

Major Events in Earth History (01:460:480)

A new capstone course in Geological Sciences

Spring Semester, 2016, M-Th, 10:20 - 11:40 AM, Wright Labs Rm 231

Major Events in Earth History (01:460:480) is EPS' newly developed capstone course geared toward upper level undergraduate students and beginning graduate students in the Earth Sciences. The course is designed with an integrated systems approach addressing some of the great issues in Earth Sciences. The course is to be taught by a team of EPS faculty under the overall direction of Prof. Claude Herzberg. Instructors for individual topics in the course include professors Ashley, Aubry, Browning, Falkowski, Fiebel, Gross, Herzberg, Kent, Kopp, Miller, Levin, McGhee, Schlische, Swisher, Van Tongeren, Withjack, and Wright. Each class period will consist of a lecture or overview followed by student discussion of one or several pertinent review papers. The final one or two classes will be devoted to student presentations, which will constitute partial student assessment. A final exam will consist of a 24 hour take home essay that summarizes the student presentation.

Who should enroll in 01:460:480 ? All upper level undergraduate majors in Geological Sciences are encouraged to enroll in this course. Beginning in 2017, the course will be required for graduation and must be taken by all Geological Sciences majors. All graduate students in Geological Sciences should also consider enrolling in *01:460:480* and beginning in 2016, the course will be required for all first year graduate students. First year students in related graduate programs in Earth, Oceans and Atmosphere are likewise encouraged to enroll.

For questions or more information, please contact Prof. Claude Herzberg (herzberg@rci.rutgers.edu).

Some of the topics to be covered in ***Major Events in Earth History (01:460:480)*** include:

1. Age and formation of the Earth (Herzberg, Gross, Swisher)
 - timing of gravitational Earth accretion & the moon-forming giant impact
 - origin of the first atmosphere & oceans in the Hadean
 - our solar system to the oldest known rocks & minerals on Earth
2. Thermal, magmatic, and tectonic history of the Earth (Herzberg, VanTongeren)
 - formation of cratons, oceanic & continental crust

- destruction of crust: subduction & drip tectonics, giant layered igneous intrusions, anorthosites

3. Craton stability, emergence of the first continents & passive margins establish ecosystems for photosynthetic life & atmospheric oxygen (Herzberg & VanTongeren)

- temporal distribution of supercontinents, passive margins, iron formation & global ice ages in the Archean & Proterozoic

4. Origin of life on Earth (Falkowski)

- the fossil record & biological inferences of origins of life

5. Evolution of Earth's atmosphere (Falkowski)

- photosynthetic contributions to atmospheric O₂ & the faint young sun paradox

6. Hazen's mineral evolution (Herzberg)

- ~ half the minerals on Earth are biologically mediated

7. Snowball Earths, atmospheric oxygen & origin of multicellular life (Kent)

8. The Cambrian explosion (Browning)

9. Major evolutionary radiations (Aubry)

10. Constraining deep time (Swisher)

- importance of accurate chronological methods for evaluating causality

11. Deep Earth structure, large igneous provinces, and surface expressions (Herzberg)

- large low shear velocity provinces and mantle plumes

- formation of Siberian & Deccan Traps

- magmatism and thermogenic processes leading to climate change

12. Paleozoic life and the Permian/Triassic mass extinction (McGhee)

- ecology of massive ecosystem collapse

13. Plate tectonics and formation Pangea (Withjack, Schlische, Levin)

14. Plate tectonics and breakup of Pangea (Withjack, Schlische, Levin)

15. CAMP and the Jurassic/Triassic mass extinction (Olsen)

- mantle insulation/plume triggers, U-Pb & magnetism timing
16. The Cretaceous/Paleogene mass extinction (Miller)
 - mantle plume, asteroidal impact triggers
 17. The Paleocene-Eocene thermal maximum (Wright)
 - mantle plume, comet, kimberlite eruption triggers
 - Iceland/Greenland Ridge, ocean circulation & climate change
 - floral/faunal turnovers & origination
 18. Long-term carbon cycle (Kent)
 - CO₂ and climate change
 - effects of volcanism, subduction, metamorphism & weathering on atmospheric CO₂
 19. Cenozoic/Mesozoic sea level, climate & tectonics (Miller, Kopp)
 - convection-driven dynamic topography & ice volume contributions to sea level
 20. Great volcanic eruptions and earthquakes (Levin)
 21. Hominid and Primate Evolution (Feibel, Ashley)
 22. The “Anthropocene” (Kopp, Miller)
 - humans as a geological force
 - climate change, and mass extinctions during the industrial era
 23. Greatest Hits in 4.47 billion years of Earth history: summary class (Herzberg)