GEOL 565 – PALEOCEANOGRAPHY – Spring 2022
Department of Atmospheric, Oceanic, and Earth Sciences
George Mason University

PALEOCEANOGRAPHY – Investigation of ocean evolution through geologic time. Earth's ocean sediment archive provides proxy data on paleo-ocean temperature, chemistry, biology and geology. Paleo-oceanic conditions reconstructed from proxy data are examined, e.g., circulation, salinity, stratification, anoxia, and biogeochemistry. The evolution of the oceans, case studies from Precambrian to Recent are discussed. (3 credits)

Instructor: Linda Hinnov, Dept. AOES, email: lhinnov@gmu.edu
Meetings: Tuesdays, Thursdays, 10.30-11.45, Exploratory 1005, Zoom from January 25-Spring Break.
Zoom: https://gmu.zoom.us/j/92263134539
Materials: Online resources, review and research articles. (*No single textbook*.) See Blackboard.
Requirements: All students: 10 "mini-workshop" write-ups; graduate students: independent project
Ethics: See https://oai.gmu.edu/mason-honor-code/full-honor-code-document/ for course policy.
Syllabus: Tuesday lectures, Thursday mini-workshops

Jan 25 – Lecture 1 – Ocean physics: bathymetry, temperature, density, circulation, couplings
Jan 27 – Mini-Workshop 1 – Basic physical properties; Coriolis force; Ekman transport

Feb 01 – Lecture 2 – Ocean chemistry: salinity, major ions, chemical divides
Feb 03 – Mini-Workshop 2 – CO_2 of ocean water; $CaCO_3$ saturation state; ocean acidification

Feb 08 – Lecture 3 – Ocean biology: productivity, decomposition, Redfield ratios, biological pump
Feb 10 – Mini-Workshop 3 – Global ocean nutrient distribution; empirical Redfield ratios

Feb 15– Lecture 4 – Ocean sedimentology: coastal to deep-ocean; terrigenous and marine sediment
Feb 17 – Mini-Workshop 4 – Sedimentary record of Ross Sea, Antarctica

Feb 22 – Lecture 5 – Temperature proxies: oxygen isotopes, clumped isotopes, Mg/Ca, alkenones
Feb 24 – Mini-Workshop 5 – Global see-saw climate change, 0-100 Ka

Mar 01 – Lecture 6 – Salinity-circulation-productivity proxies: chlorinity, carbon isotopes
Mar 03 – Mini-Workshop 6 – Atlantic Meridional Ocean Circulation over the past 1000 years

Mar 14 – 18 SPRING BREAK

Mar 22 – Lecture 7 – Ocean volume/sea-level and tidal proxies
Mar 24 – Mini-Workshop 7 – Calibrating sea-level over the Last Glacial Cycle

Mar 29 – Lecture 8 – Recent paleo-oceans and the Last Glacial Maximum
Mar 31 – Mini-Workshop 8 – Holocene sediment core, Santa Barbara Basin, California

Apr 05 – Lecture 9 – Cenozoic ocean evolution: gateways, global cooling, and glaciation

Apr 07 – Mini-Workshop 9 – Drying out the Mediterranean Sea

Apr 12 – Lecture 10 – Phanerozoic greenhouse-icehouse cycles
Apr 14 – Mini-Workshop 10 – Halothermal vs. thermohaline ocean circulation

April 19– Lecture 11 – Earth's late Proterozoic oceans
April 21– Lecture 12 – Earth's early Proterozoic oceans

April 26 – Lecture 13 – Earth's Archean oceans
April 28 – Lecture 14 – Earth's Hadean oceans

May 03 – Lecture 15 – Grand challenges – Part 1
May 05 – Lecture 16 – Grand challenges – Part 2

May 18 – submit research papers and any remaining miniworkshops by midnight!