

# Precambrian impacts and the Genesis Flood

Michael J. Oard

Only 182 impacts have been 'confirmed' on the earth. This number may be very low for two reasons. First, numerous impact craters are observed on the moon and other inner solar system bodies. Second, terrestrial impacts have been significantly modified by erosion and the emplacement of lava flows and thick sedimentary cover. The large Vredefort and Sudbury impact structures illustrate the extent of this alteration. Based on this evidence, other impact features may be difficult to identify. Other factors hindering the confirmation of past impacts, especially in the Precambrian, include overly stringent requirements for impacts, thick Phanerozoic cover, and the fact that until recent decades few geologists have been looking for impacts. Indirect evidence for other impacts, especially during the Precambrian, include cratonic basins, other circular or arc-shaped features, impact spherule layers, and other subtle geological and geochemical features. Thousands of impacts may have occurred during the Precambrian. It is likely that many Precambrian sedimentary rocks are Flood deposits, such as black shale, quartz arenite, phosphate-rich rocks, or those with diagnostic fossil traces, such as raindrop imprints. This suggests that many Precambrian impacts occurred during the Flood. These may have contributed to the energy needed to start and sustain the Genesis Flood.

Some creation scientists believe Precambrian sedimentary rocks are from the Flood, while others believe they are pre-Flood. The latter group also believes that the pre-Flood/Flood boundary is at or slightly below the Precambrian/Cambrian boundary<sup>1,2</sup> (assuming the geological column for sake of discussion). If the Precambrian is pre-Flood, where does it fit into biblical Earth history? The pre-Flood world is commonly seen as a generally benign geological period,<sup>3</sup> which I agree with. So, the Precambrian is believed to be mostly a record of Creation Week.<sup>3,4</sup>

I have previously argued for a large number of unidentified terrestrial impacts, based on the size/frequency diagram of moon craters as well as other inner solar system bodies that have not been resurfaced. Based on that analysis, more than 36,000 impacts producing craters greater than 30 km (some very large) could have struck Earth during its history.<sup>5</sup> Spencer updated this number to 58,000 based on newer data from the Lunar Reconnaissance Orbiter, and discussed that a crater-size cutoff of 30 km would eliminate most secondary craters caused by ejecta from large impacts.<sup>6</sup> These data suggest that the solar system intersected a homogenous distribution of impactors in the past, assuming all impacts occurred about the same time.

However 58,000 impacts would have devastated Earth. Since it does not appear to have suffered that extent of damage, the number of impacts must have been fewer on Earth. Possibly some occurred during Creation Week,<sup>7</sup> but I will focus on those likely to have occurred during the Genesis Flood. Very few impacts have been confirmed, relative to the numbers expected from the extraterrestrial evidence. One reason might be the overly stringent requirements to confirm impacts, which would have resulted in scientists having overlooked the vast majority of impacts. If that is the

case, then much looser criteria must be found. To help define these, I examined the geological work expended by impacts, generally within the first hour.<sup>8</sup> One significant result was that impact craters greater than 300 km in diameter create circular basins, without central uplifts. So we should not expect to find central uplifts when looking for large craters.

This paper will provide evidence for many more impacts than have been confirmed, especially Precambrian impacts. Furthermore, I will show that these Precambrian impacts likely occurred during the Flood, based on similar rocks and features in both the Precambrian and the Phanerozoic.<sup>9</sup> This would indicate that the pre-Flood/Flood boundary is much lower than at or near the Precambrian/Cambrian boundary.

The RATE project and Catastrophic Plate Tectonics (CPT) propose the pre-Flood/Flood boundary is at or near the Precambrian/Cambrian boundary. If that aspect of RATE and CPT is wrong, then that work may require modification.

## Recognized Precambrian impacts

As of 2011, 182 impacts had been reported by scientists,<sup>10</sup> with one or two impact sites continuing to be added each year. Of these, 44 are greater than 20 km. Some of these are disputed by some geologists.<sup>11,12</sup> Phanerozoic rocks contain 155 impacts; Precambrian rocks contain only 27, or 15% of the reported total (table 1). About six of these are of moderate (30 km or more) size.<sup>11</sup> These Precambrian impacts are spread rather evenly from 545 Ma (million years before the present) to 2.4 Ga (billion years before present), assuming the uniformitarian dating of both impacts and rocks are accurate.

Twenty-seven is a small number compared to the moon and other inner solar system bodies. This may imply that more

Precambrian impacts exist but have not been recognized. Since the Phanerozoic has been better explored, it is unlikely that a significant number of new structures will be discovered, especially those greater than 30 km in diameter. Geophysical exploration of the subsurface has added only a small number of buried craters.<sup>13</sup> If the actual total number of impacts is much greater than 182, and if these additional structures have not yet been found, then the logical conclusion is that geologists have not been looking for the right features.

Many Precambrian rocks are deformed, highly modified by tectonics, volcanism, and metamorphism. They, along with any craters they might contain, have been modified by erosion and buried by sediments. I therefore suggest that many unrecognized impacts in the Precambrian do in fact exist, and have been disguised by subsequent geological activity. Some impacts may even be obscured by later impacts in the same location. We know that large impacts occurred in the Precambrian: the Vredefort in South Africa and the Sudbury in Ontario, Canada. Both were devastating and their recognition controversial for some time. Therefore, it would appear that the great majority of Precambrian impacts may be unrecognized for various reasons or the evidence for impacts destroyed.

#### The Vredefort impact

The Vredefort impact is believed to be about 2 Ga old with a final crater diameter of about 250–300 km, making it both the largest and one of the oldest known impact structures on Earth. There is some debate on its diameter (table 1). It caused a central uplift with upturned and overturned Precambrian sedimentary rocks (figure 1). Erosion, estimated to be 8–11 km,<sup>14</sup> has removed the rim and the crater fill, leaving behind concentric rings of granite, gneiss, migmatite, greenstone, and mantle rocks.<sup>15,16</sup> To complicate the recognition of the Vredefort structure as an impact, there has also been post-impact regional deformation.

#### The Sudbury impact

An extraterrestrial origin of the Sudbury impact was also controversial for many years. It is not circular, but elongated in a northeast-southwest direction (figure 2).<sup>8</sup> The impact diameter is unknown but the final crater diameter is believed to be 250 km in diameter, although some have claimed it is only 150–200 km in diameter or less. It is dated at about 1.8 Ga old<sup>17</sup> and about 5 km of erosion is believed to have occurred over the impact area.<sup>14</sup> The Sudbury structure is most likely to be a 3-km-thick differentiated impact melt sheet, thought to have taken approximately a million years to cool.<sup>18</sup> The Sudbury structure has yielded world-class ore deposits. Some of the debris ejected from Sudbury is now believed to have been found 600 km away, north of Lake Superior.<sup>19</sup>

### Likely reasons for not recognizing impacts

Although Vredefort and Sudbury are now recognized as impact structures, their erosion and deformation suggests that other Precambrian impact structures may similarly have been heavily altered or even eradicated by erosion. If so, this suggests that other Precambrian impact structures will only be found by looking for features that are more subtle.

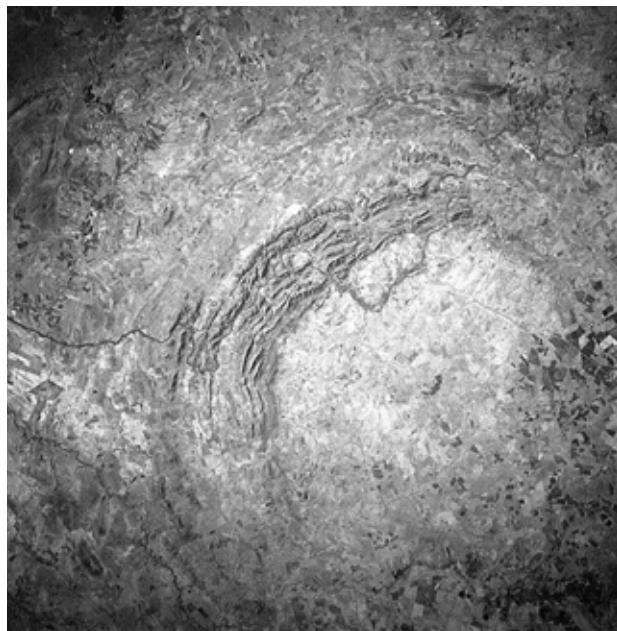
However, the stringent requirements for confirmation of impacts used by secular scientists likely means that the identification of many of these features may be impeded, especially in a Flood model. French and Koeberl, in their summary of convincing evidence for impact craters, downplayed the significance of circular or arc-shaped features and suggested that the only positive evidence for impacts is shatter cones and planar deformation features (PDFs) in

**Table 1.** Twenty-seven Precambrian impacts with their estimated diameter and age. Crater diameter estimates can be quite variable, especially for the larger impacts.<sup>10</sup>

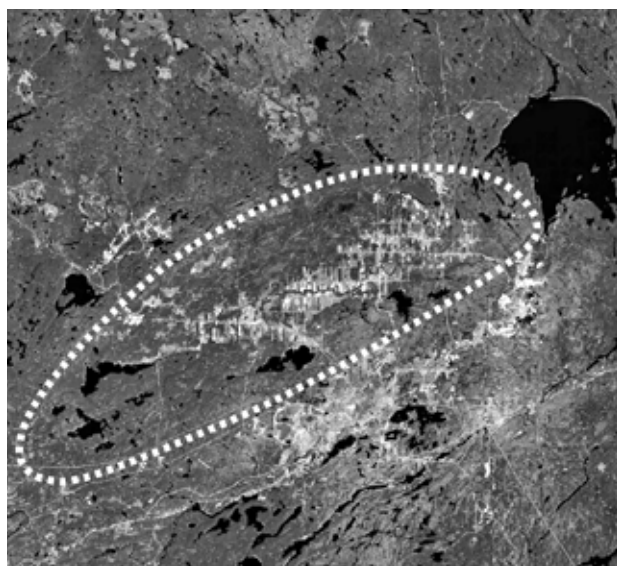
Impact Name	Diameter (km)	Age (Ma)
Foelsche	6	545
Holleford	2.35	>550
Kelly West	10	550
Sääksjärvi	6	560
Spider	13	>570
Luizi	17	<573
Acraman	90	590
Söderfjärden	6.6	600
Beaverhead	60	600
Saarijärvi	1.5	>600
Strangways	25	646
Jänisjärvi	14	700
Suvasvesi N	4	<1,000
Lumparm	9	1,000
Iso-Naakkima	3	>1,000
Santa Fe	6 to 13	<1,200
Goyder	3	<1,400
Matt Wilson	7.5	1,402
Shoemaker (formerly Teague)	30	1,630
Amelia Creek	20	1,640
Dhala	11	>1,700 <2,100
Keuruselkä	10 to 20	<1,800
Paasselkä	10	<1,800
Sudbury	130 to 250	1,850
Yarrabubba	30 to 70	2,000
Vredefort	160 to 300	2,023
Suavjärvi	16	2,400

quartz or other crystals.<sup>20</sup> However, they admit that these features would *not* be common. Furthermore, recognizing shatter cones in the field is quite difficult, and many may have been eroded. PDFs would have formed only near the centre of the impact and would have been absent in the annular zone because the impact pressures decrease rapidly from the point of impact outward:

“The extreme pressure and temperature conditions of shock metamorphism, and the resulting diagnostic



**Figure 1.** The upturned central portion of the Vredefort impact structure, South Africa.



**Figure 2.** The almond-shaped Sudbury impact melt structure, Ontario, Canada.

shock-deformation effects, are produced only within a relatively small volume of target rock near the impact point.”<sup>21</sup>

Moreover, it is difficult to find planar deformation features in a marine environment. Such stringent requirements, for the Precambrian, would contribute to far fewer impacts than have been recognized. The restrictive requirements may have resulted in hundreds of unidentified impacts being missed, especially since even suspected impact structures do not meet these requirements.<sup>20</sup> The criteria should instead cover a comprehensive range of evidence.<sup>22</sup>

French and Koeberl are also thinking in uniformitarian terms. They assume isolated impacts separated by millions of years, which would better preserve shatter cones and PDFs, although these features would degrade in ‘older’ impacts. After all, the two largest recognized Precambrian impact features have been eroded 5–10 km. If, during the Flood, there was a meteorite storm that resulted in as many as some thousands of impacts in a matter of days, forces would have been in play that would have obscured many of the impact structures. Nearby impacts would have destroyed previous craters and erratic, strong currents would have rapidly eroded shatter cones, PDFs, and other impact features. Cumulative heat from many impacts would have caused more rapid crustal metamorphism and deformation. The only remaining evidence may be large arc-shaped features.

It will also be difficult to find many Precambrian impacts on other than eroded cratonic shields because Precambrian rocks are usually buried under Phanerozoic sediments.

Another reason for the under-identification of impact structures may be psychological. If one does not expect to see signs of impacts, one most likely will not see the evidence. Recent studies have shown that bias by scientists does occur. For example, sleep researcher William Dement and writer Christopher Vaughan said referring to scientific observations: “even when they are looking, people usually see only what they expect to find and they do not see what they assume for whatever reason could not exist”.<sup>23</sup>

### Evidence for many more Precambrian impacts

A few scientists have pointed out that the official criteria for identifying impacts are too stringent, and that finding ancient impacts is still a relatively new facet of earth science.<sup>24,25</sup> That is why a statistical extrapolation from other solar system bodies may be the best method of determining that many more impacts in both Precambrian and Phanerozoic rocks exist. Some of the more indirect evidence pointing to many more impacts follows.

#### Cratonic basins

The main feature formed by an impact is the crater. It stands to reason, then, that craters from large impacts may

appear as crater- or saucer-shaped basins. Although basins can form from other causes, these other mechanisms would not often produce a circular basin. We would expect such features to be better preserved on stable continental cratons. Indeed, 600 cratonic basins exist which have an approximate saucer shape in three dimensions.<sup>26</sup> Most of these basins are greater than 300 km in diameter. Most have no central uplift, but usually have thinned crust, an uplifted mantle, and are filled with relatively undeformed, thick sedimentary rocks. All these features would be expected from impacts with little or slow subsequent deformation after the first hour. Although uniformitarian scientists have developed several hypotheses attempting to explain cratonic basins, they have been unable to explain them, and hardly ever think of an impact mechanism.<sup>26</sup>

#### Unconfirmed impacts

Besides confirmed impacts, researchers have come up with many more possible impact structures, such as the Mt Ashmore structural dome in the Timor Sea,<sup>27</sup> the Morokweng structure in South Africa,<sup>28</sup> the buried East Warburton basin in northeast South Australia,<sup>29</sup> a 500-km-diameter structure off the coast of India, a 300-km-diameter structure off Columbia, and a 225-km-diameter structure off Cuba.<sup>30</sup> These identifications are based on generally circular or arc-shaped features. Large-scale circular or arc-shaped features are special features that are difficult to explain by any other geological process, other than impacts.<sup>31</sup> Corner *et al.* write:

“Old structures are often difficult to recognize and are deeply eroded, but may still show geophysical signatures . . . that indicate the existence of a regionally distinct structure—especially if such signatures show a significant degree of circularity.”<sup>32</sup>

Based mainly on circular or arc-shaped features, Pesonen concludes that there are 50 unconfirmed impacts in Scandinavia with the largest at about 400 km in diameter, which compares to 22 confirmed impacts.<sup>33</sup> That is 2.5 times as many unconfirmed impact structures as confirmed. Wikipedia<sup>34</sup> lists many unconfirmed impact structures, four of which are large and of Precambrian ‘age’ (table 2). A new impact crater estimated to be 100 km in diameter was recently found in West Greenland (table 2) and dated to around 3 billion years old.<sup>35</sup> This suggested impact was based mainly on its circular structure detected by geophysical means; normal criteria used to identify most of the recognized impacts could not be applied. Consequently, this impact is controversial and unconfirmed.<sup>36,37</sup>

#### Precambrian impact spherules

Geologists have discovered significant indirect evidence of more Precambrian impacts in the form of spherule layers in sedimentary rocks. Twelve spherule layers have been identified in various Precambrian formations.<sup>38</sup> Most occur

**Table 2.** Unconfirmed large Precambrian impacts with their estimated diameter and age listed by Wikipedia.

Impact Name	Diameter (km)	Age (Ma)
Australian impact structure	600	545
Ullapool, Scotland	150	1,177
Czeck crater	450	2,000
Maniitsoq crater, Greenland	100	3,000

in the Archean Barberton formation of the Kaapvaal Craton of Africa and in the Pilbara Craton rocks of Western Australia. The Archean is older than 2.5 Ga, older than the oldest recognized impact from table 1. One Archean spherule bed extends over 325 km.<sup>39</sup> Impact ejecta and spherules have been claimed in several other Precambrian formations.<sup>40–42</sup> The significance of the Archean spherule layers has been challenged in the past,<sup>43,44</sup> but most believe they are the result of impacts, mainly because of elements that are similar to those found in meteorites.<sup>45–49</sup>

Based on spherule-layer thickness and extent (tens of kilometres), some scientists have estimated the size of the impactors as tens of kilometres in diameter, which would have yielded craters hundreds of kilometres across.<sup>49,50</sup> Glikson and Allen believe they have discovered the evidence of three major impacts in the Barberton formation of South Africa and the Hamersley Group rocks of Western Australia.<sup>51</sup> They believe they can even estimate the size of the impactors at about 46 km, 16 km, and 28 km in diameter. Alternatively, the spherule evidence could be from a large number of impactors.<sup>52</sup>

#### Other possible impact evidence

Additional, indirect evidence for Precambrian impacts in sedimentary rocks is controversial. Geochemists have suggested an impact origin for some metasedimentary rocks in Greenland based on tungsten isotope ratios.<sup>53</sup> Iridium spikes and chromium isotope ratios reinforce the impact origin of three early Archean layers within the Barberton formation of South Africa.<sup>54</sup>

Uniformitarian geologist Andrew Glikson, among others, believes that a wide range of mysterious geological features in the Precambrian, such as greenstone belts, banded iron formations, and large igneous provinces, can potentially be explained by impacts, but the evidence at this time is speculative.<sup>25,35,39,55–57</sup>

## Summary

In addition to the 27 confirmed Precambrian impact structures, hundreds of possible impact structures have been detected, especially in the Precambrian. Evidence for an impact origin is based on the morphology of cratonic



basins, other circular and arc-shaped structures, spherule layers, and other more indirect geological and geochemical features. As previously stated, other impact structures may have been destroyed or buried by other impacts, tectonics, volcanism, erosion, and deposition. The numbers of these may be substantial. Therefore, the number of impacts, especially in the Precambrian, could be in the hundreds to possibly a few thousand.

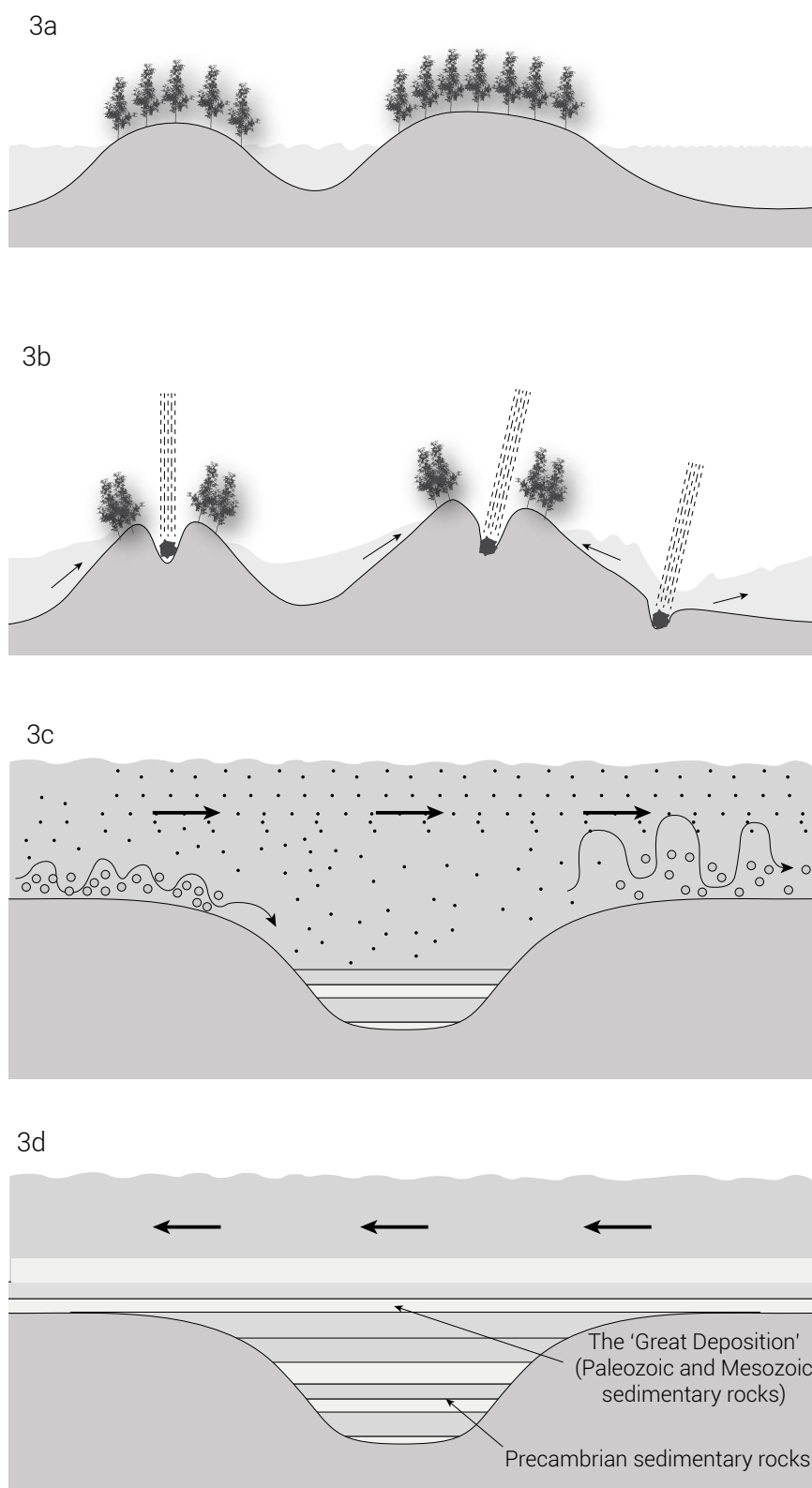
### A large number of Precambrian impacts started the Flood

Where do these potential impacts fit in biblical Earth history? Even a small number of Precambrian impacts—the Vredefort impact is 300 km in diameter—would have devastated a large portion of the earth. Hundreds of large impacts within a short time would probably destroy life on Earth. Thus, it does not seem reasonable to place an impact event during the Creation Week.

Also, impact events of this magnitude seem inconsistent with the divine pronouncement that the creation was ‘very good’. During a panel discussion at the 2013 International Conference on Creationism, Austin suggested that crystal defects were created in the rocks during Creation Week, and he stated that this apparent imperfection would justify a Creation Week impact event. However, that seems a tenuous inference.

Most, if not all, Precambrian sedimentary rocks from the Flood

If Earth impacts did not occur during Creation Week, the most probable option is during the Flood. This implies a Flood origin for Precambrian sedimentary rocks. Froede and I provided evidence that



**Figure 3.** Schematic of the impact bombardment of the early Flood and the formation of the Great Unconformity with Precambrian sedimentation occurring in impact basins (3a to c). After the initial onslaught, Paleozoic and Mesozoic sedimentation occurred with little deformation over large areas (3d) (drawn by Mrs Melanie Richard).

the diagnostic criteria placing the beginning of the Flood at or near the Precambrian/Cambrian contact are equivocal, and that this boundary was instead much lower in the Precambrian, possibly as deep as the crystalline basement.<sup>58,59</sup> I am also inclined to the opinion that God miraculously modulated the impacts on Earth during the Flood, but not on other solar system bodies.<sup>60</sup> After all, God is intimately involved and sustains His creation. He began the Flood, ended the Flood, and sat as King over the Flood.<sup>61</sup>

Another reason for assigning Precambrian sedimentary rocks to the Flood is their similarity to Phanerozoic rocks. They are similar in lithology; including limestone, dolomite, salt, chert, and diamictite. Moreover, some unusual rock types occur in both Precambrian and Phanerozoic strata, such as organic-rich black shale, quartz arenite, and phosphate-rich rocks. Raindrop imprints also occur as early as the late Archean.<sup>9,62</sup> These suggest that most Precambrian sedimentary rocks are from the Flood, and therefore many, if not all, Precambrian impacts occurred during the Flood.

#### Early Flood impact model

An early Flood impact model is suggested (figure 3). Powerful Precambrian impacts probably initiated the Flood<sup>63</sup> (figure 3b), creating thousands of craters across the earth that would have been quickly modified due to differences in rock type, temperature, viscosity, etc. The erosion caused by the resulting currents would have been tremendous. Deposition at this time would have been restricted to deep impact basins where turbulence and currents would have been less (figure 3c). The remainder of the sediments would have been in suspension, often in water thousands of metres deep. This would explain why Precambrian sediments are found mostly in what were once deep basins. Some of these basins were uplifted and eroded by isostatic recovery, such as the Belt Basin of the northern Rocky Mountains.<sup>26</sup>

The turbulence and strong currents would have scoured a planation surface over large areas (figure 3c), such as the Great Unconformity and similar surfaces in the western United States. This erosional surface appears to be a world-wide surface.<sup>64</sup> Impacts probably declined rapidly through the mid and late Flood, with a few after the Flood. As the density and frequency of impacts declined, water current strength declined too, until a time of sedimentation was initiated—the ‘Great Deposition’ (figure 3d). Paleozoic and Mesozoic sedimentary rocks were deposited over large areas, with little evidence of erosion or deformation within and between sedimentary layers. The thickness of these layers reaches thousands of metres in places. The ‘Great Deformation’, with differential vertical tectonics, tilting, and erosion, occurred later in the Flood, during the Recessional Stage, mainly during the Cenozoic.

Sedimentary rocks from the Cambrian through the end of the Mesozoic show little internal deformation. The

absence of rocks reflecting the higher energy levels of the Flood’s beginning is a reason to place the pre-Flood/Flood boundary lower in the Precambrian. It may be that the impact event of the early Flood lasted 40 days, since impacting probably caused the torrential rain,<sup>65</sup> and therefore the Great Deposition may not have begun until Day 40.

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**Michael J. Oard** has an M.S. in atmospheric science from the University of Washington and is now retired after working as a meteorologist with the US National Weather Service in Montana for 30 years. He is the author of *Frozen in Time*, *Ancient Ice Ages or Gigantic Submarine Landslides?*, *Flood by Design*, *Dinosaur Challenges and Mysteries*, and *Exploring Geology with Mr. Hibb.* He serves on the board of the *Creation Research Society*.