Georgia Journal of Science

Volume 74 *No. 2 Scholarly Contributions from the Membership and Others*

Article 12

2016

SHELL BLUFF – A FOSSILIFEROUS RIDGE, THE SITE OF THE EXTINCT OYSTER CRASSOSTREA GIGANTISSIMA AND HISTORY OF ITS IDENTIFICATION

elliott o. edwards jr.

Bartram Trail Conference, elliotoedwardsjr@gmail.com

SHELL BLUFF – A FOSSILIFEROUS RIDGE, THE SITE OF THE EXTINCT OYSTER *Crassostrea gigantissima* AND HISTORY OF ITS IDENTIFICATION

Elliott O. Edwards, Jr.
Bartram Trail Conference
122 Grays Creek Drive
Savannah, Georgia, 31410
elliotoedwardsjr@gmail.com

ABSTRACT

Shell Bluff is described by geologists as stratigraphically one of the most important exposures in the Georgia Coastal Plain because the bluff is home to the large oyster, *Crassostrea gigantissima*, now extinct. Native Americans inhabited this area prior to Hernando DeSoto and his men who visited the area in 1540. They were probably the first Europeans to visit Shell Bluff. John and son William Bartram visited the bluff in 1764 and John described the bluff in his journal and the existence of large oysters. The British naturalist, John Finch, described a fossil oyster taken from the site in 1824 as *Ostrea gigantissima,* but later named *Crassostrea gigantissima*. This paper reviews the natural history of the oyster's identification, and the importance of the oyster and its name.

Keywords: Shell Bluff, *Crassostrea gigantissima*, extinct oyster, Eocene, Georgia natural landmark.

INTRODUCTION

In the evolution of science, scientists have met with many challenges. One is that the progression of science is slow. The hypothesis was understood, although not a documented step in the early years, as more of a theorized prediction and the proposed theory was not considered proven until it was peer reviewed, published and republished, and again accepted by peers. It was the natural order of things (Dana 1918).

There is fascination in scientific naming as evidenced in the time it took scientists to name *Crassostrea gigantissima*. Each scientist built on the one before he or she. The published trail of *Crassostrea gigantissima* is well documented and we can ascertain the successive stages it took scientists to date the oyster until its final name was accepted. John Bartram wrote the first description in 1765 (Bartram 1942) and, in 1823, Dr. John Finch described the oyster in a paper read before the Academy of Natural Sciences, at Philadelphia, July 16, 1823 as *Crassostrea gigantissima* (Lawrence 1991). *Crassostrea* was erected by Sacco in 1897 and this species was recombined by Ward in 1992 as *Crassostrea gigantissima* (Coan and Valenti-Scott 2012). Also, *Crassostrea gigantissima* has recently been synonymized with *Striostrea* by Bolton and Portell (2013).

The *Crassostrea gigantissima* is shown in Figure 1, a specimen from Shell Bluff, and it rests in its geologic period of history, the Eocene. In 1911, Veatch and Stephenson correlated the extensive shell bed with the McBean formation (Veatch

and Stephenson 1911). The oyster was collected by Veatch and Stephenson in 1911 as *Ostrea gigantissima* and later renamed *Crassostrea gigantissima* as explained above.

Figure 1. Extinct oyster *Crassostrea gigantissima* from Shell Bluff. The specimen was provided by John D. Carswell.

Location

Shell Bluff, an Eocene formation of the Tertiary Period, as shown in Figure 2, is described by geologists as stratigraphically one of the most important exposures in the Georgia Coastal Plain (Veatch and Stephenson 1911). The length of the bluff against which the Savannah River impinges is an average of 150 feet (45.72 m) high. The bluff is calcareous rock, and a sandy and argillaceous marl, with comparatively pure limestone.

The bluff has been written about and noted in geologic literature more often than any other site in Coastal Georgia (Veatch and Stephenson 1911). The site is significant because the bluff is home to the large oyster, *Crassostrea gigantissima*. The adjacent bluffs on the Savannah River downstream of Shell Bluff expose sandstone, limestone, limey sandstone, beds of clay, and beds of the extinct oyster shell. The bluff is also significant botanically because it supports a population of "the rare Ocmulgee skullcap (*Scutellaria ocmulgee*)," a mint restricted "to the Fall Line and the inner coastal plain of Georgia" (Georgia bot. soc. 2014). The bluff is

located on the Savannah River in Burke County, approximately 24.94 km (15.5 miles) east of Waynesboro.

Figure 2. Shell Bluff along the Savannah River (photo courtesy of The Augusta Chronicle).

Many scientists and individuals in related fields have visited Shell Bluff for the last three centuries. Native Americans occupied the area for generations. Hernando de Soto, on an expedition in 1540, was the first European to explore the interior of Georgia. He visited Augusta and the surrounding area during the summer of 1540, before traveling into South Carolina. John Bartram, America's first botanist (naturalist), and son William, visited Shell Bluff in 1765 on an expedition on their way to Florida. John Bartram described their visit in his journal of 1765 (Harper 1958). William was 26 years old accompanying his father as King's Botanist on his Florida expedition in 1765 when John Bartram recorded the first scientific account of the site in his journal. William would return the last week of April 1775, on his own expedition, and would describe it in his journal, and later publish that description in his book Travels, in 1791 (Harper 1958).

The collecting expedition for the king, which Bartram began in Charleston, South Carolina, took them all the way to Florida. They would travel through Georgia while stopping at Shell Bluff. John described their visit to Shell Bluff as a scientist would, making entries of everything scientific in his journal. The large oyster he found within "a strata of large shells" had yet to be placed in a genus (Harper 1958). But John's journal entry was meticulously written and historically leaves probably the first scientific description of the bluff. John was held in high esteem by his peers and well regarded as a botanist in Philadelphia and as a

phenomenal writer and illustrator of the natural landscape, well qualified to write such a site description (Harper 1958).

John Bartram's Journal Accounting of Shell Bluff

They continued south and on September 9, 1765, thermometer 77 degrees, "fine morning, a little cloudy, then cleared up, hot to 88 degrees. Travailed to A bluff near Savannah River, A large flat and rich ground lying between y^{e} bluff seemed to be 200 foot from y^{e} surface of y^{e} water. Y^{e} upper surface vegetable mould one foot then a sandy clay 3 foot more or less, then a strata of gravel shells as fine as course and so rotten as to feel like mould, then 2 or 3 foot of a kind of brownish marl, then a strata of large shells, all in clusters, near 18 inches long and as close Jumbled together as y^{e} surf could force them on all directions, a foot or more deep: in some places A strata of powdered shells would succeed 10 inches deep, in others y^{e} whole mass would appear like a rock but with a pick might pretty easily be broke to pieces, not being petrified. Yet in some places some detached masses seems petrified to A rock: y^{e} thickness of y^{e} shells bears A full proportion to their length and breadth, and their numerous Lamina determines their periodical growth - whether yearly or monthly I shant say, but its certain y^{e} most porous and tender part of each lamina is by length of time much wasted and numerous cavities left, some of which is near filled up with cristaline spar, and many of y^{e} others glitter on each side like dimond sparks, which seems not to loose their luster. in observing vast parcels of these shells that y^{e} adjacent inhabitants burn to lime, I observed one small clam about 2 inches diameter, but for several miles these monstrous oisters appear without mixture. We then found upon y^{e} moderat steep descending part of this bluff several of our pensilvania plants, as maiden hair, rattle snake golden rod, sweet roasted Sanicle, prenanthes, noble liverwort, Uvulary, berry bearing Solomon seal, mitella and many others. They say y^{e} Ginseng grows here as it's a north east exposition and rich soil. We then descended into y^{e} low lands which is from, 12 to 20 foot above ye surface of y^{e} water. It's a mixture of yellow sand loam and in some places clay under a foot of vegetable mold. Y^{e} river is about 120 or 150 yards over and 12 foot deep in y^{e} channel. We crossed in a ferry boat , then rode A mile over y^{e} low ground full of very large timber, while oaks 5 foot diameter, liquid amber near as much, Cypress 6, shag bark hickory 4, beach 4, black or red oak 4, tupelo 4, tulip tree 4" (Harper 1958).

William Bartram was 27 years old when he and his father returned to Philadelphia after the one year expedition to Florida. William had already confirmed that his career would be one in natural history, like his father. He would return to Shell Bluff in 1775 while on his famous four year expedition to the eight southeastern states. He recorded his journey in his journal and it would eventually be published as a book, Travels, in 1791, his account of the long expedition (Harper 1958).

Today, the site is considered a famous geological site and has been visited extensively by geologists, naturalists, malacologists, and other scientists. Although many stops were made and they were important on their own merit, Shell Bluff is mentioned because of its scientific significance as a part of the Eocene Era, a period of high sea levels, where marine layers covered the majority of the Coastal

Plain of Georgia (Gore and Whitherspoon 2013). John Bartram was a botanist, but he made many geologic contributions during his field trips because of his keen eye and his intelligence to write a precise field report on any natural historic place. This report is a good example of why his peers considered him a notable botanist. His field report is still being used by scientists today (Mancke 1977).

In 1823, Professor John Finch, a British naturalist, wrote a paper on an oyster he proposed to call *Ostrea gigantissima*. He read the paper before the Academy of Natural Sciences at Philadelphia in 1823. He opened the paper by reading his definition of the study of the geologist. "To trace the connection between the rocks of different continents, to observe the order of their superposition, and to examine the exterior formations of the earth, are the business and study of the Geologist." He went on to describe his observations of the mountain masses which he says "obey one general law, the Foundation of Geology, that crystallized rocks which contain no fossils and are equally called primitive, whether they occur in Europe, Asia, or America, are constantly found in the same position. When we ascend in the scale of formations, and arrive at those rocks which contain fossils, we find each stratum decidedly marked by the remains of zoophytes, or shells, peculiar to it. These fossils constitute the metals of the ancient world, by which to ascertain the various periods, during which the exterior coat of the earth was consolidated" (Lawrence 1991).

In 1824, Finch described the large fossil oyster from Shell Bluff and proposed the name *Ostrea gigantissima* (Lawrence 1991). "I propose to mention the most remarkable formation in this world, when we consider the almost incredible quantity of fossil shells which it contains. This extensive formation is chiefly composed of a large species of *Ostrea*, which I believe has not yet been described. I propose to call them *Ostrea gigantissima*. The shells appear but slightly changed by their residence in the earth, and are in many parts used for burning into lime. In some situations it contains large quantities of iron pyrites."

In 1828, Vanuxem presented the first geologic description of any logical result for a paper that was read by S.G. Morton in 1828 and described the Shell Bluff strata as upper Tertiary (Clark 1828). Approximately ten years later, T.A. Conrad studied the fauna of the bluff while, at the same time, he was the first to classify the beds as Eocene and described this same taxon as *Ostrea georgiana*, as the common oyster, although Vanuxem knew this oyster before Conrad and he had already named it *Ostrea gigantea* (Clark 1828). Some of his specimens were 22 inches (55.88 cm) in length. Figure 3 shows specimens collected from Shell Bluff. The oyster in the bottom of Figure 3 was originally 13 inches but due to a fire, a section of the specimen was destroyed and it is now approximately 6 inches in length.

Charles Lyell (1797 – 1875) was a pioneering geologist from Scotland and came to America in 1842 to study the geology of America. He visited Shell Bluff accompanied by his wife, Wilde, an attorney, and crew on January 2, 1842. They walked from Demery's Ferry, located a mile below Shell Bluff. Lyell immediately began to collect fossils, while in a pouring rain. The next morning Lyell continued his collecting and planned to spend the whole day at the site. He collected more than 40 species of shells, from beds of the Eocene. A couple of days later they boarded a steamboat and travelled along the Savannah River, while observing the

high bluffs. Lyell compared the London Bluff with the same stratified beds of white shell–limestone as at Shell Bluff. Red clay and loam covered the limestone at the top of the bluff (Wilson 1998).

Figure 3. *Crassostrea gigantissima*. The specimens are from the author's personal collection.

Upon Lyell's return to Philadelphia, for the next six weeks he would deliver 12 lectures at the Philadelphia Museum. He compared his fossils of the south with those of Timothy Conrad, Samuel George Morton, and Isaac Lea. Lyell felt Lea's collection of New American species was impressive; he could see the relationship

between a number of species and the distinctive geography of North America. "It reminds the geologist," said Lyell, "of the different states of the animal creation which have accompanied the successive changes of the earth's surface in former ages" (Wilson 1998). Conrad assisted Lyell in identifying 12 species of shells from Shell Bluff. They determined the species to be Eocene, which had the same characteristic of the Eocene beds of Claiborne, Alabama. They collected fossil casts from the limestone at Jacksonborough, which were new species to Conrad, and the genera had characteristics of the Eocene. Lyell also concluded that the ratio of species that lived in the American Miocene formation was characteristic of that in the European Miocene formation. Lyell also concluded that living species in European Miocene fossils were of European fossils living in the warmer waters of coastal America. Lyell suggested that these results show the accuracy of species determination for fossils. Lyell published Travels in North America in 1845, his three year journey through America (Wilson 1998).

A discussion was taking place in 1866 concerning the stratigraphic position of the beds when the name *Shell Bluff* was proposed by Conrad (1866). These were strata characterized by *Ostrea georgiana* and which were earlier placed below the "Orbitolite" limestone of the Jackson group. However, Hilgard placed the Shell Bluff group above the Jackson, and debated the occurrence of *Orbitoides* beneath the Vicksburg (Hilgard 1866).

In 1895, Dr. W.H. Dall placed the Shell Bluff group under the lower Oligocene, or Vicksburgian, but wrote that its position was not yet agreed upon (Dall 1895). Later, Dr. Vaughn conducted paleontologic studies and his conclusions were that the marl that existed below the *Ostrea georgiana* bed should exist in the lower portion of the Eocene's Claiborne group (Vaughn 1901).

However, in 1897 a recent change occurred when the species was specified in the genus *Crassostrea sacco*, and given the name *Crassostrea gigantissima*. This taxon from the Cenozoic possesses particular significance because it is explicitly a direct ancestor of *C. virginica*, the example for *Crassostrea* (Sohl and Kauffman 1964).

Years later, in 1937, Howe commenced to investigate the history of John Finch's original shell of *C. gigantissima*. Howe received a letter of 20 February 1935, by H.A. Pilsbry, at that time curator of the Academy of Natural Sciences of Philadelphia, stating that he conducted a thorough search for the *Ostrea gigantissima* and could not locate it. It apparently had burned with many of the shell specimens at the Philadelphia Museum. When he learned of the lost specimen, he went to Shell Bluff the following month and collected several new specimens. He observed that these specimens coincided precisely with the measurements given by Finch of *O. gigantissima*. He deposited one at the Philadelphia academy and the remainder at the School of Geology, Louisiana State University in Baton Rouge, Louisiana. While Howe was at the Philadelphia academy, he was assisted by Dr. E.G. Vannatta who located Conrad's types of *O. georgiana*. He observed that Conrad's specimens are slightly larger than ones described by Finch, but had the same characteristics and dimensions and were of undoubtedly the same species (Howe 1937).

Shell Bluff Description

In 1911, Shell Bluff was described in the annual report of the Georgia Geologic Survey as a bluff of calcareous rock, which is sandy and argillaceous marl (Veatch and Stephenson 1911). Silica and clay are more predominant than lime and the rock can appear as a fine sand in a matrix of clay and calcium carbonate.

The angular quartz, scattered, reddish brown needles, which could be rutile appeared as microscopic particles and included a small amount of white mica. The calcium carbonate is in the form of fine fragments of shells. Glauconite is there but only in small amounts. Fossilized bones appear in very small brown and black particles in the rock, located in the lower part of the bluff. Occasionally, larger fragments are found. The marls which contain scattered quartz pebbles range in size from the size of a pea to 1 inch (2.54 cm) in diameter. The oyster shell *Crassostrea gigantissima* can be seen from 80 to 100 feet (24.4 to 30.5 m) above the level of the river. The shells are 12 to 15 inches (30.48 to 38.10 cm) long with a width of 3 to 4 inches (7.62 to 10.16 cm), and up to 2 inches (5.08 cm) thick. Some specimens are known to be 22 inches (55.80 cm) in length (Veatch et al. 1911). Dr. William H. Dall, distinguished the *Crassostrea gigantissima* as different from *Ostrea mauriciensis* or *Ostrea virginica* of Georgiana by their radical riblets (Veatch and Stephenson 1911).

These rocks are of late Eocene age, which are part of the Dry Branch Formation. There is a fossiliferous limestone of the Clinchfield Formation below the Dry Branch Formation that includes caves with lime sinks. This formation includes scallop shells, sand dollars (*Periarchus* genus), molds of gastropods and bivalves, sharks teeth, stingray tooth plates, crab claws, and bryozoans (Gore and Witherspoon 2013).

The fascinating and important geologic breakdown of this escarpment is a chalky white material due to weathered limestone which rises over 100 feet above the river. The calcareous rock is a sandy and argillaceous marl. Variations occur from pure limestone through highly argillaceous and sandy marls to brown friable sand, only slightly calcareous. Silica and clay predominate over lime and the rock often presents the aspect of a fine sand in a matrix of clay and calcium carbonate. The microscopic sand consists mainly of angular quartz, reddish brown needles (rutile), and a very small amount of mica (Veatch and Stephenson 1911).

Paulk (1986) states “the bluff is underlain by calcareous material of the McBean formation of late Eocene age.” “The existence of the fossil oyster shell is proof that the Fall line (Augusta to Columbus) represents an ancient coastline” (Morris 2003).

Charles H. Wharton’s Natural Environments of Georgia Bulletin 114 was a much needed natural resources book, according to the Georgia DNR, and was necessary as a part of the stewardship of Georgia’s natural resources (Wharton 1998). The book had long been needed by persons and institutions and since its first printing has gone through many additional printings. The following quote by Charles Wharton sums up his support for the natural environment.

The scene of forest luxuriance greets the visitor standing on the west bank of the Savannah River looking up at the BLUFF FOREST OF NORTHERN AFFINITIES at Shell Bluff (Burke County). “Found on ridges or low hills truncated by river erosion or held up by rock outcrops, especially on north-facing bluffs, the

vegetation show strong affinities. They may also be found on north-facing valleys walls along Upatoi Creek (Chattahoochee County) and other streams which have cut ravines as they drop towards the Chatahoochee River. The appearance of the shell bluff forest is one of almost subtropical luxuriance" (Wharton 1998).

Natural and Cultural Values to the Bluff

Wharton (1998) also states, "absolutely essential to prevent bluff erosion, these irreplaceable and rare environments hold botanical and zoological rarities – not yet studied in any detail. They are unknown genetic reservoirs, important to science. Sometimes unusual rock outcrops or fossil reefs are associated. Sometimes paleontologically significant (Shell Bluff) they are frequently associated with archaeological sites or historic cannon revetments (Shell Bluff). They are esthetically pleasing and natural outdoor laboratories of exceptional value. These bluffs are threatened by logging or other mismanagement, or as sites for cabins and refuse dumps. They are not recognized by the public."

Shell Bluff Botanical Inventory

The Georgia Botanical Society has compiled an inventory of the plants and trees at Shell Bluff in Burke County. These include overstory trees, understory trees, herbs, and a population of the unique and rare Ocmulgee skullcap (Georgia Botanical Society 2014).

There are other factors that make Shell Bluff important in addition to its geologic significance. For example, the unique combination of the northern and northeastern exposures of the bluff, the soils derived from limestone, the bluff has steep topography, the bluff continues to evolve without the frequent occurrence of fires, and the humid conditions associated with temperature which acts as a buffer. This condition is due to the Savannah River which flows at the base of the bluff and has thus led to the natural process of growth of southern mixed hardwood forests. This forest upholds several species that are characteristic to a greater degree of northern lines of latitude. The bluff botanical species are naturally found in the upper piedmont including the Blue Ridge and The Blue Ridge and Valley of Georgia. The Georgia Botanical Society inventory lists "green violet (*Hybanthus concolor*), wild ginger" or Canada ginger "(*Asarum canadense*), sweet cicely (*Osmorhiza longistylis*), black cohosh (*Cimicifuga racemosa*), ravine grass (*Brachyelytrum erectum*), starry campion (*Silene stellata*), tall bellflower (*Campanulastrum americanum*), and black walnut (*Juglans nigra*) as found" mainly "in the Ridge" and "Valley, Blue Ridge, and upper piedmont of Georgia." Close "to the crest of the bluff, an altered longleaf pine-turkey" sand-hill community exists and favors a distinct, "fire adapted flora when" adequately controlled. "The dominant trees visible are black walnut (rare in this environment) southern sugar maple, sweet gum, and mulberry" (Georgia Botanical Society 2014).

Shell Bluff also supports a population of the rare Ocmulgee skullcap (*Scutellaria ocmulgee*), a mint, that is large when compared to other members of the same genus (Georgia Botanical Society 2014; R. Bozeman, DNR personal communication). It is restricted almost totally to the Fall Line and inner coastal plain of Georgia. It flowers in June and July.

Additional Scientific Studies

Shell Bluff and surrounding communities remain scientifically important exposures of soil and oyster specimens that warrant continued study. Scientists see a difference in the thickness of the Eocene shell and their descendants with thinner shells.

Crassostrea oysters that grew during the earlier period of the Cenozoic era (Tertiary) were "large and" had "thick shells. Their descendants," the "living *Crassostrea*" have "smaller and thinner shells." The "ecological differences between" fossils "and living Crassostrea" were studied and were found to have "differences in body size. The" stationary isotope sclerochronology was examined in "two North American species, late Oligocene" *Crassostrea* "*gigantissima* (Belgrade formation, North Carolina) and" Quarternary *Crassostrea "virginica* (Chesapeake Bay & Mississippi Delta) both" claimed "to share an ancestor-descendent relationship." The "$\delta^{18}O$ and $\delta^{13}C$ "profiles across skeletal growth increments in two well preserved" *Crassostrea "gigantissima* shells show significant differences with profiles from Pleistocene and recent" *Crassostrea virginica*. The results of the study suggest a higher than normal "food supply that may have" prompted *Crassostrea "gigantissima* to grow" with thicker shells. The study also suggests that the *Crassostrea gigantissima* may have departed the salty environments to escape marine predation in search of shallow-marine environments during the Eocene (Kirby 2000). Another study used Griffins Landing a few miles upstream of Shell Bluff which also has Eocene specimens to evaluate paleotemperatures.

Jointed specimens were collected in situ from Griffins Landing, Georgia, to evaluate climate during late Eocene (35 plus or minus 0.5 Ma) for the southeastern United States. The study considered the paleotemperature records of the unaltered shells only. Late Eocene winter sea temperatures appear to resemble the modern coast of Georgia while the temperature of summer was 2-8 ^{0}C cooler. There was consistency with paleo-temperatures estimated from bivalves of the fossils of the Gulf Coastal Plain of the United States and they suggest that a regional cooling event impacted fauna in the Gulf of Mexico and the southeast United States during the Eocene (Jarrett et al. 2009).

Georgia Natural Landmarks – Status

In October 1977, Shell Bluff (Burke County) was recommended to be a nationally significant landmark under the Georgia Natural Landmark Program. The application was submitted by Dr. Rudolph E. Mancke, III, who at the time was curator of natural history at the South Carolina Museum Commission, in Columbia, South Carolina. The 10 page report made a strong case for why the site should be approved as a Georgia Natural Landmark (Mancke 1977). The application included ownership of the site, land use integrity, threats to the site, a comprehensive description of its natural values, and a discussion of the site's unique feature, the *Crassostrea gigantissima*. A botanical inventory of the bluff's flora was described in detail including a note on the threatened or endangered species. The results of the application based its findings on the extinct oyster, the variety of habitats, and the exploration of the site by William Bartram who was the

second person to describe the site. It also used the species of fauna, some now extinct, as a significant resource.

The results of the application are sketchy. The application process became incomplete along the way. Records are nonexistent, little information was carried forward. In retrospect, the Shell Bluff Natural Landmark was never approved on the state or federal level, although the landowner was willing to cooperate for its protection. Possibly a renewed interest in the site has surfaced; the site may or may not be considered again for nomination for state or federal assistance for its preservation.

SUMMARY

Shell Bluff, located on the Savannah River in Burke County, was described by the Georgia Geologic Survey in 1911 as the most visited site in coastal Georgia. They described the site as a classic locality and stratigraphically one of the most important exposures in Georgia. It is home to the now extinct *Crassostrea gigantissima*, a large oyster that existed during the Eocene approximately 40 million years ago. The oyster went through many years of study and observation before its name was confirmed as *Crassostrea gigantissima*. After John Bartram was appointed King's Botanist from Philadelphia, his first expedition was to travel to Florida through Georgia and South Carolina skirting the coast. He took his son William on the journey and on this trip William confirmed a career in botany as a naturalist like his father. John was the first to write a description of the bluff on the large oyster, long before it took a genus or species. The bluff had been visited by many geologists, including Charles Lyell, a British geologist who was in America to deliver the prestigious Lowell lectures and to explore America's geology. He wrote "Travels in America," a book of his explorations while exploring America. The natural history of the oyster overlapped several decades before the name *Crassostrea gigantissima* became the final name, owed to Dr. Finch. The site was so vital to malacology and geology that the bluff was recommended for preservation by the South Carolina Museum, however the process broke down and was never revived. The site is on private property and hopefully will remain protected for the time being. Much is owed to the scientists who wrote on the bluff which led to the naming of the oyster. It is one of our oldest sites in Georgia dating to the Eocene and possesses specimens that provided aid in dating Georgia geology with specimens for the geologic column. Renewed interest in the bluff gives hope that a vehicle will be found to restudy the bluff and protect it from further deterioration and looting of the oyster specimens. The bluff is important for five reasons: The bluff is Eocene dating back approximately 40 million years. It is home to the extinct *Crassostrea gigantissima*. The shells may reveal more information on the climate during the late Eocene. Rare flora and the rare Ocmulgee skullcap grows atop the bluff. The bluff contains the zoological rarities Charles Wharton touched on. Shell Bluff justifies more scientific study using modern scientific methods that were not available in earlier days.

ACKNOWLEDGMENTS

Research into old journals and papers enlisted the help of many people during the research period. Sometimes names can be lost of those who assisted with the project; I hope this did not happen in my case.

First, I want to thank the Georgia Academy of Science for providing a means to those who are engaged in historical and scientific work and those who are interested in the development of science, for the opportunity to present this paper to the Academy. Second, I wish to thank Mrs. Ruth Quattlebaum Edwards for her efforts in typing, editing, and most of all her support in this paper, for without her patience, it would not happen.

I would also like to thank Rick Monroe for his expertise in slide design and slide installation in the paper, Dr. John Bozeman long time friend (Department of Natural Resources) for his help in site topography, his botanical knowledge at Shell Bluff and notes on rare species; the Chatham County Library interlibrary loan department, Mr. John Tuggle and staff for their efforts in locating old journal articles; Dr. James Kennedy, geologist, DNR, sources at the Georgia Geologic Survey (GGS); Dr. Clark Alexander – a colleague, for his recommendations in some references, especially the new book entitled Roadside Geology which is a must for Georgia geologists in which and I have added to my personal library; the Georgia Botanical Society for their help in the botanical inventory atop Shell Bluff and a note on the rare Ocmulgee Skulcap; Dr. Rudulph Mancke – faculty of the University of South Carolina and past curator of the natural history South Carolina Museum Commission for his help in tracing the events of his original application to recommend Shell Bluff for a Georgia Natural Landmark in 1977; Tom Patrick, Non Game Conservation, DNR, endangered species and photo of Ocmulgee Skullcap; Dr. William Frazier, faculty of Colorado State University; Mrs. Sally Eve – Chatham County school teacher who loaned me one of her Shell Bluff specimens for photographing; Dr. Tony Chumbley, geologist, DNR, GGS resources; Jan Mackinnon, DNR, GGS resources; the late Miss Clermont Lee, a mentor, who introduced me to the site prior to 1977 and who helped me make a inventory of the botany at Shell Bluff; and especially to Ms. Cathy Buckwalter, eeference and digital services librarian, Academy of Natural Sciences of Drexel University, for her kindness and one who spent much time researching the Proceedings of the Academy of Natural Sciences for old proceedings vital to this paper, and Mr. Alan Giles – Georgia Department of Natural Resources, formerly with the now extinct Georgia Geologic Survey (GGS) who answered many questions about old papers published by the GGS, especially the Georgia Mineral Newsletter holdings, and who explained the ownership of these papers who is now Ga. DNR, when the GGS was an operating organization. Appreciation to Mr. Brian Tansey, business teacher, Islands High School for his research help and thanks to Mr. John D. Carswell for use of his specimen from Shell Bluff.

REFERENCES

Bartram, J. 1942. Diary of a Journey through the Carolinas, Georgia, and Florida, from July 1, 1765 to April 10, 1766. The American Philosophical Society.

Bolton, M.J. and R. W. Portell. 2013. A New Species of *Striostrea* (*Bivalveia: Flemingostreidae*) from the upper Pliocene and lower Pleistocene strata of Florida, USA. Florida Museum of Natural History, University of Florida, Gainesville, Florida..

Clark, W.B. 1828. Journal Academy of Science, Philadelphia, 6, 59-71.

Coan, E.V. and P. Valenti-Scott. 2012. The Paleobiology Database, Revealing the History of Time, *Crassostrea sacco* 1897, World Register of Marine Species.

Conrad, T.A. 1866. Observations on the Eocene formation of the US with descriptions of species of shells. American Journal of Science, 41, 96.

Dall, W.H. 1895. Eocene and Lower Oligocene Coral Faunas of the United States. U.S. Geologic Survey, 18th Annual Report, Pt. II, p. 342.

Dana, J.S. 1918. Medicine in America, a Century of Science in America, The American Journal of Science, 1818 – 1918. Applewood Books.

Georgia Botanical Socity. 2014. http://www.gabotsoc.org/articleShellBluff.htm

Gore, P.J.W. and W. Witherspoon. 2013. Roadside Geology of Georgia. Mountain Press Publishing Company.

Harper, F. 1958. The Travels of William Bartram, Naturalists Edition, The John Bartram Association, Yale University Press.

Hilgard, E.W. 1866. Remarks on the new division of the Eocene, or Shell Bluff group. American Journal of Science, 42, 68-70.

Howe, H.V. 1937. Large oysters from the Gulf coast Tertiary. Journal of Paleontology, 11, 355-366.

Jarrett, M.B., C.S. Romanek, and Yanes. 2009. Late Eocene Paleotemperatures: Insights from *Crassostrea gigantissima*. Portland GSA Annual Meeting., Paper No. 151-13

Kirby, M.X. 2000. Paleoecological differences between Tertiary and Quaternary Crassostrea oysters, as revealed by stable isotopes sclerochronology. Society for Sedimentary Geology, 15(2), 132-141.

Lawrence, D.R. 1991. The neotype of *Crassostrea gigantissima* (Finch, 1824) Journal Paleontology, 65(2), 342–343. The Paleontological Society, (0022-3360/91/0065-0342).

Mancke, R.E. 1977. Natural Landmarks Site Evaluation, Georgia, Shell Bluff, Burke County. Natural History Commission, Columbia, South Carolina.

Morris, W. 2003. An Introduction to the Flora of Shell Bluff, Burke County, Georgia: A field trip destination for the 2003 Annual Pilgrimage. Georgia Botanical Society, Georgia. Formerly available at http://www.gabotsoc.org

Paulk, H.V. 1986. Soil Survey of Burke County, Georgia. U.S.D.A. In Cooperation with the University of Georgia College of Agriculture, Agricultural Experiment Station, 130 pp.

Sohl, N.F. and E.G. Kauffman. 1964. Giant upper Cretaceous oysters from the Gulf Coast and Caribbean. U.S. Geological Survey Professional Paper 483-H, 22p.

Vaughan, T.W. 1901. Shell Bluff, Georgia, one of Lyell's original localities. Science, D.S. 13, 270.

Veatch, O.V. and L.W. Stephenson. 1911. Preliminary Report on the Geology of the coastal plain of Georgia, two volumes, Bulletin No. 26, S.W. McCallie, state geologist, prepared in cooperation with the United States Geological Survey under the direction of T. Wayland Vaughan, geologist in charge of coastal plain investigations, Atlanta, Georgia, Foote & Davies Co.

Wharton, C.W. 1998. The Natural Environments of Georgia, Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey, Bulletin 114.

Wilson, L.G. 1998. Lyell in America, Transatlantic Geology, 1841 – 1853, The John's Hopkins University Press.