cal shape.

Who "Invented" Geography?

Imagine this. You've been shipwrecked and washed up on a desert island, a modern-day Robinson Crusoe. A selective amnesia has erased any memory of dates, places, seasons, or time. You have no watch, no maps, no recollection of where you were when your boat went down.

How long would it take you to figure out the time of day? The season? The month? The approximate date? You notice that the water comes way up onto your beach and then goes back out later in the day. Why does it do that? As you lay back in your tropical paradise and looked at the night sky, could you tell the difference between those pinpoints of light that moved through the heavens?

When would you plant some crops to keep yourself fed? After all, coconut milk and wild berries only go so far.

Do you know the distance to the other side of the island? How would you measure it? And what about your approximate location in the world? You've forgotten latitude and longitude exist. Do you know where in the world you are?

If you managed to figure all of that out, could you then determine what shape the world is? And how large that world might be?

Well, the ancient Greeks—or more accurately, a various group of people we have lumped together and called the Greeks—managed to do just about all of these things. Of course, it took several geniuses working over the course of a few centuries to pull all of this together—not without a few substantial mistakes that were kept alive for most of the next twenty centuries, influencing everyone from the hierarchy of the Roman Catholic Church to Christopher Columbus.

But the Greeks did it. And they managed it without watches, telescopes, sextants, Black & Decker tape measures, or any of the

DAVIS, Kenneth C. Don't Know Much About Geography. William Morrow & Co. New York (1992).

time and space possible. The Greeks were not the first to look at the world and attempt to explain its workings. The Egyptians and Mesopotamians produced much of the groundwork from which the Greeks proceeded. And the Hindu and Chinese cultures were working things out in their own way for much of the same time.

But what set the early Greek thinkers apart from their contemporaries as well as from earlier cultures was their systematic attempt to apply rational thought to the world. They were the first to explore the notion of testing their ideas about the world in the beginning of what we now call the scientific method. And while they fell back on myth and superstition when they were unable to explain the universe—just as past and future generations of humanity would—they were the first to attempt to *know* the universe.

Geography is a word derived from the Greek—*ge*, meaning "the Earth," and *graphe*, "to describe." Many Greeks thought and talked and wrote about geography without exactly calling it that. In fact, Homer's epic *Odyssey* is viewed as one of the first geographic works in Western culture because it describes the many recognizable places that Odysseus (Ulysses) reached during his long voyage home from Troy. (See in Chapter 4, "Imaginary Places: Was There a Troy?," page 207.)

More scientific approaches to geography came about in Miletus, a Greek trading center that flourished in what is modern Turkey some seven hundred years before Christ. There Greek philosopher-mathematicians began to apply mathematical principles to measuring the Earth. Thales, a sort of ancient Thomas Edison, combined his success in the olive-oil business with an extraordinary ability to both ponder and invent. He made several major contributions to geometry and was said to have accurately predicted a solar eclipse in 585 B.C. But one of his influential conclusions was that the Earth was a disk floating in water.

Anaximander, a younger colleague who introduced a sundial, made a rather astonishing guess when he surmised from fossil remains that life originated in the sea that once covered much of the Earth's surface. He drew the first scaled world map. With Greece in

the center showed a world bounded by an endless river or sea. He believed that the Earth was a cylinder with a disk resting on top being the habitable part. But instead of floating on an endless sea, as his mentor Thales had thought, Anaximander's Earth was suspended freely in space; the heavens were attached to a sphere that revolved around the Earth, explaining the daily circuit of sun, stars, and planets.

Other Greek writers, philosophers, historians, and mathematicians followed—Herodotus, Plato, and Aristotle among them—all expanding the Greek inquiry into the size and shape of the world, its place in the universe, and the bounds of human habitation. Plato believed the Earth was spherical, but for philosophical reasons rather than scientific evidence; the sphere, he believed, was the perfect geometric form. Aristotle later agreed, but sought observable evidence which he found in the shadow cast by the Earth on the face of the moon.

On the other hand, the great philosopher also fell back on fairly simplistic reasoning. Aristotle thought that the closer one gets to the equator, the hotter the temperature becomes. His proof lay with the black skin of Libyans who, in Aristotle's thinking, had been seared by the sun. Life at the equator was not possible, in Aristotle's conception, because it would be too hot there. Aristotle also believed in a natural balance that dictated the existence of a continent to the south of the equator equal to that north of the equator, introducing the concept of the Antipodes, or "opposite feet," that lasted from Aristotle's time until the voyages of Captain Cook in the mid-eighteenth century.

But three other so-called Greeks stand out because they all addressed Greek knowledge of the world in separate books, all with *Geography* in the title.

The first of these was Eratosthenes (circa 276–196 B.C.), actually a Libyan-born librarian who was the first to use the word *geography* and who also managed to come up with a way to measure quite accurately the circumference of the Earth, with little more than a shadow, a well and some basic camel sense.

Eratosthenes was appointed chief of the library at Alexandria,

where he controlled a collection of more than a hundred thousand "books"—they were actually papyrus scrolls—containing . . known world's collective knowledge. About 250 years before the birth of Christ, the Western world's most important city was Alexandria, in Egypt, the home of the renowned library started by Alexander the Great, the young soldier from Macedon tutored by Aristotle. After Alexander's death, his heirs as rulers of Egypt were the Ptolemies (the legendary Cleopatra among them). Under the three-hundred-year-long Ptolemy dynasty, Alexandria became the world's preeminent center of scientific, mathematical, and literary studies, as well as a rather seamy den of cutthroats drawn by the riches of the world that passed through the city. It was, as one poet called it, the "house of Aphrodite" (goddess of love) with plenty of wine, wealth, fine young men, and beautiful women. Makes you wonder how they got any work done.

One of Eratosthenes's greatest contributions seems simple enough, given the benefit of hindsight. However, nobody else thought of it sooner so Eratosthenes gets the credit for dividing the world by parallel east-west and north-south lines, or meridians. He failed to lay these lines down at regular intervals and instead used notable landmarks and prominent places such as Rhodes, Alexandria, the Pillars of Hercules (Gibraltar), and the tip of the Indian Peninsula as the basis for dividing his world.

Hearing of a well in Syene (modern Aswan) where the sun's reflection could be seen in the water at noon on June 21, the longest day of the year, Eratosthenes surmised that the sun was directly above the Earth at that moment. The Libyan librarian then made some interesting logical leaps. He believed that Syene was due south of Alexandria on the same meridian (or longitudinal line, the imaginary north-south running lines on the map). By measuring the shadow cast by an obelisk in Alexandria at the same moment there was no shadow in Syene, Eratosthenes computed the length of two sides of a triangle—the length of the shadow and the height of the obelisk. With that information and some basic geometry, Eratosthenes figured the angle of the triangle and with that figure determined the degree that the sun was from directly overhead. That proved to

be 7° 12′ which is approximately equal to one fiftieth of a circle's 360°.

Knowing this, Eratosthenes further reasoned that if he knew the distance from Syene to Alexandria—which would equal the third side of his triangle connecting the sun, Alexandria, and Syene—he could simply multiply that distance by 50 and would have the approximate size of the Earth. Enter the camels.

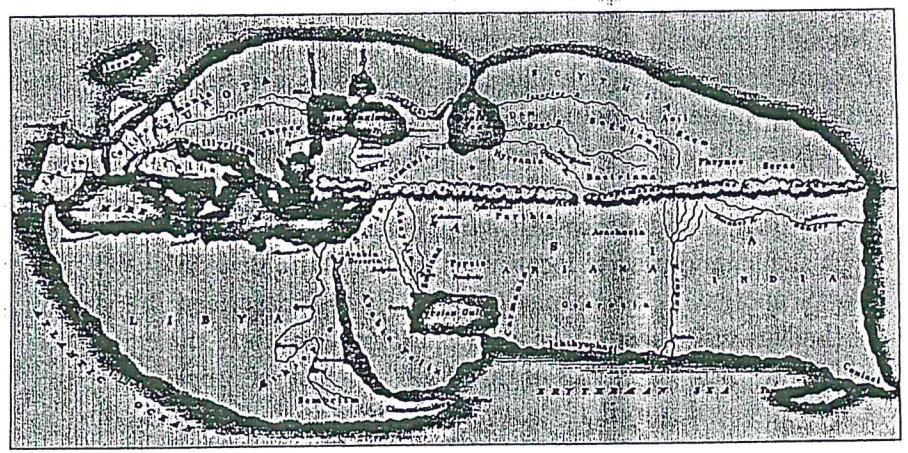
Eratosthenes learned that it took camels fifty days to make the trip from Syene to Alexandria. Using ancient EPA camel standards of 100 stadia per day (stadia is an ancient measurement that related to the size of a Greek race course), the clever librarian came up with a distance of 5,000 stadia from Syene to Alexandria. Multiplying that by 50 gave Eratosthenes an Earth circumference of 250,000 stadia. Using various estimates of modern equivalents, his Earth measured about 25,000 miles, very near to its actual measurement at the poles of 24,860 miles. Given the number of small mistakes involved, all of which canceled each other out, this calculation was an extraordinary example of the Greek ability to apply logic and mathematics to measuring—and knowing—the world.

After Eratosthenes died, a conflicting view of the size of the Earth came from another Greek historian-geographer named Poseidonius (c. 130–51 B.C.) of Rhodes. His calculation was based upon the height of the star Canopus, determined algebraically, and used the sailing time of ships. Ironically, his calculations were close to the figure Eratosthenes had reached. But for some reason they were later reduced to the much smaller size of 18,000 miles by Strabo, another significant scholar who comes along next. It was this figure that Columbus would rely upon in making his case for a voyage west to the Orient.

While this mistake—a smaller Earth—was widely accepted and perpetuated, another of the conclusions reached by Poseidonius was correct, but dismissed because it contradicted Aristotle. Poseidonius believed that the equatorial zone was quite habitable and that the highest temperatures were to be found in deserts inside the so-called temperate zone, which is the case.

The expert who inaccurately recorded Poseidonius' the second key "Greek" geographer, Strabo (c. 64 B.C.–c. A.D. 20?, who was born in modern Turkey and who wrote at about the time of Christ. Like Eratosthenes, Strabo worked in the Alexandria library. Unlike Eratosthenes, Strabo was no innovative genius who came up with new theories about the world. His genius, instead, was as a compiler and his work, *Geographica,* filling all of seventeen volumes, brought together the sum of the Mediterranean world's knowledge to that time, describing Asia, North Africa, and much of Europe, which Strabo had seen himself in his rather extensive travels. Among his chief contributions were dividing the world into frigid, temperate, and tropic zones, although he badly miscalculated how far north and south of the equator these lands were habitable. He believed, like Aristotle, that the dark skin of the Ethiopians was the result of scorching by the sun and the blond barbarians of the north were so savage because of the frigidity of the arctic zones.

And finally, there was Ptolemy (c. A.D. 100–170), an Egyptian-Greek or Greek-Egyptian, but not one of the royal Ptolemies, who condensed the sum of Greek world knowledge together during the



The world of Strabo was compiled from travelers' reports and the writings of the ancients. It represented the sum total of Western cartographical knowledge before the Christian Era. COURTESY, DEPARTMENT OF LIBRARY SERVICES, AMERICAN MUSEUM OF NATURAL HISTORY

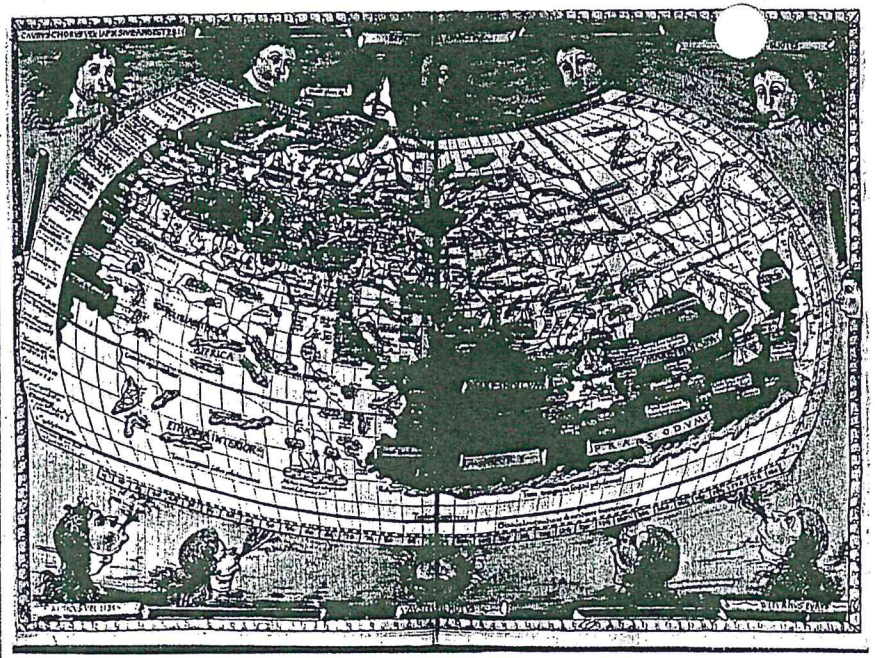
period of the Roman Empire and whose views were accepted for centuries.

Although best known for his work in the area of astronomy—kept alive by the Arabs and known by its Arabic name, *Almagest*—Ptolemy's *Geographia* laid out many of the principles still followed in modern cartography and included an atlas of the known world, based on the experiences of the Roman legions as they spread the Roman Empire. It included some eight thousand places identified by their *latitude* and *longitude*, words Ptolemy is said to have coined. And the system he adopted is basically that of modern geography, including the seemingly simple notion of "orienting" maps with the north at the top and the east on the right. That is, it seems simple enough until you realize that if you set out to orient a map today, what would you place at the top? Given the notion that the world is a sphere, any arbitrary spot might have been used. For many centuries, for instance, European maps were "oriented" with East on top, emphasizing the centrality of the Holy Lands, and Jerusalem in particular.

Ptolemy also attempted to address a problem that still exists: the impossibility of representing a round Earth on a flat piece of paper. His solution was a globe, but that posed its own problems, as a globe cannot be made large enough to encompass the fine details that Ptolemy wanted to include in his maps.

Ptolemy's world was surprisingly large, consisting of the three continents then known to the people around the Mediterranean—Europe, Asia, and Africa. Although often inaccurate in matters of size, shape, and precise location, it included the British Isles, Scandia (Scandinavia), and Sinae (China). He also described the source of the Nile quite accurately as lakes in Africa south of the equator—hidden in the "Mountains of the Moon"—a fact left unproven to the European world until the travels of the British explorers, Burton and Speke, in the nineteenth century.

Like his predecessors, Ptolemy made mistakes, influencing the course of science, philosophy, and religion. His Earth-centered universe would be accepted by the learned world for centuries to come. He elaborated on the concept of the Antipodes, expanding it into a



The World of Ptolemy, second century A.D. COURTESY, DEPARTMENT OF LIBRARY SERVICES, AMERICAN MUSEUM OF NATURAL HISTORY

Terra Australis Incognita (unknown southern lands) which, on one hand, fueled speculation and hope of finding a great continent attached to the bottom of Africa but, on the other hand, made sailing around Africa seem impossible.

But one of his mistakes was even more far-reaching. Relying upon Strabo's figures, Ptolemy declared the world to be 18,000 miles around. On his maps, Asia extended far beyond its true width, making the Orient seem far closer to Europe than it actually is. Ptolemy's authority, like Aristotle's, was unquestioned by later Europeans, including most significantly one Genoan named Cristóbal Colón, who used Ptolemy's figures to argue his case before the king and queen of Spain.

Geographic Voices From Strabo's *Geographica,* written between A.D. 17 and 23.