

Department of Earth and Ocean Sciences

SPRING 2019 COURSES

eos.tufts.edu



Course #	Title	Instructor	Block	Day & Time
EOS 0002	ENVIRONMENTAL GEOLOGY W/LAB	Jack Ridge	C or E	TWF 9:30AM-10:20AM or MWF 10:30AM-11:20AM
	LAB	Staff	5+, 6+, 7+, 8+, or 9+	M, T, W, R or F 1:20PM-4:20PM

Environmental geology is an introduction to geologic environments and the processes that shape and modify Earth's surface. Of particular interest are the roles of water, ice, wind, and gravity and their effects in different surface environments and climates. These modern surficial processes strongly influence humans and their ability to live and interact with their surroundings. They also provide us with much of the evidence for interpreting ancient geologic environments, allowing us to understand how the earth has evolved over time and to predict the changes we can expect it to undergo in the future.

Specific topics covered in environmental geology include an overview of earth materials, groundwater, and processes of the hydrologic cycle. Also considered from a geological and human perspective are weathering and erosion, landslides, river, glacial, and ocean systems, and environments ranging from arid to periglacial (cold climate). The past climatic and sea level history of Earth's recent ice ages is discussed in relation to modern climate change.

No prerequisite.

EOS 12	IGNEOUS AND METAMORPHIC PETROLOGY W/LAB	Jennifer Axler	D	M 9:30AM-10:20AM TR 10:30AM-11:20AM
EOS 192	LAB	Jennifer Axler	6+	T 1:20PM-4:20PM

The history of our planet is recorded in the igneous, sedimentary, and metamorphic rocks that formed throughout Earth's development. In these rocks we find the evidence for ancient volcanic eruptions, shallow inland seas, and extensive mineralogical and structural changes which occurred deep beneath the earth's surface. EOS 12 is the study of the igneous and metamorphic rocks and the processes that form them. Together, these rocks comprise 95% of Earth's crust and are exposed over approximately one-third of the continental land masses.

Petrology begins with a review of the classification of igneous rocks, followed by a study of the field occurrences, mineralogy, textures, compositions and origins for the major extrusive and intrusive rock associations. As the semester proceeds, experimental evidence is evaluated which can shed light on the origin and crystallization of magmas. During the second half of the term, metamorphic rocks, processes, and structures are considered from a field, laboratory, and experimental perspective. Igneous and metamorphic rocks and processes are considered at all scales, from global plates, mountain ranges, large outcrops, and hand-samples, through microscopic and submicroscopic observations.

Laboratory work emphasizes hand sample and microscopic analysis of rocks and rock suites, often in the context of their natural field occurrences. Interpretation of igneous and metamorphic rocks will be one of the major goals of the course. Weather permitting, we will visit several igneous and metamorphic rock localities late in the semester.

Prerequisite: EOS 11.

Note: must register separately for Lab EOS 192.

EOS 0042	SEDIMENTOLOGY & STRATIGRAPHY	Anne Gardulski	G+	MW 1:30PM-2:45PM
	LAB	Anne Gardulski	I+ M only	M 3:00PM-4:15PM

Sediments and sedimentary rocks form a thin veneer enveloping Earth and reveal a wealth of information about modern and ancient tectonic, climatic, and oceanographic processes. The principles of sedimentology applied to observations and interpretations of modern sediments allow geologists to decipher and model ancient depositional environments and controls on sediment accumulation. Stratigraphy encompasses the study of how these depositional environments change in time and space. We will use information gathered from sedimentary rocks to unravel the dynamics of environments and how they record events such as mountain-building episodes, sea level changes, extinctions, and the splitting apart of continents at rifts.

In this course, we will examine the major types of sediments and how strata are arranged in depositional basins. Topics covered will include rock description and classification, water and wind as transport agents, provenance and biogenic sources of sediment, and statistical analysis of grain parameters, such as size, sorting, and roundness. The identification and interpretation of sedimentary structures as clues to depositional environments will be an integral part of the course. We will also consider what happens to sediment after it is deposited, by studying diagenesis - the complex processes by which unconsolidated sediments are transformed into rock. Study of sediments and sedimentary rocks in hand sample and thin section will be supplemented by field trips during the labs to examine rocks in their natural setting.

We will address the types of depositional processes that operate in various marine and continental environments, and we will integrate the tectonic, climatic, and oceanographic processes and events that may lead to changes in the environments. Stratigraphic studies require a detailed record of the timing of sedimentary depositional units. A number of techniques can provide such age constraints, such as isotopic compositions of certain fossils (isotope stratigraphy), radiometric dating of interbedded volcanic units, the pattern of polarity changes recorded in magnetic minerals (magnetostratigraphy), and assemblages of fossils in the strata (biostratigraphy). These methods and others will be studied to resolve sedimentary correlation problems and to evaluate the effects of events such as change in sea level, from one location to another.

Prerequisite: EOS 2 or consent

EOS 52	PALEOCLIMATE	Andrew Kemp	C	TWF 9:30AM-10:20AM
EOS 152	PALEOCLIMATE	Andrew Kemp	C	TWF 9:30AM-10:20AM

A key component of almost all disciplines within the Earth and Ocean Sciences is the evolution of climate through geological time on scales of billions of years to decades and from the birth of Earth to the present day and into the future. Understanding the important phases and events in paleoclimate provides context for research in related fields and is a critical part of the discussion surrounding modern climate changes. By the end of this course you will be familiar with the major climate shifts that took place during the last ~4bn years, understand the evidence on which current thinking is based, and be able to explain the mechanism(s) that drove paleoclimatic change. We will begin by developing some basic understanding of how Earth's climate system works before moving onto discussion of widely used proxies. We will then embark on a 4bn year journey beginning with the wrongly perceived "hell" of the Hadean and ending with Quaternary glaciations, the Holocene, the Hockey Stick and a glimpse into the near future.

Two lectures per week. Prerequisite: EOS 2 or EOS 51.

For graduate credit, register for EOS 152.

EOS 133	FIELD METHODS IN HYDROGEOLOGY	Grant Garven	8+	R 1:20PM-4:20PM
	RECITATION	Grant Garven	F+R	F 12:00PM-1:15PM

Field aspects of geohydrology, groundwater mapping and sampling, aquifer testing, well drilling, monitoring, and instrumentation of boreholes. The course will blend lecture with basic field methods to understand how monitoring and production wells are planned and drilled, and what types of geologic, geophysical, and geochemical data can be gathered for subsurface flow systems. A network of boreholes on the Tufts campus will be used as field sites to characterize subsurface parameters in the unsaturated and saturated zones, and study regional flow in an urban watershed. Field trips, with quantitative analysis of geohydrologic data.

Prerequisite: EOS 1 or 2 and Physics 1 or 11 or equivalent.
Note: Engineers register for CEE 114, cross-listed.

EOS 288	GROUNDWATER MODELING	Grant Garven	K+	MW 4:30PM-5:45PM
----------------	-----------------------------	--------------	----	------------------

Numerical analysis of groundwater flow, with applications. Topics include: numerical formulation of the governing equations using finite difference, finite element, integrated finite difference, particle tracking, boundary element, and discrete element techniques; matrix and iterative solutions; algorithms for 1-D, 2-D, and 3-D flow; stability and accuracy; applications using popular USGS software in the public domain. Students will be expected to apply existing Fortran programs for 1-D, 2-D, and 3-D solutions as part of computational laboratory modeling assignments.

Prerequisite: Graduate standing.

FACULTY CONTACTS IN THE DEPARTMENT

Any one of our faculty members would be happy to speak with you about your interest in our courses or major and minor concentration programs.

Jack Ridge, Professor, Chair jack.ridge@tufts.edu

- Glacial Geology & Geomorphology

Anne Gardulski, Associate Professor anne.gardulski@tufts.edu

- Stratigraphy & Sedimentology

Grant Garven, Professor grant.garven@tufts.edu

- Groundwater Hydrology & Modeling

Andrew Kemp, Assistant Professor andrew.kemp@tufts.edu

- Sea-Level & Climate Change