An Examination of the Odessa Meteor Craters (Ector County, Texas, U.S.A.) Within the Context of the Young-Earth Flood Framework

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Abstract

The Odessa Meteor Craters are located in West Texas (U.S.A.). The site is approximately five miles southwest of the town of Odessa, Texas in Ector County. The locale consists of five impact craters with the largest being approximately 550 feet in diameter and 103 feet deep. The impact event is viewed by uniformitarian scientists as having occurred between 10 to 50 thousand years ago. At the largest crater, the meteor penetrated Cretaceous-age limestone and underlying clastics creating a raised rim of considerable relief. In the intervening time erosion has removed much of the elevated rim and nearly filled the crater with sediments. The eroded nature of each of the impact craters suggests that they formed near the end of the Flood Event Timeframe while Floodwater was still slowly withdrawing from the North American continent. Fossils of Ice Age megafauna found within some of the craters suggests that they may have provided a source of drinking water. However, once the creatures entered the depressions some could not escape and they perished. Today, only the largest crater retains any visible expression of its catastrophic origin as the smaller craters have been filled with sediments.

Introduction

It should not surprise young-Earth creationists to realize that the Bible was not written to describe geologic processes. We are told in Proverbs 25:2, that:

> It is the glory of God to conceal a thing: but the honour of kings is to search out a matter.

So, mankind is provided the opportunity to investigate the Earth and in return bring God all the glory due Him. Extraterrestrial impact studies allow us to discover the greatness of our God. We tend to think that everything related to planet Earth originates as a function of God's use of Earth's geological processes, but impact craters on Earth as well as across the Solar System reveal that God has command of the entire universe. Much has been written by young-Earth creationists regarding the role that meteorites and comets have played in Earth's brief history and this subject will not reviewed here. Rather, we will examine a specific location and seek to understand it within the context of a biblical framework.

There are no historical meteor or comet impact events recorded in the Bible. However, there are approximately 150 known impact sites across the Earth (Hodge, 1994). This number will increase as new sites are identified and added to this list (e.g., Wetumpka crater, Alabama—see Froede and Williams, 1999a; Froede, 1999b; King, Neathery, Petruny, Koeberl, and Hames, 2002).

Impact craters are recognized in two areas of West Texas, those being the Sierra Madera and Odessa Meteor Craters (Hodge, 1994). The Odessa Meteor Craters site consists of five depressions that have been interpreted as having formed as a result of the impact of a small-scale meteor shower. The craters are located in south central Ector County, Texas (U.S.A), approximately five miles southwest of Odessa (Figure 1).

History of the Impact Craters

The town of Odessa, Texas, was founded as a stop along the Texas and Pacific Railroad, and passenger service began in 1881 (Pollard, 1998). The original discovery of the impact crater is credited to Odessan Julius D. Henderson who came across the site while retrieving a lost cow during the winter of 1892 (Sherburn, 1998). In 1921, Arthur Bibbins was provided samples of what was reported as iron ore by a local rancher who found them adjacent to a blowout feature (Bibbins, 1926). Bibbins submitted a sample to

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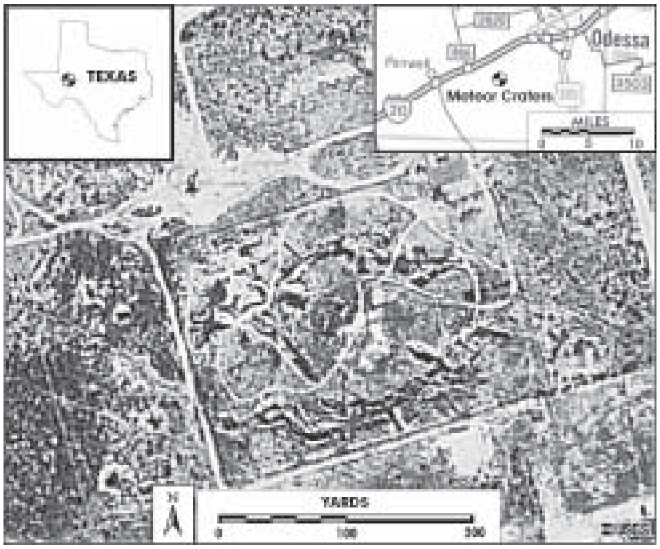

Figure 1. Aerial photograph showing the location of the largest impact crater. Foot trails wind through and around the site. Modified from U.S. Geological Survey aerial photograph. Smaller inset shows the location of the site in relation to Odessa and Penwell, TX.

Smithsonian research scientist George Merrill (1922), who analyzed the iron material (Table I) and determined it was of extraterrestrial origin. A careful examination of the site, however, did not occur until 1926, when D. M. Barringer (son of the famous discoverer of the Arizona Meteor Crater) identified it as an meteor impact crater (Anonymous, n.d.; 2001; Barringer, 1929). In 1927, University of Texas geologist Dr. E. H. Sellards reported on the unusual crater-like feature found southwest of Odessa, Texas. He stated that resolving its origin could occur only if excavation or drilling were conducted (Sellards, 1927). Meteorite expert H. H. Nininger visited the area in 1933, and in seven hours collected 1500 pieces of iron meteorite by using an electromagnet (Anonymous, 2001).

From 1939 to 1941, extensive excavations were conducted at the largest crater by Sellards and Glen Evans (Sellards, 1940; Sellards and Evans, 1941; Sherburn, 1998). A total of 35 wells were drilled to varying depths both in and around this feature (Sellards and Evans, 1941). Several trenches were constructed through portions of the crater walls (Figure 2) and a 165-foot shaft (Figure 3) was excavated in its center (Dearen, 1995). Two other meteor

Figure 2. Photograph of a still-remaining trench constructed during the 1939 to 1941 period that Sellards and Evans investigated the largest crater at the site. Their investigation was to determine the cause of the largest crater. They determined it to be the result of an extraterrestrial impact.

Chemical Analysis of Odessa Meteorite Sample	
Element	**Weight Percent**
Iron	90.69
Nickel	7.25
Cobalt	.74
Copper	.02
Platinum	None
Chromium	Trace
Manganese	None
Carbon	.35
Phosphorus	.23
Sulphur	.03
TOTAL	**99.31**

Table 1. Merrill's (1922) analysis of the Odessa iron meteorite sample. He suggested that the cause of the apparent absence of platinum was likely the result of the small sample size provided to him.

craters were also found during the investigation using a magnetometer (Sellards and Evans, 1941). Meteorite material weighing as much as 100 pounds became commonplace during the course of these investigations (Stowers, 1998). The shaft completely penetrated the impact crater (approximately 103 feet deep) and continued down through Cretaceous-age clastics to the top of a carbonate layer. With all of this extensive field work, the shape and stratigraphic composition of both the crater fill and surrounding area have been more clearly defined (Figure 4). In 1958, Glen Evans returned to the site and conducted additional investigations resulting in the discovery of two additional craters and hundreds of ground surface indentations caused by the smaller falling fragments (Sherburn, 1998). Several paleontological finds have also occurred as a result of these investigations. Mammoth remains were found in one of the smaller craters and in sinking the 165-foot shaft in the largest crater, Evans reported finding fossils of Pleistocene horses and elephants (Dearen, 1995).

Today, the craters still show scars from the extensive excavations. However, there remain a few areas around the largest crater that likely reflect its original physical state (Figure 5). Unfortunately, the lack of any significant

Figure 3. Photograph of the metal cover over the 165 foot-deep shaft also constructed by Sellards and Evans to understand the depth of meteor penetration. Scale in inches and centimeters.

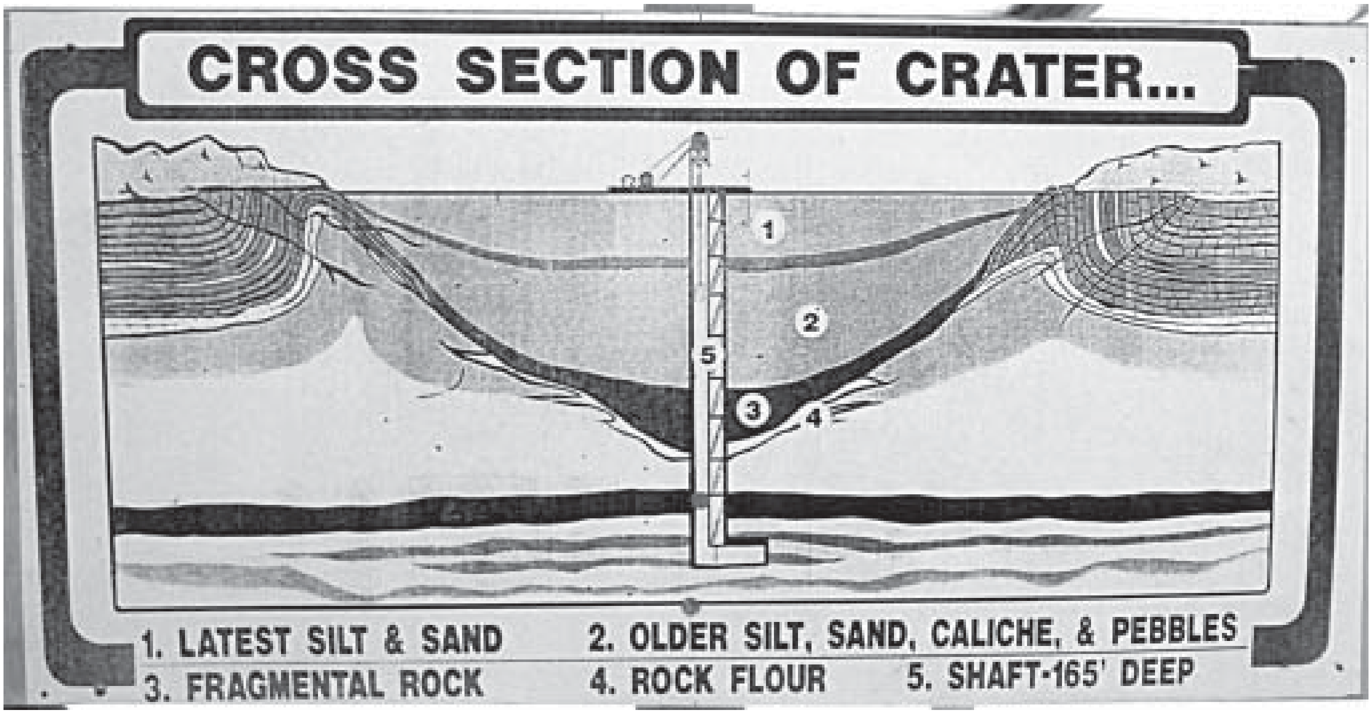

Figure 4. Photograph of the general stratigraphy of the crater from a sign located at the largest crater. This geological information was obtained during the course of the extensive investigation conducted by Sellards and Evans from 1939 to 1941.

Figure 5. Upturned strata along sections of the crater rim still exist today. The rim around the largest crater is highly eroded and suggests either extended periods of time have passed or more properly that it was created and eroded during the closing stages of the Flood. Scale in inches and centimeters.

Figure 6. The crater as it exists today. This view is looking down into the crater from along the northeastern rim. Its highly eroded condition reflects extensive erosion which we interpret as corresponding to the Upper Flood Event Timeframe (Froede, 1995; 1998).

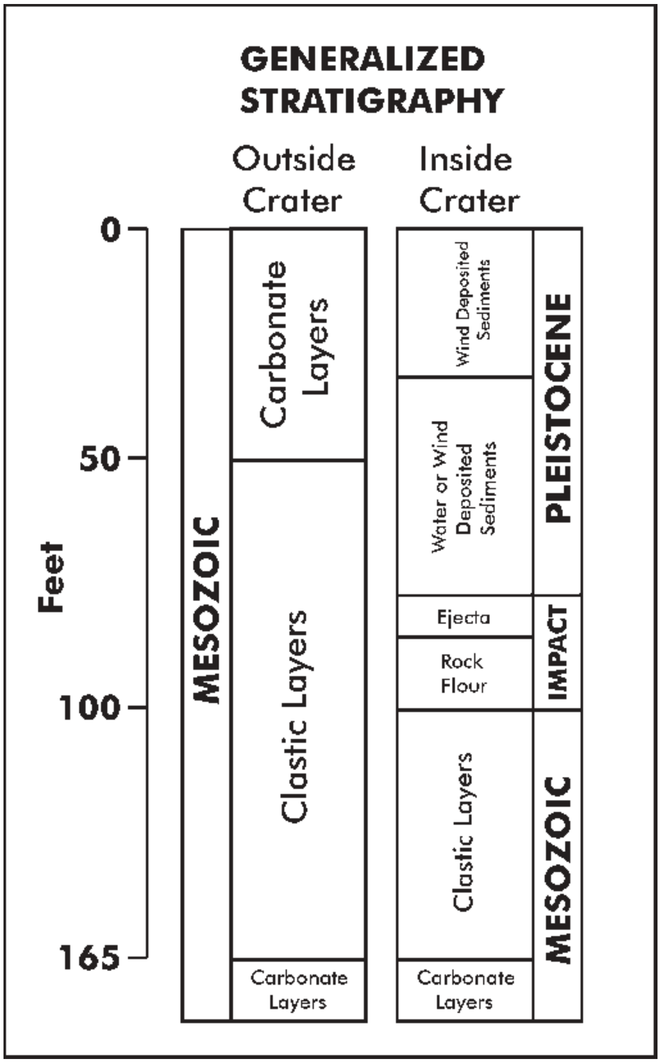

Figure 7. Generalized stratigraphic columns for both inside and outside of the impact crater. The information is adapted from several sources (Anonymous, No date; Anonymous, 2001; Dearen, 1995; Spearing, 1991).

elevational relief reduces the impressive nature of these impact craters (Figure 6).

Site Stratigraphy

The most complete knowledge of the site comes from the investigation conducted by Sellards and Evans (1941) at the largest crater. From their work we are able to reconstruct the stratigraphy of the area both before and as a result of the impact event. This information aids us in determining the timing of this event within the young-Earth Flood framework.

Figure 7 provides a general stratigraphic column from both outside and within the impact crater. All of the strata affected by the impact are interpreted by uniformitarian scientists as being deposited during the Cretaceous period. A series of carbonate layers form a significant cap over underlying clastics which in turn rest upon additional carbonates. It is estimated that the top of the Triassic shale occurs approximately 200 feet beneath the ground surface (Anonymous, 2001; Dearen, 1995; Sellards and Evans, 1941).

The pre-impact stratigraphy of the area reflects a former marine environment. The surficial carbonate strata would have been deposited during the Late Cretaceous when a seaway linked the Arctic Ocean with the Gulf of Mexico (Froede, 1995a). The eventual withdrawal of the epeiric seaway resulted in the exposure of the limestone to subaerial conditions resulting in its eventual lithification. Post-impact Pleistocene clastic material fills the smaller craters and nearly so the largest crater.

Impact Object and Resulting Craters

The exact size of the object that broke apart and created

Figure 8. During the course of the investigation of the largest crater an adjacent smaller crater was identified based on a magnetometer survey of the surrounding area. This crater was originally filled with sediment and was only partially excavated to verify its extraterrestrial origin.

the Odessa impact craters is unknown. However, it has been speculated to range in size from 300 to 1500 tons (Dearen, 1995; McSpadden, 1998; Sellards and Evans, 1941; Spearing, 1998; Stowers, 1998). There is little doubt that the five craters and surrounding depressions are all the result of one wide-spread fall event.

At the largest crater, the meteor impacted into sedimentary rocks and is said to have raised rim of carbonate strata rising 50 feet in elevation around the crater (Smith, 1997). The resulting crater is 550 feet in diameter and approximately 103 feet deep (Anonymous, 2001; Hodge, 1994; Sellards and Evans, 1941; Sherburn, 1998). Subsequent erosion and infilling of the largest crater has reduced rim relief to five to seven feet above the surrounding area. Four other smaller impact craters are also recognized across the site (Figure 8). They range in size from 15 to 70 feet in diameter and seven to 18 feet in depth (Dearen, 1995). None of the smaller craters fully penetrates the surficial carbonate/clay layers that extend across the site.

Analysis of the octahedral iron meteorite by Merrill (1922) reveals a composition similar to that of other typical iron meteorites (Table I, Figure 9). A recent discovery northwest of the Odessa craters presents interesting information that possibly explains the original composition of the meteor and why this fall was a meteor shower as opposed to the fall of a single large object. A stony-iron meteorite was found near Penwell, Texas–a locality not far from

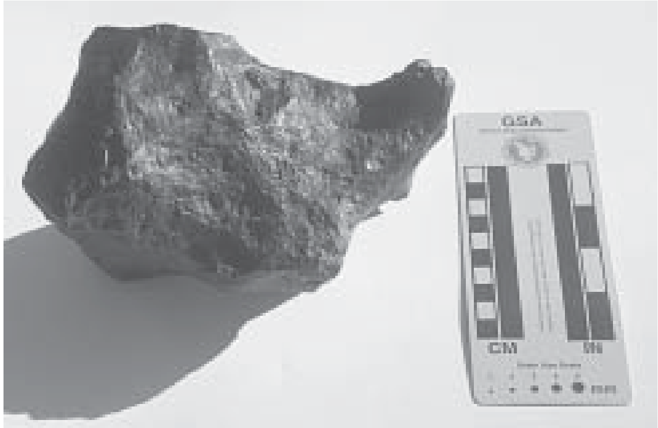

Figure 9. Photograph of an Odessa meteorite on display at the Gallery of Creation, Stone Mountain, Georgia. Scale in inches and centimeters.

the Odessa craters site (Moore, Lewis, and Clark, 1981; 1982; Kempton, 2002). Similar composition between this meteorite and those from the Odessa craters locale lead Moore, Lewis, and Clark (1982) to the following conclusion:

> It thus appears that it is possible that the parent meteoroid of the Odessa iron contained various inclusions which may have broken free during entry and scattered over a moderately large area.

Analysis of the Penwell stony-iron meteorite reveals that in addition to iron-nickel (50%), it contains 30% silicates and 20% graphite by weight (Moore, Lewis, and Clark, 1981). According to Norton (1998), the presence of silicates in iron meteorites is common in octahedrites collected from the Odessa crater. We believe that the breakup of the large meteor likely created a shower of materials across a broader area than is presently recognized.

Impact Crater or Volcanic Explosion?

In the past, controversy surrounding the identification of impact craters has largely focused on the belief that catastrophic processes (such as impact events) simply did not occur. Until the 1960's, the general scientific consensus held that the Earth was bombarded early in its history, but nothing like this has occurred since. Thankfully, this view has changed as many impact craters have been discovered. Some of the earliest evidence used to persuade scientists of an impact origin came from the iron found in association with the depression. The abundant iron-nickel found around the Odessa craters provided important tangible evidence that scientists required to confirm it as an impact crater (Figure 10). More recently, additional evidence has been documented in the form of shatter cones (Figure 11). These features are important in documenting impact crater sites where other evidence (e.g., iron-nickel materials, meteorite debris, impact crater) is missing (Dietz, 1947; 1959; 1963; 1964; 1968; French, 1998). The Odessa Craters not only provide metallic evidence of their extraterrestrial origin, but shatter cones as well.

Age Dating the Impact Event

Presently, the age of the Odessa meteor craters ranges from 10 to 50 thousand years (ka). However, the stratigraphic interpretation more narrowly defines the craters as being from 20 to 25 thousand years old (Dearen, 1995; McSpadden, 1998; Stowers, 1998). Initially, investigators believed that the Odessa craters were linked to the Arizona Meteor Crater based on the similarity of the iron-nickel and age of the individual craters (Anonymous, 2000; Dearen, 1995; Hoyt, 1987). As recently as 1987, late geolo-

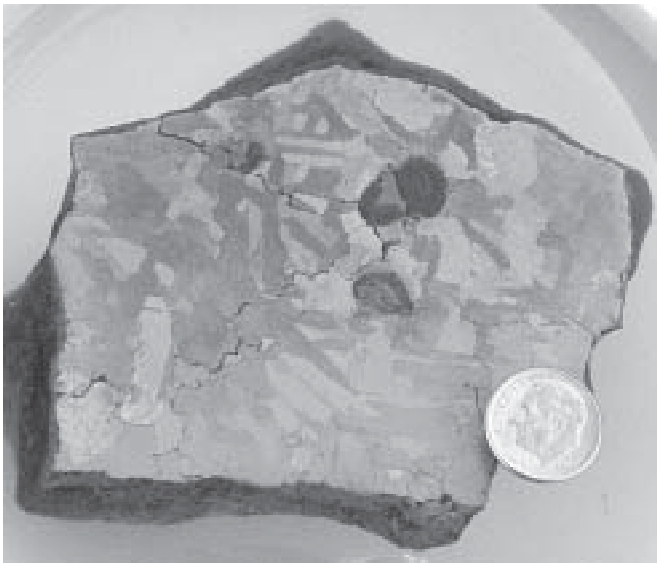

Figure 10. Photograph of a slabbed Odessa meteorite showing the classic Widmanstätten pattern. This regular geometric pattern reflects the intergrowth of kamacite and taenite during slow cooling (McSween, 1999). This fragment is on display at the Gallery of Creation, Stone Mountain, Georgia. Coin is 0.7 inches (1.8 centimeters) in diameter.

Figure 11. A photograph of two shatter cones in limestone collected from the Odessa Meteor Craters on display at the Gallery of Creation, Stone Mountain, Georgia. Scale in inches and centimeters. These features are indicative of impact craters and do not require exceptional impact forces to form them (French, 1998). The impact force propagates in an expanding manner and results in the formation of a cone-shaped feature. Scale in centimeters.

gist Eugene Shoemaker expressed his belief that the Odessa craters and Arizona Meteor Crater were both part of the same southeasterly directed meteorite (Hoyt, 1987). However, some confusion still exists as the Arizona Meteor Crater is presently believed to have formed 50 ka years ago (French, 1998) and the Odessa Craters are believed to be of more recent age. Hence, based on site stratigraphy the age of the Odessa Meteor Craters remains unresolved and open to interpretation.

Fossils are commonly used to age-date strata. Mammalian fossils have been collected from Pleistocene sediments within the Odessa Meteor Craters during the course of several investigations. However, these fossils do not constrain the possible age of the various craters. Rather, they indicate a period of time following crater formation. Based on the age of these fossils, it has recently been proposed that the Odessa craters are 10,000 years old (Mark, 1987).

It is interesting to note that the craters are located in an area with an abundance of windblown sand. Only the largest crater retains a surface expression due to its remaining unfilled within this active eolian setting for at least 10 to 50 ka. One might expect all of the craters to have been completely filled and buried with such an extended period of time available to transport windblown sand across this area.

A Young-Earth Flood Framework Interpretation

The biblical view of Earth history requires less time to form impact craters (Froede and DeYoung, 1996). An analysis of the stratigraphic setting, coupled with the geologic energy of the event and present condition of the site, allow for a reasonable interpretation. Former crater features subsequently removed by erosion can provide us with important clues in attempting to determine their possible age.

Impact events typically create craters with a raised rim and a surrounding ejecta blanket (the ejecta blanket is formed from materials blasted from inside the newly-formed crater). It has been estimated that the impact associated with the largest crater would have produced a rim approximately 50 feet higher than the surrounding ground surface. Past excavations in and around the various craters have not revealed any significant rim-related elevation, either buried or present, across the site. Significant erosion has occurred to reduce the original crater rim to its five- to seven-foot elevation.

An ejecta blanket 10 to 12 feet thick was identified immediately surrounding the crater during the course of the Sellards and Evans (1941) investigation. This material thins with distance from the crater and was postulated to have been “thicker when the crater was first formed” (Sellards and Evans, 1941). Large weathered blocks of limestone and shale ranging in size from three to four feet immediately surround the largest crater. Some of this ejected material is identified within the adjacent smaller crater as having been water deposited (Sellards and Evans, 1941). It is interesting to note that Sellards and Evans (1941) believed that a “considerable length of time” had passed since the impact event based on the “accumulation of caliche cements.” The ejecta blanket is covered by one or more caliche layers.

The fill material within the largest crater aids in defining the time frame in which the impacts occurred. Lining the bottom of the crater is rock flour created as a result of the tremendous meteor impact. Above this layer is sediment believed to be ejecta material that fell back into the crater following impact. Overlying this layer are clastic materials (i.e., sands, silts, and clays) that have washed into the crater and have been partially cemented by caliche which also suggested “an appreciable time interval” to Sellards and Evans (1941). Windblown sediments nearly fill the remaining space.

At least two interpretations addressing the formation and age of the Odessa Meteor Craters are possible within the young-Earth Flood framework:

1) The impact event occurred at the closing stages of the Flood when water was slowly retreating from the North American continent (Froede, 1995a). This retreating Floodwater eroded the elevated crater rim and surrounding ejecta blanket. Some of those materials could have been transported and deposited within the submerged craters.
2) The craters formed following the retreat of Floodwater. The wetter-than-present conditions associated with the Ice Age (Oard, 1990) eroded the crater rim and transported the majority of the surrounding ejecta blanket away from the site as well as possibly returned a portion of it to the crater.

Discussion

Several interpretations are possible within the context of the biblical framework when considering the impact event along with subsequent erosion and deposition. We favor an interpretation that links the impact to the late stages of the Flood (i.e., Upper Flood Event Timeframe; Froede, 1995b; 1998) while marine water still covered this portion of West Texas. Retreating Floodwater (and tidal forces) created the erosive conditions necessary to remove the elevated crater rim and weather/remove most of the surrounding ejecta blanket. The erosion of the uplifted carbonate strata rim would have been more easily accomplished in a subaqueous setting as the carbonates were still in a soft, semi-lithified state. A subaerial setting for the impact event would have rapidly hardened the upturned crater rim carbonate strata and lithification would have greatly reduced the rate of erosion. The conditions at the site do not appear to support an impact event occurring subaerially during the Ice Age Timeframe.

The presence of caliche cement within and above the ejecta blanket is easily explained within a subaqueous setting. Some of the cement associated with the impact-generated sediments was derived from carbonate-rich water and suspended fine-grained calcareous sediments deposited across this portion of Texas due to the subaqueous Floodwater conditions. Following the impact event the carbonate depositional setting merely continued until the Floodwater retreated from the area. Hence, the presence of one or more caliche cement layers within and above the impact ejecta blanket represents the continuation of carbonate deposition across the site which only concluded with the cessation of marine conditions. We do not believe that a post-Flood impact event would not have provided the conditions necessary to yield one or more caliche layers in association with the weathered ejecta blanket.

The abundance of meteorite material to the northwest (and west) of the site reflects the expansive area covered by the meteorite shower. The heavier iron-nickel meteorite debris likely remains at or near its original position. Less dense meteorite material, such as the Penwell stony-iron meteorite, might have been transported away from the site due to tidal effects or strong water currents and additional investigation is required.

The identification of the fossilized remains of Pleistocene megafauna within some of the larger craters suggests two possible scenarios:

1) The fossils are the remains of animals killed during the Flood and washed into the depressions with the retreat of Floodwater, or more likely,
2) The largest impact crater would have been rather deep (estimated at 60 feet below the ground surface) following the withdrawal of Floodwater. It could have served as a source for drinking water following the flushing of marine water and the establishment of freshwater conditions within the shallow subsurface. The water-saturated clastics within the crater floor might not have sufficiently consolidated to allow animals to exit once they entered the crater for drinking water. Animals could have become trapped and died. In the case of the smaller craters, the water-saturated carbonates/clays would have created a slick, sticky mud that might have trapped unfortunate animals that happened to stumble into them. It is also possible that animals were killed in and around the craters by predators. However, no fossils of any kind of Pleistocene predator(s) have been identified or reported from this area in the literature. Much speculation exists and we offer no real final solution. More research into the question of why these fossils were found in some of the craters is clearly warranted.

Our interpretation presently assumes no link to a possible fragmentation event in outer space that also created the Arizona Meteor Crater, although this still remains to be determined within the context of the young-Earth Flood framework. Comet Shoemaker-Levy 9 has demonstrated that a single meteoroid/comet body can break apart and produce a series of related impact events around the globe which might otherwise be interpreted as being non-related. The link to the Penwell stony-iron meteorite suggests that (barring any transport from the original impact site) the fragmentation of the Odessa meteoroid occurred earlier in its Earth-bound course than is presently realized by uniformitarian scientists.

Conclusions

The location of the Odessa Meteor Craters provides an interesting and unique setting in which to study and understand the fragmentation of a parent meteoroid as it enters Earth's atmosphere. The timing of this event and size of the impact object are not resolved within the uniformitarian model of Earth history. While the size of the object likely remains unresolved within the young-Earth Flood framework, the period of time in which this event occurred is resolvable. The present highly-eroded condition of the multiple impact craters suggests they formed when geologic processes were operating on the surface of the planet at a higher energy level than experienced at present. We interpret this period of time to correspond to the end of the Flood (Upper Flood Event Timeframe: Froede, 1995; 1998) when Floodwater still covered this portion of West Texas sufficiently to erode both the elevated carbonate crater rim and surrounding ejecta blanket. We propose that some of the clastics associated with the crater rim and ejecta blanket were eroded and returned into the crater. Following the complete withdrawal of Floodwater, the area was subject to wetter and windier conditions associated with the Ice Age. It was during this time that some Pleistocene megafauna became trapped in the various crater-formed water holes. These animals died and were buried by precipitation-transported and windblown sands. With the drying out of the climate, wind transport of additional clastic materials became the predominant means of depositing additional sediments into the craters. Insufficient time has passed to fill all of the craters with sedimentary materials which we believe supports the young-Earth Flood framework. Today, we find the craters as weathered shadows of their former existence, providing testimony to the extraterrestrial effects and erosional energy of the global Flood of Genesis.

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Book Review

An Agenda for Antiquity: Henry Fairfield Osborn and Vertebrate Paleontology at the American Museum of Natural History, 1890–1935

by Ronald Rainger

University of Alabama Press, Tuscalosa. 1991, 360 pages, $44.95

How did we arrive at this point? Why has evolutionary thought so dominated our academic, scientific, mass media and even religious establishments? Several years ago a professor of history at Texas Tech University, H.F. Osborn, wielded great influence. Author Rainger highly has researched Osborn and produced a readable and important summary.

Henry Fairfield Osborn (1857–1935) had a significant impact on the public's perception and acceptance of evolutionary thought. From his work at Princeton and Columbia Universities he developed strategies that bore their greatest fruit when he became curator and president of New York City's American Museum of Natural History (AMNH).

Osborn was a very capable organizer, networker and self-promoter. He took advantage of his high social standing and learned from the mistakes of others. Two prominent paleontogists of the previous generation, Edward Drinker Cope and Othniel Marsh, both exhausted their personal fortunes on the expensive business of fossil excavation and preparation. While Osborn used some of his own money, he had a circle of very wealthy friends who contributed significant financial support for museum projects. Osborn organized his departments and personnel effectively to promote passionate interests in vertebrate paleontology in the realms of ancient mammals, dinosaurs, and ancient man.

What was Osborn's "agenda for antiquity"? At Princeton in the late 1880s Osborn became a neo-Lamarckian (p. 39) as reflected in his writing. He later developed his own "tetraplastic/tetrakinetic" (p. 128) non-Darwinian view of evolution. Osborn advanced a type of theistic evolution, "Any random, discontinuous change, indeed any change that was not fully predictable, was equivalent to chance or accident, events that occurred without reason, plan, or purpose. Such phenomena could have no place in Osborn's interpretation of evolution or in his conception of nature, where everything operated strictly according to law and under the guidance of God"(p. 139). Rainger also comments on Osborn, "For him the laws of evolution demonstrated the presence and handiwork of the creator every bit as much as the Bible. On those grounds he steadfastly opposed William Jennings Bryan and the fundamentalists who claimed that evolution undermined religion" (p. 131).

Osborn was admonished by his parents and other mentors to use his influence for society's betterment. Through the exhibits at the AMNH Osborn advocated his agenda. He believed the modern educational system produced individuals who "had become domesticated and effeminate, characteristics that Osborn, as a part of the male power structure, considered degenerate" (p. 119). Rainger explains, "But for Osborn the immersion in nature was a personal confrontation that led to self-fulfillment. Osborn, perhaps influenced by the views of his good friend [Theodore] Roosevelt, glorified the outdoor study of nature as a transforming experience that could bring social and spiritual redemption" (p. 120). The museum exhibits especially on the Neanderthal and Cro-Magnon cultures exemplified this "return to nature" ideology.