

The rapid formation of siliciclastic stratigraphy: an example from Panama City Beach, Florida (USA)

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The global stratigraphic record undergirds the naturalist interpretation of Earth history. Its construction has purportedly occurred over vast periods by the slow accumulation of both organic and inorganic sediments. Counter to this is the young-earth Creation/Flood framework which states that the stratigraphic record is consistent with the biblical account of Earth's history. This approach advocates the global Flood as the primary geologic force in creating the majority of Earth's stratigraphic record. Recently, an escarpment formed along the western side of the St Andrews Bay Channel at Panama City Beach, Florida, USA. The sediments, bedding structures and fossil content noted along the exposed sidewall were recently and rapidly emplaced by a sand-water slurry, resulting in the creation of a synthetic (i.e. manmade) stratigraphy. With no prior knowledge of beach nourishment activities in this area, one might mistakenly interpret this outcrop as reflecting thousands to tens of thousands of years of Earth history. This exceptional outcrop provides a one-to-one comparison (on a limited scale) between expected depositional conditions associated with highly energetic floodwater and recent high-energy beach nourishment activities.

According to naturalists, Earth's extended history is recorded in its rocks, minerals and fossils. Sedimentologists and stratigraphers focus their investigative efforts on the study and analysis of rock-forming strata, including their arrangement, geographic positions and chronological order of sequences.¹ While catastrophic

forces and processes are recognized within this actualistic framework, they are generally viewed as limited in time, magnitude and extent.

The erosion of a portion of the nourished sands along the western side of the St Andrews Bay Channel (Panama City Beach, Florida, USA) has created an unusual

exposure of synthetic stratigraphy (deemed 'synthetic' because it was entirely manmade) (figure 1). The erosional escarpment provides a cross-section through siliciclastic sediments. Displayed are sedimentary features ranging from the thickly bedded to the thinly laminated that were created in violent conditions over a very short period. Such conditions would have favoured similar formation of strata during the Flood where abundant siliciclastic sediments were eroded, transported and deposited by highly energetic Floodwater.

Beach nourishment activities along the western side of the St Andrews Bay channel

Beach nourishment occurs periodically along portions of Florida's coast due to ongoing erosion. Typically, quartz sand is collected from offshore source areas and is pumped in a water slurry onto the shore through large-diameter pipes (figure 2). The western side of the St Andrews Bay Channel

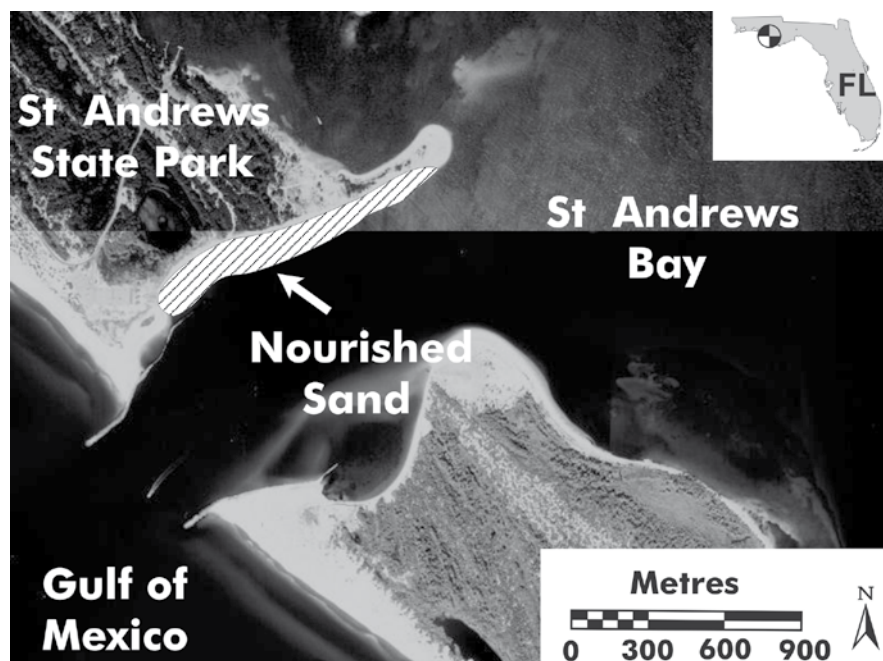


Figure 1. The area of beach nourishment is located on the western portion of the St Andrews Bay Channel. Sand was added to the beach in July/August 2003. Hurricane Ivan (16 September 2004) did the most damage in removing sand from along the shoreline. As a result, a cliff scarp was created that displays the synthetic stratigraphy that formed rapidly in 2003.

shoreline was nourished in 2003 (figure 3). This newly added sand also contains a mixture of mudballs and abundant invertebrate shell material.

Typically, a small scarp is initiated at the toe of the newly emplaced sand as the shoreline seeks to maintain equilibrium. This scarp usually does not develop to any significant elevation (i.e. less than 1.0 m) as the beach slope changes to maintain its stability to the shoreline. However, hurricanes and other large tropical storm systems can dramatically change conditions such that large escarpments can rapidly form due to elevated storm surges and storm waves.

On 16 September 2004, Hurricane Ivan made landfall approximately 192 km to the west of the study site. As a result, this area experienced a storm surge estimated at 1.5 m above mean high tide level.² The weakly cemented sands that extended along the channel shoreline were rapidly eroded away, creating a long, continuous escarpment (figure 4).

Exposed sedimentary structures

The northern section of the scarp has the best vertical exposures with the highest scarp face (figure 5). Viewed through an uninformed perspective, there are many possible coastal depositional settings exposed in cross-section along the outcrop.

For example, a large-scale 'U'-shaped structure containing mudballs and large shells along the bottom of the depression suggests channel lag deposits (figure 6). Smaller sedimentary structures with shells along the bottom that are interspersed within the lower sections of these structures could imply tidal deposits (figure 7). Weakly cemented, fine-grained, thinly bedded sand layers could be interpreted as windblown deposits (figure 8). High-angle cross-beds could be cited as evidence of a subaqueous sandbar or a subaerial sand dune (figure 9). Without knowing the rapid manner in which these deposits were formed, actualistic scientists could easily invoke many different coastal-to-shallow marine settings using various sections of this outcrop. However, this escarpment face presents

a dramatic display of siliciclastic sediments and bed forms demonstrating the natural segregation of materials in an energized fluid.

Conclusions

The rapid formation of sedimentary features and structures into stratified deposits supports the young-earth Creation/Flood framework. Recently, both storm surge and storm waves associated with Hurricane Ivan created an escarpment along the western side of the St Andrews Bay Channel. The scarp displays bedding forms in cross-section from the thinly laminated to the thickly bedded.

The beach nourishment materials (i.e. sand, mud clasts and invertebrate shells) were deposited from a sand-water slurry in an aqueous manner similar to highly energetic conditions likely associated with the high-energy portion of the global Flood (i.e. Lower to Middle Flood Event Timeframe^{3,4}). Resulting from this process are sedimentary details and bedding structures that are unexpected from such energetic conditions. The sediments and strata form features suggestive of a variety of coastal settings ranging from subtidal offshore to nearshore.

Sedimentary bedding and structures can form quickly due to highly energetic geologic forces. The separation and segregation of the transported materials occurred naturally,



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 2.5 m high.



Figure 3. Beach nourishment activities along the channel shoreline occurred over July/August 2003. Black plastic piping that was used to transport quartz sand to the beach is visible in the background.



Figure 4. Hurricane Ivan (16 September 2004) removed considerable volumes of sand from the shore and created a very pronounced cliff scarp. This image is from June, 2005.



Figure 5. The weakly cemented siliciclastic sediments along the cliff scarp expose the synthetic stratigraphy created from high-energy beach nourishment. The exposure will continue to develop as sand is removed from the base of the escarpment. Scale in 15 cm divisions.

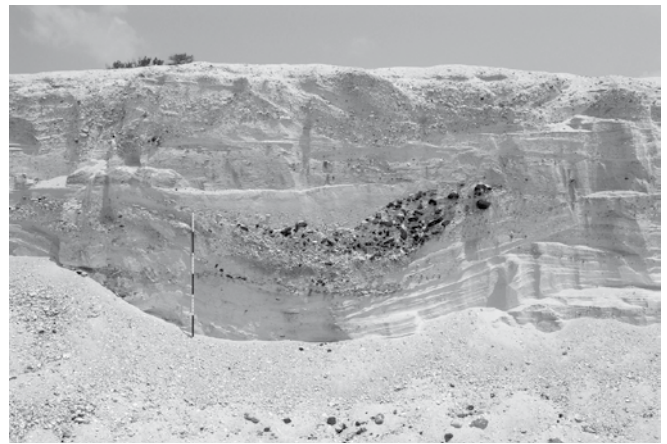


Figure 6. Dark mudballs and large shells lie along the bottom of this 'U'-shaped feature. They could be incorrectly interpreted as lag deposits within a former tidal channel. Scale in 15 cm divisions.

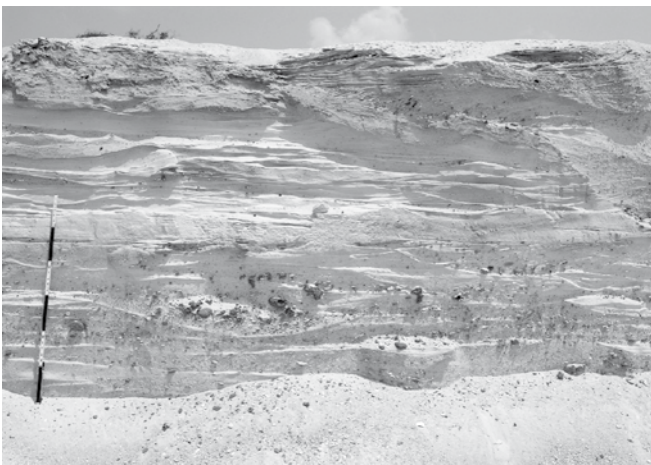


Figure 7. Shells along the bottom of the sandy structures could imply tidal or storm deposits within an actualistic interpretation (figure 8). Scale in 15 cm divisions.

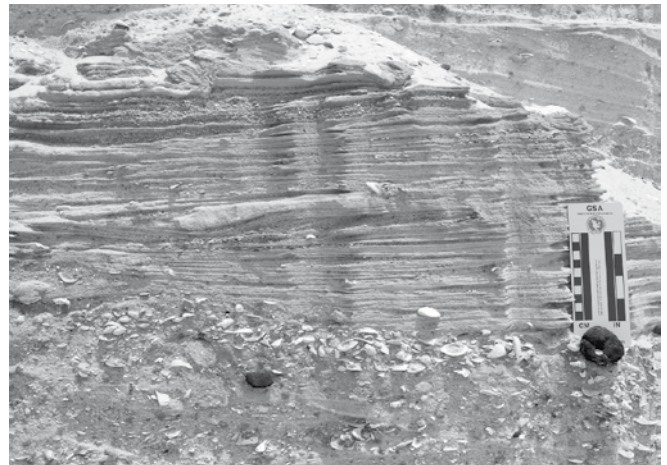


Figure 8. Thin-laminated, cross-bedded sands could be misinterpreted as shallow nearshore deposits. These delicate bed forms were created from a high-energy sand-water slurry in a very short time. Scale in inches and centimetres.



Figure 9. Having no prior knowledge of beach nourishment activities, one could interpret these cross-beds in a variety of nearshore marine settings. Extended periods of time would be an inherent assumption for the formation of these sandy deposits within the actualistic interpretative framework. However, these bedding features formed rapidly under high-energy conditions. Scale in 15 cm divisions.

forming features ranging from the delicate to the massive. Time is not important in the creation of these stratified deposits, but it is implied under the actualistic paradigm. The rapid segregation of siliciclastic sediments forming strata is not surprising, but is predicted within the Flood framework. An escarpment along the western side of the St Andrews Bay Channel allows examination of strata having an appearance of age that were rapidly formed during recent beach nourishment activities.

Acknowledgments

I am grateful for the constructive reviews provided by A. Jerry Akridge and John K. Reed. Any mistakes that may remain are my own. Glory to God in the highest! (Proverbs 3:5–6).

References

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Editors' note

A very similar situation was reported 10 years ago.¹ This involved a sand pumping operation on the south end of Australia's Gold Coast, in south-eastern Queensland. Clearly laminated deposits had formed in about one hour of sand pumping, which were revealed when storm surges quickly removed much of the sand that had been added in the beach restoration project (see illustration). These observations back up the flow tank work of Berthault and colleagues,² who showed that a flowing slurry of sand of different particle sizes would sort into alternating layers, without the need for alternating deposition cycles, which are usually assumed when such features are reported in geological studies.



Laminations visible in the cliff scarp (this exposure about 650 mm high) formed in August 1995 at Coolangatta Beach, Queensland, Australia.

References

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