

Las Positas College  
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## Course Outline for GEOL 3

### HISTORICAL GEOLOGY

Effective: Fall

#### I. CATALOG DESCRIPTION:

GEOL 3 — HISTORICAL GEOLOGY — 3.00 units

Formation and development of the earth, its oceans, atmosphere and life through time. Emphasis on the Geologic Time Scale, the fossil record, introductory biostratigraphy, radiometric dating, index fossils, fossil assemblages, mass extinctions, types of fossil preservation, Ice Ages and glacial events through time, paleogeography: plate tectonic configurations throughout time, major events through the scope of Geologic Time, etc.

3.00 Units Lecture

#### Prerequisite

GEOL 1 - Physical Geology

or

GEOL 5 - Environmental Geology: Hazards & Disasters

or

GEOL 7 - Environmental Geology: Resources, Use Impact & Pollution

#### Grading Methods:

Pass/No Pass

#### Discipline:

	<u>MIN</u>
<b>Lecture Hours:</b>	54.00
<b>Total Hours:</b>	54.00

#### II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

#### III. PREREQUISITE AND/OR ADVISORY SKILLS:

**Before entering the course a student should be able to:**

- A. GEOL1
- B. GEOL5
- C. GEOL7

#### IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

1. explain and discuss the most commonly proposed theories for the formation of the earth and solar system;
2. construct the geologic time scale; including the Eons, Eras and Periods;
3. recognize the important, notable and/or common fossils found in each basic Eon, Era and Period;
4. explain the basic methods by which fossils are formed
5. explain and discuss the fundamentals of the geologic axiom: The Present is The Key to the Past
6. explain and discuss the fundamentals of studying the history of life through correlating ancient fossil animals with current fossil animals as well as present living organisms;
7. explain and apply the methods of radiometric dating.
8. explain and discuss the basics concepts of Geologic Time in terms of the development and understanding of the geologic time scale throughout human history and the techniques and methods for interpreting the geologic time scale.

#### V. CONTENT:

##### A. Concepts and Principles of Geologic Time

1. The concept of geologic time throughout history
  - a. Uniformitarianism
  - b. Catastrophism
  - c. The age for the formation of the earth through human history
  - d. The scientific method
2. Relative Age Dating
  - a. Stratigraphy
  - b. Biostratigraphy

- c. Facies
  - d. Transgressions and regressions
  - e. The Eons, Eras and Periods of the Geologic Time Scale
- 3. Fossils and Fossilization
  - a. How do fossils form?
  - b. Types of fossils; including trace fossils
  - c. Types of fossilization
- 4. Absolute Age Dating: Radiometric Dating
  - a. Principles of radioactive decay
  - b. Half-lives
  - c. Common types of radiometric elements used to date geologic fossils and strata
  - d. Calculation of radiometric ages
  - e. Understanding the errors inherent with radiometric dating
- 5. Absolute Ages for the Relative Geologic Time Scale
  - a. Evolution of the Geologic Time Scale throughout human history
- 6. Life through Time
  - a. Evolution and the fossil record
  - b. Natural selection
  - c. Mass extinctions
  - d. Speciation and the rate of evolution
  - e. Divergent, convergent and parallel evolution
  - f. Cladistics and cladograms
  - g. Functional morphology
- B. The Earth through Time from the Geologic Record (the rocks and fossils)
  - 1. The formation of the Universe, Solar System and Earth
    - a. Current theories; including the Big Bang
    - b. Current theories for the formation of the Earth's early atmosphere, oceans and continents
    - c. Estimated absolute ages
  - 2. The Precambrian
    - a. The Hadean; Azoic
      - 1. The rock record; shields and cratons
      - 2. Evidence for life
      - 3. Amount and types of rocks
    - b. The Archean and Proterozoic
      - 1. The rock record; shields and cratons
      - 2. The fossil record
        - a. Prokaryotes
        - b. Eukaryotes
        - c. Stromatolites
        - d. Trace fossils and early metazoans
          - 1. Ediacaran fauna
      - 3. Current theories for the origin of life
        - a. Volcanic gasses; Oparin
        - b. Submarine hydrothermal vents and chemosynthesis
        - c. Organic soup
        - d. Minerals as templates
      - 4. Evolution and development of the atmosphere
        - a. The Banded Iron Formation
        - b. Ice Ages and periods of glaciation
        - c. Oxygen isotopes  $O^{18}$ ,  $O^{16}$ ; etc.
      - 5. Paleogeography, plate tectonics and supercontinents
  - 3. The Phanerozoic
    - a. The appearance of 'hard parts' and the impact of the fossil record
    - b. The Paleozoic
      - 1. Paleogeography and plate tectonics of the Paleozoic
      - 2. Notable fossils, fossil assemblages and geologic events of the each Paleozoic period
        - a. Cambrian
        - b. Ordovician
        - c. Silurian
        - d. Devonian
        - e. Carboniferous (Mississippian and Pennsylvanian)
        - f. Permian
      - 3. Mass extinctions of the Paleozoic
    - c. The Mesozoic
      - 1. Paleogeography and plate tectonics of the Mesozoic
      - 2. Notable fossils, fossil assemblages and geologic events of the each Mesozoic period
        - a. Triassic
        - b. Jurassic
        - c. Cretaceous
      - 3. Mass extinctions of the Paleozoic
        - a. Current theories concerning the demise of the dinosaurs
      - 4. The evolution of birds
    - d. The Cenozoic
      - 1. Paleogeography and plate tectonics of the Cenozoic
      - 2. Notable fossils, fossil assemblages and geologic events of the each Cenozoic period
        - a. Tertiary
        - b. Quaternary
      - 3. Mass extinctions of the Cenozoic
      - 4. The evolution of marine mammals
      - 5. The Pleistocene Ice Ages

## VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. **Discussion** -
- C. CD-ROM/DVD images and animations
- D. 35mm and powerpoint slides
- E. **Field Trips** - at the instructor's discretion for the lecture
- F. Video clips
- G. Internet

- H. Textbook and textbook cd-rom
- I. Online materials, websites, quizzes, bulletin boards, etc.
- J. **Demonstration** -

#### VII. TYPICAL ASSIGNMENTS:

A. Read Chapters 1 thru 4. Look up the vocabulary words in these chapters and complete online Vocabulary Quiz 1. Use the textbook glossary and index, the Geologic Dictionaries available in the Science Center, and Internet search engines such as Google. B. Memorize the Eons, Eras and Periods of the Geologic Time Scale C. Complete the Study Guide questions for Exam 2. D. Complete the homework assignment and problems on radiometric dating. E. Read Chapter 15 in the textbook. This topic will not be covered during class time. 1. Look up all vocabulary for this chapter. 2. Make sure that you understand the basic geologic processes discussed in this Chapter. 3. Complete the questions in the Study Guide that refer to the topics in this chapter. F. Research Paper. Submit a 5-10 page 12-point paper on a geologic topic approved by the instructor. G. Presentation. Create and present a 5-10 minute presentation on a geologic topic approved by the instructor.

#### VIII. EVALUATION:

##### A. **Methods**

1. Quizzes
2. Papers
3. Home Work

##### B. **Frequency**

1. Frequency
  - a. Homework can be assigned daily, weekly or all at the beginning of the term or only as needed, at the discretion of the instructor
  - b. Quizzes will be given daily, weekly, bi-weekly or at the discretion of the instructor
  - c. Quizzes/Midterms/Final Exam/Term Paper – at least 3 or 4 total. For example, there may be 2 midterms, one final exam and one term paper. Or, there may be 4 on-line quizzes, 3 in-class midterms and one in-class final exam.
  - d. The comprehensive Final Exam will be given at the end of the semester on the day specified in the campus Final Exam schedule.

#### IX. TYPICAL TEXTS:

1. Levin, H.L.. *The Earth Through Time*. 8th ed., Wiley Text Publisher, 2009.
2. Prothero, D.R. and Dott, R.H. *Evolution of the Earth*, . 7th ed., McGraw Hill Publishers, 2004.
3. Stanley, S.M. *Earth Systems History*. . 3rd ed., W.H. Freeman & Company Publishers, 2009.
4. Wicander, R. and Monroe, J.S *Historical Geology*. 5th ed., Thomson Brooks Cole Publishers, 2009.

#### X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. A. Access to the Internet and computers, through the LPC Computer Center, or access to a personal computer at home with an Internet connection B. A small booklight for taking notes while satellite images and slides are discussed in class C. A set of colored pencils D. A calculator that can calculate logarithms E. Study guides as made available by the instructor