A Large Cliff Scarp Exposure of Beach-Nourished Sands Along the St. Andrew Bay Channel, Florida: Evidence for the Rapid Formation of Siliciclastic Stratigraphy

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Abstract

Naturalists define Earth history from the stratigraphic record. Modern settings and processes are used to construct the geologic column. Every sedimentary layer purports to convey the passage of time, usually immense periods, and the features within the sediments are used to explain their long depositional history. Conversely, the young-Earth creation/Flood framework proposes that the majority of the rock record is the result of the global Flood of Genesis. Support for this approach has come from highly energetic volcanic settings and laboratory studies of sedimentary deposition. Another setting offers additional supporting evidence for the Flood depositional framework. Beach nourishment activities along Florida's coastline have been ongoing for many years. A nourished dune escarpment occurs along the western side of the St. Andrew Bay Channel at Panama City Beach, Florida. Along this side-wall, the siliciclastic sediments, bedding structures, and fossil content can be closely examined. This quartz-rich sand-particle-size material was naturally segregated and rapidly deposited into bed forms that correspond to siliciclastic strata observed in the rock record. This locale effectively demonstrates the rapid formation of siliciclastic strata within conditions likely analogous to the Flood.

Introduction

Uniformitarian scientists contend that the rocks composing Earth's crust convey the history of the planet. They believe that the passage of eons of time is documented by changes in life-forms within the enclosing sediments. Sediments are eroded from existing geologic materials only to be transported and recast to rock and eroded once again. We are told this rock cycle has been ongoing since this planet began approximately 4.55 billion years ago. While the deposition of sediments can occur at varying rates, it is usually inferred to have happen at a slow and steady rate. While storm deposits are recognized within the uniformitarian stratigraphic record they are interpreted to have formed within a brief moment of time and are of a small scale.

Counter to this perspective is the biblical understanding of Earth history which suggests that the majority of the rock record formed during the global Flood of Genesis. During this large and convulsive event, sedimentary materials would have been naturally segregated and deposited by hydraulic forces during transport. Perhaps only short periods of time passed between the deposition

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of successive strata and any changes in material composition is probably due to differences in sediment source areas and associated materials.

Any explanation of the rock record is based in history and not empirical science. The formation of the rock record has already occurred and was not observed. Uniformitarian scientists invoke modern settings and their sediments to define and defend their construction of the global stratigraphic record. However, young-Earth creationists point to the biblical record of catastrophism as a better way of understanding the development of the rock record. Further studies of this approach can be enhanced by contemporary examples of high-energy processes yielding sedimentary products that directly correspond to the rock record. Only recently have examples come from volcanic settings and sedimentological laboratory analyses.

Beach nourishment activities provide an additional setting that supports the rapid formation of siliciclastic strata. An eroded segment of a constructed beach is exposed along the western side of the St. Andrew Bay Channel (Panama City Beach, Florida). The escarpment displays an unusual exposure of manmade stratigraphy (Figure 1). This outcrop provides a cross-section through siliciclastic sediments rapidly emplaced during high-energy beach nourishment activities. This setting corresponds to conditions expected during the Flood where abundant siliciclastic sediments were eroded, transported, and deposited by highly energetic Floodwater.

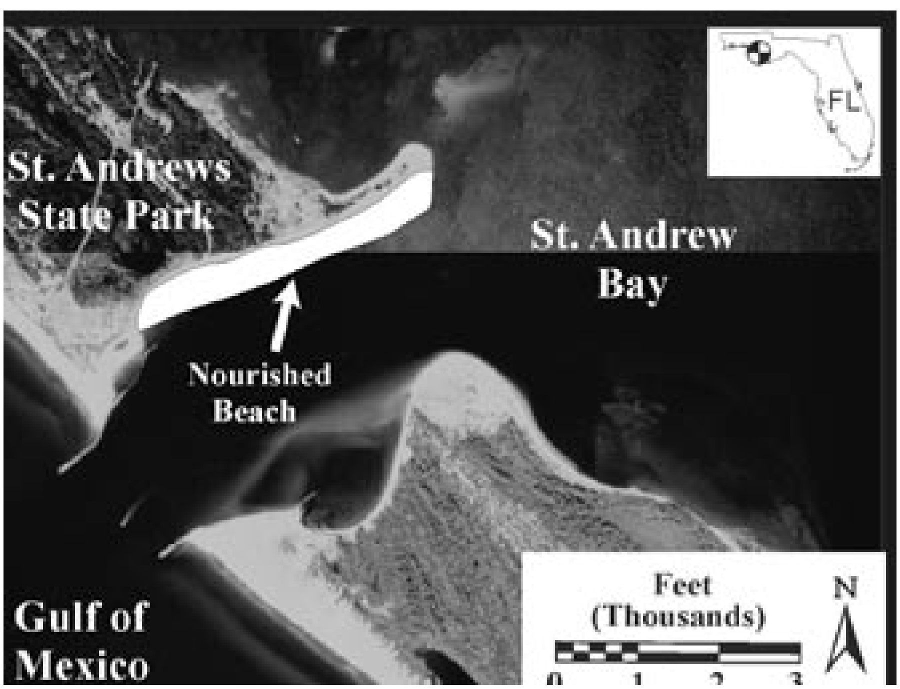

Figure 1. The area of beach nourishment is located on the western portion of the St. Andrew Bay Channel. This area is within St. Andrews State Park. Sand was added to the beach in July/August, 2003.

Examples of Rapid Stratification from the Field and Laboratory

Studies indicate that sediments naturally segregate, forming layers based on particle characteristics as wind, mud, water, or even gravity transport them. Sedimentologists are learning that time is not a critical factor in the production of individual sediment layers or even larger-scale strata. What is required is an abundant supply of sedimentary materials transported in highly energetic conditions that allow the separation and segregation of particulates and their eventual deposition.

Rapid Formation of Strata within a Volcanic Setting

An active volcanic setting typically provides both the sediments and energy (via eruptive conditions) necessary to rapidly produce stratified sediments (Fisher and Schmincke, 1984). Delicate sedimentary structures, individual bed forms, and massive strata can all be created almost instantaneously by wind energy (e.g., pyroclastic surge deposits) (Fisher and Schmincke, 1984; Cas and Wright, 1988) or by mudflows (i.e., lahars) (Newhall and Punongbayan, 1996; Orton, 1996).

Deposits derived from subaerial hydroclastic to phreatomagmatic eruptions (i.e., combination of steam and magmatic powered eruptions) can exhibit planar bedding that can range from flat, parallel beds to steep cross-bedding. Structures developed in these types of volcanic deposits include penecontemporaneous soft sediment deformation, gas related vesicles, bedding sags, and mudcracks (Fisher and Schmincke, 1984). Pyroclastic flows and surges develop some of the best sedimentary bedding features associated with volcanic eruptions (Nakada, 2000). These types of deposits were first recognized in rhyolitic strata in New Zealand (Marshall, 1935) and in pumice flows in Japan (Kuno, 1941). Later they were identified in association with underwater nuclear detonations at Bikini Atoll in 1947 (Fisher and Schmincke, 1984), and subsequently at numerous subaerial locations (Moore et al., 1966; Moore, 1967; Fisher and Waters, 1970; Schmincke et al., 1973; Crowe and Fisher, 1973). Bed forms derived from pyroclastic density currents include sand waves, and massive and plane parallel bedding (Fisher and Schmincke, 1984). These types of deposits can also exhibit fine-grained lamination and delicate bedding structures that are produced almost instantaneously from rapidly-moving volcanic ash and debris clouds (Branney and Kokelaar, 2002). In the past, these styles were thought to be restricted to annual varves. The May 18, 1980 eruption of Mount St. Helens produced variably-bedded and finely-laminated pyroclastic surge and flow deposits documented by both uniformitarian (Hoblitt et al., 1981; Moore and Sisson, 1981) and young-Earth creation/Flood geologists (Austin, 1986; 1991; Morris and Austin, 2003). These deposits demonstrate the natural segregation of particles in air under highly energetic eruptive conditions and provide a somewhat similar analogue to expected sedimentary conditions associated with the Flood of Genesis. (According to Branney and Kokelaar (2002), stratified materials formed under subaerial volcanic conditions do not exactly conform to deposits produced by water. Simple one-to-one comparisons between pyroclastic flow and surge deposits to Flood deposited strata must be conducted with some caution.)

Laboratory Analysis of Rapid Particle Deposition and Strata Formation

Sedimentology has largely developed from extensive field investigations. Numerous reference works contain summaries of these field-based studies (e.g., Reineck and Singh, 1980; Scholle and Spearing, 1982; Scholle et al., 1983; Allen, 1984; Reading, 1996; Friedman et al., 1992). More recently, there has been some effort to better link field studies to laboratory water tank and computerized models (e.g., Pye, 1994; McCaffrey et al., 2001).

Much of the laboratory work in sedimentology is based on fluid mechanics specific to hydrodynamic forces related to the transport of single particles, suspensions, and hyperconcentrations (Julien, 1995). This work tends to focus predominately on numerical modeling and less on actual field examples. As a result, the extrapolation of laboratory results to the field has not necessarily proceeded in a manner where immediate application can be identified. However, some recent analytical modeling was conducted that focused primarily on depositional results and its application to the fluvial-deltaic setting is impressive (Berthault, 2004).

Several laboratory studies involving sediment transport in water tanks have documented the natural segregation and rapid deposition of sedimentary particles transported by moving water (Berthault, 1994). These studies demonstrate that vertical and lateral stratification occur at the same time and in a manner that appears to contradict, if not violate several important key concepts in stratigraphy (e.g., stratigraphic correlation, law of superposition, and facies succession) (Berthault, 1990; Julien and Berthault, 1994). These findings are important within the context of a biblical approach to defining the rock record. Additionally, this laboratory work has not been limited to the defense of the young-Earth creation/Flood framework, but has also been published in the secular geologic literature (Julien et al., 1993; Berthault, 2002a; 2002b).

Beach Nourishment Activities along the Western Side of the St. Andrew Bay Channel

Much of Florida's coastline is subject to ongoing erosion. Beach nourishment activities occur in an effort to both protect beach property and secure tourism. Typically, quartz sand is collected from offshore source areas and is pumped in a slurry onto the beach through large-diameter pipes (Figure 2). This process both elevates and extends the beach shoreward in the nourished area.

Figure 2. Active beach nourishment along Panama City Beach, Florida. The image is from January 2006, and shows the manner in which the sand-water slurry is pumped onto the beach. The water drains leaving sand deposited under energetic aqueous conditions. The water-sand plume is approximately 8 ft in height.

Figure 3. The cliff scarp exposed in January 2006. Three hurricanes did significant damage to the new beach deposits by removing large volumes of sand from along the shoreline. This resulted in the formation of the lengthy cliff scarp that varies in elevation up to 12.5 ft.

Figure 4. These siliciclastic sediments could be interpreted as reflective of wave-derived bedforms associated with tidal water movement. However, they were rapidly emplaced in a sand and water slurry. Scale in inches and centimeters. This image was taken on January, 2006.

The western side of the St. Andrew Bay Channel beach was nourished in 2003. The added quartz sand contained a minor fraction of mud clasts and invertebrate shell material.

In many instances following sand emplacement, a small scarp is initiated at the shoreline due to disequilibrium. This scarp usually does not develop to any significant elevation (typically less than one yard) as the beach slope changes to maintain its stability to the shoreline. However, hurricanes and other large tropical storm systems can dramatically change conditions; large escarpments can rapidly form due to elevated storm surges and storm waves. This was first recognized and reported following scarp development associated with Hurricane Ivan (Froede, 2006).

Two subsequent hurricanes passed to the west of this study site in 2005, Hurricane Dennis (July 10, 2005), and Hurricane Katrina (August 29, 2005). These storms produced storm surges between 3.0 and 5.5 ft that further eroded the nourished beach sand. The resulting escarpment is approximately 3,200 ft long and as high as 12.5 ft (Figure 3).

One could envision a great variety of coastal depositional settings if this outcrop was examined through an uninformed perspective. Foremost would be the presumption that sea level was higher in this area in the past as these are aqueous deposits. Examining the strata along the escarpment sidewall, one would then note the work of changing tides (Figure 4) and wave-derived features (Figure 5). Lag deposits of mud clasts (now rolled into mud balls) and shells would appear to indicate channel deposits (Figure 6). However, this outcrop of siliciclastic sediments and fossils presents in dramatic form the natural segregation of materials in an energized fluid.

The rapid manner in which these sediments were deposited forming bedding indicative of daily coastal processes, demonstrates the ease of

Figure 5. The weakly cemented siliciclastic sediments exposed along the cliff scarp reveal bedforms created from high-energy beach nourishment. Without knowing the history of these deposits, they could be interpreted as reflective of Pleistocene deposits formed under uniformitarian processes. Scale in six-inch divisions. This image was taken on January, 2006.

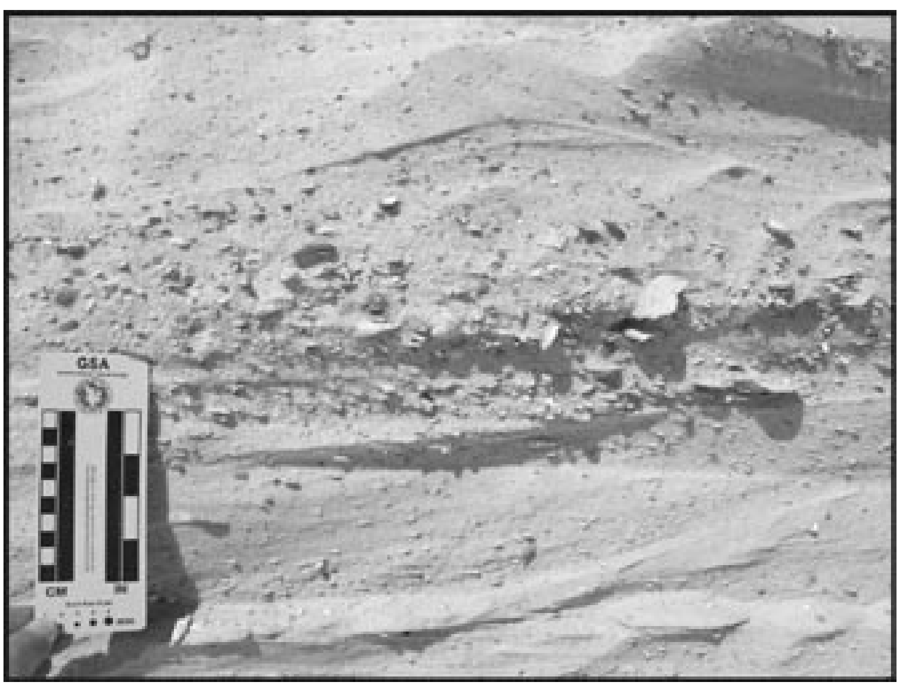

Figure 6. Mudballs and shells lie within a former drainage channel. They could be incorrectly interpreted as lag deposits within a pre-existing tidal channel. It is not surprising that lag deposits like these can rapidly form and still convey two competing worldviews, one purely naturalistic and the other based on Scripture. Scale in inches and centimeters.

understanding siliciclastic strata within both the perspectives of uniformitarian and young-Earth/Flood interpretations. Uniformitarian scientists look to modern settings and uniform processes to explain strata. However, these strata can also form quickly under highly energetic conditions analogous to the Flood.

Conclusions

The reconstruction of Earth history is either derived from an interpretation of its sediments or from Scripture. Naturalists invoke modern settings and processes and project them backward over billions of years to explain the stratigraphic record. The biblical framework invokes a completely different interpretation requiring high-energy processes operating over very short periods of time, little of which can be demonstrated by modern settings. Young-Earth creationists look for special conditions and settings that can be used to demonstrate the formation of strata within the time-restricted requirements of our framework. Most of these studies have come from volcanic environs and water tank experiments.

Along the western side of the ship channel leading into St. Andrew Bay, beach nourishment activities delivered sand, mud clasts, and invertebrate shells from a sand-water slurry in an aqueous manner similar to expected highly energetic conditions associated with the global Flood (i.e., Flood Event Timeframe) (Froede, 1995; 1998). The sedimentary details and bedding structures exhibited at the escarpment are surprising considering the energetic conditions in which these siliciclastic sediments were originally deposited. The resulting bed forms and strata are similar to those found in a variety of modern day aqueous coastal settings ranging from subtidal offshore to nearshore.

This outcrop demonstrates that siliciclastic sedimentary bedding and structures can form quickly as a result of highly energetic geologic forces.

The separation and segregation of the transported materials occurred naturally, forming features ranging from the delicate to the massive. Time was not important in the creation of these stratified deposits, though it is essential in the uniformitarian framework. It is the worldview used to interpret the strata that makes a difference—*not* the strata. The rapid segregation of siliciclastic sediments is not surprising, and is predicted within the Flood framework. An escarpment along the western side of the St. Andrew Bay Channel allows examination of strata having an appearance of age, but that were rapidly formed during recent beach nourishment activities.

Acknowledgments

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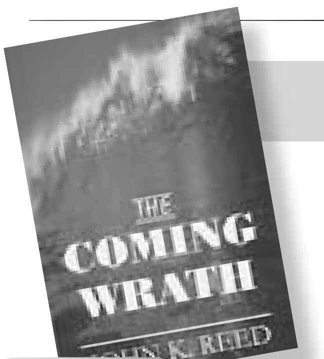

Book Review

The Coming Wrath

by John Reed

Mabbul Publishing, Evans, GA, 2005, 380 pages, $10.00.

AVAILABLE THROUGH CRS BOOKS!

Geologist John Reed has an unsuspected talent for writing. His novel stretches from about one hundred years before Noah's flood to the event itself and beyond. The book has a very engaging and believable plot, excellent character development, and a heart-rending climax. It is my hope that this will not be the last of his books.

The book opens with Madrazi looking back over her adventure-filled life. She was born to a shipping family and grew up in a lovely home by the sea. Her father Pomorolac developed and ran a successful maritime trade. Through experience he learned how to design ships, discovered how to use ocean currents to his advantage, and learned to navigate using the stars. Madrazi loved learning her father's trade but feared the sea. From the time her grandfather Methuselah visited, Madrazi struggled with a frightening dream about a huge tsunami swallowing her along with the land. Her mother was able to comfort her when she woke from her frightening dreams. One day, much to her horror, her mother never returned from a swim. Madrazi buried her grief by focusing her energies on learning shipbuilding and navigation. Many years later the purpose of Methuselah's visit became apparent. He once again made the long journey from Lamech to the port but this time it was to offer an arranged marriage to her cousin, Shem. The love and trust Madrazi had for this kind man encouraged her to accept. After her marriage, Noah told her of his meeting with God and the coming wrath. He invited her to participate with the family in building the ark. Although she loved them all, she could not and would not accept the prophecy as true. She realized all of her hopes for living in the city had to be put on hold until the prophecy proved false. Meanwhile, she lived in apparent obedience to Shem and his father as she struggled with God.

Madrazi's account traces the growing rebellion of mankind against worship of the Creator. She expresses well the attitude of the times: "He (Noah) is a good man, but Father (Pomoralac) thinks that he expects too much of people. He and his grandfather speak much of doing good and loving the Creator, but most men wish to pursue happiness, profit, and peace without excess religious restraint." Through the years the rebellion against God grew into full bloom. Jared the young General of Lamech, became convinced he needed to protect the city. Against Noah and Methuselah's wishes, he developed the military into a fighting machine instead of trusting in God's protection. Wars brought unbridled ambition and a lust for violence among his men. Jared's own love for power and recognition led him into an unsuspected trap. Madrazi's once peaceful existence turned into a time of great fear. This is a story of love, betrayal, war, and the Wrath and, ultimately, a time of decision for Madrazi.

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