

formed after the Flood was over but only the island of Hawai'i (the "Big Island") is active. The others are now extinct and have moved west/northwest, carried away from the hot spot by the migration of the Pacific Plate. Following the west/northwest trend, there are numerous other extinct volcanic structures under the ocean surface, some of which have coral reefs built on top of the submarine volcanoes. Further out, this chain abruptly shifts to the north, with numerous submarine extinct volcanoes (called the Emperor Seamounts) leading all the way to a subduction zone near the Aleutian Islands of Alaska. All together, the Hawaiian Island chain and Emperor Seamounts span about 6,000 km. These hot

spot-generated features have been used by geologists to infer plate movement direction and speed.

With the development of the Global Positioning System (GPS), plate motions can now be directly measured in the present. These tools were unavailable to Wegener in the 1920s or Hess in the 1960s, but they now confirm that the plates are moving according to the expectations of plate tectonics theory. The plate directions shown on Figure 4.13 are based on the velocities of dozens of GPS sites, with thousands more located around the world. We know that current plate velocities vary around the globe from only a few mm/yr up to 20 cm/yr.

4.6 NOAH'S FLOOD: WHERE SCRIPTURE MEETS GEOLOGY

To this point, we have considered the evidence that the Earth's surface is composed of lithospheric plates capped by oceanic and/or continental crust, and that there is sufficient evidence to convince us that these plates have moved significant distances throughout Earth's history. As young-Earth creationists, these evidences require a historical account and mechanism that can satisfactorily explain them while remaining faithful to the foundational truths of the Biblical record.

Does the Bible specifically state that the continents and oceans have either moved or remained unmoved over time? That answer is "no"; the Bible makes no direct claim for either situation. In terms of geology, is the evidence for long-distance, horizontal movements of the continents and ocean basins compelling? We believe that answer is "yes." Given this, we seek to discover how plate tectonic movements can be understood within the young-Earth framework provided by the Bible. Surprisingly, the answer helps us understand the likely mechanism behind Noah's Flood.

4.6.1 Scriptural Framework

The account of Noah is found in Genesis chapters 6-9, and chapters 7 and 8 describe the event that we commonly

call "Noah's Flood." There are over 200 accounts of a large-scale flood from different peoples and cultures around the world (which lends helpful extra-biblical evidence for its occurrence), and the account found in Genesis is the most realistic and detailed of all. In following the days and months outlined in the account, the Flood lasted about 371 days from the time Noah enters the ark to the time he and the animals leave it (compare Gen. 7:11 and 8:14-16). This is much longer than the commonly assumed duration of 40 days, which is actually just the first phase of the Flood (Gen. 7:17).

Several terms and phrases used in Genesis 6-9 point to Noah's Flood being a unique event that was global in scope, affecting the entirety of both the physical Earth and all the organisms (including humans) living on it. These include:

Mabbul—This Hebrew word translated is as "flood" or "deluge" in Genesis 6-11 and also in Psalm 29:10. In Greek, the term *kataklysmos* is used in the Septuagint (the Greek translation of the Hebrew Old Testament) and in the New Testament. Both *mabbul* and *kataklysmos* are used only for Noah's Flood; it is a singular event unlike any other in history.

“All” and “every”—These terms are used over 60 times in the Flood account to describe the scope and extent of the destruction of the world. Constant and repetitive, they are an emphasis to drive home to the Israelites that indeed *all flesh* was destroyed. This included not only all humans (whose wickedness brought judgment upon themselves) but also all the land dwelling, air-breathing animals: domestic livestock, wild animals, birds, and “creeping things.”

The waters rose—This phrase is a continuous reminder throughout Gen. 7 that the waters of the *mabbul* are drowning the entire planet, not just a localized region. By covering all of the high hills by more than 6 meters (20 feet), the flood left no place for land-dwelling, air-breathing animals or humans to escape (see Gen. 7:20-23; I Pet. 3:20).

But God remembered Noah—The first words of Gen. 8 function as both the focal and hinge point for the entire Flood account. It is the focus because God’s “remembering” of Noah is God acting upon the covenant to save Noah as promised in Gen. 6:8. It is the hinge because the first half of the Flood account (Gen. 7) is filled with rising water and death; the second half

(Gen. 8) sees lowering water and the promise of life.

With these and the other details presented in the Biblical text, creationists recognize that the Flood occurred at a particular time in Earth history, had a specific duration, covered the entire planet, and killed off vast numbers of humans, plants, and animals. We now turn to a possible mechanism that fits these parameters and can also explain the physical evidence of dramatic plate motions discovered by geologists.

4.6.2 Catastrophic Plate Tectonics

For many decades, young-Earth creationists simply did not have an adequate scientific model of Noah’s Flood. Admittedly, the Bible’s record of the flood does not include many clues about the mechanisms that caused it. We are told that “the fountains of the great deep burst open, and the floodgates of the heavens were opened” (Gen. 7:11, NIV), and we are given details regarding rain and rising and falling water levels, but little else. After all, Noah couldn’t see down to the lithosphere from the ark!

The prospects for a useful and comprehensive Flood theory began changing in 1994, when a group of six creation scientists proposed **catastrophic plate tectonics** (or CPT; see Austin *et al.* in the Further

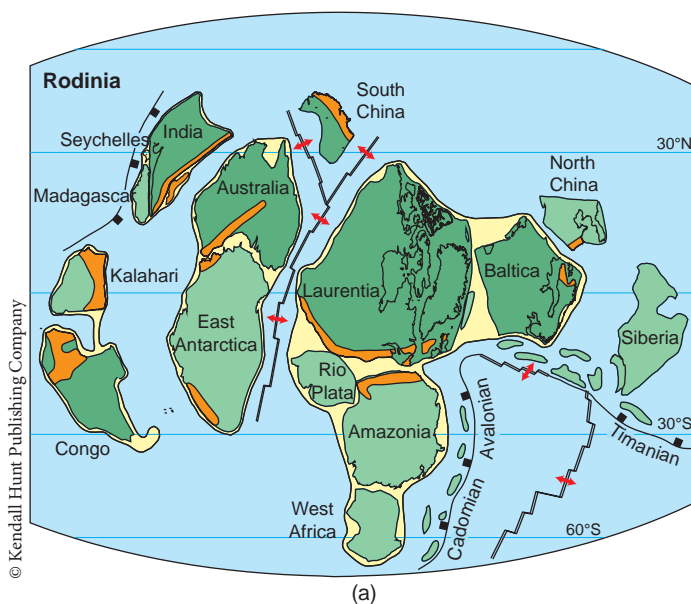


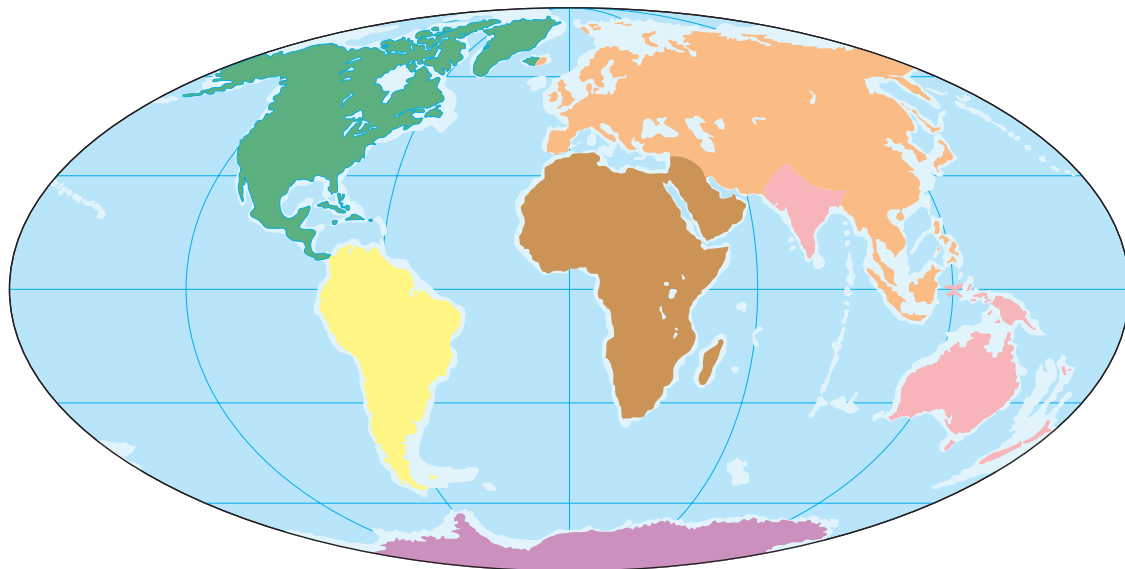
FIGURE 4.24. Three stages of Earth’s tectonic history is a biblical perspective: (a) The pre-Flood (Precambrian) continental assemblage known as Rodinia; (b) the mid-Flood supercontinent of Pangaea; and (c) modern world geography.

FIGURE 4.24. (Continued)



The formation of Pangaea early in the Flood.

(b)



The current position of the continents.

(c)

Reading section). This theory argued that very rapid movements of the plates occurred during Noah's Flood, and indeed was the major physical mechanism that God used to destroy the world. It remains the best comprehensive explanation for the many physical features on the Earth that point towards large-scale plate motions while remaining faithful to the Biblical record of Earth history.

The CPT model begins with the Earth structured similar to today, comprised of an inner and outer core, mantle, and crust. The pre-Flood world had oceanic and continental crust for the oceans and the land. The configuration of the continents, however, was dramatically different than the present: perhaps organized as a supercontinent known as Rodinia (figure 4.24a). The ocean crust was cold and dense, similar to its

composition today far from ocean ridges (which probably did not exist at the beginning of creation). Given that God called his creation “very good” at the end of creation week, we doubt that there were many large volcanic structures, earthquakes, or other geologically produced natural hazards before the Flood.

The Flood begins when the ocean crust alongside the continents fractures and begins to sink. This occurs because dense ocean crust (such as that seen at the subduction zone by Japan) is actually denser than the underlying mantle, creating an unstable arrangement. As the pre-Flood ocean lithosphere sinks into the mantle, the friction between them creates large amounts of heat, which makes the mantle less viscous and allows the ocean slab to subduct even faster. This generates even more heat and allowing for more and faster subduction, resulting in a positive feedback loop. Dr. John Baumgardner, who pioneered the computer modeling of CPT, calls this “runaway subduction”, and may be part of the “fountains of the great deep burst open” described in Gen. 7:11. According to Baumgardner’s modeling, the ocean lithosphere was moving at a few *kilometers per hour* both at the surface and through the mantle during the Flood. This is much, much faster than the current

few cm/yr we see today, and can move the oceans and continents thousands of miles during the year-long period of the Flood.

As the subducting slabs travel down through the mantle, two things are occurring. At the surface, rocks (including ocean crust) are brittle, and as the subducting slab moves deeper into the mantle, some portion of the ocean crust still at the surface breaks, forming a huge rift exposing the upper mantle. This exposure causes the mantle to partially melt, forming magma for new ocean crust to fill in the gap. This is the beginning of ocean ridges, which being the process of seafloor spreading to replace ocean lithosphere lost to subduction. As the new magma comes in contact with ocean water, it creates a massive, linear geyser around the world that blasts superheated water from the oceans high into the atmosphere, where it cools and condenses as a drenching downpour of rain (figure 4.25). This begins the intense rainfall described when “the floodgates of heaven were opened” (Gen. 7:11), which is described right after the breaking of the fountains of the great deep. Deeper in the mantle, as the cold lithosphere sinks, warmer regions of the mantle rise and create a convection current, similar to the movement of boiling water in a pot.

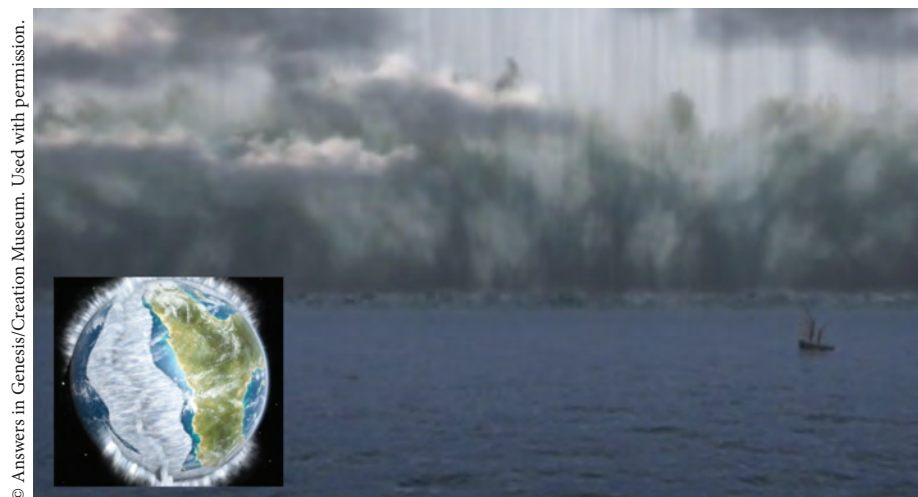


FIGURE 4.25. The eruption of water at the beginning stages of the Flood.

Back at the Earth's surface, the continents cannot subduct (they are too light), but they are strongly affected by these events. The subduction of ocean lithosphere, formation of seafloor spreading zones, and convection of the mantle tear Rodinia apart, and begin moving the pieces around the Earth's surface. At some point early in the Flood, these broken continental fragments recombine to form Pangaea, producing the mountain belts, sedimentary basins, and other features that help geologists reconstruct its shape and location (figure 4.24b). Then, perhaps a month or two after Pangaea's formation, continued mantle convection, subduction, and continental rifting split Pangaea apart into new fragments that will become today's continents. These fragments shifted and moved closer to their present-day position through the remainder of the flood, gradually slowing but continuing to move in the centuries after the Flood until they reached their present-day locations (figure 4.24c).

Most of the description of the Flood in Gen. 7 and 8 concerns the rising and falling of water. How did that happen according to CPT? There are several components, and the following four mechanisms described

below and illustrated in figure 4.26 show how water from the ocean basins caused global flooding over all of the shifting continents during the Flood:

Geyesers at ocean ridges—as discussed above, the fracturing of the ocean crust during the flood resulted in the formation of the ocean ridge system. Rising magma contacting the ocean created a massive, linear geyser of superheated water, which cooled and condensed to form torrential rains (Hebrew: *geshem*).

Subduction at continental margins—where the pre-Flood ocean lithosphere subducted along continental margins, friction between the plates caused the continents to be pulled downward towards the mantle. While they did not sink into the mantle, this downward pull allowed ocean water to invade far into the continents and hundreds of meters deep.

Formation of new ocean crust—while the pre-Flood ocean crust was cold and dense, the formation of ocean crust at the new ocean ridges produced much warmer and more buoyant

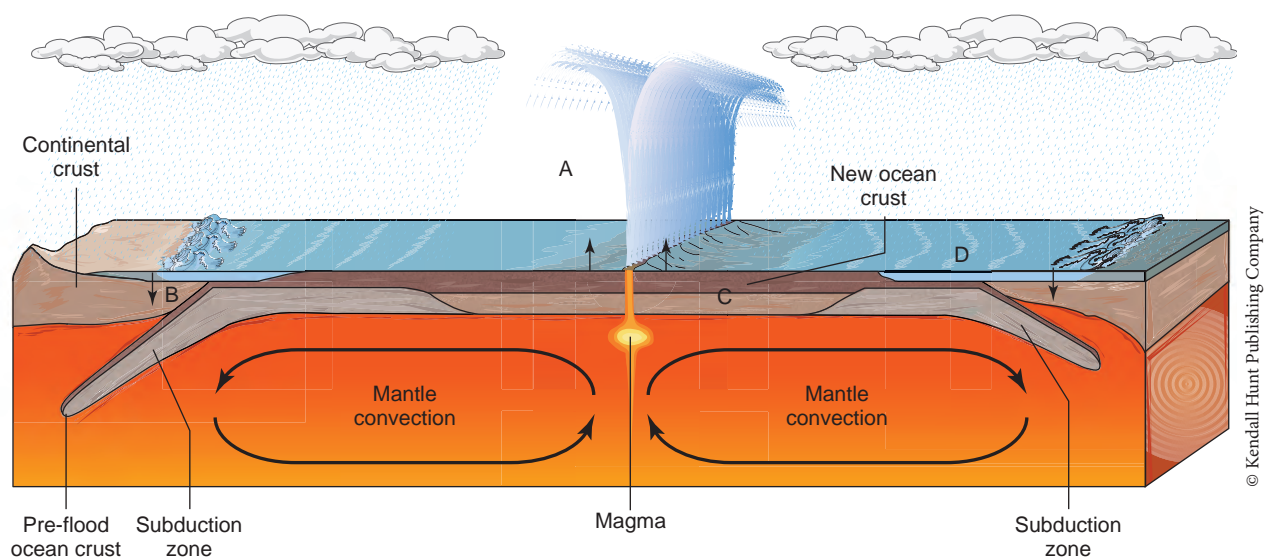


FIGURE 4.26. A cross-section through the crust and upper mantle during the Flood, showing the principle mechanisms by which ocean water covers over the continents: (a) rainfall from mid-ocean ridge geysers; (b) drag-down of continents at subduction zones; (c) new, thicker ocean crust; and d) thermal expansion of ocean water.

ocean crust during the Flood. This effectively lifted the elevation of the ocean basin by as much as one *kilometer* or more, causing huge volumes of ocean water to advance over the continents.

Thermal expansion of ocean water—as the water of the oceans was warmed by volcanic activity during the Flood, it expanded like all other substances do when heated. This effect is the least important of all, having very little influence on flooding the continents. The expansion rate of water is small ($0.000214/^{\circ}\text{C}$), and even multiplied by the enormous volume of ocean water, would likely result in less than a 10m rise.

Combined, these factors were easily sufficient to move large volumes of ocean water over the continents to erode and cover “all the high hills” of the pre-Flood world as recorded in Genesis. How did the Flood stop? That answer comes from the eventual shutdown of runaway subduction. As new ocean crust was formed and pulled away from the ocean ridges, it eventually came to subduction zones. While early in the Flood runaway subduction and mantle convection could continue to draw down this lighter, more buoyant new ocean crust, at some point its lower density overcame these forces and the ocean crust began resisting subduction. Once that happened, subduction and seafloor spreading rates began to dramatically slow. The massive geysers would eventually come to a stop, and the continents would rise back up as slowing subduction speeds reduced their downward pull on the continental margins, allowing water to drain off the continents. Cooling of the ocean crust would also cause it to contract, lowering the sea floor level and increasing the volume of water in the oceans. The waters for the Flood came from the oceans to flood the continents, then returned to new ocean basins at the Flood’s end, where they remain to this day, as promised by God to never again destroy the world with a flood (Gen. 9:8-17, Ps. 104:8-9; see Box 4.2.).

A theory such as CPT is helpful in understanding the movement of the plates as they occurred during Noah’s flood and in the years following it. But a good scientific theory should be not only descriptive, but also predictive. CPT has many significant challenges, particularly in dealing with how much heat would be generated by all of the proposed tectonic activity, how it relates to accelerated nuclear decay (discussed in Chapter 6, and which adds even more heat to the global system), and whether there are alternate, Flood-based interpretations of geological features that seem to indicate a non-marine origin (such as the evidence for glaciers used by Wegener and others to reconstruct Pangaea). These are all areas that challenge CPT and any other model of the Flood.

Yet despite challenges, CPT has also seen powerful confirmation of important parts of the theory. Data regarding Earth’s magnetic field and its history of reversals show that reversals can occur very quickly. Evidence in support of this comes from both ocean crust basalts and terrestrial lava flows. As mentioned earlier, the ocean crust records magnetic field reversals in parallel bands opposite each side of the spreading center (figure 4.11). The details are a bit more curious, however because the normal and reverse polarity bands show a mottled pattern of magnetic field orientation within the rock, rather than a solid and uniform block of north- or south-oriented magnetic orientations. That is, within a normal polarity segment of the crust there are many spots and areas that show a reverse polarity, and vice versa. This indicates that the rock far away from the spreading center had not completely cooled by the time the reversal occurred. Most of the rock cooled to record one polarity, while some parts remained hot enough that when a reversal happened, they picked up the opposite polarity. In a young-Earth and CPT view, this would be expected, because the ocean crust is forming quickly and reversals are happening frequently. In an old-Earth plate tectonics view, the basalt far from the ridge would have cooled

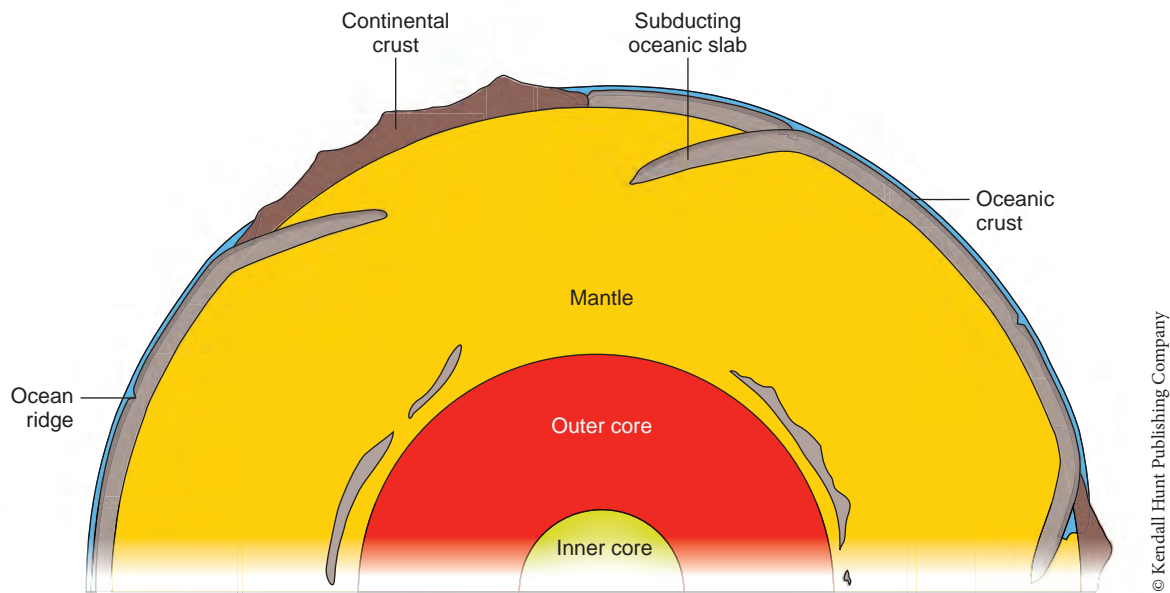


FIGURE 4.27. A cross-section through the geosphere, showing subducting oceanic lithosphere and the remains of pre-Flood ocean lithosphere located in a “plate graveyard” near the core-mantle boundary.

entirely, with no mottling except right near a reverse zone while the lava was erupting.

Terrestrial, post-Flood lava flows from Oregon show us that the reversals themselves occur quickly. Creationist D. Russell Humphreys predicted in 1986 that if reversals happened in a young-Earth setting, then thin, fast-cooling lava flows might “capture” the evidence of the reversal by recording different magnetic directions in different parts of the lava (fast-cooling outer part vs. slower-cooling inner parts). Three years later, old-Earth geologists discovered that a thin lava flow recorded a 90° shift in polarity that would have taken only 15 days to form. The same group of researchers again described even faster shift rates in 1995. These point strongly to rapid changes in the magnetic field as predicted by young-Earth models, but competing old-Earth models expect these changes to happen over *thousands of years*, not a few *weeks*!

A different type of confirmation came from seismic studies of the Earth’s interior. Chapter 5 discusses how earthquake waves are used to

determine the materials and features of the crust, mantle, and core. The theories of runaway subduction and CPT require that large slabs of the cold, pre-Flood ocean lithosphere sank down through the mantle, traveling towards the outer core. If Noah’s Flood occurred only a few thousands of years ago, then there has not been enough time for these slabs of lithosphere to become the same temperature as the mantle around them. In 1995, just one year after CPT was presented, old-Earth geologists discovered large, cold regions of the deep mantle near the outer core, just as CPT would expect (figure 4.27). This was surprising to many old-Earth geologists, whose own models for plate tectonics kept the subducted ocean lithosphere in the upper mantle. But even when adjusting their model (as a good scientist does when faced with contradictory data), old-Earth views still have trouble explaining why the slabs are cold, since they are supposed to have been subducting and warming in the mantle over tens to hundreds of millions of years. Here the young-Earth and CPT

views are much more consistent with the data we know, and provide us with confidence that CPT, though still incomplete, is on the right path to a better understanding of Earth history.

Regardless of the actual mechanism by which the flood occurred, the result of the flood was a completely different world. Noah and his family entered the ark seeing a world similar to, but corrupted after, the initial creation; they left the ark to find new continents, new oceans, new valleys and mountain chains (such the Rockies, Himalayas, and the “mountains of Ararat” where the ark landed; figure 4.28). *Everything* is different now.

BOX 4.2

GOD’S ENDURING PROMISE

After Noah left the ark, God speaks with him and makes a covenant with both humans and all other animals that He will never again destroy the world with a flood. This is seen in Genesis 9:8-17 and Psalm 104:8-9 (ESV).

Genesis 9:8-17.

⁸Then God said to Noah and to his sons with him, ⁹“Behold, I establish my covenant with you and your offspring after you, ¹⁰and with every living creature that is with you, the birds, the livestock, and every beast of the earth with you, as many as came out of the ark; it is for every beast of the earth. ¹¹I establish my covenant with you, that never again shall all flesh be cut off by the waters of the flood, and never again shall there be a flood to destroy the earth.” ¹²And God said, “This is the sign of the covenant that I make between me and you and every living creature that is with you, for all future generations: ¹³I have set my bow in the cloud, and it shall be a sign of the covenant between me and the earth. ¹⁴When I bring clouds over the earth and the bow is seen in the clouds, ¹⁵I will remember my covenant that is between me and you and every living creature of all flesh. And the waters shall never again become a flood to destroy all flesh. ¹⁶When the bow is in the clouds, I will see it and remember the everlasting covenant between God and every living creature of all flesh that is on the earth.” ¹⁷God said to Noah, “This is the sign of the covenant that I have established between me and all flesh that is on the earth.”

Psalm 104:5-9

- ⁵ He set the earth on its foundations, so that it should never be moved.
⁶ You covered it with the deep as with a garment; the waters stood above the mountains.
⁷ At your rebuke they fled; at the sound of your thunder they took to flight.
⁸ The mountains rose, the valleys sank down to the place that you appointed for them.
⁹ You set a boundary that they may not pass, so that they might not again cover the earth.