

**SOUTHEASTERN GEOLOGICAL SOCIETY
FIELD TRIP GUIDEBOOK 43**

**THE FLORIDAN AQUIFER WITHIN THE MARIANNA
LOWLANDS**

Compiled And Edited By Carl R. Froede Jr.



August 2, 2003

**Southeastern Geological Society
P.O. Box 1634
Tallahassee, Florida 32302**

THE FLORIDAN AQUIFER WITHIN THE MARIANNA LOWLANDS

SOUTHEASTERN GEOLOGICAL SOCIETY

**Field Trip Guidebook 43
Summer Field Trip
August 2, 2003**

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Introduction/Acknowledgments

The Marianna Lowlands physiographic province is the setting for the 43rd annual Southeastern Geological Society field trip. Key to this area are surface outcrops of the Floridan aquifer—composed of a number of limestone strata ranging in age from Eocene to Miocene. Uplift, erosion, and limestone dissolution have created the Florida Caverns, the only state park in Florida with publically-accessible caves containing beautiful flowstone. While caves abound across much of the state most are submerged, contain no flowstone, and can only be visited with the use of SCUBA equipment. Fortunately, Florida Caverns State Park provides us with the opportunity to walk through a cave system and attempt a better understanding of the geologic setting and potential problems related to the Floridan aquifer. This aquifer likely represents northern Florida's most valuable drinking water resource. It is hoped that this field trip will provide the attendee with a greater appreciation for the geologic setting and environmental issues not only for this area, but the whole of Florida.

This field trip would not be possible but for the kind assistance provided to me by several individuals who I wish to acknowledge here. As some of you may know, I have attempted on several occasions to conduct this field trip for geologists living in the Atlanta, Georgia area only to receive limited interest (insufficient to conduct this field trip). I decided this year (i.e., 2003) to reach out through the SEGs to the many geological societies throughout the southeastern United States and see if there was sufficient interest to conduct the Marianna, Florida “Floridan aquifer” field trip. I was greatly encouraged by our President, Harley Means and field trip leaders Dr. Jon Bryan and Dr. Brian Rucker and acknowledge that this field trip (and especially the guidebook) has benefitted greatly as a result of their active involvement. Will Evans, with the Florida Geological Survey (FGS), also provided me with excellent information about the geology of the area along with several contacts. Ms. Carol Armstrong, FGS librarian, supplied me with necessary information about Jackson County, Florida, and the latest geological maps for this portion of the panhandle. I thank Mr. Leon Brooks who allowed the SEGs access to his wonderful quarry as part of this field trip. Finally, I thank my wife Susan for her continued support and kindness in putting up with a geologist-husband. Nothing happens in a vacuum and this trip is not possible but for the kind help and support that I have received. Thank you to everyone who has helped me.

Carl R. Froede Jr.
Atlanta, Georgia
July 2003

SOUTHEASTERN GEOLOGICAL SOCIETY FLORIDAN AQUIFER FIELD TRIP OVERVIEW

The growing population of the southeastern United States is placing unprecedented demands on the natural resources that we once mistook as limitless. Perhaps at the forefront of this situation are groundwater and surface-water resources. Both point-source and non-point source pollution create problems where even low levels of contaminants adversely impact these important natural resources. Addressing the remediation of a contaminated groundwater aquifer or surface-water body typically is both time consuming and costly. In some cases, cleanup is limited due to the complexity of the subsurface geology or the volume of water necessary for treatment. The public is typically unaware of the technical issues. Politicians are just starting to understand the seriousness of the situation.

Geoscientists play a key role in defining the geologic and hydrogeologic stratigraphic conditions, both in outcrop as well as within the subsurface. We know from experimentation that for any given area in Florida both surface water and groundwater are interrelated. Therefore, knowledge about responsible water resource management and protection is important to providing the public with beneficial use.

The Floridan aquifer is perhaps the most important source of drinking water to the residents of northern Florida. Recharge areas are not limited to uplands located outside the bounds of the state. The Eocene to Miocene limestone strata that compose the Floridan aquifer outcrop across several areas within the panhandle and are most prominently exposed within the Marianna Lowlands province. With regard to the Floridan aquifer, the character of the limestones define the nature of the aquifer. Lithologic variations are expected over a given distance due to differing factors (e.g., facies changes, diagenesis, tectonism, etc.). Understanding the nature of these changes provides a means of defining the hydrogeologic properties of the formation(s) both laterally and down dip. The protection and management of the Floridan aquifer will depend upon its characterization both at the surface and within the subsurface.

This field trip will provide the attendee with an opportunity to examine firsthand the surficial limestone units of the Floridan aquifer exposed within the Marianna Lowlands, and to walk through a portion of its former flowpath (i.e., Florida Caverns). The paleoenvironment played an important role in shaping the aquifer's hydrogeologic conditions and we will discuss the historical setting of the various limestone units. Several geological factors (e.g., tectonism, eustasy, dissolution, erosion) have shaped the area into the Marianna Lowlands we observe today. The numerous caves created as a result of these geologic processes have played a role in local history with the influx of native Americans followed by European settlers. Recent cave exploration has revealed a complex set of interrelated caves and much work remains in identifying the flora and fauna within this unique setting.

Physiography of the Marianna Lowlands Province

Introduction

The panhandle of Florida falls within the East Gulf Coastal Plain physiographic province (Hunt, 1967) and represents mostly marine strata that have recently emerged from the sea (Shimer, 1972). The geomorphology of the region is defined by topographic features which have similar characteristics and lie contiguous in their surficial expression across this portion of the Gulf Coastal Plain. Although a region of little topographic relief, the panhandle exhibits a diverse number of areas that can be grouped into mutually linked physiographic provinces (Tanner, 1992).

According to Schmidt (1997), landform divisions in Florida have been grouped based upon several common factors:

The dominant factors affecting landforms are the local geologic structure and rock type, and the type and rate of erosion or aggradation. Each geologic structure, through the associated geomorphic processes acting on it, develops its own characteristic group of landforms. The landforms of Florida are an expression of its geologic history.

Various physiographic approaches have been proposed to address the diverse and complex geomorphological provinces of Florida. The first was by geologist Cooke in 1939. In 1951, Vernon proposed several subdivisions based on erosion to uplands, changing sea-level position, and the dissection and alluviation by river systems. Vernon's subdivisions were used to define the geomorphology of Jackson County by Wayne Moore in 1955. A much simpler division of landforms was developed by White, Vernon, and Puri (1964) and further refined by White in a 1970 publication. Physiography as defined in Florida today largely draws from the work of White (1970) and Cooke (1939, 1945). An excellent overview of the physiography of Florida can be found in Schmidt (1997). More recent work by Scott (in preparation) has resulted in the recognition of additional smaller-scale geomorphic provinces.

The Marianna Lowlands

The Marianna Lowlands province (Figure 1) is a landform division consistent with both White, Vernon, and Puri (1964) and Cooke (1945). According to Schmidt (1988), this area developed as a result of the uplift created across Jackson County from the northeast-southwest directed Chattahoochee Anticline (Figure 2).

Regarding the physiography of the area, Schmidt (1988, p. 4) states:

...the land area of Jackson and Holmes counties is lower than the surrounding counties to the west, south, and east. This "low" area has been called the Marianna Lowlands (Cooke, 1945). A large volume of clastic sediments has been eroded from this area due to surface erosion by streams and due to infilling of subsurface solution features. Repeated sea-level fluctuations directly impacted this area regarding groundwater levels, stream gradients, and baselevels. The final result is the karst terrain including caves, springs, sinkholes, and natural bridges we see today in this area.

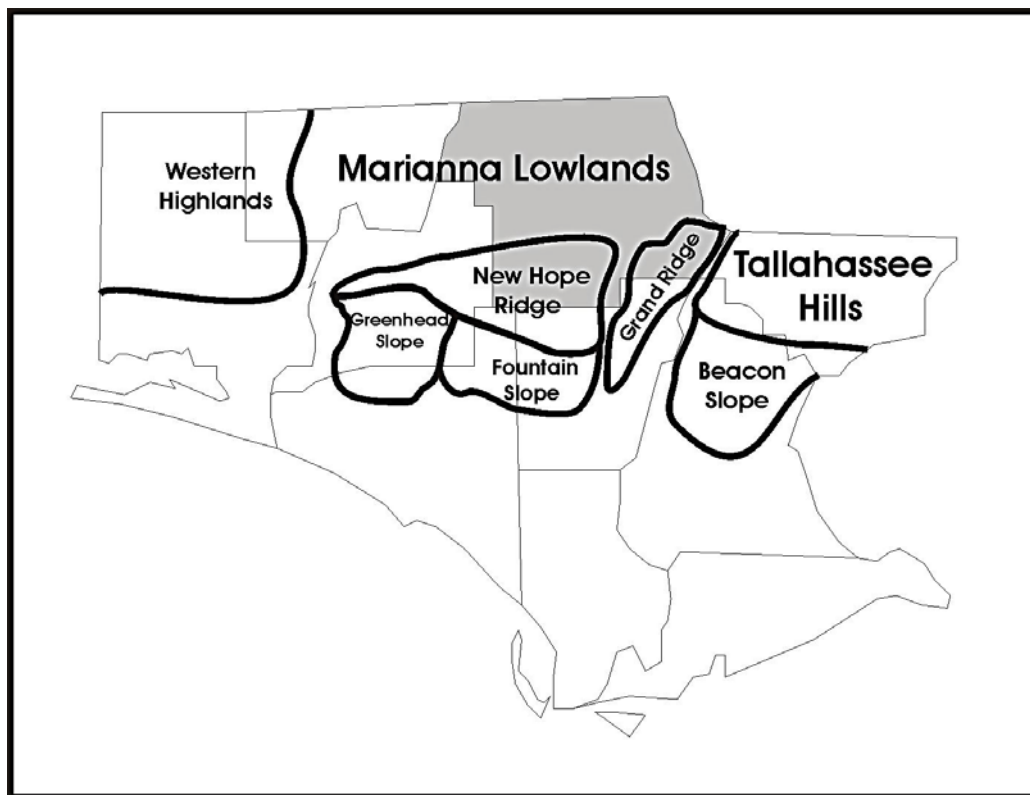


Figure 1. The Marianna Lowlands Province Redrawn from Scott (1992). Jackson County is highlighted in gray and contains the field trip stops described within this guidebook.

In more recent work, Scott (in prep.) subdivides the Marianna Lowlands into physiographic districts and units based on the similar geomorphic settings. Our area of interest is located in the Dougherty Karst Plain District which can be further subdivided into the Marianna Karst Plain Unit, defined as a region of low-rolling hills, sinks, and depressions that extend north into southeastern Alabama (Scott, in prep.). The lowland area has resulted from fluvial deposition and erosion and underlying karst activity (Green, Evans, Bryan, Paul, and Garboardi, 2002). Elevations of the Marianna Karst Plain range from 75 to 150 ft above sea level (Scott, in prep.).

Groundwater Protection In Karst

Surface exposures of karst such as occur in the Marianna Karst Plain can prove detrimental to groundwater protection. According to Scott (1992):

The development of karst features and basins has a direct impact on the recharge in the region. The karst features allow the rapid infiltration of surface water into the aquifer systems and offer direct access to the aquifer by pollutants.

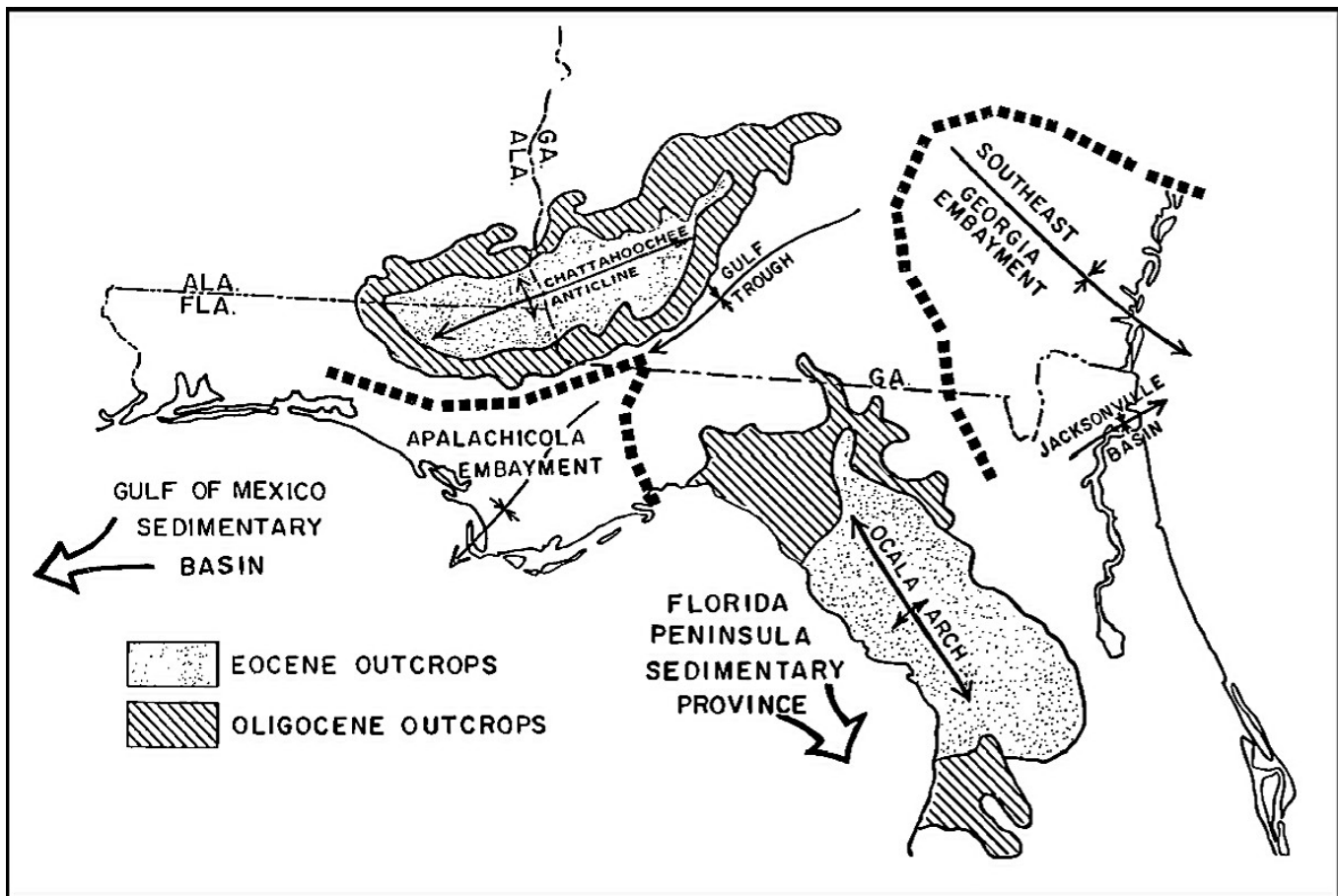


Figure 2 - Geological Structures of northern Florida (Schmidt, 1988)

While a portion of the Floridan aquifer exposed within the Marianna Karst Plain exhibits a positive pressure head resulting in the outflow of groundwater at springs and seeps, the karstic setting allows for relatively unrestricted potential for aquifer contamination where conditions might allow. Work continues into the investigation of the hydrogeology of the area in an effort to understand and protect potable fresh water sources in this locale and across the State (Scott, Lloyd, and Maddox, 1991).

Several areas in Jackson County have been negatively impacted by pollution due to the upwelling of contaminated groundwater. Perhaps the best location to discuss this situation is at Merritt's Mill Pond. Geologist Harley Means (this volume) provides an overview of the problems associated with low levels of agricultural pollution that have occurred at Merritt's Mill Pond and what steps were taken to eliminate the *Hydrilla* outbreak.

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Overview of the Geology of the Marianna Lowlands Province

Introduction

With its rather recent emergence from marine conditions, it would seem that Florida would be easy to define stratigraphically. Nothing could be farther from the truth. Eustasy, changing clastic and carbonate sediment source areas, varying depositional environments, topographic impediments, and areas of local to regional tectonism have all contributed to the complex stratigraphy found across the State. Much of this geologic activity has created one of the largest and most important aquifers in the United States—the Floridan.

The Marianna Lowlands is located on the Gulf Coastal Plain and provides a unique setting in which to examine surficial exposures of strata that compose the Floridan aquifer (Figure 1). The study of this karstic plain reveals a complex geological story, one that is only beginning to be understood.

Generalized Stratigraphy and Hydrogeology of the Panhandle of Florida			
SYSTEM	SERIES	Lithostrat Units	Hydrostrat Units
Quaternary	Holocene	Undifferentiated Pleistocene-Holocene Sediments	Surficial Aquifer System
	Pleistocene		
Tertiary	Pliocene	Citronelle Formation Miccosukee Formation Coarse Clastics	Intermediate Confining Unit
	Miocene	Alum Bluff Group Pensacola Clay Intracoastal Formation Hawthorn Group Bruce Creek Limestone St. Marks Formation Chattahoochee Formation	
		Chickasawhay Limestone Suwannee Limestone Marianna Limestone Bumpnose Limestone	Floridan Aquifer System
		Ocala Limestone Claiborne Group Undifferentiated Sediments	
		Undifferentiated Sediments	Sub-Floridan Confining Unit
		Undifferentiated Sediments	
Cretaceous and older		Undifferentiated Sediments	

Figure 1. Stratigraphy-Hydrostratigraphy of the Panhandle of Florida (Modified from Scott, 1992; Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition, 1986)

Stratigraphy

The stratigraphy of the area is both simple and complex. Simple in that most of the strata are composed of limestone, and complex as they are subdivided by lithologic and paleontologic changes which are subtle in expression (Reves, 1961). While not the first to review the geology of the area, Wayne Moore's (1955) *Geology of Jackson County* has served as the standard work on the subject for many years. More recently, geologist Walter Schmidt (1988) provided an excellent summary on the geology of the Florida Caverns. Schmidt noted the importance of tectonism and sea-level change to cavern formation (1988), a critical concept which has recently been reinforced by workers seeking to explain cave formation in other areas in Florida (Brinkmann and Reeder, 1994). Florida Geological Survey geologist, Frank Rupert (no date) has published an interesting and up-to-date overview of the caverns in a pamphlet available at the park visitors center.

Only in the last few years have geologists begun a more detailed reexamination of this particular area of the state, one that is redefining our understanding of the limestone and overlying clastic units and their former depositional setting (Bryan, 1991; Green, et al., 2002). The ongoing nature of this work should result in a better understanding of the interrelationship between the stratigraphy of the area and the protection of valuable natural resources like the Floridan aquifer.

One of the best exposures in which to examine the stratigraphy of the area can be found in Brooks Quarry. This locale exposes several limestone layers ranging from the Ocala Limestone (Eocene) to the Marianna Limestone (Oligocene). Dr. Jonathan Bryan, a geology professor at Okaloosa-Walton Community College, has spent considerable time in the quarry studying the various exposed carbonate units and he (personal communication, 2003) defines the stratigraphy in the following manner:

<u>Formation</u>	<u>Thickness(m)</u>	<u>Description</u>
Residuum	Variable	Highly oxidized silty clay with numerous limonitic nodules.
Marianna Limestone	2.6	Grayish-yellow (5Y 8/4) dolosilt. Top 20 cm is partially-indurated, crumbly, and bioturbated marl. Limonitized <i>Ledocyclina</i> , pectinid bivalves, and turritellid gastropods are common. Other fossils include a small <i>Schizaster</i> echinoid, carbonized impressions of seagrasses, dugong ribs, and other marine vertebrate bones.
	5.0	Variably indurated, white, fine-grained limestone (mudstone to wackestone). Top partly silicified (chert).
	0.5-1.0	Irregular, nodular chert. Same lithology as underlying bed, but variably silicified (which may represent lithification at a bedding contact). Bryozoa <i>Lunulites</i> and some aragonitic molluscs <i>Xenophora</i> present.

Marianna Limestone (Con't)	4.0	Soft, white, wackestone, with minor bioclastic debris. In the northern most exposure in the quarry complex (and about 2 m above the Bumpnose) is a cross-bedded sequence consisting of laminated, fossiliferous sand (packstone/grainstone) and micrite (mudstone) in what appears to be channel deposits or tempestites, with several truncated cross-bedded sets. Marianna bioclastic laminae are composed of <i>Lepidocyclina</i> tests and bryozoa, limestone and are speckled with iron-oxide that appear to be altered glauconite grains. Micritic beds 13 to 16 cm in thickness are also common, and micritic rip-up clasts are found in some of the bioclastic debris. The maximum apparent dip of the cross-bedded strata is 15 degrees to the north. A shark tooth and fish vertebra have been found in the cross-bedded debris, perhaps indicating some lag concentration from water-current activity. A discontinuous, nodular dark brown chert is found at one location 2-3 meters above the Bumpnose.
	0.3	Irregular, nodular, burrowed, cherty limestone.
	0.96	White mudstone/wackestone. Some <i>Lepidocyclina</i> present. Bumpnose-Marianna contact is sharp and very similar to the Ocala-Bumpnose contact. The upper Bumpnose is a well-indurated ledge, above which is a nodular zone (31 to 61 cm thick), overlain by the typical mudstones and wackestones of the Marianna.
Bumpnose Limestone	3.5	Well-indurated, white, fossiliferous limestone (grainstone to packstone). Nearly a coquina of <i>Lepidocyclina</i> , some of which are several centimeters in diameter. Common bivalves <i>Amusium ocalanum</i> , <i>Chlamys anatipes</i> , <i>Spondylus dumosus</i> , gastropod <i>Xenophora</i> , nautiloid <i>Aturia alabamensis</i> (at very top of Bumpnose), echinoid <i>Clypeaster rogersi</i> , trace fossils, and shark teeth. Top is a very well-indurated, bioturbated, glauconitic, nodular ledge. Ocala-Bumpnose contact is sharp, and occurs at the top of a well-indurated ledge (0.5 m thick), above which is a nodular zone (up to 0.5 m thick), which is overlain by the typical <i>Lepidocyclina</i> -rich packstone lithology of the Bumpnose.
Ocala Limestone	4.25	Densely fossiliferous, white- to pale-yellow limestone, poorly indurated grainstone. Essentially a coquina of smaller and larger foraminifera, bryozoa, echinoid spines, and brachiopods, all in a matrix of finer-grained, comminuted bioclastic debris. Larger foraminifera include <i>Asterocyclina</i> , <i>Lepidocyclina</i> , <i>Pseudophragmina</i> , and <i>Nummulites</i> . Bivalve <i>Amusium ocalanum</i> becomes especially abundant in upper half. Other macrofossils include echinoids, moldic molluscs, and crab carapaces.



Figure2 - Brooks Quarry. The wall exposed in this image displays most of the limestone section described by Bryan in this guidebook

According to Bryan (2003), the limestones exposed in this quarry represent a paleogeographical midpoint between the classic Gulf Coastal Plain sections in Alabama and Mississippi (which are geochronologically well-constrained) and the carbonate sequences of the Florida Platform. The strata were deposited on the northern flank of the Gulf Trough and therefore represent a unique and transitional facies between the coastal plain and the Florida platform (see Figure 2, page 4). The Gulf Trough for a time separated the clastic sequences common to the Gulf Coastal Plain from the carbonates found out on the peninsula. Work by Chen (1965), Bryan (1991), and Huddlestun (1993) have documented the facies differences between chronostratigraphically equivalent units on both sides of the trough. Their work is integral to defining the geologic history of the area.

The fossiliferous limestone layers exposed in Brooks Quarry likely reflect a stacked series of shallow marine carbonate shelf paleoenvironments with the intervening chert layers likely condensed sections and/or periods of minor terrigenous sedimentation. A similar setting can be found today in Florida Bay and the Bahamas where occasional African dust storms contribute silica to the shallow water carbonate environments (c.f. Tihansky, Prager, and Shinn, 1997; Shinn, Halley, and Hine, 2000).

The small caverns exposed within Brooks Quarry and the caverns that are found within Florida Caverns State Park are believed to be formed within the Jacksonian age Ocala Limestone (Upper Eocene) and capped by the Vicksburgian age (Lower Oligocene) Bumpnose and Marianna limestones (Beck and Arden, 1983; Brooks, 2003; Bryan, 2003; Randazzo and Jones, 1997; Rupert, no date; Schmidt, 1988). According to Randazzo (1997, p. 51), dissolution of the carbonate rocks:

... has produced significant changes in rock fabric, accompanied by development of many different types of pore spaces. Moldic, vug, and interparticle pore types are most common. Extensive dissolution can create caves and caverns, the underlying cause of sinkholes and karst landscapes.

Generalized descriptions of the various stratigraphic units found within the Marianna Lowlands province are not presented here, instead the reader is advised to review this information in Scott (1992). However, one interesting historic note on the Marianna Limestone. According to Murray (1961, p. 397), the Marianna Limestone:

... is widely known in this region, as well as in the formal geologic literature, as “chimney rock.” The name is derived from the extensive use, earlier during the settlement of this region, of the limestone as a building material, especially for foundation blocks and chimneys.

The Florida Caverns State Park Visitor Center is covered in limestone blocks which in some instances exhibits various micro- and macroscopic fossilized life forms. The building walls make for an interesting and easily accessible “outcrop” while waiting for the next cave tour. Remember that there is NO collecting in the Park.

Hydrogeology

The Floridan aquifer is generally divided into an upper and lower aquifers, separated by less-permeable beds of highly variable hydrogeologic properties [Figure 1] (Miller, 1986). According to Johnston and Bush (1988), regionally the Upper Floridan aquifer:

... forms one of the world’s great sources of ground water. This highly permeable unit consists principally of three carbonate units: the Suwannee Limestone (Oligocene), the Ocala Limestone (upper Eocene), and the upper part of the Avon Park Formation (middle Eocene).

The lower Floridan aquifer is less known stratigraphically and hydraulically and has not been investigated as the Upper Floridan provides sufficient yield to meet the current withdrawal demands (Johnston and Bush, 1988). The Marianna Lowlands contains areas of hydraulic transmissivity ranging from 10,000 to 250,000 square feet per day (Johnston and Bush, 1988). This represents tremendous groundwater yield and also reflects the speed and extent in which contamination can travel within this hydraulic unit.

Tectonics

The Chattahoochee Anticline formed during the middle to late Eocene and affected deposition across this elevated feature during its development (Galloway and others, 1991). The area of uplift was first noted by Veatch and Stephenson (1911) along the Chattahoochee River. The feature is most prominent in Jackson County (Applin and Applin, 1944; Schmidt and Coe, 1978), and extends into southwestern Georgia contributing to the formation of the Dougherty Karst Plain.

Most of what little clastic deposition that occurred across the anticline has been eroded away leaving carbonate rocks exposed at the surface across most of the county. The uplift also aided in the development of the now-exposed Florida Caverns. Scalloped marks along the surfaces of the cave walls testify to prehistoric fluid flow through the formerly submerged passages. Only when subaerial conditions eventually resulted did speleothem formation and development occur.

Paleontology

The area around Marianna offers many interesting fossilized life forms as exemplified by the list provided in the stratigraphic description of Brooks Quarry (Bryan, 2003). The alternate stop of this field trip also offers a Marianna Limestone exposure with some invertebrate fossils. Pleistocene vertebrate fossils occur in the upper reaches of the Chipola River south of Marianna (Rupert, 1994). Another excellent resource for locating and identifying various fossils within the area is found in Rupert (1989). In years past, I have collected a few small Pleistocene vertebrate fossils (mostly pieces) from just south of the dam at Merritt's Mill Pond.

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Agricultural Impact to Merritt's Mill Pond

Jackson Blue Spring, located at the northeast end of Merritt's Mill Pond, is a first magnitude spring (100 cubic feet per second [cfs] or greater) which is approximately 5 miles (8 km) east of the city of Marianna, Florida. Numerous smaller springs (e.g., Twin Caves, Shangri-La Spring, Indian Washtub, and Gator Spring) also feed into the lake at various locations. The vent for Jackson Blue Springs is situated about 10 feet (3 m) west of the diving board platform. The adjacent uplands are owned by the state, but Jackson County manages the park. There is a submerged cave system associated with Jackson Blue (Figure 1) that trends to the northeast and has been extensively mapped by cave divers.

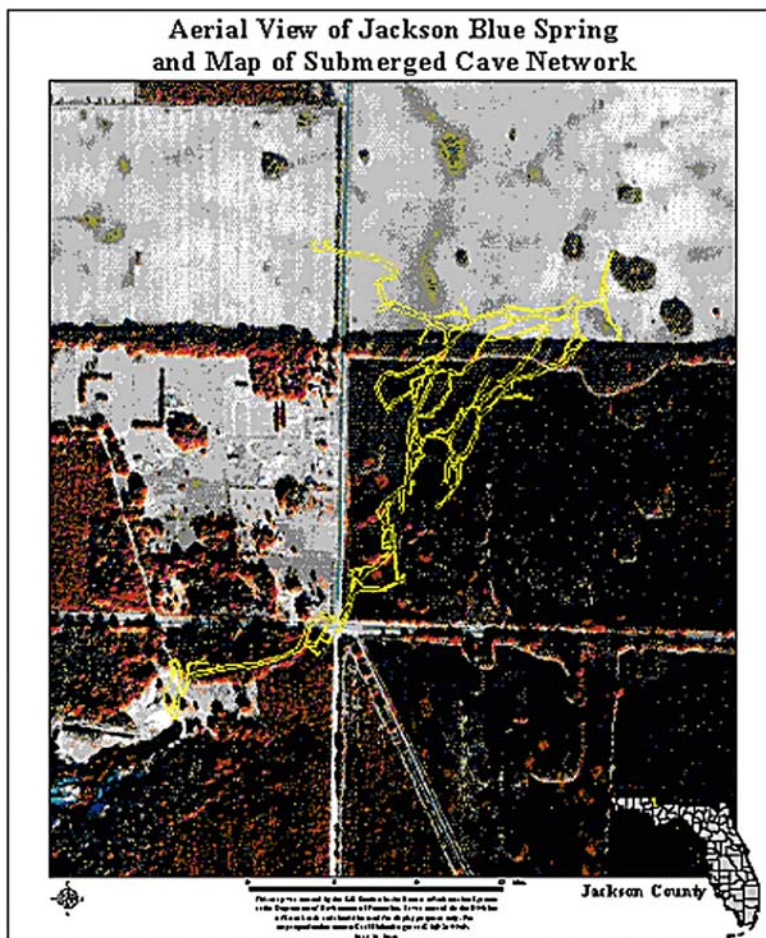
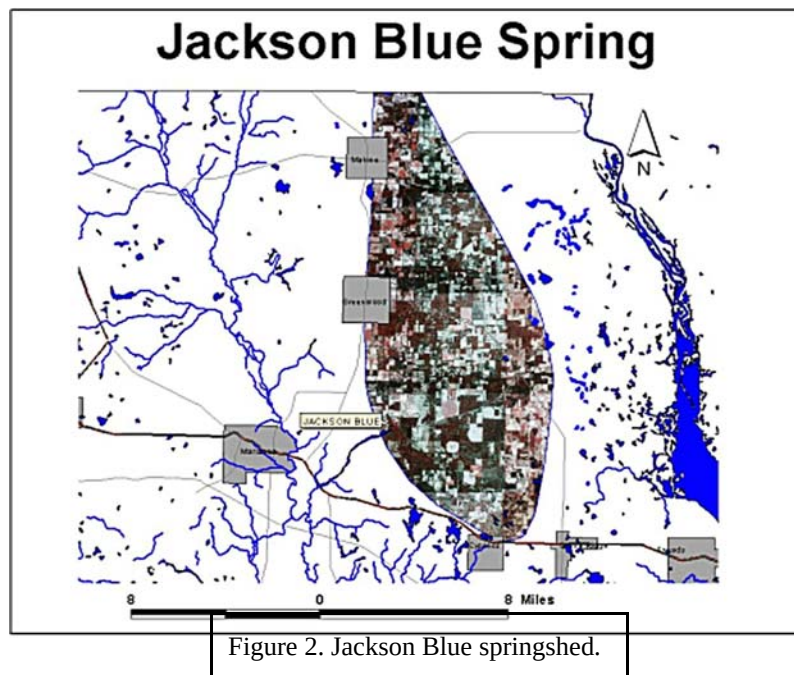
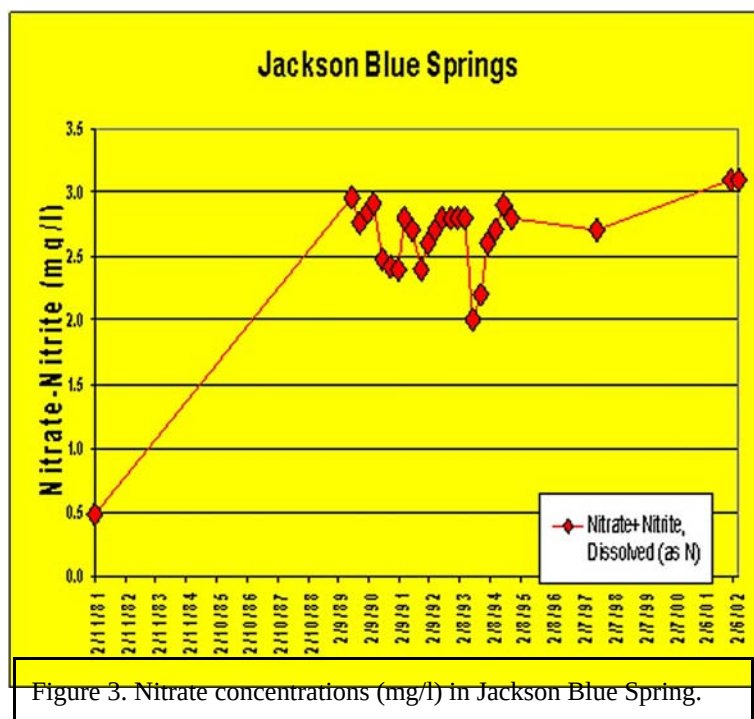


Figure 1. Cave map of Jackson Blue Spring.

The spring shed that supplies water to Jackson Blue (Figure 2) is dominated by agricultural land use and as a result the water quality of the spring has declined over the past two decades. Pesticides and nitrates are some of the contaminants that have been identified as problems for this particular spring. Nitrate levels in Jackson Blue have been measured in excess of 3.0 mg/l. Nitrate levels that exceed 1.0 mg/l initiate ecological damage in springs and associated surface streams. The increased nutrients cause algal blooms which result in the eutrophication of the spring and spring run.



The background nitrate concentration in the Floridan aquifer system has been measured around 0.02 mg/l. Figure 3 presents the dramatic change in nitrate concentration in Jackson Blue Spring over the course of the past two decades.



Merritt's Mill

Pond is an artificial lake that was formed by damming up Jackson Blue Spring run. This dam is located where U.S. Hwy 90 crosses the spring run east of Marianna. A small patch of *Hydrilla verticillata* (a non-native aquatic plant common to home aquariums) was discovered near the boat ramp on Hunter's Fish Camp Road in Merritt's Mill Pond (202 acres) on June 11, 1991. A variety of efforts were undertaken to contain and kill the initial infestation but none proved successful. By the summer of 1994, *Hydrilla* was dominant in 165 acres of the Mill Pond (Figure 4).



Figure 4. Merritt's Mill Pond choked with Hydrilla. Image taken July 1997, by Carl R. Froede Jr.

A complex weir was constructed at the lake discharge point which was designed to capture and prevent the plant from spreading into Spring Creek and the Chipola River (Figures 5 and 6).



Figure 5. Weir prevented plant material from flowing downstream. Photo taken 7/97 by Carl R. Froede Jr.



Figure 6. Hydrilla plant mass collects in front of the weir. Image taken 7/97 by Carl R. Froede Jr.

From 1996 to 2001, Merritt's Mill Pond was treated annually with Aquathol K at a rate of 1600 gal/2 days. Concurrently, triploid grass carp were added to the system incrementally. The goal of this cooperative effort between DEP and FWC was to reduce *Hydrilla* while encouraging the expansion of native plants, especially *Vallisneria*. Currently, *Vallisneria* dominates the system, and *Hydrilla* is difficult to find. No herbicide treatments are anticipated for the foreseeable future (Jess VanDyke, DEP, personal communication).

Jackson Blue Spring Discharge Magnitude

Discharge measurements taken at Jackson Blue Spring show a wide range of variation from a high of 287 cubic feet per second (cfs) on August 6, 1973 to a low of 56 cfs on December 22, 1934. The variability of discharge at Jackson Blue Spring reflects the natural cycle of drought and may also be a result of groundwater withdrawals within the springshed (Figure 7).

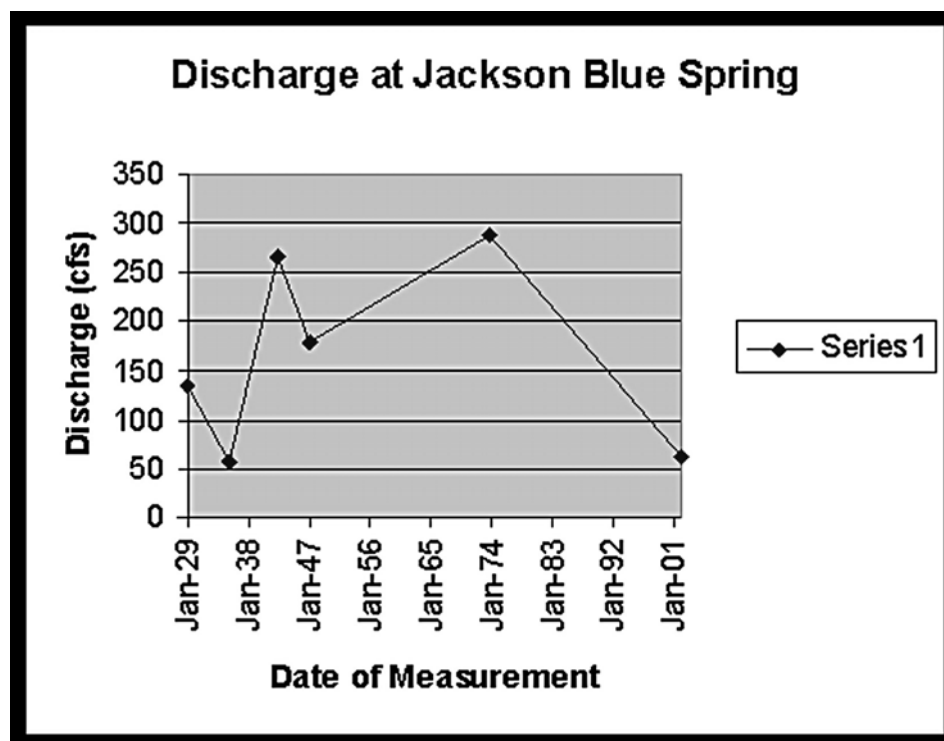


Figure 7 – Discharge at Jackson Blue Spring.

Florida's 33 first magnitude springs are sampled quarterly for water quality and most have discharge monitoring as well. Analytes monitored include temperature, dissolved oxygen, pH, specific conductivity, turbidity, color, alkalinity, total dissolved solids, nutrients, bacteriological analyses, major cations and anions. These data are available from the Florida Department of Environmental Protection. The Florida Geological Survey has also produced a publication, Open File Report 85: The First Magnitude Springs of Florida that contains some water quality data.

HISTORY OF THE MARIANNA AREA

Florida State Caverns

The area of the Florida State Caverns has been utilized for thousands of years by human beings. The presence of Native Americans has been documented by archaeological excavations at the site. Indians used the various caves for a source of rock and pottery clay, for storage, for dumping, and for refuge. The caves were not utilized for habitation, but surrounding areas were. At a "Rock Shelter" located at the park, an overhanging ledge protected an area roughly twelve feet wide and seven feet deep. The ceramic shards identify this site with the Deptford or early Santa Rosa-Swift Creek culture (ca. 100-500 C.E.). This site was either a primary abode or a hunting camp where the Indians seem to have subsisted chiefly on shell fish, wild animals, and birds, probably supplemented by roots, nuts, and fruit. Communication with the Gulf of Mexico is evident through the remains of cockle, scallop, and clam shells.¹

From investigation of a small midden in the area of the park's Parking Area, archaeologists theorize a small village existed during the Fort Walton period (ca. 1450-1650 C.E.). These Indians were farmers who supplemented their diet by hunting. The people from this village also utilized the caves for various non-habitational purposes, as identifiable shards have been recovered from the caverns.²

The first Europeans to discover the caverns were Spanish missionaries in the late 1600s. As early as 1674, a mission was established at a Choctaw village in the vicinity of Florida State Caverns. Father Rodrigo de la Barreda returned to the site in 1693 and recorded the first European description of a North American cave. The village had been abandoned but the Spaniard recorded that "here we spent the night in the hollow of such a beautiful and unusual rock that I can state positively that more than 200 men could be lodged most comfortably in it. Inside, there is a brook which gushes from the living rock."³

In 1818, General Andrew Jackson entered Spanish Florida in pursuit of hostile Indians. Journeying from Apalachicola to Pensacola, he passed through the Florida Caverns park area, crossing the "Natural Bridge," a limestone formation across the Chipola River which was a well-known landmark on the east-west road across Florida. According to some accounts, local Indians took refuge in the caverns as Jackson and the American soldiers passed nearby.⁴

Florida became a United States possession in 1821, and American travelers began to discover the natural beauty of the caverns. Jackson County, in 1822, was the third county created in the Florida territory. The county seat became Marianna, established in 1823. This town was named by the original owners of the site, Mr. and Mrs. Robert Beveridge, for their two daughters, Mary and Anna.⁵ Agriculture became the mainstay of Jackson County, and several large plantations sprung up in the period before the Civil War. One of the best descriptions of the caves comes from 1827, and is quoted extensively here, since these particular caves are no longer available to the public:

"The Arch cave is situated near the public road, about three miles west of the ferries on [Chipola] river, in Jackson County. It opens, to the east, an aperture under a vast limestone rock; about five feet high, and thirty feet wide. This passage descends gently, for three or four rods; the cavern then opens, to the extent of a hundred feet wide, and fifty feet high. A deep channel, of transparent water, skirts the south side, for some distance; it then breaks off in wells, and finally disappears altogether. The course of the cave now turns north-west; it grows narrower, and resembles an arch

of the gothic order.

After proceeding about sixty yards, the cave is crossed by a stream twenty feet wide, and five deep; in this, numbers of craw fish are seen: after passing this stream, the passage turns north of east, and presents a hall, one hundred feet in length; pretty straight, with a very uneven floor of red clay, covered with the debris of the decomposed rock. A row, or rather cluster of stalactical columns, supports the centre of this hall; while thousands of stalactites stretch down their long tubes towards the white bases, which are growing up to meet them, from the floor. Many large holes, in the rock above, are filled with bats, which on the approach of lights, flit off to other dark recesses, with a roaring sound, like heavy wind.

"The passage now becomes crooked and intricate, for a few rods; and then opens into another lofty apartment; from which, there are many avenues, most of which remain unexplored; as well as two water courses, one of which bounds the passage.

"This cave has been explored about four hundred yards. The congelations, on the sides of the walls, have the appearance of grey ice; through which, a sparkling crystallization appears: they often project into curls and folds, representing draperies, and mouldings of inimitable forms: the projections are nearly white, but the same sparkling crystalline appearance continues. The regular stalactites are hollow; the outside a soft chalky decomposition; the centre irregular sparry crystals, of a yellowish hue....

"The Ladies' cave is about one mile south-east from the Arch cave; it opens to the north-west; the entrance is wider, and easier of access, than the former; it is, also more spacious within. About fifteen paces from the entrance, it is divided into two passages; the left, about fifty yards in extent, terminates in a deep river, which passes to the north, under a bold arch of sparry congelations, which has not been, nor cannot, without a boat, be explored; the banks are bold, rocky, and difficult of access. The right hand passage is formed of rugged rocks, bold projecting pillars, curious excavations, and fanciful galleries, which it would be difficult to describe. The congelations are fine and infinitely various. The passage terminates in a narrow chasm, which has the appearance of a water-course; through which, at about three rods distance, another room appears: this has been but imperfectly explored. To the right of this last branch of the cave, the excavation has been examined about one hundred feet; many holes appear to lead off in different directions; some of these may lead to other caverns."⁶

Outlaws, runaway slaves, and others seeking concealment from authorities apparently utilized the caverns in the 1800s. In 1864, during the Civil War, Union troops invaded West Florida and marched into Marianna on a raid. While a home guard unit composed of men too young or too old to fight remained behind in the city to ward off the Union forces, many women, children, and slaves hid in the caverns for refuge.⁷

By the early 20th century the caverns had become despoiled. The Natural Bridge had been cut through by a log ditch in an effort to float timber to sawmills downstream.⁸ The old caves had all been stripped of their speleothem formations and their interiors blackened from the smoke of torches. Preparations began ca. 1936 to turn the cave area into a state park, but "explorations were undertaken to determine if there were other caves in the vicinity that could be developed to provide cave trips of superior quality."⁹ New caves were indeed found; in fact, one new cave was discovered when a surveyor for the park noticed a small opening under a tree that had been blown down by a recent hurricane. Of

course, some work had to be done.

Through the joint efforts of the Florida Forest Service, the Florida Park Service, the National Park Service and several New Deal agencies (Federal Emergency Relief Administration, Works Progress Administration, and the Civilian Conservation Corps' Camp Florida SP-12) three separate series of rooms were opened up and connected by a continuous underground trail three-quarters of a mile in length. Tons of dirt and stone were removed from the floors of some of the caves to facilitate foot traffic. Electric lights were finally installed, along with an administration building built from the native limestone. Florida Caverns State Park was officially opened to the public on August 1, 1942.¹⁰

Jackson Blue Spring

Present-day Jackson Blue Spring east of the caverns is also one of Jackson County's oldest landmarks. There are several significant "blue springs" near Marianna, one being located only a short distance from the Natural Bridge and in the Florida Caverns State Park. The spring in the park is referred to as "Blue Hole Spring," and is the head of Carter's Mill Branch which flows into the Chipola. In 1693, while making an overland expedition from the area of present-day Tallahassee to Pensacola Bay Spanish explorers made note of a major spring, which they called "Calistobe." One Spaniard described it as "such a large and excellent spring that a stream deep enough for a canoe actually issues from it." This may have been Jackson Blue Spring. General Andrew Jackson and his American forces camped at Jackson Blue Spring on his 1818 expedition through West Florida. When Jackson County was created in 1822, the Legislative Council directed the courts to be held at the "Big Spring of the Chipola," a common name for Jackson Blue Spring in the early 1800s. The spring came into the possession of William H. Robinson and became known as Robinson's Big Spring. The novelist Caroline Hentz dramatized the site in the 1850s as "Long Moss Spring" in her plantation romance novel *Marcus Warland*. The site has been known as Blue Spring for many years; two underwater cave openings emit an enormous volume of water. In 1956, the local Chamber of Commerce and the Florida Public Utilities began to transform the spring into a modern water recreation facility. The utility company now leases Jackson Blue Spring to the Jackson County Board of County Commissioners during the summer months. As many as 30,000 visitors use the park for swimming and picnics. In 1978, the power company commissioned the National Speleological Society to explore the caves below the springs, and divers discovered more than 18,000 feet of underwater passages. This makes Jackson Blue Spring the second largest cave in the world.¹¹

Merritt's Mill Pond

Merritt's Mill Pond is the outflow from Jackson Blue Spring. It was used as the power source for a grist mill and an ice plant originally, but in the 1940s it was converted into a hydro-electric plant by the utility company. It has become a favorite recreational and fishing spot in the area, but in recent years it has become choked with aquatic plants and suffers from pollutants.¹² However, today the troublesome aquatic plants have been eliminated and the lake has once again become a popular place for fishing and enjoyment.

NOTES

1. Judith A. Bense, *Archaeology of the Southeastern United States: Paleolndian to World War I* (San Diego: Academic Press, 1994), 111, 158-60; and Ripley P. Bullen, "Indian Sites at Florida Caverns State Park," *Florida Anthropologist* 2 (May 1949): 6-7, 8-9.

2. Ibid., 1-9.

3. Lewis G. Scoggin, "Florida Caverns State Park - A Nature-Made Wonderland," *The Florida Naturalist* 25 (April 1952): 66-67. See also Franklin Folsom, *Exploring American Caves - Their History, Geology, Lore and Location: A Spelunker's Guide* (New York: Crown Publishers, Inc., 1956), 61; and J. Randall Stanley, *History of Jackson County* (Marianna, FL?: Jackson County Historical Society, 1950), 2-3, 13.

4. Scoggin, "Florida Caverns State Park," 67; Jerrel H. Shofner, *Jackson County, Florida -A History* (Marianna, FL: The Jackson County Heritage Association, 1985), 15; and Stanley, *Jackson County*, 6, 13.

5. Allen Morris, comp., *The Florida Handbook, 1973-1974* (Tallahassee: The Peninsular Publishing Company, 1973), 401, 407.

6. John Lee Williams, *A View of West Florida*, 1827, facsimile reproduction (Gainesville: University Press of Florida, 1976), 35-37. See also Rt. Rev. Michael Portier, "From Pensacola to St. Augustine in 1827," *Florida Historical Quarterly* 26 (October 1947): 151-52.

7. Scoggin, "Florida Caverns State Park," 67; and Stanley, *Jackson County*, 13.

8. *Florida Caverns State Park ... More of the Real Florida* (brochure); Scoggin, "Florida Caverns State Park," 67.

9. Stanley, *Jackson County*, 14.

10. *Florida Caverns State Park* ; Folsom, *Exploring American Caves*, 189; Scoggin, "Florida Caverns State Park," 68; and Stanley, *Jackson County*, 14.

11. *Florida Caverns State Park*; Portier, "From Pensacola to St. Augustine," 151-52; Shofner, *Jackson County*, 563; Stanley, *Jackson County*, 4-12; and Williams, *View of West Florida*, 22, 37-38.

12. Shofner, *Jackson County*, 563; and Stanley, *Jackson County*, 12.

Florida Caverns Karst
(Edited from the 1993 SEGS guidebook)

**CAVE PASSAGE ORIENTATION AND DEVELOPMENT WITHIN FLORIDA CAVERNS
STATE PARK; JACKSON COUNTY, FLORIDA**

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 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, down dip 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 1). 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.

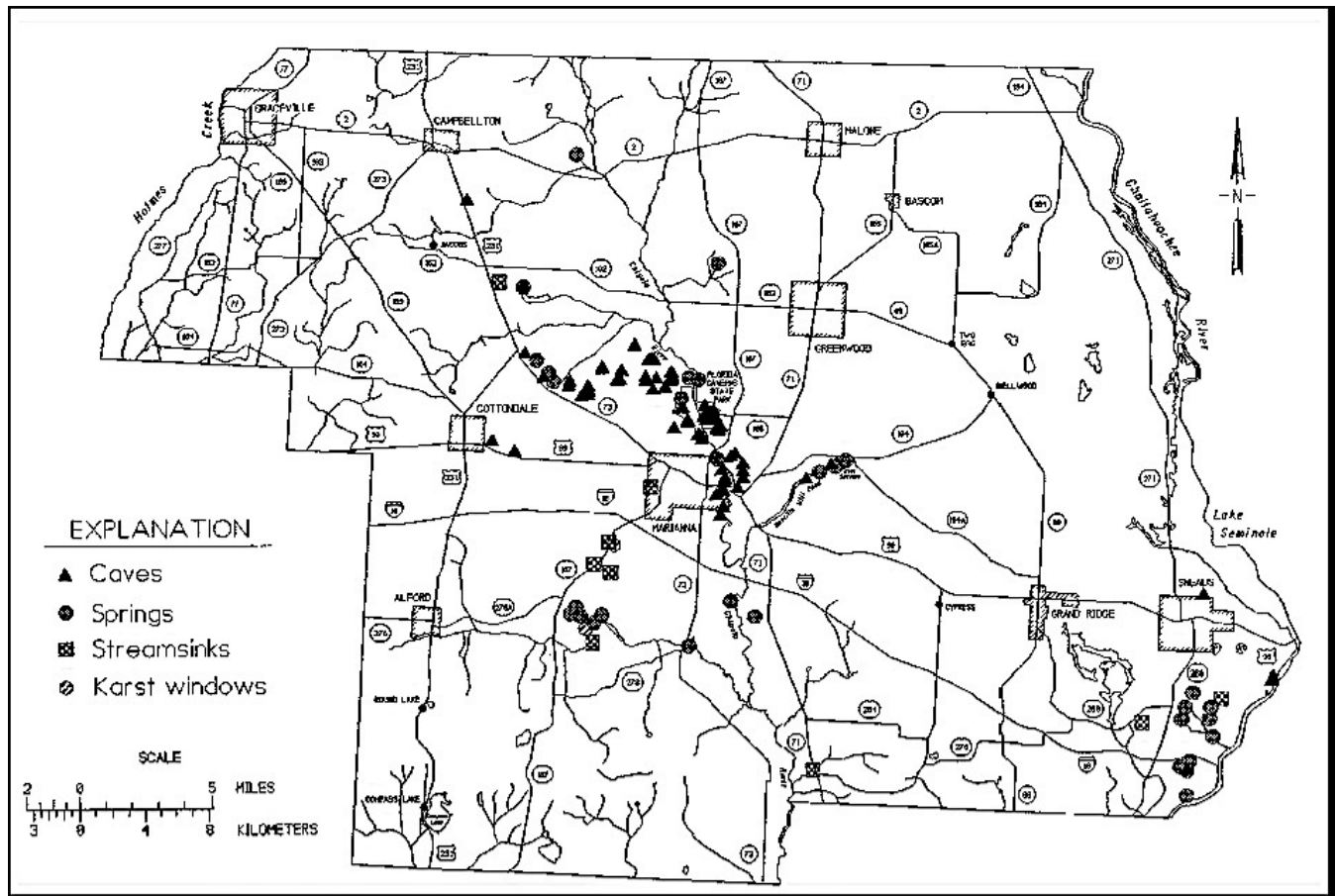


Figure 1. Distribution of some major karst features in Jackson County, Florida

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. 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.

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 2. 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.

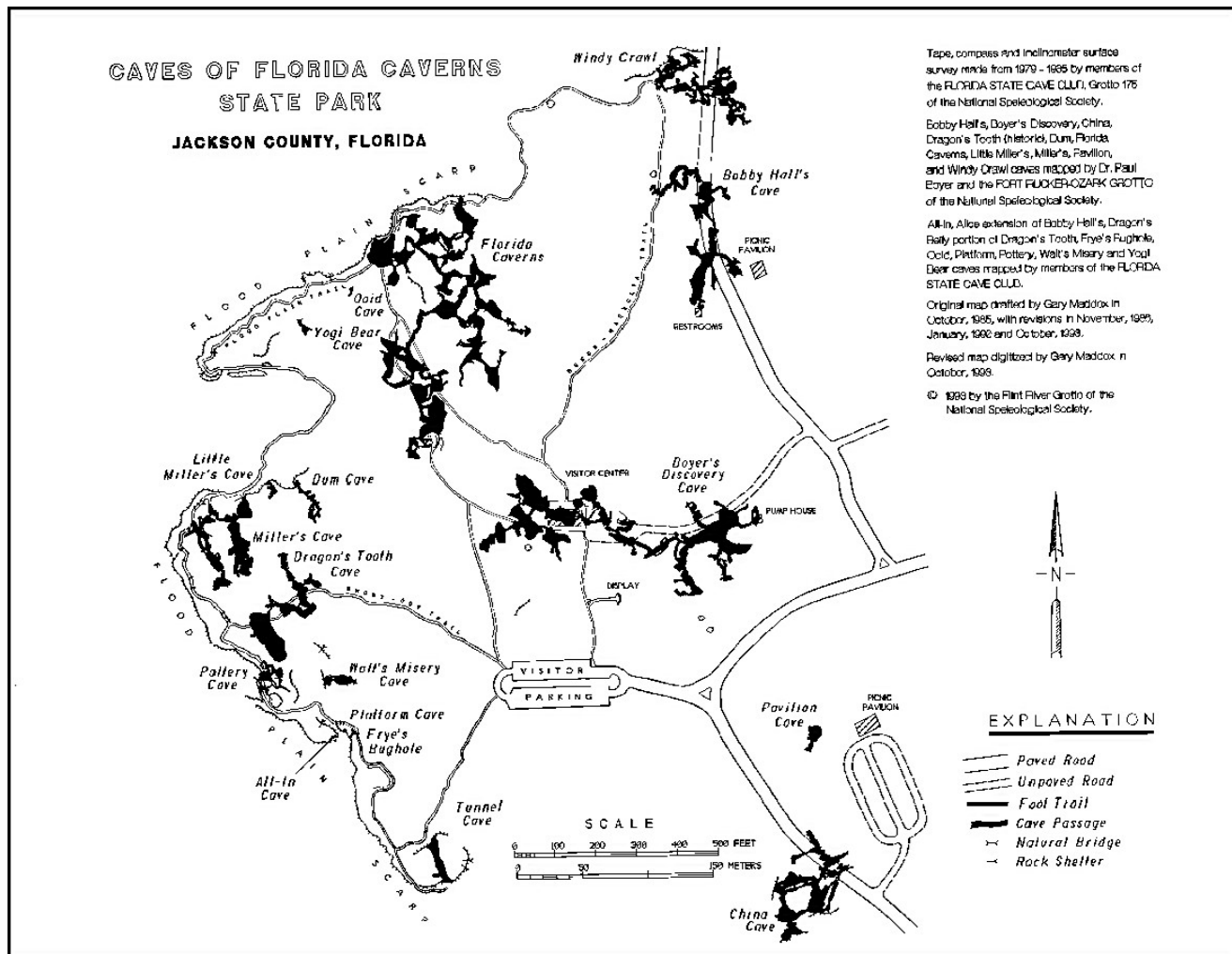


Figure 2. Caves of Florida Caverns State Park, Jackson County, Florida

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 multi-level 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.

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 3) 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.

An excellent summary of the history and area geology of the Park can be found in Schmidt (1988).

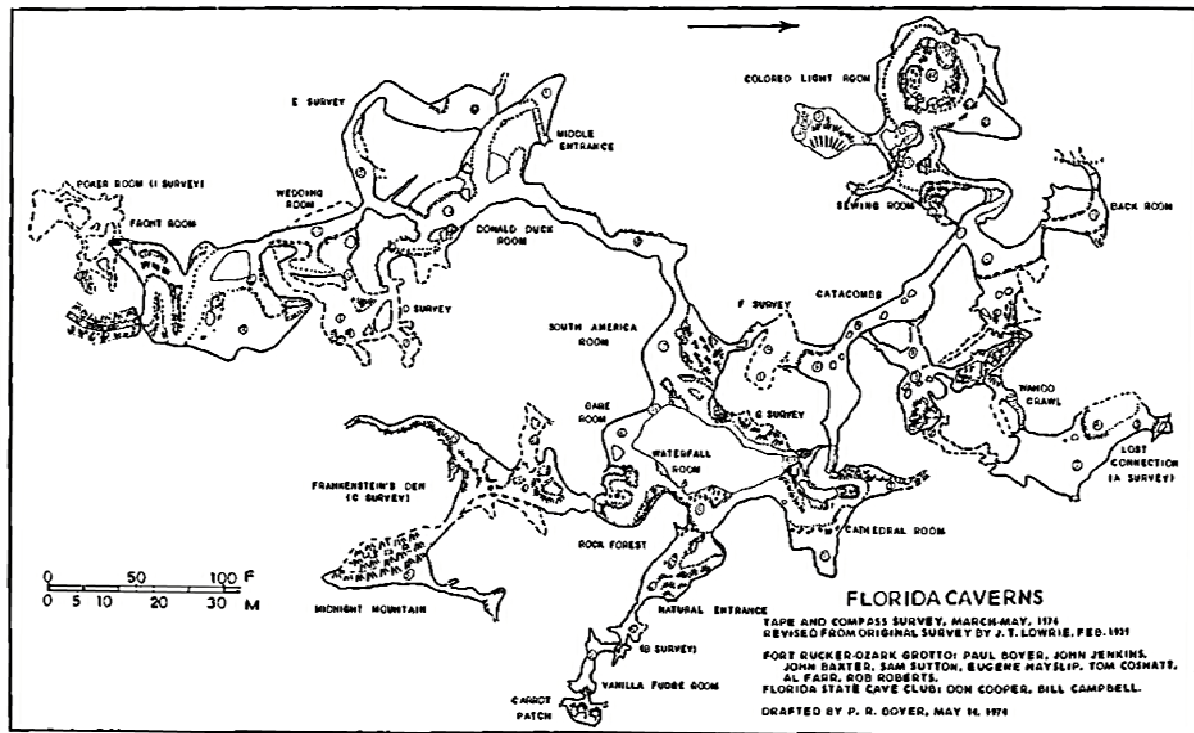


Figure 3. Planimetric Map of Florida Caverns

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Jackson Blue Spring
(Modified from <http://www.dep.state.fl.us/springs/locator/jacksonblue.htm>)
(Information current to August 2003)

Numerous springs feed into Merritt's Mill Pond. Jackson Blue Spring provides the greatest volume of water to the pond and is located at the head of the lake. Clear water issues from the cave opening above which is a small man-made concrete diving platform. Entrance to the cave is easily accessible to swimmers. Maximum depth over the cave opening is approximately 16.5 ft. The boil is easily visible at the surface. Water temperature is 72 degrees F. There is 20% algae coverage on the pool bottom within the large swimming area.

The spring is located approximately five miles east of Marianna, Florida at the northeast end of Merritt's Mill Pond, at lat. 30° 47' 25.9" North, and long. 85° 08' 24.3" West. From Marianna, drive east one mile on U.S. Hwy 90, north one mile on State Road (SR) 71, east 3.3 miles on SR 164. Look for the sign to the spring.

The spring is open for swimming from May 1st to September 30th. Hours are 11:00 a.m. to 6:00 p.m. The entrance fee is \$2.00 per person and there are plenty of activities both in and out of the water. There is ample parking with bathrooms, picnic tables, and a new concession building where food and drinks are readily available.



Figure 1. Blue Springs on a hot day in July. The cool water is very refreshing.

Field Trip Map and Stops
Floridan Aquifer
Marianna, Florida

ROAD LOG AND STOP DESCRIPTIONS

Mileage Between Points	Total Mileage	Directions
0.0		Begin from the Microtel Inn & Suites. Turn right and proceed north on State Road 71 to U.S. Hwy 90/State Road 10.
1.6	1.6	Turn left on U.S. Hwy 90/State Road 10 and proceed west.
4.9	6.5	Bear right onto State Road 73 (Dothan Hwy)
1.5	7.0	Turn right (north) on Valley View Road and drive until you reach the Brooks Quarry
1.0	8.0	Stop 1 - Marianna Lime Products, Inc. (HI CAL Limerock) (GPS Coordinates: N 30° 48.398 W 85° 15.575) Vehicle parking will be dictated by the weather. Best areas to collect fossils are from the small spoils piles and the exposed blocks of limestone. Please keep away from overhanging walls. See stratigraphic description by Dr. Jon Bryan in the geology section of the guidebook. The quarry is owned by Mr. Leon Brooks of Marianna. Over 69 feet of section is exposed in the quarry, including the Ocala, Bumpnose, and Marianna Limestone. This very fossiliferous sequence includes the Eocene-Oligocene boundary (Ocala-Bumpnose contact).
1.0	9.0	Return to vehicles and proceed south to State Road 73. Turn left (southeast) and proceed on State Road 73 toward Marianna
1.5	10.5	Turn left (east) onto U.S. Hwy 90/State Road 10. Proceed through town until reaching State Road 166 (To Florida Caverns).
2.0	12.5	Turn left (north) onto State Road 166.
2.6	15.1	Proceed to the entrance of Florida Caverns State Park.
1.0	16.1	Turn left (west) into Florida Caverns State Park and proceed to the Visitors Center.

Stop 2 - Florida Caverns Tour

The park contains many interesting and beautiful areas—more than we will experience in this quick trip. It encompasses approximately 1300 acres packed with a fabulous variety of animals and plants. At a later time you should return and explore the park and discover all that it has to offer. It is a great place to camp and bring the family. The caverns were developed by the Civilian Conservation Corps from 1938 to 1942 (see historical review of the caverns in the article by Dr. Brian Rucker). Scallop marks on cave wall passages reveal the subaqueous development of the cave system by flowing water. Following subaerial exposure, speleothem development occurred resulting in the beautiful stalactites and stalagmites we witness today. A small museum is located above the visitors center along with restrooms for changing clothes, if necessary. We will take the cave tour and enjoy cooler temperatures and beautiful cave geology.

1.0	17.1	Return to vehicles and proceed to State Road 166. Turn right (south) and continue to U.S. Hwy 90/State Road 10.
2.5	19.6	Turn left (east) onto U.S. Hwy 90/State Road 10.
2.6	22.2	Turn right into Spring Creek Park (adjacent to Merritt's Mill Pond Dam).

Stop 3 - Spring Creek Park/Merritt's Mill Pond Dam

This dam was created to provide water power for a variety of uses (see article by Dr. Brian Rucker). Today it serves to provide a recreational lake. However, low levels of agricultural pollution emanating from numerous springs that feed into the lake created problems during the 1990's and resulted in the uncontrolled growth of *Hydrilla verticillata* (a non-native aquatic plant common to home aquariums). See Harley Means article where he documents the pollution of the lake along with the actions taken to mitigate the Hydrilla problem.

0.3	22.5	Return to automobiles and proceed east to a place to turn around (i.e., U-Turn) on U.S. Hwy 90/State Road 10. Proceed west.
1.4	23.9	Turn right (north) onto State Road 71 and proceed to State Road 164.
1.1	25.0	Turn right (east) onto Blue Springs Road (State Road 164). Proceed to sign for Blue Springs Recreational Area on the right side of road.
3.2	28.2	Turn right into Blue Springs Recreational Area and park.

Stop 4 - Blue Springs Recreational Area

This is the final stop of the day and one that is sure to create memories. This is a first-magnitude spring with an average flow measured at 190 gallons per second! The water is cool, but refreshing after a long morning in the field. See articles by Harley Means and Brian Rucker regarding this stop.

Alternate Stop - Marianna Limestone

(GPS Coordinates: N 30° 46.319 W 85° 12.684)

An easily accessible outcrop of the Marianna Limestone is included, but will not be visited as part of this field trip. The outcrop exposes 3 meters of section. It is located just to the west of the intersection of State Road 71 and U.S. Hwy 90 (3.7 miles from Microtel Inn). It is adjacent to the parking lot of an abandoned building next door to an Auto Zone Discount Auto Parts store. It is an excellent outcrop of Marianna Limestone that contains numerous micro- and macrofossils in an indurated carbonate matrix.

END OF FIELD TRIP

