GEOLOGY BY DESIGN ANSWER KEY

Chapter One

1A. Day 3 (earth) and day 4 (universe)

1B. Supernatural creation versus a cosmic accident

1C. No

2. Trust the biblical account because it is from the God who is the source of all creation and was there.

3. A worldview is a philosophy, a means of explaining everything around us. It could be biblical or based in evolution or based on aliens from outer space, etc. History is a study of the past based on some sort of record. The record could be from a written account (e.g., the Bible) or from an interpretation of the rocks. Science is reproducible — you can repeat the process. A particular worldview will underlie the historical interpretation and it might not be based in any science. For example, a particular fossil might be interpreted to be 100 million years old. The acceptance of that idea requires that you accept the earth is old (worldview) and that based on evolution (worldview) it lived 100 million years ago and was eventually buried within the context of earth's 4.55 billion-year-old natural history (worldview). No science is involved — this cannot be reproduced. It is belief-based. Christians accept the biblical record and it would serve as our worldview. So we would interpret that same fossil as a former living organism that was either created or descended from a created life form (worldview). It was probably buried during the great Flood (biblical history) and we can understand it within the context of created kinds (worldview and biblical history).

4. If the worldview can be reproduced, then it would meet the definition of meeting scientific principles. Neither naturalistic nor biblical worldviews meet scientific principles. We cannot recreate what has happened in earth's past. Concepts within those worldviews can be scientifically tested. For example, we should be able to breed animals in a manner that might suggest or demonstrate evolution. Instead, we see that life exists in specific created kinds (e.g., cats are cats and dogs are dogs). This test uses science to determine if a belief or worldview is credible and the biblical worldview is best supported by that particular test. If tests in support of a particular worldview fail then it is time to question the worldview and seek another. The Bible account of earth history has never failed any scientific test in support of the worldview that it proposes.

5. The physical rock record (a creationist concept) is what you observe at a specific location (i.e., the rocks, sediments, fossils) on earth. However, naturalists know that no place on earth has the complete thickness and associated fossils of the entire time scale. Instead, naturalists use the conceptual uniformitarian time scale to place all of the rocks, sediments, and fossils across the earth into a chronological order that is consistent with the evolution of life on earth. One is based in reality and the other is conceptual.

6. Yes. Christians would use the biblical record of earth history to define when and why the rocks formed and how fossils became preserved in those materials — see page 16.

7. We can age-date earth's materials using common sense and a biblical time scale — see page 16.

Chapter Two

1. The uniformitarian geologic time scale

2. It is based on the linear progression of evolution for all life on earth. The Bible offers an alternative creation account. God created everything.

3. An outcrop exhibiting a combination of sediments, sedimentary features, and fossils could be used to visualize a former environment. For example, finding marine shells and sand ripple marks together (see figure 1-3) would suggest that you are looking at a former beach setting. However, as shown in this example, you would be incorrect. While the materials were derived from a nearshore marine setting, that environment never existed at this location. The naturalist idea that certain environmental settings existed in earth's past over the course of millions of years is based on their worldview. As Christians, we would place greater emphasis on the global Flood of Genesis operating over a short period of time as the force that created the majority of the physical rock record. The individual's worldview would define what interpretation of the data is acceptable.

4. No. Two different worldviews. The environments we observe today were only established following the global Flood. We really do not know what the antediluvian world was like — we can only postulate a guess based on the jumbled mix of rocks, sediments, and fossils we find in the rock record.

5. We would expect to see many sediments and fossils deposited in high energy (e.g., storm-like) conditions. The bioturbation of sediments would occur as depositional and erosive energy conditions would allow, but it would not be vertically continuous or extensive, but limited in scale and extent. We would see little evidence of extended time along stratigraphic contacts. This type of investigation would begin at a specific location and spread outward. We would also need to compare laboratory experiments of the deposition of sediments and fossils against what we observe at a particular outcrop — that's applying science to the interpretation. See figure 1-3.

6. No. It's a matter of the individual's worldview.

7. Yes — we would reject the worldview and naturalistic version of earth history but can accept the science and in some instances the interpretation (with modification) when it is consistent with the biblical worldview — e.g., storm deposits, river flood deposits, etc. These individual high-energy storm/flood events would actually be a part of the much larger Flood event and therefore we could integrate them (with adjustments) into the global Flood.

Chapter Three

1. A storm deposit. The Flood would have created conditions where moving water could form a deposit resembling a tempestite. However, this was not due to atmospheric conditions. In order to help define the biblical perspective of earth history, we should try and separate Flood deposits from atmosphere-derived tempestites. In doing this we can (hopefully) better understand conditions across the earth as it transitioned out of the Flood event.

2. Not much — but further investigation may show that more should be included when adding Flood-derived hypercane deposits.

3. See text. Yes.

4. See text. No. Minutes to hours to possibly even days depending on the size and intensity of the storm.

5. It would erode sediments from one area and deposit them across another area. Modern hurricanes do this and there is no reason not to expect similar conditions during the Flood. Isolated fossiliferous

layers suggest limited community size and extent. However, it is also possible that Flood currents dispersed shells from a much larger community preserving only a small fraction. This could probably be determined through site/area specific study. Are isolated accumulations of the same fossils found nearby (suggesting limited transport) or farther afield (suggesting either distant transport or a different community) — only a site-,specific study might offer an answer.

6. Yes. As a storm would move into an area, sediments/shells would be eroded/winnowed out and deposited in certain areas (likely depressions) due to current and/or wave action. During the storm, additional storm sediments and fossils could be added if the depression was large enough to accommodate additional materials. The resulting vertical profile of this deposit would be a series of sedimentary and shell layers reflective of a single passing storm. However, it is more likely that naturalists would interpret this vertical profile as a series of passing storms over time.

7. It would appear to be a storm or high energy deposit that was deposited rapidly. One factor in making this determination would be the individual's worldview. Another might be in determining the environment of deposition of the bounding strata. If it is bound by marine sediments then it was likely deposited in a marine setting too. However, if there is evidence of a beach setting (insect traces, plant fragments, etc.) then a former beach setting is possible. In many instances, the interpretation is a function of the individual's perspective and not based on specific evidence.

Chapter Four

1. A fossil soil — see text.

2. Naturalists have identified paleosols all the way back to the Precambrian — more than 542 million years old (see timescale on page 9). It is inconsistent with the biblical record of earth history.

3. See text. To form a paleosol, a soil must be developed, buried, and preserved. Only those environments that can bury and preserve a soil provide the potential for paleosols.

4. Many paleopedologists use modern standard soil classification techniques. However, some use their own ideas in identifying a paleosol. See text.

5. The worldview of the individual will set the manner in which a paleosol would be interpreted. Naturalists contend that the earth is old and environments slowly change over time. This suggests that there should be an abundance of paleosols in the rock record. Christians would counter that the earth has only recently come out of a global Flood and that paleosols would be formed in a post-Flood setting if environmental conditions would allow. They would be fewer in number and limited in lateral extent. Today, we find few paleosols and they are laterally restricted — even in settings where they should be abundant. Hence, the biblical record appears to be supported by paleosols.

6. See text.

7. The fact that they are not abundant and very limited in lateral extent suggests that they are consistent with the biblical record of earth history. Soils forming after the Flood could have been buried and preserved, thus forming a paleosol. They can help us understand the biblical history of an area when they can be properly identified possibly conveying sedimentation rates, depositional conditions, and even climatic changes.

Chapter Five

1. See text.

2. They form under freshwater conditions so they would suggest that marine Floodwater was no longer present and the area was exposed land.

3. Top-down transfer of minerals from the surface down into the subsurface and laterally, by groundwater dissolution of minerals, transport, and precipitation of those minerals within the subsurface.

4. In the subsurface where groundwater flow is rich in sediment leached dissolved minerals. A change in the oxidation or pH of the groundwater could result in further sediment mineral leaching or the precipitation of the dissolved minerals.

5. It was derived from distant sediments rich in iron. These sediments leached a certain percentage of iron which was dissolved in the groundwater and transported laterally.

6. It is a function of the groundwater table within the subsurface. Ferricretes and laterites could form several hundred feet below the ground surface if the groundwater table is located at great depth.

7. Ferricretes and laterites can form rapidly within the subsurface (days, months, or even over several years) depending on the site-specific conditions.

Chapter Six

1. See text. They indicate that the area has experienced some level of seismic activity.

2. See text.

3. Seismites can form in seconds or minutes depending on the force of the seismic event.

4. Sands, silts, clays, and carbonate sediments.

5. The size might correlate to a large event or a smaller scale event operating over a longer period of time. Site specific investigation would be necessary to make this determination.

6. The Flood Event Timeframe (see p. 16) probably had the highest level of seismic activity.

7. That area was seismically active or if along linear projection then it might indicate a fault that is associated or the direct cause of seismic activity.

Chapter Seven

1. See text.

2. Based on the limited studies to date, many naturalists do not accept that some concretions are in fact rounded sedimentary boulders. This viewpoint will not change until sufficiently documented otherwise. It is also a function of their worldview as they do not envision Floodwater currents rolling large sedimentary structures around in former channels.

3. Not all sedimentary concretions were formed by Floodwater currents and further study is necessary. But the greatest levels of energy and water movement occurred during this period of time and would have been available to form rounded sedimentary structures.

4. They formed and rolled in rapidly moving water currents during a portion of the Flood.

5. We would expect to find rounded sedimentary structures in former channels or in areas where Floodwater flow velocity was accelerated and then decelerated, allowing the rounded structures to be deposited. Concretions could also form in former channels or in areas where organic materials were incorporated into sediments creating the conditions necessary for organic concretion development.

6. Size is a function of the water current velocity if it is a rounded sedimentary structure. Size is a function of organic content if the concretion was organically derived.

7. The larger the size of the rounded sedimentary structure the greater the Floodwater velocity necessary to erode and transport the large clay layer transforming it into a round mass.

Chapter Eight

1. The largest ripple form is a sand bar. The smallest is a micro-ripple. They are found in every depth of water and where air can move sedimentary particles.

2. No.

3. Yes.

4. They can indicate that air or water flowed across loose particles in one direction, in two directions, or in several directions. Eleven different ripples have been identified in the rock record by Collinson and Thompson (1989). Rubin (1987) identified as many as 78 types based on computer modeling.

5. They can be used to help identify water or air flow patterns when found in the rock record. The timing of the formation of these features will be linked to site-specific locations and the biblical time scale.

6. There is currently no test to determine if ripple marks formed in air or water. It is typically based on the nature of the sediments and the interpreted paleoenvironment.

7. No. It is based on an interpretation derived from a worldview. The Coconino Sandstone has been interpreted by naturalists as a desert deposit. The lack of any marine fossils is believed to support that position. That amphibian tracks have been reproduced in flowing water across submerged sand in a manner similar to what is found in the Coconino has no bearing in this discussion. The naturalists continue to define the Coconino Sandstone as a desert sand deposit. Hence, it is not a scientific discussion, rather one based on a worldview.

Chapter Nine

1. Radiometric age dating is thought to be the primary method of age-dating volcanic rocks. However, if fossils are present then they can be used as well.

2. Naturalists contend that radiometric dating can provide a very narrow age range for the deposit. This value can then be plugged into the conceptual uniformitarian geologic time scale, providing it with greater "scientific" credibility. None of this is true as everything depends on the accepted radiometric date. If the radiometric age was older or younger than the acceptable age (as defined by the scientist) then it would be rejected. The correct age date is only accepted because it conforms to the established worldview. There is no "science" involved in age-dating rocks — only the reinforcement of a value that will conform to an accepted worldview.

3. Yes. Ash is largely composed of glass particles that rapidly break down with the aid of acidic rainwater or by groundwater if within the subsurface.

4. The greatest volumes of ash would have been generated during the Flood. This is when the earth's crust was ripped apart and volcanic vents released ash and gas first into the atmosphere followed by Floodwater as they became submerged.

5. Yes. The ash would have been transported by Floodwater currents until reaching a place where they could have settled out of the water and been deposited.

6. If all the ash has not yet converted to clay then we could possibly observe glass shard particles within the clay. If it has converted to clay then perhaps it could still be identified as having been derived from an ash, based on geochemical trace minerals or elements.

7. It would demonstrate that much more of the rock record is composed of volcanic ash than is currently recognized. Likewise, volcanic ash does not take millions of years to form, so time might not be a factor in the origin and development of the clay — it shortens the time scale.

Chapter Ten

1. See text.

2. A seismic event or uplift could destabilize unconsolidated water-saturated sediments in a manner that creates a gravitational flow.

3. They have been estimated to flow as fast as 42 mph, but even faster velocities are possible.

4. See text.

5. Proximal turbidite deposits occur closer to the original source area while distal are farther away. The proximal deposits have larger particles and the distal deposits have smaller particles. Distance traveled is believed to be a function of diminishing particle size — the farther away, the smaller the particle size. However, recent study has shown that this is not necessarily true — see text for discussion. No — we need to examine the rocks at specific locations and place them within the context of the area. They may in fact be proximal deposits with a small particle size.

6. Trace fossils indicate that the deposition of additional sediments ceased or greatly decreased allowing the creatures (i.e., trace makers) the opportunity to forage for food in the newly deposited sediments. Despite extensive study, trace makers are not restricted to certain depths and therefore cannot be used as depth indicators. Traces makers were formed by clams, snails, worms, arthropods (e.g., shrimp, crabs, etc.), and echinoderms (starfish, sea urchins, etc.).

7. The uplift of a large area of a continent could initiate the gravitational flow of watery sediments which would spread across a very broad area forming turbidite deposits. Naturalists look to the small scale and invoke individual unrelated turbidity current flows while the Flood would have operated across a continent and created large-scale flows of great thickness over large areas — all related to the uplift of a large area and the gravitational instability of the water-saturated sediments.