 - POST 703**

(Occasional online-sync lect. as needed W 10:30-11:20. Occasional in-person lect. as needed MF 10:30-11:20)

**Lab: In-person W 1:30-4:20 - POST 703****Instructor: Dr. Craig Glenn:** POST 720A; 956-2200/394-5155; [glenn@soest.hawaii.edu](mailto:glenn@soest.hawaii.edu) (or [cglenn@hawaii.edu](mailto:cglenn@hawaii.edu))

Office Hours: After labs on Wed or by appointment

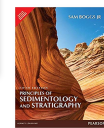
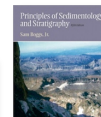
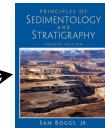
Teaching Assistant: TBA. TA Office Hours: TBA

**WHY SEDIMENTOLOGY AND STRATIGRAPHY?****This course is devoted to understanding the environmental processes that form sediments and sedimentary rocks, and how we go about interpreting past environments and processes from the sedimentary record.**

Sedimentology encompasses the study of modern earth surface environments, and the processes that result in the deposition of sediments that each environment leaves in its wake. Sediments and sedimentary rocks cover most of Earth's surface, record much of Earth's history, and contain all of Earth's fossil record. The premise that many of the fundamental processes affecting the earth today are much like those in the past is the key basis for determining how ancient sediments formed. From modern sediment compositions, textures, sedimentary structures, fossils and geochemistry we decipher Earth's past terrestrial and marine environments, climates, ecosystems, mountain building and plate tectonics. Thus, the study of sediments and sedimentary rocks also forms the primary basis for the historical sciences of paleoclimatology, paleogeography, paleoecology, and paleoceanography. In addition, many sediment systems act as excellent archives of environmental change allowing us a window into the recent past, as well as providing tools for monitoring change within modern sedimentary environments; these in turn can be used to inform management strategies. Sedimentology is also closely linked to **stratigraphy**, which is the study of the physical and temporal relationships between sediments, rock layers, and strata.

**MATERIALS YOU WILL USE:**

- (1)
- Textbook**
- (Contact Craig:
- Boggs, *Principles of Sedimentology and Stratigraphy***
- )

Either **4th Ed.** (2006=Cheap\$), 5th Ed. (2012), or 5E (International Ed) are OK!Not available at UH Bookstore. **Buy used or/rent online, or...**(google... "PDF Boggs Principles of Sedimentology")**4th Ed.**

- (2)
- Supplemental text:**
- Perry & Taylor 2007
- Environmental Sedimentology*
- , Blackwell.

- (3)
- Other supplemental readings:**
- posted on Laulima.

- (4)
- Lecture slides:**
- posted on Laulima following lecture (
- <https://laulima.hawaii.edu/portal>
- ).

- (5)
- Labs:**
- Labs build upon and follow lectures. "
- Craig Glenn's Lab Cookbooks*
- " and other texts are provided

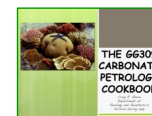
- (6)
- Useful Resources:**

A Glossary of Geology Terms: <https://www.webref.org/geology/geology.htm>Geology and Earth Science Definitions: <https://geology.com/geology-dictionary.shtml>Wikipedia Glossary of Geology: [https://en.wikipedia.org/wiki/Glossary\\_of\\_geology](https://en.wikipedia.org/wiki/Glossary_of_geology)

Glossary of Geology (5th Ed/AGI): Hard Copy Text or iPad/iPhone or Kindle, or Nook Version:

<https://www.americangeosciences.org/pubs/glossary/#online>

- (7)
- Required Supplies:**
- A 10X (or 20X) Hand Lens!
- (Buy on Amazon.com or elsewhere)

**GRADING****ALL LABS ARE DUE BEFORE EACH NEW LAB SECTION BEGINS (LAB OVERLAPS ARE NOT ALLOWED)****MIDTERMS ARE SCALED BY NUMBER OF LECTURES AND LABS FOR EACH****ATTENDANCE IS REQUIRED AND INCLUDED AS PART OF YOUR GRADE****COURSE GRADE: 3 MIDTERMS + QUIZZES = 65%, LABS = 30%, IN-CLASS PARTICIPATION = 5%**

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## – TENTATIVE LECTURE AND LABORATORY SCHEDULE –

\* = MF Online Synchronous

### ***PART I: Environments and Environmental Processes***

### **Required Readings (Boggs 4th/5th)**

JAN	10 (Mon)	*Introduction, Discussion of the Course	Boggs: Introduction (xvii-xviii)
	12 (Wed)	Weathering Reactions and Soils	Boggs Ch. 1
	14 (Fri)	<b>Lab: Semester Microscope Assignments/Time Scale Quiz</b> *Weathering Reactions and Soils	Boggs Ch. 1
	17 (Mon)	<b>HOLIDAY - MARTIN LUTHER KING JR. DAY</b>	
	19 (Wed)	Sedimentary Textures	Boggs: Ch. 3 + Textural Maturity in Ch. 5 + Craig's Lab Manual
	21 (Fri)	<b>Lab: Sedimentary Textures</b> *Particle Transport and Bedforms (Sed. Structures 1)	Boggs Ch. 2 & 4
	24 (Mon)	*Primary Sedimentary Structures (Sed. Structures 2)	Boggs Ch. 2 & 4
	26 (Wed)	Primary Sedimentary Structures (Sed. Structures 3)	
	28 (Fri)	<b>LAB: Sedimentary Structures</b> *Alluvial Fans	Boggs Ch. 2 & 4
	31 (Mon)	*Braided & Meandering Streams; Stream Terraces; Entrenchment	Boggs Ch. 8 & Ch. 9
FEB	2 (Wed)	Marginal Marine Environments – Deltas/Estuaries	
	4 (Fri)	<b>Lab: Sedimentary Structures (Cont'd)</b> *Marginal Marine Environments –Estuaries/Beaches	Boggs Ch. 9
	7 (Mon)	*Beaches and Shelf Environments	
	9 (Wed)	Shelf Environments	Boggs Ch. 9 & Ch. 10
	11 (Fri)	<b>Lab: Siliciclastic Shelves Exercise:</b> *Shelf/Deep Marine Environments	Boggs Ch. 10
	14 (Mon)	*Deep Marine Environments: Clastics	Boggs Ch. 10
	16 (Wed)	Deep Marine Environments: Clastics	Boggs Ch. 10
	18 (Fri)	<b>Lab: Siliciclastic Shelves Exercise</b> *Deep Marine Environments: Carbonate, Siliceous, and Red Clays	Biogenic Seds Read Me Docs
	21 (Mon)	<b>HOLIDAY - PRESIDENTS DAY</b>	
	23 (Wed)	Deep Marine Environments: Carbonate, Siliceous, and Red Clays	Biogenic Seds Read Me Docs
		<b>Lab: MIDTERM REVIEW SESSION</b>	

25 (Fri) <b>MIDTERM EXAM 1 ON PART I – Exam administered in POST 703</b>
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### ***PART II: Rocks Can Talk: Interpreting Past Environmental Processes from Sedimentary Record***

MAR	28 (Mon)	*Introduction to Siliciclastic Rocks: QFL Classifications and Why	Boggs Ch. 5
	2 (Wed)	Siliciclastic Rocks Provenance Studies	
	4 (Fri)	<b>Lab: Sandstones Lab (w/ Thin Section Slide Show)</b> <i>Craig's Sandstone Petrology Cookbook</i> *Siliciclastic Rocks	
	7 (Mon)	*Carbonate Reef Systems	Boggs Ch. 11.1-11.5
	9 (Wed)	Carbonate Minerals & Carbonate Rock Classifications	Boggs Ch. 11 and 6.1-6.7
	11 (Fri)	<b>Lab: Carbonate Lab (w/ Thin Section Slide Show)</b> *Carbonate Diagenesis	<i>Craig's Carbonate Petrology Cookbook</i> Boggs 6.8/Handouts

<b>MARCH 14-18</b>	<b>Spring Break</b>
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**Spring Break**



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**Lab: In-person W 1:30-4:20 - POST 703**

<u>DATE</u>	<u>TOPIC</u>	<u>Required Readings (Boggs 4th/5th)</u>
21 (Mon)	*Carbonate Diagenesis	Boggs 6.8
23 (Wed)	<b>LEC/LAB REQUIRED FIELD TRIP: 10:30 – 5:00 PM, Barbers Point Carbonates Project</b> <b><u>NOTE: Be sure to get clearance ahead of time from your other Wednesday instructors</u></b>	
25 (Fri)	<b>HOLIDAY - KUHIO DAY</b>	
28 (Mon)	*Evaporites and Evaporite Environments	Evaporites: Boggs 4th Ch. 7.1-7.2 & Ch. 11.6
30 (Wed)	Evaporites/Sabkha Dolomites (Required Movie) <b>Lab: Wild Cat Lab – Sed. Rock Synthesis and Interpretation</b>	Dolomites: Boggs 4 <sup>th</sup> p159-161; 167-168;182-190
APRIL 1 (Fri)	*Dolomites	Dolomites: As above
4 (Mon)	*Dolomites	
6 (Wed)	Phosphorites, Siliceous Seds, and Black Shales <b>Lab: Sed Rock Synthesis (Cont'd)</b>	Boggs 7.3, 7.5; Glenn 2003
8 (Fri)	*Coastal Upwelling Environments and Sediments	Film and Discussion
11 (Mon)	*Coastal Upwelling Sediments and Oxidic/Suboxic/Anoxic Diagenesis	Berner; Froelich; Glenn
13 (Wed)	Microbial Diagenesis and Catch Up <b>Lab: MIDTERM REVIEW SESSION</b>	
15 (Fri)	<b>HOLIDAY - GOOD FRIDAY</b>	
18 (Mon)	<b>MIDTERM EXAM 2 ON PART II – Exam administered in POST 703</b>	
<b><i>PART III: Principles of Stratigraphy</i></b>		
20 (Wed)	Stratigraphy Intro & Lithostratigraphy	<i>Both: Boggs Ch 12 (Lithostrat) + Ch 15 (Chronostrat.)</i> For Lecture and Lab ALSO READ “Chpt. 2: Stratigraphic Principles and Correlation” (on Laulima) <b>Lab: Exercises in Physical Stratigraphy &amp; Correlation</b>
22 (Fri)	*Lithostratigraphy and Wireline Logging	Boggs Ch. 12 and Ch. 15
25 (Mon)	*Biostratigraphy	Boggs 14 (Biostrat) + 15
27 (Wed)	Biostrat & Sequence Stratigraphy and Sea Level Change <b>Lab: Time Scale Quiz and Exercises in Physical Stratigraphy &amp; Correlation (Continued)</b>	Boggs 12.4 & Ch. 13, handout
29 (Fri)	*Sequence Stratigraphy & Sea Level Change: How to Build a Continental Margin	12.4 & Ch. 13, handout
MAY 2 (Mon)	*Oxygen Isotopes, Milankovitch Cycles and Sr isotopes	Boggs 12.4, Ch. 15
4 (Wed)	Catch up <b>Lab: REVIEW SESSION FOR EXAM 3 MIDTERM</b>	
Week of May 9-13	<b>FINAL EXAM (= EXAM 3 ON PART III) – Exam administered in POST 703</b>	

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### **LEARNING OBJECTIVES:**

The **Department of Earth Sciences** has five overall Student Learning Objectives (SLOs) related to the BA and BS degrees. This course's objectives encompass three levels of maturity in all five of these categories:

- Students can explain the relevance of geology and geophysics to human needs, including those appropriate to Hawaii, and be able to discuss issues related to geology and its impact on society and planet Earth.
- Students can apply technical knowledge of relevant computer applications, laboratory methods, field methods, and the supporting disciplines (math, physics, chemistry, biology) to solve real-world problems in geology and geophysics.
- Students use the scientific method to define, critically analyze, and solve a problem in earth science.
- Students can reconstruct, clearly and ethically, geological knowledge in both oral presentations and written reports.
- Students can evaluate, interpret, and summarize the basic principles of geology and geophysics, including the fundamental tenets of the sub-disciplines, and their context in relationship to other core sciences, to explain complex phenomena in geology and geophysics.

### **DISABILITY ACCESS:**

If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as “Kokua”) located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services: KOKUA Program; 2600 Campus Road; Honolulu, Hawaii 96822 Voice: 956-7511; Email: kokua@hawaii.edu; URL: [www.hawaii.edu/kokua](http://www.hawaii.edu/kokua)

### **TITLE IX:**

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the confidential resources available here: <http://manoa.hawaii.edu/titleix/resources/#confidential>

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact: Dee Uwono Title IX Coordinator (808) 956-2299 [t9uhm@hawaii.edu](mailto:t9uhm@hawaii.edu).

### **BASIC NEEDS:**

Basic needs include food and housing, childcare, mental health, financial resources and transportation, among others. Student basic needs security is critical for ensuring strong academic performance, persistence and graduation and overall student well-being. If you or someone you know is experiencing basic needs insecurity, please see the UHM Student Basic Needs website: <https://www.hawaii.edu/student-basic-needs/resources/manoa/>.