OEB/EPS 56

The History and Evolution of Life on Earth

Course instructors
Nadja Drabon, Earth and Planetary Sciences
Email: ndrabon@fas.harvard.edu

Javier Ortega-Hernández, Organismic and Evolutionary Biology
Email: jortegahernandez@fas.harvard.edu

Teaching Fellows:
Edna Rodriguez-Sánchez, Organismic and Evolutionary Biology
Email: ednarodriguezsanchez@g.harvard.edu

Emily Stoll, Earth and Planetary Sciences
Email: estoll@fas.harvard.edu

Preceptor:
Chloe Anderson, Earth and Planetary Sciences
Email: chloeanderson@fas.harvard.edu

Meeting
Lectures - Monday and Wednesdays 10:30-11:45am.
Laboratory practical – Wednesday 3:00-5:45pm.

Description
Within our solar system, Earth is distinguished as the planet with life. Living organisms are complex entities that originated from planetary processes, have been sustained by the same processes for approximately four billion years, and have fundamentally affected the functioning and composition of the Earth's surface and atmosphere. In this course we will investigate the ways that Earth and Life interact with each other in deep time, focusing on the biogeochemical cycles of major elements, and the interplay between complex organisms and their ever-changing environment. Throughout the course you will obtain key knowledge and practical skills that will allow you to interpret the fascinating history of Life captured in the rock record, and how living organisms have built the world as we know it today.

Grading system:
30% mid-term
20% weekly lab assignments
20% student presentations
30% final exam

Reading: Reading assignments are provided for each lecture. These will primarily be from the course text, but will also include a moderate number of other, accessible articles.

Participation: Students are expected to attend synchronous bi-weekly meetings and the lab section. Further, students will be expected to schedule a brief, 15 minute "get to know you" meeting with one of the course instructors within the first 2 weeks of class. In class participation is always welcomed.

OEB/EPS 56

The History and Evolution of Life on Earth

Class norms: Lectures and practical sessions will take place in-person. In the need of self-isolation, the course instructors will accommodate a remote viewing of the lecture via Zoom. It is important to contact the course instructors immediately if self-isolation is needed to make preparation for s remote delivery in a timely manner.

Prerequisites
Any of the following classes: EPS 10, 21, EPS 22, OEB 10, or permission from the instructor.

Academic support: Please don't hesitate to reach out to any member of the teaching team with any concerns or difficulties that you're experiencing. We hope to help with the transition to in person learning however we can! Additional resources are available through Harvard's Academic Resource Center: https://academicresourcecenter.harvard.edu/college-students which offers individual consultations, workshops, and tutoring services. Any student needing academic adjustments or accommodations is requested to present a letter from the Accessible Education Office (AEO) and speak with the professor by the end of the second week of the term. All discussions will remain confidential, although the AEO may be consulted to discuss appropriate implementation.

Spring fieldtrip to Upstate New York and Western Massachusetts: The course will include an *optional local fieldtrip* to visit Paleozoic and Mesozoic fossil localities in New York and Massachusetts. **The fieldtrip will take place during the Spring term on April 19th and 20th 2025.** All costs associated with the fieldtrip will be covered by the organizing departments, but students are required to bring appropriate clothing and personal items. We will circulate more instructions and recommendations about the fieldtrip over the course of the semester. Please get in touch with the course instructors, teaching fellows or preceptor if you have any questions or might require any accommodations during the fieldtrip.

Student presentations: Students will have time to prepare oral presentations on Week 10 after the Spring break, which will be delivered during Week 10. We expect a total of four to six presentations depending on class size, half on each class day for Week 10, and they will require students to work in small groups (3 to 4 individuals) to provide a more in-depth overview of a specific topic related to the course. We will provide more details about the topics, objectives and format of student presentations during the course.

Statement of Artificial Intelligence use: The course is designed to provide active learning and engage students with material directly. Although the course instructors do not actively discourage the use of Artificial Intelligence (AI) resources as potential tools that might aid studying sessions or summarizing course material outside of class, the use of such AI resources during graded examinations is strictly prohibited.

Academic integrity: Course attendees agree to adhere to the Harvard College Honor Code as outlined below (more information at https://honor.fas.harvard.edu/honor-code):

Members of the Harvard College community commit themselves to producing academic work of integrity – that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or problem sets, plagiarizing or misrepresenting the ideas or language of someone else as one's own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs.

OEB/EPS 56

The History and Evolution of Life on Earth

Lecture and Lab schedule

Welcome to the history and evolution of life on Earth
Session 1. M Jan 27: Introduction to course, the language of stratigraphy and the fossil record (JOH)
Session 2. W Jan 29: How to tell time – introduction to basic geology (ND)
LAB 1: The nature of fossils and fossilization

A brief introduction to planet Earth
Session 3. M Feb 3: Sediments: the book of Earth's History (ND)
Session 4. W Feb 5: The Hadean Eon: making Earth habitable (ND)
LAB 2: The rock cycle, sedimentary rocks, and depositional environments

Early Life on a young Earth
Session 5. M Feb 10: The Archean Eon: conditions for an early biosphere (ND)
Session 6. W Feb 12: Life during the Archean and the Great Oxidation Event (ND)
LAB 3: The Carbon Cycle

The rise of complex organisms and global glaciations
M Feb 17 President's Day, no class
Session 7. M Feb 19: Life during the Proterozoic (JOH)
LAB 4: Stromatolites and microfossils – the fossil record of early life

OEB/EPS 56

The History and Evolution of Life on Earth

The enigmatic dawn of animals
Session 8. M Feb 24: Neoproterozoic Snowball Earths (ND)
Session 9. W Feb 26: The Ediacaran Period and the dawn of animals (JOH)
Review session for Midterm Exam

The origin of major body plans
Session 10. M Mar 3: The Cambrian Explosion and the origin of the Phanerozoic biosphere (JOH)
W Mar 5 Midterm Exam
No lab this week

Animals spread across the oceans
Session 11. W Mar 10: The Great Ordovician Biodiversification Event (JOH)
Session 12. M Mar 12: Silurian reefs and the Devonian Nekton Revolution (JOH)
LAB 5: Marine life during the Paleozoic

March 17 to 21 Spring Break 2025

Preparation for student presentations
M March 24: No class – preparation for student presentations
W March 26: No class – preparation for student presentations
No lab this week

OEB/EPS 56

The History and Evolution of Life on Earth

Select topics in sedimentology and paleontology
Session 13. M March 31: Student presentations (groups 1 to 3)
Session 14. W April 2: Student presentations (groups 4 to 6)
No lab this week

Life on land and the Great Dying
Session 15. M April 7: Terrestrialization and the evolution of life on land (JOH)
Session 16. W April 9: The Permian Mass Extinction (ND)
LAB 6: Paleozoic life on land

Life during the Age of Reptiles
Session 17. M April 14: The Mesozoic Marine Revolution (JOH)
Session 18. W April 16: Terrestrial evolution during the Mesozoic (JOH)
LAB 7: Mesozoic life in the sea and land

Sedimentological and paleontological evidence in the field
Fieldtrip – 19-20 April (Upstate New York and West Massachusetts)

The meteoric demise of dinosaurs and the rise of mammals
Session 19. M April 21: The end-Cretaceous Mass Extinction (ND)
Session 20. W April 23: Life during the Cenozoic (JOH)
LAB 7: Cenozoic life in the sea and land

OEB/EPS 56

The History and Evolution of Life on Earth

The Ice Ages
Session 21. M April 28: Life during the Ice Ages (ND, JOH)
Session 22. W April 30: Evolution and climate change during the Anthropocene (ND, JOH)
LAB 8: Reconstructing past climates

Final Exam (May 2025, date TBC)