DeSoto Falls in DeSoto State Park, Alabama: Evidence for Recent Formation?

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Abstract

Uniformitarian geology is based on long periods of time which are demanded for the formation of geomorphic features found on Earth. According to this doctrine, most extant geomorphic structures required millions of years of slow and gradual processes for their formation (Dunbar, 1955). In contrast to this, the Young-Earth Flood model predicts that these features were formed within the last few thousand years while undergoing the effects of high-energy, short-term, catastrophic processes (Gish, 1985). Conditions which favored rapid modification of the Earth's surface were present during the period of the Flood Event and the subsequent Ice Age (following the geologic framework proposed by Froede, 1998). DeSoto Falls, located in DeSoto State Park, Alabama, is such a geomorphic feature that is best explained within the framework of the Young-Earth Flood model.

Site Location

DeSoto Falls is located within DeSoto State Park near Mentone, Alabama (Figure 1). This waterfall was formed by the west fork of the Little River which flows atop Lookout Mountain.

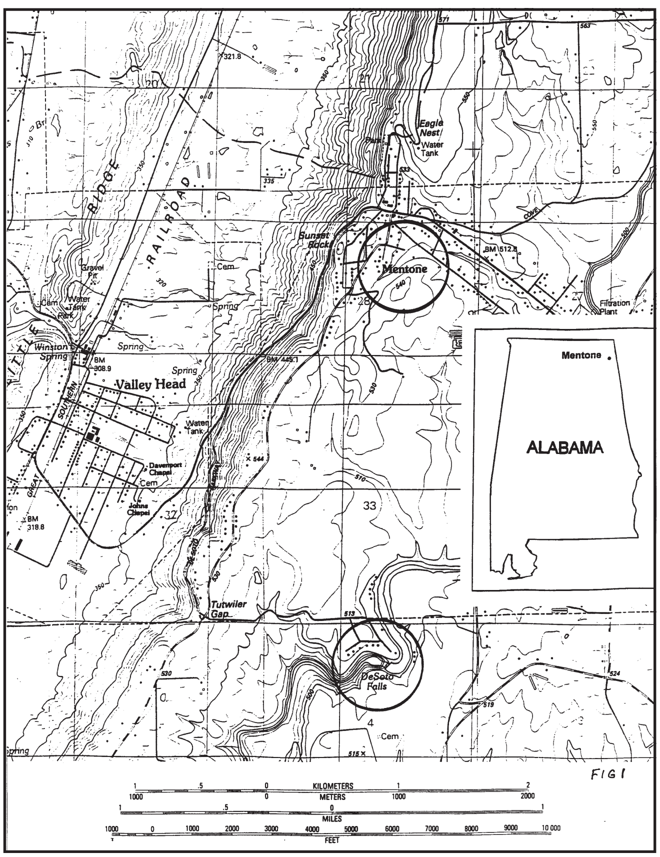

Figure 1. Map showing the location of DeSoto Falls in DeSoto State Park near Mentone, Alabama.

Description of Lookout Mountain

Lookout Mountain is the narrowest synclinal plateau within the Appalachian Plateaus Province of Alabama. It extends in a northeast to southwest direction from Chattanooga, Tennessee, to Gadsden, Alabama, a distance of approximately 80 miles (127 km) (Figure 2). The plateau varies in width from an approximate maximum of 10 miles (16 km) to a minimum of one mile (1.6 km). Compared to the long anticlinal valleys adjacent to and paralleling Lookout Mountain, the topographical relief is approximately 1,600 feet (488m). This syncline is capped by sandstone which is considered by uniformitarian geologists to be Pennsylvanian in age. This sandstone is part of the Pottsville Formation which covers much of north Alabama (Osborne, et al., 1989).

Description of the West Fork of the Little River

One of the major tributaries in the drainage basin associated with this part of Lookout Mountain containing DeSoto Falls is the west fork of the Little River. This river is approximately 25.3 miles (40.7 km) in length from its origin to its conjunction with the east fork of the Little River. Water flow in the tributary varies from almost none in dry weather to a heavy discharge during wet conditions. In its meandering, southward course, the tributary approaches within approximately 1,200 feet (366 m) of the western

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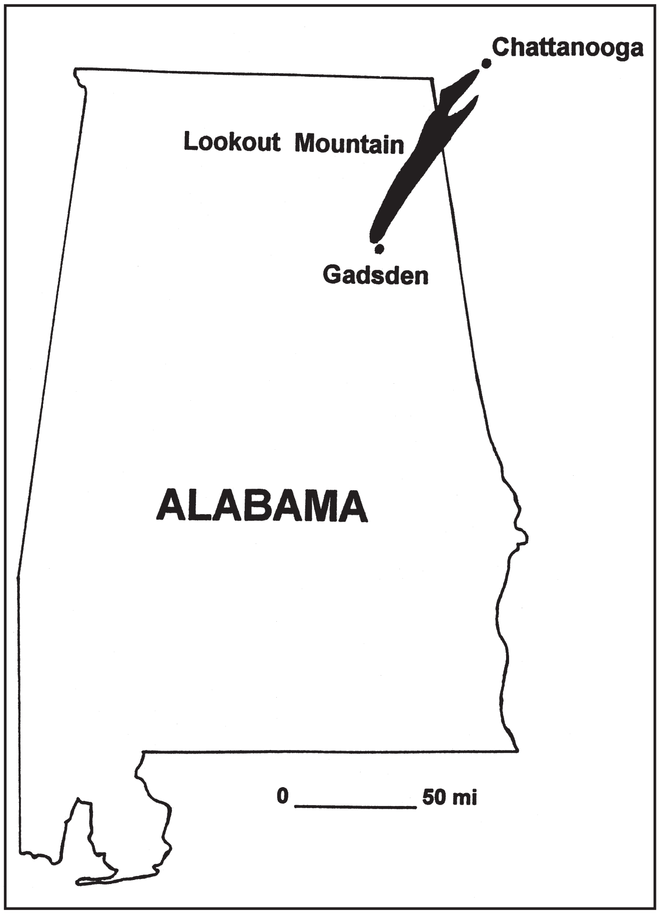

Figure 2. Map showing location of Lookout Mountain between Gadsden, Alabama, and Chattanooga, Tennessee.

Figure 3. View looking downcanyon from the lip of DeSoto Falls with a small part of plunge pool visible in lower right. The south side of the cirque-shaped basin is seen on the left. The sheer cliff faces of the canyon of the west fork of the Little River are barely discernible through the heavy vegetation. The underfit west fork of the Little River can be seen exiting the catchment basin at the uppermost part of the plunge pool. Note people on light-colored area in lower right for scale.

margin of Lookout Mountain and approximately 4,000 feet (1.2 km) from its eastern margin. The gradient of the tributary is 834 feet (254 m) from its origin to the point of intersection with the east fork of the Little River. The west fork of the Little River exhibits the characteristics of an underfit stream in that it is too small to have carved the canyon through which it flows.

The Canyon of the West Fork of the Little River

A canyon, cut entirely from undifferentiated Pottsville Formation sandstone and varying in depth up to approximately 180 feet (54.9 m), hosts portions of the west fork of the Little River. The canyon has sheer cliff faces which drop 50 feet (15.2 m) or more before the talus apron is reached (Figure 3). Talus accumulation is minimal throughout the course of the canyon.

Description of DeSoto Falls

From its location on the west fork of the Little River, DeSoto Falls (Figures 4a and 4b) is approximately 9.3 miles (15 km) upriver from the conjunction of the east and west forks of the Little River. DeSoto Falls, comprised of a major and minor waterfall, provides an abrupt change in the topographical relief of the west fork of the Little River. The major waterfall measures approximately 100 feet (30.5 m). Approximately 75 feet (23 m) upstream from the major waterfall is another waterfall measuring 21 feet (6.4 m). A 19 foot (5.8 m) high dam spans the west fork of the Little River approximately 90 feet (30.5 m) upstream from the minor waterfall. Water flow in Figures 4a and 4b is about the maximum normally observed except during rare and unusually wet conditions.

DeSoto Falls plunges into a cirque-shaped catchment basin which is approximately 375 feet (114 m) in diameter. The plunge pool occupies most of the diameter of the catchment basin and is 35 feet (10.7 m) deep directly under the waterfall (Thomas, 1998). DeSoto Falls faces almost due west and is positioned approximately 4,700 feet (1.43 km) from the western margin of Lookout Mountain. The sides of the catchment basin have a maximum relief of approximately 180 feet (54.9 m) measured from the elevation of the plunge pool (Mizener, 1998).

An Anomaly of the Cross-Sectional Profile at DeSoto Falls

There are at least two apparent erosional profiles for the west fork of the Little River at DeSoto Falls (Figure 5). The

Figure 4a. Aerial view of DeSoto Falls. Note minor waterfall and cirque-shaped catchment basin.

Figure 4b. View of DeSoto Falls showing both minor and major waterfalls.

prominent profile exhibits an erosional pattern in the sandstone which has a flattened, U-shaped cross-sectional profile (Figure 5-A). The other profile is the smaller cross-section (Figure 5-B) formed by downcutting of the sandstone ledge over which the present water flows to form the major waterfall. This rectangular-shaped erosional downcut in the ledge measures 50 feet (15.2 m) wide by eight feet (2.4 m) high and normally contains all of the water flowing over the waterfall except during rare and unusually wet conditions. During periods of moderate rainfall, the water depth at the lip of the falls is usually less than one foot (0.3 m). The amount of water flow in the rectangular downcut varies as the flow volume varies in the west fork of the Little River.

Possible Flood-Based Events Leading to the Formation of DeSoto Falls

This area of Alabama containing Lookout Mountain is within the Appalachian Plateaus and Valley and Ridge Provinces. How the folding and faulting of these strata were accomplished remains an enigma to uniformitarian geologists. However, much of the mystery can be unraveled by creationists in viewing the formation process as occurring rapidly during the high-energy events of the earth-covering Flood and its aftereffects.

During the Flood, large areas of the earth's surface became covered by layers of water transported sediment. Following deposition, the unlithified sediments were apparently subjected to compressional and tensional forces parallel to the Earth's surface and perpendicular to the resulting folds that formed throughout the Appalachian fold and thrust belt. These forces probably began during the later stages of the Flood after the deposition of these immense sediment layers, increased rapidly, and then exponentially decreased in intensity with the waning of the Floodwater and associated diastrophism. The unlithified sediments could have been bent and folded without cracking the strata, examples of which can be observed in many locations. When certain conditions, dependent on such factors as compressional/tensional forces, depth of sediments, resultant radii of folding, and the degree of lithification, were present in localized areas of Flood-laid strata, cracks and thrust faulting would have occurred. These factors would have resulted in the folding and faulting of strata which were then acted on by the power of the abating Floodwater.

Lookout Mountain is a narrow syncline bounded on each side by long anticlinal valleys which lie parallel to the synclinal axis of the mountain. During the Flood, compressional and tensional forces caused the formation of this synclinal structure and adjacent anticlines. The anticlines, which were initially higher in elevation than the syncline, were eroded more rapidly than the syncline to form the existing adjacent valleys (Akridge, 1998; Froede, 1997). Al-

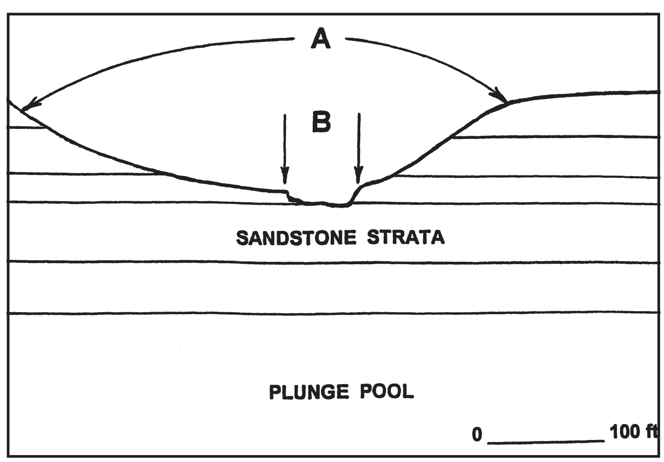

Figure 5. A cross-sectional profile of the west fork of the Little River at DeSoto Falls showing major (A) and minor (B) erosional profiles.

though this striking reversal of the elevations of the syncline and anticlines seems improbable, empirical data demonstrate that this did actually happen, leaving the structures now in existence. Uniformitarian geology does not supply a reasonable explanation of how this anomaly could have taken place. Only the Young-Earth Flood model provides credible answers to the otherwise perplexing mysteries found in these and other Appalachian geomorphic structures.

As the retreating Floodwater gathered kinetic energy during the later stages of the Flood, it would have had tremendous erosive power in carving the Earth's features. As the newly formed syncline and adjacent anticlines were subjected to the erosional assault of fast moving Floodwater, they would have undergone differential erosion. Initially, the elevated anticlines would have offered greater hydrodynamic resistance to the energized water and they would have been eroded at a faster rate than the adjacent synclines. As the anticlines were rapidly worn down, the folded strata which had high angles of dip within the anticlinal structures would be exposed and eroded faster than the syncline (Akridge, 1998). The water would have moved in a direction paralleling the exposed edges of the folded strata which would have had greater susceptibility to erosion than the comparatively horizontal beds of the syncline.

In the area of study, the plateau-like top of the Lookout Mountain syncline dips to the west and south. Floodwater would have flowed across this area in the direction of the slope of the top of the syncline. Once the anticlines were eroded to lower elevations than the syncline, the water would have concentrated its erosive power in the newly forming anticlinal valleys. Thus, the differential rate of erosion would have been amplified with the greater concentration of Floodwater flowing around the syncline at this time during the Flood.

Speculations on the Formation of DeSoto Falls

The drainage basin on top of the Lookout Mountain syncline was likely established by the swift currents of Floodwater. During the later time frame of the Flood, the abating, high-energy water would have been directed through this drainage system, its energy being focused along newly forming downcuts. The semi-lithified strata on top of the syncline underwent rapid downcutting in the areas favoring maximum water flow. Canyons would have been quickly formed in the path of the energetic water. What is now the west fork of the Little River would have been one of the major concentrations for the route of water on its way to a lower elevation. This fast moving water would have been perhaps many tens of feet deep as it gouged out the canyon and drainage patterns which now contain the west fork of the Little River.

Water flow through this area of interest during the inception of the canyon, coupled with the existing topography, would have established conditions favoring the construction of waterfalls at appropriate points in its travel. With the establishment of a drainage gradient directing Floodwater withdrawal across the top of the synclinal ridge, conditions would have been optimum for the enhancement and development of erosional scarps later remaining as waterfalls throughout the drainage basin and canyon system of Lookout Mountain. While this paper is written mainly as a treatise on one major waterfall (DeSoto Falls), I propose that other waterfalls within this area may have also been established by the same processes in effect at the time of large-scale canyon formation.

As huge volumes of water surged at high velocities over sudden relief changes in the rapidly forming canyon which now hosts the west fork of the Little River, the erosional rate at and near the relief changes would be greatly amplified. The high velocity water would change from a more laminar flow to become increasingly turbulent as it entered the zones of relief change. This very turbulent water would propagate powerful forces which could have dislodged fragments from the rock forming the relief changes and multiply the rate of erosion by the impact and abrasion by these fragments with the surrounding rock. When water flow is greater than 30 ft/sec (9 m/sec), cavitation can be produced. As vapor bubbles produced from the effect of cavitation implode in contact with rock in the path of the water, a powerful erosive agent is introduced which can hammer on the affected rock with a force of up to approximately 440,000 lb/in^2 (31,000 kg/cm^2) (Barnes, 1956). Thus, cavitation impacts could have quickly eroded large quantities of rock in the path of the energized water (Holroyd, 1990a, b).

As tens of feet of water flowed over erosional scarps which would later become waterfalls, powerful eddies would have been generated which would erode the foot of the relief changes such that undercutting of these structures would be accomplished. Once enough of the underlying strata was undercut, failure of the upper portions of the ledges would have resulted, causing the ledges to break off and the cycle to be repeated in an upgradient portion of the strata. This is believed to have been one of the main causes of erosional retreat of the waterfalls formed by these processes.

Initially, what is now DeSoto Falls would probably have been located many miles downstream from its present position. Due to massive amounts of headward erosion during the formative processes described above, the erosional retreat of the structure could have been as much as tens of feet per hour. For example, during the Lake Missoula Flood, it is postulated that in a week of flooding, Palouse

Falls, a 180 foot high (54.9 m) feature, would have had an erosional retreat from its beginning at the Snake River of 180 ft/hr (54.9 m/hr) [Austin, 1992]. The 400 foot deep (122 m), six mile (9.7 km) long Palouse Canyon and Palouse Falls were apparently formed within this short time frame by the same catastrophic type of erosion believed to be responsible for DeSoto Falls and the related canyon.

Significance of the Cross-Sectional Profile at DeSoto Falls

As discussed earlier, the Floodwater would have initially flowed across the Lookout Mountain syncline and adjacent anticlines in similar volumes. With the erosion of the anticlines and the subsequent reduction in elevation of the anticlines below the level of the synclinal plateau, greater amounts of water would have been diverted through the newly forming anticlinal valleys and away from the higher elevation of the plateau. At the point in time when the anticlines became lower in elevation than the syncline, I believe that the major erosional work in forming the main cross-sectional profile (Figure 5-A) of the canyon at DeSoto Falls was accomplished.

With the detour of major volumes of water through the anticlinal valleys and away from the synclinal plateau, the large cross-sectional profile (Figure 5-A) would have then undergone minor erosional modification as compared to its catastrophic beginning. The reduced water flow from that point in time would serve as the erosional agent in forming the rectangular downcut (Figures 5-B and 6) on the lip of the major waterfall. Large amounts of rainfall and abnormally wet years subsequent to the Flood during the Ice Age would have supplied heavy water flow through this tributary basin, further enhancing erosion of the rectangular downcut. This rectangular downcut, along with the major erosional profile of the canyon, now represent the effects of a much greater water flow than is observed now.

Evidences for the Recent and Cataclysmic Formation of DeSoto Falls

Many evidences speak of DeSoto Falls and its host canyon being of relatively recent origin. Waterfalls are recognized as short-lived features in the existence of a stream (Leet and Judson, p. 235). By their very nature, waterfalls are hurrying their own demise in that their concentrated erosional energy seeks to smooth the sudden drop of a waterfall to a gradual descent in the longitudinal profile of a stream.

The canyon containing DeSoto Falls has vertical sidewalls until the talus slope is contacted. Vertical cliffs indicate formation in the relatively recent past as insufficient time has elapsed for erosion to smooth the cliff scarp to a shallower angle. Also, the presence of minimal talus along the steep canyon walls is an indicator of recent origin. Given the uniformitarian model of millions of years of erosion, there should be no waterfalls present as erosion would have occurred evenly across the surface of the syncline. Additionally, the talus volume should be much greater, with talus extending upward to the formerly steep cliff edges which would be but gentle undulations in the topography.

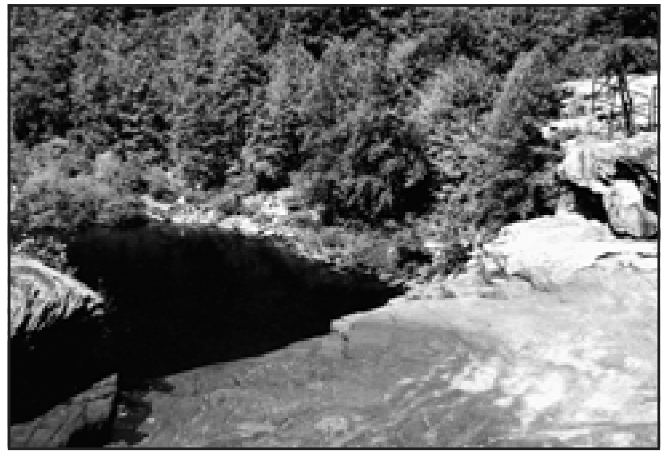

Figure 6. The rectangular downcut on the lip of DeSoto Falls which normally contains all the water going over the waterfall. The downcut extends from just below the fence in the upper right to the sandstone shelf on the left. This photo taken during a drought when only a small amount of water flow present. The plunge pool is visible in the catchment basin above the lip of the falls. Four foot (1.2 m) fence provides scale.

This logic can also be applied to the sheer catchment basin walls which are shaped similar to a huge cylinder that has been turned vertically on its end. Given time, the catchment basin would be eroded such that the structure would tend to resemble a large wash bowl with shallow sloping sides. In this scenario, DeSoto Falls would not exist, its former vertical structure having been reduced by erosion such that water in what is now the west fork of the Little River would enter this area flowing over gentle slopes.

If a stream is the only agent responsible for valley formation, one can predict that the result would be a vertical-sided gorge which is no wider than the channel of the stream (Leet and Judson, p. 234). This canyon supplies evidence of a large current of water (the original "stream") having carved the canyon through which it coursed. There was insufficient time for the effects of slope wash and mass movement to be primary factors in eroding the canyon walls such that they sloped upward and outward from the stream channel as modern examples demonstrate operating under uniform conditions. When huge volumes of

Floodwater assuaged after a short period of high-energy catastrophic action, the canyon was left much as it remains today. The canyon then became subject to relatively minor erosional modification by the effects of the wet post-Flood Ice Age and the introduction of recent uniform processes.

While the vertical walls of the canyon and catchment basin both speak of recent formation, they also indicate that cataclysmic forces were at work during this same time frame. The catchment basin and canyon are both geomorphic features which could not have been carved by present day levels of water movement as postulated by uniformitarian geologists. The catchment basin has been undercut around much of its base at the elevation of the plunge pool (Figure 7). This undercutting was probably caused by the effect of erosion as high volumes of swirling, sediment-laden water poured over this sharp relief change during the later stages of the Flood, and extending into the wet weather conditions of the Ice Age. Today, the relatively minor turbulent action and low sediment load of swirling water from the waterfall cannot significantly impact or erode the catchment basin. Much of the undercut feature is now protected from further significant erosional modification by a talus dike cover (Figure 7).

Because there is minimal talus accumulation, it is apparent that a large volume of sandstone has been removed from the canyon during its formation. Once eroded, the talus was flushed from the canyon and deposited somewhere beyond modern discovery. The Flood is the only recorded source of energized water that could have accomplished such a task given minimal time in relatively recent history.

Figure 7. Undercut areas of DeSoto Falls' catchment basin at the elevation of plunge pool. Note talus dike now protecting undercut areas from significant erosion. Person on rock in water provides scale.

Conclusion

The physical evidences for the formation of DeSoto Falls and its host canyon favor a rapid origin within the past few thousand years by hydraulic forces not now in effect. The data collected in this study support an interpretation within the Young-Earth Flood model with continuing post-Flood modification of the features during the time of increased precipitation and wet weather in the subsequent Ice Age.

Erosion which occurred during the Flood appears to have had the greater effect on this topography. However, features in this area seem to indicate that lesser, but significant erosion did also occur during the wet period following the Flood. The rectangular downcut on the lip of the major waterfall is one evidence which strongly supports this interpretation.

The physical evidences found here directly contradict the uniformitarian presuppositions of up to 300 million years of time said to be necessary for the origin of the canyon and waterfalls. The locale has a youthful appearance that speaks of high-energy erosional processes which were introduced quickly, accomplished their work rapidly, and were attenuated exponentially over a short time frame. After the Flood and the Ice Age, the forces which were responsible for the catastrophic modification of this area had ended, allowing the more uniform processes to begin their erosional work. This would be predicted by the Young-Earth Flood model.

DeSoto Falls and its host canyon stand as a visible and strong testimony of the power and effect of a hydraulic cataclysm which impacted the area in the relatively recent past. Because the geomorphic features in this area support an interpretation based on the Young-Earth Flood model, continued study of this interesting area of Alabama by creation researchers is encouraged.

Acknowledgments

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Book Review

Tornado in a Junkyard, by James Perloff
Refuge Books. P.O. Box 191, Arlington, MA 02476-0002. 1999, 321 pages, $ 16.95

James Perloff has aimed at the layman in writing this book and as such includes mild warnings such as the material "is full of technical words" (p. 33). He also throws in layman-friendly words such as Bozo, fiddlesticks, blooey, nah, and oh yeah, and phrases such as "Whoa! Here comes a Nolan Ryan fastball" (p.31), and "Come on, gimmie a break!" (p.170). Although this style may be disconcerting to someone expecting a "college-level" dissertation, Perloff has succeeded in presenting a number of analyses about aspects of the creation/evolution controversy without losing the layman reader.

Some might argue that he has gone too far in his attempt to align himself with the masses. For example, in his second chapter he says,

> This book will examine the growing case against evolution. That means we'll deal with—ugh—"science stuff." But we'll try to keep it simple and interesting, like those *Dummies* books (p.8).

The book's title, of course, comes from Sir Fred Hoyle's famous quote that the probability of higher life forms emerging by chance are comparable to the odds that "a tornado sweeping through a junk-yard might assemble a Boeing 747 from the materials therein" (p.74).

Perloff says "all but a few of my quotes come from evolutionists" (p.23), and this is easily verified by a look at his "Notes" on page 281 where avowed evolutionists are noted most often, followed by creationists and a few such as Behe and Denton who tell of the extensive problems with evolution but do not fully accept creationism.

The author has included far more illustrations (83) than have most other creationist writers in a book this size and this fact will appeal very much to the layman he is trying to reach.

Several books recently have referred to the Scopes trial and its negative aspects for creationism. In a chapter titled, "Trial by Hollywood," Perloff gives details of the trial not often seen in creation/evolution literature. He gives the true account of the Scopes trial as contrasted with the movie version called "Inherit the Wind." Perloff cites at least 23 instances in which the movie sharply disagreed with the facts of the trial.

Perloff has used a unique approach by his extensive use of colloquial language but, hopefully, it will be an effective method to bring the creation viewpoint to those who otherwise might never read about it.

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