Documenting the Sedimentary and Stratigraphic Transition between the Middle/Upper Flood Event Divisions and the Lower/Middle Ice Age Divisions in and Surrounding Providence Canyon State Park, Stewart County, Georgia (U.S.A.)

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Abstract

Providence Canyon State Park, Stewart County, Georgia (U.S.A.), and the surrounding vicinity provide an excellent location in which to define sediments and fossils within a Bible-based framework of Earth history. The results of this investigation indicate that the strata reflect the transition from a middle-shelf subaqueous marine setting to subaerial conditions. Within the Flood framework, these sediments and strata record the transition from the Middle/Upper Flood Event Divisions to the Lower/Middle Ice Age Divisions. The stratigraphy within the study area indicates that Floodwater retreated from this part of Georgia as a function of sea-level decline and the concomitant uplift of the coastal plain across southwestern Georgia.

Introduction

The Genesis Flood was a singular event in Earth history. Any understanding of the geologic energy expended during this period can come only from the preserved rock record. While many theoretical models and regional studies have been offered describing the geological processes in operation during the Flood, validation of those ideas will require data collected from specific locations. Conducting this location-specific work should eventually lead to an understanding of the geologic energy expended across a broader area and aid in defining those sediments, rocks, and fossils within the geologic Timeframes/Divisions of the Genesis Flood (Froede, 1995a, 2007; Figure 1).

Providence Canyon State Park, Stewart County, Georgia (U.S.A.), and the surrounding vicinity provide many excellent exposures of sediments, sedimentary features, and trace and body fossils. Understanding the changes in geologic energy expected during the Flood should allow the diluvial geoscientist to define the materials and features within their former depositional settings. For example, we would expect the highest levels of geologic energy with the onset of the Flood followed by its reduction with passing time (Reed et al., 1996; Froede, 2007). This knowledge should allow correlation to a specific period within the diluvial geologic timescale (Froede, 1995a, 2007). The application of this process within the study area (Figure 2) indicates that the strata reflect the transition from a middle-shelf marine environment to terrestrial condi-

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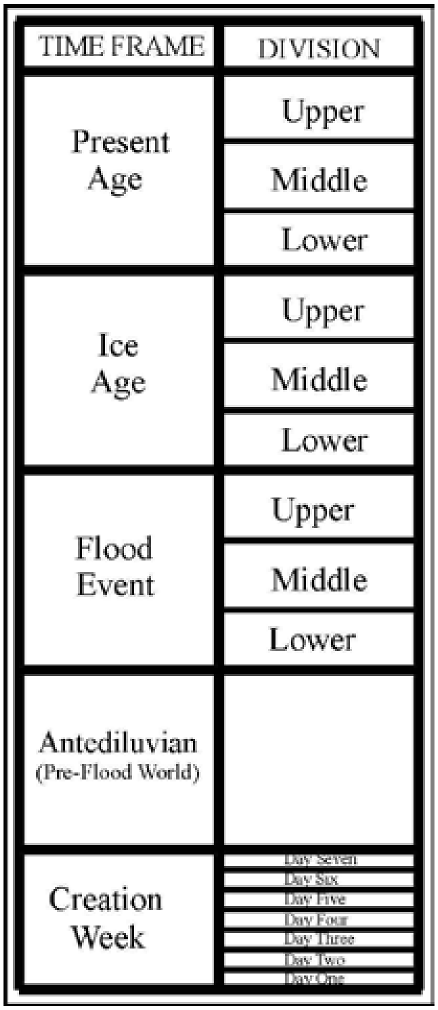


Figure 1. This geologic timescale is consistent with the Biblical record of Earth history. The examination of sediments, rocks, and fossils at site-specific locations should allow their insertion into this timescale based on changes in geologic energy (see Reed et al., 1996; Froede, 2007). The sedimentary materials composing the United States Gulf and southern Atlantic Coastal Plains suggest that Floodwater withdrew at a slow rate (Froede, 1995b, 1997; Froede and Reed, 1999). The sediments and fossils exposed at Providence Canyon State Park and the surrounding area reinforce this interpretation.

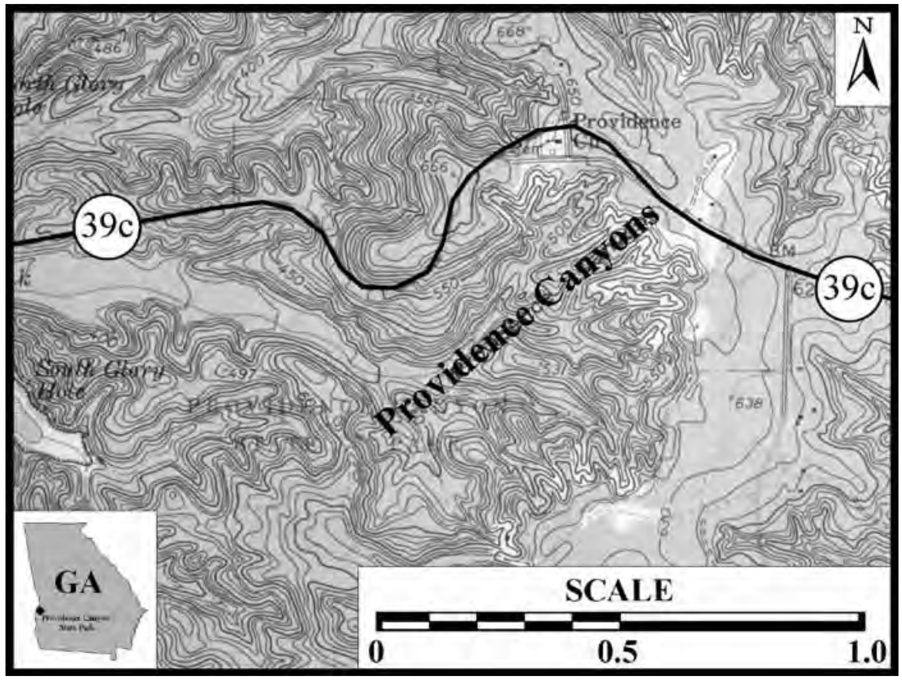


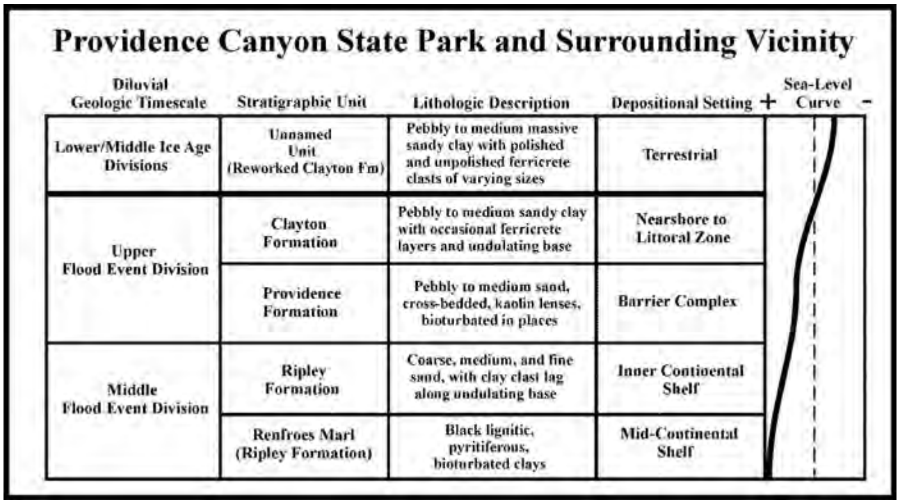
Figure 2. The study area includes Providence Canyon State Park, Stewart County, Georgia, and surrounding vicinity. Multiple outcrops both in and around the park allow a stratigraphic construction consistent with a Biblical timescale (Froede, 2007, 2008b). Scale in miles.

tions. Applying this setting to the Flood framework would suggest that these strata record the transition from the Middle/Upper Flood Event Divisions to the Lower/Middle Ice Age Divisions (Figure 3). The stratigraphy within the study area indicates that Floodwater retreated from this portion of Georgia as a function of both actual sea-level decline and concomitant uplift.

Providence Canyon Stratigraphy

In 1995, Williams offered a young-Earth creationist perspective on the stratigraphy and rapid formation of the many canyons found at Providence Canyon State Park. Subsequently, Froede and Williams (2004) explained the geology and hydrogeology of the park. Recently, Froede (2008a) postulated the shallow marine deposition of the updip portion of the Clayton Formation, which was followed by: (1) subaerial exposure and subsurface ferricrete development (Froede, 2010), and (2) channel development and infill by reworked Clayton Formation clastics and ferricrete debris.

The lowest exposed sediments (Renfroes Marl of the Ripley Formation) were deposited as silts and clays and then bioturbated. They are overlain by cross-bedded quartz sands mixed with kaolin clays (Ripley Formation and Providence Formation). *Ophiomorpha* trace fossils (created by burrowing shrimp) have been identified in the Providence Formation (Figure 4). This type of trace would indicate that it was formed in marine conditions during the Flood. Above the Providence Formation are nearshore-to-littoral zone clastic sediments of the Clayton Formation.



Providence Canyon State Park and Surrounding Vicinity

Diluvial Geologic Timescale	Stratigraphic Unit	Lithologic Description	Depositional Setting +	Sea-Level Curve −
Lower/Middle Ice Age Divisions	Unnamed Unit (Reworked Clayton Fm)	Pebbly to medium massive sandy clay with polished and unpolished ferricrete clasts of varying sizes	Terrestrial	
Upper Flood Event Division	Clayton Formation	Pebbly to medium sandy clay with occasional ferricrete layers and undulating base	Nearshore to Littoral Zone	
	Providence Formation	Pebbly to medium sand, cross-bedded, kaolin lenses, bioturbated in places	Barrier Complex	
Middle Flood Event Division	Ripley Formation	Coarse, medium, and fine sand, with clay clast lag along undulating base	Inner Continental Shelf	
	Renfroes Marl (Ripley Formation)	Black lignitic, pyritiferous, bioturbated clays	Mid-Continental Shelf	

Figure 3. The sediments and stratigraphy of the study area cover the transition from the middle Flood (Middle/Upper Flood Event Divisions) through the middle Ice Age (Lower/Middle Ice Age Divisions; see Froede, 2007, 2008b). The stratigraphic profile presents the formation/member names, their sedimentary composition, and inferred depositional setting relative to sea level. Modified from Veatch (1909), Eargle (1955), Donovan and Reinhardt (1986), and Froede and Williams (2004).

Figure 4. An *Ophiomorpha* trace in the Providence Formation was created by a burrowing shrimp. These traces are found today in the marine environment, and this trace fossil was formed when Floodwater still covered this portion of southwestern Georgia. Scale in inches and centimeters.

Exposures along Georgia State Highway 39C

Stratigraphic outcrops immediately outside of the park along Georgia State Highway 39C provide additional exposures of the Providence Formation, the Clayton Formation, and an unnamed stratigraphic unit that overlays and in places incises into the Clayton Formation. An iron-cemented layer (i.e., ferricrete) of one to three inches in thickness occasionally occurs at the base of the Clayton Formation (Figure 5). Horizontal layers of ferricrete also occur higher in the Clayton Formation sediments at some locations. Rare marine fossils have been found in some of these iron-rich layers, and their carbonate skeletons have been replaced by hematite (Figure 6). The unnamed stratigraphic layer above the Clayton Formation is a massive sandy-clay layer (these sediments were eroded from upgradient Clayton Formation exposures) containing ferricrete clasts of varying sizes (Figure 7).

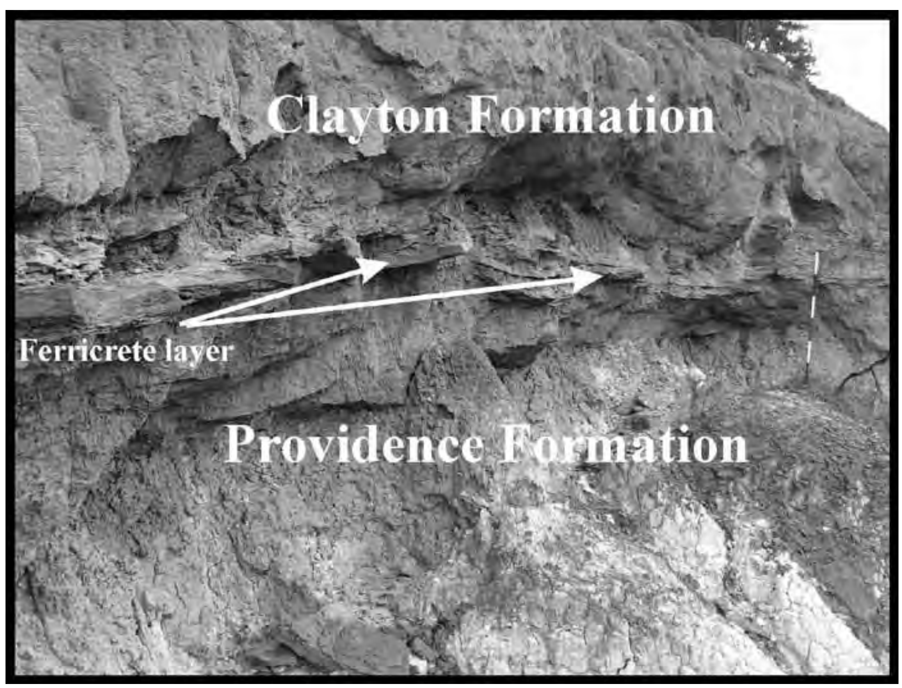


Figure 5. Ferricrete occurs at many locations between the Providence Formation and overlying Clayton Formation (see Froede, 2007, chapter 5). Oxidation of the dissolved iron-rich groundwater caused the iron minerals to precipitate out of solution forming the ferricrete layer. Scale in six-inch (15-cm) divisions.

Figure 6. Iron cement has replaced the carbonate skeleton of this former sea urchin. Fossils such as this one indicate that the Clayton Formation clastic sediments were deposited in a marine setting. The general lack of any pronounced sedimentary structures (e.g., cross-bedding) in the Clayton Formation suggests that it was deposited and reworked in a low-energy environment, indicating that Floodwater agitation had decreased.

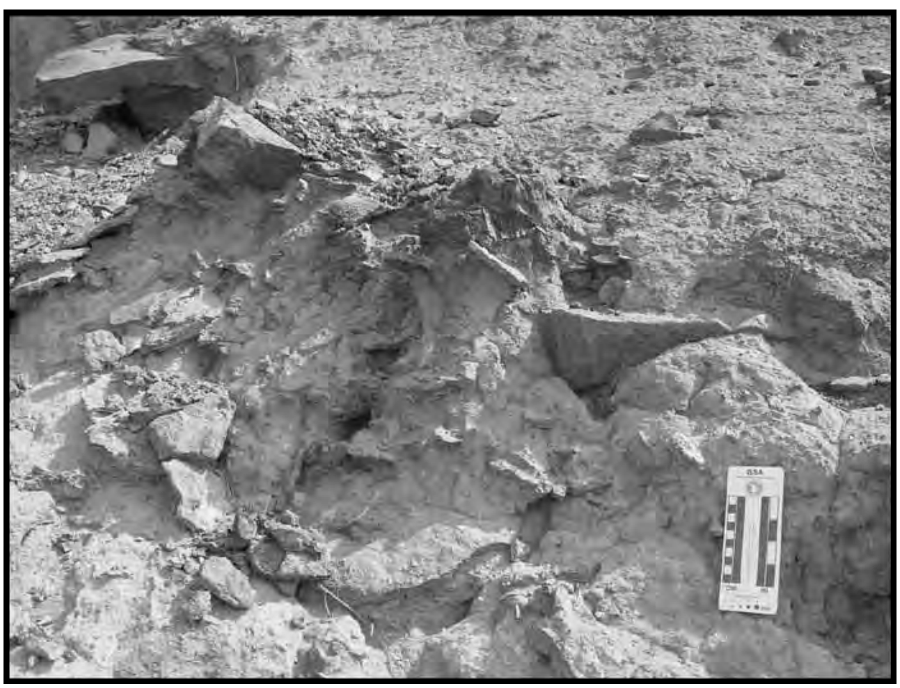


Figure 7. In many places, polished and unpolished ferricrete clasts of varying sizes line the sidewalls and bottom of the incised channels in the Clayton Formation. This mixture of clasts and sediment is not indicative of fluvial transport, but rather suggests mudflow deposition. Scale in inches and centimeters.

In some locations this unnamed unit incises the Clayton Formation (Figure 8). The age of this stratigraphic layer has not been resolved by geologists due to the lack of any datable body or plant fossils.

A Young-Earth Creationist Interpretation

The sediments and strata exposed within the study area exhibit an ascending profile reflective of sea-level regression. Changes in geologic energy, as displayed by the sedimentary features within each stratigraphic unit, will allow us to assign the strata to specific time intervals within the diluvial geologic timescale (Figure 1). Through this exercise we will be able to understand the Biblical geologic history of this area within the context of the Flood and ensuing Ice Age.

The Renfroes Marl is the lowest exposed stratigraphic unit in Providence Canyon State Park. A diluvial interpretation of this unit would place this marl in a submerged middle continental shelf setting. Sufficient organic content, oxygen, and time made it a prime target for rapid bioturbation by a variety of marine creatures (Froede, 2009). In the overlying Ripley and Providence formations, the high-angle cross-bedded sand indicates swift-moving currents. The depositional setting is envisioned as an inner-shelf to nearshore environment. High-energy conditions, coupled with a lack of organic content (as a food source), probably prevented these sediments from being extensively bioturbated.

The contact between the Providence Formation and the overlying Clayton Formation reveals an energetic mixing zone that decreases in energy moving upward into the Clayton section (Figure 9). The Clayton Formation sands were likely deposited and reworked in a nearshore-to-beach setting. Eventually, Floodwater completely withdrew from the area, marking the onset of the Ice Age Timeframe (Lower Ice Age Division) (see Froede, 1995a, 2007). Tectonic

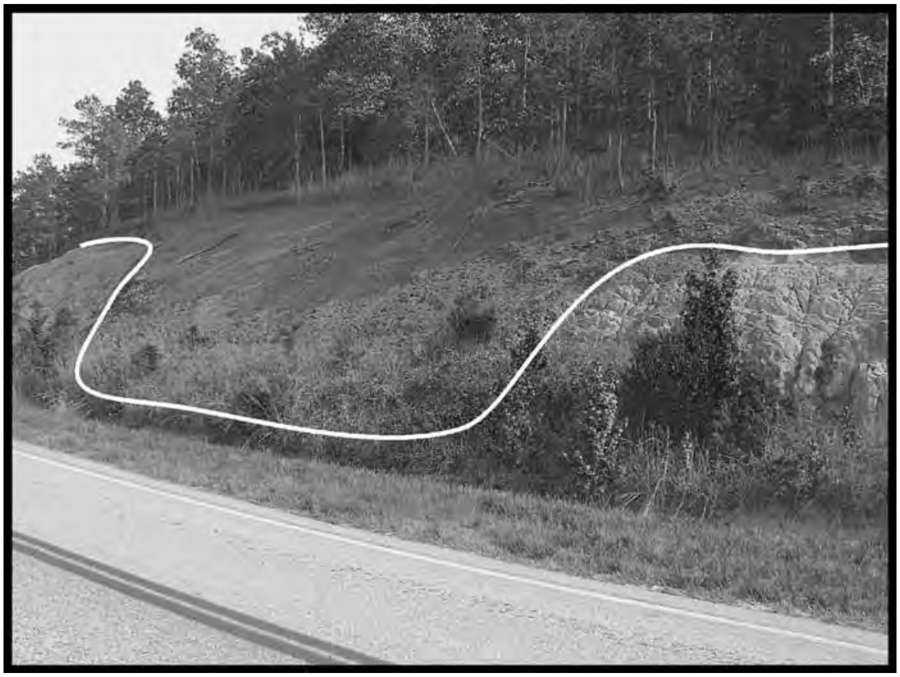


Figure 8. In places, a massive sandy-clay layer covers and incises into the Clayton Formation. This unnamed unit contains clasts of polished and unpolished ferricrete mixed within the stratigraphic unit. The exposed cliff face is approximately 25 feet high.

Figure 9. Kaolin clay clasts from the top of the Providence Formation are mixed with sands, silts, and clays at the base of the Clayton Formation. This suggests that the Clayton Formation clastic sediments were derived from a different sedimentary source and were deposited on top of the Providence Formation as geologic energy was decreasing and sea level was regressing. Scale in six-inch (15-cm) divisions

uplift of this portion of southwestern Georgia continued throughout the Lower/Middle Ice Age Divisions. With the onset of subaerial conditions, the marine connate water was displaced by ferrous groundwater as Floodwater continued to withdraw from the area. The dissolved iron within the groundwater was probably associated with the area of uplift to the northeast. The oxidation of the groundwater within the subsurface created ferricrete layers, which likely formed over the course of several decades (Ferguson et al., 1983; Phillips, 2000; Phillips et al., 1997; Yager et al., 2003).

With continued uplift across this portion of southwestern Georgia, precipitation eroded elevated areas, scoured channels, and filled them with reworked Clayton Formation clastics and ferricrete debris (Figure 8). The eventual cessation of uplift and the establishment of a vegetative cover reduced or eliminated the sandy mudflows across the area. This portion of Georgia remained for millennia in geomorphic equilibrium until clear cutting of timber and poor farming practices began in the early/middle 1800s. Clearing of the land, coupled with uncontrolled runoff, created conditions of rill, gully, and eventual canyon development across this area (Williams, 1995; Froede and Williams, 2004).

Conclusion

A bottom-to-top study of the exposed strata in and surrounding Providence Canyon State Park reveals an interesting geologic history. Applying the diluvial concept of changing geologic energy to the exposed sediments suggests that the depositional setting changed from middle/inner continental shelf through nearshore/beach to terrestrial conditions. This likely occurred over the course of several centuries as Floodwater gradually withdrew from the southwestern Georgia Coastal Plain. Inserting this dynamic depositional setting in a manner consistent with a diluvial geologic column would suggest that the strata found in the park and surrounding vicinity record the transition from the Middle/Upper Flood Event Divisions to Lower/Middle Ice Age Divisions. The strata suggest that Floodwater slowly retreated from this portion of the state due to a combination of sea-level decline and concomitant uplift across the southwestern Georgia coastal plain.

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