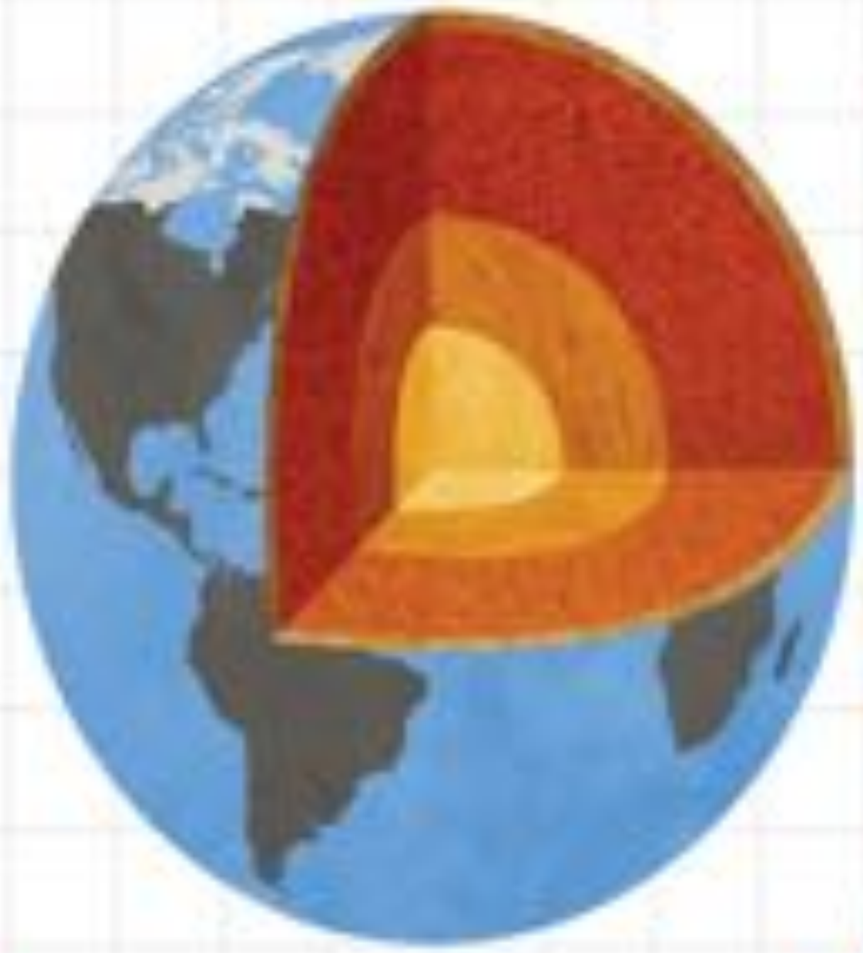
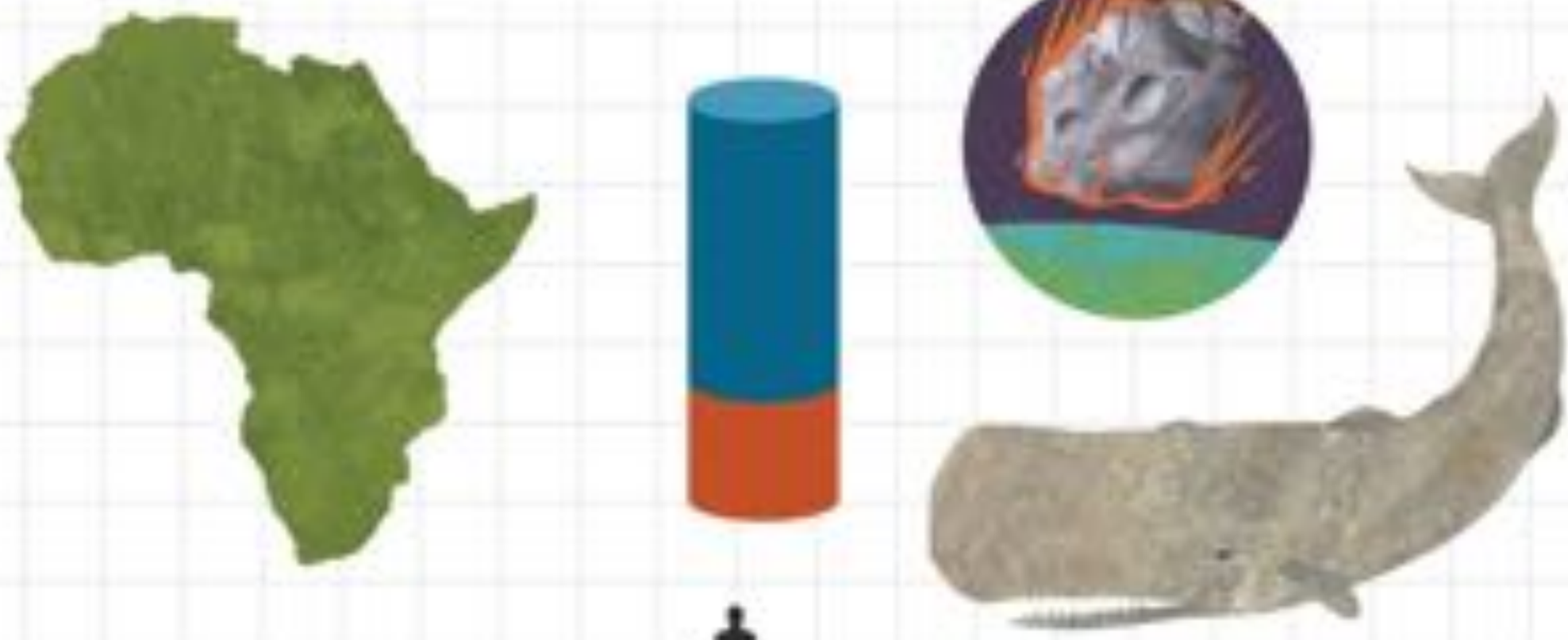
A BOOK OF INFOGRAPHICS



EARTH

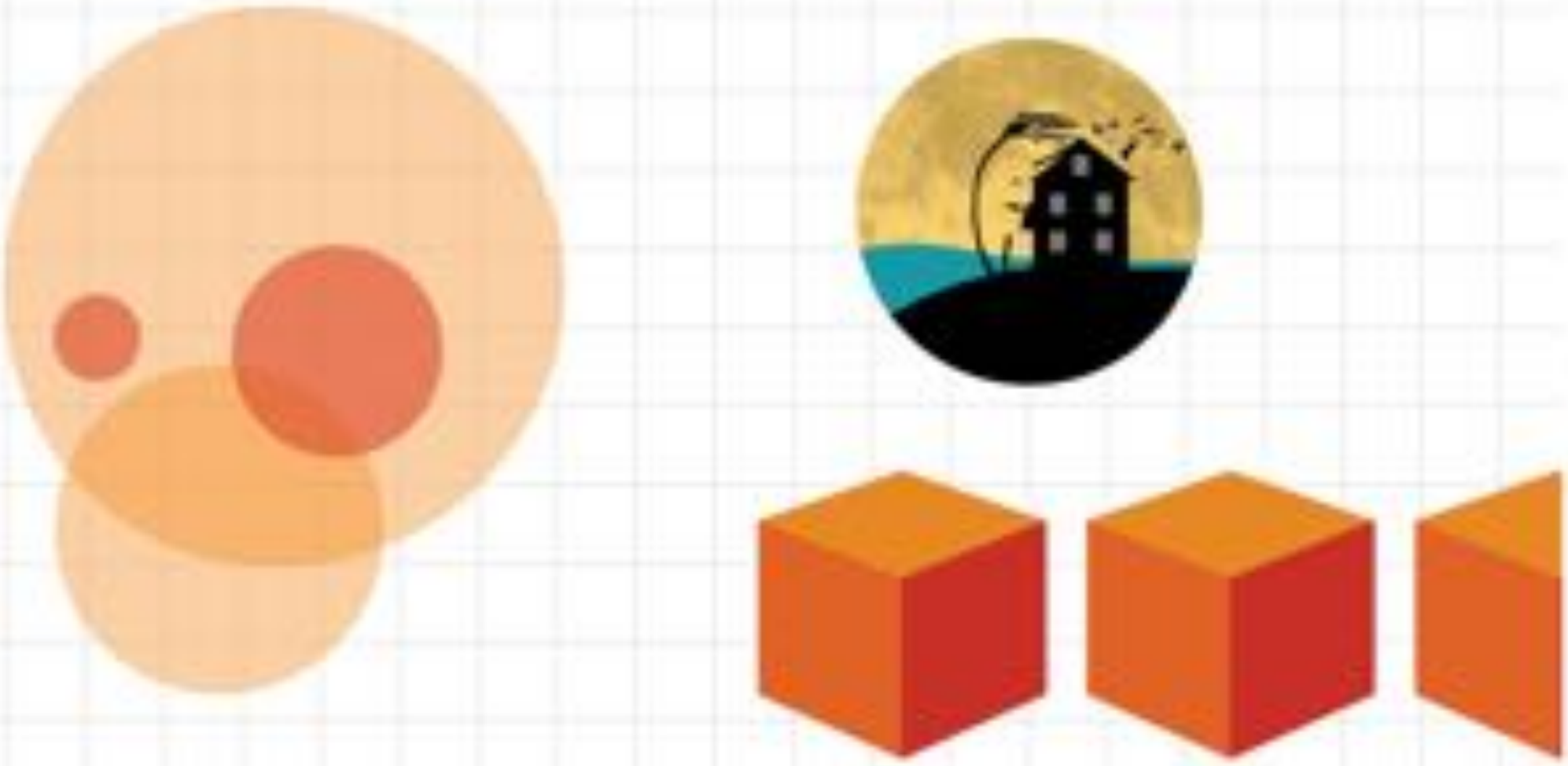
BY THE NUMBERS

A BOOK OF INFOGRAPHICS



EARTH

BY THE NUMBERS



STEVE JENKINS

HOUGHTON MIFFLIN HARCOURT • BOSTON • NEW YORK

Contents

From space, the earth looks like a smooth blue ball. Move closer, and you'll see towering mountain peaks and rugged canyons. There are deep, dark seas, vast deserts, and huge flowing sheets of ice.

The earth is constantly changing. Over millions of years, mountains rise, rivers change course, and continents collide. Other things happen much more quickly. In the blink of an eye, hurricanes, earthquakes, and volcanoes change the earth in dramatic ways.

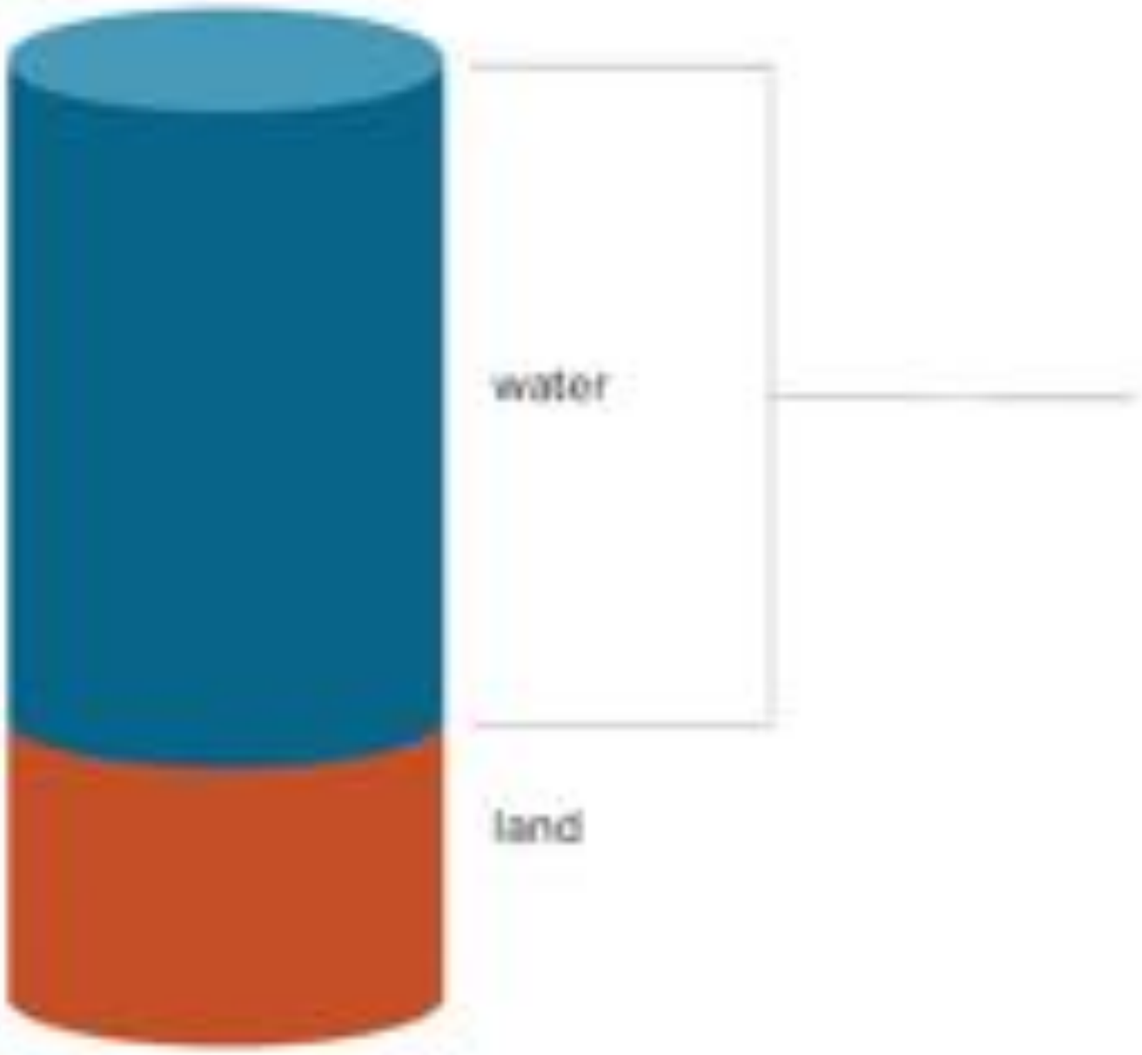
This book uses infographics—illustrations, charts, graphs, and diagrams—to help us understand some of the forces that shape our planet.

* *Words in blue can be found in the glossary on page 38.*

The earth's surface

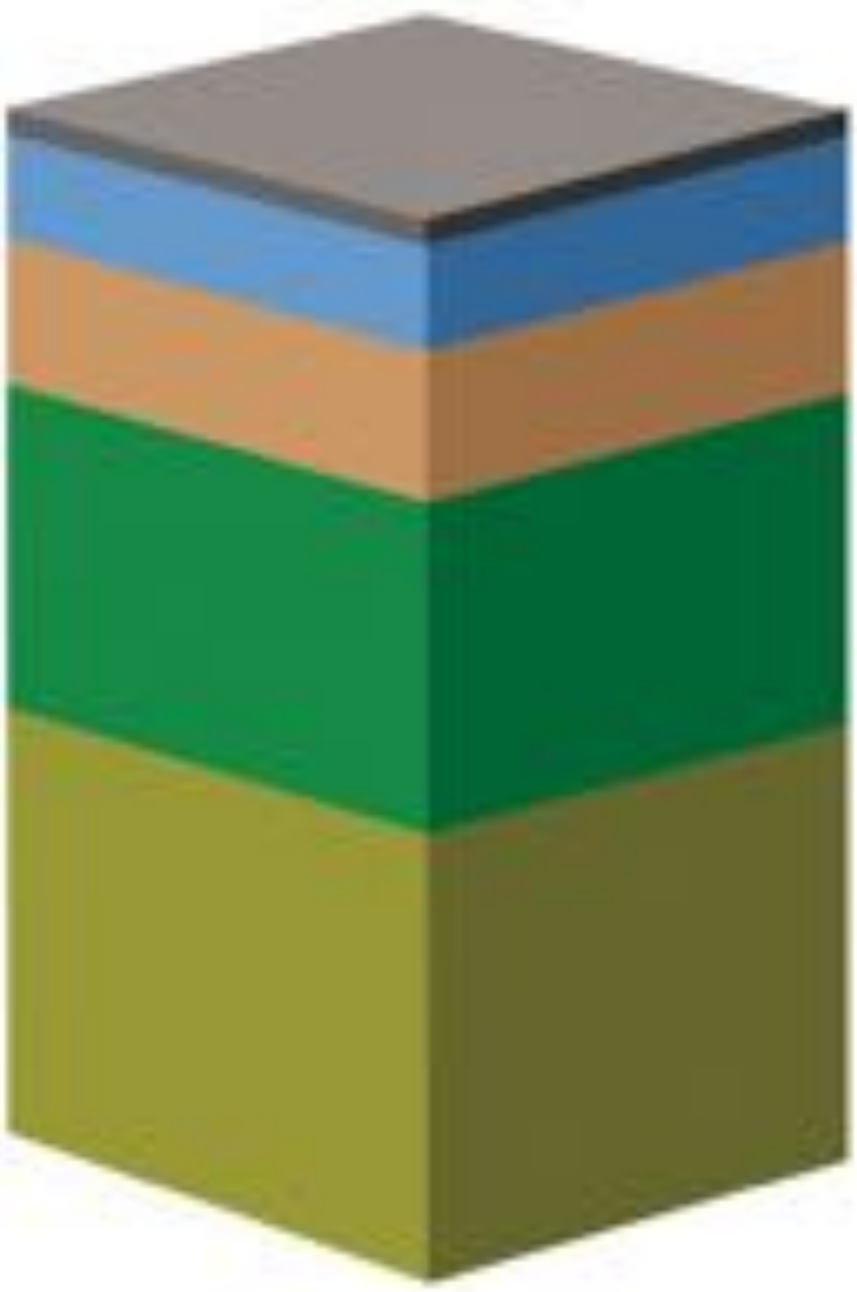
water

More than two-thirds of our planet's surface is covered by water.



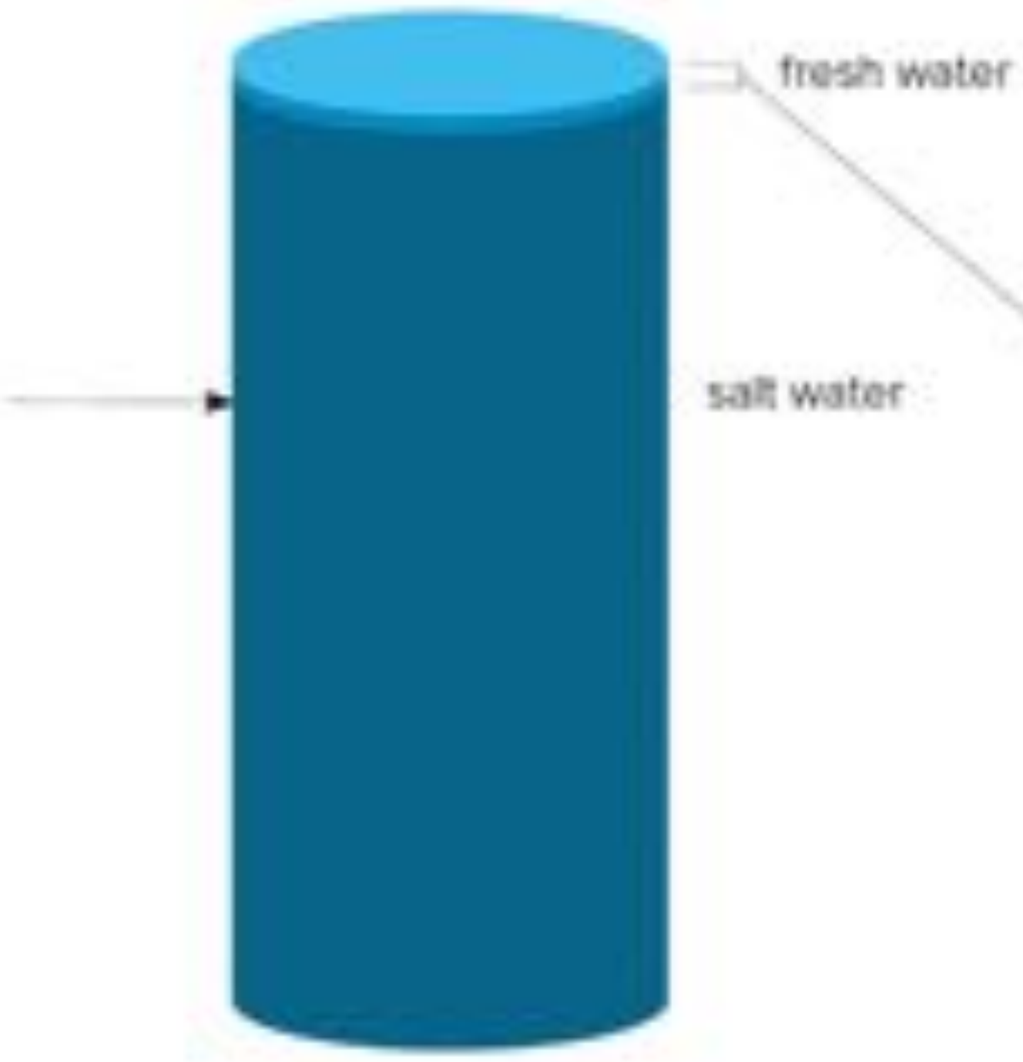
land

Human settlements cover only a small fraction of the earth's land.

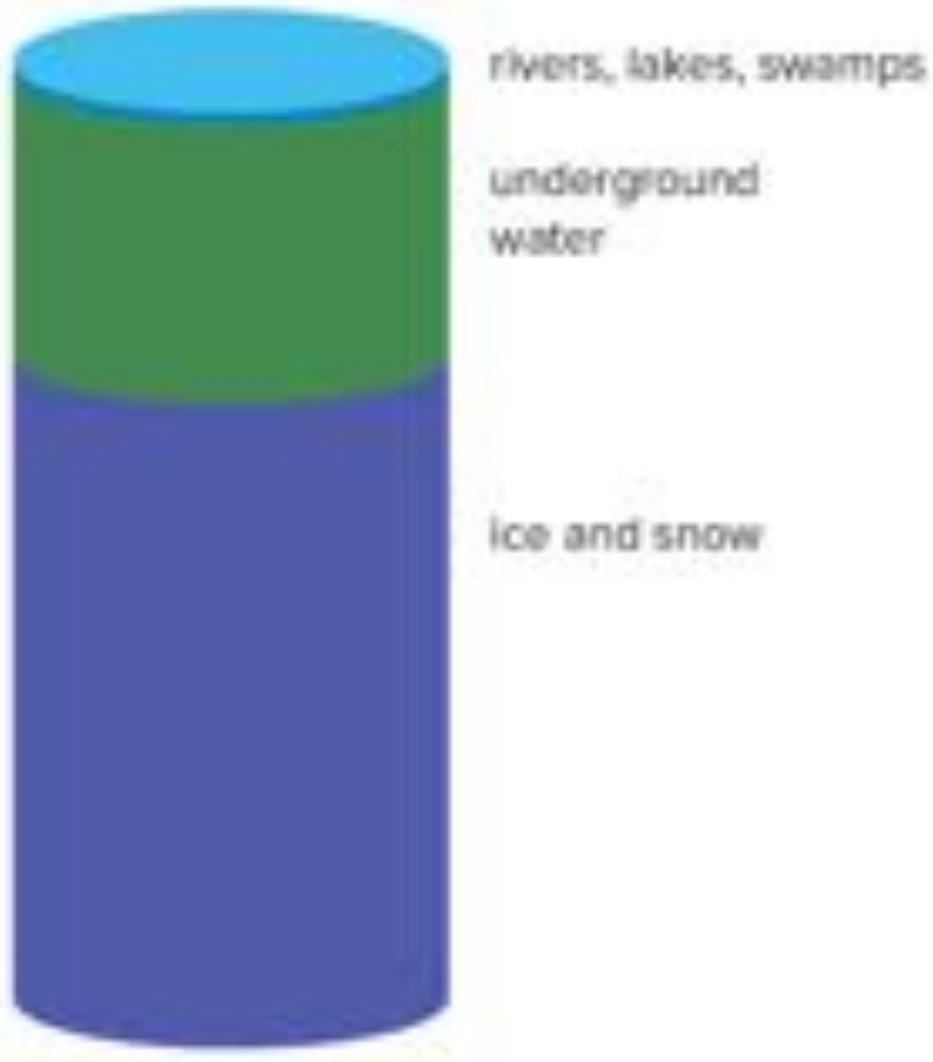


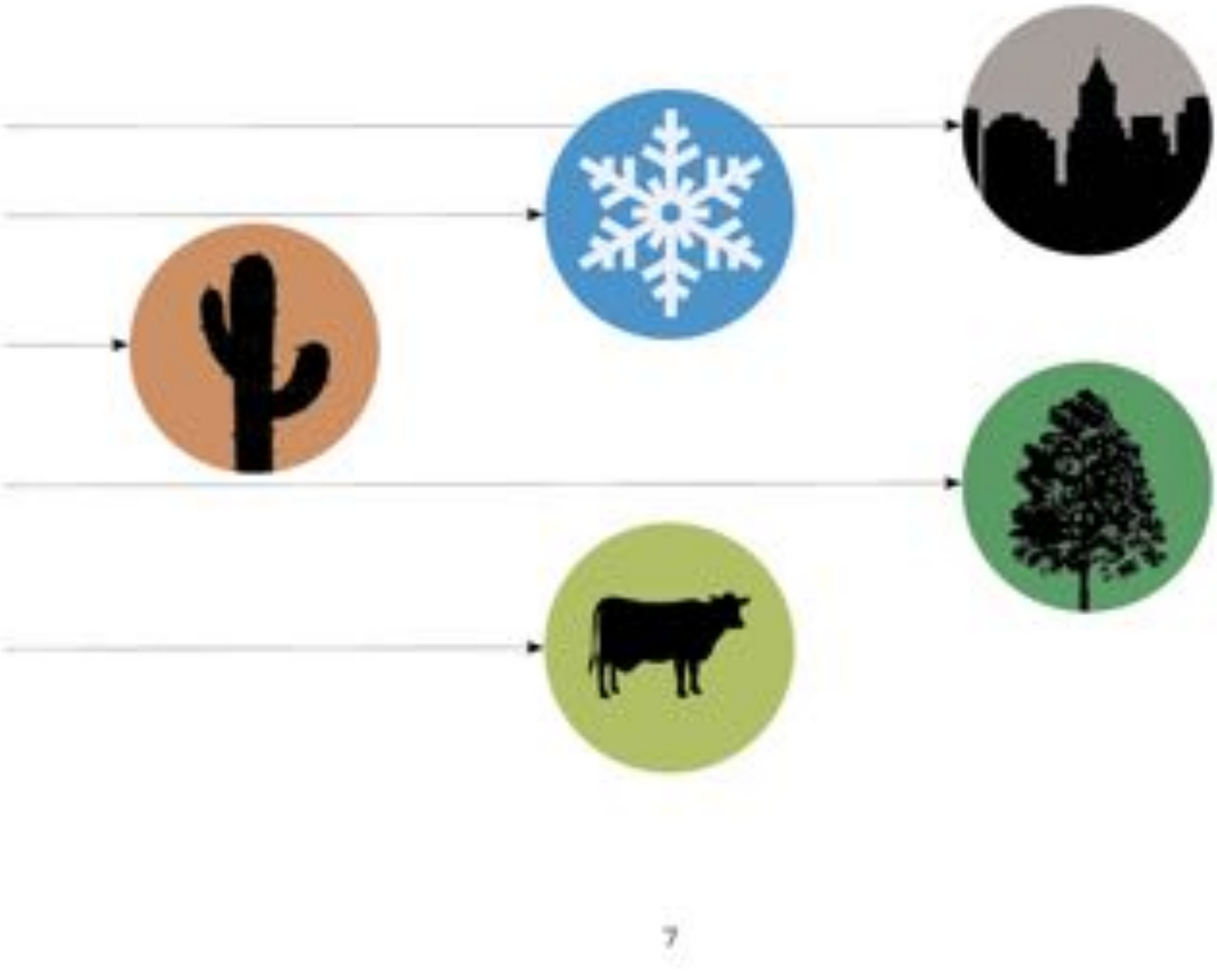
The thickness of the color bands shows how much of the land's surface is taken up by each environment.

But most of the earth's water is salty.



And most of earth's fresh water is underground or frozen.





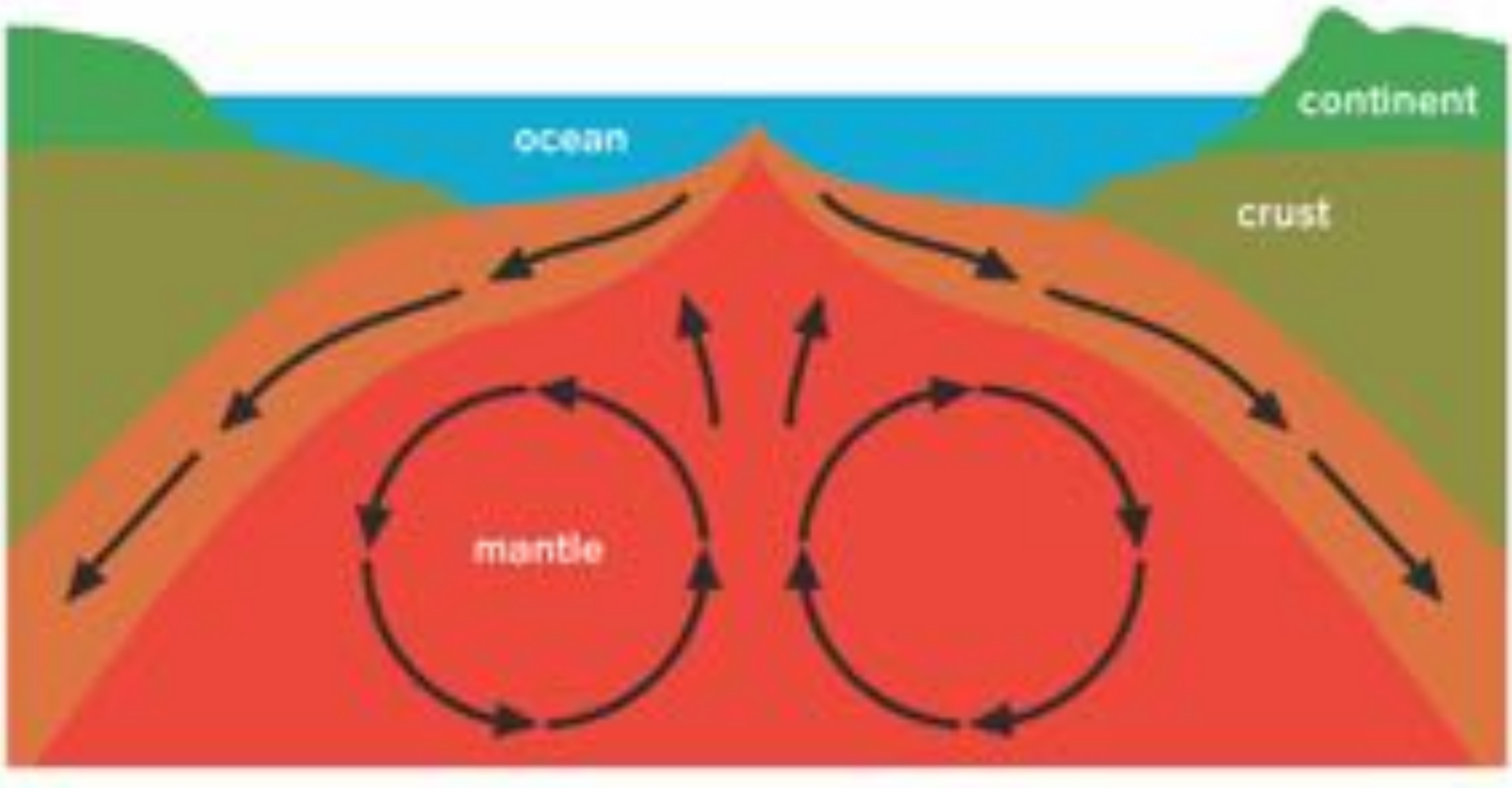
The changing globe

Over millions of years, the continents have drifted all over the globe, moving apart or crashing into each other.

290 million years ago

150 million years ago

The motion of molten rock deep in the earth makes the continents move.



The continents move at about the same rate that your fingernails grow.

75 million years ago

Present day

Millions of years from now, the continents will once again come together and create one large landmass.

250 million years from now

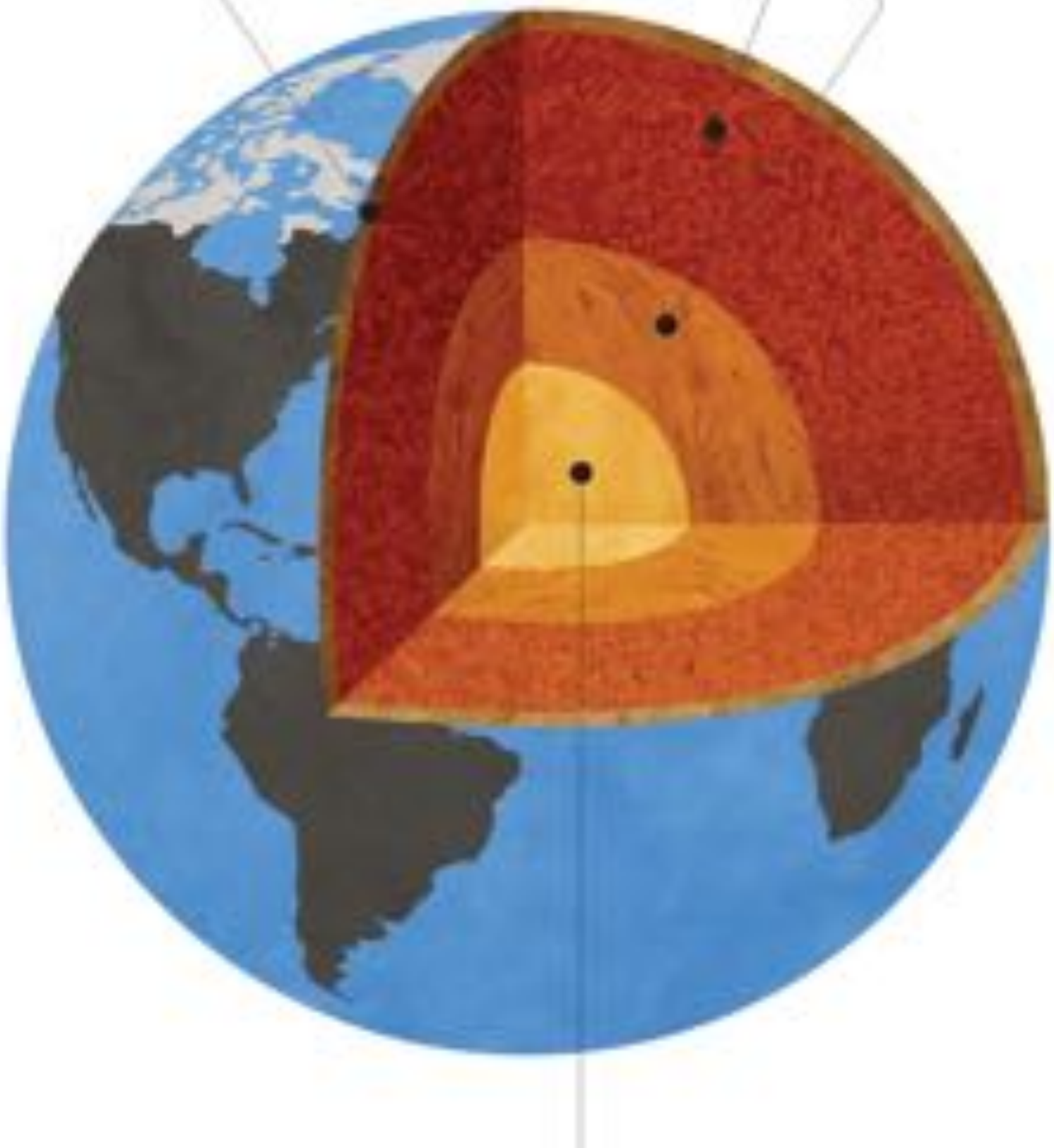
What's inside?

It is 3,960 miles (6,373 kilometers) from the surface to the center of the earth.

crust
solid rock
3 mi.–25 mi.*
(5 km.–40 km.)
thick

mantle
partially molten rock
1,800 mi. (2,897 km.)
thick

outer core
liquid metal
1,400 mi. (2,253 km.)
thick



inner core
solid metal
1,520 mi. (2,446 km.)
in diameter

* *Throughout the book:*
***miles** are abbreviated as mi.*
***kilometers** are abbreviated as km.*
***feet** are abbreviated as ft.*
***meters** are abbreviated as m.*

The deepest places on earth

Grand Canyon
United States

Krubera Cave
(deepest cave)
Southwest Asia

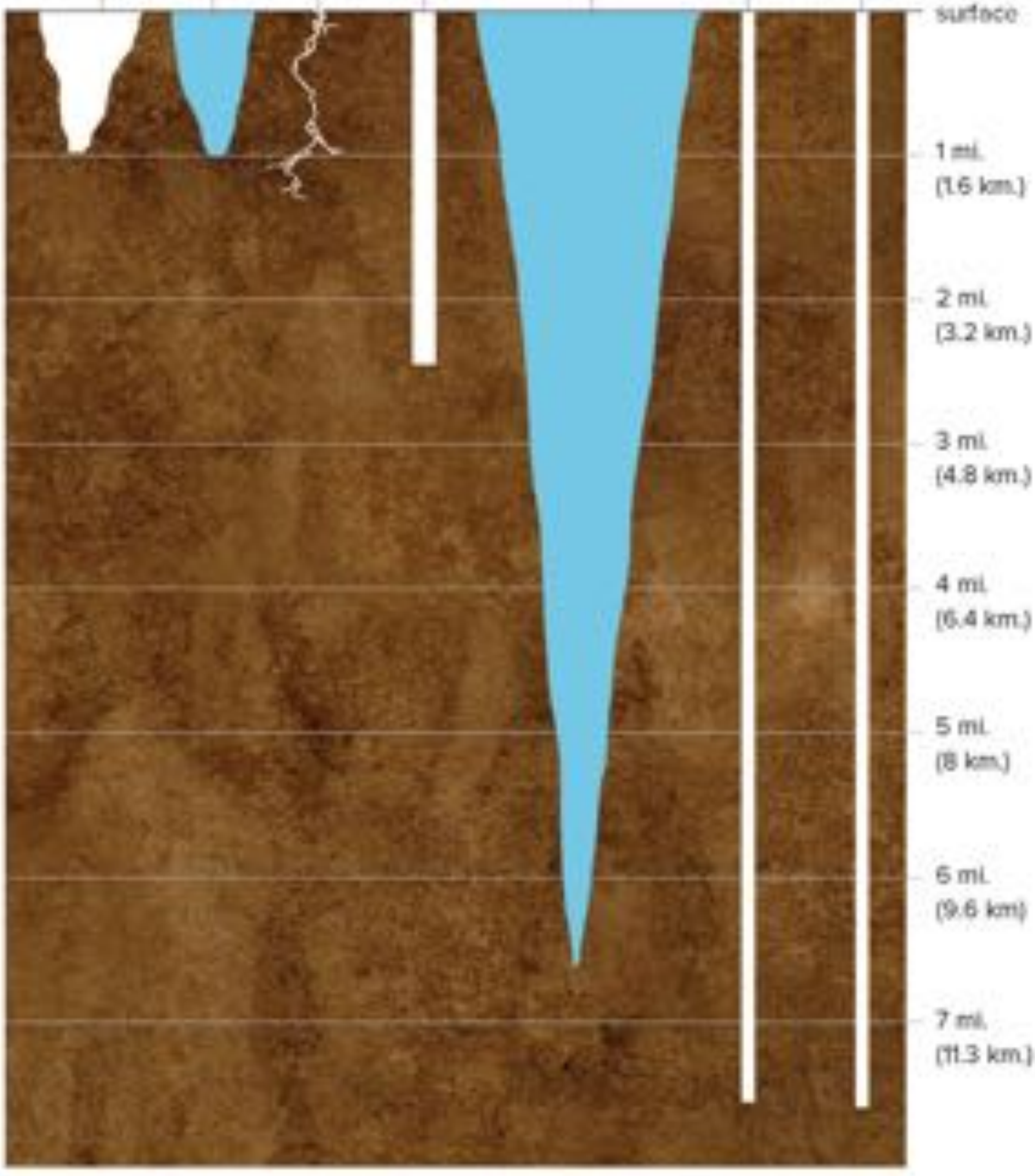
Challenger Deep
(deepest spot in the sea)
Pacific Ocean

Kola Superdeep Borehole
(for research—deepest hole ever drilled)
Russia

Lake Baikal
(deepest lake)
Russia

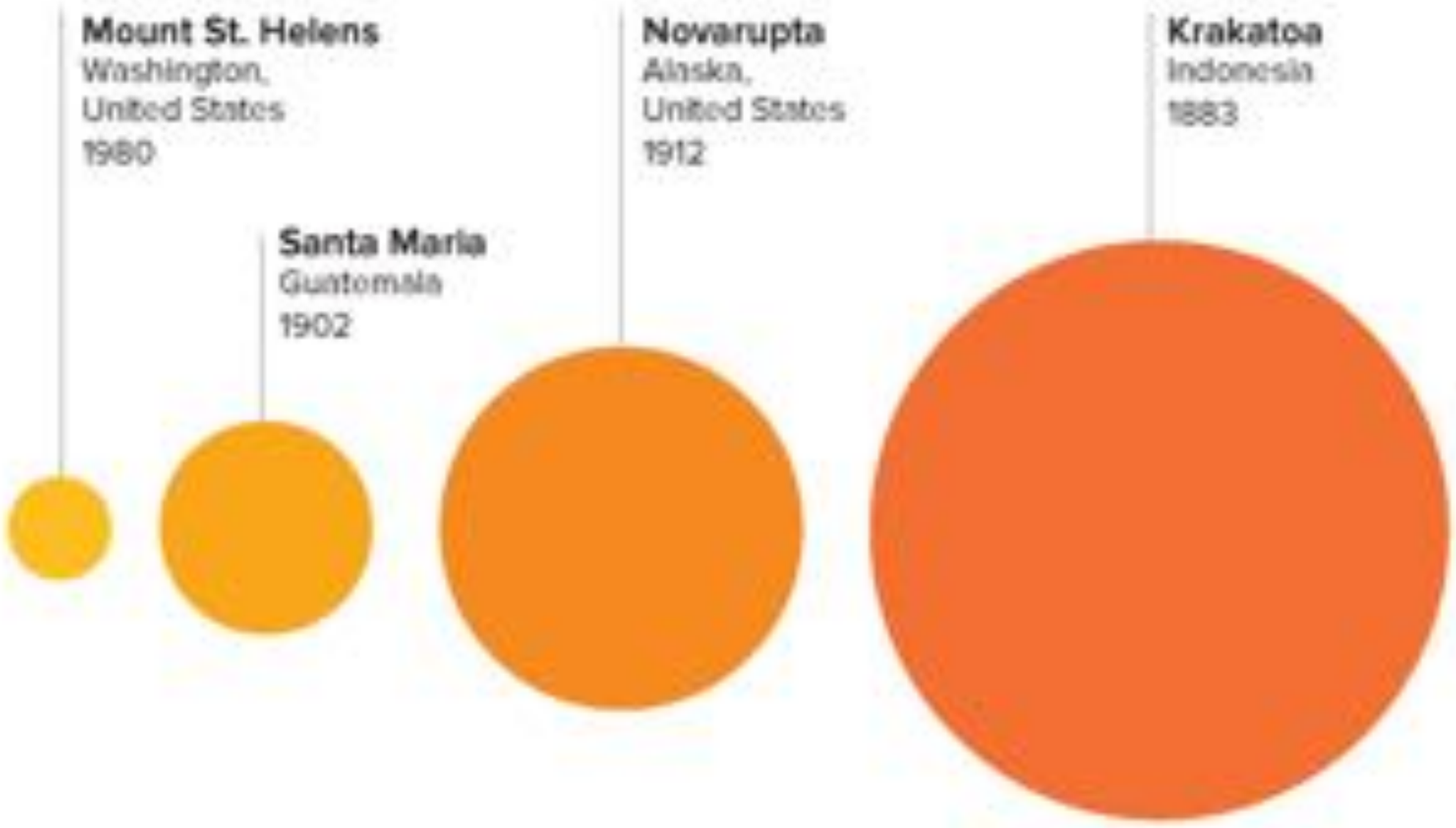
Mponeng gold mine
(deepest mine)
South Africa

Chayvo oil well
(deepest well)
Russia



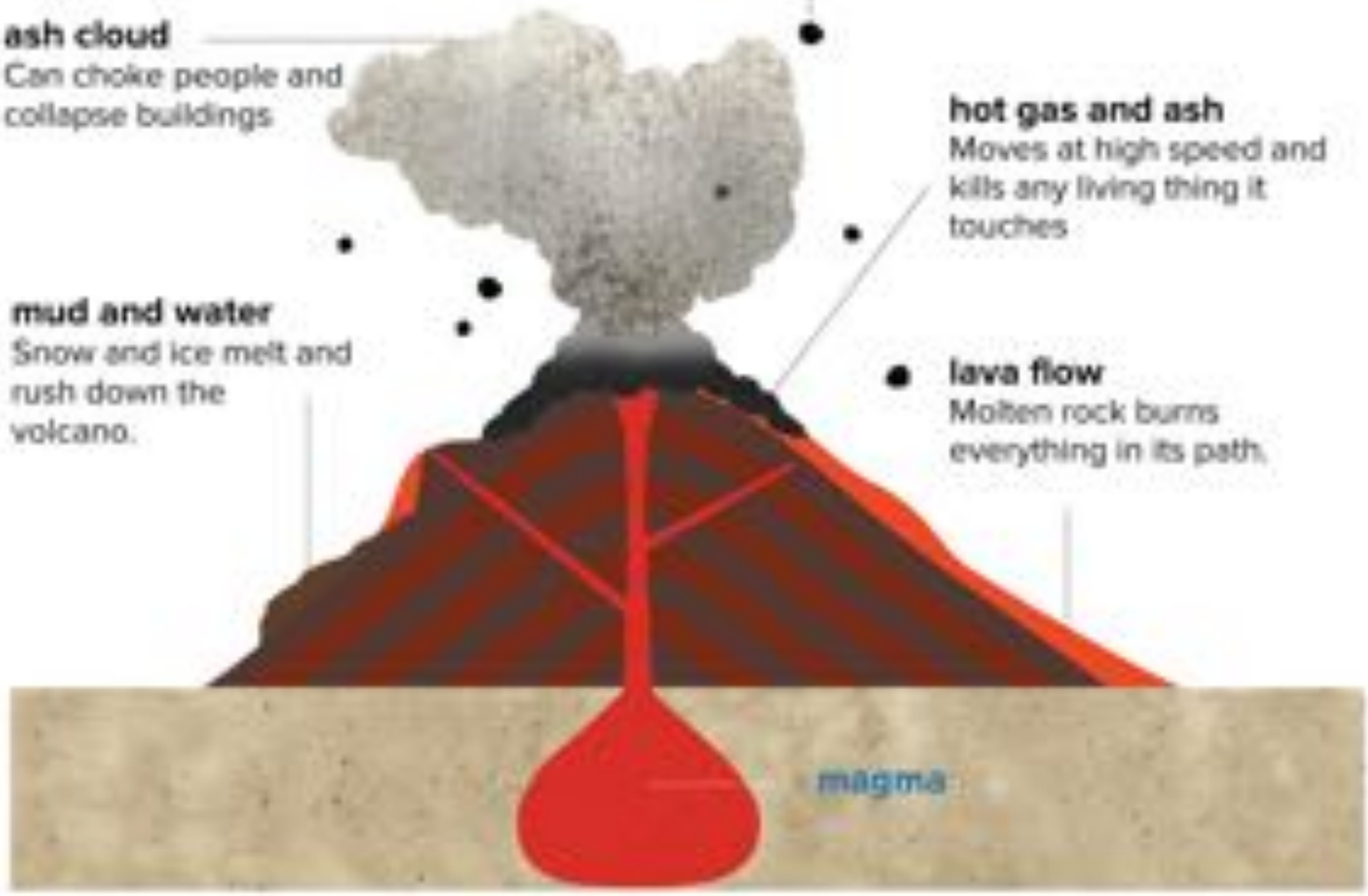
Volcanoes

Six volcanic eruptions



Volcanic dangers

These are some of the things that make a volcano deadly.



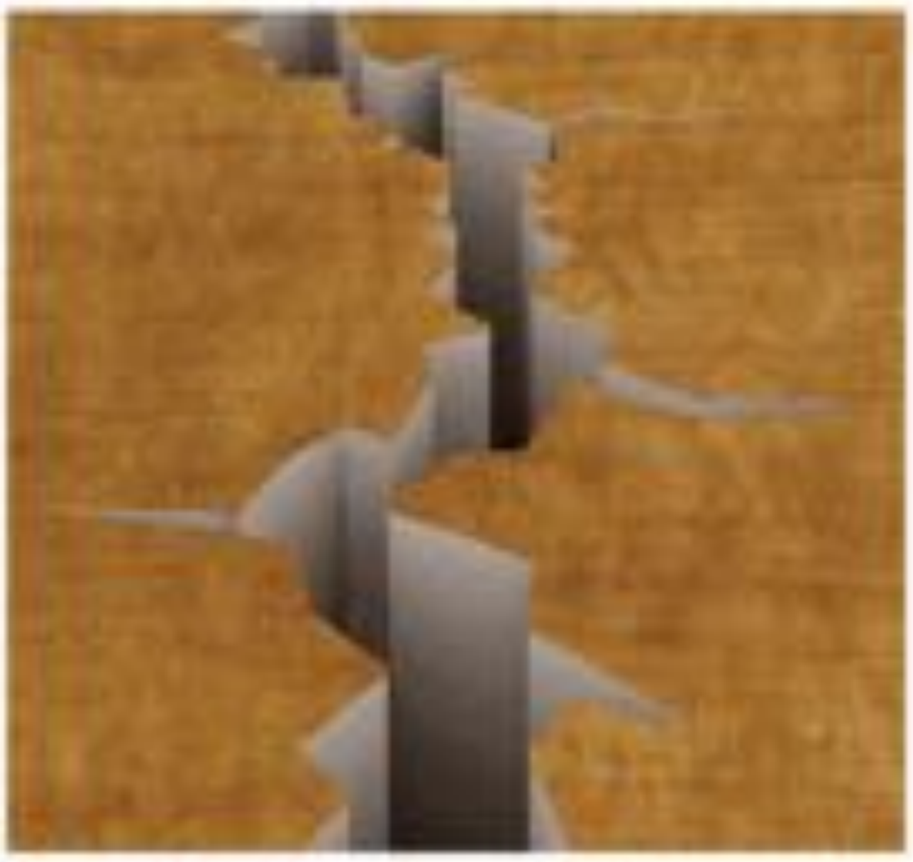
Tambora
Indonesia
1815
The largest eruption of the past 10,000 years

Toba
Sumatra
75,000 years ago
The largest eruption of the past 25 million years

The Toba eruption ejected enough material to fill 23 million football stadiums with ash and lava.

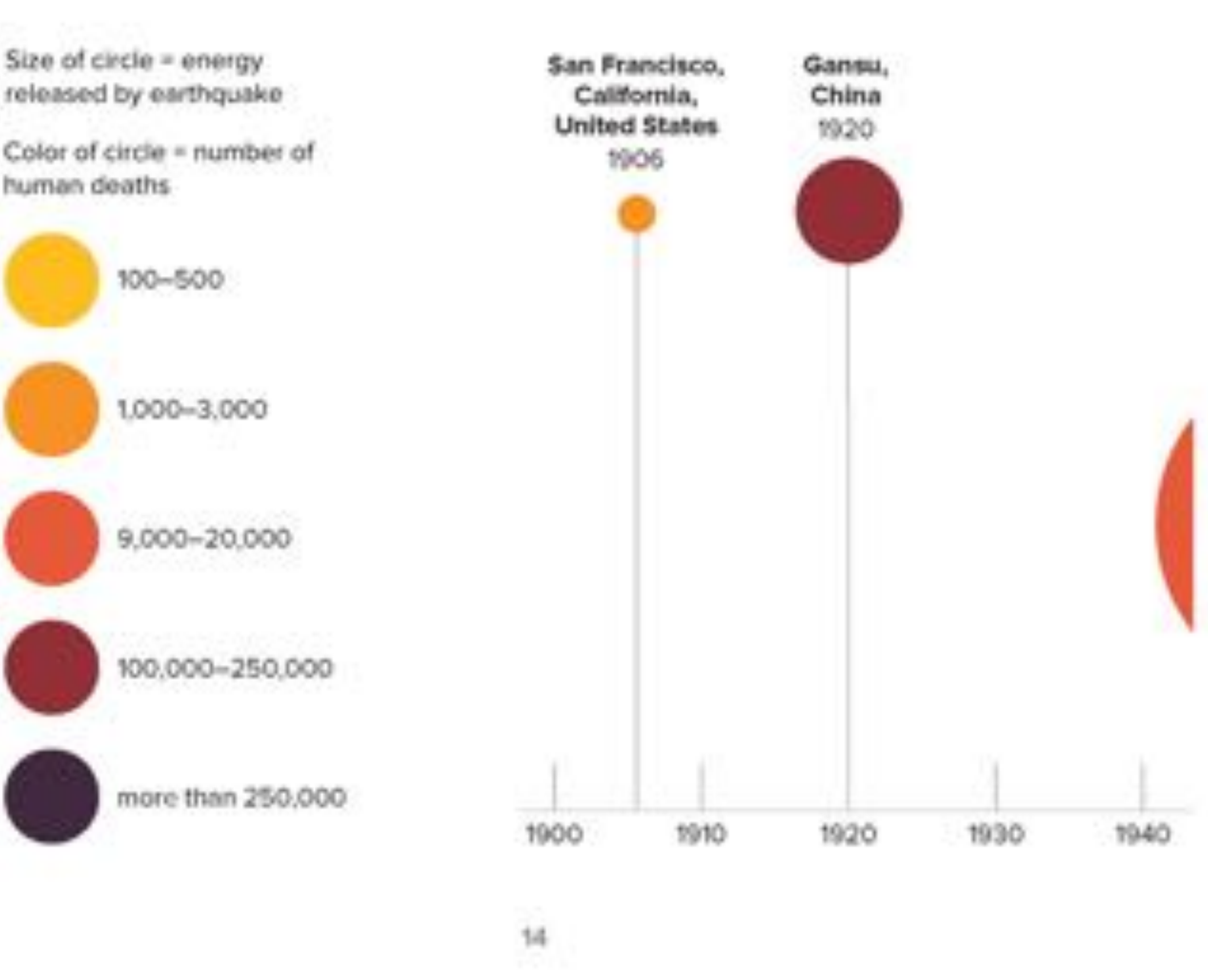
The force of a volcano is measured by how much rock, ash, and lava is blown out during an eruption. The size of each circle represents the amount of this material ejected in each eruption.

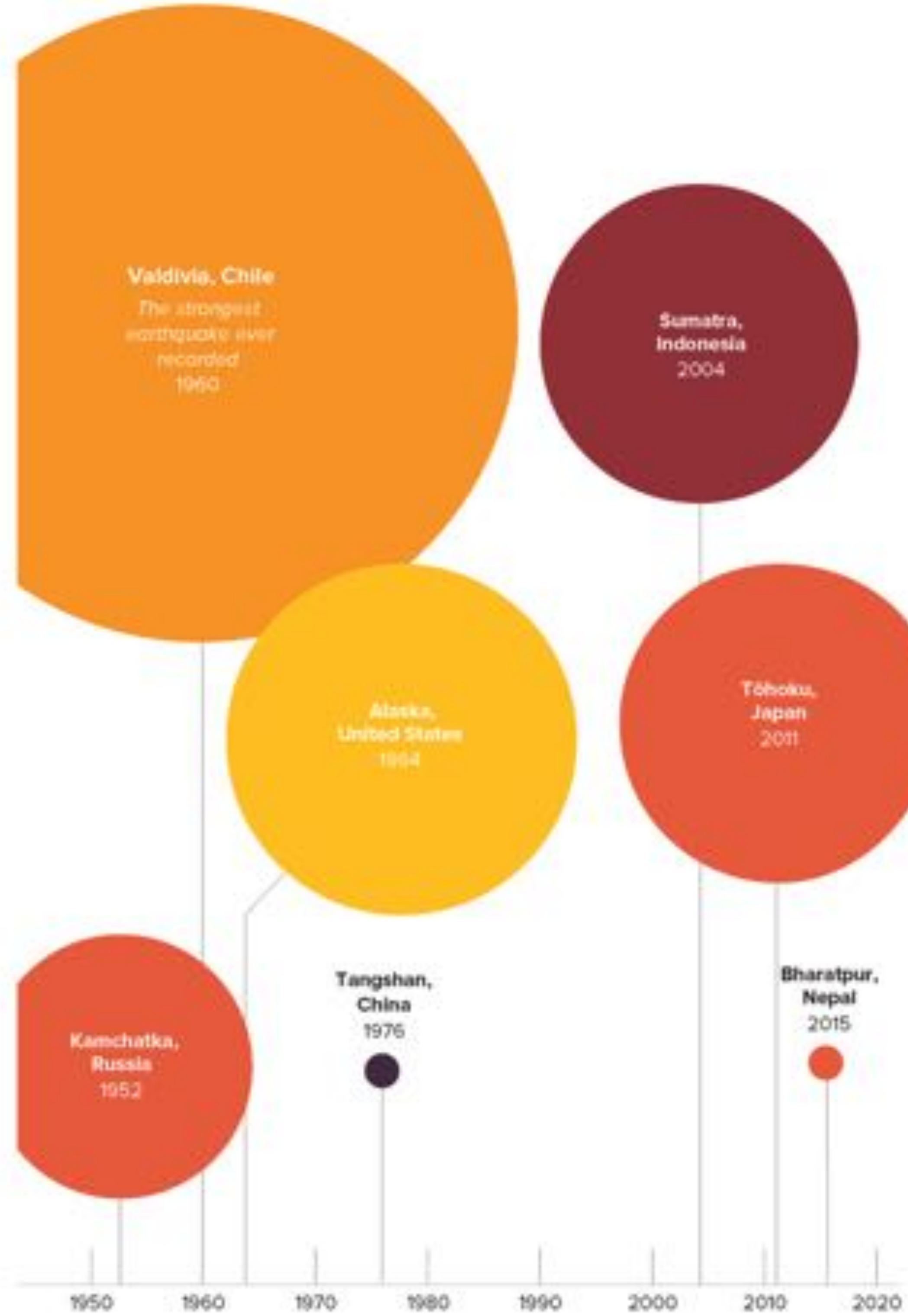
Earthquakes



A small earthquake can kill more people than a big one if it occurs in a place where many people live.

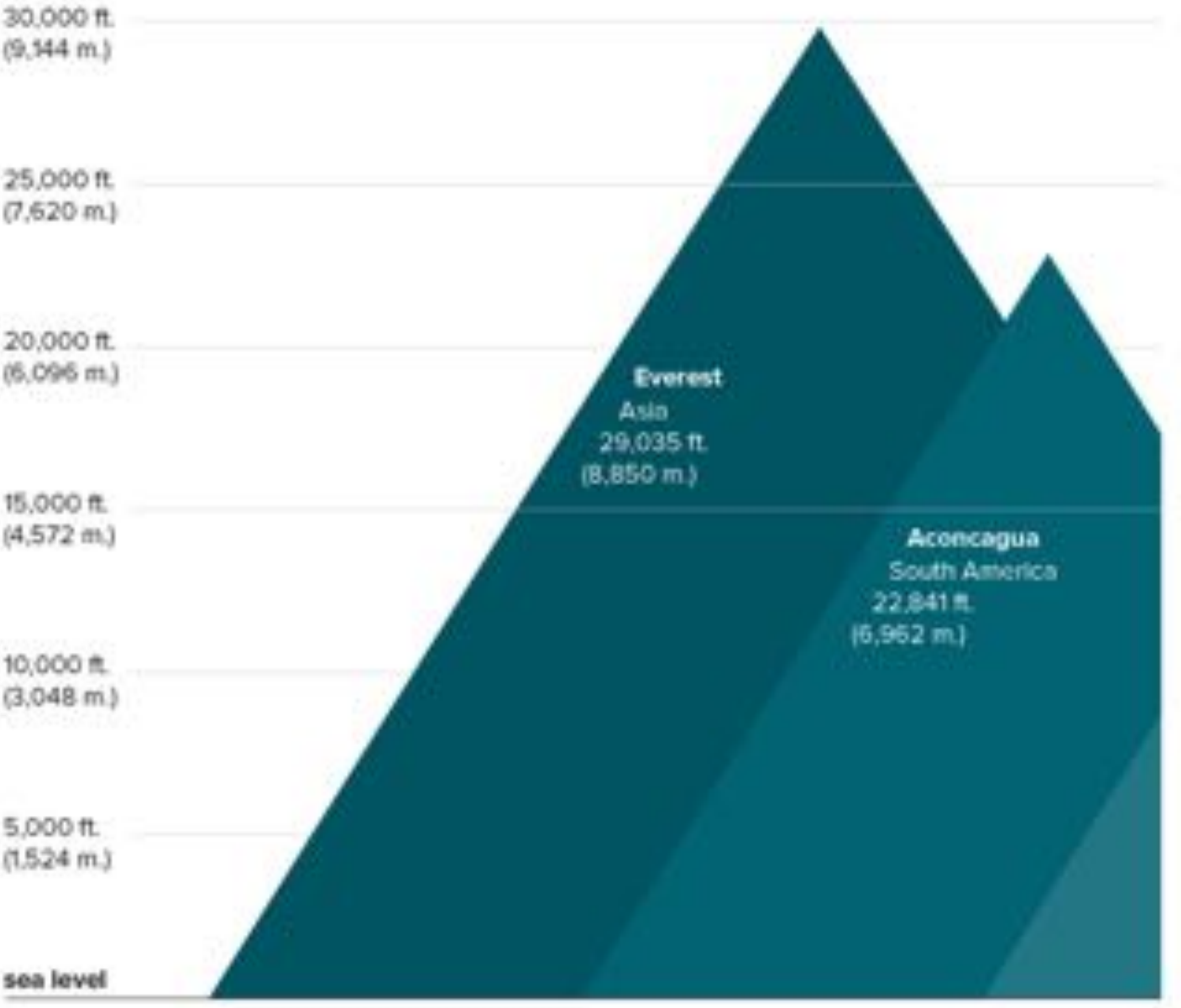
Sometimes rocks shift deep within the earth. If this movement is large and sudden, a lot of energy is released. The ground cracks, shifts, and shakes violently—it's an earthquake!




Valdivia, Chile
The strongest earthquake ever recorded
1960
Sumatra, Indonesia
2004
Alaska, United States
1964
Tōhoku, Japan
2011
Tangshan, China
1976
Kamchatka, Russia
1952
Bharatpur, Nepal
2015
1950
1960
1970
1980
1990
2000
2010
2020

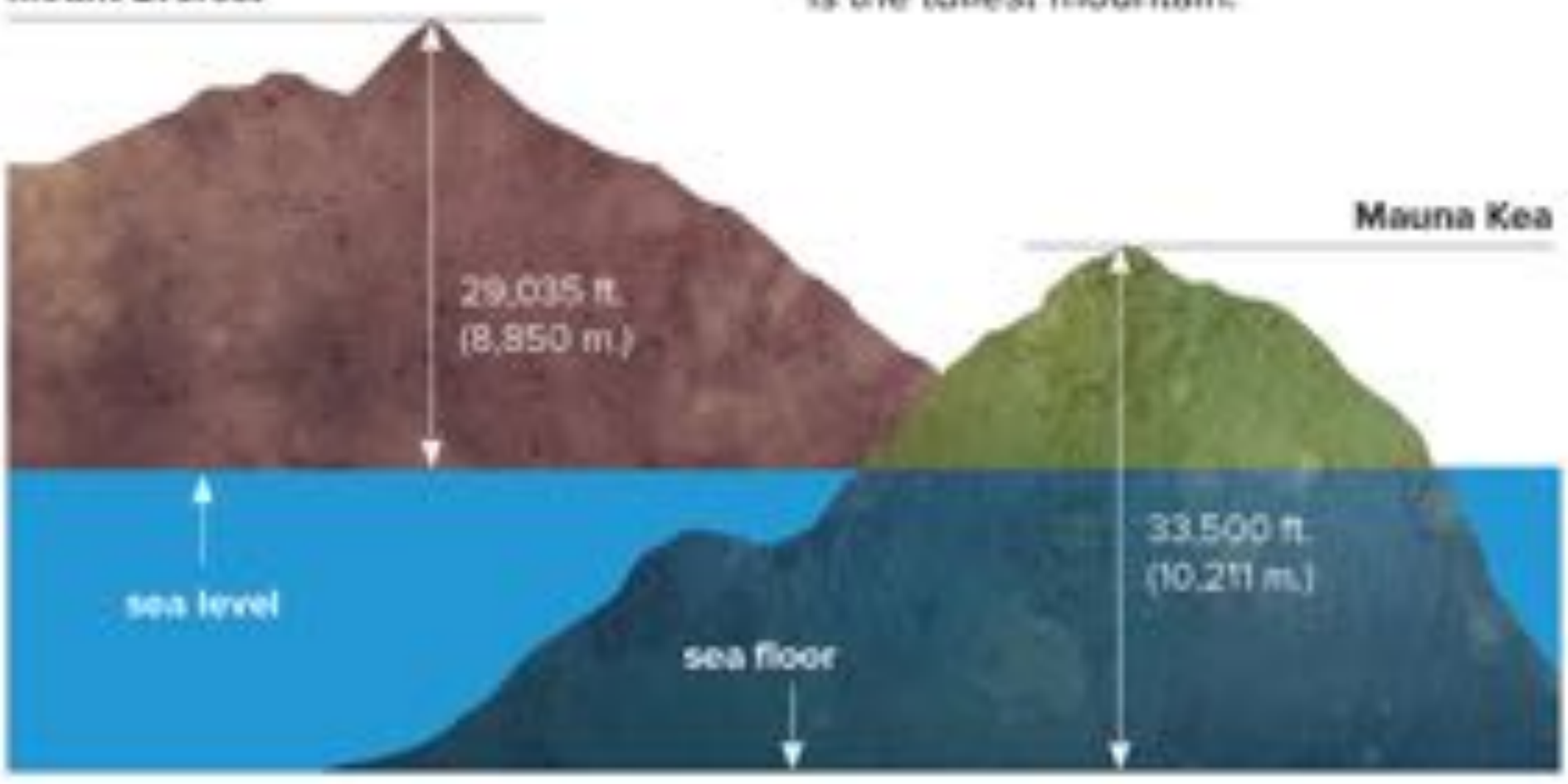
Mountains

These are the highest mountain peaks on each of the seven continents.

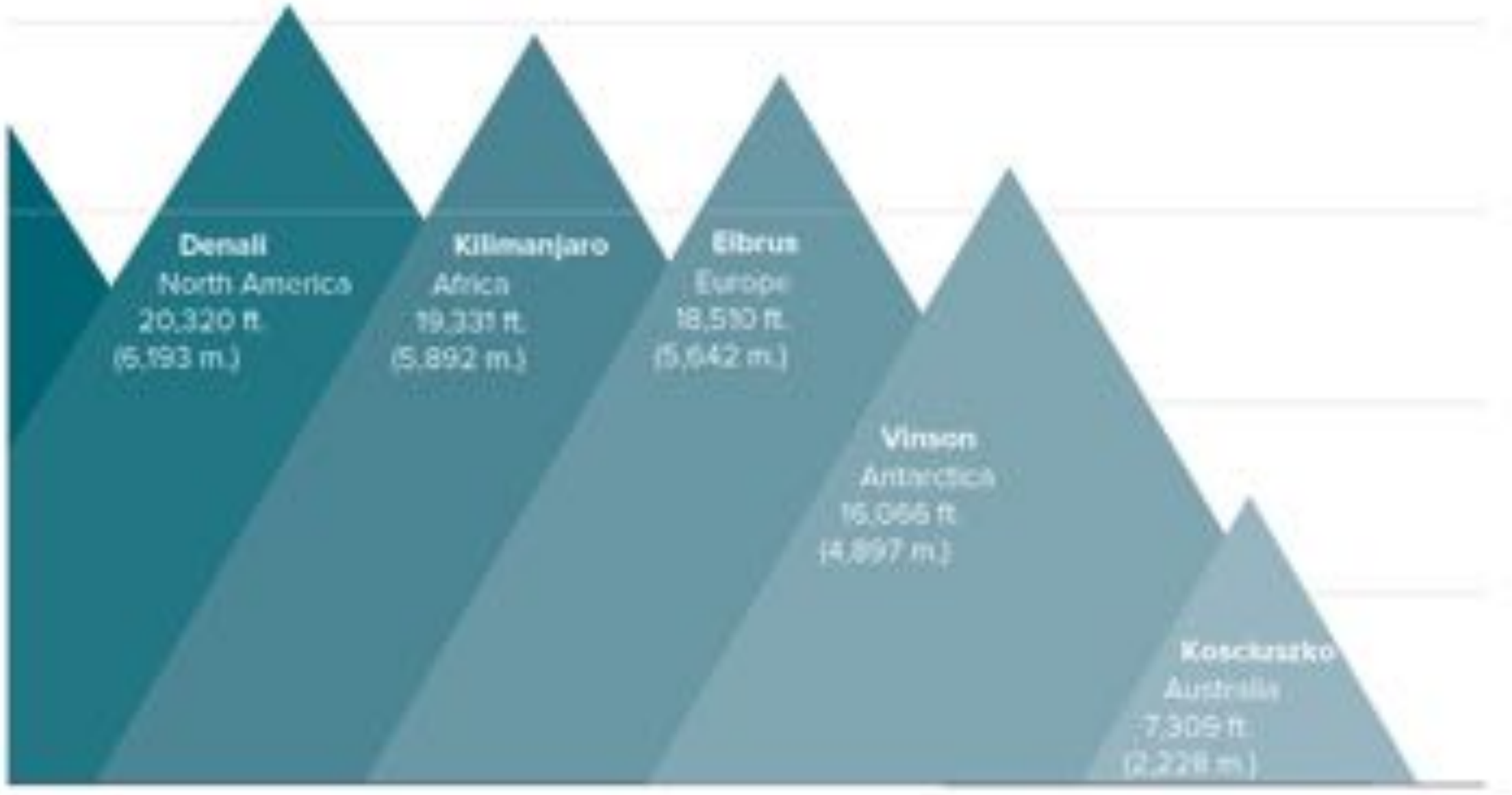


The tallest mountain

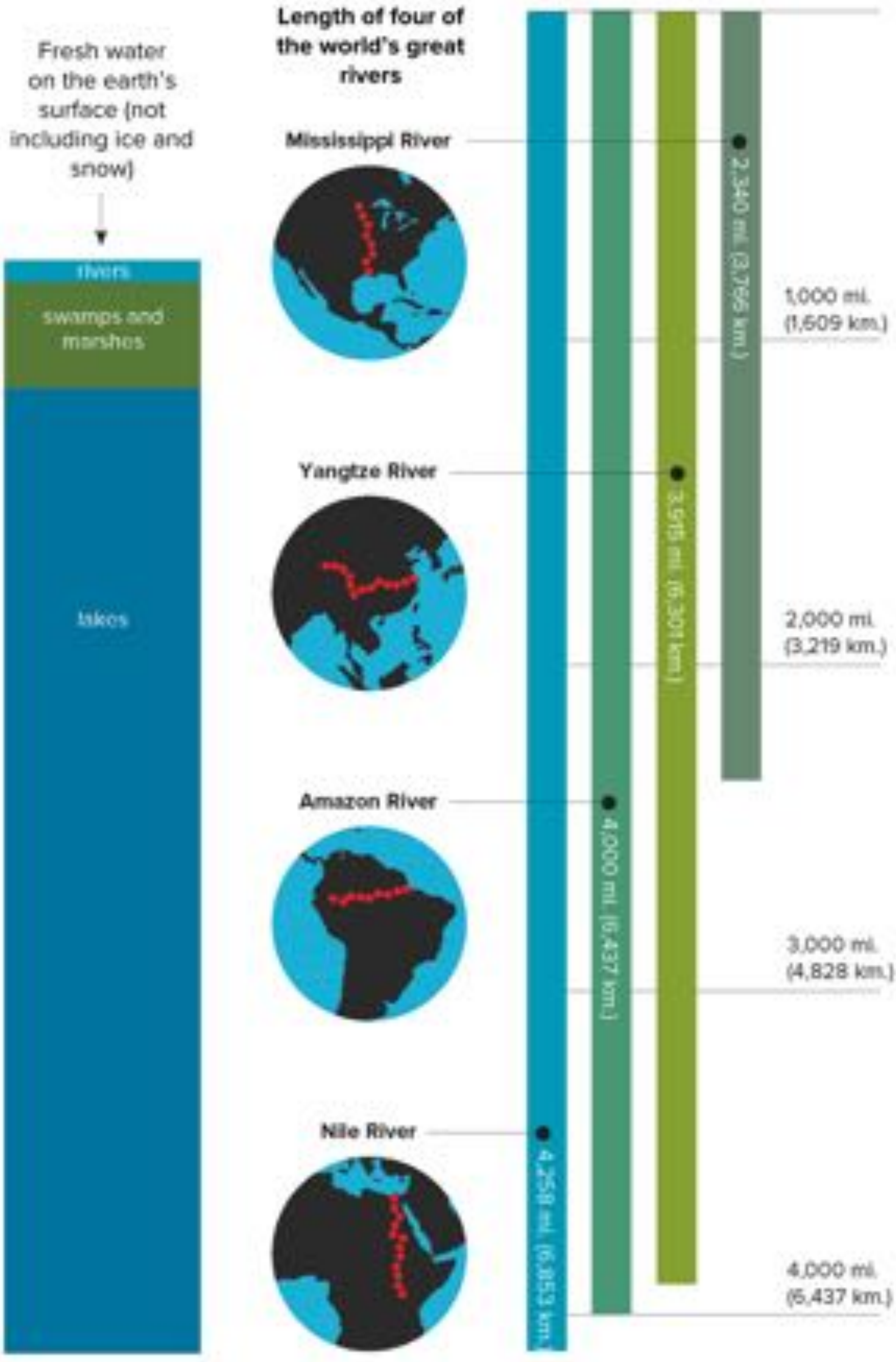
Mount Everest, in Asia, is the *highest* mountain (above sea level). But measured from its base on the sea floor to its peak, Mauna Kea in Hawaii is the *tallest* mountain.



In 2015, the name *Mount McKinley* was changed to *Denali*, a name used by the native people who live in the area.

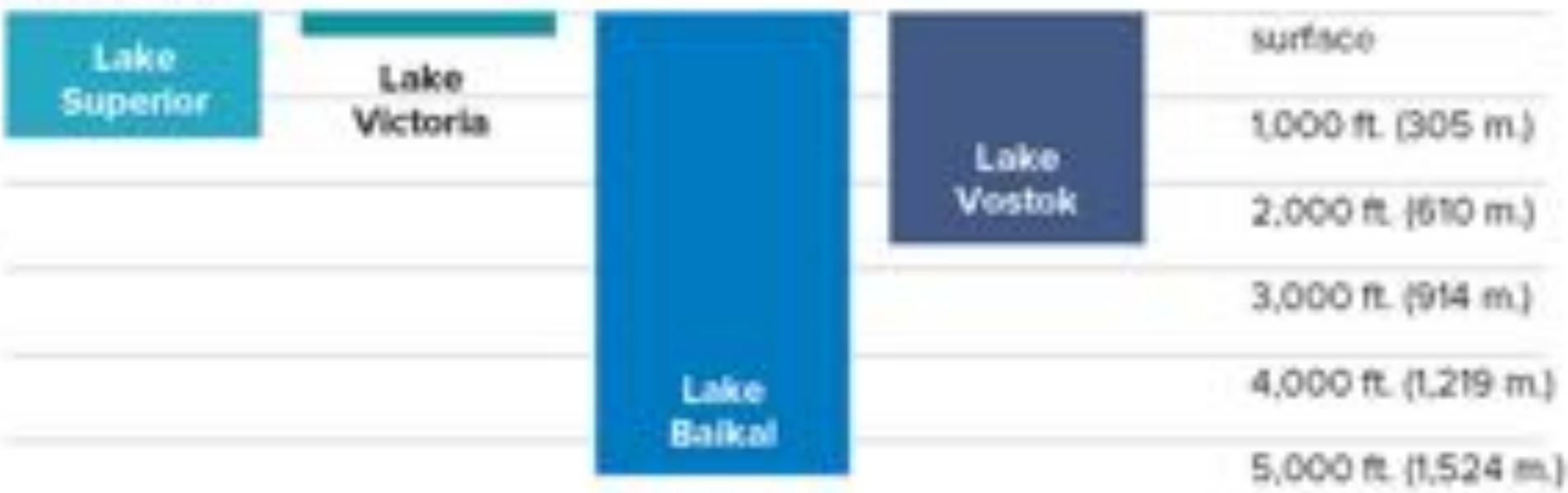


Rivers and lakes

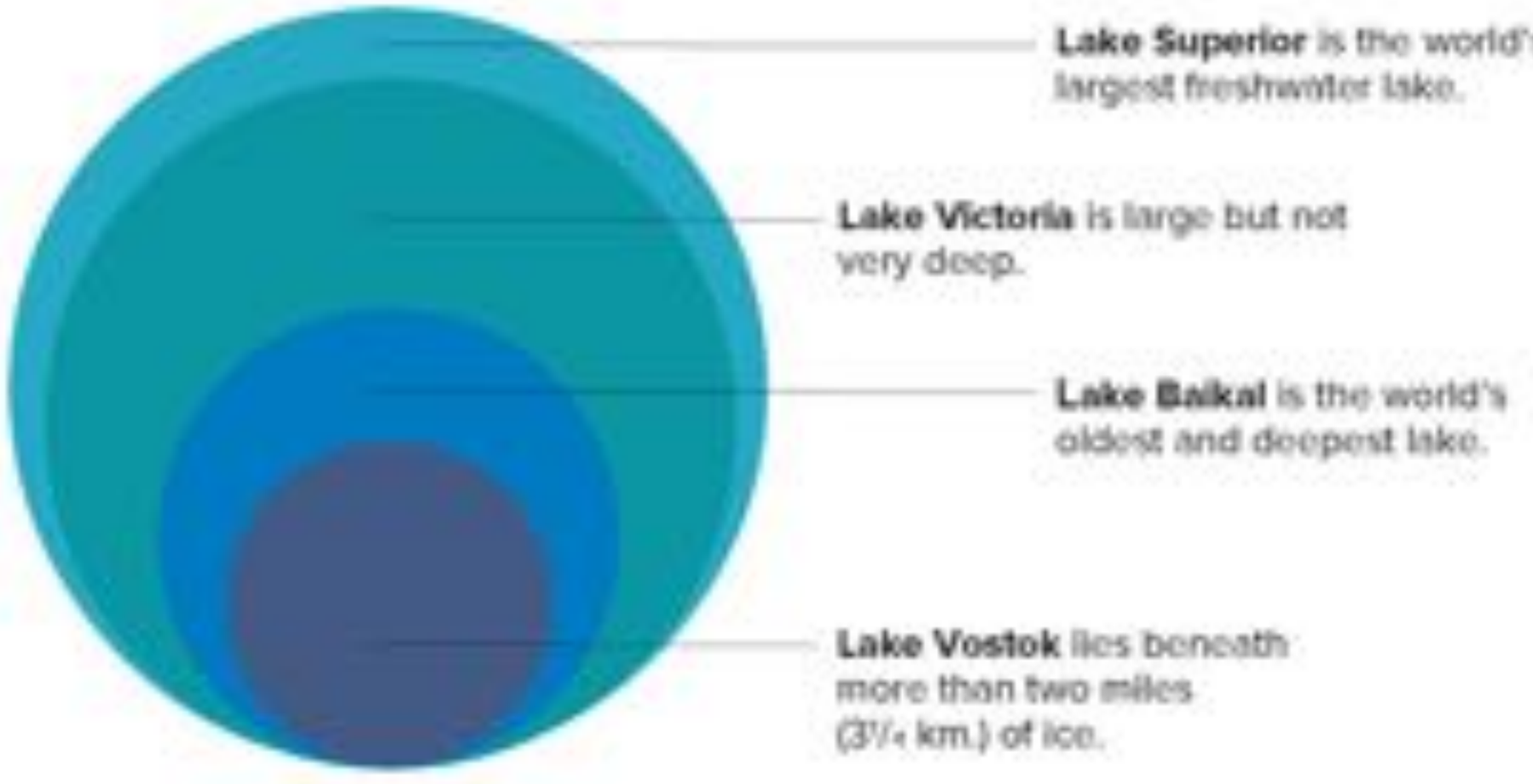


Four of the world's largest lakes

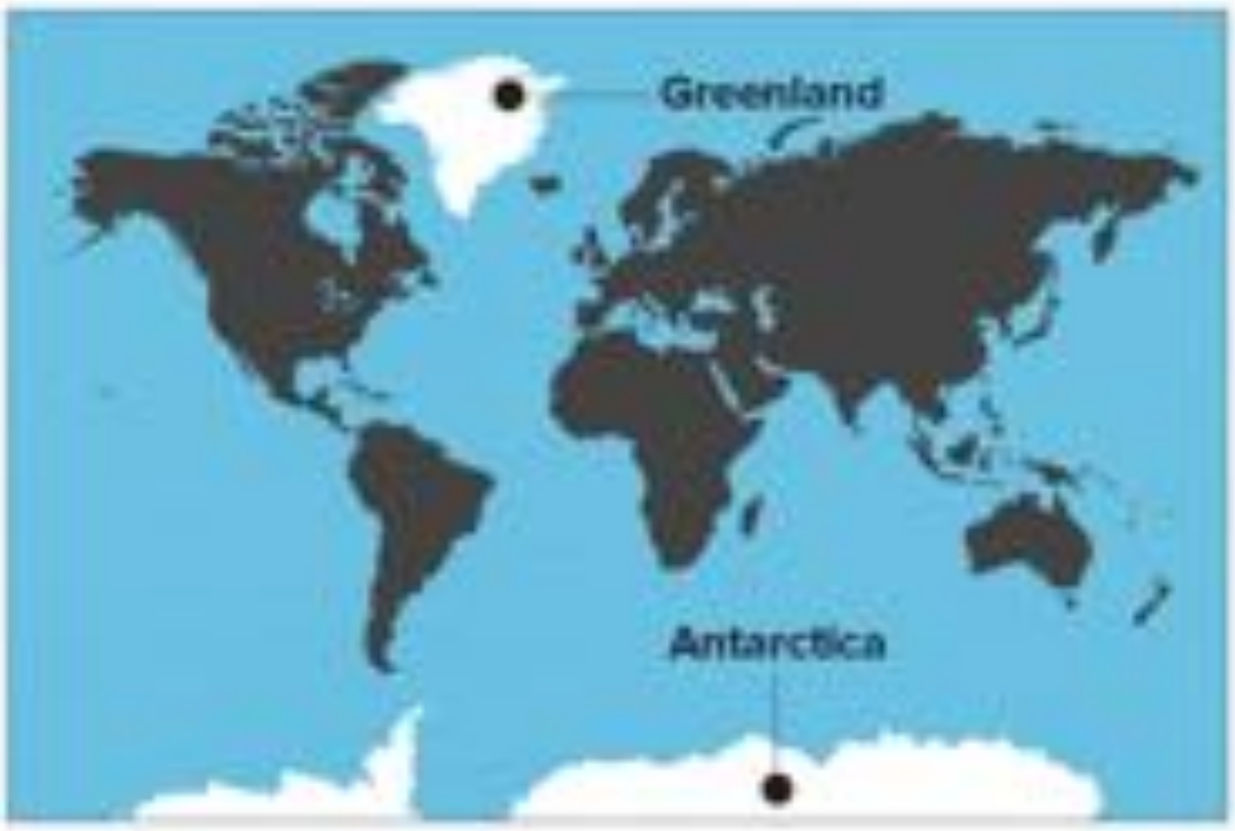
How deep?



The surface area of the four lakes compared

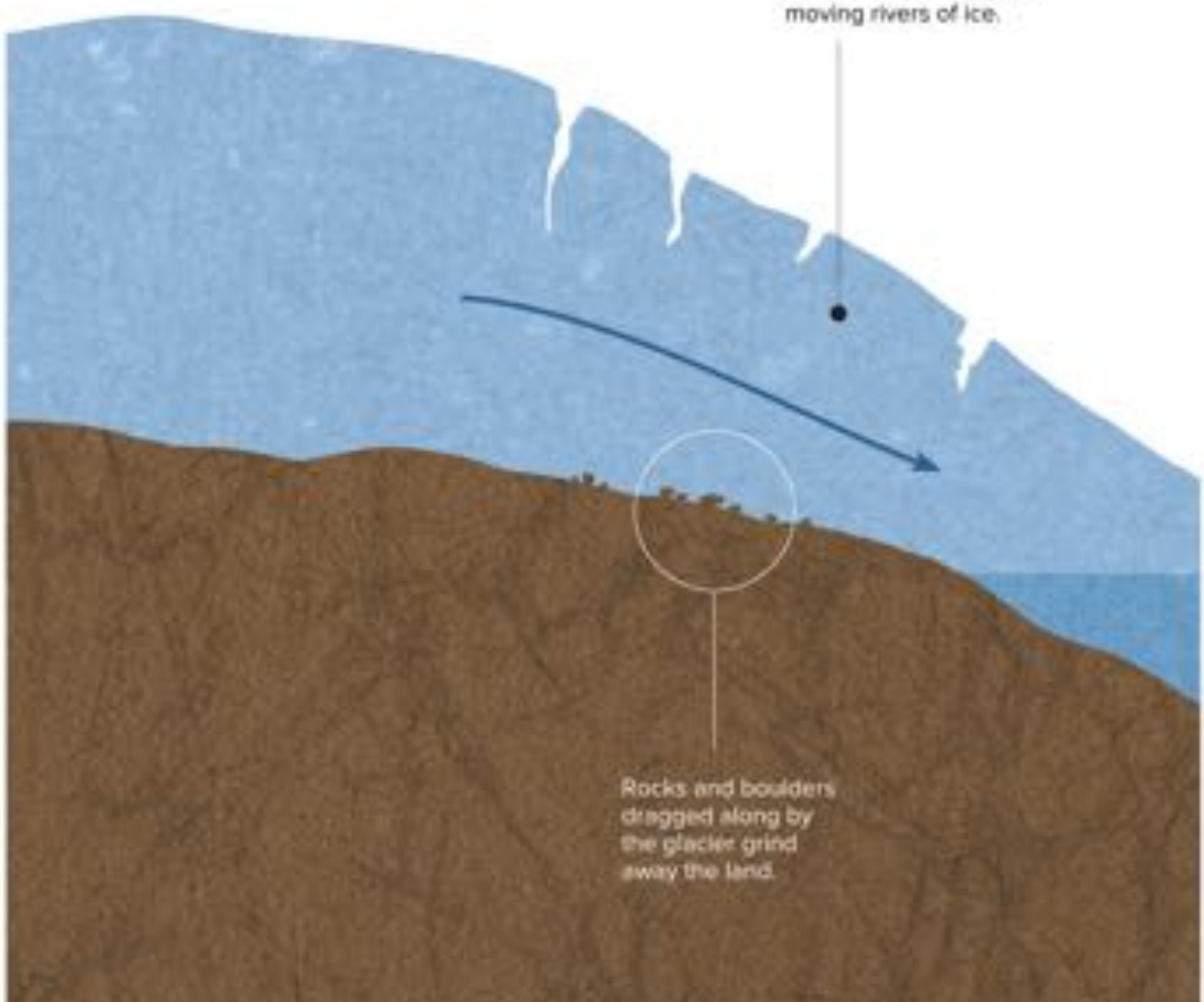


Ice and snow



The thick layers of ice that cover most of Greenland and Antarctica are called ice caps.

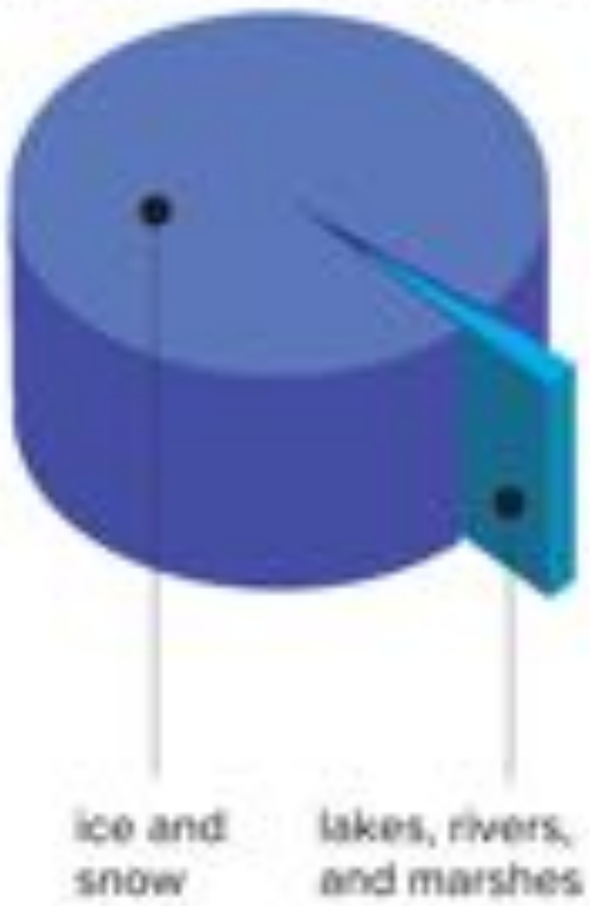
In some places, the ice covering Antarctica is more than three miles (5 kilometers) thick.



Glaciers and ice caps form when snow builds up year after year. The weight of the snow turns the bottom layers of the snowpack into ice.

A speedy glacier moves about as fast as a snail crawls.

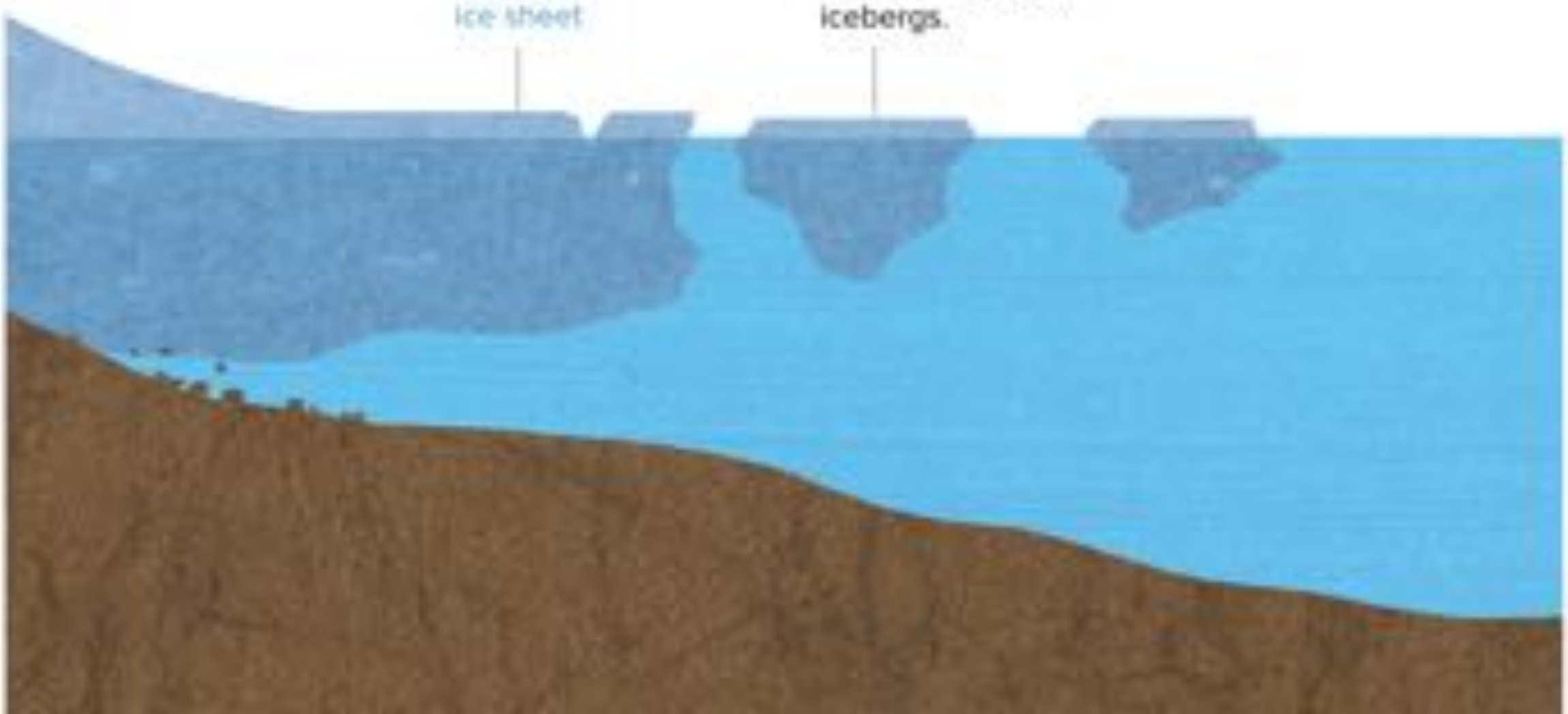
Most of the fresh water on the earth's surface is frozen.



Most of an iceberg lies below the water's surface.

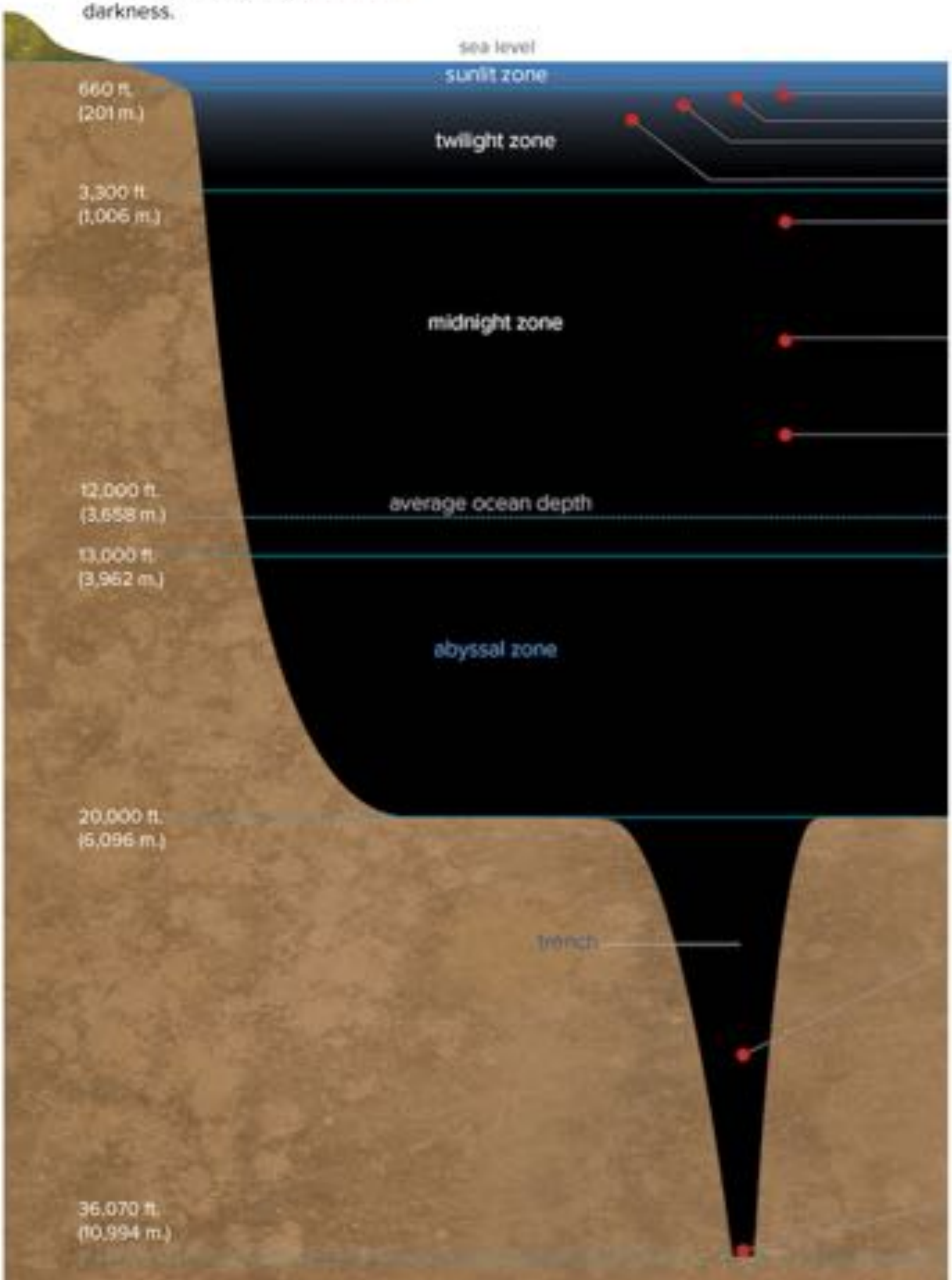
When a glacier reaches the sea, chunks of ice break off and form icebergs.

floating ice sheet



Oceans

Most of the ocean is in perpetual darkness.



How deep?

Some record dives
(Illustrations not to scale)

murre
deepest diving flying bird
690 ft.
(210 m.)

emperor penguin
deepest diving bird
1,755 ft.
(535 m.)

human freediving record
without air tanks
702 ft.
(214 m.)

scuba diving **record**
1,090 ft.
(332 m.)

leatherback turtle
deepest diving turtle
4,200 ft.
(1,280 m.)

sperm whale
7,380 ft.
(2,250 m.)

Cuvier's beaked whale
deepest diving mammal
9,816 ft.
(2,992 m.)

deepsea snailfish
deepest fish
26,247 ft.
(8,000 m.)

Challenger Deep
in the Mariana Trench, the deepest spot in the ocean

Deepsea Challenger
submersible
35,756 ft.
(10,898 m.)

Tornadoes

Tornadoes are violent, spinning columns of air. They can cause enormous damage.

Tornadoes usually last for just minutes or hours.

More tornadoes occur in the Midwestern United States than anywhere else on earth.

A tornado over water forms a waterspout.

A tornado's powerful winds can turn everyday objects into deadly missiles.

The force of a tornado is measured on the six-step EF scale.
(mph = miles per hour, kph = kilometers per hour)

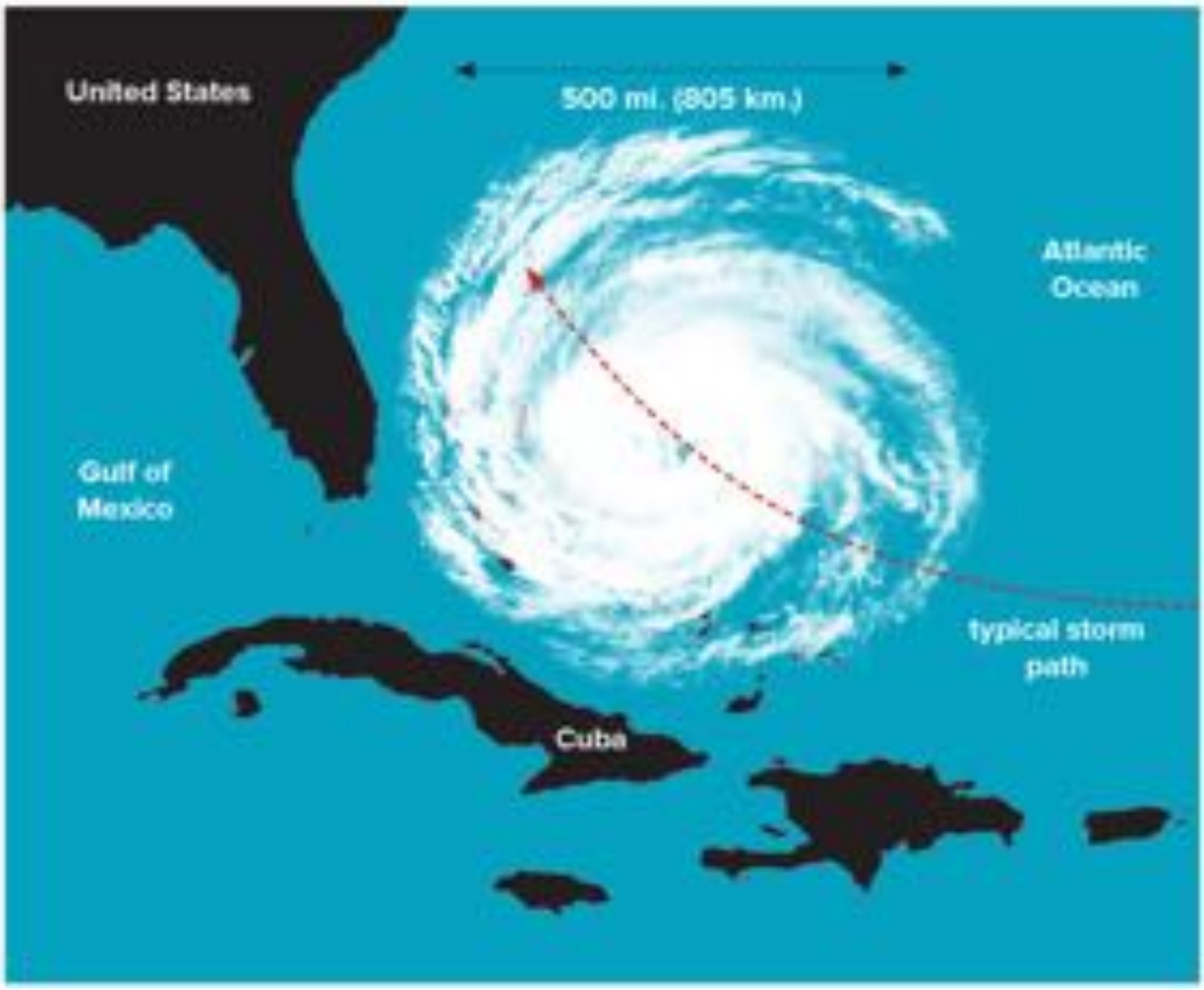
EF-scale	wind speed	damage	
EF-0	65–85 mph (105–137 kph)	minor	
EF-1	86–110 mph (138–177 kph)	significant	
EF-2	111–135 mph (178–217 kph)	severe	
EF-3	136–165 mph (218–266 kph)	extreme	
EF-4	166–200 mph (267–322 kph)	devastating	
EF-5	over 200 mph (over 322 kph)	total	

Hurricanes

Hurricanes are large tropical storms. They bring destructive winds, floods, and waves to coastal areas.

Hurricanes rotate counter-clockwise in the northern hemisphere . . .

. . . and clockwise in the southern hemisphere.



A large hurricane can be hundreds of miles across and last for days or weeks.

The strength of a hurricane is measured on a five-category scale based on top wind speeds.

The Atlantic Ocean hurricane season

JAN	FEB	MAR	APR
MAY	JUN	JUL	AUG
SEP	OCT	NOV	DEC

Danger from the sky

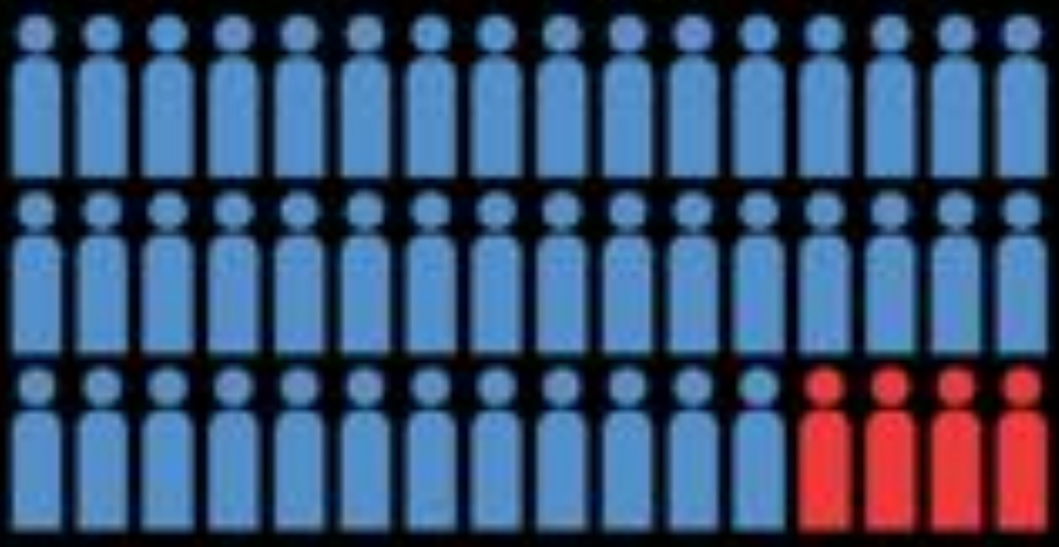
Lightning strikes occur during a thunderstorm. They can be awesome, but they are also very dangerous.

A lightning flash can heat the air around it to five times hotter than the surface of the sun.

Sound travels more slowly than light. That's why we see the flash before we hear the thunder.

The light from a strike reaches us almost instantly. But it takes the sound of thunder five seconds to travel one mile (1.6 km.).

People around the world struck by lightning each year (240,000 struck, 20,000 killed)



= 5,000 people struck but not killed

= 5,000 people killed by lightning

Lightning strikes somewhere in the world about 50 times every second.

Danger from the sea

A tsunami is a wave, or series of waves, that can cause enormous destruction to ocean coastlines.

Most tsunamis are caused by undersea earthquakes. An earthquake pushes up the sea floor, which creates a surge of water.

Tsunamis can also be caused by landslides.

volcanoes.

and meteorite impacts.

The height record for a tsunami is 1,720 feet (524 meters). It was caused by a landslide crashing into a bay in Alaska in 1958.

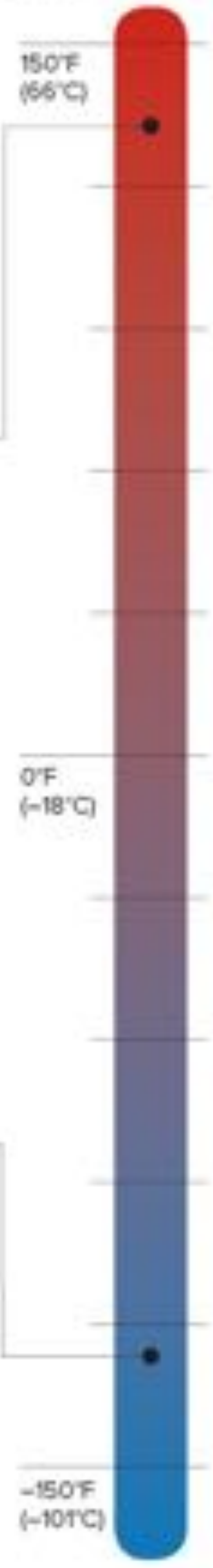
A 2004 earthquake in Sumatra caused a tsunami that killed more than 240,000 people.

Earth's extremes

Highest and lowest temperatures

134.1°F
(56.7°C)
Death Valley,
California,
United States
1913

−128.6°F
(−89.2°C)
Vostok Station,
Antarctica
1983



Windiest place on earth

maximum wind speed
recorded here:
231 mph (372 kph)

Mount Washington,
New Hampshire,
United States
1934

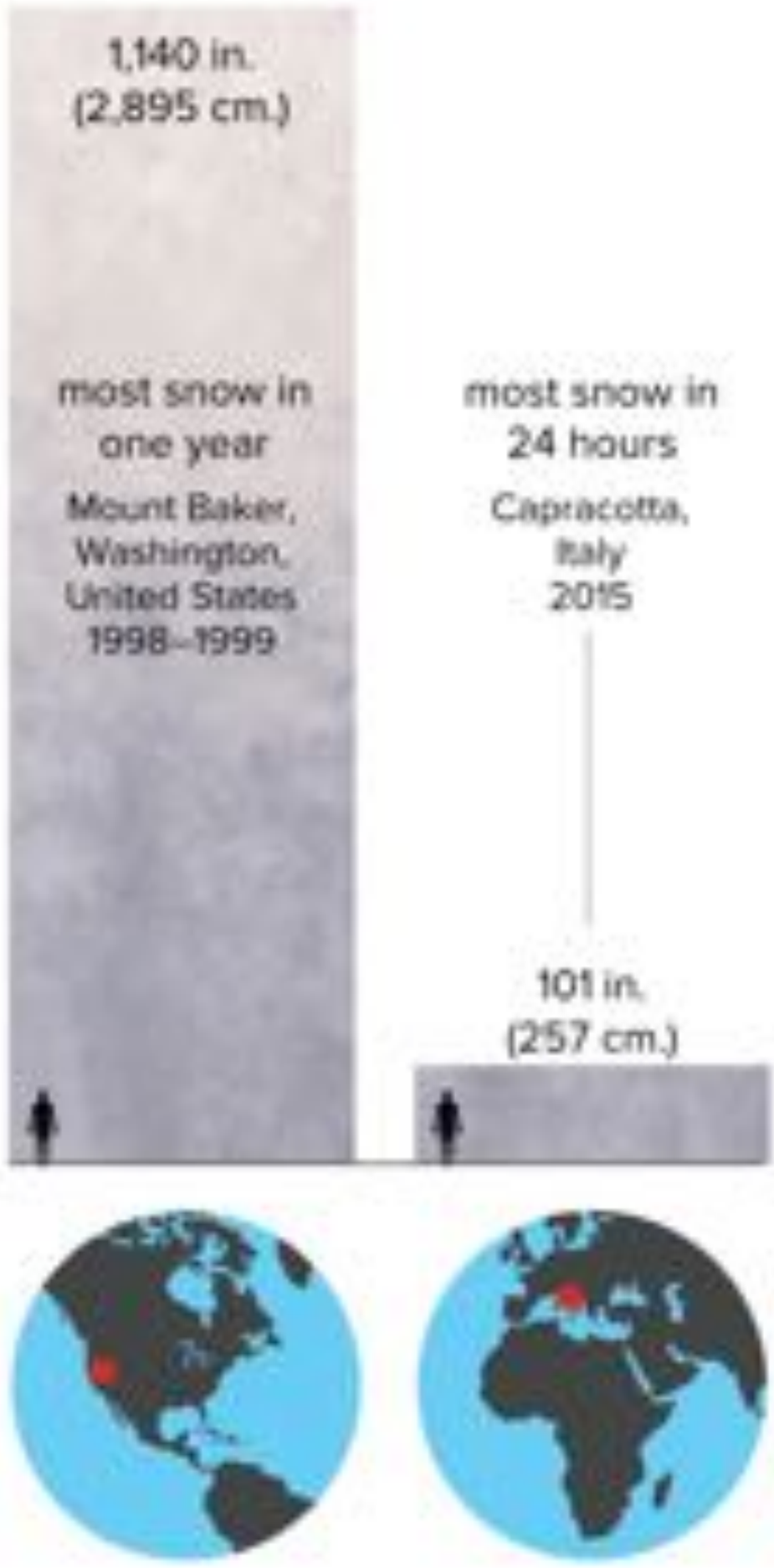
Largest hailstone

8 in. (20 cm.)
in diameter

South Dakota,
United States
2010

Rainfall records

Snowfall records

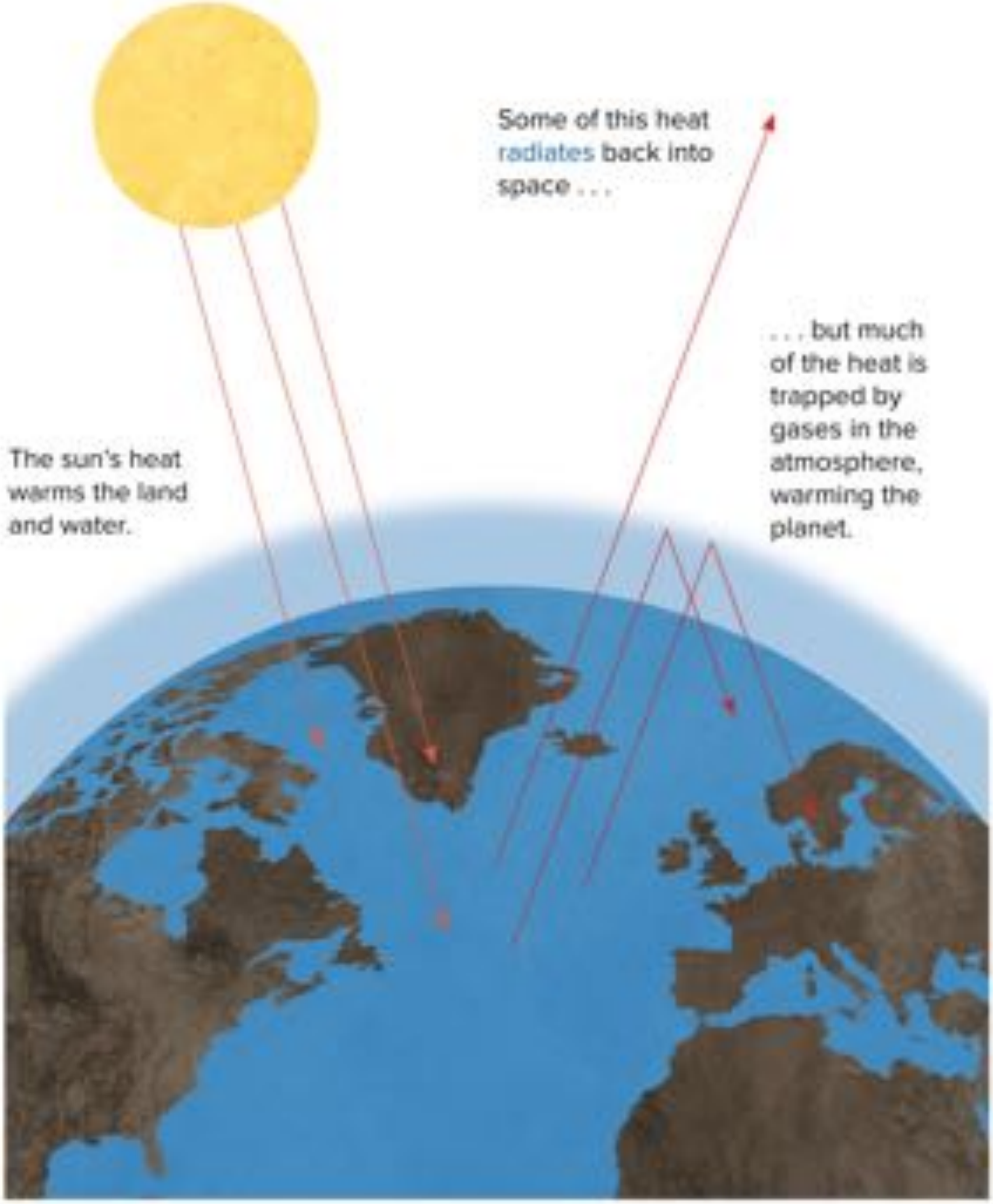


Driest places on earth

A warming planet

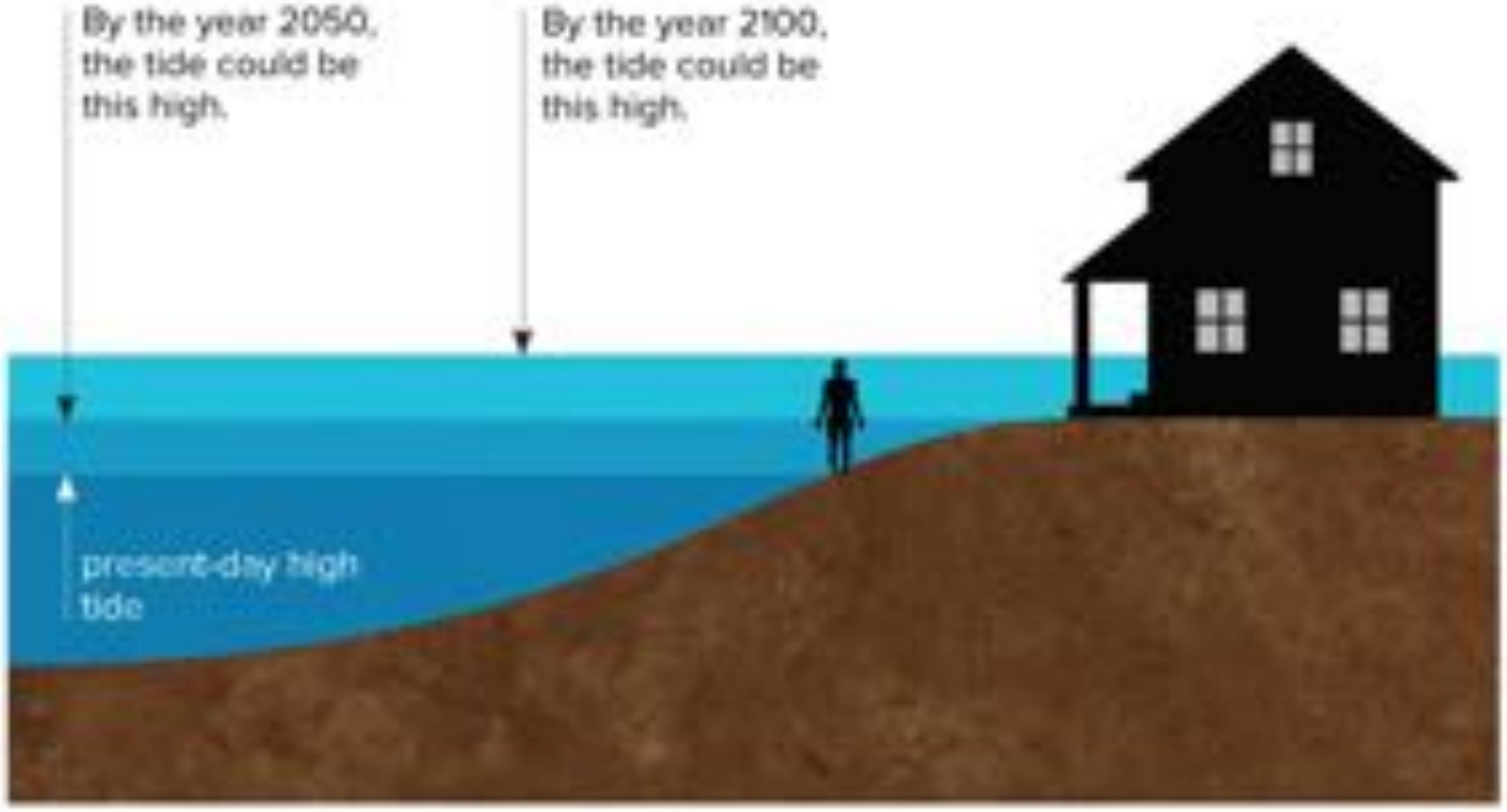
Our planet is heating up. Some of this warming is due to natural causes. But most of it is because humans are adding greenhouse gases to the atmosphere.

What is the greenhouse effect?



What happens when the earth's temperature rises?

One of the most serious effects of a warming climate is sea level rise. Water in the world's oceans is rising.



Higher temperatures are causing the ice caps and glaciers to melt.

There are many other possible effects of a warmer climate.

Storms are stronger and there are more floods.

The land in many places gets drier and there are more forest fires.

Crops fail and many animals die.

The earth: a timeline—part 1

1,000 MYA = one billion years ago

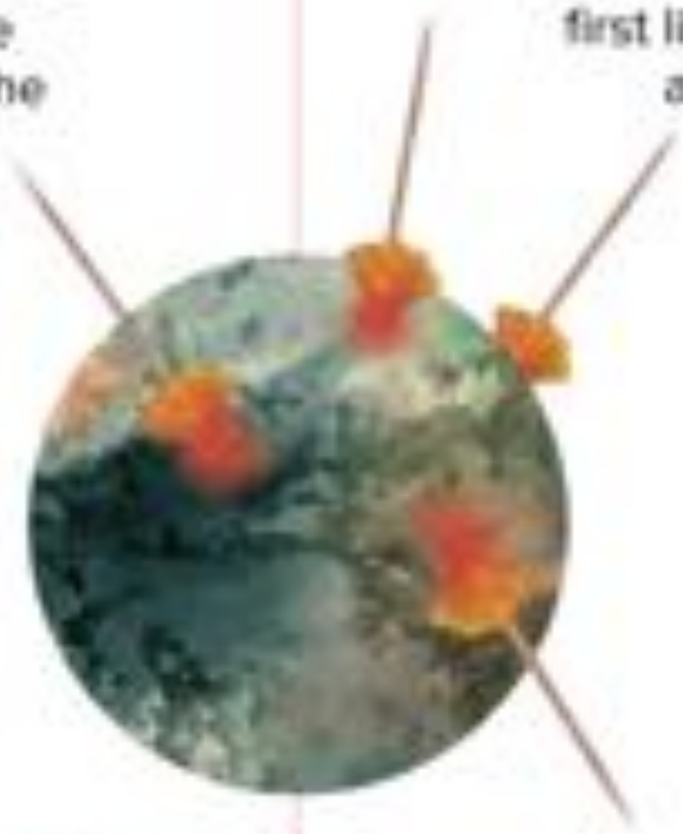
Gas, dust, and rocks in the early solar system clump together and form the earth.

4,600 MYA

A planet the size of Mars crashes into the earth. The debris from the collision forms the moon.

4,500 MYA

For millions of years, the earth is bombarded with comets and asteroids.



4,000 MYA

Oceans form—the earth is covered in water. The first living things appear.

3,800 MYA

3,100 MYA

Land—the first continent—appears.

More continents have formed.

Snowball earth—the world is completely covered in ice. Widespread volcanic activity will eventually melt the ice.

750 MYA

650 MYA

The earth: a timeline—part 2

Many new kinds of animal life appear.

525 MYA

The first four-legged animals move from the sea onto the land.

395 MYA

A single large continent called Pangaea forms.

335 MYA

The biggest mass extinction of all time kills 85% of all animal species. Extreme volcanic activity may have been the cause.

250 MYA

The first dinosaurs appear on earth.

235 MYA

An asteroid hits the earth and wipes out the dinosaurs.

66 MYA

The earth today

present

Glossary

abyssal zone
The deep, dark depths of the sea. This zone lies between 13,000 feet (3,962 meters) and 20,000 feet (6,096 meters) below the ocean's surface.

asteroid
A rocky, irregularly shaped object that circles the sun. Asteroids range from a few feet to 600 miles (966 kilometers) across.

bombarded
Struck repeatedly with objects.

climate
The weather of a region over a long period of time.

continent
A large body of land. The earth is usually considered to have seven continents.

debris
Loose or broken pieces of rock or other material.

eject
To throw out forcefully.

environment
Everything—including soil, water, temperature, vegetation, and animals—that surrounds a place or living thing.

glacier
A large mass of ice formed by snow building up over many years. If the ground is sloped, the glacier will slowly move downhill.

greenhouse gases
Gases that accumulate in the atmosphere, trapping the sun's heat and making the earth warmer.

iceberg
A large, floating chunk of ice that breaks off of a glacier.

ice cap
A thick layer of ice that covers a large area or entire continent.

ice sheet
A layer of ice that covers a large area, but not as large as an ice cap. It can be on land or floating on water.

infographics
Facts and information presented visually as diagrams, charts, and graphs rather than just text.

kilometer
The kilometer is a metric unit of distance equal to $^{6}/_{10}$ of a mile.

landmass
A continent or large body of land.

magma
Hot, liquid rock below the earth's surface. If magma escapes to the surface, it is called lava.

mantle
A layer of the earth that lies between the crust and the core. Due to the heat of the earth's interior, it is partially molten.

mass extinction
An event that kills at least half of all living plant and animal species. There have been at least five mass extinctions over the past 450 million years.

meteorite
A meteor is a small, rocky object from space. Meteors burn up in the earth's atmosphere. A meteorite is a meteor that doesn't completely burn up and hits the surface.

molten
Melted.

perpetual
Constant, continuous.

radiate
To emit or project heat, light, or energy.

scuba diving
Staying underwater for an extended time by using a self-contained breathing system and air storage tanks.

sea level rise
A gradual increase in the level of the ocean. It is caused by water expanding as it gets warmer and by the melting of glaciers and ice caps. We are experiencing sea level rise at an increasing rate.

Snowball Earth
A period about 650 million years ago when a thick layer of ice and snow covered the earth from pole to pole. It lasted for millions of years. The ice melted when enough volcanoes erupted to change the atmosphere and heat the planet back up.

snowpack
A layer of accumulated snow that has not been compressed into ice.

species
A group of living things that look alike, behave in a similar way, and are able to produce offspring.

submersible
An underwater vessel often used for research. Unlike a submarine, it is connected to the surface or a supporting ship with cables that provide power and air.

trench
In the ocean, a long, narrow, and very deep valley in the sea floor. Trenches are the deepest spots in the ocean.

tsunami
A large wave or series of waves that are caused by a sudden change in the sea floor or ocean. Earthquakes, volcanoes, landslides, and meteorite impacts can all cause tsunamis.

volcanic eruption
A violent release of gas, ash, and lava from a volcano.

Bibliography

The Best Book of Volcanoes. By Simon Adams. Kingfisher, 2001.

Down, Down, Down. By Steve Jenkins. HMH Books for Young Readers, 2009.

The Earth Book. By Jonathan Litton. 360 Degrees, 2016.

The Earth Pack: A Three-Dimensional Action Book. By Ron Van Der Meer. National Geographic Society, 1995.

Everything Volcanoes and Earthquakes. By Kathy Furgang. National Geographic Children's Books, 2013.

Everything Weather. By Kathy Furgang. National Geographic Children's Books, 2012.

Forces of Change: A New View of Nature. By Daniel Botkin. National Geographic, 2000.

Global Warming. By Seymour Simon. Collins, 2013.

Incredible Earth. By Nick Clifford. DK Children, 1996.

Tornadoes! By Gail Gibbons. Holiday House, 2009.

For Jeffrey

hmhbooks.com

The illustrations are cut- and torn-paper collage.
The infographics are cut-paper silhouettes and graphics created digitally.
The text type was set in Proxima Nova.

ISBN: 978-1-328-85101-7 hardcover
ISBN: 978-1-328-85102-4 paperback

eISBN 978-0-358-05587-7