Topic Page: Geology

Definition: **geology** from *Philip's Encyclopedia*

Study of the materials of the Earth, their origin, arrangement, classification, change and history. Geology is divided into several categories, the major ones being mineralogy (arrangement of minerals), petrology (rocks and their combination of minerals), stratigraphy (succession of rocks in layers), palaeontology (study of fossilized remains), geomorphology (study of landforms), structural geology (classification of rocks and the forces that produced them), and environmental geology (study of use of the environment).

Image from: **By determining geologic processes and timing....** in *Encyclopedia of Environment and Society*

Summary Article: **Geology**
From *Encyclopedia of Environment and Society*

GEOLOGY IS THE study of the solid, nonliving earth, including earth's materials, structure, processes, and history. Earth's nonliving materials and features are the result of geologic processes. Geologists study these processes, operating today, and in doing so interpret how ancient earth materials or features formed. By determining these processes, and the time at which they occurred, geologists interpret the history of the earth. The science of geology includes the following subdisciplines: mineralogy, the study of minerals; petrology, the study of rocks and their formation; geomorphology, the study of earth surface processes and landform development; sedimentology and stratigraphy, the study of sediment and strata; paleontology, the study of fossils and ancient life; structural geology, the study of rock deformation; geophysics, physics of the earth; and geochemistry, chemistry of the earth.

To environmental science, geology provides the knowledge base for several basic areas of study. Geology includes the study of geologic time and earth history. Information about ancient (prehuman) earth and its atmosphere, hydrosphere, environments, and geologic processes, is preserved in the rock record. Geologists interpret the information in the rocks and provide analyses of earth's ancient conditions. For example, information about the Precambrian atmosphere is interpreted from mineral assemblages and fossils contained in Precambrian strata. Similarly, the long-term record of global climate change, including global warming and cooling, is preserved in the rock record.

Geologic maps portray the surface occurrence of different types of rocks. These maps are the result of careful ground-based investigations. Geologic maps provide the locations of different rocks and sediment deposits on earth's surface. They can be used to predict the suitability of various places for different types of land use, and to show the surface occurrence of mineral and energy resources.

Geologic maps are also used, sometimes in conjunction with subsurface information obtained through drilling and geophysical methods, to interpret the location and structural geometry of rocks in the subsurface. Such information is used to find and assess the occurrence of mineral and energy resources in the subsurface. In addition, these configurations, together with information about the permeability of the rocks, control the presence and movement of subsurface fluids such as groundwater, oil or natural gas. For example, the direction and speed of groundwater flow, including any contaminants, may be predicted by understanding the nature and geometry of rocks in the subsurface.

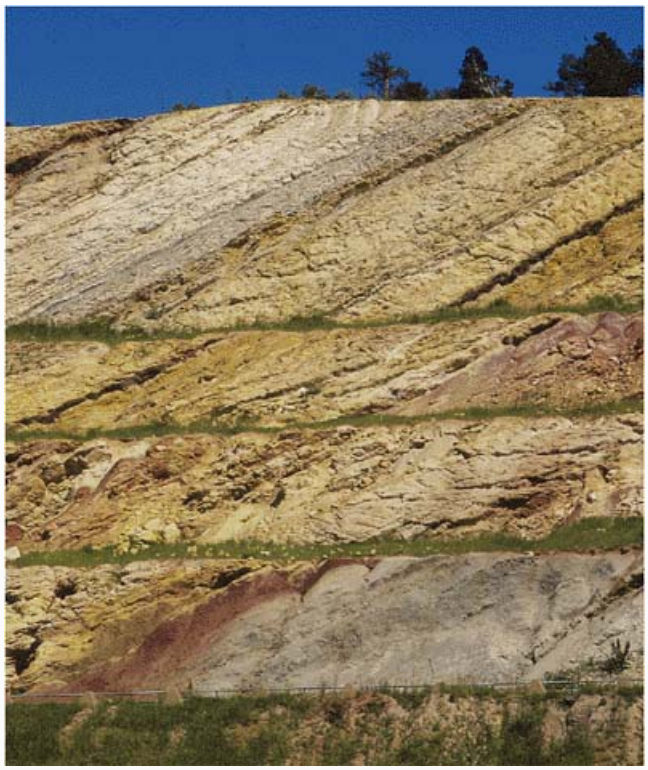
Information about the surface and subsurface occurrence of rocks, sediments, and minerals is also important to the extent that these materials interact with water or other fluids. Through the process of weathering, bedrock contributes solid and dissolved constituents to groundwater, surface water and soils. These constituents may constitute basic nutrients or contaminants, depending on the constituent and its concentration. Some subsurface materials—such as sand or sandstone—may act as a natural filter, removing particulate matter and thereby purifying groundwater.

GEOMORPHOLOGY

Geomorphology is the study of landforms and their genesis through processes such as weathering and erosion. These processes include the agents by which the earth's surface is modified by the action of gravity, running water, wind, groundwater, glaciers, and ocean waves and tides. Sedimentology is the study of sedimentary depositional processes. The history of conditions that occurred at various places on earth's surface is preserved in strata. Stratigraphy is the study of these strata and the historical conditions they represent. Paleontology is the study of fossils and the conditions under which ancient life forms existed.

Geology includes the study of the tectonic process, which is driven by the interactions between earth's tectonic plates. These interactions result in earthquakes, volcanoes, tsunami, uplift or subsidence of the land surface, and long-term deformation of rocks. Plate tectonics is a relatively young discipline, and has been understood since the 1970s. Plate tectonics has revolutionized and unified the science of geology. We now know that mountain belts, continents, ocean basins, and the earth's crust are all formed by slow plate tectonic processes that have been operating for billions of years.

Geologic hazards are a major environmental concern. These hazards include earthquakes, volcanoes, tsunami, ground subsidence, floods, and landslides. Most of these hazards are the result of an extreme case scenario of an otherwise normal geologic event. For example, rivers usually flood every year. We don't notice many of these floods because they are a normal occurrence in the yearly variation in the flow of the river. However, conditions that control river flow, such as precipitation and runoff, may be excessive and may result in an extreme flood event. A 100-year flood is the maximum flood that occurred, or is statistically estimated to have occurred, over a 100-year interval. Similarly, most earthquakes have a low magnitude and are not noticed or have minimal effects. However, the less frequent, high magnitude earthquakes have been extremely destructive, as is the case for San Fransisco.



By determining geologic processes and timing, such as in rock strata, geologists interpret the history of the earth.

Time is an important dimension in geology. All geologic information must be understood in the context of geologic time. When and over how long a period did a geologic feature (mineral, rock, landform, mountain belt, etc.) form? Some geologic processes such as floods, earthquakes, and volcanic eruptions occur over observable time spans. Each of these processes, however, is part of longer term processes that occur slowly, over thousands to hundreds of millions of years. Floods are part of the process by which river landscapes are developed. Earthquakes and volcanoes—which themselves occur quickly—are involved in the long-term formation of ocean basins, or in mountain-building. These long-term processes can not be directly observed, but must be interpreted from the record preserved in rocks. The interpretation of these processes, and the time and duration of their formation, is a major emphasis in the science of geology.

SEE ALSO:
Earthquakes; Floods and Flood Control; Geographic Information Science; Groundwater; Hazards.

BIBLIOGRAPHY

- Michael L. McKinney; Kathleen M. McHugh; Susan P. Meadows, Current Perspectives in Geology (Brooks/Cole, 2000).
- Bernard W. Pipkin; Dee D. Trent; Richard Hazlett; Paul Bierman, Geology and the Environment, 5th ed. (Brooks/Cole, 2008).
- Edward J. Tarbuck; Frederick K. Lutgens, Earth, an Introduction to Physical Geology (Pearson-Prentice Hall, 2005).

Rick Diecchio
George Mason University

APA

 *Copyright © 2007 by SAGE Publications, inc.*

APA

Diecchio, R. (2007). Geology. In P. Robbins, *Encyclopedia of environment and society*. Thousand Oaks, CA: Sage Publications. Retrieved from https://search.credoreference.com/content/topic/geology

Chicago

Diecchio, Rick. "Geology." In *Encyclopedia of Environment and Society*, by Paul Robbins. Sage Publications, 2007. https://search.credoreference.com/content/topic/geology

Harvard

Diecchio, R. (2007). Geology. In P. Robbins, *Encyclopedia of environment and society*. [Online]. Thousand Oaks: Sage Publications. Available from: https://search.credoreference.com/content/topic/geology [Accessed 18 October 2019].

MLA

Diecchio, Rick. "Geology." *Encyclopedia of Environment and Society*, Paul Robbins, Sage Publications, 1st edition, 2007. *Credo Reference*, https://search.credoreference.com/content/topic/geology. Accessed 18 Oct. 2019.