

American Museum of Natural History

# Our DYNAMIC Planet

Explore Our  
Ever-changing  
And  
Rearranging  
Turbulent  
Home

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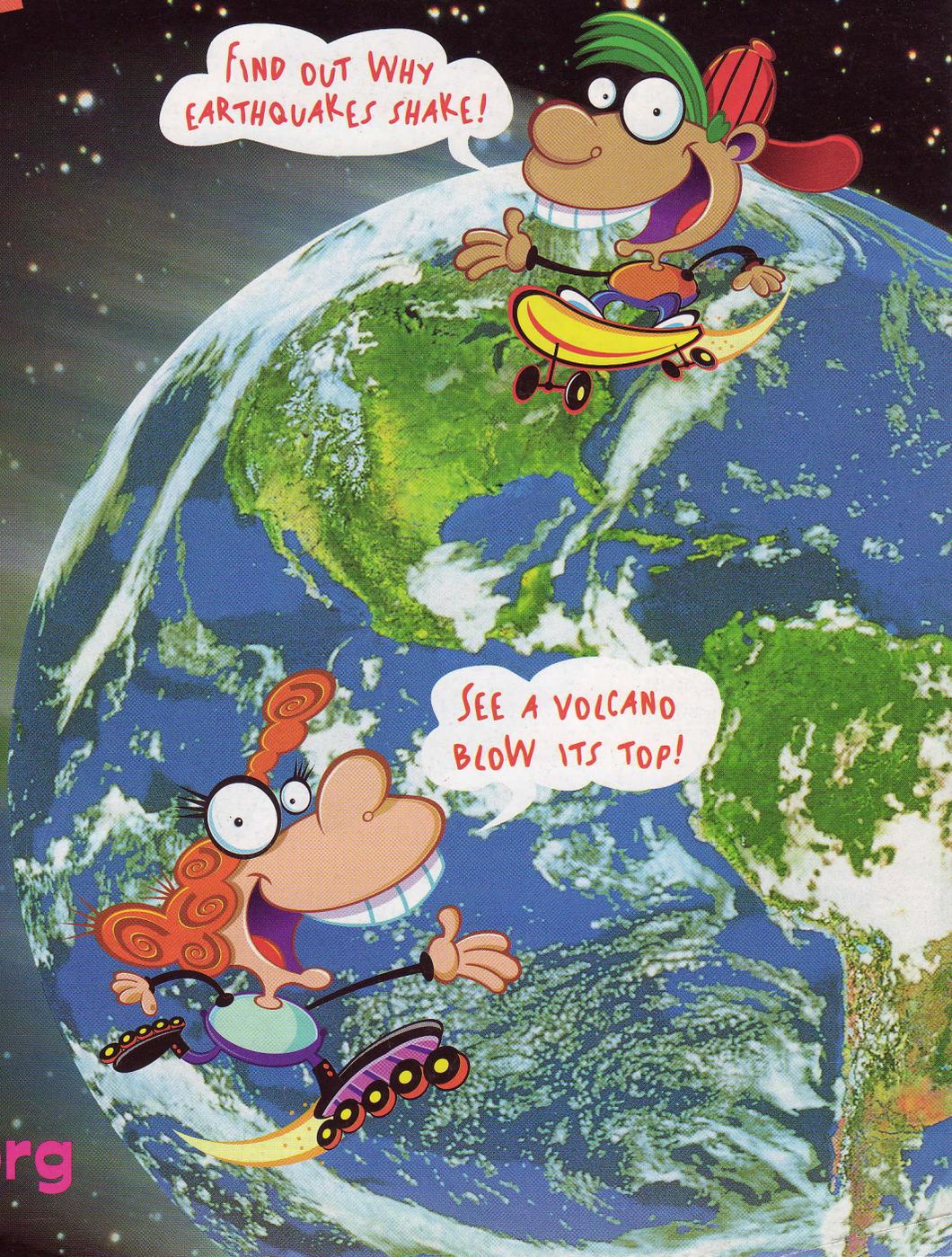
Play the  
EL NIÑO  
GAME



Cook up an  
EDIBLE  
EARTH



[www.amnh.org](http://www.amnh.org)



# Can You Name 4 Ways Earth Changes and Rearranges?



v \_ \_ \_ \_ \_ e s e r **U** p t



r \_ \_ \_ \_ \_ s c a r v e



m \_ \_ \_ \_ \_ s **b** u i l d



w \_ \_ \_ \_ e r o d e s

Answers on back cover

## COOL EARTH FACTS

### Bet You Can't Stand Still!

- Earth spins at about 1000 miles per hour at the Equator. That's twice as fast as a jet plane.
- The ground beneath your feet is always on the move. To be specific, it's the continents we live on that are changing position—about 1/4 inch every month.

### Water World

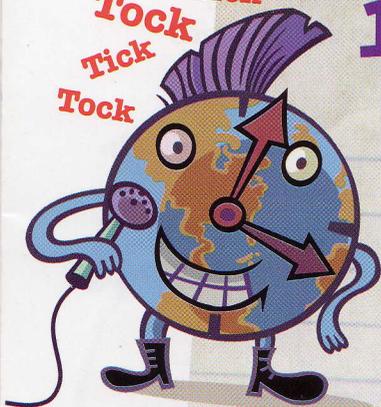
Almost 75% of the planet is covered by oceans and seas. Their powerful currents spread the sun's heat around the planet. This keeps the temperature from getting too hot or too cold. Water makes life possible. Instead of Planet Earth should we call it Planet Water?

Tick  
Tick  
Tick  
Tock

## Rock Around the Clock

A million years is hard to imagine. But if you pretend that Earth's history took place in a single day, each minute on this 24-hour clock would stand for about 3 million years.

midnight (4.5 billion years ago)	Earth forms from cosmic dust	
3:20 AM (3.96 billion years ago)	age of oldest rock ever found	
9:23 PM (500 million years ago)	first animals with backbones	
11:00 PM (190 million years ago)	age of the dinosaurs	
11:35 PM (80 million years ago)	Rocky Mountains start to form	
11:58 PM (6 million years ago)	small stream begins carving Grand Canyon	
11:59 and 26 sec. (1.8 million years ago)	earliest humans appear	
11:59 and 45 sec. (750 thousand years ago)	humans begin using fire	
11:59 and 59 sec. (20 thousand years ago)	last Ice Age	



I can't believe I ate the **WHOLE WORLD!**

Stir in the rest of the marshmallows until melted. Remove from heat and stir in cereal. **Cool for 5 minutes.**

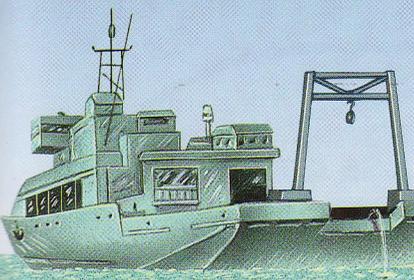
- Wet your hands with water. Then roll the cereal mixture into a ball around the core.
- To make the crust:** Use a butter knife and spread a thin layer of peanut butter all over the mantle. Then put cookies inside a sandwich

bag, close the bag, and crush the cookies into crumbs. Pour cookie crumbs onto a plate. Roll your Earth in the cookie crumbs until all the peanut butter is covered.

5. Slice your Earth in half and admire the layers of inner core, outer core, mantle, and crust.

6. **EAT!**

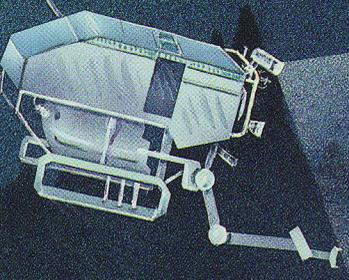




# Hi, I'm Margaret Carruthers

and I'm a geologist at the American Museum of Natural History. In 1998, I went on an amazing journey with a team of geologists, chemists, biologists, teachers, and engineers to study strange rock structures on the sea floor. We traveled by ship to the **Juan de Fuca Ridge** located at the bottom of the Pacific Ocean, off the coast of Washington State.

The Juan de Fuca Ridge is part of the long chain of underwater volcanoes that circles Earth. The ridge is over 1.5 miles underwater. This is too deep to scuba dive, so we use a remotely operated vehicle (**ROV** for short). This robot has a video camera and a mechanical arm that are operated from aboard the ship. As the ROV explores the ocean floor, we watch what it sees on a video monitor aboard the ship. My job is to describe and identify what I see. One thing I see are **sulfide chimneys** crawling with life. Active chimneys belch black smoke and are nicknamed **black smokers**. The smokers give off heat and minerals that make it possible for deep-sea creatures to live in this extreme environment.

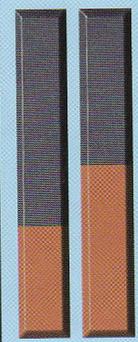


# HOLY SMOKE!

Life where you'd least expect it!

## CRABS

Spider crabs are often found munching away in the bushes of tube worms. Scientists are not sure exactly what it is they are eating.



## PALM WORMS

These worms are shaped like a long tube with an end that looks like a tropical palm tree. The palm "leaves" filter the water for bacteria, which the worms use for food.

## How is a sulfide chimney created?

When very cold water seeps into cracks in the ocean floor, it is heated by very hot, melted rock (called magma) in an underground chamber. The heated water grabs and dissolves minerals as it flows through the underground rock. When the hot water gushes back into the ocean, it mixes with cold water causing tiny mineral crystals to form. This mixture of minerals and water looks like black smoke. These minerals pile up on the ocean floor and form chimneys. They are called "sulfide chimneys" because they are made of many different sulfur-rich minerals.

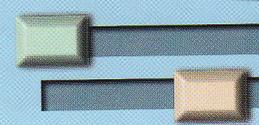
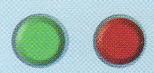
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PALM WORM



TUBE WORM



## How tall is Godzilla? **FIND OUT!**

In 1991, scientists discovered a gigantic "black smoker." They nicknamed it Godzilla.

## How tall is this monster chimney?

To find the answer:

1. Read these pages carefully.
2. Search for tube worms, palm worms, and sulfide chimneys in the ship's video monitor.

3. Write the matching number in each blank.

\_\_\_\_\_ (tube worms)

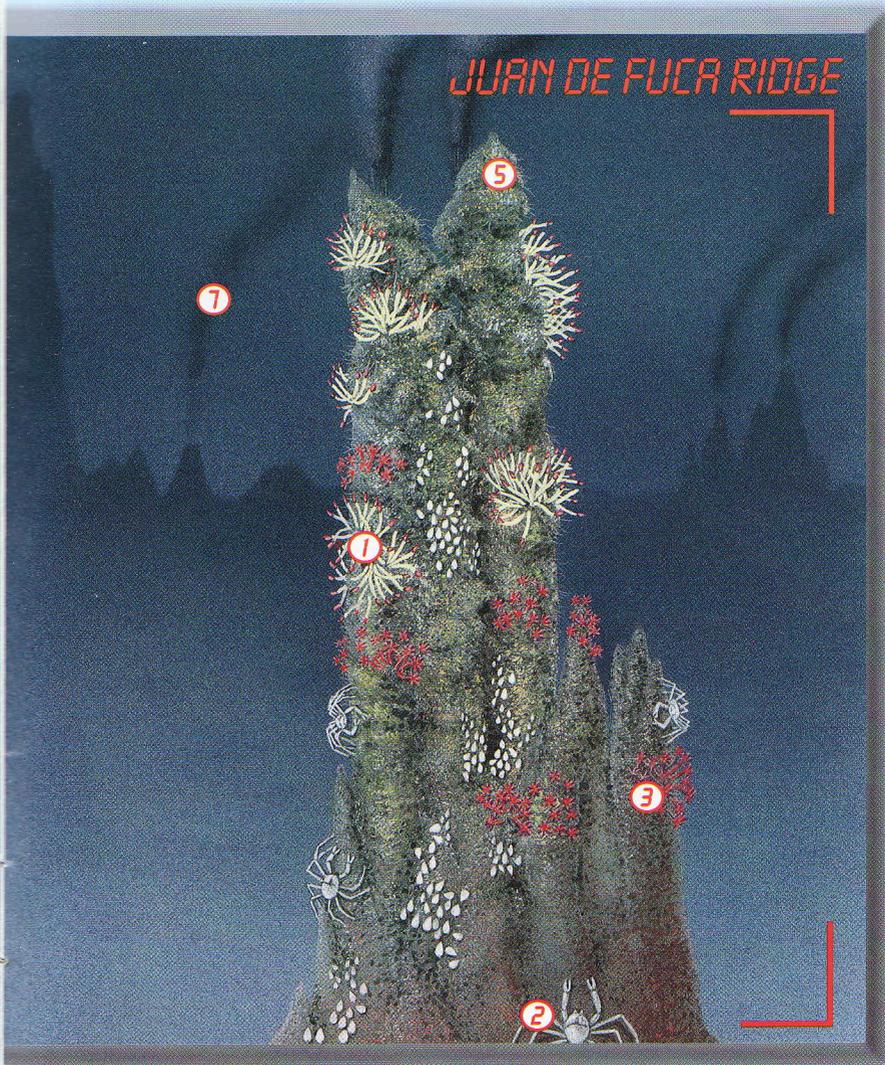
\_\_\_\_\_ (palm worms)

\_\_\_\_\_ (sulfide chimneys)

**feet tall**

**UPDATE:** Godzilla is no longer as tall today. When scientists went back to study Godzilla, they found it had fallen over.

Answers on back cover



## TUBE WORMS

These creatures have distinctive red tips or plumes. The worms rely on bacteria living inside of them to convert chemicals in the water into their food.

## SNAILS

Several kinds of small snails live on the sulfide chimneys. Unlike the palm and tube worms, the snails move around the chimney's surface. Scientists think they eat bacteria that grow on the chimneys.

## extreme conditions

- Ⓞ **V-V-VERY C-C-C-COLD:** Without sunlight, the water on the ocean floor is 2°C (degrees Celsius). Fresh water freezes at 0°C.
- Ⓞ **HOT ENOUGH FOR YOU?:** The hot water that gushes out of the chimneys can be as hot as 400°C. The magma deep underground gets as hot as 1,200°C.
- Ⓞ **SUPER PRESSURE:** At the surface of the ocean, fresh water boils at 100°C. Down here, the pressure is so great that the water doesn't boil. The pressure here is so great that it would feel like 500 pounds pressing in from all sides on every inch of your body.