Flood processes into the late Cenozoic: part 3—organic evidence

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It is important in any Flood model to locate the Flood/post-Flood boundary, which will help determine which catastrophic events occurred late in the Flood and which happened after the Flood. The proper location will also determine the amount of post-Flood differentiation of animals after the Flood. Seven general features of the Tertiary organic record are summarized, showing that they are unlikely to be accounted for by post-Flood catastrophism. These evidences are thick, pure coal seams; amber; oil and natural gas; micro-organism skeletons that can be thick and pure; the lack of mammals that died in the Flood while many millions supposedly died and were fossilized after the Flood; the existence of mammal graveyards; and the Tertiary 'order' of mammals. Although there are challenges, the Flood offers a much better paradigm for explaining these Tertiary organic mysteries.

Some creation scientists are attempting to develop a sophisticated Flood model. In this model, it is important to get the lower and upper boundaries correct. As a first estimation, it is good to deduce a general boundary by assuming the geological column. The exact placement in the geological column can be refined later. Determining the boundary also affects the amount of animal differentiation that must be explained after the Flood within the Genesis kinds, as well as settling controversies on biostratigraphy. Knowing the amount of post-Flood catastrophism will give us some idea of the environment in which both people and animals repopulated the earth at God's command.

A previous paper summarized seven general features of the Cenozoic sedimentary rocks that are best explained by the Flood and not by post-Flood catastrophism.[1] This paper gives an overview of seven general features of the Tertiary organic record that suggest a similar conclusion. These are thick, pure coal seams; amber; oil and natural gas; micro-organism skeletal layers; and the characteristics of Cenozoic mammal fossils, in particular the lack of mammals in the Mesozoic, mammal bonebeds, and the order of the Tertiary fossil mammal order (table 1).

Tertiary coal

It is estimated that between 12.3% and 28.7% of coal resources are Tertiary in age.[2] Many early Tertiary coal deposits are very thick and extensive, such as those in the Powder River Basin of north-east Wyoming and south-east Montana (figure 1). Some of these coal seams are nearly pure and extend about 100 km north-to-south, 25 km east-to-west, and range up to 75 m thick in the Powder River Basin.[3] Late Tertiary coal beds are found in several areas of the world, e.g. a late Miocene coal with polystrate trees in Hungary,[4] and the Miocene Latrobe coal in south-east Australia that is 100 m thick and covers about 565 km^2.[5]

Can post-Flood catastrophism account for Tertiary coal? It is plausible that trees and plants left on the surface after Flood water drainage could be mobilized and buried or swept into a large lake to possible form coal. It would take an enormous number of trees and plants and a method to *concentrate* them during burial to form a substantial thickness of coal over a large area. Mass wasting would tend to mix trees and plants with sediments, so that a thick, widespread, pure coal seam would be implausible. Then there is the problem of burial and re-exposure of thousands of metres of sediment, since it takes deep burial to form coal.

Otherwise, the plants must first grow, which based on the diameter of some logs in coal could take hundreds of years. Petrified tree stumps with diameters up to 2 m occur in a coalmine of early Cenozoic age in Alaska.[6] Vertical petrified trees up to about 2.5 m in diameter occur in the

Table 1. Summary of Cenozoic organic evidences best explained by Flood processes. The strength is based on the comparative likelihood of the Flood over possible post-Flood explanations.

Organic Evidences	Strength
1. Coal	strong
2. Amber	strong
3. Oil and natural gas	strong
4. Large, pure micro-organism skeletal layers	moderate
5. Lack of mammals buried in the Flood but millions afterwards	strong
6. Mammal bonebeds	weak
7. Fossil order and massive, numerous extinctions	moderate

Figure 1. The Wyodak coal seam in the north-east Powder River Basin, just east of Gilette, Wyoming, USA

early Cenozoic Absaroka Volcanics of Yellowstone Park, Wyoming (figure 2). Second, the plants must be uprooted and concentrated in one very thick, widespread, accumulation with very little sediment—a problem since mass wasting mixes material. Third, the material must be buried several thousand metres, since the temperature must be raised to around 200°C to form coal. Where is the burial sediment going to come from in a timeframe sufficient to form the coal? This is a major uniformitarian problem, which post-Flood models must also account for. Fourth, the overburden must later be eroded to expose the coal at or near the surface, which requires powerful post-Flood erosional mechanisms, often at high altitudes. The conditions a post-Flood model has to satisfy closely resemble the conditions present only during the Flood. Therefore, coal measures into the late Cenozoic are much better explained by Flood processes than post-Flood catastrophism.

Amber formed in the Flood

Amber is a hard, brittle fossil resin or pitch that is derived mostly from coniferous trees. It is usually yellow to brown in colour and is translucent or transparent. Amber is commonly associated with coal, found in marine sedimentary rocks, and needs water to form but cannot be oxidized.[7] Many types of organisms are preserved in amber, which are as diverse as diatoms, radiolarians, sponge spicules, bits of coral, foraminifera, and a spine of a larval echinoderm.[8,9] Even *marine* organisms are found in Cretaceous amber,[10] This observation is puzzling to uniformitarian scientists: "The presence of marine organisms in tree resin, however, seems highly unlikely".[11]

Amber is found at hundreds of sites worldwide and can be as old as the upper Paleozoic,[12] though most of it is found from the Cretaceous into the Miocene within the uniformitarian geological timescale.[13] The youngest amber from the Miocene is found in the Dominican Republic,[14] the western Amazon basin,[15] New Zealand, and Australia.[16] Early Cenozoic Baltic amber is probably the most well-known.[15] It is found in Poland, Russia, Germany, Lithuania, Latvia, Estonia, Denmark, Sweden, Great Britain, and Holland. Ninety percent of Baltic amber is found in a thin 32–40 km long layer on a peninsula in the Baltic Sea. Storms expose the amber in sea cliffs by eroding the Tertiary sedimentary rocks that contain the amber, and redistribute the amber on the beach. Mining operations began in the 1800s when the amber layer was discovered. The quantity mined so far is staggering: half a million kilograms. The size of the Baltic amber deposits raises the question of how so much resin could be secreted in one relatively small area—a challenge for any model.

Given these mysterious observations, it is not surprising that uniformitarian scientists cannot explain the origin of amber.[13,15,17] Martinez-Declòs and others ask: "How is amber transported from the producing tree to the sediment in which it is preserved?"[18]

Several of the properties of amber make a post-Flood catastrophic scenario unlikely. How can amber, which forms from trees, end up buried in marine sediments in a non-oxidizing environment, and be commonly associated with coal? The only possibility seems to be a lake environment with floating logs, such as observed at Spirit Lake, Mount St Helens, but on a much larger scale. In this scenario, there are additional problems of accounting for all the floating logs from trees that are not living today,[16] and the production of a prodigious amount of amber, sometimes containing

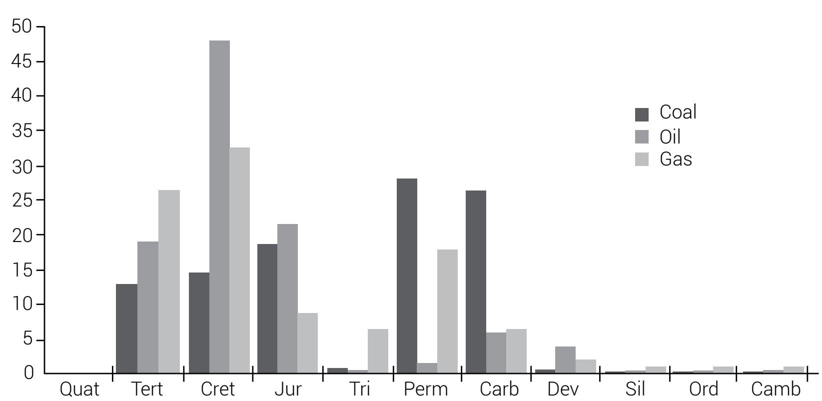

Figure 2. 2.5 m diameter vertical petrified tree at the top of Specimen Ridge, Yellowstone National Park, WY (Madison Gilmore provides scale)

organisms. The amber must still end up in a marine, non-oxidizing environment.

Logs mats floating in the Flood water potentially can account for the amber and the organisms in amber.[7] Billions of logs would likely have been floating on the Flood water and coalescing into mats after being uprooted during the onset of the Flood. These logs would be damaged by violent contact with other logs or rocks. Lambert and Poinar stated: "Numerous genera of plants all over the globe spontaneously *or as the result of trauma* produce sticky substances that have been termed resins [emphasis added]."[19] Trauma in today's environment can be caused by storm damage, fires, and outbreaks of wood-boring insects.[20] The greater trauma of Flood-induced damage would result in abundant resin exuded from the floating logs.

Since a large amount of amber comes from the Tertiary, even from the late Tertiary, amber seems best explained by the Flood and not by post-Flood catastrophism. Amber is a strong indication that the Flood/post-Flood boundary is in the very late Cenozoic, at least in those areas that contain the Miocene amber.

Oil and natural gas

Fossil fuels include coal, oil, and natural gas. They are the altered remains of buried marine and terrestrial organisms. Oil and natural gas represent only about 10% of the total carbon content in all fossil fuels; coal contains the largest amount of carbon by far. Oil is believed to form when burial temperatures of organic matter are raised to about 60–175°C, while natural gas probably forms between temperatures of 175 and 315°C.

Figure 3 shows the source rock for fossil fuels by period. Despite figure 3 being an estimate that could change with more exploration, it remains useful for this analysis. Figure 3 shows that there are no significant fossil fuels sourced from Quaternary rocks, which is mostly considered post-Flood, while substantial amounts are sourced from Tertiary and late Mesozoic rocks. It is estimated that between 15.2% and 19% of crude oil comes from Tertiary source rocks.[21]

An example of the great amount of oil from Cenozoic (Tertiary) sedimentary rock comes from the Green River Formation of Utah, Wyoming, and Colorado.[22] This formation is thought to have been deposited in a post-Flood lake by some creation scientists, and there is some evidence supporting this position, but there are several other features that point to a Flood origin. For example, it contains a huge amount of oil within the shale. It is estimated that there are 1.2 to 1.8 trillion barrels of oil, only 800 billion considered recoverable, in the Green River Formation. The recoverable oil is three times the proven oil reserves of Saudi Arabia and can supply the oil needs of the United States for 100 years.[23] Other Cenozoic sources of oil include the Orinoco oil belt of northern Venezuela and the Pear Springs, Asphalt Ridge, Hill Creek, and Sunnyside deposits in Utah.[24]

The vast quantity of fossil fuels, along with the hundreds of billions of fossils, argues for the burial of a huge amount of organisms in a large catastrophe, such as the Genesis Flood. It could be possible that local or regional mass wasting catastrophes could bury enough organisms to produce small quantities of oil and natural gas, but could they produce the amount of oil and gas generated in the Tertiary? It is possible that oil and natural gas could be abiogenic or partly abiogenic, but this is uncertain for many reasons.[25,26]

It would be difficult to account for the oil and natural gas that developed just in the Tertiary by postulated local to regional post-Flood catastrophes. This would especially be the case if oil is mostly produced from the remains of marine algae, as many petroleum geologists believe, because mass wasting would have to have occurred in the oceans or been carried into the oceans from the land. The burial of the tremendous amount of organic material to form the oil and natural gas in the Tertiary would require a very large cataclysm, consistent with the Flood but not with postulated post-Flood catastrophes. Holt summarizes the argument well:

"If one ignores the organic content of sediments, except for fossil fuels, placing the Flood/post-Flood other than late in the Cainozoic [Cenozoic] still creates severe difficulties for post-Flood

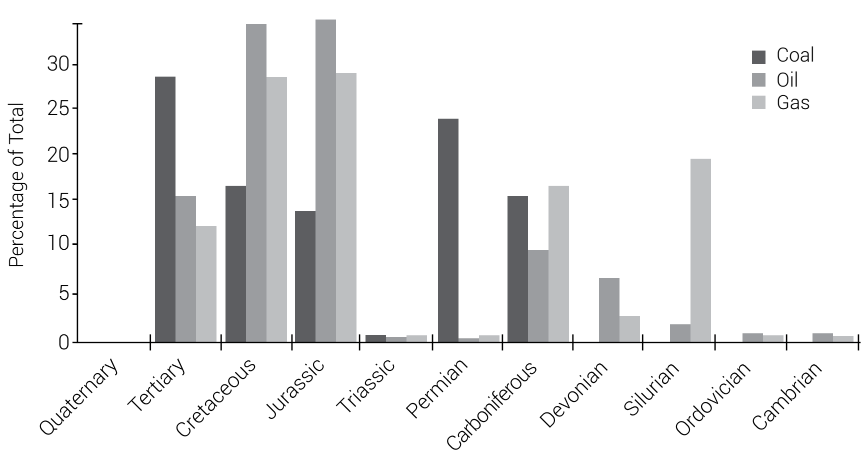

Figure 3. Distribution of coal, oil, and gas source rocks (from Holt[2] redrawn by Mrs Melanie Richard)

organic carbon accumulation and deposition. … Placement of the boundary at or near the end of the Mesozoic would require post-Flood time to be more productive than the Flood at producing heavy oil and tar sands. Any placement of the boundary other than late in the Cainozoic requires post-flood catastrophes and floods of enormous proportions."[27]

Micro-organism skeletal layers difficult to accumulate post-Flood

Extensive, thick layers of micro-organism skeletons are found in sedimentary rocks. The micro-organisms include the calcium carbonate skeletons of coccolithophores called coccoliths and the silica skeletons of diatoms. The former deposit is called chalk and the latter is diatomite or diatomaceous earth. These deposits are difficult for both uniformitarian scientists and Flood geologists to explain, but it seems like they would be even more difficult to explain by post-Flood mass wasting. Since chalk is usually dated as Cretaceous, below the K/T boundary, I will not discuss it. However, nearly pure diatomite is found in the Tertiary.

Diatoms are unicellular algae, lacking flagella, and have a skeleton of silicon dioxide (silica).[28] Living diatoms are ubiquitous, inhabiting the oceans and a wide range of freshwater habitats in abundance. Diatoms require light and so live in the upper part of water bodies. As they die and sink to the bottom, their skeletons pile up and the resulting deposit is called diatomite. Today, they mostly collect on the sea bottom below surface water that is cool, where they mix with a lot of other sediments that dilute the purity of the diatom deposit. The skeletons are also subject to dissolution in deep water.

One of the most significant Tertiary deposits of diatomite is the Miocene (early in the late Tertiary) deposit in the Monterey Formation in west-central California that has diatomite units up to 1,000 m thick.[29] Another layer is about 80 m thick in Peru within the Pisco Formation that is 200 to 1,000 m thick and dated as Miocene and Pliocene (late Tertiary).[30]

Just like with chalk, diatomite shows features that it was deposited rapidly. Whereas present ocean deposits are diluted with other sediments, those in the geological record are exceedingly pure, and therefore can be used in industrial processes.[31] Furthermore, there are also large fossils in diatomite that reinforce the conclusion that the deposits were buried rapidly. For instance, whales up to 25 m long are found in the diatomite of the Monterey Formation.[32] Creation scientists from the Geoscience Research Institute, Loma Linda University, California, found 346 whale skeletons in the Pisco Formation.[30,33] These whales were so well preserved that even some soft tissues was found. Just like with large organisms found in chalk, these well-preserved large vertebrates imply rapid burial because such large animals could not be preserved in the slow rain of diatoms to the ocean bottom observed today.

The uniformitarian model of slow accumulation of diatomite over millions of years has major problems. Huge blooms within the Flood potentially could account for them, although specific details need to be researched, similar to how Cretaceous chalk could have formed.[34] Can diatomaceous beds be explained by post-Flood catastrophism, such huge mass-wasting events? Not knowing of any specific models for these post-Flood catastrophes limits comment on them. It seems like it would be difficult to account for *pure*, *thick* Tertiary deposits of micro-organism skeletons after the Flood by heavy precipitation events and mass wasting.

Unique Cenozoic mammal fossil characteristics

Flood processes seem much better able to explain several aspects of Tertiary mammal fossilization than post-Flood mass wasting. For instance, if the Tertiary was post-Flood, then there would be a huge lack of Flood mammals, since there is a lack of fossilized mammals from the Mesozoic. Then there is the problem of how Cenozoic mammal graveyards would form. How would mass wasting concentrate mammals into thin layers? And finally, how can the Cenozoic mammal burial order be explained (if accepted by those who believe in post-Flood catastrophism)?

Where are all the Flood mammals?

Mammal fossils are almost exclusively found in the Cenozoic. There have been some mammals recently discovered in the Mesozoic,[35] and they are not the shrew-like mammals but ones with special features such as hooves and adaptions to digging, swimming, and burrowing.[35,36] These instances are still a very small number compared to those in Tertiary deposits.

If the Tertiary is a product of post-Flood mass wasting, where are the pre-Flood mammals that died and were buried in the Flood? The lack of mammals is unlikely in the Flood that buried all land creatures that breathed air. Why would the global catastrophe of the Flood bury very few mammals, while post-Flood catastrophes buried tens of millions?

If the Tertiary is post-Flood, the Tertiary mammal fossils found in the rocks would be a result of mammals spreading across the earth after leaving the Ark. The mammals would have to multiply dramatically and migrate globally, which would probably take at least a few hundred years. Then, they would have to be overwhelmed, buried, and fossilized in gigantic post-Flood mass wasting events. This would also have to occur largely *before* the Ice Age, which is unlikely since all the conditions for the Ice Age to start were in place right after the Flood. Considering all the thick layers of Tertiary strata plus the erosion of the top of the strata, there must have been countless post-Flood catastrophes of regional scale.

How do mammal graveyards form after the Flood?

One would expect that in post-Flood catastrophes many mammals would be buried, but it seems unlikely that mammals would be concentrated into large graveyards such as those observed in Tertiary deposits. A recent book on bonebeds in sedimentary rock lists 25% of them in Tertiary strata.[37]

The Tertiary graveyard with the most concentrated mammals is likely that at Agate Springs in western Nebraska, USA. It is now Agate Fossil Beds National Monument and contains a wide variety of extinct Miocene mammals, mostly concentrated within layers in University and Carnegie Hills. Figure 4 shows a sample of the concentrated bones. There are supposed to be over 9,000 animals entombed here.

It would probably not be difficult to concentrate a *small* number of mammals into one graveyard during post-Flood catastrophes. However the Flood would better explain a large number at one location, such as those concentrated at Agate Springs.

How would the Tertiary order of mammals be explained?

According to the uniformitarian geological column, the Tertiary has a certain order of mammals that supposedly evolved and went extinct. The following arguments can also be made with other organisms in the Tertiary, but the discussion will focus on mammals. Those who believe the Tertiary represents a series of post-Flood catastrophes seem to believe this mammal fossil order.[38] So, this 'fossil order'

Figure 4. Mammal graveyard depiction at Agate Fossil Beds National Monument Visitors Center, western Nebraska, USA

must be explained during post-Flood catastrophism. It could be explained by how fast mammals multiplied and spread all over the world. Those that were fast would end up in the early Tertiary fossil record, while those that were slow would end up in the late Tertiary fossil record. Or there could have been a systematic change in climate that favoured certain mammals instead of others (see below). Regardless, in order to maintain the fossil order, mammals must go extinct in a certain order. How could so many different types of mammals go extinct over the *entire* earth throughout the Tertiary? Surely post-Flood catastrophes would not wipe out one particular mammal everywhere across the earth at the *same time*. For instance, why did the titanotheres, those rhinoceros-like beasts with strange horns, all go extinct in the late Eocene?[39]

It is claimed that the early Cenozoic was wet and warm, favouring certain types of mammals. Then the climate became cooler and drier in the late Cenozoic, causing the extinction of the early Cenozoic mammals and favouring other types of mammals that now show up in the strata of the late Cenozoic.[38] Wise and Richardson state:

> "Many of these animals would become extinct by the catastrophic and changing environments after the Flood, but many others would survive for a time—long enough to produce new generations of different organisms [within their kinds]."[40]

It is further claimed that the wet early Tertiary favoured those animals with a browsing diet, and the drier late Tertiary favoured those that ate grass.[41] That is why horses found in the Tertiary supposedly evolved longer teeth and legs with the earlier ones unable to survive and hence going extinct. The above scenario is simplistic from a climatic and environmental point of view, assuming post-Flood catastrophism, because it would be a generalization with many exceptions. In a wet, warm post-Flood climate, there would always be dry, cool areas and in a dry, cool climate, there would be warm, wet areas. So, one would expect that in the above climates very few mammals would be systematically wiped out globally. Janis *et al.* state in respect to supposed horse evolution, still used to date sedimentary layers:

> "The story of evolutionary progression to the present-day genus *Equus* also overlooks the fact that, in addition to the mid Miocene radiation [spreading out] of the hypsodont Equinae [horses with long teeth], there was also a radiation of more specialized horses within the subfamily Anchitheriinae. These equids were obviously committed browsers (very low-crowned cheek teeth), with stocky limb proportions suggestive of a preference for closed habitats such as woodland (parentheses theirs)."[42]

So, you can see that there were browsers even during the dry late Tertiary.

Those who believe in post-Flood catastrophism must explain with a realistic mechanism the order of extinctions of a large number of different mammals in the Tertiary fossil record, all going extinct within several hundred years after the Flood.

Conclusions

Explaining the scope, provenance, and history of organic deposits in the Cenozoic with respect to the Flood has been a source of much controversy in the creationist literature. Different parties have suggested different factors are more important than others in determining where the post-Flood boundary should be located. This paper summarized seven features of the Tertiary organic material record that are better explained by Flood processes than post-Flood processes, such as heavy precipitation and mass wasting. Tertiary coal deposits, comparable in scope to other coal deposits unequivocally from the Flood, imply a history of burial by thousands of metres of sediment, heating to about 200°C, and erosion of the thousands of metres of sediment—the scale and history clearly fit a Flood explanation better than post-Flood catastrophism. The formation of amber is a unique process that uniquely fits Flood processes. The large quantities of oil and gas that originate in Cenozoic sediments provide a similar problem for post-Flood catastrophism to explain as with Tertiary coal. Thick, pure micro-organism skeletons have accumulated in the Cenozoic, which does not seem plausible in a scenario invoking heavy precipitation and mass wasting.

There are three mammal conundrums if the Tertiary were post-Flood. First, hardly any mammals would have died in the Flood while many millions were overwhelmed, buried, and fossilized *after* the Flood. Second, mammal graveyards found in thin Tertiary layers are also difficult to explain. And third, the evolutionary order of the mammals must be accounted for by post-Flood catastrophes.

These factors favour a Flood mechanism for Tertiary organic remains, and Tertiary sedimentary rocks.

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