

Chapter 37

The Columbia River Basalts in the Northwest States

Another geological feature that has been assumed to be deposited in the post-Flood period is the Columbia River Basalts (CRBs) in eastern Washington, western Idaho, and northern Oregon (Figure 37.1). The CRBs are the youngest of a series of basalt flows across the earth called Large Igneous Provinces.¹ The CRBs are dated about 17 to 6 million years, which is the Miocene, the very early Late Cenozoic. The Columbia River Basalts cover 51,000 mi³ (210,000 km³) with an average depth of 0.6 of a mile (1 km).² They are up to 13,000 feet (4 km) deep in the center of the Columbia Basin and are believed to represent more than 350 large flows of basalt, one after the other oozing from 21,000 cracks in the earth called dikes. The flows average 100 feet (30 m) thick with a maximum of 330 feet (100 m).³ Some of the flows are the largest in the world with individual volumes of flows ranging from about 24 mi³ (100 km³) to 2,400 mi³ (10,000 km³).⁴ Some of these flows spread hundreds of miles west from near the Idaho/Washington border to what is now the Pacific Ocean. The basalt province is larger than previously published because the Steens Mountain volcanic area of southeast Oregon has been added as the first major eruption of the CRBs.

The timing of all these basalt flows is rather controversial within uniformitarian geology. Some propose emplacement over many years and others suggest it took much less time.² There is no doubt that Flood geologists need to explain the CRBs and other large igneous provinces within biblical earth history. The CRBs hold several challenges for us.

Several creation geologists have come to believe the CRBs erupted after the Flood,^{5,6,7,8} which would make the Miocene and other rocks in the Pacific Northwest post-Flood. As far as I can discover, this deduction is based on about thirteen criteria (see in-depth section at the end of the chapter.)

¹ Mahoney, J.J. and Coffin, M.F. (editors), 1997. *Large Igneous Provinces: Continental, Oceanic, and Planetary Flood Volcanism*, Geophysical Monograph 100, American Geophysical Union, Washington, D.C.

² Reidel, S.P., Camp, V.E., Tolan, T.L., and Martin, B.S., 2013. The Columbia River flood basalt province: stratigraphy, areal extent, volume, and physical volcanology; in: Reidel, S.P., Camp, V.E., Ross, M.E., Wolff, J.A., Martin, B.S., Tolan, T.L., and Wells, R.E. (editors), *The Columbia River Flood Basalt Province*, GSA Special Paper 497, Geological Society of America, Boulder, CO, pp. 1–43.

³ Reidel, S.P., 2005. A lava flow without a source: the Cohasset Flow and its compositional components, Sentinel Bluffs Member, Columbia River Basalt Group. *The Journal of Geology* 113:1–21.

⁴ Reidel, S.P. and Tolan, T.L., The Grand Ronde basalt, Columbia River Basalt Group; in: Reidel, S.P., Camp, V.E., Ross, M.E., Wolff, J.A., Martin, B.S., Tolan, T.L., and Wells, R.E. (editors), *The Columbia River Flood Basalt Province*, GSA Special Paper 497, Geological Society of America, Boulder, CO, pp.117–153.

⁵ Nevins, S.E., 1971. The Mesa Basalt of the northwestern United States. *Creation Research Society Quarterly* 7(4):222–226.

⁶ Nevins, S.E., 1974. Post-Flood strata of the John Day Country, northeast Oregon. *Creation Research Society Quarterly* 10:191–204.

⁷ Molén, M., 1994. Mountain building and continental drift; in: Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, p. 358.

⁸ Garner, P., 1996. Continental Flood basalts indicate a pre-Mesozoic Flood/post-Flood boundary. *Journal of Creation* 10(1):114–127.



Figure 37.1. Area of the Columbia River Basalts (CRBs), including the Steens Volcanics of southeast Oregon that are now correlated to the CRBs (drawn by Mrs. Melanie Richard).

Another reason why the CRBs are believed to be post-Flood is the volcanic rocks and sediments below them in north central Oregon are thought to be post-Flood.⁶ This is in the John Day Country and includes the John Day and Clarno Formations, which are dated as old as Eocene, the middle part of the Early Cenozoic.⁹ So, all of the volcanic activity in the northwest states is assumed to be post-Flood by some creation scientists. But is it? Is there evidence that these volcanic rocks were deposited in the Flood that has been either unnoticed or ignored? Can the evidence for a post-Flood environment be explained as a Flood deposit? These are crucial questions that determine whether the Cenozoic of the northwest states is Flood or post-Flood. It sometimes is not easy to determine the environment from a biblical point of view.

Evidence the CRBs were erupted during the Flood

I will focus mainly on the CRBs because if they are from the Flood, the rocks below the CRB, the John Day and Clarno Formations, would be too. The question of whether the CRBs are Flood or post-Flood generally boils down to whether the flood basalts erupted underwater or not. It is theoretically possible that flood basalts could either partially or totally be laid down subaerially during the Flood, but I think it is more likely they erupted underwater. If they erupted after the Flood it is most likely the CRBs would have erupted above water.

⁹ Bokovoy, D., Coffin, H., and Hergenrather, J., 2004. *Road Guide to the John Day Area of Central Oregon as Viewed from a Creationist Perspective*. Creation Research Society Books, Chino Valley, AZ.

At one time I leaned towards the idea that the CRBs were post-Flood.¹⁰ I grew up in Washington State and traveled there extensively. Upon a closer examination I changed my mind. I believe there is substantial evidence these basalts erupted underwater during the Flood.¹¹ A summary of the evidence is presented in the following table.

1) Well-rounded quartzites on top of the CRBs
2) Diatomite layer between basalt flows
3) The massive Thorp Gravel
4) The rounded, eroded anticlines
5) Subtropical trees within and between the lava flows
6) Water Gaps
7) Rapid, long distance basalt flows
8) Volcanic winter could occur

Table 37.1. Eight reasons why the Columbia River Basalts were laid down during the Flood.

Well-Rounded, Exotic Quartzite on Top of CRBs

One of the most convincing arguments is the well-rounded quartzite rocks that have spread westward from the western Rocky Mountains of western Montana and central and northern Idaho.^{12,13,14} This quartzite spread up to 440 miles (km) to the Pacific Ocean. Rounded quartzites are found at numerous locations of Washington and Oregon in valleys and on tops of mountains. They are found on top of the Wallowa Mountains at 8,200 feet (2,500 m) above msl on a ridge from Lookout Mountain (see Figure 24.2). Rounded quartzites are also found on top of all the basalt ridges around Yakima, Washington. They filled a canyon near the mouth of the Columbia River and are 1,100 feet (335 m) thick. The important point is that most of this well-rounded quartzite has been rounded by the action of powerful, turbulent water flow and lie on *top* of the CRBs. Since the quartzites provide powerful evidence for Flood runoff, criterion 10 in Table 34.1 and Chapter 24, and they are on top of the CRBs, it is reasonable that the CRBs erupted under water during the Flood.

Diatomite Layer between Basalt Flows

A second reason why I believe the CRBs were laid down in the Flood is there is a nearly pure diatomite layer between basalt layers (Figure 37.2). At a diatomite mine near Quincy, Washington, the diatomite is 20 feet (6 m) thick. These layers present challenges for both the uniformitarian and post-Flood catastrophic views because slow deposition in a lake between lava flows would not be expected to produce nearly pure diatomite. If deposition of the lava and diatomite layer were rapid, how would all the diatoms reproduce so fast in a lake? Such purity

¹⁰ Oard, M.J., 1990. *An Ice Age Caused by the Genesis Flood*. Institute for Creation Research, Dallas, TX, pp. 69–70.

¹¹ Oard, M.J., 1996. Where is the Flood/post-Flood boundary in the rock record? *Journal of Creation* 10(2):258–278.

¹² Oard, M. J., 2008. *Flood by Design: Receding Water Shapes the Earth’s Surface*. Master Books, Green Forest, AR.

¹³ Oard, M.J., 2013 (ebook). *Earth’s Surface Shaped by Genesis Flood Runoff Volume I: Tectonics and Erosion*. <http://Michael.oards.net?GenesisFloodRunoff.htm>.

¹⁴ Oard, M.J., Hergenrather, J., and Klevberg, P., 2006. Flood transported quartzites: Part 2—west of the Rocky Mountains. *Journal of Creation* 20(2):71–81.

points to rapid deposition from a body of water much larger than a lake, and so the diatomite is easier to explain in a Flood model.



Figure 37.2. A thick layer of diatomite between CRB lava flows south of George, Washington, on the Frenchman Hills (Dr. Harold Coffin provides the scale).

The massive Thorp Gravel

A third piece of evidence is the Thorp gravel that locally outcrops as a sheet in the Yakima-Ellensburg area and lies between lava anticlines.^{15,16,17} The sheet of gravel was dissected after deposition. Figure 37.3 shows a 250-foot (75 m) high cut through the pre-glacial gravel about 5 miles (8 km) west of Ellensburg on the old Highway 10. The well-rounded gravel with boulders up to 14 inches (35 cm) in diameter is mostly andesite lava transported from the Cascade Mountains to the west. What watery catastrophic process would transport a sheet of gravel in the valleys between anticlines from about 20 miles (32 km) to the west? It is easier to believe channelized Flood erosion of the Cascade volcanics deposited the Thorp gravel rather than some unspecified post-Flood catastrophe.

¹⁵ Campbell, N.P., 1983. Correlation of late Cenozoic gravel deposits along the Yakima River drainage from Ellensburg to Richland, Washington. *Northwest Science* 57:192.

¹⁶ Waitt, Jr., R.B., 1979. Late Cenozoic deposits, landforms, stratigraphy, and tectonism in Kittitas Valley, Washington. *U.S. Geological Survey Professional paper 1127*, U.S. Government Printing Office, Washington, D.C.

¹⁷ Smith, G.A., 1988. Neogene synvolcanic and syntectonic sedimentation in central Washington. *GSA Bulletin* 100:1,479–1,492.



Figure 37.3. The Thorp gravel just off Highway 10 about 5 miles west of Ellensburg, Washington, where it forms a terrace at least 250 feet (75 m) high.



Figure 37.4. The eroded and rounded top of the Rattlesnake Hills lava ridge in the Yakima Fold Belt. The amount of erosion can be inferred from the erosional remnants of lava layers projected up over the top of the ridge (dashed line).

A Rounded, Eroded Anticline

Fourth, the lava anticlines around Yakima not only have rounded quartzite rocks from Idaho topping them, but the *tops* of some ridges have been eroded and rounded, as if by the action of water. For instance, the top of the Rattlesnake Hills anticline, southeast of Yakima, has eroded about 1,000 feet (300 m) based on the lava erosional remnants dipping away from the anticline (Figure 37.4). It is difficult to envision a post-Flood state that would erode the top of this anticline and leave behind well-rounded quartzites. The erosion occurred after deposition of the CRBs. If the Flood eroded the anticline, it follows the CRBs are from the Flood.

Subtropical Trees within and between Lava Flows

Fifth, subtropical petrified trees have been found within and interbedded with the CRBs. The most prolific location is at Ginkgo Petrified Forest State Park at Vantage, Washington, where 200 species of trees have been found. Some are subtropical such as Eucalyptus and Taxodium.¹⁸ This area has not moved much north or south from its present location, assuming plate tectonics. So, there is no reason why these trees would grow in eastern Washington after the Flood (see criterion 13 of Table 34.1 and Chapter 29).



Figure 37.5. Last water gap through a lava ridge in southern Ellensburg Canyon (view north).

Water and Wind Gaps

The sixth reason for considering the CRBs as a Flood deposit is water and wind gaps cut through the lava ridges (Figure 37.5). Water and wind gaps were carved by channelized Flood runoff (see Chapter 27). There are about 5 water gaps cutting through the lava ridges between Ellensburg

¹⁸ Coffin, H., 1983. *Origin by Design*, Review and Herald Publishing Association, Washington, D.C., pp. 150–151.

and the lower Yakima River Valley. Normally the Yakima River, which presently runs through the water gaps, should have flowed east from Ellensburg to the Columbia River, over a low pass instead of taking a southward turn and cutting through high lava ridges. There are two recognized wind gaps through the Rattlesnake Hills. One is Konnowac Pass which cuts about 650 feet (200 m) down into the lava ridge. How can a post-Flood catastrophe account for these water and wind gaps? Since water and wind gaps were cut after the CRBs were laid down, they point to a Flood origin for the CRBs.

Rapid, Long Distance Basalt Flows

Seventh, some flows were very likely emplaced rapidly over a distance of about 310 miles (500 km) based on the amount of cooling in the flow.¹⁹ Based on “paleothermometers” within the lava, the large Ginkgo flow cooled only 18 to 36°F (10 to 20°C) while it transversed this distance.²⁰ These cooling rates are much less than modern flows, and shows a very much greater eruption rate. It seems more likely that such a huge volume of lava and its rapid flow with little cooling is more a Flood signature and a post-Flood one.

Volcanic Winter Could Occur

As discussed in Chapter 30, the rapid emplacement of the CRBs, as demanded by a post-Flood catastrophe, would possibly result in a volcanic winter, even after taking into account the heat from the basalt flows. The cooling caused by the sulfur-rich aerosols reaching into the troposphere and sometimes the stratosphere from the numerous basalt flows would undoubtedly cause volcanic winter, also making it difficult to account for the subtropical trees associated with the CRBs (see above).

Conclusion

Based on these eight pieces of evidence, especially the well-rounded quartzite cobbles and boulders on top of the CRBs, it seems there is sufficient proof the CRBs were deposited in the Flood. Therefore, the CRBs are not evidence for a post-Flood Cenozoic.

What about the Evidence for a Post-Flood Environment? (in-depth)

The deduction that the CRBs erupted as erupting during the Flood does not mean that all features indicative of a post-Flood environment for both the CRBs and the John Day Country can be explained. Geology is more difficult. About thirteen reasons from the literature have been suggested that the CRBs erupted above the water, and, therefore, indicate it was a post-Flood environment.^{5,6,8,21} These are listed in Table 37.2. I will make brief comments on each one of them.

¹⁹ Oard, M.J., 1999. Rapid emplacement of Columbia River basalts. *Journal of Creation* 13(2):8–9.

²⁰ Ho, A.M. and Cashman, K.V., 1997. Temperature constraints on the Ginkgo flow of the Columbia River Basalt Group. *Geology* 25(5):403–406.

²¹ Northrup, B.E., 1974. Comments on the Stuart E. Nevins paper – post-Flood strata of the John Day Country, northeastern Oregon. *Creation Research Society Quarterly* 10:205–207, 228.

1) Widespread basalt layers
2) Rare pillow lavas
3) columnar structures
4) Welded ash
5) Pumice fragments within ash beds
6) Location at edge of continents
7) Interbedded sediments
8) Local laterites and paleosols, some tree-bearing
9) Terrestrial fossil in interbedded sediments
10) Poor textural sorting of ash, similar to air-fall ash
11) Rocks in conglomerate from a local source
12) Abrupt lateral variation in volcanic rock types
13) Thickness of volcanic deposits

Table 37.2. Thirteen reasons why several Flood geologists believe the CRBs were extruded above water and therefore are post-Flood.

Widespread Basalt Layers

The idea behind this argument is that underwater flows would “quench” too quickly and slow, restricting its later spread. This has been observed with present day local, small flows. However, the much larger flood basalts would be expected to travel farther and faster. We cannot use the slow flows of today to say that the huge flows in the past were just as slow, even underwater.

Rare Pillow Lavas

Pillow lavas are evidence of underwater eruption. Sometimes the pillows accompany a yellow breccia called pelagonite, caused by the disintegration of lava in water. However, the converse is not true; the lack of pillow lava does *not* eliminate an underwater eruption, since non-pillowed basalt has been observed on the bottom of the ocean.²² Whether pillows form, depends upon the extrusion rate. Slow extrusion of a flow, or a fast flow that slows, can produce pillow lavas. Huge lava extrusions and fast flows would not result in many pillow lavas. Since the CRBs were huge eruptions, not many pillow lavas would be expected. Regardless, there are well over a hundred locations of pillow lavas (Figure 37.6).

Columnar Structures

Columnar joints (cracks) are a sign of slow cooling that allows the lava to form hexagonal vertical structures from shrinkage (Figure 37.7). The cooling time of all the CRBs is a challenge for both the Flood and the post-Flood view. It is interesting that columnar joints are also observed associated with, and even between, pillow lava on Crown Point and at Multnomah Falls (personal observation), indicating that water may have been involved in cooling.

²² Cas, R.A.F. and Wright, J.V., 1987. *Volcanic Successions: Modern and Ancient*. Allen and Unwin, London, U.K., pp. 73–75, 405–407.



Figure 37.6. Pillow pelagonite complex within the Columbia River Basalts (Dennis Bokovoy provides the scale).



Figure 37.7. Multiple thin columnar structures in a series of lava flows as seen in the walls of Moses Coulee.

Welded Ash

It had been assumed that welded ash, also called welded tuff, had to have happened above water because the process requires high heat. Welded tuff has been observed in the John Day Country. However, it is now known that ash can weld underwater.²³ It very likely depends upon the extrusion rate. Underwater welding was inferred for a 100-foot (30m) thick layer of pyroclastic material within a very thick marine deposit in the Sierra Nevada Mountains of California.²⁴ A tuff that is believed to have been erupted both underwater and above the water was just as welded in the underwater section as the above water section.²⁵ Other creationists and I examined the Rattlesnake Formation welded ash in the John Day Country, which lies above the CRBs in the area, and deduced that it very likely was erupted underwater during the Flood for a number of reasons.²³ It was interesting that the upper and lower contacts were not welded and only the center welded, as would be expected if cooled from above and below under water.

Pumice Fragments within Ash Beds

Pumice floats on water and can be separated from the ash that sinks. So, pumice within ash beds seems like a good argument for above water deposition. However, nature is often more complex. Recent observations of volcanic debris on the ocean bottom near volcanic islands indicate that pumice can be deposited within the ash underwater.²⁶ Moreover, experiments simulating ash fall have shown that hot pumice cubes can sink almost immediately when dropped in water. I observed floating pumice within the Rattlesnake welded ash that was likely extruded underwater.

Location at the Edge of Continents

It is assumed that flood basalts were formed by continental breakup, and that any lava formed in the rift must have been above water.⁸ This claim is based on the *assumption* of continental breakup. It really is not evidence against the Flood extrusion of the CRBs, whether one continent broke up in the Flood or not.

Interbedded Sediments

A variety of interbedded sediment occurs between lava flows of the CRBs, but mainly along the edge. These are interpreted to be from fluvial, lake, and windy environments.⁸ However, these deductions are purely uniformitarian paleoenvironmental interpretations, which we need to question.²⁷ They do not constitute evidence against the Flood. With high sedimentation rates during the Genesis Flood, interbeds would be expected to be deposited between basalt flows. That fact that the interbeds are quite thin, usually less than 15 feet (4.5 m) thick, strongly implies the rapid emplacement of the lava during the Flood.

²³ Oard, M.J., Can welded tuffs form underwater? *Journal of Creation* 16(2):114–117.

²⁴ Kokelaar, P. and Busby, C., 1992. Subaqueous explosive eruption and welding of pyroclastic deposits. *Science* 257:196–201.

²⁵ Kokelaar, P. and Königer, S., 2000. Marine emplacement of welded ignimbrite: the Ordovician Pitts Head Tuff, North Wales. *Journal of the Geological Society, London* 157:517–531.

²⁶ Nishimura, A. *et al.*, 1991. Pliocene-Quaternary submarine pumice deposits in the Sumisu rift area, Izu-Bonin arc; in: Fisher, R.V. and Smith, G.A. (editors), *Sedimentation in Volcanic Settings*, Society for Sedimentary Geology Special Publication No. 45, Society for Sedimentary Geology, Tulsa, OK, pp. 201–208.

²⁷ Oard, M.J., 1999. Beware of paleoenvironmental deductions. *Journal of Creation* 13(2):13.

Local Laterites and Paleosols, Some Tree Bearing

The assumption of uniformitarianism seems to be behind the deductions that some interbeds are laterites (Figure 37.8) and paleosols, naturally presuming a long period of time for development. Laterites are believed to be long-weathered soils from a warm climate. There are other ways to interpret these sediments.^{28,29}



Figure 37.8. Claimed laterite interbed (arrow) between CRB lava flows.

Terrestrial Fossils within Interbeds

In light of the Genesis Flood, just because a terrestrial fossil is found within a sediment does not mean that the *environment of deposition* was terrestrial. It is expected that the Flood would inundate terrestrial environments and deposit the organisms in water. In point of fact, there are marine fossils in the CRB interbeds. Marine dinoflagellate microfossils have been found in interbeds between lavas on the Rattlesnake Hills³⁰ and in Palouse Canyon of southeast Washington.³¹ Sponge spicules, predominantly found in marine environments, have been found in the Latah Formation interbeds near Spokane, Washington.³²

²⁸ Woodmorappe, J. and Oard, M.J., 2002. Field studies in the Columbia River basalt, North-west USA. *Journal of Creation* 16(1):103–110.

²⁹ Klevberg, P., Oard, M.J., and Bandy, R., 2003. Are paleosols really ancient soils? *Creation Research Society Quarterly* 40(3):134–149.

³⁰ Coffin, Ref. 18, p. 213.

³¹ Barnett, J. and Fink, L.H., 1980. Palynology and paleoecology of a sedimentary interbed in the Yakima Basalt (Miocene), Palouse Falls, Washington. *Northwest Science* 54:259–278.

³² Hosterman, J.W., 1969. Clay deposits, Spokane County, Washington. *U.S. Geological Survey Bulletin 1270*, U.S. Government Printing Office, Washington, D.C.

Poor Textural Sorting of Ash, Similar to Air-Fall Ash

This tenth piece of evidence is just as equivocal as many of the others. During the Flood, it is expected that some volcanic eruptions would erupt from underwater and shoot above the water with the ash carried by the atmosphere. Since volcanism would be catastrophic, as demonstrated by the huge deposits in eastern Oregon,⁹ it is quite possible that the ash did not have time to sort. The amount and the rapidity of the ashes descent into the water could have truncated the sorting.

Rocks in Conglomerate from a Local Source

This objection assumes that Flood transported rocks would always be exotic (from far away). However, it has been observed in association with the surficial quartzites in the northwest states and adjacent Canada (see Chapter 24) that many local rocks were also eroded and deposited with the exotic rocks. In places in Washington and Oregon, I have noted surficial gravel (not associated with the Lake Missoula flood that also deposited gravel in the area) that more than 90% of the rocks are basalt (local) and less than 10% are quartzite (exotic). The fact that there are some exotic rocks seems more important as to the scale of the flood.

Abrupt Lateral Changes in Volcanic Rock Type and the Thickness of Lavas

The last two pieces of evidence will be discussed together, mainly because neither seems to be an argument against Flood deposition. Catastrophic volcanism during the Flood is expected to extrude thick layers of lava. The rapid change in volcanic rock types comes from the John Day Country. The CRBs, which top many of the volcanic rocks in the John Day Country, show little variation with distance. However, with multiple volcanic eruptions and volcanic centers for different types of lava, one would expect that there would be abrupt changes in volcanic rock type and thickness.