SEMESTER AT SEA COURSE SYLLABUS

Colorado State University, Academic Partner

Voyage: Discipline: Course Number and Title: Division: Faculty Name: Semester Credit Hours: Fall 2018 Geology GEOL 120 Exploring Earth: Physical Geology Lower Benjamin R. Jordan 3

Prerequisites: None

COURSE DESCRIPTION



Geology is the study of the Earth (and other planetary bodies). The world that we live on is a result of billions of years of interconnected processes that continue to shape the Earth. This course aims to provide students with an understanding of the processes by which the Earth was formed and modified, and by which it is still being modified today. Taking this course during Semester-at-Sea will give students an incredible opportunity to see the geology of the whole Earth and gain first-hand knowledge of the universal nature of geologic processes. This class WILL change the way that you view the world around you.

LEARNING OBJECTIVES

By the end of the semester students should, at a minimum, be able to do the following:

- Know common mineral and rock types and how they are related.
- Understand how the Earth and the other planets of our solar system formed.

- Have an understanding of plate tectonic processes, their global nature, and how the processes of plate tectonics were discovered.
- Have an ability to identify common, worldwide, geologic features firsthand, and understand the processes of their formation.
- Have an understanding of the importance of Earth's resources what they are and how they are used, as well as the impacts humans can have, globally, for good and bad on those resources.
- Have an understanding of the major hazards associated with geologic processes and methods to mitigate those processes.
- Understand the nature of "deep time," the age of the Earth, and how it has changed over time.
- Understand the impact of Earth's geologic processes on life and, specifically, on human societies and individuals.

REQUIRED TEXTBOOKS

AUTHOR: Eric H. Christiansen and W. Kenneth Hamblin TITLE: Dynamic Earth: An Introduction to Physical Geology PUBLISHER: Jones & Bartlett Learning ISBN #: ISBN-10: 1449659845 DATE/EDITION: 2014 / 1st

Students are **required** to bring:

- 1. Pencils (wooden or mechanical) NOT pens
- 2. A small set of colored pencils (at least 12 count).
- A Notebook. It is recommended that students purchase this one: Rite in the Rain notebook (4 5/8" x 7", spiral bound): <u>https://www.amazon.com/Rite-Rain-All-Weather-Side-Spiral-973T/dp/B009F1E28G/ref=sr_1_4?ie=UTF8&qid=1505863728&sr=8-4&keywords=rite%2Bin%2Bthe%2Brain&th=1
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Field and lab tools will also be supplied by the professor. However, if students wish to have their own, it is **recommended** for students to bring the following:

A <u>10x</u> gemologist handlens (students will NOT need a stronger magnification) For example: <u>https://www.amazon.com/uxcell-Jewelers-Loupe-MAGNIFYING-GLASS/dp/B008LTIAXQ/ref=sr_1_2?ie=UTF8&qid=1505864027&sr=8-2&keywords=10x+handlens</u>

Additional resources and texts will be made available onboard ship.

TOPICAL OUTLINE OF COURSE

Depart Hamburg, Germany – September 9

- **B1–September 12:** Introduction, Course Nuts and Bolts What is geology? Overview and discussion of the Ship's course and ports-of-call
- **B2– September 14:** Systems and Equilibrium (Textbook Chapter 2 Geologic Systems) **Preparation for Barcelona and Valencia** – The Geology of Spain (supplementary readings)

Barcelona, Spain — September 15-16 Valencia, Spain — September 17-18

The geology of Spain extends over 500 million years, from the time over Earth's earliest complex life until the present. It is still geologically active, as the Iberian Peninsula on which Spain sits continues to move tectonically, colliding with Europe and forming the Pyrenees Mountains. Its unique geologic history produced the Almadén mercury mines (a UNESCO World Heritage Site), which have existed since antiquity. Spain also has the world's largest reserves of the volcanic mineral cinnabar (upper image). Images from Wikimedia.org



- **B3–September 20:** The Stuff of Stars and Earth: What We're Made Of (Textbook Chapter 3 Minerals)
- **B4— September 22:** Hard Rock vs. Soft Rock: Igneous and Sedimentary Rocks (Textbook Chapters 4 (pages 84 96 only) and 5)
- Study Day September 23: No Class
- **B5–September 25:** Old Rocks. Changed Rocks. (Textbook Chapters 6 and 7) **Preparation for Ghana** – The Geologic Resources of Africa (supplementary readings)

Tema, Ghana — September 27-28 Takoradi, Ghana — September 29-30

The continent of Africa has a long and complex geologic history. Many questions about it remain unanswered. Part of it contains pieces of some of the oldest continental crust. It is home to one of the largest rift valleys on Earth and one of the most unique regions of volcanism. It is rich in many geologic resources, such as oil, gas, diamonds (lower left), gold, and copper ore (upper image). Map from: http://sp.lyellcollection.org

Diamond image from: alibaba.com



B6–October 1: The Formation of the Earth and its Solar System (Textbook Chapters 1 and 25)

Community Programming Day - October 2: No Class

- B7–October 4: Exam 1
- B8— October 6: The Structure of the Earth (Textbook Chapter 18 Seismicity and the Earth's Interior, pages 554 561 only)
 Preparation for Cape Town: Diamonds and What They Tell Us (supplementary readings)

Cape Town, South Africa – October 7-12



Table Mountain, which rises above Cape Town is mostly sandstone that was formed in a rift valley between 400 and 510 million years ago. The base of the mountain is made of the older Cape Granite, which formed from intruding magma ~630 million years ago. Image from: travelbutlers.com

B9–October 14: The Dynamic Earth: Introduction to Plate Tectonics (Textbook Chapter 17)

Study Day – October 16: No Class

B10—October 17:Pulling Apart: Divergent Boundaries (Textbook Chapter 19 – Divergent
Plate Boundaries)
Preparation for Mauritious: Evolution, Dodos, and Extinction
(supplemental reading)

Port Louis, Mauritius - October 19



The country of Mauritius consists of the Island of Mauritius as well as several smaller islands, including the Island of Rodrigues. The Island of Mauritius is very young geologically. It was created by volcanic eruptions beginning only 8 million years ago, although it may sit atop crust that is much, much older (2-3 billion years). The island is most famous for being the home of the Dodo bird, which was hunted to extinction. Images from Wikimedia.org

B11–October 20: Sliding By: Transform Plate Boundaries (Textbook Chapter 20 – Transform Plate Boundaries)

Study Day – October 21: No Class

B12–October 23: Coming Together: Convergent Plate Boundaries (Textbook Chapter 21 – Convergent Plate Boundaries, *pages* 628-647 *and* 657-665 *only*) **Preparation for India**: The Deccan Traps and the Rise of the Himalayas (supplemental readings)

Cochin, India – October 25-30

The Indian Subcontinent has a long and complex history. It is underlain by continental rocks formed in the earliest ages of the Earth and contain precious gems. Its central, western region is a vast area of volcanic lava flows formed by massive eruptions from a hotspot. Today, it continues to evolve as it collides with Asia forming the Himalayas and producing earthquakes. Multiple river systems reshape its surface and support well over a billion people. Images from Wikimedia.org



Reflection & Study–October 31: Global Studies Reflection

B13–November 1: Random Volcanoes: Hotspots and Island Chains (Textbook Chapter 22 – Hotspots and Mantle Plumes)

B14—November 3: Exam 2 Preparation for Yangon, Myanmar: Coastal Changes (supplemental readings)

Yangon, Myanmar – November 4-8



Yangon, Myanmar is located at the convergence of the Yangon and Bago Rivers, approximately 30 km (10 miles) inland from the Gulf of Martaban and the Indian Ocean. The area around Yangon is part of the Irrawaddy Delta, which formed as sediments from the rivers were deposited in the ocean. This low-lying delta is prone to serious flooding from storm surge. In 2008, surge from Cyclone Nargis killed an estimated 130,000 people. Image source: NASA

B15–November 10: The Ocean and Sky (Textbook Chapter 9 – The Climate System, Earth's Atmosphere and Oceans)

Community Programming Day – November 11: No Class

B16—November 13: The Flow of Water: Rivers Systems (Textbook Chapter 12 – River Systems) Preparation for Vietnam: The Mekong River and its Delta (supplemental readings)

Ho Chi Minh City, Vietnam - November 14-18

Recent changes to the Mekong River system caused by the construction of a series of agricultural dikes and canals have helped Vietnam to become one of the largest producers of rice in the world. However, these changes have changed the normal nutrient cycle of the river and the coastal regions it flows into, threatening the extensive mangrove forests along the shore.



Image: http://pacificagroecology.com

B17–November 20: Weathering and Mass Wasting (Textbook Chapters 10 and 11 – Weathering and Slope Systems)

Study Day – November 21: No Class

B18– November 23: Groundwater and Karst (Textbook Chapter 13 – Groundwater Systems) **Preparation for Shanghai**: Stone Towers - The Fantastic Karst of Southern China (supplemental readings)

Shanghai, China – November 24-29



China contains some or the world's most unique geology, from active fault zones to feathered dinosaurs, from some of the world's highest mountains to some of the world's largest flood plains. One of the most unique geologic features is the karst region of southern China – an area of rock pinnacles, caves, and winding rivers. The area formed as vast areas of limestone have been dissolved by groundwater. Image: Wikimedia.org

B19—December 1:Earthquakes (Textbook Chapter 18 – Seismicity and the Earth's Interior,
pages 534 553 only)Preparation for Kobe: The Great Hanshin Quake of 1995 (supplemental
readings)

Kobe, Japan – December 2-6

Kobe, Japan is the sixth-largest city in Japan.O In 1995 the city was devastated during the Great Hanshin Earthquake. The earthquake was caused by subduction of the Philippine Tectonic Plate beneath Japan, which lies on the Eurasian Plate. Much of the damage occurred due to liquefaction of the soil, as much of Kobe was built on near-sea level sediments with a high water table. Image from: IBTimes UK.



B20– December 8: Volcanoes (Textbook Chapter 4 – Igneous Rocks, *pages* 96 – 116 *only*, and Chapter 21, *pages* 647-657 *only*)

B21–December 10: Glaciation (Textbook Chapter 14 – Glacier Systems)

B22–December 12: Deserts and Winds (Textbook Chapter 16 – Eolian Systems)

 B23—December 14:
 Where the Land Meets the Sea (Textbook Chapter 15 – Shoreline Systems)

 Preparation for Hawaii: The Geology of the Hawaiian Islands (supplemental readings)

Honolulu, Hawaii – December 16



The Hawaiian Islands are the world's most remote island archipelago. They were formed as the Pacific Tectonic Plate moves over a mantle plume or hotspot. The only active volcanoes are found on the Big Island of Hawaii, which is too young to have coral reefs. The Island of Oahu is surrounded by a broad, fringing reef made up predominately of coralline algae and a small variety of hard corals.

B24—December 17: Geologic Time (Textbook Chapter 8)

Study Day – December 18: No Class

B 25–December 20: Final Exam

Arrive San Diego, California – December 23

FIELD WORK

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage. In addition to the one field class, students will complete independent field assignments that span multiple countries.

Field Class & Assignment

The field class for this course is on Monday, 3 December in Kobe, Japan.

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class. Field Classes constitute at least 20% of the contact hours for each course, and are developed and led by the instructor.

Field Class Location: Kobe, Japan. Field excursion to the Disaster Reduction and Human Renovation Institution, the Kobe Disaster Memorial Park, and the Arima Historical Retreat and Spa.

In January 1995 the city of Kobe, Japan was hit by one of the most destructive earthquakes in modern Japanese history. Ironically, at the time the city was considered one of the world's most "earthquake proof." However, liquefaction of the soil amplified the shaking and dramatically increased the amount of destruction. The earthquake resulted from fault movement caused by the subduction of the Pacific Tectonic Plate beneath Japan. The purpose of this field experience is to give students a firsthand look and experience with the power of the Earth and the forces of related to plate tectonics. In addition, students will be able to talk with survivors, gaining powerful insights into the reality of a natural disaster. At the same time, students will also be able to see the beneficial side of Earth's processes, while also having the traditional culture experience of using a Japanese hot spring.

During this field experience students will visit, first, the Disaster Reduction and Human Renovation Institution, otherwise known as the Kobe Earthquake Memorial Museum, where they will see exhibits and experience realistic, multimedia recreations of the earthquake, as well as meet survivors of the earthquake. Second, the students will visit the Kobe Disaster Memorial Park, a preserved section of the city showing damage that occurred along the waterfront of Kobe. After discussing and observing the dangerous and negative destruction caused by plate tectonics activity, the day will end with a visit to the hot springs at the Arima Historical Retreat and Spa. This is one of the oldest, continually used hot springs in Japan. The hot springs result from magmatic activity that heats the local ground water and enriches it with minerals.

Assignments:

During the trip, the students will do the following:

- Students will keep a field notebook in which they will record their observations and thoughts on the Great Hanshin Earthquake, paying special attention to the processes that caused the earthquake and the comments and stories of survivors.
- After the field excursion, students will prepare a synthesis report of their observations by answering the following questions:
 - 1. What were the processes that led to the Great Hanshin Earthquake?
 - 2. What was the reason that such an "earthquake-proof city" wasn't?
 - 3. Is there anything that could have been done to mitigate the damage and number of deaths?
 - 4. What stories and/or experiences of the earthquake survivors stood out to you?
 - 5. What can you do, personally, to be better prepared for potential natural disasters?
 - 6. How are the hots springs at Arima Onsen related to the processes that produced the Hanshin Earthquake?
 - 7. Would you choose to live in this area? Why or why not?

Students will be graded on their participation, thoroughness of their field notes, and how well they tie their observations into a coherent whole.

Independent Field Assignments

Ports-of-Call Report: Students are assigned to make note of the use of geologic materials in construction and any geology/earth history-related subjects or features in all of the ports-of-call relative to the local culture and/or history – including photographs. The features/subjects can include architecture, art, cultural and religious beliefs, etc., but the students are welcome to note other, non-traditional references to geology or earth history (e.g. creation beliefs or mythologies). At the end of each port-of-call visit, students are required to submit a short paragraph of what they observed.

At the end of the semester students are required to write a 5-page essay discussing their interpretation of the connection, or lack of connection, between their observations and the material discussed in the class. The theme of the paper will be: "In What Ways Does Geology Impact Humanity?" Students will be graded on how well they present their observations and relate it to the course material.

Classroom Assignments/Labs

Throughout the semester students will be required to complete reading and homework assignments. Each reading assignment will include a quiz that will require completion BEFORE coming to class.

In-class lab assignments will be explained and assigned in class, but completed outside of class. They will cover major geology skills such as rock/mineral identification, map reading, earthquake epicenter triangulation, etc.

METHODS OF EVALUATION / GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

Excellent		<u>Good</u>	Satisfactory/Poor	<u>Failing</u>
97-100%:	A+	87-89%: B+	77-79%: C+	Less than 60%: F
93-96%:	А	83-86%: B	70-76%: C	
90-92%:	A-	80-82%: B-	60-69%: D	

A student's grade will be calculated based on the total number of points that they earn on assignments, exams, etc. as a percentage of the total number of points available in the class. Whatever percentage of points that the students earn, that will determine their grade based on the scale above. However, as a general note, the following is an estimate of the percentage of a student's final grade contributed by each assignment:

Exams (including Final) – 30% Field Class Attendance and Report – 30% Lab Assignments – 15% Reading Quizzes – 15% Participation and Attendance – 10%

ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance in all Semester at Sea classes, including the Field Class, is mandatory. Students must inform their instructors prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

LEARNING ACCOMMODATIONS

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation.

A letter from the student's home institution verifying the accommodations received on their home campus (dated within the last three years) is required before any accommodation is

provided on the ship. Students must submit this verification of accommodations to <u>academic@isevoyages.org</u> as soon as possible, but no later than two months prior to the voyage.

STUDENT CONDUCT CODE

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

ADDITIONAL RESOURCES

All other materials (additional readings, etc.) will be uploaded by the professor and made available to students via the ships intranet.

Field and lab tools will also be supplied by the professor. However, if students wish to have their own, it is **recommended** for students to bring the following:

 A <u>10x</u> gemologist handlens (students will NOT need a stronger magnification) For example: <u>https://www.amazon.com/uxcell-Jewelers-Loupe-MAGNIFYING-GLASS/dp/B008LTIAXQ/ref=sr_1_2?ie=UTF8&qid=1505864027&sr=8-2&keywords=10x+handlens</u>