IMPACT EVENTS WITHIN THE YOUNG-EARTH FLOOD MODEL

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Abstract

Terrestrial impact craters have been identified from the Earth's surface and subsurface. Currently, the most significant subsurface example is the Chicxulub Crater on the Yucatan Peninsula in Mexico. Many uniformitarians propose this impact crater as initiating events which culminated in the demise of ***the dinosaurs at the Cretaceous-Tertiary boundary. We propose, instead, that most Earth cratering events occurred during the Flood Event Timeframe as a result*** of ***impacts with extraterrestrial objects. Impact collisions reached a maximum during the Flood, exponentially decreasing thereafter. We also propose that the collision objects may have originated from the disintegration*** of ***a planet in the region of the asteroid belt.***

Introduction

Critics of the young-earth Flood model have suggested that creation science fails to defend its postulates. It has been suggested that creationists stand on the sidelines with their religious beliefs and malign uniformitarian theories and processes (Berra, 1990, pp. 124-126; Van Till, Young, and Menninga, 1988, p. 44; Godfrey, 1983; Futuyma, 1982, p. 176; Kitcher, 1982, pp. 1-51). Additionally, creationists are often portrayed as failing to suggest alternative theories on scientific issues. However, many of the evolutionary issues under investigation have less to do with science than with interpretation. Most of the uniformitarian historical postulates have little basis for testability or reproduction. They only exist due to the interpretation of physical evidences which exist in the present. One example is found in the occurrence of the platinum group metals (i.e., ruthenium [Ru], rhodium [Rh], palladium [Pd], osmium [Os], iridium [Ir], and platinum [Pt]), shocked-quartz grains, microtektites, and other impact related ejecta at select stratigraphic boundaries within the worldwide evolutionary stratigraphic column.

The common view is that these impact related materials along with their associated impact craters represent cyclical visitations by bolides which resulted in mass-extinction events throughout geologic time (e.g., Cretaceous-Tertiary or K-T, late Eocene, Middle Miocene, and Upper Pliocene) [Orth, 1989, pp. 37-72; Raup and Sepkoski 1984; 1986; Raup, 1992; Sepkoski, 1994]. However, the extinction events, along with the periodicity suggested are still speculative. Clemens (1994, p. 247) has stated that several well-documented impact events are not contemporaneous with times of major or even minor extinctions. The impact events are dated using evolutionary methods (i.e., biostratigraphy and radiometric dating) and are believed to occur in a cyclic rhythm. However, these impact structures along with their associated ejecta can be interpreted in several ways depending on the model (i.e., impactor, volcanist, uniformitarian, or catastrophist) used to explain the physical evidence. Futuyma (1982, pp. 175-176) identifies the K-T boundary as a place where uniformitarians are clearly engaged in the science of testing a scientific hypothesis, specifically the "collision hypothesis."

This paper suggests a hypothesis for the formation of impact structures within the same testable limits as those proposed by Uniformitarians. However, our theory will be developed within the constraints of the young-earth Flood model. We believe that the Earth was and still is subject to bombardment by asteroids, meteoroids, and comets. Evidence of these historical impact events can be found in the form of crater structures and associated ejecta which dot the globe (e.g., DeYoung, 1994; Haag, 1992; McCall, 1979; Spearing, 1991, pp. 366-367; Neathery, Bentley, and Lines, 1976; Becker et al., 1994; Monastersky, 1995; Hart et al., 1995). The differences between the young-earth catastrophist view of the impact events and those of the Uniformitarians are in the time frames in which these events occurred (Froede, 1995; Walker, 1994), and of the source for the objects in question. The possible origin and impact of extraterrestrial bolides on the Earth (viewed in some cases as initiating the Flood, or simply as occurring during and/or following the Flood) have been previously discussed by several individuals (e.g., Velikovsky, 1955; Patten, 1966; Morris, 1984; Unfred, 1984; Berlitz, 1987; Parks, 1990; Auldaney, 1992; Spencer, 1992; 1994; von Fange, 1994). More recently, Fischer (1994) has suggested that a giant meteorite impact in the Western Somali Basin of Africa perhaps initiated the break up of the Antediluvian landmass.

Figure 1. A Cretaceous-Tertiary (K-T) boundary outcrop, located southeast of Braggs, Lowndes County, Alabama. This specific site is probably the most widely studied K-T boundary site on the Gulf Coastal Plain (see Copeland and Mancini, 1986).

The three objects commonly associated with impact craters are asteroids, meteorites, and comets. An ***asteroid*** is one of many thousands of large rocks which circle the Sun, mainly between Mars and Jupiter. The are usually miles in size, and grade into ***meteoroids***

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when small, on the order of dust to several feet. Most meteoroids are of dust size. A *meteorite* is any space rock, either asteroid or meteoroid, that impacts a moon or planet. The actual streak of light made when an object passes through the Earth's atmosphere is called a *meteor. Comets* are multi-mile-size objects consisting of dust, rocks, and frozen chemicals. Most orbit in elliptical paths which carry them both near (perihelion) and far (aphelion) from the Sun. For example, Halley's comet travels from within the orbit of Venus, to beyond Neptune's orbit and back again, about every 76 years. A *bolide* is the term for a bright meteor which enters Earth's atmosphere and explodes (Hopkins, 1980, p. 113-114). A glossary of terms is included at the end of this article to aid the reader in understanding some of the specialized words used in this paper.

Dinosaur Extinction

The fact that dinosaurs are no longer found on Earth has fascinated scientists for many years. Many theories have been suggested to account for their death at the close of the uniformitarian Cretaceous Period, specifically marked by the K-T boundary contact. This specific boundary has been discussed and debated for many years in an effort to determine the cause of the K-T mass extinction event(s) (Christensen and Birkelund, 1979). In a monumental paper published in 1980, Alvarez, Alvarez, Asaro, and Michel, suggested that the K-T extinction was caused by a bolide impact. Their paper offered as evidence of this event the occurrence of platinum group metals, specifically iridium, along the K-T boundary from two locations recognized as representing a nearly complete rock transition from the Mesozoic into the Cenozoic, specifically, Gubbio, Italy; and Stevns Klint, Denmark (Alvarez, Alvarez, Asaro, and Michel, 1980; see also Ganapathy, 1980; Russell, 1982; Alvarez, Asaro, and Montanari, 1990). The paper suggested that, based on the concentration of iridium found at the two K-T boundary sites, the asteroid was 6-14 kilometers (3.6-8.4 miles) in diameter. This impact is suggested to have created a number of environmental disasters such as darkness and cold temperatures due to the loss of sunlight, global wildfires and acid rain due to the heat and particulate matter thrown up into the atmosphere, and a global greenhouse effect created as water vapor and carbon dioxide were also released in large volumes in the atmosphere (Evans, 1992, p. 141).

Since the publication of the Alvarez paper there has been a worldwide search for the impact crater(s) associated with the K-T extinction, and also for additional boundaries which indicate significant concentrations of the platinum group metals. Over the ensuing years scientists have found the occurrence of iridium at seven stratigraphic horizons other than the K-T boundary (Raup, 1991a, p. 172; Orth, 1989, pp. 37-72). Iridium has been used as a stratigraphic boundary marker because its occurrence is viewed as indicating a condensed section paleosurface and a place where continuous deposition can be documented (Wang, Chatterton, Attrep, and Orth, 1992, p. 40; Froede, 1994a). Additional information regarding where iridium is found in the uniformitarian stratigraphic column along with its probable origin is provided in Table I. Research is continuing and additional boundaries will probably be added in the future, as scientists further quantify and qualify the platinum group metals along stratigraphic boundaries.

Iridium by itself does not require a bolide impact event to explain its occurrence. Several investigations have now been performed which indicate that iridium can become concentrated due to other causes, described later. Additional evidence must be supplied to clearly link the iridium concentrations to extraterrestrial origin.

In the continuing search for cosmogenic debris and impact rock ejecta associated with the K-T boundary, scientists have identified what is believed to be evidence of wildfires (i.e., soot) which resulted from the impact of the bolide (Wolbach, Lewis, and Anders, 1985; Wolbach, Gilmour, and Anders, 1990). The soot is found interbedded with the iridium at only a few K-T boundary sites; however, it is suggested that this represents a global scale wildfire. Additional support for the occurrence of global wildfires has been based on the change in carbon isotopic ratios across certain K-T boundary sites (Ivany and Salawitch, 1993) and the presence of fullerenes (C_{60}) [Heymann, Chibante, Brooks, Wolbach, and Smalley, 1994]. However, the

Table I.

Geologic Interval	Original Source	General Location
Upper Pliocene (Tertiary)	Bolide	Southeast Pacific
Middle Miocene (Tertiary)	Bolide	South Pacific
Late Eocene (Tertiary)	Bolide	Southeast U.S./Caribbean
K-T boundary	Bolide	Italy, Denmark, U.S.
Cenomanian-Turonian boundary (late Cretaceous)	Sea-floor Spreading	Western U.S. Western Canada
Callovian-Oxfordian boundary (Middle-Upper Jurassic)	Bolide	Spain, Poland
Permian-Triassic boundary (very minor traces)	Weathered volcanics derived from the Earth's Mantle	China, Austria
Frasnian-Famennian boundary (Upper Devonian)	Bioaccumulation	U.S.A., Belgium, Australia, Germany, China
Ordovician-Silurian boundary	Weathering of iridium containing rocks	Czechoslovakia

Table I. Adapted from Raup (1991a, p. 172). Orth (1989, pp. 37-72), Erwin (1993, pp. 248-258), and McGhee (1994). The Tertiary bolide events are believed to support the 26 million year periodicity proposed by Raup and Sepkoski (1984; 1986). Serious questions remain regarding the real versus apparent relevance of iridium to an impact boundary (see Donovan, 1987).

evidence for global wildfires has not been agreed upon by all scientists at this time (Keller and MacLeod, 1993). Additional support for a global K-T impact has been suggested based on the occurrence of shocked-quartz grains found at the various crater sites (Bohor, Modreski, and Foord, 1987).

In 1991, Hildebrand et al., proposed that the Chicxulub Crater, located beneath the upper northwestern edge of the Yucatan Peninsula, Mexico, was the site of the impact event associated with the K-T mass extinction boundary. Additional evidence, beyond the occurrence of shock metamorphism and gravity surveys, was suggested by rock compositional similarities with tektites found in the Caribbean (Hildebrand et al., 1991, p. 870; Koeberl, 1993) and evidence of impact induced tsunami deposits found in nearby deep sea sediments (Alvarez et al., 1992). However, evidence that the Chicxulub Crater was actually formed by impact is still rather scarce (Heide and Wlotzka, 1995, pp. 63-64).

Whether or not the Chicxulub crater is the only impact structure associated with the K-T extinction is still being debated. Recently it has been proposed that multiple impacts bracketed the various extinction boundaries. These meteor/comet showers provide a better explanation for the variation in impact ejecta composition (i.e., granitic versus basaltic) and tend to support the seemingly slow extinction of the terrestrial vertebrates, as found across the globe (Clube and Napier, 1984; Davis, Hut, and Muller, 1984; Alvarez and Muller, 1984: Rampino and Stothers, 1984; Whitmire and Matese, 1985; Hut et al., 1997; Bailey, Clube, and Napier, 1990, p. 397; Glen, 1984a, p. 4: Clube, 1994, p. 155; Glen, 1994b, p. 19). Several impact events associated with the K-T boundary are now suggested as having contributed to the K-T extinction (Koeberl et al., 1990; Koeberl, Sharpton, Murali, and Burke, 1990; Hartung, Kunk, and Anderson, 1990; Monastersky, 1993a, p. 212-213). However, the Chicxulub Crater is currently recognized as the largest impact crater on Earth (i.e., minimum 112 miles in diameter) and is generally agreed upon as the primary impact structure which ultimately resulted in the K-T mass-extinction event (Hildebrand et al., 1991, p. 867; Swisher et al., 1992; Monastersky, 1993b; Monastersky, 1994; Schuraytz, Sharpton, and Marin, 1994; Coccioni and Galeotti, 1994; Kamo and Krogh, 1995). Ahrens and O'Keefe (1983) have suggested that the impact of the 10-kilometer (6.2 mi) bolide would have released almost one million times the energy of the strongest earthquake ever recorded, resulting in an earthquake of about 13 on the Richter scale.

Many scientists still question the worldwide effect that the Chicxulub impact had on the K-T boundary. This is due to the lack of evidence of its direct effect on the fossil or rock record at other exposures of the K-T boundary found around the globe (Elliot, Askin, Kyte, Zinsmeister, 1994; Hsü, 1994; Briggs, 1994; Savrda, 1993; Kerr, 1992; Sheehan and Fastovsky, 1992; MacLeod and Keller, 1991; Kunk, Izett, Haugerud, and Sutter, 1989; Donovan, et al., 1988; Fassett and Rigby, 1987; Buffetaut, 1990; Hallam and Perch-Nielsen, 1990; Longoria and Gamper, 1995; Marshall 1995). Several geologists working in northeastern Mexico have investigated deposits interpreted as being tsunamian in origin, reflecting the Chicxulub impact event. These scientists suggest that the sediments do not indicate tsunami deposition, rather they represent incised valley fill deposits resulting from noncatastrophic depositional conditions (Stinnesbeck et al., 1993). However, this site and its noncatastrophic re-interpretation is still under debate (Smit, Roep, Alvarez, Claeys, and Montanari, 1994).

Another theory has also been suggested to account for the iridium and other materials claimed to represent impact ejecta. This group suggests that volcanoes and volcanic processes associated with both subaerial and subaqueous eruptions can explain these various materials (i.e., iridium, tektites, shock-quartz grains). Additionally, this group suggests extinction events correlate directly to volcanism; however, Vermeij (1995, p. 137) has stated that many of these large scale volcanic events fail to correlate with extinction events. While many of the arguments for this theory are compelling (Vogt, 1972; Officer and Drake, 1985; Courtillot and Besse, 1987; Hallam, 1987; Courtillot, 1990), it would appear that the volcanists are losing ground in explaining all of the physical evidences in support of the impact theory (Harris, Hutchison, and Paul, 1972, pp. 313-314; Bohor, 1990a; Meisel, Krähenbühl, and Nazarov, 1995). Glen (1994b) presents the details of this debate and should be consulted by the reader for further information.

Periodic Collisions

Various extraterrestrial events and their effect on life history as viewed via the stratigraphic record have previously been discussed by several scientists over the years; however, no physical evidences have been presented to support the various theories (Schindewolf, 1963; McLaren, 1970; Urey, 1973). The success of the Alvarez et al. 1980) proposal was based on their ability to present iridium as the physical evidence to support the proposed K-T impact event. Additionally, the Alvarez et al. 1980, p. 1107) proposal predicted a 100 million year (abbreviated 100 Ma) cycle between asteroid collisions in an attempt to unify asteroid impact events with the various extinction event boundaries. Strong arguments have been presented suggesting that large bolide impacts have caused mass-extinctions throughout the uniformitarian stratigraphic record. Several Cenozoic stratigraphic boundaries have been found to contain both cosmogenic and impact-related materials. This prompted Raup and Sepkoski (1984; 1986) to propose a cyclical occurrence of impacts throughout the Cenozoic Era. Their statistical analysis of the periodicity of the impacts suggested the occurrence of cyclic extinctions every 26 Ma for the past 250 Ma, although not all of the data clearly fall within the predicted range (Raup, 1986a, p. 1532; Raup, 1986b, pp. 115-122; Raup, 1991a, p. 164; Raup 1991b; Kerr 1985, p. 1452: Goldsmith, 1985, pp. 61-65). Several scientists (e.g., Clube, 1994, p. 155; Bailey, Clube, and Napier, 1990, pp. 397-401) have suggested that decadal-to-centennial intensifications of the sporadic Taurid meteor flux can account for impact events recorded in Earth history. The source of the crumbling Taurids was created by giant comets, or Chirons, from the Oort cloud that were deflected by Jupiter into sub-Jovian space, where they proceed to break up under the influence of the Sun (Clube, 1994, p. 167). Still others

have suggested a 33 Ma periodicity not based on extraterrestrial impacts, but on the extinction events observed in the fossil record (Fischer and Arthur, 1977).

In 1994, the world observed the impact of more than 20 fragments of Comet Shoemaker-Levy 9 onto the planet Jupiter (Cowen, 1994a, p. 55; Levy, Shoemaker, and Shoemaker, 1995). Interesting questions remain following this multiple impact event regarding the size and composition of the material (i.e., comet or asteroid) and its depth of penetration into Jupiter (Cowen, 1994b, p. 133; 1994c, p. 412-414). However, these impacts have served to reinforce the uniformitarian predictions for the periodic bombardment of Earth by bolides from its earliest beginnings to present times (Alper, 1994; McGhee 1994; Glen, 1994, 1994a, p. 38). Some scientists are now suggesting that bolide impact events could be the primary driver behind evolutionary processes (McGhee, 1990, p. 49; Monastersky, 1995, p. 59).

The reader should realize at this point that there is much evidence to support the fact that extraterrestrial objects have impacted the Earth. However, the dating of the impact craters is based on the uniformitarian stratigraphic column, so vast ages are often inferred. DeYoung (1994) presents evidence to suggest that the dating of any impact structure is questionable at best. The evolutionary stratigraphic column is used to support the suggested ages of the various impact structures across the globe and their periodicity, and this concept should be challenged by creationists.

Collision Objects

Originally, asteroids were suggested as the source for the iridium found at the various stratigraphic boundaries (Alvarez et al., 1980, p. 1105). This is because asteroids are thought to be of sufficient size and to contain the metals necessary to result in the accumulation of higher-than-background concentrations of platinum group metals found along select stratigraphic boundaries. Meteorites also contain metals, but are too small to account for the quantities of iridium and other metals found at the many boundaries.

More recently comets have come into the forefront as potential sources of the platinum group metals. This is primarily because comet collisions in the size range necessary to account for the higher-than background concentrations of iridium are thought to occur twice as frequently as asteroid impacts (Alvarez et al., 1980, p. 1107). However, a problem with the comet hypothesis exists in their metal carrying capacity when compared to the more dense asteroids. It would take a 12-kilometer (7.5 mi) comet to bring to Earth the same amount of iridium as a 7-kilometer (4.3 mi) asteroid, assuming the fraction of iridium is the same in both objects (Goldsmith, 1985, p. 104). Additionally, the larger the size of the comet or asteroid, the less statistically likely and fewer in number the impact events become. This is because the large Apollo asteroids and comets are few in number and also are not predicted to be in significant numbers in Earth's past. According to Heide and Wlotzka (1995, p. 64), Apollo asteroids are a special group which cross the Earth's orbit and:

> About 30 of these Apollo asteroids are known (diameters between 0.2 and 8 km [656 ft and 5 miles]); and their actual number is estimated to be between 750 and 1000. [Brackets ours]

The number of known space objects also works against frequent comet collisions with Earth. There are about 1,000 comets identified today. The suggestion of a million additional comets in the distant Oort Cloud is pure conjecture. Meanwhile, the nearby asteroid belt between Mars and Jupiter consists of more than 100,000 asteroids. Asteroids thus appear to be much more likely collision objects than comets. Currently, many astronomers believe that the gravitational force of Jupiter can disturb the orbits of the asteroids such that they cross into the orbital paths of both Mars and Earth (Heide and Wlotzka, 1995). According to Clube (1994, p. 167) the original source of the planet-crossing asteroids was at one time believed to be from the asteroid belt; however, it is now generally held that the extraterrestrial material is derived from the disintegration of giant comets generated from the distant Oort Cloud.

Recently, it has been suggested that the disintegration of large comets, by outgassing or sublimation of ice, could produce asteroid fragments through their break-up and decay (Bailey, Clube, and Napier, 1990, p. 372). Additionally, Bailey, Clube, and Napier (1990, p. 397) have suggested that the Taurid-Arietid meteor stream has been produced in this manner. This theory would then provide a relatively constant source of asteroid and comet objects with which to impact Earth over the suggested billions of years (Ga) of geologic time.

The only probable occurrence of a comet striking the Earth occurred on the night of June 30, 1909 in the Tungus forest in Siberia, Russia. Bailey, Clube, and Napier (1990, p. 399) have suggested that this comet was probably from the Taurid-Arietid meteor stream (again due to the source considerations). Trees were blown down from a central "ground zero" point as far away as 30-40 kilometers (19-25 mi) and people were knocked to the ground over 30 miles away (Brandt, 1981, pp. 86-87). However, no large crater was created because the object was believed to have disintegrated miles above the Earth. Some astronomers still doubt the comet idea for Tungus, Siberia preferring a large exploding meteorite instead (Heide and Wlotzka, 1995, p. 55).

Comet Clouds

Investigations are underway to locate asteroids or comets within the solar system which might collide with Earth in the future, as well as shed light on possible impacts from the past (Shoemaker, Wolfe, and Shoemaker, 1990, p. 155-169). Two comet clouds have been proposed to explain the presence of comets today. The Oort cloud is said to be 10,000-100,000 astronomical units from the sun (1-10 trillion miles), with a second Kuiper belt of comets closer than the Oort cloud. Neither cloud has ever been observed. It is further thought that passing stars occasionally perturb these outer comets into Earth's orbital path (Goldsmith, 1985; Raup, 1986b; Muller, 1988). Because such remote comets cannot be detected and would have periodicities which are not within observable limits e.g., 26 Ma vs. 33 Ma vs. 100 Ma) they exist mainly in the minds of the people who propose and follow the uniformitarian model.

Titius-Bode Law**

The distance to the planets, measured outward from the sun, can be estimated from the Titius-Bode law. This 200 year-old relationship is outlined in Table II. Distances are given in astronomical units (AU); the Earth averages one AU, or 150 million kilometers (93 million miles) from the sun. The Titius-Bode law closely predicts the distances to the first seven planets and also to the asteroid belt. Neptune and Pluto diverge from the general rule, perhaps because of past collisions or close encounters with other space objects. The Titius-Bode law is not regarded as a fundamental law of nature. This is because there is no physical reason such as gravity or celestial mechanics which requires the planets to be spaced according to this numerical pattern. However, the law appears too accurate to be merely coincidental. One credible conclusion is that the relationship displays an original, intelligent pattern in the positioning of the planets.

The asteroid belt is also of special interest in that it "fits" with the approximate location of another planet using the Titius-Bode law. Several theories have been suggested to account for the materials which presently form the asteroid belt. One theory suggests that several small planetary bodies actually formed within this orbital path and that they eventually collided and scattered resulting in the generation of orbit crossing asteroids and the asteroid belt (Allègre, 1992, p. 123). Another theory has suggested that an outside object collided with the former planet thus creating the ejecta and the asteroid belt. However, at this time the authors support the explosion of a single large planet composed of rock and ice (i.e., terrestrial, not gaseous like Jupiter). This concept within the young-earth Flood model has previously been suggested by Parks (1990).

Due to causes beyond scientific testability, the hypothetical planet disintegrated, exploded, and sent debris (asteroids and comets-i.e., rock and ice), throughout the solar system. This theory would generate materials whose object size would vary from the microscopic to several miles in diameter. Much of this debris would impact with the planets and moons and evidence would be provided by impact craters. Some of these impacts were tremendous events resulting in the creation of space-entering ejecta. For example, ejecta from both Mars and the Moon are believed to have entered into space and to have later fallen on Earth (Condie, 1989, p. 17; Allègre, 1992, p. 124; Evans, 1992, pp. 134-138; Heide and Wlotzka, 1995, pp. 184-186).

The distance and gravitational pull of the planets and moons would directly effect the number of impacts, with the larger planets and moons having a higher incidence of impacts than the smaller planets and moons. Some debris might also go into large orbits around the solar system. Currently, scientists estimate that over 100,000 asteroids of various sizes exist in the asteroid belt. These asteroids are presently gravitationally locked in place and cannot be moved from their orbital pathway unless gravity or collision provides the energy to free them (Glass, 1982, p. 326).

**Also known as Bode's law and is a mnemonic device discovered by J.D. Titius in 1766 and advanced by J.E. Bode in 1772, used for remembering the distances of the planets (and asteroid belt) from the Sun (Hopkins, 1980, p. 18; Allaby and Allaby, 1991, p. 378).

Current asteroid fragments contained within the asteroid belt would combine to form an object size of about 1500 km (932 mi) in diameter. This is less than half the size of the moon and is also smaller than Pluto. Because of this limited asteroid mass and the lack of a disintegration or explosive mechanism, most astronomers reject the planet-explosion idea for the origin of the asteroid belt. However, we suggest that the original planet was substantially larger than the combination of today's asteroid belt remnants. This larger-than-present size is based on the summation of the observed asteroid remnants combined with the other planetary ejecta occurring as imprints (i.e., craters) on all the terrestrial planets and satellites within our solar system.

We realize that many impact features which have occurred on the Earth and surrounding planets have probably been erased due to tectonics, flood basalts, ice flows, flood waters, subduction, and erosion. Hence, we are forced to only guess at the original size of the planet in question. Based on the number of impacts and the size of the planet necessary to generate the mass of impact material and resulting asteroid belt, it would appear that the planet would be at minimum the size of Earth. The theory of an exploding or disintegrating planet once existing where the asteroid belt occurs today is not a new idea. Two centuries ago, Heinrich von Olbers described the breakup of a planet between Mars and Jupiter (Marvin, 1986, p. 144).

Creation Model

Young-earth creationists accept the Biblical account of a worldwide Flood. It was a period of time in which high-energy catastrophic processes operated. While the Bible speaks of "stars" (perhaps asteroids, meteors, or comets) falling from the sky in the last days, nothing is mentioned regarding falling stars associated with the Flood event. So we must attempt to interpret the physical record of terrestrial impacts without direct Biblical reference.

As a similar example, the Ice Age is not directly referenced in the Bible, yet we have the physical proof that one existed in Earth's past. Michael Oard (1990) has proposed a theory which explains the oc-

Table II.

Number sequence	Add 4; Divide by 10	Actual planet distances from sun (AU)	Planet
0	.4	.39	Mercury
3	.7	.72	Venus
6	1.0	1.0	Earth
12	1.6	1.52	Mars
24	2.8	2.8	Asteroids
48	5.2	5.2	Jupiter
96	10.0	9.54	Saturn
192	19.6	19.2	Uranus
384	38.8	30	Neptune
768	77.2	28-50	Pluto

Table II. Planet distances from the Sun as estimated from the Titius-Bode law (column 2) and actual measurements (column 3). Distance measurements are in astronomical units (AU), where one AU equals 150 million kilometers. An AU is the average distance between the Earth and Sun.

currence of a single ice age within the young-earth Flood model to address the physical evidence. The occurrence of meteor craters on and buried within the Earth requires the same type of analysis and model development.

We suggest that the majority of these impacts occurred during the Flood with an exponential decrease afterward. Exact age determination of any impact structure, within the young-earth Flood model, would be dependent upon the types of rocks in which they are found (e.g., igneous and metamorphic shield craters versus sedimentary rock craters) along with the depth and conditions of burial, not based on any paleontology associated with the rocks affected by the impact.

Platinum group metals, specifically iridium, do not themselves suggest an extraterrestrial source. Studies performed by several scientists have shown that iridium can come from a number of sources, including: basaltic lava flows, weathering of mantle derived iridium containing rocks (Bird and Bassett, 1980; Finnegan, Miller, and Zoller, 1990), concentration by biological activity (Orth, 1989, p. 55; Wallace, Keays, and Gostin, 1991), normal cosmic influx at a condensed section (Wang, Chatterton, Attrep, and Orth, 1992), or precipitation due to redox changes in marine chemistry (Colodner, Boyle, Edmond, and Thomson, 1992; Wang, Attrep, and Orth, 1993). However, the fact that shocked quartz grains and tektites are also found associated with some of the suspected impact boundary cosmogenic metals tends to support the occurrence of a meteor impact. The occurrence of extraterrestrial impacts on Earth is not counter to any Biblical teaching.

Rampino (1994; see also Glen, 1994b, p. 34) has called for the reexamination of many Proterozoic glaciated deposits due to their similarity with impact diamictites. He stated that impact ejecta deposits were originally misidentified as being of glacial origin (Rampino, 1994, p. 439). This could explain the lack of any additional glacial features, beyond the occurrence of tillites, for several sites currently accepted as reflecting Proterozoic glaciation. Rampino (1994, pp. 449-450) has correlated several mass-extinction boundaries with known "glacial" episodes which, based on evidence to support its impact origin, could more easily be explained within the framework of impact extinction events. Hence this impact versus glacial determination could potentially affect various Paleozoic climatological models and plate tectonic links between the continents (e.g., South America, Africa, Antarctica, India, and Australia).

The Flood Timeframe

The Flood caused a worldwide redistribution of previously existing crustal materials along with additional material added through volcanic and cosmogenic sources. Ecological communities were decimated during this event with some probably being buried in their original environment (i.e., in situ). If these communities were within an impact area, then cosmogenic debris could be added in the form of overlying sediments. The deposition of subsequent sediments, above the previously deposited impact materials, would then serve to preserve the debris until the rock section was later examined. Hence, communities buried in situ and covered over by a thin layer of cosmogenic and impact related ejecta would give the appearance of a mass-extinction event via a bolide impact. A suggested creationist position regarding the meaning and relevance of the iridium layer to the K-T boundary has previously been discussed (Oard, 1993; 1994; Auldaney, 1994; Froede, 1994b).

During the Flood event, impact structures would remain intact if they occurred in areas of either non-erosion or in basins where they would become buried and preserved. However, all records of impact structures could be obliterated if the structure occurred in an area subject to erosion. Many of the structures observed in various sedimentary rocks exposed at the Earth's surface appear to be recent and would suggest their post-Flood formation during the Ice Age to Present Age Timeframes (such as the Arizona Meteor Crater).

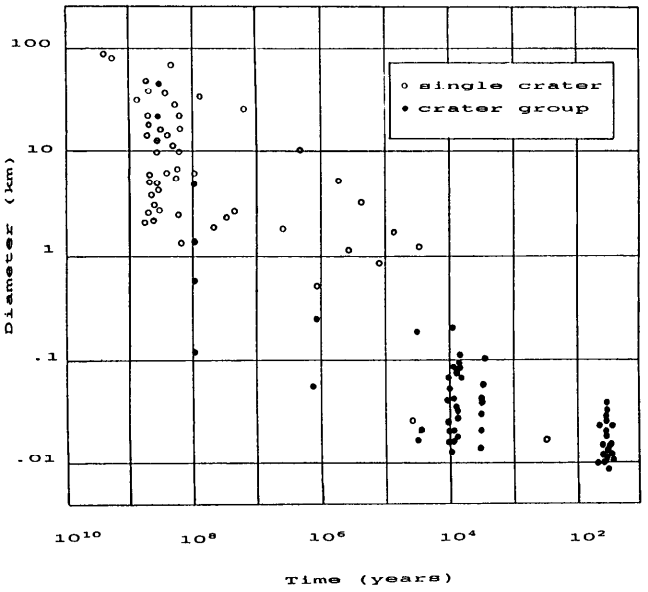

Figure 2. A log-log graph of earth impacts. Collision object size (vertical axis) is plotted against uniformitarian time (horizontal axis). The timescale is relative, and may well reflect the Flood Event through Ice Age Timeframes, with greatest bombardment activity occurring during the Flood.

Figure 2 summarizes impact collisions during Earth history (Andes, 1995). This log-log plot shows an exponential decrease of object size with time. The uniformitarian timescale shown is entirely relative. It is interesting to interpret this graph from the young-earth creationist viewpoint. The young-earth Flood model would suggest the frequency of collision with large objects as peaking during the Flood event, and decreasing exponentially thereafter. The rapid decrease in the numbers of impact events indicates that there are no new major sources of asteroids. While occasional impacts continue today, these collisions are a mere remnant of earlier activity. This same concept of increased impact activity during the uniformitarian Phanerozoic equivalent to the Lower to Middle Flood Event Timeframe) has been recognized and suggested by Shoemaker (1984). However, others view bombardment as exponentially decreasing since the formation of the Earth approximately 4.5 Ga ago (Allègre, 1992, p. 113).

The impact structure associated wit the K-T boundary at Chicxulub, Mexico is found approximately 3650

feet below the present land surface (Hildebrand et al., 1991, pp. 868-869). Because of its depth and condition of burial it probably represents a time of impact during the Lower to Middle Flood Event Timeframe. We suggest that this period of time probably followed global precipitation, when plate spreading may have occurred and waters were moved about by winds. The Flood waters had not yet started their initial withdrawal from the land. During this period of time, water currents generated by wind and tectonic movement served to erode and redeposit sediments across the globe. Impact events which occurred during this period would strike the Flood waters and penetrate into the soft or semi-lithified sediments. This would result in the blasted impact altered sedimentary debris spreading far across the area. Some scientists currently view the Chicxulub Crater as having formed within a shallow marine setting in this manner (Glen, 1994b, p. 15). Sedimentation would continue as erosional forces served to redistribute materials around the globe. Impact sites which occurred in soft newly deposited sediments and the debris from those impacts would either be buried and preserved or eroded, reworked, and deposited wherever the currents transported them. This is suggested by the distribution of impact craters and their associated ejecta found at several sites, and at various stratigraphic boundaries, around the world (Bohor et al., 1987; Bice, Newton, McCauley, Reiners, McRoberts, 1992; Hodych and Dunning, 1992; McGhee, 1994; Schultz et al., 1994; Poag and Aubry, 1995).

The record of extraterrestrial impact events is preserved at only certain localities and is extrapolated (using the uniformitarian stratigraphic column-a "global" rock record) to suggest worldwide conditions. The fact that these impact events occurred during the cataclysmic worldwide Flood event would be reflected throughout the uniformitarian rock record. The would occur in rocks identified from the Earth's earliest beginnings (represented by "Precambrian" age rock) to "modern" impact structures such as that of the Arizona Meteor Crater (possibly dated to the close of the Ice Age or even later, due to the minor erosion observed at this site [DeYoung, 1994]). (Figure 3).

We suggest that the majority of the uniformitarian stratigraphic record represents sediments deposited on a worldwide scale during the Flood. If the majority of the impact structures date to the Flood Event Timeframe, then it is likely that the resulting impact deposits would occur at specific locations throughout the stratigraphic record. The concentrated cosmogenic layers would indicate areas where impact structures occurred with burial resulting in their preservation. Impact site location would directly correlate to the occurrence of shocked quartz grains and tektites. These materials would be concentrated in areas near impact structures and their preservation would decrease in direct proportion to the distance from the original structure, especially if it were in an erosive area. The occurrence of soot with the cosmogenic debris would only suggest that smoke was in the air and that some level of soot was deposited along with the impact ejecta and associated platinum group metals i.e., iridium). Bolides striking floating or sunken woody materials during the proposed timeframe (Lower to Middle Flood Event) could have resulted in the explosive occurrence of fire

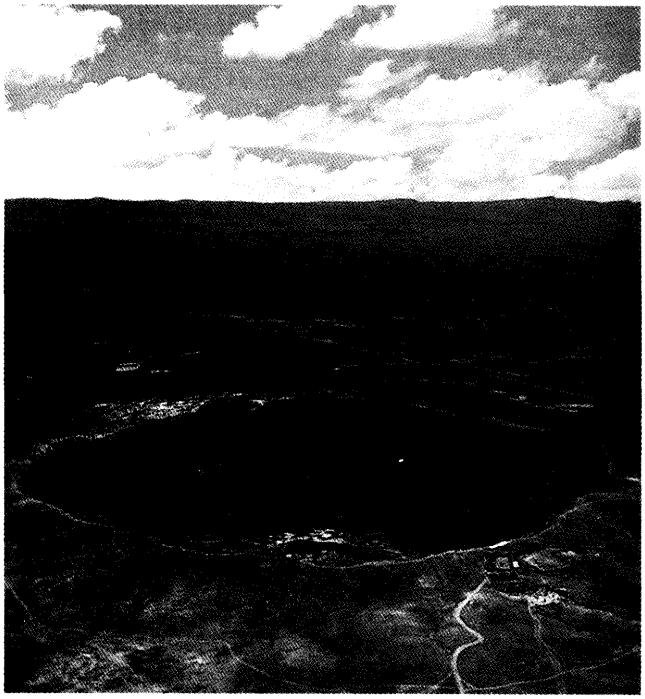

Figure 3. The Arizona Meteor Crater. Note the fresh, uneroded nature of this crater, which suggests its formation following the Flood, possibly during the closing stages of the Ice Age (Upper Ice Age Timeframe), but probably in even more recent times Lower Present Timeframe).

and soot. Some of the soot could then have been deposited on the Flood waters until it was buried under additional sediments. The fact that the soot is only found at a few of the K-T sites worldwide would limit the size of the proposed fires. The young-earth Flood model would predict that impact events would only be recognized-within a localized area, because of the erosive conditions which occurred during the Flood. The local impact effect is supported by the physical evidence found to date. Thus, the physical evidences necessary to support impact events for each of the various stratigraphic layers (i.e., K-T, late Eocene, Middle Miocene, and Upper Pliocene) are not always recognized in rocks the same age (i.e., chronostratigraphically across the global. Additionally, it has been suggested that some layers have been improperly identified as having multiple ejecta layering (thus-suggesting multiple comet showers) due to the lateral spread of the impact-generated microspherule debris (Wei, 1995). Bailey, Clube, and Napier (1990, p. 375-376) have stated that other than at the K-T boundary, iridium levels (along with impact craters) do not appear to support comet "showers" which have been suggested as having occurred over the past 33-67 Ma. Thus we note the fine-tuning still being performed as scientists attempt to explain the physical evidences and their link to extinction events across certain stratigraphic boundaries.

The spacing of the impact craters across Earth's surface during the Flood would place them in different strata (both paleontologic and lithologic). These differences when viewed from the uniformitarian model would place the impact events within different "dated" strata. This may explain why uniformitarian scientists

view the different periods of impact events at specific boundaries and locations in Earth's past. By using the evolutionary model developed on evolutionary paleontology (i.e., first and last occurrences of flora and fauna) and stratigraphic position, they observe a periodicity to the impact events. Where impacts occurred in equivalent "dated" strata they would appear to support a comet shower. Luck and Turekian (1983) have noted a difference in osmium concentrations between two K-T sites, which suggests that different meteorites were involved.

These various impact event beds could also offer the young-earth Flood modeler a means of correlating localized areas or even regions in terms of chronostratigraphy. Only through additional detailed studies can the importance of these impact event beds be determined within the young-earth Flood model.

Time Of Explosion

In order to project the input of extraterrestrial material into the Flood Event and Ice Age Timeframes, we need to propose both when and how it could have occurred. We must start with the original planetary disintegration and explosive event and approximate its average travel time to Earth. No mechanism is presently known by which we can predict the cause(s) for the destruction of a planet, resulting in the generation of ejecta (i.e., asteroids and comets) and the formation of the asteroid belt. We acknowledge that the Flood was a single event of Divine initiation and any attempt to understand the original cause is only speculation. Additionally, we suggest that cratering primarily occurred during the Flood Event Timeframe. However, we do not suggest that asteroids or comets were the ultimate cause of the Flood event. The cause of Divinely initiated actions cannot be determined, but we can possibly explain the resulting actions, in this case the asteroid/comet input into the Flood.

The average distance from the center of the asteroid belt to the Earth is 170 million miles. Speed of ejecta moving in a direct path toward Earth might be 15 miles per second, typical meteorite speed. This could place the arrival of extraterrestrial material within 131 days following the proposed planetary breakup. The authors can only speculate when the extraterrestrial material reached Earth's surface, during the year-long Flood. We suggest that the first occurrence of extraterrestrial impacts coincided with the beginning of the Flood. This theory would then require the planet's disintegration and subsequent explosion some 4-5 months before the onset of the Flood event. Any narrowing of this time would require knowledge of the actual positions of the Earth and the original planet, and the speed of its ejecta.

The cause of this planetary disintegration and subsequent explosion is unknown. As a similar example, we do not know what initiated the breaking of the fountains of the deep (Genesis 7:11), but we are told that it happened and we have oceanic rift margins which appear to support this fact. Any attempt to explain the cause of the planetary explosion remains a matter of conjecture.

Asteroids and meteoroids might also have contributed to the collapse of the vapor canopy, if one was present, and aided in the "breaking up of the fountains of the deep." However, the authors are not attempting to explain the Flood event by using the explosion of the planet in question. Rather, we are only formulating a source for the impact craters on Earth along with materials which are also of extraterrestrial origin.

Because this planetary explosion was a one time event it is not repeatable and the testability of this theory is limited to the same physical evidences used by uniformitarians for their proposed impact hypothesis. However, this event does work within the short time frame and duration proposed for the Flood and Ice Age. Debris from this explosion would rapidly be swept up as the planets and moons captured the material which crossed the various orbital paths, as it traveled across the solar system. Anything not captured by gravity probably continued into space or developed elongated orbits around the Sun.

Discussion

We suggest that a disintegrating/exploding planet located in an orbital path between Mars and Jupiter could provide a catastrophic yet limited supply of asteroid and comet material with which to bombard not only Earth but all of the planets and moons in the Solar System. These impact events occurred mainly during the Flood Event Timeframe and exponentially decreased thereafter. Today, the asteroid belt continues to undergo perturbations from nearby Jupiter, resulting in the release of asteroids which occasionally cross into Earth's orbital path. Asteroids continue to impact Earth, albeit in fewer numbers than in Earth's past.

However, we have not solved a number of issues in proposing this planetary explosion event. For example, when was the actual time of the planet explosion? Could it possibly have occurred at the Fall of man? Massive impact events are not recorded in the Bible during the Antediluvian Timeframe. Is this because none occurred during this period or because it was not considered important to the issues associated with the depravity of man before the Flood event? The authors suggest that the impact events are best correlated with the Flood with a rapid decrease in impact events immediately thereafter, based on our interpretation of the evidence. Many other interpretations are certainly possible.

Another issue is the cratering seen on the other planets (Mercury, Venus, Earth, Mars), and moons (those of the Earth, Mars, Jupiter, and Saturn) of the Solar Systern. Were there any original craters associated with creation or are the craters the result of impacts associated with the proposed planetary disintegration and subsequent explosion? We suggest that most of the cratering seen on the planets and moons is a result of impact events associated with the Flood Event Timeframe. This is because many of the Earth's craters are preserved in the sediments associated with the worldwide Flood. If the planets and moons were created (Day 4) with impact structures already on their surface, then any craters originally on Earth probably would have been obliterated during the Flood event.

Another point of interest in developing the asteroid impact hypothesis is that much of the evidence used to support the impact hypothesis is also believed to support a volcanic extinction hypothesis (Glen, 1994b, pp. 29-33). While the majority opinion among scientists

appears to support the asteroid impact hypothesis, there are a number of scientists who support volcanism as the main extinction event driver (e.g., Erwin and Vogel, 1992; Officer and Drake, 1989; Officer and Carter, 1991: Glen, 1994b, pp. 29-33). This is further complicated when viewed within the framework of a repeatable extinction cycle, as was originally proposed by a number of previously cited scientists. The issue of extraterrestrial versus volcanic input into the stratigraphic record, during the Flood Event Timeframe, has not been resolved among young-earth creationists.

Currently, the young-earth Flood model does not have all of the answers to the impact hypothesis and much research and field work remain to be performed. However, this proposed impact model does satisfy the time frames suggested by the young-earth Flood model and would provide the same physical evidences (e.g., cratering on the planets and moons, platinum group metals, impact ejecta, shock quartz, and tektites).

Glossary

Apollo asteroids- Asteroids with elongated orbits that cross the Earth's orbit. Most Apollo asteroids have highly elliptical orbits that extend to the vicinity of the asteroid belt, or in some cases, beyond (Glass, 1982, p. 328).

Asteroid- One of the many small celestial bodies in orbit around the Sun. Most asteroid orbits are between those of Mars and Jupiter.

Bolide- A large meteor that explodes in passing through the Earth's atmosphere (Allaby and Allaby, 1991, p. 44).

Chirons- Used here to describe any number of slow moving minor planets (i.e., large asteroids) which cross the various orbital paths of the planets.

Comet- A small cold object that travels around the Sun, usually in an eccentric orbit. Short-period comets have orbital periods of less than 150 years. Others have very long periods, some exceeding 100,000 years.

Condensed Section- A facies consisting of thin marine beds of sediments deposited during the time of regional transgression of the shoreline (Van Wagoner et al., 1988, p. 44). This particular facies is commonly associated with the buildup of sediments which are enriched in authigenic minerals, volcaniclastics, and cosmogenic debris (see MacLeod and Keller, 1991). See Froede (1994a) for information regarding the concepts of sequence stratigraphy within the young-earth Flood model.

Cosmogenic debris- Sedimentary materials which were derived from extraterrestrial sources.

Diamictite- A comprehensive, nongenetic term for a nonsorted or poorly sorted, noncalcareous, terrigenous sedimentary rock that contains a wide range of particle sizes, such as a rock with sand and/or larger particles in a muddy matrix (Bates and Jackson, 1987, p. 180).

Facies- The aspect, appearance, and characteristics of a rock unit, usually reflecting the conditions of its origin (Bates and Jackson, 1987, p. 232). It can be singular or plural depending upon its usage.

Ga- Geological abbreviation for "billions of years." Term actually represents Giga-annum (10^9 years).

Meteor- Any physical object or relatively small fragment of solid material made luminous as a result of friction during its passage through the Earth's atmosphere.

Shocked Quartz Grains- Quartz grains bearing multiple sets of planar deformation features. These features are recognized as forming at high pressures during loading experiments, and at nuclear detonation sites and impact craters (Bohor, 1990b, p. 336).

Tektites- A rounded, pitted jet-black to green-yellow body of silicate glass of nonvolcanic origin, usually walnut sized, found in groups in several widely separated areas of the Earth's surface and generally bearing no relation to the associated geologic formations (Bates and Jackson, 1987, p. 676).

Tillite- A consolidated or indurated sedimentary rock formed by lithification of glacially derived unsorted an unstratified drift (Bates and Jackson, 1987, p. 688).

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LETTERS TO THE EDITOR

Deceitfulness And The Appearance of Age

I enjoy very much the C.R.S. Quarterly and found myself concerned over Dr. Hugh Ross's statements about "the deceitfulness of God" which were noted in reviews of his book written by DeYoung and Faulkner for the March 1995 and June 1995 issues respectively. He argues that God would be deceitful if He should make a universe with the appearance of age or that implies the existence of things that never truly existed. His point, if true, would be a very important one and Faulkner was completely correct that Ross has "fired a shot across our bow with this book" because obviously we do not believe God to lie nor to be deceptive (from Titus 1:2 "God who cannot lie . . ." and Hebrews 6:18 "it is impossible for God to lie"). We would be guilty of a grave heresy if we accepted that He were. But on closer examination I believe Dr. Ross's argument itself to be untenable to anyone who accepts the Bible as an authority and who does not deny miracles.

Theologians have stated that "creation is, of course, breaking into a circle," meaning that since all parts of creation interact and seem to move in cycles through time, any creation must necessarily include choosing some starting point that seems to have many actions leading up to it like a point on the arc of the circle rather than just a point on a line. Dr. Ross would apparently argue that God cannot "break into a circle" without deceiving an observer into thinking that other things came before.

However, God is not being deceptive if He tells us by special revelation what we might not know by examining natural revelation. God essentially says, "Looking at this you might think of several interpretations, but I am telling you which interpretation is correct? For a Christian, special revelation must take precedence over our interpretation of natural revelation. Creation is not the only case of this, but several miracles could be thought to be deceptive on the same grounds if the Bible did not explain them.

DeYoung quotes Dr. Ross which shows he does not consider the water turned into wine as a counter example to his argument. Yet the miracle is certainly an example of a sudden appearance of something that would normally imply the existence of grapes and vines since eye witnesses explain that it really was water before Jesus acted, and wine afterwards.

In the feeding of the 5,000 and the 4,000, we could say that Jesus was deceitful because someone examining the crumbs left over would be assured of the existence of fish and wheat plants that never truly swam or grew since 12 baskets remained from two fish and five loaves. Yet the Bible explains their existence as an act of Jesus which we accept as evidence of His deity. The disciples give no sign of being deceived but rather seem to have felt that Jesus was giving them important information or evidence for very important true matters.

We should also consider healing miracles, and those whom Jesus raised from the dead. Would a blood test of Lazarus or Jairus's daughter minutes after their resurrection not deceive a doctor into thinking that they had been healthy for days? It would seem that new life in a dead body requires the sudden appearance of some hormones or enzymes that would have disappeared at death. At the very least, Jesus must have rearranged the atoms already present to recreate the dynamic equilibrium of a living body. Similarly, if a test, minutes after a healing, could not show any sign of illness which would be present in a sick body, was Jesus being deceptive? Or was He simply showing His power? If miracles like these were random and purposeless, we would have to distrust what we consider "laws of the universe." But in Jesus' hands the miracles have important educational value as proof of His power, His love for people, and the value of listening to His words. These miracles never have been considered deceptive.

Dr. Ross certainly takes an evangelical viewpoint, but he may have shot himself in the foot using this