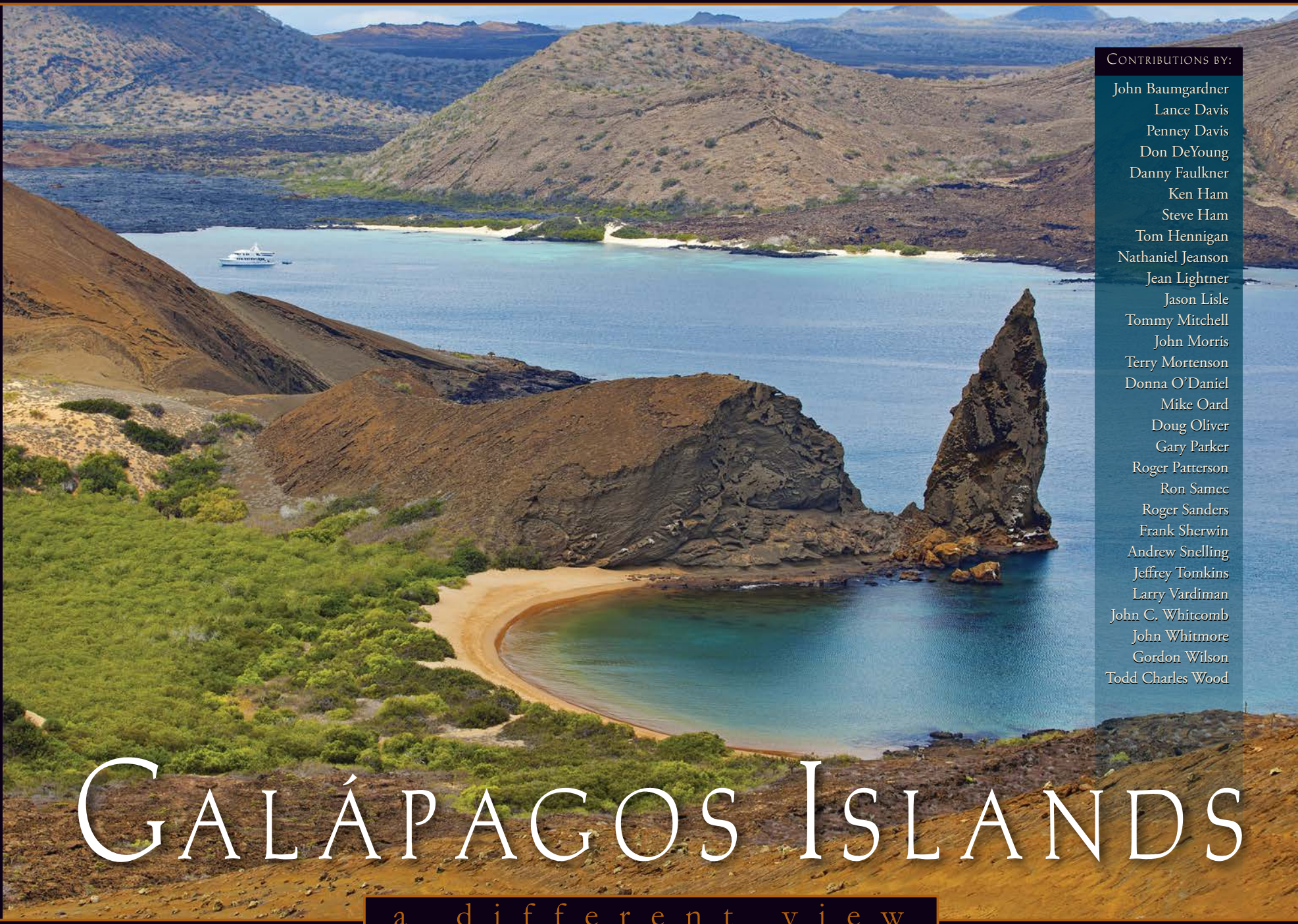

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Galápagos Islands

a different view

Georgia Purdom, *General Editor*

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Sally Lightfoot crab

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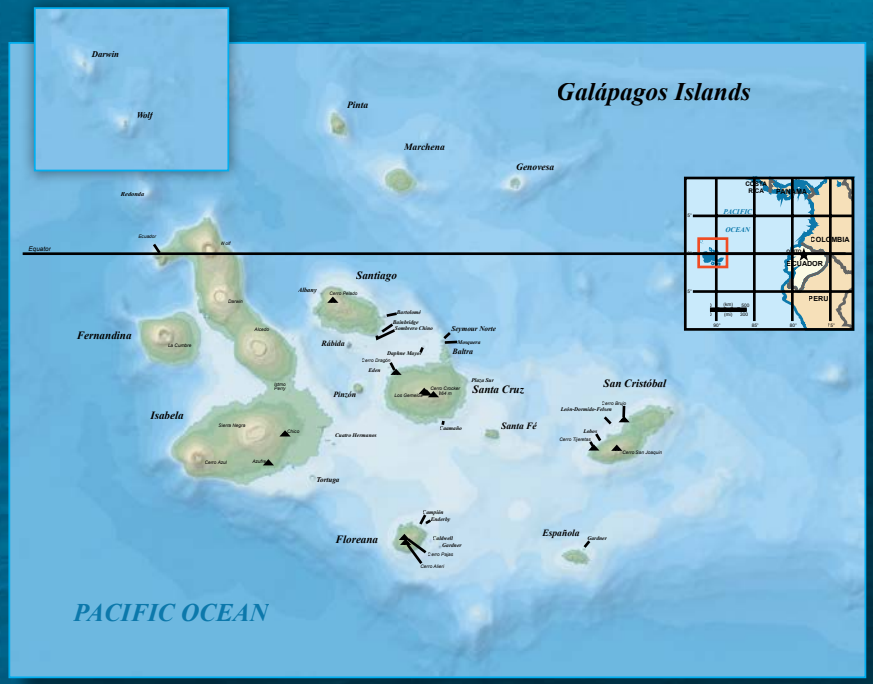
Most of all, thank you God for Your mercy and majesty that is clearly exhibited in the Galápagos Islands and for Your Son Jesus Christ who saves us.

Introduction

An aura of mystery surrounds the Galápagos Islands, located off the coast of Ecuador in the Pacific Ocean. How were they formed? Why are so many species of animals found only on these islands? Why do they play such a prominent role in the debate over origins?

Over the years, scientists and theologians alike have visited this archipelago that spans the equator, seeking to find answers to these questions. One of the most famous visitors was Charles Darwin, a naturalist aboard the ship the HMS *Beagle* in 1835. While in the Galápagos for several weeks, he observed a wide variety of animals — large tortoises, marine iguanas, blue-footed boobies, and, perhaps the most famous of them all, finches.



The differences he saw among living creatures — tortoises with different shell shapes, finches with a variety of beak shapes, iguanas with very different eating behaviors (and other observations and influences apart from the Galápagos) — eventually led Darwin to propose the idea that all living things descended from a common ancestor over millions of years. He believed that the small differences in living creatures that he observed could over time result in large differences that would change one kind of organism into a different organism.

Yet, with a better understanding of what the Bible teaches, Darwin could have arrived at a much different — and true — conclusion about the past history of the Galápagos Islands.

A Biblical Perspective on the Galápagos

But now ask the beasts, and they will teach you; and the birds of the air, and they will tell you; or speak to the earth, and it will teach you; and the fish of the sea will explain to you. Who among all these does not know that the hand of the LORD has done this, in whose hand is the life of every living thing, and the breath of all mankind?

— Job 12:7–10


Nazca boobies

The Galápagos Islands are truly a living testament to these verses in Job. The wildlife of the Galápagos displays both the majesty of God's creation and His mercy in preserving life in a cursed world.

In Genesis 1 we read that God created everything by His spoken command in six days. The Hebrew word for *day* used throughout Genesis 1 should be understood as a literal 24-hour day, since it is used with the words morning, evening, and a number (for example, "So the evening and the morning were the first day" [Genesis 1:5]). And calculations from father-son genealogies given in Genesis 5 and 11 and elsewhere in Scripture give us a date for creation that is approximately 4,000 years before Jesus came to earth (or roughly 6,000 years before today).

Genesis 1 also reveals that God created plants and animals according to their kind (Genesis 1:12, 21, 24–25). The inference from Scripture (Genesis 1 and 6–8) is that plants and animals were to reproduce according to their kinds. The word *kind* most likely correlates to the family level in modern classification schemes. One basis for this determination is that most animals within today's "family" can breed with one another and produce offspring (e.g., a zebra and donkey can mate and produce a zonkey).

The mistake made in Darwin's day (and before) was teaching that this meant God created each species of today's animals in the spot where they're found today. A better understanding is that, in the beginning, God created a wide variety of animal and plant kinds and from these have descended the various species. Further, today's animals have migrated to their respective habitats over the past few thousand years and were not created *in situ*. The teaching from Genesis is clear that one kind of plant or animal did not evolve into a different kind over millions of years.

Thus, the finches Darwin observed are descendants of the original kinds and have adapted (via mutations, natural selection, mediated design, and other mechanisms) to their present environment over the past few thousand years. Scientific studies show that this type of change and speciation can happen very quickly (on the order of tens or hundreds of years, not millions). And scientific studies have also shown that mechanisms such as mutation and natural selection actually work against molecules-to-man evolution (the type proposed by Darwin).

Everything God originally created was "very good" (Genesis 1:31). There was no disease or death. And God gave all animals and humans plants to eat — carnivory was not present in the very beginning (Genesis 1:29–30). There was no fear between man and animals or between various kinds of animals. We see echoes of this in the Galápagos Islands with the animals who have no fear of humans.

Then Adam disobeyed God's command (sinned) and God's decreed punishment for sin was death (Genesis 2:16–17, 3:6, 3:19; Romans 5:12). God placed a curse on His beloved creation (Genesis 3:14, 3:16–19; Romans 8:22). This event introduced death, disease, and suffering into God's once-good creation. And this is the reason the echoes of Eden seen in the Galápagos are marred. We no longer live in a "very good" world. If Darwin had kept this event in mind, it would have reshaped how he viewed God and His creation.

Galápagos finch

Adam and Eve's children and grandchildren continued to disobey God's command. In Genesis 6–8 we read of God's judgment on sin in the form of a catastrophic global Flood about 4,500 years ago. The tectonic upheaval associated with the "fountains of the great deep" (Genesis 7:11) eventually resulted in the formation of the Galápagos Islands.

God mercifully saved Noah, his family, and representatives of all air-breathing, land-dwelling animal kinds on the ark. After the floodwaters subsided and the ark landed, the animals began migrating over the globe via land bridges, rafting, and other means. Some of the Galápagos animals appear to have migrated to the islands from the mainland of South America. God designed organisms with the ability to adapt in the new and different world (caused by both the Fall and the Flood) and this is clearly seen in the Galápagos flora and fauna.

The Place of Science

But how do we know that this account of the formation and colonization of the islands is true? These events happened in the past and, therefore, fall into the category of historical (or origins) science. Historical science encompasses past events that we cannot observe, test, or repeat.

When people use the term *science,* they are usually referring to observational (or operational) science. This is science that happens in the "here and now." We can observe, test, and repeat it. Scientists use it to develop computers, vaccines, and airplanes. It is very different from historical science that tries to understand events that have occurred in the past. Observational science is not as dependent on the scientist's worldview. Historical science—encompassing origins, events from the past, and the age of the earth—is dependent on the scientist's worldview. All scientists look at the same evidence when it comes to the past — the same rocks, the same fossils, the same islands, and the same animals. The difference is in their starting point.

Many reject the God-inspired biblical accounts of past events, such as creation, the Fall, and the Flood because they prefer instead the ideas that humans have come up with based on their own reasoning.

Galápagos dove

Since we were not eyewitnesses of the past, we must rely on outside help to understand the past. Many will use expressions like "science says," or "the evidence says," to support their ideas about the past. But evidence such as rocks and fossils doesn't speak. Instead, scientists are the ones doing the speaking, and their interpretation of past events is always based on their starting point, or worldview. Do they start with man's ideas apart from God or do they start with God's Word?

The scientists and theologians in this book interpret evidence based on the worldview that the Bible is the history book of the universe and inerrant in its original form. God begins His record of history in the Bible when time begins (Genesis 1:1), and since God is the author (2 Timothy 3:16; 2 Peter 1:21) and cannot lie (Titus 1:2), we can only have an accurate account of the past when we start with God's Word. Likewise, when we look at events that are not directly recorded in Scripture, we can only develop an accurate understanding of the past when we base our thinking on God's Word.

Does It Matter What I Believe about the History of the Galápagos?

The problem that arises when secularists and even some Christians deny the history presented in Genesis is the undermining of the authority of Scripture. If one part of the biblical record is wrong, then it is possible other parts are wrong, too. Many Christians accept the virgin birth and Resurrection of Jesus Christ, yet question the Genesis account of creation. Many will say that science proves the earth is old and evolution has occurred. The problem with this appeal to "science" is the impact it has on their other beliefs related to Scripture. "Science" has clearly shown that virgins don't give birth and people don't come back to life after being dead for three days. These Christians are


Waved albatross

inconsistent not only in what miracles of God they choose to believe but also in their definition of the word *science*.

Even though the formation of the Galápagos Islands and its colonization by plants and animals occurred in the past, we can still use observational science to study it today. We can observe how recent volcanic activity is changing the islands. We can observe how animals are continuing to change. Catastrophic events like volcanic eruptions change the landscape in a short period of time. Millions of years are not required. Mutations, natural selection, and other mechanisms cannot change animals and plants from one kind into a completely different kind. Evolution from a single common ancestor is not true. What we understand from historical science, beginning our thinking with a biblical starting point, is actually confirmed by the findings of observational science.

Ultimately a choice has to be made: do we put our faith in man's ideas about the past or in God's Word? I hope that this book will help you see the Galápagos Islands from a different view — a biblical view. I pray that the choice will be clear and that you will learn to trust the Creator of the heavens and the earth and His Word, the Bible.

Beginnings: Creation, Fall

Creation (Genesis 1:1–2:3)

In the beginning God created the heavens and the earth. The earth was without form, and void; and darkness was on the face of the deep. And the Spirit of God was hovering over the face of the waters.

Then God said, "Let there be light"; and there was light. And God saw the light, that it was good . . . God called the light Day, and the darkness He called Night. So the evening and the morning were the first day.

Then God said, "Let there be a firmament in the midst of the waters, and let it divide the waters from the waters." . . . And God called the firmament Heaven. So the evening and the morning were the second day.

Then God said, "Let the waters under the heavens be gathered together into one place, and let the dry land appear"; and it was so. And God called the dry land Earth, and the gathering together of the waters He called Seas. And God saw that it was good.

Then God said, "Let the earth bring forth grass, the herb that yields seed, and the fruit tree that yields fruit according to its kind, whose seed is in itself, on the earth"; and it was so. And the earth brought forth grass, the herb that yields seed according to its kind, and the tree that yields fruit, whose seed is in itself according to its kind. And God saw that it was good. So the evening and the morning were the third day.

Then God said, "Let there be lights in the firmament of the heavens . . ." and it was so. Then God made two great lights: the greater light to rule the day, and the lesser light to rule the night. He made the stars also . . . And God saw that it was good. So the evening and the morning were the fourth day.

Then God said, "Let the waters abound with an abundance of living creatures, and let birds fly above the earth across the face of the firmament of the heavens." So God created great sea creatures and every living thing that moves, with which the waters abounded, according to their kind, and every winged bird according to its kind. And God saw that it was good. And God blessed them, saying, "Be fruitful and multiply, and fill the waters in the seas, and let birds multiply on the earth." So the evening and the morning were the fifth day.

Then God said, "Let the earth bring forth the living creature according to its kind: cattle and creeping thing and beast of the earth, each according to its kind"; and it was so. And God made the beast of the earth according to its kind, cattle according to its kind, and everything that creeps on the earth according to its kind. And God saw that it was good.

Then God said, "Let Us make man in Our image, according to Our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the cattle, over all the earth and over every creeping thing that creeps on the earth." So God created man in His own image; in the image of God He created him; male and female He created them. Then God blessed them, and God said to them, "Be fruitful and multiply; fill the earth and subdue it. . . .

And God said, "See, I have given you every herb that yields seed which is on the face of all the earth, and every tree whose fruit yields seed; to you it shall be for food. Also, to every beast of the earth, to every bird of the air, and to everything that creeps on the earth, in which there is life, I have given every green herb for food"; and it was

so. Then God saw everything that He had made, and indeed it was very good. So the evening and the morning were the sixth day.

Thus the heavens and the earth, and all the host of them, were finished. . . . and He rested on the seventh day from all His work which He had done.

The Fall (Genesis 2:15–3:19)

Then the LORD God took the man and put him in the garden of Eden to tend and keep it. And the LORD God commanded the man, saying, "Of every tree of the garden you may freely eat; but of the tree of the knowledge of good and evil you shall not eat, for in the day that you eat of it you shall surely die." . . .

And the LORD God caused a deep sleep to fall on Adam, and he slept; and He took one of his ribs, and closed up the flesh in its place. Then the rib which the LORD God had taken from man He made into a woman, and He brought her to the man. . . .

Then the serpent said to the woman, "You will not surely die. For God knows that in the day you eat of it your eyes will be opened, and you will be like God, knowing good and evil."

So when the woman saw that the tree was good for food, that it was pleasant to the eyes, and a tree desirable to make one wise, she took of its fruit and ate. She also gave to her husband with her, and he ate. Then the eyes of both of them were opened, . . .

So the LORD God said to the serpent:

"Because you have done this, you are cursed more than all cattle, and more than every beast of the field; on your belly you shall go, and you shall eat dust all the days of your life.

And I will put enmity between you and the woman, and between your seed and her Seed; He shall bruise your head, and you shall bruise His heel."

To the woman He said:

"I will greatly multiply your sorrow and your conception; in pain you shall bring forth children; your desire shall be for your husband, and he shall rule over you."

Then to Adam He said . . . "Cursed is the ground for your sake; in toil you shall eat of it all the days of your life. Both thorns and thistles it shall bring forth for you, and you shall eat the herb of the field. In the sweat of your face you shall eat bread till you return to the ground, for out of it you were taken; for dust you are, and to dust you shall return."

Death came as a result of sin

The Flood (Genesis 6:5–9:16)

Then the LORD saw that the wickedness of man was great in the earth, and that every intent of the thoughts of his heart was only evil continually. And the LORD was sorry that He had made man on the earth, . . . So the LORD said, "I will destroy man whom I have created from the face of the earth, both man and beast, creeping thing and birds of the air, for I am sorry that I have made them." But Noah found grace in the eyes of the LORD. . . .

And God said to Noah. . . . "Make yourself an ark. . . . The length of the ark shall be three hundred cubits [450 feet], its width fifty cubits [75 feet], and its height thirty cubits [45 feet]. . . . And behold, I Myself am bringing floodwaters on the earth, to destroy from under heaven all flesh in which is the breath of life; everything that is on the earth shall die. But I will establish My covenant with you; and you shall go into the ark — you, your sons, your wife, and your sons' wives with you. And of every living thing of all flesh you shall bring two of every sort into the ark, to keep them alive with you; they shall be male and female. Of the birds after their kind, of animals after their kind, and of every creeping thing of the earth after its kind, two of every kind will come to you to keep them alive. . . .

Thus Noah did; according to all that God commanded him, so he did. . . .

So Noah, with his sons, his wife, and his sons' wives, went into the ark because of the waters of the flood. Of clean animals, of animals that are unclean, of birds, and of everything that creeps on the earth, two by two they went into the ark to Noah, male and female, as God had commanded Noah. And it came to pass after seven days that the waters of the flood were on the earth. . . . all the fountains of the great deep were broken up, and the windows of heaven were opened. And the rain was on the earth forty days and forty nights. . . .

He cuts out channels in the rocks, and his eye sees every precious thing.

—Job 28:10

And the waters prevailed exceedingly on the earth, and all the high hills under the whole heaven were covered. . . . And all flesh died that moved on the earth: birds and cattle and beasts and every creeping thing that creeps on the earth, and every man. All in whose nostrils was the breath of the spirit of life, all that was on the dry land, died. . . . Only Noah and those who were with him in the ark remained alive. . . .

Then God remembered Noah, and every living thing, and all the animals that were with him in the ark. And God made a wind to pass over the earth, and the waters subsided. The fountains of the deep and the windows of heaven were also stopped, and the rain from heaven was restrained. And the waters receded continually from the earth. . . . Then the ark rested in the seventh month, the seventeenth day of the month, on the mountains of Ararat. . . .

And it came to pass . . . in the first month, the first day of the month, that the waters were dried up from the earth. . . . And in the second month, on the twenty-seventh day of the month, the earth was dried.

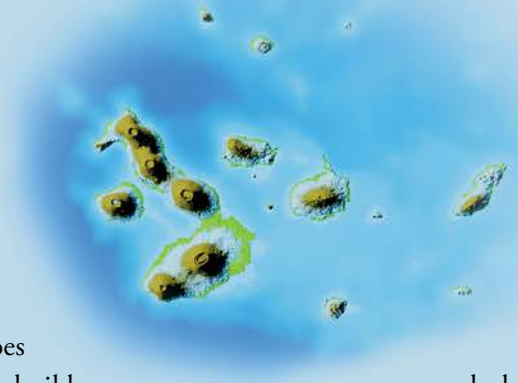
Then God spoke to Noah, saying, "Go out of the ark, you and your wife, and your sons and your sons' wives with you. Bring out with you every living thing of all flesh that is with you . . . so that they may abound on the earth, and be fruitful and multiply on the earth." . . .

Then Noah built an altar to the LORD. . . . Then the LORD said in His heart, "I will never again curse the ground for man's sake, although the imagination of man's heart is evil from his youth; nor will I again destroy every living thing as I have done. . . .

Then God spoke to Noah and to his sons with him, saying: "And as for Me, behold, I establish My covenant with you and with your descendants after you, and with every living creature that is with you. . . . Never again shall all flesh be cut off by the waters of the flood; never again shall there be a flood to destroy the earth."

And God said: "This is the sign of the covenant which I make between Me and you, and every living creature that is with you . . . I set My rainbow in the cloud, and it shall be for the sign of the covenant between Me and the earth. . . . The rainbow shall be in the cloud, and I will look on it to remember the everlasting covenant between God and every living creature of all flesh that is on the earth."

Stones and Stars



The Galápagos Islands are a chain of islands crossing the equator about 600 miles off the coast of Ecuador. The islands are exclusively the result of volcanic activity. As ocean-floor plates move over stationary "hot spots" in the earth's mantle, volcanoes form first underwater and eventually build to the point where they are visible above the water. The formation of these islands has been likened to a conveyor belt carrying the Nazca plate that is part of the earth's crust eastward over a hot spot. This results in the oldest islands being farther to the east (closest to mainland South America) and the newest islands to the west.

When I visited the Galápagos Islands, I was amazed at the great diversity of landscapes — from lush vegetation on the oldest islands to nearly barren lava fields on the youngest islands. On Isabela and Fernandina (the youngest of the islands) we viewed many prominent and still-active volcanoes. On some of the younger islands like Bartolomé, we saw the landscape dotted with numerous parasitic cones (the result of side eruptions). The combination of looming volcanoes, parasitic cones, and large black lava fields made you feel as if you were on another planet!

On Santiago, a "middle-aged" island, we hiked across a very large lava field, the result of an eruption just over a hundred years ago. The lava flowed for three months and was seven feet deep. Today, the field covers 15 square miles. It takes a boat moving along the coastline two hours to completely survey this lava field from the water! But even amid the seeming harshness of this landscape, we observed beauty and life — beauty in the amazing shapes formed as the pahoehoe lava flowed to form its smooth ropes and life in pioneer plants like mollugo, tiquilia, and lava cacti that conquered the bleak landscape.

On older islands, evidence of past volcanic activity is not as obvious. Española, the oldest island, is covered in lush vegetation such that it was hard for us to imagine volcanic eruptions ever took place there. However, when we viewed the black volcanic rocks composing steep cliffs on the coasts of the island we were vividly reminded of its origins. Another old island, Floreana, had over 50 small "hills," each the result of previous volcanic activity but now flourishing with vegetation.

We saw the beauty of God's creation not only on the land but also in the sky. The majority of the Galápagos Islands are not inhabited and light pollution is minimal. As a result, the view of the evening sky was breathtaking! The sentence "He made the stars also" in Genesis 1:16, telling of God's creation of the stars, doesn't seem adequate to express the beauty of the night sky. The Milky Way was clearly seen along with objects only seen in the Southern Hemisphere like the Southern Cross, the globular cluster Omega Centauri, and the Small and Large Magellanic Clouds.

Both secular and creation scientists can observe and study the land and sky of the Galápagos in the present. This falls under the category of observational science. But developing models for understanding how the islands formed in the past or how starlight reached earth rapidly in the past falls under

He gathers the waters of the sea together as a heap; He lays up the deep in storehouses.

—Psalm 33:7

the category of historical science. This type of science is greatly dependent on the scientists' worldview. Do the scientists start with man's ideas apart from God or do they start with God's Word?

Secular geologists believe the Galápagos Islands formed slowly over millions of years. They begin their studies with the belief that the present is the key to the past and that the slow geological processes we observe today were happening at the same rate in the past. Interpreting the evidence from this starting point, a view known as uniformitarianism, they conclude that the islands must have taken millions of years to form. Likewise, secular astronomers, operating from similar uniformitarian beliefs, think that light from objects, like the stars that compose the Small Magellanic Cloud, took around 200,000 years to reach earth.

Creation geologists believe the Galápagos Islands formed rapidly over hundreds of years. They start with God's Word and understand that past geological processes were greatly impacted by Noah's Flood. Rapid and catastrophic changes occurred in a short period of time, resulting in the formation of the islands in only a few hundred years. Biblical creationists reject uniformitarianism because of the presence of supernatural events revealed in the Bible — especially the creation week and the Flood. Creation astronomers believe that the light from stars was visible on earth from the fourth day of creation only about 6,000 years ago (Genesis 1:14–18). The rocks and the stars — the evidence — studied by all scientists, are the same; the only difference is the starting point or worldview of the scientist.

Many secular scientists believe radiometric dating proves that the islands are millions of years old. However, radiometric dating is based on assumptions about the past. If the scientists weren't

▲ Parasitic cones on Bartolomé

▼ Hills are dormant volcanoes on Floreana

there to observe the past, how do they know their assumptions about the past are accurate? Radiometric dating has been shown many, many times to give outrageously incorrect dates for rocks of known ages (like rocks from modern volcanic eruptions). According to these faulty dating results and because of the many unknown factors involved, the assumptions the scientists are using are wrong and radiometric dating does not prove the islands are millions of years old.

In Psalm 24:1–2, David says, "The earth is the LORD's, and all its fullness, the world and those who dwell therein. For He has founded it upon the seas, and established it upon the waters." And in Psalm 19:1 he says, "The heavens declare the glory of God; and the firmament shows His handiwork." The rocks of the Galápagos and the stars above it truly declare both the majesty and mercy of God. The earth and universe that God created can only be rightly understood when we look to His Word, which as David declares in Psalm 19:7, is "perfect."

▾ Volcano on Fernandina

▴ Marine Iguanas

▲ La Cumbre volcano, Fernandina Photographed from the International Space Station.

◀ Volcanoes on Isabela and Fernandia

THE GALÁPAGOS ISLANDS began as a group of underwater volcanoes that grew progressively from the ocean bottom until they finally emerged above sea level. Today there are 13 large islands, 6 small islands, and 42 islets all located near the equator in the Pacific Ocean about 600 miles west of Ecuador. Each island consists of a single volcano, except for Isabela, which consists of an overlapping string of six volcanoes.

The underwater volcanoes that became the Galápagos Islands are the result of a blob of hot rock that rose beneath this region during the latter stages of the Genesis Flood. As the blob came to within about 150 miles of the surface it began to undergo partial melting and generate basaltic magma. This magma was able to penetrate through cracks in the plate above it, pour out profusely onto the ocean floor, and form rapidly growing volcanoes.

What caused the rising blob? It was a response to the catastrophically rapid plate motions that occurred during the Genesis Flood. These rapid plate motions transferred the entirety of the pre-Flood ocean floor, in conveyor-belt-like fashion, into the earth's mantle. The rapid surface motions of the plates in the eastern Pacific region produced a rising plume that brought hot upper mantle rock close to the surface. The partial melting of this hot rock produced the magma and volcanism that formed the Galápagos Islands. Based on relative radioisotope dates, the Galápagos volcanism began near the end of the Flood. It continued at high volume for several centuries. The volcanism continues today, although at a much reduced level.

The Galápagos Archipelago, as it is called, is a chain of islands. Active volcanoes currently exist on the northwestern end of the chain, while the volcanoes on the southeastern end are completely dormant. This is not the result of motion of

the plume, but rather southeastward movement of the Nazca Plate on which the islands ride over the plume. Today the rate of plate movement is only about three inches per year. However, at the end of the Flood cataclysm, the rate was much higher, on the order of a mile per year. The islands on the southeastern end of the chain, such as Española, formed first while they were located directly over the plume. As the Nazca Plate moved southeastward and these islands were transported away from the plume center, their volcanism diminished and eventually ceased. New islands formed to the northwest of the older ones as magma from the plume continued to find cracks in the plate it could penetrate.

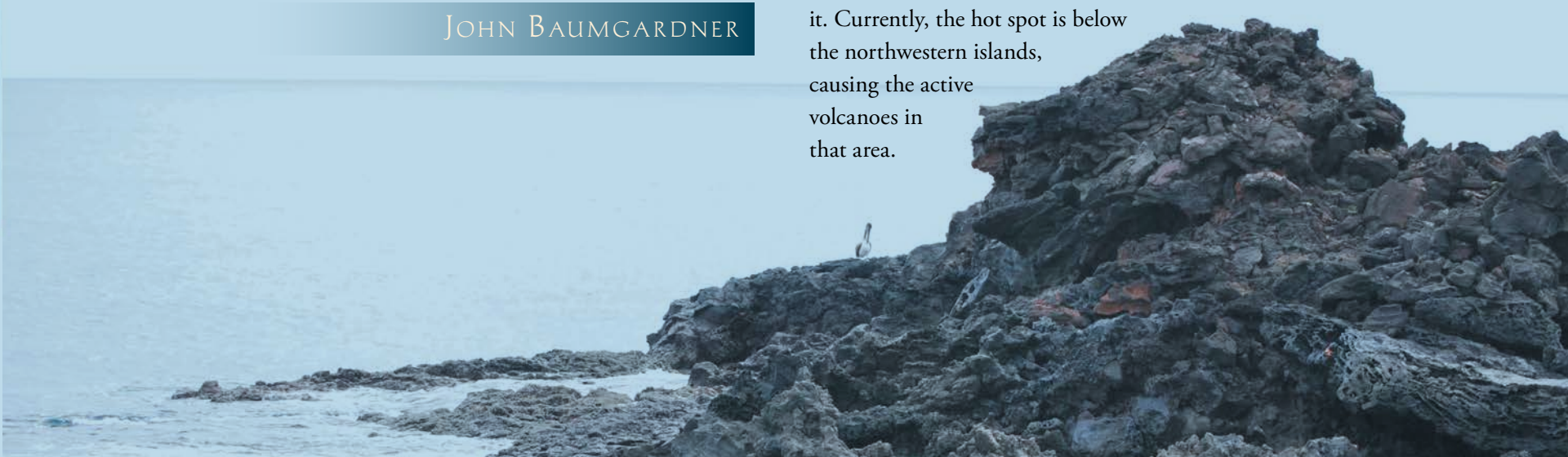
Today the islands of Fernandina and Isabela on the northwest end of the chain now lie above the plume. These islands are the youngest and the most volcanically active, with more than 50 eruptions in the last 200 years. Although plate movement and island formation are relatively slow processes in the present, the catastrophic changes associated with the Flood caused rapid plate movements and formation of the islands in the past. The Bible's record of the past is an important starting point for a correct understanding of how the Galápagos Islands were formed.

John Baumgardner

VOLCANIC LANDSCAPES ARE some of the most unsettled places on the earth's surface. Not only do eruptions spew large volumes of ash and lava, they are responsible for dislodging huge masses of rock that can drastically alter landscapes within minutes.

The Galápagos are completely of volcanic origin, growing from the ocean floor after Noah's Flood (they have no fossil-bearing Flood sediments on them). There is currently not much rainfall in the Galápagos, nor are there many rivers to deeply erode the islands; so island geography must be completely explained by volcanism.

The Galápagos Islands are on the Nazca Plate that is moving southeast, toward the coast of Ecuador. The southeastern-most islands are smaller and lower in elevation, while the northwestern-most islands (where the active volcanoes are) are larger and higher in elevation. Farther to the southeast, there are numerous seamounts on the ocean floor — extinct volcanoes that never grew high enough to make it above sea level. Molten rock is generated in the earth's mantle under the Galápagos Islands, below the moving plate in a "hot spot." Over time, the hot spot doesn't move, but the plate does, producing a long chain of volcanoes building up on the ocean floor as the plate moves over the top of it. Currently, the hot spot is below the northwestern islands, causing the active volcanoes in that area.



During Noah's Flood the earth's plates moved rapidly (feet per second), and then they slowed to today's rates (inches per year). This explains the size pattern we see in the Galápagos Islands. The first volcanoes to build up on the seafloor were the seamounts toward the southeast. The plate was moving more quickly then, so those volcanoes never made it above sea level. As plate velocity slowed, the volcanoes grew larger and taller. That is why the biggest and highest islands, and the active volcanoes, are on the northwestern edge of the island chain — those islands have been sitting over the hot spot longer.

The Galápagos soils form as volcanic rock is chemically decomposed and then combined with organic debris from decaying plants. Soil formation is highly dependent on annual precipitation because moisture is necessary to alter the rock. Since many places in the Galápagos have near-desert conditions, soils are often thin or nonexistent. Many of the small islands are characterized by bare volcanic rock surfaces. Today, ocean waters off the coast of the Galápagos are cool and do not evaporate very well, resulting in the low annual rainfall totals. As the smaller islands were first starting to form after the Flood, ocean conditions were probably quite a bit warmer, leading to more rainfall, rapid rates of erosion, and faster rates of soil formation than what we see today. By the time the larger islands began to form closer to the present, conditions had changed. Thus, the larger islands have much more pristine volcanic features due to their more recent formation and lesser amounts of rainfall. Again, the Bible's record of the past is an important starting point in developing models to correctly understand how the Galápagos were formed, how the soils on the islands formed, and how past processes differ from present-day processes.

John Whitmore

Pahoehoe lava

THE VOLCANOES OF the Galápagos Islands have varied shapes, eruptive histories, and compositions. The seven volcanoes of Isabela and Fernandina islands are large shield volcanoes with well-developed craters, but they differ conspicuously from the familiar shield volcanoes of Hawaii. Whereas the Hawaiian volcanoes are very broad with gently sloping sides, the Galápagos volcanoes have slopes that steepen abruptly, giving them a distinctive "inverted soup-bowl" outline.

Eruptions have occurred either from fissures around the craters or from vents and fissures lower on the sides. Where side-branching fissures have developed laterally from these volcanoes and lava flows from them, parasitic cones developed. If gas bubbles were in those lavas, they erupted explosively, sending showers of ash up into the air that fell back and landed around the vents, forming cinder cones.

The volcanoes on the other islands are very different from the volcanoes of Fernandina and Isabela. Floreana is a roughly circular, low shield whose outline is dominated by numerous cinder cones. Santiago is an elongated shield. Rábida consists mainly of a cluster of steep-sided domes, with the remains of two cinder cones at its northern base. Pinzón is a small shield volcano with two overlapping craters. Santa Cruz is a gently sloping, elliptical shield. San Cristóbal has the longest history of activity, having had at least five recognizable episodes of eruptions. An older shield volcano dominates its southwestern half, while the northeastern half consists primarily of relatively young lava flows erupted from fissures.

Santa Fé and Española are the only two major Galápagos islands that are different. Once thought to be uplifted large areas of seafloor, subsequent investigations have determined that both islands consist primarily of lava erupted on land, rather than underwater. Though a number of small cinder cones have been identified on each island, various indicators suggest that the main vents for Santa Fé and Española lie offshore. The islands are probably remnants of somewhat larger shield volcanoes.

The volcanic rocks on all the Galápagos Islands are dark (usually black) and very fine-grained basalts, similar to those found on the Hawaiian Islands. And similar to the Hawaiian volcanoes, the Galápagos Island volcanoes have erupted quietly (non-explosively) and the lava flows cooled as pahoehoe and aa types, the former having smooth, ropy, or billowy surfaces, and the latter rough, jagged surfaces. Even though mass destruction is usually associated with volcanoes, there is beauty in their varied shapes and picturesque patterns of the lava fields.

ANDREW SNELLING


Volcano Cerro Azul


Parasitic cones on Bartolomé

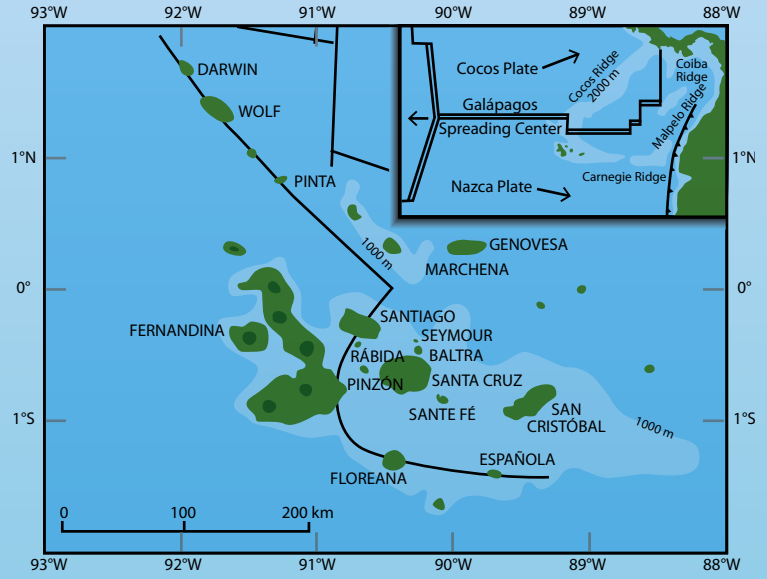

Aa lava on Isabela

HOW OLD ARE the Galápagos Islands? The volcanic lava flows throughout the islands have been subjected to potassium-argon (K-Ar) and argon-argon (^{40}Ar-^{39}Ar) radiometric dating. The oldest lava flows dated by those methods occur on Española (3.04 and 3.31 million years old). In contrast, lava flows on Isabela date to much less than a million years.

But how reliable are these dates? All the dated lava flows erupted only recently since the Flood, so they can't be millions of years old. However, we need to remember that these radiometric methods depend on three crucial assumptions.

Conditions at Time Zero	Can we be sure all the argon (daughter material) in these lavas was produced by radioactive decay of potassium (parent material)? Many recently erupted lava flows are known to contain argon that was added to them from the volcanic gases, making young rocks appear millions of years old. (The more argon that is present, the older the rock is assumed to be.)
No Contamination	Can we be sure there was no contamination or weathering of the lavas that added or removed potassium respectively? As the molten rock rises from the volcano, potassium can be added to the lava. (Addition of potassium would make the rock appear younger, and removal of potassium would make the rock appear older.)
Constant Decay Rate	Has the potassium always decayed at today's slow measured rate? There are several lines of evidence that support the idea that radioactive decay rates were much faster in the recent past. With such unreliable "clocks" ticking at faster unknown rates in the past, they simply cannot be used to "tell the time"!

None of these assumptions are provable, because geologists were not present when these lavas erupted to observe whether there was no addition of argon,



Map of the Galápagos Archipelago. The bold line shows the inferred fault system that seperates thin, weak oceanic crust to the north and east from stronger and thicker oceanic crust to the south and west. The inset shows the regional tectonic setting, with the Galápagos Archipelago at the western end of the Carnegie Ridge. Courtesy of Dr. Andrew Snelling and the Institute for Creation Research.

Exploded gas bubbles in pahoehoe lava