An impact Flood submodel—dealing with issues

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I am developing an impact submodel for the beginning of the Flood. Previously, I estimated the number of impacts that struck the earth during biblical earth history. Another major issue is the time correlation of the impacts with the beginning of the Flood. Impacts testify strongly against uniformitarianism and were not widely accepted as a widespread phenomenon until the 1960s. Moreover, practically all inner solar system impacts occurred in one event identified in the uniformitarian scheme as the Late Heavy Bombardment, which can be telescoped into the time of the Flood. However, the impact model is still in its infancy, and a number of important objections have been raised against it. There is much detail yet to be worked out in the model, but there are some helpful lines of reasoning that may provide some solutions, and there are suggestions from the evidence that provide fruitful avenues for future investigation.

I am developing a model for the Flood, which has been discussed and debated in the review of a proposed movie on the Flood.[1] The Flood model is divided into two submodels. The first is the impact submodel, which initiates the Flood and is responsible for early Flood tectonics, sediment generation, and sediment deposition during the Inundatory Stage of the first 150 days.[2] The second is the differential vertical tectonics submodel that results in the mountains and continents rising out of the floodwater while the ocean basins and valleys subside (Psalm 104:6–9 NASB). This causes the floodwater to drain during the Recessive Stage of the Flood. Together, the model can be called the impact vertical tectonics (IVT) model.

In the impact submodel, at least 36,000 impact craters greater than 30 km in diameter were produced in Earth history.[3] This estimate was based on the impacts on the moon transformed to the earth. The impactors could have been either asteroids or cometary material, or something in between. For sake of simplicity, I will assume they were asteroids. At this point, the type of impactor really does not matter, since craters on these bodies are related to the kinetic energy, besides the angle of approach and the geological properties of the planet or moon. Neither do we know the velocity or size of the asteroids. The values used in the literature, and which I will use for sake of argument, are based on the assumption that the asteroids originated from the asteroid belt, which, as shown below, is unlikely. What we can reasonably estimate is the kinetic energy, based on the properties of the craters, and the kinetic energy is related to the mass and the velocity.

I also made the case that it was unlikely that these impacts could have occurred before the Flood or afterwards, but most likely occurred during the year of the Flood. The Flood would have destroyed most of the typical evidence we should expect with an impact, such as impact craters, melt sheets, and ejected debris. For instance, we should not expect to find any pristine craters or shocked quartz because of all the erosion and turbulence. Subtle, tell-tale signs should still exist, however. After the bombardment, the earth would be variably out of isostatic equilibrium as a result of the excavation of variable thicknesses of the crust. The material blasted away as impact debris would become sediment for sedimentary rocks, which accumulated in variable thicknesses. Those impacts striking the pre-Flood ocean would blast water upward that would be the source for the 40 days and nights of rain. In restoring isostatic equilibrium, differential vertical tectonics occurred after Day 150 during the Recessive Stage. A large number of geomorphological surface features attest to this differential vertical tectonics and the formation of unique landforms by Flood runoff.[4] Despite many hypotheses, the origin of most of these landforms remains a mystery within the uniformitarian paradigm.

Evidence for the model's initial condition

The initial condition for the Flood submodel of numerous impacts early in the Flood is not speculative compared to other Flood models, because the evidence for all these impacts is *clearly* seen on all the solid bodies of the solar system:

> "Impact craters characterize the surfaces of most solid bodies in the solar system and constitute landforms on many planets and moons. Impact craters are also present on small bodies like the asteroids… ."[5]

Mercury, the highlands of Mars, and the moon have a similar crater size frequency distribution (figures 1–3).[6] The same group of impactors likely also affected the outer solar system: e.g. there are over 800 impact craters on Uranus's moon, Miranda. Mercury, Mars and the moon (and their orbits) represent extremely tiny points and arcs

within the inner solar system. Since these bodies have a similar size frequency distribution of craters, it is likely the *whole* inner solar system passed through the same uniform cloud of impactors, which, by interpolating between bodies, implies many trillions of impactors.

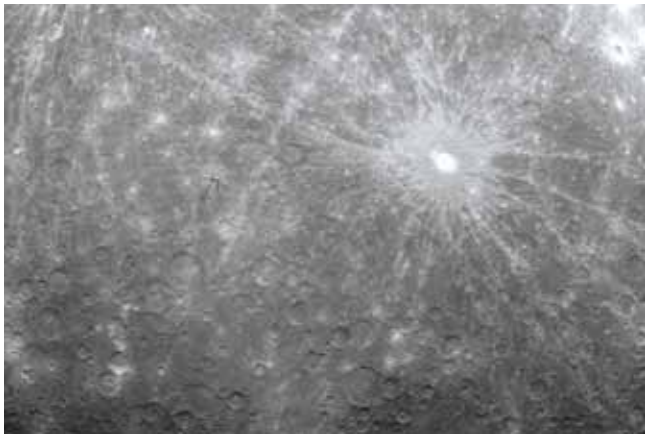

Photo courtesy of NASA

Figure 1. New equator-to-pole image of Mercury.

Photo courtesy of NASA

Figure 2. Map of Mars showing abundant craters.

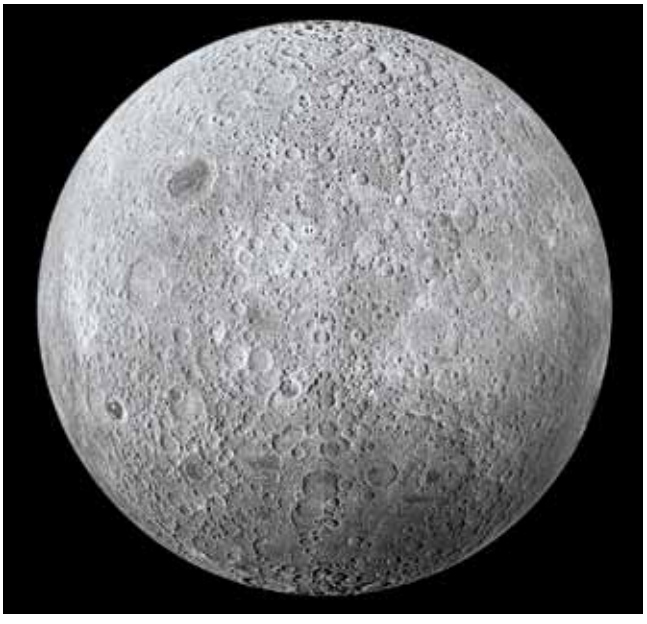

Photo courtesy of NASA

Figure 3. New topographic images of the far side of the moon.

Such a similar impact distribution on the moon, Mercury, and the highlands of Mars also indicates that Venus and Earth could not have been missed with this uniform stream of asteroids. The many fewer observed impacts on Venus, Earth, and the northern lowlands of Mars must have been caused by subsequent processes. The thick atmosphere on Venus and its resurfacing by lava and debris has modified and covered up most of the craters, although more impact craters are likely observed on the surface than experts think.[7] The northern hemisphere of Mars is much lower than the southern hemisphere and has accumulated a large amount of volcanics and impact debris. Many craters have been covered, but sophisticated instruments are picking up more and more craters. And on the earth the Flood probably modified all the craters.

Impact energy too devastating

The amount of energy from all these impacts, based on the size frequency distribution of impacts on the moon, is so huge that the surface of the earth would be destroyed many times over. A program has been developed to determine the effects of impacts on the earth,[8,9] which can be assessed on the internet.[10] The computer program shows that large asteroids in the range 10 km to over 100 km result in horrific damage to earth. For instance, a 100-km-diameter asteroid hitting the earth at 20 km/s (considered an average velocity) and at a 45° angle (the average impact angle) would cause a transient crater nearly 400 km in diameter and over 100 km deep, easily penetrating the mantle. The transient crater would then rapidly be modified to the final crater, which would end up over 800 km in diameter and over 2 km deep.

But the most significant aspect would be the seismic shaking with a Richter scale energy of 11.8, which moves beyond 10,000 km from the impact! This seismic shaking is about three orders of magnitude more severe than the largest earthquakes on Earth, and it is this seismic shaking that is the most devastating effect far from the impact site. At a distance of 10,000 km, there would also be a wind blast with a velocity of about 170 m/sec. At 5,000 km, the maximum wind would be about 470 m/sec. At 3,000 km away, the wind would be nearly 900 m/sec with about 6.5 m of ejecta falling on the surface. Even closer, the fireball would reach about 600 km high and be 44 times as intense as the sun. And this 100-km-diameter asteroid would not be the smallest asteroid, based on crater sizes in the inner solar system.

The only way out of this conundrum of the earth's surface being totally destroyed by all these impacts is if God modulated the effects of the impacts on the earth, unless the earth passed through a low density of impactors. This latter possibility is not too likely because my estimate on the number of Earth impactors is based on our nearest solar system body, the moon. The reason for such a modulation

is because He wanted to protect the occupants of the Ark and other life that had to be spared outside the Ark, but He had no need to modulate the impacts on other solar system bodies because there was no life there.[11,12] This is also why I believe the impacts must have occurred during the Flood: even a few moderately sized asteroids striking the earth would be so devastating that all life could easily have been destroyed.

But there is an alternative view that has merit. Faulkner believes that there were two impacting periods in biblical Earth history; one at creation and one during the Flood.[13] The highland craters on the moon represent Day 4 impacts as part of the final making of the solar system bodies from previously created matter. The large impact basins, plus a small number of the other craters, represent Flood impacts. Such a scenario results in fewer impacts for the earth during the Flood, but unfortunately it would be the larger impacts that occurred, which would carry a large proportion of the total kinetic energy of all possible imapcts. Thus, the devastation on the earth would probably be only modestly less than if all the moon impacts can be extrapolated to the earth during the Flood. Faulkner's hypothesis merits further study, but in this paper I will assume that the earth was struck by over 36,000 thousand impacts that produced craters greater than 30 km in diameter.

As creationists we do not invoke miracles lightly, but Scripture does say that God was intimately involved in the Flood. He started the Flood: "Behold, I, even I am bringing the flood of water upon the earth…" (Genesis 6:17a, NASB). He ended the Flood: "At Your rebuke they [the floodwaters] fled…" (Psalm 104:7a, NASB). And He was in charge of all the events: "The Lord sat as King at the flood" (Psalm 29:10a, NASB). Furthermore, the Flood account is a giant chiasm centred around "But God remembered Noah and all the beasts and all the cattle that were with him in the Ark ..." (Genesis 8:1a).[14] Thus God watched over the occupants of the Ark.

Impact craters once strongly rejected by uniformitarians

Scientists have long noticed the circular features on the moon and other bodies of the solar system. But these features were attributed to volcanism, a typical uniformitarian response. After a checkered debate in the mid-20th century, reminiscent of how creationists are sometimes treated by the secular establishment, strong evidence emerged that the circular features on solid solar system bodies were practically all impact craters, now believed by probably every astronomer.[15] There are of course volcanic features on the solar system, such as the Tharsis area on Mars. But the change in belief from volcanic to impact features did not happen until as late as the 1960s to early 1970s![16]

The reason for the resistance to the impact theory was that impacts were considered a violent contradiction to uniformitarianism, and hence the idea was strongly attacked:

> "A hypervelocity meteorite impact is an extraordinary event, originating from outside the Earth, and wreaking change instantaneously. Such a process violates every tenet of uniformitarianism. Largely for this reason, hypotheses of impact origin for craters on the Earth and the moon were vigorously opposed for the better part of the past century."[17]

This is another instance in which belief in uniformitarianism has retarded science.

And just like what happened after geologists accepted the Lake Missoula flood (another resisted catastrophe that occurred at the peak of the Ice Age),[18] impacts are now simply no big deal and *part* of uniformitarianism. As a result, many secular geologists now call themselves neo-catastrophists or actualists because they believe in a few large catastrophes. They really believe in uniformitarianism for practically all of earth history with the placid environment of the earth punctuated by extremely rare catastrophic events. So it is generally business as usual; uniformitarianism reigns supreme with a large impact every 100 Ma or so.

Those who do not know the history of the impact concept (as well as the history of the Lake Missoula flood and even the Ice Age) would never know that impacts were for a long time considered a violent contradiction to the founding assumption of secular geology. It seems that once secular geologists formalized their 'slow processes over millions of years' model (in the early 1800s), that assumption has been under assault from reality ever since, starting with the Ice Age in about 1840. Martin Rudwick, writing on the history of the uniformitarian takeover of geology, writes:

> "The most important point about the controversy over the Ice Age was that any such episode in the geologically recent past was *totally unexpected* by leading geologists of all stripes: by Buckland no less than by Lyell, to mention just two representative figures. It was drastic enough to count as a catastrophe, yet this particular catastrophe was the very last kind of event that might have been anticipated … it was too drastic, and in geological terms too sudden and catastrophic, to have been anticipated … [emphasis in original]."[19]

Uniformitarian scientists have come to terms with impacts, despite the powerful contradiction they present to their original assumption of solar system history. But to aid their paradigm, they have shoved practically all impacts to near the origin of the earth in what are called the Early Heavy

Bombardment (EHB), before about 4 Ga, and the Late Heavy Bombardment (LHB), at about 3.9 Ga ago. There supposedly have been only isolated moderate-sized impacts every 100 Ma or so after the LHB.

Practically all craters from the LHB

Now that scientists have accepted impacts as the origin of the circular features on solar system bodies, they have run into numerous problems explaining them. The EHB is tied up with the evolution of the solar system in which huge asteroids, or planetesimals, collided and somehow formed the bodies of the solar system. Planetesimals then became part of the growth of each solar system body.

But the vast majority of real craters are believed to have been formed very quickly in the LHB. This is based on relative crater dating and tied to the radiometric dates on moon rocks. Relative crater dating is mostly based on the idea that surface areas with more craters of a given size are older than surfaces with less craters of that size.[20]

The EHB is imaginary

In analyzing craters from the LHB, we discover that there apparently are very few to none that can be attributed to the EHB. Within the secular story of solar system origins the asteroids for the LHB could not have been left over planetesimals that supposedly amalgamated into the planets of the solar system during the EHB because any lingering planetesimals would have disappeared long before 3.9 Ga ago.[21] Therefore, several hypotheses have been invented to account for the LHB.

In trying to dismiss the LHB, William Hartmann has indirectly stated that there really is no evidence for the EHB. He complained that astronomers invoke either a zero rate or an extremely high impact rate at 4.45 to 4.0 Ga for the EHB on the moon from the *same* data![22] This is because there really is no direct evidence for the EHB; it is simply a naturalistic hypothesis based on the nebular hypothesis. Those that hold to the EHB believe that the sudden LHB simply erased or disguised the evidence of the EHB:

> "If the cataclysmic LHB hypothesis is true, the most obvious implication is the impossibility to use [*sic*] crater record to date surfaces older than ~3.9 Ga … ."[23]

Those who believe in the EHB believe the LHB was not a spike or rapid increase in cratering rate of the inner solar system, but is simply the end of the EHB (figure 4). But if the LHB destroyed the evidence, then planet and moon formation by planetesimals is hypothetical, and there really is no evidence of the EHB.

There are a few large craters that some solar system scientists have claimed could be from late in the EHB. These craters are generally claimed to be 'pre-Nectarian',

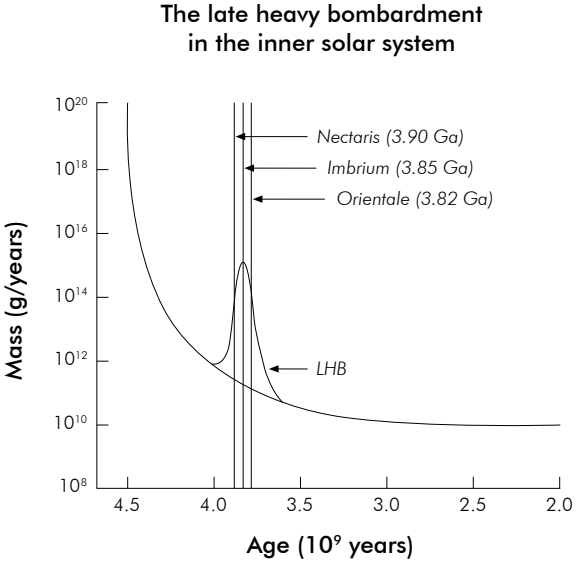

Figure 4. Curve of impacting rate in grams/year over the supposed age of the solar system. The curve before about 3.9 Ga is the hypothetical EHB, with the LHB being just the tail end of the EHB. The LHB added as many astronomers believe.

but other scientists believe these could easily be from the beginning of the LHB.[24]

Even post-LHB craters can be placed at the end of (within) the LHB

If the pre-Nectarian impacts on the moon can be considered the early part of the LHB, there is also evidence that those impacts considered later than the LHB are actually the tail end of the LHB. This would essentially place practically all impacts during the LHB.[25]

What is this evidence that impacts younger than about 3.9 to 3.5 Ga, the supposed end of the LHB based on relative crater dating, are part of the LHB? This result depends upon the surprising discovery that the *youngest* craters 10 to 100 km in diameter on the lunar highlands have the *same* surface densities of impacts as those on the Orientale impact basin and ejecta, which are considered late in the LHB. This discovery means that these youngest highland craters are also part of the LHB:

> "This is consistent with the class 1 [youngest lunar highland craters] and Imbrian [time between about 3.8 and 3.2 Ga] craters reflecting the same impactor population, the majority of which struck *during the tail of the lunar cataclysm* rather than during the subsequent 3.5 Gyr [emphasis in original]."[26]

Remember that crater dating is relative and is fit into the 4.5-Ga age believed for the solar system. So, all ages are stretched considerably. The relative dates before and after Imbrium (the impact and not the time range) can theoretically be *compressed* to around the time of Imbrium or the LHB, instead of stretching them from about 3.5 Ga to the present.

Thus, it appears that practically *all* the impacts on the moon were caused by the LHB. The same can be said for the other bodies of the inner solar system[27] (and probably the outer solar system as well) because the cratering rate on these other bodies is correlated to the moon. For instance, Mars crater dating is highly dependent on lunar crater dating, both relative and 'absolute':

> "The chronology of Mars is based on stratigraphic relationships between surface features, with absolute age estimates of martian stratigraphic units being made by comparing its crater densities with those of the Moon. But these ages are severely model-dependent and rely on the extrapolation of the ancient cratering record of the Moon to that of Mars."[28]

Where do the asteroids originate for the LHB?

Most planetary scientists believe the LHB was a sudden increase in impacts. The most popular model for the LHB is that the outer planets moved farther away from the sun after their formation, perturbing the asteroid belt and causing the LHB.[29] This is called the NICE model after the city in which the model was proposed. However, some astronomers are skeptical of the NICE model as well as asteroids originating from the asteroid belt.[25] The astronomers criticizing the NICE model lean toward the source of the asteroids suddenly coming from *outside* the solar system—an idea that seems plausible to me.

The LHB during the Flood

It appears that the great asteroid impacts of the solar system occurred in a near instant in time within their stretched-out timescale, which uniformitarians call the LHB. Thus, in the biblical timescale, it would have been a very quick pulse of impacting, which as stated above is reasonably placed within the year of the Flood.[3] It behoves creationists to study impacts and the cratering process since impacts are bound to have had a major influence during biblical Earth history, namely during the Flood.

Many creationists see impacts as significant for the Flood. Impacts are considered either the cause of the Flood or as just one more effect during the Flood. Some believe impacts triggered catastrophic plate tectonics (CPT), considered the real mechanism for the Flood by some creationists. Some advocates of CPT dismiss the significance of impacts for their model, but I don't see how they can ignore them. To those creationists who minimize the effects of impacts during the Flood, I would like to point out that the number and size of impacts during the Flood is so huge that impacts can easily be the only mechanism for the Flood, so that other mechanisms are not needed. It only remains to fill in the details—a monumental task.

Where did the asteroids originate for the Flood?

A number of questions or challenges have been raised to the impact submodel as the mechanism of the Flood. One of those challenges is where the asteroids originated for the Flood.

I believe that the secular astronomers mentioned above are correct that the asteroids (up to 800 km in diameter) for the LHB originated outside the solar system. It seems unlikely that trillions of asteroids could have originated from the explosion of a planet between Mars and Jupiter, as Froede has recently reiterated.[30] The asteroid belt is considered the remnant of this exploded planet. The main problem is that there likely would not be enough asteroids to cause all the craters on the solid bodies of the inner solar system in one year. The asteroids from an exploding planet would spread out in many directions and would become much less numerous the farther away, probably on a $1/d^2$ scale, where d is the distance from the exploding planet. Another issue is what would cause a planet to explode? If the exploding planet were true, Mars should have a great number of craters while Mercury would have only a few. But the size/frequency of impacts on Mercury, the highlands of Mars, and the highlands of the moon (figures 1 to 3) indicate a more even distribution of asteroids, suggesting the solar system travelled through a homogeneous cloud of asteroids.

On the other hand, it is possible that the asteroid belt was *formed* by a giant asteroid hitting and shattering a small planet between Mars and Jupiter during the solar-system-wide impacting at the time of the Flood. The mass of the present asteroid belt is only about 4% of the mass of the moon. Assuming that little mass has left the asteroid belt, if all the particles can be brought together into a planet, the radius would be less than about 700 km. If the diameter of an impact crater, compared to the radius of the body is more than 1.6, the body would likely shatter upon impact.[31] For a planet between Mars and Jupiter, the crater diameter would have to be greater than 1,100 km. The largest asteroids responsible for the observed craters on Mercury, Mars, and the moon are believed to be 800 km in diameter.[6] Since the crater is many times the diameter of the impacting object, a moderate sized impactor would be enough to shatter a postulated planet between Mars and Jupiter.

The date of the LHB is too old to have occurred in the Flood

Another challenge is that the LHB is dated about 3.9 Ga ago, based on radiometric dates from moon rocks. These old dates are a product of accelerated radiometric decay during creation and possible during the Flood.[32] So, if radiometric dates can be taken in a relative sense, the LHB would have

occurred *before* the Flood, possibly during Creation Week. This position has a number of problems.

Relative radiometric dating seems to have become an 'absolute' with some creationists. Relative dating is mostly based on a study done by Russell Humphreys,[33] which in turn is based on Woodmorappe's statistical analysis of anomalous radiometric dates.[34] The idea of absolute relative dating has also been propounded to lay audiences by Andrew Snelling in *Answers*.[35] Figure 5 shows the graph. I have already commented on this subject,[36] but I will briefly summarize the case. First, there is a small number of huge outliers where the dates are billions of years old when they are supposed to be a few 100 Ma. Second, there are likely many more rejected dates that would result in many more outliers. Third, 'good' dates are those that correlated with the geological column, so the scatter of the points around the dates of the geological column is partly based on circular reasoning. Bates McKee could not have said it any better:

> "One might imagine that direct methods of measuring time [radiometric dating] would make obsolete all of the previous means of estimating age [fossil dating], but these new 'absolute' measurements are used more as a supplement to traditional methods than as a substitute. Geologists put more faith in the principles of superposition and faunal succession than they do in numbers that come out of a machine. If the laboratory results contradict the field evidence, the geologist assumes that there is something wrong with the machine date. To put it another way 'good' dates are those that agree with field data."[37]

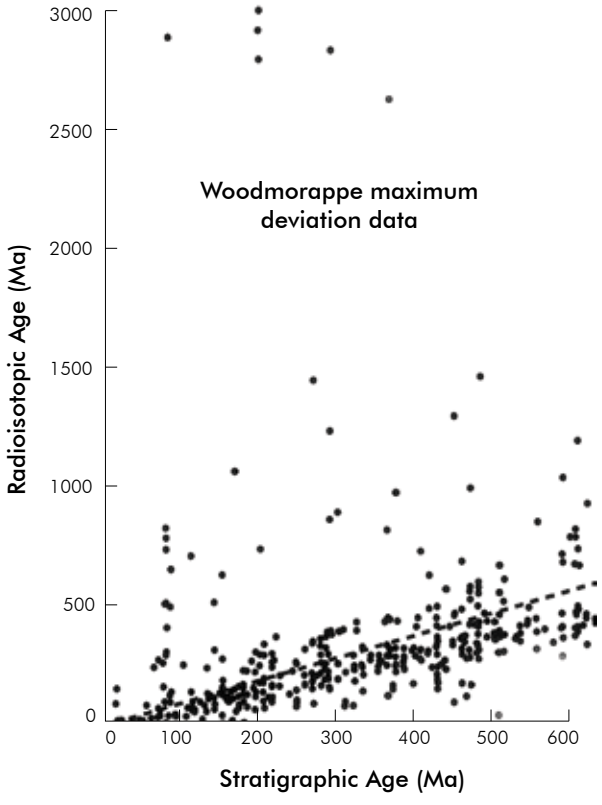

Figure 5. Deviation of published radioisotope ages of samples related to their published age according to the geological column (dotted line) (refs. 33 and 34).

So, if all the rejected radiometric dates were plotted on figure 5, the scatter and the outliers would be much greater.

So, just because the LHB is dated around 3.9 Ga based on radiometric dates of moon rocks, it does not mean that the LHB occurred before the Flood.

I have previously discussed the problem with putting even a small fraction of the LHB impacts before the Flood, for instance on Day 4 of Creation or the Fall of man into sin as described in Genesis 3.[38] The main problems with this idea are:

1. Fitting impacts into a *very good* creation presents a problem if impacts occurred on Day 4
2. If the moon and other planetary bodies were bombarded on Day 4, the earth should also have been bombarded killing *nephesh* animals when there was no death before sin (Romans 5:12; Genesis 1:30), and
3. Any significant bombardment before the Flood, remembering that the first impacts were probably from the largest asteroids, would wipe out the biosphere on Earth.

The problem of impacts not mentioned in Genesis 6–9

Sarfati, in a very good critique of Flood models, challenged the impact model as not being mentioned in Scripture, when such a huge bombardment would surely not be missed by Noah or his family.[39] Even more importantly, Sarfati points out that the Flood was written from God's perspective, and whether Noah missed seeing impacts or not, God knew about impacts and could have easily mentioned them in Genesis 6–9. This is a good point. (Sarfati refers mainly to the model of one impact causing the Flood, and although there is a model that postulates one impact, my model would start out with tens of thousands of asteroids striking the earth on the first day and tailing off afterwards. I would agree with Sarfati that one impact very likely would not cause the Flood.) As a defence, I can only offer the following possible explanations.

First, it is possible that Noah did not see any asteroids striking nearby because he and his family were deep within the Ark on the lower deck away from the window waiting for the Flood to begin.

Second, there were likely few, if any, impacts in Noah's location. This is a reasonable deduction because even a small impact close to the Ark could have caused

considerable damage from the seismic shaking, the very strong wind, or the fireball without God's protection. So, it is possible that God kept asteroids far from the Ark, if Noah or any of his family was even in a position to view them.

A third possibility is that asteroids take very little time to pass through the atmosphere, while water shooting up into the air, tsunamis, and tsunamis coming onto the land from the pre-Flood oceans would last much longer and be more noticeable. It may be easier to miss an asteroid than the 'fountains of water'. So it is possible Noah noticed the oceanic consequence of the asteroids but not the asteroids passing through the atmosphere. Alternatively, the effects of the asteroids were more dramatic and longer lasting than the asteroids themselves moving through the atmosphere and striking the land. The focus was on the Flood and the water, not on rocks moving through the atmosphere or volcanic eruptions or the darkness that these would have caused by what is called either impact or volcanic winter.

But, it still is disconcerting that not even one phrase directly mentions asteroids bombarding the earth (but see below). However, Genesis 6 to 9 is not known for its copious number of details on the Flood.

Fourth, the meaning of the two mechanisms for the Flood in Genesis 7 is uncertain. It could be that the phrase "… on the same day all the fountains of the great deep burst open …", in Genesis 7:11, is the description of impacts striking the pre-Flood ocean or large lakes. Impacts would shoot water many kilometres up into the air and beyond.[40] The water blasted up from the rim as well as from the central uplift (figure 6[41]) would rapidly rise many kilometres into the air and fall back down, sort of like a fountain, if that is one of the possible meanings of the Hebrew word. Impacts blasting water upward could be likened to jets or fountains of water, as stated by Price.[42] Tsunamis from impacts could also be described as "the fountains of the great deep bursting forth" as they approached the shore. This could be how God wished to describe the bombardment by impacts.

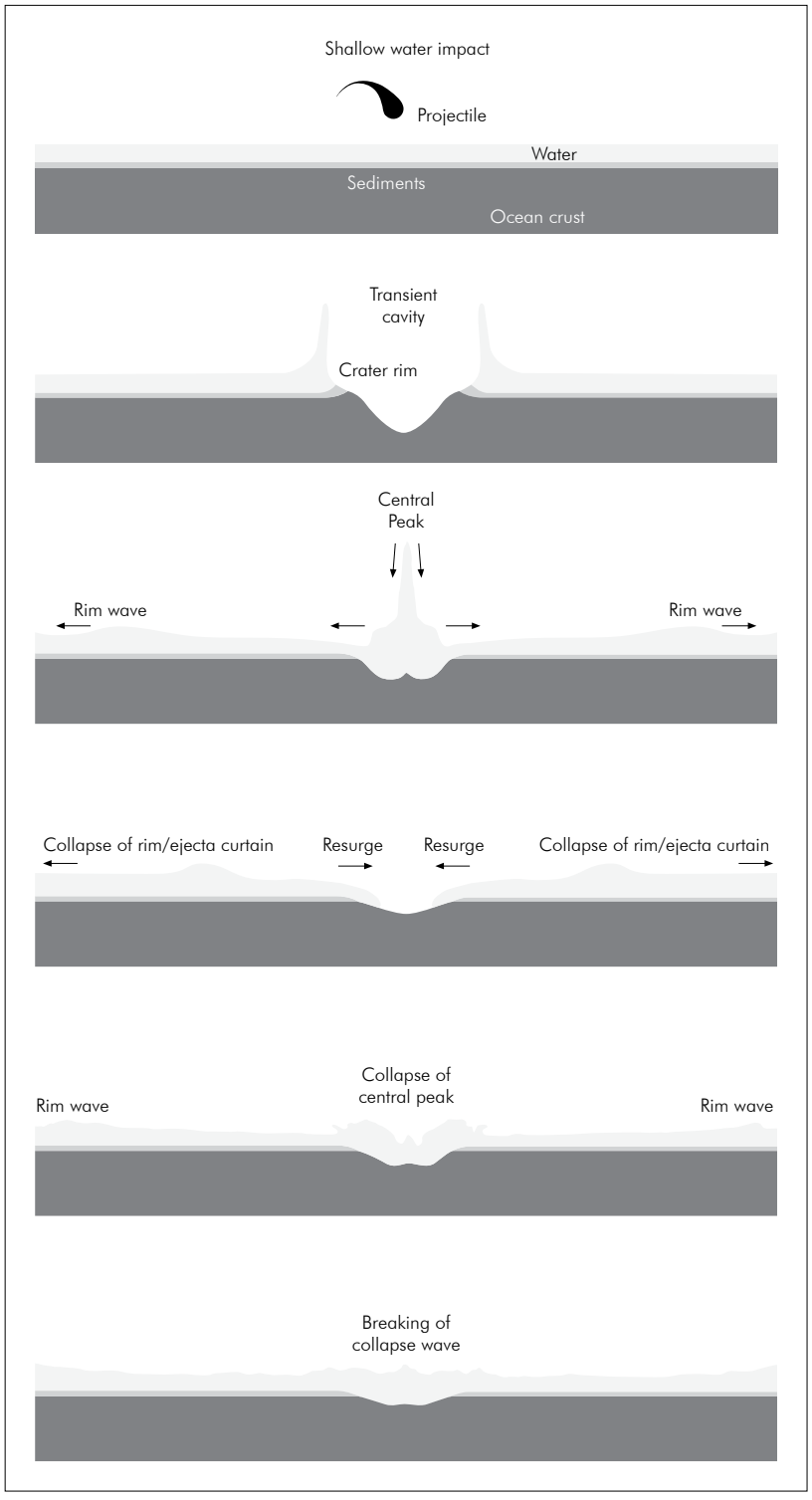

Figure 6. An impact in shallow water, shooting water upward along the rim and in the centre (from Wünnemann *et al.*, ref. 41).

Fifth, it is also possible that subsurface water existed under pressure before the Flood, for example to provide the water in the Garden of Eden that gushed up to supply water for four rivers (Genesis 2:10–14). Impacts would break up this underground water system, adding water for the Flood, and causing water to be released under pressure as 'fountains'.

Sixth, the phrase 'the windows of heaven' could also refer to impacts coming from space, since the windows of heaven do not necessarily tie directly to the 40 days of rain. This rain could be a consequence of both of the two mechanisms of the Flood. Just like with 'fountains of the great deep', such a phrase could be all God wished to say, if 'windows of heaven' really refers to impactors hitting the earth (Mark Amunrud, personal communication).

All the impacts, oceanic tsunamis, and torrential rain could also be the reason why the Ark likely did not start floating until Day 40,[43,44] which means the Ark was likely built far inland and at high elevation (to avoid impact tsunamis). By waiting for 40 days, it is likely that the most catastrophic activity of asteroid impacts had ended, so that the floodwater was calmer.

Summary

An impact submodel as the mechanism to start the Flood is being developed. It depends upon more than 36,000 impacts causing craters greater than 30 km in diameter striking the earth during the Flood with most of them very early in the Flood. The model is based on the observations that all the solid bodies of the solar system, except those bodies subsequently modified, are covered by impacts. As pointed out by a number of creationists, the impacting energy would be too great, and so God must have modulated the effects of the impacts, unless there is some other explanation of which I am unaware. Invoking God is not an unreasonable idea since God was involved in the Genesis Flood.

The impacting idea has a checkered history within uniformitarian science and was not accepted until the 1960s and early 1970s. There is controversy within uniformitarian circles on the timing of the impacts in the solar system. It can be shown that the early heavy bombardment (EHB) has no objective evidence but is based on secular hypotheses on the origin of the solar system. Those impacts considered pre-Necterian, instead of being late in the EHB, can be placed at the beginning of the late heavy bombardment (LHB). Those impacts after the LHB can easily be placed into the tail end of the LHB. Therefore, practically all the impacts in the solar system can be shown to have occurred quickly during the LHB, and if the impactors came over a very short time within the *uniformitarian* timescale, they would have struck Earth in days to weeks within the much shorter *biblical* timescale.

The LHB would also have affected the earth and the most likely time is the year of the Flood. It is reasonable to assume that there were trillions of impactors that passed through the solar system from the outside. The asteroids have since passed through the solar system and should be about 1,000 AU away—too far to be detected by telescopes or cause the stars to twinkle.

Two objections to the impact submodel were addressed. One is the claim that the relative dating of the LHB places the impacting during Creation Week, which is problematic. Besides, it is too early to claim that we can use relative radiometric dates in an absolute sense within the biblical timescale. Thus a date of the LHB of about 3.9 Ga does not invalidate the Flood timing.

The second objection is that asteroids are not mentioned in Scripture. A number of possible reasons for this absence were mentioned, such as Noah and his family hunkered down in the Ark, the effects of the water being more dramatic and impressive to Noah than the asteroids in the terse account of the Flood, and the possibly that asteroids are indirectly mentioned in Genesis 7.

The next step in an impact submodel is to first determine what geological work an asteroid accomplishes when it hits; the subject of the next paper in this series. Except for slower isostatic effects, the geological work of an impact is finished in about one hour. The crater has formed and been rapidly modified to its final shape in this short time. It is important to know this, because then we will know what to look for as subtle features on the earth since the Flood destroyed most of the evidence.

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