

**SAW Course # WH.421
Geological Oceanography**

Fall, 2019

Instructors: Liviu Giosan (WHOI, Clark 253B, x2257, lgiosan@whoi.edu)
Dan Lizarralde (WHOI, Clark 260, x2942, danl@whoi.edu)
Olivier Marchal (WHOI, Clark 109A, x3374, omarchal@whoi.edu)
Adam Soule (WHOI, Clark 272C, x3213, asoule@whoi.edu)

Class Times: TBD

Places: TBD

Class Website: <http://www.whoi.edu/sites/12.710>

Course Description: This course provides a survey of a broad range of active topics in *Geological Oceanography*. The course presents background material to graduate students with interests in various aspects of geology, including solid-earth geophysics, geochemistry, sedimentology and stratigraphy, coastal processes, paleo-oceanography, and paleo-climatology. The course relies on the scientific material described in textbooks, important papers from the peer-reviewed literature, and the most recent contributions in these different disciplines. Broad topics include the formation of the Earth, petrogenesis, volcanism, plate tectonics, geodynamics, sedimentation in the oceans, coastal morphodynamics, the Pleistocene ice ages and astronomical theory of climate change, Last Glacial Maximum, and sub-orbital climatic variability. The interconnectedness of and feedbacks between processes discussed under various topics are emphasized throughout the course in order to stress the coherence of the research field of geological oceanography.

The course is taught in four sections, representing the four core disciplines of the WHOI G&G department: Solid Earth, Geochemistry, Coastal Processes, and Paleoclimate.

There will be two 1 1/2 hour-long lectures each week and a total number of 36 hours for this course. Problem sets will be regularly assigned. Class size is typically small, and so class participation is an important component of learning in this course.

Text/Readings: Because of the breadth of topics covered, there is no single textbook that is adequate for the purpose. Material will be available online for each class along with reading assignments. Several relevant textbooks will also be placed on reserve. Examples of relevant textbooks are referenced at the end of this document.

Grading: Mid-term exam - 25%
Class participation - 25%
Problem Sets/writing assignments - 25%
Final exam - 25%

Geological Oceanography

FALL 2019

FORMATION OF THE EARTH, PETROGENESIS AND VOLCANISM

09/05	(Soule)	Cosmochemistry & Earth Formation
09/10	(Soule)	Isotope Geochemistry & Geochronology
09/12	(Soule)	Igneous Petrogenesis
09/17	(Soule)	Mid-Ocean Ridges
09/19	(Soule)	Ocean Islands and Mantle Plumes
09/24	(Soule)	Arcs

PALEO-OCEANOGRAPHY AND PALEO-CLIMATOLOGY

09/26	(Marchal)	Climate System & Climatic Indicators
10/01	(Marchal)	Astronomical Theory of Climate Change
10/03	(Marchal)	Pleistocene Ice Ages
10/08	(Marchal)	Last Glacial Maximum
10/10	(Marchal)	Abrupt Climate Changes: Dansgaard-Oeschger Events
10/15	Holiday	
10/17	(Marchal)	Abrupt Climate Changes: Heinrich Events

10/22 Mid Term Exam

SEDIMENTATION IN THE OCEANS AND COASTAL PROCESSES

10/24	(Giosan)	Shaping the Earth: Nature and/vs. Humans
10/29	(Giosan)	The Sediment Factory: From Source to Sink
10/31	(Giosan)	Flowing Water: Sediment Transport
11/05	(Giosan)	Continental Margins: Sedimentology and Sequence Stratigraphy
11/07	(Giosan)	The Coast: Landscapes and Seascapes
11/12	(Giosan)	Waves and Coastal Morphodynamics

SOLID EARTH GEOPHYSICS

11/14	(Lizarralde)	Whole Earth Structure
11/19	(Lizarralde)	Earth's Lithosphere: Formation and Evolution
11/21	(Lizarralde)	Plate Boundary Processes
11/26	(Lizarralde)	Seismology: Earthquakes and Earth imaging
11/28	Holiday	
12/03	(Lizarralde)	Potential fields, electro-magnetics, linear inverse theory
12/05	(Lizarralde)	Whole Earth Tomography/Geodynamics

12/17 Final Exam

Recommended Textbooks

(on reserve in Lindgren Library, Building 54, MIT, and in Clark 237, WHOI)

Faure, G. *Principles and Applications of Geochemistry*, Prentice Hall, 1998

Kennett, J., *Marine Geology and Geophysics*, 1982

Bender M., *Paleoclimate*, Princeton Primers in Climate, Princeton University Press, 2013

Bradley, R., *Paleoclimatology, Reconstructing climates of the Quaternary*, Academic Press, vol. 64 of International Geophysics Series, 1999 (or most recent edition)

Imbrie J. and Imbrie K., *Ice Ages – Solving the Mystery*, Harvard University Press, 1979

Ruddiman, W. F., *Earth's Climate : Past and Future, Second Edition*, W. H. Freeman & Co., 2007 (or most recent edition)

Vallis G., *Climate and the Oceans*, Princeton Primers in Climate, Princeton University Press, 2012

Huggett, R., *Fundamentals of geomorphology*. Routledge, 2016.

Nittrouer, C.A. et al., *Continental Margin Sedimentation: From Sediment Transport to Sequence Stratigraphy*: Wiley-Blackwell, 2007

Woodroffe, C.D., *Coasts: Form, process, and evolution*: Cambridge University Press, 2003

Press and Siever, *Understanding Earth*, W.H. Freeman & Co., 1998

Fowler, C.M.R., *The Solid Earth*, Cambridge University Press, 1993

Stacey, F.D., *Physics of the Earth*, 3rd Edition, Brookfield Press, 1992

Cox, A., *Plate Tectonics and Geomagnetic Reversals*, W.H. Freeman and Co., 1973

Turcotte, D.L., and G. Schubert, *Geodynamics*, Wiley & Sons, 1982