University of California, Santa Barbara
Program Learning Outcomes

B.S. or B.A. in Earth Science

Students graduating with a B.S. or B.A. in Earth Science should be able to:

Knowledge

1. Recognize common Earth materials and structures.
2. Place basic geologic observations (e.g. rock type, structure, seismicity, and volcanism) into a broader plate tectonic framework.
3. Describe how Earth scientists construct the geological time scale and apply age dating techniques.
4. Describe the broad attributes and interactions of the Earth System, as well as its geological history, how and why it is changing today, and how those changes impact society.

Skills

5. Perform simple calculations to evaluate and manipulate quantitative geologic data.
6. Interpret a geologic map in terms of the sequence of geologic events (e.g., sedimentation and erosion, deformation, landscape evolution) as well as what it implies about the subsurface 3-D geologic structure.
7. Collect, interpret, and synthesize basic field observations and measurements to produce a coherent model of how the landscape, rocks, and geological structures around them evolved.
8. Use basic geological laboratory techniques and approaches (e.g., microscope) to generate meaningful data.
9. Communicate results of scientific inquiries orally, visually, and in writing.
10. Summarize and evaluate primary geological literature
    a. Identify the hypothesis of a paper
    b. Identify the predictions the hypothesis makes
    c. Identify the methods used to test the hypothesis
    d. Distinguish between data (observations) and interpretations
    e. Provide critical analysis of the authors' interpretations, distinguishing between scientific and non-scientific approaches.
11. Make scientific observations of Earth materials and structures in the field and in the laboratory, and formulate and test hypotheses to explain these observations.

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University of California, Santa Barbara
Program Learning Outcomes, continued

In addition, graduates with a chosen <u>emphasis</u> (all B.S. degrees) will be able to do the following *(refer to relevant emphasis):*

Geology

12. Construct and interpret geologic maps, geologic cross-sections and stratigraphic columns using modern mapping tools to evaluate the geologic history of a region and to interpret the geometry of rock units at depth.
13. Relate sedimentary, igneous, and metamorphic minerals and rocks to the rock-forming processes to their tectonic setting.
14. Analyze ancient and modern geologic regions to determine geologic history, tectonic setting, and environmental patterns.
15. Identify and rigorously describe a broad spectrum of geologic structures (faults, folds, fabrics) and analyze the deformational history of a region.

Geophysics

12. Explain the major features in the solid Earth (crust, mantle and core) with evidence based on geophysical (i.e., seismic, gravity, and geomagnetic) data.
13. Explain the major physical processes operating in the solid Earth such as earthquakes, plate tectonics, and mantle convection.

Climate and Environment

12. Explain the influence of tectonic processes on long-term climate evolution and provide examples.
13. Explain Milankovitch theory and its role in explaining Glacial-Interglacial cycles.
14. Explain the carbon cycle in terms of reservoirs, transport and transformation, and explain how these factors affect atmospheric CO2 in the past, present and future.
15. Contrast the structure of the ocean and atmosphere and how these differences influence climate.
16. Explain the use of climate proxies and how they are applied to the study of past climates.
17. Explain Earth's radiation budget and define the action of the different atmospheric gases.

Paleobiology

12. Outline the broad sweep of physical and biological events in the history of our planet.
13. Explain the process of evolution by natural selection and reconstruct the broad phylogeny of life arising therefrom.
14. Interpret fossil evidence in a field and laboratory context.

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Geohydrology

12. Map the flow directions of groundwater assuming basic geologic and hydrologic data such as groundwater head or topography.
13. Compare flow and transport.
14. Explain the role of surface and groundwater processes linked to Earth materials and geologic hazards including rock and soil mechanics, flooding, landslides, and earthquakes.