## Part III

# Sedimentary Rock Evidence

Sedimentary rocks are important for determining the location of the Flood/post-Flood boundary and the extent of post-Flood catastrophism because these rocks are the outcome of the Flood, uniformitarian processes, or post-Flood processes. So, an examination of these rocks should provide clues as to which process above is responsible for the origin of Cenozoic sedimentary rocks.

Postulated large post-Flood catastrophes are expected to lay down a significant volume of sedimentary rocks, more so than by uniformitarian processes, so some of these evidences can seem subjective. However, the magnitude of post-Flood catastrophes has not been specified, so there is nothing to compare the properties of sedimentary rocks with any post-Flood catastrophic scenarios.

Regardless in this part it is hoped that the magnitude of some sedimentary rocks for the Cenozoic, as well as the character of the sedimentary rocks, will eliminate any imagined post-Flood catastrophic scenario.

**Chapter 5**

# Huge Volume of Cenozoic Sedimentary Rocks

Erosion since the Ice Age, about 4,000 years ago, has been a slow process, with the brief exception of local events like landslides, volcanism, and glaciation, etc. Wet mountainous terrain has the highest rate of erosion, no more than10 feet (3 m) in 4,000 years.[1]

Precipitation during the Ice Age was much higher than today's average.[2] Even then, erosion probably did not exceed ten to twenty times today's rate for the several hundred years the glaciers grew. Holt calculated that the total amount of post-Flood sediments would be only one twentieth of the total non-carbonate Pleistocene marine sediments (see Figure 5.4).[3] Based on this alone, the Flood/post-Flood boundary would more likely be in the *early to mid Pleistocene*.

Some readers may object since the Pleistocene is often used as the term for the Ice age. Many creationists simply think that the "Pleistocene" data corresponds to the post-Flood Ice Age. It works for the upper part. There are many sediments and sedimentary rocks simply labeled Pleistocene, based on their microfossils. Some of these Pleistocene deposits are several thousand feet thick and have no real associations with the Ice Age or even seeming post-Flood processes. It is more likely they were deposited during the Flood

Today erosion and deposition are still very small even in high accumulation landslide areas. The largest continental landslides have been only about 25 $km^3$ in volume.[4] This would agree with uniformitarian expectations. If we assume a several hundred year period of post-Flood catastrophes, we would expect the erosion and deposition to be much greater. Dr John Whitmore of Cedarville University is convinced that post-Flood catastrophes can deposit sediments over a thousand to ten thousand or more feet deep.[5] The question still stands: can this much sediments really accumulate in hypothesized post-Flood catastrophes? If so, what characteristics would they have?

It is of course difficult to know the volume of sediments deposited by any post-Flood catastrophe when we know nothing about these events. We only know about possible processes, like mass wasting, unlithified sediments, heavier precipitation, and hypercanes.[5] In this chapter, I will mention a few examples of the vast volume of Cenozoic sedimentary rock so we can evaluate whether post-Flood catastrophes are even reasonable.

### Examples of Huge Cenozoic Sedimentary Rock Layers

Ager made the point that some pre-Cenozoic formations extend significantly farther than most geologists realize.[6] Some cover large parts of continents.[7] This further information provides evidence against the Late Paleozoic and Precambrian boundary models. The K/T boundary model was built upon Cenozoic formations having less volume.[8] However, it is not having less

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[1] Summerfield, M.A. 1991. *Global Geomorphology*, Longman Scientific & Technical, New York, NY, p. 396.

[2] Oard, M.J., 2004. *Frozen in Time:The Woolly Mammoth, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR.

[3] Holt, R.D., 1996. Evidence for a Late Cainozoic Flood/post-Flood boundary, *Journal of Creation* 10(1):139.

[4] Dade, W.B. and Huppert, H.E., 1998. Long-runout rockfalls, *Geology* 26:803.

[5] Whitmore, J., 2013. The potential for and implications of widespread post-Flood erosion and mass wasting processes; in: Horstemeyer, M. (Ed.), *Proceedings of the Seventh International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA.

[6] Ager, D.V., 1981. *The Nature of the Stratigraphic Record*, second edition. Macmillan/Wiley, Basingstoke, U.K.

[7] Morris, J.D., 2012. *The Global Flood: Unlocking Earth's Geologic History*. Institute for Creation Research, Dallas, TX.

[8] Wise, K.P., Austin, S.A., Baumgardner, J.R., Humphreys, D.R., Snelling, A.A., and Vardiman, L., 1994. Catastrophic plate tectonics: a global flood model of earth history; in: Walsh R.E. (Ed), *Proceedings of the Third*

of a volume than the Mesozoic or Paleozoic sedimentary rocks, but the absolute volume of Cenozoic strata that is a serious problem for the model.[9]

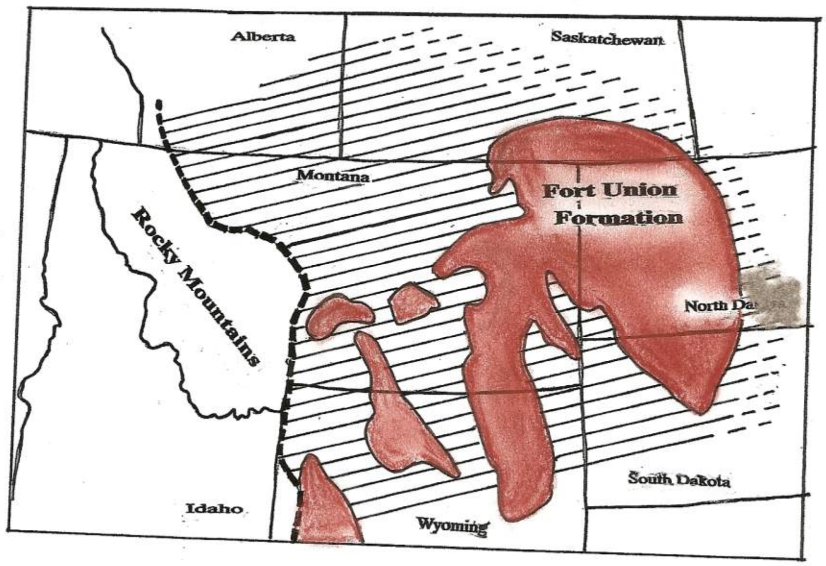


*Figure 5.1. Current extent of the Fort Union Formation (solid pattern) and the area from which uniformitarian scientists believe it was eroded (slanted pattern) (drawn by Mrs. Melanie Richard). The combined area is about 177,000 $mi^2$ (450,000 $km^2$).*

**The Fort Union Formation**

In the 2008 International Conference in Creationism, Whitmore and Garner indicated the early Cenozoic Fort Union Formation on the High Plains of the United States was post-Flood.[10] This formation outcrops over an area of about 60,000 $mi^2$ (150,000 $km^2$) in eastern Montana, western North Dakota, parts of Wyoming and South Dakota, and part of adjacent Saskatchewan, Canada (Figure 5.1, solid pattern). About 117,000 $mi^2$ (300,000 $km^2$) of it is supposed to have been eroded (for a total area before erosion of about 177,000 $mi^2$ (450,000 $km^2$) before erosion). The Cenozoic Fort Union Formation covers a vast area and is around 1,000 feet (300 m) thick in eastern Montana and western North Dakota.[11] If this is the average thickness over the entire area, as well as the eroded area, the formation had a volume of 34,000 $mi^3$ (140,000 $km^3$) before erosion.

The deposition of this formation is not the only problem for post-Flood catastrophism. There are indications of a complicated geologic history. Erosional remnants of sedimentary rocks about 1,000 feet (300 m) high can be found lying *above* the Fort Union Formation in at least western

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*International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, Pennsylvania, pp. 609–621.

[9] Oard, M.J., 2010. Is the K/T the post-Flood boundary?—part 1; introduction nd the scale of sedimentary rocks. *Journal of Creation* 24(2):95–104.

[10] Whitmore J.H. and Garner, P., 2008. Using suites of criteria to recognize pre-Flood, Flood, and post-Flood strata in the rock record with application to Wyoming (USA); in: Snelling, A.A. (Ed), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship and Institute for Creation Research, Pittsburgh, PA, and Dallas, TX, pp. 425-448.

[11] Belt, E.S., Hartman, J.H., Diemer, J.A., Kroeger, T.J., Tibert, N.E., and Curran, H.A., 2004. Unconformities and age relationships, Tongue River and older members of the Fort Union Formation (Paleocene), western Williston Basin, U.S.A., *Rocky Mountain Geology* 39(2):113–140.

North Dakota (Figure 5.2). This means 1,000 feet (300 m) or more of sedimentary rock was added to the top of the Fort Union Formation before erosion. This additional deposition covered a significant area as evidenced by Sentinel Butte's vertical cliffs. Therefore, the formation above the Fort Union Formation had to be almost totally eroded before the Fort Union Formation was extensively eroded.

*Figure 5.2. Sentinel Butte, western North Dakota, USA, a flat-topped mesa about 1,000 feet (300 m) above the Fort Union Formation. This mesa shows that at least 1,000 feet (300 m) of sedimentary rock once lay over the Fort Union Formation in this part of its area and was mostly eroded.*

Several problems occur for the post-Flood catastrophism model. First, the Fort Union Formation and other formations above need to be first deposited in the post-Flood period over a huge area. (Remember that a 1,000 feet (300 m) or more of sediments were deposited on top of the Fort Union Formation in at least eastern Montana and western North Dakota.) Most of the strata lay too far from the mountains for mountain erosion to be the source. Second, after deposition, a huge amount of erosion took out most of the sediment (the erosional implications will be developed in Chapter 21). Third, the huge volume of eroded sediments went somewhere and they are not found in the vicinity; they appear to have been swept totally off the continent. This brings up the issue of what erosional mechanism operated after the Flood to erode so much sediments and sweep them clean off the continent. How could post-Flood mass wasting accomplish this?

**The Rocky Mountain Basins and Valleys**

All of the basins and valleys in the Rocky Mountains have thick Cenozoic sedimentary rocks.

There are many examples including the Green River Formation and its equivalents which I will develop in Chapter 36. Another is the Hanna Basin in south-central Wyoming which contains the following thicknesses and ages of sedimentary rocks: (1) 4.4 miles (7 km) upper Cretaceous, about 2.5 miles (4 km) early Cenozoic (Paleocene), and about 1,600 feet (500 m) late Cenozoic.[12] In southwest Montana, the Big Hole Valley contains 15,000 feet (4,575 m) of Cenozoic sedimentary rocks. This basin is 50 miles (80 km) long by 12 miles (20 km) wide, with an average elevation of 7,000 feet (2,135 m) above sea level just east of the continental divide. The only source for the sediments in a post-Flood catastrophe model would be the surrounding mountains but once again there is no mechanism to move this much material into the basins. The only possible explanation would be Noah's Flood.

Then in a post-Flood model, there is the issue that space or volume needs to be made within the valleys to collect the sediments. This implies strong subsiding and/or horizontally extending valleys and basins took place after the Flood, before the valleys could be filled (tectonic effects will be discussed in Chapter 18).

**Twenty-Thousand Feet of Late Cenozoic Strata in Southern California Basins**

The basins of southern California commonly are deeply subsided and filled with thick sediments. The Salton Depression (also the Salton Trough) is a giant rift (crack in the crust) in Southeast California. It lies between the Transverse Range on the west and the mountains of southwest Arizona on the east and is connected to the opening of the Gulf of California.[13,14] The Salton Sea is approximately north of the depression, with the Imperial Valley being the southern extension toward the Gulf of California. The rift is filled with at least 20,000 feet (6,000 m) of *late Cenozoic* sedimentary rocks[13] from the surrounding mountains during uplift. Differential vertical tectonics resulted in landsliding with boulders of all sizes slipping into the depression from the east flank of the Transverse Range, such as seen at Split Mountain Gorge (Figure 5.3).[15,16] Some small volcanic eruptions contributed to the fill. Occasionally, entire slabs of granite from the Transverse Range slid into the depression.[14]

Other California basins also contain very thick late Cenozoic strata. The Los Angeles, California, basin subsided in the late Cenozoic collecting about 20,000 feet (6,000 m) of sediment, now sedimentary rock, before it uplifted during the past 4 million years in the uniformitarian timescale.[17] The Santa Clara Valley, northwest of Los Angeles, California, too contains about 20,000 feet (6,000 m) of late Cenozoic strata that has been uplifted along the edges, deformed, and the top eroded off.[18] The Maricopa sub basin in the southern San Joaquin Basin has more than 22,000 feet (6.7 km) of late Cenozoic sedimentary rocks according to drill holes.[19]

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[12] Grimaldi, D.A., Lillegraven, J.A., Wampler, T.W., Bookwalter, D., and Shedrinsky, A., 2000. Amber from upper Cretaceous through Paleocene strata of the Hanna Basin, Wyoming, with evidence for source and taphonomy of fossil resins. *Rocky Mountain Geology* 35(2), p. 165.

[13] Elders, W.A., R.W. Rex, T. Meidav, P.T. Robinson, and S. Biehler, Crustal spreading in Southern California, *Science* **178**:15-24, 1972.

[14] Dorsey, R. and A. Martín-Barajas, Sedimentation and deformation in a Pliocene-Pleistocene transtensional supradetachment basin, Laguna Salada, north-west Mexico, *Basin Research* **11**:205-221, 1999.

[15] Woodard, G.D., Redefinition of Cenozoic stratigraphic column in Slit Mountain Gorge, Imperial Valley, California, *American Association of Petroleum Geologists Bulletin* **58**:521-539, 1974.

[16] Oskin, M. and J. Stock, Marine incursion synchronous with plate-boundary localization in the Gulf of California, *Geology* **31**:23-26, 2003.

[17] Ingersoll, R.V. and Rumelhart, P.E., 1999. Three-stage evolution of the Los Angeles basin, southern California, *Geology* 27(7):593–596.

[18] Sharp, R.P., 1975. *Southern California*, Kendal/Hunt Publishing Company, Dubuque, IA, p. 13.

[19] Saleeby, J., Saleeby, Z, Nadin, E., and Maheo, G., 2009. Step-over in the structure controlling the regional west tilt of the Sierrea Nevada microplate: eastern escarpment system to Kern Canyon system, *International Geology Review* 51(7–8):634–669.

*Figure 5.3. Wall of Split Mountain Gorge, southeast California, showing landsliding debris that slid from the west off the Transverse Range.*

In a post-Flood model, all of the thick late Cenozoic strata had to erode from the surrounding mountains of the region. What would cause the mountains to uplift, then subside, forming the basins, eroding the mountain's rock en mass and, transporting the sediments into the basins?

The K/T Boundary Model requires a huge amount of differential vertical tectonics to take place after the Flood The mountains had to be uplifted and the basins sunk *tens of thousands of feet*. It also requires water deposition considering the character of the sedimentary rocks. Water too, has to be the erosive mechanism, implying that the erosion of the rising mountains and subsiding basins occurred *underwater*. This seems too much to ask of a post-Flood catastrophe. The tectonic activity sounds more like Psalm 104:8 in which the mountains rose and the valleys sank down draining the Floodwater.

**The Incredible South Caspian Basin**

And if that is not enough, the most remarkable Cenozoic depositional event in the world was in the Caspian Sea area. The southern Caspian Sea basin is a deep sedimentary basin that is somewhat circular with a diameter of roughly 250 miles (400 km),[20] or more accurately, 220 miles (350 km) by 345 miles (550 km).[21] It is filled with sedimentary rocks measuring up to 18 miles (28 km) thick![22] Seismic profiling shows that the sedimentary layers are generally horizontal, and interbedded with volcanic rocks.[21] The basin is surrounded by uplifts;[23] the

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[20] Artyushkov, E.V., 2007. Formation of the superdeep South Caspian basin: subsidence driven by phase change in continental crust. *Russian Geology and Geophysics* **48**:1,002–1,014.
[21] Nadirov, R.S., Bagirov, E., Tagiyev, M., and Lerche, I., 1997. Flexural plate subsidence, sedimentation rates, and structural development of the super-deep South Caspian Basin, *Marine and Petroleum Geology* **14**:383–400.
[22] Knapp, C.C., Knapp, J.H., and Connor, J.A., 2004. Crustal-scale structure of the South Caspian Basin revealed by deep seismic reflection profiling, *Marine and Petroleum Geology* **21**:1,073–1,081.
[23] Richardson, S.E.J., Davies, R.J., Allen, M.B., and Grand, S.F., 2011. Structure and evolution of mass transport deposits in the South Caspian Basin, Azerbaijan, *Basin Research* **23**:702–719.

Alborz Mountains in Iran wrap around the southern end of the basin and are believed to have risen about 6 miles (10 km) as the South Caspian Basin subsided.[24] The Greater Caucasus Mountains to the west also rapidly uplifted when the basin subsided.[25] Needless to say, this presents a significant challenge to uniformitarian geologists as well as the K/T Boundary Model:

> The Caspian Sea basins of Central Eurasia constitute one of the major petroleum provinces of the world (Devlin et al., 1999), and one of the most enigmatic basin systems worldwide.[25]

Most of the basin fill is Cenozoic; possibly some of the lowest strata are Cretaceous.[26] The top 6 miles (10 km) are thought to be Pliocene and Quaternary, the very late Cenozoic![20,27] Those who think the Flood ended at the K/T boundary are faced with the necessity of explaining the uplift and deposition of 18 miles (28 km) of basin fill sediments! To complicate matters, the sediments are not simply from landslides, as would be expected as the major processes believed to be acting after the Flood.[5] The horizontal bedding precludes that explanation. Instead, rapid subaqueous deposition is required. Again, this strongly suggests the Flood extended into the very late Cenozoic, at least in this region.

### Thick Cenozoic Sedimentary Rocks all over the World

Thick Cenozoic sedimentary rocks are found all over the world and would extend this chapter to book length to describe them. A sampling includes, late Cenozoic sedimentary rocks that are 20,000 to 26,000 feet (6,000 to 8,000 m) thick in the basins surrounding the Himalaya Mountains.[28]

The Tiburon Basin in the northern Gulf of California that contains about 20,000 feet (6 km) of Late Cenozoic sedimentary rocks.[29] The Alboran Basin in the western Mediterranean Sea that has greater than 32,800 feet (10 km) of Late Cenozoic sedimentary rocks.[30] Late Cenozoic sedimentary rocks are up to 29,500 feet (9,000 m) thick in northern Hawke's Bay, New Zealand.[31]

## Cenozoic Sedimentary Rocks—Thickest of Any Geological Period

From the above examples, readers may suspect that the total amount of Cenozoic sedimentary rocks from around the world would be substantial. The Tertiary period, which is includes most of the Cenozoic, has the *largest* volume of sedimentary rocks, greater than any of the other nine periods of geological time since the Precambrian (Figure 5.4).[32] Only the Cretaceous period comes close. The Precambrian contains only 25% of the sedimentary rocks of the world (Holt, personal communication). Figure 5.4 shows that the Cenozoic contains 25% of the total sedimentary rocks since the Cambrian, and 20% of all sedimentary rocks in the world, including the Precambrian. If the average thickness of sedimentary rocks on the continents is 6,000 feet (1,830 m), the Cenozoic represents an average of 1,200 feet (365 m) over three-

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[24] Axen, G.J., Lam, P.S., Grove, M., and Stockli, D.F., 2001. Exhumation of the west-central Alborz Mountains, Iran, Caspian subsidence, and collision-related tectonics. *Geology* **29**:559–562.
[25] Knapp *et al.*, Ref. 22, p. 1,073.
[26] Artyushkov, Ref. 20, p. 1,005.
[27] Richardson *et al.*, Ref. 23, p. 704.
[28] Critelli, S. and Garzanti, E., 1994. Provenance of the lower Tertiary Murree redbeds (Hazara – Kashmir syntaxis, Pakistan) and initial rising of the Himalayas, *Sedimentary Geology* 89:265-284.
[29] Mar-Hernández, E., Gonzálex-Escobar, M., and Martin-Barajas, A., 2012. Tectonic framework of Tiburon Basin, Gulf of California, from seismic reflection evidence, *International Geology Review* 54(11):1,271–1,283.
[30] Gutscher, M.-A., Dominguez, S., Westbrook, G.K., Le Roy, P., Rosas, F., Duarte, J.C., Terrinha, P., Miranda, J.M., Grainorge, D., Gailler, A., Sallares, V., and Bartolome, 2012. The Gibraltar subduction: a decade of new geophysical data, *Tectonophysics* 574-575:72–91.
[31] Hilgen, F.J., Lourens, L.J., and Van Dam, J.A., 2012. The Neogene Period; in: Gradstein, F.M., Ogg, J.G., Schmitz, M., and Ogg, G., *The Geological Time Scale 2012*, volume 2, Elsevier, New York, NY, p. 937.
[32] Holt, Ref. 3, p. 131.

quarters of the continents, where sedimentary rocks actually outcrop (igneous and metamorphic rocks are found at the surface over the other 25% of the continents). We are to believe all this Cenozoic strata can be explained by post-Flood catastrophes, which have yet to be specified?

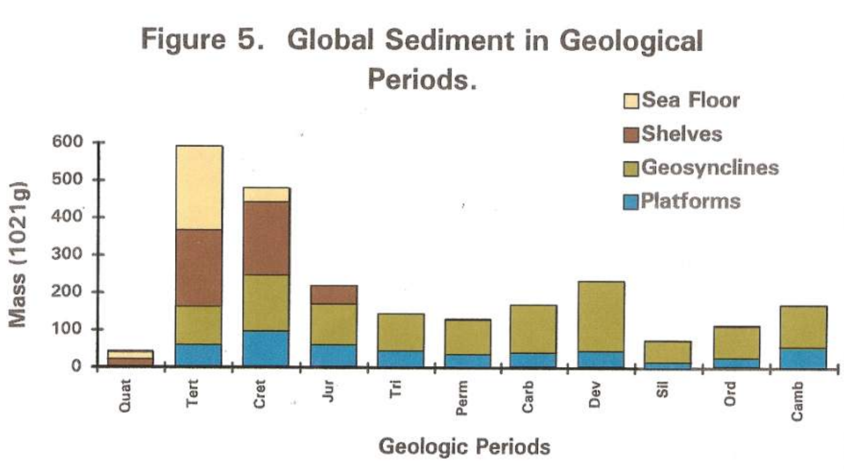


*Figure 5.4. Global distribution of sedimentary rocks by periods since the Precambrian (courtesy of Roy Holt).*

I have only considered the deposition of thick and/or widespread Cenozoic sediments. A post-Flood catastrophe model has other problems, such as shown with the Fort Union Formation. It must provide a mechanism for (1) the generation of sediment from these catastrophes; (2) transport of the sediment, probably from long distances; (3) erode the sediments after deposition; and (4) transport the newly eroded sediments into mountain or coastal basins or clean off of the continent, since they are not found nearby. Uniformitarianism is hopelessly inadequate as an explanation. Such uplift, erosion, and deposition can easily be accommodated within the global scale of the Genesis Flood.

So far we have mainly discussed bulk sedimentation. Now we will examine the character of these sediments which have since become rock to see if regional, continental, or even global post-Flood catastrophes could possibly account for their features. So, we will move onto our second sedimentary criterion.