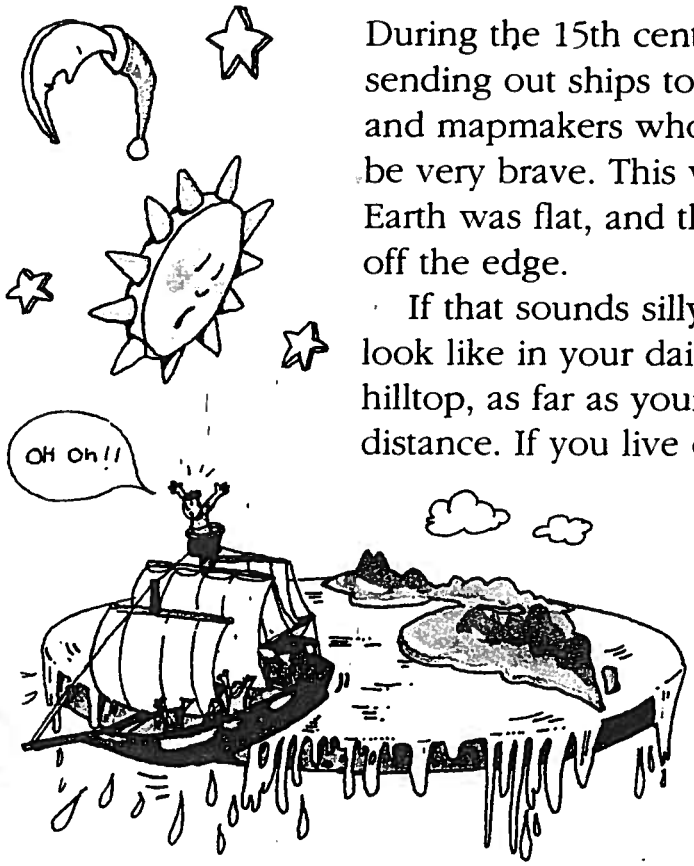
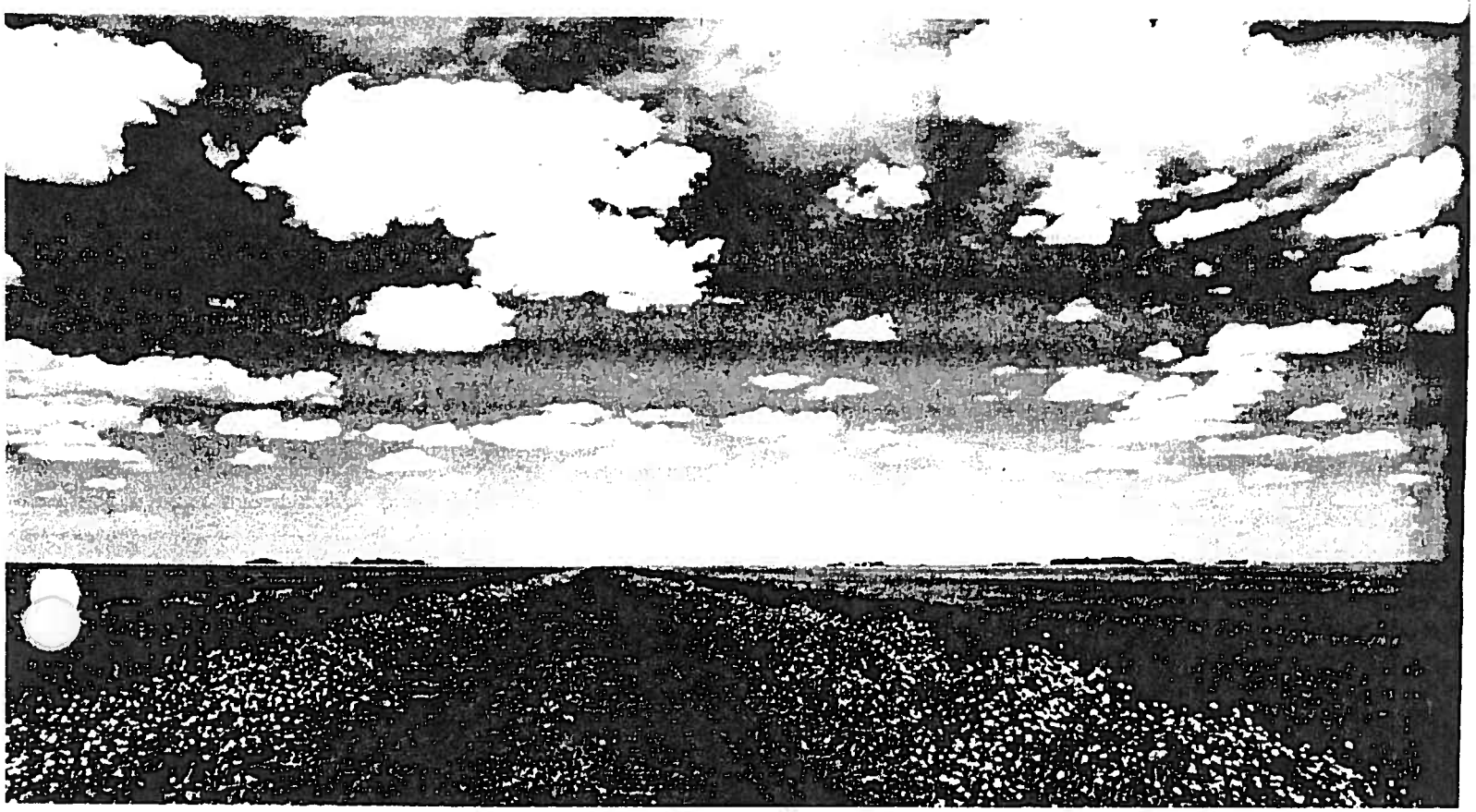
The Spherical Earth



During the 15th century, some wealthy European countries began sending out ships to explore the world. The sailors, scientists, and mapmakers who went on these expeditions were thought to be very brave. This was because most Europeans assumed the Earth was flat, and that if ships sailed too far the crew would fall off the edge.

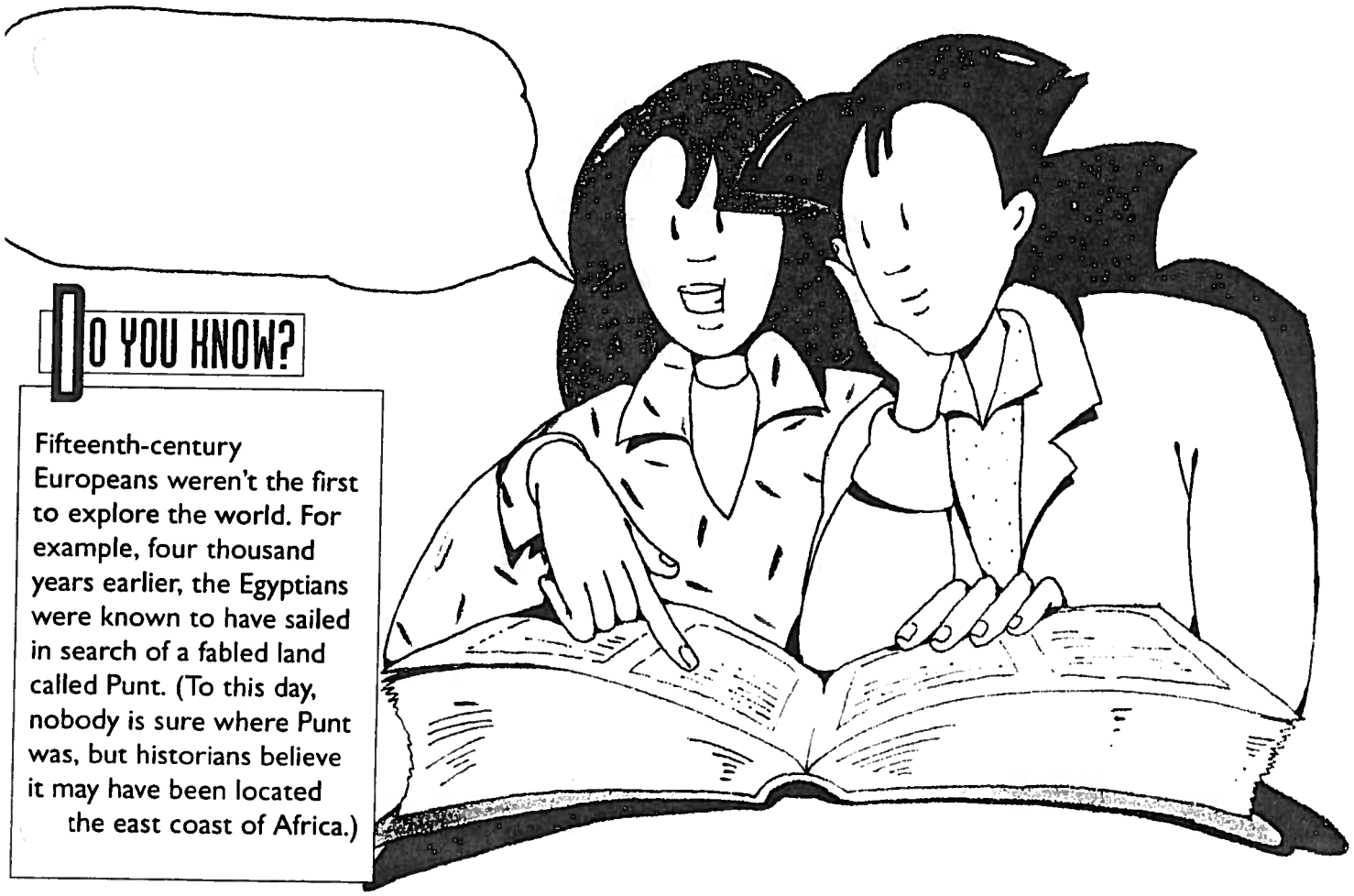
If that sounds silly to you, think about what the Earth and sky look like in your daily experiences. From the highest building or hilltop, as far as your eyes can see, the land stretches into the distance. If you live on the prairie, the line where the land meets the sky may look straight. If you live in hill country, the line may look jagged. But it doesn't look curved. So it isn't surprising that many people supposed the Earth must be flat.



Flat Earth or Spherical Earth?

The idea of a flat Earth seems to make sense, but the European explorers must have thought otherwise. If they had believed that the Earth was flat, they wouldn't have risked sailing on such long voyages. The people of the 15th century didn't have pictures like photos A and C on pages 154-155 to convince them that the Earth is spherical. In fact, the technology needed to take pictures like these didn't exist until the 1960s. So you might be wondering how 15th-century explorers inferred that the Earth is spherical.

The answer began more than two thousand years earlier with ideas that were developed by the philosophers of ancient Greece. These philosophers didn't have advanced technology for making observations and measurements. But they did have well-developed thinking skills. In the next Activity, you will use your own thinking skills to look at the Earth in the same way that the early philosophers did.



DO YOU KNOW?

Fifteenth-century Europeans weren't the first to explore the world. For example, four thousand years earlier, the Egyptians were known to have sailed in search of a fabled land called Punt. (To this day, nobody is sure where Punt was, but historians believe it may have been located the east coast of Africa.)

Inferring a Spherical Earth

Activity

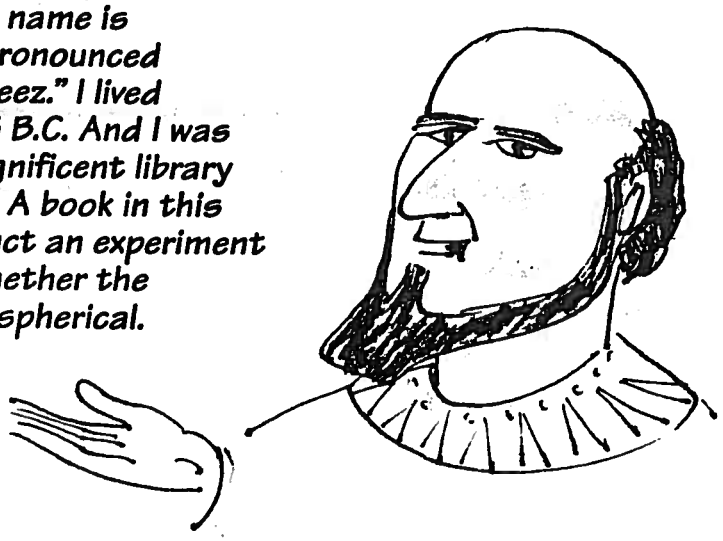
Focussing

These three philosophers from ancient Greek history will be your hosts for this Activity. After you meet them, read what they have to say in the What You Will Do section. Then answer the questions that follow.

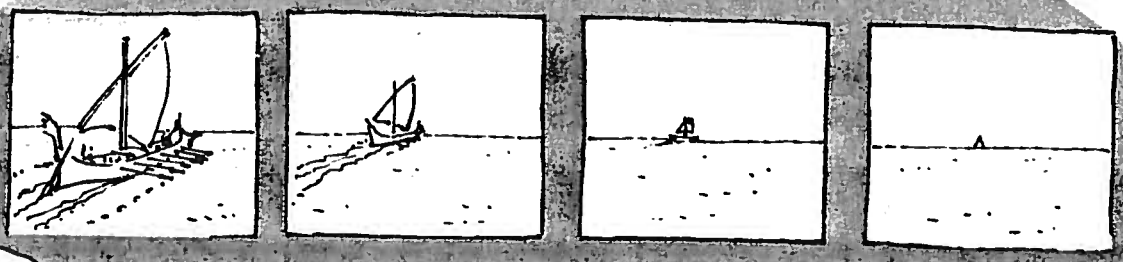
Pythagoras, here. That's "Pith-agor-as," if you need some help pronouncing it. I was teaching in southern Italy at the time when I suggested the idea of a spherical Earth, about 530 B.C. I'm remembered for my studies of mathematics, too. You'll probably hear my name in math class in a year or two.

I'm Anaxagoras—pronounced "A-nax-a-gore-as." I lived in Athens, Greece around 450 B.C. In addition to my ideas about the Earth being spherical, I also believed that the moon shines because light from the sun reflects from its surface. Later scientists have proved me correct.

Greetings. My name is Eratosthenes, pronounced "Era-toss-then-eez." I lived from 276 B.C. to 196 B.C. And I was the librarian of a magnificent library in Alexandria, Egypt. A book in this library helped me conduct an experiment to determine whether the Earth is flat or spherical.



What You Will Do

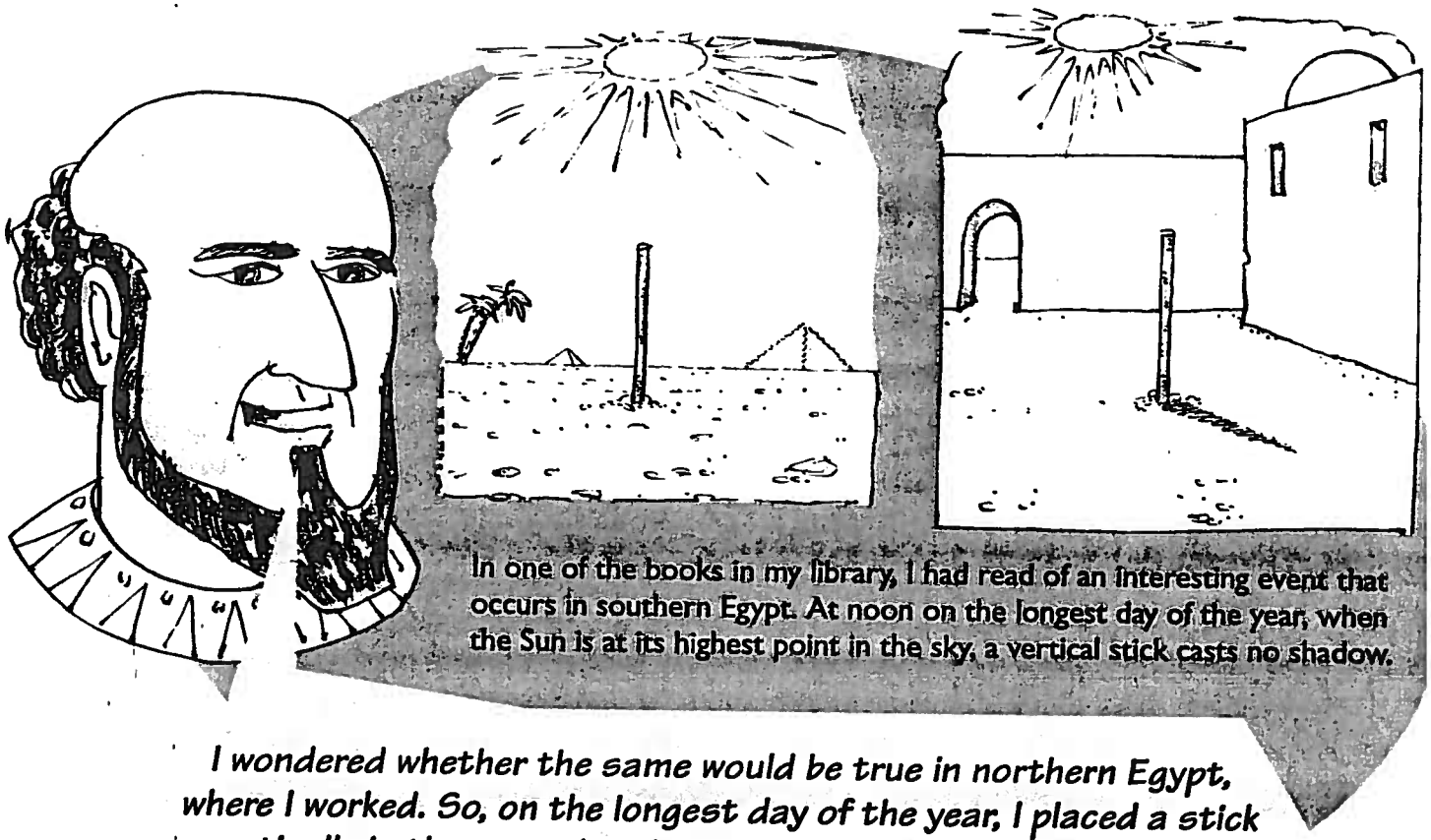


I came up with my idea about the Earth being spherical by watching ships set out to sea. As a ship sails farther from shore and closer to the place where the sea meets the sky, the ship gets smaller and smaller. Eventually, it disappears from view. But the whole ship doesn't do this all at once. The big hull of the ship disappears from view first. And the tall mast disappears from view last.

I said to myself, "If the Earth is flat, the whole ship should disappear from view all at once." Since parts of it disappear from view at different times, with the tallest part disappearing last, I inferred that the Earth is curved. Since the Sun and the Moon are curved and spherical, I decided that the Earth must be spherical like them, too.

Personally, I was more interested in the Moon than in ships. In particular, I liked watching eclipses of the Moon. I had concluded that eclipses occur when the Earth moves between the Sun and the Moon. This blocks off some of the Sun's light that shines on the Moon. When this happens, part or all of the Moon is left in total darkness.

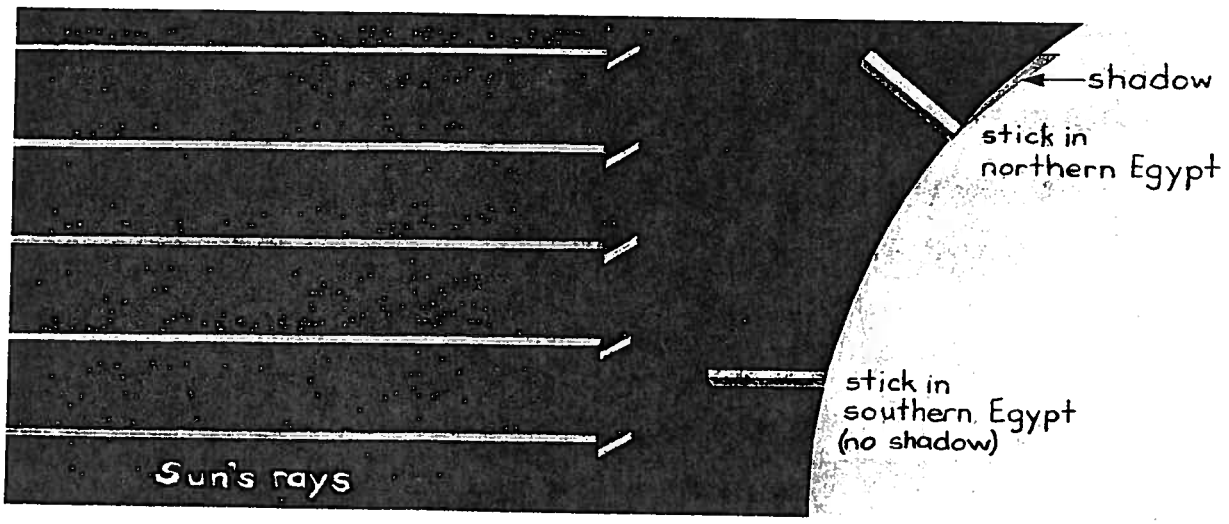
Do you see in the photo that the dark area on the Moon is curved? I was the first known person to realize that this dark area is really the Earth's shadow. Since it's curved, I inferred that the Earth must be spherical.



In one of the books in my library, I had read of an interesting event that occurs in southern Egypt. At noon on the longest day of the year, when the Sun is at its highest point in the sky, a vertical stick casts no shadow.

I wondered whether the same would be true in northern Egypt, where I worked. So, on the longest day of the year, I placed a stick vertically in the ground and waited. But when noon hour came, I observed that my stick cast a noticeable shadow.

So, I said to myself, "If the Earth is flat, a stick in northern Egypt should do the same thing as a stick in southern Egypt." In other words, neither stick should cast a shadow. But since my stick in northern Egypt did cast a noticeable shadow, I inferred that the Earth is curved. Since spheres are also curved, I decided that the Earth must be spherical.



Inferring a Spherical Earth

1. **What did Pythagoras observe that convinced him that the Earth was sperical? (use a diagram in your answer)**

In words	Picture

2. **What did Eratosthenes observe that convinced him that the Earth was spherical? (use a diagram in your answer)**

In words	Picture

3. **What did Anaxagoras observe that convinced him that the Earth was spherical? (use a diagram in your answer)**

In words	Picture