

Teacher's Guide For

Core Geology

For grade 7 - College

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| Table of Contents | Page |
|--|-------------|
| Table of Contents and Rights..... | 2 |
| Materials in the Programs..... | 3 |
| Instructional Notes..... | 3 |
| Introduction and Summary of the Program..... | 3 |
| Links to Curriculum Standards..... | 4 |
| Summary of Program <i>Core Geology</i> | 4 |
| 1669 - The Geological Laws..... | 5 |
| 1812 – Properties of Minerals..... | 5 |
| 1830 - Geology Occurs by Natural Processes..... | 5 |
| 1833 - The Three Types of Rocks – Igneous, Sedimentary and Metamorphic..... | 5 |
| 1837 - A Past Ice Age is Theorized..... | 6 |
| 1907 - Radioactive Decay is Used to Date the Earth..... | 6 |
| 1912 – Alfred Wegener Proposes Continental Drift Theory..... | 6 |
| 1972 - Ancient Life and the Fossil Record..... | 6 |
| Answers to Blackline Master 1A Quiz..... | 7 |

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MATERIALS IN THE PROGRAM

Teacher's Guide -This Teacher's Guide has been prepared to aid the teacher in utilizing materials contained within this program. In addition to this introductory material, the guide contains the following:

- Suggested Instructional Notes
- Student Learning Goals
- Test Questions on Blackline Master Quiz A for duplication and handout to students
- Timelines for key events in Earth's geologic history and in the study of geology

INSTRUCTIONAL NOTES

It is suggested that you preview the program and read the related Student Goals and Teacher Points. By doing so, you will become familiar with the materials and be better prepared to adapt the program to the needs of your class. You will probably find it best to follow the programs in the order in which they are presented in this Teacher's Guide, but this is not necessary. It is also suggested that the program presentation take place before the entire class and under your direction. As you review the instructional program outlined in the Teacher's Guide, you may find it necessary to make some changes, deletions, or additions to fit the specific needs of your students. After viewing the programs you may wish to copy the Test Questions on Blackline Master 1A, and distribute to your class to measure their comprehension of the events.

INTRODUCTION AND SUMMARY OF PROGRAM

Core Geology is a unique approach to presenting in a logical way the science of the earth's crust, its composition and the forces that produce the planet's physical features. Geology includes the study of rock types, the formation of metals and other minerals, natural resources such as coal and oil, and paleontology, the study of fossils. Presented in an effective format designed to promote successful student learning, these core principles are laid out in chronological order, each naturally building on the former. *Core Geology* examines the key points in the development of geology beginning with Nicholas Steno's three fundamental laws of geology and continuing with geology's naturally occurring processes, the properties of minerals, the three types of rocks Louis Agassiz's theory of Ice Ages, using radioactive decay to measure the age of the earth, Alfred Wegener's continental drift theory, and ending with the fossil record of ancient life.

Below is a list of the program and its segments. Using this program, teachers can create a lesson plan to cover the specific concepts, themes and the historical figures mentioned. In addition, this *Core Geology* is used in the geology unit of Earth Sciences courses.

Core Geology

1669 - The Geological Laws

1812 - Properties of Minerals

1830 – Geology Occurs by Natural Processes

1833 - The Three Types of Rocks – Igneous, Sedimentary and Metamorphic
1837 - A Past Ice Age is Theorized
1907 - Radioactive Decay is Used to Date the Earth
1912 – Alfred Wegener Proposes Continental Drift Theory
1972 - Ancient Life and the Fossil Record

LINKS TO CURRICULUM STANDARDS

The design for this program includes the following curriculum correlations: National Science Educations Standards, Content Standard B - Properties and changes of properties in matter, motions and forces, transfer of energy: Content Standard D – Structure of the Earth system, Earth’s history, Earth in the solar system and the McRel K-12 Science Standards and Benchmarks, Level III (Grades 6-8) and Level IV (Grades 9-12). There are also many correlations to the standards of Astronomy, Chemistry and Geology. The content of this program presents the foundational discoveries and principles of geology in an historical order.

SUMMARY OF PROGRAM

Core Geology

This program on Core Geology presents the key concepts in the development of geology.

Chapter one follows the development of geology fundamental laws by Nicholas Steno in the 17th century.

Chapter two discusses the properties of minerals and the geological processes that created them.

Chapter three examines how the forces that shaped the Earth's features are the same forces at work today and show us not only how old the Earth is, but how these forces shaped the Earth over time.

The three basic rock types – igneous, sedimentary and metamorphic – are outlined in chapter four.

Chapter five examines how glaciation was one of the forces that shaped the planet’s physical features; and with this came the understanding that the earth had experienced numerous ice ages.

Chapter six shows how nuclear science found that radioactive decay occurred in precise time intervals called half lives and that half lives could be used to date rocks and the earth.

Chapter seven examines how geologists observed that the continents move over time and that these movements of the continental plates explained the occurrence of earthquakes

volcanoes and mountain building.

How the fossil record shows the creation and extinction of species is discussed in chapter eight.

1669 - The Geological Laws

Student Goals - In this Core Geology chapter the students will learn:

- Danish naturalist Nicolas Steno deduced the three fundamental laws of geology in his 1669 *Dissertationis Prodomus*
 - The law of super imposition - when a lower layer is formed, the upper layers did not exist; therefore, the lower layers are always older
 - The principal of original horizontality- that all rock layers were originally horizontal and only further geological forces, such as mountain building, could explain any strata deviation from the horizontal
 - The principle of discontinuity – when a volcanic eruption cuts through existing strata, or crystals form in a rock matrix, this discontinuity must have occurred after the base strata were formed
- One implication of all these laws is that the earth was not created in one moment

1812 - Properties of Minerals

Student Goals - In this Core Geology chapter the students will learn:

- Minerals have played a dramatic role in the rise and fall of civilizations since humanity moved out of the Stone Age
 - Two of the most significant developmental time periods of humanity are called the Bronze Age and the Iron Age
- Minerals are the product of geological processes
- Minerals are naturally occurring solids with a distinct chemical composition and a crystalline structure
- In 1812, German mineralogist Frederick Moh proposed his famous system of mineral classification based on the hardness of each mineral, known as Moh's Hardness Scale
- Minerals have other distinguishing properties, including luster, color and fluorescence
- The primary way of distinguishing minerals is by their chemical composition

1830 – Geology Occurs by Natural Processes

Student Goals - In this Core Geology chapter the students will learn:

- How the earth's physical features were produced overtime
- How old the earth is

1833 - The Three Types of Rocks – Igneous, Sedimentary and Metamorphic

Student Goals - In this Core Geology chapter the students will learn:

- The earth's surface was formed by processes that are still occurring today – volcanism, mountain building and erosion
- During the rock cycle, rocks are constantly being formed, destroyed and reformed in endless cycles that started when the earth's crust solidified approximately four billion

- years ago
- There are three basic rock types – igneous, sedimentary, metamorphic
 - Igneous rock occurs when molten lava, under intense heat and pressure from the earth's core, rises up from the magma layer
 - Sedimentary rocks are formed at the earth's surface either in water as particulates and dissolved minerals settling to the bottom, or on land as particles that consolidate over great stretches of time
 - Metamorphic rock is igneous or sedimentary rocks that have been exposed to such intense heat and pressure that they're completely changed chemically

1837 - A Past Ice Age is Theorized

Student Goals - In this Core Geology chapter the students will learn:

- That the earth has experienced many ice ages
- How greenhouse gases can affect the global climate
- How changes in the earth's orbit and spin on its axis may produce the ice ages

1907 - Radioactive Decay is Used to Date the Earth

Student Goals - In this Core Geology chapter the students will learn:

- What radioactivity's half-life is
- That radioactive decay can be used to date rocks and the earth
- What cosmic rays are
- What carbon 14 dating is

1912 – Alfred Wegener Proposes Continental Drift Theory

Student Goals - In this Core Geology chapter the students will learn:

- That the continents moved over time
- How continental drift and plate tectonics explained the occurrence of earthquakes, volcanoes and mountain building
- What Pangaea is
- What the layers of the earth are

1972 - Ancient Life and the Fossil Record

Student Goals - In this Core Geology chapter the students will learn:

- In 1796 French naturalist George Cuvier theorized that life on the planet had a long history, marked by change and extinction of species
- Cuvier realized that fossils of both animals and plants, found in rocks, were a partial record of this ancient life as it changed through time
- Fossilization can occur in a number of ways
 - The most common is when the organism becomes buried and the original material is dissolved away leaving a mold. The mold is then filled with some type material and a cast of the original organism is created
 - Petrification occurs when the original molecules of the organism are replaced by some other molecules such as silica.
 - Sometimes, the original material of an organism is preserved

- Charles Darwin suggested a slow continuous process of one species replacing another
- Niles Eldredge and Stephen Jay Gould theorized from the fossil record that speciation occurred suddenly, with the daughter species not necessarily replacing the mother species; they called this new idea - punctuated equilibrium

Answers to Blackline Master 1A Quiz

1-c; 2-b; 3-a; 4-b; 5-c; 6-b; 7-a; 8-a; 9-b; 10-d; 11-a; 12-a; 13 b&c; 14-b; 15-b&d; 16-a; 17-d; 18-a