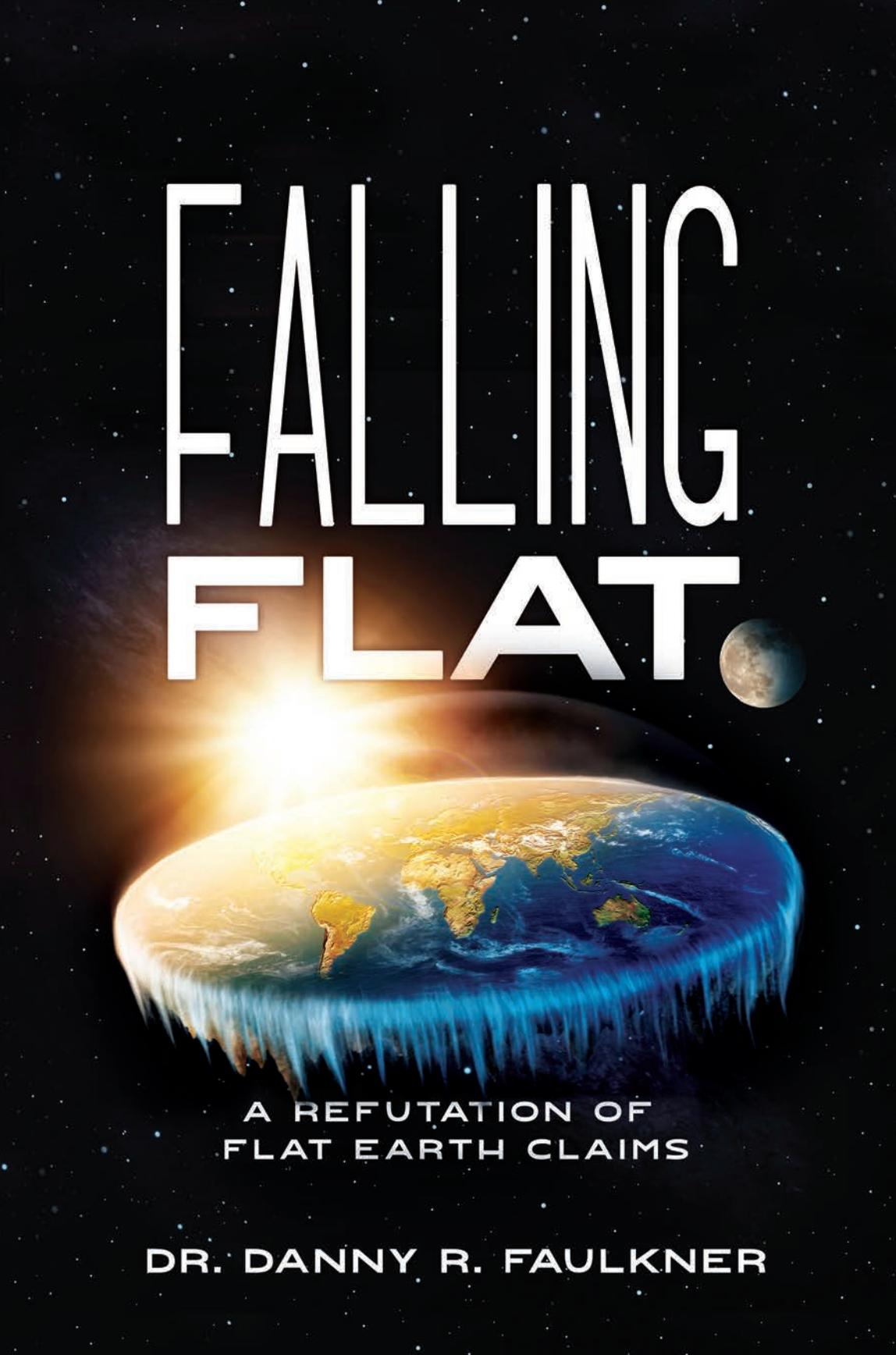


# FALLING FLAT.



A REFUTATION OF  
FLAT EARTH CLAIMS

DR. DANNY R. FAULKNER

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*Dedicated to Teddy, a lifelong friend and  
companion. May we have many more  
adventures together.*

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## Chapter 1

### *Why Write About Flat Earth?*

Many people probably wonder why it is necessary to write a book about the flat earth. After all, didn't we settle that question more than five centuries ago when Christopher Columbus proved that the earth is round? Well, no, Columbus didn't settle that question, and therein lies a major part of the problem — but more about that later. Beginning around 2012, there has been a major resurgence in interest in the flat earth. Much of this was started by Eric Dubay, who began posting on the Internet and published two books on the subject, *The Flat-Earth Conspiracy* and *200 Proofs the Earth Is Not a Spinning Ball*. Soon, others took up the cause, and a movement was born. Much of this has been promoted on the Internet, particularly through social media. Some of the more prominent leaders in the flat-earth movement are Mark Sargent, Jeran Campanella, Robbie Davidson, and Rob Skiba. The last two are notable because they promote a Christian version of the flat earth based upon their understanding of the cosmology of the Bible.

There is a wide diversity of theological beliefs within the flat-earth movement — conservative Christians, New Agers, deists, and pantheists, to name just a few. Flat-earthers often remark that there are no atheists in their ranks. I suppose that's because the flat-earth model is so contrived, no one would seriously suggest it evolved. However, belief that there is a creator doesn't necessarily lead one to faith in Jesus Christ, or, for that matter, belief in the Bible.

In this book, I will be most concerned about the Christian version of the flat-earth movement because I see it as a great threat to true Christi-

anity today. I want to provide answers for people who, when confronted with arguments that the earth is flat, may not know how to respond. Since I learned of the flat-earth movement in February 2016, I have conducted extensive study of the phenomenon. I've read numerous books on the subject, read much material online, and watched far more videos about the flat earth on the Internet than I'd care to admit. I also attended the first International Flat Earth Conference in November 2017, as well as the second one in 2018. I'm confident that this study, combined with my knowledge of astronomy and physics, as well as my understanding of the aspects of the sky developed over a half-century as a serious student of the sky, uniquely qualifies me to tackle this task. Since the Christian version of flat-earth cosmology ostensibly is built upon a biblical foundation, I must respond to the biblical arguments put forth for flat earth as well. I doubt that the other theological persuasions within the flat-earth movement will be interested in that part.

I will discuss some topics relative to the Bible in this chapter. However, I will defer a fuller discussion of biblical passages that allegedly teach that the earth is flat until chapters 10 and 11. For those more interested in that, please feel free to skip ahead to those chapters. Some of my friends thought that the biblical discussion ought to appear earlier in this book. However, a certain amount of introductory material, such as historical context, must be addressed first. That also necessitated a sort of logical progression in the order of material in this book. That would defer the biblical discussion until at least chapter 3. I thought it best to conclude the book with a more detailed discussion of the supposed biblical support for the earth being flat.

Before proceeding, I want to make it clear why I use the term "flat-earthers" to refer to those who believe that the earth is flat. For a long time, that term has been thrown around as a pejorative for people who aren't terribly bright or at the very least cling to cherished old notions that no longer have relevance. I've never used the term in this manner. Therefore, I use the term "flat-earther" as a very descriptive term. At first, I was reluctant to use it, because I feared some flat-earthers would take offense, but then I found that many flat-earthers use the term to describe themselves.

## Some Basics

At the outset, I also ought to describe briefly the conventional understanding of cosmology and the flat-earth understanding of cosmology and to contrast those views. First, what is cosmology? Cosmology is the study of the structure of the universe. Unfortunately, much of what passes as cosmology today technically is cosmogony, the study of the origin and history of the universe. However, for our needs, it isn't necessary to discuss cosmogony, so I will restrict my discussion to cosmology proper.

In the conventional understanding of cosmology, the earth is one of eight planets revolving around the sun. The moon is a natural satellite that orbits the earth once per month. The earth rotates<sup>1</sup> once per day, which causes the sun, moon, planets, and most stars to rise and set each day from the perspective of a person on earth. The sun is a star. Contrary to common misconception, the sun isn't an average star. Rather, the sun is a bit more massive, larger, and brighter than the average star. What confuses people on this count is that most stars are relatively small and dim, but the relatively larger stars are fantastically bright. There is an incredible range in stellar brightness so that if one merely compares the sun to the range in stellar brightness, the sun is average. If the sun is a star, then why do the other stars appear so faint? It is because the other stars are incredibly far away. The nearest star is 275,000 times farther away than the sun. Light diminishes with the inverse square of the distance, so if the sun were as far away as the nearest star, the sun would appear 1/75 billionth as bright as it does now. But even if the sun were that much fainter, it would be among the brighter appearing stars in the sky, though not the brightest star. Other stars are much farther away than the closest star is to the sun. I could go on to include a description of the Milky Way Galaxy, a collection of billions of stars to which the sun and stars we see belong, and that there are billions of other galaxies in the universe, but that is at best tangential to the discussion of flat earth.

In the flat-earth cosmology, the earth is flat and round. The North Pole is at the center of the earth. There is no South Pole. The edge of the explored earth consists of an ice wall that we call Antarctica. This

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1. Note that I use the terms *rotate* and *revolve* in the manner that astronomers do. That is, a rotating body turns about an axis passing through or very near the body's center. Revolution is a turning motion about an axis not passing through a body.



Flat-Earth Cosmology

Credit: Shutterstock

ice wall not only limits the earth as we know it, but it also keeps the oceans contained. There is disagreement among flat-earthers how far Antarctica extends. Above the earth is a dome in which the stars are embedded. The dome rests on Antarctica beyond the ice wall. The dimensions and exact shape of the dome are debated among flat-earthers. In many versions, the dome is a hemisphere, while others prefer a dome with greater radius at the

center (over the North Pole) than at its edges, so that it resembles the roof of a sports arena. Each day, the dome spins around an axis passing through the earth's North Pole. This causes the stars to move in the sky. The North Star is located almost directly over the North Pole, so it remains nearly motionless while the other stars go in loops around it. In most flat-earth models, the sun and moon are above the earth but generally below the dome. They also orbit around the axis of the North Pole each day, which accounts for their daily motion. The sun and moon move at a slightly different rate from the dome, which accounts for their motion with respect to the stars. Since the sun and moon are always above the earth, they never rise or set. The sun and moon merely *appear* to rise and set due to perspective. The sun is like a spotlight shining down on the earth. When locations are under the spotlight, it is day; when the spotlight passes a location, it is night. There are variations on this theme, but I trust I have accurately portrayed the basics of the flat-earth cosmology.

A related, yet separate, issue is geocentrism. All flat-earthers are geocentrists, but not all geocentrists are flat-earthers. For several decades, there has been a small, but vocal, group of geocentric recent creationists who believe that the earth is spherical but does not move, at least with respect to space. They subscribe to the Tychonic cosmology, where the other planets orbit the sun, but the sun orbits the earth, carrying the

other planets with it. This amounts to a coordinate transformation from the sun to the earth. Newtonian gravity explains the orbits of the earth and other planets, but, thanks to the coordinate transformation, the earth does not move. This coordinate transformation essentially is geocentrism by definition. The earth moves in some sense, but since space is attached to the earth, and the earth is at rest with respect to itself, the earth is at rest with respect to space. Flat-earthers don't have much in common with the Tychonic geocentrists, but flat-earthers heavily borrow from the Tychonic geocentrists' arguments.

I have found that flat-earthers frequently conflate the question of the earth's shape with the question of whether the earth moves. In the West, the majority cosmology for nearly four centuries has been that the spherical earth orbits the sun. For 2,000 years prior to that, the majority cosmology in the West was that the spherical earth was the center of the universe (generally expressed as the Ptolemaic model). As mentioned above, some people today believe in a geocentric spherical earth (generally expressed as the Tychonic cosmology). If one believes that the earth is flat, it would seem obligatory to believe in geocentrism. I suppose that it's possible to believe in a heliocentric flat-earth cosmology, but I am not aware that anyone does. How do some flat-earthers conflate these two questions? They do so by confusing the history of Western cosmology on this matter and by giving stock geocentric arguments, mistakenly thinking that the arguments also prove that the earth is flat. Those in the modern geocentric movement would strongly disagree with that. I generally won't discuss geocentric arguments, except where they directly relate to flat earth. I defer that discussion to chapter 7.

### **Epistemological Exercise**

*Epistemology* is the study of knowledge. In simple terms, epistemology answers the question of "How do we know what we know?" Flat-earthers raise a good epistemological question. While most people believe the earth is a sphere, how do we know this? In my years at the university, I asked this question in my introductory astronomy classes, partly to discuss the history of astronomy, but also to motivate my students into thinking more deeply. Almost none of my students could give me a good answer. Eventually, someone would suggest photos taken from space that

show the earth is spherical. However, I would ask my students whether such photos could be faked, and they all readily agreed.<sup>2</sup> Furthermore, since the first satellite was launched in October 1957, if this is how we know the earth is spherical, that knowledge came very late.<sup>3</sup> By raising this question, I challenged our cultural mythology that, until the time of Christopher Columbus five centuries ago, nearly everyone thought the earth was flat. Supposedly, with our sophistication and intelligence today, we know better than the ignorant people of the past. Most of my students were surprised to learn that the facts of history are very different from the Columbus mythology they grew up hearing. The question of the earth's true shape had been settled two millennia before Columbus. Yet rarely could any of my students give a good reason why the earth is spherical. So much for our modern smug superiority over the supposedly ignorant people of the past.

Most people have not given this question any thought because they have been taught their entire lives that the earth is spherical, so why worry about it? Consequently, with no idea of the reasons we know that the earth is spherical, most people long ago entered a complacent state of taking someone else's word for the matter. When a modern flat-earther comes along and begins to raise what appear to be simple objections to the earth's spherical shape, it doesn't take much to fluster most people. When cornered in this manner, people generally respond with the observation that we have photos from space that clearly show a spherical earth. However, the flat-earther almost certainly will respond that such photos easily can be faked (but note that I thought of this first). Indeed, because we all know that it is very easy to fake such photos, perhaps those photos don't prove much after all. Furthermore, belief in a spherical earth goes back much earlier than the space age, so obviously there must be better responses.

Once the space photos of a spherical earth are shot down, most people usually have one of two responses. The most common response is to dismiss the person asking the questions as a crank or fool because "everyone knows that the earth is round." The other response is to pay

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2. Therefore, I was pointing this out long before the flat-earthers were, though it's not as though I believed that photos from space are faked.

3. This was three years after I was born. I think that my parents believed the earth was spherical long before I was conceived.

more attention to the flat-earthers, looking for errors in their facts or logic. However, rarely having the knowledge readily at hand to refute the case for a flat earth, most people who take this approach soon look for help (this is what this book is for). That search for help usually ends up on the Internet, whereupon they quickly find a slew of websites and videos promoting the flat earth, but precious little, if any, refuting it. Some people emerge a few hours later, their egos bruised and their intelligence a bit insulted, because they still think that the earth being flat is nonsense but are frustrated that they can't seem to answer many of the arguments they've just encountered. Still others never emerge from this rabbit hole and end up thinking that maybe the conspiracy theories that they have encountered along the way may be right — perhaps for a long time we've all been fed a whopping lie about the true shape of the earth.

### **Back to Columbus**

Perhaps the rise of the flat-earth movement is a symptom of a deeper problem. Far too much of our educational system is geared toward rote memorization of facts without assimilation of those facts or reasoning to understand how we came to know those facts. Hence, it's understandable why most people know the earth is spherical, but don't know how we know this. This also explains why it is so easy for flat-earth arguments to fluster so many people. But compounding the problem is that some of the things we think are true aren't true. An excellent example of this is what I call our Columbus mythology. Most of us grew up learning that Columbus thought that the earth was spherical, so sailing westward from Europe to reach Asia was shorter and faster than traveling eastward. This wasn't just an academic exercise because Muslims had closed to Europeans the overland trade routes to the Far East. According to the story, nearly everyone opposed Columbus' rash plan because they believed that the earth was flat, so such a foolhardy trip would end in disaster, such as falling off the edge of the earth. It may make for a good story, but it's not true.

To the contrary, at least in the West, for 2,000 years before Columbus nearly everyone had known that the earth was spherical. Most people today are astounded to learn this. Then what was the nature of

the argument about Columbus' proposal? The dispute was over the size of the earth, not its shape. People knew that one could sail westward to reach the Far East, but the question was why would you want to do that? Most people thought that there was a vast ocean all the way to Asia (they didn't know about the American continents yet), which would require a very long voyage across an open ocean without the prospect of resupply. Vessels at that time were small and rarely traveled more than a few days out of sight of land. Besides concerns about resupply, there also were concerns for safety because if a problem developed, the crew had hope of limping back toward land only if they weren't far from land. Therefore, a voyage across a large, unknown ocean was a very frightening thing, but not because of fear of falling off an edge.

By the way, a look at any globe (or map) of the earth shows that Columbus was wrong and Columbus' critics were right — the distance from Europe to Asia is much shorter going eastward (the straight-line distance from Spain is about 7,500 km, or 4,500 miles) than going westward (more than 30,000 km or nearly 20,000 miles). How did Columbus come to think that Asia wasn't that far westward from Europe? First, for centuries there had been stories of reported sightings of land to the west of Europe. For instance, the Vikings briefly settled on the far northeast coast of North America less than five centuries before Columbus' voyage, and Irish legends placed Brendan the Navigator in lands to the west four centuries before the Vikings. There are other examples. Columbus accepted such stories as true and reasoned that the lands to the west were Asia. Second, Columbus cooked the numbers to make his case. The distance to the Far East was known by subtracting the eastward distance to the Far East from the earth's circumference. Columbus reduced the earth's circumference and increased the eastward distance to Asia to get a reasonable distance for getting to the Far East by sailing west. Most people are surprised to learn that people five centuries ago knew the earth's circumference. I'll take up that topic shortly.

### **Confusing Heliocentrism and a Spherical Earth**

Flat-earthers consistently conflate this mythology about Columbus with the Galileo affair a little more than a century later. In 1543, a half-century after Columbus' voyage, Nicolaus Copernicus published

his *Revolutionibus*,<sup>4</sup> in which he promoted the heliocentric theory. Contrary to popular misconception, it was not immediately banned by the Roman Catholic Church. Instead, Copernicus' work was widely read and prompted much discussion. One convert to the heliocentric theory was Galileo Galilei. In 1610, Galileo published *The Starry Messenger*,<sup>5</sup> in which he shared his telescopic observations of the phases of Venus and four natural satellites, or moons, orbiting Jupiter, which supported the heliocentric model and disproved the geocentric Ptolemaic model, along with relevant aspects of the dominant Aristotelian physics. This book, along with Galileo's continued teaching of the heliocentric theory, aroused some opposition, but not from the theologians, as most people think. Rather, it was the other scientists who opposed Galileo, because if the heliocentric model were true, it would overturn the Ptolemaic model, which had been the dominant cosmology for 15 centuries. This opposition demanded a hearing, which led to a trial in 1616 (six years after the publication of Galileo's book). The trial resulted in banning heliocentric books, primarily those of Galileo and Copernicus. The court also instructed Galileo to refrain from teaching heliocentrism.

Galileo continued to work on his cosmology, though he didn't write on it much for two decades. However, in 1632, more than 15 years after the trial, Galileo published his *Dialogue*.<sup>6</sup> This book once again promoted heliocentrism, this time in the form of a discussion between three people, an advocate of the Copernican model, an advocate of the Ptolemaic model, and a supposedly neutral third person. Despite the order of the trial, Galileo had permission from Roman Catholic officials to publish the book. Those officials clearly had no idea what direction Galileo would take in his book. Rather than being in Latin, which was the usual practice of the time, the book was written in Italian to reach a larger audience. Immediately, the book was very popular, but it brought very

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4. The full title of Copernicus' book is *De Revolutionibus Orbium Coelestium*, which, translated from Latin to English, is *On the Revolutions of Heavenly Spheres*.

5. The original Latin title was *Sidereus Nuncius*. While other important books of the time are more often known by their Latin titles, Galileo's book is better known by the English translation of its title. It may be because of the relatively short title of this book compared to others of the period, the Latin titles of which generally are shortened.

6. The full title in Italian was *Dialogo Sopra i Due Massimi Sistemi del Mondo*, which translates into English as *Dialogue Concerning the Two Chief World Systems*. This book usually is referred to by the first word of its title.

swift opposition from church leaders. Galileo did lay his argument on thick. He was required to include a disclaimer that what the book taught wasn't true, but merely was an intellectual exercise. Galileo fulfilled this requirement by calling the book a fantasy, after all, he wrote, any fool knows that the earth doesn't move. Get it? Galileo subtly called anyone who disagreed with him a fool. The Ptolemaic supporter in his book was named Simplicio, which roughly translates as "simpleton." Galileo made Simplicio look foolish. To make matters worse, the pope had insisted that his views be included in the book, so since the pope believed the Ptolemaic model, Galileo put the pope's words in Simplicio's mouth. Understandably, the pope was furious. The uproar the book stirred resulted in a second trial in 1633. The pope had been sympathetic to Galileo, but Galileo's intemperate attitude had thrown that away, along with any other support he once enjoyed. Therefore, the decision of the court was a foregone conclusion. Galileo was found guilty of teaching a heretical doctrine, and he was sentenced to house arrest for the rest of his life. He further was forced to recant and was banned once again from teaching heliocentrism.

Note that Copernicus' book, which had been much read and discussed, wasn't banned for 70 years, and then only in response to Galileo's actions. Hence, contrary to common misconception, the Roman Catholic Church did not react to the heliocentric model *per se*. Had Galileo acted more prudently, the outcome may have been very different. Galileo wasn't quite the innocent victim of an overzealous Roman Catholic Church as many people today think. Rather, his caustic attitude invited the treatment that he received. And was that treatment so harsh? At that time, the Inquisition was executing people for real heresy or for just being Protestant, but Galileo never even came close to that sentence.

As I've previously mentioned, the question of the earth's shape and the question of whether the earth moves (geocentric vs. heliocentric) are not directly related. Yet many flat-earthers (as do many other people) consistently confuse the two. I can't begin to count the times I've heard flat-earthers blame Copernicus for introducing the spherical earth. Their ignorance of the history of cosmology is appalling. In a weird way, this faux history of man's knowledge of the earth's shape is an aid in roping people into the flat-earth camp.

One obstacle to belief in flat earth is the realization that if the earth truly is flat, many people must know that the earth is flat despite being told it is spherical, so why do these people who supposedly know better continue to lie about the earth's shape? The only answer is that there must be a vast conspiracy behind the spherical earth. Belief in all sorts of conspiracies is rampant among flat-earthers, which is a fascinating facet of the flat-earth movement, but I shall not explore it here. It seems that the flat-earth conspiracy is the grandest of all conspiracies which subsumes all others.

Why is there supposedly a conspiracy to conceal the earth's true shape? The most common answer is that it is an attempt to control people, though it isn't clear how promoting and maintaining a false belief about the earth's shape accomplishes that. To the Christian flat-earthers, belief in the spherical earth is the strong delusion spoken of in 2 Thessalonians 2:11. Belief in a spherical earth is very diabolical, supposedly linked to paganism or even Satan worship, and often it is tied in with beliefs about end times. Things really did begin to change five centuries ago, as it marked the transition from the Middle Ages to modern times. The claim is that belief that the earth is spherical ultimately led to belief in evolution, so spherical earth, not evolution, is the real root of the problem.<sup>7</sup> To the true believers that the earth is flat, the revival of flat-earth belief represents a return to basic values and ancient wisdom. To the Christian believers that the earth is flat, the modern flat-earth movement means even more, for it represents a return to biblical Christianity. Though, as we shall soon see, the church never taught that the earth is flat.

### **Ancient Greek Cosmology**

Much of Western science and philosophy traces back to the ancient Greeks. Therefore, if we want to know the history of cosmology, such as beliefs about the earth's shape, we ought to start with them. The writings of many early Greek scientists, mathematicians, and philosophers do not exist today. Instead, we must rely upon much later sources that reported on their teachings. However, the writings of later Greeks, such

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7. The flat-earthers stole this idea from the geocentrists. For many years, the geocentrists had argued that it was belief in the heliocentric theory that eventually led to belief in evolution.

as Aristotle and Ptolemy, do exist. The Greeks borrowed heavily from the Egyptians and Babylonians, though they soon built on what they borrowed and developed their own ideas. The ancient Egyptian and Babylonian cosmologies predominantly were flat earth. However, the details varied, so there were many cosmologies of the Ancient Near East (ANE). It has become fashionable now, even in some conservative circles, to believe that the Bible, being a product of the ANE, reflects the ANE cosmology. Therefore, it is reasoned, the Bible teaches that the earth is flat. I will take up this question later, but I will mention here two problems with this teaching. First, there was no single ANE cosmology, so how could the Bible reflect *the* ANE cosmology? Second, this belief undermines the inspiration and authority of Scripture.

In the early sixth century B.C., Anaximander thought that the earth was a disk with a thickness  $\frac{1}{3}$  its diameter, making him a flat-earther. However, Anaximander had the sun, moon, and stars orbit around the earth each day, passing below the earth to permit rising and setting. This is in stark contrast with the modern flat-earth cosmology. In the modern flat-earth model, the sun and moon do not rise and set, but merely appear to do so, as the sun and moon perpetually remain above the flat earth. Earlier Greek cosmologies probably were flat earth, but we have no knowledge of them.

Later in the sixth century B.C., Pythagoras proposed that there were eight concentric spheres surrounding the earth. The outermost sphere carried the stars, while the other seven spheres carried the sun, moon, and the five naked-eye planets. The spheres turned at different rates to produce the motions of the heavenly bodies. As they turned, the friction between them produced the *music of the spheres* that only the most gifted could hear. In the fourth century B.C., Eudoxus and Callippus improved upon Pythagoras' scheme by adding many more nested spheres to account for the intricacies of the motions of the sun, moon, and planets. Eudoxus' system required a total of 27 spheres, while Callippus' system required 34 spheres. Therefore, by the fourth century B.C., heavenly spheres concentric with the earth had become an integral part of cosmology in the West and would remain so for the next 2,000 years. The motions of these spheres allowed celestial objects to rise and set. This is in stark contrast to the modern flat-earth model of a flat, round earth,

covered by a dome. Despite flat-earth's claims to the contrary, almost no one in the West (of course, later including the church) believed that there was a dome over the earth. Instead, the dominant belief was that the earth was surrounded by the celestial sphere and possibly additional concentric spheres.

Pythagoras is best known for his contributions to mathematics, such as his famous Pythagorean theorem. The Greeks came to view the circle as the perfect shape, along with the sphere, which is a circle in three dimensions. The ancient Greeks may have reached this conclusion through the influence of Pythagoras. At any rate, Pythagoras thought that the earth, moon, and sun were spheres. It's not entirely clear what his reasons were, but Pythagoras, and possibly his contemporaries, Empedocles and Parmenides, are given credit with originating the idea that the earth is spherical. In his *Histories*, written in the mid-fifth century B.C., Herodotus reported that around 600 B.C., Phoenician explorers circumnavigated Africa and reported that the sun was in the northern part of the sky rather than the southern part of the sky. This is indeed what is expected as one passes south of the tropics if the earth is spherical, though not necessarily expected in a flat-earth cosmology.<sup>8</sup> Because of this detail, some modern scholars suggest that the ancient Phoenicians may have known of the earth's spherical shape. Unfortunately, no record of Phoenician geography survives.

By the fourth century B.C., the concept of a spherical earth was well-established in Greek thought. In his *On the Heavens*, Aristotle taught the sphericity of the earth and moon, with clear reasons for both. First, let's tackle the moon's shape. Lunar phases make sense only if the moon is a sphere. If the moon is a sphere, then half of the moon will be lit by the sun. Lunar phases are caused by the changing geometry of the moon and sun with respect to the earth. More specifically, lunar phases are determined by how much of the moon's lit half faces the earth. When the moon is opposite the sun in the sky, its lit half faces the earth, so we see the moon fully illuminated. We call this full moon. When the moon is in the same part of the sky as the sun, the lit half of the moon faces

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8. Modern flat-earth's are sure to object that they can explain this, and indeed they can.

However, I chose the words "not necessarily expected" carefully. It appears that at the time of Herodotus, those committed to the flat earth could not explain it.

toward the sun, so the moon's unlit half faces the earth. Besides the unlit half of the moon being very dim, the moon appears in the same part of the sky as the sun. The sun's glare so overpowers the very dim unlit half of the moon facing the earth that we can't see the moon for several days. We call this new moon. It takes the moon about two weeks to travel from new to full, and another two weeks to return to new from full. As the moon goes from new to full, we see progressively more of the lit half of the moon, so we call these the waxing phases. As the moon travels from full to new, we progressively see less of the moon's lit half illuminated, so we call these the waning phases. We call the division between light and dark on the moon the *terminator*. The terminator is curved, except when the moon is briefly exactly at quarter phases (which happens about half-way between new and full phases). The moon appears round to observers on earth, so obviously the moon is round in the plane tangent to the sky at its location. But is the moon round and flat, like a plate, or is it round in our line of sight as well, like a ball? The phases of the moon, and especially the curved terminator, only make sense if the moon is spherical.

Interestingly, modern flat-earththers generally deny that the moon is a sphere, insisting that it is a disk. It's not clear why they think this. For one thing, it leaves them with no explanation for lunar phases. They claim that the moon produces its own light, so it doesn't reflect the light of the sun. I guess it's something like National Geographic's product "Moon in My Room." A friend gave me one of these a few years ago. It requires AA cells to power it and a remote control as well. You mount it on the wall, and in the dark it simulates the phases of the moon by switching on various lights in compartments behind its slightly curved translucent face. I suppose that the moon *could* operate this way, but keep in mind that the "Moon in My Room" merely is an imperfect simulation of the moon's real phases. Why would God have made a flat, round moon that varies in its own light in a manner that strongly implies that the moon is a sphere illuminated by the sun? Do flat-earththers think that God is so malicious as to make the world in such a way that we so easily could be led astray on this?

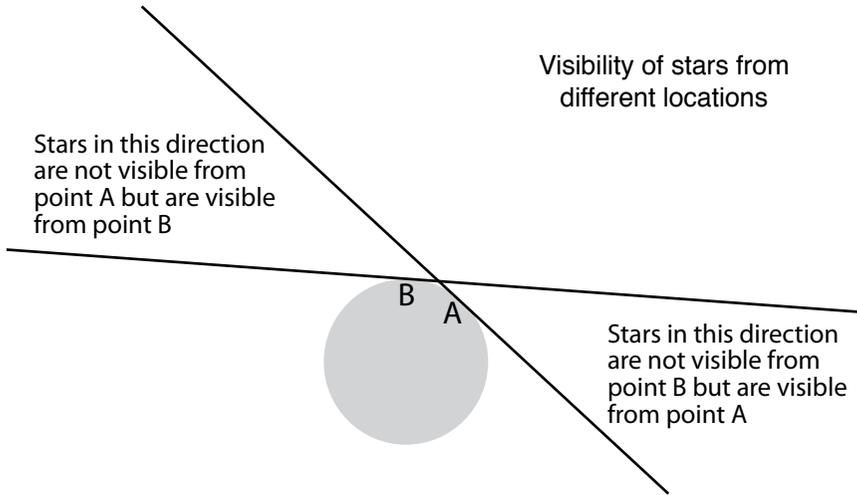
Besides, what if the moon is spherical? Does that automatically mean that the earth is spherical too? Apparently, the flat-earththers think so. This brings us to one of Aristotle's arguments for believing the earth is spherical. Once Aristotle realized that the moon was spherical, he surmised

that the earth was spherical too. This is an argument by analogy, so it hardly is a rigorous argument. Underlying this argument is the assumption that the earth and moon must be similar in certain respects. That is a huge assumption, and it is very clear that while the moon and earth share some common properties, they differ in many other respects. I suspect that modern flat-earthers are employing the similar argument by analogy: they know the earth is flat and round, so the moon must be flat and round, too. Either way, this argument by analogy isn't anything more than confirmation of what one already believes.

Beside the argument by analogy, Aristotle gave much better arguments for the earth's sphericity. He noted that as a ship departs, it progressively disappears hull first. If the earth were flat, the ship would appear progressively smaller as it moves away, ultimately reaching the vanishing point, but no part of the ship would disappear first. On the other hand, if the earth is spherical, then one would expect the curvature of the sea's surface progressively to obscure more and more of the ship from the bottom up. Since this is what we see, the earth must be spherical. I've always been a little skeptical of this argument, because without optical aid, this would be difficult to observe (the telescope was invented a little more than four centuries ago, long after Aristotle lived). On the other hand, Aristotle almost certainly was aware of a sort of reverse of this argument. A lookout perched atop the mast of a ship will spot approaching land long before those on the deck will. Furthermore, Greece is a hilly country with many islands. From a beach, an island some distance off shore may not be visible, but it will become visible as one ascends a bluff by the shore. This is not possible on a flat earth, but it is if the earth is spherical. I once observed this for myself on the Door Peninsula of Wisconsin. The peninsula divides Green Bay from Lake Michigan. I was on the western side of the northern part of the peninsula overlooking Green Bay with the Upper Peninsula (UP) of Michigan 18 miles away. From the beach, the tree line of the UP wasn't visible — all I saw was open water. I drove up to the top of the bluffs that overlook the beach. From there, it was easy to see the tree line of the UP.

Another argument that Aristotle invoked was the visibility of stars in the northern and southern parts of the sky as one travels north or south. Traveling northward, stars near the northern horizon climb higher in

the sky, even revealing stars that were below the northern horizon when the observer was farther south. At the same time, stars near the southern horizon get lower in the sky, with some stars disappearing below the southern horizon. As one travels southward, the reverse is true. This cannot happen on a flat earth, but it is what one expects if the earth is spherical. I shall return to this topic in chapter 5.



However, the best argument for the earth's sphericity from the ancient Greeks is the shape of the earth's shadow during lunar eclipses. This requires an understanding of what causes lunar eclipses — the earth passing between the sun and moon so that the earth's shadow falls on the moon. The cause of lunar eclipses was easy enough to grasp for the ancient Greeks because they were careful observers of the world around them. Lunar eclipses occur only at full moon, when the moon appears opposite the sun in the sky. While the moon being full is a necessary condition for a lunar eclipse, it is not a sufficient condition, because a lunar eclipse does not occur at every full moon. Why is that? The moon's orbital plane is tilted a little more than five degrees to the plane of earth's orbit around the sun (we call the earth's orbital plane the *ecliptic*<sup>9</sup>). Therefore, at most

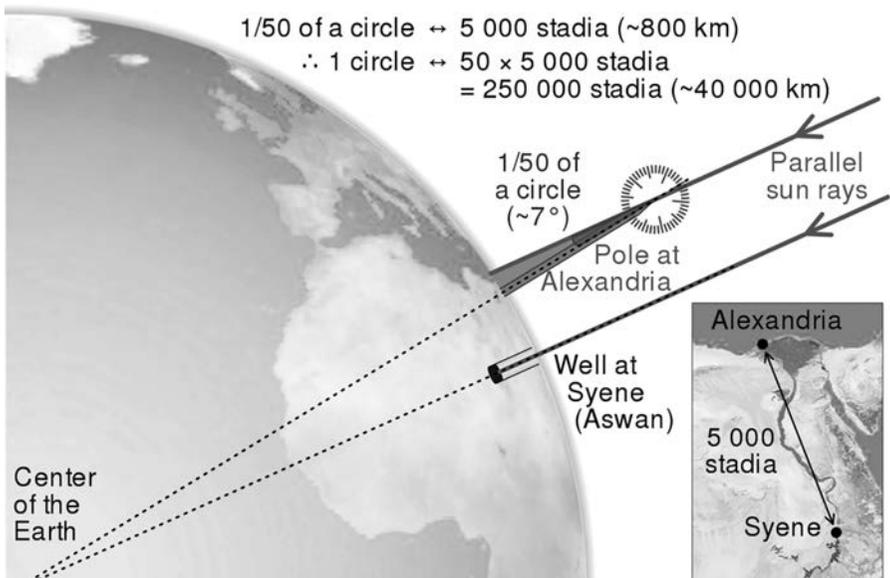
9. The ecliptic, the name for the earth's orbital plane, goes back to the ancient Greeks. Its name derives from the observation that eclipses, both lunar and solar, occur only when the moon is near the ecliptic. The etymology of this name indicates that the ancients correctly

full moons, the moon passes above or below the earth's shadow so that no eclipse occurs. The *nodes* are the two places where the moon's orbital plane and the ecliptic intersect. If the moon is near a node at the time of full moon, a lunar eclipse occurs. By keen observations made over many years, the Greeks and many other ancient cultures knew about the ecliptic, the moon's orbit, and the nodes. From this information, they could anticipate when a lunar eclipse was possible. However, their information was not precise enough to predict exactly when and where eclipses would be visible. Related to this is the saros cycle, which I will discuss in chapter 3.

The earth's shadow is larger than the moon, so we cannot see the entire shadow at once. However, as the earth's shadow creeps across the moon, it always appears as a portion of a circle. The distance between the moon and earth varies, and the distance to the sun varies throughout the year, so the size of the earth's shadow changes slightly. However, to the naked eye, the size of the earth's shadow is about the same at every lunar eclipse. If the earth were round and flat, such as a disk, could it cast a circular shadow on the moon? Yes, but only when a lunar eclipse occurs at midnight, and then only in winter, when the full moon is very high, and the sun is very low below the horizon. However, if a lunar eclipse occurs at sunrise or sunset, the orientation of the disk is different, so the earth's shadow would be an ellipse or a rectangle, or some combination of both, but not a circle. The only shape that consistently casts a circular shadow regardless of its orientation is a sphere. Many flat-earthers are well aware of this problem, so they have spent time critiquing the conventional explanation of lunar eclipses. I will take up this matter in chapter 3.

I previously described how as one travels north or south, the stars change in a manner that indicates the earth is curved in the north-south direction. However, some ancient sources also noted evidence that the earth is curved in the east-west direction. There is a time difference of three hours between the east and west coasts of the United States. That is, the sun rises and sets approximately three hours earlier on the east coast than it does on the west coast. This is easily verified by anyone who has flown between the east and west coasts of the United States. Not

only will your watch show that there is a time difference of three hours, but your body will notice the difference in time as well. If one drives from one coast to the other, the trip will take several days, so our bodies will not notice the time difference as much. However, our watches reveal that the time has changed. Such rapid transportation was not possible in ancient times, nor were there watches, but the ancients could see this time difference a different way. A lunar eclipse obviously must happen simultaneously for everyone on earth, but it will be at different times at different locations. For instance, a lunar eclipse may start shortly after sunset in the eastern Mediterranean, such as in Greece. However, in the western Mediterranean, such as in Spain, the moon might already be in eclipse when the moon rose that night. This means that the lunar eclipse began before sunset/moonrise in Spain, but after sunset/moonrise in Greece. While communication was much slower in the ancient world than it is today, people did record and share their observations, so people in the ancient world were aware of this effect. This shows that the earth is curved in the east-west direction. If the earth is curved in both the north-south and east-west direction, the most likely shape of the earth is

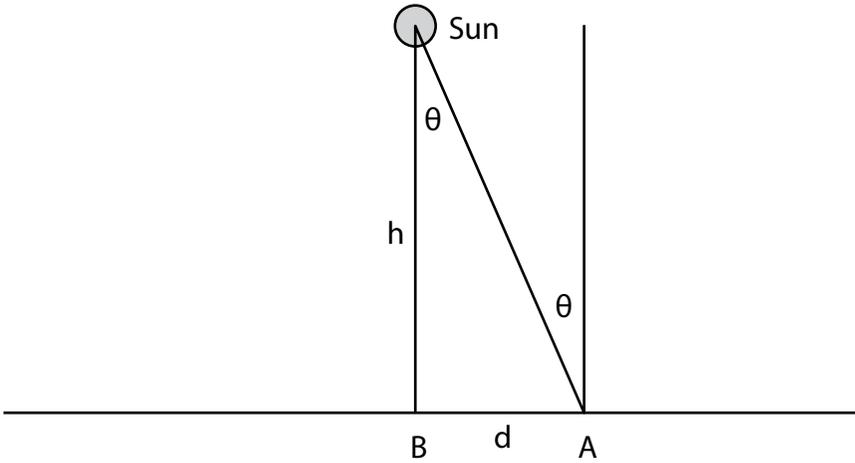


Eratosthenes' measure of earth's circumference.

a sphere.

Building on this knowledge that the earth was spherical, around 200 B.C. Eratosthenes accurately measured earth's size. Eratosthenes worked at the Great Library in Alexandria, Egypt. Eratosthenes is the father of geography because he coined the term and commissioned the creation of many maps. On the summer solstice one year, Eratosthenes was in Syene, a city (now called Aswan) in southern Egypt. Being on the northern limit of the tropics, the sun was directly overhead at noon on the summer solstice. Eratosthenes realized this because he peered into a deep well and saw the bottom. Normally, the bottom of a deep well is not visible because the sun's light does not shine directly on the bottom, but it does at noon on the summer solstice on the Tropic of Cancer because the sun is directly overhead. The sun never is directly overhead in Alexandria because it is north of the tropics. Back in Alexandria a following year, Eratosthenes measured the angle that the sun made with the *zenith*, the point directly overhead, at noon on the summer solstice. He did this by constructing a *gnomon*, a vertical pole of known height, and by measuring the gnomon's shadow at noon. Trigonometry allowed Eratosthenes to compute how far the sun was from the zenith. Eratosthenes found that the angle was about one-fiftieth of a circle. This meant that Alexandria and Aswan were separated by one-fiftieth of the earth's circumference. Eratosthenes knew the distance between those two locations (he was the father of geography, after all), so multiplying that distance by 50 gave him the earth's circumference.

Flat-earthers frequently argue that Eratosthenes didn't prove that the earth was spherical, but that Eratosthenes *assumed* that the earth is spherical. Flat-earthers further claim that they can explain Eratosthenes' result on a flat earth. Both statements are true, but flat-earthers have missed the point. Notice above that I didn't state that Eratosthenes proved that the earth was a sphere. Rather, I said, "Building on this knowledge that the earth was spherical, around 200 B.C. Eratosthenes accurately measured earth's size." Eratosthenes' observation can be explained in the flat-earth model as a parallax effect due to viewing the sun from different positions on the earth's surface. Furthermore, just as in the globe-earth model Eratosthenes' result can be used to measure the earth's circumference, in the



flat-earth model Eratosthenes' result can be used to measure how high the sun is above the earth.<sup>10</sup> This figure shows the situation. The sun is directly over Syene at point B. Meanwhile, the sun makes an angle  $\theta$  from the vertical at Alexandria at point A. The angle  $\theta$  also is an angle in the right triangle formed by the sun and points A and B. Let  $h$  be the height of the sun and  $d$  be the distance between points A and B. Then

$$h = \frac{d}{\tan \theta}$$

The north-south distance,  $d$ , between Alexandria and Syene is 490 miles. Eratosthenes measured  $\theta$  to be  $1/50$  of a circle = 7.2 degrees. Therefore, the height of the sun is 3,900 miles. However, many flat-earththers, following the lead of 19th-century promoters of flat earth, claim that the sun is 3,000 miles above the earth. This is a difference of 30%. There are many different heights of the sun claimed in the flat-earth model. This is because different approaches produce different results. If the flat-earth model were true, this ought not to be the case. In recognition of this problem, many flat-earththers now simply refuse to quantify dimensions

10. Apparently, not one flat-earthther has yet recognized the inconsistency of their claim here. They insist that it somehow is improper to assume a spherical earth and use Eratosthenes' result to find the earth's circumference, while at the same time claim that it is proper for them to assume a flat earth to constrain the sun's height within their model.



Ptolemy  
Wikimedia

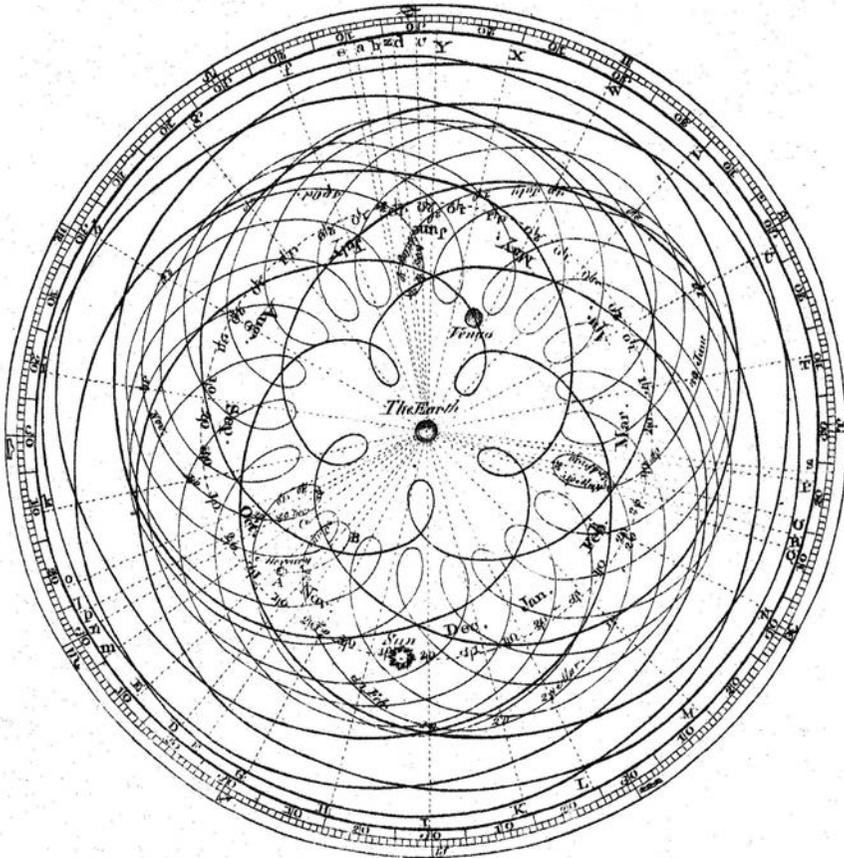
in their model.

The final word on ancient Greek cosmology was Claudius Ptolemy in the early second century A.D. Ptolemy, as he usually is called, also lived in Alexandria. He authored an exhaustive work on astronomy that in the ancient world was called the *Syntaxes Mathematica*, but it is better known today by the title medieval Arabs gave it, the *Almagest*.<sup>11</sup> The *Almagest* contains a good discussion and history of ancient Greek astronomy. Indeed, much of what we know of ancient

Greek astronomy comes via the *Almagest*. The *Almagest* also included a star catalog of more than 1,000 stars listed among 48 constellations. Most of those constellations still survive, and with Ptolemy's coordinates and descriptions of the locations of stars within the constellations, we have a good understanding of the constellations as the ancient Greeks saw them, and we can unambiguously identify many of the stars in Ptolemy's catalog. Ptolemy clearly taught that the earth was a sphere (*Almagest*, book 1, section 4). From his observations, Ptolemy also computed the sizes and distances of the sun and moon (*Almagest*, book 5, sections 15 and 16). Ptolemy found that the earth was  $3\frac{3}{5}$  the size of the moon, and that the average distance to the moon was 59 times that of the earth's diameter. These are close to the correct values. However, Ptolemy determined that the sun was nearly  $5\frac{1}{2}$  times larger than the earth and 1,210 times the earth's radius away. These are woefully short of the correct values. However, these results clearly reveal how wrong the flat-earthers are on the history of cosmology.

11. In Arabic, *almagest* means "the greatest." Obviously, the Arabs were very impressed with Ptolemy's book.

However, the *Almagest* is best known for its system of predicting the positions of the moon and the five naked-eye planets. While the positions of the stars are relatively simple to calculate, the planets' positions are very complicated. The main difficulty is the back-and-forth motion that planets appear to trace out in the sky from time to time. We call this backward motion *retrograde motion*. Retrograde motion of *superior planets* (those planets orbiting farther from the sun than the earth) occurs as the earth passes them on its smaller, swifter orbit. Retrograde motion of *inferior planets* (planets that orbit the sun closer to the sun than the earth) happens when they lap the earth in its orbit. To model retrograde motion, Ptolemy had each of the five planets move on its own circle called an *epicycle*. The epicycle of each planet, in turn, moved along its



The epicycle of each planet  
(Wikimedia)

own larger circle called the *deferent*. By adjusting the sizes of the epicycle and deferent for each planet, as well as the rates of the motion of each planet on its epicycle and the motion of each epicycle on its deferent, Ptolemy could match retrograde motion. Since the orbital planes of the planets are inclined slightly to the ecliptic, they bob up and down slightly with respect to the ecliptic. Ptolemy modeled this by adding an additional small epicycle for each in a plane perpendicular to the ecliptic. Thus, each planet required two epicycles. The moon also required two epicycles, and the sun required one epicycle.

The Ptolemaic model was very successful because it could predict the positions of the planets so well when no previous model could. For a long time, historians thought that most ancient Greek astronomers believed the geocentric theory, with the notable exceptions of Aristarchus and Eratosthenes, who believed the heliocentric theory. Part of their reasoning was that the heliocentric model did not require epicycles to explain retrograde motion. Now some historians are suggesting that prior to the Ptolemaic model, the heliocentric theory may have enjoyed more of a following than previously thought. However, with the success of the Ptolemaic model, any belief in the heliocentric theory soon faded. What led Copernicus and others to reconsider the heliocentric model after nearly a millennium and a half of dominance by the geocentric theory? From time to time, small discrepancies between the predictions of the Ptolemaic model and observations of planetary positions arose. The fix was the addition of more epicycles. By the late Middle Ages, these additions had accumulated to more than a hundred epicycles. Occam's razor<sup>12</sup> dictates that when confronted with two solutions, one simple and one convoluted, the simple explanation usually is the correct one. By eliminating the large epicycles to explain retrograde motion, the heliocentric model offered the desired simplicity.

### **The Early and Medieval Church on the Earth's Shape**

There are examples of early church authorities who taught that the earth was a globe. Three examples are Athenagoras (late second century),

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12. Named for William of Ockham (1287–1347), Occam's razor (notice variations in the spelling of his name) is the law of parsimony. It states that when one must decide between two competing hypotheses, the one with the fewest assumptions generally is correct.

Methodius (late third century), and Arnobius (early fourth century). However, early church fathers did not address cosmology much. There probably are at least two reasons for this. One reason was that the early church was battling some very serious issues of considerably more immediate concern. Early on, there was the influence of gnosticism that had to be driven from the church. Then there were debates about the nature of Jesus Christ. The gospels portray Jesus as fully human, yet they also record that Jesus claimed to be divine. How could Jesus be both God and man? Different answers to this question arose, and they all could not be correct. The doctrine of the trinity eventually emerged as the proper understanding. After the Council of Nicaea in A.D. 315, fundamental doctrines, including the Trinity, clearly defined orthodox Christianity. The second reason was that there probably was not much dispute about cosmology — why write about matters that don't appear to be doctrinal, especially on questions where there was no debate? Therefore, among Christians, there was not much impetus to discuss cosmology in the late ancient world and throughout the medieval period. However, discussion of cosmology began to appear more in the 13th century, as Thomas Aquinas explicitly wedded Aristotle's teaching and the Ptolemaic model to the doctrines of the Roman Catholic Church. This set the stage for the Galileo affair 3½ centuries later.

Let me reiterate that historically, the cosmology of the Church was geocentric, but not flat earth. The medieval scholar Jeffrey Burton Russell's 1991 book, *Inventing the Flat Earth: Columbus and Modern Historians*,<sup>13</sup> is a detailed refutation of the flat-earth myth. Admittedly, there were two individuals in the history of the church worthy of note that did indeed teach that the earth was flat. One was Lactantius, an early-fourth-century Berber who eventually became an advisor to Constantine. In chapter 24 of book III of his *Divine Institutes*, Lactantius mocked those who believed that the earth was spherical. The other was Cosmas Indicopleustes, a Greek from Alexandria, who in the early sixth century made several voyages to India and Ceylon. He later wrote *Christian Topography*, in which he argued that the earth was flat and rectangular. The heaven above was shaped like a box with a curved lid. He took his contemporary

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13. Jeffrey Burton Russell, *Inventing the Flat Earth: Columbus and Modern Historians* (New York: Praeger, 1991).

Christians to task for believing that the earth was spherical, claiming that the spherical earth was pagan-inspired.<sup>14</sup> That is evidence that Christians at that time generally believed the earth to be a globe, for why would one criticize a belief that did not exist? Neither Lactantius nor Cosmas are known for anything else. If not for their odd ideas about the earth's shape, they would be more obscure than they already are. In the 19th century, critics falsely portrayed the teachings of Lactantius and Cosmas as typical of the early and medieval church. Sadly, modern flat-earthers have unquestionably accepted this faux history created by the critics.

The critics even claim that Augustine taught that the earth was flat when he clearly thought otherwise. The relevant portion of Augustine's writing is chapter 9 of book XVI of his *City of God*. That entire chapter reads:

But as to the fable that there are Antipodes, that is to say, men on the opposite side of the earth, where the sun rises when it sets to us, men who walk with their feet opposite ours, that is on no ground credible. And, indeed, it is not affirmed that this has been learned by historical knowledge, but by scientific conjecture, on the ground that the earth is suspended within the concavity of the sky, and that it has as much room on the one side of it as on the other: hence they say that the part which is beneath must also be inhabited. But they do not remark that, although it be supposed or scientifically demonstrated that the world is of a round and spherical form, yet it does not follow that the other side of the earth is bare of water; nor even, though it be bare, does it immediately follow that it is peopled. For Scripture, which proves the truth of its historical statements by the accomplishment of its prophecies, gives no false information; and it is too absurd to say, that some men might have taken ship and traversed the whole wide ocean, and crossed from this side of the world to the other, and that thus even the inhabitants of that distant region are descended from that one first man. Wherefore let

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14. Many modern flat-earth Christians raise this same objection. Perhaps they got the idea from Cosmas. At any rate, they generally would reject Cosmas' cosmology.

us seek if we can find the city of God that sojourns on earth among those human races who are catalogued as having been divided into seventy-two nations and as many languages. For it continued down to the deluge and the ark, and is proved to have existed still among the sons of Noah by their blessings, and chiefly in the eldest son Shem; for Japheth received this blessing, that he should dwell in the tents of Shem.<sup>15</sup>

The context, established by the adjoining chapters, is the repopulation of the world after the Flood and the confusion of languages at the Tower of Babel. Here Augustine concludes that there are no *antipodes*. Many people incorrectly assume that the antipodes refer to locations on the other side of the spherical earth, and so erroneously conclude that Augustine's rejection of the antipodes amounts to rejection of the earth being spherical. However, Augustine defined the antipodes as "men on the opposite side of the earth." The word "antipode" means "opposite feet," coming from the idea that people on the opposite side of the earth would have their feet oriented opposite to him. Furthermore, if Augustine had intended the antipodes to mean the opposite side of the earth, the singular form of antipode would have been appropriate. The fact that he used the plural is consistent with the proper interpretation. Augustine went on to state that the argument for the existence of antipodes was conjecture based upon the scientifically established fact that the earth is spherical. However, he pointed out that it doesn't follow that the other side of the globe has any land, or if that land exists there, that it is inhabited. Here Augustine reflects the geography of his day that Europe, Asia, and Africa comprised the only significant landmass on the earth.<sup>16</sup> Though he doesn't explicitly state it, Augustine here also reflected the widespread belief of the ancient world that it was too hot in the tropics for man safely to traverse the tropics to reach any land on the other side of the earth. Given the huge stature of Augustine in the medieval church, it is inconceivable that later students would have abandoned belief that the earth is spherical.

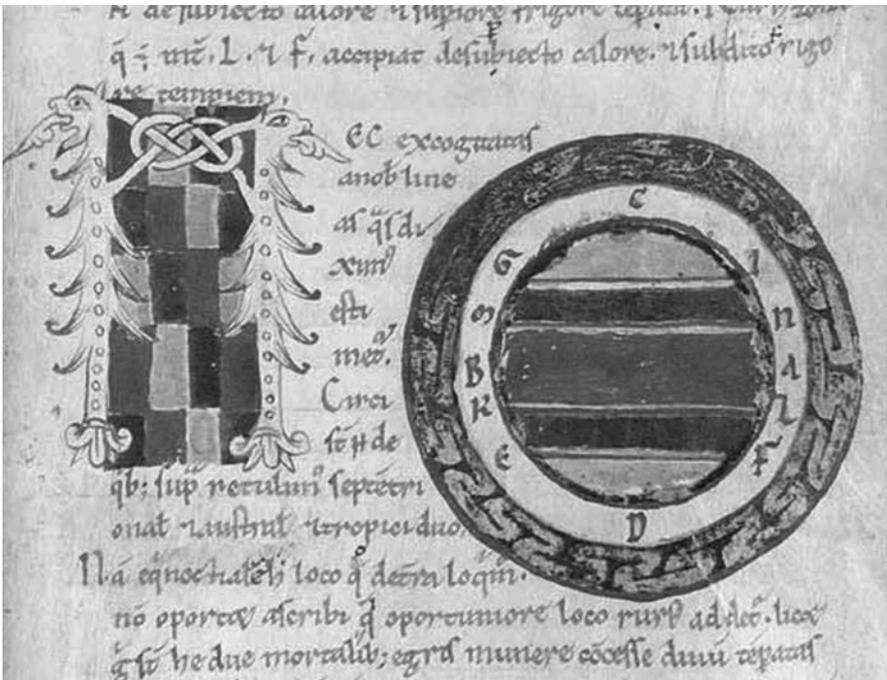
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15. *The City of God*, translated by M. Dods in *Great Books of the Western World, Volume 18*, Robert M. Hutchins, editor (Chicago, IL: William Benton, 1952), p. 428.

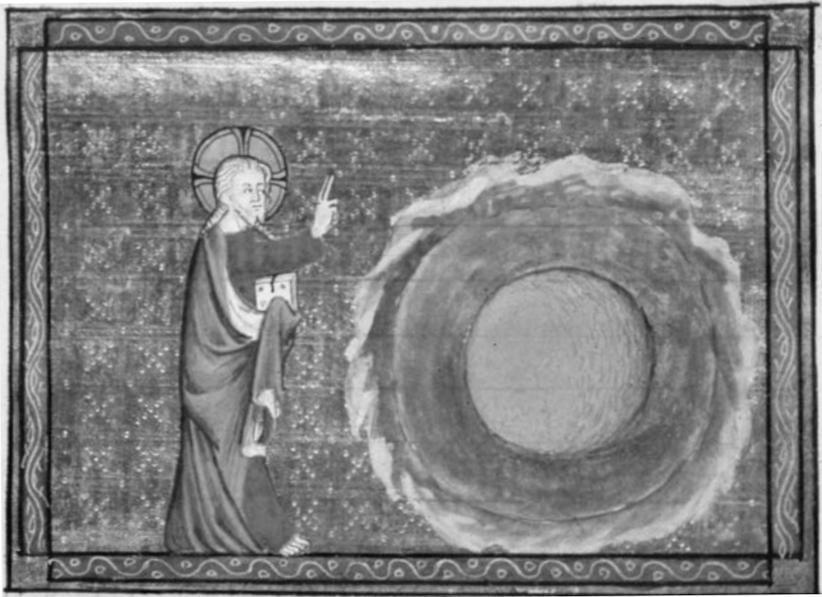
16. The name of the Mediterranean Sea reflects this as well, for it means "middle of the earth," lying between Europe, Asia, and Africa.

In the first century B.C., Cicero wrote *The Dream of Scipio* based on the second century B.C. Roman general. *The Dream of Scipio* is just a part of a much larger work, *De re Publica*, but most of that work did not survive. However, we have all of *The Dream of Scipio* thanks to a *Commentary on the Dream of Scipio*, written by Macrobius in the fifth century A.D. This work was one of the most popular books during the Middle Ages. *The Dream of Scipio* describes a spherical earth that is much smaller than the rest of the universe. The accompanying figure comes from a 12th-century copy of the book. It shows a spherical earth divided into different climate zones.

Isidore of Seville (early 7th century) wrote about the earth being spherical in his *On the Nature of Things*. In his *On the Reckoning of Time*, the Venerable Bede (early 8th century) clearly taught that the earth is spherical. In his *Opus Majus*, Roger Bacon (13th century) indicated belief that the earth is spherical. Also in the 13th century, Johannes de Sacrobosco wrote a well-read textbook on astronomy, *On the Sphere of the World*. In this book, Sacrobosco gave reasons why the earth is spherical. The



A spherical earth divided into different climate zones



A spherical earth.

accompanying figure from a copy of the book illustrates a spherical earth. The next illustration is one of the creation, and it shows a spherical earth surrounded by water above (day two of the creation week). This image comes from a French Bible that belonged to King John the Good dating from about 1350. We know the vintage of the Bible because the English have possessed the Bible continually since they captured it as booty in the Battle of Poitiers in 1356.

In his commentary on Genesis, Martin Luther certainly indicated that the earth is spherical. He frequently referenced Aristotle in his commentary. Aristotle clearly taught that the earth was spherical, which if Luther disagreed with this, there was ample opportunity to express that.

Many flat-earthers confuse this matter by referencing a quote attributed to Luther. In the *Table Talk*, number 4638, dated June 4, 1539, we find:

There was mention of a certain new astrologer who wanted to prove that the earth moves and not the sky, the sun, and the moon. This would be as if somebody were riding on a cart or in a ship and imagined that he was standing still while the earth and the trees were moving. [Luther remarked,] “So it

goes now. Whoever wants to be clever must agree with nothing that others esteem. He must do something of his own. This is what that fellow does who wishes to turn the whole of astronomy upside down. Even in these things that are thrown into disorder I believe the Holy Scriptures, for Joshua commanded the sun to stand still and not the earth.”<sup>17</sup>

Again, notice that this quote is in reference to the question of whether the earth moves, not what shape the earth is. Flat-earthers persist in confusing these two issues. Though Copernicus is not mentioned by name, Copernicus likely is the astrologer mentioned (astronomers often were called astrologers then, for the two were mingled at that time). This is table talk number 4638, from June 4, 1539, four years prior to the publication of Copernicus’ book. Apparently, Copernicus had been discussing the heliocentric model for a while, and news of this had spread across Europe. Note that Luther first objected on the grounds that what Copernicus proposed would overturn the whole of astronomy. This was true, as most people in the West, including Luther, subscribed to Aristotelian/Ptolemaic cosmology, which was geocentric. But that cosmology was not flat earth, as many flat-earthers consistently and erroneously seem to think. Luther’s scriptural basis for rejection was secondary. However, we must note that the *Table Talks* were not penned by Luther. Rather, they were recollections by others of informal conversations published 20 years after Luther’s death. And this particular conversation occurred nearly 30 years before publication. One must wonder how accurately this attribution reflected Luther’s thoughts on the matter.

This discussion of the history of Western cosmology is far from exhaustive. There are many more examples that one could site that demonstrate the dominant cosmology in the West for 25 centuries has been that the earth is spherical. However, that dominant cosmology was geocentric until four centuries ago when the heliocentric theory replaced the geocentric theory. The faux history of cosmology that the flat-earthers peddle, that nearly everyone believed the earth was flat until 500 years ago, could not be more wrong. Furthermore, their repeated confusion of the geocentric model with the flat-earth model further clouds this false history.

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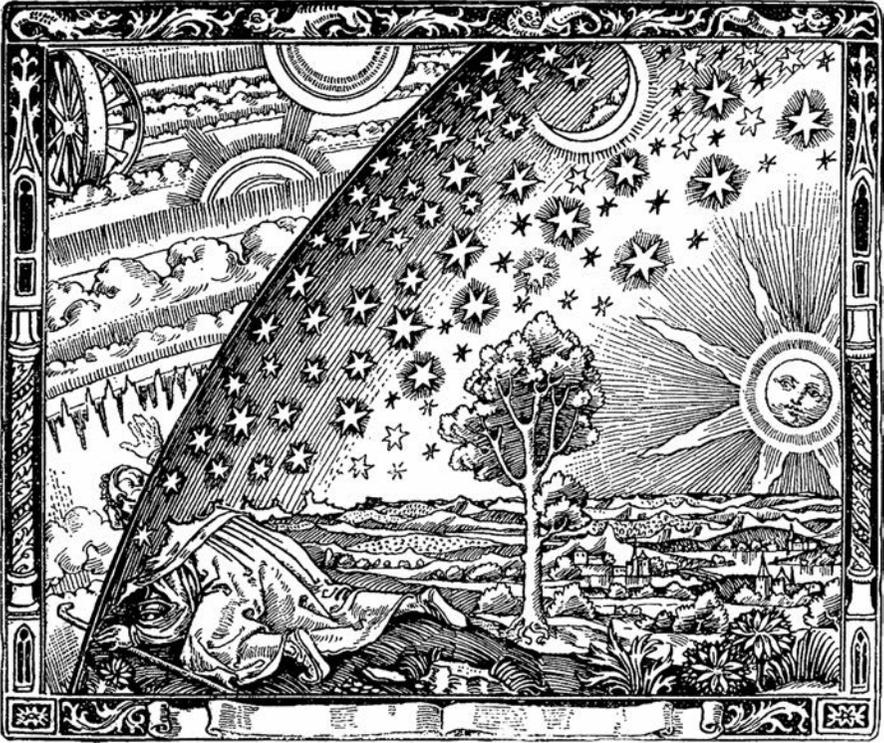
17. Martin Luther, *Table Talk*, translated by Theodore G. Tappert. In *Luther’s Works, Volume 54*, Helmut T. Lehmann, editor, (Philadelphia, PA: Fortress Press. 1967), p. 358–359.

### Accusation Against Christianity

Since from ancient times and through the Middle Ages people in the West thought the earth was spherical, how did the widespread belief that everyone thought the earth was flat until five centuries ago come about? It is a result of a concentrated effort to discredit Christianity and the Bible. Consider the depiction of the Middle Ages as the “dark ages.” That term apparently was first used by Petrarch in the 14th century. He meant it as a reference to the glory of the Greco-Roman world that obviously had disappeared by his day. By the time of the so-called Enlightenment, this term was appropriated to disparage the Church. The Age of Reason supposedly was in stark contrast to the Age of Faith, a term then applied to the Middle Ages. This thinking came to fruition in the 19th century when the flat-earth myth was concocted.

A major figure in creating the flat-earth myth was Washington Irving, who in 1828 published *A History of the Life and Voyages of Christopher Columbus*. It appeared to be an exhaustive tome, consisting of three volumes when published in the United States and in four volumes in the United Kingdom. The book proved to be quite popular, for it went through 175 editions before the end of the 19th century. Because of its length, most people assumed that it was accurate. However, Irving blended true information with many details that were not true. Today, we understand that authors frequently do this, but two centuries ago, this was a new concept. It was Irving who sold the myth that Columbus had to battle the foolish superstition of flat-earthers in demonstrating that the earth was round. For instance, Irving fabricated the dispute with religious authorities in Salamanca and the fears of Columbus’ crew.

Others soon followed Irving’s lead. In 1834, Jean Antoine Letronne published *On the Cosmographical Ideas of the Church Fathers*, where he falsely accused the church fathers and the medieval church of believing the earth was flat. In his 1837 book, *History of the Inductive Sciences*, William Whewell continued Letronne’s false claims, citing Lactantius and Cosmas as evidence. Other historians quickly joined, though they couldn’t find other examples. One would think other examples would have been easy to find if the church actually had taught that the earth was flat. This led to the *conflict thesis*, the idea that religion in general and Christianity in particular had held back progress. This was the theme of



Flammarion engraving.

John William Draper's 1874 book, *History of the Conflict Between Religion and Science*. Andrew Dickson White followed suit with his book, *The Warfare of Science*, just two years later, followed by his much larger two-volume tome, *History of the Warfare of Science with Theology in Christendom* in 1896. It was in this climate that Camille Flammarion included the engraving illustrated here in *The Atmosphere: Popular Meteorology*. Most people who have seen the Flammarion engraving think it is medieval in origin, but it first appeared in his book published in 1888.

Flat-earthers frequently quote Ferdinand Magellan as saying:

The church says the earth is flat; but I have seen its shadow on the moon, and I have more confidence even in a shadow than in the church.

This quote certainly seems to sum up what flat-earthers claim about history. However, Magellan said no such thing. This quote actually comes

from “The Great Agnostic,” Robert G. Ingersoll, who in his 1873 essay “Individuality,” wrote:

It is a blessed thing that in every age some one has had individuality enough and courage enough to stand by his own convictions — some one who had the grandeur to say his say. I believe it was Magellan who said, “The church says the earth is flat; but I have seen its shadow on the moon, and I have more confidence even in a shadow than in the church.” On the prow of his ship were disobedience, defiance, scorn, and success.<sup>18</sup>

This is the earliest known reference to this quote, indicating that it originated with Ingersoll, not Magellan. And Ingersoll wrote this at the height of the conflict thesis. The Roman Catholic Church never opposed the flat earth because no one seriously was teaching it. On the other hand, the Roman Catholic Church did oppose the heliocentric theory because the Roman Catholic Church had adopted the geocentric model, and there were people questioning that decision. Once again, this is the result of conflation of the shape of the earth with the question of whether the earth moves.

### The Flat-Earth Movement Is Born

In 1838, Samuel Birley Rowbotham became convinced that the earth was flat. What prompted him to reach this conclusion? Was it because he read Irving, Letronne, or Whewell? It likely wasn't Letronne, for Letronne's book was in French. Because his book went through so many editions and was popular in the UK, it could have been Irving's book. However, Irving didn't make such a strong case that the Church taught the earth was flat. It is more probable that Rowbotham was influenced by fellow Englishman Whewell, who published his book the year before. If



Samuel Rowbotham

18. R.G. Ingersoll, *The Gods, and Other Lectures* (Washington, DC: C.P. Farrell, 1879), p. 171.

so, then instead of recognizing that Whewell was peddling a false history of cosmology and the Church, Rowbotham unfortunately accepted the lie. At any rate, Rowbotham conducted what has become known as the Bedford Level experiment on the Old Bedford River near Norfolk, England. The Bedford Level is a six-mile stretch of the river that is straight, allowing an uninterrupted view along the six miles. Furthermore, there is no gradient there, so that portion of the river amounts to a slow-flowing drainage canal. If the earth is spherical, then the drop from one end of the Bedford Level to the other is about 24 feet. That is, if one were to use a telescope at water level to view along the water on one end of Bedford Level, an object less than 24-feet high on the other end would not be visible. Rowbotham waded into the river and used a telescope held eight inches above the water to observe a rowboat with a five-foot-high mast row away. Rowbotham claimed that he could see the mast when it was six miles away, even though the spherical earth required that the top of the mast be about 11 feet below his horizon (as viewed from eight inches above the water). As is usually recounted, Rowbotham concluded that the earth must be flat based on this experiment. However, as I argued above, it is more likely that Rowbotham had already concluded that the earth was flat, so this experiment merely confirmed his thesis, at least to his satisfaction. Using the pseudonym Parallax, Rowbotham published his results in a pamphlet titled *Zetetic Astronomy: Earth Not a Globe* in 1849, which he expanded into a book in 1865 under his own name.

Rowbotham preferred to call his cosmology “zetetic astronomy,” a term flat-earthers today occasionally use. As he explained at the beginning of his book, Rowbotham chose this term because:

The term Zetetic is derived from the Greek verb *Zeteo*; which means to search, or examine; to proceed only by inquiry; to take nothing for granted, but to trace phenomena to their immediate and demonstrable causes. It is here used in contradistinction from the word “theoretic,” the meaning of which is, speculative — imaginary — not tangible — scheming, but not proving.<sup>19</sup>

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19. S.B. Rowbotham, *Zetetic Astronomy: Earth Not a Globe* (Forgotten Books, 1881, reprinted in 2007), p. 3.

I'll let pass Rowbotham's mischaracterization of "theoretic," an alternate word for theoretical. Instead, I wish to emphasize that Rowbotham's zetetic flat-earth model is very different from ancient flat-earth cosmologies. Many ancient flat-earth cosmologies had a dome over the earth as the zetetic model has.<sup>20</sup> However, unlike the zetetic model, which has the sun and moon moving in circles perpetually above the earth, ancient flat-earth cosmologies had the sun and moon passing below the flat earth each night. That is, in ancient flat-earth cosmologies, the sun and moon (as well as many of the stars) rose and set, but in the zetetic model, the sun, moon, and stars never rise or set. Modern flat-earthers must go through elaborate mental gymnastics to explain how it is possible for the sun, moon, and many stars to only *appear* to rise and set.

Why the difference? The ancient flat-earth models could account for some aspects of the sky, a subject I take up in chapter 4. However, in these ancient flat-earth models, the sun, moon, and stars had to rise and set at the same time across the flat earth. Given the lack of good timepieces in the ancient world and slow transportation as compared to the modern world, it is not surprising that many ancient cultures were not aware that different times exist at different places in the world. As I discussed earlier, the ancient Greeks became aware that time was not the same across the earth, but that time became progressively earlier as one traveled westward. This was one of the evidences that they used to argue that the earth is a sphere. In the 19th century, even Rowbotham had to admit that there were different time zones around the world, hence the need to create his model in a way that was very different from ancient flat-earth cosmologies. Hence, while ancient flat-earth models could account for certain aspects of the sky, they could not explain the existence of time zones. While Rowbotham's zetetic model can accommodate time zones, it utterly fails to explain some of the aspects of the sky that ancient flat-earth cosmologies could explain. However, the conventional cosmology of a spinning globe earth can explain all of these, and then some.

Most people ignored Rowbotham's work. However, in 1870, John Hampden, another flat-earth proponent, offered a wager of a hefty sum to anyone who could demonstrate a convex curvature of a large body of

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20. However, by the Christian era, any domed cosmology in the West had been replaced by a sphere or spheres surrounding a spherical earth.

water, as a spherical earth would require. The famous evolutionist Alfred Russell Wallace took the challenge. Apparently aware of Rowbotham's result, Wallace altered the technique a bit. He placed two identical objects at different locations along the Bedford Level. Wallace examined each object from a telescope mounted on a bridge. He found that the nearer object appeared higher than the more distant one, consistent with the results predicted by a spherical earth.<sup>21</sup> Why the difference? A temperature inversion is common over bodies of water during spring and summer when these experiments were done. A temperature inversion causes light initially traveling tangent to the earth's surface to bend downward, resulting in light traveling around the earth's curvature. I shall discuss this phenomenon more in the next chapter.

As new converts joined the movement, several of them wrote books, but most aren't referenced much anymore. Two exceptions are William Carpenter's *A Hundred Proofs the Earth Is Not a Globe* (1885) and David Wardlaw Scott's *Terra Firma: The Earth Not a Planet, Proved from Scripture, Reason, and Fact* (1901). Rowbotham founded zetetic societies in England and New York in 1883, two years before his death. Lady Elizabeth Blount was perhaps the next leader in the flat-earth movement. In 1893, she founded the Universal Zetetic Society, which counted among its members the well-known British theologian E.W. Bullinger. This is a bit strange. Bullinger wrote on many topics, even some odd ones, such as the gospel in the stars and numerology, but he never wrote about the earth being flat. If Bullinger was a flat-earther, he was not outspoken about it. Perhaps Bullinger joined the society out of curiosity. The society published a journal called *Earth Not a Globe Review*. In reading flat-earth material, one sometimes sees this publication referenced. It took me a while to figure out what this publication was. Apparently, this journal was published 1893–1897. The society published another journal, *Earth*, 1901–1904. One occasionally sees this journal referenced in flat-earth material, too. Neither journal is easy to find.

An interesting case is Wilbur Glenn Voliva. In 1906, Voliva had gained control of the Christian Catholic Church based in Zion, Illinois.

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21. The outcome of the wager was a messy affair. The referee of the wager awarded the money to Wallace. Hampden accused Wallace of cheating and sued for return of the money. Eventually, the court imprisoned Hampden for libeling and threatening to kill Wallace, but it also ordered Wallace to return the money because Hampden had retracted the bet.

Voliva amassed total power in the church, as well as the city of Zion and the industries in town. Voliva came to embrace the flat-earth cosmology, which he made a doctrine of the church. At its height, the church claimed 20,000 followers worldwide. However, by the late 1920s, Voliva's lavish lifestyle and dictatorial control had alienated many church members. This dissension and the Great Depression took its toll, and the church fell on hard times. By the time of Voliva's death in 1942, the church virtually ceased to exist. Though a few members revived and renamed the church, it never has enjoyed the following it once had. It also jettisoned flat-earth teaching.

Belief that the earth is flat probably peaked in the late 19th and early 20th centuries. From there, it underwent decline. In 1956, Samuel Shenton organized the International Flat Earth Research Society (better known simply as The Flat Earth Society) in the United Kingdom. Shenton may have been earnest in his belief, but with the advent of the space program, many people joined the society as a joke. It's ironic that at times membership of The Flat Earth Society was dominated by people who thought the earth was a globe. After Shenton's death in 1971, Charles K. Johnson of California incorporated the International Flat Earth Research Society. It never had more than a few thousand members. The society was inactive after Johnson's death in 2001, but in 2004, Daniel Shenton (not related to Samuel Shenton) began a society website. Therefore, contrary to common misconception, there is no single flat-earth society. Rather, the group has gone through several incarnations, and it's not clear how serious various leaders or its members have been.

Before moving on, I ought to mention a few other, more obscure, books about flat earth (while omitting many pamphlets and booklets). The American Alexander Gleason published *Is the Bible from Heaven? Or Is the Earth a Globe?* in 1893. Gleason is best known for his azimuthal equidistant projection map of the earth, the representation of the earth most favored by flat-earthers (I discuss this map in chapter 5). The South African Thomas Winship published *Zetetic Cosmogony: Or Conclusive Evidence That the World Is Not a Rotating Revolving Globe, but a Stationary Plane Circle* in 1898. More recently, the French woman Gabrielle Henriette wrote *Heaven and Earth*. It isn't clear when this book was published — there is no publication date on the copyright page. Its publication

date often is stated as being 1958, but the last text on the final page of the book enigmatically is “1938–1956.” Is 1958 the date of the English translation, and is 1938 the publication of the original French version?<sup>22</sup> This book failed to attract the attention that the books of the late 19th century did. These appear to be the last flat-earth books published before Dubai’s two books in the second decade of the 21st century. It is interesting that the flat-earththers of today have published few books on the subject, opting instead to promote flat-earththers primarily with YouTube videos. The only other recent books about flat earth that I’m aware of are Nathan Roberts’ 2017 *The Doctrine of the Shape of the Earth*, Chad Taylor’s 2017 *Where Are We? Earth, According to the Bible* and Edward Hendrie’s 2016 *The Greatest Lie on Earth: Proof that our World is Not a Moving Globe*.

### Why I Wrote This Book

This brings me back to where I began this chapter — the revival of the flat-earth movement in the 21st century. Apparently, Dubai or others stumbled across some flat-earth writings from more than a century earlier, perhaps Carpenter’s book. These 21st-century converts began to repeat and repackage flat-earth arguments. It’s not entirely clear that some of the people involved in this revival believe the earth was flat. It could be that some of them merely promoted flat earth as a prank.<sup>23</sup> Unfortunately, as flat-earth websites proliferated on the Internet, thousands of people soon joined the movement. It’s ironic that more people in the West today may believe that the earth is flat than have in two millennia.

I have interacted with a few flat-earththers in person, via email, and on a few websites. It’s been impossible to convince true believers in the flat earth that the earth is a globe. They are very quick to dismiss all evidence to

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22. I’ve seen Henriet credited with a 1963 book entitled *The Solid Vault of Heaven*, however, I have not been able to find a copy or a facsimile of this book. I suspect that it may be a reprinting of her earlier book with a different title.

23. I’ve wondered about the sincerity of some flat-earth promoters for some time. For instance, Rowbotham originally authored his ideas under the pseudonym Parallax. But Rowbotham argued that parallax, the apparent shift in position of stars due to the earth’s orbit around the sun, doesn’t exist. Could use of this pseudonym have telegraphed that Rowbotham wasn’t being serious in his claims? Or consider Dubai’s book entitled *The Flat Earth Conspiracy*. If Dubai were serious, shouldn’t that title be *The Globe Earth Conspiracy*? Might Dubai cleverly be indicating that his work about flat earth merely is a joke?

the contrary. What about photos from space showing a spherical earth? There are no satellites, no astronauts, we haven't been to the moon, and so NASA has lied about everything. What about astronauts who testify that they have been in space and directly observed that the earth is a globe? They're all Freemasons, which proves that they are part of a large conspiracy (and big liars, to boot). It doesn't seem to faze in the least professing Christian believers in the flat earth when I point out that this puts them into the position of accusing several Christian brothers of lying about one of the biggest things that has happened in their lives.

My own personal observations that dispute what flat-earthers teach is met with great skepticism. I've asked several flat-earthers who question what I say on these matters if I'm lying about my evidence or if I'm just so professionally incompetent I can't properly make and interpret such observations. That question usually is left unanswered. I wish that flat-earthers would apply even an ounce of such skepticism to the flat-earth arguments that they encounter on the Internet. To my questions of flat-earthers, they often link to webpages that mock and mischaracterize the conventional (and I think correct) understanding of reality. Supposed arguments for the flat earth do much the same. For instance, one person recently posted on a Facebook (FB) page dedicated to discussing flat earth a frame from the beginning of a Three Stooges movie with the images of myself and two other creation scientists who have taken on the flat-earth movement superimposed over the faces of Moe, Larry, and Curly. For the record, I wasn't offended. In fact, I was amused, because I like lampoon. However, this sort of thing hardly constitutes a rational argument for something. This sort of thing is all too common among promoters of flat earth. Many flat-earthers seem to think that ridicule of their opponents' position is a logical argument for their own position. If they truly think this, then that may explain why they were so easily duped into believing that the earth is flat in the first place. I haven't written this book for the benefit of these people, because I don't think anything I could possibly say could change their minds. To the contrary, one of the reasons that I wrote this book is for people who have encountered flat-earth arguments and are seeking help in deciding if those arguments are sound.

But there are two other reasons that I wrote this book. The flat-earth books of more than a century ago argued that the Bible taught that the

earth was flat. Never mind the fact that almost no one for two millennia seemed to think so. When these writings recently began to circulate on the Internet, some very conservative Christians who take a hyper-literal approach to Scripture encountered these arguments and accepted them. Hence, to them, belief that the earth is flat became a question of orthodoxy. I wrote this book to counter this wrong approach to the Bible. It is no coincidence that some Christians of the 19th century began believing that the Bible teaches that the earth was flat precisely when critics of the Bible started laying that false accusation. Those misguided Christians unquestionably accepted that lie. We shouldn't believe the devil's lies.

Finally, I've always suspected that there is a hidden agenda behind the recent revival of 19th-century flat-earth belief. We biblical creationists frequently are accused of believing that everything in the Bible is literally true.<sup>24</sup> I think that there are people out there who are saying, "If you think it's literal, then I'll show you literal!" That is, part of the motivation behind the modern flat-earth movement is to undermine the credibility of the creation science movement. As one who has dedicated his life to sharing the reality of biblical creation with the world, I view the flat earth as a threat to my calling. Therefore, the third reason I wrote this book is to counter this attack.

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24. As I will show in chapter 10, there are many examples of nonliteral uses in the Bible.

However, that does not mean that everything in the Bible can be taken nonliterally. Far from it. It is patently false that *everything* in the Bible is literally true.