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## CONTENTS

Editorial	iv
Books in Brief	v

## ARTICLES

How Old is the Earth? JASON S. DeROUCHIE and WAYNE GRUDEM	1-29
Participating in the Jesus Drama: Roles in Johannine Discourse TODD R. CHIPMAN	30-58
Saul as a King-Priest NICHOLAS MAJORS	59-78
The Magi's Fulfillment of the Hebrew Bible's Theme "East of Eden" JASON KEES	79-95

## FOR THE CHURCH

Missions at Midwestern: Why 'For the Church' Means For the Nations JOE M. ALLEN III	96-113
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## How Old is the Earth?

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In AD 1658, Irish Archbishop James Ussher (AD 1581–1656) posited that God created the earth and its universe about 6:00pm, October 22, 4004 BC (according to the proleptic Julian calendar).<sup>2</sup> Few today would attempt such exactness, but many evangelicals would still hold that Scripture requires and science supports that the earth is relatively young ranging from 6,000–10,000 years old. Other evangelicals, however, believe that Scripture does *not* require a young earth and that science indicates an earth that is 4.5 billion years old and a universe that is 13.8 billion years old.

In this study, biblical scholars Jason DeRouchie and Wayne Grudem offer arguments for their respective young-earth and old-earth views and then respond to each other.<sup>3</sup> Throughout the process of this exchange, both authors operated independently. They each wrote their initial arguments with no awareness of the other's claims, and then they each responded without seeing the other's response. No changes or updates

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<sup>1</sup> Dr DeRouchie also serves as content developer and global trainer with Hands to the Plow Ministries.

<sup>2</sup> James Ussher, *The Annals of the World* (London: Tyler, 1658), 1.

<sup>3</sup> The original versions of DeRouchie and Grudem's exchange appeared on July 7, 2022, at DesiringGod.org: <https://www.desiringgod.org/series/how-old-is-the-earth/articles>. The authors are grateful for the chance to publish their conversation here.

were allowed after initial submissions. Both Drs. DeRouchie and Grudem hope their studies and evaluation will serve the church by providing a synthesis of the issue from biblical and scientific perspectives and by modeling respectful yet convictional, conservative Christian dialogue over important but debatable topics.

### **Our Young Earth: Arguments for Thousands of Years**

Jason S. DeRouchie

At stake in the question of the earth's age is faithful exegesis of the biblical text aligned with a faithful interpretation of the scientific data. Because no one but God was present at the beginning, and because the Bible is God's inerrant word, Scripture holds highest authority in answering questions of time and space. Scripture's teaching on a subject must bear guiding weight in assessing all matters related to the created sphere.

Let us be clear: God's role as creator, his purpose for creation, and the historicity of Adam and Eve as the first parents are non-negotiable for Christian belief. Furthermore, evolutionary creationism (i.e., theistic evolution) of any form is unwarranted biblically. Nevertheless, while there is much at stake, the age of the earth is not among the central doctrines that should divide. Conservative Christianity has remained broad enough for both young-earth and old-earth creationism (akin somewhat to credo- versus paedo-baptism or varying millennial views). I remain a convinced young-earth creationist because of the overwhelming biblical data. However, there is no single silver-bullet biblical or scientific argument for my position, and old-earth creationists can craft legitimate, thoughtful responses to each of my claims. The weight of my case is cumulative, and I question whether every argument I make can be legitimately falsified.

### **Humanity in the First Week**

*Argument 1: Genesis 1:1-2:3 places the creation of humanity within the first week of creation.* The most natural reading of the Bible's introduction points to a young earth.

The use of Hebrew *yôm* (meaning *day*) with the refrain "there was evening and there was morning" (Gen 1:5, 8, 13, 19, 23, 31), along with the mention of light and darkness, day and night, and the one-week

structure strongly, suggests that the communicator of this revelation was portraying the equivalent of 24-hour calendar days, even though the sun is not created until day four (1:14–19). Mankind is here portrayed as being created on day six of God’s first workweek. The day-age theory (wherein God created all of physical creation out of nothing in a chronological progression of ages spanning an indefinite period of time) does not seem to fit this context. And the gap theory (which posits a very long span between 1:1 and 1:2) does not appear to be allowed by the Hebrew text.

While later meditations on creation (e.g., Ps 104) never refer to the “days,” the fact that Yahweh built Israel’s 6+1 pattern of life upon the pattern of the creation week (Exod 20:11) seems best understood only if Israel was already aware of the 6+1 pattern of the creation week (see Exod 16:23–29; cf. Gen 7:4, 10; 8:10, 12) and viewed it as an actual as opposed to figurative or analogical reality. Specifically, Israel’s call to keep the Sabbath is grounded in God’s original workweek, which is difficult to read analogically: “The seventh day is a Sabbath to the LORD your God. On it you shall not do any work.... For in six days the LORD made heaven and earth, the sea, and all that is in them, and rested on the seventh day” (Exod 20:10–11).

### **In the Beginning**

*Argument 2: The New Testament closely associates the history of Genesis 2–4 with the beginning of the world.* Old-earth models require either that mankind’s creation be separated from the “beginning” by millions or even billions of years, or that the Genesis 1:1 “beginning” stretched out for a period of time massively longer than all the time that has followed. The former discounts the New Testament link between the “beginning” of Genesis 1:1 and the creation of mankind in 1:26–28, and the latter forces a strange use of the term of “beginning,” wherein what happens in the ninth inning is still the “beginning.”

In the New Testament, we read that Jesus saw the institution of marriage as being closely linked to the beginning of creation (Mark 10:6; cf. Gen 2:21–25; Matt 19:4, 8). He declared that Satan’s murderous activity (not just his tendencies) through his deception of Eve was closely associated with the beginning of creation (John 8:44). He linked this murderous, sinful activity with the promise that the offspring of the woman would stand in friction with the serpent and his offspring (1 John

3:8; cf. Gen 3:1–6, 15). He saw the first human experience of tribulation as being located near the beginning of creation (likely referring to Cain’s killing of Abel) (Mark 13:19; cf. Gen 4:8; Matt 24:21). He placed the martyrdom of Abel near the foundation of the world (Luke 11:49–50; cf. Gen 4:8; Matt 23:35).

The writer of Hebrews also considered the “foundation of the world” to be the conclusion of the sixth day, placed humanity’s rebellion (for which Jesus suffered) very near this time, and contrasted this foundation with the “end of the ages” realized in the work of Christ (Heb 4:3–4; 9:25–26).

### Linear Genealogies

*Argument 3: The linear genealogies in Genesis 5 and 11 point to a recent humanity.* While some biblical genealogies are clearly selective (e.g., Matt 1:1; 1:2–17), the genealogies in Genesis 5 and 11 are so specific that they resist a selective reading and thus require that humanity has existed for a relatively short time.

The linear genealogies in Genesis 5 and 11 are unique in all of Scripture with respect to the age detail they provide (see, e.g., Gen 5:3–11). Even if “son” at times means grandson or great-grandson (as can happen in Scripture), the specificity of the ages counters the likelihood of gaps. Moreover, several the seemingly “father-son/grandson/great-grandson” relationships are shown elsewhere to be just that — e.g., Adam with Seth (4:25), Noah with Ham, Shem, and Japheth (6:10), Terah with Abraham (11:31).

A solid explanation for the presence of specific ages in these genealogies is the messianic and missiological purposes of Genesis. Moses seems to have gone out of his way to show that God preserved the line of hope in every generation from Adam to Noah, from Shem to Terah, and from Abraham to Israel. The specified years all highlight the faithfulness of God to preserve his line hoping in the offspring promise of Genesis 3:15. As such, leaving out generations would have gone against the apparent purpose. Adding the ages in the genealogies points to humanity being around 6,000 years old.

### Climax of Creation

*Argument 4: Adam’s high role as head of the first creation and mankind’s station as the climax of creation and image of God both support a young*

*earth*. It makes less sense to think that God allowed the bulk of creation to exist for millennia without its overseers.

Genesis 1:1–2:3 associates all major “rulers” of the first creation with humanity. The luminaries separate day and night and establish the earth’s calendar (Gen 1:14), but they also serve as “signs” for humans that stress the surety of God’s promises (15:5; Jer 33:22). Humans are called to “fill the earth and subdue it” and to “have dominion over the fish ... birds ... and every living thing that moves on the earth” (Gen 1:28).

Humans are the climax of creation and sole representatives of God on the earth, with some being chosen “in Christ before the foundation of the world, that we should be holy and blameless before him, having been predestined in love for adoption as sons through Jesus Christ ... to the praise of his glorious grace” (Eph 1:4–6). Only on the sixth day is the definite article “the” added to the day-ending formula (“a first day, a second day, a third day, ... *the* sixth day”).

Day six gets the most literary space and includes the longest speeches. Only at the end of day six does God declare creation “very good” (Gen 1:31). Only at day six does God declare something he makes to be “in his image,” giving humanity oversight in the world. Scripture portrays the first man, Adam, as representative covenantal head over the first creation (Gen 2:15; Rom 5:18–19; 1 Cor 15:45). In addition, God’s oversight, provision, and protection of animals (Pss 104:14, 21, 24, 27; 145:14–16; 147:9; Matt 6:26; Luke 12:24) is significantly manifest through mankind (Gen 1:28; 2:15; Ps 8:6–8).

### **Animal Suffering and Death**

*Argument 5: Scripture usually portrays the suffering and death of living creatures, including animals, as part of the curse, so millions of years of animal death and suffering pre-fall seems unlikely.* God initially curses the world on account of human sin, so death and suffering in land animals and birds most likely resulted *from mankind’s fall* and were not present before it, as all old-earth models require.

The principal consequence of humanity’s garden rebellion was human death both physically and spiritually (Gen 2:17; 3:16–19; Rom 5:12). Humanity’s sin in the garden brought negative consequences not only on humanity, however, but also to the created world at large: God cursed the animals (Gen 3:14). God cursed the ground (3:17–19). God subjected the whole world to futility (Rom 8:20–21). Scripture regularly associates

animal death with curse and animal life with blessing. Both realities suggest that death and suffering in land animals and birds would have resulted from the fall and not been present before it.

1. The fact that the serpent is cursed “more than/above” (= Hebrew *min* of comparison) all livestock and beasts of the field implies that the land animals were indeed impacted directly and negatively by humanity’s fall (Gen 3:14; cf. 3:1).
2. Second, the curse on the ground (Gen 3:17) shapes the backdrop to Noah’s birth (5:29), and the judgment curse of the flood includes the death of all beasts, birds, and creeping things (7:21–23), save those on the ark, which were set apart to preserve non-human land creatures after the flood (6:19–20; 7:3).
3. Eight of the ten judgment plagues on Egypt included animals becoming pests to humans or the mass suffering and death of livestock in a way that negatively impacted human existence (Exod 8–12).
4. The penal substitutionary blood of the Passover lamb alone secured the lives of Israel’s firstborn among both humans and beasts (Exod 12:12–13).
5. Under the blessings of the Mosaic (old) covenant, mankind would live in safety from animal predation (Lev 26:6) and cattle and herds would flourish and increase (Deut 7:13–14; 28:4, 11). In contrast, under curse, humans would stand in fear of animal predation (Lev 26:22), cattle and herds would languish (Deut 28:18), and dead human flesh would be the food of beast and bird (28:26). These realities are all affirmed in the prophets (e.g., Jer 7:20; 12:4, Hag 1:9–11, Mal 3:9–12; 4:6).
6. In the context of his wars of judgment, Yahweh called Israel to slaughter everything that breathes, including the animals (Deut 13:15; 20:16; 1 Sam 15:3).
7. The Preacher in Ecclesiastes associates the death of animals with that of humans (Eccl 3:19–20) and unhesitatingly connects the reality of both deaths with the curse at the fall: “All are from the dust, and to dust all return” (see Gen 3:19–20). This link strongly points to the death of both animals and humans as beginning at the same time.

Old-earth creationists struggle to clarify what changes in the non-human world at the curse, for they believe an extended period (even millions of years) of animal suffering and death already existed pre-fall. In contrast, Scripture points to God's curse of the world as a decisive turning point and then commonly associates animal death with curse.

### **Eating Meat and the Curse's End**

*Argument 6: The limiting of animal death in the eternal state as a restoring of Eden suggests that all terrestrial death began after the fall.* Specifically, because eating meat likely symbolizes Jesus's victory over the curse, the limiting of animal death in the eternal state to redeemed humanity's consuming of meat likely signals the restoring of Eden rather than an escalation beyond it and suggests that all terrestrial death began after the fall and that, therefore, the earth is young.

Scripture explicitly connects sin, suffering, and death in all its forms only to the fall (Gen 3:14–15; Rom 1:24, 26, 28; 8:18–23). It also highlights Christ's death and resurrection as the only solution to the problem of human rebellion and its consequences, which appears to include all earthly evil, both natural evils like cancer and car accidents and moral evils directly related to rebellion against God. Specifically, the Bible teaches that Christ's work was designed to restore all things (Acts 3:21), to unite all things (Eph 1:10), to reconcile all things to God (Col 1:17), to do away with death, tears, and pain (Isa 25:8; Rev 21:4), and to eradicate the curse and all that is unclean (21:27; 22:3).

This eternal redemptive reality is portrayed both as restoring the garden of Eden (pre-fall) and as escalating beyond it by completing what the first Adam failed to secure. This new/re-creation will bear elements that are similar to the original creation pre-fall (Ezek 36:35; Isa 51:3; Rom 8:20–21; Rev 2:7; 22:1–5, 14, 19), but it will be absent of any past or potential influence of evil or curse (21:27; 22:3), save the sustained reminder of the former rebellion of the elect in order to sustain their awe of the saving work of King Jesus. Examples of such reminders will include lament over sin (Ezek 36:31), the presence of salt in the bogs around the once-Dead Sea (47:11; cf. Gen 13:10; 19:24–26), the presence of transformed multiple tongues rather than a single language (Zeph 3:9; Rev 5:9; 7:9; cf. Gen 11:6–9), and the visual identification of Christ as both sacrificial and conquering Lamb (Rev 5:5–6, 12–13; 7:10, 14; 17:14; 19:9; 21:22–23; 22:1, 3).



In such a context of restoration, reconciliation, and eradication, it is important to recognize that predatory activity among the animal kingdom will cease and that death will be present only in relation to humans eating meat. In the present fallen age, animals' predatory activity is part of God's revealed purposes (Ps 104:21; Job 38:39–41), so long as it does not threaten humans (Ps 104:23; Deut 7:22; Judg 14:5; 2 Kgs 17:25) or domesticated animals (1 Sam 17:34–35; Isa 31:4; Amos 3:12). Only after mankind's fall and the global curse did humans become a target for animal predatory activity and did God grant people permission to consume animal meat, partly to cause the animals to fear them (Gen 9:2–3; cf. 1:30). In this cursed world, eating meat affirms mankind's call to reflect, resemble, and represent God by exerting dominion (1:26, 28; cf. Ps 8:6–8), and it also testifies to God's curse-overcoming power.

Specifically, from the earliest days after God exiled humanity from the garden, humans distinguished clean animals from unclean ones (Gen 7:2–3, 8). After God allowed humans to consume animal flesh, he allowed his people to eat only the clean (Lev 20:25–26). Scripture treats as unclean all animals that in some way symbolically look like the serpent in the garden — whether due to their crafty, predatory, killing instincts (Gen 3:1–5 with 2:17; cf. John 8:44; 10:10) or due to their dust-eating association with death and waste (Gen 3:14). And it is because Christ overcomes the evil one at the cross (Eph 2:16; Col 2:15; cf. Luke 10:18; John 12:31; Rev 12:9) that all foods are now clean (Mark 7:19; Acts 10:10–15, 28; Rom 14:14, 20; 1 Tim 4:4). That makes the eating of all foods a testimony of Christ's curse-overcoming power.

In view of the full redemptive work of Christ, the restored new creation and new covenant will extend to the beasts, birds, and creeping things, resulting in global safety (Hos 2:18; Isa 35:9), as the once-predatory animals (perhaps a picture of hostile nations) become vegetarian and dwell peacefully alongside lamb and the child king, so that no creature need fear them (11:6–9; 65:25; cf. 9:6–7). In that day of consummation, God will put down all enemy oppression, abolish all human disease, suffering, and death, and make an end of the curse (Isa 25; 65:17–25; Rev 21:3–5; 22:3).

In the new heavens and new earth, humans will never fear predators, and terrestrial creatures will not be the diet of one another. These realities are part of Christ's fixing what went wrong at the fall and help

identify the return to the pre-fall state rather than an escalation beyond it.

Furthermore, as a sustained testimony that Christ has fully overcome the curse, humans will continue to eat animals in the new heavens and new earth (e.g., Isa 25:6, 8; Ezek 47:9–10; Matt 22:2–4; Luke 22:15–18, 29–30; Rev 19:7, 9; 21:1, 4, 10; cf. Luke 24:41–43; John 21:12–13). Because God allowed humans to eat meat only post-fall, and because eating that meat testifies to Christ’s curse-overcoming victory, which culminates in Jesus’s triumph over the unclean serpent at the cross, the restriction in the eternal state of animal death to redeemed humanity’s meat-consumption points to the absence of animal death before the fall and, therefore, to a young earth.

### **Conclusion: Young Earth**

The biblical data supports the belief that the earth is young. We see this (1) in the way Scripture portrays creation as a literal work week, (2) in the way the New Testament links the early history of mankind with the beginning, (3) in the unlikelihood that there are time gaps in the linear genealogies of Genesis, (4) in the way the Bible consistently portrays humanity as head of terrestrial creation, (5) in the fact Scripture regularly associates animal death and suffering with curse and makes it unlikely that such was happening before the fall, and (6) in the way human meat consumption in the eternal state testifies to Jesus’s curse-overcoming work.

## **A Response to Young-Earth Arguments**

*Wayne Grudem*

I want to thank Dr. DeRouchie for his thoughtful and clear argument in favor of a young earth. I agree with him that this discussion is one where Christians can hold different viewpoints but still affirm that the opposite position is acceptable within doctrinal orthodoxy.

But I’m not persuaded by his six arguments, as I explain in the following replies.

### **The ‘Most Natural Reading’**

*Reply 1: Our initial reading of a passage is not always the correct reading.*

Dr. DeRouchie says, “The most natural reading of the Bible’s introduction points to a young earth,” and he gives several reasons why he thinks the six “days” of creation were “the equivalent of 24-hour calendar days, even though the sun was not created until day four (Gen 1:14–19).”

It is not clear what he means by saying that the young-earth view is “the most natural reading.” I understand this expression to mean something like “the first-impression reading”—that is, the meaning that an ordinary reader “naturally” gives the passage when first reading it.

But many times in Scripture, further inspection of the text allows us to see that our first understanding was not correct. For example, someone could read, “The sun rises, and the sun goes down, and hastens to the place where it rises” (Eccl 1:5), and think that Scripture teaches that the sun goes quickly around the earth at night and reappears in the east the next morning. But eventually, scientific observation proved conclusively that the earth rotates on its axis, showing that a first impression or “most natural reading” was not correct. Rather, Ecclesiastes 1:5 was only describing the movement of the sun as it appeared to an observer standing on earth. That is not our first-impression reading, but that is the correct meaning. Similarly, our first impression of the six “days” in Genesis 1 might not be the correct understanding—the “days” might represent long periods of time (as in Gen 2:4) rather than 24-hour days.

And when the original readers saw that the sun was not established to mark “days and years” until day 4 (Gen 1:14), they would realize that the first three creation days (at least) were somehow different from ordinary days.

### **What About the Science?**

Reply 2: *The scientific evidence requires explanation.*

I was a bit surprised that Dr. DeRouchie gave no explanation for how a young-earth position can explain the many evidences of extreme age in the universe and especially on the earth, such as the radiometric dating of rocks from the earth, the moon, and asteroids; the billions of light-years distance of many stars; the expansion rate of the universe; the observation of distant stars burning out millions of years ago; the rate of continental drift; hundreds of thousands of years of ice layers in the Arctic; tens of thousands of years of layers of sediment in lakes, and so

forth. These scientific observations are the reason so many thousands of Christians hold to an old-earth position, and one can hardly expect us to change our minds if no convincing alternative interpretation of this evidence can be given.

### **Genesis 1–4 as ‘the Beginning’**

*Reply 3: The New Testament views all of Genesis 1–4 as “the beginning” because it all is preparation for the main story of the Bible: the history of the creation, fall, and redemption of human beings through the work of Jesus Christ.*

It is not surprising that the events of Genesis 1–4, for example, are all spoken of as “the beginning,” because, from a literary standpoint, that is how Genesis 1–4 functions in relationship to the rest of the Bible. The creation of human beings is not “the ninth inning,” as Dr. DeRouchie claims, but all of Genesis 1–4 is more like the first inning, and the rest of the Bible—moving through Noah, Abraham, David; the exile and return; the life, ministry, death, and resurrection of Jesus; the establishment of the church; and the return of Christ—is the remaining eight innings of the redemption story.

### **Role of Genealogies**

*Reply 4: The genealogies in Genesis 5 and 11 lay the groundwork for the New Testament to show the descent of Christ from Adam, and they show the remarkable age and health of the pre-flood generations, but they are not intended to teach us the age of the earth or of the human race.*

Dr. DeRouchie agrees that the word *son* in Scripture can sometimes mean grandson or great-grandson, so he (in principle) does not have to hold to Archbishop Ussher’s date of 4004 BC for the creation, but he comes close to that when he notes that “adding the ages in the genealogies points to humanity being around 6,000 years old.”

But if we agree that the genealogies can have gaps, and that they highlight only certain individuals, and that many individuals in the early generations lived several hundred years, then there is little reason to oppose a figure of 10,000 or even 20,000 years for the human race.

### **God's Eternity and Patience**

*Reply 5: An earth that existed for billions of years without human beings can encourage us to ponder with amazement God's even greater eternity and his infinite patience.*

Peter writes, "With the Lord one day is as a thousand years, and a thousand years as one day" (2 Pet 3:8). We cannot fully understand this reality, but it does suggest that from God's perspective, 13.8 billion years may not seem like a long time at all, and that age does allow for the light from distant stars, traveling at 186,000 miles per second, to have enough time to reach the earth and awaken our awe and worship as we ponder the infinite wisdom and power of a Creator who could make such an immense universe.

### **Possibility of Peaceful Animal Death**

*Reply 6: It is entirely possible that, before the fall of Adam and Eve, animals, like plants, lived a normal life span and then died quietly and peacefully.*

The warning God gave to Adam and Eve was that, if they ate from the tree of the knowledge of good and evil, *they* would die, not that animals would also begin to die. Paul writes, "Sin came into the world through one man, and death through sin, and so death spread to all men because all sinned" (Rom 5:12). At the fall, death spread to "all men" (plural of *anthrōpos*, "men, human beings"), not animals. (Note that animals are never said to sin.)

Back in 1975, in arguing that there will be "no final conflict" between the facts of science and the teachings of Scripture, apologist Francis Schaeffer noted that there was the possibility of "the death of animals before the fall." He said, "If we watch a dog die in a warm chimney corner, there is no struggle. It is like a leaf falling from a tree.... One could think of there being natural cycles for the animals, up to all that does not include man, with death not by the chase and not in agony."<sup>4</sup>

Dr. DeRouchie allows for the death of animals to provide meat for us to eat in the age to come, so there should be no objection in principle to the idea of animals, like plants, living a normal course of life and then peacefully dying on earth—for millions of years, with their bodies

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<sup>4</sup>Francis Schaeffer, *No Final Conflict* (Downers Grove, IL: InterVarsity Press, 1975), 31.

decaying and, along with dead plants, decomposing and providing the material that produced the fossil fuels like coal and oil that we find in the earth today. I do not believe that Dr. DeRouchie gave adequate consideration to the idea of peaceful animal death before the fall, which would provide an answer his fifth and sixth arguments.

And so, despite Dr. DeRouchie's thoughtful arguments, I end up where I began: God does not intend in the Bible to tell us the age of the earth, and an overwhelming amount of evidence from many different fields of science leads us to conclude that the universe is 13.8 billion years old and the earth is 4.5 billion years old. God created a truly amazing, truly gigantic universe.

### **Our Old Earth: Arguments for Billions of Years**

*Wayne Grudem*

I do not believe that God intended in Scripture to tell us the age of the earth. In the following material, I will explain the factors that led me to this conclusion about Scripture and then summarize some scientific indications of the age of the earth.<sup>5</sup>

#### **Meaning of the Word *Day***

The word *day* as used in Genesis 1 translates the Hebrew word *yôm*, which often refers to 24-hour days, but in other contexts clearly refers to an unspecified period of time. We see this in the immediate context, in Genesis 2:4: "... in the *day* that the LORD God made the earth and the heavens." Here, *day* refers to the entire creative work of the six days of creation.

Other examples of the word *day* to mean a period of time include Psalm 20:1 ("May the LORD answer you in the *day* of trouble!"), Proverbs 24:10 ("If you faint in the *day* of adversity, your strength is small"), Proverbs 25:13 ("Like the cold of snow in the *time* [*yôm*] of harvest ..."), and Ecclesiastes 7:14 ("In the *day* of prosperity be joyful, and in the *day* of adversity consider"). Even the first use of the word *day* in Genesis 1 does not mean a day of 24 hours but simply the daylight hours: "God called the light *Day*, and the darkness he called Night" (Genesis 1:5).

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<sup>5</sup> For more detailed arguments for the old-earth position, see Wayne Grudem, *Systematic Theology*, 2nd ed. (Grand Rapids: Zondervan, 2020), 385–413.

### Genesis 1 in Light of Science

The context of Genesis 1 does not clearly require one meaning of *day* over another, and if scientific data, drawn from many different disciplines and giving similar answers, convinces us that the earth is billions of years old, then this possible interpretation of *day* as a long period of time may be the best interpretation to adopt.

For those who hold to an old earth, the situation is something like that faced by Christians who first held that the earth rotates on its axis and revolves about the sun. They needed an explanation for verses about the sun “rising” or “going down,” like Ecclesiastes 1:5: “The sun rises, and the sun goes down, and hastens to the place where it rises.” (See also Ps 104:22; Jas 1:11; and others.) They did not have to claim that the passages *require* us to believe in a heliocentric (sun-centered) solar system, nor did they have to say that this was the most natural or the easiest interpretation, but only that this is a *possible* legitimate understanding of the texts, seeing these verses as speaking from the standpoint of the observer. From there, observational evidence taken from science shows us that this is, in fact, the correct way to interpret those texts.

### Answering Objections

Each of the days of Genesis 1 ends with an expression such as, “And there was evening and there was morning, the first day” (Gen 1:5). Does this require us to conclude that the days must be 24-hour days? Not necessarily, because the phrase may be simply the author’s way of telling us that the end of the first creative “day” (that is, a long period of time) occurred, and the beginning of the next creative “day” had come. In addition, alert readers would recognize that the first three creative “days” could not have been marked by evening and morning as caused by the sun shining on the earth, for the sun does not appear until the fourth day (1:14–19). Therefore, Genesis 1 itself shows that references to “evening and morning” in the chapter do not refer to the *ordinary* evening and morning of days as we know them now.

Does it matter that the days are numbered? Supporters of a young-earth position sometimes argue that, while the Hebrew *yôm* can elsewhere refer to a longer period of time, its use in Genesis 1 is different

because numbers are attached, and whenever *yôm* has a number attached, it refers to 24-hour days.

I do not find this argument persuasive because the requirement to consider only cases of the Hebrew *yôm* with a number attached acts as a filter to preselect the desired “24-hour day” answer. This is because, in the course of ordinary human life, the usual kinds of “days” that people count are 24-hour days, not longer periods of time. The creation narrative just happens to be the only context where longer periods of time are counted.

Nevertheless, interpreters who have decided that the days of Genesis 1 must be 24-hour days have another option available to them. The creation days might be 24 hours long, with many millions of years between the days. I think this must be considered another possible way to understand Genesis 1 in a manner that is consistent with an old earth.

### Gaps in the Genealogies

In the 1650s, Irish archbishop James Ussher, a distinguished historian and biblical scholar, argued from the genealogies in Genesis 5 and 11 that the date of God’s creative work in Genesis 1 was October 22, 4004 BC. To arrive at this conclusion, he used both the genealogies in Genesis 5 and 11 and extrabiblical historical sources.

However, it is doubtful that God’s purpose in these genealogies was to enable us to calculate the date of creation. If that had been God’s intention, he could have done so clearly by having Moses write, “So all the years from Adam to Abraham were 2004 years” (or some similar number). But there is no such summary statement in Genesis 5 or Genesis 11.

It is certainly possible, on the other hand, that the genealogies in Genesis 5 and 11 contain gaps. For instance, the genealogy in Matthew 1 tells us that Joram was “the father of Uzziah, and Uzziah the father of Jotham” (Matt 1:8–9). But from 1 Chronicles 3:10–12 (which uses the alternate name Azariah for Uzziah), we learn that three generations have been omitted by Matthew: Joash, Amaziah, and Azariah.

So when Genesis 5 says, “When Seth had lived 105 years, he fathered Enosh,” it could mean that Seth fathered someone whose descendent was Enosh. Thus, Enosh in Genesis 5:6–8 could in fact be someone who came many generations after Seth. In that case, the large number of years is not meant to give us a chronology that can be added together to get the



age of humanity, but rather it is given to show us the health and longevity of someone who could still beget children at more than 100 years old and could even live to 912 years.

For the God who lives forever, for whom “one day is as a thousand years, and a thousand years as one day” (2 Pet 3:8), and who delights in gradually working out his purposes over time, perhaps 13.8 billion years was just the right amount of time to wait for light from vastly distant stars to reach the earth, so that as we discover the age and size of the universe, we would be amazed at the greatness of our Creator, who made such an immense universe and whose eternal existence is far greater than even 13.8 billion years.

### **Scientific Evidence for an Old Earth**

Different kinds of observational (or scientific) evidence from astronomy and the earth sciences seem to indicate that both the earth and the universe are extremely old (13.8 billion years for the universe and 4.5 billion years for the earth).<sup>6</sup>

### **Expansion Rate of the Universe**

Astronomers can measure the distance from earth to various stars and galaxies. They can also measure the speed at which they are moving away from us. With those two values, they can “back up” the process to find how long the universe has been expanding. After summarizing three different methods of measuring such expansion, Hugh Ross says they show an average age of the universe of “13.79 ± 0.06 billion years,” and he adds, “The consistency of the three independent methods is remarkable.”<sup>7</sup>

### **Starlight from Events in the Distant Past**

Many stars are so far from the earth that it would take millions or even billions of years for their light to reach us. They give us evidence that requires a brief discussion of the speed of light.

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<sup>6</sup> Much of the following material, plus the relevant documentation, comes from the Christian astronomer Hugh Ross, *A Matter of Days: Resolving a Creation Controversy*, 2nd ed. (Covina, CA: RTB Press, 2015). Ross interacts repeatedly and specifically with young-earth objections to his arguments.

<sup>7</sup> Ross, *A Matter of Days*, 147, 150.

The speed of light (in a vacuum) is approximately 186,000 miles per second, and the sun is about 92,960,000 miles from the earth. That means it takes just over eight minutes for light from the sun to reach us. Therefore, when we see a sunrise or sunset, we are not seeing the sun as it is at that very moment, but *we are seeing the sun as it was eight minutes ago*.

This principle also applies to light from other stars. When we look through a telescope at Alpha Centauri (the star that is closest to us, after the sun), we are looking at a star that is 4.4 light-years away, which means the light from that star took 4.4 years to reach us. Therefore, what we see is Alpha Centauri *as it existed 4.4 years ago*. In the same way, some of the stars we can observe are so distant that their light would take 13,800,000,000 years to reach us. This indicates a very old universe.

Young-earth supporters may respond that perhaps God created the universe with light rays already in place, so that Adam and Eve would see thousands of stars on the first night after they were created. This of course is possible. Certainly Adam and Eve themselves had an “appearance of age” (God created them as adults, not as infants), as did all the animals that God created as “grown-up” animals.

But there are difficulties with this suggestion. First, there is the existence of white dwarfs, which are formed when stars reach the end of their lifetimes and run out of nuclear fuel.<sup>8</sup> But “a star takes millions of years, minimum, to burn up all of its nuclear fuel and become a white dwarf.”<sup>9</sup> If the universe is only 10,000 years old, and if God created stars with light rays in place, why would he also create optical illusions that *look like* material from stars that died billions of years ago, when in fact those stars never even existed?

The same is true for other events that astronomers observe in space, such as the existence of supernovas, which are massive, extremely bright explosions, lasting several weeks or months, that happen when stars are about to burn out. But according to young-earth advocates, as Ross notes, “The supernova eruption astronomers claim to see in the Large Magellanic Cloud 163,000 light-years away did not occur 163,000 years ago.” In fact, according to a young-earth view, it never occurred, since

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<sup>8</sup> Ross writes, “White dwarfs are the final state of all stars possessing less than enough mass to become either black holes or neutron stars.” Ross, *A Matter of Days*, 156.

<sup>9</sup> *Ibid.*

*nothing existed* before 10,000 years ago. When astronomers see such supernovas that explode and then quickly die out, these would be optical illusions placed in outer space to make us *think (wrongly) that supernovas happened* hundreds of thousands of years ago. It would seem contrary to God's character to deceive us like this.<sup>10</sup>

Some young-earth advocates have responded that perhaps the speed of light has changed, and perhaps light traveled much faster a few thousand years ago. But the speed of light is one of the most universal constants in physics, and the need to speculate that it *might have* been vastly different (a million times faster?) seems to me to cast doubt on the entire young-earth viewpoint.

### Ice Layers

Scientists have drilled deep into the ice layers in the central parts of Antarctica and northern parts of Greenland. They have found that "three ice cores from Antarctica . . . provide a continuous record of the past 800,000, 720,000, and 420,000 years, respectively."<sup>11</sup> A young-earth advocate might respond that multiple layers could be laid down within a single year, but Ross notes that "within the layers are dust signatures of known volcanic eruptions," including eruptions of Mount Vesuvius in AD 79, 472, 512, 968, 1037, 1139, 1631, and 1944. "Counting the layers between layers that contain the dust signatures of these eruption events, researchers have confirmed that each layer indeed corresponds to one year."<sup>12</sup>

### Sediment Layers at the Bottom of Lakes

Geologists Gregg Davidson and Ken Wolgemuth have written an extensively documented article showing that "finely layered sediments from Lake Suigetsu [in Japan] were deposited annually going back more than 50,000 years." They also show that the most recent of these layers

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<sup>10</sup> I am glad to see that the ministry Answers in Genesis, though holding to a young earth, rejects the idea that God created the universe with light rays from stars and the earth already in place; see Jason Lisle, "Does Distant Starlight Prove the Universe Is Old?" *Answers in Genesis*, December 13, 2007, <https://answersingenesis.org/astronomy/starlight/does-distant-starlight-prove-the-universe-is-old/>.

<sup>11</sup> Ross, *A Matter of Days*, 190.

<sup>12</sup> *Ibid.*

of sediment correspond closely with tree rings that go back more than 14,000 years, and that carbon-14 decay rates (measured by various samples taken at various depths of the sediment layers) “have remained unchanged.”<sup>13</sup>

### **Radiometric Dating of Rocks**

Igneous rocks are formed when lava or magma (very hot molten material found beneath the earth) cools and changes from a liquid to a solid. Some igneous rocks consist partly of radioactive material that begins to decay as soon as a rock solidifies, and when it decays it changes into another element. For example, uranium-238 decays and turns into lead-206. But uranium-235 becomes lead-207, and thorium-232 becomes lead-208.<sup>14</sup> For every type of radioactive substance, the rate of such decay can be measured. With that information, geologists can measure the amount of each kind of uranium and thorium isotope and the amount of each kind of lead isotope in a rock, and with that information they can determine six independent measures of the age of a rock.

Since each of the uranium and thorium isotopes decays at a different rate, if a rock sample has all three of the uranium and thorium isotopes and all three isotopes of the resulting lead, the proportion of each kind of uranium, thorium, and lead gives us six different independent measures of the age of the rock. Ross reports that “ratios of different radiometric elements relative to the lead end products and the ratios of the different lead end products relative to one another provide consistent, accurate dates—all saying that the earth is billions of years old.”<sup>15</sup>

### **Continental Separation**

Fossil-bearing rock fields near the coasts of Africa and South America were apparently previously joined together and then separated by continental drift as the continents gradually moved apart. In fact, anyone who looks at a globe can see that, if the continents of North and South

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<sup>13</sup> Gregg Davidson and Ken Wolgemuth, “Testing and Verifying Old Age Evidence: Lake Suigetsu, Varves, Tree Rings, and Carbon-14,” *Perspectives on Science and Christian Faith* 70, no. 2 (June 2018): 75–89.

<sup>14</sup> Ross, *A Matter of Days*, 187.

<sup>15</sup> *Ibid.*

America could be moved eastward and the continents of Europe and Africa could be moved westward, with slight rotation the continental shelves would fit together. In addition, underneath the Atlantic Ocean there is a large mountain ridge called the Mid-Atlantic Ridge that follows the curved pattern of a line halfway between these continents. All this is evidence of plate tectonics, the scientific study that explains movements of the plates on which the continents rest.

Now, there are two separate methods to determine how long ago the continents separated. Taking samples from the crust of the Atlantic Ocean at the edges of the continents, “maximum ages of about 180 million years for the Atlantic Ocean crust are obtained.”<sup>16</sup> This suggests that the continents separated about 180 million years ago, leaving the Atlantic Ocean between them. If we measure the distance from a point on the North American coastline to the corresponding point on the African coastline, the distance is 3,480 miles. If we divide 3,480 miles by 180,000,000 years, it “yields an average rate of 1.2 inches per year.”<sup>17</sup> Repeated calculations at different points vary only slightly, from 1.1 to 1.7 inches per year.

But are these continents actually moving apart at that rate? Long-term precise satellite “measurements of the relative positions of North America and North Africa document a current spreading rate of approximately 1 inch per year, a value in remarkable agreement with the radiometrically determined rates.”<sup>18</sup> This confirms that the continents began to move apart 180,000,000 years ago—but that is impossible if the earth is less than 10,000 years old.

### Conclusion: Old Earth

I realize that young-earth advocates will disagree with my assessment of this evidence. They will claim that maybe the speed of light was vastly different, maybe the rate of sediment deposit in lakes was vastly different, maybe the speed of movement of the earth’s tectonic plates was vastly different, maybe the rate of decay of radiometric elements in rocks was vastly different, and so forth. Eventually this begins to sound

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<sup>16</sup> Roger Wiens, “So Just How Old Is That Rock?” in *The Grand Canyon: Monument to an Ancient Earth*, ed. Carrol Hill, Gregg Davidson, Tim Helble, and Wayne Ranney (Grand Rapids: Kregel, 2016), 94.

<sup>17</sup> Wiens, “So Just How Old,” 94.

<sup>18</sup> *Ibid.*

to me like, “If the facts were different, they would support my position.” But that kind of argument is just an admission that the facts do not support one’s position.

As for the biblical evidence, I think it can be legitimately and honestly understood to allow for either an old-earth or a young-earth view. I do not think the Bible tells us or intends to tell us the age of the earth or the age of the universe.

### A Response to Old-Earth Arguments

*Jason S. DeRouchie*

Dr. Grudem usually uses Scripture to ground his Christian doctrine and ethics. However, he supports his belief in an old earth with almost no biblical evidence, dismisses the proposals of scientists guided by God’s word, and follows an interpretation of the observable data put forward by scientists who are calculating the universe’s age based on naturalistic uniformitarian assumptions.<sup>19</sup>

#### **Day Means Ages?**

Context determines the meaning of *day* (e.g., daylight vs. an unspecified time in Genesis 1:5 and 2:4). The weeklong structure of Genesis 1:1–2:3 and the repeated ending formula “evening and ... morning” on days 1–6 (Gen 1:5, 8, 13, 19, 23, 31) indicate that the days are not ages but 24-hour periods. While the week structure could be figurative (as some old-earthers hold), Moses does not portray the “days” as ages. Because God built Israel’s workweek (6+1) off his creation week (Exod 20:11), the six workdays in Genesis 1 are most naturally 24-hour periods.

The earth only needs to rotate in relation to a fixed light source to produce evening and morning. In Genesis 1, light is the only matter that simply “was” (Gen 1:3); God “makes” or “creates” everything else (1:7, 16, 25, 26; 1:21, 27) or guides its production (1:11–12). Furthermore, “God is light” (1 John 1:5), and Jesus is “the light of the world” (John 8:12), through whom God made all things and in whom was the life that became

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<sup>19</sup> For more on why uniformitarian assumptions are naturalistic, see Terry Mortenson, “Philosophical Naturalism and the Age of the Earth: Are They Related?” *TMSJ* 15, no. 1 (Spring 2004): 71–92.

the light of men (John 1:3–4). In the consummate new creation, there will be “no need of sun or moon ..., for the glory of God gives it light, and its lamp is the Lamb” (Rev 21:23). Similarly, Scripture suggests that, at the beginning, God sustained the earth and provided evening and morning through his own glory’s fixed light, centered in his Son. Indeed, the one who spoke light into darkness is now shining into the new creation (2 Cor 4:6). That God gave light apart from luminaries on days 1–3 adds to the implied polemic against pagan worldviews that “the two great lights ... and the stars” are not “gods” but merely secondary, unnecessary agents by which the true Creator supplies life and order to his universe.<sup>20</sup>

### Gaps in the Genealogies?

“When Seth had lived 105 years, he fathered Enosh” (Gen 5:6). For Grudem, the presence of selective genealogies elsewhere (e.g., Matt 1:8–9) implies the genealogies in “Genesis 5 and 11 contain gaps.” While not common, the Hebrew verb translated “fathered” (Hiphil *yld*) allows for *genealogical gaps* (unnamed descendants), meaning the subject may be the marked direct object’s ancestor and not his immediate father (see Deut 4:25; 2 Kgs 20:18). Thus, Enosh could be Seth’s son, grandson, or more distant relative.

Nevertheless, Grudem infers that Genesis 5:6 allows for *chronological gaps* (i.e., missing years). Yet the text requires that Seth was 105 years old when Enosh was born, regardless of whether Enosh was Seth’s immediate son or more distant relative. Seth’s age marks the time when the action and result happened, with no chronological gaps.<sup>21</sup> Even if one allows for genealogical gaps, Genesis 5 and 11 supply a chronological timeline that implies a young humanity.

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<sup>20</sup> See esp. John D. Currid, *Against the Gods: The Polemical Theology of the Old Testament* (Wheaton, IL: Crossway, 2013), 44–46.

<sup>21</sup> See esp. Jeremy Sexton, “Who Was Born When Enosh Was 90? A Semantic Reevaluation of William Henry Green’s Chronological Gaps,” *WTJ* 77, no. 2 (Fall 2015): 193–218; Jeremy Sexton, “Evangelicalism’s Search for Chronological Gaps in Genesis 5 and 11: A Historical, Hermeneutical, and Linguistic Critique,” *JETS* 61, no. 1 (March 2018): 5–25.

### Death and Suffering Before the Fall?

While unstated, Grudem's position requires millions of years of animal death and suffering *before the fall*. Yet Scripture associates creature mortality and misery only with curse (see my original arguments for a young earth).<sup>22</sup>

### Scientific 'Evidence' for an Old Earth?

Grudem has no compelling biblical reasons for believing in an old earth. Furthermore, if any of my biblical arguments for a young earth is sound, then Scripture indicates that Grudem's scientific interpretations are seriously flawed and need to be aligned with Scripture's inerrant testimony.

Grudem's "facts" are actually only interpretations of the observable data growing from his belief that present measurable processes are the key to understanding the remote past. He slights young-earthers for highlighting this, but the point stands: uniformitarian assumptions drive all six of his scientific claims, even though *Scripture and science suggest that scientific means alone will not establish the earth's age*.

First, the Bible portrays creation as the omnipotent God's supernatural work. Grudem upholds this yet hesitates to affirm Scripture's testimony that light and terrestrial vegetation (Gen 1:3, 11) preceded the luminaries, whose sole revealed purpose is to guide life on earth (1:14) and to highlight Yahweh's promises (15:5; Jer 33:22) and power (Isa 40:25–26; Amos 5:8). Moses had no problem portraying God causing life-giving light to shine without the sun. Why should we?

Second, against scoffers who claim, "All things are continuing as they were from the beginning of creation" (2 Pet 3:4), Peter stressed how this conviction overlooks that "the world that then existed was deluged with water and perished" (3:5–6). In the same way that miracles can alter normal time rates in ways unperceived by non-onlookers (e.g., John 2:9–10), so too the global flood's heat and pressures would have radically altered geography, geology, climate, and more. Scientists recognize that

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<sup>22</sup> For further reflections on this issue, though with some theological affirmations with which I do not fully agree, see Terry Mortenson, "The Fall and the Problem of Millions of Years of Natural Evil," *Journal of Ministry and Theology* 16, no. 1 (Spring 2012): 122–58, <https://answersingenesis.org/theory-of-evolution/millions-of-years/the-fall-and-the-problem-of-millions-of-years-of-natural-evil/>.



energy and force can drastically compress matter's formation time, and because God shaped the earth through cataclysm (see Gen 7:10–24), the process rates the flood affected *must* have been very different from those measured today.

The third reason science alone cannot establish the earth's age is because so many assumptions shape scientific interpretation. I will mention six.<sup>23</sup>

1. With his belief that the universe is expanding,<sup>24</sup> Grudem assumes light's one-way speed is equal to its roundtrip speed (which is unnecessary), that the universe began with no size (in contrast to a mature universe), and that cooling and expansion rates have remained constant over billions of years (which we cannot know and which many physicists question).<sup>25</sup>
2. Because travel effects time, physicists can measure only light's roundtrip speed (e.g., off mirrors = 186,000 mi/sec or 300,000 km/sec). Grudem assumes that light's speed is constant in all directions (isotropic), but light's one-way speed could be virtually instantaneous (anisotropic), which is what Genesis 1:14–15 suggests.<sup>26</sup>

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<sup>23</sup> I thank my friends Drs. Bill Barrick, Jeremy Lyon, Terry Mortenson, and Andrew Snelling for directing me to resources and for offering helpful feedback. All the assessment is my own.

<sup>24</sup> Physicist John Hartnett thinks this is far from proven: John Hartnett, "Does Observational Evidence Indicate the Universe Is Expanding? — Part 2: The Case against Expansion," *Journal of Creation* 25, no. 3 (December 2011): 115–20.

<sup>25</sup> Please see the following studies by physicist Emily Conover for a more rapid expansion model: Emily Conover, "New Data Fuel Debate on Universe's Expansion Rate," *ScienceNews*, February 2, 2017, <https://www.sciencenews.org/article/new-data-fuel-debate-universes-expansion-rate>; Emily Conover, "Scientists Still Can't Agree on the Universe's Expansion Rate," *ScienceNews*, July 16, 2019, <https://www.sciencenews.org/article/universe-expansion-rate-mystery>.

<sup>26</sup> Einstein's relativity physics highlights that light's one-way speed is relative, so long as the roundtrip speed remains constant. Albert Einstein, *Relativity: The Special and General Theory*, trans. R.W. Lawson (New York: Crown, 1961), 22–23. For the basic implications of this fact for a young universe, see Jason Lisle, "Distant Starlight — The Anisotropic Synchrony Convention," *Answers Magazine*, January 1, 2010,

3. The polar ice sheets' age and formation determine the expected annual layer compression-thickness in the cores,<sup>27</sup> and this guides where one measures cycles of oxygen isotopes to calculate age.<sup>28</sup> If weekly storms formed the ice masses rapidly in a single ice age following the flood,<sup>29</sup> then the annual thickness would be greater (not having thinned as much under eons of pressure), and old-

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<https://answersingenesis.org/astronomy/starlight/distant-starlight-thesis/>.

For a more detailed discussion with answers to objections, see Lisle, "Anisotropic Synchrony Convention — A Solution to the Distant Starlight Problem," *Answers Research Journal* 3 (2010): 191–207.

<sup>27</sup> Both old-earth and young-earth scientists generally agree about the annual compression thickness in the highest layers of the polar ice sheets; it is when one gets deeper that one's pre-judgment on the earth's age influences assessment. All the volcanic eruptions Grudem cites come from the higher layers related to recent history and are not linked to the lower core commonly associated with the ice age(s).

<sup>28</sup> Geologists can identify "cycles" of oxygen isotopes, because water evaporation leaves behind heavier oxygen atoms (<sup>18</sup>O), whereas snowfall has a greater concentration of lighter oxygen atoms (<sup>16</sup>O). After the initial layers at the top of ice cores, melting and pressure have caused the lower ice cores to get blurry, necessitating a different way for dating. Tracking oxygen isotopes is a common solution, but storms and other phenomena like a moving snow dune can easily skew one's interpretation, especially if the estimated annual thickness is misguided. Note the following quote from a number of old-earth geologists: "In counting any annual marker, we must ask whether it is absolutely unequivocal, or whether nonannual events could mimic or obscure a year. For the visible strata (and, we believe, for any other annual indicator at accumulation rates representative of central Greenland), it is almost certain that variability exists at the subseasonal or storm level, at the annual level, and for various longer periodicities (2-year, sunspot, etc.). We certainly must entertain the possibility of misidentifying the deposit of a large storm or a snow dune as an entire year or missing a weak indication of a summer and thus picking a 2-year interval as 1 year." See R. B. Alley et al., "Visual-Stratigraphic Dating of the GISP2 Ice Core: Basis, Reproducibility, and Application," *Journal of Geophysical Research* 102, no. C12 (November 1997): 26,378.

<sup>29</sup> See especially Larry Vardiman, *Ice Cores and the Age of the Earth* (El Cajon, CA: Institute for Creation Research, 1993).

earthers would be falsely treating multiple storm cycles in single years as if each one represented a year.<sup>30</sup>

4. Dating old lake deposits assumes their pattern and rate remained unchanged throughout time, but catastrophes like floods, hurricanes, and volcanic eruptions create moving slurries, resulting in storm or flood deposits (called rhythmites) that are indistinguishable from the annual seasonal deposits (called varves).<sup>31</sup> And because varve counts, tree-ring counts, and

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<sup>30</sup> For more on this, see Michael Oard, *Frozen in Time: The Woolly Mammoth, the Ice Age, and the Bible* (Green Forest, AR: Master Books, 2004), 119–26, <https://answersingenesis.org/environmental-science/ice-age/do-ice-cores-show-many-tens-of-thousands-of-years/>; cf. Andrew A. Snelling, “Layers of Assumption: Are Tree Rings and Other ‘Annual’ Dating Methods Reliable?” *Answers Magazine*, January 1, 2017, <https://answersingenesis.org/age-of-the-earth/layers-assumption/>. The old-earth interpretation of the data assumes that the middle and lower ice-age portions of the polar ice sheets grew up over three or more ice-age cycles, each approximately 100,000 years long. Milankovitch first posited this “astronomical theory of the ice ages”; see M. Milankovitch, “Expansion and Current Status of the Astronomical Theory of Geological Climates,” *Experientia* 4, no. 11 (1948): 413–18. For an overview and response, see Oard, *Frozen in Time*, 65–68.

<sup>31</sup> Representing twelve months’ deposit in a lake bottom, a varve is a pair of contrasting sedimentary layers or laminae—the thick, coarse “summer” layer caused by spring run-off and made of large, light-colored grains of sand or silt, and the thin, fine-grained “winter” layer caused by settling debris and made of dark, clay-like particles from plants. As disclosed in recent major disasters—like Hurricane Donna (1960), the flood in Bijou Creek, CO (1965), and the volcanic eruption of Mount St. Helens (1980), huge amounts of water, landslides, flows of mud or volcanic ash, steam water, and other catastrophic phenomena can deposit many altering laminae in short amounts of time (be it weeks, days, or even hours). Hence, the altering of coarse and fine laminae could result from event-layering and does not necessarily signal annual sediment deposition. Furthermore, the biblical flood would have caused massive amounts of such sedimentation, which cautions all attempts to date the remote past by means of sedimentary layers. See especially Jake Hebert, Andrew A. Snelling, and Timothy L. Clarey, “Do Varves, Tree-Rings, and Radiocarbon Measurements Prove an Old Earth? Refuting a Popular Argument by Old-Earth Geologists Gregg Davidson and Ken Wolgemuth,” *Answers Research Journal* 9 (2016): 339–61; Snelling, “Layers of Assumption.”

radiocarbon-14 dates are inter-calibrated, they should not be used to reinforce one another.<sup>32</sup>

5. While radiometric dating of rocks helps establish relative formation sequence in earth history, Grudem assumes that we know the starting conditions (e.g., only uranium [= parent isotope] and no lead [= daughter isotope]), that no contamination or leaching has altered rock makeup (which can't be measured without an independent benchmark),<sup>33</sup> and that the decay rate has remained constant,<sup>34</sup> uninfluenced by altered forces of heat or pressure (i.e., catastrophe) that could speed the decay.<sup>35</sup>

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<sup>32</sup> As Hebert, Snelling, and Clarey note, varve dating is dependent on radiocarbon dating, which is calibrated against tree-ring counts, whose tree-ring chronologies were developed through radiocarbon dating. Thus, “none of these dating methods are truly independent and thus objective. They are inter-calibrated and adjusted to agree because of the assumption they are supposed to agree, due to the assumed uniformity of geologic and physical processes that willfully ignores the evidence for the global Flood cataclysm and its aftermath” (Hebert, Snelling, and Clarey, “Do Varves, Tree-Rings, and Radiocarbon Measurements Prove an Old Earth?” 357). For an overview of radiocarbon dating, its challenges, and a young-earth response, see this three-part study: Andrew A. Snelling, “Carbon-14 Dating: Understanding the Basics,” *Answers Magazine*, October 1 2010, <https://answersingenesis.org/geology/carbon-14/carbon-14-dating/>; Andrew A. Snelling, “Carbon-14 in Fossils and Diamonds: An Evolutionary Dilemma,” *Answers Magazine*, January 1, 2011, <https://answersingenesis.org/geology/carbon-14/carbon-14-in-fossils-and-diamonds/>; Andrew A. Snelling, “A Creationists Puzzle: 50,000-Year-Old-Fossils,” *Answers Magazine*, April 1, 2011, <https://answersingenesis.org/geology/carbon-14/a-creationist-puzzle/>.

<sup>33</sup> “Contamination” occurs when an outside constituent or impurity seeps in and alters a natural material; “leaching” occurs when a soluble chemical or mineral drains away due to percolating liquid, especially rainwater.

<sup>34</sup> The “decay rate” is how long one element (a parent isotope) takes to change into another (a daughter isotope).

<sup>35</sup> For a helpful overview of radiometric dating that details its challenges due to uniformitarian assumptions, see Andrew A. Snelling, “Radiometric Dating: Back to Basics,” *Answers Magazine*, June 17, 2009, <https://answersingenesis.org/geology/radiometric-dating/radiometric-dating-back-to-basics/>; Andrew A. Snelling, “Radiometric Dating: Problems with the Assumptions,” *Answers Magazine*, October 1, 2009,

6. Plate tectonics best explains why the continents are no longer united (Gen 1:9–10), but Grudem assumes that the rate of continental separation was always gradual, as it is today, whereas the catastrophe model of rapid separation also aligns with the data, answers why plate movement would have slowed drastically after the flood,<sup>36</sup> and explains both the lack of compression in ocean sediments and the erratic magnetic polarity in the ocean crust (suggesting rapid cooling in non-uniform ways due to contact with chaotic ocean waters).<sup>37</sup>

### Conclusion

God has written two “books” — the word and the world, and the former’s infallible and inerrant nature requires that it must always guide

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<https://answersingenesis.org/geology/radiometric-dating/radiometric-dating-problems-with-the-assumptions/>; Andrew A. Snelling, “Radiometric Dating: Making Sense of the Patterns,” *Answers Magazine*, January 1, 2010, <https://answersingenesis.org/geology/radiometric-dating/radiometric-dating-making-sense-of-the-patterns/>. Snelling supplies a number of examples where all three assumptions have been called into question based on modern natural disasters.

<sup>36</sup> Once the heavier pre-flood crust was subducted (one plate plunging beneath another) into the mantle and replaced by the lighter, more fluid mantle rock, the continental displacement would have decelerated drastically. See especially John R. Baumgardner, “Catastrophic Plate Tectonics: The Geophysical Context of the Genesis Flood,” *Journal of Creation* 16, no. 1 (April 2002): 58–63, <https://answersingenesis.org/geology/plate-tectonics/catastrophic-plate-tectonics-geophysical-context-of-genesis-flood/>; Andrew A. Snelling, “Hawaii’s Volcanic Origins — Instant Paradise,” *Answers Magazine*, January 1, 2014, <https://answersingenesis.org/geology/plate-tectonics/hawaiis-volcanic-origins-instant-paradise/>.

<sup>37</sup> See Andrew A. Snelling, “Can Catastrophic Plate Tectonics Explain Flood Geology?” in *The New Answers Book 1: Over 25 Questions on Creation/Evolution and the Bible*, ed. Ken Ham and Bodie Hodge (Green Forest, AR: Master, 2006), 186–97, <https://answersingenesis.org/geology/plate-tectonics/can-catastrophic-plate-tectonics-explain-flood-geology/>. For a detailed scientific overview of the catastrophic plate-tectonics model, see Steven A. Austin et al., “Catastrophic Plate Tectonics: A Global Flood Model of Earth History,” *Answers in Depth* 5 (2010): 1–13, <https://answersingenesis.org/geology/plate-tectonics/catastrophic-plate-tectonics-global-flood-model-of-earth-history/>.

our reading of the latter. Grudem attempts to establish the earth's age from science alone. However, he makes far too many assumptions, most of them guided by uniformitarian thinking that runs counter to Scripture's testimony to God's powerful control and to the flood catastrophe. God alone was present at the beginning, and his word strongly points to a young earth and should guide our scientific interpretations of the observable data.