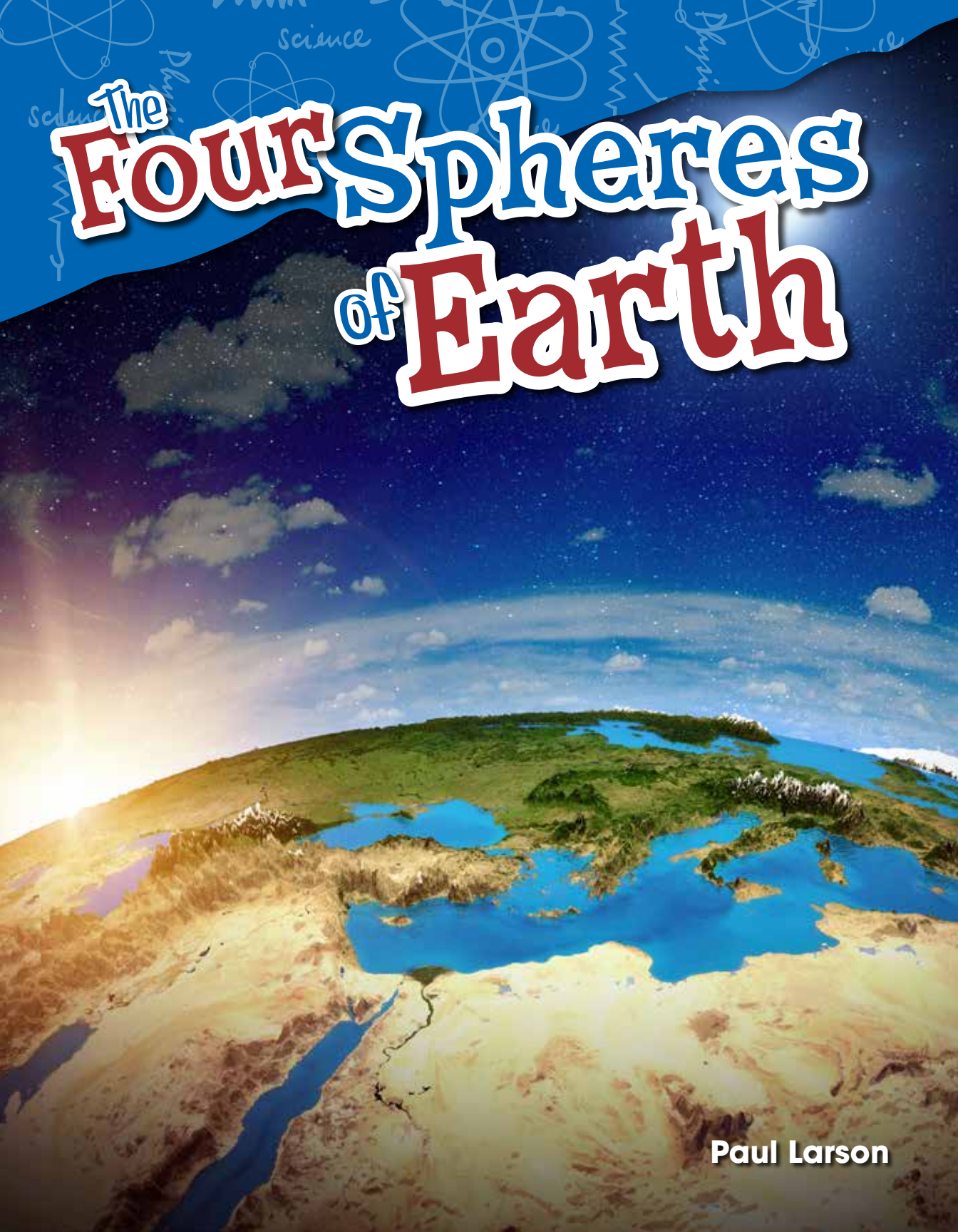
The Four Spheres of Earth



Paul Larson

For teachers' inspection ONLY

Table of Contents

Big Blue Marble 4

Geosphere 5

Hydrosphere 12

Atmosphere 20

Biosphere 25

Planet Home 27

Think Like a Scientist 28

Glossary 30

Index 31

Your Turn 32

For teachers' inspection ONLY

Big Blue Marble

"The Earth's a Big Blue Marble
When you see it from out there
The sun and moon declare
Our beauty's very rare …"

—from the *Big Blue Marble* theme song

On December 7, 1972, from out in space, astronauts on the *Apollo 17* mission to the moon took a photo of Earth. To them, Earth looked like a "big blue marble." That name has been with the image ever since.

This beautiful blue sphere tells many stories. Four of those stories will be shared here. They are stories of Earth's four spheres. The four spheres of Earth are the **geosphere**, **hydrosphere**, **atmosphere**, and **biosphere**. Each one paints a unique picture of our home.

Geo- means "Earth."

Mixing Spheres

Even though each sphere is unique, it can sometimes be hard to tell one from the other. There is water inside Earth. If you pick up a clump of mud, is it part of the geosphere or the hydrosphere?

Geosphere

Scientists think of the geosphere as the part of Earth that includes its interior, rocks and minerals, landforms, and the processes that shape Earth's surface. Let's take a look at Earth from the outside in. That means looking at the layers of Earth.

A Quick Tutorial

Here is a simple breakdown to remember Earth's four spheres.



geosphere: land



hydrosphere: water



atmosphere: air



biosphere: life

For teachers' inspection only

For teachers' inspection ONLY

Layers of Earth

Even though Earth looks like a big blue marble, it is rugged and covered with pinnacles and valleys. These range from the peak of Mt. Everest to the deepest canyons of the Mariana Trench.

Like a giant jawbreaker, Earth is made of several layers. One layer is the lithosphere. It encompasses the hard, rocky **crust** and the outer layer of the **mantle**. The lithosphere is made up of rocks and minerals.

Beneath the lithosphere lie several more layers. They are the rest of the mantle, the outer core, and the inner core. These layers are hot!

One layer of the mantle is the asthenosphere. It is thick and sticky. It is somewhere between a solid and a liquid. Scientists think that Earth's **magma** resides here.

The outer core is made up of superheated liquid rock. Because it's below Earth's surface, it's hard for scientists to know what it looks like. They think this layer is mostly melted iron and nickel. These metals affect Earth's magnetic field.

Earth's inner core is about 1,200 kilometers (745 miles) thick. At about 5,000° Celsius (9,032° Fahrenheit), it's Earth's most scorching layer. Because of the large amount of pressure, the inner core is solid.

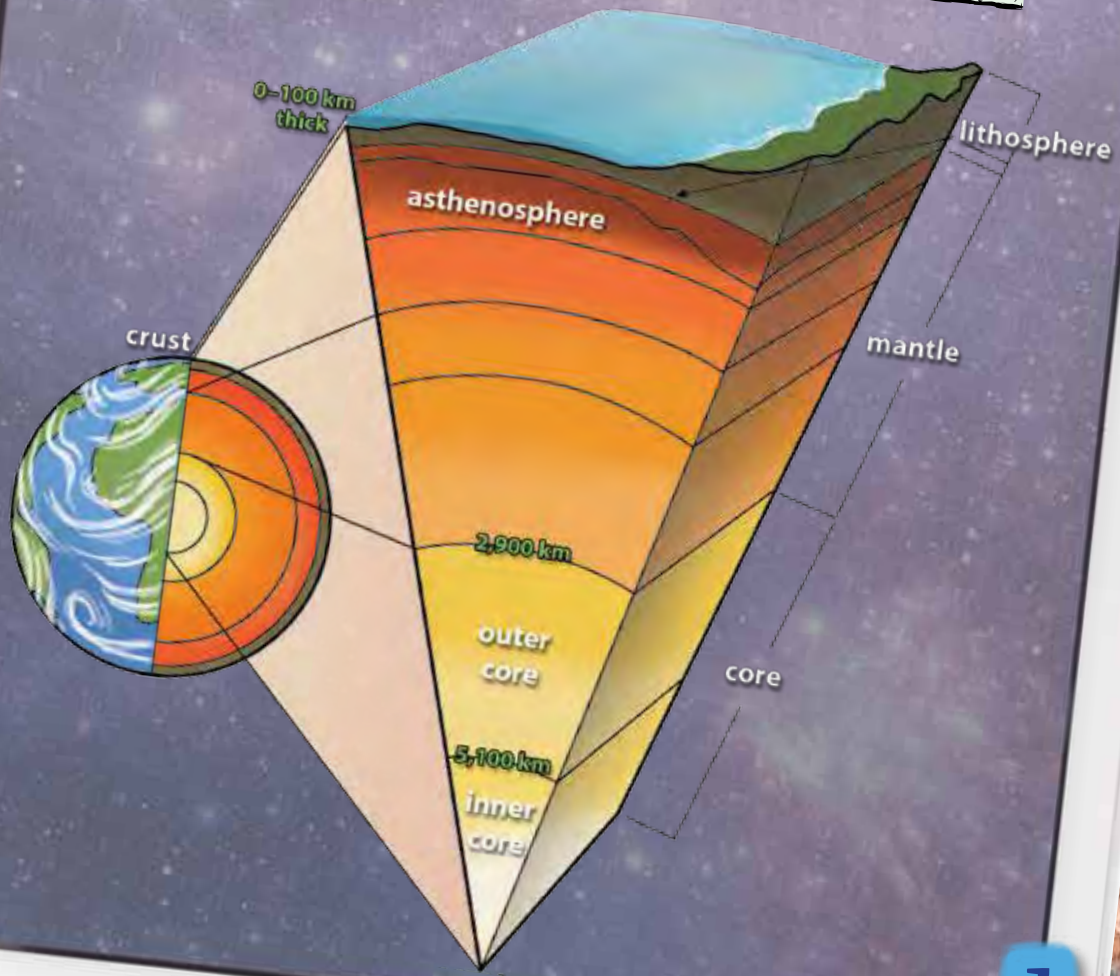


For teachers' inspection ONLY

Different Dynamics

Check out the chart below to learn more about the layers of Earth.

Layer	Temperature	Thickness	Description
crust	0°C (32°F)	5 km (3 mi.)	hard, rocky
mantle	1,000°C (1,832°F)	2,900 km (1,800 mi.)	hot, semi-solid rock
outer core	3,700°C (6,692°F)	2,300 km (1,430 mi.)	liquid iron and nickel
inner core	4,300°C (7,772°F)	1,200 km (745 mi.)	solid iron and nickel



For teachers' inspection ONLY

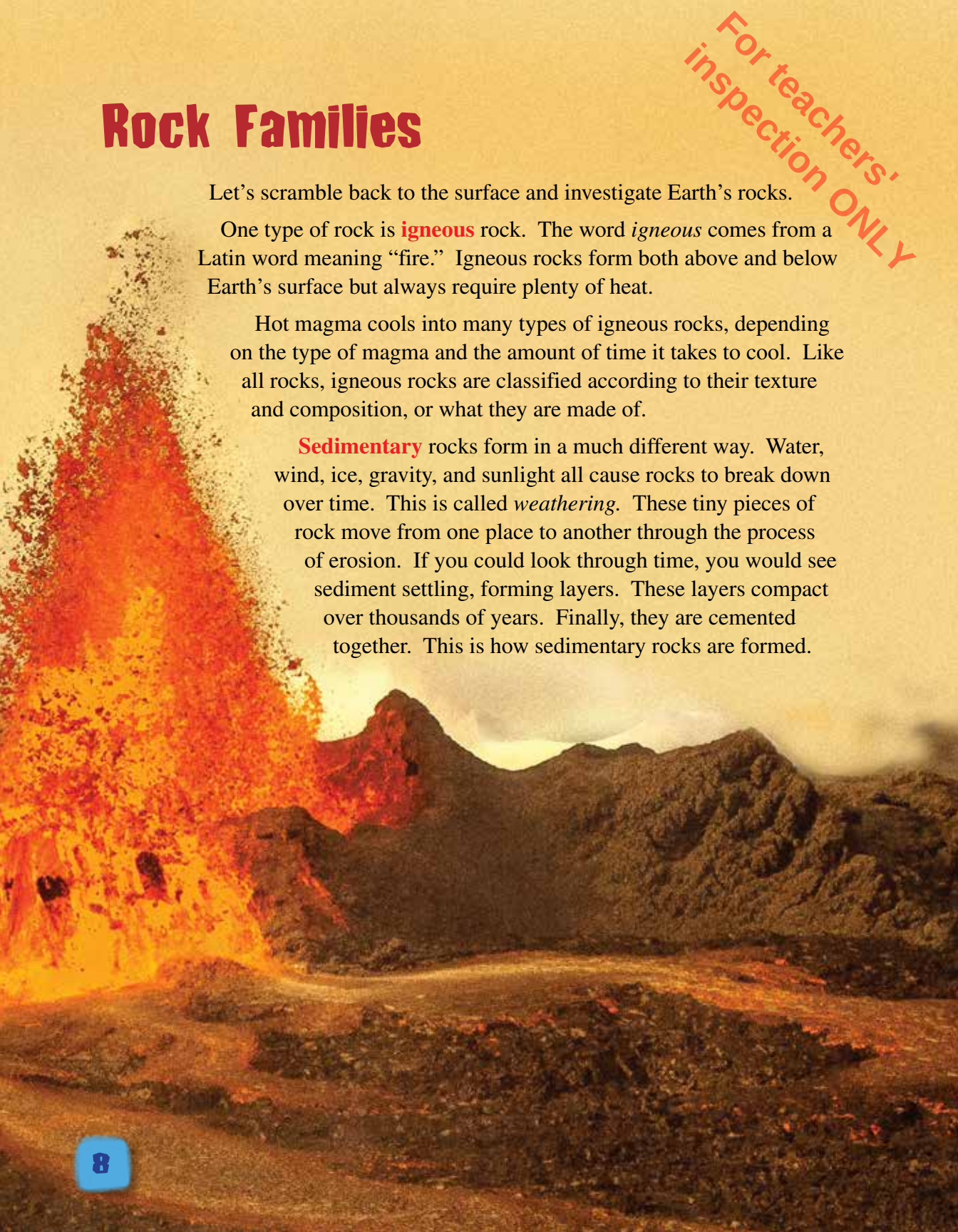
Rock Families

Let's scramble back to the surface and investigate Earth's rocks.

One type of rock is **igneous** rock. The word *igneous* comes from a Latin word meaning "fire." Igneous rocks form both above and below Earth's surface but always require plenty of heat.

Hot magma cools into many types of igneous rocks, depending on the type of magma and the amount of time it takes to cool. Like all rocks, igneous rocks are classified according to their texture and composition, or what they are made of.

Sedimentary rocks form in a much different way. Water, wind, ice, gravity, and sunlight all cause rocks to break down over time. This is called *weathering*. These tiny pieces of rock move from one place to another through the process of erosion. If you could look through time, you would see sediment settling, forming layers. These layers compact over thousands of years. Finally, they are cemented together. This is how sedimentary rocks are formed.



For teachers' inspection ONLY

Obsidian

Obsidian is an igneous rock that has a smooth, hard texture and no grains or crystalline structure. Because of the way it breaks and fractures, obsidian has been used for centuries to make hunting and cutting tools.



Bryce Canyon

The erosion of limestone and sandstone at Bryce Canyon National Park in Utah has created a forest of canyons, ridges, and hoodoos, which are tall, stone spires. It's almost as if you are looking at a cave with its top cut off!

For teachers' inspection ONLY

Think Like a Scientist

How does Earth's atmosphere affect the other spheres? Experiment and find out!

What to Get

- dirt
- plastic tray
- small handheld fan
- small pieces of grass
- spray bottle
- water

