

Course Syllabus, MSCI/GEOL 545

Course Description: This course will examine the geological aspects of oceanography; those pertaining to the formation of oceanic crust, the structure of ocean basins, formation and deposition of particles, and the sedimentary environment. All of these processes are related to chemical cycling in the oceans, biological activity, and physical processes, emphasizing the importance of incorporating geological oceanography into a comprehensive study of marine science.

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PSC 519B Phone: 777-2410
Office hours: W 10-11 am; Th 11 – 12 am, and by appointment

Website: USC Blackboard: <http://blackboard.sc.edu>

Class schedule: Tuesday and Thursday mornings, 9:30-10:45 in Wardlaw College 122

Texts: **The Ocean Basins: Their Structure and Evolution, Second Edition
(Open University Oceanography) [Paperback]
ISBN-10: 0750639830 | ISBN-13: 978-0750639835**

**Waves, Tides and Shallow-Water Processes, Second Edition
[Paperback]
ISBN-10: 0750642815 | ISBN-13: 978-0750642811**

**Marine Biogeochemical Cycles, Second Edition [Paperback]
ISBN-10: 0750667931 | ISBN-13: 978-0750667937**

Papers from the literature, handouts, and reliable Internet sources

Grading:	Midterm	15%
	Final	20%
	Problem sets	25%
	Proposal/project and presentation	20%
	Participation during group presentations and class discussions	20%

Grades are awarded as straight percentages (> 90% = A, 87-89% = B+, 80-86% = B, etc.)

Attendance is MANDATORY: Following University Policy: Failure to attend class will affect your grade. For every 5 days of missed class, your final grade will be reduced by one letter.

Exams: The midterm and final will require completing quantitative problems and interpreting diagrams and maps. Both will be take home exams with at least three days given to complete the exams.

Problem sets: Problem sets will be based on material covered in class and several will involve the use of the desktop GIS interface GeoMapApp (www.geomapapp.org).

Course Outline:

Abbreviations: OB = *The Ocean Basins: Their Structure and Evolution*
MBC = *Marine Biogeochemical Cycles*
WTSW= *Waves, Tides, and Shallow Water Processes*

1. Plate tectonics review (OB, pages 26-28)
 - Isostatic compensation
 - Lithosphere and asthenosphere
 - Paleomagnetism

Assignment 1 – Plate boundaries and earthquakes

2. The Ocean Basins (OB Chapter 1)
 - Ocean provinces
 - Active vs. Passive margins
 - The hypsometric curve
 - Mapping the deep – methods in bathymetry

Assignment 2 – hypsometric curve

3. Evolution of Ocean Basins (OB Chapter 2)
 - Stages in the development of ocean basins
 - Overview of major ocean basins and their characteristics
4. Structure and formation of oceanic lithosphere (OB Chapter 3)
 - Development of a mechanism for oceanic lithosphere formation
 - Seismic profiles of oceanic lithosphere
 - Ophiolites
 - Transform faults, fracture zones, and segmented spreading centers
 - Seamounts, ocean islands, and large igneous provinces
 - The age-depth relationship of oceanic lithosphere
 - Hydrothermal circulation in oceanic crust (OB Chapter 4)

Assignment 3 – Age depth relationship of oceanic lithosphere

5. Deep sea sediments

Classification and distribution (MBC Chapter 1)
Accumulation rates
 Linear sedimentation rates
 Constant flux proxies
 Sediment redistribution proxies
Distribution of biogenic sediments (MBC Chapter 3)
 Siliceous sediments
 Deep sea carbonates

Assignment 4 – Mapping the CCD using seafloor sediments

6. Chemical reactions and microbial activity in deep sea sediments
 Organic matter and the diagenetic sequence (Froelich, 1979)
 Authigenesis and diagenesis
 Manganese nodules
 Gas hydrates
 The deep biosphere
7. Biogeochemistry of particulate matter in the ocean
 The biological pump and the two box model of the ocean (MBC Chapter 2)
 Particles and nutrients
 Particles and trace metals
8. Shallow water sedimentary environments
 Waves and tides review (WTSW Chapters 1-2)
 Sediment transport (WTSW Chapter 3)
 Sediment supply and crustal subsidence
 Estuaries (WTSW Chapter 6)
 Nepheloid layers
9. Paleoceanography
 Marine sediments as a geological archive (Zachos et al., 2001)
 Sea level estimates from marine sediments (Miller et al., 2011)
 Carbonate accumulation
 Biogenic carbonate oxygen isotopes
 Passive margin sequence stratigraphy

LEARNING OUTCOMES: By the end of the semester it is anticipated that students will have acquired the following:

- An understanding of the structure, composition, and geological history of the ocean basins, their sediments and the water contained within
- Familiarity with methods used to date and correlate marine sediments
- Understanding the role of the ocean in the solid Earth cycle and climate system
- Appreciation of the role of biology in sediment diagenesis
- A working knowledge of the data visualization program GeoMapApp
- The ability to work efficiently with large datasets
- Improved oral and written communication skills
- Improved ability to work collaboratively

Collaboration: As Marine Science is an interdisciplinary course; marine scientists often work collaboratively on projects. I expect that many of you will choose to work in groups on assignments for this course. Please review the definitions below and come talk to one of us if you are unclear about how these apply to working together on projects.

University of South Carolina Honor Code

“It is the responsibility of every student at the University of South Carolina Columbia to adhere steadfastly to truthfulness and to avoid dishonesty, fraud, or deceit of any type in connection with any academic program. Any student who violates this Honor Code or who knowingly assists another to violate this Honor Code shall be subject to discipline.”

Forms of academic dishonesty:

Plagiarism: 1. The action or practice of taking someone else's work, idea, etc., and passing it off as one's own; literary theft.

Cheating: 1. To defraud; to deprive of by deceit. 2. To deceive, impose upon, trick. 3. To deal fraudulently, practice deceit.

Fabrication: 1. The use of invented information or the falsification of research or other findings.

Academic Misconduct: 1. An act that disrupts the educational process or provides a student with an academic advantage over another student.

I deal swiftly and harshly with all instances of academic dishonesty