The Florida Keys: Evidence in Support of Slow Floodwater Retreat Part I: The Upper Keys

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Abstract

The Florida Keys extend from just south of the city of Miami (Soldier Key) to the Dry Tortugas, a distance of 150 miles. They are composed of two different types of calcium carbonate (i.e., limestone) rock. The upper Keys are exposed sections of former living coral reef (Pleistocene–Key Largo Limestone) and the lower Keys are lithified oolite (Pleistocene–Miami Oolite) accumulations. The Key Largo Limestone contains coral species similar to the modern-day reef. In places it is greater than 170 feet thick. I propose that the Key Largo Limestone coral reef tract developed during the period of slow Floodwater retreat spanning from 500 to over 1,000 years following the one-year-long global Flood of Genesis.

Introduction

The biblical record documents the Flood as an event which resulted in total global inundation. The Scripture further states that Noah and his family disembarked from the Ark a little more than a year after the beginning of the Flood. Does this require that Floodwater had receded to the various ocean basins at today's sea-level position? No, because: 1) Scripture does not suggest or provide a sea-level position at the time of Noah's disembarking from the Ark, 2) the Bible does not provide a possible rate of Floodwater withdrawal, and 3) many physical evidences exist which indicate that Floodwater remained over sections of the Earth's continents even after the one-year-long Scriptural Flood (see Froede, 1997). One area which supports the likelihood of long-term Floodwater submergence is found in the carbonate rock accumulations of South Florida.

Many of the world's modern carbonate reefs and/or oolitic sand bank accumulations formed when sea-level was at a higher position than at present. With the drop in sea-level these formerly submerged carbonate mounds became exposed. The Florida Keys reflect these sea-level changes and provide an excellent setting in which to study the effects of slow Floodwater withdrawal from the southern peninsula of Florida. Coral reef rock found within the northern portion of the Florida Keys was at one time exposed up to 18 feet above the present sea-level position. I will relate these presently subaerially exposed coral reef rock islands to changing sea-level position within the framework of the Young-Earth Flood Model.

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Carbonate Rocks at the Southern Tip of Florida

The southern tip of the Florida peninsula is composed of thousands of feet of carbonate rock with the vast majority interpreted by uniformitarians as having formed over millions of years during the Cretaceous Period[1]. Overlying these massive Cretaceous carbonates are layers of Tertiary clastics and carbonates (Missimer, 1984; Randazzo and Halley, 1997). Many questions remain about this section of Florida since little wide-spread deep subsurface investigation (i.e., well drilling) has been conducted[2]. Pleistocene age corals (Key Largo Limestone) along with somewhat lateral equivalent age (now lithified) oolitic sands (Miami Oolite) thinly cover this entire area. Present-day exposures of the Pleistocene age coral reef limestone form the individual islands of the upper Florida Keys.

The Upper and Lower Division of the Florida Keys

The Florida Keys extend off the southern peninsula of Florida in a northeast to southwest arc, from the Atlantic

[1]Although some of the more deeply buried carbonate rock is believed to date to the earlier Jurassic Period, the majority of the carbonate build-up is viewed as having formed during the Cretaceous Period.

[2]Neither the deeply buried Cretaceous age limestones nor the overlying Tertiary age limestones and clastics will be addressed in this article. Rather, I will focus on the upper-most coral reef rock (i.e., Pleistocene age - Key Largo Limestone) which thinly overlies these older strata.

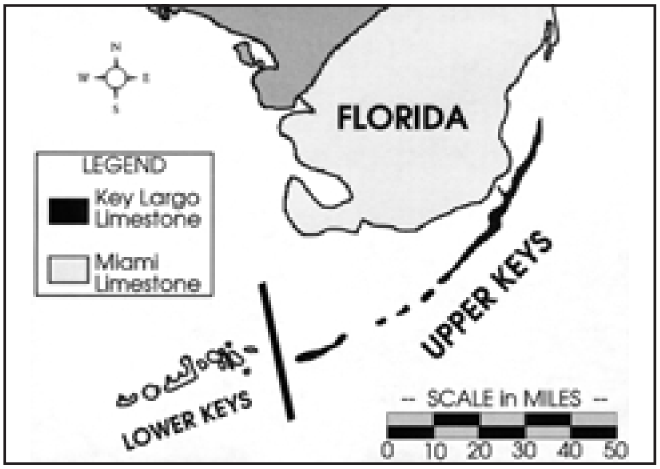

Figure 1. Generalized map showing the Florida Keys extending from Key Largo to Key West. The Dry Tortugas are not shown but lie 70 miles west of Key West. The Key Largo Limestone and Miami Limestone are viewed as chronostratigraphic. Much of the eastern Florida mainland is composed of Miami Limestone. Modified from Hoffmeister (1974, p. 85).

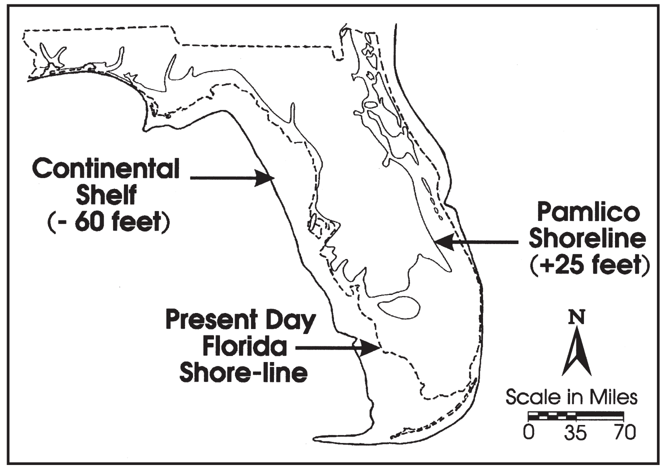

Figure 2. Map of the State of Florida showing the extent of the sea-level highstand associated with the Pamlico period of warming within the Wisconsin (Mid-Wisconsin) glaciation of the Pleistocene Ice Age. Also shown is the continental shelf most of which was exposed during the late Wisconsin glaciation. Modified from Hoffmeister (1974, p. 25).

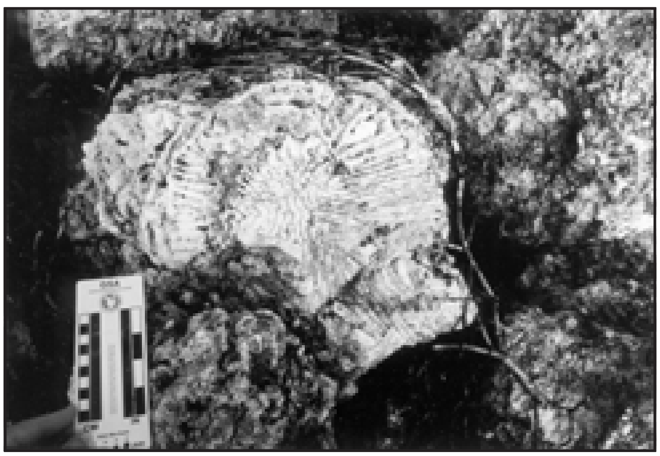

Figure 3. A block of limestone which was once a living head of coral. The upper keys are built on this Pleistocene coral reef rock. It could only have grown in a marine setting and reflects former submergence.

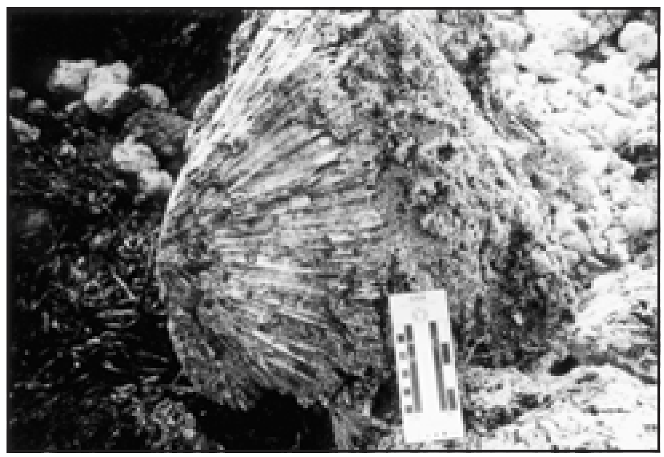

Figure 4. A block of coral turned on its side revealing the manner in which it once grew. This coral was found several feet above today's sea-level position.

Ocean to the Gulf of Mexico. Geologically, they are divided into upper and lower Keys based on the composition of the limestone rock forming the various islands (Figure 1). The upper Keys are composed of the geologic unit identified as the Key Largo Limestone which was once a living coral reef. The reef was predominantly composed of stony corals[3]. This former reef is interpreted as having formed within the Pamlico sea-level highstand of the Pleistocene Epoch (Figure 2). The lower Keys also formed during this same period of time and are elevated and lithified mounds of oolitic carbonate sand (Miami Oolite) which overlie the Key Largo Limestone in the lower Keys (Hoffmeister, 1974, p. 86).

The Upper Keys

The upper Keys Pleistocene coral reef rock is actually a collection of many different types of stony corals (Figures 3, 4, and 5). The modern coral reef tract contains many of the same coral species found within the Pleistocene Key Largo Limestone. Today, where the Key Largo Limestone

[3]Coral is commonly divided into two types: 1) the semi-precious corals, and 2) the stony corals (Hoffmeister, 1974, p. 64).

Figure 5. Another piece of limestone which was at one time part of a submerged coral reef. It is attached to other more massive chunks of limestone all of which suggest a diverse coral reef paleoenvironment.

Figure 6. Looking northward at the northeast wall of the Marvin D. Adams Waterway on Key Largo. This canal connects Florida Bay with the Florida Straits. The limestone is composed of coral reef carbonate rock and rubble and reflects what was at one time a thriving coral reef

Figure 7. A section of the eastern sidewall along the Marvin D. Adams Waterway showing chunks of limestone which was formally a coral reef environment. The wall extends eight feet above the water.

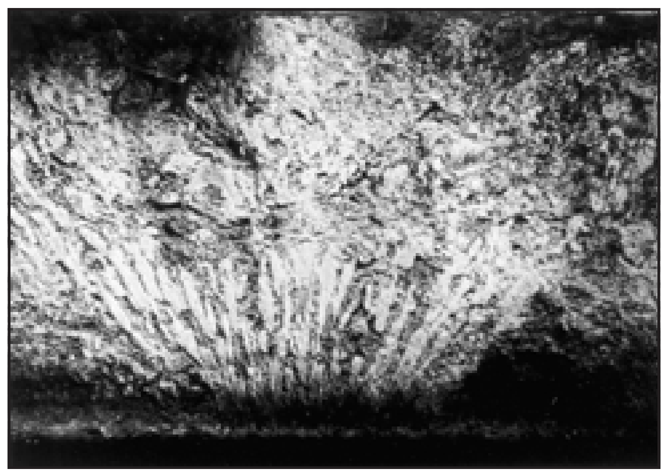

Figure 8. A closeup of the coral in the center of Figure 7. The water is black at the base of the figure and grass can be seen at the top. The section is 10 feet high and clearly visible is the former remains of a star coral (*Montastrea annularis*).

extends above sea-level, it forms the individual islands of the upper Keys (Figures 6, 7, and 8). A few islands within the upper Keys have been quarried for ornamental stone; however, the majority of the coral reef stone was used as construction material associated with the building of the first railroad line to Key West (Figures 9–15).

Uniformitarian Interpretation of the Upper Keys

Uniformitarians interpret the upper Keys as having formed during the Pamlico Stage of the Pleistocene Epoch, approximately 100,000 years ago, when sea-level was as much as 25 feet higher than present (Hoffmeister, 1974, p. 23). During this period of time approximately 25,000 years was available to form this coral reef environment before the next drop in sea-level (Following the sea-level curve found in Schroeder, Shultz, and Pilkey, 1995, p. 671, Figure 5).

Experiments were conducted on the growth rate of various modern stony corals found within the Florida Keys coral reef tract (Hoffmeister, 1974, pp. 79-81; Hoffmeister and Multer, 1964). It was concluded that the Key Largo Limestone coral reef tract could have formed at its current size under present conditions in as little as 6,000 to 12,000 years (calculated from Hoffmeister, 1974, pp. 86-91). With these experiments

Figure 9. The eastern side of the Windley Key quarry where blocks of limestone were taken for the construction of the railroad which connected Miami to Key West. The sidewalls are from five to seven feet high.

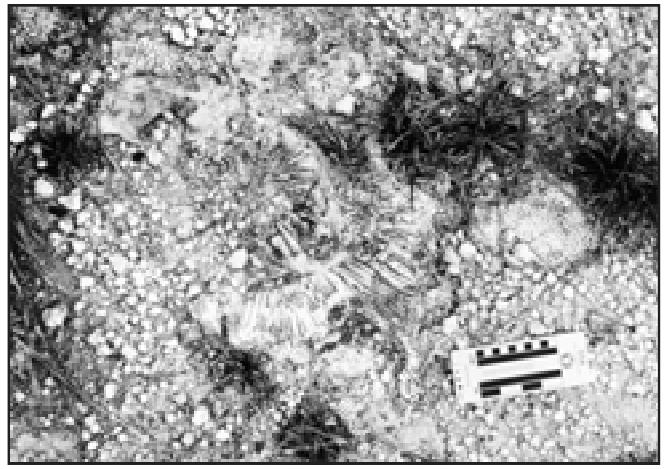

Figure 10. Key Largo Limestone coral reef rock exposed on the Windley Key quarry floor. Scale is in inches and centimeters.

Figure 11. The north quarry sidewall of the Windley Key quarry which exposes approximately seven feet of Key Largo Limestone. Coral reef material is bound together by coral debris and other carbonate materials.

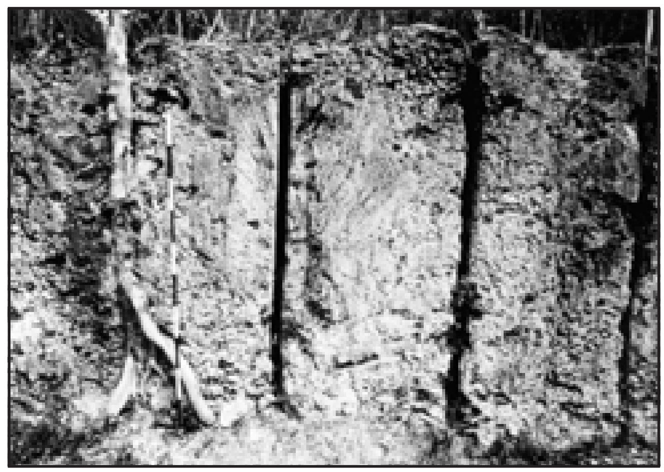

Figure 12. A coral head is exposed along the south wall of the Windley Key quarry. The scale to the left of the coral is in six-inch units.

in mind the entire Key Largo Limestone coral reef tract could have formed approximately two to four times over during the 25,000 years that were available for coral reef growth! However, with all of this time available the coral must have grown much slower than was determined experimentally within the modern coral reef tract.

A Young-Earth Flood Model Approach

The growth rate of stony coral varies both by species and as a function of the environment. The conditions under which the original coral reef formed and developed were much different from those of today. There are several reasons to believe that coral reef growth in the past occurred at a much higher rate than at present. These include the estimated depth of water, distance from silt/clay sedimentary sources, increased water nutrient levels, and the anticipated water temperature at the time that the corals developed, when the Floodwater was at the “Pamlico” water-level position. However, even with higher than present growth rates, the author does not believe that creationists need to explain the entire Pleistocene Florida Keys coral reef tract within the span of only the several hundred years of the single Ice Age (Oard, 1990). We have more time available to grow the coral reef tract if we incorporate the time that Floodwater covered this portion of Florida.

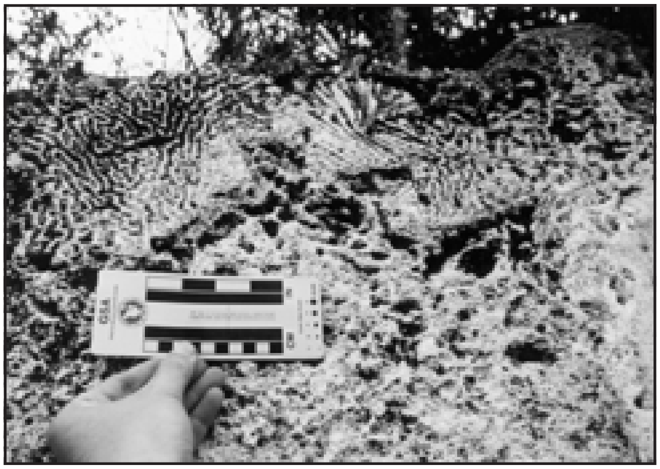

Figure 13. A coral head is exposed along the top of the Windley Key quarry sidewall. Scale is in inches (top) and centimeters (bottom).

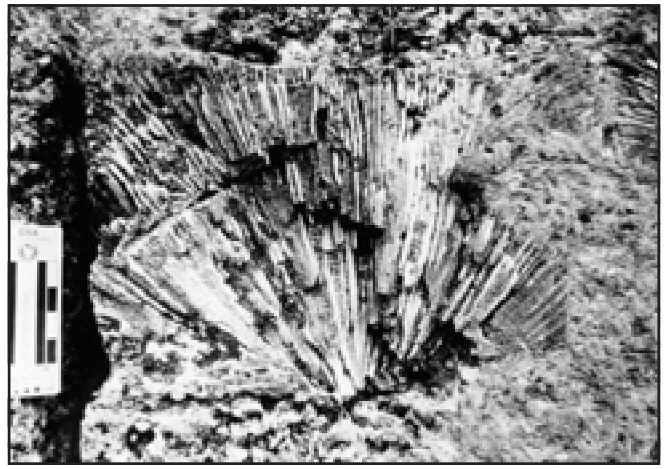

Figure 14. A coral head in growth position exposed along the Windley Key quarry sidewall. Scale in inches.

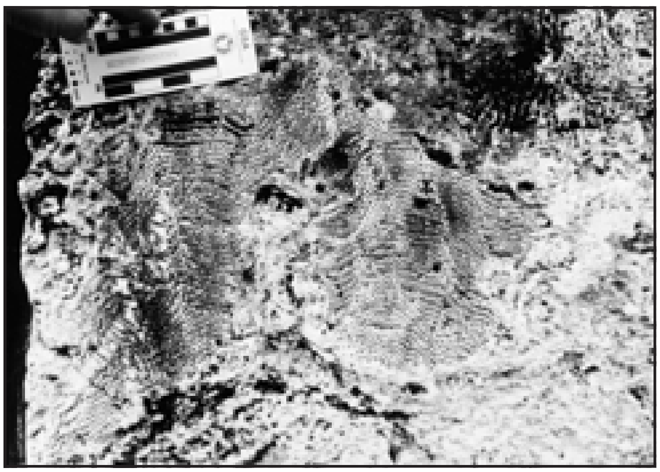

Figure 15. A coral head turned upside down and exposed along the Windley Key quarry sidewall. The coral was probably overturned in a storm (when more coral usually is broken from their base). Scale in inches and centimeters.

Discussion

We have several problems to resolve in order to explain the thickness (i.e., Pleistocene, modern, or both) of the upper Keys coral reef tract within our model. The first issue to address is the thickness of the Pleistocene Key Largo Limestone, measured at more than 170 feet thick in several places within the Florida Keys (Hoffmeister, 1974, p. 86). How can we explain such a thick accumulation of what was once living "modern" coral reef when we start from the position of a global Flood with total inundation and a high sea-level position? Coral reefs grow under very specific conditions. If the water is too deep or too shallow then the stony corals will not grow. Additionally, the water temperature, salinity, and clarity must be within certain highly-specific parameters to successfully grow a coral reef. Hence, many factors must be evaluated to understand how successful coral reef growth occurred, especially when considering an accumulation up to 170 feet in thickness.

A related issue is the rate of Floodwater withdrawal. The speed in which this occurred directly impacted the manner in which the Pleistocene coral reef tract could have developed. Rapid Floodwater retreat from the southeastern United States within the one-year-long Flood would not have allowed for a reasonable amount of time to form and develop the 220 mile long[4], 8 to 10 miles wide, by as much as 170 feet deep coral reef tract. Rapid Floodwater withdrawal from the North American continent would probably have been muddy, and not conducive for coral reef growth. Additionally, if the Floodwater retreated in a pulse type manner, then sands, muds, and silts should be found interstratified within the Key Largo Limestone, but none have been described or noted.

Slow Floodwater retreat from this area of south Florida would provide sufficient time for coral reef initiation and development, but only when the submerged surface (i.e., substrate on which the coral grew) achieved an optimum sea-level position. According to Smith (1971, p. 5) coral reef growth is limited by sunlight penetration in seawater (not depth per se):

> Because sunlight is rapidly absorbed as it passes through seawater, the requirement of strong sunlight

[4]The Key Largo Limestone has been found to extend in the subsurface from beneath an area northeast of Miami to out beyond the Dry Tortugas—a distance of approximately 220 miles. This buried coral reef (i.e, Key Largo Limestone) was formally much larger than we observe today.

restricts reef building to depths less than 150 feet, and vigorous growth to within 90 feet of the surface.

Hence, water clarity, nutrient load, and the original Tertiary substrate surface were the most important factors in the origin and development of the Pleistocene coral reef tract, with the most important being nutrient-laden current-driven warm clear marine water. This setting requires no clastic input and would support an offshore environment in which the reef tract could grow, similar to that at present.

The uneven surface of the underlying Tertiary age carbonate and clastic sediments reflect erosion and regional tilting which have influenced the growth and development of the overlying Pleistocene age Key Largo Limestone. It has been proposed that the south Florida area has experienced a decreasing rate of regional subsidence (Missimer, 1984; Winston, 1991), and that regional east-west tilting occurred which directly affected sedimentation in the Keys during the Pliocene and Early Pleistocene (Parker and Cook, 1944; Parker, Hoy, and Schroeder, 1955; Perkins, 1977; Shinn, Lidz, Halley, Hudson, and Kindinger, 1989).

The author proposes that regional subsidence (which occurred with the onset of the Flood) created a basin within the south Florida area which was rapidly filled with carbonate and clastic materials derived from source areas to the north. The rapid in-filling of the south Florida basin resulted in the formation of a submerged surface within close proximity to the elevated marine water surface at the end of the year-long Flood. During this period crustal subsidence within this area was occurring at a slightly higher rate than Floodwater was dropping. Coral reef growth simply "kept-up" with the subsiding crustal block. Eventually, subsidence slowed and reef growth continued while Floodwater slowly retreated from this area. Block rotation caused the western portion of the Keys to drop. This provided accommodation space to allow for greater reef growth and resulted in thicker accumulation of coral within the subsurface. The coral reef continued to grow until the marine water dropped below the reef tract exposing the stony coral to subaerial conditions, this served to kill the coral producing animals.

The decrease in regional subsidence (and tilting) experienced by this area during and following the Flood allowed the Key Largo Limestone coral reef to begin development within the first year of the Flood. As this large area continued to subside, the substrate remained shallow enough for continual coral reef growth. The relationship between crustal subsidence and actual sea-level change remains to be determined. Sea-level changes following the retreat of Floodwater (during the single Ice Age Timeframe) served to add new coral to the reef with each rise, and erode and in-fill the reef with debris and rubble derived from the reef with each fall.

Conclusion

The formation of the upper Keys coral reef tract (i.e., the Pleistocene Key Largo Limestone) required a relative sea-level position at least 25 feet higher than at present. This sea-level position is best correlated to the time when slowly-retreating Floodwater still covered this portion of the south Florida peninsula (see Froede, 1995a, 1995b, 1998). This period of time is defined within the Upper Flood Event Division), rather than during a short-term sea-level highstand event within the single Ice Age Timeframe. Oard (1990, p. 117) proposed that reaching maximum glaciation occurred approximately 500 years after the onset of the Flood. If this period of time is added to the year-long Scriptural Flood, then at minimum 501 years were available to form the majority of the Key Largo Limestone coral reef tract. The point of glacial maximum would correspond to a sea-level lowstand and reef exposure (and death). This would be the lowest point that sea-level dropped before rising to present day levels. Oard's (1990) period of 500 years to reach glacial maximum is viewed by this author as a minimal period. The lowest sea-level position could have been reach even several hundred years later, depending upon the role that subsidence played within this area. The continental-glacier-based drop in sea-level position does not take into account the role that subsidence played in producing the coral reef tract. Any additional time would allow for the continual development of the coral reef tract. Sea-level rise in the remaining years following the lowest drop within the single Ice Age would simply allow additional stony corals to build atop the preexisting coral reef.

The author believes that the Key Largo Limestone coral reef was already well established and thriving as the Floodwater continued to slowly recede from the southern tip of Florida many years after the end of the year-long Flood period reflected within Scripture. The length of time available for the origin and development of the Key Largo Limestone coral reef is viewed by the author as covering potentially a thousand years or more. Additional investigation is necessary to refine the time period available for coral reef (i.e., Key Largo Limestone) growth within the framework of the Young-Earth Flood model.

Acknowledgments

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Book Review

The Creation/Evolution Controversy by James L. Hayward
Salem Press, Pasadena, CA. 1998. 253 pages, $37.50
Reviewed by Don B. DeYoung

James Hayward is a Professor of Biology at Andrews University, Berrien Springs, Michigan. His ongoing research involves the nesting ecology of ancient dinosaurs and diving gulls. This book is Hayward's commendable effort to summarize literature on creation and evolution. Short, helpful summaries are provided for 447 books. The date range extends widely from Copernicus (1543) through 1996 authors. The reviews are concise and go directly to the heart of each book. Resources not included are children's books, videos, and periodical articles. I also noticed the absence of several important creationist books: *The Wonders of Creation* by Alfred Rehwinkel (1974), *Speak to the Earth* edited by George Howe (1975), *The Earth, the Stars, and the Bible* by Paul Steidl (1979), and *Physics of the Future* by Thomas Barnes (1983).

Hayward remains very objective, letting the authors speak for themselves. Regarding Carl Sagan's book and TV series "Cosmos"(1980), Hayward writes, "...nearly everyone was impressed by Sagan's communicative style ...interpretations of the universe, and superb graphics make "Cosmos" a visual and intellectual feast" (p.48). For another author Hayward writes, "The author's lack of expertise in the subject matter he purports to discuss will be apparent to knowledgeable readers" (p. 164).

This hardback book is expensive, but it is useful as a summary of a full library of Bible-science books. Full author, title, and subject indexes are provided.