MAR 515: Geological Oceanography: Fall Semester
Tues.-Thurs., 1:30-2:45, SMAST I Rm. 204
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(Office hours: Tues.-Thurs., 3:00-5:00 and by appt.)

Course Description

This course is open to upper-level under-grad. (science majors) and graduate-level students. It consists of an introduction to the principal topics in geological oceanography starting with the history of ocean floor exploration, theories of ocean basin formation, determination of geologic time and going through the major dynamic processes shaping and characterizing the seafloor--from beaches to basins, reefs to estuaries. Overviews of marine geophysics and plate tectonics, sea level variation and the formation of coastlines and reefs, and the importance of paleoceanography to assessing climate change will be presented and discussed. Throughout the course a highly interdisciplinary approach is taken and pertinent material on the interaction between marine geology/sedimentology, marine chemistry, physics, and biology will be presented. Wherever possible, the results of recent studies and special topics will be incorporated into the class material. Anticipated class size should permit student participation during lectures with respect to instructor-initiated discussion.

Learning Outcomes

Upon completion of course, students will be able to:
1. Understand and explain the geological evolution of all the major ocean basins.
2. Describe the major components of plate tectonics operating within the Earth and the differentiation of plate boundaries.
3. Describe the primary geological processes operating on the continental margin vs. the deep-sea.
4. Describe the general composition and formation of marine sediments and rock types.
5. Explain the primary technological methods and tools employed in marine geology studies.
6. Explain the basic history of ocean seafloor exploration and discovery.
Syllabus of Lecture Topics (2-3 lectures per topic)

History of geological oceanography and the geologic time scale (Hutton&Lyell, Maury, Darwin, Challenger Expedition&Murray&Agassiz, catastrophism → uniformitarianism → vertical impermanence

Sea floor scenery; Wegener& cont. drift; Heezen&Tharp, bathymetry, echosounding, multi-beam, side-scan; maps

Marine geophysics; seisms and plate action; refraction and reflection; gravity and heat flow; magnetic anomalies; Hess and Ewing

Plate tectonics (major ocean features and plate tectonic origin; plate processes of spreading, transform and subduction; hot spots and mega-plumes; hydrothermal vents and seeps); ocean basin development and destruction

Continental margins (active, passive and major depositional/erosional processes and rates; submarine canyons; sea level curves)

Sediments (origin and composition, deep-sea vs. cont. margin; ocean current and turbulence transport; turbidites, contourites, redistribution, resuspension; boundary layers; sediment/organism interactions, bioturbation, anoxic depositional environments

Particle transport to deep-sea/ biogeochemical particle fluxes, marine snow and aggregation, pelagic-benthic coupling, clays & clay mineralogy vs. weathering..

Carbonate margins, platforms, reefs, lithoherms, and cold/deep-water coral mounds; carbonate deposition and precipitation; fluctuating sea level effects; ocean acidification; climatic zonation in marine sediments.

Coastal systems and sea level (dynamic development of beaches, estuaries, deltas, barrier islands, lagoons; impacts of circulation and wave dynamics on sediment transport; glacial retreat and island formation).

Paleoceanography and deep-sea sediments (basic concepts, bio- and isotope stratigraphy; glacial-interglacial cycles; Cretaceous-Tertiary boundary impact event; Late Paleocene warming; sedimentary record of past atmospheres and ocean paleoprodutivity).

Economic aspects of marine geology (petroleum, phosphorites, sand and gravel, manganese nodules, vents and metal ores, waste disposal, geologic sequestration of CO₂).

Course Grading
Course grade will be based on exam performances, a short research paper on a geologically-related topic of your choosing, and participation in class discussions.
Texts (all available through Amazon.com)

   **By Open University**, Walton Hall, Milton Keynes, MK7 6AA, UK
   Paperback
   ISBN-10: 0-7506-3983-0

2) *Ocean Chemistry and Deep-Sea Sediments*, Open University, 1995
   **By Open University**, Walton Hall, Milton Keynes, MK7 6AA, UK
   Paperback
   ISBN-10: 0080363733

**OPTIONAL/some overlap with above 2 texts but this one is more recent:**
   **By Open University**, Walton Hall, Milton Keynes, MK7 6AA, UK
   ISBN-10: 0-7506-6793-1