

STUDY GUIDE & WORKBOOK

THE GEOLOGY BOOK



DR. JOHN D. MORRIS

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GEOLOGY
BOOK

**STUDY GUIDE
& WORKBOOK**



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For more information, write:
Answers in Genesis, PO Box 510, Hebron, KY 41048

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1

Planet Earth

Text: Pages 4–10

Scripture: Genesis 1:1–31; Genesis 3:17–21; Romans 6:23; Romans 8:22

Questions

1. What is the difference between “origins” and “operational” science? (See www.AnswersInGenesis.org/science for information.)
2. There are two ways of thinking about the unobserved past. What are they?

3. Where is the true history of the earth found?
4. In what order did God create the heaven and earth? (e.g., describe what He created on Day 1, Day 2, etc.)
5. What are some “not so good” things that were not part of the original creation?
6. Write a short paragraph answering the question, “What is sin?”
7. There are nine planets circling the sun. Name them in order starting with the one closest to the sun.

8. List five things that confirm that the earth was designed for life by a wise and powerful God.
9. What are the main “zones” into which the earth is divided?
10. What is the earth’s crust composed of? What are the two categories into which it is divided?
11. What is the purpose of the earth’s atmosphere?

Terms to define

Principle of uniformity

Principle of catastrophe

Asthenosphere

Basaltic rock

Sedimentary rock

Activity

Throughout the text, two views of earth history will be compared. Keep a chart of the comparisons. (See page 4.)

2

The Ground We Stand Upon

Text: Pages 10–19

Scripture: Genesis 1:1; Obadiah 1:3

Questions

1. This chapter lists three categories of rock, with each category containing a discussion on several types of rock. Draw an expanded version of the table on the next page.
 - a. In the first column, list each type of rock mentioned in this chapter.
 - b. In the second column, list the category under which the rock is found.
 - c. In the third column, describe the composition of each rock type.
 - d. In the fourth column, describe how the rock is formed.

- e. In the fifth column, make a list of where the rock is found today.
- f. Watch out for types within types!

(We've done the first one for you!)

Type	Category	Composition	Formation	Found
Granite	Igneous	Quartz and feldspar with mica and hornblende	Formed when molten rock is cooled	Mountains Upper mantle

Terms to define

Ryolite

Obsidian

Sedimentary rocks

Ripple marks

Crossbed

Concretions

Metamorphism

Activity

Start collecting stones/small rocks from around your area (or other areas to which you travel). Try to classify the type of rock you have found. Can you find samples of each rock you described in the above table?

Note: If you go to a National/State/local park, please ask permission to remove the stones/rocks you are collecting. Do not remove any rocks or stones from someone's garden without permission.

3

The Earth's Surface

Text: Pages 20–27

Scripture: Genesis 8:4; Psalm 121

Questions

1. Give a brief description of the seven kinds of plains discussed in this chapter.

2. Three types of plateaus are mentioned. Write a short description of each type and give an example of each type.

3. Write a short description of how mountains are formed, and give an example of each type.

4. Name two erosional features. Write a brief description of each type.

Terms to define

Sediment

Alluvial sediment

Continental shield

Canyon

Activity

This “experiment” will take a few weeks. Erect a mound of dirt in your backyard (pile of dirt should be at least three feet high). Visit the mound each day and record the following information: height of mound, width of mound. You will notice that the mound will get shorter and the base wider. Determine what could have caused the difference in height and width. Was it the wind? Was it rain? Was it a dry-spell? etc. Have fun with this.

4

Erosion/Deposition

Text: Pages 28–35

Scripture: Genesis 8

Questions

1. List and describe the five main causes of erosion. How many types of erosion can you observe happening around where you live?

2. Research various large hurricanes that have happened in the past few years. How much damage did each one do?
3. Describe the rapid erosive processes (three are discussed).
4. What is a “delta”?
5. How is a turbidite formed?
6. What causes a tidal wave (tsunami)?

Terms to define

Law of disintegration

decomposition

cavitation

kolk

turbidite

sedimentation

Activity

This is week 2 of the experiment started in the last lesson.
Has your mound decreased any? What caused this decrease?

5

Sediments/Fossilization

Text: Pages 36–41

Scripture: Genesis 7, 8

Questions

1. Sand is made primarily of what mineral?
2. Write a paragraph describing how sedimentary rocks are formed.
3. What conditions are required to form a fossil?

4. Name four different types of fossils.

5. In your own words write a description of how dinosaur fossils were formed.

Terms to define

Compaction

Cementation

Petrification

Gastrolith

Coprolite

Activities

NOTE: This week's activities reinforce the fact that fossils and petrified wood can be made over a short period of time.

- Make a “fossil,” using plaster of paris. Mix the plaster of paris and pour it onto a paper plate. Gather different objects (leaves, toy dinosaurs, etc.). Press each into the plaster of paris and then lift the object off. Include a print of your hand or foot. Let dry. Paint when dry, if desired.
- This is week 3 of the experiment started in Lesson 3. Has your mound decreased any? What caused this decrease?

6

Volcanism / Deformation of Rocks / Continents

Text: Pages 42–48

Scripture: Genesis 7, 8

Questions

1. At least two ways that volcanoes erupt are discussed in the text. What are they?
2. When forces in the earth's crust build up to a breaking point along a fault, the sections move in one of three ways. What are they? Write a short description of each type.

3. What factors influence whether a rock will “bend” or “break”?
4. Write a short paper on continental separation using just the facts given in the text. (Older students should use other materials as well as those in the text—see www.AnswersInGenesis.org/tectonics.)

Terms to define

Fumaroles

Geyser

Fault

Metamorphism

Activities

1. You might want to do a more in-depth study of volcanoes. Research some of the more famous volcanoes that have erupted in the past. When did they erupt? How devastating to the surrounding areas were they? What types of devastation did they cause? How often do these volcanoes erupt? How long do the eruptions last? (For additional information, visit www.AnswersInGenesis.org and search for “volcano.”)
2. This is week 4 of this experiment started in Lesson 3. Has your mound decreased any? What caused this decrease?

7

Metamorphism / Radioisotope Decay

Text: Pages 48–53

Scripture: Psalm 18

Questions

1. In your own words, describe the different ways metamorphic rocks are thought to form.

2. What are unstable atoms called? What is the most well-known radioactive atom?

3. Why can't the process of carbon-dating be used to date most fossils?
4. What is the difference between a parent isotope and a daughter isotope?
5. What are three assumptions made when using radiometric dating to give an age of a rock?

NOTE: For more information on this topic, see www.AnswersInGenesis.org/dating.

Terms to define

Isotope

Heavy radioactive atoms

Radioisotope dating

8

Ways to Date the Entire Earth

Text: Pages 54–57

Scripture: Psalm 18

Questions

1. What does measuring the chemicals in the ocean tell us about the age of the earth?
2. What does measuring the total volume of the continents and the rate of sediment erosion tell us about the age of the earth?
3. What does the amount of helium in the atmosphere tell us about the age of the earth?

4. What does the rate of decline in the earth's magnetic field tell us about the age of the earth?
5. What conclusion can be drawn about the age of the earth from the various dating methods discussed in this chapter?

NOTE: Be sure to read the picture captions! See www.AnswersInGenesis.org/young for additional information.

Terms to define

Magnetic field

Sediment

Activity

This is a simple experiment to study wind erosion. Stick a piece of two-sided tape on one side of several different stirring paddles (you can get these from a paint store) and place them in the ground in various places around your home. Make sure they don't all face in one direction. Have one face north, another south, etc. At regular intervals check the amount of dust or soil sticking to the tape. Depending on the amount of wind and the direction from which it blows, you will see that some paddles collect more dust than other paddles. More soil will stick to the paddles where wind erosion is taking place. What is in the way that is preventing dirt from sticking to those paddles where little is collected?

9

Great Geologic Events of the Past

Text: Pages 58–68

Scripture: Genesis 1–11; Romans 6:23

Questions

1. What four events have had the greatest impact in shaping Earth's geology?
2. How did the creation event affect the earth's geology?

3. Although the book states, “It may not have rained then as it does now, but a heavy dew watered the plants,” and discusses a “dense cloud of water vapor,” see the section on the “canopy theory” at www.AnswersInGenesis.org/dont_use for updated information.

4. Although the book indicates that the Second Law of Thermodynamics began at the Fall, consider this:

The Second Law of Thermodynamics says that the entropy (disorder) of the Universe increases over time, and some have thought that this was the result of the Curse. However, disorder isn't always harmful. An obvious example is digestion, breaking down large complex food molecules into their simple building blocks. Another is friction, which turns ordered mechanical energy into disordered heat. Otherwise Adam and Eve would have slipped as they walked with God in Eden! A less obvious example to laymen might be the sun heating the earth. To a physical chemist, heat transfer from a hot object to a cold one is the classic case of the Second Law in action. Also, breathing is based on another classic Second Law process, that is, gas moving from a high pressure to low pressure. Finally, all beneficial processes in the world, including the development from embryo to adult, increase the overall disorder of the universe, showing that the Second Law is not inherently a curse.

Death and suffering of nephesh animals before sin are contrary to the biblical framework, as are suffering (or groaning in travail (Rom. 8:20–22)). It is more likely that God withdrew some of His sustaining power (Col. 1:15–17) at the Fall so that the decay effect of the Second Law was no longer countered.

5. What role has the Fall played in shaping today's Earth? (See also www.AnswersInGenesis.org/curse.)
6. What was the cause of the global Flood? What were the geological results of the Flood?
7. Why do we find ocean fossils near the top of Mt. Everest?
8. What caused the Ice Age? (See also www.AnswersInGenesis.org/iceage.)
9. On a map, outline the extent of the ice covering at the peak of the Ice Age.

10. What happened to the mammoths? (See www.AnswersInGenesis.org/mammoth.)

Terms to define

Second law of science

Fountains of the deep

Glacier

10

Questions People Ask

Text: Pages 69–72

Questions

NOTE: This week's questions are the same as the questions in the text. We recommend reading the relevant articles at www.AnswersInGenesis.org/geology and www.AnswersInGenesis.org/Flood. After reading the text and additional information, students should answer the questions in their own words.

1. How was Grand Canyon formed?
2. What causes the geysers in Yellowstone Park?
3. How did Niagara Falls form?

4. Why are the Appalachian and Rocky Mountains so different?
5. How long does it take to form petrified wood?
6. How are stalactites and stalagmites formed?
7. How is coal formed?
8. How is natural gas formed?
9. How is oil formed?
10. Are dinosaur fossils the most abundant type of fossils?

Terms to define

Volcanism

Answer Key

Lesson 1

1. Operational science is the science that deals with repeatable, observable experiments in the present. Origins science deals with reconstructing events that have happened in the past. (See www.AnswersInGenesis.org/science for information.)
2. Uniformity (the present is the key to the past) and catastrophe (highly energetic events operated over short periods of time and did much geologic work rapidly)
3. In the Bible
4. Day 1: Earth, space, time, light; Day 2: Atmosphere; Day 3: dry land, plants; Day 4: sun, moon, stars, planets; Day 5: sea and flying creatures; Day 6: land animals, people
5. Death, disease, suffering, catastrophes, earthquakes, hurricanes
6. Sin can be defined as rebellion against God
7. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto
8. Accept reasonable answers: magnetic field shields the earth from harmful radiation from the sun; Earth is perfect distance from the sun; atmosphere provides air for breathing; Earth has liquid water, which is necessary for life; moon's gravity causes tides, which helps prevent the ocean water from becoming stagnant
9. Crust, mantle, outer core, inner core

10. Continental crust (composed of granitic rock covered by sedimentary rock); oceanic crust (composed primarily of basaltic rock)
11. Provides the air we breathe and protects us from harmful cosmic radiation

Lesson 2

1.

Type	Category	Composition	Formation	Found
Granite	Igneous	Quartz and feldspar with mica and hornblende	Formed when molten rock is cooled	Mountains Upper mantle
Rhyolite	Igneous	Quartz and feldspar with mica and hornblende	Formed when molten rock erupts on land and solidifies	Land
Obsidian	Igneous	Quartz and feldspar with mica and hornblende	Formed by the rapid cooling of lava as it flows in the surface of the ground	Land
Pumice	Igneous	Quartz and feldspar with mica and hornblende	Formed by eruptions on land—the cooling process forms air pockets in the rock	Land
Basalt	Igneous	Pyroxene, plagioclase feldspar	Solidified molten lava under water and on land	Oceanic crust, land
Shale	Clastic Sedimentary	Cemented particles of clay (and minor silt)	Formed from previously existing rocks which were eroded, transported and redeposited elsewhere	Mountains, land
Sandstone	Clastic Sedimentary	Quartz sand, particles big enough to be seen	Formed from previously existing rocks which were eroded, transported and redeposited elsewhere	Mountains, land

Conglomerate	Clastic Sedimentary	Pebble-size to boulder-size grains mixed with smaller sand or clay particles	Formed from previously existing rocks which were eroded, transported and redeposited elsewhere	Mountains, land
Limestone	Organic chemical sedimentary	Calcium carbonate from shells of sea creatures, reef fragments or limey secretions of sea creatures	Formed when water can no longer keep various chemicals dissolved within it	Sea floors, land
Diatomaceous earth	Organic chemical sedimentary	Collection of shells from diatoms or radiolarians and certain algae	Formed when water can no longer keep various chemicals dissolved within it	Land
Coal	Organic chemical sedimentary	Buried plant material	Formed when water can no longer keep various chemicals dissolved within it	Land
Limestone	Inorganic chemical sedimentary	Calcium carbonate derived from inorganic sources	Formed when water can no longer keep various chemicals dissolved within it	Caves, mineral springs, stalactites, stalagmites
Dolomite	Inorganic chemical sedimentary	Calcium carbonate with magnesium atoms	Formed when water can no longer keep various chemicals dissolved within it	Land
Evaporites	Inorganic chemical sedimentary	The remains of evaporated seawater	Some were formed when a huge volume of mineral-laden water came up through the ocean floor basalts and released its dissolved content when it hit the cold ocean waters	Land
Slate	Metamorphic	Shale	Shale subjected to heat and pressure	Land
Schist	Metamorphic	Shale	Slate that continues to undergo heat and pressure	Land

Gneiss	Metamorphic	Alternating bands of different minerals from other sedimentary or igneous rocks	Formed from other sedimentary or igneous rocks that have been subjected to heat and pressure	Land
Quartzite	Metamorphic	Quartz sandstone	Quartz sandstone that has been subjected to change	Land
Marble	Metamorphic	Limestone	Heat and pressure applied to limestone	Land

Lesson 3

- Low-lying: formed when moving water deposits sediment a few hundred feet above or below sea level
alluvial plain: sediments deposited when water slows down
coastal plain: flat areas upriver or uphill from an alluvial plain—may have been uplifted or sea level dropped since deposition
lake plains: deposits in a lake bed that are later exposed;
glacial plains: sediments deposited by ice melt on flat areas eroded by ice
lava plains: hardened leveled lava
offshore deposits: sediments distributed offshore by strong currents
- Fault: rock is broken and shoved up (Colorado Plateau); warped: regional squeezing or slow uplift (Appalachian mountains); lava: hardened lava plains that may have been uplifted or hardened at the current level (Columbia River basalts)
- Folded: layers of sediments that have been crumpled by pressures from the side (Alps, Himalayas, Appalachians, Rocky Mountains); Domed: sediments pushed up from

below (Black Hills of South Dakota); fault block: one area of sediments are pushed up (Grand Teton Mountains); volcanic: molten lavas pushed out to the surface of the earth (Hawaii's volcanic islands, Mount Rainier, Mount St. Helens, Mount Ararat)

4. Canyons: streams and rivers carve out areas in rocks; continental shield: the exposed granite core of continents due to glacial flow scraping off the overlying sedimentary rock

Lesson 4

1. Rain, ice, plants and animals, chemicals, ocean waves
2. Formulate your own response.
3. Cavitation occurs when tiny bubbles in moving water explode inwardly; plucking is where rocks are picked up by moving water; kolk is like an under-water tornado that breaks up rock.
4. Slowing water from a river into a larger body of water deposits its sediments onto the sea floor.
5. First, an event such as an earthquake starts a mud flow underwater. Next the mud flow spreads out. Eventually the mud flow hardens into a layer of rock.
6. An underwater earthquake or volcanic eruption causes a shock wave of energy to race through the water. As the wave nears the shoreline, it becomes a wall of water which slams into the shoreline.

Lesson 5

1. Silica
2. See page 37.
3. The organism must be buried rapidly, protected from

scavengers and from decomposition by bacteria and chemicals.

4. Hard parts are preserved; replacement by other minerals; cast or mold are all that remains; petrification; carbonization; preservation of soft parts; frozen animals; animal tracks and worm burrows; coprolites; gastroliths
5. See page 41.

Lesson 6

1. Some volcanoes erupt by just spilling lava out from their top; others explode out of their top.
2. See pages 44, 45.
3. Whether it is soft or brittle, how deep it is buried
4. Allow students to respond.

Lesson 7

1. Heat and pressure recrystallize the minerals in rock into new mineral combinations. Some believe it happened over long periods of time; others believe it happened over short periods of time.
2. Radioactive; uranium
3. The fossil must have once been living and must still contain carbon.
4. The daughter isotope is formed from the decay of the parent isotope.
5. Rate of decay has not changed; system has been closed from the beginning; there was no daughter material present in the beginning

Lesson 8

1. Technically, measuring the chemicals doesn't tell us anything about the age of the earth—it just tells us how much of each chemical is present in today's oceans. However, we can attempt to figure out how old the oceans are by assuming various things. Some studies indicate that the oceans can't be older than 62 millions years.
2. Again, the actual measuring doesn't tell us anything about the age of the earth. When we begin assuming things about the past, we can try to estimate how old the continents are based on present-day measurements (no older than 15 million years).
3. See above answers—that the atmosphere can't be older than 2 million years.
4. Measuring the rate of decline in the magnetic field simply tells us how much it has declined within the measured time period. However, we can extrapolate back in time and suggest that 10,000 years ago the magnetic field would have been too strong for life to exist.
5. A majority of methods used to age-date the earth yield ages far less than the acclaimed billions of years.

Lesson 9

1. Creation, the Fall, Flood, Ice Age
2. Formed the cores of the continents, some erosion and deposition probably happened
5. Because God withdrew some of His sustaining power at the time of the Fall, this has allowed for various “natural” disasters to happen which affect the earth's geology—earthquakes, floods, etc. Everything is wearing down and deteriorating.

6. God sent the Flood as a judgment on the wickedness of mankind. The Flood formed many of the rock and fossil layers. See pages 63-66 for more details.
7. The top of Mount Everest was once underwater and was later pushed up after the Flood waters receded.
8. The warm ocean waters rapidly evaporated and condensed over the colder continents, causing a buildup of ice and snow. See page 67 for more detailed information.
10. Many of the mammoths were probably killed when wind-blown sediments covered them at the end of the Ice Age.

Lesson 10

1. For the answers to the questions in this chapter, see the text.

Whether jutting skyward or languishing in the murky depths of the deep, rocks and sediments hold our planet together. Dr. John Morris takes the reader on a tour of the earth's crust, pointing out both the natural beauty and the scientific evidences for creation.

This study guide takes you through each main idea of the *Geology Book*, which includes the following topics:

- What really carved Grand Canyon.
- Why the earth is unique for life.
- Fossilization and the age of the dinosaurs.
- The powerful effects of volcanic activity.
- Radioisotope and carbon dating.

THIS STUDY GUIDE is a great tool for small group study and home school. Use the time-tested method of filling in answers as you read for greater comprehension and retention.

Use this book to be better prepared to defend and proclaim the authority and relevance of God's Word.

ABOUT THE AUTHOR

Dr. John D. Morris, president of the Institute for Creation Research (ICR), holds a B.S. in civil engineering from Virginia Polytechnic Institute and a M.S. and Ph.D. in geological engineering from the University of Oklahoma. He served as a research assistant from 1978–1980 and taught geological engineering from 1980–1984 at Oklahoma University.

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