

ERTH 423 Marine Geology / OCN 622 Geological Oceanography

— ONLINE SYNCHRONOUS, FALL 2024 —

INSTRUCTORS: CRAIG GLENN and KATHLEEN RUTTENBERG

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Office Hours: Send us an email or talk to us to schedule a convenient time

Class Times: Tuesday-Thursday 12:00 – 1:15pm (VIA ZOOM)

Course Synopsis:

The primary objective of this course is to learn about the origin, structure and evolution of the ocean basins and their margins, ranging from the open ocean and the deep-water abyss to oceanic islands and the continental shelves and their coastlines. Our approach is interdisciplinary, involving integration of chemical, physical and biological processes with geologic processes.

Prerequisites: Undergraduates: EARTH 200 (or consent). *ERTH 302 is NOT a required prerequisite.* Grads.: Open to all EARTH and OCN graduate students.

Text Books: You do not need to purchase textbooks. All readings made available to students.

1. *The Ocean Basins: Their Structure and Evolution*, 2004, 2nd edition, Butterworth-Heinemann, in association with The Open University, ISBN 0-7506-3983-0; available online through UHM Library, unlimited access.
2. *Earth*, by Press and Siever, 1986, 4th edition, W. H. Freeman and Co., ISBN 0-7167-1743-3
3. *Marine Geology*, by James Kennett, 1982, Prentice-Hall, Inc., ISBN No. 0-13-556936-2
4. *Marine Biogeochemical Cycles*, 2005, 2nd edition, Elsevier Butterworth-Heinemann, in association with The Open University, ISBN No. 0-7506-6793-1
5. *Other Readings:* A variety of additional readings will be made available throughout the semester.

Laulima: PDFs will be posted on Laulima, as will course information (syllabus, schedule of lectures, homework assignments, etc.). Laulima will also be used for posting class project materials generated by students enrolled in OCN622.

Lecture Format: Lectures for EARTH 423 and OCN 622 are combined, all will be on Zoom, and unless previously approved for special or unusual circumstances, attendance participation in all lectures is mandatory (see Grading below). The class times will be devoted to lectures, discussion, and occasional in-class activities. Please be sure to read the appropriate section in the assigned readings *before* class. Time will be set-aside at the beginning of each class to answer questions from previous lectures or readings, and to present any current geologic events.

Grading: EARTH 423 grades will be based on class participation (8%), and two mid-term exams (~46% each) and homework. The second exam will be given during final exams week, but will cover only the second half of the class. There will be a separate grading system for Graduate and Undergraduate students. See separate OCN 622 Syllabus for information about OCN 622 grading.

Make-up exams and incomplete grades will be given only with a written excuse. Full credit for class participation means attending all classes, staying current on the readings, asking good questions during the lectures, and answering questions and participating in class discussions.

2024 TENTATIVE DAILY SCHEDULE

OCN 622 (only) graduate student projects and due dates in blue; OCN 622 oral presentations will be scheduled at a later date, by class consensus.

Part I: Dynamics, Geophysics, Igneous & Metamorphic Processes in the Ocean Basins			
Lect #	Day	Date	Topic
1	Tu	27-Aug	Introductions; Goals & mechanics of course; Introduction to fundamental tenets of geology and marine geology
2	Th	29-Aug	Fundamental tenets of geology and marine geology (cont'd); Geologic Time Scale; Geological/Geophysical Techniques: Exploring the Seafloor <i>All students – HW 1 Geologic Time Scale Homework Assigned</i>
3	Tu	3-Sep	Geological/Geophysical Techniques (cont't); Exploring the Seafloor; Deep Sea Drilling
4	Th	5-Sep	Deep sea Drilling (cont'd); Internal structure of the Earth <i>All students – HW 1 Geologic Time Scale Homework Due</i>
5	Tu	10-Sep	Internal structure of the Earth (cont'd); Origin of solar system & formation of Earth's moon; Age of Earth; Differentiation of Earth & Core formation; Chemical Zonation of Earth
6	Th	12-Sep	Core formation (cont'd); Chemical Zonation of Earth; Earth's magnetic field; Magnetostratigraphy; Intro to Plate tectonics; Origin of Water on Earth; Earliest Life
7	Tu	17-Sep	Paleomagnetism (cont'd); Origin of Water on Earth; Earliest Life; Plate tectonics Overview
8	Th	19-Sep	Plate tectonics overview (cont'd); Sea level through Geologic time; Hysometric curve; Theory of Continental Drift
9	Tu	24-Sep	Theory of Continental Drift; Theory of Plate Tectonics; Terranes and structure of continents; Seafloor spreading; plate boundaries
10	Th	26-Sep	Types of Margins; Physiography of the Oceans <i>OCN 622 ONLY - HW-2 - Geological Cross-section Homework assigned</i>
11	Tu	1-Oct	Physiography of the Oceans (cont'd); Plate tectonics clues to formation of 2 different types of crust; Plate movement determination and summary
12	Th	3-Oct	Plate movement determination and summary (cont'd); Hot spots, Mantle Plumes; Mechanisms driving plate tectonics <i>OCN 622 ONLY - HW-2: Geological Cross-section Homework due</i>
13	Tu	8-Oct	Rocks and Minerals; Bowens Reaction Series; Ocean Basin History & Continent Formation <i>OCN 622 ONLY - Class Project Topic Due</i>
14	Th	10-Oct	Large Igneous Provinces and Mass Extinctions
15	Tu	15-Oct	Large Igneous Provinces and Mass Extinctions <i>OCN 622 ONLY - Class Project Topic Approved</i>
16	Th	17-Oct	1st EXAM on Part I

Part II: Sedimentary Processes in the Oceans and Along Their Margins			
17	Tu	22-Oct	Intro to Part II: Global Inputs / Near Shore Processes
18	Th	24-Oct	Near Shore Processes - Beaches, Estuaries, Deltas
			<i>All Students – HW-3 Beach Systems Homework Assignment</i>
19	Tu	29-Oct	Reefs and Shallow Water Carbonate Shelves
20	Th	31-Oct	Reefs and Shallow Water Carbonate Shelves (Continued)
			<i>All Students – HW-3 Beach Systems Homework Due</i>
21	Tu	5-Nov	Quaternary Sea Levels & Oceanic Shelf Systems (Relict, Palimpsest & Modern)
22	Th	7-Nov	Deep Sea Canyons & Turbidity Currents
23	Tu	12-Nov	Turbidites, Slumps, Submarine Fans
			<i>OCN 622 ONLY - Draft Abstracts Due</i>
24	Th	14-Nov	Ocean Circulation / Contourites and Drifts
25	Tu	19-Nov	Deep Sea Biogenic Oceanic Sediments
			<i>OCN 622 ONLY - Draft Abstracts Returned with edits</i>
26	Th	21-Nov	Deep Sea Biogenic Oceanic Sediments & Red Clays
27	Tu	26-Nov	Continental Margin Upwelling Systems (Corg-Si-P) & Sediment Diagenesis
			<i>OCN 622 ONLY -Final Abstracts Due; shared with entire class.</i>
28	Th	28-Nov	<i>Thanksgiving holiday (no class)</i>
29	Tu	3-Dec	Microbial Sediment Diagenesis/Authigenic Ocean Sediments
30	Th	5-Dec	Mechanisms of Sea Level Change and The Building Continental Margins
31	Tu	10-Dec	Cenozoic Paleooceanography/Orbital Forcing
32	Th	12-Dec	2nd Midterm Exam Review (last day instruction)
33	Th	19-Dec	2nd EXAM on Part II Thursday Dec. 19, 2024 12:00-2:00

Learning Objectives:

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

1. 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.
2. 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.
3. Students use the scientific method to define, critically analyze, and solve a problem in earth science.
4. Students can reconstruct, clearly and ethically, geological knowledge in both oral presentations and written reports.
5. 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.

* http://www.soest.hawaii.edu/GG/resources/docs/gg-undergrad-SLO_Master_Checklist_Final.pdf

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

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://www.manoa.hawaii.edu/titleix/resources.html#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: Jennifer Rose Title IX Coordinator (808) 956-2299 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 following resources: <https://www.hawaii.edu/student-basic-needs/resources/manoa/>.