TABLE OF CONTENTS

Cave passage orientation and development within Florida Caverns State Park; Jackson County, Florida – Gary L. Maddox................................................................. 4

Introduction to the geology of the upper Apalachicola River basin – Harley Means................................................................. 15

Human history of the Apalachicola River – Ryan Means and Rebecca Meegan................................................................. 30
CAVE PASSAGE ORIENTATION AND DEVELOPMENT WITHIN FLORIDA CAVERNS STATE PARK; JACKSON COUNTY, FLORIDA

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INTRODUCTION

Cave development in Florida Caverns State Park is primarily the result of vadose solution within the upper Eocene Crystal River formation of the Ocala Group. Fluvial erosion and the resultant lowering of the Chipola River valley through the uplifted Tertiary limestones provides the gradient and successively lower water table elevations responsible for development of dry cave passages. Passage orientation is controlled by two predominant vertical joint sets, combined with solution along bedding plane-parallel horizons. The caves are mature karst features, containing profusely decorated chambers.

CAVE DISTRIBUTION IN FLORIDA

Cave distribution by county is shown in Figure 1. From this map, one can see that Alachua County leads the state, with over 150 known caves. Jackson County is second, with about 80 known caves. These numbers reflect to some degree the intensity of exploration in known cave areas; other areas in adjacent counties may hold similar potential for new discoveries. Several new caves are found and mapped every year throughout Florida, mostly by cavers affiliated with organized chapters (grottos) of the National Speleological Society. An excellent summary of karst processes and features in Florida, including cave development, is presented by Lane (1986).

Major vadose cave development in Florida is associated with two positive regional structural features: the Ocala Arch and the Chattahoochee Anticline. A majority of the larger caves in Florida occur in these two areas (Figure 2). Caves found along the axis of the Ocala Arch are developed in Eocene Ocala Group limestones, and display a variety of morphological influences, including joint and bedding plane control. These caves are primarily the result of solution along vertical fractures and joints, extending downward to the water table. At this point, horizontal passages are developed at current or past elevations reflecting the juncture of the saturated zone with the vadose zone. Many of these lower horizontal passages contain pools of standing water, reflecting the upper potentiometric surface of the Floridan aquifer system. These caves and smaller karst conduits provide direct pathways for recharge to the aquifer. Most of these caves are relatively short lengthwise, and contain few
NUMBER OF KNOWN CAVES PER COUNTY WITH PASSAGE ABOVE MEAN WATER TABLE

1 - 5
6 - 10
11 - 25
26 - 50
51 - 100
100 - 200

- Updated by Gary Maddox from a map originally drafted by Florida State Cave Club, April, 1980

SCALE

0 50 100 150 MILES
0 80 100 240 KILOMETERS

FIGURE 1 - Distribution of Caves in Florida
Areas where Vadose Cave Passages are common

FIGURE 2 - Occurrence Areas of Vadose Caves in Florida
speleothems. Warren's Cave (Alachua County), the longest known dry cave in the state (Table 1), occurs just east of the major peninsular cave zone. It is a modified network maze cave (White, 1988), developed within an anomalously thick carbonate zone in the Hawthorn Group.

**TABLE 1: Florida's Longest "Dry" Caves**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cave Name</th>
<th>Length (m)</th>
<th>Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Warren's Cave, Alachua County</td>
<td>6005</td>
<td>19,700+</td>
</tr>
<tr>
<td>2</td>
<td>Boyer's Discovery, Jackson County</td>
<td>1219</td>
<td>4000</td>
</tr>
<tr>
<td>3</td>
<td>Ellis Cave, Jackson County</td>
<td>1097</td>
<td>3600</td>
</tr>
<tr>
<td>4</td>
<td>Hollow Ridge Cave, Jackson County</td>
<td>1006</td>
<td>3300</td>
</tr>
<tr>
<td>5</td>
<td>Florida Caverns, Jackson County</td>
<td>884</td>
<td>2900</td>
</tr>
</tbody>
</table>

SOURCE: Pease, Young and Zymowski, 1993

Development of significant horizontal cave passage requires the existence of a gradient through which ground water must pass. This gradient can be dynamic, such as the steep elevational changes associated with phreatic cave development in the deep mountain caves of Mexico or along the margins of the Appalachian Plateau. In Florida, this gradient is much less dynamic, consisting of a chemical horizon at the local water table and extending upward along fractures and joints within the vadose zone. Chemical dissolution along vertical joints and horizontal bedding planes at and above the water table is the primary mechanism responsible for cave development. The process in Florida, though less dynamic in a physical sense, is very effective nonetheless, primarily due to the relatively granular and porous nature of the Tertiary limestones exposed in uplifted regions of the state.

CAVE DISTRIBUTION AND DEVELOPMENT IN JACKSON COUNTY

Uplift along the southern flank of the Chattahoochee Anticline in the late Tertiary (Schmidt and Coe, 1978) has elevated Oligocene and older marine carbonates to an average elevation of 45 m (150 ft) above mean sea level in northern Jackson County. These elevated carbonates, thinly mantled by Pleistocene and younger sediments and dipping gently southward, enabled the development of mature karst features in the area. The northeastern portion of the Jackson County is a mature karst plain, underlain by upper Eocene Crystal River limestone. Shallow dolines, mostly cover subsidence sinks, are widely distributed throughout the region. Surface streams are rare; the area is mostly internally drained. In many ways this area appears to be geologically similar to, and perhaps the southwestern extension of the Dougherty Karst Plain of southwestern Georgia (see Beck and Arden, 1984).

Dry caves in the Marianna region occur primarily in a series of remnant limestone ridges adjacent to and roughly paralleling the Chipola River, downdip at the southern margin of the northern Jackson County karst plain. Successive downcutting of the Chipola River channel has eroded the uplifted Tertiary limestones, providing a vertical component for ground water movement. The existence of many springs along
the Jackson County portion of the Chipola River demonstrates that this process continues today. The elevation of the Chipola River valley floor in the vicinity of Florida Caverns State Park is about 21 m (70 ft). Horizontal cave development along formerly higher water table horizons has caused development of most of the larger caves of the area. This development is most pronounced in the Bumpnose member of the Crystal River formation. The development of cave passage at the upper juncture of former saturated zones may have been influenced by higher Pleistocene sea level stillstands, which would influence the ability of the Chipola River to deepen and widen its valley. Inundation of some cave passages by clastic fill during periods of higher sea level may have also occurred (Boyer, 1975b).

Horizontal vadose passage development benefits from the existence of a resistant caprock. In the Marianna area, most large caves are developed in the upper Bumpnose member of the Crystal River formation, a soft, white fossiliferous limestone characterized by abundant Lepidocyclina (Nephrolepidina) chaperi. It is very soft and granular, owing to the presence of many bryozoa and foraminifera (Moore, 1955). Overlying the Bumpnose member is the more resistant Oligocene Marianna limestone, a hard to soft cream to white fossiliferous limestone containing highly indurated zones and characterized by the occurrence of Lepidocyclina (Lepidocyclina) mantelli. Marianna limestone was once quarried in the area for use as a building stone. The Marianna limestone acts as a caprock, protecting horizontal cave development in the softer underlying limestones of the Ocala Group. The distribution of major caves in Jackson County, therefore, occurs in a generally northwest-southeast trending band centered along and passing through Florida Caverns State Park (Figure 3). This band roughly corresponds to the outcrop pattern of the Marianna limestone along and adjacent to the Chipola River (see geologic map of Jackson County in Moore, 1955). Interestingly, the Marianna limestone has been eroded and is largely absent from most of the cave-bearing ridges within Florida Caverns State Park.

Besides the Park caves and those of similar morphology in the Marianna area, two other types and areas of cave development exist. A small number of caves are located along the Chattahoochee River corridor in eastern Jackson County (Figure 3). These are primarily short, vadose stream caves with secondary phreatic solution enlargement. Most are contained within the lower Miocene Chattahoochee formation.

There are many underwater caves present in the county. Most are associated with springs discharging into the Chipola River or its tributaries, particularly Merritt’s Mill Pond and Spring Lake. These underwater caves are generally larger in section and much longer than their "dry" counterparts. Many display well-developed passage at particular depth horizons parallel to bedding. Many of these were possibly "dry" water table caves during past advances of continental glaciation, when sea level and ground water levels were lower, as evidenced by possible relict vadose features.
FIGURE 3 - Distribution of Some Major Karst Features in Jackson County, FL
CAVE PASSAGE ORIENTATION

Caves within Florida Caverns State Park and surrounding areas display preferential development along three planes: two vertical joint directions at roughly right angles to each other, and a horizontal direction parallel to bedding.

The predominant vertical controlling joints of the region strike at approximately N.30° W. This major orientation is responsible for development of the largest and most predominant vadose cave passages in the Park. China, Tunnel, Miller’s and Dragon’s Tooth Caves display this preferential development orientation exceptionally well, as shown on Figure 4. The western half of Miller’s Cave, the "Dragon’s Belly" room in Dragon’s Tooth Cave and the "Vandal Room" in Pottery Cave are all developed along the same joint. "Dragon’s Belly", the largest single cave room in the Park, is dimensionally approximately 41 m (135 ft) long, 17 m (55 ft) wide and 6 m (20 ft) high. This north-northwest trending fracture orientation may also be responsible for controlling the course of the Chipola River, which is oriented in the same direction.

A conspicuous secondary vertical joint orientation strikes at approximately N.60° E. Passages developed along these joints can be seen in Boyer’s Discovery, China and Miller’s Cave. These passages are usually lower than the passages developed along the primary joints, and more poorly defined. They often form low connector passages between the larger north-northwest trending chambers.

A third vertical fracture or joint orientation of approximately N.20°E. is well developed in China Cave and Bobby Hall’s Cave. This orientation is rarely manifest in preferential passage development in other Park caves.

Virtually all caves within the Park contain areas of low, wide passage parallel to bedding. These lower passages are most likely best developed along the unconformity separating the Ocala Group Bumpnose Member of the Crystal River formation from the underlying lower Crystal River formation. Because most of these passages contain significant clastic infill, this relationship is difficult to investigate. Morphological features, such as certain conduit cross-sections, suggest that some of these passages may have initially developed as phreatic conduits, which were later modified through vadose solution. Dum Cave and Windy Crawl both possess excellent examples of bedding plane parallel passage development.

Many Park caves are located along the limestone scarp above the Chipola River floodplain. Some of these are relict cave segments, remnants of larger systems which have been destroyed by enhanced solution and mass wasting along the scarp. Pottery Cave is a good example of this, displaying truncated passage, "dead" speleothems and multilevel cave development. At least three distinct levels have developed in this cave. Other related karst landforms, such as rock shelters and natural bridges, can also be seen along the scarp.
Caves of Florida Caverns State Park

Jackson County, Florida

Tapes, compass and inclinometer surface survey made from 1979 - 1985 by members of the FLORIDA STATE CAVE CLUB, Grotto 175 of the National Speleological Society.

Bobby Hall’s, Boyer’s Discovery, China, Dragon’s Tooth (historic), Dum, Florida Caverns, Little Miller’s, Miller’s, Pavilion, and Windy Crawl caves mapped by Dr. Paul Boyer and the FORT RUSHER-CZARK GROTTO of the National Speleological Society.

All-in-One extension of Bobby Hall’s, Dragon’s Belly portion of Dragon’s Tooth, Frye’s Bughole, Cold, Platform, Pottery, Wall’s Misery and Yogi Bear caves mapped by members of the FLORIDA STATE CAVE CLUB.


Revised map digitized by Gary Maddox in October, 1993.

© 1993 by the FORT RUSHER-CZARK GROTTO of the National Speleological Society.

EXPLANATION

- Paved Road
- Unpaved Road
- Foot Trail
- Cave Passage
- Natural Bridge
- Rock Shelter

SCALE

0 100 200 300 400 500 Feet

0 50 100 150 Meters

FIGURE 4
Known caves in the Park contain from one to five entrances. Caves with only one humanly passable entrance are most common. Because many of the caves now exist above the zone of saturation, dissolution of overlying calcium carbonate via downwardly percolating meteoric water produces extensive speleothem development in many of the Park caves. Stalactites, stalagmites, columns, flowstone, rimstone dams, cave pearls, "popcorn" and draperies are all commonly found in these caves. Of particular note are the "bedpost" stalagmites present in several of the caves. Speleothem development of this type is indicative of the last stages in the "life cycle" of the cave. Speleothems are developed in the cave at the expense of overlying roof rock, the source of calcium carbonate, which will eventually weaken to the point of collapse. Several Park caves already have precariously thin roof zones. In Florida Caverns, during heavy rainfall events the thin, perforated roof zone allows numerous small waterfalls to cascade from the ceiling to the floor in the northern part of the cave.

Florida Caverns, the commercial tour cave in the Park, actually consisted of two smaller caves joined by a tunnel dug through the surrounding limestone by Civilian Conservation Corps workers in the 1930's. The cave was discovered in 1937, when the original entrance was exposed by the roots of a fallen tree. The present map of the cave (Figure 5) was produced by Dr. Paul Boyer and members of the Fort Rucker-Ozark Grotto and the Florida State Cave Club (Boyer, 1975a). The cave displays most of the aspects of passage development discussed above, and is heavily decorated.

A good summary of the history and area geology of the Park can be found in Schmidt (1988).
FIGURE 5 - Planimetric Map of Florida Caverns
REFERENCES


Pease, Kenny, Kevin Young and David Zymowski (editors), 1993, The Rigamortis Report: newsletter of the Dead Caver’s Society, Orlando, Florida; Volume 2, Number 1, p. 3.


The upper Apalachicola River basin provides an excellent setting for studying the local geology because it harbors numerous outcrops, one of which is the tallest in the state. These outcrops are uncharacteristic for Florida, which is known for its lack of topographic relief. The Apalachicola River begins where the Flint and Chattahoochee Rivers merge, just north of the Florida/Georgia state line. The Jim Woodruff Dam (Figure 1), which was built in the late 1940's, is located about 300 yards downstream of the original confluence of the Flint and Chattahoochee River (Hendry and Yon, 1958). Water within the Jim Woodruff Reservoir, which is held by the dam, now covers the historic confluence.

**Figure 1** – Jim Woodruff Dam and Reservoir

**LOCATION**

Localities for this field trip are located between the US 90 bridge in Bristol at the southern most location up to the Jim Woodruff Dam to the north. We will begin by looking at the type locality of the Chattahoochee Formation, located near the boat landing.
in Chattahoochee and work down river where we will finish at Alum Bluff, which is located just north of Bristol (Figure 2).

![Map of field trip localities](image)

**Figure 2** – Field trip localities.

Each locality is accessible by land; however we will access them by water. The Chattahoochee boat landing and Aspalaga Landing (Stop 1) are located on public land. Rock Bluff (Stop 2) is part of Torreya State Park, and Alum Bluff (Stop 3) belongs to the Nature Conservancy. Access to the later two, via land, can be obtained from the owners. Access from the water is not limited.

**NOMENCLATURAL HISTORY**

For a detailed discussion of the nomenclatural history of the vicinity see Schmidt, 1983. The S.E.G.S. last investigated this area in October, 1983, and produced the S.E.G.S. Guidebook 25, entitled: Cenozoic Geology of the Apalachicola River Area Northwest Florida. This volume contains detailed geologic information about this area. In an attempt to avoid redundancies, this author will concentrate on specific outcrops north of the Bristol Landing, and update the nomenclature where needed.

**STRUCTURAL FEATURES**

A negative feature in the panhandle (Figure 3), trending NE-SW, represents a boundary that has existed between sedimentary depositional environments since the Late Cretaceous. The older feature, known as the Suwannee Straight, existed from Late
Cretaceous to Middle Eocene, and the younger feature, known as the Gulf Trough, existed from Middle Eocene to Middle Miocene (Randazzo, 1997). These two features may reflect the underlying zone of flexure at the suture between the North American basement and the African basement, or are a surficial expression of the Tallahassee Graben, which is a Triassic feature (Bryan, 1991).

The Apalachicola Embayment is the dominant geologic structural feature influencing the sediments in the central portion of the Florida panhandle (Schmidt, 1984). The axis of this feature trends SW, and sediment thickening occurs toward the Gulf of Mexico. As the Gulf Trough was filled or bridged, the migration of siliciclastics down the peninsula began. Since the Pliocene, sediments have accumulated and completely filled in the Apalachicola Embayment.

To the northeast of the Gulf Trough lies a positive feature previously called the Chattahoochee “Anticline” (Puri and Vernon, 1964). This feature is identified by the presence of Eocene and Oligocene carbonates near the surface with younger units pinching out against its flanks. Considerable argument as to the origin of this feature has taken place and various interpretations ranging from faulting to preferential erosion have been hypothesized. Schmidt (1984) discusses the pros and cons of each and the reader is referred there for a more detailed discussion.

![Image of regional structure](image)

**Figure 3** – Regional structure. From Huddleston, 1988.
GEOMORPHOLOGY

The upper Apalachicola River basin is encompassed by several geomorphic districts: The Dougherty Karst Plain District, Sneads Hills Province to the west, and the Tifton Upland District, Tallahassee Hills Province to the east, and just above Bristol, the Apalachicola River Delta District, High Level Delta and River Terrace Province (Scott, in prep). This is reflected in the diversity of geomorphic land forms that occur in the area, and include springs, karst topography, hills, floodplain, and steepheads.

The Apalachicola Bluffs and Ravines Province borders the floodplain from the Georgia border to just north of Bristol. The sandy highlands of this province have been incised by streams that flow toward the Apalachicola River. This has produced some spectacular topography. Siliciclastic sediments of the Citronelle Formation provide the sandy overburden which caps the Oligocene to Miocene carbonates exposed in the upper reaches of the river. Near Alum Bluff, the Citronelle Formation overlies the clayey Jackson Bluff Formation, which is an effective aquiclade. This is where some of the best examples of steepheads occur (see B. Means later chapter).

Near the Jim Woodruff Dam, scattered throughout the floodplain and in the riverbed, are numerous karst features including springs and sinkholes which are sometimes obscured by the river, especially during times of high water. Not much is known about the rate of discharge or water quality of the springs since, for the most part, they vent directly into the bed of the Apalachicola River. Some water quality work was done on a spring that issues from the western side of the river near the dam, which showed that the source of water from the spring was lake water from Lake Seminole. Water held behind the Woodruff Dam has created enough head pressure to drive the flow in this spring system. A similar situation occurs just below the dam, on the west side below the dam lock. A large boil can be seen on the water surface which represents an area of spring discharge. It is unknown whether this system is venting lake water or aquifer water.

The floodplain of the Apalachicola varies in width from about one mile in its upper reaches to over 8 miles near its mouth. The upper portion of the river, above Bristol, meanders little relative to the lower portion, and may be degrading its channel (Bishop, 1983). The upper portion of the river, where the floodplain is relatively narrow, is where most of the exposures and outcrops occur.

STRATIGRAPHY

The surficial geology of the upper Apalachicola River has been studied and mapped by many previous authors. Most recently, Scott et al, 2001, produced an updated state geologic map of which a portion is reproduced below (Figure 4). This map shows the distribution of stratigraphic units that occur at or near the surface in the vicinity of the upper Apalachicola River. From it one can see that Oligocene and Miocene units occur in this area and each unit will be discussed in detail below.
Figure 4 – Surficial geologic map of the field trip area. From Scott, et al (2001).
Figure 5 – Geologic column at Chattahoochee. From Gremillion (1966).
Figure 6 – Aspalaga Landing (Stop 1).
Figure 7 – Geologic section at Rock Bluff (From Schmidt, 1983).
CHATAHOOCHEE BOAT LANDING

The field trip begins at the Chattahoochee boat landing near where the type section of the Chattahoochee Formation is exposed. Upon approach to the boat ramp, elevations drop rapidly toward the river and an excellent outcrop is exposed along the right hand side of the road. Carbonates of the Chattahoochee Formation are exposed here and are overlain by clays and sandy clays of the Hawthorn Group, Torreya Formation. Gremillion (1966) provided a detailed description of an outcrop near here at Jones Bluff (Figure 5).

The Chattahoochee Formation, as named by Puri and Vernon (1964), is described as a very pale orange to light gray, moderately to well-indurated, dolomitic, calcilutitic, mudstone to fossiliferous micrite. Quartz sand is common, as are minor amounts of phosphorite. Some zones contain sucrosic dolomite. Puri and Vernon did not map the lateral extent of the formation; however Scott (1986) traced the extent of the Chattahoochee Formation into Leon and Gadsden Counties where it grades into the St. Marks Formation. Northward into Georgia, the Chattahoochee grades into the basal Hawthorn Group (Huddleston, 1988).

The Chattahoochee Formation is thought to be early Miocene (Aquitanian) in age based on correlation with the Parachucha Formation in the Gulf Trough and eastern Georgia (Huddleston, 1988). Some studies of benthic foraminifera have suggested a late Oligocene age for the Chattahoochee, but no planktonic forams have been discovered that collaborate this age assignment.

STOP 1 – ASPALAGA LANDING

Aspalaga Landing provides an excellent opportunity to examine the Chattahoochee Formation (Figure 6). An occasional mollusk mold or dugong rib can be found when water levels are low. For the most part, the Chattahoochee Formation is sparsely fossiliferous. Since most of the area surrounding the type section at the Chattahoochee boat landing is vegetated or paved, this outcrop provides a better chance for investigation.

There is quite a bit of relief at this locality with the maximum elevation being close to 220 feet above msl, and the elevation at the river edge being about 50 feet. Several streams have carved out steep sided valleys as they enter the Apalachicola River here. These valleys are unique, ecologically, and harbor some unique plant and animal species.

The lithology of the Chattahoochee here is predominantly a clayey dolosilt with interbedded sandy zones. The upper portion of the section is more indurated than the lower section. Dolomitization of the Chattahoochee Formation appears to have been post depositional because fossils of calcareous organisms are present now as molds (Huddleston, 1988). See T. Scott chapter in this volume for a more detailed discussion of the Chattahoochee Formation.
STOP 2 – ROCK BLUFF

The next stop is Rock Bluff. This locality is located within Torreya State Park, and is the type section of the Torreya Formation of the Hawthorn Group. It was named by Banks and Hunter (1973) for pre-Chipola, early Miocene age deposits in the eastern Florida panhandle (Huddleston, 1988). The Torreya Formation is currently only recognized in the eastern panhandle of Florida and the extreme southern most portions of Georgia. At Rock Bluff, the Torreya Formation disconformably overlies the Chattahoochee Formation (figure 7). Between Rock Bluff and Alum Bluff, the Torreya Formation either pinches out or grades laterally into the Chipola Formation. The lithostratigraphic relationship between the Torreya and Chipola Formations is poorly understood but some chronostratigraphic evidence suggests that the Chipola and Torreya Formations overlap in age and may interfinger (Bryant et al, 1992).

The Torreya Formation is described as variably fossiliferous, argillaceous, fine grained sand/finely sandy clay that is variably calcareous and dolomitic. In outcrop, the carbonate component is generally absent due to leaching, and the Torreya Formation can be divided into an upper, clayey unit, and a lower carbonate unit. Two members of the Torreya Formation are recognized: the Dogtown Member and the Sopchoppee Member, neither of which occur at this locality.

STOP 3 – ALUM BLUFF

The section exposed at Alum Bluff is probably one of the most extensively studied sites in Florida. Five lithologic units are exposed at Alum Bluff, several of which contain some of the most diverse and abundant molluscan faunas in the southeast. As early as 1892, geologists had visited and described this wonderfully unique outcrop. Since then, numerous studies ranging from the stratigraphy to the paleontology of Alum Bluff have been conducted.

The Alum Bluff exposure is the result of the erosional forces of the mighty Apalachicola River. The river has cut a broad floodplain through the surrounding highlands and at the summit of Alum Bluff you can see the extent of this erosion to the west. The top of the bluff is at about 190 feet of elevation, and the base is around 50 feet depending on water levels. Thus, approximately 140 feet of vertical exposure occurs here. This makes Alum Bluff the tallest natural exposure in the state (Figure 8).

At Alum Bluff, sediments exposed include the Miocene Chipola Formation and Alum Bluff Group, undifferentiated, Pliocene Jackson Bluff Formation, Plio-Pleistocene Citronelle Formation, and a section of undifferentiated surficial clastics (Figure 9). During flood stage of the river, water levels can cover the Jackson Bluff Formation. At low river stage, as much as 10 feet of Chipola Formation can be exposed.

The Chipola Formation is probably the best known and most fossiliferous unit of the Florida Miocene. Its lithologies include carbonate and clay rich sands with biofacies.
ranging from shoreline beach, to lagoonal to coral patch reefs. None of the formation appears to have been deposited in more than 30 meters of water (Vokes, 1989). The fauna preserved in this unit is one of the most ecologically diverse and well preserved in the western Atlantic, and has been estimated to contain as many as 1100 molluscan species (Vokes, 1989). The Chipola Formation is considered to be late Early, or Middle Miocene in age and may interfinger with the Torreya Formation.

The Alum Bluff Group, undifferentiated, lies unconformably on the Chipola Formation at Alum Bluff. Matson and Clapp (1909) first proposed the Alum Bluff Formation to describe units with Alum Bluff lithologies; namely the Chipola, Oak Grove Sand, and the Shoal River Formations. This unit consists of sands and clays, some of which are cross bedded. Within some of the clay beds, various plant remains can be found. This is one of the few localities where terrestrial plant remains can be found. Some plants remains recovered include palm fronds, deciduous leaves, nuts and seed pods. Also, some terrestrial vertebrate remains can be found within this unit. These sediments are interpreted as deltaic deposits and are thought to be Middle to Late Miocene in age.

The Jackson Bluff Formation, as named by Puri and Vernon (1964), unconformably overlies the Alum Bluff Group sediments. The Jackson Bluff Formation is clayey sand containing numerous, well preserved mollusks, corals and microfossils. The upper section has been leached, leaving behind moldic impressions of marine organisms. Based on fossil evidence, the Jackson Bluff Formation is thought to be Pliocene in age. It represents a shallow water, estuarine deposit.

The Citronelle Formation, named by Matson (1916), unconformably overlies the Jackson Bluff Formation at Alum Bluff. The Citronelle consists of sands and gravels with minor amounts of clay. The typical reddish, oxidized iron color of the Citronelle Formation can be observed at this locality. For the most part, the Citronelle Formation is devoid of fossil material and only in rare, isolated outcrops can any fossil material be found. Based on this limited fossil evidence, the Citronelle Formation is thought to be Pliocene in age. For the most part, the sediments of the Citronelle Formation were deposited fluvially.

Undifferentiated sands overlie the Citronelle Formation. These sands are thought to have originated from the underlying Citronelle, and represent reworking of the Citronelle Formation. The deep sequence of undifferentiated sands and Citronelle Formation sands overlying the clayey Jackson Bluff Formation creates the perfect situation for the formation of steephead ravines. These geomorphic features are abundant in the vicinity of Alum Bluff and have provided refuge to numerous relict species now found further north.
Figure 8 – USGS 1:24,000 map of Alum Bluff – Stop 3.
Figure 9 – 1961 graphic representation of the Alum Bluff section. The Hawthorn is now Alum Bluff Group, undifferentiated, the lower and upper Choctawhatchee are now the Jackson Bluff Formation, and the Continental Sands are the Citronelle Formation and upper reworked undifferentiated sands. After Dubar and Beardsly, 1961.
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Human History of the Apalachicola River

By

Ryan C. Means and Rebecca P. Meegan

Florida Geological Survey

Humans have occupied the Apalachicola River corridor continuously for at least 12,000 years. Evidence of their existence has been recovered from submerged sites on the riverbed and from land sites along the river course. The river was an excellent living site for both prehistoric and European people because it provided abundant food, water, transportation, raw materials for tool making, and relatively warm climate. In this chapter, we will discuss the people of the Apalachicola River beginning from the late Pleistocene through historic times. Their occupation carries continuously through all recognized archaeological time periods for the southeastern U.S. The general time periods that will be addressed include the Paleo, Late Paleo, Archaic (early, middle, and late), Woodland, and Historic Periods.

The earliest evidence of human occupation along the Apalachicola includes a fluted Clovis projectile point and associated unifacial flake tools that were recovered on the submerged riverbed in 2001 (pictured at right). These tools were made out of locally occurring chert that had eroded out of the underlying limestones.
Clovis points have been recognized as being approximately 11,500 years old from sites that have been radiocarbon dated in the Southwest. This places them within the Paleo Period, or late Pleistocene Epoch at the end of the last Ice Age. Clovis points are lanceolate-shaped, have concave bases, and they have a distinct channel or "flute" running from the base toward the center. Interestingly, Clovis is the most widely distributed lanceolate point type in North America, but their abundance is very low in any one location. This suggests that the people responsible for their making were nomads, perhaps migratory hunters, and scarce in numbers.

Clovis points and tools have been found in association with extinct large vertebrate animals known as "megafauna." Well known examples of Pleistocene megafauna in North America include mammoth, mastodon, giant ground sloth, horse, bison, saber-tooth cat, and giant tortoise. All told, there were about 25 species of megafaunal vertebrates alive until very recently, geologically speaking. There is much evidence suggesting that Paleoindians hunted megafaunal animals (painting at right). In the nearby Aucilla River, east of the Apalachicola, butchering scars have been detected on the bones of mastodons and giant ground sloths. In the Wacissa River, an Aucilla tributary, an extinct bison skull with a projectile point tip embedded was recovered. With increased archaeological exploration on the Apalachicola, finds like these probably will be found. Fossil bones and teeth of mammoth, mastodon, and horse have been found on the riverbed and gravel bars.
Pleistocene peoples of North America who coexisted with the megafauna are referred to as Paleoindians. Paleoindians lived throughout North America during the late Pleistocene. They are thought to have arrived on this continent anywhere from 12,000 yrs. BP to as much as 20,000 yrs. BP. Prior to the recent discovery of Clovis material in the Apalachicola River, there had been virtually no known Paleoindian artifacts from there.

At the close of the last Ice Age approximately 10,000 years ago, the great Pleistocene megafauna became extinct. Climate change during this time often is cited as the cause for their disappearance; however, Paleoindians may have had a hand in causing the megafaunal extinctions. Around this time, climate in the Southeast had become warmer and less arid, and plant community composition had changed into something similar to what exists today. During this time of great ecological change and extinction, a cultural transition also took place. The region’s people had to adapt to new climate and ecological conditions. Consequently, their way of life changed, and they became hunters and gatherers. The largest game animals were now gone, and this ushered in a greater dependence on plant material, fish, and shellfish for food. The transition took perhaps 500 or 1000 years. Lanceolate points transitioned into points that had side or corner notches, like the Bolen point pictured at left from the Apalachicola riverbed. These point types belong to the Late Paleo Period.

After the ecological and cultural transition, a new general style of projectile point that had a distinct stem at the base appeared. The longest archaeological period of
Southeastern human history, called the Archaic period, began with the appearance of the stemmed projectile point and lasted for perhaps 7,000 years, from around 9,500 yrs. BP to 2,500 yrs BP. The Archaic period is further broken down into the early, middle, and late Archaic.

There are many recognized varieties of Archaic-stemmed points in the Southeast, and along the Apalachicola, this is no exception. The stemmed points in the photo at right were all recovered from the riverbed and gravel bars. They probably represent a several thousand year time spread, and they are all skillfully chipped from local chert found along the exposed river corridor. These points were made to function as knives hafted to antler handles or projectile tips hafted to the end of a spear. An ingenious mechanism, known as the "atlatl," or spear thrower, was used to hurl spears at game such as the white-tailed deer. The human arm alone can throw a spear perhaps 30 mph with some accuracy. When a spear was thrown using the atlatl, speeds of near 100 mph were achieved with accuracy.

If stemmed points were the first cultural invention of Archaic peoples, then the second, and arguably the most important, was fired ceramics. During the later portion of the Archaic period, approximately 4,000 yrs. BP, the first fired ceramic pottery appeared. From that time onward, all of Florida's people manufactured pottery. Pottery was made from clay, an abundant resource along the Apalachicola River. The clay was hand-shaped into vessels and figurines, then carefully fire-baked. The first type of pottery was
strengthened by mixing organic fibers into the clay before shaping the vessel. This kind
of pottery is referred to as “fiber-tempered.”

The importance of ceramics in the lifestyles of late Archaic people was
paramount. Now people could store and haul water with greater efficiency. They could
cook and store food within containers. And they could express their artistic genius
through designs on clay vessels and with figurines. Clay could be hand sculpted into
most any shape for utilitarian or artistic purposes.

The Archaic people occupied coastal and riverine locations throughout Florida.
They developed villages and discarded large amounts of trash where they lived along
rivers and coastlines. These trash piles are called “middens.” In the Apalachicola Basin,
middens were composed of empty conch and oyster shells sometimes intermixed with
pottery shards, like the one on St. Vincent Island. Middens can be several meters thick
and dozens of meters long. Eventually they grew so large after centuries of trash
deposition that they began to serve as higher ground suitable for living on. The human
population grew throughout the long Archaic Period.

Around 2,500 yrs. BP vessels were hardened by other materials such as sand or
sponge spicules, and they were elaborately incised
with regular designs that are temporally,
geographically, and culturally specific. Projectile
point styles also changed and basal stems were
replaced by basal notches (pictured at right on the
top row). These technological advances begin the Woodland Period of human
occupation along the Apalachicola River and in the Southeast. Specific Woodland
cultures that are recognized within the Apalachicola Basin include Deptford, Swift Creek, Weeden Island, and Ft. Walton. These cultures are identified mainly by the style of pottery they produced. Pottery shards from these cultures like the ones pictured below are very common finds on gravel bars along the Apalachicola. Other tools and decorative objects that have been recovered in the region include stone celtc and axes, drills, scrapers, gaming stones, smoking pipes, plummets, and gorgets (breast plates). Most of the raw materials that were used in the manufacture of tools along the Apalachicola were located along the river. In some instances; however, raw materials were transported long distances both up and downstream. Slate from the southern Appalachians has been recovered along the Apalachicola and was used in the manufacture of smoking pipes, gorgets, and other tools. Also, shell material from Florida crafted into tools and pendants occasionally can be found at archeological sites hundreds of miles north of their coastal origin. The Apalachicola River system served as a trade corridor.

By the later part of the Woodland Period, projectile points again changed in association with a new hunting and warfare invention, the bow and arrow. Points were much smaller in order to fit onto the tip of an arrow and travel efficiently (bottom row last point picture). The atlatl and spear became obsolete in the presence of the more efficient bow and arrow, and eventually disappeared.

Throughout the Woodland Period, Native American villages and cultures were regionally developed and thriving in North Florida. The Apalachicola River Basin supported a relatively large human population as evidenced by its rich archaeological
record. During a short time period beginning nearly 500 years ago, human history of the Apalachicola and North America would drastically change with the arrival of Europeans.

An estimated 100,000 Indians inhabited La Florida when Juan Ponce de León first sighted eastern North America in 1513. The predominant tribe along the Apalachicola River, the Apalachee, ranged between the Aucilla and Apalachicola rivers above Apalachee Bay. They were an agricultural people who depended on the river as a source of food, transportation, and recreation. They also depended extensively on fish and shellfish, remnants of which, in the form of shell middens, can still be found today.

The first European-Indian contact along the Apalachicola River occurred in 1528 when Pánfilo de Narváez (pictured at left) entered Apalachee territory, but he soon withdrew due to persistent Indian attacks. Eleven years later, Hernando de Soto crossed the Apalachicola River at Chattahoochee and was also forced to find more hospitable lands. Not until the middle 1600s did the Spanish successfully expand their missions westward past Tallahassee and into the Apalachicola River area.

The first mission along the Apalachicola River was established in 1633 and a business relationship soon began between the Spanish and the Apalachee tribe. The British, who occupied lands to the north, feared the Spanish were encroaching on their territory and allied with the Creek Indians to fight against them. In 1702, James Moore, the English Governor from South Carolina, led a raiding party into eastern Florida, leaving the coastal missions in ruins. Moore returned again two years later to destroy the
missions in Apalachee territory. A few survivors escaped to Mobile, but the whole of the Apalachee tribe vanished from the area by the end of 1704.

The Treaty of Paris 1763 transferred Florida from Spanish to British rule. The Apalachicola River served an important function during this era as the dividing line between the two British colonies: East Florida and West Florida. Florida was again ruled by the Spanish (1784 – 1821), who regained control of Florida as part of the peace treaty that ended the American Revolution. During these times, the United States of America formed and the expansion of European colonies continued. As settlement spread in the North, the native peoples were pushed farther West and South. Seminoles, composed of bands of Creeks, Alabama, and Yamasee, filtered into Florida throughout the 1700s, establishing permanent towns along the Apalachicola River. These Indians occupied northern Florida until the end of the 2nd Seminole War 1835-1842.

Skirmishes along the borders of Florida heightened in the early 1800s. Settlers increasingly looked to Seminole lands as their expansion increased. Additionally, Indian communities provided a sanctuary for the runaway slaves that the settlers wanted returned. In 1816, U.S. Colonel D.L. Clinch attempted to quell the conflicts by invading Spanish Florida from Fort Scott on the Apalachicola River (in present day Georgia). Over 300 Indians and escaped slaves took refuge at Fort Gadsden downstream, also known as Negro Fort. A cannonball shot from a U.S. ship hit the Fort’s
powder magazine and killed all the people in the fort instantly. The Seminole Indians retaliated by increasing their attacks on settlers. The pivotal point in the conflicts was reached when a band of Seminoles attacked a U.S. military supply ship led by Lieutenant R.W. Scott. The boat, carrying men, women and children, was ascending the Apalachicola River on its way to Ft. Scott in Georgia. Only six men escaped. As a result of these conflicts, General Andrew Jackson (pictured above) invaded Seminole territory burning villages and capturing former slaves. The Seminoles were pushed farther south into peninsular Florida.

By 1830s, with Florida officially ceded to the United States, Seminole lands were becoming more attractive to settlers. The Second Seminole War began over the question of whether Seminoles should be moved westward across the Mississippi River into present-day Oklahoma. A small number of Seminoles signed the Treaty of Payne’s Landing, agreeing to cede Seminole land and move west. However, the majority of Seminoles refused, which ignited the Second Seminole War. In 1842, a nominal end to the hostilities occurred, though no peace treaty was ever signed. A Third Seminole War, which ended in 1858, reduced the Seminole population to about 200, concentrated in the Everglades area of South Florida.

In the early nineteenth century, virtually all travel and commerce was dependent on the rivers. The Apalachicola River was the main artery flowing from the cotton farmers in the North to ports along the Gulf of Mexico. With each new farmer, timberland was cleared for cotton and the iron-rich soils eroded into the streams that fed the river. The formerly clear Apalachicola River became the more silt laden, turbid waterway it is today. In early 1822, farmers poled boats and rafts to carry the first cotton
from Georgia downstream to Apalachicola Bay. The first attempt to run a steamboat up the river was in 1827 with the *Fanny*, but navigating the rocks, falls and tree dams proved to be difficult. Steamboats were later employed to carry cotton (pictured at right) and other trade goods up and down the river. By the 1850s, railroads threatened the steamboat trade along the Apalachicola River.

Florida was not ravaged by the Civil War as much as other states in the South. The interior of Florida saw little of the war and remained in Confederate hands, however many coastal towns and forts were seized by the Union. In 1862, Union forces seized the port of Apalachicola, which enabled them to blockade Confederate ships and reduce the importation of food, supplies and munitions. In response, Confederates placed blockades along the Apalachicola River and established two batteries, at Rock Bluff and Ricco’s Bluff, to prevent Federal gunboats from moving inland. Additionally, a Confederate arsenal was established in Chattahoochee. The end of the Civil War found the Apalachicola silted up and choked with wreckage but the golden age of the postwar steamboat era was soon to begin.

During the late 1800’s, steamboats along the Apalachicola River functioned both as pleasure cruises as well as transports for lumber, honey, and cotton. The longest running steamer on the river was the *Naiad* (pictured below). Its cooks were renowned for their fare, serving plates piled high with fresh shrimp, oysters, and fish on their return
trips from the port of Apalachicola. In addition to the Apalachicola River, steamboats cruised up and down the Suwannee, St. John’s, and the Ocklawaha Rivers. Florida became a popular tourist destination for people from all over the U.S. In the early 1900s, railroads and automobiles flourished and the steamboats became an era of the past.

The Apalachicola River has remained an important transportation corridor throughout its human occupation. In the early years of boat traffic, seasonal fluctuations in the river’s water level prevented vessels from traveling the entire stretch. The U.S. government became involved in improving navigation along the river in the early 1800s. Ultimately, congress authorized a series of Acts, which resulted in the 9ft deep and 100ft wide channel that is dredged today.

The damming of the Apalachicola River began the last period of the river’s history. In 1957, the Jim Woodruff Lock & Dam was completed (pictured below), the first of three locks and dams constructed for navigation, hydro-power, and recreation on the Apalachicola, Chattahoochee, and Flint River systems. The dam is located on the Florida Georgia state line, about 1000ft below the confluence of the Chattahoochee and Flint Rivers, which unite to form the Apalachicola River. Human benefits from the Lake are many.
but the negative ecological impacts of the dam are far-reaching as natural water fluctuations are altered and nutrient-rich sediments are blocked from continuing downstream.

For almost 200 years, the federal government has dredged the river, removing sediment to improve navigation and at the same time disturbing natural habitats and ecosystems. Recently, Florida Governor Jeb Bush voted along with the Florida Cabinet for a resolution that would end dredging in the Apalachicola River. This resolution currently is awaiting legislation in the U.S. Congress.

Another major issue facing the Apalachicola River today involves water rights. The waters of the Apalachicola flow through Atlanta and other major Georgia cities. Increased use upstream lowers water levels downstream. As water demands soar from unbridled population growth along and proximal to the river, conflicts between cities up and downstream are increasing. The future of the Apalachicola River may be played out in a courtroom.

There are many reasons why the Apalachicola River has proven to be an ideal living location throughout its human history. Evidence supports that raw materials and cultural ideas were exchanged up and down the river at least since middle Archaic times (ca. 5000 yrs BP). The river provided an excellent source of water and food with its abundant shellfish and fisheries. Raw materials for tool making such as chert nodules, quartzite cobbles, and clay were distributed with great abundance along the river. The river was used as a transportation corridor, spanning from northern Georgia to the Gulf of Mexico. Lastly, the relatively warm climate of the Apalachicola has provided an ideal living existence for both prehistoric and historic people. From Paleo-indians to the
Explorers, the Steamboat Era and modern day, the waters of the Apalachicola River are steeped in history and continue to carry their stories down to the Gulf.

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