Bedrock Geology

Patrick Nurre

The Northwest Treasures Curriculum Project
Building Faith for a Lifetime of Faith

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By Patrick Nurre

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northwestexpedition@msn.com

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Title page photo: One of the many arches in the Colorado Plateau. Courtesy of John Meyer.

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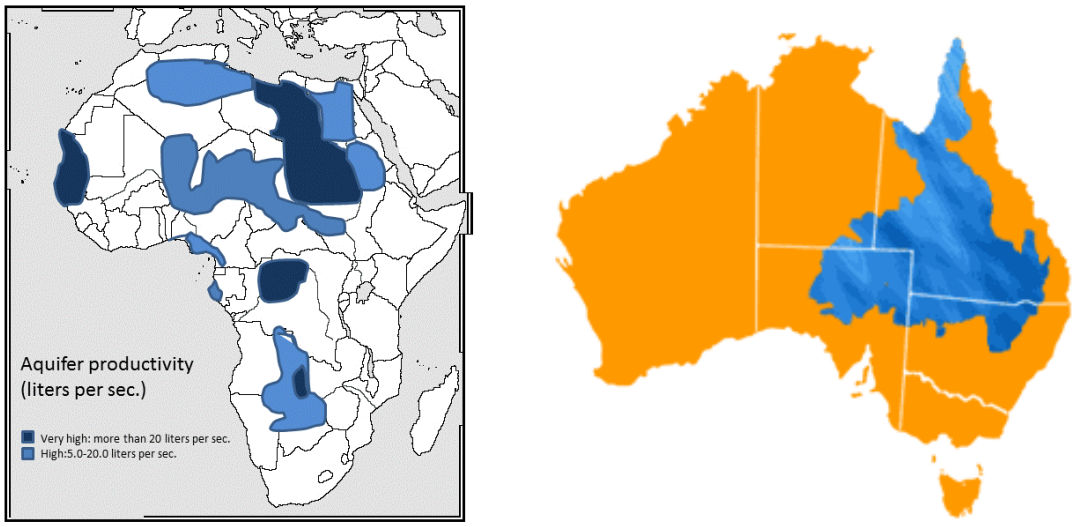
III The Genesis Flood – The Historical Turning Point of Earth History

Section 2: The Flood – Just What Happened, and When?

The Stages of the Genesis Flood

Many people think that the Genesis Flood was only a localized flood that took place somewhere in the Middle East and only lasted for 40 days. But the Scriptures tell us that it was a global flood lasting over a year with devastating geological consequences! If one reads chapters 7-8 of Genesis, it will be readily apparent that the Flood can be divided into 2 stages. Each stage of the Flood brought on tremendous geological upheaval and change to our planet.

1. **Inundatory or The Flooding Stage** – this was the beginning stage and a very violent event. For 150 days the water shot up from below the Earth, pouring warmer water into the ocean of the past and rising to cover what would have been the mountains of that time. The Scriptures record that the water covered what would have been the highest mountains at that time by 22 ½ feet. This would have been the maximum depth of the Flood. No land animal, bird or air-breathing creature survived this devastating geological event, except Noah, his family and all the animals which were on the ark. This stage of the Flood would have been responsible for tremendous amounts of sediments being torn up, transported and then deposited into layer after layer all over Earth. An example of this stage of the Flood would be the many layers of sedimentary rock in The Grand Canyon before it was a canyon. Where do you think all the water came from? Deep underground, all over the world are geological structures called aquifers. This word comes from the Latin for water, "aqua". Even under places that seem to be totally devoid of water are aquifers. These aquifers might have served two purposes in the days of the Flood:
   a) A source of water (besides the ocean that was present at the time), and
   b) One of the drainage places for the water (besides the present ocean basins) *Study the maps below and notice that abundant aquifers exist even under places like Africa and Australia.*



Approximate location of major aquifers in Africa and Australia.

2. The Receding or Retreating Stage.

Activity Y: Read Psalm 104:5-9 and record your observations in your notebook.

Toward the end of the flooding or inundatory stage of the Flood, Psalm 104 states that at God's rebuke the mountains rose and the valleys sank down. This effectively describes:

a) *Mountain building or orogeny*
b) *Creating the ocean basins*
c) *More sediments being torn up, transported and redeposited*
d) *Canyon cutting*

Secular geologists tell us that most of our most famous mountain ranges like the Rocky Mountain Range and the Himalayan Mountain Range were formed recently in geologic time. Actually this is exactly what the Biblical framework would describe. Mountain ranges were formed (according to Psalm 104:5-9) in the end stage of the Flood. The building of these mountain ranges would have served two purposes:

a) *To facilitate the draining of the flood waters that had been covering the Earth, and*
b) *To provide a boundary so that the waters would not cover the Earth again*

Once the sediments of The Grand Canyon were laid down across a broad area, then the cutting action of the receding or retreating stage of the Flood would have gone to work, removing a large amount of sediments, still not quite hard enough to resist.

The weaker sediments would have been cut away while the stronger sediments would have remained. Effectively huge "scars" would have been left in many places around the world. Besides The Grand Canyon, Monument Valley would have been carved at this same time, leaving the stronger or tougher rock in the form of isolated sandstone structures or "monuments".

The Grand Canyon and Monument Valley

Take Quiz #8, pg. 104.

Bryce Canyon, Utah.

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Section 4: The Rocks of the Flood

The Rocks of the Genesis Flood

Volcanic Rocks. Volcanic rocks are also identified by their grain or mineral size. Rocks where the minerals cannot be discerned with the naked eye are called volcanic rocks, after the Roman god of fire, Vulcan. Geologists have seen many of these rocks form and these rocks are associated with volcanoes or lava flows. These are the true igneous rocks, because we know that they are formed from very hot lava that has extruded from volcanoes or rifts in the Earth and cooled. Volcanic rocks are referred to as fine grained rocks. A person can see a general color to the volcanic rock, but usually cannot make out the individual minerals in the rock. One other type of volcanic rock can be a little confusing because some of its minerals can be seen.

Geologists call this type of volcanic rock, porphyry or porphyritic. The word means, "purple". Huh? It's a little confusing isn't it? I have included a volcanic porphyritic rock in your kit. Volcanic porphyritic rocks are quite common.

Activity BB:

Take out the **volcanic** rocks in your kit and a magnifying glass and see if you can see any of the minerals that make up the rock. Record what you see.

We call the mix of minerals in the volcanic rock the "groundmass". It is the overall rock that consists of the minerals that form the rock. Many volcanic rocks have incidental mineral crystals showing. These are called "phenocrysts". These are not the actual groundmass of the volcanic rock, but simply individual minerals called porphyry. These phenocrysts also help identify what type of volcanic rocks they are. Certain volcanic rocks have predictable phenocrysts.

1. **Basalt**. This word actually means "hard". Basalt is a very hard rock. Like gabbro, it is formed of dark minerals. In fact basalt may even be the lava equivalent of melted and cooled gabbro.
2. **Rhyolite**. This word means "flow". Rhyolite is a type of lava that is so viscous that as it cools and hardens it leaves flow patterns. It is the equivalent of granite. In fact rhyolite may even be the lava equivalent of melted and cooled granite.

Basalt and Rhyolite

Metamorphic Rocks

The word "metamorphic" is from a Greek word meaning change. It is used in the New Testament in Romans chapter 12: 2, "… *be* ***transformed****…."*

Metamorphic rocks are identified by the terms "foliated", meaning that there is visible banding or layering, and "nonfoliated" meaning that there is no visible banding or layering. In foliated rocks the minerals appear to have been rearranged into bands. Nonfoliated metamorphic rocks rather display a crystalline appearance. Many metamorphic rocks display reworking of the minerals such that they appear to have been deformed or stretched. They also appear to be rocks that have changed from some previous rock. For example take a look at the pictures of granite (a plutonic rock) and gneiss (a metamorphic rock) below and see why geologists might conclude that gneiss is really reworked or "recooked" granite.

Granite (plutonic rock) and Granite Gneiss (foliated metamorphic rock)

Limestone (sedimentary rock) and Marble (nonfoliated metamorphic rock)

What on Earth would cause rocks to change like this? Although metamorphic rocks have not been observed to be forming, geologists guess that these rocks have formed over millions of years under a great deal of heat and pressure. Biblical geologists would agree that it probably took a great deal of heat and pressure to

produce these rocks. The big difference is the time frame. The Biblical chronology will not allow millions of years. So, what in Biblical history would have produced such intense heat and pressure to deform and change rocks? Well, of course, the Genesis Flood. Take a look at the drawing below and imagine the very first day of the Genesis Flood. The Bible says that all the fountains of the great deep burst open. (Genesis 7:11) This description implies that the Earth of that time went through catastrophic upheaval. In geology we call this tectonics. The Earth would have cracked and shook to its very core. Such Earth movement would have generated a great deal of heat and pressure as huge amounts of existing rock moved against each other. The Genesis Flood implies that there was rapid tectonics and thus rapid metamorphism. The next pictures are of the MidAtlantic Rift. The one below right runs through Iceland. Ever since the 1970s, mapping the ocean floor has revealed some amazing evidence for the Genesis Flood. Take a look at the picture of the ocean floor and notice the seams all around the globe. These are most likely the remnants of the breaking up of the fountains of the great deep.

Sedimentary Rocks

As the name implies, these rocks are made up of sediments that have been cemented together and then hardened into rock. Does it take a long time to turn sediments into rock? Let's investigate. Try the following activity.

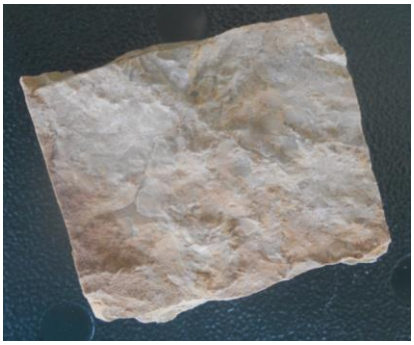
Activity CC:

1. Put four cups of sand in a bucket. Add four cups of water. What happened to the water?
2. Next, get a bucket of dirt. Make a small hole in the middle. Then, get a small bowl of wet sand out of your first bucket. Mix Epsom salt with the sand. Dump the mixture in the hole in the bucket of dirt and gently pat it. Wait two days and examine the mixture. *Answer in Answer Key.*

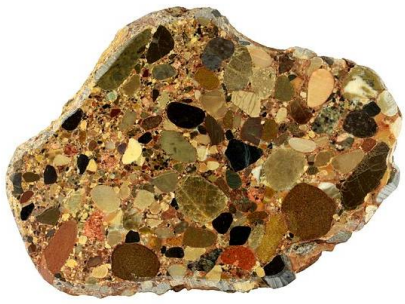
Sedimentary rocks are rocks laid down by water and mud. 70% of the Earth's surface is covered with sedimentary rock. That's a lot of rock. Sedimentary rocks are grouped according to the terms **clastic**, **chemical** and **biochemical**.

Clastic Sedimentary Rocks

The word "clast" is from the Greek word for "broken". So, sedimentary rocks consist of other broken bits and pieces of rocks and minerals cemented together into a rock. The clastic sedimentary rocks are grouped according to the size of the clasts.








1. **Shale**; 80% of the sedimentary rock on Earth is shale. Shale is also called claystone or mudstone because it is made of *very fine particles of clay and mud.* It is very fine grained and extremely brittle. Shale may contain fossils. 2. **Siltstone**; consists of clasts that are *a little larger than clay particles.* 3. **Sandstone** has clasts *easily seen with the naked eye.* 4. **Arkose** is *coarse sandstone (more coarse than regular sandstone)* with the mineral feldspar as one of the cementing agents. 5. **Conglomerate** can consist *of rather large* ***rounded*** *clasts called pebbles, cobbles and boulders.* 6. **Breccia** is a *type of conglomerate, but with angular clasts.* These two clastic sedimentary rocks can be rather large.

With so much sedimentary rock on Earth, one has to be a little bit curious as to where it came from and how it got here. If the Genesis Flood was a real catastrophic event, it would have torn up and removed huge amounts of sand, silt and small rocks and then transported them hundreds of miles from their native place. The sediments would then have been deposited into thick beds which hardened rather quickly. Some of the more famous sedimentary rock formations are: The Grand Canyon, Mt. Everest, The Colorado Plateau (over 130,000 square miles of sedimentary rock!), The Great Smokey Mountains, Ayers Rock in Australia (a huge sandstone formation over a 1,000 feet high), and Pamukkale (a large travertine formation in Turkey which is 8,100 feet long, 1,800 feet wide and 450 feet high). These types of sedimentary formations are not being formed like this today.


Travertine Hot Spring Terraces, Yellowstone National Park. Travertine – a limestone sedimentary rock produced by the precipitation of chemical-rich waters that have permeated limestone rock from below ground

Chemical Sedimentary Rocks

Chemical sedimentary rocks have been deposited by supersaturated mineral-rich solutions. No one really knows how they were formed. One of the chemical sedimentary rocks is limestone. And as the name implies, the rock is made up of lime cemented together with either calcium carbonate (calcite) or silica (quartz). Limestone has the mineral calcium carbonate in its makeup. One way that geologists test for calcium carbonate is by dropping a tiny bit of strong acid on it. If it fizzes, then the rock contains calcium carbonate and more particularly there is a good chance it is limestone.



A question that is sometimes asked is whether the Genesis Flood could account for all the limestone formations in one single event? The answer is a resounding "yes." It is exactly what one would expect given the global nature of the Flood and its power to tear up huge amounts of rock and soil, living things, transport them and then deposit them into successive layers.

Biochemical Sedimentary Rocks

As the name implies, these are rocks made from the remains of once-living plants and animals. A good example is coal, made from the compressed remains of ferns, leaves and wood. Geologists do not know for sure how the vast coal beds around the world were formed. But coal has been formed in the laboratory using heat, plant material and pressure – and a relatively short period of time!

Bituminous Coal

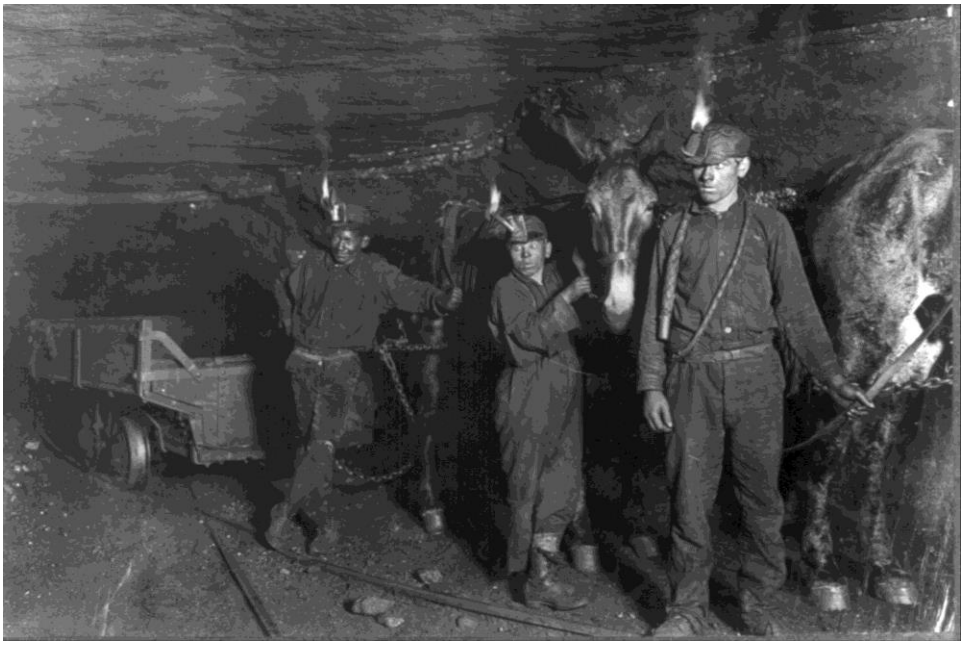
Lignite Coal (soft coal)

Anthracite Coal
(metamorphosed hard coal)

Examples of continuous coal beds. Great Britain; United States.

Activity DD:

1. How could massive coal beds form in today's environment?
2. In your notebook write out an explanation for the formation of coal beds using your Biblical geology framework. *Answers in the Answer Key.*



Child coal miners, 1908, West Virginia.

Take Quiz #10, pg. 105.